FINAL
ENVIRONMENTAL ASSESSMENT

West Corporate Development and East Parcel Development

Manassas Regional Airport

Prepared for

City of Manassas

And

U.S. Department of Transportation
Federal Aviation Administration

As lead Federal Agency pursuant to the National Environmental Policy Act of 1969

Prepared by:

RS&H, Inc.

This Environmental Assessment becomes a Federal document when evaluated, signed and dated by the Responsible Federal Official.

Responsible Federal Official

3/30/18
Date

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

FINDING OF NO SIGNIFICANT IMPACT (FONSI)

Location

Manassas Regional Airport (HEF)
Manassas, Virginia

Proposed Federal Action

The proposed federal action consists of approval for the Airport's proposed redevelopment of the west side corporate area and development of a parcel on the east side of the Airport. The Federal Aviation Administration (FAA) must comply with the National Environmental Policy Act of 1969 (NEPA) prior to processing applications for federal assistance in funding various airport development projects and approval of the Airport Layout Plan (ALP) that depicts the proposed development projects. Issuing a FONSI does not constitute a commitment by the FAA to provide federal financial assistance for these development actions.

Project Description

HEF's proposed development program includes the following projects, which constitute the Proposed Action:

West Corporate Area

- *On-Airport roadway improvements* – Improvements to the intersection of Observation Road and Piper Lane, located on the northwest side of the Airport and realignment of Observation Road to the west. The roadway improvements would equate to about 4,000 linear feet.
- *Fixed Base Operator (FBO) building and parking lot reconstruction* – Demolition of two existing FBO buildings and associated structures and replace with a 71,100 square foot consolidated FBO building to the west of the current FBO buildings. A new parking lot would extend around the west and north sides of the proposed new FBO building to provide parking for FBO employees and users. The existing apron would be expanded to the northwest to provide FBO access to the airfield.
- *Corporate hangar/building and parking lot construction* - Eleven new corporate hangars/buildings would be constructed on the west side. All of the hangars would be about 3,600 square feet in size. The corporate hangar/buildings could also serve as office space. All corporate hangars/buildings would have access to the airfield. Parking lots would also be constructed in the areas near the corporate hangars/buildings to provide parking for employees and users.
- *T-hangars demolition/replacement and construction and T-hangar parking lot* - Five T-hangars would be demolished, equating to about 130,000 square feet, and replaced with new T-hangars of similar size. In addition, six new T-hangars would be constructed in the same area. The new T-hangars would increase the building footprints by a total of about 61,000 square feet. The apron area would be expanded to provide airfield access from these T-hangars.
- *Aircraft apron and taxilane tie down parking expansion* - The west apron area would be extended by about 25 acres. The apron expansion would provide airfield access for the

proposed T-hangars, corporate hangars, and relocated FBO. The apron expansion would also provide increased areas for designated tie-downs and taxilane extensions.

- *Maintenance and storage building construction* – An approximate 1,180 square foot maintenance and storage building would be constructed in the current location of one of the two FBO buildings, which will be demolished, on the northwest side of the Airport. The Airport maintenance equipment currently housed on the east side of the Airport would be relocated to the proposed new maintenance and storage facility.
- *Wash rack construction* – An approximate 1,180 square foot wash rack would be constructed north of the T-hangars for use by all Airport tenants.
- *Utilities extension and stormwater drainage improvements* - Utilities, including electricity, water, sewer, and communication services, would be extended to the proposed new development from nearby electrical lines and water/sewer mains. Stormwater drainage improvements would occur west of the proposed relocated FBO facility and would accommodate the increase in impervious surface from the proposed development.
- *Security fence extension* - The Airport's security fence would be extended to encompass the extended improvements. Access gates would be added in various locations to provide access to the airfield by authorized Airport tenants and personnel.

East Parcel Area

- *On-Airport roadway improvements* – Realignment of Wakeman Drive to the northeast. The roadway improvement would equate to about 3,000 linear feet.
- *Corporate hangar/building and parking lot construction* - New corporate hangars/buildings would be constructed on the east side of varying sizes, equating to about 120,000 square feet. The corporate hangar/buildings could also serve as office space. All corporate hangars/buildings would have access to the airfield. Parking lots would also be constructed in the areas near the corporate hangars/buildings to provide parking for employees and users.
- *Taxilane extension* - The taxilane would be extended by about 135,000 square feet to provide airfield access to the proposed development.
- *Utilities extension and stormwater drainage improvements* - Utilities, including electricity, water, sewer, and communication services, would be extended to the proposed new development from nearby electrical lines and water/sewer mains. Stormwater drainage improvements would occur to accommodate the increase in impervious surface from the proposed projects.
- *Security fence extension* - The Airport's security fence would be extended to encompass the extended improvements. Access gates would be added in various locations to provide access to the airfield by authorized Airport tenants and personnel.

Purpose and Need

The purpose of the Proposed Action is to develop and maintain safe and modern facilities and to improve the Airport's ability to be financially self-sustaining. The current west side infrastructure is aging and existing hangars and pavements have exceeded their useful life and are in need of renovation or upgrade. In addition, portions of the west side of the Airport are underutilized. The City of Manassas seeks to maximize the redevelopment potential on the west side of the Airport and to initiate new development with access to the airfield on the east side of the Airport. The Airport's goal is to renovate or upgrade the facilities located west of Runway 16R-34L and to facilitate new development on the east side of the Airport.

Alternatives

In addition to the No Action Alternative, the following alternatives were considered for the Proposed Action:

No Action Alternative - Under the No Action Alternative, the City would not redevelop the west corporate area or develop the east parcel. Observation Road would remain in its current alignment. In addition, there would be no need to seek the FAA's unconditional approval of the ALP. The City would continue to operate the Airport and serve existing and forecast aviation activity. The No Action alternative would not satisfy the Purpose and Need because it would not allow the City to update and enhance the safety and efficiency of Airport facilities, nor would it allow the City to undertake activities to ensure the Airport remains a profitable enterprise with a positive economic impact.

Preferred Alternative – The preferred alternative includes developable areas on the west and east sides of the Airport that collectively encompass about 80 acres. The City proposes to redevelop the west side corporate area and develop a parcel on the east side of the Airport as described in the project description. In order to minimize encroachment into the 100-year floodplain and avoid the existing regulated floodway, the proposed west side development does not fully extend to the Airport's western property boundary and does not include an otherwise developable 30-acre parcel south of the east parcel area. Implementation of the preferred alternative would relocate Observation Road outside of the existing regulatory floodway and provide uninterrupted vehicular access to the west corporate development area when Broad Run overflows its banks and floods the intersection of Observation Road and Piper Lane. Avoiding a flooded intersection would provide emergency vehicles an uninterrupted roadway needed to access the west corporate development area. The preferred alternative would unavoidably affect about 20 acres of the 100-year floodplain and 2.7 acres of the regulatory floodway. Given the location of the Airport between Broad Run and Cannon Branch, the FAA safety area, and Airport property available for development, floodplain impacts are not completely unavoidable.

Alternative A – As a result of a developable on-Airport land analysis, there is an alternative on-Airport area that is currently undeveloped, outside of the Code of Federal Regulations (CFR) Title 14 Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* transitional surface and Runway Protection Zones (RPZs), and has existing access to local roads. This alternative would provide about 100 acres of on-Airport property for new aviation hangars, apron, and taxilanes. This area is located on the east side of the airfield, southeast of the existing T-hangars, and northwest of Broad Run. Under Alternative A, Wakeman Drive would be extended approximately 1,100 feet to the southeast to provide vehicular access to this alternative's proposed new aviation development. Alternative A would provide more area for development than the preferred alternative; however, it would not be consistent with the screening criterion of minimizing floodplain encroachment to the maximum extent practicable. Alternative A would affect about 20 acres of the 100-year floodplain (similar to the preferred alternative) and about five acres of the regulatory floodway (about two acres more than the preferred alternative). As a result, Alternative A was not carried forward for further analysis.

Alternative B – There is an additional on-Airport area that is undeveloped and outside of the Part 77 transitional surface and RPZs. Alternative B would provide about 110 acres of on-Airport property for new aviation hangars, apron, and taxilanes. Alternative B is located on the east side of the Airport

airfield and extends from the existing T-hangars to the southern end of the Airport property. Under Alternative B, Wakeman Drive would be extended about 4,000 feet to the southeast to provide vehicular access to the area. Alternative B would also provide more area for development than the preferred alternative; however, it would not minimize floodplain encroachment to the maximum extent practicable. Alternative B would affect about 100 acres of the 100-year floodplain, about 80 more acres than the preferred alternative and Alternative A. In addition, Alternative B would affect about 20 acres of the regulatory floodway, about 17 more acres than the preferred alternative and 15 more acres than Alternative A. As a result, Alternative B was not carried forward for further analysis.

Discussion

The attached Environmental Assessment (EA) addresses the effect of the Proposed Action on the quality of the human and natural environment and is made a part of this Finding. The following impact analysis highlights the more thorough analysis presented in the document.

Air Quality

According to the Environmental Protection Agency (EPA), the project study area is in a maintenance area for the particulate matter (PM2.5) standard. The area is a marginal nonattainment area for the 2008 ozone (O3) standard. The project study area is also within an emission control area for oxides of nitrogen (NOx) and volatile organic compounds (VOCs). The Airport is in attainment for all other National Ambient Air Quality Standards (NAAQS).

Temporary construction emissions were modeled for the Proposed Action deriving tons per year of expected emissions. Based upon the generated emissions inventory for total project construction emissions, the Proposed Action is below the applicable de minimis thresholds for all NAAQS. There is the potential for generators to be used during construction. The City would ensure that the installation of all generator(s) complies with 9VAC 5-80, Article 6, Permits for New and Modified Sources. The Proposed Action would increase surface traffic due to increased employment at the Airport; estimated to be at about 30 employees. It is likely that these future employees would already reside in the region and would already be commuting to employment elsewhere in the region. Given the comparatively small change in the regional employment and the likelihood that future employees would already reside in the region, the Proposed Action would not materially change vehicle emissions in the area. In addition, the Proposed Action would not change aviation operations at the Airport; therefore, the operation of the Proposed Action would not significantly affect air quality.

Biological Resources

The Official Species List generated by the U.S. Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) system, identified three federally listed species within the project area, the Dwarf wedgemussel (*Alasmidonta heterodon*) (endangered), Harperella (*Ptilimnium nodosum*) (endangered), and Northern long-eared bat (NLEB) (*Myotis septentrionalis*) (threatened). None of these species were observed during the field survey and no critical habitat was identified in the IPaC report. Based on the field survey and assessment, no suitable habitat for the Dwarf wedgemussel or Harperella exist in the area of ground disturbing activities. The Proposed Action will therefore have No Effect on these species. There is suitable habitat for the NLEB, but the area of ground disturbing activities is not near a mapped or known hibernacula. Relying on the findings of the 1/5/2016 Programmatic Biological Opinion for Final 4(d) Rule on the NLEB and Activities Exempted from

Take Prohibitions to fulfill our project specific Section 7 responsibilities, a determination of Not Likely to Adversely Affect was made for this species.

The Virginia Department of Conservation and Recreation (VDCR) indicated that nine Commonwealth listed species may occur within two miles of the area of ground disturbing activities. The Broad Run Stream Conservation Unit (SCU), located adjacent to the study area, has a biodiversity ranking of B3, which represents a site of high importance. The Brook floater and Yellow lance are listed as natural heritage resources of concern in the SCU. Broad Run is also designated by the Virginia Department of Game and Inland Fisheries (VDGIF) as a "Threatened and Endangered Species Water" for the Brook floater. VDCR recommended implementation of, and strict adherence to, applicable state and local erosion and sediment control/storm water management laws and regulations and further coordination with the VDGIF for the Brook floater. Because no instream work is proposed as part of this Proposed Action, VDGIF does not anticipate adverse effects to the Brook floater.

Migratory birds were not observed in the area of ground disturbing activity. In addition, there are no known bald eagle nests near the area of ground disturbing activity. Wildlife biologists will conduct pre-construction surveys to determine the presence of active avian species nests in the area of ground disturbing activities. The construction contractor would avoid direct impacts to birds or active nests during construction and avoid impacts on any species the Migratory Bird Treaty Act (MBTA) protects. This could be accomplished through the implementation of time of year restrictions. The City would coordinate with USFWS and VDGIF to determine the appropriate avoidance measures, if necessary; therefore, avian species would not be affected by construction of the Proposed Action.

Coastal Resources

The Proposed Action was coordinated with the Virginia Department of Environmental Quality (VDEQ) through submittal of a Federal Consistency Certification. The VDEQ concurred that the proposed Action is consistent with the enforceable policies of the Virginia Coastal Zone Management Program provided that all applicable permits and approvals are obtained prior to the implementation of the Proposed Action.

The western portion of the project study area, which is in the City of Manassas limits, is not within the Virginia Coastal Zone Program (VCP) boundary. The eastern portion of the project study area is within Prince William County and within the VCP boundary. Given the eastern portion of project study area's location in the VCP, the eastern portion of the project study area is subject to the requirements of the Chesapeake Bay Preservation Act (CBPA). In addition, Broad Run, which intersects the western portion of the project study area, is within Prince William County and subject to the CBPA. The CBPA is an enforceable program of the VCP and establishes resource protection areas (RPAs) around land at or near the shoreline that plays a critical role in the water quality value. RPAs have a 100-foot vegetation buffer along streams or rivers to help protect water quality. An onsite delineation of the Cannon Branch RPA within the eastern portion of the project study area was reviewed and approved by Prince William County with a determination that the Proposed Action will not affect the RPA. The proposed east parcel development would avoid the 100-year floodplain and delineated wetlands. Road improvements (e.g., realignment of Wakeman Drive in the east parcel) are considered exempt from the provisions of the Chesapeake Bay Preservation Act provided the road improvements are constructed in accordance with local and state water quality protection criteria.

Department of Transportation Act, Section 4(f)

The boundary of Manassas Station Operations Battlefield (VDHR #076-5036), a National Register of Historic Places (NRHP) eligible resource, is located on airport property partially within the project area where ground disturbing activities are anticipated to occur. Archaeological site 44PW0729, a potentially eligible resource, is located immediately adjacent to proposed ground disturbing activities. The FAA made a *de minimis* determination for historic properties based on the lack of archaeological evidence for the Manassas Station Operations Battlefield within the project area, the lack of visual impacts on additional historic properties located within the viewshed of the proposed undertaking, and implementation of mitigation measures to protect site 44PW0729. Coordination with the Virginia Department of Historic Resources (VDHR) determined that the proposed undertaking will have no adverse effect on historic properties and no adverse effect on site 44PW0729 provided the City protect this site from construction-related activities by placing temporary fencing along a 20-foot buffer surrounding the site.

Hazardous Materials, Solid Waste, and Pollution Prevention

One hazardous waste site was identified by the U.S. Environmental Protection Agency in the project study area under the Resource Conservation and Recovery Act (RCRA), Dulles Aviation, Inc. Dulles Aviation, Inc. is the fixed base operator at the Airport and is a conditionally exempt small quantity generator. An Environmental Phase I report was generated for the Proposed Action. This report did not identify any sites in the project area other than Dulles Aviation, Inc. VDEQ's Division of Land Protection and Revitalization (DLPR) conducted a search of its solid and hazardous waste databases (2,000-foot radius), including petroleum release sites, in the project area vicinity to identify waste sites in close proximity to the area. The DLPR identified three additional RCRA sites near the Airport and several petroleum releases, which are listed as closed. A physical inspection of the survey area was conducted in late 2016. No hazardous waste, toxic materials, or potential origins of hazardous waste production were observed in the survey area.

If hazardous materials are encountered at any time during the construction phase, all work would cease and actions per Virginia Solid Waste Management Regulations (9VAC 20-81-620), Virginia Hazardous Waste Management Regulations (9VAC 20-60), Virginia regulations governing the transportation of hazardous materials (9VAC 20-110 *et seq.*) and EO 13514 (*Federal Leadership in Environmental, Energy, and Economic Performance*) Section 2(e) would be followed. Previously identified hazardous waste sites would not be affected by the Proposed Action. All structures being demolished/renovated/removed would be checked, and cleared of asbestos-containing materials and lead-based paint prior to demolition/renovation/removal. The selected construction contractor would follow federal, state, and local regulations regarding these types of materials, should any be found.

Construction of the Proposed Action would temporarily increase on-site hazardous material storage. This would be primarily in the form of diesel fuel necessary for the operation of construction equipment. The installation and use of an aboveground storage tank greater than 660 gallons for temporary fuel storage greater than120 days during the project must follow the requirements in 9VAC 25- 91-10 *et* seq. Construction of the Proposed Action would also cause a short-term temporary increase in the quantity of solid waste generated at the Airport. The selected construction contractor would be responsible for disposing of any waste in accordance with all federal, state, and local rules and regulations. Vegetative debris would be managed in accordance with the Virginia Department of

Forestry *Best Management Practices for Water Quality* and EO 12088 *Federal Compliance with Pollution Control Standards.*

Historical, Architectural, Archeological and Cultural Resources

The boundary for the potentially eligible Manassas Station Operations Battlefield, which is associated with the Manassas Battlefield Historic District, is partially located within the project area where ground disturbing activities would occur. The closest documented NRHP listed property is located approximately one-half mile from the project. Coordination with the VDHR resulted in a finding of no adverse effect for the proposed undertaking associated with the battlefield as well as the overall viewshed.

A Phase I subsurface archaeological survey was conducted for portions of the western study area where prior ground disturbance was not previously documented. Subsurface testing was followed by a metal detector survey of undisturbed areas in the eastern and western portions of the study area. The surveys did not encounter archaeological resources. Based on the survey results, as well as the proposed mitigation for site 44PW0729, the VDHR determined that there will be no adverse effects to archaeological resources associated with the proposed undertaking.

Natural Resources and Energy Supply

Construction of the Proposed Action would temporarily increase the amount of natural resources used at the Airport. This could include prefabricated building components, aggregate, sub-base materials, and oils associated with construction. Construction would also increase the energy demand at the Airport; however, this increase would be temporary and minor, and within the supply capabilities of the City of Manassas. Operation of the Proposed Action would increase the use of natural resources at the Airport in the form of water consumption, aviation fuel, and energy. The increase in the use of natural resources would not be significant and would not place a strain on the availability of resources for the surrounding area. The natural resources required by the Proposed Action are not rare or in short supply.

Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

An analysis of the Proposed Actions assumes that there would be about 75 construction workers based on the extent of the Proposed Action and about 30 new employees at the Airport for operation of the Proposed Action. The construction of the Proposed Action could cause the short-term employment of construction workers. Because construction associated with the Proposed Action would be temporary (estimated five (5) years), this would not cause a shift in population growth or change population growth patterns. Increased employment is assumed to draw employees from the surrounding area and would not require relocation from other areas. If relocations were to occur, the resulting shift would only account for a maximum of one percent population increase.

The Proposed Action does not include the permanent closure of any roads. The intersection of Observation Road and Piper Lane would be modified to prevent flooding during precipitation events. Wakeman Drive would ultimately be realigned to allow for the development of the east parcel. These roadway realignments would not affect traffic patterns, and would ultimately improve access to the west side of the Airport during precipitation events, as well as continue to allow access to the east side of the Airport. Increases in surface traffic are assumed to be 60 vehicles or 120 trips per day during construction. Construction-related traffic is anticipated to occur before or after peak traffic times, and

would not significantly affect the level of service of roadways around the Airport. The City would phase construction in a way that allows Airport employees, tenants, and other users to have uninterrupted access to the Airport during construction-related activities. It is also anticipated that the potential increase in tenant employees at the Airport would also increase the number of people traveling to the Airport; however, given the nature of operations at the Airport, it is unlikely that all tenant employees would travel to the Airport everyday (tenant employees would only travel to the Airport when needed for general aviation flights). In addition, the potential increase in employees (city and tenant) would not be significant.

Construction and operation of the Proposed Action would occur entirely on Airport property and would not require the relocation of residents or businesses. Construction and operation of the Proposed Action would also not affect surrounding communities.

Water Resources

Wetlands

A field delineation of the survey area identified 4.84 acres of wetlands and 114 linear feet of other surface waters. The U. S. Army Corps of Engineers (USACE) provided a Preliminary Jurisdictional Determination confirming the field delineation. Of the identified wetlands, the proposed West Corporate Development could potentially affect 0.02-acre of palustrine emergent wetlands and 1.60-acres of palustrine forested wetlands on the west side of the Airport. The impact to 1.60 acres of palustrine forested wetlands would be to meet floodplain mitigation requirements. The development of the east parcel would not affect wetlands. A total mitigation requirement of 3.22 credits is anticipated for the wetland impacts. Currently, there are over 20 banks that provide mitigation credits within the service area associated with the Proposed Action with over 70 credits available across the service area; therefore, it is anticipated that the Proposed Action will be able to offset the wetland impacts through purchasing wetland credits.

The City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission (VMRC) to determine the appropriate permit(s) and mitigation measures. During the preliminary design of the Proposed Action, a Joint Permit is likely to be required for potential wetland effects. Based on the potential effects, it is likely that an Individual Permit from the USACE would be required as well as a Virginia Water Protection General Permit 4 from the VDEQ.

Floodplains

Approximately 58 acres of floodway and about 41 acres of 100-year floodplain are located within the project area. About 2.7 acres of the proposed West Corporate Development are within the designated floodway and 19.9 acres are within the 100-year floodplain. The proposed east parcel development would not affect the designated floodway or 100-year floodplain. To comply with minimum floodplain standards required by the National Flood Insurance Program (NFIP) for new buildings in a Zone AE floodplain, new structures must be elevated to or above the base flood elevation (BFE). This could require placing fill in the floodplain. Additionally, the portion of the existing Airport access road within the designated floodway would be raised above the BFE to provide improved accessibility during flood events. A floodplain analysis was conducted using Hydrologic Engineering Center's River Analysis System (HEC-RAS). This analysis concluded that the Proposed Action would not result in an increase in the 100-year flood elevation and would result in a change in flood boundaries on airport property only.

Floodplain impacts are unavoidable given the location of the Airport between Broad Run and Cannon Branch, the FAA safety area, and Airport property available for development. Efforts to minimize impacts on the floodway and 100-year floodplain were made during the design and grading of the proposed West Corporate Development. Observation Road was realigned to avoid the floodway to the maximum extent practicable at the intersection with Piper Lane. Roadway elevations were set at approximately the base flood elevation (BFE) as a safety measure to allow access to and from the Airport during a major storm event. To mitigate any increases in the BFE, an additional floodwater storage area was designed along Broad Run to convey floodwaters. The proposed mitigation site, adjacent to the project study area and on Airport property, achieved a "no-rise" condition of flood elevations required by the local floodplain authority, whereas other potential sites that were evaluated did not achieve a "no-rise" condition. Clearing & grubbing, excavation, other earthwork and ground stabilization are anticipated to complete the required mitigation.

Surface Waters

There are two surface water features in the project study area. Broad Road intersects the western portion of the project study area and Cannon Branch intersects the eastern portion of the project study area. Cannon Branch connects with Broad Run. Cannon Branch and the west bank of Broad Run have an associated RPA, which extends 100 feet on each side of the stream. The Proposed Action would increase impervious surface by approximately 25 acres. The Proposed Action would affect wetlands, which are also considered surface waters, but would not directly affect other surface waters in the project study area.

To meet Virginia Stormwater Management Program (VSMP) requirements for water quantity as identified in Virginia Administrative Code 9VAC 25-870-66, the Proposed Action would include on-site stormwater management facilities for detention. Water quality compliance as identified in 9VAC 25-870-65 requires that the Proposed Action include best management practices such as dry swales, bioretention, infiltration, and sheet flow to open space. In addition, the City would register for coverage under the VSMP General Permit for Discharges of Stormwater from Construction Activities (9VAC 25-870-1 *et seq.*) and would amend the Airport's Virginia Pollutant Discharge Elimination System (VPDES) Industrial Stormwater General Permit (VAR050985) for stormwater discharges associated with industrial activities. This update includes updating the Airport's Stormwater Pollution Prevention Plan (SWPPP). The SWPPP is not expected to significantly change, but would be modified to reflect the Proposed Action and the associated outfalls. The City would also be responsible for ensuring that a project-specific erosion and sediment control plan, and stormwater management plan if required, is submitted for review and approval prior to the start of ground disturbing activities.

Other Impact Categories

Additional categories addressed in the EA include, but are not limited to, climate, land use, noise and noise-compatible land use, visual effects, groundwater, and wild and scenic rivers. It is the FAA's finding that the Proposed Action will not have any significant effect on any of the addressed categories within the EA.

Mitigation Measures/Conditions of Approval

The FAA is conditioning approval of the Proposed Action upon implementation of the measures outlined below. The FAA may also take appropriate steps through contract plans, specifications, grant assurances, and special grant conditions to ensure these measures are undertaken.

Best Management Practices (BMPs) shall be implemented during construction to minimize erosion and sediment transport into surface waters following all standards and specifications under the Virginia Erosion & Sediment Control Handbook (1992, 3rd Edition).

Construction impacts will also be mitigated by the Sponsor's adherence to applicable BMPs specified in FAA AC 150/5370-10G, Standards for Specifying Construction of Airports, Item P-156, "Temporary Air and Water Pollution, Soil Erosion, and Siltation Control."

Registration for coverage under the General Permit for Discharges of Stormwater from Construction Activities (VAR10) is required for projects involving land disturbing activities equal to, or greater than, one acre, as well as development of a project-specific SWPPP. The SWPPP must be developed in accordance with the Virginia Stormwater Management Program (VSMP) permit regulations. It is anticipated that the City will amend the Airport's VPDES Industrial Stormwater General Permit (VAR050985) for stormwater discharges associated with industrial activities which will include updating the Airport's SWPPP.

A project-specific erosion and sediment control (ESC) plan must be completed, and approved by the locality in which the project is located, prior to any land disturbing activities equal to or greater than 10,000 square feet (2,500 square feet in a Chesapeake Bay Preservation Area). The ESC plan must be prepared in accordance with the Virginia Erosion and Sediment Control Law and Regulations (VESCL&R). In addition, a project-specific stormwater management (SWM) plan may be required prior to beginning land disturbing activities. If required, the SWM plan must be prepared in accordance with the Virginia Stormwater Management Law and Regulations (VSML&R).

Impacts to jurisdictional waters will require prior approval by the VDEQ and/or the USACE. Submit a Joint Permit Application (JPA) to VMRC for the proposed impacts to surface waters and wetlands.

All potential wetland and stream mitigation must comply with USACE-USEPA Compensatory Mitigation for Losses of Aquatic Resources (33 CFR 325 and 332/40 CFR 230). Non-impacted wetlands within 50 feet of any clearing, grading, or filling activities will be flagged or clearly marked during construction activities.

Fugitive dust must be kept to a minimum by using control methods outlined in 9VAC 5-50-60 et seq. of the Regulations for the Control and Abatement of Air Pollution.

If project activities include the open burning of construction material or the use of special incineration devices, this activity must meet the requirements under 9VAC 5-130 *et seq.* of the *Regulations* for open burning, and may require a permit.

All structures being demolished, renovated, or removed will be inspected for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations, state regulations 9VAC 20-81-620 for ACM and 9VAC 20-60-261 for LBP must be followed.

Projects requiring the installation, operation, or modification of fuel burning equipment or other air pollution emitting equipment may be subject to registration or permitting requirements in accordance with 9VAC 5-80-1100 *et* seq.

Limit the use of "cut-back" (liquefied asphalt cement, blended with petroleum solvents) for road construction and paving work in accordance with 9VAC5-45-780 *et seq.*

All solid waste, hazardous waste, and hazardous materials, including contaminated soils, must be managed in accordance with all applicable federal, state, and local environmental regulations.

If evidence of a petroleum release is discovered, it must be reported to DEQ, as authorized by Virginia Code§ 62.1-44.34.8 through 9 and 9VAC 25-580-10 *et seq.*

The installation and use of an aboveground storage tank (>660 gallons) for temporary fuel storage (>120 days) during the project must follow the requirements in 9VAC 25- 91-10 *et* seq.

Implement mitigation measures to protect site 44PW0729 from construction-related activities, which require placing temporary fencing along a 20-foot buffer surrounding the site.

Submit a Water Quality Impact Assessment (WQIA) to the Office of Local Government Programs for proposed land development within the RPA per 9VAC25-830-140.

Complete and coordinate a Conditional Letter of Map Revision (CLOMR) with the Federal Emergency Management Agency (FEMA) prior to initiation of any construction activities that affect the floodplain.

Coordinate roadway improvements with the appropriate local and stated entities during design and construction and obtain a Virginia Department of Transportation Land Use Permit if required.

All required permits and approved plans for the projects comprising the Proposed Action must be obtained prior to construction.

Construction activities must be conducted in accordance with the provisions set forth in applicable permits.

Public Involvement

A public notice was published in the Fauquier Times/Prince William Times/Gainesville Times beginning January 31, 2018. Copies of the draft EA were made available for the public to review at the Manassas Regional Airport Administrative Office, 10600 Harry J. Parrish Boulevard, Manassas, Virginia 20110; The Manassas Regional Airport website at http://www.manassasregionalairportprojects.com/; the Central Community Library, 8601 Mathis

Avenue, Manassas, Virginia 20110; and Manassas City Hall, 9027 Center Street, Manassas, Virginia 20110. A public workshop was held on February 20, 2018 at the Airport's Administrative Office Lobby and Conference Room. The comment period ended on March 3, 2018. No comments were received from the general public.

Comments on the draft EA were received from the VDEQ Office of Environmental Impact Review (OEIR), the EPA, and the VDGIF. Comments provided mitigation measures and recommendations for the Proposed Action. Mitigation measures are summarized in the Mitigation Measures/Conditions of Approval discussion above. Responses to comments have also been incorporated into the final EA and included in Appendix I.

Conclusion and Approval

I have carefully and thoroughly considered the facts contained in the attached EA. Based on that information, I find the proposed Federal action is consistent with existing national environmental policies and objectives of Section 101(a) of the National Environmental Policy Act of 1969 (NEPA) and other applicable environmental requirements. I also find the proposed Federal action will not significantly affect the quality of the human environment or include any condition requiring any consultation pursuant to section 102(2)(C) of NEPA. As a result, FAA will not prepare an EIS for this action.

Recommended: _____ 3/30/18
Susan Stafford — Date
Environmental Specialist, Beckley AFO

Approved: _____ 3/30/18
Matthew DiGiulian — Date
Manager, Beckley AFO

Disapproved: _____ _____
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Acronyms and Abbreviations

A

ACRP	Airports Cooperative Research Program
ALP	Airport Layout Plan

B

BFE	Base Flood Elevation
BMP	Best Management Practice

C

CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLOMR	Conditional Letter of Map Revision
CO	Carbon Monoxide
CWA	Clean Water Act

E

EA	Environmental Assessment
ESA	Endangered Species Act
EO	Executive Order

F

FAA	Federal Aviation Administration
FBO	Fixed Base Operator
FEMA	Federal Emergency Management Agency
FR	Federal Register

G

GAO	U.S. Government Accountability Office
GHG	Greenhouse Gas

H

HEC-RAS	Hydrologic Engineering Center's River Analysis System

I

ICAO	International Civil Aviation Organization

L

LED	Light-emitting Diode

N

NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NPS	National Park Service
NO_2	Nitrogen Dioxide
NPIAS	National Plan of Integrated Airport Systems

O

O_3	Ozone

P

Pb	Lead
PM	Particulate Matter

R

RCRA	Resource Conservation and Recovery Act
RPZ	Runway Protection Zone

S

SIP	State Implementation Plan
SO_2	Sulfur Dioxide
SPCC	Spill Prevention, Control and Countermeasures
SWPPP	Stormwater Pollution Prevention Plan

T

TSCA	Toxic Substances Control Act

U

USACE	U.S. Army Corps of Engineers
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

V

VaFWIS	Virginia Fish and Wildlife Information Service
VCP	Virginia Coastal Zone Management Program
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDOT	Virginia Department of Transportation
VMRC	Virginia Marine Resources Commission
VPDES	Virginia Pollutant Discharge Elimination System Permit
VSMP	Virginia Stormwater Management Program

CHAPTER 1

INTRODUCTION

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This Environmental Assessment (EA) identifies and evaluates the potential environmental effects of the construction and operation of various proposed airside and landside improvements at Manassas Regional Airport (Airport).

The Federal Aviation Administration (FAA) is the lead federal agency to ensure compliance with the National Environmental Policy Act (NEPA) for airport development actions. This EA is prepared in accordance with FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, as well as applicable Council on Environmental Quality (CEQ) regulations implementing NEPA, applicable Executive Orders (EOs), and other applicable federal, state, and local requirements.

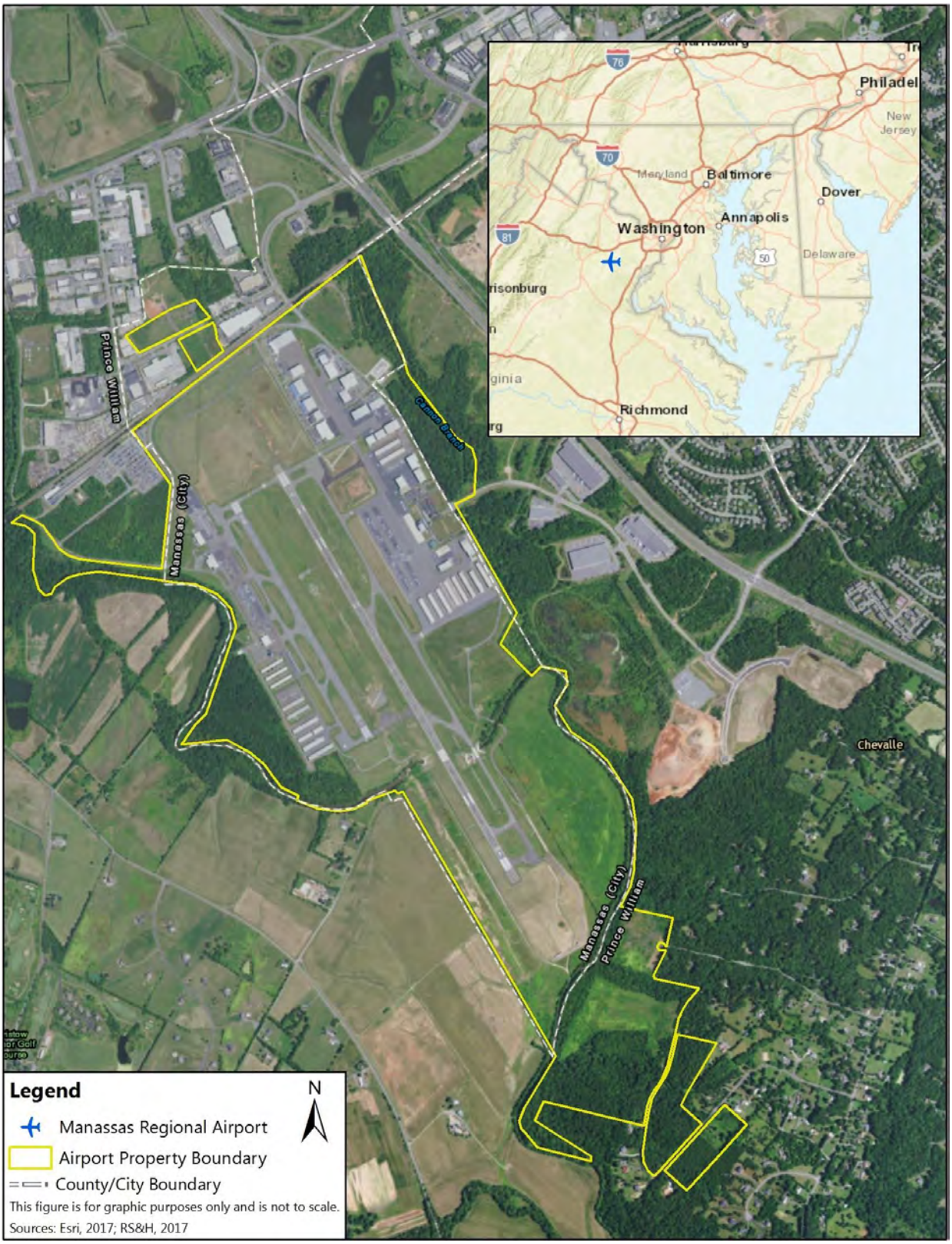
1.1 AIRPORT OVERVIEW

The City of Manassas (City), Virginia owns and operates the Airport. The Airport encompasses about 920 acres, largely within the City of Manassas. About 20 acres land on the east side of Airport property fall within the limits of Prince William County. Major roadways near the Airport include Nokesville Road to the north and Prince William Parkway to the east. Bristow Road is west of the Airport and Brentsville Road is south of the Airport. **Figure 1-1** shows the Airport location.

The FAA's National Plan of Integrated Airports Systems (NPIAS) classifies the Airport as a national general aviation airport, meaning that the Airport "supports the national airport system by providing communities with access to national and global markets." (FAA, 2016b) In 2016, the Airport had an estimated 87,312 total operations and no enplanements, with 402 based aircraft (FAA, 2017). The Airport is the busiest general aviation airport in the Commonwealth of Virginia, and in the 2011 *Virginia Airport System Economic Impact Study*, it was determined that the Airport contributed more than $234 million to the local economy (Virginia Department of Aviation, 2011).

The Airport has a terminal building, fixed base operator (FBO) hangars/buildings, and various corporate and general aviation hangars. There are two runways at the Airport: Runway 16L/34R is 6,200 feet long by 100 feet wide; Runway 16R/34L is 3,704 feet long by 100 feet wide.

FIGURE 1-1
AIRPORT LOCATION



1.2 PROPOSED ACTION

The City proposes to redevelop the west side corporate area and develop a parcel on the east side of the Airport (Proposed Action). The Proposed Action includes:

- On-Airport roadway improvements
- FBO building and parking lot reconstruction
- Corporate hangar/building and parking lot construction
- T-hangars demolition/replacement and construction and T-hangar parking lot
- West aircraft apron and taxilane tie down parking expansion
- Taxilane extension
- Maintenance and storage building construction
- Wash rack construction
- Utilities extension and stormwater drainage improvements
- Security fence extension

The following subsections describe the proposed development in the west corporate area and east parcel.

1.2.1 West Corporate Area

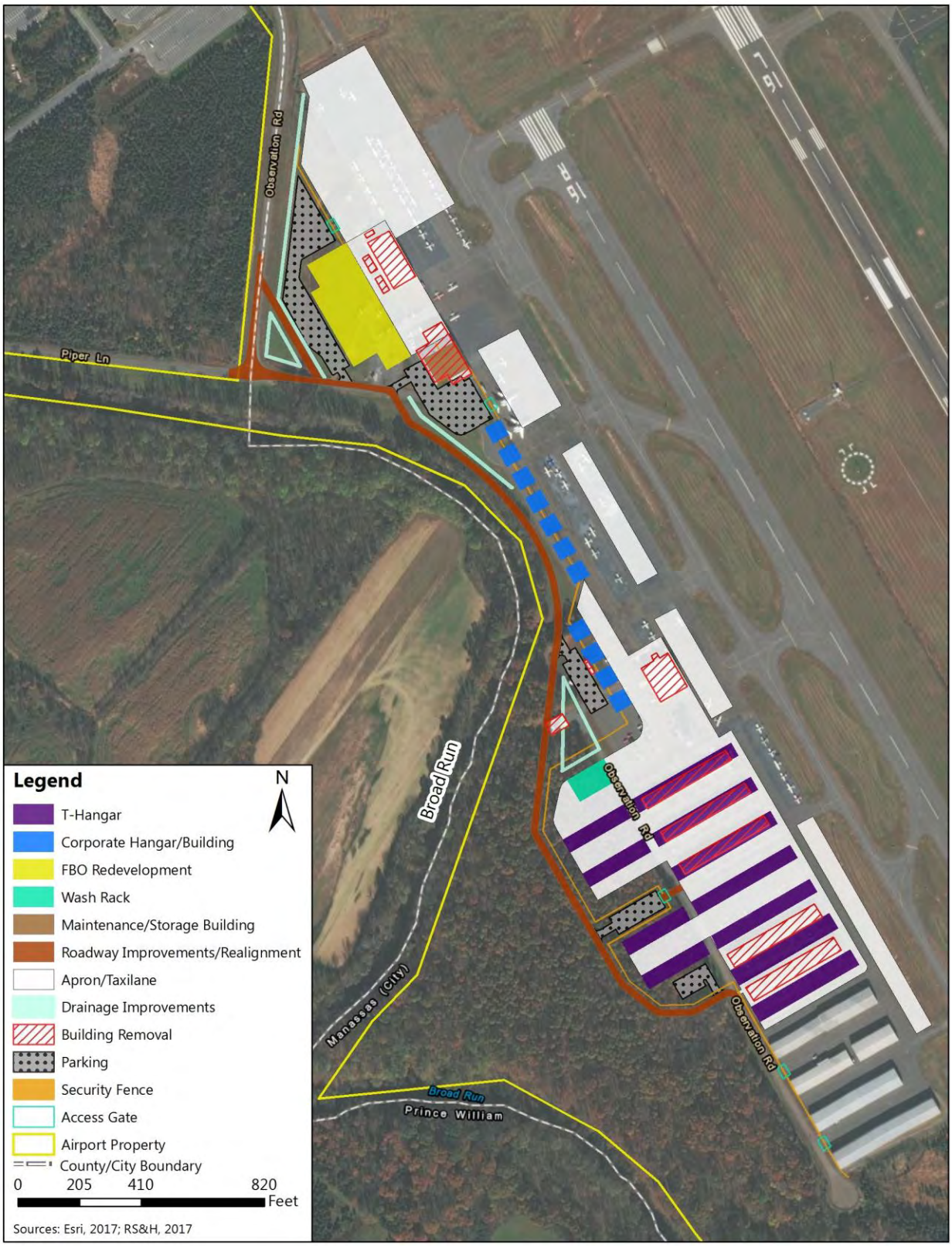
The proposed development of the West Corporate Area (**Figure 1-2**) is based on the West Corporate Development Study that the City completed in 2013. By analyzing the condition of area (e.g., condition of hangars/building, apron, etc.) and the Airport's short-term and long-term goals, specifically the Airport's Strategic Plan, the West Corporate Development Study provided a development layout that would maximize the redevelopment potential for the west side of the Airport.

On-Airport Roadway Improvements: Improvements would be made to the intersection of Observation Road and Piper Lane, located on the northwest side of the Airport (see **Figure 1-2**). Additionally, Observation Road would be realigned to the west (see **Figure 1-2**). The roadway improvements would equate to about 4,000 linear feet.

FBO Building and Parking Lot Reconstruction: The two existing FBO buildings and associated structures would be demolished and replaced by a 71,100 square foot consolidated FBO building to the west of the current FBO buildings (see **Figure 1-2**). A new parking lot would extend around the west and north sides of the proposed new FBO building to provide parking for FBO employees and users. The existing apron would be expanded to the northwest to provide FBO access to the airfield.

Corporate Hangar/Building and Parking Lot Construction: Eleven new corporate hangars/buildings would be constructed on the west side; all of the hangars would be about 3,600 square feet in size (see **Figure 1-2**). The corporate hangar/buildings could also serve as office space. All corporate hangars/buildings would have access to the airfield. Parking lots would also be constructed in the areas near the corporate hangars/buildings to provide parking for employees and users.

FIGURE 1-2
PROPOSED WEST CORPORATE AREA DEVELOPMENT



T-hangar Demolition/Replacement and Construction and T-hangar Parking Lot: Five T-hangars would be demolished, equating to about 130,000 square feet, and replaced with new T-hangars of similar size. In addition, six new T-hangars would be constructed in the same area (see **Figure 1-2**). The new T-hangars would increase the building footprints by a total of about 61,000 square feet. The apron area would be expanded to provide airfield access from these T-hangars.

Aircraft Apron Expansion: The west apron area would be extended by about 25 acres (see **Figure 1-2**). The apron expansion would provide airfield access for the proposed T-hangars, corporate hangars, and relocated FBO. The apron expansion would also provide increased areas for designated tie-downs and taxilane extensions.

Maintenance and Storage Building Construction: As **Figure 1-2** shows, an about 1,180 square foot maintenance and storage building would be constructed in the current location of one of the two FBO buildings located on the northwest side of the Airport (southern most building of the two FBO buildings), which would be demolished. The Airport maintenance equipment currently housed on the east side of the Airport would be relocated to the proposed new maintenance and storage facility.

Wash Rack Construction: An about 1,180 square foot wash rack would be constructed north of the T-hangars and would be available for all Airport tenants to use (see **Figure 1-2**).

Utilities Extension and Stormwater Drainage Improvements: Utilities, including electricity, water, sewer, and communication services, would be extended to the proposed new development from nearby electrical lines and water/sewer mains. Stormwater drainage improvements would occur west of the proposed relocated FBO facility and would accommodate the increase in impervious surface from the Proposed Action (see **Figure 1-2**).

Security Fence Extension: The Airport's security fence would be extended to encompass the extended improvements. Access gates would be added in various locations to provide access to the airfield by authorized Airport tenants and personnel.

1.2.2 East Parcel Area

The proposed development of the east parcel (**Figure 1-3**) is the maximum developable land area within the parcel. While the exact layout of the area has not been determined, this EA analyzes the maximum amount of development.

On-Airport Roadway Improvements: Wakeman Drive would be realigned to the northeast (see **Figure 1-3**). The roadway improvement would equate to about 3,000 linear feet.

FIGURE 1-3
POTENTIAL EAST SIDE PARCEL DEVELOPMENT



Corporate Hangar/Building and Parking Lot Construction: New corporate hangars/buildings would be constructed on the east side of varying sizes, equating to about 120,000 square feet (see **Figure 1-3**). The corporate hangar/buildings could also serve as office space. All corporate hangars/buildings would have access to the airfield. Parking lots would also be constructed in the areas near the corporate hangars/buildings to provide parking for employees and users. Under the current preliminary design, there would be about 35,000 square feet of parking.

Taxilane Extension: The taxilane would be extended by about 135,000 square feet to provide airfield access to the proposed development (see **Figure 1-3**).

Utilities Extension and Stormwater Drainage Improvements: Utilities, including electricity, water, sewer, and communication services, would be extended to the proposed new development from nearby electrical lines and water/sewer mains. Stormwater drainage improvements would occur to accommodate the increase in impervious surface from the Proposed Action. Because the development in this area has not been designed further than preliminary drawings, the specific location of the stormwater drainage improvement(s) is not known. However, the improvements would occur in the surrounding area, within the area analyzed in this EA.

Security Fence Extension: The Airport's security fence would be extended to encompass the extended improvements. Access gates would be added in various locations to provide access to the airfield by authorized Airport tenants and personnel.

1.2.3 Requested Federal Action and Time Frame

The City will request the FAA's unconditional approval of these projects, which are shown on the conditionally approved Airport Layout Plan (ALP).

Construction of the proposed development in the west corporate area is anticipated to start in calendar year 2018 and would occur over six phases. The City anticipates that the proposed development in the west corporate area would take about five years to complete, and that construction of the proposed development in the east parcel would start between 2018 and 2022.

1.3 DOCUMENT ORGANIZATION

This EA is organized into the following chapters:

Chapter 1: Introduction – This chapter provides an overview of the Airport, describes the Proposed Action that this EA evaluates, and outlines the organization of the EA.

Chapter 2: Purpose and Need – This chapter identifies the problem being addressed (i.e., need) and describes how the City of Manassas proposes to solve the problem (i.e., purpose).

Chapter 3: Alternatives – This chapter provides a description of the No Action Alternative and identifies the alternatives that this EA considers or eliminates from detailed analysis.

Chapter 4: Affected Environment – This chapter provides an overview of the existing environmental conditions in the areas that the Proposed Action may affect. This chapter also identifies past, present, and reasonably foreseeable future actions that may contribute to cumulative impacts when considered in combination with the Proposed Action.

Chapter 5: Environmental Consequences – This chapter describes the potential environmental effects that the Proposed Action and each reasonable alternative would have on the affected environment. Pursuant to regulations and CEQ Guidance documents, this chapter also discusses cumulate effects. That discussion focuses on the effects that the Proposed Action would have on environmental resources, in combination with the effects of those resources from past, present, and reasonably foreseeable future actions.

Where appropriate, this EA contains figures and tables to clarify the analysis presented in this chapter.

Chapter 6: Agency Coordination and EA Distribution – This chapter describes the coordination process associated with the development of the EA.

Chapter 7: List of Preparers – This chapter identifies the individuals who prepared, contributed to, and reviewed this EA.

Chapter 8: References – This chapter lists the references used in the development of this EA.

Appendices – The appendices contain relevant material, analyses, or technical reports used in preparing this EA.

CHAPTER 2

PURPOSE AND NEED

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FAA Order 1050.1F, Section 6-2.1(c) states that the Purpose and Need should briefly describe the underlying purpose and need for the federal action and provide the foundation for identifying reasonable alternatives to a Proposed Action. The Purpose and Need identifies the problem facing the proponent (i.e., the "need" for the action) and the proposed solution to the problem (i.e., the "purpose" of the action).

2.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

The City of Manassas seeks to maximize the redevelopment potential on the west side of the Airport and to initiate new development with access to the airfield on the east side of the Airport. The current west side infrastructure is aging and existing hangars and pavements have exceeded their useful life. In addition, portions of the west side of the Airport are underutilized. The Airport's goal is to renovate or upgrade the facilities located west of Runway 16R-34L and to facilitate new development on the east side of the Airport.

The City completed an airport strategic plan for the years 2012 through 2021. This plan identified short-term and long-term goals of the Airport. In working toward those goals, and consistent with the FAA's mission of promoting a safe and efficient National Airspace System (NAS), the purpose of the Proposed Action is to meet the following needs:

1. Develop and maintain safe and modern facilities.
2. Improve the Airport's ability to be financially self-sustaining.

2.1.1 Develop and Maintain Safe and Modern Facilities

The City completed the *West Corporate Redevelopment Study* and Airport Master Plan Update (City of Manassas, 2013b). These studies identified the need for on-Airport roadway improvements, additional building/hangar space and building/hangar replacement, and improvements to the airfield pavement to continue to work toward the long-term goals of the City. By addressing these various improvement needs, the City is able to develop and maintain safe, modern facilities at the Airport. In addition to the airport planning reports, the *2032 Comprehensive Plan Manassas Next* recommends improving the Airport's facilities to enhance safety and comply with FAA design standards (City of Manassas, 2013a). A summary of these needs follows.

On-Airport Roadway Deficiencies: Sections of Observation Road and Piper Lane are within the Broad Run floodway and 100-year floodplain. These roadways frequently experience flooding, which restricts access to facilities on the west side of the Airport (see photo right). Additionally, the swales along the intersection of Observation Road and Piper Lane, public roadways, have experienced erosion.



The City recently acquired a parcel of land on the east side of the Airport. Currently, Wakeman Drive, a public roadway, separates the east parcel from the remainder of the Airport property. In order to provide access to and from the airfield from future development in the east parcel, Wakeman Drive would need to

be realigned east of the east parcel. The current alignment of Wakeman Drive prevents the City from developing this land for its planned use as aviation development because it prevents airfield access.



Building/Hangar Space and Age: All of the Airport-owned hangars on the west side of the Airport are leased and the City has a waiting list of people who have requested a hangar when one becomes available. Many of the existing hangars have exceeded their useful lives and have deteriorated to the point that refurbishment would not be cost effective (see photo left).

During the development of the *West Corporate Redevelopment Study*, the City held meetings for interested tenants, stakeholders, the Airport Commission, and the public to review airport alternatives and solicit feedback. The participants preferred having an FBO on the west side of the airfield to service the needs of pilots and aircraft. Since all of the existing hangars are occupied, the participants liked the plan to increase the number of hangars on the west side. The participants also liked the planned increase in available parking to make it easier to access their aircraft on the west airfield. Another development element that was recommended by the tenants was a wash rack.

Airfield Pavement Conditions: Investigation of the west corporate development area revealed numerous pavement deficiencies including failing pavement sections, deficient pavement widths, and insufficient drainage. A pavement maintenance and management report completed at the Airport in 2008 found that many of the apron areas in the west airfield area had pavement condition indices[1] between 55 and 67, representing fair to good conditions. Forecast 2018 conditions for these areas yielded indices between 37 and 49, which indicates poor to fair conditions. Recent site visits to the area in 2016 and 2017 indicate that the pavement is in poor to fair condition. Many of these taxilanes were in visibly poor condition during the site investigation (see photo right).



2.1.2 Improve Financial Self-Sustainability

The FAA NPIAS for 2017-2021 identifies airport financial performance a key indicator of NAS performance. The financial performance of an individual airport is an important component of the NAS because nonfederal revenues from rents, fees, and taxes paid by airport users largely support the system. The NPIAS states: "Airports should be affordable to both users and the Government, relying primarily on user fees and placing minimal burden on the general revenues of the local, state, and federal governments." (FAA, 2016b)

Currently, portions of the Airport property are underutilized. Specifically, areas southwest of Observation Road and northwest of Wakeman Drive are undeveloped and in a prime location for development. The

[1] A pavement condition index is a numerical index between 0 and 100 that reflects the structural integrity and surface condition of the pavement. Zero indicates a failed pavement and 100 represents new pavement.

generation of revenue through the proposed aviation related development will help the Airport to become more efficient, and supports the FAA's statutory responsibilities under 49 U.S.C. § 47101 and the City's grant obligations arising from the acceptance of property and federal grant funds. Grant Assurance 24 requires that an airport sponsor maintain a fee and rental structure for the facilities and services at the airport to be as self-sustaining as possible.

In addition to its role in the NAS, the Airport is a vital component of the City's economy. According to the 2032 Comprehensive Plan: Manassas Next (City of Manassas, 2013a), the Airport offers accessibility to the region, and many business uses can take advantage of the proximity to support business growth and the opportunity for economic development. In addition, the City proposes to encourage greater utilization and further development of the Airport as a key provider of air service in the region. Key customers of economic development at the Airport include developers, tenants, airport operators, and existing businesses (City of Manassas, 2016). The proposed development would encourage greater utilization and further development of the Airport as a key provider of air service in the region.

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CHAPTER 3

ALTERNATIVES

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NEPA, CEQ regulations, and FAA Order 1050.1F require an analysis of alternatives that satisfy the Purpose and Need for a proposed action. As **Chapter 2** of this EA describes, the City's Purpose for the Proposed Action is to develop and maintain safe and modern facilities and to improve the Airport's ability to be financially self-sustaining. The Need is to replace aging infrastructure that have exceeded their useful life and to maximize the redevelopment potential on the west side of the Airport and to initiate new development with access to the airfield on the east side of the Airport. This serves as a basis for the comparison of alternatives and may prompt the selection of an alternative that has fewer environmental effects.

In addition, NEPA requires agencies to consider a "no action" alternative in their NEPA analyses and to compare the effects of not taking action with the effects of the action alternative(s).

3.1 SCREENING CRITERIA FOR ALTERNATIVES

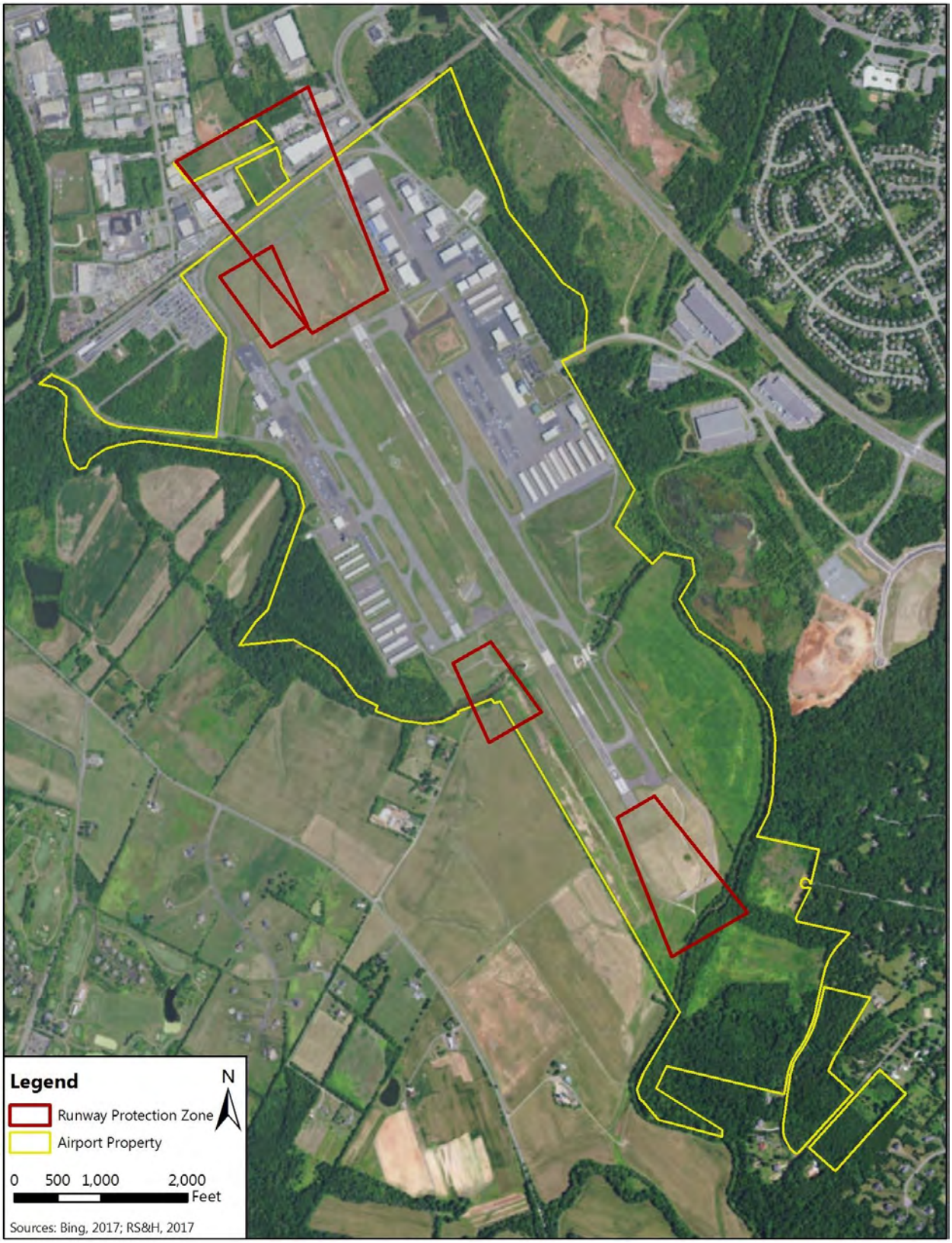
The potential alternatives included on-Airport locations that could accommodate new aviation development of similar magnitude to the Proposed Action. The consideration of alternatives also addressed the potential use of environmental resources. In compliance with EO 11998, *Floodplain Management* and U.S. Department of Transportation (USDOT) Order 5650.2, *Floodplain Management and Protection*, this EA also evaluates alternatives that might avoid or minimize effects to the 100-year floodplain. FAA Order 5050.4B (Paragraph 706.d(5)(a)) requires consideration of alternatives if unresolved conflicts regarding environmental resources would result from implementation of a proposed action. The following sections describe the screening criteria used to evaluate alternatives.

3.1.1 Developable on-Airport Land

The investigation of developable on-Airport land followed the guidance of FAA Advisory Circular (AC) 150-5300-13A Change 1, *Airport Design,* and Code of Federal Regulations (CFR) Title 14 Part 77, *Safe, Efficient Use, and Preservation of the Navigable Airspace* (Part 77). Areas within designated FAA safety areas (e.g., runway protection zone (RPZ)), or areas in which building height is restricted for airspace protection, were eliminated from consideration.

According to FAA AC 150-5300-13A Change 1, RPZs are trapezoidal areas off the end of the runways that serve to enhance the protection of people and property on the ground in the event an aircraft travels beyond the runway end. The Airport maintains and clears on-Airport RPZs of incompatible objects and activities. The FAA guidance considers the congregation of people and new construction of buildings or other improvements obstructions are not permitted in an RPZ. New aviation development (i.e., incompatible objects and activities) within a RPZ is not compatible with aircraft operations at the Airport. Therefore, on-Airport property within existing RPZ areas were eliminated from consideration of new aviation development at the Airport. **Figure 3-1** shows the location of the RPZs.

FIGURE 3-1
AIRPORT RPZS



3.1.2 Avoidance / Minimization of 100-Year Floodplain

The 100-year floodplain and floodway extends over a majority of the Airport property. A floodplain is a land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. The floodplain consists of two sections: the floodway and the flood fringe. The Federal Emergency Management Agency (FEMA) defines the "regulatory floodway" as the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Floodways carry the bulk of the floodwater downstream, and is usually the area where water velocities and forces are the greatest. To the greatest extent, a floodway should be keep free of encroachments including new development or substantial improvements.

EO 11988, *Floodplain Management*, requires federal agencies to avoid, to the greatest extent possible, the long- and short-term adverse effects associated with use and/or modification of the 100-year floodplain, and to avoid direct or indirect development in the floodplain wherever there is a practicable alternative. Alternate on-Airport areas available for aviation development having lesser floodplain impacts would therefore be preferable to those with greater floodplain impacts. An alternative with greater floodplain impacts would not be consistent with EO 11998 and is not carried forward for further environmental analyses in this EA. **Figure 3-2** shows the FEMA-designated flood zones in and around the Airport.

3.2 ALTERNATIVES CONSIDERED

The alternatives screening criteria described in **Section 3.1** were used to identify on-Airport areas that could accommodate new aviation development. Developable land was also determined by narrowing the search to on-Airport areas that would be compatible with aircraft operations, have access to existing roadway, and minimize floodplain encroachment. In addition, NEPA requires agencies to consider a "no action" alternative in NEPA analyses and to compare the effects of not taking action with the effects of the action alternative(s). The No Action Alternative serves as a baseline to assess the effects of the Proposed Action.

3.2.1 No Action Alternative

Under the No Action Alternative, the City would not redevelop the west corporate area or develop the east parcel. Observation Road would remain in its current alignment. In addition, there would be no need to seek the FAA's unconditional approval of the ALP. The City would continue to operate the Airport and serve existing and forecast aviation activity.

3.2.2 Alternative A

As a result of the developable on-Airport land analysis, there is an alternative on-Airport area that is currently undeveloped, outside of the Part 77 transitional surface and RPZs (congregation of people and new construction of buildings or other improvements obstructions are not permitted in an RPZ), and has existing access to local roads. As **Figure 3-3** shows, Alternative A would provide about 100 acres of on-Airport property for new aviation hangars, apron, and taxilanes. This area is located on the east side of the airfield, southeast of the existing T-hangars, and northwest of Broad Run. Under Alternative A, Wakeman Drive would be extended approximately 1,100 feet to the southeast to provide vehicular access to this alternative's proposed new aviation development.

FIGURE 3-2
FLOODPLAINS IN AND AROUND THE AIRPORT

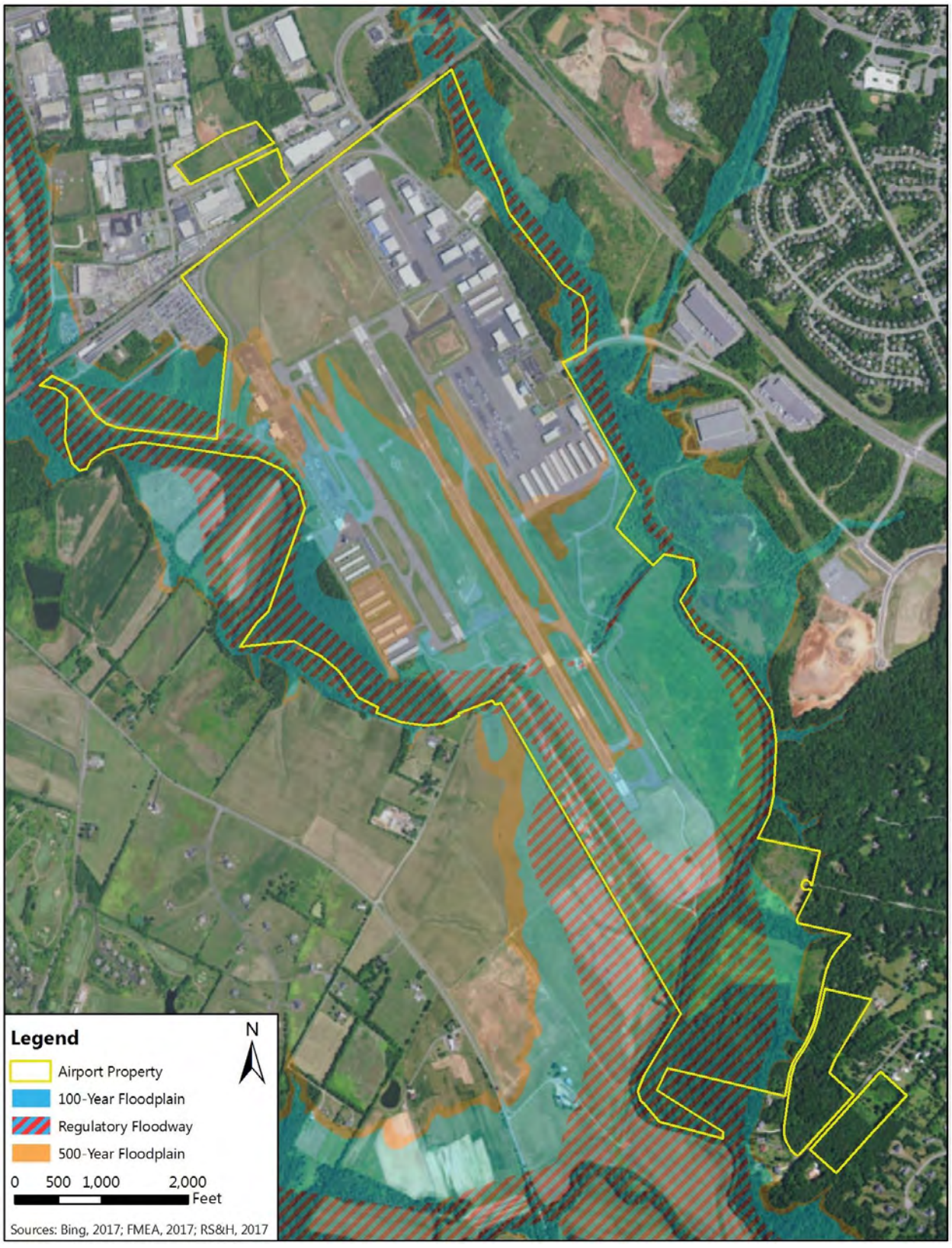
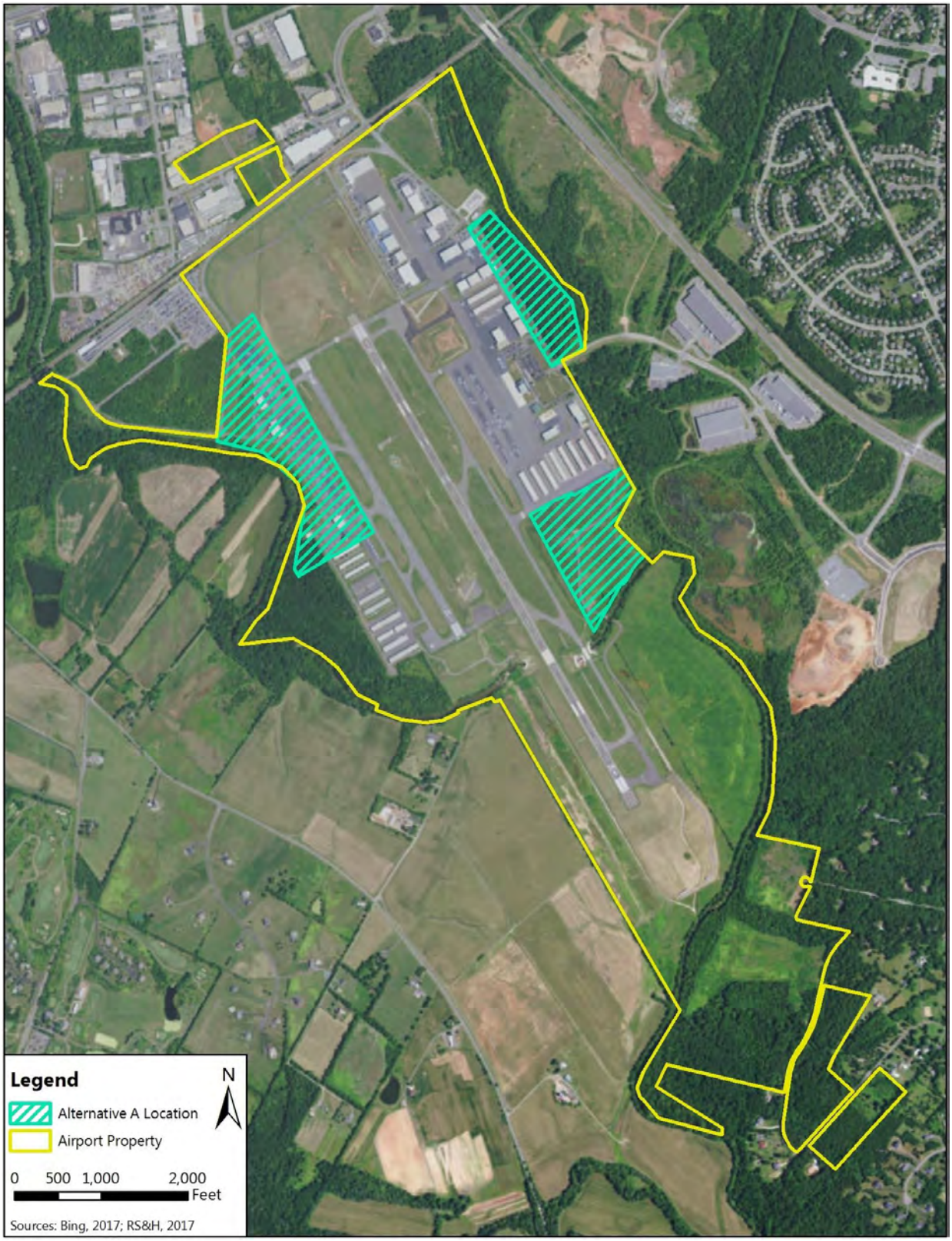


FIGURE 3-3
ALTERNATIVE A



3.2.3 Alternative B

There is an additional on-Airport area that is undeveloped and outside of the Part 77 transitional surface and RPZs. As **Figure 3-4** shows, Alternative B would provide about 110 acres of on-Airport property for new aviation hangars, apron, and taxilanes. Alternative B is located on the east side of the Airport airfield and extends from the existing T-hangars to the southern end of the Airport property. Under Alternative B, Wakeman Drive would be extended about 4,000 feet to the southeast to provide vehicular access to the area.

3.2.4 Proposed Action

As **Section 1.2** describes, the Proposed Action includes developable areas on the west and east sides of the Airport that collectively encompass about 80 acres, as depicted on **Figure 3-5**. The City proposes to redevelop the west side corporate area and develop a parcel on the east side of the Airport (Proposed Action). The Proposed Action includes:

- On-Airport roadway improvements
- FBO building and parking lot reconstruction
- Corporate hangar/building and parking lot construction
- T-hangars demolition/replacement and construction and T-hangar parking lot
- West aircraft apron and taxilane tie down parking expansion
- Taxilane extension
- Maintenance and storage building construction
- Wash rack construction
- Utilities extension and stormwater drainage improvements
- Security fence extension

3.3 ALTERNATIVES EVALUATION

Alternatives were evaluated for compatibility with existing aircraft operations and whether development of the alternative would avoid and/or minimize the effects to areas protected by EO 11988, *Floodplain Management* (i.e., avoidance or minimization of effects to the 100-year floodplain).

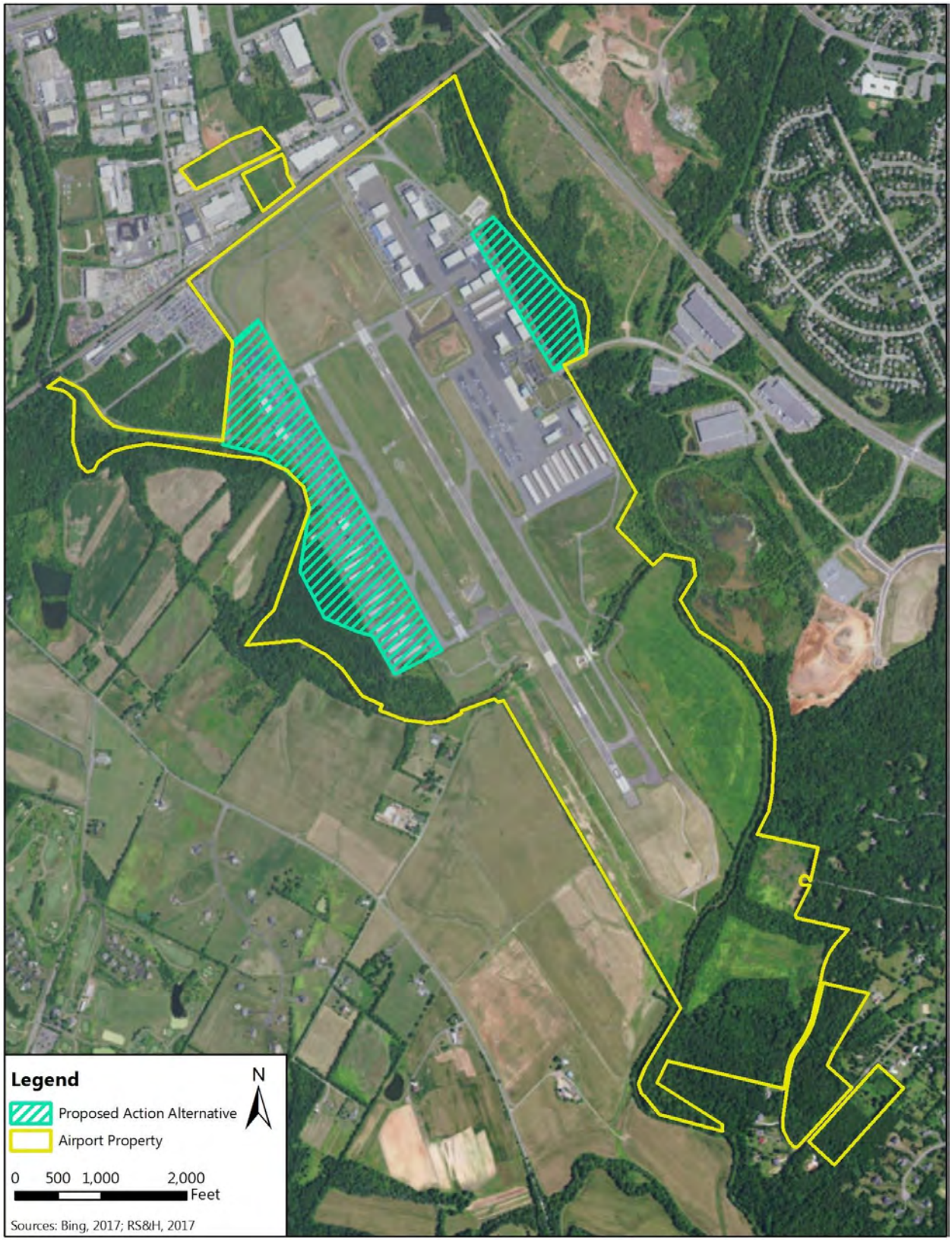
3.3.1 No Action Alternative

The No Action Alternative would not satisfy the Purpose and Need for the Proposed Action because it would not allow the City to update and enhance the safety and efficiency of Airport facilities, nor would it allow the City to undertake activities to ensure the Airport remains a profitable enterprise with a positive economic impact. The EA retains the No Action Alternative for environmental baseline comparative purposes, to fulfill CEQ regulations (40 CFR Part 1502) implementing NEPA, and to comply with FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*. Therefore, the No Action Alternative is retained as the base against which the effects of the Proposed Action can be assessed (see **Chapter 5** for further details).

FIGURE 3-4
ALTERNATIVE B



FIGURE 3-5
PROPOSED ACTION ALTERNATIVE



3.3.2 Alternative A

Alternative A (see **Figure 3-3**) would provide more area for development than the Proposed Action. However, it would not be consistent with the screening criterion of minimizing floodplain encroachment to the maximum extent practicable. Alternative A would affect about 20 acres of the 100-year floodplain (similar to the Proposed Action) and about five acres of the regulatory floodway (about two acres more than the Proposed Action). Therefore, Alternative A would not avoid or minimize impacts to the 100-year floodplain when compared to the Proposed Action. As a result, this EA does not carry Alternative A forward for further analysis.

3.3.3 Alternative B

As with Alternative A, Alternative B (see Figure 3-4) would provide more area for development than the Proposed Action. However, it would not minimize floodplain encroachment to the maximum extent practicable. Alternative B would affect about 100 acres of the 100-year floodplain, about 80 more acres than the Proposed Action and Alternative A. In addition, Alternative B would affect about 20 acres of the regulatory floodway, about 17 more acres than the Proposed Action and 15 more acres than Alternative A. Therefore, Alternative B would not avoid or minimize impacts to the 100-year floodplain when compared to the Proposed Action. As a result, this EA does not carry Alternative B forward for further analysis.

3.3.4 Proposed Action

In order to minimize encroachment into the 100-year floodplain and avoid the existing regulated floodway, the Proposed Action's west side development does not fully extend to the Airport's western property boundary and does not include an otherwise developable 30-acre parcel south of the east parcel area shown in **Figure 3-4**. In addition, water resource specialists reviewed current FEMA Flood Insurance Rate Maps to assist with the development in the both project areas to minimize and, where possible, avoid impacts to the floodway and floodplain. Implementation of the Proposed Action would relocate Observation Road outside of the existing regulatory floodway and provide uninterrupted vehicular access to the west corporate development area when Broad Run overflows its banks and floods the intersection of Observation Road and Piper Lane. Avoiding a flooded intersection would provide emergency vehicles an uninterrupted roadway needed to access the west corporate development area. The Proposed Action would unavoidably affect about 20 acres of the 100-year floodplain (similar to Alternative A) and 2.7 acres of the regulatory floodway (about two acres less than Alternative A). Given the location of the Airport between Broad Run and Cannon Branch, the FAA safety area, and Airport property available for development, floodplain impacts are not completely unavoidable. As a result, the Proposed Action is carried forward for further analysis in **Chapter 5**.

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CHAPTER 4

AFFECTED ENVIRONMENT

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As FAA Orders 1050.1F and 5050.4B require, this chapter describes the environmental resources that the Proposed Action or its reasonable alternatives may affect. This information establishes a baseline for use in determining the potential effects of the Proposed Action and any reasonable alternatives.

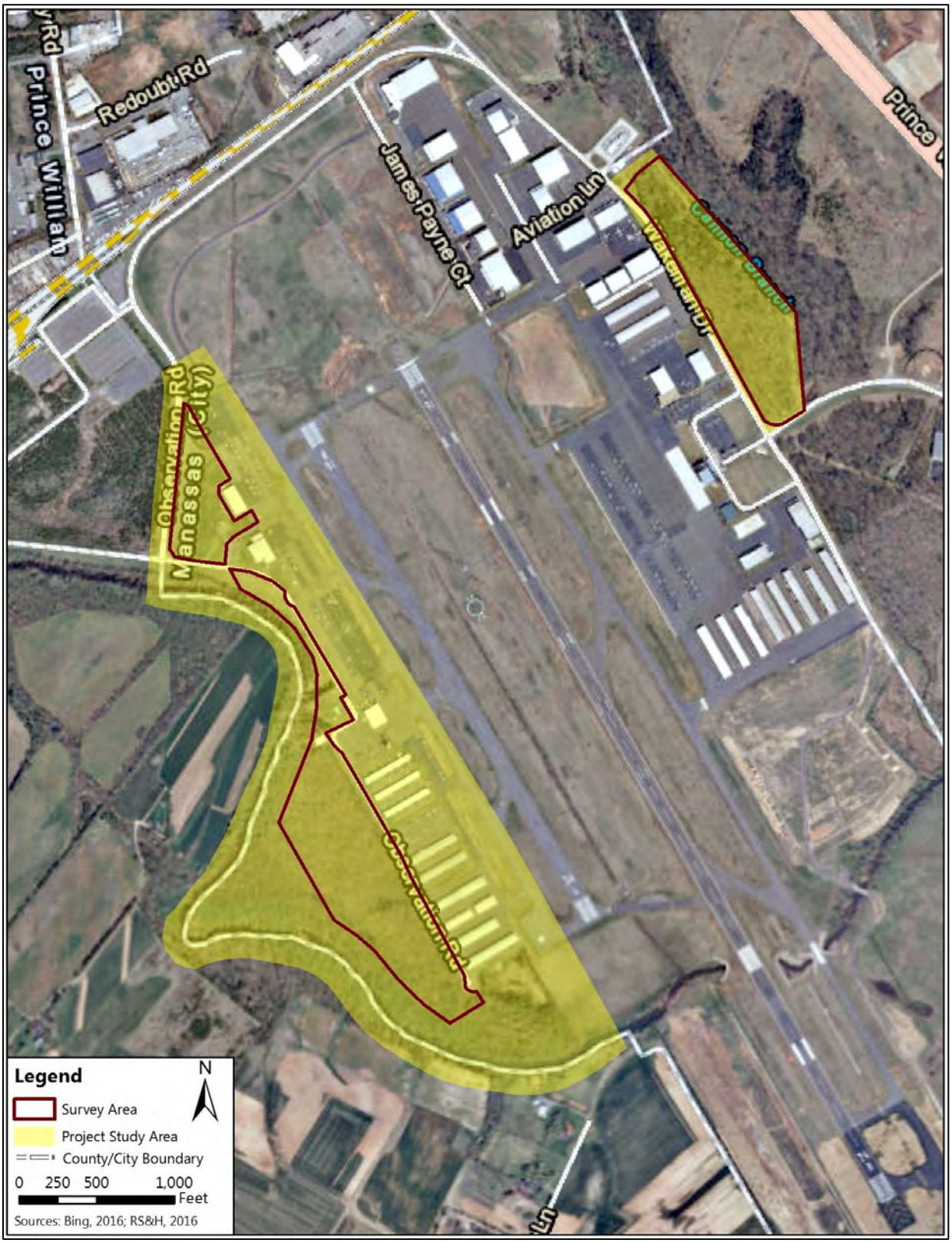
A survey area was established for the purposes of this EA to identify the area where ground-disturbing activities may occur in previously undeveloped area. The survey area excludes areas that have been previously disturbed because the environmental conditions of that area are well known. Conversely, the environmental characteristics (e.g., wetlands, biological resources, hazardous materials, etc.) of the areas that are undeveloped or undisturbed have not been previously recorded. The survey area is about 50 acres in size. The survey area serves as the boundaries for the biological, hazardous materials, archaeological, and wetland surveys. A project study area was also established for this EA in order to identify the environmental characteristics of the entire area that may be directly or indirectly affected by the Proposed Action. The project study area encompasses about 160 acres and encompasses the area that construction and operation of the Proposed Action may affect (see **Chapter 5**, Environmental Consequences, for further information on potential environmental effects). **Figure 4-1** shows the survey area and project study area.

As **Chapter 6** describes in detail, early coordination letters were sent to federal, state, and local agencies regarding the Proposed Action. Information received from agencies pertinent to the affected environment is included in this chapter. Agency response letters are located in **Appendix A**.

This chapter describes the existing conditions for the following environmental resources:

- Air Quality (**Section 4.1**)
- Biological Resources (**Section 4.2**)
- Climate (**Section 4.3**)
- Coastal Resources (**Section 4.4**)
- Department of Transportation Act, Section 4(f) (**Section 4.5**)
- Hazardous Materials, Solid Waste, and Pollution Prevention (**Section 4.6**)
- Historical, Architectural, Archaeological, and Cultural Resources (**Section 4.7**)
- Natural Resources and Energy Supply (**Section 4.8**)
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks (**Section 4.9**)
- Visual Effects (**Section 4.10**)
- Water Resources (**Section 4.11**)

FIGURE 4-1
PROJECT STUDY AREA

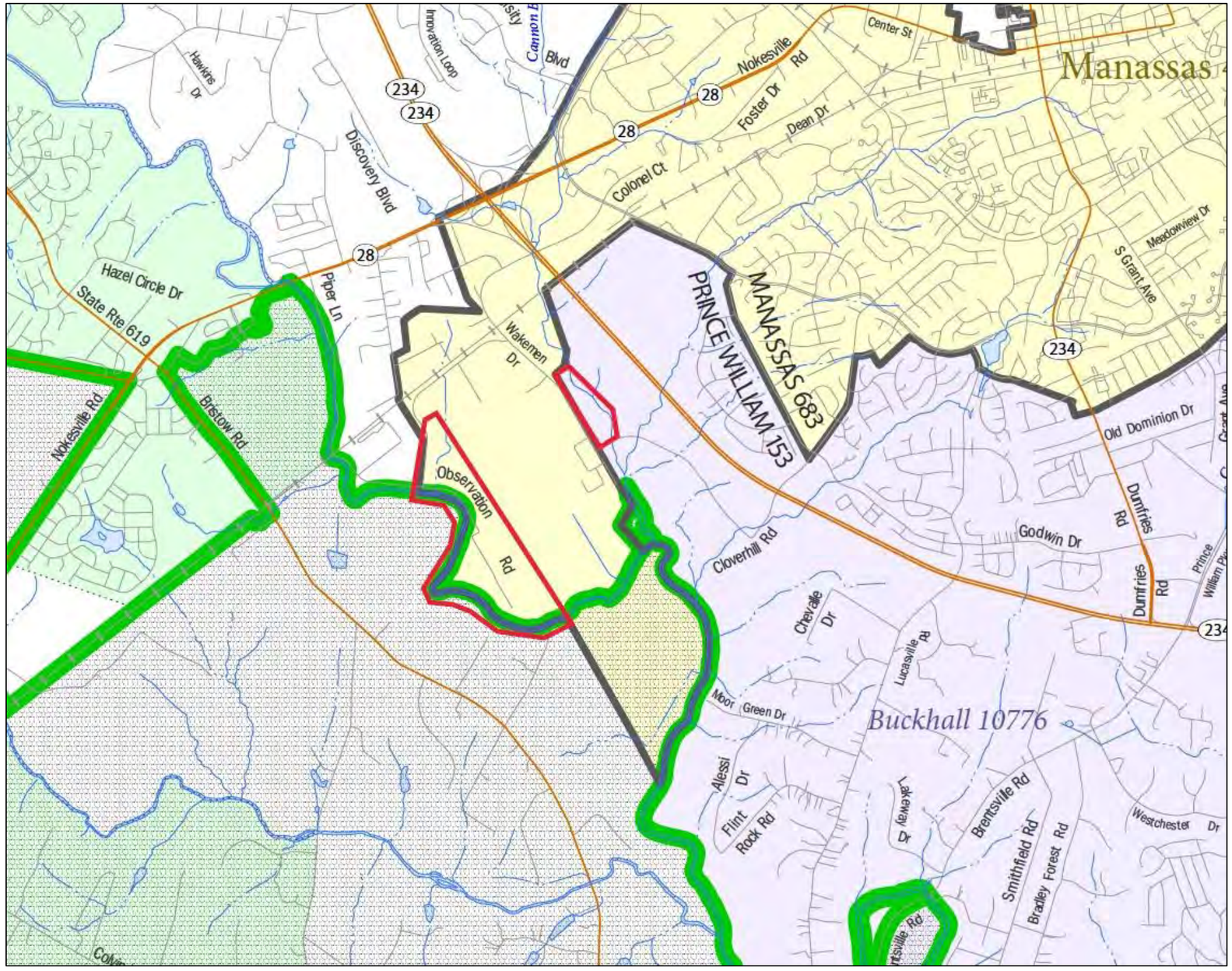


Based on the following information, this EA does not analyze potential effects to these resource categories:

- Farmlands: Portions of the project study area are classified as prime farmland or farmland of statewide importance. Specifically, these areas are at the intersection of Observation Road and Piper Lane, the southern end and western edge of the western project study area, a majority of the eastern project study area. However, the majority project study area and the entire area where ground disturbing activity would occur, is within an area that the U.S. Census Bureau identifies as an urban area (U.S. Census Bureau, 2010). Under Section 523(10)(B) of the Farmland Protection Policy Act, land that the U.S. Census Bureau identifies as urbanized areas are not subject to the provisions of the Farmland Protection Policy Act. Figure 4-2 shows and excerpt from the official U.S. Census Bureau Urbanized Area Map, with the project study area outlined in red.
- Land Use: The Proposed Action would be constructed on Airport property and would be consistent with the current and future use of the Airport. In addition, the Proposed Action would not affect local comprehensive plans or zoning.
- Noise and Noise Compatible Land Use: The Proposed Action would not change the number or type of existing and future aviation operations at the Airport. Therefore, the Proposed Action would not affect the noise environmental at or around the Airport. Temporary noise from construction of the Proposed Action would be localized to the immediate vicinity of the Airport. The closest residential area is about 500 feet southeast of the project study area. Because construction would occur primarily during day-time hours, and given the dense vegetation, and current noise environment in the area (operation of aircraft), construction of the Proposed Action is not anticipated to cause significant effects to noise-sensitive land uses. In addition, construction and operation of the Proposed Action would comply with local noise ordinances.
- Wild and Scenic Rivers: The closest Wild and Scenic River is White Clay Creek, about 115 miles northeast of the project study area. Given the distance from the Proposed Action, the Proposed Action would not affect this resource.

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FIGURE 4-2
2010 U.S. CENSUS BUREAU URBANIZED AREA MAP WITH PROJECT STUDY AREA



LEGEND

SYMBOL DESCRIPTION	SYMBOL	LABEL STYLE
International		CANADA
Federal American Indian Reservation		L'ANSE RES 1880
Off-Reservation Trust Land		T1880
Urbanized Area		Dover, DE 24580
Urban Cluster		*Tooele, VT 88057*
State (or statistically equivalent entity)		NEW YORK 36
County (or statistically equivalent entity)		ERIE 029
Minor Civil Division (MCD) [1,2]		Bristol town 07485
Consolidated City		MILFORD 47500
Incorporated Place [1,3]		Davis 18100
Census Designated Place (CDP) [3]		*Incline Village 35100*

DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL
Interstate	3	Water Body	*Pleasant Lake*
U.S. Highway	2	Military	Fort Belvoir
State Highway	4	Outside Subject Area	
Other Road	Marsh Ln		
Railroad	Southern RR		
Perennial Stream	*Tumbling Cr*		
Intermittent Stream	*Piney Cr*		

Where international, state, county, and/or MCD boundaries coincide, the map shows the boundary symbol for only the highest-ranking of these boundaries.

1 A ' ° ' following an MCD name denotes a false MCD. A ' ° ' following a place name indicates that a false MCD exists with the same name and FIPS code as the place; the false MCD label is not shown.

2 MCD boundaries are shown in the following states in which some or all MCDs function as general-purpose governmental units: Connecticut, Illinois, Indiana, Kansas, Maine, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New Hampshire, New Jersey, New York, North Dakota, Ohio, Pennsylvania, Rhode Island, South Dakota, Vermont, and Wisconsin. (Note that Illinois and Nebraska have some counties covered by nongovernmental precincts and Missouri has most counties covered by nongovernmental townships.)

3 Place label color corresponds to the place fill color.
Label colors: Davis Davis Davis Davis Davis

Geographic Vintage: 2010 Census (reference date: January 1, 2010)
Data Source: U.S. Census Bureau's MAF/TIGER database (TAB10)
Map Created by Geography Division: March 10, 2012

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4.1 AIR QUALITY

The Clean Air Act (CAA) (42 U.S.C. §§ 7401-761q) is the primary statute that relates to air quality. The U.S. Environmental Protection Agency (USEPA) sets National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The USEPA identifies the following six criteria air pollutants for which NAAQS are applicable:

1. carbon monoxide (CO)
2. lead (Pb)
3. nitrogen dioxide (NO_2)
4. ozone (O_3)
5. particulate matter (PM_{10} and $PM_{2.5}$)
6. sulfur dioxide (SO_2)

USEPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels (USEPA, 2017). The USEPA classifies geographic areas that are in violation of one or more NAAQS as nonattainment areas. The USEPA bases nonattainment designations on the degree of nonattainment (e.g., serious, severe, moderate, marginal), which dictates the year by which the area must be brought into attainment of the NAAQS. States with nonattainment areas must develop a State Implementation Plan (SIP) that demonstrates how the state will bring the area into attainment of the NAAQS within designated timeframes. The USEPA classifies areas where concentrations of the criteria pollutants are below the NAAQS as attainment areas. Lastly, areas with prior nonattainment status that have since transitioned to attainment are maintenance areas.

The project study area is in a maintenance area for the USEPA's $PM_{2.5}$ standard. The area is a marginal nonattainment area for the USEPA's 2008 O_3 standard. The Metropolitan Washington Air Quality Committee is the lead planning organization for the project study area. As the USEPA requires, the Metropolitan Washington Air Quality Committee has a SIP for the 8-hour O_3 standard and a maintenance plan for the $PM_{2.5}$ standard (Metropolitan Washington Council of Governments, 2007; Metropolitan Washington Air Quality Committee, 2013). According to the VDEQ (see **Appendix F**), the project study area is within an emission control area for oxides of nitrogen (NOx) and volatile organic compounds (VOCs).

4.2 BIOLOGICAL RESOURCES (INCLUDING FISH, WILDLIFE, AND PLANTS)

Relevant federal laws, regulations, EOs, and other guidance related to the protection of biological resources include:

- Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544)
- Bald and Golden Eagle Protection Act (16 U.S.C. §§ 668 *et seq.*)
- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. § 1801 *et seq.*)
- Fish and Wildlife Coordination Act of 1980 (16 U.S.C. § 661-667)
- EO 13112, *Invasive Species* (64 Federal Register (FR) 6183)
- Marine Mammal Protection Act (16 U.S.C. § 1361 *et seq.*)

- Migratory Bird Treated Act (MBTA) (16 U.S.C. §§ 703 *et seq.*)
- EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (66 FR 3853)
- Incorporating Biodiversity Considerations into Environmental Impact Analysis under NEPA (CEQ, 1993)
- Memorandum of Understanding to Foster the Ecosystem Approach (CEQ, 1995)

The following regulations implement the federal acts that protect biotic communities:

- 50 CFR Parts 17 and 402 implement the ESA.
- 50 CFR Part 22 implements the Bald and Golden Eagle Protection Act.
- 50 CFR Part 600 implements the Magnuson-Stevens Fishery Conservation and Management Act.
- 50 CFR Parts 18 and 216 implement the Marine Mammal Protection Act.
- 50 CFR Part 21 implements the MBTA.

A survey of the area in which ground-disturbing activities could occur identified habitat types and the presence or absence of federally and/or state listed species. Analysis was conducted in the field by walking and evaluating transects, designed to allow the consultant to cover the topography in a manner that would evaluate the entirety of the study area and the habitat present. If any potential habitat for a listed species was identified as present or potentially present, a species-specific survey would have been requested from an individual listed on the *USFWS approved surveyors in Virginia list*. This list is a list of surveyors approved for specific species throughout the commonwealth. A species specific survey request was not necessary as part of this EA as the habitat for the Dwarf Wedgemussel (*Alasmidonta heterordon*) and Harperella (*Ptilinium nodosum*) was not present. The remainder of this section summarizes those findings and the full report is included in **Appendix B**. The survey area includes mature, mixed hardwood forest; upland vegetation; forested wetland; and areas of compactly graded grass. **Appendix B** describes these areas in detail. No federally or state listed fauna were observed in the area. Common species observed within or known to exist in these areas include white tailed deer, wild turkey, raccoon, gray squirrel, striped skunk, eastern cottontail, Virginia opossum, Eastern box turtle, black racer, and various species of frogs and skinks. No species were observed in the area of compactly graded grass, and no evidence of species was observed in the area. However, it is likely that birds and smaller species (field mice, rabbit, frogs, skinks) use the area.

According to the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Conservation (IPaC), there is the potential for three federally listed species to occur in the area. This includes the Dwarf wedgemusslce (*Alasmidonta heterodon*) (clam), Northern long-eared bat (*Myotis septentrionalis*) (bat), and Harperella (*Ptilimnium nodosum*) (flowering plant). None of these species were observed during the field survey. Based on the field survey and assessment, no suitable habitat for the Dwarf wedgemusscle or Harperella exist in the area of ground disturbing activities. There is suitable habitat for the Northern long-eared bat, but the area of ground disturbing activities is not near a mapped or known hibernacula.

The Virginia Department of Game and Inland Fisheries (VDGIF) information tool (VaFWIS) and input from the Virginia Department of Conservation and Recreation (VDCR), indicate that nine Commonwealth listed

species may occur within two miles of the area of ground disturbing activities (**Table 4-1**). As VDEQ's October 2017 letter (see **Appendix F**) describes, the Broad Run Stream Conservation Unit is adjacent to the project study area. The Broad Run Stream Conservation Unit has a biodiversity ranking of B3, which represents a site of high importance. Natural heritage resources for the Brook floater and Yellow lance are associated with that site.[2] Broad Run is also designated by the VDGIF as a "Threatened and Endangered Species Water" for the Brook Floater.

TABLE 4-1
STATE LISTED SPECIES WITH THE POTENTIAL TO OCCUR IN OR AROUND THE AREA OF GROUND DISTURBING ACTIVITIES

Species Common Name (*Scientific Name*)	Status	Field Survey Assessment
Atlantic Sturgeon (*Acipenser oxyrinchus*)	State Endangered / Federally Endangered	Not Observed/No Suitable Habitat
Northern long-eared bat (*Myotis septentrionalis*)	State Threatened / Federally Threatened	Not Observed/No Known cave or hibernacula
Little Brown Bat (*Myotis lucifugus lucifugus*)	State Endangered	Not Observed/No Known cave or hibernacula
Tri-colored Bat (*Perimyotis subflavus*)	State Endangered	Not Observed/No Known cave or hibernacula
Brook Floater (*Alasmidonta varicosa*)	State Endangered	Not Observed/No Suitable Habitat
Peregrine Falcon (*Falco peregrinus*)	State Threatened	Not Observed
Loggerhead Shrike (*Lanius ludovicianus*)	State Threatened	Not Observed
Henslow's Sparrow (*Ammodramus henslowii*)	State Threatened	Not Observed
Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*)	State Threatened	Not Observed

Source: Mill Creek, 2016

Of the species identified by the VaFWIS, only the Brook Floater has been confirmed to have been observed within a two mile radius. While none of the four listed avian species (peregrin falcon, loggerhead shrike, Henslow's sparrow, and migrant loggerhead shrike) were observed during the field survey, the habitat in the area is suitable for those species. Given the migratory nature of those species, the current development, and countermeasures associated with the Airport's Wildlife Hazard Management Plan, it is unlikely that these species regularly use the area. This assessment is supported by the fact that none of the four avian species have been observed within a two mile radius of the survey area (see **Appendix B**).

4.3 CLIMATE

Relevant federal laws, regulations, and EOs that relate to climate include:

- CAA (42 U.S.C. §§ 7408, 7521, 7571, 7661 *et seq.*)

[2] The Yellow lance is currently listed as a species of special concern by the USFWS; the designate of species of special concern has no official legal status.

- EO 13514, Federal Leadership in Environment Energy and Economic Performance (74 FR 52117)
- EO 13653, Preparing the United States for the Impacts of Climate Change (78 FR 66817)
- EO 13693, Planning for Federal Sustainability (80 FR 15869)
- 40 CFR Parts 60, 85, 86, and 600 implement the CAA

The following regulations implement the federal acts related to climate.

- 40 CFR Parts 60, 85, 86, and 600 implement the CAA.

Greenhouse gases (GHG) are gases that trap heat in the earth's atmosphere. Both naturally occurring and man-made GHGs primarily include water vapor, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Activities that require fuel or power are the primary stationary sources of GHGs at airports. Aircraft and ground access vehicles, which are not under the control of an airport, typically generate more GHG emissions than airport-controlled sources.

Research has shown there is a direct correlation between fuel combustion and greenhouse gas (GHG) emissions. In terms of U.S. contributions, the U.S. Government Accountability Office (GAO) reports that "domestic aviation contributes about three percent of total carbon dioxide (CO_2) emissions, according to USEPA data," compared with other industrial sources, including the remainder of the transportation sector (20 percent) and power generation (41 percent) (GAO, 2009). The International Civil Aviation Organization (ICAO) estimates that GHG emissions from aircraft account for roughly three percent of all anthropogenic GHG emissions globally (Melrose, 2010). Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global climate (USEPA, 2009).

The scientific community is continuing efforts to understand the impact of aviation emissions on the global atmosphere. The FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, USEPA, and U.S. Department of Energy), has developed the Aviation Climate Change Research Initiative in an effort to advance scientific understanding of regional and global climate impacts from aircraft emissions. The FAA also funds the Partnership for Air Transportation Noise & Emissions Reduction Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. The ICAO is examining similar research topics at the international level (Maurice & Lee, 2007).

4.4 COASTAL RESOURCES

Relevant federal laws, regulations, and EOs that protect coastal resources include the Coastal Barrier Resources Act (16 U.S.C. § 3501 *et seq.*) and the Coastal Zone Management Act (16 U.S.C. §§ 1451-1466).

The western portion of the project study area, which is in the City of Manassas limits, is not within the Virginia Coastal Zone Program (VCP) boundary. The eastern portion of the project study area is within the

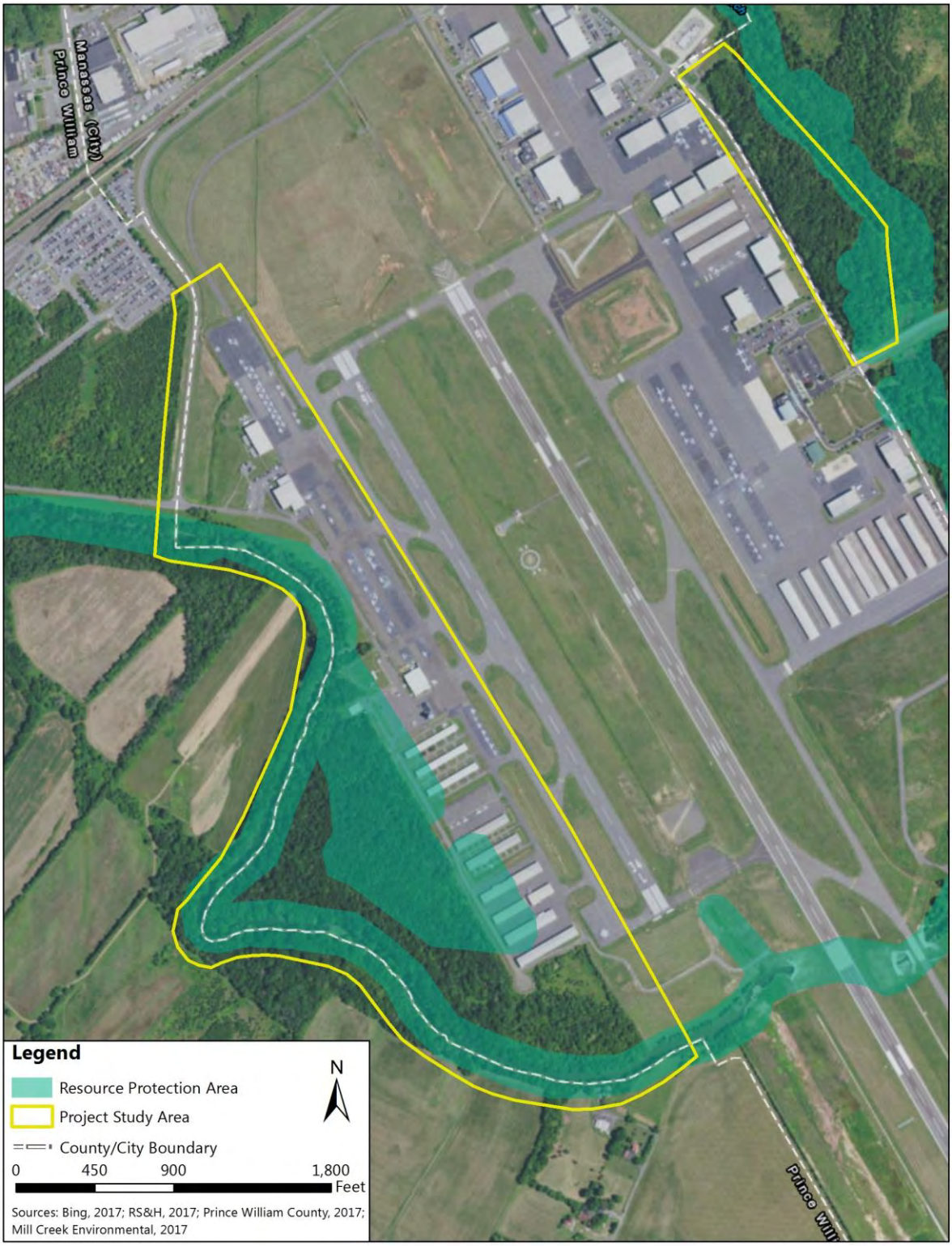
VCP boundary. The VDEQ is the lead agency and oversees the VCP office. The VCP has the following goals (VDEQ, 2017):

- "Goal 1: To protect and restore coastal resources, habitats, and species of the Commonwealth. These include, but are not limited to, wetlands, subaqueous lands and vegetation, beaches, sand dune systems, barrier islands, underwater or maritime cultural resources, riparian forested buffers, and endangered or threatened species.
- Goal 2: To restore and maintain the quality of all coastal waters for human and ecosystem health through protection from adverse effects of excess nutrients, toxics, pathogens, and sedimentation.
- Goal 3: To protect air quality.
- Goal 4: To reduce or prevent losses of coastal habitat, life, and property caused by shoreline erosion, storms, relative sea level rise, and other coastal hazards in a manner that balances environmental and economic considerations.
- Goal 5: To provide for sustainable wild fisheries and aquaculture.
- Goal 6: To promote sustainable ecotourism and to increase and improve public access to coastal waters and shorefront lands compatible with resource protection goals.
- Goal 7: To promote renewable energy production and provide for appropriate extraction of energy and mineral resources consistent with proper environmental practices.
- Goal 8: To ensure sustainable development on coastal lands and support access for water-dependent development through effective coordination of governmental planning processes.
- Goal 9: To avoid and minimize coastal and ocean resource use conflicts through research, planning, and a forum for coordination and facilitation among local, regional, state and federal government agencies, interest groups, and citizens.
- Goal 10: To promote informed decision-making by maximizing the availability of up-to-date educational information, technical advice, and scientific data including the use of new tools such as marine spatial planning."

Given the eastern portion of project study area's location in the VCP, the eastern portion of the project study area is subject to the requirements of the Chesapeake Bay Preservation Act. In addition, Broad Run, which intersects the western portion of the project study area, is within Prince William County and subject to the Chesapeake Bay Preservation Act.

The Chesapeake Bay Preservation Act is an enforceable program of the VCP and establishes resource protection areas (RPAs) around land at or near the shoreline that plays a critical role in the water quality value. RPAs have a 100-foot vegetation buffer along streams or rivers to help protect water quality. See **Figure 4-3** for the Prince William County designated RPAs in and around the project study area. Although RPAs are shown within the limits of the City of Manassas, the City of Manassas does not recognize RPAs because it is not part of the VCP, and, therefore, is not subject to the Chesapeake Bay Preservation Act which establishes RPAs. With regards to the RPA in the eastern portion of the project study area, an on-site delineation of the Cannon Branch RPA within the eastern portion of the project study area was reviewed and approved by Prince William County (see **Appendix F**).

FIGURE 4-3
RESOURCE PROTECTION AREAS



According to Prince William County, all creeks and streams in the County are subject to RPA buffers because they feed into the Potomac River and eventually to the Chesapeake Bay (Prince William County, 2017). Any work within an RPA requires County review and approval. The County does not allow the following activities in an RPA:

- New development
- Parking lots
- Clear-cutting trees
- Filling and grading activities
- Establishing Lawns

4.5 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F)

Department of Transportation Act, Section 4(f) provides protection for special properties, including significant publicly owned parks, recreation areas, wildlife and waterfowl refuges, or any significant historic and archaeological sites. Relevant federal laws, regulations, and EOs that relate to Section 4(f) resources include:

- U.S. Department of Transportation (USDOT) Act – Section 4(f) (49 U.S.C. § 303.)
- Land and Water Conservation Fund Act of 1965 (16 U.S.C. §§ 4601-4604 et seq.)
- Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) – Section 6009 (49 U.S.C. § 303.)
- U.S. Department of Defense Reauthorization (Public Law (P.L.) 105-185, Division A, Title X, Section 1079, November 18, 1997, 111 Stat. 1916)

The following regulations implement the federal acts related to Section 4(f) resources.

- 23 CFR Part 774 et seq. implements USDOT Act – Section 4(f) and SAFETEA-LU – Section 6009
- 36 CFR Part 59 et seq. implements the Land and Water Conservation Fund Act of 1965

Section 4(f) of the USDOT Act provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly-owned park, recreational area, or wildlife or waterfowl refuge of national, state, or local significance or land from an historic site of national, state, or local significance, as determined by the officials having jurisdiction thereof, unless there is no feasible and prudent alternative to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use.

There are no publicly owned wildlife and/or recreational areas, or lands purchased with Land and Water Conservation Funds (Section 6(f) resources) within the project study area. **Section 4.7** describes, in detail, potential historic properties in the project study area. Specifically, the Manassas Station Operations (VDHR # 076-5036), which extends into the project study area and the area where ground disturbing activities would occur, and archaeological site number 44PW0729, just west of the area where ground disturbing activities would occur.

4.6 HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

Relevant federal laws, regulations, and EOs that relate hazardous materials, solid waste, and pollution prevention include:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- (42 U.S.C. §§ 9601-9765);
- Emergency Planning and Community Right to Know Act (42 U.S.C. §§ 11001-11050)
- Federal Facilities Compliance Act (42 U.S.C. § 6961)
- Hazardous Materials Transportation Act (49 U.S.C. §§ 5101-5128)
- Oil Pollution Prevention Act of 1990 (33 U.S.C. §§ 2701-2762)
- Pollution Prevention Act (42 U.S.C. §§ 13101-13109)
- Toxic Substances Control Act (TSCA) (15 U.S.C. §§ 2601-2697)
- Resource Conservation and Recovery Act (RCRA) (42 U.S.C. §§ 6901-6992k)
- EO 12088, *Federal Compliance with Pollution Control Standards* (43 FR 47707)
- EO 12580, *Superfund Implementation* (52 FR 2923), (63 CFR 45871), and (68 CFR 37691)
- EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (72 FR 3919)
- EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (74 FR 52117)

The following regulations and memorandum implement the federal acts related to hazardous materials, solid waste, and pollution prevention.

- 40 CFR Parts 300, 311, 355, 370, and 373 implement CERCLA.
- 40 CFR Parts 350-372 implement the Emergency Planning and Community Right to Know Act.
- 40 CFR Part 22 implements the Federal Facilities Compliance Act.
- 49 CFR Parts 100-185 implement the Hazardous Materials Transportation Act.
- 40 CFR Parts 109-116 implement the Oil Pollution Act.
- 40 CFR Parts 240-299 implements RCRA.
- 40 CFR Parts 745, 761, and 763 implements TSCA.

In a regulatory context, the terms "hazardous wastes," "hazardous substances," and "hazardous materials" have very specific meanings as described below.

- Hazardous Wastes: Subpart C of RCRA defines hazardous wastes (sometimes called characteristic wastes) as solid wastes that are ignitable, corrosive, reactive, or toxic. Examples include waste oil, mercury, lead or battery acid. In addition, Subpart D of RCRA contains a list of specific types of solid wastes that the USEPA has deemed hazardous (sometimes called listed wastes). Examples include degreasing solvents, petroleum refining waste, or pharmaceutical waste.
- Hazardous Substances: Section 101(14) of CERCLA defines this term broadly. It includes hazardous wastes, hazardous air pollutants, or hazardous substances designated as such under the Clean Water Act (CWA) and TSCA and elements, compounds, mixtures, or solutions, or substances listed

in 40 CFR Part 302 that pose substantial harm to human health or environmental resources. Pursuant to CERCLA, hazardous substances do not include any petroleum or natural gas substances and materials. Examples include ammonia, bromine, chlorine, or sodium cyanide.

- Hazardous Materials: According to 49 CFR Part 172, hazardous materials are any substances commercially transported that pose unreasonable risk to public health, safety, and property. These substances include hazardous wastes and hazardous substances as well as petroleum and natural gas substances and materials. As a result, hazardous materials represent hazardous wastes and substances. Examples include household batteries, gasoline, or fertilizers.

The USEPA identifies one hazardous waste site under RCRA in the project study area, Dulles Aviation, Inc. (USEPA, 2016). Dulles Aviation, Inc. is the FBO at the Airport and is a conditionally exempt small quantity generator (Handler ID: VAD982704686) under RCRA. The USEPA classifies Dulles Aviation as a petroleum and petroleum products merchant wholesalers (National Industry Classification System Codes 42472), flight training (National Industry Classification System Codes 611512), and other support activities for air transportation (National Industry Classification System Codes 48819). There are no toxic release sites, superfund sites, brownfields, or TSCA sites in the project study area (USEPA, 2016).

A physical inspection of the survey area was conducted in late 2016. No hazardous waste, toxic materials, or potential origins of hazardous waste production were observed in the survey area (see **Appendix C** for the full report). An Environmental Phase I report from Environmental Data Resources, Inc. was also obtained for the survey area. This report includes a search of all federal, state, and local databases for instances of pollution or environmental contamination in and around the survey area, which encompassed the area of ground disturbing activities and the construction staging area. No sites were reported in the survey area. One site, Dulles Aviation, was identified (see previous paragraph for description of this site) near the survey area. See **Appendix C** for the full Environmental Phase I report.

The closest landfill to the project study area is the Prince William County Sanitary Landfill, about 13 miles northwest of the project study area. The County expects the landfill to accommodate waste for the next 50 years (Prince William County, 2017). The County limits the amount of construction and demolition debris accepted at the facility in an effort to conserve space for municipal disposal needs. Construction and demolition debris are accepted at various recycling facilities in the area. Three of these facilities are within a five-mile radius of the project study area and include Envirosolutions, Galaxy Transfer Systems, Inc., and Broad Run Construction Waste Recycling (Metropolitan Washington Council of Goverments, 2017). These facilities are anticipated to have the capacity to accept construction and demolition debris for the foreseeable future.

4.7 HISTORICAL, ARCHITECTURAL, ARCHEOLOGICAL AND CULTURAL RESOURCES

The National Historic Preservation Act (NHPA) (54 U.S.C. §§300101 *et seq.*) establishes the Advisory Council on Historic Preservation, which oversees federal agency compliance with the NHPA. The NHPA also establishes NRHP, which the NPS oversees. Other applicable statues and EOs include:

- American Indian Religious Freedom Act (42 U.S.C. § 1996)

- Antiquities Act of 1906 (54 U.S.C. §§320301-320303)
- Archeological and Historic Preservation Act (54 U.S.C. §§ 312501-312508)
- Archeological Resources Act (16 U.S.C. §§ 470aa-470mm)
- USDOT Act, Section 4(f) (49 U.S.C. § 303)
- Historic Sites Act of 1935 (16 U.S.C. §§ 461-467)
- Native American Graves Protection and Repatriation Act (25 U.S.C. §§ 3001-3013)
- Public Building Cooperative Use Act (40 U.S.C. §§ 601a, 601a1, 606, 611c, and 612a4)
- EO 11593, *Protection and Enhancement of the Cultural Environment* (36 FR 8921)
- EO 13006, *Locating Federal Facilities on Historic Properties in Our Nation's Central Cities* (61 FR 26071)
- EO 13007, *Indian Sacred Sites* (61 FR 26771)
- EO 13175, *Consultation and Coordination with Indian Tribal Governments* (65 FR 67249)
- Executive Memorandum, Government-to-Government Relations with Native American Tribal Governments (April 29, 1994)
- Executive Memorandum on Tribal Consultation (Nov. 5, 2009) (65 FR 67249)
- USDOT Order 5650.1, Protection and Enhancement of the Cultural Environment

The following regulations implement the federal acts related to historical, architectural, archeological, and cultural resources.

- 36 CFR Parts 60, 62.1, 65, 68, 73, 78, 79, and 800 implement the NHPA.
- 43 CFR §§ 7.7 and 7.32, and 25 CFR Part 262.7 implement the American Indian Religious Freedom Act.
- 43 CFR Part 3 implements the Antiquities Act of 1906.
- 36 CFR Parts 68 and 79 implements the Archeological and Historic Preservation Act.
- 43 CFR Part 7, 36 CFR Part 79, and 25 CFR Part 262 implement the Archaeological Resources Protection Act.
- 23 CFR Part 774 implements the USDOT Act – Section 4(f).
- 36 CFR Part 65 implements the Historic Sites Act of 1935.
- 43 CFR Part 10 and 25 CFR § 262.8 implement the Native American Graves Protection and Repatriation Act.
- 41 CFR Parts 101-117 implement the Public Building Cooperative Use Act.

The Area of Potential Effect (APE) is the project study area and includes all areas of potential disturbance and all property within the view shed of the Airport. The FAA consulted with the Virginia Department of Historic Resources (VDHR) on the appropriateness of the APE. The VDHR did not object to the APE. See **Appendix D** for the consultation letter from the VDHR.

A Phase I archaeological survey was conducted for two portions of the survey area. Initial archival research shows that there has been extensive archaeological testing previously conducted at the Airport. Other areas were exempt from testing because of evidence of soil disturbance. The methodology used to determine the limits of the Phase I archaeological survey are included in **Appendix D**. No archaeological resources were identified in the survey area. One archaeological site, Site 44PW0729, has been identified within the project study area, just west of the survey area. This site has subsurface integrity and is interpreted as a campsite. The site is associated with the Middle Archaic to the Late Woodland prehistoric time period and is considered potentially eligible for listing on the NRHP. Planning efforts have resulted in the placement of a 20-foot buffer around the site for any planned development.

The closest National Register of Historic Places (NRHP)-listed resource is the Davis Beard House (10726 Bristow Road), about one-half mile west of the project study area (USEPA, NEPAssist, 2016). None of the buildings proposed for demolition or relocation are over 50 years old, a criterion for being eligible for listing on the NRHP. The Manassas Station Operations (VDHR # 076-5036) is a historic battlefield associated with the Manassas Battlefield Historic District, which is potentially eligible for listing on the NRHP. The district extends into the project study area and the area where ground disturbing activities would occur. **Appendix D** provides a detailed description of this site.

4.8 NATURAL RESOURCES AND ENERGY SUPPLY

The federal government encourages airport development that minimizes the use of consumable natural resources and minimizes demands on energy supplies. FAA policy also encourages developing facilities utilizing the highest design standards and incorporating sustainable designs.

Statutes and EOs that are relevant to natural resources and energy supply impacts include:

- Energy Independence and Security Act (42 U.S.C. § 17001 *et seq.*)
- Energy Policy Act (42 U.S.C. § 15801 *et seq.*)
- EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management* (72 FR 3919)
- EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (74 FR 52117)

Natural resources and energy are consumed in the western portion of the project study area. The eastern portion of the project study area is undeveloped and, as such, no natural resources or energy are used in that area. Airport personnel and tenants regularly use consumable materials to maintain various airside and landside facilities and services. Those materials may include asphalt, concrete, aggregate for sub-base materials, various metals associated with such maintenance, and fuels associated with the operation of aircraft and vehicles.

Electrical power is necessary to keep the Airport operational and safe. The western portion of the project study area receives electricity supplies from the City of Manassas, which owns and maintains the electric distribution system within the city limits (City of Manassas, 2017). There is no electrical power provided to the eastern project study area because it is undeveloped. However, there are the existing electrical cables that run along the western edge of the eastern project study area.

4.9 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

This section describes the existing demographics of the area in and around the project study area as they relate to socioeconomics, environmental justice, and children's environmental health and safety risks. Workers related to construction at and operation of the Proposed Action are likely to reside in the City of Manassas and Prince William County. U.S. Census Bureau information for the City and County is the basis of the socioeconomic and environmental justice analyses. Census tracts are the smallest units that provide information on poverty, which is needed to determine effects on low-income populations. For consistency across this section, this EA uses information from the U.S. Census Bureau for Census Tracts 9013.04, 1903.05, and 9104.02 (see **Figure 4-4**).

4.9.1 Socioeconomics

The Uniform Relocation Assistance and Real Property Acquisitions Policy Act of 1970 (42 U.S.C. § 61 *et seq.*), implemented by 49 CFR Part 24, is the primary statute related to socioeconomic impacts. Population, housing, and labor force data for the City of Manassas and Prince William County is included as the basis for evaluating potential socioeconomic impacts in **Chapter 5** of this EA.

4.9.1.1 Population

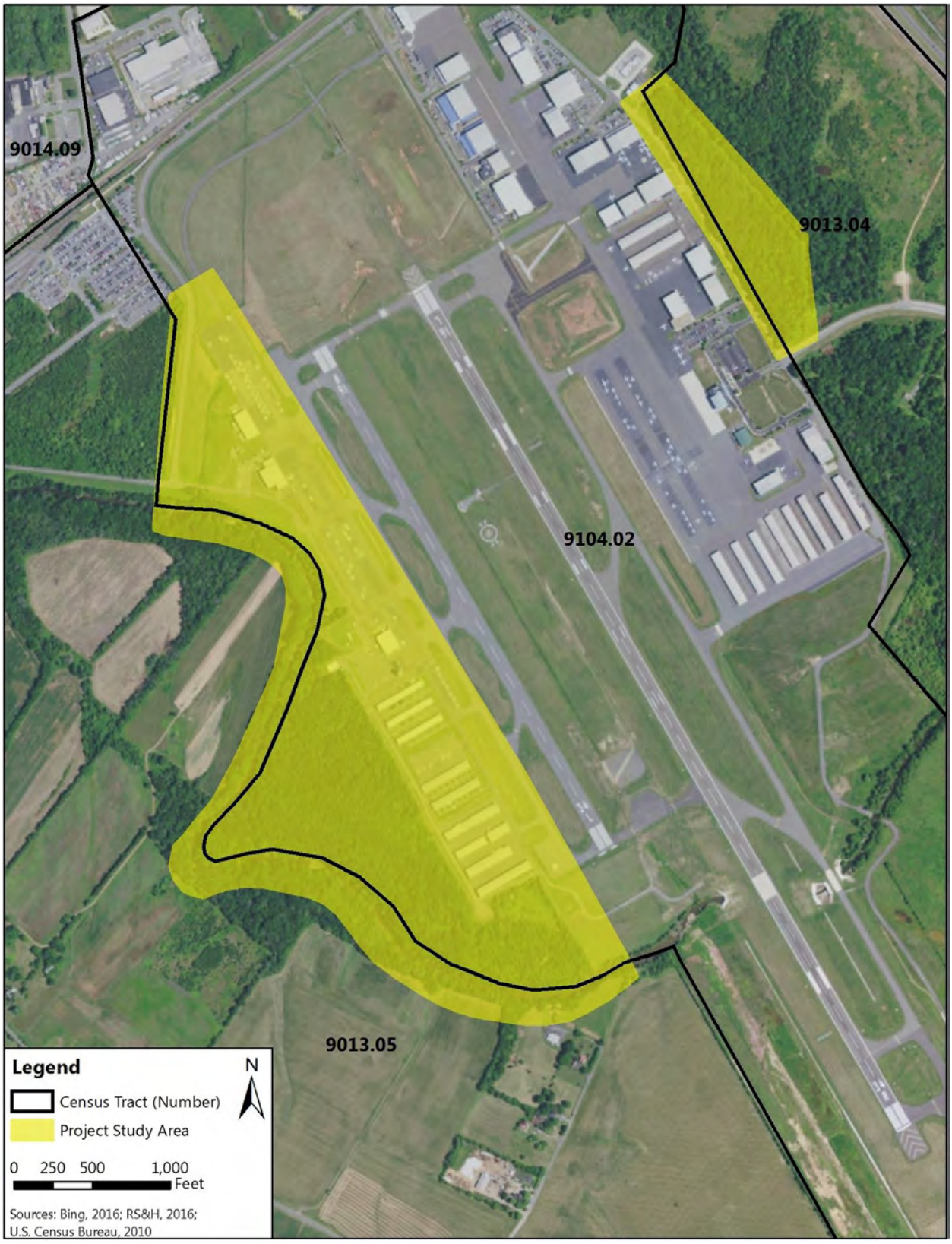
Table 4-2 lists the population growth from 2010 to 2015 in the census tracts that the project study area intersects, as well as the City, County, Commonwealth, and U.S. for comparison purposes. Between 2010 and 2015, the population in and around the project study area increased by an average of 10.51%. Comparatively, the population in the City and County increased at a slightly greater rate. The Commonwealth and U.S. had a slower rate of increase than the Census Tracts that the project study area intersects.

TABLE 4-2
POPULATION CHANGE BETWEEN 2010 AND 2015

Area	2010	2015	Percent Change
Census Tract 9013.04	2,486	2,388	-3.94%
Census Tract 9013.05	2,519	3,041	20.72%
Census Tract 9104.02	4,951	5,681	14.74%
City of Manassas	36,067	40,743	12.96%
Prince William County	379,415	437,271	15.25%
Commonwealth of Virginia	7,841,754	8,256,630	5.29%
United States	303,965,272	316,515,021	4.13%

Source: U.S. Census Bureau, 2010; U.S. Census Bureau, 2015

FIGURE 4-4
U.S. CENSUS BUREAU CENSUS TRACTS



4.9.1.2 Housing

Table 4-3 lists the total and vacant housing units in the referenced Census Tracts and surrounding geographies. An average of 8.14% of housing units are vacant in the referenced Census Tracts. About six percent and four percent of the housing units in the City and County, respectively, are vacant.

TABLE 4-3
HOUSING UNITS

Area	Total Units	Vacant Units (percentage)
Census Tract 9013.04	917	9.49%
Census Tract 9013.05	1,029	10.2%
Census Tract 9104.02	1,774	4.74%
City of Manassas	13,284	6.41%
Prince William County	142,786	4.20%
Commonwealth of Virginia	3,423,291	10.53%
United States	133,351,840	12.32%

Note: The U.S. Census Bureau considers vacant housing units those for rent; rented but not occupied; for sale; sold but not occupied; for seasonal, recreational, or occasional use; for migrant workers; and other vacant units.
Source: U.S. Census Bureau, 2015

4.9.1.3 Labor Force

The U.S. Census Bureau lists 5,734 employed civilians in the Census Tracts that intersect the project study area. The unemployment rate averages about eight percent in those tracts. Comparatively, the unemployment rate in the City and County is about eight percent and five percent, respectively. According to the 2012 Economic Census, retail trade and wholesale have the highest values of sales, shipments, receipts, revenue, or business done in the City and County (U.S. Census Bureau, 2012).

4.9.2 Environmental Justice

Relevant statutes, EOs, memorandums, and guidance include:

- Title VI of the Civil Rights Act, as amended (42 U.S.C. §§ 2000d-2000d-7)
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (59 FR 7629)
- Memorandum of Understanding on Environmental Justice and EO 12898
- USDOT Order 5610.2(a), Environmental Justice in Minority and Low-Income Populations (77 FR 27534)
- CEQ Guidance: Environmental Justice: Guidance Under the NEPA
- Revised USDOT Environmental Justice Strategy (77 FR 18879)

The following regulation implements the federal acts related to environmental justice:

- 28 CFR §42.401 implements Title VI of the Civil Rights Act, as amended.

In accordance with EO 12898, the CEQ issued guidance for each federal agency to "make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations (CEQ, 1997). FAA Order 1050.1F, which is consistent with USDOT Order 5610.2(a) on Environmental Justice, establishes the requirements for assessing environmental justice impacts.

Table 4-4 describes the share of the population in poverty within the referenced Census Tracts compared to the City and County. About 6.6% of the population in the referenced Census Tracts are below the poverty level. **Table 4-5** shows the total minority presence in the referenced Census Tracts compared to the City and County. According to the U.S. Census Bureau, about 17.9% of the population in the referenced Census Tracts are minorities. This is less than that of the City and County.

TABLE 4-4
POPULATION BELOW THE POVERTY LEVEL

Area	Population for Whom Poverty Status is Determined	Percent of Population Living Below the Poverty Level
Census Tract 9013.04	1,894	5.8%
Census Tract 9013.05	3,041	4.4%
Census Tract 9104.02	2,372	9.6%
City of Manassas	40,716	9.7%
Prince William County	432,147	6.7%

Source: U.S. Census Bureau, 2015

TABLE 4-5
MINORITY POPULATION

Area	Total Population	Percent Minority
Census Tract 9013.04	2,388	9.8%
Census Tract 9013.05	3,041	12.4%
Census Tract 9104.02	5,681	31.4%
City of Manassas	40,743	28.6%
Prince William County	432,271	38.6%

Source: U.S. Census Bureau, 2015

4.9.3 Children's Environmental Health and Safety Risks

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (62 FR 19885) is the primary EO related to Children's Environmental Health and Safety Risks. EO 13045 directs federal agencies to identify and assess environmental health risks and safety risks that may disproportionately affect children.

In addition to the residential areas near the project study area, areas of particular concern for children's environmental health and safety risks include schools, day care facilities, children's health clinics, and

recreational facilities. The closest school to the project study area is Pennington Tradition School, about four miles northeast. As **Table 4-6** shows, the referenced Census Tracts, other than Census Tract 9013.05, have a lower percentage of children than the City and County.

TABLE 4-6
PERCENT OF CHILDREN (UNDER 18)

Area	Total Population	Percent Under 18 Years of Age
Census Tract 9013.04	2,388	22.5%
Census Tract 9013.05	3,041	28.5%
Census Tract 9104.02	5,681	22.8%
City of Manassas	40,743	27.1%
Prince William County	432,271	28.2%

Source: U.S. Census Bureau, 2015

4.10 VISUAL EFFECTS

A majority of the project study area is undeveloped (see **Figure 4-1**). The western portion of the project study area has Airport-related development (e.g., hangars, airfield pavement, parking). Off-Airport areas do not have a direct line-of-sight to the project study area due to other commercial development and vegetative buffers. The eastern portion of the project study area is undeveloped and has dense vegetation. Airport related development occupies most of the western portion of the project study area. The east parcel area consists largely of dense vegetation similar to the surrounding area.

The western portion of the project study area is illuminated for safety and security reasons by various types of landside lighting. These include lighting for buildings, the access roadway, apron area, and automobile parking areas. The closest residential area is about 500 feet southeast of the project study area. Given the dense vegetation, lighting from the project study area does not affect this area.

4.11 WATER RESOURCES

The following subsections describe the water resources in and around the project study area. Water resources include wetlands, floodplains, surface waters, and groundwater. As previously described, there are no Wild and Scenic Rivers in or around the project study area; therefore, that resource is not discussed in this section.

4.11.1 Wetlands

Statutes and EOs that are relevant to wetlands include:

- EO 11990, *Protection of Wetlands* (42 FR 26961)
- Clean Water Act (CWA) (33 U.S.C. §§ 1251-1387)
- Fish and Wildlife Coordination Act (16 U.S.C. § 661-667d)
- USDOT Order 6660.1A, Preservation of the Nation's Wetlands
- State statutes protecting wetlands

The following regulation implements the federal act related to wetlands.

- 33 CFR Parts 320-332 and 40 CFR Parts 230-233 implement the Clean Water Act as it pertains to wetlands.

The CWA defines wetlands as "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands have three necessary characteristics:

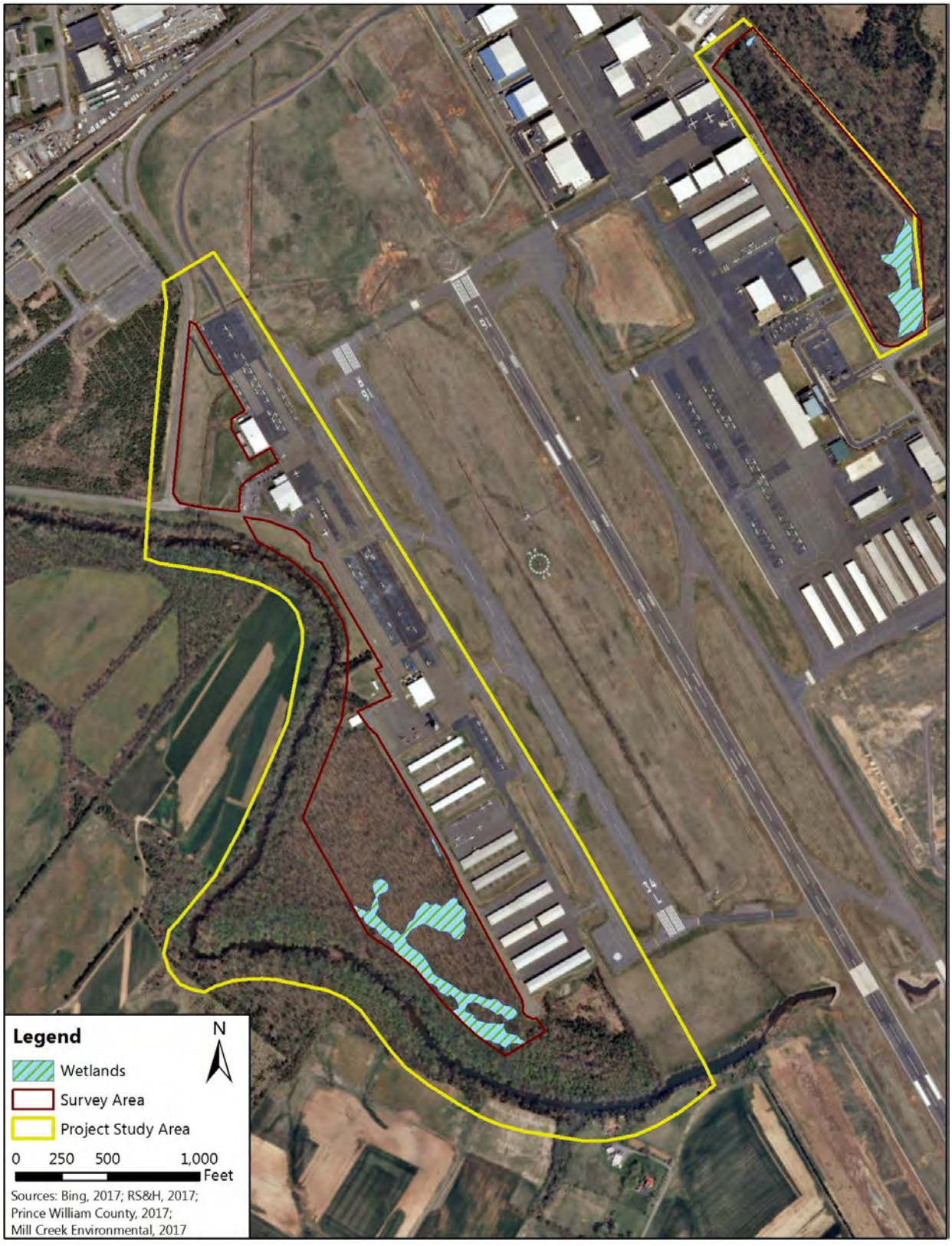
- Water: presence of water at or near the ground surface for a part of the year
- Hydrophytic Plants: a preponderance of plants adapted to wet conditions
- Hydric Soils: soil developed under wet conditions

A wetland field delineation of the survey area was conducted between October 24 and 26, 2016. Using the Wetland Determination form for the Eastern Mountains and Piedmont Region, 33 sample locations were used to make wetland/non-wetland determinations. Under the field survey, 4.84 acres of wetlands and 114 linear feet of other surface waters were delineated. The U.S. Army Corps of Engineers (USACE) confirmed the wetland boundaries on February 16, 2017. See **Appendix E** for the full wetland delineation report, including the Preliminary Jurisdictional Determination letter. The wetland types include palustrine forested wetlands and palustrine emergent wetlands. **Figure 4-5** shows the location of the identified wetlands in the survey area.

The wetlands identified in the west portion of the project study area appear to serve both hydrologic and biogeochemical functions. These wetlands serve a hydrologic function to the local area by providing a source of both long and short-term surface water storage. This surface water storage reduces flood peaks and serves as a source of stream moderation, especially during high runoff events. The storage provided by these wetlands also helps to reduce the amount of surface erosion sediments that could potentially make its way into Broad Run. These wetlands also provide a biogeochemical service to the local ecosystem through the retention of sediment. Much of the water entering this system enters via sheet, and storm-water flow associated with impervious surfaces. These surfaces can possess sediments, nutrients, metals, and other substances that have the potential to make their way into Broad Run. These wetlands may help store or filter these sediments.

The wetlands associated with the east portion of the project study area serve a hydrologic function to the local watershed by providing source of long and short-term water storage. Sheet and storm-water flow originating via precipitation on the surrounding landscape makes its way via steep downhill gradients toward Canon Branch, a perennial waterway. The water captured in the 1.49 acres of Palustrine Forested Wetlands is stored and slowly released in the adjacent Canon Branch. This hydrologic function serves as a source of short-term surface water storage, reducing downstream flood peaks. Additionally, the long-term storage provided by these wetlands helps moderate seasonal stream flows associated with Canon Branch.

FIGURE 4-5
DELINEATED WETLANDS



4.11.2 Floodplains

Relevant statutes and EOs pertaining to floodplains include:

- EO 11988, *Floodplain Management* (42 FR 26951)
- National Flood Insurance Act (42 U.S.C. § 4001 *et seq.*)
- USDOT Order 5650.2, Floodplain Management and Protection
- State and local statutes protecting floodplains

The following regulation implements the federal act related to floodplains.

- 44 CFR Part 60 implements the National Flood Insurance Act.

FEMA identifies portions of the 100-year floodplain (1% chance of annual flood) and floodway in the project study area. Floodplains are low-lying or flat areas adjoining waters that have a one percent or greater chance of a flood in any given year; also referred to as a 100-year flood event. FEMA defines a "regulatory floodway" as "the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height." (FEMA, 2016) **Figure 4-6** shows the location of the 100-year floodplain and floodway relative to the project study area. In the project study area, there are about 58 acres of floodway and about 41 acres of 100-year floodplain.

4.11.3 Surface Water

Relevant regulations and statues pertaining to surface waters include:

- CWA (33 U.S.C. §§ 1251-1387)
- Fish and Wildlife Coordination Act (16 U.S.C. § 661-667d)
- Rivers and Harbors Act (33 U.S.C. § 401 and 403)
- Safe Drinking Water Act (42 U.S.C. §§ 300(f)-300j-26)
- State statutes protecting surface waters

The following regulations implement the federal acts related to surface water.

- 40 CFR Parts 110-112, 116, 117, 122, 125, 129-131, 136 and 403 implement the Clean Water Act.
- 33 CFR Parts 114-118 and 320-332 implement the Rivers and Harbors Act.
- 40 CFR Parts 141-149 implement the Safe Drinking Water Act.

There are two surface water features in the project study area. Broad Road intersects the western portion of the project study area and Cannon Branch intersects the eastern portion of the project study area. Cannon Branch connects with Broad Run. As previously described, Cannon Branch and the west bank of Broad Run have an associated RPA which extends 100 feet on each side of the stream.

FIGURE 4-6
FLOODPLAINS



Precipitation that falls in the project study area moves to into Broad Run naturally or through a series of ditches and channels, which flows into the Middle Potomac-Anacostia-Occoquan basin. As the Virginia Department of Health – Office of Drinking Water describes (see **Appendix A**), there are no surface water intakes within a five-mile radius of the project study area.

The Airport operates under a Virginia Pollutant Discharge Elimination System Permit (VDEPS) General Permit (VAR050985) for stormwater discharge associated with industrial activity. This permit expires on June 30, 2019. The City also maintains an Oil Discharge Contingency Plan, an Integrated Spill Prevention, Control and Countermeasures (SPCC) Plan, and a Stormwater Pollution Prevention Plan (SWPPP) for the Airport. These plans outline best management practices (BMPs) for controlling potential pollutant releases to the surrounding surface waters. These plans also provide detailed procedures to follow in the unlikely event of a spill in order to minimize potential effects to the surrounding environment.

4.11.4 Groundwater

Relevant regulations and statues pertaining to groundwater include:

- Safe Drinking Water Act (42 U.S.C. §§ 300(f)-300j-26)
- State statutes protecting surface waters

The following regulation implements the federal act related to groundwater.

- 40 CFR Parts 141-149 implement the Clean Water Act as it pertains to groundwater.

The project study area is within the Broad Run Watershed (Prince William County, 2017). The City provides water sanitary sewer services to the Airport. The City draws water from Lake Manassas, the primarily water source, and if needed, the Prince William County Service Authority who draws water from the Potomac River (City of Manassas, 2015). The City uses the Prince William County Service Authority during peak consumption periods or in emergencies. As the Virginia Department of Health – Office of Drinking Water describes (see **Appendix A**), there are two public groundwater wells within one mile of the project study area at Broad Run Golf (PWS ID: 6153264) and Bristow Manor Golf Club (PWS ID: 6153041).

4.12 CUMULATIVE PROJECTS

This section identifies past, present, and reasonably foreseeable future actions that, when considered in combination with the Proposed Action, could contribute to potentially significant cumulative effects. The following summary of past, present, and reasonably foreseeable future actions include those undertaken or regulated by the City (on- and off-Airport property) and County. Past actions include actions completed between 2012 and 2016, present actions include those currently underway, and reasonably foreseeable future actions include those actions planned to occur between 2018 and 2020.

4.12.1 Past Actions

The following describes past actions that have occurred on- and off- Airport property between 2012 and 2016.

The City reported the following past actions on the Airport property:

- Extension of Runway 16L/34R

The following off-Airport projects have been completed near the Airport:

- Commercial development north of the Airport
- Widening of Route 28 to six lanes (Phase I)

4.12.2 Present Actions

The following projects are under construction at the Airport:

- HVAC unit replacement for the terminal building
- Airfield lighting regulator upgrades
- Airport signage upgrades
- Runway 34 Medium Intensity Approach Lighting System upgrade
- Taxiway D rehabilitation
- Comcast and Verizon fiber optics projects

There are no projects currently under construction around the Airport.

4.12.3 Reasonably Foreseeable Future Actions

The following describes the reasonably foreseeable future actions planned to occur at and around the Airport between 2018 and 2020.

The following on-Airport projects are reasonably foreseeable at the Airport between 2018 and 2020:

- Taxiway A rehabilitation
- Runway 16R/34L rehabilitation
- Security fiberline installation throughout the Airport
- Air Traffic Control Tower roof replacement
- Runway 16R/34L lighting system and Precision Approach Path Indicators upgrade
- Additional perimeter security gate installation
- Aurora development project

The following off-Airport projects are reasonably foreseeable between 2018 and 2020:

- Streetlight replacement throughout the City of Manassas
- Widening of Route 28 to six lanes (Phase II)

CHAPTER 5

ENVIRONMENTAL CONSEQUENCES

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This chapter presents an analysis of the potential environmental effects from implementation of the Proposed Action compared to the No Action Alternative. The analyses in this chapter are consistent with FAA Orders 1050.1F and 5050.4B. To evaluate potential impacts, the analyses in this chapter overlay the components of the Proposed Action and No Action Alternative onto the existing conditions within the project study area for each environmental impact category presented in **Chapter 4**. The remainder of this chapter discusses the following environmental resource categories:

- Air Quality (**Section 5.1**)
- Biological Resources (**Section 5.2**)
- Climate (**Section 5.3**)
- Coastal Resources (**Section 5.4**)
- Department of Transportation Act, Section 4(f) (**Section 5.5**)
- Hazardous Materials, Solid Waste, and Pollution Prevention (**Section 5.6**)
- Historical, Architectural, Archaeological, and Cultural Resources (**Section 5.7**)
- Natural Resources and Energy Supply (**Section 5.8**)
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks (**Section 5.9**)
- Visual Effects (**Section 5.10**)
- Water Resources (**Section 5.11**)

5.1 AIR QUALITY

This section describes the significance threshold(s) pertaining to air quality and describes methodologies used to determine the potential air quality effects from of the Proposed Action compared to the No Action Alternative, and describes what those potential effects are.

5.1.1 Significance Threshold

FAA Order 1050.1F, Exhibit 4-1, provides the FAA's significance threshold for air quality, which states, "The action would cause pollutant concentrations to exceed one or more of the NAAQS, as established by the USEPA under the Clean Air Act, for any of the time periods analyzed, or to increase the frequency or severity of any such existing violations."

In addition, air quality analysis considers the conformity of the Proposed Action with the SIP, as required by the General Conformity Rule under the Clean Air Act, as amended.

5.1.2 Methodology

Construction emissions are quantified using the USEPA MOVES model. Construction emissions include, but are not limited to, estimation of construction duration; construction type; materials used; estimated cost of construction; number, type, duration, and intensity of construction equipment usage; vehicle miles traveled; ambient meteorological conditions; fuel type used; and anticipated quantity of materials consumed. As **Chapter 1** describes, construction would occur over an estimated five-year period. The analysis provides the average annual construction emissions inventory over the five year period.

5.1.3 Environmental Consequences

The following sections describe the potential air quality effects from the No Action Alternative and Proposed Action.

5.1.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. Therefore, there would be no affect to air quality.

5.1.3.2 Proposed Action

Equipment and vehicle operations, demolition activities, paving activities, and other construction activities associated with the Proposed Action would cause air pollutant emissions. **Table 5-1** summarizes the estimated annual construction emissions from various sources. See **Appendix G** for the detailed construction emissions inventory.

TABLE 5-1
ANNUAL CONSTRUCTION EMISSIONS INVENTORY (TONS)

	CO	NO_x	SO_x	PM_{10}	$PM_{2.5}$	VOC
Emission Quantity	5.93	9.77	0.03	0.64	0.57	15.11
USEPA Threshold	N/A	100	N/A	N/A	100	50

N/A = Not Applicable
Source: RS&H, Inc.

The Proposed Action would increase surface traffic due to increased employment at the Airport; estimated to be at about 30 employees.[3] It is likely that these future employees would already reside in the region and would already be commuting to employment elsewhere in the region. Given the comparatively small change in the regional employment and the likelihood that future employees would already reside in the region, the Proposed Action would not materially change vehicle emissions in the area. In addition, the Proposed Action would not change aviation operations at the Airport. Therefore, the operation of the Proposed Action would not significantly affect air quality.

As **Chapter 4** describes, the project study area is in a nonattainment area for O_3 and a maintenance area for $PM_{2.5}$. This analysis compares the Proposed Action's emissions of VOC and NO_x, which are precursors to O_3, and the $PM_{2.5}$ to those of the No Action Alternative to determine if the net emissions would exceed the *de minimis* thresholds associated with the region's nonattainment status. As **Table 5-1** shows, the construction emissions associated with the Proposed Action would be below the applicable *de minimis* thresholds established under the General Conformity Rule and are presumed to conform. There is the potential for generators to be used during construction. The City would ensure that the installation of a generator(s) complies with 9 VAC 5-80, Article 6, Permits for New and Modified Sources, as the October VDEQ letter describes (see Appendix F).

[3] The number of employees is estimated based on projects at other airports of similar size and extent, as well as the type of development proposed (e.g., T-hangars and other GA/corporate hangars).

5.1.3.3 Mitigation and Best Management Practices

As described above, the Proposed Action would not exceed the *de minimis* threshold and no significant effect is anticipated. In the absence of potentially significant effects, mitigation measures are not proposed. Although construction of the Proposed Action would not cause a significant effect to air quality, the construction contractor would conduct construction activities, in accordance with 9 VAC 5-50-60 *et seq*. of the *Regulations for the Control and Abatement of Air Pollution* and FAA AC 150/5370-10G, *Standards for Specifying Construction of Airports*.

During construction, fugitive dust would be kept to a minimum by using control measures outlined in 9 VAC 5-50-60 *et seq*. of the *Regulations for the Control and Abatement of Air Pollution*. These include, but are not limited to:

- Use of water of chemicals for dust control (where possible and practicable);
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dust material;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments from soil erosion.

While open burning is not anticipated to occur during the construction of the Proposed Action, if open burning or use of special incineration devices were determined to be necessary, the activity would meet the requirements under 9 VAC 5-130-10 through 9 VAC 130-60 and 9 VAC 5-130-100 of the *Regulations for Open Burning*.

As described in the VDEQ's October letter (see **Appendix F**), the City would also ensure the selected construction contractor is aware of 9 VAC 5-45-780 *et seq*., typically applied to road construction, which places limitations on the use of "cut back."[4] Asphalt must be emulsified except when specific circumstances apply. In addition, there are time-of-year restrictions on its use from April through October in VOC emission control areas.

The selected construction contractor would also implement best management practices (BMPs), including, but not limited to:

- Reducing equipment idling time
- Using cleaner burning or low emissions fuel in equipment
- Encouraging employee carpooling
- Limiting construction activities during high wind events to prevent dust
- Reducing vehicle speeds on unpaved roads
- Installing tire washes and truck washes to deter tracking dirt and mud to areas outside the airport as vehicles enter and leave the disturbed, project-related work sites.

[4] Cut back is liquefied asphalt cement, blended with petroleum solvents.

The City would notify the selected construction contractor of the possible BMPs and incorporate BMPs into the construction contract.

5.2 BIOLOGICAL RESOURCES (INCLUDING FISH, WILDLIFE, AND PLANTS)

This section describes the significance threshold(s) pertaining to biological resources and describes methodologies used to determine the potential effects of the Proposed Action compared to the No Action Alternative, and describes those potential effects.

5.2.1 Significance Threshold

FAA Order 1050.1F, Exhibit 4-1, provides the FAA's significance threshold for biological resources, which states, "The USFWS or the National Marine Fisheries Service determines that the action would be likely to jeopardize the continued existence of a federally listed threatened or endangered species, or would result in the destruction or adverse modification of federally designated critical habitat."

5.2.2 Methodology

FAA Order 1050.1F, Exhibit 4-1, provides the factors that should be considered in evaluating the context and intensity of potential environmental impacts to biological resources, which include:

- "a long-term or permanent loss of unlisted plant or wildlife species, i.e., extirpation of the species from a large project area (e.g., a new commercial service airport);
- adverse impacts to special status species (e.g., state species of concern, species proposed for listing, migratory birds, bald and golden eagles) or their habitats;
- substantial loss, reduction, degradation, disturbance, or fragmentation of native species' habitats or their populations; or
- adverse impacts on a species' reproductive success rates, natural mortality rates, non-natural mortality (e.g., road kills and hunting), or ability to sustain the minimum population levels required for population maintenance."

5.2.3 Environmental Consequences

The following sections describe the potential effects to biological resources of the Proposed Action compared to the No Action Alternative.

5.2.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. Therefore, there would be no affect to biological resources.

5.2.3.2 Proposed Action

The Proposed Action would, in part, disturb about 17 acres of previously undeveloped habitat. As previously described, some of this habitat has been previously disturbed (graded grassland) and is regularly mowed and maintained to help ensure a safe operating environment at the Airport. None of the affected habitats are rare, unique, or protected. These habitats are common in other areas around the Airport.

During construction activities, vegetation would be removed and water resources would be impacted within the limits of disturbance and direct mortality to individual animals could occur. As **Section 4.2** and **Appendix B** describe, no federally or state listed species, or evidence of those species, were observed in the area of ground disturbing activity. **Table 5-2** shows the determination of potential effects to federally and state listed species. For all species, the determinations are either "No Effect" or "Not Likely to Adversely Affect"

TABLE 5-2
THREATENED AND ENDANGERED SPECIES EFFECT DETERMINATION

Species Common Name (*Scientific Name*)	Status	Effect Determination
Dwarf wedgemussel (*Alasmidonta heterodon*)	Federally Endangered	No Effect
Harperella (*Ptilimnium nodosum*)	Federally Endangered	No Effect
Atlantic Sturgeon (*Acipenser oxyrinchus*)	State Endangered / Federally Endangered	No Effect
Northern long-eared bat (*Myotis septentrionalis*)	State Threatened / Federally Threatened	Not Likely to Adversely Affect
Little Brown Bat (*Myotis lucifugus lucifugus*)	State Endangered	Not Likely to Adversely Affect
Tri-colored Bat (*Perimyotis subflavus*)	State Endangered	Not Likely to Adversely Affect
Brook Floater (*Alasmidonta varicosa*)	State Endangered	No Effect
Peregrine Falcon (*Falco peregrinus*)	State Threatened	Not Likely to Adversely Affect
Loggerhead Shrike (*Lanius ludovicianus*)	State Threatened	Not Likely to Adversely Affect
Henslow's Sparrow (*Ammodramus henslowii*)	State Threatened	Not Likely to Adversely Affect
Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*)	State Threatened	Not Likely to Adversely Affect

Sources: Mill Creek, 2016; RS&H, 2017

The USFWS certified the determination for federally-listed species through the USFWS IPaC process (see **Appendix B**). As VDEQ's October 2017 letter describes, VDCR found that the Proposed Action would not affect any documented state-listed plant and insect species. VDCR correspondence describes that the Yellow lance and Brook floater as natural heritage resources of concern (see Appendices B and F). VDCR recommended implementation of, and strict adherence to, applicable state and local erosion and sediment control/storm water management laws and regulations and also recommended further coordination with the VDGIF for the Brook floater. In VDEQ's October 2017 letter, it states that because no instream work is proposed as part of this Proposed Action, VDGIF does not anticipate adverse effects to the Brook floater. Overall, VDGIF did not indicate that wildlife or threatened and endangered species would be affected by the Proposed Action.

Federally and Commonwealth protected avian species, as well as species protected by the MBTA, were not observed in the area of ground disturbing activity. In addition there are no known bald eagle nests near

the area of ground disturbing activity. Wildlife biologists would conduct pre-construction surveys to determine the presence of active avian species nests in the area of ground disturbing activities. The selected construction contractor would avoid direct impacts to birds or active nests during construction and avoid impacts on any species the MBTA protects. This could be through the implementation of time-of-year restrictions. For example, the selected construction contractor would not remove trees during the time of year when certain avian species are known to nest through the time when youngling leave the nest. Time-of-year restrictions would depend on the species found, if any. The City would coordinate with USFWS and VDEQ to determine the appropriate avoidance measures, if necessary. Therefore, avian species would not be affected by construction of the Proposed Action.

5.2.3.3 Mitigation and Best Management Practices

The Proposed Action would not significantly affect biological resources, and is not likely to adversely affect protected species; therefore, mitigation is not required as part of the Proposed Action. The selected construction contractor could implement BMPs described in FAA AC 150/5370-10G to minimize potential indirect effects to biological resources (e.g., air quality, water quality). The City would notify the selected construction contractor to incorporate BMPs into the construction contract. Additionally, should any migratory bird nests be found during construction, the selected construction contractor would contact the City. The City would coordinate with the FAA, USFWS, and VDEQ. Construction activities would not resume without verbal and/or written authorization.

As VDEQ's October 2017 letter describes (see Appendix F), the selected construction contractor could also implement the following measures during development activities:

- Avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable.
- Maintain naturally vegetated buffers of 100 feet in width around wetlands and on both sides of perennial and intermittent streams, where practicable.
- Conduct significant tree removal and ground clearing activities outside of the primary songbird nesting season (March 15 through August 15).
- Implement and maintain appropriate erosion and sediment controls throughout project construction and site restoration.

5.3 CLIMATE

This section describes the significance threshold(s) pertaining to climate and describes methodologies used to determine the potential effects of the Proposed Action would have on climate compared to the No Action Alternative, and describes those potential effects.

5.3.1 Significance Threshold

While FAA 1050.1F does not provide a significance threshold for aviation-related GHG emissions, the projected increase in GHG emissions from the Proposed Action is discussed in the context of national and global GHG emissions from all sources.

5.3.2 Methodology

There are currently no accepted methods of determining significance for GHG emissions. Because the FAA has not established significance thresholds for climate, this section focuses on the disclosure of GHG emissions, rather than provision of an effect determination.

5.3.3 Environmental Consequences

The following sections describe the potential effects to climate from the No Action Alternative and Proposed Action.

5.3.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands; consequently, the No Action Alternative would have no effect on climate. GHG emissions from operations at the Airport would continue to increase as aviation or other aviation related activity increased.

5.3.3.2 Proposed Action

Although there are no federal standards for aviation-related GHG emissions, it is well established that GHG emissions can affect climate. The Council on Environmental Quality (CEQ) has indicated that climate should be considered in NEPA analyses (FAA, 2012). As noted by CEQ, "it is not useful, for NEPA purposes, to link GHG emissions from a proposal to specific climatological changes to a particular site...When considering the GHG emissions, agencies do not need to calculate a proposal's GHG emissions as a percentage of nationwide or worldwide GHG emissions unless the agency determines that such information would be helpful to decision makers and the public to distinguish among alternatives and mitigations, or that the emissions and sequestration associated with a proposed action may rise to a significant level (CEQ, 2014)."

The use of fossil fuel powered machinery during construction of the Proposed Action would emit GHGs such as CO_2. These emissions would only last as long as construction activities (five years)..

The increase in employees at the Airport (an estimated 30 new employees), would increase vehicle-related GHG emissions in the project study area. As **Section 5.1** describes, the majority of the employees are likely to already live and work in the area; therefore, the vehicle-related GHG emissions in the area would not significantly change. In addition, the Proposed Action would not increase the number of aircraft operating at the Airport. Overall, the Proposed Action would not have a significant effect on GHGs and the global climate.

5.3.3.3 Mitigation and Best Management Practices

The FAA has not established a significance threshold related to GHG emissions and no significant affect is anticipated. In the absence of potentially significance effects, no mitigation measures are proposed. Although the Proposed Action would not significantly affect global GHG emissions, the Proposed Action could include BMPs to reduce construction-related GHG emissions to the highest level practicable. FAA AC 150/5370-10G identifies BMPs to minimize GHG emissions during construction. BMPs are similar to those for air quality and could include, but are not limited to:

- Reducing equipment idling time
- Using cleaner burning or low emissions fuel in equipment
- Encouraging employee carpooling,

5.4 COASTAL RESOURCES

This section describes the significance threshold(s) pertaining to coastal resources, describes methodologies used to determine the potential effects of the Proposed Action would have on coastal resources, and describes those potential effects.

5.4.1 Significance Threshold

FAA Order 1050.1F does not define a significance threshold for coastal resources; however, it does provide factors to consider in evaluating the context and intensity of potential environmental impacts to coastal resources. These include when the action would have the potential to:

- Be inconsistent with the relevant state coastal zone management plan(s);
- Impact a coastal barrier resource system unit (and the degree to which the resource would be impacted);
- Pose an impact to coral reef ecosystems (and the degree to which the ecosystem would be affected);
- Cause an unacceptable risk to human safety or property; or
- Cause adverse impacts to the coastal environmental that cannot be satisfactorily mitigated.

5.4.2 Methodology

This EA uses the requirements protecting coastal resources described in **Section 4.4** to assess environmental consequences. A coastal consistency letter was been prepared and submitted to VDEQ for review and concurrence. As **Section 4.4** describes, an on-site RPA delineation was conducted for this EA for the eastern portion of the project study area to determine the extent of the Cannon Branch RPA.

5.4.3 Environmental Consequences

The following sections describe the potential effects to coastal resources of the Proposed Action when compared to the No Action Alternative.

5.4.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. The No Action Alternative would not alter existing conditions related to coastal resources.

5.4.3.2 Proposed Action

The construction and operation of the east parcel development portion of the Proposed Action would occur in the VCP boundary. As **Section 4.4** describes, the west corporate development area is located entirely in the City of Manassas, which is not part of the VCP. This is supported by the VDEQ's October 2017 letter (see Appendix F), which states that the west corporate development is not subject to review for compliance with the Chesapeake Bay Preservation Act. Aside from the realignment of Wakeman Drive,

the construction associated with the east parcel development would not affect the designated Cannon Branch RPA. Prince William County approved the RPA delineation (see **Chapter 4** and **Appendix F**). Because the Proposed Action would not affect the RPA, Prince William County does not require the completion of a Preservation Area Site Assessment or PASA. The proposed development associated with the east parcel development would avoid the 100-year floodplain and delineated wetlands. As the October 2017 VDEQ letter describes, road improvements (e.g., realignment of Wakeman Drive) are considered exempt from the provisions of the Chesapeake Bay Preservation Act provided the road improvements are constructed in accordance with (i) regulations promulgated pursuant to the Virginia Erosion and Sediment Control Law and the Virginia Stormwater Management Act, (ii) an erosion and sediment control plan and a stormwater management plan approved by VDEQ, or (iii) local water quality protection criteria at least as stringent as the above state requirements (see **Appendix F**). The exemption of public roads is further conditioned on optimization of the road alignment and design, consistent with other applicable requirements, to prevent or otherwise minimize (i) encroachment into the RPA and (ii) adverse effects on water quality. Through coordination with VDEQ, the City realigned the potential extent of development associated with the east parcel development area in an effort to minimize encroachment into the RPA (see **Appendix F**). As the February 2018 VDEQ letter states, 9 VAC 25-830-110 of the Chesapeake Bay Preservation Area Designation and Management Regulations requires a site-specific RPA determination (see **Appendix F**) and a Water Quality Impact Assessment be submitted for projects that proposed land disturbing activities in RPAs. 9 VAC 25-830-140 also requires a Water Quality Impact Assessment for any proposed land development in an RPA.

The City would ensure that the Proposed Action is consistent with the enforceable policies of the VCP to the maximum extent practicable. A review of permits and approvals required for the Proposed Action under the enforceable polices of the VCP is included in the federal consistency certification in **Appendix F**. The City would coordinate the required Water Quality Impact Assessment with the VDEQ and Prince William County during the design phase of the east parcel development area. The layout analyzed in this EA is preliminary, and serves only as a basis to analyze the potential environmental effects associated with the maximum development of that area. As such, there is not sufficient data to complete a Water Quality Impact Assessment at this time. The VDEQ reviewed the Proposed Action and found the Proposed Action to be consistent with the Virginia Coastal Zone Management Program, provided that all applicable permits and approvals listed under the enforceable policies of the Coastal Zone Management Program are obtained prior to the implementation of the Proposed Action (see **Appendix F**).

5.4.3.3 Mitigation and Best Management Practices

As previously described, the Proposed Action is consistent with the Virginia Coastal Zone Management Program, provided that all applicable permits and approvals listed under the enforceable policies of the Coastal Zone Management Program are obtained prior to the implementation of the Proposed Action. The City would ensure that the Proposed Action is constructed and operated in accordance with all applicable federal, state, and local laws and regulations.

5.5 DEPARTMENT OF TRANSPORTATION ACT, SECTION 4(F)

This section describes the significance threshold(s) pertaining to Section 4(f) resources. This section also describes methodologies used to determine the potential effects of the Proposed Action compared to the No Action Alternative, and describes those potential effects.

5.5.1 Significance Threshold

FAA Order 1050.1F, Exhibit 4-1, provides the FAA's significance threshold for Section 4(f), which states, "The action involves more than a minimal physical use of a Section 4(f) resource or constitutes a "constructive use" based on an FAA determination that the aviation project would substantially impair the Section 4(f) resource."

For Section 4(f) purposes, a proposed action would "use" a resource in one of two ways.

Physical Use: The action physically occupies and directly uses the Section 4(f) resource. An action's occupancy or direct control (via purchase) causes a change in the use of the Section 4(f) resource. For example, building a runway safety area across a fairway of a publicly-owned golf course is a physical taking because the transportation facility physically used the course by eliminating the fairway.

Constructive Use: The action indirectly uses a Section 4(f) resource by substantially impairing the resource's intended use, features, or attributes. For example, a constructive use of an overnight camping area would occur when project-related aircraft noise eliminates the camping area's solitude. Although not physically occupying the area, the project indirectly uses the area by substantially impairing the features and attributes (i.e., solitude) that are necessary for the area to be used as an overnight camping area.

5.5.2 Methodology

FAA Order 1050.1F, Environmental Desk Reference (Desk Reference), Chapter 5, Section 3 provides guidance specific to airport projects to determine project use of a Section 4(f) resource. Methods used to determine land use compatibility under 14 CFR Part 150 (Noise Compatibility Planning) are helpful in determining if aircraft noise would cause a constructive use of Section 4(f) resources.

The project study area was reviewed for any publicly-owned park, recreational area, wildlife or waterfowl refuge, or historic site. An analysis of whether any components of any of the reasonable alternatives would have a physical or constructive use of the Section 4(f) was conducted. As described in **Section 4.7**, there are two Section 4(f) resources identified in the project study area: the Manassas Station Operations (VDHR # 076-5036) and Site 44PW0729.

5.5.3 Environmental Consequences

The following sections describe the potential effects to Section 4(f) resources associated with implementation of the Proposed Action compared to the No Action Alternative.

5.5.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. Therefore, there would be no affect to Section 4(f) resources.

5.5.3.2 Proposed Action

Construction and operation of the Proposed Action would occur entirely on Airport property and would not require the physical use (direct effect) of any Section 4(f) resource. With regards to Site 44PW0729, the City would ensure the protection of this site from construction-related activities by placing temporary fencing along the 20-foot buffer. In addition, the Proposed Action would not affect air quality, noise, or water quality in a manner that would indirectly affect that or any Section 4(f) resource. See **Section 5.7** for a detailed discussion regarding the *no adverse effects* determination for historic resources, including the FAA's *de minimis* determination for the Manassas Station Operations.

5.5.3.3 Mitigation and Best Management Practices

The City would place temporary fencing to ensure that construction-related activities avoid Site 44PW0729 and the associated 20-foot buffer. Because the Proposed Action would not cause direct or indirect effects to Section 4(f) resources, the City does not propose further mitigation or best management practices. See **Section 5.7** for the detailed discussion regarding historic resources.

5.6 HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

This section describes the significance threshold(s) pertaining to hazardous materials, solid waste, and pollution prevention. This section also describes methodologies used to determine the potential effects of the Proposed Action compared to the No Action Alternative, and describes those potential effects.

5.6.1 Significance Threshold

FAA Order 1050.1F does not define a significance threshold for hazardous materials, solid waste, and pollution prevention; however, it does provide a number of factors to consider in evaluating the context and intensity of potential environmental impacts. FAA Order 1050.1F, Exhibit 4-1 states that these include when the action would have the potential to:

- "Violate applicable federal, state, tribal, or local laws or regulations regarding hazardous materials and/or solid waste management;
- Involve a contaminated site (including but not limited to a site listed on the National Priorities List). Contaminated sites may encompass relatively large areas. However, not all of the grounds within the boundaries of a contaminated site are contaminated, which leave space for siting a facility on non-contaminated land within the boundaries of a contaminated site. An EIS is not necessary required. Paragraph 6-2.3.a of [FAA Order 1050.1F] allows for mitigating impacts below significant levels (e.g., modifying an action to site it on non-contaminated grounds within a contaminated site). Therefore, if appropriately mitigated, actions within the boundaries of a contaminated site would not have significant impacts;
- Produce an appreciably different quantity or type of hazardous waste;
- Generate an appreciably different quantity or type of solid waste or use a different method of collection or disposal and/or would exceed local capacity; or

» Adversely affect human health and the environment."

5.6.2 Methodology

This EA uses the information presented in **Section 4.6**, as well as the USEPA NEPAssist online tool. In order to determine potential impacts to those areas, the EA analyzes the potential increase in hazardous materials and waste at the Airport under the Proposed Action. The EA also analyzes how those materials and wastes would be handled and stored at the Airport.

5.6.3 Environmental Consequences

The following sections describe the potential effects to hazardous materials, solid waste, and pollution prevention of the Proposed Action compared to the No Action Alternative.

5.6.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. No construction related increase in the use or storage of hazardous materials would occur. The use and storage of hazardous materials would increase as activity levels at the Airport increased over time.

5.6.3.2 Proposed Action

Construction of the Proposed Action would temporarily increase on-site hazardous material storage. This would be primarily in the form of diesel fuel, necessary for the operation of construction equipment. Construction of the Proposed Action would also cause a short-term, temporary increase in the quantity of solid waste generated at the Airport. The selected construction contractor would be responsible for disposing of any waste in accordance with all federal, state, and local rules and regulations, including characterizing the all construction and demolition debris in accordance with the Virginia Hazardous Waste Management Regulations prior to disposal at an appropriate facility. Vegetative debris would be managed in accordance with the Virginia Department of Forestry *Best Management Practices for Water Quality* and EO 12088 *Federal Compliance with Pollution Control Standards*. As **Section 4.6** describes, the facilities in the area that accept construction and demolition debris are anticipated to have sufficient capacity for the foreseeable future. The addition of the construction and demolition debris from the Proposed Action would not have a substantial effect on the capacity of these facilities. In addition, the use of those facilities would allow some of the construction and demolition debris to be recycled or reused.

Construction would not occur at sites known or suspected to be contaminated. If hazardous materials are encountered at any time during the construction phase, all work would cease and actions per Virginia Solid Waste Management Regulations (9 VAC 20-81-620), Virginia Hazardous Waste Management Regulations (9 VAC 20-60) and Virginia regulations governing the transportation of hazardous materials (9 VAC 20-110-10 *et seq.*), and EO 13514 (*Federal Leadership in Environmental, Energy, and Economic Performance*) Section 2(e) would be followed. The construction of the Proposed Action would not affect the sites that **Section 4.6** describes. As the VDEQ October 2017 letter describes (see Appendix F), all structures being demolished/renovated/removed would be checked and cleared of asbestos-containing materials and lead-based paint prior to demolition/renovation/removal. The selected construction contractor would follow federal, state, and local regulations regarding these types of materials, should any

be found. If evidence of a petroleum release is discovered during construction activities associated with the Proposed Action, the selected construction contractor would immediately notify the City, which would report the discovery to VDEQ (per Virginia Code § 62.1-44.34.8 through 9 and 9 VAC 25-580-10 *et seq.*). Additionally, if the installation and use of an aboveground storage tank (less than 660 gallons) for temporary fuel storage (less than 120 days) is determined to be necessary for construction activities, the selected construction contractor would follow the requirements in 9 VAC 25-91-10 *et seq*.

Because the construction of the Proposed Action would disturb over one acre of land, the City would be responsible for obtaining a VPDES construction permit prior to the start of ground disturbing activities. The permit includes the development of a SWPPP to address any hazardous material issues, as necessary, associated with the Proposed Action.

Operation of the Proposed Action would not significantly change the type or quantity of hazardous materials used or stored at the Airport. Under the Proposed Action, the materials currently used in the hangars/buildings proposed for relocation would be moved to the new proposed locations. Tenants would be responsible for continuing to store and use hazardous materials in accordance with federal, state, and local rules and regulations. The Proposed Action would not significantly change the landscape maintenance needs of the Airport. However, should the use of pesticides or herbicides for landscape maintenance during construction or operation of the Proposed Action be required, the City would use chemicals in accordance with the principles of integrated pest management. Overall, the Proposed Action would not significantly affect hazardous materials, solid waste, or pollution prevention at the Airport. The County landfill has sufficient capacity to meet the solid waste needs of the Proposed Action. In addition, the Proposed Action would not affect the County landfill's expected capacity.

5.6.3.3 Mitigation and Best Management Practices

As previously described, the City would obtain a VPDES permit prior to the start of construction. Construction and operation of the Proposed Action would be in accordance with the provision of that permit, including the use of recommended BMPS. The City and selected construction contractor may also consider the following VDEQ pollution prevention recommendations as described in their February 2018 letter (see **Appendix I**):

- Development of an effect Environmental Management System.
- Consider environmental attributes when purchasing materials.
- Consider energy efficiency when choosing materials and products.
- Consider contractors' commitment to the environment when choosing contractors.
- Choose sustainable materials and practices for building construction and design
- Integrate pollution prevention techniques into the facility maintenance and operation, including inventory control for centralized storage of hazardous materials.

5.7 HISTORICAL, ARCHITECTURAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

This section describes the significance threshold(s) pertaining to historic, architectural, archaeological, and cultural resources. This section also describes methodologies used to determine the potential effects of the Proposed Action compared to the No Action Alternative, and describes those potential effects.

5.7.1 Significance Threshold

FAA Order 1050.1F does not provide a significance threshold for historical, architectural, archeological and cultural resources; however, it does provide a factor to consider in evaluating the context and intensity of potential environmental impacts. This would occur when the action would result in a finding of Adverse Effect through the Section 106 process. However, an adverse effect finding does not automatically trigger the preparation of an EIS (i.e., a significant impact).

5.7.2 Methodology

For purposes of this EA, historic, archeological, and cultural resources are districts, sites, buildings, structures, objects, landscapes, and Native American Traditional Cultural Properties (TCPs) that are on or eligible for listing on the National Register of Historic Places (NRHP). Such "NRHP properties" are nationally important due to their significant and respective roles in American history, prehistory, architecture, archeology, engineering and culture. Regulations at 36 Code of Federal Regulations (CFR) Part 800 *et seq.* provide detailed instructions to federal agencies on how to assess and address effects on those historically significant properties. A viewshed analysis was conducted to determine potential visual effects to historic resources (see **Appendix D**).

For archaeological resources, the results of the Phase I Archaeological Survey and metal detector survey (see **Section 4.7** and the complete surveys in **Appendix D**) were used to determine potential effects to archaeological resources.

5.7.3 Environmental Consequences

The following sections describe the potential effects to historical, architectural, archeological and cultural resources from the No Action Alternative and Proposed Action.

5.7.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. Therefore, there would be no affect to historical, architectural, archaeological, or cultural resources.

5.7.3.2 Proposed Action

As **Section 4.7** describes, there are no NRHP-listed resources in the APE. The closest NRHP site is over about one-half mile west of the APE. The Manassas Station Operations district is potentially eligible for listing on the NRHP and intersects the project study area. The Proposed Action would not change the viewshed of the APE or affect air quality, noise, or water quality in a manner that would affect that or any other NRHP-listed or eligible resource. See **Appendix D** for the detailed viewshed analysis. No archaeological resources have been identified in the direct APE (see **Section 4.7** and **Appendix D**). The

construction and operation of the Proposed Action would not affect archaeological resources. As previously described, Site 44PW0729 is immediately west of the survey area. The City would ensure the protection of this site from construction-related activities by placing temporary fencing along the 20-foot buffer described in **Section 4.7**.

The VDHR concurred with the FAA that the Proposed Action would have *no adverse effect on historic properties with the condition* that protective measures should be employed during construction for Site 44PW0729 (see **Appendix D**).

5.7.3.3 Mitigation and Best Management Practices

As previously described, Site 44PW0729 is located outside of the Proposed Action's limits of disturbance. However, the City would employ the measures described above (temporary fencing) to ensure that construction-related activities avoid this area and the associated 20-foot buffer. Overall, the Proposed Action would not cause direct or indirect effects to historical, architectural, archaeological, or cultural resources. In the unlikely event that there is an unanticipated discovery of archaeological material during construction, construction activities would stop immediately and the selected construction contractor would contact the City. The City will coordinate with the FAA and VDHR, and construction activities would not resume without verbal and/or written authorization.

5.8 NATURAL RESOURCES AND ENERGY SUPPLY

This section describes the significance threshold(s) pertaining to natural resources and energy supply. This section also describes methodologies used to determine the potential effects the Proposed Action compared to the No Action Alternative on those resources, and describes those potential effects.

5.8.1 Significance Threshold

FAA Order 1050.1F does not define a significance threshold for natural resources and energy supply; however, it does provide a factor to consider in evaluating the context and intensity of potential environmental impacts. Potentially significant effects could occur if the action would have the potential to cause demand to exceed available or future supplies of these resources, which include aviation and surface vehicle fuel, construction material, and electrical power.

Available industry information related to sustainable design and sustainable practices was reviewed to describe measures to reduce the potential landside development demands on natural resource and energy supplies. These useful references, recognized by the FAA are:

- Airports Cooperative Research Program (ACRP) Synthesis 10, Airport Sustainability Practices
- Sustainable Aviation Guidance Alliance Database

5.8.2 Methodology

This EA evaluates project-related potential effects on natural resources and energy supplies in the project study area. This is primarily done by examining how the Proposed Action would change landside operations compared to the No Action Alternative.

5.8.3 Environmental Resources

The following sections describe the potential effects to natural resources and energy supply of the Proposed Action compared to No Action Alternative.

5.8.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. No construction-related demand for natural resources would occur. Energy use would continue to increase as activity levels increased.

5.8.3.2 Proposed Action

Construction of the Proposed Action would temporarily increase the amount of natural resources used at the Airport. These could include prefabricated building components, aggregate, sub-base materials, and oils associated with the construction of the Proposed Action. These resources are not rare or in short supply, and the quantity required for development of this size would not place an undue strain on supplies. Construction would also increase the energy demand at the Airport; however, this increase would be temporary and minor, and within the supply capabilities of the City of Manassas.

Operation of the Proposed Action would increase the use of natural resources at the Airport in the form of water consumption, aviation fuel, and energy. The increase in the use of natural resources would not be significant and would not place a strain on the availability of resources for the surrounding area. The natural resources required by the Proposed Action are not rare or in short supply. For those reasons, the Proposed Action would not have a significant effect on natural resources compared to the No Action Alternative.

The Proposed Action would increase the overall energy requirements of the Airport compared to the No Action Alternative. Existing utilities would be extended to serve the proposed facilities. The ongoing operation of the Proposed Action would be well within the supply capabilities of the City of Manassas. The City would obtain the necessary permits for the extension of utility lines. New facilities would be built to current energy efficient building codes and would be designed to use less energy than similar existing facilities at the Airport. Sustainable design elements may be considered during the design of the Proposed Action to increase energy efficiency. For example, the proposed replacements and new structures could use light-emitting diode (LED) lighting through the facility, low flow plumbing fixtures, and energy efficient appliances, among other measures. For those reasons, the Proposed Action would not have a significant effect on energy supplies.

5.8.3.3 Mitigation and Best Management Practices

As previously described, the Proposed Action would be designed to current energy efficient code requirements and could also include sustainable design elements to reduce energy consumption. These elements may include energy efficient lighting and equipment. ACRP Synthesis 10, the Sustainable Aviation Guidance Alliance Database, and DOAV's *Virginia Airports Sustainability Management Plan* provide a wide range of sustainable elements that the selected design contractor could implement.

5.9 SOCIOECONOMICS, ENVIRONMENTAL JUSTICE, AND CHILDREN'S ENVIRONMENTAL HEALTH AND SAFETY RISKS

This section describes the significance threshold(s) pertaining to socioeconomics, environmental justice, and children's environmental health and safety risks. This section also describes methodologies used to determine the potential effects the Proposed Action compared to the No Action Alternative, and describes those potential effects.

5.9.1 Significance Threshold

The following sections describe the significance thresholds used to determine potential affects to socioeconomics, environmental justice, and children's environmental health and safety risks.

5.9.1.1 Socioeconomics

FAA Order 1050.1F does not provide a significance threshold for socioeconomics. It does provide a number of factors to consider in evaluating the context and intensity of potential environmental effects. Those factors to consider include the potential of the action to:

- Induce substantial economic growth in an area, either directly or indirectly (e.g., through establishing projects in an undeveloped area)
- Disrupt or divide the physical arrangement of an established community
- Cause extensive relocation when sufficient replacement housing is unavailable
- Cause extensive relocation of community businesses that would cause severe economic hardship for affected communities
- Disrupt local traffic patterns and substantially reduce the levels of service of roads serving an airport and its surrounding communities
- Produce a substantial change in the community tax base

5.9.1.2 Environmental Justice

FAA Order 1050.1F does not provide a significance threshold for environmental justice. It does provide a number of factors to consider include the potential of the action to have a disproportionately high and adverse impact to low-income or minority populations, due to:

- Significant impacts in other environmental impact categories
- Impacts on the physical or natural environment that affect an environmental justice population in a way that the FAA determines are unique to the environmental justice population and significant to that population.

5.9.1.3 Children's Environmental Health and Safety Risks

FAA Order 1050.1F does not provide a significance threshold for children's environmental health and safety risks. It does provide a factor to consider in evaluating the context and intensity of potential environmental impacts. This is when the action would have the potential to lead to a disproportionate health or safety risk to children.

5.9.2 Methodology

The analysis in this EA, consistent with FAA requirements, considers the potential of the No Action Alternative and Proposed Action to:

- Move people from their homes
- Move people from their businesses
- Divide or disrupt established communities
- Change surface transportation patterns or traffic levels
- Disrupt orderly, planned development
- Create a notable change in employment.

5.9.3 Environmental Consequences

This section describes the potential socioeconomic, environmental justice, and children's environmental health and safety risk effects associated with implementation of the Proposed Action compared to the No Action Alternative.

5.9.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. The No Action Alternative would not differ from existing conditions with respect to socioeconomics, environmental justice, or children's environmental health and safety risks.

5.9.3.2 Proposed Action

The following paragraphs describe the potential socioeconomic, environmental justice, and children's health and safety risks that could result from implementation of the Proposed Action.

Socioeconomics

The following paragraphs describe the potential effects of the Proposed Action on population growth, housing, labor force and revenue, and surface transportation. This analysis assumes that there would be about 75 construction workers[5] based on the extent of the Proposed Action and about 30 new employees at the Airport for operation of the Proposed Action.

Population: The construction of the Proposed Action could cause the short-term employment of construction workers. Because construction associated with the Proposed Action would be temporary, this would not cause a shift in population growth or change population growth patterns.

The operation of the Proposed Action could increase employees at the Airport by about 30 people. It is reasonable to assume that these employees would be from the surrounding area and would not relocate from other areas. If all 30 people were to relocate, including their spouses and children, it would represent about a one percent increase in the population of the census tracts intersecting the project study area,

[5] The number of construction workers is estimated based on projects at other airports of similar size and extent, as well as the type of development proposed. The number of workers also takes into consideration that construction would occur in phases rather than at once; thereby reducing the number of construction workers on site at any given time.

and a less than 0.5% increase in population of the City of Manassas. Operation of the Proposed Action would not affect population growth or growth patterns.

Housing: It is likely that construction workers would be from the neighboring area and would not require temporary housing or increase housing demand in the area. In addition, the potential increase in employees at the Airport would not be significant and employees are likely to already reside in the area. If all anticipated new employees were to relocate to the area, there is adequate housing to accommodate them (see **Section 4.9**). Construction and operation of the Proposed Action would not place a strain on housing in the area.

Labor Force and Revenue: Construction workers would most likely be those already in the construction industry; therefore, construction of the Proposed Action would not materially affect the labor force in the area. In addition, the potential increase in employees at the Airport would not significantly affect the area's labor force. The Proposed Action would not require the relocation of any businesses and, therefore, would not decrease the existing employment base or local fiscal revenue.

Surface Transportation: This EA assumes there would be about 75 construction workers for the Proposed Action, with about 1.25 construction workers per vehicle (60 vehicles or 120 trips per day), including personal vehicles and construction vehicles. Construction vehicles would need to travel on local roads to access the project study area. Because construction-related traffic would likely occur before or after peak traffic times, construction-related traffic would not significantly affect the level of service of roadways around the Airport (Observation Road, Wakeman Drive, Harry J. Parish Boulevard). The City would phase construction in a way that allows Airport employees, tenants, and other users to have uninterrupted access to the Airport during construction-related activities. Potential traffic-related effects from construction would be temporary, lasting only as long as construction of the Proposed Action (five years).

The potential increase in tenant employees at the Airport would also increase the number of people traveling to the Airport. However, given the nature of operations at the Airport, it is unlikely that all tenant employees would travel to the Airport everyday (tenant employees would only travel to the Airport when needed for general aviation flights). In addition, the potential increase in employees (city and tenant) would not be significant. For those reasons, the Proposed Action would not significantly affect traffic in the area.

The Proposed Action does not include the permanent closure of any roads. As previously described, the intersection of Observation Road and Piper Lane would be modified to prevent flooding during precipitation events. Wakeman Drive would ultimately be realigned to allow for the development of the east parcel. These roadway realignments would not affect traffic patterns, and would ultimately improve access to the west side of the Airport during precipitation events, as well as continue to allow access to the east side of the Airport. The potential change in surface transportation activity by general aviation tenants/pilots to conduct aviation related activities on the west side of the Airport (e.g., recreational flying, maintain aircraft, or other activities) would be infrequent and dependent on a few factors (e.g., weather, fuel prices, personal time, etc.). The change in surface transportation is not expected to change the area roads level of service or road pavement conditions of Observation Road or Piper Lane. For these reasons,

an analysis of Piper Lane to handle additional minor and infrequent traffic, as recommended by Prince William County, was not conducted as part of this EA. According to the VDEQ October 2017 letter (see Appendix F), the Virginia DOT did not have any transportation-related concerns related to the project.

If during the design of the roadway improvements, it becomes apparent that a VDOT right of way would be affected, the City would coordinate with the VDOT to obtain the appropriate Land Use Permit. In addition, the City would coordinate with the appropriate local entities during the design and construction of the proposed roadway improvements.

Environmental Justice

Construction and operation of the Proposed Action would occur entirely on Airport property and would not require the relocation of residents or businesses. As described throughout this chapter, the Proposed Action would not cause significant environmental effects (e.g., air quality, water quality) and, therefore, the effects would not disproportionately affect any population surrounding the Airport.

Children's Environmental Health and Safety Risks

Construction and operation of the Proposed Action would not significantly affect surrounding communities. The Proposed Action would not increase exposure of environmental contaminants to children in the surrounding community. Overall, the Proposed Action would not affect children's environmental health and safety risks.

5.9.3.3 Mitigation and Best Management Practices

The Proposed Action would not have a significant socioeconomic, environmental justice, or children's environmental health and safety risks effect. Therefore, no mitigation or BMPs are proposed in association with the Proposed Action.

5.10 VISUAL EFFECTS

This section describes the significance threshold(s) pertaining to visual effects, the methodologies used to determine the potential visual effects of the Proposed Action compared to the No Action Alternative, and describes what those potential effects are.

5.10.1 Significance Threshold

FAA Order 1050.1F does not define a significance threshold for visual effects; however, Exhibit 4-1 of the Order provides a number of factors to consider in evaluating the context and intensity of potential environmental impacts.

For light emissions, these factors include the degree to which the action would have the potential to:

- "Create annoyance or interfere with normal activities from light emissions; and
- Affect the visual character of the area due to the light emissions, including the importance, uniqueness, and aesthetic value of the affected visual resources."

For visual resources/visual character, these include the extent the action would have the potential to:

- "Affect the nature of the visual character of the area, including the importance, uniqueness, and aesthetic value of the affected visual resources;
- Contrast with the visual resources and/or visual character in the study area; and
- Block or obstruct the views of visual resources, including whether these resources would still be viewable from other locations."

Potential aesthetic effects of an action are generally assessed by comparing the visual characteristics of the proposed development to existing development in the areas and to the environmental setting, and by determining if a jurisdictional agency considers this contrast objectionable. The visual effects resulting from constructing and operating the Proposed Action would result from physical changes to the visual character of the project study area, including existing development, landforms, vegetation, and water surfaces.

5.10.2 Methodology

Airport-related light emissions are of particular concern if light is directed towards a residential area or other sensitive site. Impacts from lighting associated with the Proposed Action are determined by evaluating the individual lighting systems to be developed at the Airport and assessing distance, light angle, and intensity as they relate to the surrounding light-sensitive land uses. These factors identify the potential for lighting to result in annoyance to local residents.

While the final appearance of the proposed development would be determined through a future design process, the analysis of visual effects uses the massing and layout of the proposed development to provide an indication of the Proposed Action's consistency with the visual character of the area.

5.10.3 Environmental Consequences

This section describes the potential visual effects associated with implementation of the Proposed Action compared to the No Action Alternative.

5.10.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. The No Action alternative would not differ from existing conditions.

5.10.3.2 Proposed Action

Construction activity is unlikely to occur during the nighttime hours; therefore, glare light emissions from construction activities is not expected. The Proposed Action would require lighting for safety and security reasons. Lighting would illuminate the interior and exterior of hangars and buildings, as well as line the roadways. Exterior illumination would be directional and focused lighting on vehicle and pedestrian movement areas. The existing vegetative buffers and the non-residential character of the surrounding off-Airport development further reduce the possibility that light emissions from the Proposed Action would create annoyance or interfere with normal activities.

The final build-out of the Proposed Action would be similar to the infrastructure and buildings at the Airport and would not alter the visual character of the area. The new development would be consistent in scale with the surrounding commercial development in the viewshed of the Proposed Action. Additionally, a vegetative buffer and off-Airport commercial development separates nearby land uses from the Airport, preventing a direct line-of-sight to the project study area.

5.10.3.3 Mitigation and Best Management Practices

The Proposed Action would not cause visual effects; however, BMPs to reduce possible glare could be implemented as appropriate. For example, shield hooding on lighting fixtures to direct light to specific areas could be used. In addition, specific landscaping and architectural treatments to complement the surrounding environment could be included in the design of the Proposed Action.

5.11 WATER RESOURCES

This section describes the significance threshold(s) pertaining to water resources, including wetlands, floodplains, surface water, and groundwater. This section also describes methodologies used to determine the potential effects the Proposed Action would have on those resources compared to the No Action Alternative, and describes those potential effects. As **Chapter 4** describes, there are no protected river segments in the project study area; therefore, this section does not discuss the resource category Wild and Scenic Rivers.

5.11.1 Significance Threshold

The following sections describe the significance thresholds used to determine potential effects to wetlands, floodplains, surface water, and groundwater.

5.11.1.1 Wetlands

FAA Order 1050.1F, Exhibit 4-1, defines the FAA's significance threshold for wetlands, which states, "The action would:

1. Adversely affect a wetland's function to protect the quality or quantity of municipal water supplies, including surface waters and sole source and other aquifers;
2. Substantially alter the hydrology needed to sustain the affected wetland system's values and functions or those of a wetland to which it is connected;
3. Substantially reduce the affected wetland's ability to retain floodwaters or storm runoff, thereby threatening public health, safety or welfare (the term welfare includes cultural, recreational, and scientific resources or property important to the public);
4. Adversely affect the maintenance of natural systems supporting wildlife and fish habitat or economically important timber, food, or fiber resources of the affected or surrounding wetlands;
5. Promote development of secondary activities or services that would cause the circumstances listed above to occur; or
6. Be inconsistent with applicable state wetland strategies."

5.11.1.2 Floodplains

FAA Order 1050.1F, Exhibit 4-1 defines the FAA's significance threshold for floodplains, which states "The action would cause notable adverse impacts on natural and beneficial floodplain values."

5.11.1.3 Surface Water

FAA Order 1050.1F, Exhibit 4-1, defines the FAA's significance threshold for surface waters, which states, "The action would:

1. Exceed water quality standards established by Federal, state, local, and tribal regulatory agencies; or
2. Contaminate public drinking water supply such that public health may be adversely affected."

5.11.1.4 Groundwater

FAA Order 1050.1F, Exhibit 4-1, defines the FAA's significance threshold for groundwater, which states, "The action would:

1. Exceed groundwater quality standards established by Federal, state, local, and tribal regulatory agencies; or
2. Contaminate an aquifer used for public water supply such that public health may be adversely affected."

5.11.2 Methodology

This EA uses applicable laws and regulations to determine potential wetland impacts. The analysis includes data obtained during a wetland survey of the area, FEMA flood insurance rate maps, and information from the Virginia Department of Environmental Quality.

The potential impacts were assessed based on the location, preliminary planning, and intended function of the Proposed Action. The proposed disturbed areas and new impervious areas for the Proposed Action were analyzed to evaluate the potential short-term construction and long-term operational impacts. Possible impacts to groundwater recharge/discharge areas were investigated. Increases to potable water consumption and domestic wastewater treatment were also considered in regard to potential direct impacts or changes in operational activities.

5.11.3 Environmental Consequences

This section describes the potential wetland, floodplain, surface water, and groundwater effects associated with implementation of the No Action Alternative and the Proposed Action.

5.11.3.1 No Action Alternative

Under the No Action Alternative, the west corporate development and east parcel development would not occur. The City would continue to operate the Airport and serve forecast aviation demands. The No Action Alternative would not differ from existing conditions.

5.11.3.2 Proposed Action

The following paragraphs describe the effects of the Proposed Action in comparison with the No Action Alternative with respect to wetlands, floodplains, surface waters, and groundwater resources.

Wetlands

As **Chapter 4** describes, there are 4.84 acres of wetlands in the project study area. Of the identified wetlands, the proposed west corporate development could potentially affect 0.02-acre of palustrine emergent wetlands and 1.60-acres of palustrine forested wetlands on the west side of the Airport (see **Figure 5-1**). The impact to 1.60 acres of palustrine forested wetlands would be to meet floodplain mitigation requirements. These wetlands are considered non-tidal wetlands.[6] The development of the east parcel would not affect wetlands (see **Figure 5-2**). In total, the Proposed Action could potentially affect about 1.62-acre of wetlands. The approved mitigation ratio associated with the wetland permitting would take into account the appropriate amount of mitigation required to offset the impacts within the watershed, which includes the loss of wetland function in the watershed. Therefore, given the mitigation measures, the loss of wetland function associated with the Proposed Action would not have an overall effect on the watershed. It is anticipated that the impacts to the 1.60-acres of palustrine forested wetlands would require a minimum mitigation ratio of 2:1. Under those assumptions, the City would be required to purchase 3.2 credits for those associated wetlands, along with a 1:1 ratio for the 0.02 acre of palustrine emergent wetlands. This would lead to a total mitigation requirement of 3.22 credits that could be acquired through an invitation for bid process. As of December 15, 2017, there are over 20 banks that provide mitigation credits within the service area associated with the Proposed Action. There are currently over 70 credits available across that service area. These numbers will change and will not likely be the same when the time comes to make credit purchases. However, there does appear that the likelihood of credit availability will be high. This is also important when opened for a competitive bid process because the banks will have to compete for the opportunity to service the project.

The City would obtain an approved jurisdictional determination from the USACE, which remains valid for five years. The City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission (VMRC) to determine the appropriate permit(s) and mitigation measures. During the preliminary design of the Proposed Action, a Joint Permit is likely to be required for potential wetland effects. Based on the potential effects, it is likely that an Individual Permit from the USACE would be required as well as a Virginia Water Protection General Permit 4 from VDEQ. Both of these permit processes are initiated via the submission of a non-tidal Joint Permit Application where the VMRC, USACE, and VDEQ would get a copy and have an opportunity to request further information if necessary.

In the west corporate area, the 0.02-acre palustrine emergent wetland impact cannot be avoided because the t-hangars cannot be expanded to the northeast due to FAA safety areas. There is not sufficient space north of the existing t-hangars for the expansion. In addition, there would be greater wetland impacts if the t-hangars were extended from the existing t-hangars to the south. The 1.60-acre palustrine forested wetland impact cannot be avoided because of the requirements for floodplain mitigation. The cut area for the floodplain mitigation cannot be located elsewhere. During the floodplain analysis, several locations upstream and downstream of the development were examined as potential sites for floodplain mitigation. The proposed mitigation site, adjacent to the project study area and on Airport property, achieved a "no-rise" condition of flood elevations required by the local floodplain authority, whereas other potential sites did not achieve a "no-rise" condition.

[6] Tidal wetlands are wetlands located in the VCP.

FIGURE 5-1
WETLANDS IN THE WEST CORPORATE DEVELOPMENT AREA

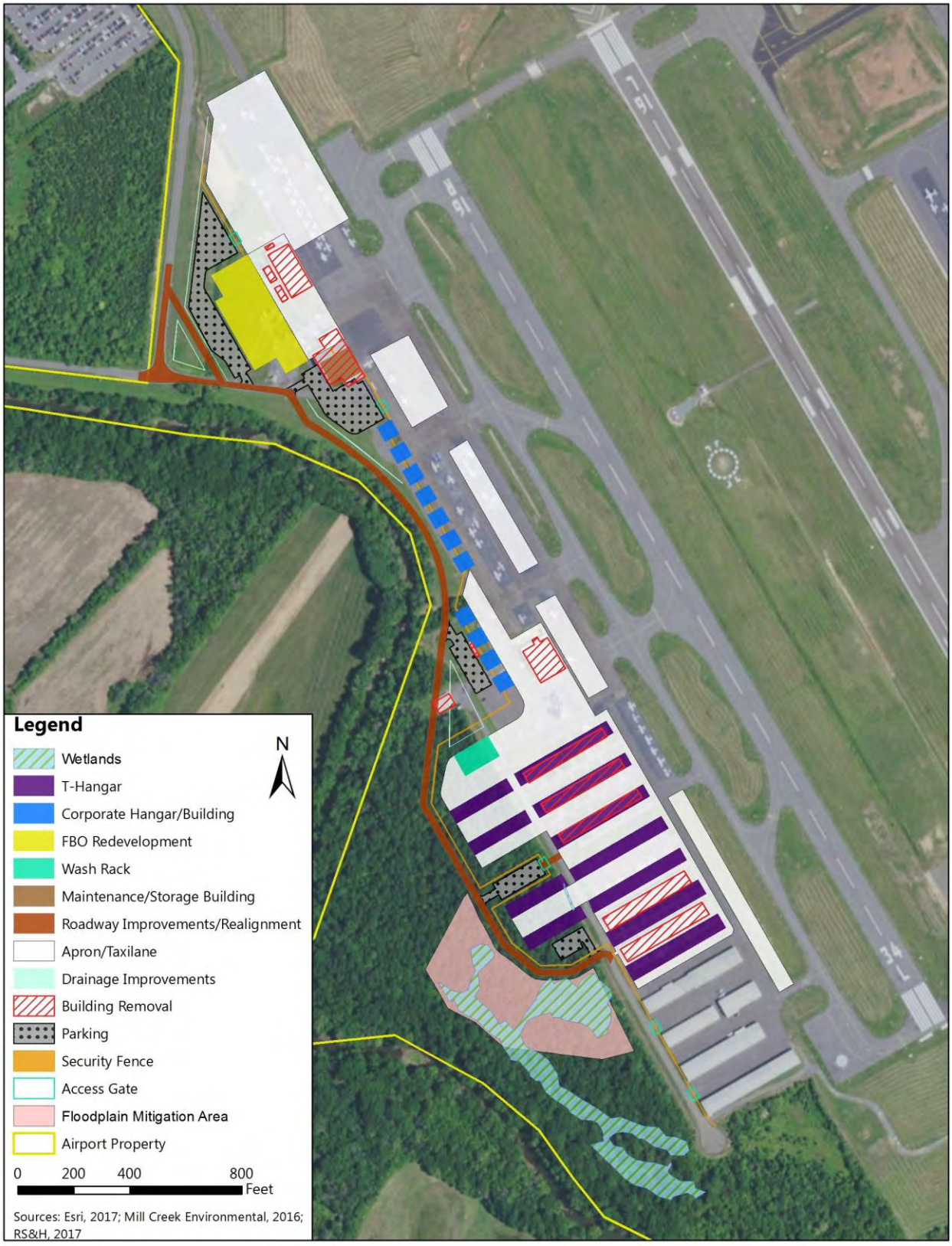
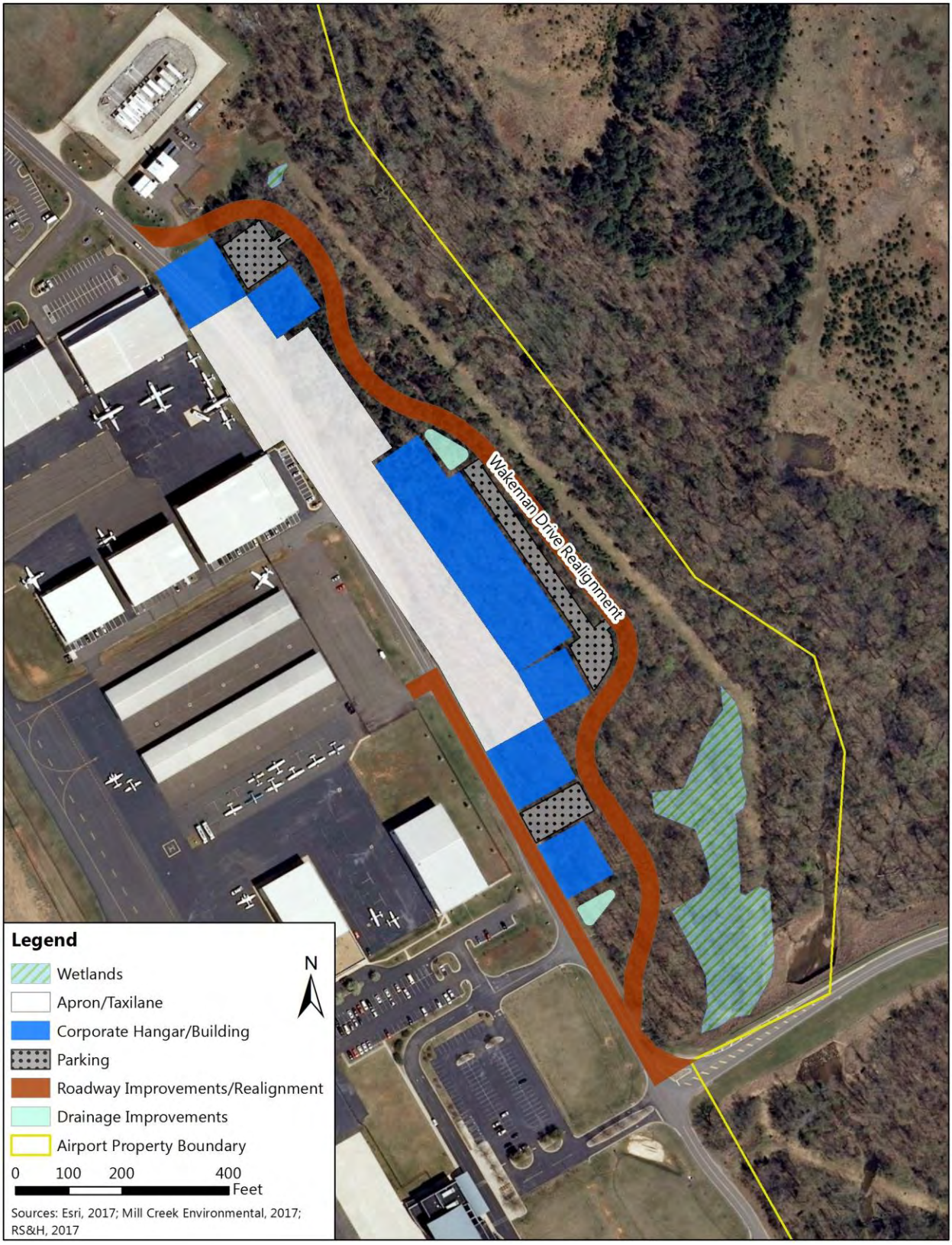


FIGURE 5-2
WETLANDS IN THE EAST PARCEL DEVELOPMENT AREA



The City would coordinate wetland mitigation with the appropriate entities (e.g., USACE, VMRC, and VDEQ) and obtain the necessary permits for wetland impacts prior to the start of ground disturbing activities associated with the Proposed Action. Potential mitigation strategies for unavoidable wetland impacts include, but are not limited to, wetland banking and in-lieu fees. Given the FAA's safety standards with regards to wildlife hazards and minimizing wildlife hazards on Airport property, the City could not create a wetland mitigation site on-Airport property.

Floodplains

About 2.7 and 19.9 acres of the proposed West Corporate Development are within the designated floodway and 100-year floodplain, respectively (see **Figure 5-3**). The proposed east parcel development would not affect the designated floodway or 100-year floodplain (see **Figure 5-4**). To comply with minimum floodplain standards required by the National Flood Insurance Program (NFIP) for new buildings in a Zone AE floodplain, new structures must be elevated to or above the base flood elevation (BFE). This could require placing fill in the floodplain. Additionally, the portion of the existing Airport access road within the designated floodway would be raised above the BFE to provide improved accessibility during flood events.

Placing fill in a base floodplain could adversely affect the floodplain's natural storage values and functions. This could result in loss of water storage during the one percent chance annual flood (100-year storm), raising the BFE, and causing flooding to areas outside the floodplain. Additionally, the floodplain provides the function of flood control by slowing flood flows and retaining water, thereby lessening the probability of upstream or downstream flooding. Placing obstructions in the floodplain could adversely affect the floodplain's flood control.

In compliance with USDOT Order 5650.2, Floodplain Management and Protection, a floodplain analysis was conducted using Hydrologic Engineering Center's River Analysis System (HEC-RAS). This analysis concluded that the Proposed Action would not result in an increase in the 100-year flood elevation (see **Appendix H**, Table 1) and would result in a change in flood boundaries on airport property only (see **Appendix H**). The Proposed Action would not affect aviation safety and Airport use or affect the likelihood of flood-induced spills of hazardous material stored at the Airport. Furthermore, it would not have substantial encroachment-associated costs or damage including interrupting service or loss of a vital transportation facility, nor result in notable adverse impacts on natural and beneficial floodplain values in or around the Airport. See Appendix H for the hydraulic report.

As **Chapter 3** describes, the floodplain impacts are unavoidable given the location of the Airport between Broad Run and Cannon Branch, the FAA safety area, and Airport property available for development. Mitigation would be required to minimize impacts of the Proposed Action on the existing floodplain boundaries and flood elevations. Mitigation measures include providing additional floodwater storage area(s) along Broad Run to convey floodwaters. Clearing & grubbing, excavation, other earthwork and ground stabilization are anticipated to complete the required mitigation.

FIGURE 5-3
FLOOD ZONES IN THE WEST CORPORATE DEVELOPMENT AREA

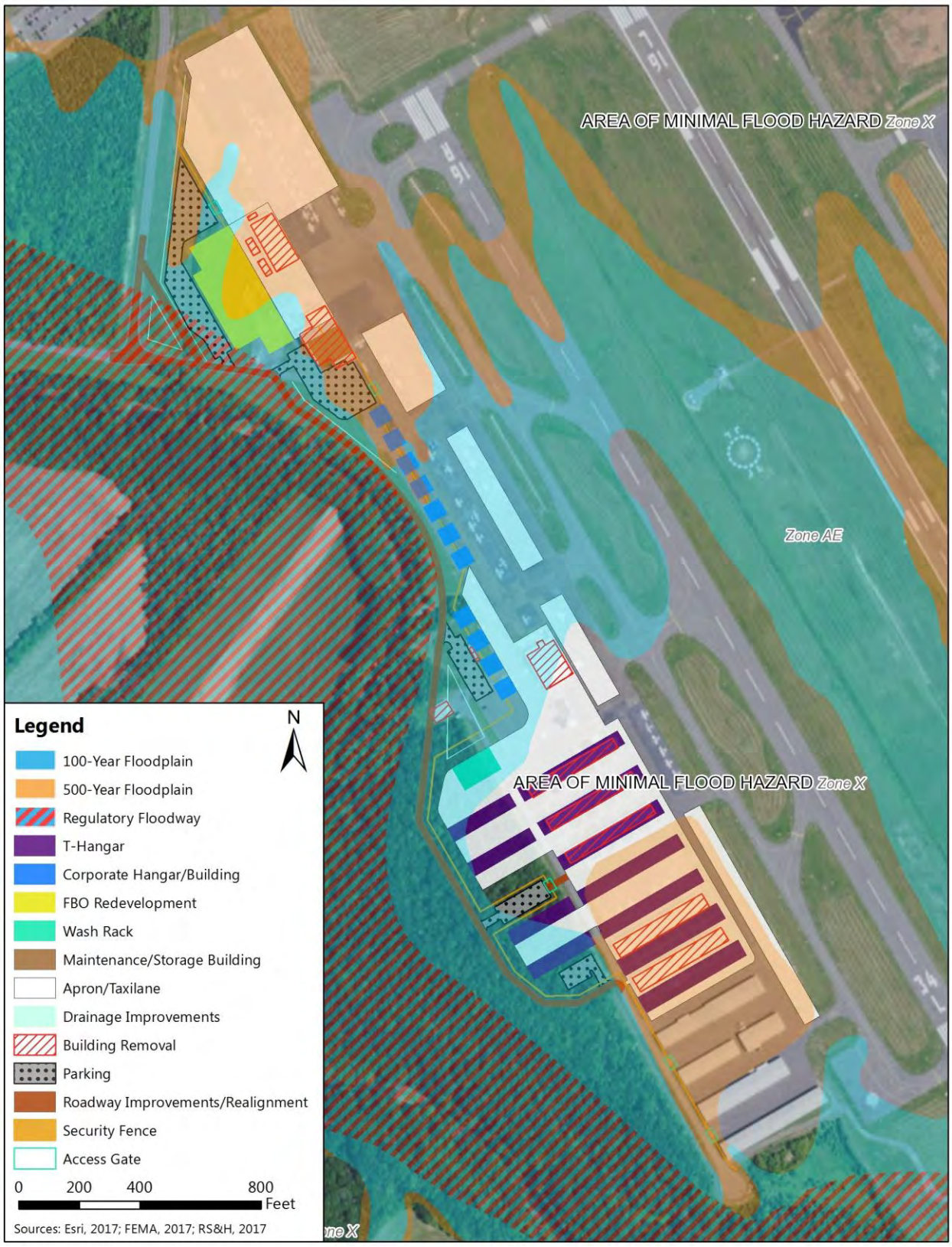
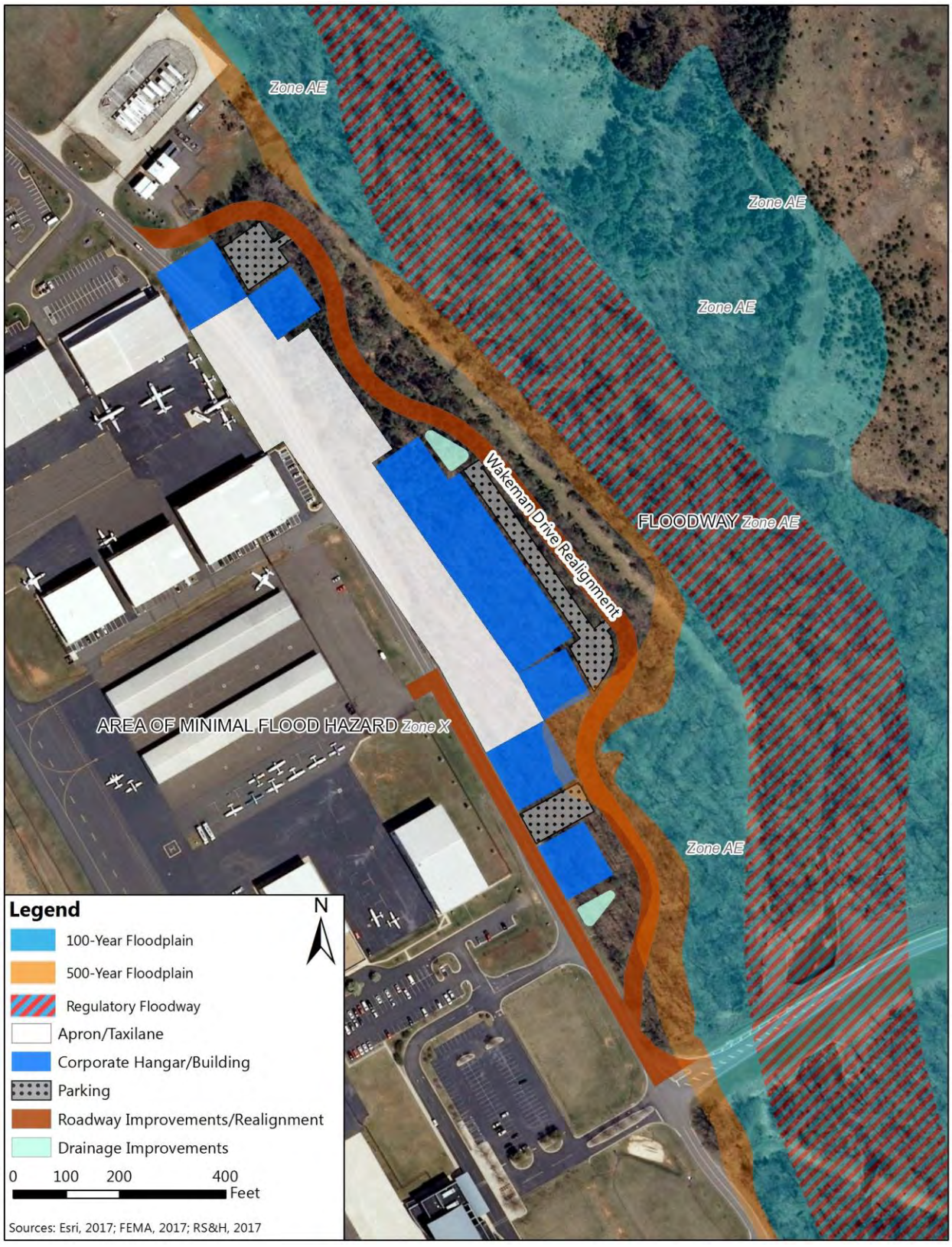


FIGURE 5-4
FLOOD ZONES IN THE EAST PARCEL DEVELOPMENT AREA



Efforts to minimize impacts on the floodway and 100-year floodplain were made during the design and grading of the proposed west corporate development. Observation Road was realigned to avoid the floodway to the maximum extent practicable at the intersection with Piper Lane. Roadway elevations were set at approximately the base flood elevation (BFE) as a safety measure to allow access to and from the Airport during a major storm event.

The City of Manassas and Prince William County have jurisdiction over the floodplain in the vicinity of the Airport. The City of Manassas and Prince William County reviewed hydrologic and hydraulic floodplain analyses and will not permit encroachment in the floodplain unless a "no-rise" condition is achieved or a Conditional Letter of Map Revision (CLOMR) is approved by FEMA. A CLOMR will be needed for the project because the Proposed Action is within the designated floodway. According to FEMA's CLOMR application instructions, the proponent (i.e., Airport) would need to submit proposed plans, certified by a registered Professional Engineer, for all the project elements. The Proposed Action is at a planning stage of development and proposed engineering plans are not ready to be developed. A CLOMR application cannot be submitted until more detail engineering plans of a facility are developed and ready for review. The information within this EA including the floodplains modeling and supporting documentation provides a significant portion of information to develop a FEMA CLOMR; when it is time to be completed. As such, a FEMA CLOMR application would need to be coordinated and completed prior to the initiation of construction of any improvement that effects a floodplain described under the Proposed Action.

Surface Water

The Proposed Action would increase impervious surface by about 25 acres. As previously described, the Proposed Action would affect wetlands, which are also considered surface waters, but would not directly affect other surface waters in the project study area (see **Section 4.11** for a description of those resources).

The implementation of the Proposed Action would permanently increase the amount of impervious surface by about 25 acres, which would increase stormwater runoff in the area. VDEQ regulates surface water quality and quantity through the Virginia Stormwater Management Program (VSMP). The Proposed Action would comply with *Virginia's Erosion and Sediment Control Law* (Virginia Code § 62.1-44.15:61) and *Regulations* (9 VAC 25-840-30 *et seq.*) and *Stormwater Management Law* (Virginia Code § 62.1-44.15:31) and *Regulations* (9 VAC 25-870-210 *et seq.*) as locally administered.

To meet VSMP requirements for water quality as identified in Virginia Administrative Code 9 VAC 25-870-66, the Proposed Action would include on-site stormwater management facilities for detention. Water quality compliance as identified in 9 VAC 25-870-65 requires that the Proposed Action include best management practices such as dry swales, bioretention, infiltration, and sheet flow to open space. In addition, the City would register for coverage under the Virginia Stormwater Management Program General Permit for Discharges of Stormwater from Construction Activities (9 VAC 25-870-1 *et seq.*) and would amend the Airport's VPDES Industrial Stormwater General Permit (VAR050985) for stormwater discharges associated with industrial activities. This update includes updating the Airport's SWPPP. The SWPPP is not expected to significantly change, but would be modified to reflect the Proposed Action and the associated outfalls.

Construction of the Proposed Action would have a less than significant effect on surface water. The City would be responsible for ensuring that a VPDES permit for construction activities is obtained prior to the start of ground disturbing activities. Under the VPDES, a SWPPP, specific to the construction of the Proposed Action, would be developed. The City would be responsible for ensuring that a project-specific erosion and sediment control plan is submitted to the City and County for review and approval prior to the start of ground disturbing activities. In addition, the selected construction contractor would be responsible for adhering to the VPDES permit requirements and implementation of BMPs during construction.

Construction and operation of the Proposed Action would not affect water quality in manner that would affect the quality of the public drinking water supply. In addition, the Proposed Action would not increase the use of public water supplies in a manner that would affect the overall supply of public water. The extension of utilities, including water and sewer lines, associated with the Proposed Action would be coordinated with, and verified by, the local utility entities.

Groundwater

The construction and operation of the Proposed Action could potentially affect groundwater due to the increase in impervious surface. In total, the Proposed Action would increase impervious surface by about 25 acres. As previously described, the City would be responsible for obtaining a VPDES permit prior to the start of ground disturbing activities, and would also be responsible for updating the existing VPDES general permit for the Airport to reflect the Proposed Action. Compliance with the requirements of the VPDES permit would prevent significant groundwater effects.

5.11.3.3 Mitigation and Best Management Practices

With regards to wetlands, the City would obtain and comply with the provisions of the applicable federal, state, and local permits. The selected construction contractor would be required to comply with these permit provisions. If mitigation is required, potential mitigation strategies for unavoidable wetland impacts include, but are not limited to, wetland banking and in-lieu fees. As stated in the February 28, 2018 VDEQ letter, the selected construction contractor may also implement the following BMPs to minimize unavoidable impacts to wetlands:

- Operate machinery and construction vehicles outside of stream-beds and wetlands.
- Preserve the top 12 inches of trench material removed from wetlands for use as wetland seed and root-stock in the excavated area
- Design erosion and sedimentation controls in accordance with the most current edition of the Virginia Erosion and Sediment Control Handbook.

In terms of floodplains and as previously described, mitigation measures for potential floodplain impacts could include providing additional floodwater storage area(s) along Broad Run to convey flood waters. Mitigation for floodplain compensation due to placement of fill from the proposed west corporate development were analyzed during the floodplain analysis. Potential floodplain compensation was modeled at three different locations along Broad Run in the hydraulic model. Compensation sites were located upstream, adjacent to, and downstream of the proposed west corporate development. The hydraulic model computed increases in BFEs for Broad Run when analyzing the compensation areas

upstream and downstream of the proposed west corporate development. Regulations governing the Airport require that potential west corporate development result in a no-rise to the BFEs from existing to proposed conditions. A combination of upstream and downstream mitigation also resulted in a rise to the BFEs. The proposed mitigation site, on Airport property, achieved a "no-rise" condition to the Broad Run BFEs required by the local floodplain authority.

As previously described, compliance with the VPDES construction and general permit would minimize potential water quality effects from construction and operation of the Proposed Action. The City would update the Airport's SWPPP, which outlines erosion and sediment control practices and methods for waste disposal and spill prevention. This include measures to reduce the possibility of accidental spills, improve response times if a spill does occur, and reduce safety hazards. Examples of these measures include, but are not limited to:

- Neat and orderly storage of any chemical or fuels being stored at the site.
- Regular garbage and waste disposal.
- Prompt cleanup of any spills of hydraulic fluids, liquid, or dray materials.
- Performance of regular preventative maintenance on all equipment to prevent leaks.

In addition to the above listed measures, the selected construction contractor may flag or clearly mark all non-impacted surface waters that are within 50 feet of any clearing, grading, or filling activities for the life of the construction activity within that area, as suggested in the February 28, 2018 VDEQ letter (see **Appendix I**)

As recommended in the VDEQ's October letter (see **Appendix F**), the City could consider utilizing permeable paving for walkways and parking areas, where appropriate, to reduce potential stormwater runoff effects. The selected construction contractor could also revegetate denuded areas promptly following construction work.

5.12 CUMULATIVE IMPACTS

This section describes the significance threshold(s) pertaining to cumulative effects. This section also describes the methodologies used to determine the potential for the Proposed Action to contribute to potentially significant cumulative impacts when considered with those of other past, present and reasonably foreseeable future actions.

5.12.1 Significance Threshold

The thresholds of significance in FAA Order 1050.1F, Exhibit 4-1 for each individual resource category apply to cumulative as well as direct and indirect impacts.

5.12.2 Methodology

The CEQ regulations require the analysis and disclosure of the Proposed Action's potential cumulative effects (40 CFR §§ 1508.25(a)(2) and (3)). This disclosure informs the public if the Proposed Action, when considered with other past, present, and reasonably foreseeable future actions would contribute to significant environmental effects.

Section 4.12 identifies past, present, and reasonably foreseeable actions that might contribute to cumulative effects. Cumulative effects are only possible for those resources that the Proposed Action would affect, specifically: air quality, biological resources, climate, coastal resources, hazardous materials, and water resources. The Proposed Action would not cause cumulative effects to resources that the Proposed Action would not affect (e.g., historic resources, visual effects). Each past, present, and reasonably foreseeable future action was cumulatively analyzed for its potential to affect the same environmental resources affected by the Proposed Action.

5.12.3 Environmental Consequences

This section describes the potential cumulative effects of the Proposed Action when considered with past, present, and reasonably foreseeable future actions.

5.12.3.1 No Action Alternative

The No Action Alternative has no effects that could contribute to potentially significant cumulative impacts.

5.12.3.2 Proposed Action

Implementation of the Proposed Action would cause less than significant environmental effects related to construction-related air emissions; biological resources; climate; coastal resources; hazardous materials, solid waste, and pollution prevention; natural resources and energy use; and water resources.

Air Quality

Construction emissions for the Proposed Action are below *de minimis* levels established in the Clean Air Act Amendments of 1993. In creating the *de minimis* emission level, EPA sought to limit the need to conduct conformity determinations for actions with minimal emission increases. General Conformity Regulations generally do not require the analysis of cumulative impacts of several projects. If that were required, all projects with *de minimis* emissions would be potential contributors to cumulative impacts. For that reason, construction of the Proposed Action would not contribute to cumulative emissions with respect to General Conformity. The fact that construction emissions would be *de minimis* limits the possibility that the Proposed Action, when considered in combination with other future projects could contribute to exceedance of a NAAQS.

As described in **Section 5.1**, operation of the Proposed Action would not increase emissions compared to the No Action Alternative. For this reason, operation of the Proposed Action would not contribute to cumulative air quality impacts.

Biological Resources

Past, Present, and reasonably foreseeable future actions and the Proposed Action could affect biological resources. The cumulative projects described in **Section 4.12** have not caused, or are not expected to cause, significant effects to biological resources. Given the potential effects of the Proposed Action that **Section 5.2** describes, the Proposed Action in addition to past, present, and reasonably foreseeable future actions is not anticipated to cause significant effects to biological resources.

Climate

The cumulative impact of the Proposed Action on the global climate when added to other past, present, and reasonably foreseeable future actions is not currently scientifically predictable. Aviation has been calculated to contribute about three percent of global CO_2 emissions; this contribution may grow to five percent by 2050. Actions are underway within the U.S. and by other nations to reduce aviation's contribution through such measures as new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, market-based measures and environmental regulations including an aircraft CO_2 standard. The U.S. has ambitious goals to achieve carbon-neutral growth for aviation by 2020 compared to a 2005 baseline, and to gain absolute reductions in GHG emissions by 2050. At present, there are no calculations of the extent to which measures individually or cumulatively may affect aviation's CO_2 emissions. Moreover, there are large uncertainties regarding aviation's impact on climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., NASA, NOAA, USEPA, and U.S. Department of Energy), has developed the Aviation Climate Change Research Initiative in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions, with quantified uncertainties for current and projected aviation scenarios under changing atmospheric conditions.[7]

Coastal Resources

Past, present, and reasonably foreseeable future actions and the Proposed Action could affect coastal resources. However, work within the VCP requires coordination with the County and Commonwealth. VDEQ determines if a project is consistent with the VCP during the environmental permitting process. The cumulative projects are not anticipated cause significant adverse effects to the VCP.

Hazardous Materials, Solid Waste, and Pollution Prevention

Review of available information for past and present projects did not reveal any significant effects to hazardous materials and solid waste. Reasonably foreseeable future projects could potentially include facilities that store or handle waste. However, those projects would be required to follow federal, state, and local rules and regulations regarding the handling, storage, and use of hazardous materials. Additionally, projects at the Airport have been and/or would be included under the Airport's VPDES permit for the Airport. The City would amend, if needed, the procedures for managing solid waste at the Airport should the amount of solid waste generated exceed what can currently be managed. For those reasons, the Proposed Action in addition to past, present, and reasonably foreseeable future actions, is not anticipated to cause a significant cumulative effect to hazardous materials, solid waste, or pollution prevention.

Natural Resources and Energy Supply

The past, present, and reasonably foreseeable future actions and the Proposed Action could cause an increase in the use of natural resources and energy demand. However, the projects listed in **Section 4.12** and the Proposed Action does not require the use of unusual materials or materials that are in short

[7] Brown, N., M. Gupta, R. Jefferies, L. Maurice (2010), *The US. Strategy for Tackling Aviation Climate Impacts*, 27th International Congress of the Aeronautical Sciences, http://www.icas.org/ICAS_ARCHIVE/ICAS2010/PAPERS/690.PDF, accessed March 2016.

supply. Additionally, the utility provider for the area is expected to have sufficient capacity to handle the increase in energy supply.

Water Resources

The past, present, and reasonably foreseeable future actions and the Proposed Action could affect wetlands, floodplains, surface water, and groundwater.

With regard to wetlands and floodplains, the past, present, and reasonably foreseeable future actions have, or could have, wetland and/or floodplain impacts. On-Airport projects require that the City obtain any necessary permits from the appropriate state and/or federal agency (e.g., USACE, VDEQ, VMRC, FEMA) prior to the start of ground disturbing activities. In some instances, mitigation would be necessary to account for the permanent loss of wetland habitat or floodplains. If mitigation is not required (e.g., if wetland/floodplain impacts are below the mitigation threshold established by the overseeing agency such as USACE, VDEW, VMRC, or FEMA), the selected construction contractor would be required to adhere to permit provisions to further minimize potential impacts. Similarly, off Airport projects undertaken by the City or County would require wetland and/or floodplain permits and/or mitigation for wetland and/or floodplain impacts. For the reasons described in this paragraph, the Proposed Action, when considered in conjunction with other actions, would not cause a significant cumulative effect to wetlands or floodplains.

With regards to surface water and groundwater, each project that has or will disturb over one acre of land would require a VPDES construction permit. In addition, various water quality standards and regulations implemented at the federal and state level require development to address the increase in impervious surface and potential pollutants found in subsequent stormwater runoff. Compliance with permit requirements would preclude potentially significant impacts to surface water or groundwater. For the reasons described in this paragraph, the Proposed Action, when considered in conjunction with other actions, would not cause a significant cumulative effect to surface water or groundwater.

5.13 ANTICIPATED PERMITS

As described throughout Chapter 5, the City would be required to obtain various permits for implementation of the Proposed Action. **Table 5-3** lists the permits that are required regardless of potential environmental effects, as well as the permits that are dependent on factors that can only be determined after the final design.

TABLE 5-3
ANTICIPATED PERMITS FOR THE PROPOSED ACTION

Permit Name	Permit Entity	Environmental Resource Category (EA Section)	Required/Conditional
VPDES construction permit	VDEQ	Hazardous Materials, Pollution Prevention, and Solid Waste (5.6)	Required for construction activities
VPDES Industrial Stormwater General Permit	VDEQ	Water Resources (5.11)	Required for anticipated effects (update to existing permit)
Joint Permit	USACE / VDEQ / VMRC	Water Resources (5.11)	Required for anticipated effects
Permits for New and Modified Sources	VDEQ	Air Quality (5.1)	Conditional upon use of generators during construction
Utility Extension Permits	City of Manassas / Prince William County	Natural Resources and Energy Supplies (5.8)	Required for anticipated effects
Land Use Permit	VDOT	Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks (5.9)	Conditional upon final roadway design
Conditional Letter of Map Revision	FEMA	Water Resources (5.11)	Required for anticipated effects
Letter of Map Revision	FEMA	Water Resources (5.11)	Required for anticipated effects

CHAPTER 6

AGENCY AND PUBLIC INVOLVEMENT

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The EA coordination process described in this chapter provide interested agencies and the public the opportunity to comment on the potential effects of the construction and operation of the Proposed Action.

As NEPA and FAA Order 1050.1F require, a public involvement process will be conducted. This process provides the opportunity for public and agency input regarding the Proposed Action analyzed in this Environmental Assessment (EA). The public and agency involvement process will:

- Provide information about the Proposed Action's purpose and need and the alternatives the EA discusses.
- Obtain feedback about the above information from the public and agencies interested in and affected by the Proposed Action (i.e., interested parties).
- Inform those interested that the EA will provide a full and fair discussion of project related environmental effects.
- Provide timely public notices to the interested parties so that they may submit comments and participate in public open meetings concerning the Proposed Action.
- Record comments received from interested parties.

6.1 PUBLIC INVOLVEMENT AND AGENCY COORDINATION APPROACH AND PROCESS

Pertinent federal statutes, regulations, executive orders, and guidance are considered when conducting the public involvement process. **Table 6-1** lists the agencies that were sent an initial coordination letter providing details on the components of the Proposed Action, and provided the opportunity to comment (see **Appendix A**). The agency comments received in response to the initial the initial coordination letters are reflected in the application sections of **Chapter 4** (Affected Environment) and **Chapter 5** (Environmental Consequences). Copies of the agency response letters are included in **Appendix A**.

As part of the VDEQ Federal Consistency Certification process, VDEQ invited the public to participate in the review of the Proposed Action. Public notice was published in the Office of Environmental Impact Review Program Newsletter and on the VDEQ website from May 3, 2017 to June 2, 2017. No public comments were received as part of the VDEQ Federal Consistency Certification Process.

6.2 DISTRIBUTION OF DRAFT EA

The City published a notice of availability for the Draft EA in the Fauquier Times | Prince William Times | Gainesville Times (see **Appendix I**). The Draft EA was made available for a 30-day review (30-days after the notice of availability advertisement) at the Airport's administrative office during normal business hours, on the Airport's projects website (http://www.manassasregionalairportprojects.com/), and at a local library (see **Table 6-2**).

Electronic copies were sent to agencies who requested a copy of the Draft EA for review. A public workshop was held on February 20, 2018 from 5:00 pm to 7:00 pm Eastern Standard Time, in the Manassas Regional Airport Administrative Office Lobby and Conference Room 1. No agency/organization

representatives attended the meeting. Three individuals of the public attended the meeting, but did not provide written comments. Agency comments on the Draft EA are addressed, as appropriate, in this Final EA. Responses to each comment received are included in **Appendix I**. **Table 6-3** lists the agencies that were sent a copy of the Draft EA and which agencies provided comments.

6.3 FINAL EA

The Final EA and the FAA's decision are available at the Airport's administrative office.

TABLE 6-1
EARLY AGENCY COORDINATION

Agency	Coordination Method	Date Initiated	Response Date
USEPA	Letter	October 21, 2016	November 28, 2016
FEMA	Letter	October 21, 2016	No Response
U.S. Department of Interior	Letter	October 21, 2016	No Response
U.S. Department of Agriculture	Letter	October 21, 2016	No Response
U.S. Army Corps of Engineers	Letter	October 21, 2016	No Response
National Oceanic and Atmospheric Administration	Letter	October 21, 2016	No Response
USFWS	Letter	October 21, 2016	October 30, 2016
VDEQ	Letter	October 21, 2016	November 10, 2016
VDHR	Letter	October 21, 2016	No Response
VDGIF	Letter	October 21, 2016	October 27, 2016
VDCR	Letter	October 21, 2016	October 31, 2016
Virginia Department of Health	Letter	October 21, 2016	November 14, 2016
Virginia Department of Aviation	Letter	October 21, 2016	No Response
Virginia Department of Transportation	Letter	October 21, 2016	November 9, 15, & 22, 2016
City of Manassas	Letter	October 21, 2016	No Response
Prince William County	Letter	October 21, 2016	December 9, 2016

Source: RS&H, 2017

TABLE 6-2
DRAFT EA AVAILABLE LOCATIONS

Location Name	Address
Manassas Regional Airport Administrative Office (hardcopy)	10600 Harry J. Parish Blvd. Manassas, VA 20110
Manassas Regional Airport Website (electronic copy)	http://www.manassasregionalairportprojects.com/
Central Community Library (hardcopy)	8601 Mathis Ave. Manassas, VA 20110
City Hall	9027 Center Street Manassas, VA 20110

Source: RS&H, 2017

TABLE 6-3
DRAFT EA DISTRIBUTION

Agency	Draft EA Format	Date Initiated	Response Date
USEPA	Hardcopy / CD	January 26, 2018	March 2, 2018
FEMA	Hardcopy / CD	January 26, 2018	No Response
U.S. Army Corps of Engineers	Hardcopy / CD	January 26, 2018	No Response
VDEQ	Hardcopy / Electronic Submittal	January 26, 2018	February 28, 2018 / March 2, 2018
Virginia Department of Aviation	Hardcopy / CD	January 26, 2018	Response included with VDEQ March 2, 2018 letter
Prince William County	Hardcopy / CD	January 26, 2018	No Response

Source: RS&H, 2018

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CHAPTER 7

LIST OF PREPARERS

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7.1 LEAD AGENCY

The FAA is the lead agency for the preparation of this EA. Responsibility for review and approval of this EA rests with the FAA. The following FAA staff members were involved in the preparation of this EA:

Susan Stafford. Environmental Protection Specialist

7.2 PRINCIPAL PREPARERS

Responsibility for preparation of this EA rests with the City. Listed below are the persons responsible for the preparation of this EA.

7.2.1 Manassas Regional Airport

Juan Rivera. Airport Director

Jolene Berry. Senior Airport Operations

7.2.2 RS&H, Inc.

David Alberts. B.A., Geography. 18 years of experience. Responsible for contractual oversight of the EA preparation, project management, technical analysis, and client coordination.

Natalie Heath, AICP. M.S.P., Urban and Regional Planning. Five years of experience. Responsible for research and technical writing.

William "Bill" Willkie. M.S., City Planning. 35 Years of experience. Responsible for quality control/quality assurance of the EA.

Julie Barrow. M.S., Environmental Science. Nine years of experience. Responsible for research and technical writing.

Nick Kozlik. B.S., Environmental Studies. Seven years of experience. Responsible for air quality and climate analyses.

7.2.3 Mill Creek Environmental Consultants, LTD

Matt Neely. Senior Environmental Scientist, PWD. Responsible for the biological, hazardous materials, and wetland surveys. Responsible for coordination with USACE regarding preliminary wetland determination. Mr. Neely holds a M.S. in Environmental Sciences and Policy from The Johns Hopkins University, is a certified Professional Wetland Delineator in the state of VA (VA PWD), and has over 10 years of experience conducting field studies all over the commonwealth.

7.2.4 Elizabeth Anderson Comer / Archaeology

Elizabeth Comer. Project Archaeologist. Responsible for archaeological survey and data analysis.

Tery Harris. Project Archaeologist. Responsible for archaeological surveys and data analysis.

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CHAPTER 8

REFERENCES

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FINAL
ENVIRONMENTAL ASSESSMENT

West Corporate Development and East Parcel Development

Manassas Regional Airport

Volume II of II

Prepared for

City of Manassas

And

U.S. Department of Transportation
Federal Aviation Administration

As lead Federal Agency pursuant to the National Environmental Policy Act of 1969

Prepared by:

RS&H

March 2018

This Environmental Assessment becomes a Federal document when evaluated, signed and dated by the Responsible Federal Official.

Responsible Federal Official **Date**

APPENDIX A

AGENCY EARLY COORDINATION

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10748 Deerwood Park Boulevard S
Jacksonville, Florida 32256

O 904-256-2500
F 904-256-2501
rsandh.com

[DATE]

<CONTACT NAME>
1234 Your Street, Suite ABC
City, State 12345

RE: Early National Environmental Policy Act (NEPA) Coordination
Environmental Assessment for Corporate Development at Manassas Regional Airport
Manassas, VA

Dear <Mr./Ms. CONTACT LAST NAME>,

The City of Manassas (City) proposes to redevelop the west side corporate area and a parcel on the east side of the Manassas Regional Airport (Airport). The City will request the Federal Aviation Administration's (FAA) unconditional approval of the projects as shown on the Airport's conditionally approved Airport Layout Plan. This request is a Federal action, and through the requirement for the City to meet FAA grant assurances, RS&H, Inc. will prepare a National Environmental Policy Act (NEPA) Environmental Assessment (EA) for the Proposed Project. The EA will assess the following development projects and actions associated with those projects (e.g., clearing and grading activities, staging areas):

- On-Airport roadway improvements;
- Maintenance and storage building construction;
- West aircraft apron expansion;
- Taxilane extension;
- Fixed base operator building and parking lot reconstruction;
- T-hangars demolition/replacement and construction and T-hangar parking lot;
- Apron taxilane tie down parking expansion;
- Corporate hangar and parking lot construction; and
- Wash rack construction.

The Airport and project are located in the City of Manassas and Prince William County, Virginia. The project study areas for this EA are on the west and east side of the Airport property and encompass all of the development actions and associated actions for the Proposed Project. Enclosed Figures 1 through 4 show the Airport location and project study areas.

In accordance with the NEPA and FAA Orders 1050.1F, *Policies and Procedures for Considering Environmental Impacts* and 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions of Airport Actions*, the EA will analyze the potential environmental effects of the Proposed Project. As part of the EA process, various field surveys will be conducted. These include a threatened and endangered species survey, floodplain analysis, hazardous materials survey, Phase I archaeological survey, and wetland delineation (including a jurisdictional determination).

On behalf of the City, we are sending you this early notification letter to:

1. Advise your agency of the preparation of the EA;
2. Request any relevant information that your agency may have regarding the project site or environs; and
3. Solicit early comments regarding potential environmental, social, and economic issues for consideration during the preparation of the EA.

You may send any information and comments to me via email at David.Alberts@rsandh.com or to the address provided at the top of this letter. We would appreciate your prompt response within 30 days.

On behalf of the City, we would like to thank you for your interest in this project and look forward to working with you as we prepare the EA. If you have any questions or need additional information regarding Proposed Project or EA, please do not hesitate to contact me at (904) 256-2469.

Sincerely,

David Alberts
Project Manager
RS&H, Inc.

Attachments

cc: Jolene Berry, Manassas Regional Airport
Susan Stafford, Federal Aviation Administration
Susan Simmers, Virginia Department of Aviation
Alan McDonald, RS&H
Project File



Sources: Esri, 2016; RS&H, 2016

This figure is for graphic purposes only and is not to scale.

N

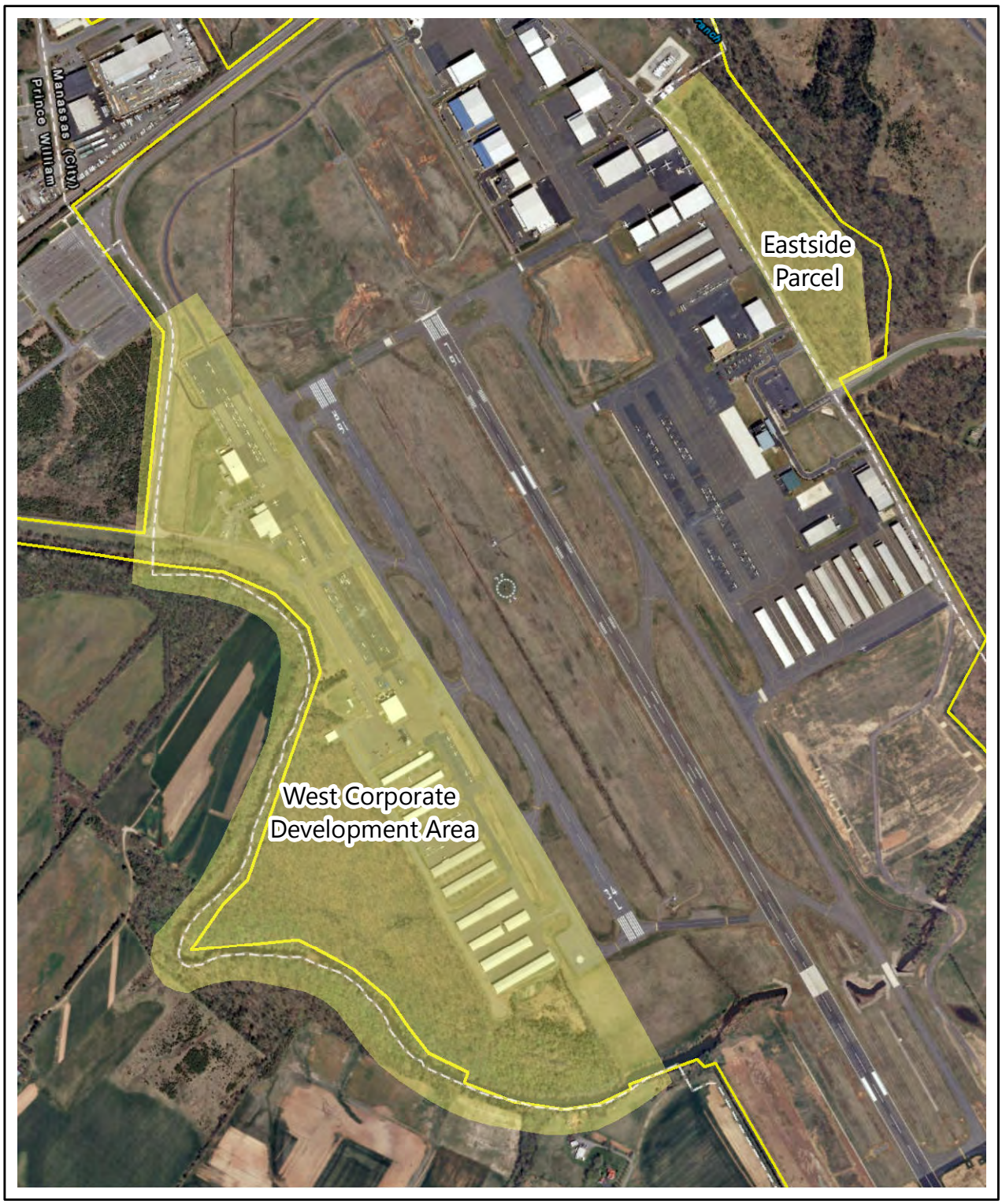
Legend

Manassas Regional Airport

Airport Property Boundary

RS&H

Figure 1
Airport Location



Sources: Esri, 2016; RS&H, 2016

0 500 1,000 2,000 Feet

N

Legend

Project Study Area

Airport Property Boundary

RS&H

Figure 2
Project Study Areas



Sources: Esri, 2016; RS&H, 2016

0 250 500 1,000 Feet

N

Legend

- T-Hangar
- Corporate Hangar/Building
- FBO Redevelopment
- Wash Rack
- Maintenance/Storage Building
- Apron/Taxilane
- Roadway Improvements/Realignment
- Drainage Improvements
- Building Removal
- Parking
- Security Fence
- Access Gate
- Airport Property

RS&H

Figure 3
West Corporate Development Area



Sources: Esri, 2016; RS&H, 2016

0 150 300 600 Feet

N

Legend

- Apron/Taxilane
- Corporate Hangar/Building
- Parking
- Roadway Improvements/Realignment
- Airport Property Boundary

RS&H

Figure 4
East Parcel Development Area

Early Coordination Mailing List

FEDERAL AGENCIES

USEPA
Mr. John "Randy" Pomponio, Director
Environmental Assessment and Innovation Division
USEPA Region 3
1650 Arch Street
Philadelphia, PA 19103

FEMA
Ms. Amanda Ciampolillo
Environment & Historic Preservation Contact
FEMA Region III
615 Chestnut Street
One Independence Mall, Sixth Floor
Philadelphia, PA 19106
Amanda.Ciampolillo@dhs.gov

DOI
Ms. Lindy Nelson
Regional Environmental Protection Specialist
Office of Environmental Policy and Compliance
U.S. Department of the Interior
1760 Market Street
Suite 500
Philadelphia, PA 19103
Lindy_Nelson@ios.doi.gov

USDA
Mr. John A. Bricker
State Conservationist
Virginia State Conservationist's Office
Natural Resources Conservation Service
1606 Santa Rosa Road, Suite 209
Richmond, VA 23229
Jack.Bricker@va.usda.gov

USACE
Ms. Lynette Rhodes
Chief, Southern Section
United States Army Corps of Engineers
803 Front Street
Norfolk, VA 23510
(757) 201-7727

NOAA-NMFS
Ms. Jennifer Anderson, NEPA Coordinator
Greater Atlantic Region Office
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
55 Great Republic Drive
Gloucester, MA 01930

USFWS
Attn: NEPA Coordination
USFWS Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

STATE AGENCIES

VDEQ
Ms. Valerie Fulcher
Office of Environmental Impact Review
Virginia Department of Environmental Quality
629 East Main Street, 6th Floor
Richmond, VA 23219

VDHR
Mr. Roger Kirchen
Director
Division of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Virginia Department of Game and Inland Fisheries
Mr. Ray Fernald, Manager
Environmental Services Section
Virginia Department of Game and Inland Fisheries
P.O. Box 90778
Henrico, VA 23228

Virginia Department of Conservation and Recreation
Ms. Roberta Rhur
Planning and Recreation
Virginia Department of Conservation and Recreation
600 East Main Street, 24th Floor
Richmond, VA 23219

Virginia Department of Health
Attn: NEPA Coordination
Environmental Health Services
Virginia Department of Heath
109 Governor Street, 5th Floor
Richmond, VA 23219

Virginia Department of Aviation
Ms. Susan Simmers
Airport Services Division
Virginia Department of Aviation
5702 Gulfstream Road
Richmond, VA 23250

Virginia Department of Transportation
Ms. Renée Hamilton
Northern Virginia District
Virginia Department of Transportation
4975 Alliance Drive
Fairfax, VA 22030

LOCAL AGENCIES

City of Manassas
Mr. Matthew Arcieri, AICP, Manager
Planning and Zoning Services
City of Manassas
9027 Center St., Room 202
Manassas, VA 20110

City of Manassas
Ms. Michelle Brickner, P.E., C.B.O.
Engineering Department
City of Manassas
8500 Public Works Drive
Manassas, VA 201110

Prince William County
Mr. Chris Price, Director
Planning Division
Prince William County
5 County Complex Court, Suite 210
Prince William, VA 22192

Molly J. Ward
Secretary of Natural Resources

COMMONWEALTH of VIRGINIA

Department of Game and Inland Fisheries

Bob Duncan
Executive Director

October 27, 2016

Mr. David Alberts
RS&H, Inc.
10748 Deerwood Park Boulevard S
Jacksonville, FL 32256

Re: Request for Determination of Impact upon Wildlife Resources: Corporate Development at Manassas Regional Airport

Dear Mr. Alberts:

We appreciate that you submitted your project(s) for review by VDGIF to ensure the protection of sensitive wildlife resources during project development. Due to current staffing limitations within our Fish and Wildlife Information Services (FWIS) and Environmental Services sections, we are unable to review and provide comments on projects that are not currently involved in one of the regulatory review processes for which we are a consultatory agency (see http://www.dgif.virginia.gov/environmental-programs/environmental-services-section.asp). Please note that no response from VDGIF does not constitute "no comment" nor does it imply support of the project or associated activities. It simply means VDGIF has not been able to respond to your request.

To assist you in determining which, if any, wildlife resources under our jurisdiction, including threatened and endangered wildlife, may be present on or near your project site, we recommend that you access the Virginia Fish and Wildlife Information System (VAFWIS) at http://vafwis.org/fwis/.

If you should have further questions or need additional information about VDGIF's Environmental Programs, please visit: http://www.dgif.virginia.gov/environmental-programs/.

Please feel free to attach a copy of this correspondence and any reports from VAFWIS with your project paper work to document your correspondence with us regarding this project.

Thank you,

Shirl Dressler, Program Support Technician
Environmental Services Admin.

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

October 30, 2015

Greetings:

Due to increased workload and refinement of our priorities in Virginia, this office will no longer provide individual responses to requests for environmental reviews. However, we want to ensure that U.S. Fish and Wildlife Service trust resources continue to be conserved. When that is not possible, we want to ensure that impacts to these important natural resources are minimized and appropriate permits are applied for and received. We have developed a website that provides the steps and information necessary to allow any individual or entity requiring review/approval of their project to complete a review and come to the appropriate conclusion. This site can be accessed at: *http://www.fws.gov/northeast/virginiafield/endangered/projectreviews.html*.

The website is frequently updated to provide new species/trust resource information and methods to review projects. Refer to the website for each project review to ensure that current information and methods are utilized.

If you have any questions about project reviews or need assistance, please contact Troy Andersen of this office at (804) 824-2428 or troy_andersen@fws.gov.

Sincerely,

Cindy Schulz
Field Supervisor
Virginia Ecological Services

Alberts, David

From: Rhur, Robbie (DCR) <Robbie.Rhur@dcr.virginia.gov>
Sent: Monday, October 31, 2016 2:04 PM
To: Alberts, David
Subject: Manassas Airport

Afternoon David:

I received your letter requesting review for the above mentioned airport. While DCR's Division of Planning and Recreation has no comment; I recommend you submit the review to the Division of Natural Heritage, it can be done electronically on our web site.

I also suggest for future review requests, email them to me, it really helps expedite the process.

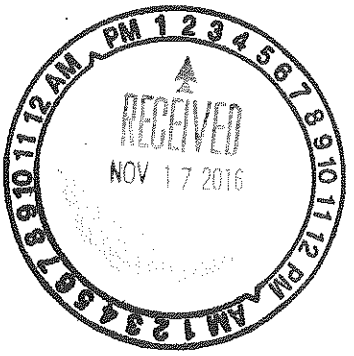
Thank you for the opportunity to comment.

Robbie Rhur
Environmental Review Coordinator/DCR
600 E Main Street 17th Floor
Richmond VA 23219
804-371-2594

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
4975 Alliance Drive
Fairfax, VA 22030

CHARLES A. KILPATRICK, P.E.
COMMISSIONER



November 9, 2016

Mr. David Alberts
Project Manager
RS & H
10748 Deerwood Park Boulevard, South
Jacksonville, Florida 32256

Re: Early National Environmental Policy Act (NEPA) Coordination, Environmental Assessment for Corporate Development of Manassas Regional Airport, Manassas, Virginia

Dear Mr. Alberts:

The Virginia Department of Transportation (VDOT) is in receipt of your early notification letter dated October 26, 2016 requesting information and comments that may be pertinent to your preparation of the Environmental Assessment (EA).

The following highway improvement projects have been completed or are underway for Route 28:

- VDOT Project Number 0028-076-982: Widening Route 28 to 6 lanes between Fitzwater Drive (Route 652) and Linton Hall Road (Route 619) and relocation of Vint Hill Road (Route 215) to align with Infantry Lane. Project administered by Prince William County and will be constructed in 2 phases. Phase 1 from Infantry Lane to Linton Hall Road is currently under construction and will be completed by the end of this year. Phase 2 from Infantry Lane to Fitzwater Drive will be advertised the end of this year and construction is anticipated to begin in Spring of 2017.

- VDOT Project Number 0028-076-111: Widening of Route 28 to 6 lanes from Linton Hall Road to Pennsylvania Avenue. Prince William County will be funding and administering this project which will be advertised through design-build procurement. Construction of this project is anticipated to begin Spring 2017.

County's real estate database is 7694-76-3569 and the address is 10151 Harry J. Parrish Boulevard.

In accordance with the Code of Virginia §10.1-1183, the Virginia Department of Environmental Quality (DEQ) coordinates the Commonwealth's review of National Environmental Policy Act documents. When the EA is available for review and comment, it should be sent to DEQ at: Post Office Box 1105, Richmond, Virginia 23210.

If your field survey crews or contractors require access on VDOT's right-of-way or property, please contact Mr. Art Kloss at our Prince William County Land Use Permit Office at (703)-366-2004 or via email A.Klos@VDOT.Virginia.gov.

Sincerely,

Renée N. Hamilton
Deputy District Administrator

cc: Richard (Dic) Burke
Nicholas Roper, P.E.
Helen Cuervo
John C. Muse
Art Klos

Alberts, David

From: ImpactReview <impactreview@vofonline.org>
Sent: Thursday, November 10, 2016 3:06 PM
To: Sullivan, Bettina (DEQ); Alberts, David
Subject: RE: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA

Ms. Sullivan and Mr. Alberts,

The Virginia Outdoors Foundation has reviewed the project referenced above. As of 10 November 2016, there are not any existing nor proposed VOF open-space easements within the immediate vicinity of the project.

Please contact VOF again for further review if the project area changes or if this project does not begin within 24 months. Thank you for considering conservation easements.

Thanks,
Mike

Mike Hallock-Solomon, AICP
Virginia Outdoors Foundation

From: Sullivan, Bettina (DEQ) [mailto:Bettina.Sullivan@deq.virginia.gov]
Sent: Thursday, November 10, 2016 11:34 AM
To: dgif-ESS Projects (DGIF) <rr.dgif-ESSProjects@dgif.virginia.gov>; Tignor, Keith (VDACS) <Keith.Tignor@vdacs.virginia.gov>; Rhur, Robbie (DCR) <Robbie.Rhur@dcr.virginia.gov>; odwreview (VDH) <odwreview-VDH@cov.virginia.gov>; Gavan, Larry (DEQ) <Larry.Gavan@deq.virginia.gov>; Sepety, Holly (DEQ) <Holly.Sepety@deq.virginia.gov>; Dacey, Katy (DEQ) <Katy.Dacey@deq.virginia.gov>; Narasimhan, Kotur (DEQ) <Kotur.Narasimhan@deq.virginia.gov>; Harlow, Kevin (DEQ) <Kevin.Harlow@deq.virginia.gov>; Evans, Gregory (DOF) <Gregory.Evans@dof.virginia.gov>; Cromwell, James R. (VDOT) <James.Cromwell@VDOT.Virginia.gov>; Jordan, Elizabeth (VDOT) <Elizabeth.Jordan@VDOT.Virginia.gov>; ImpactReview <impactreview@vofonline.org>; gmg@novaregion.org; citymanager@ci.manassas.va.us; jspatton@pwcgov.org
Cc: david.alberts@rsandh.com
Subject: RE: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA

Good afternoon—attached is a request for scoping comments on the following:

Corporate Development at Manassas Regional Airport,
Manassas, Virginia.

If you choose to make comments, please send them directly to the project sponsor (david.alberts@rsandh.com) and copy the DEQ Office of Environmental Impact Review: http://www.deq.virginia.gov/Programs/EnvironmentalImpactReview/DocumentSubmissions.aspx. **We will coordinate a review when the environmental document is completed.**

DEQ-OEIR's scoping response is also attached.

If you have any questions regarding this request, please email our office at eir@deq.virginia.gov.

Bettina Sullivan
Manager
Environmental Impact Review and Long Range Priorities Program
Department of Environmental Quality
629 E. Main Street, Richmond, VA 23219
Mailing address: P. O. Box 1105, Richmond, VA 23218
804.698.4204
www.deq.virginia.gov
For program updates and public notices please subscribe to the OEIR News Feed

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Molly Joseph Ward
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

November 10, 2016

David Alberts
RS&H
10748 Deerwood Park Boulevard S
Jacksonville, Florida 32256

RE: Scoping Response, Commercial Developmnet at Manassas Regional Airport, Manassas, Virginia

Dear Mr. Alberts:

This letter is in response to the scoping request for the above-referenced project.

As you may know, the Department of Environmental Quality, through its Office of Environmental Impact Review (DEQ-OEIR), is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. .

DOCUMENT SUBMISSIONS

In order to ensure an effective coordinated review of the NEPA document, notification of the NEPA document and federal consistency documentation should be sent directly to OEIR. We request that you submit one electronic to eir@deq.virginia.gov (10 MB maximum) or make the documents available for download at a website, file transfer protocol (ftp) site or the VITAShare file transfer system (https://vitashare.vita.virginia.gov).

The NEPA document and the federal consistency documentation (if applicable) should include U.S. Geological Survey topographic maps as part of their information. We strongly encourage you to issue shape files with the NEPA document. In addition, project details should be adequately described for the benefit of the reviewers.

ENVIRONMENTAL REVIEW UNDER THE NATIONAL ENVIRONMENTAL POLICY ACT: PROJECT SCOPING AND AGENCY INVOLVEMENT

As you may know, NEPA (PL 91-190, 1969) and its implementing regulations (Title 40, *Code of Federal Regulations*, Parts 1500-1508) requires a draft and final Environmental Impact Statement (EIS) for federal activities or undertakings that are federally licensed or federally funded which will or may give rise to significant impacts upon the human environment. An EIS carries more stringent public participation requirements than an Environmental Assessment (EA) and provides more time and detail for comments and public decision-making. The possibility that an EIS may be required for the proposed

project should not be overlooked in your planning for this project. Accordingly, we refer to "NEPA document" in the remainder of this letter.

While this Office does not participate in scoping efforts beyond the advice given herein, other agencies are free to provide scoping comments concerning the preparation of the NEPA document. Accordingly, we are providing notice of your scoping request to several state agencies and those localities and Planning District Commissions, including but not limited to:

Department of Environmental Quality:
- DEQ Regional Office
- Air Division
- Office of Wetlands and Stream Protection
- Office of Local Government Programs
- Division of Land Protection and Revitalization
- Office of Stormwater Management

Department of Conservation and Recreation
Department of Health
Department of Agriculture and Consumer Services
Department of Game and Inland Fisheries
Virginia Marine Resources Commission
Department of Historic Resources
Department of Mines, Minerals, and Energy
Department of Forestry
Department of Transportation

DATA BASE ASSISTANCE

Below is a list of databases that may assist you in the preparation of a NEPA document:

- DEQ Online Database: Virginia Environmental Geographic Information Systems

  Information on Permitted Solid Waste Management Facilities, Impaired Waters, Petroleum Releases, Registered Petroleum Facilities, Permitted Discharge (Virginia Pollution Discharge Elimination System Permits) Facilities, Resource Conservation and Recovery Act (RCRA) Sites, Water Monitoring Stations, National Wetlands Inventory:
  - www.deq.virginia.gov/ConnectWithDEQ/VEGIS.aspx

- DEQ Virginia Coastal Geospatial and Educational Mapping System (GEMS)

  Virginia's coastal resource data and maps; coastal laws and policies; facts on coastal resource values; and direct links to collaborating agencies responsible for current data:
  - http://128.172.160.131/gems2/

- DHR Data Sharing System

  Survey records in the DHR inventory:
  - www.dhr.virginia.gov/archives/data_sharing_sys.htm

- DCR Natural Heritage Search

Produces lists of resources that occur in specific counties, watersheds or physiographic regions:
  - www.dcr.virginia.gov/natural_heritage/dbsearchtool.shtml

- DGIF Fish and Wildlife Information Service

  Information about Virginia's Wildlife resources:
  - http://vafwis.org/fwis/

- Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Database: Superfund Information Systems

  Information on hazardous waste sites, potentially hazardous waste sites and remedial activities across the nation, including sites that are on the National Priorities List (NPL) or being considered for the NPL:
  - www.epa.gov/superfund/sites/cursites/index.htm

- EPA RCRAInfo Search

  Information on hazardous waste facilities:
  - www.epa.gov/enviro/facts/rcrainfo/search.html

- EPA Envirofacts Database

  EPA Environmental Information, including EPA-Regulated Facilities and Toxics Release Inventory Reports:
  - www.epa.gov/enviro/index.html

- EPA NEPAssist Database

  Facilitates the environmental review process and project planning:
  http://nepaassisttool.epa.gov/nepaassist/entry.aspx

If you have questions about the environmental review process and/or the federal consistency review process, please feel free to contact me (telephone (804) 698-4204 or e-mail bettina.sullivan@deq.virginia.gov).

I hope this information is helpful to you.

Sincerely,

Bettina Sullivan

Bettina Sullivan, Program Manager
Environmental Impact Review and
Long-Range Priorities

Alberts, David

From: Sullivan, Bettina (DEQ) <Bettina.Sullivan@deq.virginia.gov>
Sent: Monday, November 14, 2016 1:51 PM
To: Alberts, David
Subject: FW: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA

Bettina Sullivan
Manager
Environmental Impact Review and Long Range Priorities Program
Department of Environmental Quality
629 E. Main Street, Richmond, VA 23219
Mailing address: P. O. Box 1105, Richmond, VA 23218
804.698.4204
www.deq.virginia.gov
For program updates and public notices please subscribe to the OEIR News Feed

---

From: Warren, Arlene (VDH)
Sent: Monday, November 14, 2016 1:49 PM
To: Sullivan, Bettina (DEQ)
Subject: RE: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA

Project Name: Corporate Development at Manassas Regional Airport
Project #: N/A
UPC #: N/A
Location: **Manassas, Virginia**

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

The following public groundwater wells are located within a 1 mile radius of the project site:

PWS ID Number	City/County	System Name	Facility Name
6153264	PRINCE WILLIAM	BROAD RUN GOLF	WELL
6153041	PRINCE WILLIAM	BRISTOW MANOR GOLF CLUB	WELL

There are no surface water intakes located within a 5 mile radius of the project site.

The project is within the watershed of the following public surface water sources:

PWS ID Number	System Name	Facility Name
6059501	FAIRFAX CO WATER AUTHORITY	OCCOQUAN RESERVIOR INTK

Best Management Practices should be employed on the project site including Erosion & Sedimentation Controls as well as Spill Prevention Controls & Countermeasures.

There may be impacts to public drinking water sources due to this project if the mitigation efforts outlined above are not implemented.

Best regards,

Arlene Fields Warren
Virginia Department of Health,
Office of Drinking Water
James Madison Building
109 Governor St,
Richmond, VA 23219
804.864.7781

From: Sullivan, Bettina (DEQ)
Sent: Thursday, November 10, 2016 11:34 AM
To: dgif-ESS Projects (DGIF); Tignor, Keith (VDACS); Rhur, Robbie (DCR); odwreview (VDH); Gavan, Larry (DEQ); Sepety, Holly (DEQ); Dacey, Katy (DEQ); Narasimhan, Kotur (DEQ); Harlow, Kevin (DEQ); Evans, Gregory (DOF); Cromwell, James R. (VDOT); Jordan, Elizabeth (VDOT); impactreview@vofonline.org; gmg@novaregion.org; citymanager@ci.manassas.va.us; jspatton@pwcgov.org
Cc: david.alberts@rsandh.com
Subject: RE: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA

Good afternoon—attached is a request for scoping comments on the following:

Corporate Development at Manassas Regional Airport,
Manassas, Virginia.

If you choose to make comments, please send them directly to the project sponsor (david.alberts@rsandh.com) and copy the DEQ Office of Environmental Impact Review: http://www.deq.virginia.gov/Programs/EnvironmentalImpactReview/DocumentSubmissions.aspx. **We will coordinate a review when the environmental document is completed.**

DEQ-OEIR's scoping response is also attached.

If you have any questions regarding this request, please email our office at eir@deq.virginia.gov.

Bettina Sullivan
Manager
Environmental Impact Review and Long Range Priorities Program
Department of Environmental Quality
629 E. Main Street, Richmond, VA 23219
Mailing address: P. O. Box 1105, Richmond, VA 23218
804.698.4204
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For program updates and public notices please subscribe to the OEIR News Feed

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
4975 Alliance Drive
Fairfax, VA 22030

CHARLES A. KILPATRICK, P.E.
COMMISSIONER

November 15, 2016

MEMORANDUM

TO: Mr. David Alberts, Project Manager

FROM: Nina Andrews, Executive Assistant

SUBJECT: Amendment to Previous Letter in Reference to Early National Environmental Policy Act (NEPA) Coordination, Environmental Assessment for Corporate Development of Manassas Regional Airport, Manassas, Virginia

---

Please see the amended letter attached; page two was missing bulleted points from the original letter mailed on November 9th, 2016.

Thank you.



Attachment: Early National Environmental Policy Act (NEPA) Coordination, Environmental Assessment for Corporate Development of Manassas Regional Airport, Manassas, Virginia

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
4975 Alliance Drive
Fairfax, VA 22030

CHARLES A. KILPATRICK, P.E.
COMMISSIONER

November 15, 2016

Mr. David Alberts
Project Manager
RS & H
10748 Deerwood Park Boulevard, South
Jacksonville, Florida 32256

Re: Early National Environmental Policy Act (NEPA) Coordination, Environmental Assessment for Corporate Development of Manassas Regional Airport, Manassas, Virginia

Dear Mr. Alberts:

The Virginia Department of Transportation (VDOT) is in receipt of your early notification letter dated October 26, 2016 requesting information and comments that may be pertinent to your preparation of the Environmental Assessment (EA).

The following highway improvement projects have been completed or are underway for Route 28:

- VDOT Project Number 0028-076-982: Widening Route 28 to 6 lanes between Fitzwater Drive (Route 652) and Linton Hall Road (Route 619) and relocation of Vint Hill Road (Route 215) to align with Infantry Lane. Project administered by Prince William County and will be constructed in 2 phases. Phase 1 from Infantry Lane to Linton Hall Road is currently under construction and will be completed by the end of this year. Phase 2 from Infantry Lane to Fitzwater Drive will be advertised the end of this year and construction is anticipated to begin in Spring of 2017.

- VDOT Project Number 0028-076-111: Widening of Route 28 to 6 lanes from Linton Hall Road to Pennsylvania Avenue. Prince William County will be funding and administering this project which will be advertised through design-build procurement. Construction of this project is anticipated to begin Spring 2017.

- VDOT Project Number 0028-155-270: Widening of Route 28 to 6 lanes from Godwin Drive to the southern limits of the City of Manassas. Project is administered by the City of Manassas and is currently scheduled to be advertised for construction April 2018.

- VDOT Project Number 6234-076-112, L80: Manassas Wetlands Mitigation Site, this 89 acre parcel on the east side of airport property was required mitigation for unavailable impacts to wetlands resulting from the construction of Route 234-Bypass from Route 28 to I-66. This is deeded in perpetuity as conservation easement. The GPIN in the County's real estate database is 7694-76-3569 and the address is 10151 Harry J. Parrish Boulevard.

In accordance with the Code of Virginia §10.1-1183, the Virginia Department of Environmental Quality (DEQ) coordinates the Commonwealth's review of National Environmental Policy Act documents. When the EA is available for review and comment, it should be sent to DEQ at: Post Office Box 1105, Richmond, Virginia 23210.

If your field survey crews or contractors require access on VDOT's right-of-way or property, please contact Mr. Art Klos at our Prince William County Land Use Permit Office at (703)-366-2004 or via email A.Klos@VDOT.Virginia.gov.

Sincerely,

Renée N. Hamilton
Deputy District Administrator

cc: Richard (Dic) Burke
Nicholas Roper, P.E.
Helen Cuervo
John C. Muse
Art Klos

From:	Alberts, David
To:	Heath, Natalie
Subject:	FW: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA -- Review & Comments
Date:	Tuesday, November 22, 2016 10:35:45 AM
Attachments:	Manassas Airport Request Letter.pdf Reply to Alberts David - National Env Policy Act.pdf

Please add to the project files.

David E. Alberts
Aviation Senior Environmental Manager
10748 Deerwood Park Blvd South, Jacksonville, FL 32256
O 904-256-2469 | M 904-307-7049

From: Dabestani, Cina (VDOT) [mailto:Cina.Dabestani@VDOT.Virginia.gov]
Sent: Tuesday, November 22, 2016 10:28 AM
To: Alberts, David <David.Alberts@rsandh.com>
Cc: Jordan, Elizabeth (VDOT) <Elizabeth.Jordan@VDOT.Virginia.gov>; Environmental Impact Review (DEQ) <eir@deq.virginia.gov>; Cromwell, James R. (VDOT) <James.Cromwell@VDOT.Virginia.gov>; Beacher, Andrew (VDOT) <Andrew.Beacher@vdot.virginia.gov>
Subject: SCOPING REQUEST Corporate Development at Manassas Regional Airport, Manassas, VA -- Review & Comments

Hello-

Per the request by the Environmental Division at VDOT Central Office, following is NoVa District Office's comments on the subject matter.

Please note that similar request letter from you (Manassas Airport Request Letter dated October 21 2016, attached) was responded by a letter (Reply to Alberts David – National Env Policy Act) from Ms. Renee Hamilton, Deputy District Administrator, on November 9, 2016.

In addition, the following additional comments are offered:
Any realignment or improvement of roads affecting VDOT right of way will require a permit.

Any relocation of utilities will also require a permit plus the consent of the utilities affected.

Traffic impacts on the operation and safety on VDOT roadways, intersections and interchanges need to be analyzed and adequately addressed.

The City will be responsible for obtaining all necessary environmental approvals/authorizations for any work performed in VDOT right-of-way under a Land Use Permit issued by VDOT. Additionally, I would note the Manassas Wetlands Mitigation Site (VDOT Project Number 6234-076-112, L801) exists on the east side of the airport property. This 89-acre parcel was required mitigation for unavailable impacts to wetlands resulting from the construction of Route 234-Bypass from Route 28 to I-66. This is deeded in perpetuity as conservation easement. The GPIN in the County's real estate database is 7694-76-3569 and the address is 10151 Harry J. Parrish Boulevard.

Should you have any questions on this correspondence, please contact me directly.

Thank you,
Cina S. Dabestani
Sr. Transportation Engineer
Transportation Planning
Virginia Department of Transportation
703 . 259 . 2991
Cina.Dabestani@VDOT.Virginia.GOV


Please consider the environment before printing this email

Alberts, David

From: Okorn, Barbara <Okorn.Barbara@epa.gov>
Sent: Monday, November 28, 2016 1:44 PM
To: Alberts, David
Cc: Marcus.Brundage@faa.gov
Subject: Manassas Regional Airport Environmental Assessment Scoping

Mr. Alberts,

EPA has reviewed your letter dated October 21, 2016 regarding the subject project. We understand that the study is being done in compliance with the National Environmental Policy Act (NEPA) and CEQ regulations implementing NEPA. Please find below recommendations for the scope of analysis for the proposed study.

- Information regarding the purpose and need, alternatives analyzed, avoidance and minimization of resources, and cumulative effects for the proposed project should be included in the EA.
- The NEPA document should include a clear and robust justification of the underlying purpose and need for the proposed action. The purpose and need statement is important because it helps explain why the proposed action is being undertaken and what objectives the project intends to achieve. The purpose of the proposed action is typically the specific objective of the activity. The need should explain the underlying problem for why the project is necessary.
- Alternatives analysis should include the suite of other activities or solutions that were considered and the rationale for not carrying these alternatives forward for detailed study.
- The document should describe potential impacts to the natural and human environment. Existing resources should be identified and EPA encourages that adverse impacts to natural resources, especially wetlands and other aquatic resources, be avoided and minimized.
- A robust narrative fully describing any aquatic resources and functions should be included in the EA. We suggest at a minimum, a narrative should be provided that includes: a discussion of hydrology, including sources and direction of flow; the vegetative communities in the impact area, including size of trees (dbh), percent canopy cover, understory and other components such as woody debris and snags, and presence of invasive species; soil type(s); and an assessment of expected functions based on the HGM type, ecological community, and surrounding landuse. Photos should be included. Some information on resources may be gained from public websites including:
- EnviroMapper[1]: https://www.epa.gov/waterdata/waters-watershed-assessment-tracking-environmental-results-system
- Envirofacts[2]: https://www3.epa.gov/enviro/
- NEPAssist[3]: https://www.epa.gov/nepa/nepassist
- 303(d) Listed Impaired Waters: https://www.epa.gov/exposure-assessment-models/303d-listed-impaired-waters

- Stormwater ponds, best management practices (BMPs) and construction staging areas should not be located in wetlands and streams. Stormwater management alternatives that address the existing and new construction should be considered.
- EPA suggests coordinating with other appropriate federal, state and local resource agencies on possible impacts to wetlands, streams, historic resources and/or rare, threatened and endangered species. As needed, assessment of aquatic resources functions should be provided. We would be pleased to coordinate with VDOT and the U.S. Army Corps of Engineers on this work.

- An evaluation of air quality and community impacts, including noise, light and possible traffic impacts, should be included in the document. General conformity status should be included in the document.
- The NEPA document should include an analysis of any hazardous sites or materials, and the status of any ongoing or past remediation efforts in the project area. This includes any groundwater contamination.
- We recommend the NEPA document include a discussion and analysis of greenhouse gas emissions, climate change, and extreme weather events (in particular in association with resiliency design).
- Environmental Justice (EJ) should also be evaluated, including the identification of potential communities of concern, and meaningful and timely community involvement, public outreach, and access to information. Please consider application of a tool developed by EPA to help users to identify areas with EJ population: https://www.epa.gov/ejscreen. Additionally please refer to "Promising Practices for EJ Methodologies in NEPA Reviews document for EJ analysis in NEPA reviews": https://www.epa.gov/environmentaljustice/ej-iwg-promising-practices-ej-methodologies-nepa-reviews. Our regional expert on EJ would be pleased to discuss methodology for identification of EJ communities at your convenience.
- Consideration should be given to potential impacts to at-risk populations, as well as consideration to sensitive subpopulations, possibly including elderly, children and others. It is recommended community impacts be avoided, minimized and mitigated, to the greatest extent possible.
- Tribal interests should be considered in the EA.
- The document should address potential indirect and cumulative effects in the project areas; analysis may aid in the identification of resources that are likely to be adversely affected by multiple projects, and sensitive resources that could require additional avoidance or mitigation measures. It is suggested that a secondary and cumulative effects analysis begin with defining the geographic and temporal limits of the study; this is generally broader than the study area of the project. The cumulative impact analysis should evaluate impacts to environmental resources that have the potential to be impacted by the project (i.e. wetlands, surface water, etc)

1 The Watershed Assessment, Tracking & Environmental Results System (WATERS) unites water quality information previously available only from several independent and unconnected databases
2 Includes enforcement and compliance information
3 NEPAssist is a tool that facilitates the environmental review process and project planning in relation to environmental considerations. The web-based application draws environmental data dynamically from EPA Geographic Information System databases and web services and provides immediate screening of environmental assessment indicators for a user-defined area of interest. These features contribute to a streamlined review process that potentially raises important environmental issues at the earlier stages of project development.

Thank you for coordinating with EPA on this project. We look forward to working with you as more information becomes available. Please let me know if you have any questions on the recommended topics above. Please provide a copy of the EA to EPA when it is available for review.

Sincerely,
Barb

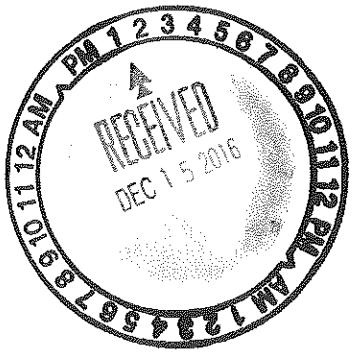
Barbara Okorn
USEPA Region III (3EA30)
1650 Arch Street
Phila, PA 19103
Phone (215) 814-3330

COUNTY OF PRINCE WILLIAM

5 County Complex Court, Prince William, Virginia 22192-9201
(703) 792-7615 FAX (703) 792-4401
Internet www.pwcgov.org

PLANNING OFFICE

Christopher M. Price, AICP
Acting Director of Planning



December 9, 2016

David Alberts
RS&H
10748 Deerwood Park Boulevard S
Jacksonville, Florida 32256

RE: Scoping Response, Commercial Development at Manassas Regional Airport, Manassas, Virginia

Dear Mr. Alberts:

This letter is in response to the scoping request for the above referenced project for an Early National Environmental Policy Act (NEPA) Coordination as requested in your letter dated October 21, 2016.

As indicated in your letter, the City of Manassas (City) proposes to redevelop the west side corporate area and a parcel on the east side of the Manassas Regional Airport (Airport). As part of this project, and to meet the associated project requirements, the City will prepare a National Environmental Policy Act (NEPA) Environmental Assessment (EA) for the Proposed Project.

The EA will assess the following development projects and actions associated with those projects (e. g., clearing and grading activities, staging areas):

- On-Airport roadway improvements;
- Maintenance and storage building construction;
- West aircraft apron expansion;
- Taxilane extension;
- Fixed base operator building and parking lot reconstruction;
- T-hangars demolition/replacement and construction and T-hangar parking lot;
- Apron taxilane tie down parking expansion;
- Corporate hangar and parking lot construction; and
- Wash rack construction.

The Airport and project are located in the City of Manassas and Prince William County, Virginia.

Your request was forwarded to our County review agencies and the following agency comments were received:

Transportation

The scoping documents don't mention improvements to Piper Lane – the only access to the western development site. An analysis of the current condition of Piper Lane and the adequacy of the roadway to handle additional traffic associated with the new development must be performed. Width, pavement thickness, drainage and capacity are items that should be reviewed for adequacy.

Cultural Resources

Analysis of impacts should include Cultural Resources. There is high potential for direct and indirect impacts to historic properties. Two Civil War battlefields eligible for listing on the National Register of Historic Places may be adversely affected by this proposal. Analysis of impacts to the Bristoe Station Battlefield and the Kettle Run Battlefield should be included in the NEPA study. Undisturbed areas proposed for construction should be archaeological surveyed and the methods should include metal detector surveys by the archaeologist. Some land in the East Parcel Development Area has been subject to archaeological survey. Consultation with the County Archaeologist on the scope of the archaeological survey is requested.

These comments represent our initial review; we would like to review all applications as this project continues to move forward. Should you have any questions or need further clarification please feel free to contact Connie Dalton via email at cdalton@pwcgov.org or by telephone at 703-792-6934.

Sincerely,

David J. McGettigan, AICP
Long Range Planning Manager

PRML2017-00661

cc: Chris Price, Acting Director of Planning
Elizabeth Scullins, Division Chief, Transportation Planning and Programming
Justin Patton, County Archaeologist

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APPENDIX B

BIOLOGICAL RESOURCES SURVEY

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Mill Creek
Environmental Consultants, LTD



Endangered, Threatened and Special Concern Species Assessment
Manassas Regional Airport (HEF)
Environmental Assessment for Corporate Development
Manassas, VA

Prepared for:
RS&H
10748 Deerwood Park Blvd South
Jacksonville, FL 32256-0597

Prepared by:
Matt Neely
Senior Environmental Scientist, PWD
Mill Creek Environmental Consultants

19 December 2016

11400 Longtown Drive Midlothian Virginia 23112 (804) 739-2147 (757) 329-0573
millcreekenvironment@comcast.net

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Exhibits

Exhibit 1 Project Location Map
Exhibit 2 USGS Topographic Map
Exhibit 3 USFWS Official Species List
Exhibit 4 USFWS Species Conclusion Table and Certification Letter
Exhibit 5 Bald Eagle Nest Buffer Map VDCR Coordination Letter
Exhibit 6 VDGIF Virginia Fish and Wildlife Information Service (VAFWIS) Search Results
Exhibit 7 VDCR Coordination Letter

1.0 Introduction

As part of a Federal Aviation Administration (FAA) Environmental Assessment (EA) at Manassas Regional Airport (HEF), Mill Creek Environmental Consultants, Ltd. recently completed an analysis of approximately ± 48 acres of study area across 3 different parcels (see Exhibit 1) immediately adjacent to the Manassas Regional Airport in Manassas Virginia. The purpose of the analysis was to determine the presence of endangered, threatened, or special concern (ETS) species of flora and fauna on the property. The findings and opinions in this report will be included in the EA to satisfy the requirements set forth in the National Environmental Policy Act (NEPA).

The Virginia Department of Conservation and Recreation (VDCR), Virginia Department of Agriculture and Consumer Services (VDACS), Virginia Department of Game and Inland Fisheries (VDGIF), and the U.S. Fish and Wildlife Service (USFWS) work cooperatively to insure the continued survival of Virginia's diverse flora, fauna, and other elements of natural diversity. The Virginia Natural Heritage Program (VNHP: a Division within VDCR) also works closely with other state and federal agencies, local governments, conservation organizations, and individuals to seek adequate protection of the State's natural heritage resources.

To achieve this protection, VNHP maintains lists of the most significant elements of Virginia's natural diversity. These lists focus the Program's Inventory on the Natural Heritage Resources most likely to be lost without conservation action in the near future. Most importantly, these lists are not only useful for VNHP, but can be used by other agencies, organizations, and individuals to guide protection and development decision making. In formulating these lists, the program uses information from previous studies, museum records, the observations and opinions of experts, DCR-DNH staff scientists, and field inventories.

All plants and animals that are officially protected by Federal or State endangered species acts are included on these lists. The Office of Plant Protection within the Virginia Department of Agriculture and Consumer Services (VDACS) has regulatory responsibility of the listing and protection of Virginia's endangered and threatened plants and insects, under the Virginia Endangered Plant and Insect Act (Section: 3.1-1020 through 1030, Code of Virginia). The Act provides for the official listing and recovery of endangered and threatened plant and insect species in Virginia. The Act also establishes a permit system for collection of listed species. A memorandum of agreement between DCR-DNH and VDACS facilitates data transfer between agencies and allows DCR-DNH to nominate candidate species for listing by VDACS,

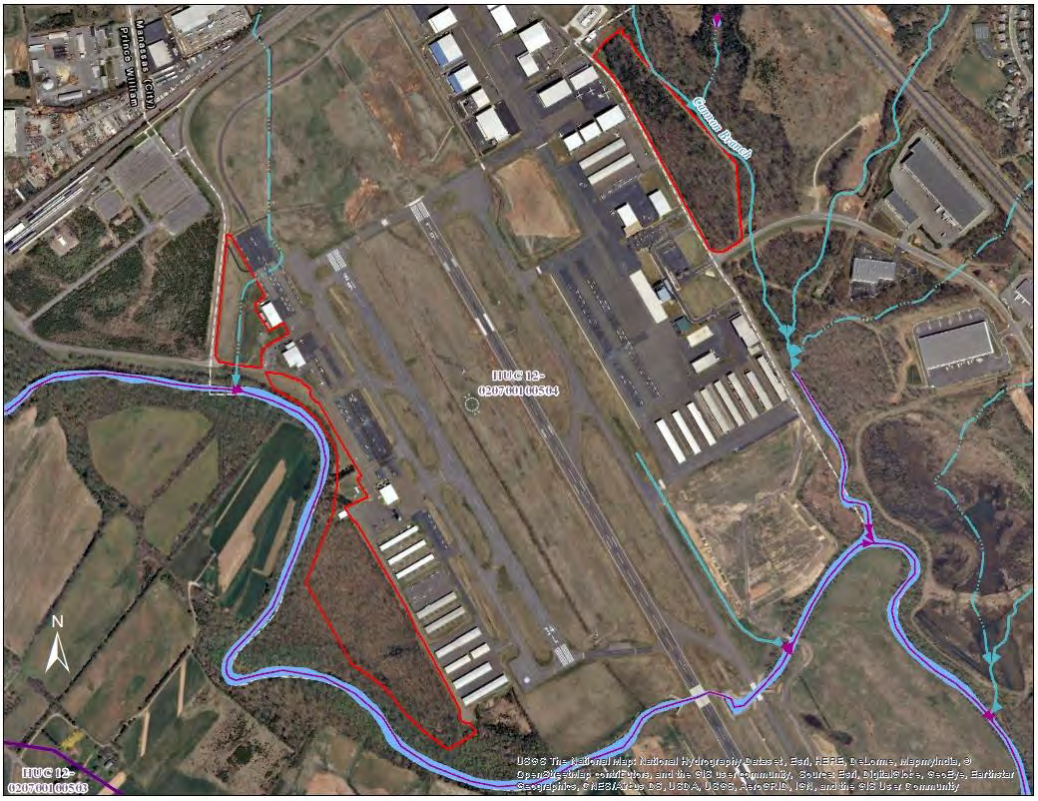
The Department of Game and Inland Fisheries has regulatory responsibility for listing and protecting Virginia's endangered and threatened animals under Virginia's Endangered Species Act (Code of Virginia, Section 19.1-564-568). The Act prohibits the taking,

transportation, sale, etc. of endangered and threatened species, except as permitted, and provides for official listing and recovery of these species.

Federally listed species are protected by the Endangered Species Act of 1973, as amended. The U.S. Department of the Interior's Fish and Wildlife Service (USFWS) administers the Act, listing and protecting federally endangered and threatened species.

2.0 Study Area Overview

The EA study area is comprised of approximately ± 48 acres adjacent to the Manassas Regional Airport in Manassas, Virginia. The EA study area is divided into three discontinuous parcels, two to the west (W) of the airport operations area (AOA) and one to the east (E). An aerial of the EA study area can be seen in Exhibit 1, while a topographic map can be seen in Exhibit 2. All three parcels sit between elevations of 160-180'. Precipitation falling within the two parcels to the west (W) of the AOA makes its way via overland sheet-flow and groundwater movement to Broad Run immediately to the west (W) and south (S). Precipitation falling within east (E) parcel makes its way via overland sheet-flow and groundwater movement down slope to the north (N) into Cannon Branch and eventually into Broad Run, which flows into the Middle Potomac-Anacostia-Occoquan basin (HUC02070010).



Area A (± 25 acres)

The largest of the three parcels comprising the study area is area A (± 25 acres). Area A is immediately adjacent to the hangar, apron, and parking spaces on the west (W) side of the AOA between the fence line and Broad Run.



The vast majority of area A (± 22 acres) consists of mature, mixed hardwood forest. Upland vegetation is comprised of a mature over-story containing species such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), and various species of hickories (*Carya spp*.), with a limited shrub understory containing instances of deerberry (*Vaccinium stamineum*) and saplings of the over-story species listed above. Representative photos can be seen below.





Areas such as forested wetlands and others containing higher soil moisture content are dominated by species such as red maple (*Acer rubrum*), pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), boxelder maple (*Acer negundo*), and sweetgum (*Liquidambar stryaciflua*). The shrub layer in these areas consisted of saplings of the species listed above, as well as a herbaceous layer containing species such as lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), shallow sedge (*Carex lurida*), and varying species of rushes (*Juncaceae spp.*). Representative photos can be seen below.





Animal species observed within or known to exist within the boundaries of this forested portion of the EA study area include white tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), Raccoon (*Procyon lotor* L.), Gray Squirrel (*Sciurus carolinensis L.*), Striped Skunk (*Memphitis memphitis L.*), Eastern Cottontail (*Sylvilagus floridanus L.*),Virginia Opossum (*Didelphis virginiana L.*), Eastern Box Turtle (*Terrapena carolina* L.), and the Black Racer (*Coluber constrictor*), and various species of frogs and skinks.

Approximately three acres of study area A consists of graded maintained/mowed grass areas immediately adjacent to observation road. The area is characterized as a level, compactly graded lot maintained regularly by normal maintenace. Representative photo seen below.



Area B (± 7 acres)

Study area B consists of ± 7 on the west (W) side of the AOA between aircraft parking aprons, hangars, and taxiway spaces and observation road. It is characterized a by mostly level, compactly graded, grass surface that only changes in elevation as it slopes down to the significant stormwater ditch making its way through the EA study area.



The vegetation in this area consists of maintained fesuces (*festuca spp.*), and other weeds such as broom sedge (*Andropogon virginicus*). Representative photos can be seen below.





No animal species or evidence there of were observed within this portion of the EA study area. Study area B is most likely frequented by birds and smaller species such as field mice, rabbit, and various frogs and skinks in and around the significant stormwater ditch.

Area C (±16 acres)

Study area C consists of ± 16 acres on the east (E) side of the AOA, immediately east (E) of wakeman drive and west (W) of Cannon Branch.



Almost all ± 16 acres consists of mature, mixed hardwood forest. Upland vegetation is comprised of a mature over-story containing species such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), eastern redcedar (*Juniperus virginiana*) and various species of hickories (*Carya spp*.), with a limited shrub understory containing instances of deerberry (*Vaccinium stamineum*) and saplings of the over-story species listed above. Representative photos can be seen below.





Areas such as forested wetlands and others containing higher soil moisture content are dominated by species such as red maple (*Acer rubrum*), pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), boxelder maple (*Acer negundo*), and sweetgum (*Liquidambar stryaciflua*). The shrub layer in these areas consisted of saplings of the species listed above, as well as a herbaceous layer containing species such as lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), shallow sedge (*Carex lurida*), and varying species of rushes (*Juncaceae spp.*). Representative photos can be seen below.





Animal species observed within or known to exist within the boundaries of this forested portion of the study area include white tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), Raccoon (*Procyon lotor* L.), Gray Squirrel (*Sciurus carolinensis L*.), Striped Skunk (*Memphitis memphitis L*.), Eastern Cottontail (*Sylvilagus floridanus L*.),Virginia Opossum (*Didelphis virginiana L*.), Eastern Box Turtle (*Terrapena carolina* L.), and the Black Racer (*Coluber constrictor*), and various species of frogs and skinks.

3.0 Federal Listed Species

Physical analysis of the EA study area was conducted to determine the presence of, or suitable habitat for any species with federal listing status that are known to, or have the possiblity of being present within portions of the study area or in its proximity. In order to determine which species could potentially be present the US Fish and Wildlife Service (USFWS) Information, Planning, and Conservation (IPaC) tool was consulted. This tool provided an official species list which identifies threatened, endangered, proposed and candidate species, as well as proposed final designated critical habitat, that may occur within the EA study area.

The official species list generated by IPaC for the ± 48 acres survey area associated with the Manassas Regional Airport Corporate Development EA revealed three federally listed species that may occur within the boundaries of the proposed project. These species include one clam, Dwarf wedgemussel (*Alasmidonta heterodon*), one flowering plant, Harperella (*Ptilimnium*

nodosum), and one mammal, Northern long-eared Bat (*Myotis septentrionalis*). The official species list generated through IPaC can be seen in Exhibit 3 .

Dwarf wedgemussel (*Alasmidonta heterodon*)

The Dwarf wedgemussel is a federally endangered species listed on March 14, 1990 (USFWS 1990). It is currently listed as State-endangered in the Commonwealth of Virginia. A general description can be read below:

"Small freshwater mussel, usually less than 45 mm length and 25 mm high. Shell subtrapezoidal, thick anteriorly and thinning posteriorly; ventral margin mostly straight; posterior margin pointed near base; dorsal margin slightly curved; beaks low and rounded, projecting only slightly above the hinge line; posterior ridge rounded, somewhat inflated and prominent; periostracum brownish or yellowish brown, with variable width reddish brown or greenish rays in young or pale colored specimens. Nacre bluish or silvery white, and iridescent posteriorly. Hinge teeth small but distinct; pseudocardinal teeth compressed, 1 or 2 in the right valve and 2 in the left; lateral teeth gently curved and reversed, that is, in most specimens, 2 in the right valve and 1 in the left. Ventral mantle margin plain; papillae flesh-colored; exhalent aperture without papillae. (Clarke, 1981; Smith, 1986; Bogan, 1993)" (NatureServe 2016)

When in occurrence the Dwarf wedgemussel is normally found in sand, firm muddy sand, or gravel bottoms of rivers of varying sizes with moderate to slow rates of current. It prefers silt-free stream beds that are stable and where the water is well-oxygenated and free of pollutants (USFWS 1990).

The mussel was believed to be extirpated from the commonwealth until it was discovered again in 1990 (Terwilliger et. al 1995). Reproducing populations are believed to be located within Aquia creek, while remnant populations exist in the South Anna and Nottoway rivers. Historically they have been found in Mountain Run, Marsh Run near Remington, Blue River, and the Maury River (North River) at Lexington (VDGIF 2016).

Haperella (*Ptilinium nodosum*)

Harperella is a federally endangered species listed on September 28, 1988 (USFWS 1988). It is currently listed as State-endangered in the Commonwealth of Virginia. A description can be read below:

"An annual herb with slender, erect stems, up to 12 dm high. The roots are shallow, diffuse-fibrous, and the plants have a faint scent of dill. Unlike those of the more common members of this genus, the leaves of P. nodosum are reduced to hollow, quill-like structures. Broad clusters

of small white flowers bloom mostly in July and August. Near rivers, fluctuating water levels often knock over the flowering stems, depositing the seeds in wet or moist soil near the site of the fallen flower." (NatureServe 2016)

"Occurs in three habitat types: rocky/gravelly shoals or cracks in bedrock outcrops beneath the water surface in clear, swift-flowing streams (usually in microsites that are sheltered from rapidly moving water); edges of intermittent pineland ponds or low, wet savannah meadows on the Coastal Plain; and granite outcrop seeps. In all habitat-types, the species occurs in a narrow range of water depths; it is intolerant of deep water and of conditions that are too dry. However, the plants readily tolerate periodic, moderate flooding - something to which few potential competitors are adapted. P. nodosum seeds generally germinate during short-duration spring floods and the plants have completed their life cycle by late summer or fall, just as water levels are lowest and competing species are moving in." (NatureServe, 2016)

Habitat not suitable for this species includes areas of deep standing water, scoured streams, areas with heavy siltation, stormwater discharge channels, damned streams, and densely vegetated areas including palustrine emergent and scrub shrub wetlands normally associated with streams or backwaters. Additionally, vegetated stream channels and wetlands with weedy flora and a dense over-story that shades growth would not support the proper habitat for Harperella (Sprenkle 2014).

Northern Long-eared Bat (*Myotis Septentrionalis*)

The Northern Long-eared Bat (NLEB) is a federally threatened species listed on April 2, 2015. It is currently a state-threatened species in the Commonwealth of Virginia.

The NLEB is a medium-sized bat between 3-3.7 inches in length, with a wingspan between 9 to 10 inches, and is characterized by its long ears compared to other bats within the same genus. The bat is present throughout much of the eastern and north central US and all of Canada. Its range includes at least 37 states. Significant populations of the bat have been affected by white-nose syndrome (WNS), which is a fungal disease known to adversely impact bats. It is currently the main threat to these bats. It is believed that throughout the northeast WNS has caused population declines in hibernation sites of up to 99% from pre WNS levels (USFWS 2016).

A brief description of the life history can be read below:
"Habitat Requirements
During summer, northern long-eared bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. Males and non-reproductive females may also roost in cooler places, like caves and mines. This bat seems opportunistic in selecting roosts,

using tree species based on suitability to retain bark or provide cavities or crevices. It has also been found, rarely, roosting in structures like barns and sheds. Northern long-eared bats spend winter hibernating in caves and mines, called hibernacula. They typically use large caves or mines with large passages and entrances; constant temperatures; and high humidity with no air currents. Specific areas where they hibernate have very high humidity, so much so that droplets of water are often seen on their fur. Within hibernacula, surveyors find them in small crevices or cracks, often with only the nose and ears visible." (USFWS 2016).

"Food Habits
Northern long-eared bats emerge at dusk to fly through the understory of forested hillsides and ridges feeding on moths, flies, leafhoppers, caddisflies, and beetles, which they catch while in flight using echolocation. This bat also feeds by gleaning motionless insects from vegetation and water surfaces." (USFWS 2016).

"Reproductive Strategy
Breeding begins in late summer or early fall when males begin swarming near hibernacula. After copulation, females store sperm during hibernation until spring, when they emerge from their hibernacula, ovulate, and the stored sperm fertilizes an egg. This strategy is called delayed fertilization. After fertilization, pregnant females migrate to summer areas where they roost in small colonies and give birth to a single pup. Maternity colonies, with young, generally have 30 to 60 bats, although larger maternity colonies have been observed. Most females within a maternity colony give birth around the same time, which may occur from late May or early June to late July, depending where the colony is located within the species' range. Young bats start flying by 18 to 21 days after birth. Adult northern long-eared bats can live up to 19 years."
(USFWS 2016).

On January 14, 2016 the USFWS issued a final 4(d) Rule for the Northern Long-eared Bat, which outlines necessary and advisable measures providing for the conservation of the bat (USFWS 2016). Rules governing the purposeful and incidental take of this species and its habitat are outlined in this rule, and should be consulted prior to development activities. Further discussion of this can be found in the conclusion section of this report.

4.0 State Listed Species

Physical analysis of the EA study area was conducted to determine the presence of, or suitable habitat for any species with state listing status that are known to or have the possiblity of being present within portions of the EA study area, or in its proximity. In order to determine which species could potentially be present the Virginia Department of Game and Inland Fisheries (VDGIF) information tool (VaFWIS) was consulted. This tool provided a list of species that are known to or likely to occur within a 2 mile radius of the Manassas Regional Airport EA study area. The full VAFWIS report can be viewed in Exhibit 6. In addition to the VaFWIS search report, input was also solicited from the Virginia Department of Conservation and Recreation (VDCR).

In addition to Northern Long-eared Bat, as discussed in the previous section, the VAFWIS search report produced a list of an additional eight species that have state statuses of State-endangered or State-threatened. These species include:

Atlantic Sturgeon (*Acipenser oxyrinchus*)	Federal/State Endangered
Northern Long-eared Bat (*Myotis septentrionalis*)	Federal/State Threatened
Little Brown Bat (*Myotis lucifugus lucifugus*)	State Endangered
Tri-colored Bat (*Perimyotis subflavus*)	State Endangered
Brook Floater (*Alasmidonta varicosa*)	State Endangered
Peregrine Falcon (*Falco peregrinus*)	State Threatened
Loggerhead Shrike (*Lanius ludovicianus*)	State Threatened
Henslow's Sparrow (*Ammodramus henslowii*)	State Threatened
Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*)	State Threatened

Of the state listed species above, only one has been confirmed to have been observed within a 2 mile radius of the ± 48 acre EA study area. That species is the Brook Floater (*Alasmidonta varicosa*). A short discussion of that species and others follows.

Atlantic Sturgeon (*Acipenser oxyrinchus*) (Federal/State Endangered)

The Atlantic Sturgeon is a long living anadromous fish species that is estuarine dependent. It can grow up to 14 feet in length and weigh up to 800lbs. These fish are anadromous, which means they spawn in freswhater, normally deep portions of large rivers, in the spring and early summer and then migrate back into the estuarine and marine waters where they will spend most of their life. It is believed that this species is currently located within 32 existing rivers within the US in which spawning is occruing in at least 20. Historically overharvesting has led to the wide spread decline of the species (NOAA Fisheries 2016).

Little Brown Bat (*Myotis lucifigus lucifugus*) (State Endangered)
The Little Brown Bat is a small to medium bat with a glossy fur ranging from dark yellow-brown to olive brown. The face and ears are dark and the bat's total length usually ranges from 3-5 inches. The species is migratory in nature and normally migrate north to south up to several hundred miles to caves and mines from October-November and March-April. They will roost in caves, buildings, rocks, trees, under bridges, in mines and tunnels and can be found in all all forested regions (VDGIF 2016).

According to VaFWIS there has been no confirmed observation of the species within two miles of the EA study area, and only one general an resident occurrence has been cited in surrounding Prince William County.

Tri-colored Bat (*Perimyotis subflavus*) (State Endangered)
The tri-colored bat is a small eastern bat with yellowish-brown tri-color fur, ranging in length from 3-3.7 inches. While active until late October, these species often hibernates in caves or mines that are two small for other species of bats. In March they begin to leave the caves. They may roost in caves, rocks, trees and buildings (less regularly) (VDGIF 2016).

According to VaFWIS there has been no confirmed observation of the species within two miles of the EA study area, and only one general an resident occurrence has been cited in surrounding Prince William County.

Brook Floater (*Alasmidonta varicosa*) (State Endangered)
The Brook Floater is a small freshwater mussel with a kidney-shaped shell (NatureServe 2016).

"Considered to be a species of creeks and small rivers where it is found among rocks in gravel substrates and in sandy shoals, the brook floater inhabits flowing-water habitats only (Nedeau et al., 2000; Nedeau, 2008). It occurs in running water and although typically found in riffles and moderate rapids with sandy shoals or riffles with gravel bottoms (Clark and Berg, 1959; Athearn and Clark, 1962), it can also be found in a range of flow conditions (usually not in very slow flow conditions). Strayer and Ralley (1993) found no consistent substrate preference but it is thought to prefer stable habitats such as coarse sand and gravel. It is more common in small to mid-sized streams or creeks than in large rivers (Clarke, 1981) and is more common in upper portions of large watersheds with intact upland forest but is absent from headwater streams (Nedeau, 2008)." (NatureServe 2016)

Of the species listed in the VaFWIS search report, the Brook Floater is the only species to have a documented observance within a 2 mile radius of the EA study area. From 1991 to 1998 five

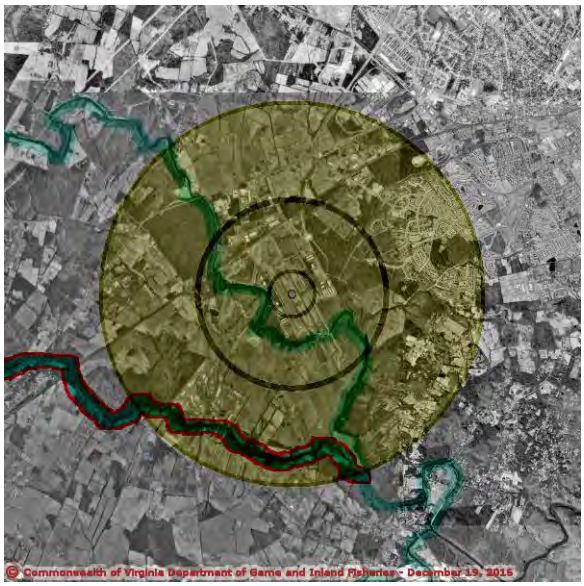
obersvations of the Brook Floater were made in segments of Broad Run in the vicinity of Manassas Regional Airport (VDGIF 2016). An observation map can be seen below:



Currently segments of both Broad Run and Kettle Run have been designated predicted habitat for WAP Tier I & II Aquatic Species. These reaches can be seen in the maps below:



Broad Run Tier I&II predicted habitat



Kettle Run Tier I&II predicted habitat

Peregrine Falcon (*Falco peregrinus*)

The Peregrine Falcon is a highly migratory falcon with long pointed wings ranging in size from 16-20 inches in length. These falcons normally have a dark crown and nape, and a dark wedge below the eye. The US Atlantic coast from New Jersey extending to South Carolina and the barrier Islands of the Gulf Coast are important feeding areas for the species (NatureServe 2016).

Preferred habitat consists of *"Various open situations from tundra, moorlands, steppe, and seacoasts, especially where there are suitable nesting cliffs, to mountains, open forested regions, and human population centers (AOU 1983). When not breeding, occurs in areas where prey concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports."* (NatureServe 2016)

According to VaFWIS there has been no confirmed observation of the species within two miles of the EA study area, and only one general occurence has been cited in surrounding Prince William County.

Loggerhead Shrike (*Lanius ludovicianus*)

The Loggerhead Shrike is a small bird typically smaller than 10 inches in length, characterized by a stout, all dark, hooked bill. It has a gray head and back with white or grayish underparts. Its prefered habitat consists of open areas with scattered trees and shrubs, and tends to build nests from twigs or animal hair in shrubs or small trees. The bird feeds primarily on larger insects, small birds, lizards, frogs, etc. (NatureServe 2016).

According to VaFWIS there has been no confirmed observation of the species within two miles of the EA study area, and only one general an resident occurrence has been cited in surrounding Prince William County.

Henslow's Sparrow (*Ammodramus henslowii*)

Henslow's sparrow is a small bird (5 inches) typically characterized by a large flat head and large gray bill with a short tail. The chest of the bird is streaked. Normally a secretive species, when the bird is "flushed" it will fly erraticaly and low while twisting its tail. The bird prefers a grassland/herbaceous terrestrial habitat such as tall meadows that are not normally maintained. Their diet consists of insects such as crickets, grasshoppers, beetles, caterpillars and other insects, as well as seeds of plants (NatureServe 2016).

According to VaFWIS there has been no confirmed observation of the species within two miles of the EA study area, and has one known general, residence, and seasonal occurrence in the surrounding Prince William County.

Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*)
The Migrant Loggerhead is similar to the species listed earlier with some distinguishing differences that can read below.

"Physical description: To differentiate this subspecies from the southern subspecies (ludovicianus): above bluish gray (vs dark slaty gray); beneath pale slaty (vs almost immaculate white); throat white; bill smaller, regularly tapering; hook delicate and sharply bent downwards. Also the tail is shorter than the wing, this follows the usual characteristic for migrating birds." (VDGIF, 2016)

"This species prefers open grassland that is grazed or mowed to keep grass short. An abundance of perching sites such as fences, woody vegetation or hedgerows is also important. This species usually nests in easern redcedar or hawthorne." (VDGIF, 2016)

According to VaFWIS there has been no confirmed observation of the species within two miles of the EA study area.

5.0 Conclusion

As part of the project review process a species conclusion table was created to address the federally listed species within the project review. This species conclusion table serves as a tool to depict the ESA Section 7 Determination for each species as well as the Eagle Act Determination. The species conclusion table and Eagle Act Determination for this project can be seen in Exhibit 4 and Exhibit 5 of this report. An explanation of these determinations follows.

The federally endangered Dwarf wedgemussel (*Alasmidonta heterodon*) is a freswhater bivalve that requires a very narrow range of riverine/stream characteristics to thrive. This type of habitat is not located anywhere within the EA study area. Thus the conclusion was made that "no suitable habitat is present" and a determination of "No effect" was made. Additionally, development within the study area boundaries done in accordance with current erosion and sediment control regulations would likely not impact water quality within the surrounding stretches of Broad Run, which is the only habitat having the possibility of the parameters supporting the mussel.

The federally endangered Harperella (*Ptilimnium nodosum*) is a flowering plant that requires a very strict set of habitat characteristics to exist. There are no streams anywhere within the EA study area that possess the energy regime necessary for scour bars, gravel deposits, rock outcrops and cobble bars. Because of this, a conclusion of "no suitable habitat present" was

made and a determination of "no effect" was also made. Thus development within the EA study area would not impact the plant.

The federally threatened Northern long-eared Bat (*Myotis septentrionalis*) is a species of bat that is currently being threatened by the spread of White Nose Syndrome (WNS). While the suitable habitat may be present in the form of the trees required during the summer roosting periods, the EA study area is not within close proximity to a mapped/known hibernacula. Relying upon the findings of the 1/5/2016 Programmatic Biological Opinion for Final 4(d) Rule on the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions to fulfill our project-specific section 7 responsibilities, a determination of "not likely to adversely affect" for the section 7 determination was made.

Based upon on the analysis of the study area in which no physical observation of the federally listed species above were observed, combined with the lack of suitable habitat for those species, it is highly unlikely that development within the EA study area would impact any federally endangered or threatened species.

In addition to the species with federal listing status discussed above. Multiple species listed as state endangered or state threatened are known or likely to exist within a two mile radius of the EA study area. These species were also analyzed for potential impacts associated with development of the study area. Of the species returned in the VaFWIS search report seen in Exhibit 6, one, the Atlantic Sturgeon (*Acipenser oxyrinchus*) is an anadromous fish for which no suitable habitat exists within the survey area or anywhere in its proximity. Therefore development would have no effect on this species of fish.

In addition to the federally and state listed *Northern Long-eared Bat (Myotis setetnrionalis)*, two additional state endangered bats, the Little Brown Bat (*Myotis lucifigus*), and the tri-colored bat (*Perimyotis subflavus*) were listed as potentially present but with no known observances within two miles. Due to the seasonal migratory nature of these species between cave hibernacula and summer roosts, such as hollowed trees and abandoned buildings, and the already robust surrounding development, combined with the distance from any known cave hibernacula, it is highly unlikely that development of the EA study area would cause any permanent negative impacts on the bats or their habitat.

One state endangered bivalve, the Brook Floater (*Alasmidonta varicosa*) has been historically observed within two miles of the EA study area in segments of Broad Run. There is no suitable riverine habitat for this species within the EA study area itself, only in segments of Broad Run in proximity. Development within the EA study area done in accordance with current erosion and sediment control regulations would likely not impact water quality within

the surrounding stretches of Broad Run, which is the only habitat possessing characteristics possible of supporting the Brook Floater. Thus development within the EA study are wouldhave no impact on the Brook Floater.

Four different avian species with state listing status of threatened were returned in the VaFWIS search report. These species include the Peregrine falcon (*Falco peregrinus*), Loggerhead Shrike (*Lanius ludovicianus*), Henslow's sparrow (*Ammodramus henslowii*), and Migrant Loggerhead Shrike (*Lanius ludovicianus migrans*). Due to the migratory nature of these species, as well as the development that currently surrounds the AOA, combined with the countermeasures associated the airport's wildlife management plan it is not surprising these species have not been observed within two miles of the EA study area. Further development in the EA study area is highly unlikely to have an adverse impact on these state listed species or their habitat.

Based upon on the analysis of the EA study area in which no physical observation of the state listed species above was noted, combined with the lack of suitable habitat, behaviorial charactertics of the species, and current countermeasures associated with the airport's wildlife management plan, it is highly unlikely that development within the EA study area would impact any of the state listed species in question.

The self certification letter associated with the conclusion table for this project review can be found in Exhibit 4. A coordination/response letter for input form VDCR can be found in Exhibit 7.

6.0 References

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Virginia Department of Game and Inland Fisheries (VDGIF). 2016 Virginia Fish and Wildlife Information Service online searchable database. Accessed on December 19, 2016

Exhibit 1
Project Location Map

Manassas Regional Airport
Corporate Development Environmental Assessment Aerial



Exhibit 2
USGS Topographic Map

Manassas Regional Airport
Corporate Development Environmental Assessment Topographic Vicinity Map

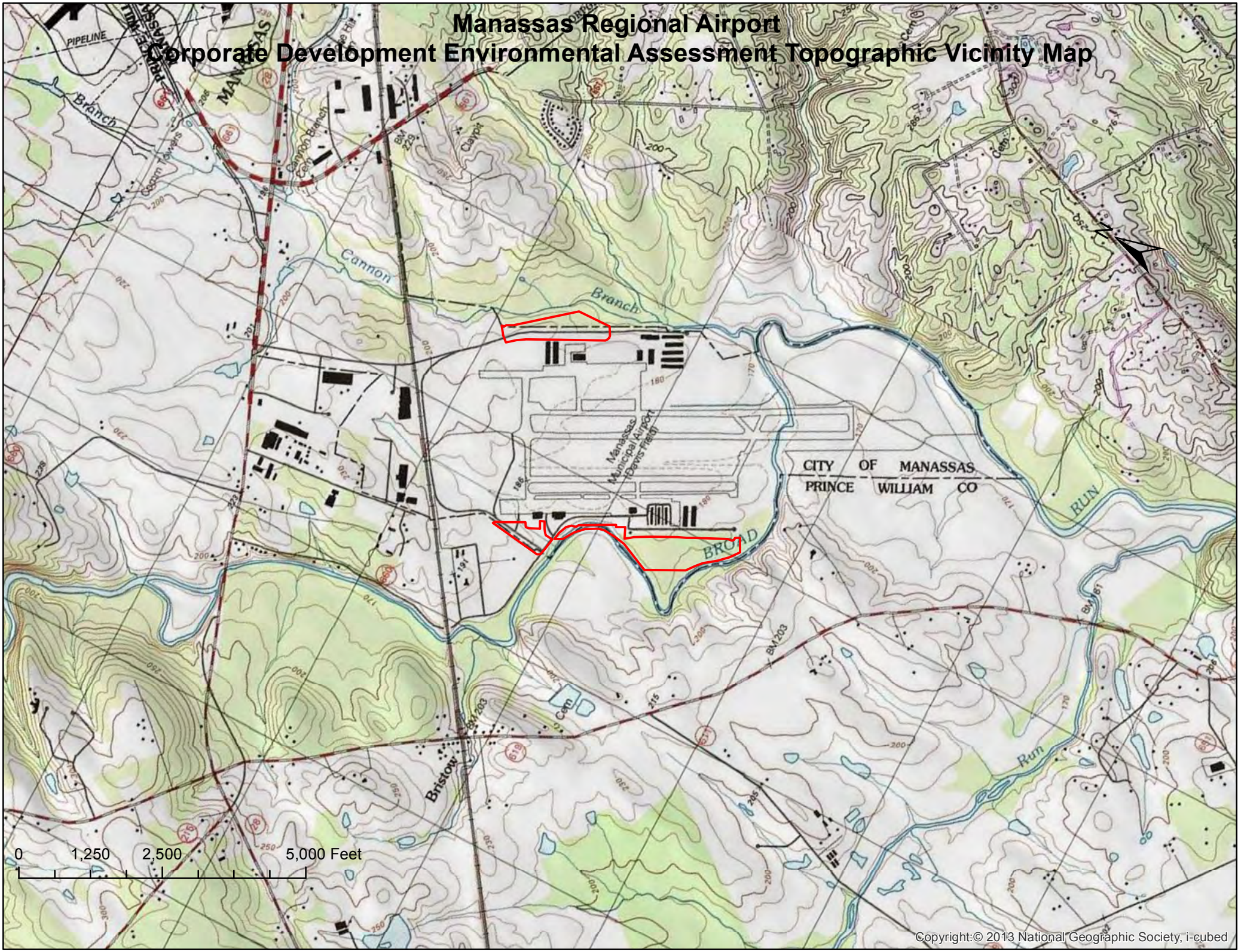


Exhibit 3
USFWS Official Species List

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Virginia Ecological Services Field Office
6669 SHORT LANE
GLOUCESTER, VA 23061
PHONE: (804)693-6694 FAX: (804)693-9032
URL: www.fws.gov/northeast/virginiafield/

Consultation Code: 05E2VA00-2017-SLI-0917 December 19, 2016
Event Code: 05E2VA00-2017-E-01187
Project Name: Manassas Regional Airport (HEF) Corporate Development EA

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*). Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and

endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment

United States Department of Interior
Fish and Wildlife Service

Project name: Manassas Regional Airport (HEF) Corporate Development EA

Official Species List

Provided by:

Virginia Ecological Services Field Office
6669 SHORT LANE
GLOUCESTER, VA 23061
(804) 693-6694
http://www.fws.gov/northeast/virginiafield/

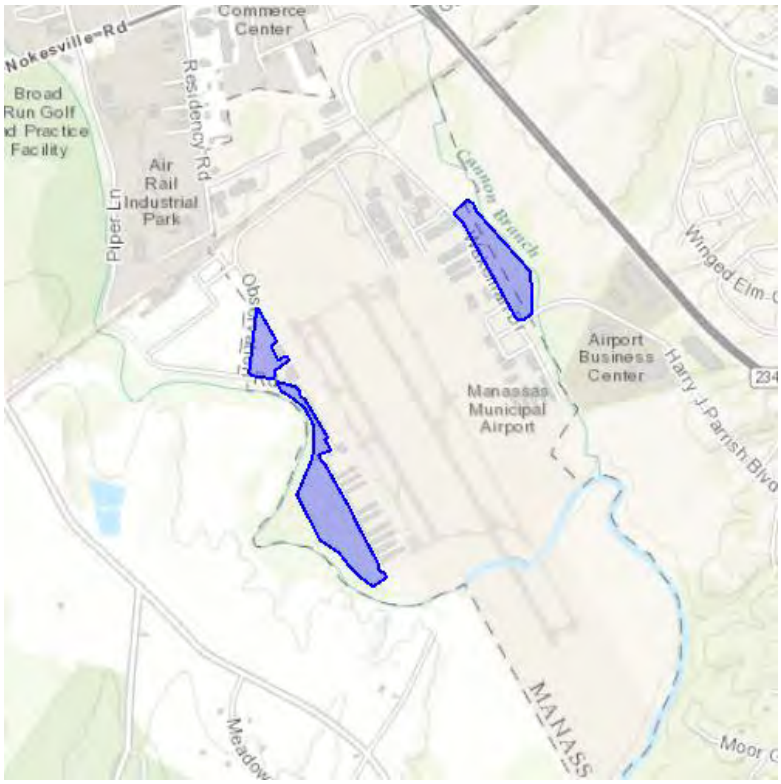
Consultation Code: 05E2VA00-2017-SLI-0917
Event Code: 05E2VA00-2017-E-01187

Project Type: Federal Grant / Loan Related

Project Name: Manassas Regional Airport (HEF) Corporate Development EA
Project Description: Manassas Regional Airport is conducting a FAA required Environmental Assessment (EA) for the purpose of corporate development within the outlined survey areas. In order to receive a decision for this EA, a survey of potential impacts to both federal and state listed species must be conducted to be in accordance with the NEPA requirements. RS&H Engineers on behalf of the Manassas Regional Airport recently hired Mill Creek Environmental Consultants, Ltd. to conduct the physical survey and proper coordination with regulatory agencies to satisfy this purpose.

Please Note: The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

Project Location Map:



Project Coordinates: The coordinates are too numerous to display here.

Project Counties: Manassas, VA | Prince William, VA

Endangered Species Act Species List

There are a total of 3 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

Clams	**Status**	**Has Critical Habitat**	**Condition(s)**
Dwarf wedgemussel *(Alasmidonta heterodon)* Population: Wherever found	Endangered		
Flowering Plants			
harperella *(Ptilimnium nodosum)* Population: Wherever found	Endangered		
Mammals			
Northern long-eared Bat *(Myotis septentrionalis)* Population: Wherever found	Threatened		

Critical habitats that lie within your project area

There are no critical habitats within your project area.

Appendix A: FWS National Wildlife Refuges and Fish Hatcheries

There are no refuges or fish hatcheries within your project area.

Exhibit 4
USFWS Species Conclusion Table and Certification Letter

Species Conclusions Table

Project Name: Manassas Regional Airport Environmental Assessment for Corporate Development

Date: 19 December 2016

Species / Resource Name	Conclusion	ESA Section 7 / Eagle Act Determination	Notes / Documentation
Dwarf wedgemussel (Alasmidonta heterodon)	No suitable habitat present	No effect	Typically, this species is found in shallow to deep quick running water on cobble, fine gravel, or on firm silt or sandy bottoms. Other habitats included are amongst submerged aquatic plants, and near stream banks underneath overhanging tree limbs. USFWS (1993) states the species commonly lives on muddy sand, sand, and gravel bottoms in creeks and rivers of various sizes. It requires areas of slow to moderate current, good water quality, and little silt deposits. This type of habitat does not fall within the boundaries of the survey area. (http://explorer.natureserve.org/servlet/NatureServe?searchName=Alasmidonta+heterodon)
harperella (Ptilimnium nodosum)	No suitable habitat present	No effect	Occurs in three habitat types: rocky/gravelly shoals or cracks in bedrock outcrops beneath the water surface in clear, swift-flowing streams (usually in microsites that are sheltered from rapidly moving water); edges of intermittent pineland ponds or low, wet savannah meadows on the Coastal Plain; and granite outcrop seeps. In all habitat-types, the species occurs in a narrow range of water depths; it is intolerant of deep water and of conditions that are too dry. However, the plants readily tolerate periodic, moderate flooding - something to which few potential competitors are adapted. P. nodosum seeds generally germinate during short-duration spring floods and the plants have completed their life cycle by late summer or fall, just as water levels are lowest and competing species are moving in. (http://explorer.natureserve.org/servlet/NatureServe?searchName=Ptilimnium+nodosum)
Northern Long-eared Bat (Myotis Septentrionalis)	Suitable habitat present	Not likely to Adversely Affect	Relying upon the findings of the 1/5/2016 Programmatic Biological Opinion for Final 4(d) Rule on the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions to fulfill our project-specific section 7 responsibilities. (*Programmatic Biological Opinion on Final 4(d) Rule for the Northern Long-Eared Bat and Activities Excepted from Take Prohibitions*; USFWS Regions 2,3,4,5,6 USFW Midwest Regional Office, Bloomington, Minnesota, date: 5 January 2016)
Critical habitat	No critical habitat present	No effect	
Bald Eagle	Unlikely to disturb nesting bald eagles	No Eagle Act permit required	

Bald Eagle	Does not intersect with eagle concentration area	No Eagle Act permit required	

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Virginia Field Office
6669 Short Lane
Gloucester, VA 23061

Date: 21 December 2016

Self-Certification Letter

Project Name: Manassas Regional Airport Corporate Development EA 2016

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Virginia Ecological Services online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the project named above in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. . 1531-1544, 87 Stat. 884), as amended (ESA), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA and Eagle Act conclusions. These conclusions resulted in:

- "no effect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- "may affect, not likely to adversely affect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- "may affect, likely to adversely affect" determination for the Northern long-eared bat (*Myotis septentrionalis*) and relying on the findings of the January 5, 2016 Programmatic Biological Opinion for the Final 4(d) Rule on the Northern long-eared bat; and/or
- "no Eagle Act permit required" determinations for eagles.

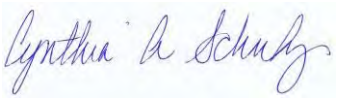
We certify that use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the "no effect" or "not likely to adversely affect" determinations for proposed and listed species and proposed and designated critical habitat; the "may affect" determination for Northern long-eared bat; and/or the "no Eagle Act permit required" determinations for eagles. Additional coordination with this office is not needed.

Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species.

Should project plans change or if additional information on the distribution of proposed or listed species, proposed or designated critical habitat, or bald eagles becomes available, this determination may be reconsidered. This certification letter is valid for 1 year.

Information about the online project review process including instructions and use, species information, and other information regarding project reviews within Virginia is available at our website http://www.fws.gov/northeast/virginiafield/endspecies/project_reviews.html. If you have any questions, please contact Troy Andersen of this office at (804) 824-2428.

Sincerely,

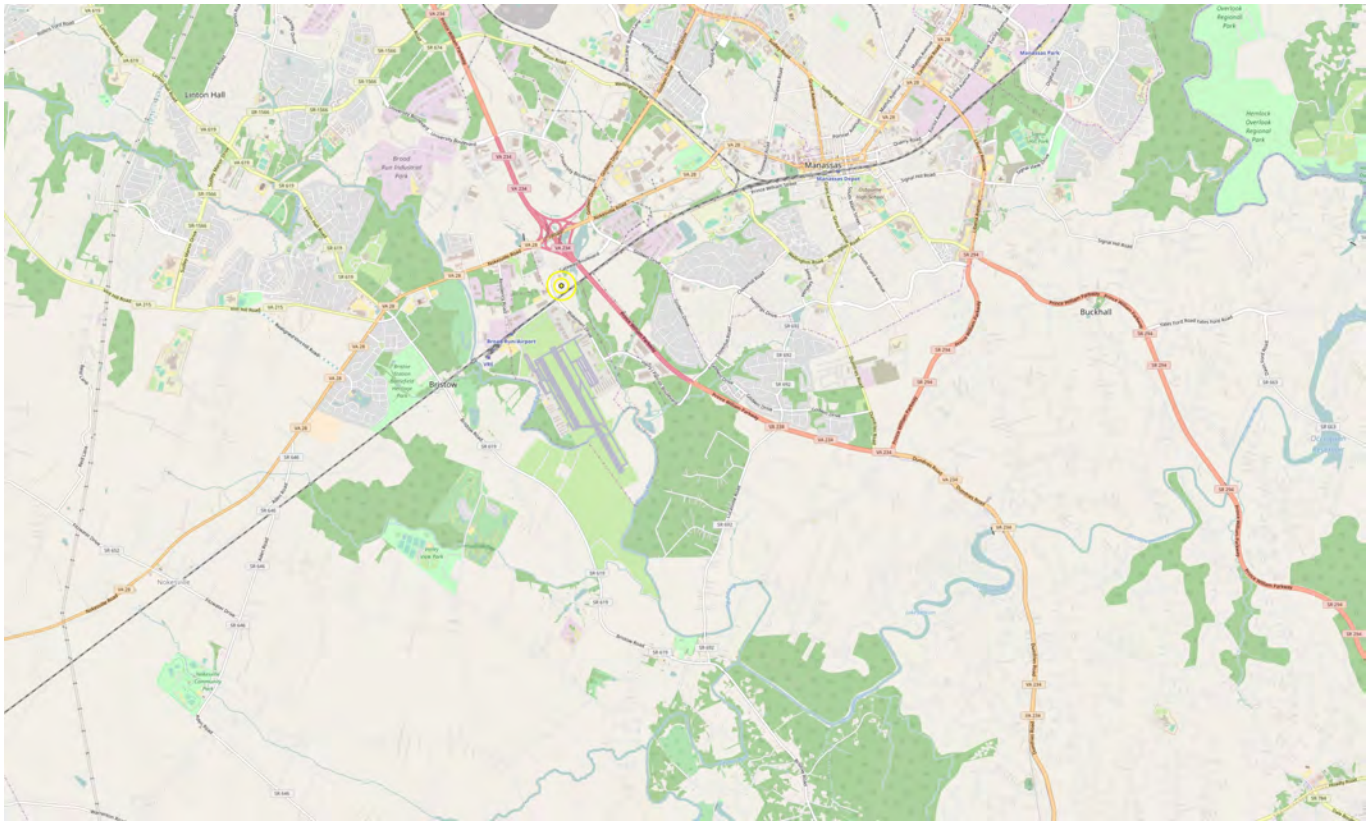


Cindy Schulz
Field Supervisor
Virginia Ecological Services

Enclosures - project review package

Exhibit 5
Bald Eagle Nest Buffer Map

CCB Mapping Portal



Layers: VA Eagle Nest Locator, VA Eagle Nest Buffers

Map Center [longitude, latitude]: [-77.50262260437012, 38.72472659806434]

Map Link:
http://www.ccbbirds.org/maps/#layer=VA+Eagle+Nest+Locator&layer=VA+Eagle+Nest+Buffers&zoom=14&lat=38.72472659806434&lng=-77.50262260437012&legend=legend_tab_7c321b7e-e523-11e4--aa0-0e0c41326911&base=Street+Map+%28OSM%29

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The Center for Conservation Biology (CCB) provides certain data online as a free service to the public and the regulatory sector. CCB encourages the use of its data sets in wildlife conservation and management applications. These data are protected by intellectual property laws. All users are reminded to view the Data Use Agreement to ensure compliance with our data use policies. For additional data access questions, view our Data Distribution Policy, or contact our Data Manager, Marie Pitts, at mlpitts@wm.edu or 757-221-7503.

Eagle Concentration Areas



December 19, 2016

1:577,791

0 4.75 9.5 19 mi

0 5 10 20 km

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey,

Exhibit 6
VDGIF Virginia Fish and Wildlife Information Service (VAFWIS) Search Results

VaFWIS Initial Project Assessment Report Compiled on 12/21/2016, 3:47:26 PM

Help

Known or likely to occur within a **2 mile radius around point 38.7230278 -77.5163887** in **153 Prince William County, 683 Manassas City, VA**

View Map of Site Location

548 Known or Likely Species ordered by Status Concern for Conservation (displaying first 23) (23 species with Status* or Tier I** or Tier II**)

BOVA Code	Status*	Tier**	Common Name	Scientific Name	Confirmed	Database(s)
010032	FESE	Ib	Sturgeon, Atlantic	Acipenser oxyrinchus		BOVA
050022	FTST	Ia	Bat, northern long-eared	Myotis septentrionalis		BOVA
050020	SE	Ia	Bat, little brown	Myotis lucifugus lucifugus		BOVA
050027	SE	Ia	Bat, tri-colored	Perimyotis subflavus		BOVA
060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes	BOVA,TEWaters,Habitat,SppObs
040096	ST	Ia	Falcon, peregrine	Falco peregrinus		BOVA
040293	ST	Ia	Shrike, loggerhead	Lanius ludovicianus		BOVA
040379	ST	Ia	Sparrow, Henslow's	Ammodramus henslowii		BOVA
040292	ST		Shrike, migrant loggerhead	Lanius ludovicianus migrans		BOVA
030063	CC	IIIa	Turtle, spotted	Clemmys guttata		BOVA
030012	CC	IVa	Rattlesnake, timber	Crotalus horridus		BOVA
010077		Ia	Shiner, bridle	Notropis bifrenatus		BOVA
040306		Ia	Warbler, golden-winged	Vermivora chrysoptera		BOVA
100248		Ia	Fritillary, regal	Speyeria idalia idalia		BOVA
040213		Ic	Owl, northern saw-whet	Aegolius acadicus		BOVA
040052		IIa	Duck, American black	Anas rubripes		BOVA
040036		IIa	Night-heron, yellow-crowned	Nyctanassa violacea violacea		BOVA
040181		IIa	Tern, common	Sterna hirundo		BOVA
040320		IIa	Warbler, cerulean	Setophaga cerulea		BOVA
			Woodcock,			

040140		IIa	American	Scolopax minor		BOVA
060029		IIa	Lance, yellow	Elliptio lanceolata	Yes	BOVA,SppObs
040203		IIb	Cuckoo, black-billed	Coccyzus erythropthalmus		BOVA
040105		IIb	Rail, king	Rallus elegans		BOVA

To view **All 548 species** View 548

*FE=Federal Endangered; FT=Federal Threatened; SE=State Endangered; ST=State Threatened; FC=Federal Candidate; CC=Collection Concern

**I=VA Wildlife Action Plan - Tier I - Critical Conservation Need; II=VA Wildlife Action Plan - Tier II - Very High Conservation Need; III=VA Wildlife Action Plan - Tier III - High Conservation Need; IV=VA Wildlife Action Plan - Tier IV - Moderate Conservation Need
Virginia Widlife Action Plan Conservation Opportunity Ranking:
a - On the ground management strategies/actions exist and can be feasibly implemented.;
b - On the ground actions or research needs have been identified but cannot feasibly be implemented at this time.;
c - No on the ground actions or research needs have been identified or all identified conservation opportunities have been exhausted.

Bat Colonies or Hibernacula: **Not Known**

Anadromous Fish Use Streams

N/A

Colonial Water Bird Survey

N/A

Threatened and Endangered Waters (1 Reach)

View Map of All Threatened and Endangered Waters

Stream Name	T&E Waters Species						View Map
	Highest TE*	BOVA Code, Status*, Tier**, Common & Scientific Name					
Broad Run (02070010)	SE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes

Managed Trout Streams

N/A

Bald Eagle Concentration Areas and Roosts

N/A

Bald Eagle Nests

N/A

Habitat Predicted for Aquatic WAP Tier I & II Species (2 Reaches)

View Map Combined Reaches from Below of Habitat Predicted for WAP Tier I & II Aquatic Species

Stream Name	Tier Species						View Map
	Highest TE*	BOVA Code, Status*, Tier**, Common & Scientific Name					
Broad Run (20700102)	SE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes
Kettle Run (20700102)	SE	060006	SE	Ib	Floater, brook	Alasmidonta varicosa	Yes

Habitat Predicted for Terrestrial WAP Tier I & II Species

N/A

Public Holdings:

N/A

Compiled on 12/21/2016, 3:47:26 PM I790825.0 report=IPA searchType= R dist= 3218 poi= 38.7230278 -77.5163887

PixelSize=64; Anadromous=0.01207; BECAR=0.010645; Bats=0.00956; Buffer=0.100288; County=0.07283; Impediments=0.01028; Init=0.149316; PublicLands=0.01739; SppObs=0.140037; TEWaters=0.029427; TierReaches=0.042762; TierTerrestrial=0.031725; Total=0.716046; Tracking_BOVA=0.162724; Trout=0.012359

Exhibit 7
VDCR Coordination Letter

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Rochelle Altholz
Deputy Director of Administration and Finance

David C. Dowling
Deputy Director of Soil and Water Conservation and Dam Safety

Thomas L. Smith
Deputy Director of Operations

January 26, 2017

Matthew Neely
Mill Creek Environmental Consultants
11400 Longtown Drive
Midlothian, VA 23112

Re: Manassas Regional Airport Corporate Development Project

Dear Mr. Neely:

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Broad Run Stream Conservation Unit (SCU) is located adjacent to the project site. SCUs identify stream reaches that contain aquatic natural heritage resources, including 2 miles upstream and 1 mile downstream of documented occurrences, and all tributaries within this reach. SCUs are also given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain. The Broad Run SCU has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resources of concern associated with this SCU are:

Alasmidonta varicosa	Brook floater	G3/S1/NL/LE
Elliptio lanceolata	Yellow lance	G2G3/S2S3/SOC/NL

The Brook floater, a small freshwater mussel species, is known from the northeastern United States primarily in the Atlantic Slope drainages (NatureServe, 2009). In Virginia, it is recorded from the Potomac River basin with a possible record from the James River. Of 14 documented records in Virginia, only two are thought to be viable. Population declines have been documented throughout its range (NatureServe, 2009). The Brook floater typically inhabits flowing-water habitats in and near riffles and rapids of smaller creeks with rocky or gravelly substrates (Nedeau et al., 2000 per NatureServe, 2009). Many facets of its life history are unknown including its fish host. Threats for the Brook floater in particular include poor water quality as this species does not tolerate silt or nutrient pollution well (Stevenson and Bruenderman, 1995). Please note that this species is currently listed as endangered by the Virginia Department of Game and Inland Fisheries (VDGIF).

The Yellow lance occurs in mid-sized rivers and second and third order streams. To survive, it needs a silt-free, stable streambed and well-oxygenated water that is free of pollutants. This species has been the subject of taxonomic debate in recent years (NatureServe, 2009). Currently in Virginia, the Yellow lance is recognized from populations in the Chowan, James, York, and Rappahannock drainages. Its range also extends into Neuse-Tar river system in North Carolina. In recent years, significant population declines have been noted across its range (NatureServe, 2009). The Yellow lance may be particularly sensitive to chemical pollutants and exposure to fine

sediments from erosion (NatureServe, 2009). Please note that this species is currently classified as a species of concern by the United States Fish and Wildlife Service (USFWS); however, this designation has no official legal status.

Considered good indicators of the health of aquatic ecosystems, freshwater mussels are dependent on good water quality, good physical habitat conditions, and an environment that will support populations of host fish species (Williams et al., 1993). Because mussels are sedentary organisms, they are sensitive to water quality degradation related to increased sedimentation and pollution. They are also sensitive to habitat destruction through dam construction, channelization, and dredging, and the invasion of exotic mollusk species.

In addition, Broad Run has been designated by the VDGIF as a "Threatened and Endangered Species Water" for the Brook floater.

Please note according to DCR's species distribution model, potential may exist for the Dwarf wedgemussel (*Alasmidonta heterodon*, G1G2/S1/LE/LE) at the project location.

To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. Due to the legal status of the Brook floater, DCR also recommends coordination with Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570).

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

New and updated information is continually added to Biotics. Please re-submit a completed order form and project map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

A fee of 125.00 has been assessed for the service of providing this information. Please find enclosed an invoice for that amount. Please return one copy of the invoice along with your remittance made payable to the Treasurer of Virginia, **DCR - Division of Natural Heritage, 600 East Main Street, 24th Floor, Richmond, VA 23219.** Payment is due within thirty days of the invoice date. Please note the change of address for remittance of payment as of July 1, 2013. Late payment may result in the suspension of project review service for future projects.

The VDGIF maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

Should you have any questions or concerns, feel free to contact me at (804) 692-0984. Thank you for the opportunity to comment on this project.

Sincerely,

Alli Baird

Alli Baird, LA, ASLA
Coastal Zone Locality Liaison

CC : Amy Ewing, VDGIF
Troy Andersen, USFWS

Literature Cited

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 16, 2010 and April 5, 2010).

Nedeau, E.J., M.A. McCollough, and B.I. Swartz. 2000. The freshwater mussels of Maine. Maine Department of Inland Fisheries and Wildlife, Augusta, Maine. 118 pp.

Stevenson, Phillip H. and Sue A. Bruenderman 1995. A Guide to Endangered and Threatened Species of Virginia. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. p. 74.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-9.

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APPENDIX C

HAZARDOUS MATERIALS SURVEY

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Mill Creek
Environmental Consultants, LTD



Survey and Analysis for Hazardous Materials/Sites
Manassas Regional Airport (HEF)
Environmental Assessment for Corporate Development
Manassas, VA

Prepared for:
RS&H
10748 Deerwood Park Blvd South
Jacksonville, FL 32256-0597

Prepared by:
Matt Neely
Senior Environmental Scientist, PWD
Mill Creek Environmental Consultants

09 January 2017

11400 Longtown Drive Midlothian Virginia 23112 (804) 739-2147 (757) 329-0573
millcreekenvironment@comcast.net

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2.0 Discussion 1

3.0 Findings 6

4.0 Conclusions 6

5.0 References 7

Exhibits

Exhibit 1 Project Study Area Map
Exhibit 2 EDR Radius Map Report

1.0 Introduction

Mill Creek Environmental Consultant's, Ltd. recently completed a survey and analysis of ± 48 acres of land associated with Manassas Regional Airport (HEF) in Manassas Virginia. The analysis was conducted as part of a Federal Aviation Administration (FAA) mandated Environmental Assessment (EA) for the purpose of corporate development within the EA study area (see Exhibt 1). A main objective of the physical and historical investigation of the study area was to determine if the EA study area might contain uncontrolled hazardous substances or might possibly be contaminated by any hazardous materials/substances or wastes.

2.0 Discussion

In order to assess the possibility of an area being contaminated by hazardous materials or substances, an investigator must have knowledge of the definition of the following terms:

a. Hazardous Material – any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce (49 CFR part 172, table 172,.101). This includes hazardous substances and hazardous wastes.
b. Hazardous Substances – any element, compound, mixture, solution, or substances defined as a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR part 302. If released into the environment, hazardous substances may pose substantial harm to human health or the environment.
c. Hazardous Waste – under the Resource Conservation and Recovery Act (RCRA) a waste is considered hazardous, if it is listed in, or meets the characteristics described in 40 CFR part 261, including ignitability, corrosivity, reactivity, or toxicity**.**

Any reconnaissance of a project area for the presence of any of the defined and listed hazardous materials, substances, or waste must consider the geographical setting of the site, its natural environment, and historic use.

The EA study area is comprised of approximately + 48 acres adjacent to the Manassas Regional Airport in Manassas, Virginia. The EA study area is divided into three discontinuous parcels, two to the west (W) of the airport operations area (AOA) and one to the east (E). A map can be seen in (Exhibit 1). All three distinct parcels sit between elevations of 160-180'. Precipitation falling within the two parcels to the west (W) of the AOA makes its way via overland sheet-flow and groundwater movement to Broad Run immediately to the west (W) and south (S). Precipitation falling within the parcel to the east (E) makes its way via overland sheet-flow and groundwater movement down slope to the north (N) into Cannon Branch and eventually into Broad Run, which flows into the Middle Potomac-Anacostia-Occoquan basin (HUC02070010).



Area A (± 25 acres)

The largest of the three parcels comprising the EA study area is area A (± 25 acres). Area A is immediately adjacent to the hangar, apron, and parking spaces on the west (W) side of the AOA between the fence line and Broad Run.



The vast majority of area A (± 22 acres) consists of mature, mixed hardwood forest. Upland vegetation is comprised of a mature over-story containing species such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), and various species of hickories (*Carya spp*.), with a limited shrub understory containing instances of deerberry (*Vaccinium stamineum*) and saplings of the over-story species listed above. Representative photos can be seen below.





Areas such as forested wetlands and others containing higher soil moisture content are dominated by species such as red maple (*Acer rubrum*), pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), boxelder maple (*Acer negundo*), and sweetgum (*Liquidambar stryaciflua*). The shrub layer in these areas consisted of saplings of the species listed above, as well as a herbaceous layer containing species such as lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), shallow sedge (*Carex lurida*), and varying species of rushes (*Juncaceae spp.*). Representative photos can be seen below.





Animal species observed within or known to exist within the boundaries of this forested portion of the study area include white tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), Raccoon (*Procyon lotor* L.), Gray Squirrel (*Sciurus carolinensis L.*), Striped Skunk (*Memphitis memphitis L.*), Eastern Cottontail (*Sylvilagus floridanus L.*),Virginia Opossum (*Didelphis virginiana L.*), Eastern Box Turtle (*Terrapena carolina* L.), and the Black Racer (*Coluber constrictor*), and various species of frogs and skinks. Approximately three acres of EA study area A consists of graded maintained/mowed grass areas immediately adjacent to observation road. The area is characterized as a level, compactly graded lot maintained regularly by normal maintenace. Representative photo seen below.



Area B (± 7 acres)

Study area B consists of ± 7 on the west (W) side of the AOA between aircraft parking aprons, hangars, and taxiway spaces and observation road. It is characterized a by mostly level, compactly graded, grass surface that only changes in elevation as it slopes down to the significant stormwater ditch making its way through the EA study area.



The vegetation in this area consists of maintained fesuces (*festuca spp.*), and other weeds such as broom sedge (*Andropogon virginicus*). Representative photos can be seen below.





Area C (±16 acres)

Study area C consists of ± 16 acres on the east (E) side of the AOA, immediately east (E) of wakeman drive and west (W) of Cannon Branch.



Almost all ± 16 acres consists of mature, mixed hardwood forest. Upland vegetation is comprised of a mature over-story containing species such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), eastern redcedar (*Juniperus virginiana*) and various species of hickories (*Carya spp*.), with a limited shrub understory containing instances of deerberry (*Vaccinium stamineum*) and saplings of the over-story species listed above. Representative photos can be seen below.





Areas such as forested wetlands and others containing higher soil moisture content are dominated by species such as red maple (*Acer rubrum*), pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), boxelder maple (*Acer negundo*), and sweetgum (*Liquidambar stryaciflua*). The shrub layer in these areas consisted of saplings of the species listed above, as well as a herbaceous layer containing species such as lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), shallow sedge (*Carex lurida*), and varying species of rushes (*Juncaceae spp.*). Representative photos can be seen below.





Animal species observed within or known to exist within the boundaries of this forested portion of the study area include white tailed deer (*Odocoileus virginianus*), wild turkey (*Meleagris gallopavo*), Raccoon (*Procyon lotor* L.), Gray Squirrel (*Sciurus carolinensis L*.), Striped Skunk (*Memphitis memphitis L*.), Eastern Cottontail (*Sylvilagus floridanus L*.),Virginia Opossum (*Didelphis virginiana L*.), Eastern Box Turtle (*Terrapena carolina* L.), and the Black Racer (*Coluber constrictor*), and various species of frogs and skinks.

3.0 Findings

Physical inspection of the EA study area revealed no hazardous waste, toxic materials or potential origins of hazardous waste production. As a whole the EA study area appears clear of trash or any other materials that may be detrimental to the overall environment or small ecosystems. Normal debris/trash was seen on the grounds, but nothing significant.

As a component of the Hazardous Materials Site Survey for the EA, Mill Creek Environmental Consultants, Ltd. also obtained an Environmental Phase I Report from Environmental Data Resources, Inc.. This report included a search of all Federal, State, and local databases for instances of pollution or environmental contamination in accordance with the radius associated with ASTM standards for the EA study area.

The radius report did not reveal any listed sites within any of the boundaries associated with the EA study area. However, there were listed sites within the external search radius of the EA studya area. Detailed information and maps of these surrounding sites can be seen in Exhibit 2.

4.0 Conclusions

Ground examination of the EA study area showed that the location appears free and clear of hazardous materials and/or toxic substances. The overall environment of the EA study area was extremely clean compared to sites of its same nature and size. There does not appear to be any cases of dumping or storing toxic or hazardous materials within the EA study area boundaries.

Development within the study area is unlikely to introduce any hazardous waste or materials to the site.

5.0 References

Bregman, J.I., Craig Kelley, and James R. Melchor. 1996. Environmental Compliance Handbook, CRC Lewis Publishers, Boca Raton, FL, 417 pp.

Jain, R.K., L.V. Urban, G.S. Stacey, and H.E. Balbach. 1993. Environmental Assessment. McGraw-Hill, Inc., New York, NY, 526 pp.

US Department of Transportation. 2004. Federal Aviation Administration Order 1050.1E Subj: Environmental Impacts: Policies and Procedures, Washington, DC, 185 pp.

Exhibit 1
Project Study Area Map

Manassas Regional Airport
Corporate Development Environmental Assessment Aerial



Exhibit 2
EDR Radius Map Report

Manassas Regional Airport
10600 Harry J Parrish Blvd
Manassas, VA 20110

Inquiry Number: 4820776.2s
January 05, 2017

The EDR Radius Map™ Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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Government Records Searched/Data Currency Tracking	GR-1

GEOCHECK ADDENDUM

GeoCheck - Not Requested

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

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EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

10600 HARRY J PARRISH BLVD
MANASSAS, VA 20110

COORDINATES

Latitude (North):	38.7235980 - 38° 43' 24.95''
Longitude (West):	77.5172620 - 77° 31' 2.14''
Universal Tranverse Mercator:	Zone 18
UTM X (Meters):	281159.3
UTM Y (Meters):	4288905.5
Elevation:	177 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5950529 NOKESVILLE, VA
Version Date:	2013
Southeast Map:	5950785 INDEPENDENT HILL, VA
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140826
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
10600 HARRY J PARRISH BLVD
MANASSAS, VA 20110

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1		10677 AVIATION LN	EDR Hist Auto	Higher	1 ft.
A2	COLGAN AIR	10677 AVIATION LANE	PA MANIFEST	Higher	1 ft.
A3		10677 AVIATION LANE	RCRA NonGen / NLR	Higher	1 ft.
A4		10678 AVIATION LANE	RCRA-CESQG, FINDS, NJ MANIFEST, ECHO	Higher	1 ft.
A5	COLGAN AIR	10677 AVIATION LN	PA MANIFEST	Higher	1 ft.
B6		10527 TERMINAL RD	RCRA-CESQG, FINDS, ECHO	Higher	1 ft.
7		10501 OBSERVATION RO	RCRA-CESQG	Lower	1 ft.
B8	DULLES AVIATION INCO	10522 TERMINAL RD	VA LTANKS	Higher	1 ft.
B9	MANASSAS REGIONAL AI	10522 TERMINAL RD	VA UST	Higher	1 ft.
B10	MANASSAS MUNICIPAL A	10522 TERMINAL ROAD	VA LUST	Higher	1 ft.
C11	GATEWAY GENERATION	10453 WAKEMAN DR	VA AST	Lower	1 ft.
C12	MANASSAS REGIONAL AI	10451 WAKEMAN DR	VA AST	Lower	1 ft.
13		9998 WAKEMAN DR.	RCRA-CESQG	Higher	1 ft.
14	AURORA FLIGHT SCIENC	9950 WAKEMAN DR	VA UST	Higher	506, 0.096, North
D15	VA RAILWAY EXPRESS B	10637 PIPER LN	VA UST, VA Financial Assurance	Higher	1122, 0.213, WNW
D16	VA RAILWAY EXPRESS B	10637 PIPER LN	VA AST	Higher	1122, 0.213, WNW
17		10599 RESIDENCY ROAD	RCRA-SQG	Higher	1240, 0.235, WNW
18	VDOT - MANASSAS AREA	10228 RESIDENCY RD	VA LTANKS	Higher	1325, 0.251, NW
19	LONG VERA RESIDENCE	11726 BRISTOW RD	VA LTANKS	Higher	2401, 0.455, South

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ---------- Federal Facility Site Information listing
SEMS ---------- Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE ---------- Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---------- RCRA - Large Quantity Generators

Federal institutional controls / engineering controls registries

LUCIS ---------- Land Use Control Information System
US ENG CONTROLS ---------- Engineering Controls Sites List
US INST CONTROL ---------- Sites with Institutional Controls

Federal ERNS list

ERNS ---------- Emergency Response Notification System

EXECUTIVE SUMMARY

State- and tribal - equivalent CERCLIS

VA SHWS ---- This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State and tribal landfill and/or solid waste disposal site lists

VA SWF/LF ---- Solid Waste Management Facilities

State and tribal leaking storage tank lists

INDIAN LUST ---- Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST ---- Underground Storage Tank Listing
INDIAN UST ---- Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

VA ENG CONTROLS ---- Engineering Controls Sites Listing
VA INST CONTROL ---- Voluntary Remediation Program Database

State and tribal voluntary cleanup sites

VA VCP ---- Voluntary Remediation Program
INDIAN VCP ---- Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

VA BROWNFIELDS ---- Brownfields Site Specific Assessments

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI ---- Report on the Status of Open Dumps on Indian Lands
ODI ---- Open Dump Inventory
DEBRIS REGION 9 ---- Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS ---- Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL ---- Delisted National Clandestine Laboratory Register
US CDL ---- National Clandestine Laboratory Register

Local Land Records

LIENS 2 ---- CERCLA Lien Information

EXECUTIVE SUMMARY

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
VA SPILLS	Prep/Spills Database Listing
VA SPILLS 90	SPILLS 90 data from FirstSearch

Other Ascertainable Records

FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
DOCKET HWC	Hazardous Waste Compliance Docket Listing
UXO	Unexploded Ordnance Sites
VA AIRS	Permitted Airs Facility List
VA NPDES	Comprehensive Environmental Data System
VA COAL ASH	Coal Ash Disposal Sites
VA DRYCLEANERS	Drycleaner List
VA ENF	Enforcement Actions Data
VA TIER 2	Tier 2 Information Listing
VA UIC	Underground Injection Control Wells
FUELS PROGRAM	EPA Fuels Program Registered Listing
ABANDONED MINES	Abandoned Mines

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants

EXECUTIVE SUMMARY

EDR Hist Cleaner..... EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

VA RGA LF..... Recovered Government Archive Solid Waste Facilities List
VA RGA LUST..... Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal RCRA generators list

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 06/21/2016 has revealed that there is 1 RCRA-SQG site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	10599 RESIDENCY ROAD	WNW 1/8 - 1/4 (0.235 mi.)	17	123

RCRA-CESQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-CESQG list, as provided by EDR, and dated 06/21/2016 has revealed that there are 4 RCRA-CESQG sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	***10678 AVIATION LANE***	***0 - 1/8 (0.000 mi.)***	***A4***	***21***
Not reported	***10527 TERMINAL RD***	***0 - 1/8 (0.000 mi.)***	***B6***	***38***

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	9998 WAKEMAN DR.	0 - 1/8 (0.000 mi.)	13	116

Lower Elevation	Address	Direction / Distance	Map ID	Page
Not reported	10501 OBSERVATION RO	0 - 1/8 (0.000 mi.)	7	40

State and tribal leaking storage tank lists

VA LUST: The Leaking Underground Storage Tank Database.

A review of the VA LUST list, as provided by EDR, has revealed that there is 1 VA LUST site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MANASSAS MUNICIPAL A	10522 TERMINAL ROAD	0 - 1/8 (0.000 mi.)	B10	58
Database: LUST REG NO, Date of Government Version: 05/18/2004 Facility Status: Closed Pollution Complaint #: 87-0385 Pollution Complaint #: 99-3317 Closed Date: 8/23/1994 Closed Date: 4/19/1999 Facility ID: 3900476				

VA LTANKS: The Leaking Tanks Database contains current Leaking petroleum tanks. The data comes from the Department of Environmental Quality.

A review of the VA LTANKS list, as provided by EDR, and dated 08/01/2016 has revealed that there are 3 VA LTANKS sites within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
DULLES AVIATION INCO Facility Status: Closed CEDS Facility Id: 200000078840 Pollution Complaint #: 20013062 Pollution Complaint #: 19910187 Pollution Complaint #: 19870385	10522 TERMINAL RD	0 - 1/8 (0.000 mi.)	B8	42
VDOT - MANASSAS AREA Facility Status: Closed CEDS Facility Id: 200000096828 Pollution Complaint #: 19900438	10228 RESIDENCY RD	NW 1/4 - 1/2 (0.251 mi.)	18	124
LONG VERA RESIDENCE Facility Status: Closed CEDS Facility Id: 200000204654 Pollution Complaint #: 20023078	11726 BRISTOW RD	S 1/4 - 1/2 (0.455 mi.)	19	124

EXECUTIVE SUMMARY

State and tribal registered storage tank lists

VA UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Department of Environmental Quality's Underground Storage Tank Data Notification Information.

A review of the VA UST list, as provided by EDR, and dated 08/02/2016 has revealed that there are 3 VA UST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
MANASSAS REGIONAL AI Tank Status: CLS IN GRD Tank Status: PERM OUT OF USE Facility Id: 3001899 CEDS Facility ID: 200000078840	10522 TERMINAL RD	0 - 1/8 (0.000 mi.)	B9	43
AURORA FLIGHT SCIENC Tank Status: REM FROM GRD Facility Id: 3042584 CEDS Facility ID: 200000873735	9950 WAKEMAN DR	N 0 - 1/8 (0.096 mi.)	14	118
VA RAILWAY EXPRESS B Tank Status: CURR IN USE Facility Id: 3041755 CEDS Facility ID: 200000850922	***10637 PIPER LN***	***WNW 1/8 - 1/4 (0.213 mi.)***	***D15***	***119***

VA AST: The Aboveground Storage Tank database contains registered ASTs. The data come from the Department of Environmental Quality's Aboveground Storage Tank Data Notification Information.

A review of the VA AST list, as provided by EDR, and dated 08/02/2016 has revealed that there are 3 VA AST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
VA RAILWAY EXPRESS B Facility ID: 3041755 CEDS Facility ID: 200000850922	10637 PIPER LN	WNW 1/8 - 1/4 (0.213 mi.)	D16	121

Lower Elevation	Address	Direction / Distance	Map ID	Page
GATEWAY GENERATION Facility ID: 3038092 CEDS Facility ID: 200000203272	10453 WAKEMAN DR	0 - 1/8 (0.000 mi.)	C11	59
MANASSAS REGIONAL AI Facility ID: 3034616 Facility ID: 3038736 CEDS Facility ID: 200000077992 CEDS Facility ID: 200000208957	10451 WAKEMAN DR	0 - 1/8 (0.000 mi.)	C12	62

EXECUTIVE SUMMARY

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

RCRA NonGen / NLR: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA NonGen / NLR list, as provided by EDR, and dated 06/21/2016 has revealed that there is 1 RCRA NonGen / NLR site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	10677 AVIATION LANE	0 - 1/8 (0.000 mi.)	A3	17

NJ MANIFEST: Hazardous waste manifest information.

A review of the NJ MANIFEST list, as provided by EDR, and dated 12/31/2015 has revealed that there is 1 NJ MANIFEST site within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported EPA Id: VAR000500389	***10678 AVIATION LANE***	***0 - 1/8 (0.000 mi.)***	***A4***	***21***

PA MANIFEST: Hazardous waste manifest information.

A review of the PA MANIFEST list, as provided by EDR, and dated 12/31/2015 has revealed that there are 2 PA MANIFEST sites within approximately 0.25 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
COLGAN AIR Generator EPA Id: VAR000504332	10677 AVIATION LANE	0 - 1/8 (0.000 mi.)	A2	8
COLGAN AIR Generator EPA Id: VAP000015896	10677 AVIATION LN	0 - 1/8 (0.000 mi.)	A5	28

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR Hist Auto: EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station,

service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

A review of the EDR Hist Auto list, as provided by EDR, has revealed that there is 1 EDR Hist Auto site within approximately 0.125 miles of the target property.

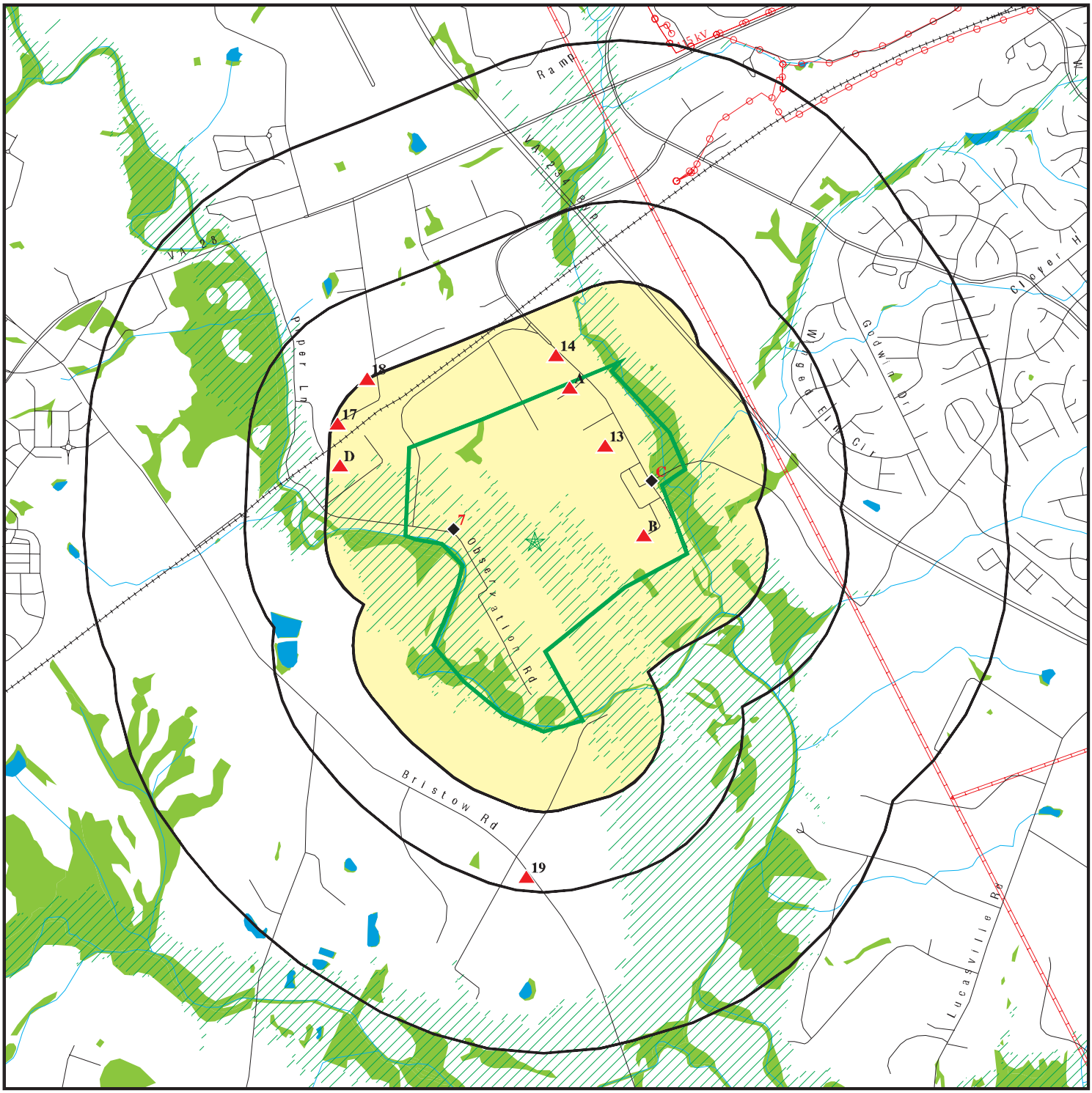
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
Not reported	10677 AVIATION LN	0 - 1/8 (0.000 mi.)	A1	8

EXECUTIVE SUMMARY

Due to poor or inadequate address information, the following sites were not mapped. Count: 6 records.

Site Name	Database(s)
COLONIAL PIPELINE - BULL RUN	VA LUST
AT&T INDEPENDENT HILL	VA LUST
MANASSAS AIRPORT	VA SPILLS
MANASSAS AIRPORT	VA SPILLS
MANASSAS AIRPORT PUMP STATION	VA SPILLS
DULLES AVIATION, INC/MANASSAS AIRP	VA RGA LUST

OVERVIEW MAP - 4820776.2S



0 1/4 1/2 1 Miles

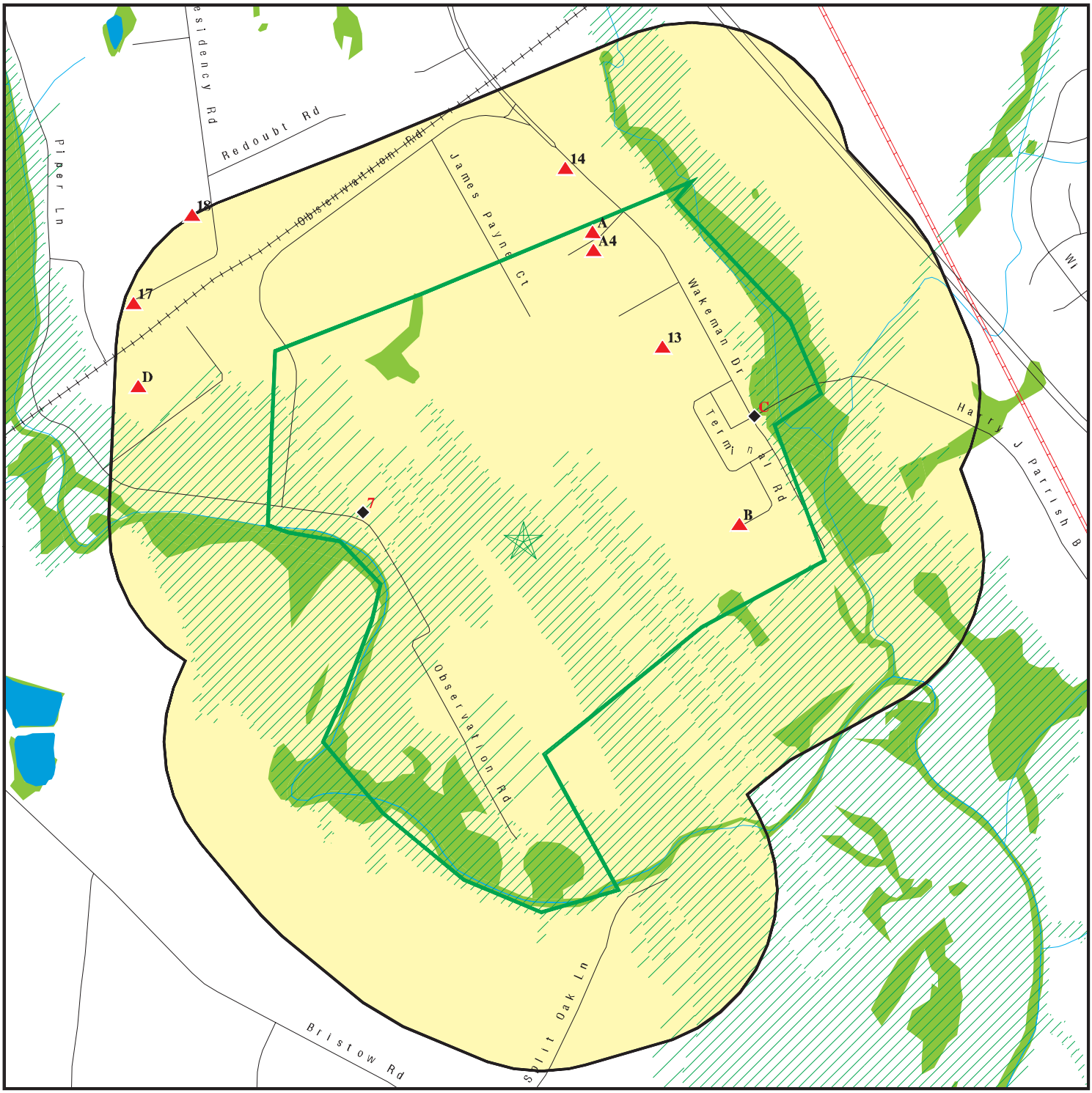
- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Power transmission lines
- Pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Manassas Regional Airport	CLIENT:	Mill Creek Environmental Consultants
ADDRESS:	10600 Harry J Parrish Blvd Manassas VA 20110	CONTACT:	Matthew Neely
LAT/LONG:	38.723598 / 77.517262	INQUIRY #:	4820776.2s
		DATE:	January 05, 2017 1:40 pm

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DETAIL MAP - 4820776.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- Pipelines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Manassas Regional Airport	CLIENT:	Mill Creek Environmental Consultants
ADDRESS:	10600 Harry J Parrish Blvd Manassas VA 20110	CONTACT:	Matthew Neely
		INQUIRY #:	4820776.2s
LAT/LONG:	38.723598 / 77.517262	DATE:	January 05, 2017 1:42 pm

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MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	1	NR	NR	NR	1
RCRA-CESQG	0.250		4	0	NR	NR	NR	4
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
VA SHWS	N/A		N/A	N/A	N/A	N/A	N/A	N/A
State and tribal landfill and/or solid waste disposal site lists								
VA SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
VA LUST	0.500		1	0	0	NR	NR	1
INDIAN LUST	0.500		0	0	0	NR	NR	0
VA LTANKS	0.500		1	0	2	NR	NR	3
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
VA UST	0.250		2	1	NR	NR	NR	3
VA AST	0.250		2	1	NR	NR	NR	3
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
VA ENG CONTROLS	0.500		0	0	0	NR	NR	0
VA INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VA VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
VA BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
VA SPILLS	TP		NR	NR	NR	NR	NR	0
VA SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		1	0	NR	NR	NR	1
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
VA AIRS	TP		NR	NR	NR	NR	NR	0
VA NPDES	TP		NR	NR	NR	NR	NR	0
VA COAL ASH	0.500		0	0	0	NR	NR	0
VA DRYCLEANERS	0.250		0	0	NR	NR	NR	0
VA ENF	TP		NR	NR	NR	NR	NR	0
VA Financial Assurance	TP		NR	NR	NR	NR	NR	0
NJ MANIFEST	0.250		1	0	NR	NR	NR	1
PA MANIFEST	0.250		2	0	NR	NR	NR	2
VA TIER 2	TP		NR	NR	NR	NR	NR	0
VA UIC	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
ABANDONED MINES	0.500		0	0	0	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		1	NR	NR	NR	NR	1
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
VA RGA LF	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
VA RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	15	3	2	0	0	20

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

N/A = This State does not maintain a SHWS list. See the Federal CERCLIS list.

A1 **EDR Hist Auto** **1015143456**
10677 AVIATION LN **N/A**
< 1/8 **MANASSAS, VA 20110**
1 ft.

Site 1 of 5 in cluster A

Relative: EDR Historical Auto Stations:
Higher
Name: MARSHALL AUTO CTR INC
Year: 2003
Actual: Address: 10677 AVIATION LN
197 ft.

A2 **COLGAN AIR** **PA MANIFEST** **1007116771**
10677 AVIATION LANE **N/A**
< 1/8 **MANASSAS, VA 20110**
1 ft.

Site 2 of 5 in cluster A

Relative: Manifest Details:
Higher

Year:	2008
Manifest Number:	000839248JJK
Actual: Manifest Type:	TSD Copy
197 ft. Generator EPA Id:	VAR000504332
Generator Date:	06/19/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	D001
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	300
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2008
Manifest Number:	004469812JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	08/15/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA

COLGAN AIR (Continued) **1007116771**

Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	x99x
Container Number:	2
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	75
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	004469812JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	08/15/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	9
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	495
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000839939JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	01/25/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	4

COLGAN AIR (Continued) **1007116771**

Waste Number:	XXXX
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	200
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000839248JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	06/19/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	3
Waste Number:	x99x
Container Number:	2
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	500
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000838040JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	06/05/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F005
Container Number:	5
Container Type:	Fiberboard or plastic drums, barrels, kegs

COLGAN AIR (Continued) **1007116771**

Waste Quantity:	800
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000839248JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	06/19/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	300
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000839939JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	01/25/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	3
Waste Number:	D035
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	200
Unit:	Pounds
Handling Code:	Not reported

COLGAN AIR (Continued) **1007116771**

TSP EPA Id: Not reported
Date TSP Sig: Not reported

Year: 2008
Manifest Number: 000839939JJK
Manifest Type: TSD Copy
Generator EPA Id: VAR000504332
Generator Date: 01/25/2008
Mailing Address: Not reported
Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: 703-331-3122
TSD EPA Id: PAD067098822
TSD Date: Not reported
TSD Facility Name: CYCLE CHEM INC
TSD Facility Address: 550 INDUSTRIAL DRIVE
TSD Facility City: LEWISBERRY
TSD Facility State: PA
Facility Telephone: Not reported
Page Number: 1
Line Number: 2
Waste Number: D001
Container Number: 2
Container Type: Metal drums, barrels, kegs
Waste Quantity: 120
Unit: Pounds
Handling Code: Not reported
TSP EPA Id: Not reported
Date TSP Sig: Not reported

Year: 2008
Manifest Number: 000839939JJK
Manifest Type: TSD Copy
Generator EPA Id: VAR000504332
Generator Date: 01/25/2008
Mailing Address: Not reported
Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: 703-331-3122
TSD EPA Id: PAD067098822
TSD Date: Not reported
TSD Facility Name: CYCLE CHEM INC
TSD Facility Address: 550 INDUSTRIAL DRIVE
TSD Facility City: LEWISBERRY
TSD Facility State: PA
Facility Telephone: Not reported
Page Number: 1
Line Number: 1
Waste Number: F005
Container Number: 1
Container Type: Metal drums, barrels, kegs
Waste Quantity: 200
Unit: Pounds
Handling Code: Not reported
TSP EPA Id: Not reported
Date TSP Sig: Not reported

COLGAN AIR (Continued) **1007116771**

Year:	2008
Manifest Number:	000839939JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	01/25/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F003
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	200
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2008
Manifest Number:	004469812JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	08/15/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F005
Container Number:	9
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	495
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2008
Manifest Number:	000838040JJK
Manifest Type:	TSD Copy

COLGAN AIR (Continued) **1007116771**

Generator EPA Id:	VAR000504332
Generator Date:	06/05/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D035
Container Number:	5
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	800
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2008
Manifest Number:	000838040JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	06/05/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	5
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	800
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2008
Manifest Number:	000839939JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	01/25/2008
Mailing Address:	Not reported

COLGAN AIR (Continued) **1007116771**

Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: 703-331-3122
TSD EPA Id: PAD067098822
TSD Date: Not reported
TSD Facility Name: CYCLE CHEM INC
TSD Facility Address: 550 INDUSTRIAL DRIVE
TSD Facility City: LEWISBERRY
TSD Facility State: PA
Facility Telephone: Not reported
Page Number: 1
Line Number: 2
Waste Number: D018
Container Number: 2
Container Type: Metal drums, barrels, kegs
Waste Quantity: 120
Unit: Pounds
Handling Code: Not reported
TSP EPA Id: Not reported
Date TSP Sig: Not reported

Year: 2008
Manifest Number: 000839248JJK
Manifest Type: TSD Copy
Generator EPA Id: VAR000504332
Generator Date: 06/19/2008
Mailing Address: Not reported
Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: 703-331-3122
TSD EPA Id: PAD067098822
TSD Date: Not reported
TSD Facility Name: CYCLE CHEM INC
TSD Facility Address: 550 INDUSTRIAL DRIVE
TSD Facility City: LEWISBERRY
TSD Facility State: PA
Facility Telephone: Not reported
Page Number: 1
Line Number: 4
Waste Number: x99x
Container Number: 1
Container Type: Metal drums, barrels, kegs
Waste Quantity: 250
Unit: Pounds
Handling Code: Not reported
TSP EPA Id: Not reported
Date TSP Sig: Not reported

Year: 2008
Manifest Number: 004469812JJK
Manifest Type: TSD Copy
Generator EPA Id: VAR000504332
Generator Date: 08/15/2008
Mailing Address: Not reported
Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: 703-331-3122

COLGAN AIR (Continued) **1007116771**

TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F003
Container Number:	9
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	495
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000838040JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	06/05/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F003
Container Number:	5
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	800
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2008
Manifest Number:	000839939JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	01/25/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC

COLGAN AIR (Continued) **1007116771**

TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	200
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2008
Manifest Number:	004469812JJK
Manifest Type:	TSD Copy
Generator EPA Id:	VAR000504332
Generator Date:	08/15/2008
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D035
Container Number:	9
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	495
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Click this hyperlink while viewing on your computer to access
40 additional PA_MANIFEST: record(s) in the EDR Site Report.

A3 **RCRA NonGen / NLR** **1015751558**
VAR000504332

10677 AVIATION LANE
< 1/8 **MANASSAS, VA 20110**
1 ft.

Site 3 of 5 in cluster A

Relative:
Higher

Actual:
197 ft.

RCRA NonGen / NLR:

Date form received by agency:	07/03/2012
Facility name:	Not reported
Facility address:	10677 AVIATION LANE MANASSAS, VA 20110
EPA ID:	VAR000504332
Mailing address:	AVIATION LANE

(Continued) **1015751558**

MANASSAS, VA 201102701
Contact: KENNETH CERRETTI
Contact address: 10677 AVIATION LANE
MANASSAS, VA 201102701
Contact country: US
Contact telephone: (703) 331-3122
Contact email: Not reported
EPA Region: Not reported
Land type: Private
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:
Owner/operator name: CITY OF MANASSAS
Owner/operator address: Not reported
Not reported
Owner/operator country: Not reported
Owner/operator telephone: Not reported
Legal status: Municipal
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: COLGAN AIR INC.
Owner/operator address: Not reported
Not reported
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/2007
Owner/Op end date: Not reported

Owner/operator name: COLGAN AIR, INC
Owner/operator address: PINNACLE AIRLINES CORP. 40 SOUTH MAIN ST
MEMPHIS, TN 38103
Owner/operator country: US
Owner/operator telephone: (901) 348-4100
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/2007
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No

(Continued) **1015751558**

Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:
Date form received by agency: 10/18/2002
Site name: COLGAN AIR
Classification: Small Quantity Generator

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D035
. Waste name: METHYL ETHYL KETONE

. Waste code: F005
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Facility Has Received Notices of Violations:
Regulation violated: Not reported
Area of violation: Generators - Manifest
Date violation determined: 05/02/2008
Date achieved compliance: 05/13/2008
Violation lead agency: State
Enforcement action: Not reported
Enforcement action date: Not reported
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: Not reported
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - General
Date violation determined: 10/26/2006
Date achieved compliance: 11/03/2006
Violation lead agency: State
Enforcement action: VERBAL INFORMAL
Enforcement action date: 11/16/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: TSD IS-Container Use and Management
Date violation determined: 10/26/2006

(Continued) **1015751558**

Date achieved compliance: 11/03/2006
Violation lead agency: State
Enforcement action: VERBAL INFORMAL
Enforcement action date: 11/16/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: Generators - Pre-transport
Date violation determined: 10/26/2006
Date achieved compliance: 11/03/2006
Violation lead agency: State
Enforcement action: VERBAL INFORMAL
Enforcement action date: 11/16/2006
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 05/02/2008
Evaluation: NON-FINANCIAL RECORD REVIEW
Area of violation: Generators - Manifest
Date achieved compliance: 05/13/2008
Evaluation lead agency: State

Evaluation date: 10/26/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 11/03/2006
Evaluation lead agency: State

Evaluation date: 10/26/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 11/03/2006
Evaluation lead agency: State

Evaluation date: 10/26/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: TSD IS-Container Use and Management
Date achieved compliance: 11/03/2006
Evaluation lead agency: State

A4
< 1/8
1 ft.

10678 AVIATION LANE
MANASSAS, VA 20110

Site 4 of 5 in cluster A

RCRA-CESQG 1004791730
FINDS VAR000500389
NJ MANIFEST
ECHO

Relative: Higher

Actual: 197 ft.

RCRA-CESQG:

Date form received by agency:	12/11/2000
Facility name:	Not reported
Facility address:	10678 AVIATION LANE MANASSAS, VA 201102729
EPA ID:	VAR000500389
Contact:	PAUL WUTTKE
Contact address:	10678 AVIATION LANE MANASSAS, VA 201102729
Contact country:	US
Contact telephone:	(703) 632-4033
Contact email:	Not reported
EPA Region:	Not reported
Land type:	Municipal
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name:	
Owner/operator address:	PO BOX 807 BRISTOW, VA 20136
Owner/operator country:	Not reported
Owner/operator telephone:	(703) 632-4000
Legal status:	Federal
Owner/Operator Type:	Owner
Owner/Op start date:	Not reported
Owner/Op end date:	Not reported

Handler Activities Summary:

U.S. importer of hazardous waste:	No
Mixed waste (haz. and radioactive):	No
Recycler of hazardous waste:	No
Transporter of hazardous waste:	No
Treater, storer or disposer of HW:	No
Underground injection activity:	No
On-site burner exemption:	No
Furnace exemption:	No
Used oil fuel burner:	No
Used oil processor:	No

(Continued) **1004791730**

User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

Evaluation Action Summary:
Evaluation date: 10/26/2006
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

FINDS:

Registry ID: 110005291745

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

NJ MANIFEST:
EPA Id: VAR000500389
Mail Address: 10678 AVIATION LANE
Mail City/State/Zip: MANASSAS 20110
Facility Phone: 7033303691
Emergency Phone: Not reported
Contact: THOMAS CRANE
Comments: Not reported
SIC Code: Not reported
County: 00
Municipal: 00
Previous EPA Id: Not reported
Gen Flag: X
Trans Flag: Not reported
TSDF Flag: Not reported
Name Change: Not reported
Date Change: Not reported

Manifest:
Manifest Number: NJA5309787
EPA ID: VAR000500389
Date Shipped: 06/09/2006
TSDF EPA ID: NJD002182897
Transporter EPA ID: TXR000050930
Transporter 2 EPA ID: Not reported
Transporter 3 EPA ID: Not reported

(Continued) **1004791730**

Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	06/09/2006
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	06/14/2006
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	07240621
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported
Manifest Number:	NJA5072103
EPA ID:	VAR000500389
Date Shipped:	12/03/2004
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	12/03/2004
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported

(Continued) **1004791730**

Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	12/12/2004
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	01210521
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported

Manifest Number:	NJA5250977
EPA ID:	VAR000500389
Date Shipped:	11/04/2005
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	11/04/2005
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	11/10/2005
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	01180625
Was Load Rejected:	MANASSAS 20110

(Continued) **1004791730**

Reason Load Was Rejected:	Not reported
Manifest Number:	NJA5070800
EPA ID:	VAR000500389
Date Shipped:	03/14/2005
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	03/14/2005
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	03/21/2005
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	05110521
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported
Manifest Number:	NJA5070132
EPA ID:	VAR000500389
Date Shipped:	08/02/2004
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported

(Continued) **1004791730**

Date Trans1 Transported Waste:	08/02/2004
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	08/06/2004
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	08300425
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported
Manifest Number:	NJA5094858
EPA ID:	VAR000500389
Date Shipped:	04/16/2004
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	04/16/2004
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	04/26/2004
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported

(Continued) **1004791730**

Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	05110421
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported
Manifest Number:	NJA5068386
EPA ID:	VAR000500389
Date Shipped:	06/29/2005
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930
Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	06/29/2005
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	07/06/2005
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	07280525
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported
Manifest Number:	NJA5259467
EPA ID:	VAR000500389
Date Shipped:	02/15/2006
TSDF EPA ID:	NJD002182897
Transporter EPA ID:	TXR000050930

(Continued) **1004791730**

Transporter 2 EPA ID:	Not reported
Transporter 3 EPA ID:	Not reported
Transporter 4 EPA ID:	Not reported
Transporter 5 EPA ID:	Not reported
Transporter 6 EPA ID:	Not reported
Transporter 7 EPA ID:	Not reported
Transporter 8 EPA ID:	Not reported
Transporter 9 EPA ID:	Not reported
Transporter 10 EPA ID:	Not reported
Date Trans1 Transported Waste:	02/15/2006
Date Trans2 Transported Waste:	Not reported
Date Trans3 Transported Waste:	Not reported
Date Trans4 Transported Waste:	Not reported
Date Trans5 Transported Waste:	Not reported
Date Trans6 Transported Waste:	Not reported
Date Trans7 Transported Waste:	Not reported
Date Trans8 Transported Waste:	Not reported
Date Trans9 Transported Waste:	Not reported
Date Trans10 Transported Waste:	Not reported
Date TSDF Received Waste:	02/21/2006
TSDF EPA Facility Name:	Not reported
QTY Units:	Not reported
Transporter SEQ ID:	Not reported
Transporter-1 Date:	Not reported
Waste SEQ ID:	Not reported
Waste Type Code 2:	Not reported
Waste Type Code 3:	Not reported
Waste Type Code 4:	Not reported
Waste Type Code 5:	Not reported
Waste Type Code 6:	Not reported
Date Accepted:	Not reported
Manifest Discrepancy Type:	Not reported
Data Entry Number:	04040621
Was Load Rejected:	MANASSAS 20110
Reason Load Was Rejected:	Not reported

ECHO:

Envid:	1004791730
Registry ID:	110005291745
DFR URL:	http://echo.epa.gov/detailed_facility_report?fid=110005291745

A5 **COLGAN AIR** **PA MANIFEST** **S107694170**
10677 AVIATION LN **N/A**
< 1/8 **MANASSAS, VA 20110**
1 ft.

Site 5 of 5 in cluster A

Relative: Higher

Actual: 197 ft.

Manifest Details:

Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported

COLGAN AIR (Continued) **S107694170**

Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	3
Waste Number:	D001
Container Number:	2
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	400
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	4
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	900
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822

COLGAN AIR (Continued) **S107694170**

TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D035
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	55
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	D006
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	50
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE

COLGAN AIR (Continued) **S107694170**

TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F005
Container Number:	4
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	900
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	3
Waste Number:	D018
Container Number:	2
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	400
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported

COLGAN AIR (Continued) **S107694170**

Page Number:	1
Line Number:	3
Waste Number:	NONE
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	55
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	F003
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	75
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F003

COLGAN AIR (Continued) **S107694170**

Container Number:	4
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	900
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	55
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F003
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	55

COLGAN AIR (Continued) **S107694170**

Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	2
Waste Number:	D018
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	75
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	003301820JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	06/20/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	D035
Container Number:	4
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	900
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported

COLGAN AIR (Continued) **S107694170**

Date TSP Sig:	Not reported
Year:	2007
Manifest Number:	000839062JJK
Manifest Type:	Not reported
Generator EPA Id:	VAP000015896
Generator Date:	07/31/2007
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	KEN CERRETI
Contact Phone:	703-331-3122
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	Not reported
Page Number:	1
Line Number:	1
Waste Number:	F005
Container Number:	1
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	55
Unit:	Gallons (liquids only)
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2006
Manifest Number:	PAH193449
Manifest Type:	TSD Copy
Generator EPA Id:	VAP000015896
Generator Date:	02/15/2006
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	Not reported
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	703-331-3122
Page Number:	1
Line Number:	4
Waste Number:	D001
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	5
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported
Year:	2006

COLGAN AIR (Continued) **S107694170**

Manifest Number:	PAH193449
Manifest Type:	TSD Copy
Generator EPA Id:	VAP000015896
Generator Date:	02/15/2006
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	Not reported
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	703-331-3122
Page Number:	1
Line Number:	3
Waste Number:	D007
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	15
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2006
Manifest Number:	PAH193449
Manifest Type:	TSD Copy
Generator EPA Id:	VAP000015896
Generator Date:	02/15/2006
Mailing Address:	Not reported
Mailing City,St,Zip:	Not reported
Contact Name:	Not reported
Contact Phone:	Not reported
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	703-331-3122
Page Number:	1
Line Number:	1
Waste Number:	D001
Container Number:	2
Container Type:	Metal drums, barrels, kegs
Waste Quantity:	500
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Year:	2006
Manifest Number:	PAH193449
Manifest Type:	TSD Copy
Generator EPA Id:	VAP000015896

COLGAN AIR (Continued) **S107694170**

Generator Date: 02/15/2006
Mailing Address: Not reported
Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: Not reported
TSD EPA Id: PAD067098822
TSD Date: Not reported
TSD Facility Name: CYCLE CHEM INC
TSD Facility Address: 550 INDUSTRIAL DRIVE
TSD Facility City: LEWISBERRY
TSD Facility State: PA
Facility Telephone: 703-331-3122
Page Number: 1
Line Number: 4
Waste Number: D007
Container Number: 1
Container Type: Fiberboard or plastic drums, barrels, kegs
Waste Quantity: 5
Unit: Pounds
Handling Code: Not reported
TSP EPA Id: Not reported
Date TSP Sig: Not reported

Year: 2006
Manifest Number: PAH193449
Manifest Type: TSD Copy
Generator EPA Id: VAP000015896
Generator Date: 02/15/2006
Mailing Address: Not reported
Mailing City,St,Zip: Not reported
Contact Name: Not reported
Contact Phone: Not reported
TSD EPA Id: PAD067098822
TSD Date: Not reported
TSD Facility Name: CYCLE CHEM INC
TSD Facility Address: 550 INDUSTRIAL DRIVE
TSD Facility City: LEWISBERRY
TSD Facility State: PA
Facility Telephone: 703-331-3122
Page Number: 1
Line Number: 3
Waste Number: D002
Container Number: 1
Container Type: Fiberboard or plastic drums, barrels, kegs
Waste Quantity: 15
Unit: Pounds
Handling Code: Not reported
TSP EPA Id: Not reported
Date TSP Sig: Not reported

Year: 2006
Manifest Number: PAH193449
Manifest Type: TSD Copy
Generator EPA Id: VAP000015896
Generator Date: 02/15/2006
Mailing Address: Not reported
Mailing City,St,Zip: Not reported

COLGAN AIR (Continued) **S107694170**

Contact Name:	Not reported
Contact Phone:	Not reported
TSD EPA Id:	PAD067098822
TSD Date:	Not reported
TSD Facility Name:	CYCLE CHEM INC
TSD Facility Address:	550 INDUSTRIAL DRIVE
TSD Facility City:	LEWISBERRY
TSD Facility State:	PA
Facility Telephone:	703-331-3122
Page Number:	1
Line Number:	2
Waste Number:	D002
Container Number:	1
Container Type:	Fiberboard or plastic drums, barrels, kegs
Waste Quantity:	10
Unit:	Pounds
Handling Code:	Not reported
TSP EPA Id:	Not reported
Date TSP Sig:	Not reported

Click this hyperlink while viewing on your computer to access
11 additional PA_MANIFEST: record(s) in the EDR Site Report.

B6 **RCRA-CESQG** **1004791360**
10527 TERMINAL RD **FINDS** **VAR000010157**
< 1/8 **MANASSAS, VA 20110** **ECHO**
1 ft.

Site 1 of 4 in cluster B

Relative: Higher

Actual: 184 ft.

RCRA-CESQG:

Date form received by agency:	02/09/1998
Facility name:	Not reported
Facility address:	10527 TERMINAL RD MANASSAS, VA 20110
EPA ID:	VAR000010157
Mailing address:	PO BOX 529 MANASSAS, VA 20108
Contact:	RONALD POHL
Contact address:	PO BOX 529 MANASSAS, VA 20108
Contact country:	US
Contact telephone:	(703) 361-4996
Contact email:	Not reported
EPA Region:	Not reported
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely

(Continued) **1004791360**

hazardous waste

Owner/Operator Summary:
Owner/operator name: T HANGARS OF VA INC
Owner/operator address: PO BOX 529
MANASSAS, VA 20108
Owner/operator country: Not reported
Owner/operator telephone: (703) 361-4996
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: F002
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Violation Status: No violations found

FINDS:

Registry ID: 110005288027

Environmental Interest/Information System
RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

(Continued) **1004791360**

ECHO:
Envid: 1004791360
Registry ID: 110005288027
DFR URL: http://echo.epa.gov/detailed_facility_report?fid=110005288027

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7 **RCRA-CESQG** **1000281347**
VAD982704686

< 1/8
1 ft.

10501 OBSERVATION ROAD
MANASSAS, VA 20110

Relative:
Lower

Actual:
174 ft.

RCRA-CESQG:
Date form received by agency: 11/13/2003
Facility name: Not reported
Facility address: 10501 OBSERVATION ROAD
MANASSAS, VA 20110
EPA ID: VAD982704686
Mailing address: OBSERVATION ROAD
MANASSAS, VA 20110
Contact: JOSEPH H GARDNER
Contact address: Not reported
Not reported
Contact country: US
Contact telephone: (703) 361-2171
Contact email: Not reported
EPA Region: Not reported
Land type: Municipal
Classification: Conditionally Exempt Small Quantity Generator
Description: Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:
Owner/operator name: OPERNAME
Owner/operator address: OPERSTREET
OPERCITY, AK 99999
Owner/operator country: Not reported
Owner/operator telephone: (215) 555-1212
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: AIRPORT DIRECTOR
Owner/operator address: Not reported
Not reported
Owner/operator country: Not reported

(Continued) **1000281347**

Owner/operator telephone: Not reported
Legal status: Municipal
Owner/Operator Type: Operator
Owner/Op start date: 01/01/1963
Owner/Op end date: Not reported

Owner/operator name: CITY OF MANASSAS
Owner/operator address: Not reported
Not reported
Owner/operator country: Not reported
Owner/operator telephone: Not reported
Legal status: Municipal
Owner/Operator Type: Owner
Owner/Op start date: 01/01/1963
Owner/Op end date: Not reported

Owner/operator name: GARDNER BELTON, H
Owner/operator address: OWNERSTREET
OWNERCITY, AK 99999
Owner/operator country: Not reported
Owner/operator telephone: (215) 555-1212
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D008
. Waste name: LEAD

. Waste code: D018
. Waste name: BENZENE

Historical Generators:
Date form received by agency: 12/06/1989
Site name: DULLES AVIATION INC
Classification: Conditionally Exempt Small Quantity Generator

(Continued) **1000281347**

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D002
. Waste name: CORROSIVE WASTE

. Waste code: F001
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLORETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: U002
. Waste name: 2-PROPANONE (I) (OR) ACETONE (I)

. Waste code: U154
. Waste name: METHANOL (I) (OR) METHYL ALCOHOL (I)

. Waste code: U159
. Waste name: 2-BUTANONE (I,T) (OR) METHYL ETHYL KETONE (MEK) (I,T)

Facility Has Received Notices of Violations:
Regulation violated: SR - 262.11
Area of violation: Generators - General
Date violation determined: 08/02/2003
Date achieved compliance: 10/16/2003
Violation lead agency: State
Enforcement action: INSPECTOR FACT FINDING LETTER - Warning letter
Enforcement action date: 09/04/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 08/02/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 10/16/2003
Evaluation lead agency: State

B8 **DULLES AVIATION INCORPORATED - MANASSAS AIRPORT** **VA LTANKS** **S104896778**
10522 TERMINAL RD **N/A**
< 1/8 **MANASSAS, VA 22110**
1 ft.

Site 2 of 4 in cluster B

Relative: Higher

Actual: 184 ft.

LTANKS:
Region: NVRO
CEDS Facility Id: 200000078840
Case Status: **Closed**
Pollution Complaint #: 20013062

DULLES AVIATION INCORPORATED - MANASSAS AIRPORT (Continued) **S104896778**

Reported: 09/25/2000

Region: NVRO
CEDS Facility Id: 200000078840
Case Status: **Closed**
Pollution Complaint #: 19910187
Reported: 08/21/1990

Region: NVRO
CEDS Facility Id: 200000078840
Case Status: **Closed**
Pollution Complaint #: 19870385
Reported: 12/09/1986

B9 **MANASSAS REGIONAL AIRPORT** **VA UST** **U004189327**
10522 TERMINAL RD **N/A**
< 1/8 **MANASSAS, VA 22110**
1 ft.

Site 3 of 4 in cluster B

Relative:
Higher

Actual:
184 ft.

Facility:
Facility Id: 3001899
Facility Type: LOCAL
CEDS Facility ID: 200000078840

Owner:
Owner Id: 36274
Owner Name: MANASSAS Regional Airport
Owner Address: PO BOX 560
Owner Address2: Not reported
Owner City, State, Zip: MANASSAS, VA 22110
Owner Type: LOCAL
Number of Active AST: 0
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 13

UST:
Facility ID: 3001899
Federally Regulated: Yes

Tank Number: COLGAN-1
Tank Capacity: 4000
Tank Contents: GASOLINE
Tank Status: **CLS IN GRD**
Tank Type: UST

Tank Material:
Install Date: 4/3/1966
Tank Materials: Bare Steel Yes
Tank Materials: Cath Protect Steel No
Tank Materials: Epoxy Steel No
Tank Materials: Fiberglass No
Tank Materials: Concrete No
Tank Materials: Composite No
Tank Materials: Double Walled No
Tank Materials: Lined Interior No
Tank Materials: Excav Liner No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes
Tank Number:	COLGAN-2
Tank Capacity:	4000
Tank Contents:	GASOLINE
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	4/3/1966
Tank Materials: Bare Steel	Yes

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes

Tank Number:	COLGAN-3

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Capacity:	4000
Tank Contents:	GASOLINE
Tank Status:	**CLS IN GRD**
Tank Type:	UST
Tank Material:	
Install Date:	4/3/1966
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Release Detection:	
Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported
Facility ID:	3001899
Federally Regulated:	Yes
Tank Number:	COLGAN-4
Tank Capacity:	4000
Tank Contents:	GASOLINE
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	4/3/1966
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes

Tank Number:	COLGAN-5
Tank Capacity:	10000
Tank Contents:	JET FUEL
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	4/3/1972
Tank Materials: Bare Steel	No
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	Yes
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported
Facility ID:	3001899
Federally Regulated:	Yes
Tank Number:	COLGAN-6
Tank Capacity:	550
Tank Contents:	UNKNOWN
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	Not reported
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes

Tank Number:	COLGAN-7
Tank Capacity:	275
Tank Contents:	UNKNOWN
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	Not reported
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes

Tank Number:	COLGAN-8
Tank Capacity:	275
Tank Contents:	UNKNOWN
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	Not reported
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes

Tank Number:	DULLESAV-1
Tank Capacity:	10000
Tank Contents:	GASOLINE: AVIATION GAS
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	4/3/1972
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

Facility ID:	3001899
Federally Regulated:	Yes

Tank Number:	DULLESAV-2
Tank Capacity:	10000
Tank Contents:	GASOLINE: AVIATION GAS

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Tank Status:	**CLS IN GRD**
Tank Type:	UST
Tank Material:	
Install Date:	4/3/1972
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Release Detection:	
Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Facility ID:	3001899
Federally Regulated:	Yes
Tank Number:	DULLESAV-3
Tank Capacity:	12000
Tank Contents:	JET FUEL
Tank Status:	**CLS IN GRD**
Tank Type:	UST
Tank Material:	
Install Date:	4/3/1972
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Release Detection:	
Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported
Facility ID:	3001899
Federally Regulated:	Yes
Tank Number:	DULLESAV-4
Tank Capacity:	2000
Tank Contents:	GASOLINE
Tank Status:	**CLS IN GRD**
Tank Type:	UST

Tank Material:

Install Date:	4/3/1972
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported
Facility ID:	3001899
Federally Regulated:	No
Tank Number:	DULLESAV-5
Tank Capacity:	Not reported
Tank Contents:	HEATING OIL
Tank Status:	**PERM OUT OF USE**
Tank Type:	UST

Tank Material:

Install Date:	4/3/1972
Tank Materials: Bare Steel	Yes
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	No
Tank Materials: Double Walled	No
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported

MANASSAS REGIONAL AIRPORT (Continued) **U004189327**

Pipe Release Detection: Leak Deferred	Not reported
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	UNKNOWN
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	Yes
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

B10 **MANASSAS MUNICIPAL AIRPORT** **VA LUST** **S104406772**
10522 TERMINAL ROAD **N/A**
< 1/8 **PRINCE WILLIAM, VA 20110**
1 ft.

Site 4 of 4 in cluster B

Relative:
Higher

Actual:
184 ft.

LUST REG NO:

Region:	NO
Facility ID:	3900476
Status:	**Closed**
Tank Size:	0
Product:	Not reported
Release Date:	12/09/1986
Closed Date:	8/23/1994
Case Type:	Article 11
Case Officer:	Thomas R. Lancaster, P.G.
Pollution Complaint #:	87-0385
Permit Number:	0
Priority:	-
Region:	NO
Facility ID:	3900476
Status:	**Closed**
Tank Size:	other
Product:	see comments
Release Date:	03/22/1999
Closed Date:	4/19/1999
Case Type:	Article 11
Case Officer:	Thomas R. Lancaster, P.G.
Pollution Complaint #:	99-3317
Permit Number:	Not reported
Priority:	Not reported

C11 **GATEWAY GENERATION** **VA AST** **A100251685**
10453 WAKEMAN DR **N/A**
< 1/8 **MANASSAS, VA 20110**
1 ft.

Site 1 of 2 in cluster C

Relative:
Lower

Actual:
176 ft.

AST:

Facility ID:	3038092
Facility Type:	LOCAL
CEDS Facility ID:	200000203272

Tank Info:

Owner:

Owner Id:	36616
Owner Name:	City of Manassas
Owner Address:	8500 Public Works Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	LOCAL
Number of Active AST:	2
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	GDT-1
Tank Type:	AST
Tank Capacity:	1000
Tank Contents:	DIESEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	1/1/1997
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	No
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	No
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	Yes
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No

GATEWAY GENERATION (Continued) **A100251685**

Release Prevention: Other	No
Release Prevention: Other Note	Not reported
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	Shop fabricated horizontal tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	36616
Owner Name:	City of Manassas
Owner Address:	8500 Public Works Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	LOCAL
Number of Active AST:	2
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	GW1

GATEWAY GENERATION (Continued) **A100251685**

Tank Type:	AST
Tank Capacity:	10000
Tank Contents:	DIESEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	4/1/1996
Containment: Curbing	Yes
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	No
Release Detection: Vapor	No
Release Detection: Interstitial	Yes
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	Yes
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	No
Release Prevention: Other Note	Not reported

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	No
Tank Roof: Other Note	Not reported

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No

GATEWAY GENERATION (Continued) **A100251685**

Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

C12 **MANASSAS REGIONAL AIRPORT** **VA AST** **A100204553**
10451 WAKEMAN DR **N/A**
< 1/8 **MANASSAS, VA 20110**
1 ft.

Site 2 of 2 in cluster C

Relative:
Lower

Actual:
176 ft.

AST:

Facility ID:	3034616
Facility Type:	AIRLINE
CEDS Facility ID:	200000077992

Tank Info:

Owner:

Owner Id:	40266
Owner Name:	Geneva Air Service
Owner Address:	10500 Terminal Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	1
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	1
Tank Type:	AST
Tank Capacity:	12000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	Not reported
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	110% Volume Dike

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	No
Tank Roof: Other Note	Not reported

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Horizontal: N
Tank Type Unknown: N
Tank Type Other: N
Tank Type Other Specify: N

Owner:
Owner Id: 42777
Owner Name: FlightWorks
Owner Address: 600 Town Park Ln Ste 550
Owner Address2: Not reported
Owner City/State/Zip: Kennesaw, GA 30144
Owner Type: PRIVATE
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42779
Owner Name: M J Colgan Associates
Owner Address: 5418 Ancestry Ct
Owner Address2: Not reported
Owner City/State/Zip: Gainesville, VA 20155
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T001
Tank Type:	AST
Tank Capacity:	12000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	2/2/1995
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	No
Release Prevention: Other Note	Not reported
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	Yes
Tank Materials: Other Note	bare steel welded, single wall, totally above the ground, horizontal
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Fed Regulated: No
Tank Number: T002
Tank Type: AST
Tank Capacity: 20000
Tank Contents: JET FUEL
Tank Status: CURR IN USE

Tank Containment:
Install Date: Not reported
Containment: Curbing No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/oil/water sepe\\arator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T003
Tank Type:	AST
Tank Capacity:	15000
Tank Contents:	GASOLINE: AVIATION GAS
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	1/1/1990
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/ oil-water separator

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T005
Tank Type:	AST
Tank Capacity:	20000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Containment:

Install Date:	1/28/1993
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/ oil-water separator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	single wall, totally above the ground, lined interior, horizontal
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T006
Tank Type:	AST
Tank Capacity:	15000
Tank Contents:	GASOLINE: AVIATION GAS
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	1/28/1993
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/ oil-water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	welded
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	42779
Owner Name:	M J Colgan Associates

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T007
Tank Type:	AST
Tank Capacity:	20000

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	3/18/2005
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete w/ coating, containment w/ oil-water separator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T008
Tank Type:	AST
Tank Capacity:	15000
Tank Contents:	GASOLINE: AVIATION GAS
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	2/28/2005
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	coated concrete, oil water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Inactive UST: 0

Owner Id: 42779
Owner Name: M J Colgan Associates
Owner Address: 5418 Ancestry Ct
Owner Address2: Not reported
Owner City/State/Zip: Gainesville, VA 20155
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Fed Regulated:	No
Tank Number:	T009
Tank Type:	AST
Tank Capacity:	20000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	2/28/2005
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	coated concrete, oil/water separator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	welded
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T010
Tank Type:	AST
Tank Capacity:	20000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	Not reported
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	coated concrete.\\, oil/water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-Horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Type: PRIVATE
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42779
Owner Name: M J Colgan Associates
Owner Address: 5418 Ancestry Ct
Owner Address2: Not reported
Owner City/State/Zip: Gainesville, VA 20155
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T011
Tank Type:	AST
Tank Capacity:	1000
Tank Contents:	GASOLINE
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	5/5/1993
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	COncrete containment w/ OWS
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Roof: Other Note	None-horizontal Tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Tank Info:

Owner:

Owner Id:	40266
Owner Name:	Geneva Air Service
Owner Address:	10500 Terminal Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	1
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	1
Tank Type:	AST
Tank Capacity:	12000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	Not reported
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Containment: Other	No
Containment: Other Note	Not reported
Release Detection:	
Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	110% Volume Dike
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	No
Tank Roof: Other Note	Not reported
Tank Material:	
Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Other Specify: N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Inactive UST:	0
Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T001
Tank Type:	AST
Tank Capacity:	12000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	2/2/1995
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	No
Release Prevention: Other Note	Not reported
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	Yes
Tank Materials: Other Note	bare steel welded, single wall, totally above the ground, horizontal
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T002
Tank Type:	AST
Tank Capacity:	20000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	Not reported
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/oil/water sepe\\arator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T003
Tank Type:	AST
Tank Capacity:	15000
Tank Contents:	GASOLINE: AVIATION GAS
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	1/1/1990
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/ oil-water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Fed Regulated: No
Tank Number: T005
Tank Type: AST
Tank Capacity: 20000
Tank Contents: JET FUEL
Tank Status: CURR IN USE

Tank Containment:
Install Date: 1/28/1993

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete containment w/ oil-water separator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	single wall, totally above the ground, lined interior, horizontal
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T006
Tank Type:	AST
Tank Capacity:	15000
Tank Contents:	GASOLINE: AVIATION GAS
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	1/28/1993
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Release Prevention: Other Note	concrete containment w/ oil-water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	none-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	welded
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Address2: Not reported
Owner City/State/Zip: Gainesville, VA 20155
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Fed Regulated: No
Tank Number: T007
Tank Type: AST
Tank Capacity: 20000
Tank Contents: JET FUEL

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Status:	CURR IN USE
Tank Containment:	
Install Date:	3/18/2005
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported
Release Detection:	
Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	concrete w/ coating, containment w/ oil-water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank
Tank Material:	
Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Fed Regulated: No
Tank Number: T008
Tank Type: AST
Tank Capacity: 15000
Tank Contents: GASOLINE: AVIATION GAS
Tank Status: CURR IN USE

Tank Containment:
Install Date: 2/28/2005
Containment: Curbing No
Containment: Weirs No
Containment: Sorbent Yes
Containment: Culvert No
Containment: Diversion No
Containment: Retention No
Containment: Dike Yes
Containment: Unknown No
Containment: Other No
Containment: Other Note Not reported

Release Detection:
Release Detection: Ground Water No
Release Detection: Visual Yes
Release Detection: Vapor No
Release Detection: Interstitial No
Release Detection: None No
Release Detection: Other No
Release Detection: Other Note Not reported
Release Prevention: Double Bottom No
Release Prevention: Double Walled No
Release Prevention: Lined Interior Not reported
Release Prevention: Poly Jacket No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	coated concrete, oil water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	T009

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Type:	AST
Tank Capacity:	20000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	2/28/2005
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	coated concrete, oil/water separator

Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	welded
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	42779
Owner Name:	M J Colgan Associates
Owner Address:	5418 Ancestry Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Gainesville, VA 20155
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	48850
Owner Name:	Manassas FBO LLC dba APP Jet Center Manassas
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0

Owner Id:	44504
Owner Name:	Volo Holdings Manassas Limited Liability Corp
Owner Address:	9998 Wakeman Dr
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	42776
Owner Name:	Dulles Aviation Incorporated
Owner Address:	10501 Observation Rd
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Owner Id:	43640
Owner Name:	Chantilly Air Incorporated
Owner Address:	10761 James Payne Ct
Owner Address2:	Not reported
Owner City/State/Zip:	Manassas, VA 20110
Owner Type:	COMMERCIAL
Number of Active AST:	10
Number of Active UST:	0
Number of Inactive AST:	0
Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T010
Tank Type:	AST
Tank Capacity:	20000
Tank Contents:	JET FUEL
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	Not reported
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	coated concrete.\\, oil/water separator
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	No
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-Horizontal tank

Tank Material:

Tank Materials: Bare Steel	No
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

Owner:

Owner Id:	42777
Owner Name:	FlightWorks
Owner Address:	600 Town Park Ln Ste 550
Owner Address2:	Not reported
Owner City/State/Zip:	Kennesaw, GA 30144
Owner Type:	PRIVATE
Number of Active AST:	10

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42779
Owner Name: M J Colgan Associates
Owner Address: 5418 Ancestry Ct
Owner Address2: Not reported
Owner City/State/Zip: Gainesville, VA 20155
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 48850
Owner Name: Manassas FBO LLC dba APP Jet Center Manassas
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 44504
Owner Name: Volo Holdings Manassas Limited Liability Corp
Owner Address: 9998 Wakeman Dr
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 42776
Owner Name: Dulles Aviation Incorporated
Owner Address: 10501 Observation Rd
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 0

Owner Id: 43640
Owner Name: Chantilly Air Incorporated
Owner Address: 10761 James Payne Ct
Owner Address2: Not reported
Owner City/State/Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 10
Number of Active UST: 0
Number of Inactive AST: 0

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Number of Inactive UST:	0
Fed Regulated:	No
Tank Number:	T011
Tank Type:	AST
Tank Capacity:	1000
Tank Contents:	GASOLINE
Tank Status:	CURR IN USE

Tank Containment:

Install Date:	5/5/1993
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	Yes
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	Yes
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported

Release Detection:

Release Detection: Ground Water	No
Release Detection: Visual	Yes
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	Yes
Release Prevention: Other Note	COncrete containment w/ OWS
Tank Foundation: Steel	No
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	None-horizontal Tank

MANASSAS REGIONAL AIRPORT (Continued) **A100204553**

Tank Material:

Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported
Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

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13 **RCRA-CESQG** **1004791712**
9998 WAKEMAN DR. **VAR000500199**
< 1/8 **MANASSAS, VA 20110**
1 ft.

Relative:
Higher

Actual:
189 ft.

RCRA-CESQG:

Date form received by agency:	10/31/2000
Facility name:	Not reported
Facility address:	9998 WAKEMAN DR. MANASSAS, VA 20110
EPA ID:	VAR000500199
Contact:	MICHAEL WEBER
Contact address:	9998 WAKEMAN DR. MANASSAS, VA 20110
Contact country:	US
Contact telephone:	(703) 361-7267
Contact email:	Not reported
EPA Region:	Not reported
Land type:	Municipal
Classification:	Conditionally Exempt Small Quantity Generator
Description:	Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste

(Continued) **1004791712**

Owner/Operator Summary:
Owner/operator name: MICHAEL WEBER
Owner/operator address: 494 OLD BRIDGE RD.
AMISSVILLE, VA 20106
Owner/operator country: Not reported
Owner/operator telephone: (540) 347-9746
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D018
. Waste name: BENZENE

. Waste code: D039
. Waste name: TETRACHLOROETHYLENE

. Waste code: D040
. Waste name: TRICHLORETHYLENE

Facility Has Received Notices of Violations:
Regulation violated: SR - 262.11
Area of violation: Generators - General
Date violation determined: 08/01/2003
Date achieved compliance: 10/16/2003
Violation lead agency: State
Enforcement action: INSPECTOR FACT FINDING LETTER - Warning letter
Enforcement action date: 09/04/2003
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

(Continued) **1004791712**

Evaluation Action Summary:
Evaluation date: 08/01/2003
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - General
Date achieved compliance: 10/16/2003
Evaluation lead agency: State

14
North
< 1/8
0.096 mi.
506 ft.

AURORA FLIGHT SCIENCES **VA UST** **U004220316**
9950 WAKEMAN DR **N/A**
MANASSAS, VA 20110

Relative:
Higher

Actual:
191 ft.

Facility:
Facility Id: 3042584
Facility Type: COMMERCIAL
CEDS Facility ID: 200000873735

Owner:
Owner Id: 48008
Owner Name: Aurora Flight Sciences
Owner Address: 9950 Wakeman Dr
Owner Address2: Not reported
Owner City, State, Zip: Manassas, VA 20110
Owner Type: COMMERCIAL
Number of Active AST: 0
Number of Active UST: 0
Number of Inactive AST: 0
Number of Inactive UST: 1

UST:
Facility ID: 3042584
Federally Regulated: Yes

Tank Number: 1
Tank Capacity: 500
Tank Contents: USED OIL
Tank Status: **REM FROM GRD**
Tank Type: UST

Tank Material:
Install Date: 1/14/1994
Tank Materials: Bare Steel Yes
Tank Materials: Cath Protect Steel No
Tank Materials: Epoxy Steel No
Tank Materials: Fiberglass No
Tank Materials: Concrete No
Tank Materials: Composite No
Tank Materials: Double Walled No
Tank Materials: Lined Interior No
Tank Materials: Excav Liner No
Tank Materials: Insulated Tank Jacket No
Tank Materials: Repaired No
Tank Materials: Unknown No
Tank Materials: Other No
Tank Materials: Other Note Not reported

Release Detection:

AURORA FLIGHT SCIENCES (Continued) **U004220316**

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	No
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	No
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	No
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	No
Pipe Release Det: Interior Double Walled	No
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported

Pipe Type:	GRAVITY
Pipe Materials: Bare Steel	No
Pipe Materials: Galvanized Steel	No
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	No
Pipe Materials: Sec Containment	No
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	No
Pipe Materials: Other Note	Not reported

D15 **VA RAILWAY EXPRESS BROAD RUN MAINT FACILITY** **VA UST** **U004175543**
WNW **10637 PIPER LN** **VA Financial Assurance** **N/A**
1/8-1/4 **BRISTOW, VA 20136**
0.213 mi.
1122 ft. **Site 1 of 2 in cluster D**

Relative:
Higher

Actual:
191 ft.

Facility:

Facility Id:	3041755
Facility Type:	STATE
CEDS Facility ID:	200000850922

Owner:

Owner Id:	45319
Owner Name:	Virginia Railway Express
Owner Address:	1500 King St Ste 202
Owner Address2:	Not reported
Owner City, State, Zip:	Alexandria, VA 22314
Owner Type:	LOCAL
Number of Active AST:	1
Number of Active UST:	1

VA RAILWAY EXPRESS BROAD RUN MAINT FACILITY (Continued) **U004175543**

Number of Inactive AST:	0
Number of Inactive UST:	0

UST:

Facility ID:	3041755
Federally Regulated:	Yes
Tank Number:	1
Tank Capacity:	500
Tank Contents:	USED OIL
Tank Status:	**CURR IN USE**
Tank Type:	UST

Tank Material:

Install Date:	5/18/2010
Tank Materials: Bare Steel	No
Tank Materials: Cath Protect Steel	No
Tank Materials: Epoxy Steel	No
Tank Materials: Fiberglass	No
Tank Materials: Concrete	No
Tank Materials: Composite	Yes
Tank Materials: Double Walled	Yes
Tank Materials: Lined Interior	No
Tank Materials: Excav Liner	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Repaired	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Not reported

Release Detection:

Tank Release Detection: Leak Deferred	No
Tank Release Detection: Manual Gauge	No
Tank Release Detection: Auto Gauge	No
Tank Release Detection:Tank Tightness	No
Tank Release Detection: Vapor Monitor	No
Tank Release Detection: Inventory	No
Tank Release Detection: Stat Invent Recon	No
Tank Release Detection: Spill Install	No
Tank Release Detection: Overfill Install	Yes
Tank Release Detection: Groundwater	No
Tank Release Detection: Int Sec Containment	No
Tank Release Detection: Int Double Walled	Yes
Tank Release Detection: Other Method	No
Tank Release Detection: Other Note	Not reported
Pipe Release Detection: Leak Deferred	No
Pipe Release Detection: Autoleak	Not reported
Pipe Release Detection: Line Tightness	No
Pipe Release Detection: Stat Invent Recon	No
Pipe Release Detection: Groundwater	No
Pipe Release Detection: Int Sec Containment	Yes
Pipe Release Det: Interior Double Walled	Yes
Pipe Release Detection: Other Method	No
Pipe Release Detection: Other Note	Not reported
Pipe Type:	PRESSURE
Pipe Materials: Bare Steel	No

VA RAILWAY EXPRESS BROAD RUN MAINT FACILITY (Continued) **U004175543**

Pipe Materials: Galvanized Steel	No
Pipe Materials: Copper	No
Pipe Materials: Fiberglass	No
Pipe Materials: Cath Protect	No
Pipe Materials: Double Walled	Yes
Pipe Materials: Sec Containment	Yes
Pipe Materials: Repaired	No
Pipe Materials: Unknown	No
Pipe Materials: Other	Yes
Pipe Materials: Other Note	PVC

VA Financial Assurance 1:

Facility ID:	3041755
Owner Name:	Virginia Railway Express
ROF Own Id:	45319
Tank Type:	UST
Mechanism:	Not reported
Gallonage:	Not reported
Per Occurence:	Not reported
Third Party:	Not reported
Annual Aggregate:	Not reported
In Compliance:	Not reported
Total Capacity:	500
CEDS Facility Name:	Virginia Railway Express - Broad Run Yard
Tank Status:	CURR IN USE
Active Federally Regualted UST:	Y

D16 **VA RAILWAY EXPRESS BROAD RUN MAINT FACILITY** **VA AST** **A100355367**
WNW **10637 PIPER LN** **N/A**
1/8-1/4 **BRISTOW, VA 20136**
0.213 mi.
1122 ft. **Site 2 of 2 in cluster D**

Relative:
Higher

Actual:
191 ft.

AST:

Facility ID:	3041755
Facility Type:	STATE
CEDS Facility ID:	200000850922

Tank Info:

Owner:

Owner Id:	45319
Owner Name:	Virginia Railway Express
Owner Address:	1500 King St Ste 202
Owner Address2:	Not reported
Owner City/State/Zip:	Alexandria, VA 22314
Owner Type:	LOCAL
Number of Active AST:	1
Number of Active UST:	1
Number of Inactive AST:	0
Number of Inactive UST:	0

Fed Regulated:	No
Tank Number:	Ast1
Tank Type:	AST
Tank Capacity:	1000
Tank Contents:	USED OIL

VA RAILWAY EXPRESS BROAD RUN MAINT FACILITY (Continued) **A100355367**

Tank Status:	CURR IN USE
Tank Containment:	
Install Date:	7/9/2010
Containment: Curbing	No
Containment: Weirs	No
Containment: Sorbent	No
Containment: Culvert	No
Containment: Diversion	No
Containment: Retention	No
Containment: Dike	No
Containment: Unknown	No
Containment: Other	No
Containment: Other Note	Not reported
Release Detection:	
Release Detection: Ground Water	No
Release Detection: Visual	No
Release Detection: Vapor	No
Release Detection: Interstitial	No
Release Detection: None	No
Release Detection: Other	No
Release Detection: Other Note	Not reported
Release Prevention: Double Bottom	No
Release Prevention: Double Walled	No
Release Prevention: Lined Interior	Not reported
Release Prevention: Poly Jacket	No
Release Prevention: Exc Liner	No
Release Prevention: None	No
Release Prevention: Unknown	No
Release Prevention: Other	No
Release Prevention: Other Note	Not reported
Tank Foundation: Steel	Yes
Tank Foundation: Earthen	No
Tank Foundation: Concrete Imp	Yes
Tank Foundation: Unknown	No
Tank Foundation: Other	No
Tank Foundation: Other Note	Not reported
Tank Roof: Float	No
Tank Roof: Cone	No
Tank Roof: Breather	Not reported
Tank Roof: Dbldeck	Not reported
Tank Roof: Pontoon	Not reported
Tank Roof: Balloon	Not reported
Tank Roof: Lifter	Not reported
Tank Roof: Pan	Not reported
Tank Roof: Other	Yes
Tank Roof: Other Note	Horizontal
Tank Material:	
Tank Materials: Bare Steel	Yes
Tank Materials: Concrete	No
Tank Materials: Insulated Tank Jacket	No
Tank Materials: Unknown	No
Tank Materials: Other	No
Tank Materials: Other Note	Shop Fab

VA RAILWAY EXPRESS BROAD RUN MAINT FACILITY (Continued) **A100355367**

Tank Type Cathodic/CP:	N
Tank Type Single Wall:	N
Tank Type Double Wall:	N
Tank Type Lined Interior:	N
Tank Type Double Bottom:	N
Tank Type Potable/Skid:	N
Tank Type Shop Fabricated/Built:	N
Tank Type Vaulted Below Grade:	N
Tank Type Vertical:	N
Tank Type Horizontal:	N
Tank Type Unknown:	N
Tank Type Other:	N
Tank Type Other Specify:	N

17
WNW
1/8-1/4
0.235 mi.
1240 ft.

10599 RESIDENCY ROAD
MANASSAS, VA 20136

RCRA-SQG **1007210911**
VAR000506774

Relative:
Higher

Actual:
194 ft.

RCRA-SQG:

Date form received by agency:	02/04/2004
Facility name:	Not reported
Facility address:	10599 RESIDENCY ROAD MANASSAS, VA 20136
EPA ID:	VAR000506774
Mailing address:	BOWLING GREEN DR. VIENNA, VA 22180
Contact:	NICK KOLLAS
Contact address:	Not reported Not reported
Contact country:	US
Contact telephone:	(703) 698-7887
Contact email:	Not reported
EPA Region:	Not reported
Classification:	Small Small Quantity Generator
Description:	Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name:	NICK KOLLAS
Owner/operator address:	Not reported Not reported
Owner/operator country:	US
Owner/operator telephone:	Not reported
Legal status:	Private
Owner/Operator Type:	Operator
Owner/Op start date:	05/10/1991
Owner/Op end date:	Not reported

Owner/operator name:	NICK KOLLAS
Owner/operator address:	Not reported

(Continued) **1007210911**

Not reported
Owner/operator country: US
Owner/operator telephone: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 05/10/1991
Owner/Op end date: Not reported

Handler Activities Summary:
U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D008
. Waste name: LEAD

Violation Status: No violations found

18
NW
1/4-1/2
0.251 mi.
1325 ft.

VDOT - MANASSAS AREA HEADQUARTERS SHOP **VA LTANKS** **S106850459**
10228 RESIDENCY RD **N/A**
MANASSAS, VA 22110

Relative:
Higher

Actual:
209 ft.

LTANKS:
Region: NVRO
CEDS Facility Id: 200000096828
Case Status: **Closed**
Pollution Complaint #: 19900438
Reported: 10/16/1989

19
South
1/4-1/2
0.455 mi.
2401 ft.

LONG VERA RESIDENCE **VA LTANKS** **S105174512**
11726 BRISTOW RD **N/A**
BRISTOW, VA 20136

Relative:
Higher

Actual:
218 ft.

LTANKS:
Region: NVRO
CEDS Facility Id: 200000204654
Case Status: **Closed**
Pollution Complaint #: 20023078
Reported: 10/12/2001

Count: 6 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
MANASSAS	S108930196	MANASSAS AIRPORT	MANASSAS AIRPORT-PIPER LANE		VA SPILLS
MANASSAS	S106239963	MANASSAS AIRPORT	1/4 MILE OFF OBSERVATION ROAD		VA SPILLS
MANASSAS	S106240124	MANASSAS AIRPORT PUMP STATION	OBSERVATION DRIVE		VA SPILLS
MANASSAS	S115962702	DULLES AVIATION, INC/MANASSAS AIRP	10501 PIPER LANE		VA RGA LUST
PRINCE WILLIAM	S104407645	COLONIAL PIPELINE - BULL RUN	ROUTE 234 & SUDLEY MANOR DRIVE	20109	VA LUST
PRINCE WILLIAM	S103459715	AT&T INDEPENDENT HILL	ROUTE 234	20112	VA LUST

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 03/07/2016
Date Data Arrived at EDR: 04/05/2016
Date Made Active in Reports: 04/15/2016
Number of Days to Update: 10

Source: EPA
Telephone: N/A
Last EDR Contact: 10/05/2016
Next Scheduled EDR Contact: 01/16/2017
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 03/07/2016
Date Data Arrived at EDR: 04/05/2016
Date Made Active in Reports: 04/15/2016
Number of Days to Update: 10

Source: EPA
Telephone: N/A
Last EDR Contact: 10/05/2016
Next Scheduled EDR Contact: 01/16/2017
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/07/2016
Date Data Arrived at EDR: 04/05/2016
Date Made Active in Reports: 04/15/2016
Number of Days to Update: 10

Source: EPA
Telephone: N/A
Last EDR Contact: 10/05/2016
Next Scheduled EDR Contact: 01/16/2017
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 09/14/2016
Date Data Arrived at EDR: 10/04/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 17

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/04/2016
Next Scheduled EDR Contact: 01/16/2017
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 03/07/2016
Date Data Arrived at EDR: 04/05/2016
Date Made Active in Reports: 04/15/2016
Number of Days to Update: 10

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 10/20/2016
Next Scheduled EDR Contact: 01/30/2017
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 03/07/2016
Date Data Arrived at EDR: 04/05/2016
Date Made Active in Reports: 04/15/2016
Number of Days to Update: 10

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 10/20/2016
Next Scheduled EDR Contact: 01/30/2017
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 06/27/2016
Date Data Arrived at EDR: 06/30/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 64

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/21/2016
Date Data Arrived at EDR: 06/30/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/21/2016
Date Data Arrived at EDR: 06/30/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 06/21/2016
Date Data Arrived at EDR: 06/30/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/21/2016
Date Data Arrived at EDR: 06/30/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Varies

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/28/2015
Date Data Arrived at EDR: 05/29/2015
Date Made Active in Reports: 06/11/2015
Number of Days to Update: 13

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/18/2016
Next Scheduled EDR Contact: 02/27/2017
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 05/09/2016
Date Data Arrived at EDR: 06/01/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 93

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/29/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 05/09/2016
Date Data Arrived at EDR: 06/01/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 93

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/29/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/26/2016
Date Data Arrived at EDR: 09/29/2016
Date Made Active in Reports: 11/11/2016
Number of Days to Update: 43

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: This state does not maintain a SHWS list. See the Federal CERCLIS list and Federal NPL list.

State Hazardous Waste Sites. State hazardous waste site records are the states' equivalent to CERCLIS. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds (state equivalent of Superfund) are identified along with sites where cleanup will be paid for by potentially responsible parties. Available information varies by state.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: Department of Environmental Quality
Telephone: 804-698-4236
Last EDR Contact: 12/19/2016
Next Scheduled EDR Contact: 04/03/2017
Data Release Frequency: N/A

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Solid Waste Management Facilities

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 09/10/2015
Date Data Arrived at EDR: 09/11/2015
Date Made Active in Reports: 11/09/2015
Number of Days to Update: 59

Source: Department of Environmental Quality
Telephone: 804-698-4238
Last EDR Contact: 01/03/2017
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Quarterly

State and tribal leaking storage tank lists

LUST REG WC: Leaking Underground Storage Tank List

Leaking underground storage tank site locations. Includes: counties of Alleghany, Bedford, Botetourt, Craig, Floyd, Franklin, Giles, Henry, Montgomery, Patrick, Pulaski, Roanoke; cities of Bedford, Clifton Forge, Covington, Martinsville, Radford, Roanoke, Salem.

Date of Government Version: 06/04/2015
Date Data Arrived at EDR: 06/05/2015
Date Made Active in Reports: 07/07/2015
Number of Days to Update: 32

Source: Department of Environmental Quality West Central Regional Office
Telephone: 540-562-6700
Last EDR Contact: 08/29/2016
Next Scheduled EDR Contact: 12/12/2016
Data Release Frequency: No Update Planned

LUST REG PD: Leaking Underground Storage Tank Sites

Leaking underground storage tank site locaitons. Includes: counties of Amelia, Brunswick, Charles City, Chesterfield, Dinwiddie, Essex, Gloucester, Goochland, Greensville, Hanover, Henrico, King and Queen, King William, Lancaster, Mathews, Middlesex, New Kent, Northumberland, Powhatan, Prince George, Richmond, Surry, Sussex, Westmoreland; cities of Colonial Heights, Emporia, Hopewell, Petersburg.

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/04/2014
Date Made Active in Reports: 01/16/2015
Number of Days to Update: 43

Source: Department of Environmental Quality Piedmont Regional Office
Telephone: 804-527-5020
Last EDR Contact: 08/29/2016
Next Scheduled EDR Contact: 12/12/2016
Data Release Frequency: Quarterly

LUST REG SC: Leaking Underground Storage Tanks

Leaking underground storage tank site locations. Includes: counties of Amherst, Appomattox, Buckingham, Campbell, Charlotte, Cumberland, Halifax, Lunenburg, Mecklenburg, Nottoway, Pittsylvania, Prince Deward; cities of Danville, Lynchburg.

Date of Government Version: 09/06/2013
Date Data Arrived at EDR: 09/06/2013
Date Made Active in Reports: 09/17/2013
Number of Days to Update: 11

Source: Department of Environmental Quality, South Central Region
Telephone: 434-582-5120
Last EDR Contact: 08/29/2016
Next Scheduled EDR Contact: 12/12/2016
Data Release Frequency: Semi-Annually

LUST REG TD: Leaking Underground Storage Tank Sites

Leaking underground storage tank site locations. Includes: counties of Accomack, Isle of Wight, James City, Northampton, Southampton, York; cities of Chesapeake, Franklin, Hampton, Newport News, Norfolk, Poquoson, Portsmouth, Suffolk, Virginia Beach, Williamsburg.

Date of Government Version: 06/30/2013
Date Data Arrived at EDR: 07/05/2013
Date Made Active in Reports: 09/16/2013
Number of Days to Update: 73

Source: Department of Environmental Quality Tidewater Regional Office
Telephone: trofoia@deq.vir
Last EDR Contact: 09/26/2016
Next Scheduled EDR Contact: 01/09/2017
Data Release Frequency: Quarterly

LUST REG VA: Leaking Underground Storage Tank List

Leaking underground storage tank site locations. Includes: counties of Albemarle, Augusta, Bath, Clarke, Fluvanna, Frederick, Greene, Highland, Nelson, Page, Rockbridge, Rockingham, Shenandoah, Warren; cities of Buena Vista, Charlottesville, Harrisonburg, Lexington, Staunton, Waynesboro, Winchester.

Date of Government Version: 12/06/2011
Date Data Arrived at EDR: 12/08/2011
Date Made Active in Reports: 01/16/2012
Number of Days to Update: 39

Source: Department of Environmental Quality Valley Regional Office
Telephone: 540-574-7800
Last EDR Contact: 08/29/2016
Next Scheduled EDR Contact: 12/12/2016
Data Release Frequency: No Update Planned

LUST REG NO: Leaking Underground Storage Tank Tracking Database

Leaking underground storage tank site locations. Includes: counties of Arlington, Caroline, Culpeper, Fairfax, Fauquier, King George, Loudoun, Louisa, Madison, Orange, Prince William, Rappahannock, Spotsylvania, Stafford; cities of Alexandria, Fairfax, Falls Church, Fredericksburg, Manassas, Manassas Park.

Date of Government Version: 05/18/2004
Date Data Arrived at EDR: 05/22/2004
Date Made Active in Reports: 07/09/2004
Number of Days to Update: 48

Source: Department of Environmental Quality Northern Regional Office
Telephone: 703-583-3800
Last EDR Contact: 09/06/2011
Next Scheduled EDR Contact: 12/19/2011
Data Release Frequency: No Update Planned

LUST REG SW: Leaking Underground Storage Tank Database

Leaking underground storage tank site locations. Includes: counties of Bland, Buchanan, Carroll, Dickenson, Grayson, Lee, Russell, Scott, Smyth, Tazewell, Washington, Wise, Wythe; cities of Bristol, Galax, Norton.

Date of Government Version: 07/15/2013
Date Data Arrived at EDR: 07/18/2013
Date Made Active in Reports: 09/16/2013
Number of Days to Update: 60

Source: Department of Environmental Quality Southwest Regional Office
Telephone: 276-676-4800
Last EDR Contact: 10/11/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: No Update Planned

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 01/07/2016
Date Data Arrived at EDR: 01/08/2016
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 41

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Quarterly

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 02/25/2016
Date Data Arrived at EDR: 04/27/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Quarterly

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 10/13/2015
Date Data Arrived at EDR: 10/23/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 118

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 10/09/2015
Date Data Arrived at EDR: 02/12/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 112

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 12/11/2015
Date Data Arrived at EDR: 02/19/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 105

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 02/05/2016
Date Data Arrived at EDR: 04/29/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 10/27/2015
Date Data Arrived at EDR: 10/29/2015
Date Made Active in Reports: 01/04/2016
Number of Days to Update: 67

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 02/17/2016
Date Data Arrived at EDR: 04/27/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 37
Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

LTANKS: Leaking Petroleum Storage Tanks
Includes releases of petroleum from underground storage tanks and aboveground storage tanks.

Date of Government Version: 08/01/2016
Date Data Arrived at EDR: 09/01/2016
Date Made Active in Reports: 11/07/2016
Number of Days to Update: 67
Source: Department of Environmental Quality
Telephone: 804-698-4010
Last EDR Contact: 12/02/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55
Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/11/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Varies

UST: Registered Petroleum Storage Tanks
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/02/2016
Date Data Arrived at EDR: 09/01/2016
Date Made Active in Reports: 11/03/2016
Number of Days to Update: 63
Source: Department of Environmental Quality
Telephone: 804-698-4010
Last EDR Contact: 12/02/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Semi-Annually

AST: Registered Petroleum Storage Tanks
Registered Aboveground Storage Tanks.

Date of Government Version: 08/02/2016
Date Data Arrived at EDR: 09/01/2016
Date Made Active in Reports: 11/03/2016
Number of Days to Update: 63
Source: Department of Environmental Quality
Telephone: 804-698-4010
Last EDR Contact: 12/02/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Semi-Annually

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 12/03/2015
Date Data Arrived at EDR: 02/04/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 120
Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 11/05/2015
Date Data Arrived at EDR: 11/13/2015
Date Made Active in Reports: 01/04/2016
Number of Days to Update: 52

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 02/05/2016
Date Data Arrived at EDR: 04/29/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 35

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 10/20/2015
Date Data Arrived at EDR: 10/29/2015
Date Made Active in Reports: 01/04/2016
Number of Days to Update: 67

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 09/23/2014
Date Data Arrived at EDR: 11/25/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 65

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 01/07/2016
Date Data Arrived at EDR: 01/08/2016
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 41

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 02/25/2016
Date Data Arrived at EDR: 04/27/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 37

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 01/26/2016
Date Data Arrived at EDR: 02/05/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 119

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Quarterly

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Controls Sites Listing

A listing of sites with Engineering Controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/27/2016
Date Data Arrived at EDR: 09/29/2016
Date Made Active in Reports: 11/03/2016
Number of Days to Update: 35

Source: Department of Environmental Quality
Telephone: 804-698-4228
Last EDR Contact: 12/22/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

INST CONTROL: Voluntary Remediation Program Database

Sites included in the Voluntary Remediation Program database that have deed restrictions.

Date of Government Version: 09/27/2016
Date Data Arrived at EDR: 09/29/2016
Date Made Active in Reports: 11/03/2016
Number of Days to Update: 35

Source: Department of Environmental Quality
Telephone: 804-698-4228
Last EDR Contact: 12/22/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

VRP: Voluntary Remediation Program

The Voluntary Cleanup Program encourages owners of elected contaminated sites to take the initiative and conduct voluntary cleanups that meet state environmental standards.

Date of Government Version: 09/27/2016
Date Data Arrived at EDR: 09/29/2016
Date Made Active in Reports: 11/03/2016
Number of Days to Update: 35

Source: Department of Environmental Quality
Telephone: 804-698-4228
Last EDR Contact: 12/22/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Quarterly

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 12/27/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Site Specific Assessments

To qualify for Brownfields Assessment, the site must meet the Federal definition of a Brownfields and should have contaminant issues that need to be addressed and a redevelopment plan supported by the local government and community. Virginia's Department of Environmental Quality performs brownfields assessments under a cooperative agreement with the U.S. Environmental Protection Agency at no cost to communities, property owners or, prospective purchasers. The assessment is an evaluation of environmental impacts caused by previous site uses similar to a Phase II Environmental Assessment.

Date of Government Version: 07/12/2016
Date Data Arrived at EDR: 07/29/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 35

Source: Department of Environmental Quality
Telephone: 804-698-4207
Last EDR Contact: 10/27/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 09/20/2016
Date Data Arrived at EDR: 09/21/2016
Date Made Active in Reports: 11/11/2016
Number of Days to Update: 51

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/20/2016
Next Scheduled EDR Contact: 04/03/2017
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 10/31/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Varies

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/24/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land

A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 11/04/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 08/31/2016
Date Data Arrived at EDR: 09/06/2016
Date Made Active in Reports: 09/23/2016
Number of Days to Update: 17

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 08/31/2016
Next Scheduled EDR Contact: 10/10/2016
Data Release Frequency: No Update Planned

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/30/2016
Date Data Arrived at EDR: 09/06/2016
Date Made Active in Reports: 09/23/2016
Number of Days to Update: 17

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/29/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014
Date Data Arrived at EDR: 03/18/2014
Date Made Active in Reports: 04/24/2014
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 06/27/2016
Date Data Arrived at EDR: 06/28/2016
Date Made Active in Reports: 09/23/2016
Number of Days to Update: 87

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Annually

SPILLS PD: PREP Database

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment.

Date of Government Version: 10/20/2009
Date Data Arrived at EDR: 10/29/2009
Date Made Active in Reports: 12/03/2009
Number of Days to Update: 35

Source: Department of Environmental Quality, Piedmont Region
Telephone: 804-527-5020
Last EDR Contact: 02/06/2012
Next Scheduled EDR Contact: 05/21/2012
Data Release Frequency: Quarterly

SPILLS BRL: Prep/Spills Database Listing

A listing of spills locations located in the Blue Ridge Regional area, Lynchburg.

Date of Government Version: 09/18/2009
Date Data Arrived at EDR: 09/18/2009
Date Made Active in Reports: 10/06/2009
Number of Days to Update: 18

Source: DEQ, Blue Ridge Regional Office
Telephone: 434-582-6218
Last EDR Contact: 11/28/2011
Next Scheduled EDR Contact: 03/12/2012
Data Release Frequency: Varies

SPILLS NO: PREP Database

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment.

Date of Government Version: 09/23/2009
Date Data Arrived at EDR: 09/29/2009
Date Made Active in Reports: 10/30/2009
Number of Days to Update: 31

Source: Department of Environmental Quality, Northern Region
Telephone: 703-583-3864
Last EDR Contact: 09/06/2011
Next Scheduled EDR Contact: 12/19/2011
Data Release Frequency: No Update Planned

SPILLS PC: Pollution Complaint Database

Pollution Complaints Database. The pollution reports contained in the PC database include the initial release reporting of Leaking Underground Storage Tanks and all other releases of petroleum to the environment as well as releases to state waters. The database is current through 12/1/93. Since that time, all spill and pollution reporting information has been collected and tracked through the DEQ regional offices.

Date of Government Version: 06/01/1996
Date Data Arrived at EDR: 10/22/1996
Date Made Active in Reports: 11/21/1996
Number of Days to Update: 30

Source: Department of Environmental Quality
Telephone: 804-698-4287
Last EDR Contact: 03/08/2010
Next Scheduled EDR Contact: 06/21/2010
Data Release Frequency: No Update Planned

SPILLS SW: Reportable Spills

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment.

Date of Government Version: 01/21/2010
Date Data Arrived at EDR: 01/22/2010
Date Made Active in Reports: 02/16/2010
Number of Days to Update: 25

Source: Department of Environmental Quality, Southwest Region
Telephone: 276-676-4839
Last EDR Contact: 07/13/2012
Next Scheduled EDR Contact: 10/29/2012
Data Release Frequency: No Update Planned

SPILLS TD: PREP Database

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment.

Date of Government Version: 09/17/2009
Date Data Arrived at EDR: 09/23/2009
Date Made Active in Reports: 10/06/2009
Number of Days to Update: 13

Source: Department of Environmental Quality, Tidewater Region
Telephone: trofoia@deq.vir
Last EDR Contact: 09/06/2011
Next Scheduled EDR Contact: 12/19/2011
Data Release Frequency: Quarterly

SPILLS VA: PREP Database

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment.

Date of Government Version: 08/08/2012
Date Data Arrived at EDR: 08/09/2012
Date Made Active in Reports: 10/05/2012
Number of Days to Update: 57

Source: Department of Environmental Quality, Valley Regional Office
Telephone: 540-574-7800
Last EDR Contact: 05/06/2013
Next Scheduled EDR Contact: 08/19/2013
Data Release Frequency: Quarterly

SPILLS WC: Prep Database

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment.

Date of Government Version: 09/21/2009
Date Data Arrived at EDR: 09/29/2009
Date Made Active in Reports: 10/30/2009
Number of Days to Update: 31

Source: Department of Environmental Quality, West Central Region
Telephone: 540-562-6700
Last EDR Contact: 09/06/2011
Next Scheduled EDR Contact: 12/19/2011
Data Release Frequency: No Update Planned

SPILLS: Prep/Spills Database Listing

The Department of Environmental Quality's POLLUTION RESPONSE PROGRAM, known as PREP, provides for responses to air, water, and waste pollution incidents in order to protect human health and the environment. PREP staff often work to assist local emergency responders, other state agencies, federal agencies, and responsible parties, as may be needed, to manage pollution incidents. Oil spills, fish kills, and hazardous materials spills are examples of incidents that may involve the DEQ's PREP Program.

Date of Government Version: 08/02/2016
Date Data Arrived at EDR: 09/01/2016
Date Made Active in Reports: 11/07/2016
Number of Days to Update: 67

Source: Department of Environmental Quality
Telephone: 804-698-4287
Last EDR Contact: 12/02/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 09/01/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/15/2013
Number of Days to Update: 43

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 06/21/2016
Date Data Arrived at EDR: 06/30/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 800-438-2474
Last EDR Contact: 12/28/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Varies

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015
Date Data Arrived at EDR: 07/08/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 97

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/08/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 10/14/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/14/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 11/17/2016
Next Scheduled EDR Contact: 11/28/2016
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 07/12/2016
Date Data Arrived at EDR: 08/17/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 65

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 11/16/2016
Next Scheduled EDR Contact: 02/27/2017
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/08/2016
Next Scheduled EDR Contact: 02/20/2017
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013
Date Data Arrived at EDR: 03/03/2015
Date Made Active in Reports: 03/09/2015
Number of Days to Update: 6

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 11/11/2016
Next Scheduled EDR Contact: 02/20/2017
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 01/15/2015
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 14

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/23/2016
Next Scheduled EDR Contact: 04/03/2017
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 11/24/2015
Date Made Active in Reports: 04/05/2016
Number of Days to Update: 133

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 11/22/2016
Next Scheduled EDR Contact: 03/06/2017
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 10/24/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 74

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/06/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2016
Date Data Arrived at EDR: 08/22/2016
Date Made Active in Reports: 11/11/2016
Number of Days to Update: 81

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 11/18/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 10/17/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 3

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 11/07/2016
Next Scheduled EDR Contact: 02/20/2017
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 01/20/2016
Date Data Arrived at EDR: 04/28/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 127

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/14/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 07/27/2016
Date Data Arrived at EDR: 08/05/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 77

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/11/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 11/17/2016
Next Scheduled EDR Contact: 03/06/2017
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 11/17/2016
Next Scheduled EDR Contact: 03/06/2017
Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016
Date Data Arrived at EDR: 09/08/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 43

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 11/07/2016
Next Scheduled EDR Contact: 02/20/2017
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 12/06/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/06/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83
Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 10/28/2016
Next Scheduled EDR Contact: 02/06/2017
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/03/2016
Date Data Arrived at EDR: 10/05/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 16
Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/05/2016
Next Scheduled EDR Contact: 01/16/2017
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40
Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42
Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/02/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees
Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 03/31/2016
Date Data Arrived at EDR: 08/01/2016
Date Made Active in Reports: 09/23/2016
Number of Days to Update: 53
Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 12/30/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 02/24/2015
Date Made Active in Reports: 09/30/2015
Number of Days to Update: 218
Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/23/2016
Next Scheduled EDR Contact: 03/06/2017
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34
Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/14/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 07/21/2016
Date Data Arrived at EDR: 07/26/2016
Date Made Active in Reports: 09/23/2016
Number of Days to Update: 59
Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 11/08/2016
Next Scheduled EDR Contact: 02/20/2017
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146
Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 09/09/2016
Next Scheduled EDR Contact: 12/05/2016
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 03/07/2016
Date Data Arrived at EDR: 04/07/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 148
Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 10/20/2016
Next Scheduled EDR Contact: 01/16/2017
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 06/30/2016
Date Data Arrived at EDR: 07/25/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 88

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 12/22/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 06/30/2016
Date Data Arrived at EDR: 07/25/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 88

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 12/22/2016
Next Scheduled EDR Contact: 04/10/2017
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 08/05/2016
Date Data Arrived at EDR: 09/01/2016
Date Made Active in Reports: 09/23/2016
Number of Days to Update: 22

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/01/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/12/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/02/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/15/2016
Date Data Arrived at EDR: 09/07/2016
Date Made Active in Reports: 11/11/2016
Number of Days to Update: 65

Source: EPA
Telephone: (215) 814-5000
Last EDR Contact: 12/06/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 06/02/2016
Date Data Arrived at EDR: 06/03/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 91

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 11/28/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 10/25/2015
Date Data Arrived at EDR: 01/29/2016
Date Made Active in Reports: 04/05/2016
Number of Days to Update: 67

Source: Department of Defense
Telephone: 571-373-0407
Last EDR Contact: 12/05/2016
Next Scheduled EDR Contact: 01/30/2017
Data Release Frequency: Varies

AIRS: Permitted Airs Facility List

A listing of permitted Airs facilities.

Date of Government Version: 09/12/2016
Date Data Arrived at EDR: 09/16/2016
Date Made Active in Reports: 11/03/2016
Number of Days to Update: 48

Source: Department of Environmental Quality
Telephone: 804-698-4000
Last EDR Contact: 11/28/2016
Next Scheduled EDR Contact: 03/13/2017
Data Release Frequency: Varies

CEDS: Comprehensive Environmental Data System

Virginia Water Protection Permits, Virginia Pollution Discharge System (point discharge) permits and Virginia Pollution Abatement (no point discharge) permits.

Date of Government Version: 09/07/2016
Date Data Arrived at EDR: 09/08/2016
Date Made Active in Reports: 11/10/2016
Number of Days to Update: 63

Source: Department of Environmental Quality
Telephone: 804-698-4077
Last EDR Contact: 12/05/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Semi-Annually

COAL ASH: Coal Ash Disposal Sites

A listing of facilities with coal ash impoundments.

Date of Government Version: 07/29/2009
Date Data Arrived at EDR: 07/31/2009
Date Made Active in Reports: 08/21/2009
Number of Days to Update: 21

Source: Department of Environmental Protection
Telephone: 804-698-4285
Last EDR Contact: 12/05/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Varies

DRYCLEANERS: Drycleaner List
A listing of registered drycleaners.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 12/10/2015
Date Made Active in Reports: 02/04/2016
Number of Days to Update: 56

Source: Department of Environmental Quality
Telephone: 804-698-4407
Last EDR Contact: 10/11/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Varies

ENFORCEMENT: Enforcement Actions Data
A listing of enforcement actions.

Date of Government Version: 09/28/2016
Date Data Arrived at EDR: 10/06/2016
Date Made Active in Reports: 11/07/2016
Number of Days to Update: 32

Source: Department of Environmental Quality
Telephone: 804-698-4031
Last EDR Contact: 12/19/2016
Next Scheduled EDR Contact: 03/20/2017
Data Release Frequency: Varies

Financial Assurance 1: Financial Assurance Information Listing
A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 08/11/2016
Date Data Arrived at EDR: 08/15/2016
Date Made Active in Reports: 11/04/2016
Number of Days to Update: 81

Source: Department of Environmental Quality
Telephone: 804-698-4205
Last EDR Contact: 10/31/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Varies

Financial Assurance 2: Financial Assurance Information listing
Solid waste financial assurance information.

Date of Government Version: 08/26/2016
Date Data Arrived at EDR: 08/29/2016
Date Made Active in Reports: 11/10/2016
Number of Days to Update: 73

Source: Department of Environmental Quality
Telephone: 804-698-4123
Last EDR Contact: 11/14/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Varies

TIER 2: Tier 2 Information Listing
A listing of facilities which store or manufacture hazardous materials and submit a chemical inventory report.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 09/01/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 76

Source: Department of Environmental Quality
Telephone: 804-698-4159
Last EDR Contact: 01/03/2017
Next Scheduled EDR Contact: 04/03/2017
Data Release Frequency: Annually

UIC: Underground Injection Control Wells
A listing of underground injection controls wells.

Date of Government Version: 08/02/2016
Date Data Arrived at EDR: 08/03/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 30

Source: Department of Mines, Minerals and Energy
Telephone: 276-415-9700
Last EDR Contact: 11/02/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information
ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 09/18/2016
Date Data Arrived at EDR: 09/20/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 12/20/2016
Next Scheduled EDR Contact: 04/03/2017
Data Release Frequency: Quarterly

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 06/09/2016
Date Data Arrived at EDR: 06/13/2016
Date Made Active in Reports: 09/02/2016
Number of Days to Update: 81

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 12/09/2016
Next Scheduled EDR Contact: 03/27/2017
Data Release Frequency: Quarterly

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 08/22/2016
Date Data Arrived at EDR: 08/23/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 59

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 11/22/2016
Next Scheduled EDR Contact: 03/06/2017
Data Release Frequency: Quarterly

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Virgina.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/20/2014
Number of Days to Update: 203

Source: Department of Environmental Quality
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Environmental Quality in Virgina and at the Regional VA Levels.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/15/2014
Number of Days to Update: 198

Source: Department of Environmental Quality
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/30/2013
Date Data Arrived at EDR: 08/19/2013
Date Made Active in Reports: 10/03/2013
Number of Days to Update: 45

Source: Department of Energy & Environmental Protection
Telephone: 860-424-3375
Last EDR Contact: 11/11/2016
Next Scheduled EDR Contact: 02/27/2017
Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 09/29/2016
Date Made Active in Reports: 01/03/2017
Number of Days to Update: 96

Source: Department of Environmental Protection
Telephone: N/A
Last EDR Contact: 10/12/2016
Next Scheduled EDR Contact: 01/23/2017
Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data
Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 10/01/2016
Date Data Arrived at EDR: 11/02/2016
Date Made Active in Reports: 01/04/2017
Number of Days to Update: 63

Source: Department of Environmental Conservation
Telephone: 518-402-8651
Last EDR Contact: 11/02/2016
Next Scheduled EDR Contact: 02/13/2017
Data Release Frequency: Annually

PA MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 07/22/2016
Date Made Active in Reports: 11/22/2016
Number of Days to Update: 123

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/14/2016
Next Scheduled EDR Contact: 01/30/2017
Data Release Frequency: Annually

RI MANIFEST: Manifest information
Hazardous waste manifest information

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 06/19/2015
Date Made Active in Reports: 07/15/2015
Number of Days to Update: 26

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 11/21/2016
Next Scheduled EDR Contact: 03/06/2017
Data Release Frequency: Annually

WI MANIFEST: Manifest Information
Hazardous waste manifest information.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 04/14/2016
Date Made Active in Reports: 06/03/2016
Number of Days to Update: 50

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 12/12/2016
Next Scheduled EDR Contact: 03/27/2017
Data Release Frequency: Annually

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
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Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Licensed Facilities
Source: Department of Social Services
Telephone: 804-692-1900

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

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EDR LIGHTBOX
MANASSAS REGIONAL AIRPORT, 10600 HARRY J PARRISH BLVD, MANASSAS, VA ...
DRAW
REPORTS
ABOUT
HISTORICAL
TAX PARCELS
TOPO
BASEMAP
LAYERS
TP MARKER
MAP FINDINGS
WATER WELLS
OIL & GAS
SOILS
AQUIFLOW
BLDG Permit
POI
STREET NAMES
QUADRANTS
Observation Rd
Piper Ln
Redoubt Rd
Residency Rd
James Payne Cv
Wakeman Dr
Carrion Branch
Harry J Parrish Blvd
Terminal Road
Prince William Pkwy
Bristow Rd
Milford Rd
Valley View Dr
Winged Elm Cir
Lobloly Trail
Plum Tree Cv
Godwin Dr
Greenleaf Dr
Candy Ct
Cedar Ridge Dr
Lee Manor Dr
Coral Berry Dr
Hawthorn Hill Ct
Glover Hill Rd
Johnson Dr
Chevalle Dr
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APPENDIX D

CULTURAL RESOURCES SURVEY

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COMMONWEALTH of VIRGINIA

Department of Historic Resources

Molly Joseph Ward
Secretary of Natural Resources

2801 Kensington Avenue, Richmond, Virginia 23221

Julie V. Langan
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
www.dhr.virginia.gov

June 2, 2017

Susan Stafford
Federal Aviation Administration
Washington Airports District Office
23723 Air Freight Lane, Suite 210
Dulles, VA 20166

Re: Manassas Regional Airport West Corporate Development and East Parcel Development
City of Manassas
DHR File No. 2017-0348

Dear Ms. Stafford,

The Virginia Department of Historic Resources (DHR) received the above referenced project for our review and comment pursuant to Section 106 (54 U.S.C. 306108) of the National Historic Preservation Act (54 U.S.C. 300101 et seq.) and it's implementing regulation, "Protection of Historic Properties" (36 CFR Part 800).

We have reviewed the report titled Phase I Archaeological Study for the Proposed West Corporate Development and East Parcel Development at Manassas Regional Airport, City of Manassas, Prince William County, Virginia prepared by Elizabeth Anderson Comer/Archaeology. It is our opinion that the fieldwork and report are consistent with applicable standards and guidelines. Much of the project area has either been previously surveyed or disturbed and the archaeological survey of roughly 18 acres of undisturbed land identified no intact sites. Based on the information provided, we find that impacts to archaeological properties are unlikely and no further archaeological survey is warranted in support of this project. We do, however, agree that protective measures should be employed during construction for adjacent site 44PW0729.

The proposed project will not be visible from most of the nine identified historic properties. Because of its scale and property type, the new development will not cause any additional

adverse impacts from what currently exists on the site, in areas where the development will be visible.

Based upon the sum of the review, DHR concurs with FAA that the proposed airport improvement project will have *no adverse effect on historic properties with the condition* that protective measures should be employed during construction for adjacent site 44PW0729.

If you have any questions regarding these comments or our review of this project, please do not hesitate to contact me via telephone at (804) 482-6092 or via email at adrienne.birge-wilson@dhr.virginia.gov.

Sincerely,



Adrienne Birge-Wilson, Architectural Historian
Review and Compliance Division

cc: Janine Howard, DEQ

Western Region Office
962 Kime Lane
Salem, VA 24153
Tel: (540) 387-5443
Fax: (540) 387-5446

Northern Region Office
5357 Main Street
PO Box 519
Stephens City, VA 22655
Tel: (540) 868-7029
Fax: (540) 868-7033

Eastern Region Office
2801 Kensington Avenue
Richmond, VA 23221
Tel: (804) 367-2323
Fax: (804) 367-2391

U.S. Department of Transportation
Federal Aviation Administration

Beckley Airports Field Office
176 Airport Circle, Room 101
Beaver, West Virginia 25813
Telephone: (304) 252-6216
FAX: (304) 253-8028

May 5, 2017

Mr. Roger Kirchen
Director, Division of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Re: A Request for Review and Concurrence Regarding the Area of Potential Effect and Other Section 106 Determinations for the West Corporate Development and East Parcel Development at Manassas Regional Airport

Dear Mr. Kirchen,

Per regulations implementing Section 106 of the National Historic Preservation Act (NHPA), this letter serves as a request of your review and concurrence of the Federal Aviation Administration's (FAA's) Area of Potential Effect (APE) and finding that there are no adversely effected properties on or eligible for inclusion in the National Register of Historic Places (NRHP) within the APE. A completed Project Review Application Form is provided with this letter (Enclosure).

The Proposed Undertaking

The City of Manassas (City) proposes to redevelop the west side corporate area and develop a parcel on the east side of the Airport (Proposed Undertaking). The Proposed Undertaking includes: on-Airport roadway improvements, fixed base operator (FBO) building and parking lot reconstruction, corporate hangar/building and parking lot construction, t-hangars demolition/replacement and construction and T-hangar parking lot, west aircraft apron and taxilane tie down parking expansion, taxilane extension, maintenance and storage building construction, wash rack construction, utilities extension and stormwater drainage improvements, and security fence extension.

In order to implement the Proposed Undertaking, the City must obtain approval from the FAA to modify the existing Airport Layout Plan and to use federal funds to provide partial funding.

The Area of Potential Effect

The Proposed Undertaking is located on the west and east side of the Airport property. The FAA has determined the APE-Direct to be the area where ground disturbing activities associated with the Proposed Undertaking could occur. The APE-Indirect was defined using a GIS based viewshed analysis (Attachment 2), incorporating all areas within line of site of the proposed new construction.

The Proposed Undertaking would not increase noise from aircraft operations because it would not change the type of aircraft currently utilizing the Airport, nor would the Proposed Undertaking increase the operational capacity/throughput for which the Airport is already designed, so these elements were not considered in the delineation of the APE-Indirect. . Attachments 1 and 2 provide more detailed documentation of the delineated APEs.

Per 36 Code of Federal Regulations (CFR) 800.4(a), the FAA requests your concurrence with the extent of the APEs.

Properties in or Eligible for Listing in the NRHP

An archives search and Phase I Archaeological Survey was completed for undisturbed portions of the APE-Direct. A copy of the Phase I Archaeological Survey is included as Attachment 1 of the Project Review Application Form. There is only one property within the APE-Direct that is listed or eligible for listing in the NRHP: the Manassas Station Operations Battlefield District, as expanded and documented in 2016. The Phase I Archaeological Survey identified no resources, including resources associated with the Manassas Station Operations Battlefield District within the APE-Direct; therefore, there is no adverse impact to archaeological resources within the APE-Direct. The Viewshed Analysis, Attachment 2 of the Project Review Application Form, determined that there are nine historic resources within the APE-Indirect which are listed in or eligible for the NRHP.

Designation	Name	Status
076-0014	Moor Green	Listed in NRHP
076-0024 (076-5161)	Bristoe Station Battlefield	Eligible for NRHP
076-0024-0001 (076-0607)	10604 Bristow Road	Contributes to 076-5344 NRHP Eligibility
076-0024-0025	New Hope Baptist Church	Contributes to 076-0024 NRHP Eligibility
076-0024-0027	10741 Milford Road	Contributes to 076-0024 NRHP Eligibility
076-0149	Bloom Hill Farm	Eligible for NRHP
076-5036 (0076-5168)	Manassas Station Operations Battlefield (The Civil War in Virginia)	Eligible for NRHP
076-5344	Village of Bristoe Historic District	Eligible for NRHP
155-5020	The Wakeman Site / Cannon Branch Fort	Listed in NRHP

Although eligible resources were identified within the APE-Indirect, the evaluation of impact to these resources determined that in most cases existing tree lines provide screening to obstruct the line of sight between historic resources and the proposed construction, and where line of sight is not obstructed, the nature of the proposed construction does not vary substantially from the existing development already visible on the airport; therefore, the proposed construction does not represent an adverse impact to the setting and character of these resources. The FAA requests your concurrence on this finding.

No Historic Properties Affected

Based on the information in this letter per the requirements of 36 CFR 800.11(d), the FAA has determined that the Proposed Undertaking would not adversely affect any known properties that Section 106 of the NHPA protects. The FAA respectfully requests your concurrence with this determination per 36 CFR 800(d)(1).

Additional Information

RS&H, a consultant for the Commission, is preparing an Environmental Assessment (EA) for the Proposed Undertaking. The EA analyzes the potential environmental effects of the Proposed Undertaking compared to the No Action Alternative. As part of the EA, the FAA intends to make a *de minimis* impact determination for historic properties under Section 4(f) of the U.S. Department of Transportation Act of 1966.

Should you have any questions or require additional information to facilitate your review, please do not hesitate to contact me at susan.stafford@faa.gov or (304) 252-6216 x130.

Sincerely,

Susan Stafford
Environmental Protection Specialist

Enclosures:
Project Review Application Form
Attachment 1 – Phase I Archaeological Report
Attachment 2 – Viewshed Study Letter Report

Cc: Juan Rivera, Airport Director
Jolene Berry, Sr. Airport Operations
David Alberts, RS&H

Project Review Application Form

This application must be completed for all projects that will be federally funded, licensed, or permitted, or that are subject to state review. Please allow 30 days from receipt for the review of a project. All information must be completed before review of a project can begin and incomplete forms will be returned for completion.

I. GENERAL PROJECT INFORMATION

1. Has this project been previously reviewed by DHR? **YES** ___ **NO** X **DHR File #** _____

2. Project Name West Corporate Development and East Parcel Development at Manassas Regional Airport

3. Project Location City of Manassas (**City**) Prince William County (**County**)

4. Specify Federal and State agencies involved in project (providing funding, assistance, license or permit). Refer to the list of agencies and abbreviations in the instructions.

Lead Federal Agency Federal Aviation Administration

Other Federal Agency Not Applicable

State Agency Virginia Department of Aviation

5. Lead Agency Contact Information

Contact Person Susan Stafford

Mailing Address 176 Airport Circle, Rm 101, Beaver, WV 25813

Phone Number (304) 252-6216 x130 **Fax Number**

Email Address Susan.Stafford@faa.gov

6. Applicant Contact Information

Contact Person Juan Rivera, Airport Director

Mailing Address 10600 Harry J. Parrish Blvd. Manassas, VA 20110

Phone Number (703) 361-1882 **Fax Number**

Email Address jrivera@ci.manassas.va.us

II. PROJECT LOCATION AND DESCRIPTION

7. USGS Quadrangle Name Nokesville

8. Number of acres included in the project About 60 acres (about 45 on the west and 15 on the east)

MAIL COMPLETED FORM AND ATTACHMENTS TO:
Virginia Department of Historic Resources
Attention: Project Review
2801 Kensington Avenue, Richmond, VA 23221
www.dhr.virginia.gov

9. Have any architectural or archaeological surveys of the area been conducted? **YES** x **NO** ___

If yes, list author, title, and date of report here. Indicate if a copy is on file at DHR.
See Attachment A

10. Are any structures 50 years old or older within or adjacent to the project area? **YES** ___ **NO** x

If yes, give date(s) of construction and provide photographs.

11. Does the project involve the rehabilitation, alteration, removal, or demolition of any structure, building, designed site (e.g. park, cemetery), or district that is 50 years or older? If *yes*, this must be explained fully in the project description. **YES** ___ **NO** x

12. Does the project involve any ground disturbance (e.g. excavating for footings, installing sewer or water lines or utilities, grading roads, etc.)? If *yes*, this must be explained fully in the project description. **YES** x **NO** ___

13. DESCRIPTION: Attach a complete description of the project. Refer to the instructions for the required information.

To the best of my knowledge, I have accurately described the proposed project and its likely impacts.

D. Mallette — April 27, 2017

Signature of Applicant/Agent — Date

The following information must be attached to this form:

- x Completed DHR Archives search
- x USGS map with APE shown
- x Complete project description
- x Any required photographs and plans

____ No historic properties affected _____ No adverse effect
____ Additional information is needed in order to complete our review.
____ We have previously reviewed this project. A copy of our correspondence is attached.
Comments: _____

Signature_____ Date _____

Phone number _____ DHR File # _____
This Space For Department Of Historic Resources Use Only

MAIL COMPLETED FORM AND ATTACHMENTS TO:
Virginia Department of Historic Resources
Attention: Project Review
2801 Kensington Avenue, Richmond, VA 23221
www.dhr.virginia.gov

Project Review Form Attachment A

PHASE I ARCHAEOLOGICAL STUDY FOR THE PROPOSED WEST CORPORATE DEVELOPMENT AND EAST PARCEL DEVELOPMENT AT MANASSAS REGIONAL AIRPORT, CITY OF MANASSAS, PRINCE WILLIAM COUNTY, VIRGINIA

VDHR File Number Not Yet Assigned

By Tery Harris, M.A.

Prepared for
The Federal Aviation Administration
The City of Manassas and the Manassas Regional Airport
and
R S and H, Inc.
909 N Washington St Suite 330
Alexandria, VA 22314

Prepared by
Elizabeth Anderson Comer/ Archaeology
4303 North Charles St
Baltimore, MD 21218
410-243-6767

April 2017

Abstract

EAC/Archaeology, Inc. was contracted to conducted and Archaeological Identification Survey within the Area of Potential Effects-Direct (APE) of the proposed West Corporate Development and East Parcel Development within Manassas Regional Airport holdings. The proposed project represents a federal undertaking under Federal Aviation Administration review and a state undertaking under the Virginia Department of Aviation review. Initial archival research indicated that extensive previous archaeological testing had been conducted within the airport and that large portions of the project APE had been surveyed and determined to be free of potentially eligible archaeological resources. Additional areas were exempted from testing based both on the sequence of historic aerial photographs of the are available for review online or through the USGS, or based on surface evidence of soil disturbance noted during the initial field inspection for the project.

Subsequently, Phase I survey investigations were conducted within two survey area of roughly 18.4 acres aggregate area and encompassing three discontinuous testing grids. Subsurface excavations were limited to the previously untested and undisturbed portions of the western survey area, while metal detecting survey was conducted both in those portions of the western survey area, and all of the previously tested eastern survey area. Excavation testing in the western survey area found evidence of wide spread soil disturbance within the northern and central portions of that testing area, and found intact but sterile soils within the southern portion of the western survey area. Metal detector survey conducted across the eastern survey area identified primarily twentieth century material associated with past hunting on the parcel, but also recovered two horseshoe fragments whose age and cultural affiliation could not be determined. Despite the high potential for previously unidentified prehistoric resources, and a moderate potential for previously unidentified historic resources only modern materials or nondiagnostic artifacts were identified.

No archaeological resources were identified and no further work is recommended. One archaeological site, 44PW729, falls just west of the present APE, with a 20-foot buffer off all planned development. The airport will ensure protection of this site by placing temporary fencing along this buffer to ensure that construction, storage, or staging activities do not impact the site.

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1.1. INTRODUCTION

The City of Manassas and the Manassas Regional Airport are proposing plans to redevelop portions of the existing airport to extend commercial support facilities, and to develop presently undeveloped land along the northern boundary of the airport. The project represents an undertaking requiring approval by the Federal Aviation Administration (FAA) and a state undertaking requiring approval from the Virginia Department of Aviation (DOAV). The project comes under State Historic Preservation Office (SHPO) review under Section 106 of the National Historic Preservation Act of 1966 (as amended in 2006), and under Virginia Code Section 10.1-1118 mandating submission of environmental impact reports on major projects.

The Manassas Regional Airport is located in central Prince William County, primarily within the City of Manassas boundaries but including roughly 20 acres of property outside the current City of Manassas boundaries (Figure 1). The project falls within the Piedmont Province of Virginia, and is bound on the west and south by Broad Run, a major tributary of the Occoquan, and Cannon Branch, a major tributary of Broad Run, on the east.

This archaeological study addressed roughly 18 acres within the airport property. The Area of Potential Effects (APE) for the project represents an area encompassing all of the proposed project elements (Figures 2 and 3). Manassas Regional Airport has been the subject of a number of previous archaeological studies, and areas previously studied and found to not contain potentially eligible archaeological resources were exempted from the present study. Areas of visually obvious past disturbance or on landforms previously documented as disturbed deep fill platforms were also exempted from the present study. After all exemptions were made, two discontinuous areas totaling 4.4 acres were subject to subsurface identification survey, and three discontinuous areas totaling 18.4 acres were subject to controlled metal detection survey.

The identification survey excavation was conducted on November 15 and 16, 2016 and the metal detector survey was conducting between February 8 and February 14, 2017. Tery Harris served as Project Archaeologist for the project, designed the metal detector survey with Mr. Joseph Clemens, conducted archival research and authored the report. Dr. Robert Wanner supervised the subsurface survey and assisted with the metal detector survey. Mr. Clemens served as Crew Chief for the project and designed and supervised the metal detector survey. Paul Alberts, Sasha Sleshkupina, and Gus Kahn served as field technicians. The qualifications of primary project personnel are presented in Appendix I.

This report follows a standard format prescribed by the Virginia Department of Historic Resources (VDHR 2011). The proposed project is described in Chapter 1 along with the project setting. A general developmental context and an overview of the results of archival research are presented in Chapter 2. Chapter 3 presents the research design and methodology utilized during the study. Field survey results are presented in Chapter 4, and a study summary and recommendations concerning further treatment are presented in Chapter 5.

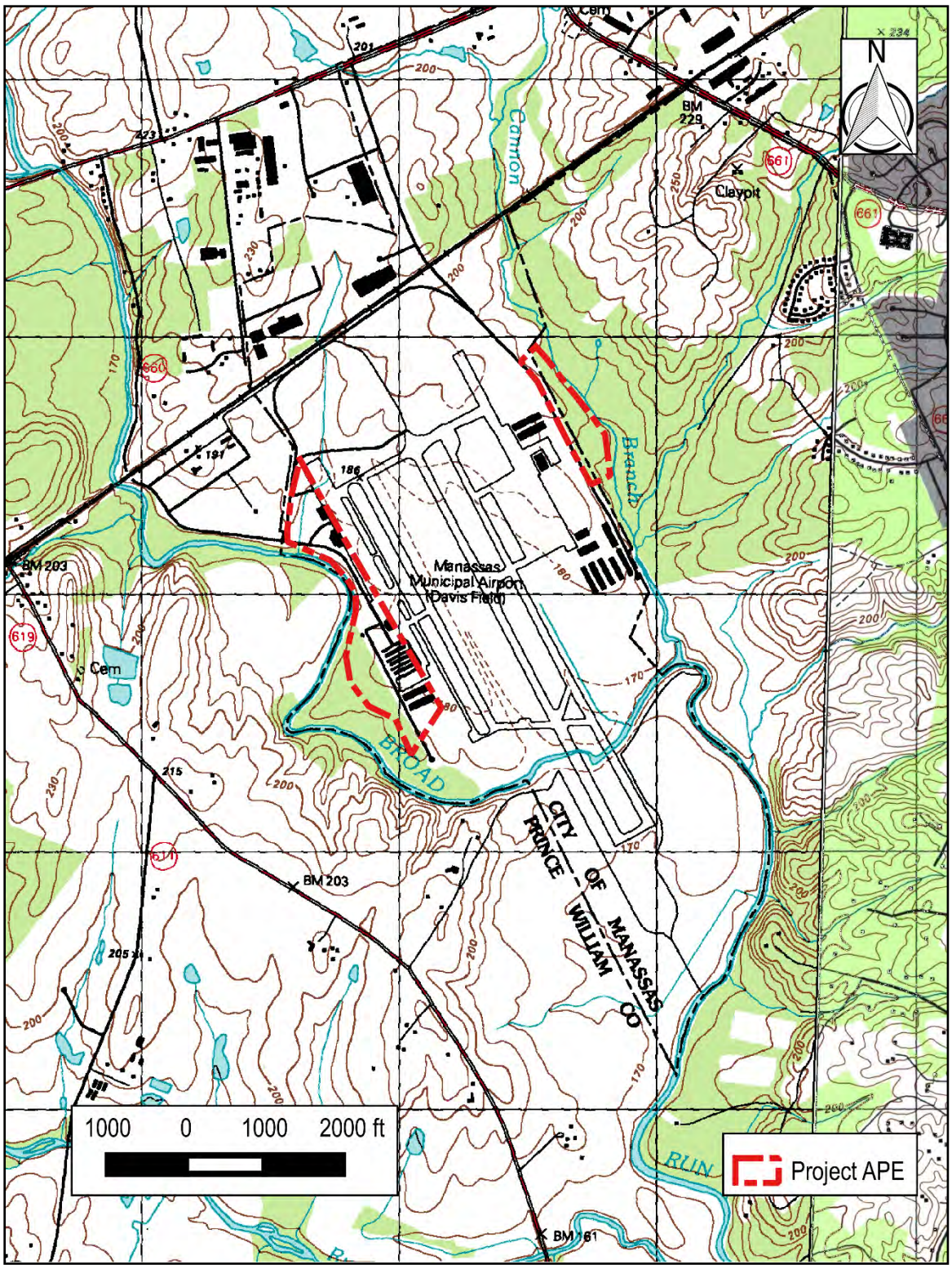


Figure 1. Project Location on the 1994 Nokesville VA and Independent Hill VA USGS 7.5 Minute Quadrangle.

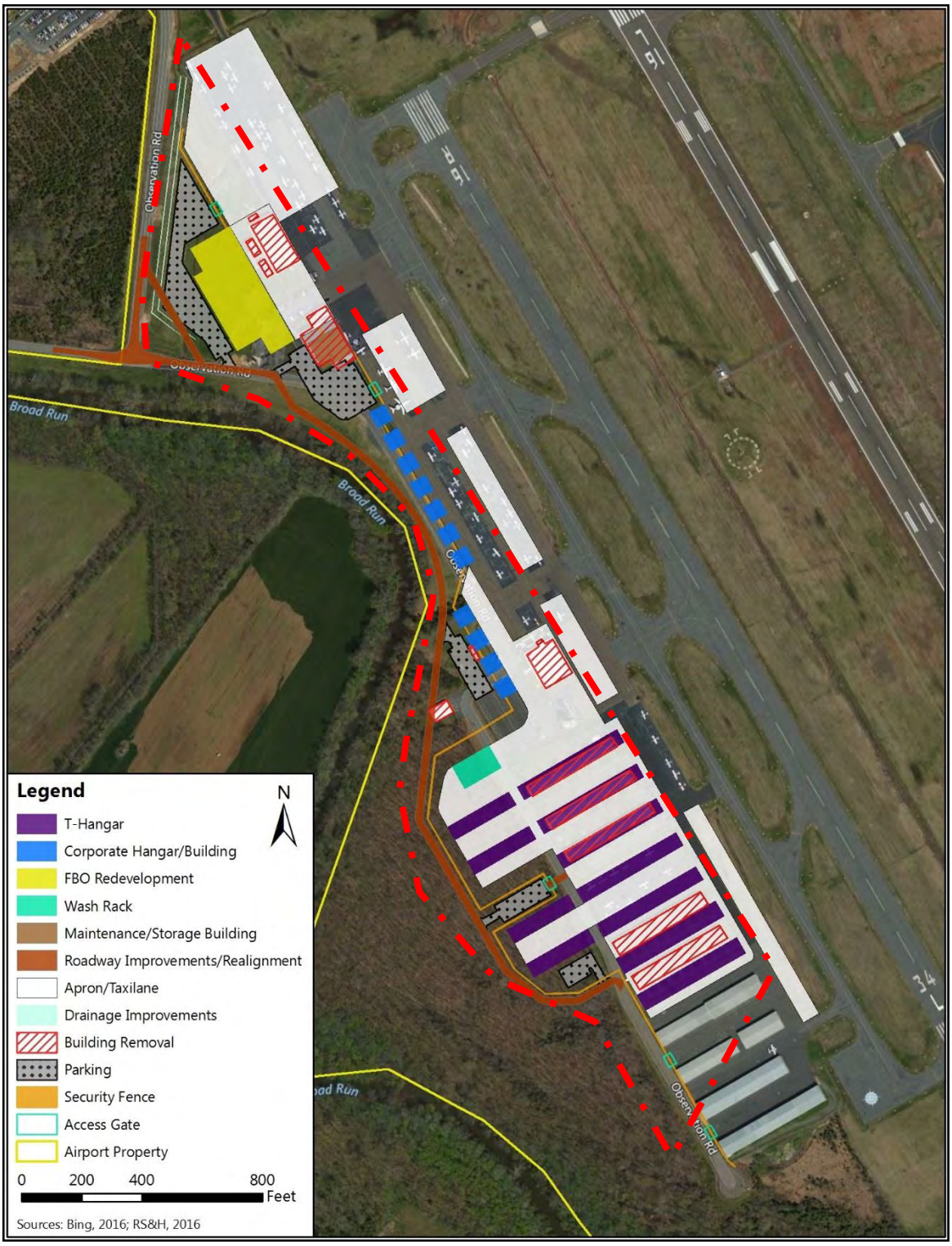


Figure 2. Project APE, western survey area and proposed project elements. (APE in red, base image courtesy of RS&H).



Figure 3. Project APE, eastern survey area and proposed project elements. (APE in red, base image courtesy of RS&H).

1.2 PROJECT DESCRIPTION AND SETTING

Project Description

The City of Manassas and the Manassas Regional Airport are proposing plans to redevelop existing support facilities along the western edge of the airport, and to develop new support facilities along the east airport boundary (Figures 2 and 3).

The proposed project elements within the West Corporate Area include: improvements to the intersection of Observation Road and Piper Lane; realignment of Observation Road to the west; demolition of two existing FBO buildings and replacement by a 71,100 square-foot FBO building; new parking lots and expansion of the existing apron, construction of roughly 11 new 3,66 square-foot hangars and construction of adjoining parking lots, demolition and replacement of five existing T-hangars, construction of seven new T-hangars, construction of a new maintenance and storage building on the site of one demolished FBO building, extension of existing apron around the site of new T-hangar construction, construction of a wash-rack north of the T-hangars. Proposed plans also include extension of existing utilities as required to support construction, extension of the existing security fence to encompass the new facilities, and improvements to existing stormwater drainage systems to accommodate the increase in impervious surface resulting from propose construction.

Proposed development within the East Parcel Area includes realignment of Wakeman Drive, construction of new hangar and office structures, with adjoining parking lots. The existing adjacent taxilane would be extended to provide airfield access to the proposed development. Proposed plans also include extension of existing utilities as required to support construction, extension of the existing security fence to encompass the new facilities, and improvements to existing stormwater drainage systems to accommodate the increase in impervious surface resulting from propose construction.

Description of the Area of Potential Direct Effects

The Area of Potential Direct Effects was defined to include all elements of the proposed project. Significant portions of the defined APE have been subject to or are adjacent to prior archaeological survey (Figure 4). These although two of these surveys did identify archaeological resources (McLearen 1978, Deitrick and McDaid 1994), these resources were either subsequently determined not to be eligible for listing on the National Register of Historic Places or fall outside the APE boundaries. The Mullens 2005 study and the Harris 2009 study did not identify archaeological resources. All acreage within the present APE previously studied was exempted from further consideration prior to fieldwork for this study. The APE was divided into a western survey area and an eastern survey area for purposes of this study.

Description of the Eastern Survey Area

The eastern survey area, of roughly 14 acres within the APE, is located just east of Wakeman Drive, and north of Harry Parish Boulevard. It is primarily second growth forest, although there is some clearance as past disturbance at the southern end associated with the construction of Parish Boulevard, and a second small area of disturbance and lawn associated with a small airport signal and support facility at the northern end of the survey area. Initial pedestrian inspection of the survey area identified a cleared sewer-line corridor on the east of the study area (Figure 5),

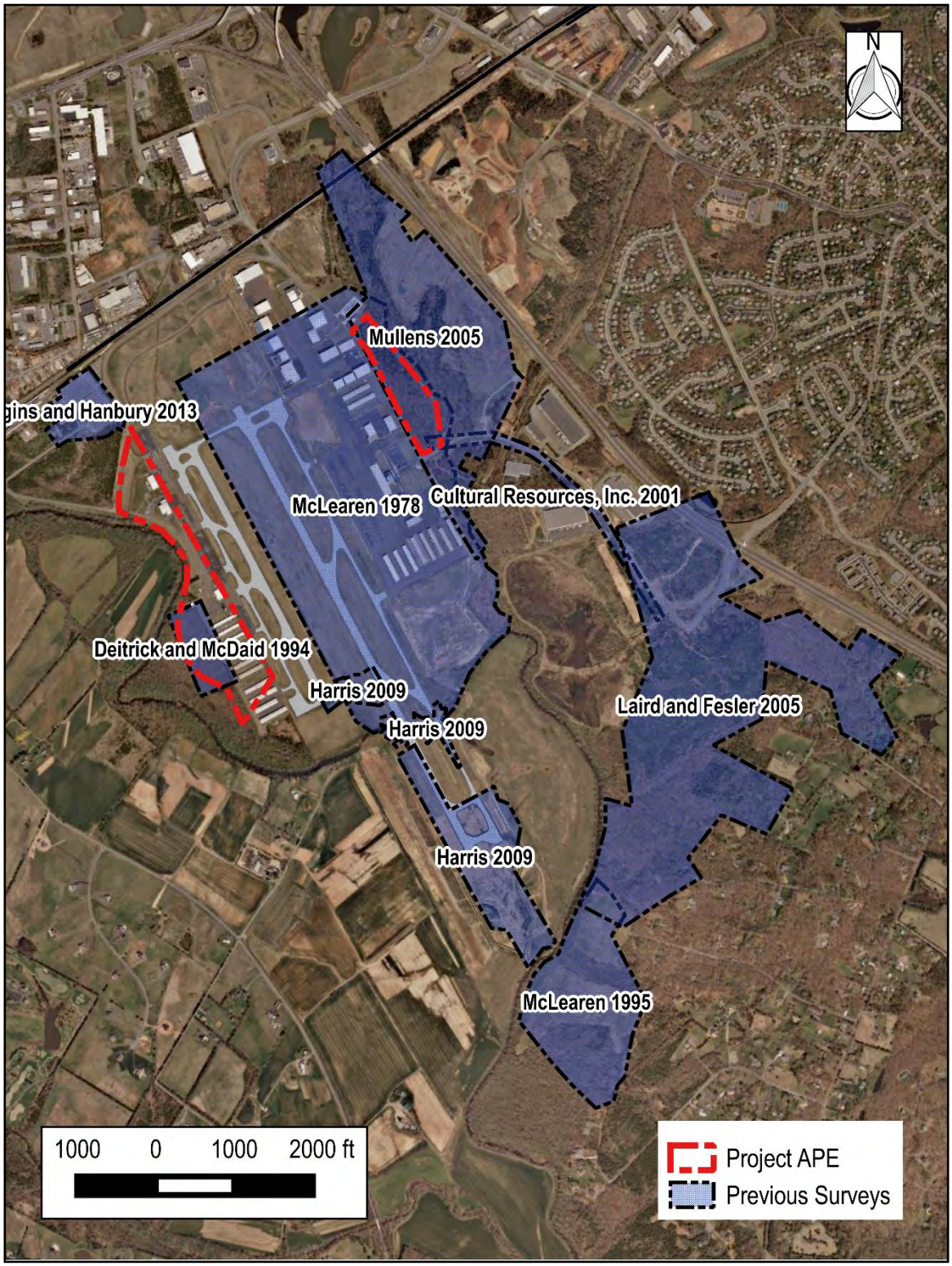


Figure 4. Previous archaeological survey within the airport.



Figure 5. View looking south down the sewer right-of-way on eastern edge of the eastern survey area.

resulting in multiple push-piles of waste soil (Figures 6 and 7) and a variety of metal debris which extended some 30 feet west into the survey area along the sewer corridor. Modern dumping was apparent both along the sewer cut and Wakeman Drive (Figure 8). The southeastern portion of the eastern survey area includes an area of low wetlands (Figure 9).

Description of the Western Survey Area

The western survey area comprised primarily of existing airport facilities. The northern end of the survey area includes two commercial hangars, the adjacent apron, access drive, and parking facilities, as well as an area of lawn to the west, between the facilities and Observation Road (Figure 10). A large man-made drainage also runs northeast-southwest through this portion of the western survey area (Figure 11). Existing elevations and surface conditions, as well as historical aerial photographs indicates that this area has been previously disturbed during construction, prior to 1977. This portion of the western survey area was exempted due to previous disturbance.

The central portion of the western survey area includes extensive paved aprons, portions of Taxiway Alpha, the continuation of Observation Road heading south, and lawn verge west of Observation Road. At its narrowest point, this area appears to have been completely disturbed by past road and apron construction. Just north of the main western hangar area, there is small complex of administrative buildings, including the tower, a temporary trailer office, and a small structure identified as Manassas Aviation on project plans (Figure 12 and Figure 13). Subsurface testing was conducted in the lawn area west of the trailer and north of the smaller building, where no surface evidence of disturbance was present.

The southern portion of the western survey area consists of second growth forest in the west, and pavement and hangar structures to the east. The bulk of this area was surveyed in 1994 (Deitrick and McDaid 1994). Subsurface testing was conducted on the small forested area south of the area tested by Deitrick and McDaid (Figure 4). No subsurface testing was possible in the paved area around and between the existing hangar structures.



Figure 6. Soil push piles adjacent to the sewer right-of-way, in the eastern survey area. Looking west from the northeastern corner.



Figure 7. Soil push pile adjacent to the sewer right-of-way in the eastern survey area. Looking north from the southeastern corner.



Figure 8. Modern surface dumping in the northwestern corner of the eastern survey area, looking east from grid point B35.



Figure 9. View looking east from grid point D3 at the wetlands in the southeastern portion of the eastern survey area.



Figure 10. Structural complex at the northern end of the western survey area. View east from Observation Road north of its intersection with the access drive.



Figure 11. Drainage channel running through the northern portion of the western survey area. View northeast from south end of the drainage near Observation Road.



Figure 12. Main structure complex including tower, central portion of the western survey area. View looking east form the turn of the dirt road.



Figure 13. Manassas Aviation structure, central portion of the western survey area. View looking east towards Observation Road.

Environmental Setting
The project falls within the Piedmont Province of Virginia, near the interface of the exposed metamorphic and igneous bedrock of the Piedmont and the Triassic Lowlands Basin.

The project area is bound by Broad Run on the west and Cannon Branch, a tributary of Broad Run, on the east. Broad Run is a major tributary to the Occoquan and represents part of the Potomac River Drainage. The original landform appears to represent both floodplain and low terrace. The natural topography across the airport is almost flat, apparently achieved by grading and addition of fill during the construction of the airport. The eastern survey area is the notable exception to this observation. Surface contours in the eastern survey area reflect a high knoll and descending sideslopes which appear to represent the original landform in the area.

Anticipated Soils
Soils mapped in the project area include Aden silt loam, Arcola silt loam, Bermudian silt loam, Delanco fine sandy loam, Dulles silt loam, Elsinboro sandy loam, Rowland silt loam, and Urban land-Udorthents complex soils (NRCS Web Soil Survey, Elder 1989). Arcola, Delanco, Dulles Elsinboro, and Rowland soils are classified as well drained or moderately well drained. Aden and Hatboro soils are classified as poorly drained.

Aden soils are soils formed in alluvium on terraces, and is mapped only in the western survey area. They are typically deep and poorly drained. The natural profile includes a surface plowzone of 8 inches of silt loam, over a deep B Horizon (up to 58 inches) which grades from silty clay loam to clay. The substratum is a mottled silt loam, with bedrock typically encountered around 80 inches below the surface. An E Horizon may be present in some profiles. Soils color, especially in the B and C Horizons, can vary widely in value and chroma, although the hue generally ranges from 10YR to 5YR.

Arcola soils are soils formed in material weathered from siltstone, shale, and fine-grained sandstone and are found on ridgecrests and sideslopes. Arcola soils are mapped only in the eastern survey area, along the higher ridge. The plowzone is typically less than 10 inches, a silt loam which is nearly identical to the gravelly silt loam B Horizon below it. The gravel content of the subsoil matrix increases with depth, and the weathered siltstone substratum is generally encountered near a depth of two feet beneath the surface. Soil colors reflect the red siltstone and sandstones from which it developed, typically a 2.5YR to 5YR in color, but can range into the 7.5YR and 10YR range.

Bermudian soils are deep, drained soils formed in recent alluvial deposits on floodplains and are mapped only in the western survey area. The plowzone is a roughly 8 inch thick silt loam which is virtually identical to the underlying upper subsoil. The B Horizon graduates from a silt loam to a silty clay and increases in reddish hue with depth. The substratum is generally encountered below four feet, and consists of a stratified sand markedly different from the overlying B Horizon. Bedrock may be encountered as high as six feet beneath the surface.

Delanco soils are also deep soils formed in alluvium on terraces and are mapped only in the western survey area. They are moderately well drained. The plowzone is generally less than a foot deep and ranges from a fine sandy loam to a silt loam. Where present the E Horizon can be up to six

inches thick, and consists of a nearly identical fine sandy loam or silt loam. The thick B Horizon is generally encountered at roughly one foot beneath the surface, and grades from a silty clay loam to a clay loam. The substratum, at roughly 40 to 45 inches below the surface, is a mottled clay loam to sandy loam. Depth of the bedrock is typically greater than 80 inches.

Dulles soils developed in Triassic residuum along toe slopes, in saddles, and at the heads of drainage ways and are mapped only in the eastern survey area. The plowzone is typically 8 inches deep and consists of an only slightly variable dark brown or brown silt loam. The underlying B Horizon approaches three feet in thickness, and grades from silty clay loam through silty clay to clay at the base. It typically rests directly on decaying red shale of the Culpeper Basin.

Elsinboro soils formed along stream terraces out of alluvium. The soils are deep and well drained. The Ap Horizon is typically roughly 10 inches of loam which ranges in color and loam proportions. Where present the E Horizon is a similar sandy or silt loam with mica inclusions. The B Horizon approaches three feet in thickness and grades from silty clay through silty clay loam to sandy loam near the base. The B Horizon rests on a discontinuous stratified or variegated gravelly sandy loam.

Rowland soils are very deep floodplain soils formed in alluvium. They are characterized as moderately well drained to somewhat poorly drained. Rowland soils are mapped only in the southeastern portion of the eastern survey area. The plowzone is typically somewhat reddish in color, roughly 10 inches deep, and consists of a silt loam or sandy loam. The underlying B Horizon is relatively thin, including an upper transitional zone of reddish silt loam that lightens in color with depth. The substratum is generally encountered just below two feet beneath the surface, and consists of an upper layer of silty clay loam and a lower zone of stratified sand and gravel, which extends to depths below five feet.

Urban land-Odorthents complex soils are defined as areas where 85% or more of the surface is covered by asphalt, concrete or other impervious surfaces and area where the soils have been altered during excavation or covered by fill materials. This complex is mapped primarily along the aprons and taxiway of the western survey area.

Current Land Use

The project APE is in use as an active regional airport serving small aircraft and helicopters. The western survey area includes a number of structures, hangars, aprons, access roads, and part of the western taxiway for this airport. The eastern survey area is outside the current active airport and represents second growth forest which appears to date to the mid-twentieth century.

2. ARCHIVAL RESEARCH AND DEVELOPMENT CONTEXT

Developmental Context

The Paleoindian Periods (Before 10,000 B.P.)

Although still debated, dated Paleoindian components from recent studies have pushed back the span of recorded history along the eastern seaboard. This earliest prehistoric period predates the classic Paleoindian Period of past development models and has been designated as Proto-Clovis. Known sites representing this period include Saltville (44SM37), Cactus Hill (44SX202), and possibly Brook Run (44CU122). Based on the Cactus Hill Pre-Clovis component, tool assemblages include prismatic blades and blade cores made from local fine grained lithic materials

(McAvoy and McAvoy 1997, Johnson 1997). Boyd cites immunological evidence of utilization of musk ox, bison, deer, elk, and small mammals such as rabbits (Boyd 2003: 68).

The Paleoindian culture is often thought of as based on big game hunting, particularly of now extinct species, although no Paleoindian artifacts associated with extinct species have been found in eastern North America. Settlement and subsistence models postulate a mosaic environment and a subsistence system focused on the hunting of large game, such as elk, caribou, and deer, with foraging of other resources as available, with a settlement system organized around the location of high quality cryptocrystalline lithic sources (Custer 1984, Gardner 1989). Archaeological excavations, such as those at the Shawnee Minisink site in the Upper Delaware Valley of Pennsylvania, have recovered evidence that eastern Paleoindians utilized many of the plant foods later important in prehistoric economies, and may have begun to utilize fish as a resource (Dent 1985, McNett l985). These early hunter-gatherers probably traveled long distances to obtain food and the raw material for tool production, as has been shown by studies of lithic procurement systems centered on the Thunderbird site in Virginia and other Middle Atlantic sites (Gardner 1977; Custer 1984).

Site types from this period include a variety of base camps, hunting sites, and quarry-related locations. Upland swamps and headwater zones are known to have been exploited during this era. Artifact assemblages associated with the Paleoindian I Period include fluted points (most notably the Clovis type) and a variety of non-diagnostic unifacial and bifacial stone tools (Dent 1995:170). Based on sites previously reported, Paleoindian base camps have a strong riverine focus, preferring river terraces and "well watered swampy areas" (Petraglia *et al.* 1993: 18). Faunal and botanical procurement areas typically favor floodplains and uplands near these riverine foci. Some adaption of older patterns has been noted in the Early Archaic, where sites have also been reported along low-order streams and upland stream-heads.

Paleoindian diagnostics include characteristic fluted points generally manufactured from high quality cryptocrystalline lithic resources. Three identified Paleoindian components have been identified in Prince William County. The Featherstone Site (44PW0003) is coastal site identified in marshlands along the Occoquan Bay shoreline, primarily known through private collections. Two upland sites, 44PW1371 and 44PW1373, have been identified upstream along Broad Run, one through the recovery of a Hardaway-Dalton point (44PW1371) and the second through the recovery of a rhyolite Clovis or Dalton point base (44PW1373). These later two sites are located roughly 6.5 miles northwest of the present project area, situated on a ridge top, and lower ridge toeslope overlooking Broad Run, respectively.

<u>The Archaic (10,000 B.P. to 3,000 B.P.)</u>

Established regional models had linked the shift from Paleoindian patterns into Early Archaic patterns with environmental changes during the Pleistocene to Holocene transition. Changes in technology and subsistence patterns are seen as directly reflecting the adaptation of newly developing resources. As the climate warmed and became moister, the Piedmont forests of oak and hickory developed; by 3,200 B.C. modern vegetative conditions essentially had stabilized (Wesler *et al.* 1981). Alternating dry and moist periods have been identified in regional pollen profiles (Brush 1986:150). The distribution and abundance of food resources would have varied in different locales during these alternating periods. Settlements expanded into more diverse

environments, apparently utilizing a wider variety of fish, game, and other plant food resources, such as nuts, berries, and roots (Johnson 1983, Custer 1990, Petraglia *et al*. 1993, Dent 1995:165-166).

By 10,000 B.P., there was a change in tool varieties, with stemmed and side-notched projectile points replacing the earlier fluted varieties. The preferred lithic materials were still imported from outside the study area. Virginia deer were the primary large game animal hunted, although bones of a number of other smaller animals recovered archaeologically show that a wide variety of species were successfully hunted. The appearance of mortars and pestles suggests that vegetable foods assumed greater importance. These changes have been interpreted as a shift in subsistence strategies towards a broad-spectrum adaptation, utilizing a number of species of animals and plants, rather than focusing primarily on large animals. This can be related to the changing environment as rapidly rising sea levels submerged the lower Susquehanna River and began forming the Chesapeake Bay (Kraft 1976). Large estuarine marshes that offered an increased quantity and variety of food resources became established in the Chesapeake Bay and its main tributaries. As temperatures increased during this period, birch and oak began to replace spruce (Brush 1986:149; Leedecker and Holt 1991:72). New evidence from Paleoindian and Early Archaic sites suggests that the transition from the Paleoindian way of life in the east was not a sharp break, but rather a gradual transition. Diagnostic artifacts for the period include Palmer, Kirk, Kirk Stemmed, and Bifurcate points.

The Middle and into the Late Archaic Periods are marked by a fully developed Holocene environment, one that was generally warm and moist (Gardner 1989). Plant gathering and processing, and fishing appear to have played increasingly important roles in subsistence systems throughout the period. This is reflected in an expansion of tool forms to include grinding stones, net-sinkers, axes, and adzes.

Wider ranging changes in subsistence and settlement patterns have been suggested for the Middle Archaic, as prehistoric populations adopted strategies which allowed them to utilize new ecological communities evolving in the Holocene. Middle Archaic populations are believed to have utilized a broader range of resources, many of which were only seasonally available. Settlement patterns reflect seasonal movement and possible reoccupation of settings with access to a variety of resources, such as low terraces, floodplains, and wetland environments. The proposed settlement system model includes large base camps located along major drainage systems. Groups would join during periods of maximum resource availability, possibly to cooperatively exploit dense but labor intensive resources such as seasonal fish runs, and then disperse to smaller groups during periods of scarce resources. Small procurement camps were typically situated in upland areas, possibly indicating the presence of social fusion/fission mechanisms, with small kin groups leaving larger base camps for seasonal exploitation of resources in other environmental niches (Gardner 1978; Custer 1984:67). In regional models the Halifax phase has been described as having a riverine oriented upland focus (Mouer 1991), although it exhibited less intensive riverine focus than the following periods of prehistory.

Artifact assemblages from this period are diverse. In this area, they may include projectile points of the following types: Stanley, Neville, Morrow Mountain, Guilford, and Halifax points. Regional Middle Archaic models also assign the Archaic triangles to this period (Custer 2000; Katz 2000).

A variety of non-diagnostic unifacial and bifacial stone tools were also produced during this period. Ground stone tools, including mortars and pestles, became common during this period (Dent 1995:170).

By the end of the Archaic Period, there were increased shallow estuarine areas in the Tidewater, and the oyster began to be intensively exploited (Dent 1995:212). Fish were also intensively harvested during this period, facilitated by the use of fish weirs. Large base camps were established at the fall lines of major freshwater streams where fish-spawning runs were most productive and at saltwater estuaries for collecting oysters (Dent 1995:212). These camps represent seasonal fusion locations. Winter fission produced a pattern of "upland hollow" hunting and foraging camps located in the Piedmont interior (Johnson 1991, Johnson 2001:82).

The Late Archaic-Transitional Period is marked by a settlement pattern focused more along interior drainages of first-order streams, with larger social groupings and increased sedentism (Mouer 1991, Steponaitis 1980). At least one researcher has suggested that the inherently linear nature of resource zones in such a system would motivate greater social interaction between groups (Mouer 1991:14).

Steatite bowls are added to the subsistence toolkit in this period. The use of the heavy steatite bowls suggests increased sedentism even in the early portions of the period (Dent 1995:213). Other diagnostic artifacts include Savannah River, Brewerton (several sub-types), Bare Island, Holmes, Perkiomen, Susquehanna Broadspears (and other broadspear types), and Vernon points. The typical toolkit included small bifaces, drills, scrapers, and utilized flakes.

In the Mid-Atlantic, Archaic sites are much more numerous, larger, and richer in artifacts than the earlier Paleoindian sites. Prince William County has 19 Early Archaic sites reported, including 44PW0432 in the project vicinity. The Middle Archaic is the best represented of the Archaic subdivisions, with 65 sites reported in the county with Middle Archaic components, including 44PW0013, 44PW0600 (although the site form has not yet been updated to reflect the reported component), and 44PW0729 adjacent to present LOD, and 44PW0249 and 44PW1110 in the project vicinity. Late Archaic components are reported at 52 Prince William County sites, including 44PW0014, 44PW0015, and 44PW0600 either on or adjacent to the airport property, and 44PW1623 and 44PW1624 in the project vicinity.

The Woodland Period (3,000 B.P. to 1600 A.D.)

The introduction of pottery into the artifact assemblage around 3,000 B.P. marks the beginning of the Woodland period. Potters' innovations, as reflected in ceramic types, have become a significant basis for dating deposits within the Woodland period. At the end of the Woodland period, the geographic distribution of ceramic types within the Middle Atlantic corresponded with ethnohistoric cultural/linguistic boundaries. Comparable boundaries extend back to at least 200 AD (Stewart 1987:118). In the Chesapeake Bay area, ceramic distributions tended to conform to physiographic provinces, with a zone of interaction along the Fall Line (Egloff 1985).

By the Woodland Period, site patterns show a distinct movement from interior areas to major rivers valleys and estuarine settings along the coast. Settlement patterns reflected multi-seasonal, repetitive occupation of base camps along rivers, and procurement of game and mass resources

conducted by small special purpose forays in to the adjacent the uplands. This pattern appears to have been most intensified during the Late Woodland, with semi-permanent villages along major floodplains. Horticulture of adopted cultigens (the classic beans, corn, and squash) provided a slightly more controllable resource base, but reflected only part of a subsistence base which included game (such as deer, waterfowl, and fish) as well as gathered nuts, berries, and tubers. Soil exhaustion in agricultural fields motivated periodic movement of the village sites within the available floodplain environment.

It was previously thought that the break between the Archaic and Woodland periods, around 3,000 B.P., represented the introduction of horticulture. Although cultivated plants were used by Early Woodland groups in the upper South and Midwest, there is presently no evidence that cultivated foods played a role in the diet of Early Woodland people in the Chesapeake Bay area. Very efficient hunting and gathering systems (Caldwell l958), including riverine and marine species, may have made the acceptance of cultigens slow at first. Only after A.D. 700, when varieties of tropical cultigens adapted to local conditions arrived in the Mid-Atlantic area, did agriculture begin to assume the important role that it had at the time of the arrival of the first Europeans.

Early Woodland Period

The period from 3,000 B.P. to 2,400 B.P. is marked by experimentation with ceramic technology. Early ceramics were tempered with crushed steatite and included vessel forms similar to the Terminal Late Archaic steatite vessels, and included Marcey Creek and Seldon Island wares. After about 1,200 B.P. sand and crushed quartz tempered Accokeek ceramics were common.

Gardner proposed that the settlement-subsistence system of this period focused on a series of base camps where the populations aggregated to exploit seasonal resources (Gardner 1982:60). These base camps focused on harvesting anadromous fish in the spring and early summer, then exploiting estuarine resources in the fall and early winter. Summer and late winter were periods of group fission, with small group settlements away from major rivers.

Thirty-eight Early Woodland components have been reported in Prince William County, including 44PW0015 within the airport and 44PW0600 adjacent to the airport. 44PW1643 in the project vicinity also has a reported Early Woodland component.

Middle Woodland Period

During the period from 2,400 B.P. to A.D. 900, the Eastern Piedmont appears to have been used only for scattered hunting sites (Curry and Kavanagh 1991:15). At this time, the adjacent Western Shore Coastal Plain of the Chesapeake Bay area was occupied by a large population that utilized a wide spectrum of wild, seasonal resources through a settlement system focused on central base camps with storage facilities and widespread procurement sites (Curry and Kavanagh 1991:16-24). The Eastern Piedmont was not intensively occupied, although they created campsites and lithic processing stations as they crossed the Piedmont on trips for direct procurement of rhyolite from quarries in the Catoctin and Blue Ridge mountains to the west (Ballweber 1990, 1991).

Diagnostics from the period include Accokeek, Popes Creek, and Mockley ceramic wares, and various forms of triangular points.

The Middle Woodland is the least represented Woodland subperiod in Prince William County, with only 14 Middle Woodland components reported. No Middle Woodland component has been reported within the vicinity of the APE.

Late Woodland Period

The period includes significant cultural changes, including changes in settlement patterns, growing social inequality, and changes in mortuary patterns (Barfield and Barber 1992, Boyd and Boyd 1992). Regional Mid-Atlantic models of settlement patterns for the Late Woodland Period postulate a shift to include permanent villages and hamlets (including fortification) as part of the subsistence and settlement system. Floodplain locales were the favored locations for settlements, likely based on the availability of fertile bottomland soils. Smaller base camps and procurement sites were located in diverse settings and tended to have periods of multiple re-use (Custer 1986). Subsistence practices included the cultivation of foodstuffs, especially corn, beans, and squash. Diverse wild food sources were also utilized, including nuts, starchy tubers, amaranth, goosefoot, shellfish, fish, elk, bear, turkey, squirrel, duck, bobcat, raccoon, rabbit, skunk and wolf. Researchers have noted regional differences between major drainages within the Piedmont (Hantman and Klien 1992), and difference between the Piedmont with its greater reliance on terrestrial fauna and the riverine and estuarine focused Coastal Plain (Barfield and Barber 1992).

The Eastern Piedmont was again intensively occupied after A.D. 900, when large village sites appear along the Potomac River and in the Western Piedmont Lowlands along the Monocacy River. These people produced Shepard ceramics. Their archaeological remains have been classified as the Montgomery Complex (Schmitt 1952; Kavanagh 1982; Slattery and Woodward 1992). Shepard ceramic vessels have rounded or semi-conoidal bases, slightly constricted necks, cord-marked surfaces, primarily corded-stick decoration with some incising (and punctuations, rarely), collars produced by adding a rim strip, and are tempered with crushed rock (quartz or granite). Living in large villages on or near rich floodplain soils, these people were dependent to some extent on corn and other cultivated crops. There is also some evidence of smaller occupations along major rivers (Curry and Kavanagh 1991:16; Dent and Jirikowic 1990:26; Slattery and Woodward 1992:158) and smaller tributaries (Fischler 1984; Hopkins and Fischler 1992; Robinson et al 2003).

Montgomery complex sites appear to have been occupied as late as A.D. 1300-1400, which may overlap in time with the Keyser complex along the Potomac in the Eastern Piedmont (Dent and Jirikowic 1990). The Keyser complex is identified by shell-tempered, cord-marked ceramics and riverside village sites.

Diagnostic artifacts include small triangular points indicative of the adoption of bow and arrow technology, and Keyser, Shepard, Rappahannock, and Potomac Creek ceramics. Toolkits include a variety of generalized bifaces, awls, drills, ground stone woodworking tools, net sinkers, mortars, pestles, manos and metates. Other artifacts typically found in the region are ground-slate pendants, gorgets, bone awls, agricultural tools manufactured from bone and antler, and projectile points manufactured from bone, antler, turkey spurs, stingray barbs, and shark's teeth (Dent 1995:228-229).

Thirty-five Late Woodland components have been reported in Prince William County, including 44PW0600 adjacent to the airport property.

European Interaction (Contact Period)

The first documented European contact in the region was the exploration of the Potomac River by Captain John Smith in 1608. He reportedly explored the Potomac as far upstream as Little Falls. His voyage marked the beginning of English trading with indigenous peoples in the area, and his maps provide an essential picture of indigenous settlement at the time of European contact (Smith 1612).

Numerous villages were noted by Captain John Smith along the Potomac (Smith 1612). The more important villages in the region included Nacotchanck, Moyaons, and Tauxenent. The village of Tauxenent, situated on the Virginia side of the Potomac near the mouth of the Occoquan River was the only one of these to fall within the present boundaries of Prince William County. The inhabitants of Tauxenent were reportedly known also as 'Taux', 'Toag', and 'Doag', and are generally believed to be part of the Powhatan chiefdom (Cissna 1990: 28). The Maryland based Piscatway were generally closely allied with the Powhatan Confederacy, sharing a common language stock (Algonquian). Some scholars dispute this interpretation, suggesting that the groups between the Rappahannock and Potomac rivers were instead relatively independent (Potter 1983:18-19). One historian, Harrison, asserts that the native groups of the Piedmont portions of the county were "Manahoac" Siouan derivatives (Harrison 1987: 24).

Regardless of cultural attribution, it seems that the native populations during the late 17th and early 18th century were a sufficient deterrent to European settlers the keep the county interior only lightly settled into the 18th century. The early seventeenth century was marked by a series of conflicts between English settlers and the Powhatan Confederacy, with conflicts in 1609, and periodically from 1622 through 1632 (Cissna 1990: 30). Indian-European hostilities generally subsided in the middle of the 17th century when Indian treaties and reservations were offered, and European settlement spread. In contrast, conflict with the Susquehannocs of the northern Bay and between the Powhatan and Monacan confederacies dated to periods before permanent English settlement and continued through the later seventeenth century.

European settlement primarily focused on the major river valleys and coastal areas, representing a significant competition to native groups whose Late Woodland patterns also placed a strong emphasis on these settings. Competition for resources and European diseases may have both operated to reduce the native population throughout the contact period, as well as a probably significant out-migration. Most indigenous groups had migrated out the Prince William County area by the early eighteenth century (Mooney 1889, Harrison 1987: 24). Harrison attributes this to conflict with the Iroquois over the control of the fur trade. In 1722 the colony of Virginia sealed a treaty with the Iroquois, and the native groups agreed to remain west of the Blue Ridge Mountains, opening up the interior for more sustained settlement (Harrison 1987: 29).

Settlement to Society Period (1607-1750)

Initial settlement in northern Virginia was largely restricted to the lower Potomac Valley and coastal area. Sustained settlement of the Piedmont interior was not undertaken until the early 18th century, after the 1722 treaty. Thus early settlement consisted of a string of independent plantations located along the coast and shores of major rivers. These scattered plantations were held together by a transportation system comprised primarily of navigable waterways and a few

interior "rolling roads" constructed to transport cash crops to collection centers. The area which would become Prince William County was initially settled along the Potomac and Occoquan Rivers. By 1648 patents granted for lands along the Potomac shore from the south border to the north border of county, and in along the lower Occoquan River (WPA Writers Program 1988:15). Grants in the interior were delayed several decades, and even then were generally not taken up (actually surveyed and occupied) until into the early 18th century.

The early plantation system revolved around tobacco. Once patented, the larger land grants would be subdivided into small holdings, and worked by tenant farmers. Puglisi notes that early 18th century farmers in the region generally worked holdings of less than 500 acres, despite the enormous land grants typical of the time (Puglisi 1989: 4487). It was these tenant farmers who would clear the land and begin farming. But tobacco proved to be an unstable economic basis; tobacco was a labor-intensive crop which quickly depleted soil nutrients. Farmers found that they were forced to acquire new land and additional labor at rates which frequently outpaced the profits of a tobacco crop which proved subject to widely fluctuating prices. Some settlers chose to relocate to new lands not yet depleted; others chose to adopt alternative crops such as grains.

By 1731 population in the region had grown sufficient to justify the formation of a new county, and establishment of a new county seat nearer to the centers of population at Occoquan Creek (Woodbridge) (Deitrick and McDaid 1994: 10, McLearen *et al.* 1995: 9). In 1742 the county seat was moved towards the interior to Cedar Run (McLearen *et al.* 1995: 9). The population of the interior continued to grow as populations both took up new tobacco lands or adopted mixed farming techniques. An increase in grain agriculture in turn motivated changes in settlement and transportation systems, as mill seats were sought out and mills constructed, subsequently developing their own road connections.

An example of this process is one of the earliest patents in the project vicinity; the 30,000 acre Brent Town grant patented in 1686/7 to George Brent, Richard Foote, Nicholas Haywood, and Robert Bristow (Hunter 2004). Although a Brent Town was established on paper in 1688, the settlement was never successful and the grant remained largely undeveloped until 1737. At that date the grant was subdivided between the surviving heirs for individual development (Hunter 2004). Subsequent court records and rent rolls indicate that the lots were envisioned as 100 or 150 acre lots, but were generally taken up as two or three lots combined (Hunter 2004). The 1737 Brent Town survey indicates that the farm of John or Jonathan Adams was located in the vicinity of the present project area.

Colony to Nation Period (1750-1789)

As population increased in northern Virginia, both through natural increase and immigration, lands in the region were resurveyed and large holdings were divided into smaller parcels. Unfortunately, as soils were exhausted tobacco farming began to fail in the region, and new fertile land became difficult to acquire (Catlin 1988). Wheat began to replace tobacco as the primary crop in northern Virginia starting circa 1760 (Cissna 1990:37).

There is little evidence of continued development within the immediate project vicinity during this period. The Bristow portion of the Brent Town grant (west and south of the present APE) was subject to significant legal encumbrances during the end of the period, with attempted land sales

blocked in 1780 and the properties transferred to the State in 1781 (Hunter 2004). The courts then blocked state sale of the land in 1783 under a suit brought by the Bristow tenants. Robert Bristow the son was briefly awarded the land in the late 1790s, but the State appealed and the tract was finally awarded to the State in 1806 (Hunter 2004). Throughout the whole period of legal proceedings it appears that the same tenants continued to hold the land, alternately paying rent to Bristow or the State.

Early National Period (1789-1830)

Transportation improvements were a noteworthy development in the late 18th century and the early 19th century. Although the internal road system was developing more rapidly in the nineteenth century, water routes were still important transportation routes, especially for heavy or bulky raw commodities. While water transportation continued to represent an economical mode of cargo transportation, most personal transportation and an increasing amount of cargo transportation required the use of inland road systems. This was especially true as soil exhaustion, parcel subdivision, population pressure, and mill and mining development moved populations west into the Piedmont. Private corporations were organized that would build turnpikes to link towns in Virginia and nearby states throughout the early nineteenth century (Durrenberger 1968). Bristow Road and Route 28 both seem to have been well established by the end of this period (O'Neill 2007).

Once the question of the land ownership was settled in 1806, settlement in the previous Bristow Tract seems to have increased. By 1823 roughly 4,800 acres of the 7,000 acre tract was under lease, and the town of Brentsville had been laid out within the southern portion of the tract (Hunter 2004, Harrison 1987: 668). By 1820 the county seat was moved again, to Brentsville, in response to the interior movement of population in Prince William County (Ratcliffe 1978: 73). Harrison notes "[the] country on either side of Broad Run, above the confluence with Cedar, had now become the most populous part of the county, and included the land owners of the largest political influence (Harrison 1987: 317)."

Antebellum Period (1830-1860)

During the early nineteenth century, weakened by soil exhaustion, parcel subdivision, and fluctuating staples prices, the older plantation based economy of northern Virginia began to wear down. Previously established populations were shifting westward seeking fertile land, with a resulting depopulation in the coastal areas of northern Virginia. The settlement pattern continue to adapt, as populations migrated to new soils in the interior, and adapted to the new importance of grains in the agricultural economy. The number of mills along interior streams increased rapidly in the first half of the nineteenth century, and the internal road system shifted to include these important processing centers. Crossroads communities began to develop throughout northern Virginia, as commercial and service enterprises developed at prominent road junctions. Churches often were situated at road junctions as well. As the majority of personal travel shifted from water to roads, crossroads were becoming community centers.

Brentsville, which remained the county seat until 1893, represents one of these crossroad communities. Writing in 1835, Joseph Martin described the town … "[t]he Court House, clerk's office, and jail are handsomely situated on the main street, in a public square of three acres. Besides them, the village contains 19 dwelling houses, 3 miscellaneous stores, 2 handsome taverns,

built of brick and stuccoed, 1 house of entertainment, 1 house of public worship, free for all denominations, a bible society, a Sunday school, a temperance and a tract society…There is in the vicinity a common school in which the rudiments of English education are taught…Population 130 persons, of whom 3 are attorneys and 3 regular physicians…." (quoted in Ratcliffe 1978: 73).

Additional transportation improvements in the form of railroads marked the onset of a second shift of both settlement and subsistence patterns near the end of the period. The Orange and Alexandria Railroad and the Manassas Gap Railroad were both completed in the early 1850s, and an 1854 map of the Orange and Alexandria suggests that by that time a small community was established at the Broad Run crossing on that line, just south of a small community called Milford (Faul 1854, Figure 14). This small unnamed community appears to be the backbone of what would be the Bristoe Station settlement, including the Stewart farm which appears to have been just off the northwest corner of the project APE. The development of these two rail lines in the region would have profound effects on both the surrounding agricultural systems, and the surrounding communities during the Civil War.

Civil War (1861-1865)

Manassas and Bristow Station both became major focal points during the Civil War, with major effects on the communities and economy of Prince William County. The Manassas Gap Railroad provided a direct link to the Shenandoah Valley grain producers, and the Orange and Alexandria Railroad presented a route directly into the Federal Capital. Manassas Junction, the location of the exchange between these lines, quickly became an important strategic target. The following summary of military engagements in the project vicinity depends heavily on information and reconstructions provided in the *Bristoe Station and Kettle Run Battlefields Preservation Study* (Jacobs *et al.* 2016).

The first military engagement in the project region was Confederates occupation of the Manassas Junction area early in 1861, and shortly thereafter they were faced with a Federal force during the First Battle of Manassas, July 21, 1861. By the fall and winter of 1861, the Confederates had established troop encampments in the Manassas Junction region, including Camp Jones established in the Bristoe Area (Jacobs *et al* 2016).

The first documented military engagement of August of 1862 lasted a brief two days, when Jackson moved his troops through arriving on the 26th. The Confederate forces sabotages segments of the rail near the Broad Run crossing, resulting in derailment of two trains late on the 26th. Ewell's Division was subsequently left at Bristoe to guard Jackson's rear as his main force moved onto Manassas Junction to the east. Responding Union forces set up and defined at the bridge crossing over Kettle Run to the west, where they held position until Confederate forces pushed west on the morning of the 27th. Reinforcements reached the withdrawn Union troops in early afternoon, and the Federals pushed back east. After several hours of bloody engagement, the Confederate forces called an orderly retreat, and moved east to join Jackson's main force. These engagements comprise the lead up to the Second Battle of Bull Run.

Confederate and Union forces clashed at the rail station again on October 14th, 1863. Union and Confederate forces arrived at Bristoe Station the afternoon of October 14th. The federal forces gained the upper hand when they established strong defensive positions along the railbed, and were

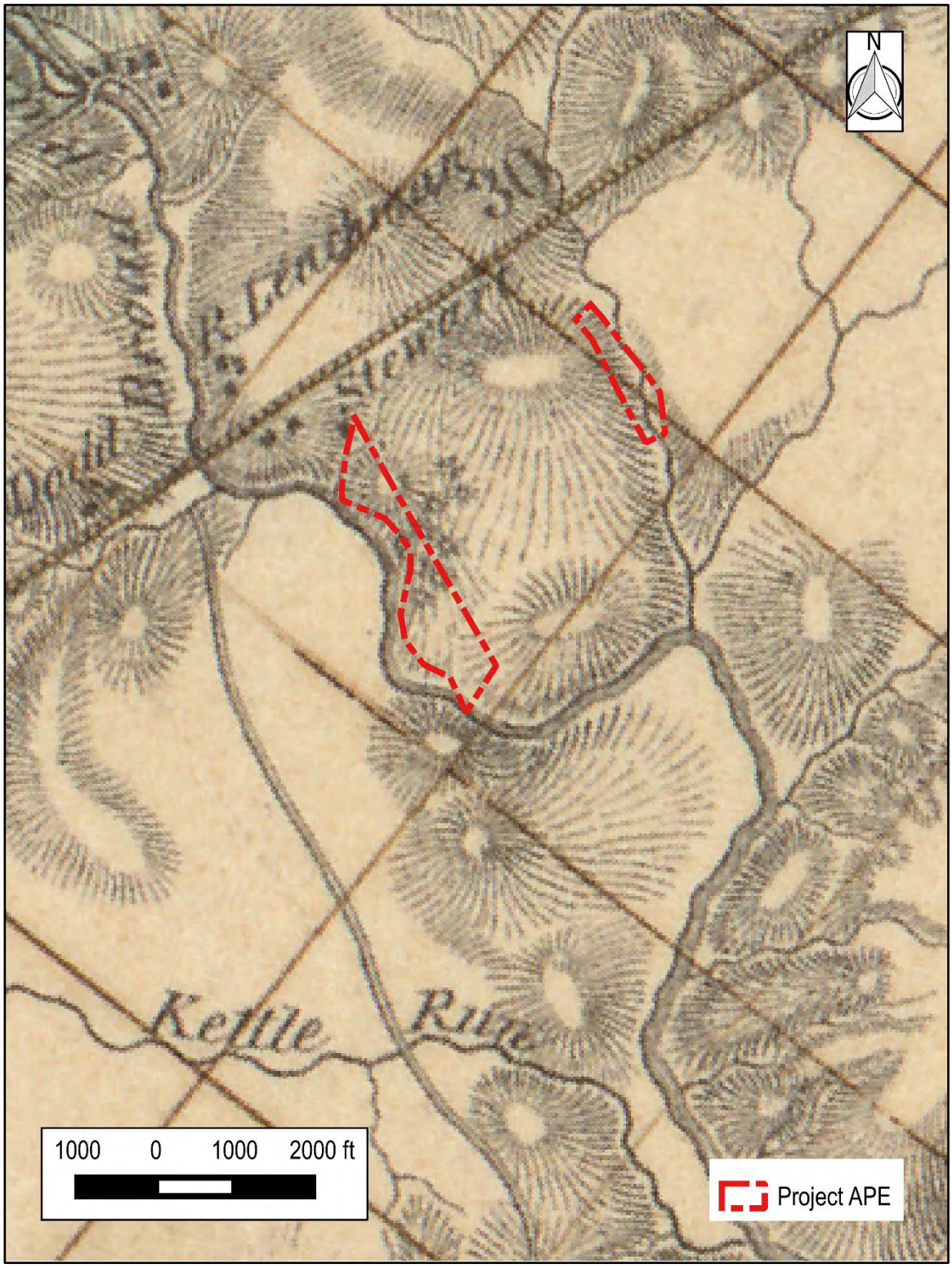


Figure 14. Approximate location of the LOD on the 1854 *Map and Profile of the Orange and Alexandria Rail Road.*

were able to resist the Confederate push to take the position until night fell. During the night the Union troops, out-numbered roughly 5 to 1 by Lee's Army of the Northern Virginia, withdrew from the position and moved on towards Manassas Junction. Subsequent movements saw the confederates advance to Manassas only to redraw and move back west.

The effects of the Civil War transcended simple property damage. Communities found themselves dealing with dead on the battlefield and wounded within their homes. In addition to stock and supplies requisitioned by both Confederate and Federal forces, farmers found themselves dealing with a profound shortage of labor, and land prices were depressed (McLearen *et al* 1995: 12).

Reconstruction and Growth (1865-1914)

Most of northern Virginia found itself economically depressed for decades following the Civil War, as the residents reclaimed their lands and rebuilt their lives and livelihoods. The population in the region continued to shift during this period, with additional families from the North moving into the area, while long time county residents moved further west (Ratcliffe 1978).

In the interior, small towns along transportation routes and surrounded by farms characterized this period. Excellent farmland and close proximity to urban areas helped the area prosper as an agricultural center. Farm practices were diverse, with some dairy production, cattle and poultry farming, fruit, vegetable and flower growing, and grain production. Established rail lines provided economical and reliable freightage into the urban markets to the east, a vital support to the rapidly developing dairy industry. By the beginning of the 20th century, the same rail lines provided commuter transportation into the federal centers at Washington and adjacent suburbs. Both Manassas and Bristow Station represent towns grown up around transportation routes, although Manassas was by far the more successful of the two.

World War I to Present

During most of the early twentieth century, Prince William County remained a primarily rural setting dependent on an agricultural economy. Industrial development was largely constrained to the major transportation hubs, and Federal involvement restricted to the eastern portion of the County. The Marine Base at Quantico was established in 1917, and expanded again during World War II.

By the second half of the 20th century, national trends in transportation improvement and settlement organization started to change the character of Prince William County. Although most of the county remained rural and agricultural into the 3rd quarter of the 20th century, improvement in the highway system worked to change Manassas and Woodbridge into commuter settlements focused on the Metropolitan D.C. area.

The project area appears to have remained agricultural until 1963. The first Manassas City Airport, a small airport closer to Manassas, was established in 1932 (Connell 1992). The airport was expanded at the location twice, and subsequent increase in the traffic motivated a proposal to relocate the airport in 1961. The present site, the former Ralph McDonald farm, was purchased in 1963. Harry P. Davis Field, consisting of a single 3700' paved runway, a maintenance hangar with limited office space, 30 "T-hangars", and a sewage treatment plant, opened in 1964.

Multiple improvements have been necessary since that time. A parallel 3700' taxiway was added in 1967, and measures to "strengthen the support" of both runway and taxiway were implemented in 1972. In 1973 an additional 276 acres (noted as the balance of the McDonald farm) was purchased for airport expansion. The eastern parallel runway and taxiway were begun in 1975 and completed in 1979, then extended in 1985. In 1980 the Manassas City Limits were expanded to include the airport. More property was acquired during the 1990s, and the airport continued to expand facilities through the 1980s and 1990s.

Results of Records Search

EAC/A conducted a search of both the physical site files and the VDHR DSS database to identify sites previously reported within the APE or within a two-mile radius (Table 1). This review identified 70 sites within the two-mile search radius, 14 of which are within or adjacent to the airport property. One site, 44PW729 falls just west of the present APE, which was adjusted early in the project planning process to insure a 20-foot buffer off the boundaries of the site. Subsequent development plans will ensure protection by placing temporary fencing along this buffer to ensure that construction, storage, or staging activities do not impact the site.

Sites previously reported in the vicinity are predominately historic, with 30 sites reported as solely historic components and an additional 16 sites reported with both prehistoric and historic components. Twenty-five solely prehistoric sites have been previously reported in the vicinity. Prehistoric occupation ranges from the Early, Middle, and Late Archaic, and the Early and possibly Middle Woodland, however most prehistoric sites reported are chronologically indeterminate. Functionally, most prehistoric sites have been classified as small temporary or ephemeral campsites, although 44PW0249 is specifically named as a seasonal base camp, and six other prehistoric sites are interpreted as smaller campsites, generally satellite procurement camps or possibly seasonal micro-fission camps. Based on chronologically classifiable sites, the Late Archaic Period appears to represent the period of most intense prehistoric utilization along Broad Run and its vicinity.

Prehistoric sites interpreted as larger camps are roughly evenly distributed between terrace or interior flat settings and ridge top settings. The one known base camp, and several of the larger campsites are located at confluences of major streams in drainage system, including confluences of Broad Run and its tributaries.

Historic sites span the 18th to 20th centuries. The most common period is the late 19th and early 20th centuries, although this may be biased by relatively intensive survey within the mid-to-late 19th century Bristoe Station settlement and battlefield just north of the APE.

Table 1. Archaeological resources within a two-mile radius of the APE.

Site Name &/or Number	Historic or Prehistoric	Description	Location	Comments
44PW0011	Prehistoric	Indeterminate Prehistoric	Interior flat	Interpreted as a small campsite or specialized tool production site. Assemblage reported as 10 quartz and quartzite flakes and one flake of an unidentified coarse grained igneous material.
44PW0012	Prehistoric and Historic	Archaic Woodland 18th Century 19th Century	Interior flat	Prehistoric component interpreted as a campsite. Prehistoric assemblage includes 2 Savannah River points, 2 generic side-notched points, 1 generic stemmed point, 1 broad bladed side-notched point, 1 quarry blank, 1 cord-marked sherd of shell tempered aboriginal ceramic, 1 knife or preform of chert, and quartz, quartzite and minimal chert debitage. The historic assemblage includes generic stoneware, and single examples of Buckley, tin-glazed earthenware, and pearlware. Specifically identified stonewares include a sherd of Rhennish and 4 Albany slip decorated sherds.
44PW0013	Prehistoric	Archaic- Middle	Interior flat	Interpreted as a small campsite. Assemblage reported as quartz and quartzite. 1 Halifax point, 1 generic side-notched point, 1 rough biface, and 8 flakes.
44PW0014	Prehistoric	Archaic- Late	Interior flat	Interpreted as a campsite. Assemblage reported includes 4 Savannah River and 1 Savannah River variant, 1 Kirk stemmed point, and 5 unidentified points and point fragments. Additional material included several knives and preforms, 5 cores and core fragments, 2 large core tools, 1 hammerstone, 1 FCR, and debitage of quartz, quartzite, felsite, and siltstone.
44PW0015	Prehistoric	Archaic- Late Woodland- Early	Interior flat	Interpreted as a campsite. Reported assemblage includes 1 Savannah River and 1 Piscataway point, 1 bifacial chopper, several bifaces, 2 unidentified points, and debitage of quartz, quartzite, chert, and rhyolite.
44PW0016	Prehistoric	Archaic Woodland	Interior flat at confluence of Kettle and Broad Runs	Large site, primarily surface collected. Assemblage includes knives, a steatite shard, blanks, cores, and presumably debitage. Diagnostic points include Stanly, Halifax, Savannah River, Piscataway, and Clarksville points.
44PW0027- Wakeman Site Cannon Branch Fort	Historic	19th Century- 3rd Quarter	Low terrace/hillslope	Earthenwork parapet with associated ditches, presumed Civil War.
44PW0249	Prehistoric	Middle Archaic	Ridge overlooking confluence of Cedar and Broad Run	Base Camp. Surface collection only. Assemblage includes quartz flakes, a rhyolite flake, a quartz flake tool, quartz debitage, and a quartz Halifax point.
44PW0431	Prehistoric and Historic	Indeterminate Prehistoric 19th Century 20th Century	Ridge	Prehistoric assemblage includes quartz and quartzite shatter, quartz and quartzite flakes, and one stemmed quartz projectile point. Historic assemblage includes cut nails, domestic glass, and several creamware sherds.
44PW0432	Prehistoric	Archaic- Early	Ridge	Assemblage is small, but includes both a quartz uniface and a fragment of a gray chert projectile point believed to be a Kirk-type point.

Site Name &/or Number	Historic or Prehistoric	Description	Location	Comments
44PW0433	Prehistoric	Indeterminate Prehistoric	Ridge	Assemblage is restricted to non-diagnostic quartz and quartzite debitage.
44PW0434	Prehistoric	Indeterminate Prehistoric	Ridge	Assemblage is restricted to non-diagnostic quartz debitage.
44PW0435	Prehistoric and Historic	Indeterminate Prehistoric Indeterminate Historic	Ridge	Prehistoric assemblage includes quartz debitage and one corner-notched quartz projectile point. Historic assemblage includes domestic glass and creamware.
44PW0436	Prehistoric	Indeterminate Prehistoric	Ridge	Two quartz flakes.
44PW0486	Historic	20th Century	Upland flat	Surface features include a stone cellar and a stone lined well. Artifact material is a light scatter only.
44PW0487	Historic	19th Century 20th Century	Upland flat	Site consists of ice house remains associated with a surviving late 18th/early 19th century farmhouse.
44PW0509	Prehistoric	Indeterminate Prehistoric	Ridge	Assemblage includes quartz and quartzite debitage, one quartz general biface, and one piece of FCR.
44PW0510	Prehistoric and Historic	Woodland 19th Century- 4th Quarter 20th Century- 1st Half	Interior flat	Ephemeral Camp. Prehistoric assemblage includes one quartz Yadkin triangle point, a basalt flake, a possible quartzite core, and a quartzite tested cobble. The historic assemblage includes domestic glass, machine made brick, lead, and two unidentified ceramic sherds.
44PW0511	Historic	19th Century- 2nd Half 20th Century- 1st Half	Interior flat	Historic farm complex and associated artifact scatter.
44PW0600	Prehistoric and Historic	Archaic- Late Woodland- Early 18th Century- 2nd Half 19th Century- 1st Half	Low terrace on Broad Run	Prehistoric component interpreted as a multi component campsite, the historic component as domestic remains. Prehistoric assemblage includes a partial hafted Middle Woodland biface, FCR, a steatite bowl fragment, a sherd of shell tempered aboriginal ceramic, and debitage of quartz, quartzite, chert, and jasper. The historic assemblage includes hand made nails, hand made brick, cut nails, creamware, and painted pearlware.
44PW0601	Prehistoric	Indeterminate Prehistoric	Low terrace on Broad Run	Interpreted as an ephemeral camp. Assemblage includes a partial hafted biface and debitage of quartz, quartzite, and "metavolcanic" material.
44PW0602	Prehistoric	Indeterminate Prehistoric	Ridge	Ephemeral camp. Assemblage restricted to non-diagnostic quartz and quartzite debitage.
44PW0603	Prehistoric	Indeterminate Prehistoric	Low terrace on Broad Run	Interpreted as an ephemeral camp. Assemblage includes FCR and debitage of quartz, chalcedony, and "metavolcanic" material.
44PW0604	Prehistoric	Indeterminate Prehistoric	Low terrace on Broad Run	Interpreted as an ephemeral camp. Assemblage includes 3 pieces of quartz and metavolcanic debitage.
44PW0729	Prehistoric	Archaic- Middle Woodland	Low terrace on Broad Run	Interpreted as campsite, explicitly noted as retaining subsurface integrity. Assemblage includes a possible Rossville or Morrow Mountain hafted biface, 1 cord-marked shell-tempered aboriginal sherd, 1 shell-tempered sherd, 1 sand and grit tempered sherd, 7 FCR, and debitage of quartz, quartzite, and metavolcanic material.

Site Name &/or Number	Historic or Prehistoric	Description	Location	Comments
44PW0866	Prehistoric	Indeterminate Prehistoric	High terrace/toe slope	Assemblage restricted to non-diagnostic quartz debitage.
44PW0867	Prehistoric	Indeterminate Prehistoric	Low terrace on Broad Run	Tentatively identified as a campsite. Assemblage includes rhyolite and quartz debitage, a possible cobble tool or FCR, and FCR.
44PW0868	Prehistoric	Indeterminate Prehistoric	Toe slope	Prehistoric assemblage recovered from seven positive test locations, primarily non-diagnostic quartz debitage, and one biface base.
44PW0869	Prehistoric	Indeterminate Prehistoric	Low terrace on Broad Run	1 quartz flake and several pieces of FCR.
44PW0870	Prehistoric	Indeterminate Prehistoric	Low terrace on Broad Run	Artifacts noted as recovered from the interface of "recent flood deposits and a truncated B Horizon". Assemblage includes a large quartzite core utilized as a scraping tool, a quartzite core, and quartz and quartzite debitage.
44PW0971	Prehistoric and Historic	Archaic 19th Century-2nd Half	Ridge	No description of prehistoric assemblage. Historic component is major component, representing five clusters believed to be associated with a Civil War encampment.
44PW0977	Prehistoric	Indeterminate Prehistoric	Ridge	Ephemeral Camp. Total of four quartz flakes.
44PW0978	Prehistoric and Historic	Indeterminate Prehistoric 19th Century	Ridge	Prehistoric assemblage included 22 flakes, primarily quartz (also quartzite and chert), and a possible Halifax projectile point fragment. Historic component may be associated with Civil War period, includes both architectural and domestic materials.
44PW0979	Prehistoric and Historic	Indeterminate Prehistoric 19th Century	Toe slope	Prehistoric assemblage consists of five flakes. Historic assemblage dates primarily to the first half of the 19th century, including both domestic and architectural materials.
44PW0980	Prehistoric and Historic	Indeterminate Prehistoric 19th Century	Hillslope	Densest portion of the historic scatter may represent an early to mid-19th century tenant farm.
44PW1107	Historic	19th Century- 4th Quarter 20th Century- 1st Quarter	Ridge	Yard deposits associated with a surviving turn of the century residence. Located within the Bristow Battlefield and the recovered assemblage included Civil War era glass and grape shot.
44PW1110	Prehistoric and Historic	Archaic- Middle 19th Century- 3rd Quarter	Hillslope	Prehistoric component described as a camp, with "later domestic stuff". Located within the Bristow Battlefield.
44PW1111	Historic	19th Century- 4th Quarter	Hillslope	Identified on the basis of a surviving hand pump.
44PW1112	Historic	20th Century- 1st Quarter	Hillslope	Robertson Cemetery.
44PW1113	Historic	19th Century- 2nd Half 20th Century- 1st Quarter	Hillslope	Artifact scatter surrounding the Robertson Cemetery. A "wide scatter of 19th century artifacts with a few Civil War period artifacts.
44PW1114	Historic	19th Century- 2nd Half 20th Century- 1st Quarter	Upland flat	Trash scatter.

Site Name &/or Number	Historic or Prehistoric	Description	Location	Comments
44PW1115	Prehistoric and Historic	Indeterminate Prehistoric 19th Century- 4th Quarter 20th Century- 1st Quarter	Knoll	Trash scatter adjacent to existing structure.
44PW1116	Historic	19th Century- 3rd Quarter	Hillslope	Military camp, no further information provided.
44PW1117	Historic	19th Century- 3rd Quarter	Interior flat	Military camp, no further information provided.
44PW1118	Historic	19th Century- 2nd Half	Interior flat	Trash scatter.
44PW1119	Historic	19th Century- 4th Quarter 20th Century- 1st Quarter	Hillslope	Trash scatter.
44PW1120	Historic	19th Century- 3rd Quarter	Low terrace/interior flat	Reputed Civil War cemetery. Currently only two markers and many unmarked sinks, local history reports more markers present prior to the 1980s.
44PW1234-Bristow Battlefield Cemetery 2	Historic	19th Century- 3rd Quarter	Low terrace/interior flat	Located using a combination of infrared thermal imaging and metal rod probing.
44PW1246-Brentville Historic Center	Prehistoric and Historic	Indeterminate Prehistoric 19th Century	Upland flat	Early 19th century to early 20th century settlement with intact stratified deposits.
44PW1247-Brentville Historic Center 2	Historic	19th Century 20th Century	Ridge	Includes trench features which may be either Civil War entrenchments or mining pits.
44PW1336-Lucaville 1	Historic	19th Century-2nd Half 20th Century-1st Half	Interior flat	Site appears to represent a small field scatter, with two whiteware sherds and two late 19th-early 20th century bottle glass sherds.
44PW1337-Lucaville 2	Prehistoric	Indeterminate Prehistoric	Interior flat	Site represents one positive STP producing 4 quartz flakes.
44PW1338-Lucaville 3	Historic	20th Century	Interior flat	Yard deposits adjacent to a 20th century structure.
44PW1339-Lucaville 4	Historic	20th Century	Upland flat	Yard deposits adjacent to a 20th century structure. Several structures were relocated to this location in the 1930s.
44PW1340-Lucaville 5	Historic	19th Century	Upland flat	Site represents one positive STP producing 2 dark green bottle sherds, one nail fragment, and 4 clinker.
44PW1393	Historic	19th Century 20th Century	Low terrace/toe slope overlooking Broad Run	Site includes a concrete structure pad over possible older structure remains. An early county survey also noted the presence of the Lipscomb family cemetery. The recovered assemblage includes both architectural and domestic materials recovered in disturbed contexts.
44PW1623	Prehistoric and Historic	Archaic- Late 19th Century- 2nd Half	Ridge	Prehistoric component is a light scatter of debitage but also includes steatite bowl fragments. Historic component is a possible Union Battery emplacement and camp.
44PW1624	Prehistoric and Historic	Archaic- Late 19th Century- 2nd Half	Hillslope	Prehistoric component is probably from ephemeral campsite, historic component appears to be a residential concentration.

Site Name &/or Number	Historic or Prehistoric	Description	Location	Comments
44PW1625	Prehistoric and Historic	Archaic 18th Century- 4th Quarter 19th Century- 1st Half	Ridge	Prehistoric component is an ephemeral camp, historic component is a trash scatter dating from several periods in the 19th century.
44PW1626	Historic	20th Century	Interior flat	Trash scatter associated with a standing structure.
44PW1627	Historic	20th Century- 1st Half	Hillslope	Trash scatter.
44PW1629	Prehistoric	Indeterminate Prehistoric	Low terrace/toe slope	Ephemeral Camp. One jasper flake and five quartz (secondary) flakes.
44PW1630	Historic	19th Century- 2nd Half	Low terrace/toe slope	Trash scatter, possibly associated with Union occupation during the Battles of Bristoe Station.
44PW1631	Historic	19th Century- 4th Quarter 20th Century- 1st Quarter	Hillslope	Trash scatter, primarily architectural.
44PW1632	Historic	19th Century	Hillslope	Trash scatter of cut nails.
44PW1633	Historic	19th Century- 1st Half	Knoll	Residential concentration including bottle glass and architectural debris.
44PW1634	Historic	19th Century- 4th Quarter	Hillslope	Trash scatter, possibly associated with Union occupation during the Battles of Bristoe Station. Also yielded a stemmed quartz projectile point.
44PW1635	Historic	19th Century- 4th Quarter 20th Century- 1st Quarter	Hillslope	Trash scatter.
44PW1643	Prehistoric	Woodland- Early	Ridge overlooking Broad Run	Ephemeral camp, revisited. Assemblage includes quartzite flakes, quartzite debitage, quartz flakes, and a Bare Island point.
44PW1644	Historic	20th Century- 2nd Quarter 20th Century- 2nd Half	Ridge	Artifact scatter associated with circa 1930s to 198-s farmstead.

A review of VDHR historic resources files identified 51 resources within a two-mile radius of the APE (Table 2). Only one of these resources, The Manassas Station Operations Battlefield District (076-5036), actually extends to within the project APE. Twenty-four of these resources have already been determined not eligible for listing on the National Register. Only one reported resource predates the nineteenth century (076-0149). Four resources date to the early nineteenth century (076-0014, 076-0148, 076-5399, and 155-5024), including the former Orange and Alexandria Railway, now part of the Norfolk Southern rail system. Twelve reported resources date to the mid and late nineteenth century, although this number includes two overlapping Civil War battlefield listings (076-0024 and 076-5036) and the multiple resource Village of Bristow Historic District (076-5344). Thirty resource date from the twentieth century, with half of those constructed after 1940.

The majority of reported resources are residential structures or surviving farm complexes. Two are associated with the railroad, and a third is related to mid-twentieth century communication development. One church is represented. Several family cemeteries are reported with their associated farmsteads.

Overall, this represents the development of the project vicinity primarily after the arrival of the Orange and Alexandria Railway in 1851. The railway provided transportation for agricultural goods east towards Washington, and eventually provided commuter transportation from Washington to the minor residential development which centered around Bristoe Station on the line.

A review of previous surveys on file at the VDHR archives identified seven previous cultural resources studies conducted on airport property (McLearen 1978, Smith 1978, Thomas 1981, Deitrick and McDaid 1994, McLearen *et al.* 1995, Cultural Resources, Inc. 2001, and Harris 2009). The Prince William County Archaeologist identified two additional studies conducted at the county level (Mullens 2005 and Laird and Fesler 2005) (See Figure 4). The two 1978 studies represent a Phase I survey and the subsequent Phase II investigation by Southside Historical Sites, Inc., covering those portions of the airport north of the bend in Broad Run (McLearen 1978, Smith 1978). The survey phase consisted primarily of walk-over and surface collection in well-plowed fields, although subsurface excavation was carried out once artifact concentrations were defined by surface collection. Six such artifact concentrations were initially identified, but only five were considered worthy of further investigations (Area 6 consisted of an isolated Vernon point with a single flake). The other five concentrations represent sites 44PW0011 through 44PW0015, a small tool-production camp, a multi-component possible residential campsite and 18th and 19th century historic site, a small Middle Archaic campsite, a Late Archaic possible residential campsite, and a Late Archaic and Early Woodland campsite, respectively. The subsequent Phase II evaluation study (Smith 1978) examined the five sites and determined that further study would not be likely to yield significant new information. This survey included the eastern survey area, although no physical testing appears to have been conducted at that time, in the area described as the wooded fringe along the creek.

Table 2. Historic resources within a two-mile radius of the APE. (National Register Listed resources in bold typeface) (Resources within Districts not listed separately).

VDHR number	Resource Name	Date	Type	Comments
076-0013	Bristow Manor/ Wellfly	1900	Farm complex	
076-0014	**Moor Green**	**c.1800**	**Residence**	**Brick on stone farmhouse with barn and smoke house.**
076-0024	Bristoe Battlefield	1861-1863	Military	Expanded boundaries include the northern portion of the Manassas Regional Airport. 1,162 acres representing the location of the August 17, 1862 engagement between Hooker and Jackson, and the October 14, 1863 Battle of Bristoe. There are 54 non-contributing late 19th through 20th century structures within the boundaries, four within the review radius which have individual VDHR listings. There are also two cemeteries. Files list its status as "VLR listing removed", now listed under 076-5344.
076-0148	Boardman/Fostern	c.1825	Residence	Surviving resources include a slave cemetery.
076-0149	Bloom Hill Farm	c.1780	Residence	Recommended eligible for listing on the NRHP. Also appears under 44PW487.
076-0245	**Davis-Beard House**	**1870**	**Residence**	**Part of the Bristoe Battlefield district under 076-0024-0004, also under 076-5344**
076-0285	W.J. Thomasson House and Barn	c. 1900, 1929	Farm complex	Determined eligible.
076-0294	Carr Family Cemetery	1908, c.1920	Cemetery	Associated farm complex in ruins. Also known as 076-0024-0031 and 44PW981.
076-0584	10815 Milford Road	1900, c.1940, c.1980	Residence	Also known under 076-0024-0013 and 076-5344.
076-0598	10708 Bristow Road	1940, c.1980	Farm complex	Also known under 076-0024-0001 and 076-5344.
076-0599	10710 Bristow Road	1890	Farm complex	Also known under 076-0024-0001 and 076-5344
076-0601	10721 Milford Road	1870, c. 1940	Farm complex	Also know under 076-0024-0012
076-0604	10823 Bristow Road	1960,	Residence	Also known under 076-0024-0009 and 076-5344.
076-0607	10604 Bristow Road	1900, c. 1950-1960	Farm complex	Also known under 076-0024-001
076-0609	10106 Piper Lane	1900	Residence	

VDHR number	Resource Name	Date	Type	Comments
076-0611	10204 Piper Lane	1900	Residence	
076-0612	10115 Linton Hall Road	1900	Residence	Found not eligible
076-0614	11712 Nokesville Road	1940	Farm complex	Found not eligible
076-0615	11812 Nokesville Road	1945	Residence	Found not eligible
076-0616	11909 Nokesville Road	1940	Transportation, commercial	Service Station. Found not eligible.
076-0658	10215 Linton Hall Road	1900, c. 1940-1950	Residential	Also known as 44PW1773. Found not eligible
076-5036	Manassas Station Operations Battlefield (Bristoe Station Battlefield, Bull Run Bridge, Kettle Run Battlefield,Union Mills)	1862	Military	Listed as potentially eligible. Also known as 076-5168.
076-5042	Conner Farm	1904	Farm complex	Found not eligible.
076-5043	9550 Godwin Drive	1925	Residence	Found not eligible
076-5044	Hersch Farm	1900	Farm complex	Found not eligible
076-5073	Robertson Cemetery	1878	Cemetery	Also known as 076-0024-0029 and 076-5344, 44PW1112.
076-5099	Kline House	c.1860	Farm complex	Found not eligible.
076-5100	WKDV Transmitter Site	1965	Technology. Communications	Found not eligible.
076-5146	11009 Bristow Road	1880, c. 19801	Farm complex	Farm in ruins. Also known as 076-0024-0011.
076-5288	de Gastyne House	1907	Residence	
076-5344	Village of Bristow Historic District	1870	Historic District	Railroad/crossroad community dating to the late 19th century.
076-5395	Blue Grass Acres Farm	1906, c. 1940	Farm complex	
076-5397	Hersch House	1915	Residence	Includes former kennel and workshop. Found not eligible.
076-5398	Outbuilding, 9850 Chevalle Road	1900	Domestic	Found not eligible.
076-5399	Orange and Alexandria Railway	1851	Railroad	This section evaluated and found not eligible
155-5020	**Cannon Branch Fort/ The Wakeman Site**	**1863**	**Military**	**Also known as 076-5168, 44PW0227. Civil War earthworks.**
155-5022	10034 Dean D	1890	Residence	Found not eligible

VDHR number	Resource Name	Date	Type	Comments
155-5024	Cemetery Foster Drive	1850	Cemetery	Found not eligible.
155-5025	Cannon Branch Cemetery	1896	Cemetery	Found not eligible
155-5026	Railroad Utility Building Godwin Drive	1950	Railroad	Found not eligible
155-5027	10017 Nokesville Road	1945	Residence	Found not eligible
155-5028	10021 Nokesville Road	1945	Residence	Found not eligible
155-5030	Oakwood	1960	Residence	Found not eligible
155-5031	10033-10035 Nokesville Road	1952	Residence	Found not eligible
155-5032	The Manassas Church of the Brethren (Current)	1950, 1960s, 1980s	Religious	Found not eligible.
155-5033	10053 Nokesville Road	1960	Residence	Found not eligible
155-5034	Prince William Animal Hospital	1950	Residential	Converted to commercial. Found not eligible.

MAAR's 1981 study consisted of a limited Phase I survey of a small area along Little Bull Run roughly 7 miles north of the airport property, intended as the installation location of an Outer Marker locator for the airport (Thomas 1981). No archaeological resources were identified.

Phase I survey was conducted in 1994 prior to proposed improvements at the airport to add helicopter facilities (Deitrick and McDaid 1994). The Deitrick and McDaid survey falls within the western survey area in the APE. This study incorporated surface inspection and subsurface testing of a roughly 10 acre portion of the western airport property, and identified one site: 44PW0729. This site was interpreted as a revisited ephemeral campsite utilized from the Middle Archaic to the Late Woodland, and considered potentially eligible for listing on the NRHP. The past project was redesigned to avoid the site, and no further work was conducted at this location. The present project has also been redesigned to avoid this site.

The 1995 Phase I survey by the Archaeological Research Center of Virginia Commonwealth University covered a large parcel south of the present project APE, in Prince William County (McLearen *et al.* 1995). The survey identified five archaeological sites: 44PW0866 to 44PW0870. All appear to represent small transient campsites, from indeterminate prehistoric occupations. None of the sites were considered potentially significant, and no further work was recommended.

Additional Phase I study was conducted for the airport in advance of proposed connector road northeast of the airport proper (Cultural Resources, Inc. 2001). This survey consisted of surface reconnaissance, and subsurface testing of a 2,900' portion of the proposed alignment. No archaeological resources were identified.

The final survey conducted within the airport consisted of work conducted by EAC/Archaeology in 2008 in advance of the proposed extension of Runway 16L/34R and Taxiway B. This study examine 53 acres of the airport along the proposed extension and including proposed drainage improvements and signaling changes. The study identified three isolated finds: one isolated quartz flake, two out of context rhyolite flakes, and one undecorated whiteware sherd, and several instances of modern material. It also documented large amounts of soil disturbance and twentieth century fill around and under the existing runway and its drainage system

One County level compliance study was conducted within the present APE (Mullens 2005). This survey was conducted by Thunderbird Associates, Inc. in 2005 in advance of proposed development of the Glen-Gery Brick property, a 120-acre tract which included the eastern survey area. Archival research conducted for the study determined that significant portions of the project tract had been historically used for clay mining and retained no potential for intact archaeological resources, therefore physical testing was restricted to the undisturbed portions of the low rise and terrace west of Cannon Branch (including the present eastern survey area. The 22 test location excavated during the survey recovered one quartzite flake and one hornfels flake, but identified no archaeological sites.

Three additional cultural resources studies were conducted in the immediate project vicinity as part of extensive study associated with the Route 234 Bypass Project: Phase II and Phase III studies at the Moor Hoff Farm (44PW0600) a multi-component prehistoric and historic site (Higgins and Downing 1996, Pullins and Downing 1998) and a Phase I supplementary study (Rinehart 1999).

Work at the Moor Hoff site focused on both the prehistoric (Middle Archaic through Late Woodland) and the historic component (late 18th to mid-19th centuries). Site 44PW0600 was considered pertinent to the present study not only due to proximity, but also because its low terrace setting along Broad Run is similar to the much of the present project area. Phase II determined that the site retained subsurface deposits and at least one major historic subsurface feature (Higgins and Downing 1996). Phase III study determined that the prehistoric component rested within a deflated soil context with Middle Archaic and Late Woodland materials carried within a 15 cm stratigraphic zone (Pullins and Downing 1998). However, the historic component proved quite fruitful, retaining features and deposits associated not only with the main Foster residence, but also a blacksmith shop, a detached kitchen, a combined slaves quarter and workshop, and a cemetery.

The smaller supplemental Phase I of a proposed Route 234 access road was conducted just northeast of the present project area, and in part reinvestigated site 44PW0602. The survey consisted of surface inspection and subsurface testing (Rinehart 1999). Rinehart's study of 44PW0602 confirmed the site as a low density lithic scatter, which he dated to the Early Archaic and Early Woodland. As all cultural material was recovered from mixed plowzone context, the site was determined not eligible for listing on the NRHP, and no further work has been conducted at this location.

In 2005 the James River Institute for Archaeology, Inc. conducted a Phase I survey of 150 acres of the 183-acre Airport Gateway tract (Laird and Fesler 2005). This study consisted of subsurface survey and identified one small prehistoric lithic scatter and a small twentieth century artifact scatter, as well as 13 "archaeological locations" consistent of single or double artifacts finds below

the threshold of site density in under VDHR guidelines. Most, but not all, of these isolated finds consisted of prehistoric debitage. Where isolated historic artifacts were recovered the material was nondiagnostic material consistent with field scatter. Both archaeological sites identified were sparse and restricted to the plowzone, and neither was considered eligible for listing on the National Register. No further work was recommended for either site.

The most recent archaeological survey in the project vicinity was the 2013 William and Mary Center for Archaeological Research (WMCAR) survey for the proposed Virginia Rail Express Broad Run Parking Expansion (Higgins and Hanbury 2013). This survey examined roughly 4 acres of the larger 13-acre APE, the majority of which was covered by existing paving. The survey included both subsurface testing and metal detector survey. WMCAR identified four archaeological locations, no archaeological sites, and extensive disturbance of the survey area associated with the 1991 construction of the existing facilities. No further archaeological study was recommended.

3. RESEARCH DESIGN AND METHODOLOGY

Objectives

This investigation sought to determine the presence or absence of previously unrecorded archaeological resources within the survey area. These objectives are consistent with state and federal guidelines pertaining to identification (Phase I) surveys.

Archival and Background Research

Cartographic and archival research was conducted as part of these investigations. Research was conducted at the National Archives in College Park, Maryland; the Library of Congress; the Fairfax County Public Library; the Bull Run Regional Library and its Ruth E. Lloyd Information Center, and the Central Branch of the Prince William County Public Libraries; and the archive and DSS server of the Virginia Department of Historic Resources. Additional information concerning county level survey work was supplied by the office of the Prince William County Archaeologist.

The general history of the region was reviewed to determine historical trends and influences upon the project area. The impact of local, state, regional and national events and trends on the project area was considered. Previous archaeological research conducted in the project vicinity was reviewed and evaluated. Information was reviewed pertinent to sites within a two-mile radius of the project area.

Field Methods

As previously discussed, subsurface testing was restricted to apparently undisturbed portions of the western survey area not subject to previous archaeological survey. To determine the presence or absence of archaeological deposits, field investigations in this area consisted of the systematic excavation of shovel test pits (STPs). STPs were placed along transects established using an optical sight compass and a fiberglass tape, based on datum points established and measured in using a Leica DTM-520 Total Station. Testing was conducted at a 15-meter (50-foot) test interval. Tests containing modern material, while considered positive, were not surrounded by additional testing.

Due to presence of a substantial area previously tested by Deitrick and McDaid in 1994, field testing was conducted as two discontinuous clusters of test, utilizing two grids. The northern grid included the apparently undisturbed area in the central portion of the western survey area, north and west of the administrative building complex. The datum for this grid (N0E0) was located off the northwestern corner of the Manassas Aviation structure.

The southern grid was restricted to the forested area south of the Deitrick and McDaid survey boundaries. The datum for this grid was established at the west edge of Observation Road at the north end of the current cul de sac, and the grid carried 30-meters north and 45-meters west to bring it into the survey area.

A total of 54 test locations were excavated during the field survey. All testing conducted is discussed and illustrated in Chapter 4 of this report. STPs measured approximately 40 centimeters (cm) in diameter and extended approximately 10 cm into sterile subsoil where not prevented by a high water table or compact gravel matrix.

All excavated soil was screened through 1/4-inch hardware cloth for artifact recovery. Each shovel test was recorded on a standardized recording form, which included provenience, setting, soil texture and color. Recovered artifacts were placed in bags labeled with provenience information, although some modern materials were discarded in the field.

After subsurface survey was completed within the western survey area, a metal detector survey was completed within undisturbed portions of the western survey area and the eastern survey area. The metal detector survey in the western survey area utilized the already existing transects marked for the subsurface survey, and worked at 25-foot intervals within this grid. A second 50-foot grid was established in the eastern survey area, aligned to Wakeman Drive on the western boundary, and again worked at 25-foot intervals. Areas of modern dumping with multiple metallic items present, primarily adjacent to the sewer right-of-way and at the northern end of the eastern survey, where excluded as this material would mask readings and removal of the material was not within the scope of this study.

Initial metal detecting was done east-west starting in the south and working north. Once this was completed the survey was repeated moving north-south beginning in the south, providing intensive coverage on the 25-foot grid. In the relatively undisturbed eastern survey area, areas that would be more suitable to military camp or emplacement use were tested for a third time; these area included the spring, the top of the rise, and the area around the recovered horseshoe.

Positive readings were flagged, and a second crew member excavated and proofed positive signal finds. Metal detector finds were mapped initially using the 25-foot grid as a data backup and so that artifact "hotspots" could be identified in the event something of substance was found. All finds were subsequently remarked using a handheld Trimble GPS unit to record accurate Universal Transverse Mercator (UTM) coordinates for each find. Reported accuracy varied between 15 and 30 inches depending on signal reception.

Laboratory Methods
Artifacts collected during the Phase I investigation were washed and catalogued in accordance with the current state guidelines (VDHR 2011). As only three pieces of modern material and four pieces of nondiagnostic coal were recovered, it is anticipated that the small collection recovered during this project will not be retained for conservation at any facility. The full artifact catalog is presented as Appendix II. Artifact catalogs were compiled using the SHARD (Sonoma Historic Artifact Research Database) developed by the Anthropological Studies Center at Sonoma State University and the Society for Historical Archaeology.

Expected Results
Given the large number of previously registered prehistoric sites previously noted in the project vicinity, including 44PW729 adjacent to the APE, it was anticipated that a number of small lithic scatters or short term camps sites may have existed in the APE. However, extensive previous disturbance in the western survey area reduced the potential for surviving archaeological resource. It was anticipated that the primary potential for prehistoric resource consisted of additional materials associated with 44PW729 might be found in the northern grid.

Archival research identified limited early historic development north of study area, mid-nineteenth century development of rural farmsteads to the northwest, and with the Civil War engagement at Bristow Station west of the project area. It was anticipated that there was a moderate potential for historic resources associated with these developments within the survey area. Based on troop movement reconstructions and field of fire analysis presented in Jacobs *et al.* 2016, it is anticipated that the greatest potential for historic resources within the project APE is associated with the 1863 Battle of Bristoe Station, and would be restricted to the northern portion of the airport. Specifically, the analysis in Jacob *et al.* suggests that potential shelling debris from the Confederate A.P.Hill, McIntosh and Graham emplacements, and firing debris and personal items from Poague's forward movement (Confederate), and from the position and movement of the Federal 2nd Corps may be expected in at least the northern portion of the western survey area. One map available for review but not reproduction indicated that a Union battery manned by Ricketts' troops may have been adjacent or extended into the eastern survey area (Cope 1863), and a moderate potential for associated material was anticipated there as well.

4.0 FIELD RESULTS

As noted before, the project APE consists of multiple discontinuous areas of proposed impact. The western survey area includes large areas with clearly observable signs of disturbance and large areas of paving which precluded testing, as well as the area of the previous Deitrick and McDaid archaeological survey (1994). Survey testing in the western survey area included both subsurface excavation and metal detector survey. The eastern survey area was included in both the 1978 McLearen study and the 2005 Mullens study, although only the later conducted subsurface excavation testing. Only metal detector survey was conducted within the eastern survey area.

The Western Survey Area
Subsurface testing in the western survey area utilized one grid oriented true north, with two testing areas distinguished by the reference datum used to measure displacement (Figure 15). Test location in the northern grid were designated by displacement north and east from a datum just off the northwest corner of the Manassas Aviation building (Figure 16). Test locations in the southern

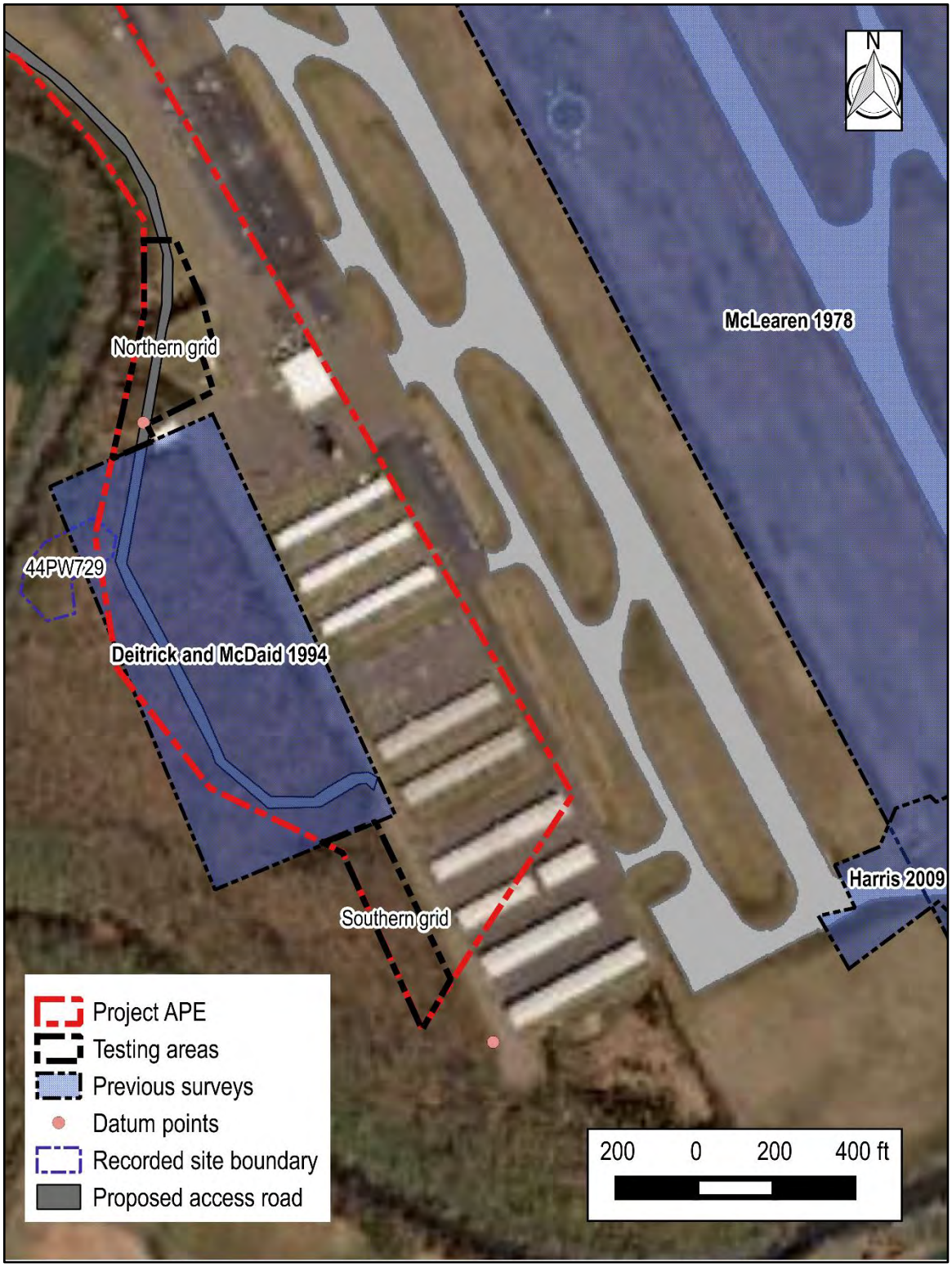


Figure 15. Western Survey Area, undisturbed testing areas.

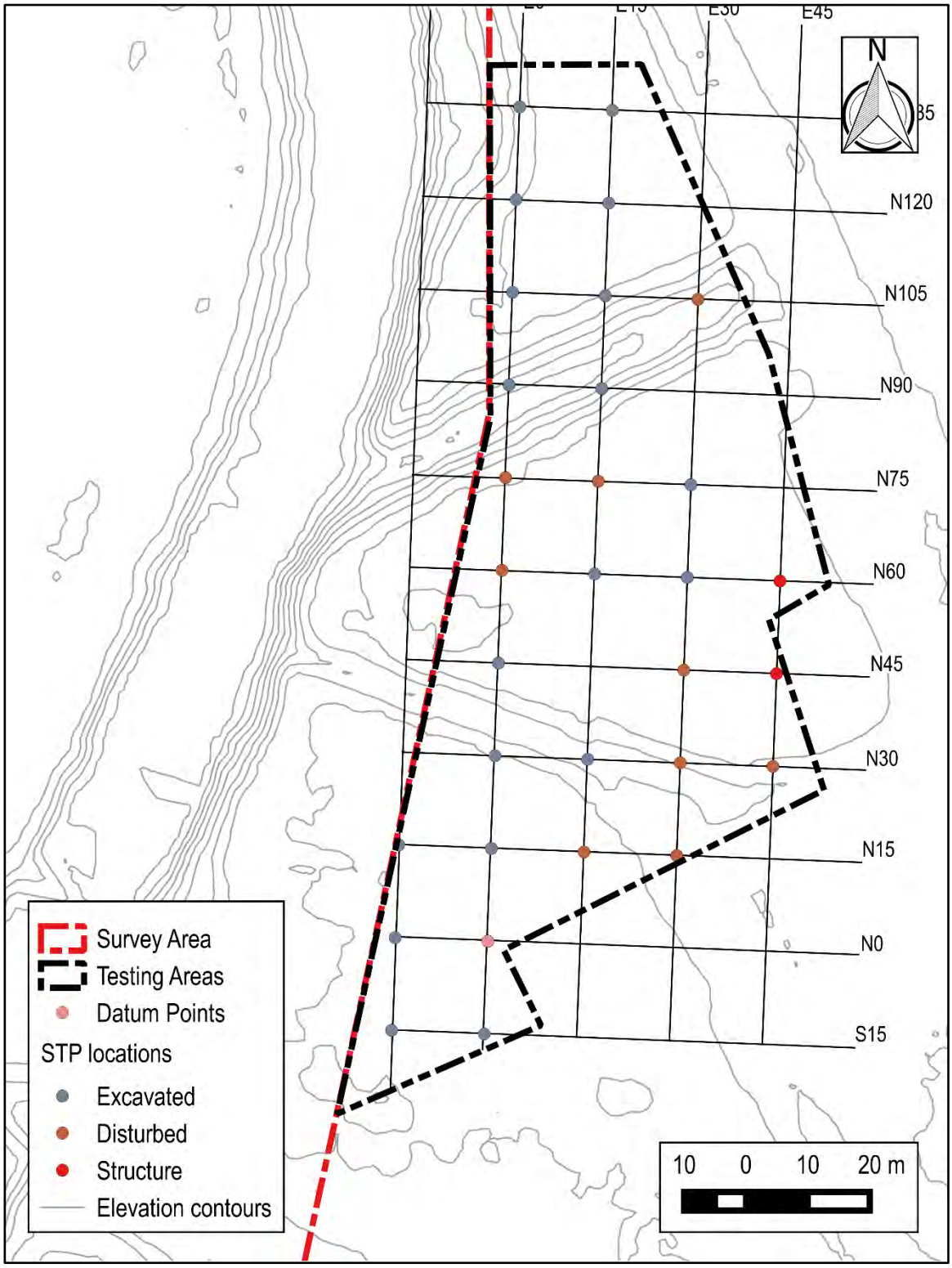


Figure 16. Testing locations within the northern grid.

grid were designated by displacement north and west from a datum on the west side of Observation Road at the north edge of the existing cul de sac (Figure 17).

Testing on the northern grid included 30 proposed test locations, 11 of which were not excavated either because of surface evidence of disturbance (including utilities marking) or where located under existing pavement or structures (Figure 16). Of the 19 test locations excavated, nine more showed clear evidence of disturbance in the excavated soil profile, indicated by soil mixing in lower subsoil layers or substratum found directly below the surface layer (Figure 18 A). Past soil disturbance is primarily concentrated along the W15 and E0 transects, especially in the north of the grid. As historic maps depicting topographic relief within the APE (Faul 1854, USGS 1944) indicate that the northwestern portion of the APE encompassed a small knoll (Faul 1854) or a low rise (USGS 1944) which is no longer present, it is anticipated that significant erosion or twentieth century grading has resulted in truncated soil profiles in this area.

Typical undisturbed soil profiles reflect a thin surface plowzone directly over subsoils (Figure 18 B). The Layer I plowzone was typically a brown to yellowish brown silt loam or loamy clay which ranged from 4 to 9 centimeters in depth. Layer II was a silty clay or clay light yellowish brown or pale brown in color, or occasionally a reddish brown. Where subsoil was not present, the surface Layer I plowzone appears to rest on deeper subsoil or substratum matrix, which highly mottled soils of gray and yellowish brown or brownish yellow clays.

Four test locations produced cultural material from test excavations within the northern grid. N30E0 and N45E0 each produced a single fragment of a pink glazed floor or wall tile, S15W15 produced a single piece of clear container glass from it disturbed second excavation level, and N0W15 produced four coal fragments from its disturbed second excavation level.

The metal detector survey conducted within the northern grid identified nothing but modern materials including foil wrappers, bottle caps, beverage cans and pull tabs, and a small collection of coins ranging from 1967 to 1986. These materials were primarily found in the exposed lawn areas rather than the woodland (Figure 19).

Testing within the southern grid of the western survey area consisted of 22 test excavation locations, one of which was not excavated due to surface evidence of disturbance (Figure 17). Soil profiles within the southern grid exhibited little evidence of past soil disturbance beyond some possible erosion (Figure 20). The typical soil profile was a surface plowzone of brown to dark yellowish brown silt loam ranging from 4 to 14 centimeters in depth. Layer II was a upper subsoil, either a yellowish brown to brownish yellow silt loam, and was not present in all test excavation suggesting that past plowing has completely incorporated the upper subsoils in some area, probably due to past erosion. Layer III was a lower subsoil zone of strong brown to yellowish red silty clay or clay loam. or mottled gray and yellowish brown silty clay to clay. The southern grid within the western survey area produced no cultural material, either from test excavations or the metal detector survey.

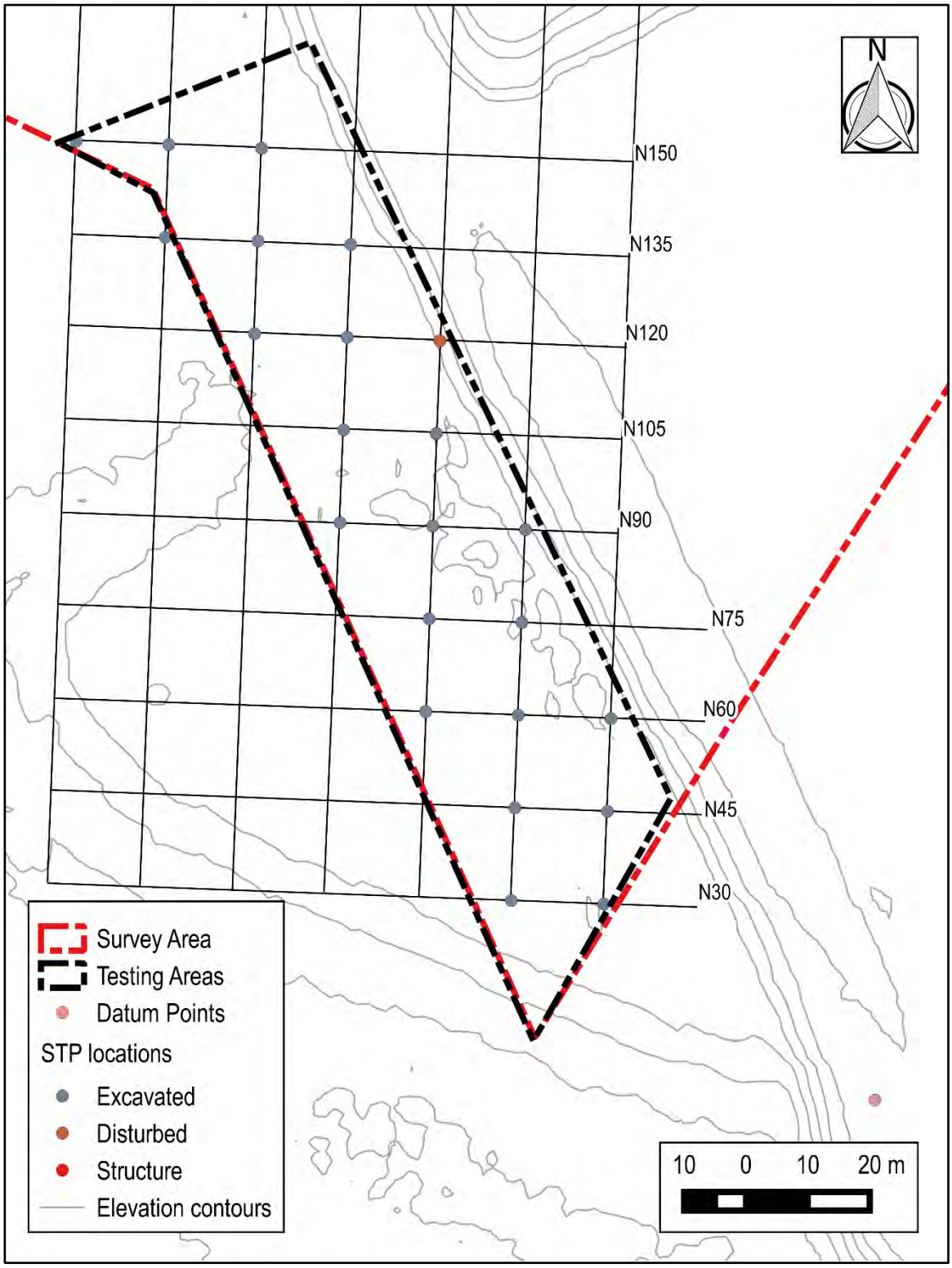


Figure 17. Test locations within the southern grid.

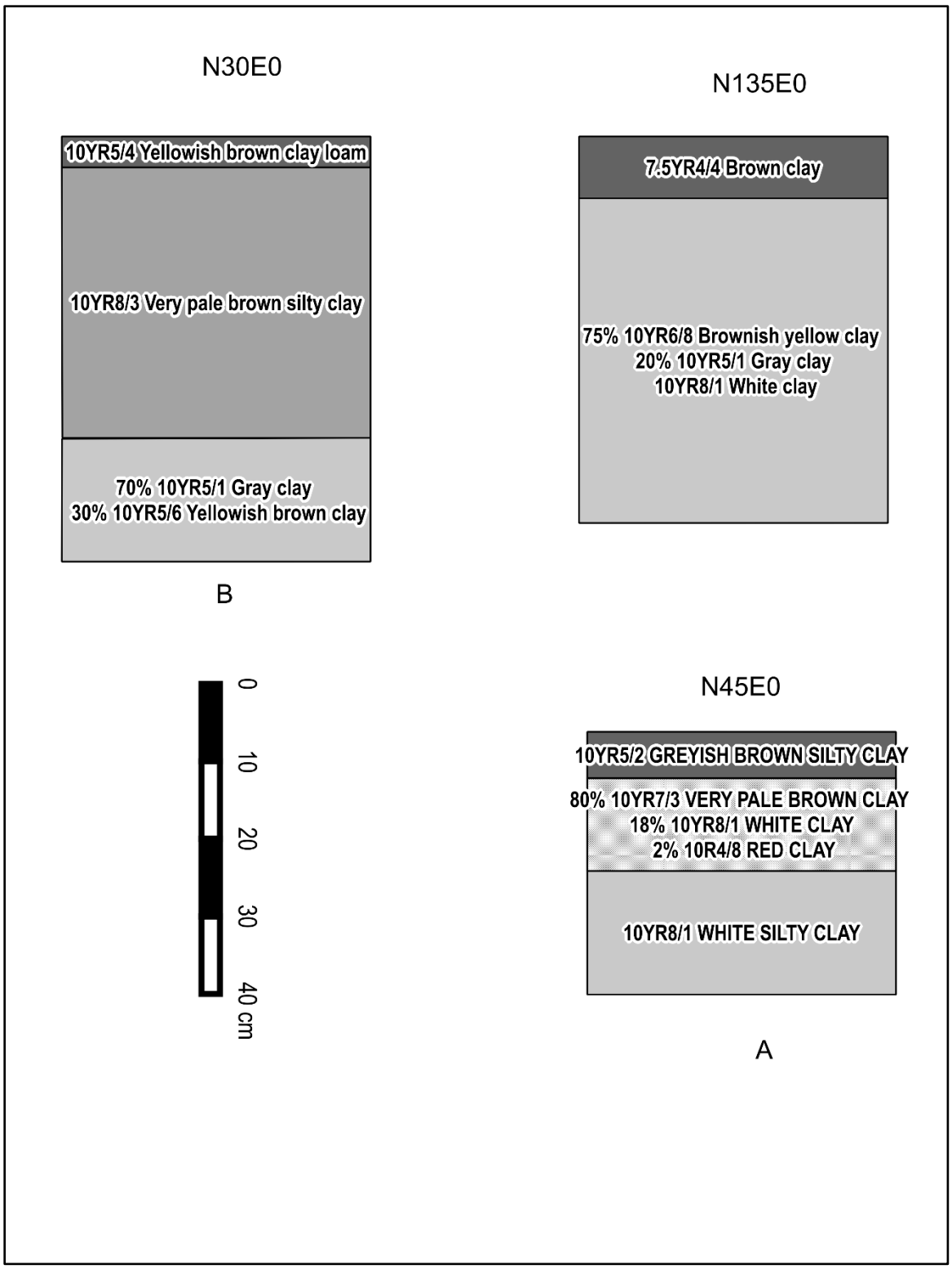


Figure 18. Soil profiles from the northern grid, western survey area.

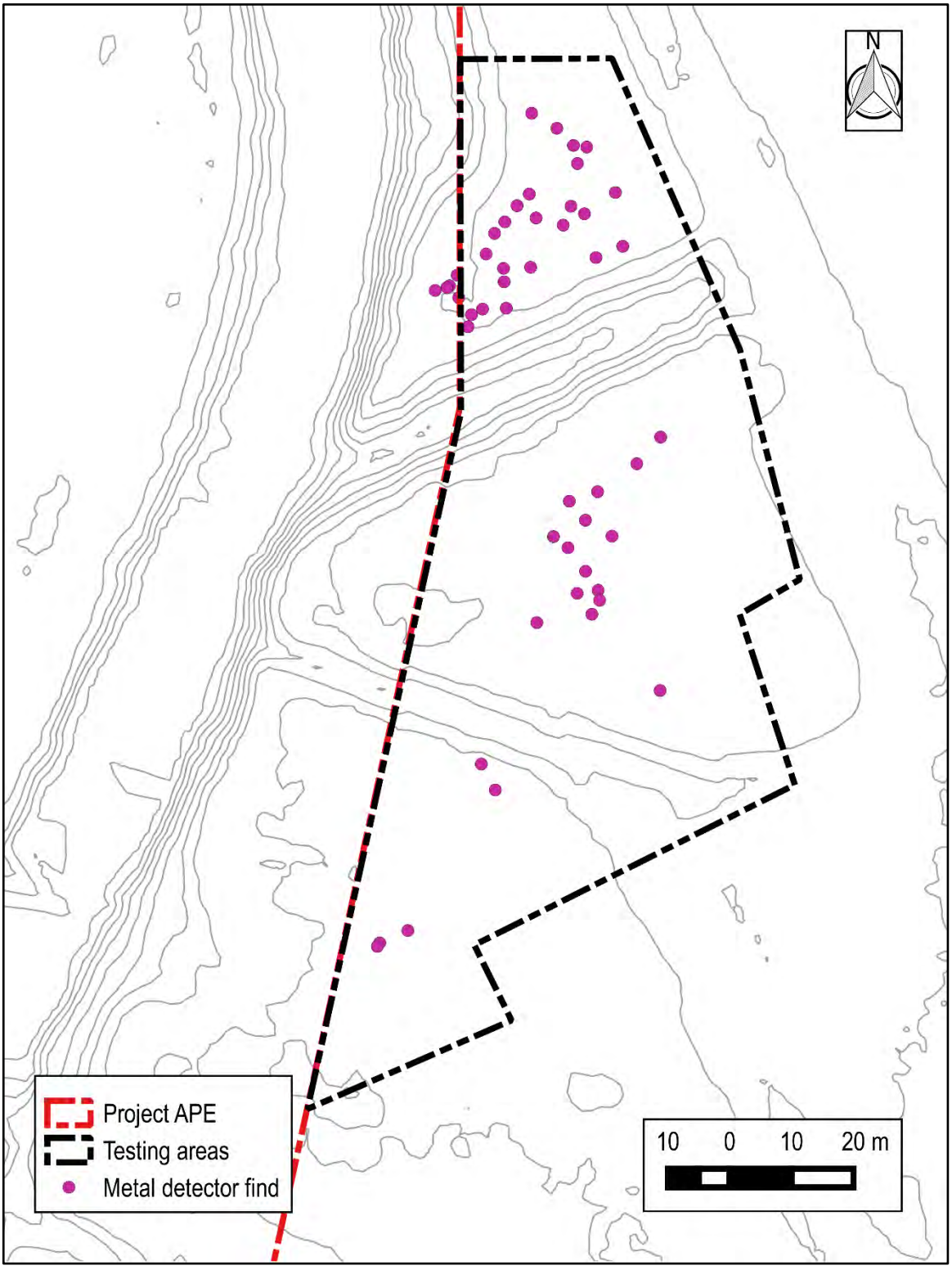


Figure 19. Metal detector survey hits, north grid of the western survey area.

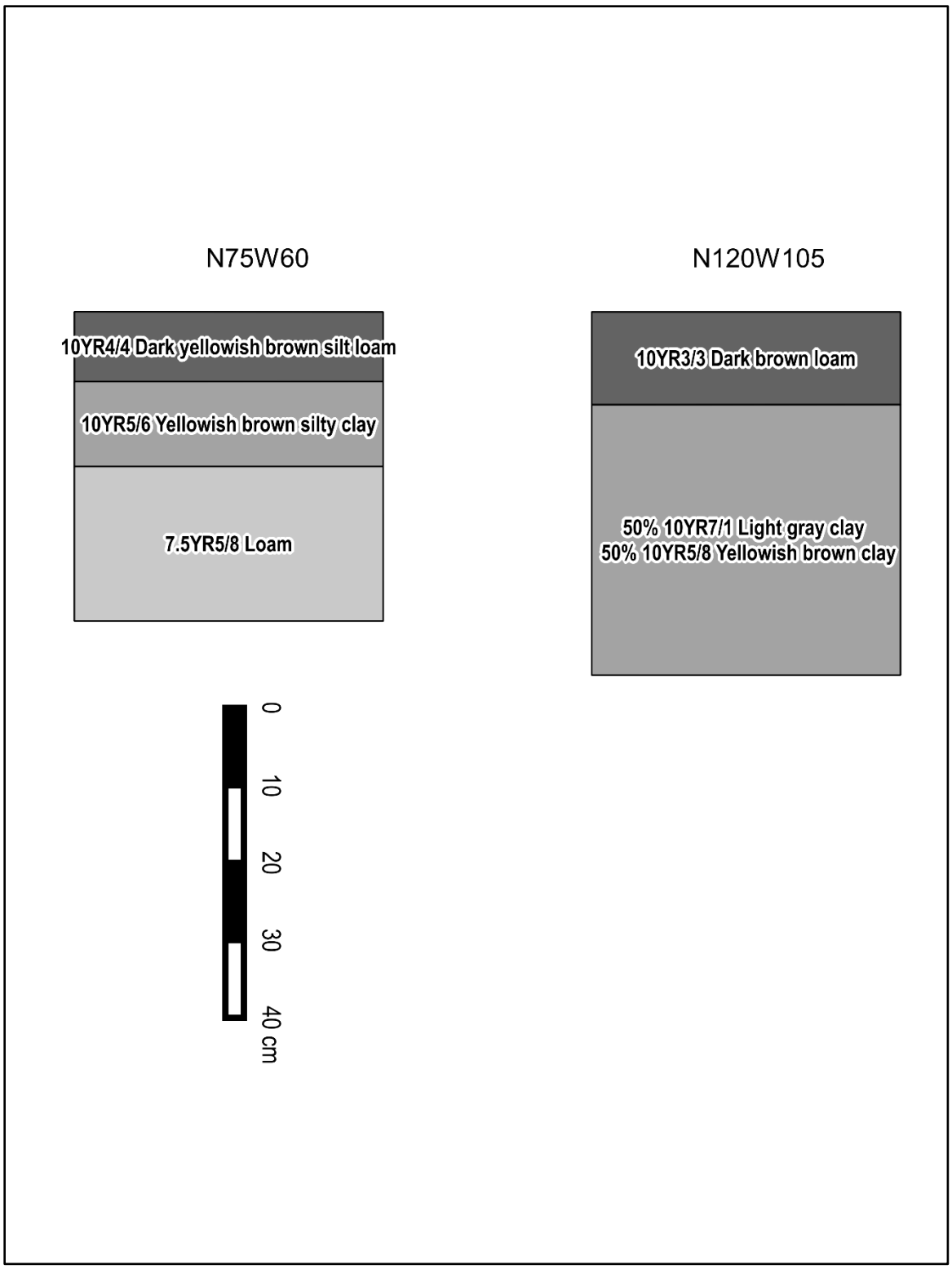


Figure 20. Soil profiles from the southern grid, western survey area.

The Eastern Survey Area

As the eastern survey area had been subject to adequate subsurface testing during the 2005 Thunderbird Associates study, the current investigation in this area consisted solely of the metal detector survey. The roughly 14 acre survey area produced only 24 finds (excluding metallic items from modern dumping), all but three of which represent twentieth century material. This included 13 brass bases from twentieth century shotgun shells, two twentieth century bullet casings, a wire nail, a jar lid, a pull tab, a can lid, and a piston. Three artifacts could not be definitively dated, including a corroded ferrous disk and two corroded partial horseshoes. All material recovered was relatively dispersed, and distribution is largely parallel to Wakeman Drive (Figure 21). None of the material recovered appears to be clearly associated with either Confederate or Union troops, or rises to the level of an archaeological site.

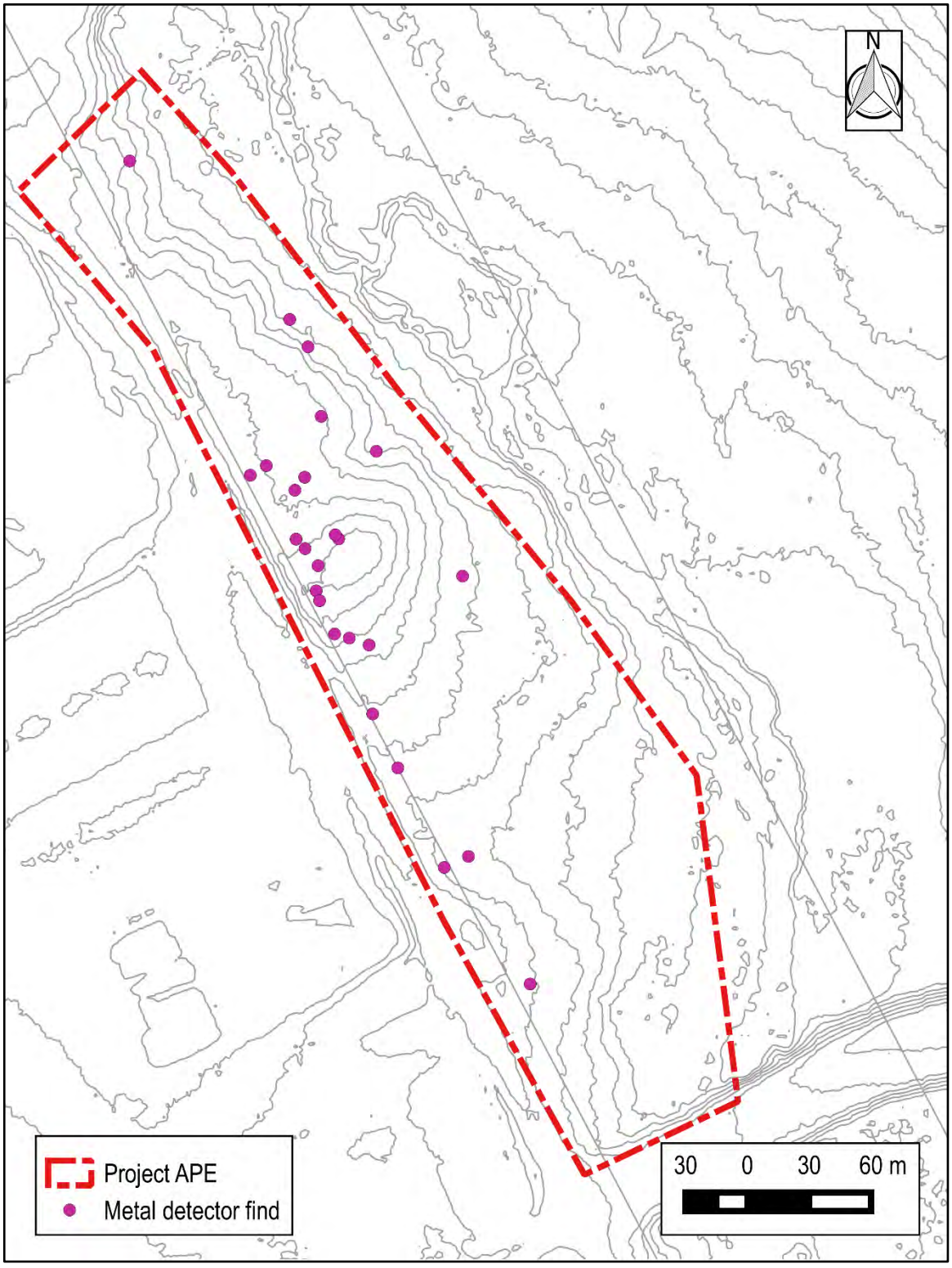


Figure 21. Metal detector survey hits, eastern survey area.

5. SUMMARY AND RECOMMENDATIONS

EAC/Archaeology, Inc. was contracted to conduct an Archaeological Identification Survey within portions of the proposed West Corporate Development and East Parcel Development Area of Potential Effects-Direct within Manassas Regional Airport land holdings. Initial archival research indicated that extensive previous archaeological testing had been conducted within the airport and that large portions of the project LOD had been surveyed and determined to be free of potentially eligible archaeological resources. Additional areas were exempted from testing based both a the sequence of historic aerial photographs of the are available for review online or through the USGS, or based on surface evidence of soil disturbance noted during the initial field inspection for the project.

Subsequently, Phase I survey investigations were conducted within two survey area of roughly 18.4 acres aggregate area and encompassing three discontinuous testing grids. Subsurface excavations were limited to the previously untested and undisturbed portions of the western survey area, while metal detecting survey was conducted both in those portions of the western survey area, and all of the previously tested eastern survey area. Excavation testing in the western survey area found evidence of wide spread soil disturbance within the northern and central portions of that testing area, and found intact but sterile soils within the southern portion of the western survey area. Metal detector survey conducted across the eastern survey area identified primarily twentieth century material associated with past hunting on the parcel, but also recovered two horseshoe fragments whose age and cultural affiliation could not be determined. Despite the high potential for previously unidentified prehistoric resources, and a moderate potential for previously unidentified historic resources only modern materials or nondiagnostic artifacts were identified.

No archaeological resources were identified and no further work is recommended. One archaeological site, 44PW729, falls just west of the present APE, with a 20-foot buffer off all planned development. The airport will ensure protection by placing temporary fencing along this buffer to ensure that construction, storage, or staging activities do not impact the site.

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2001 "Gulf Branch (44AR5): Prehistoric Interaction at the Potomac River Fall Line" *Quarterly Bulletin of the Archeological Society of Virginia* 56(3):77-114.

Katz, Gregory M.
2000 *Archaic Period Triangular Bifaces in the Middle Atlantic Region: Technological and Functional Considerations.* M.A. Thesis, Department of Anthropology, Temple University, Philadelphia, PA.

Kavanaugh, Maureen
1983 "Prehistoric Occupation of the Monocacy River Region". In *Piedmont Archaeology: Recent Research and Results,* J. Mark Wittkofski and Lyle E. Browning editors. Archaeological Society of Virginia Special Publication No. 10, Richmond VA..

Kraft, John C.
1976 Geological Reconstructions of Ancient Coastal Environments in the Vicinity of the Island Field Archaeological Site, Kent County, Delaware. In *Transactions of the Delaware Academy of Science 5*, edited by John C. Kraft, pp. 83-118. The Delaware Academy of Science, Newark.

Laird, Matthew and Garrett Fesler
2005 *Phase I cultural resources survey of approximately 183 acres at the Airport Gateway Property, Prince William County, Virginia.* James River Institute for Archaeology, Inc., Williamsburg, Virginia. Prepared for A.J. Dwoskin and Associates, Inc. Fairfax, Virginia.

Leedecker, Charles H., and Cheryl A. Holt
1991 Archaic Occupations at the Indian Creek V Site (18PR94), Prince George's County, Maryland. *Journal of Middle Atlantic Archaeology* 7:67-90

McAvoy, Joseph M. and L.D. McAvoy
1997 *Archeological Investigations of Site 44SX202, Cactus Hill, Sussex County, Virginia*. Survey and Planning Report Series No. 8. Virginia Department of Historic Resources, Richmond, VA.

McLearen, Douglas C.
1978 *Archaeological Reconnaissance of the Manassas Municipal Airport, Prince William County, Virginia.* Prepared by Southside Historical Sites, Inc., Williamsburg, Virginia.

McLearen, Douglas, Christopher Egghart, and Mary Bushey
1995 *Phase I Archaeological Survey of A Proposed Runway Protection Zone, Manassas Regional Airport, Prince William County, Virginia.* Prepared by Virginia Commonwealth University Archaeological Research Center, Richmond Virginia.

Mc Nett, Charles W. (editor)
1985 *Shawnee-Minisink: A Paleo-Indian to Early Archaic Stratified Site in the Upper Delaware Valley*. Academic Press, New York.

Mouer, Daniel
1991 "The Formative Transition in Virginia". In *Late Archaic and Early Woodland Research in Virginia: A Synthesis*, edited by T.R. Reinhardt and M.E. Hodges. Archaeological Society of Virginia, Richmond, VA.

Mullens, John
2005 *Phase I Archaeological Investigations of the circa 120 acre Glen Gery Property, Prince William County, Virginia.* Thunderbird Archeology, Chantilly, Virginia. Prepared for Geln Gery Corporation, Wyomissing, Pennsylvania.

NRCS (Natural Resource Conservation Service
2015 Web Soil Survey. Available at http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx . Accessed July 7, 2015.

O'Neill, Patrick
2007 "Two Extraordinary Surveys: The 1737 Brent Town and 1824 Bristow Tract Maps" *Prince William Reliquary* 2007 Vol. 6 (2): 27-37.

Petraglia, Michael, Dennis Knepper, and Peter Glumac
1993 *Prehistoric Occupations in the Piedmont: Archaeological Excavation in Faquier, Prince William, and Loudoun Counties, Virginia.* Engineering-Science, Inc. On file at the archives of the VDHR, Richmond, VA.

Potter, Stephen
1993 *Commoners, Tribute, and Chiefs: the Development of Algonquian Culture in the Potomac Valley.* University Press of Virginia, Charlottesville, VA.

Puglisi, Michael
1989 "Settlement Patterns in the Northern Neck of Virginia, 1700-1730". *Northern Neck of Virginia Historical Magazine* XXXIX: 4487-4503.

Pullins, Stevan C. and Charles M. Downing
1998 *The Moore Hoff Farm: Life and Landscape on a Northern Virginia Farmstead at the Turn of the Nineteenth Century Archaeological Data Recovery at Site 44 PW600, Associated with the Route 234 Wetlands Mitigation Project, Prince William County, Virginia.* Prepared by the William and Mary Center for Archaeological Research, Williamsburg, VA.

Ratcliffe, R. Jackson
1978 *This Was Prince William*. Private publication, Second Printing by REF Typesetting & Publishing, Manassas, Va.

Rinehart, Charles
1999 *Archaeological Investigation of Proposed Route 234 Access Road, VDOT Project No. 6234-076-125,C501; VDHR File No. 90-0911; PPMS No. 3790.* Prepared by the Cultural Resources Group Louis Berger & Associates, Inc., Richmond, Virginia.

Schmitt, Karl, Jr.
1952 Archaeological Chronology of the Middle Atlantic States. In *Archaeology of the Eastern United States*, edited by James B. Griffin, pp. 59-70. University of Chicago Press.

Slattery, Richard G., and Douglas R. Woodward
1992 *The Montgomery Focus: A Late Woodland Potomac River Culture*. Bulletin Number 2 of the Archeological Society of Maryland, Inc.

Smith, Captain John
1612 Map of Virginia. Facsimile of an Engraving in the Collections of the Library of Congress. Copy on file at Fairfax City Public Library, Fairfax, Virginia.

Smith, James
1978 *Phase II Archaeological Survey of the Manassas Municipal Airport, Prince William County, Virginia.* Prepared by Southside Historical Sites, Inc., Williamsburg, Virginia.

Steponaitis, Laurie C.
1980 *A Survey of Artifact Collections from the Patuxent River Drainage, Maryland*. Maryland Historical Trust Monograph Series No. 1. Maryland Historical Trust, Crownsville, Maryland.

Stewart, R. Michael
1987 "Catharsis: Comments on Thurman's Coastal Plain Synthesis." *Journal of Middle Atlantic Archaeology* 3:111-124.
1990 The Middle to Late Woodland Transition in the Lower/Middle Delaware Valley, in *North American Archaeologist,* 11(3): 231-254.

Thomas, Ronald
1981 *Phase I Archaeological Survey, Manassas Municipal Airport, Runway 16L Outer Marker Navigational Aid, Manassas, Virginia.* Prepared by Mid-Atlantic Archaeological Research, Inc., Newark, Delaware.

Virginia Department of Historic Resources (VDHR)
2011 *Guidelines for Archaeological Investigations in Virginia*. VDHR, Richmond, VA.

United State Geological Survey
1944 Nokesville, VA 7.5 minute Quadrangle
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1994 Nokesville, VA 7.5 minute Quadrangle

United States War Department (ed.)
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Wesler, K.D., and D. Pogue, A, Button, R. Hurry, G. Fine, P. Sternheimer, and G. Furguson
1981 *The M/DOT Archaeological Resources Survey*. Prepared by the Maryland Historical Trust, for the Maryland Department of Transportation and the Maryland Board of Public Works.

WPA Writers Program
1988 *Prince William: The Story of Its People and Its Places*. Originally compiled in 1941 by Worker of the Writers Program of the Work Projects Administration in the State of Virginia. Reprint sponsored by the Bethlehem Club, Manassas Virginia

APPENDIX I

QUALIFICATION OF INVESTIGATORS

ELIZABETH ANDERSON COMER
EAC/Archaeology, Inc.
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Baltimore, Maryland 21218-1054
phone 410-243-6767
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ecomer@eacarchaeology.com

AREAS OF SPECIALIZATION

Historical Archaeology, Prehistoric Archaeology, Architectural History, Public Archaeology, Interpretation of Archaeological Data for the Public, Heritage Tourism Research and Development, Historic Preservation, Archival Research, Museum Management.

EDUCATION

B.A. in History and Political Science, Hood College, Frederick, Maryland 1977
University of London, Richmond College, London, England 1975-1976
M.A. in Anthropology, University of Kansas, Lawrence, Kansas 1981
Ph.D (in progress), University of Maryland, College Park, Maryland

PROFESSIONAL EXPERIENCE

1983 - Present

Project Manager and Principal Investigator, EAC/Archaeology, Inc.

Personally managed and completed more than 250 projects over 31 years. Studies have included the Annapolis Historic District, Fort McHenry National Monument and Historic Shrine, Riversdale Mansion National Historic Landmark, and Londontown House and Gardens National Historic Landmark.

1998 - Present

Chief Technical Advisor - Public Archaeology Project
UNESCO Regional Office for Culture in Asia and the Pacific, Bangkok, Thailand.

Developing public archaeology initiative for UNESCO with pilot project planned in India.

1983-1987

City Archeologist and Director of The Baltimore Center for Urban Archeology, City of Baltimore

Established and directed Baltimore's public archeology program including selection of excavation sites and development of research designs. Additional activities included: fostering legislation to protect finite archeological resources; educating the public through continual speaking engagements and presentations; production of exhibits for private developers, public groups and the archeology museum.

1981-1983

Area Vice-President, Soil Systems, Inc. (SSI)

Served as Principal Investigator and/or Project Manager on all projects. Managed a large staff of archeologists, historians, architectural historians and other professional personnel.

1975-1981

Archeologist

Worked as an archeologist excavating numerous sites in Kansas, Missouri and Maryland for universities and federal agencies as well as analyzing and preparing displays and exhibits of prehistoric and historic materials recovered from sites.

TEACHING POSITIONS

Adjunct Professor, University of Maryland College Park,
Historic Preservation Program, 1996 - present
Courses Taught: "Management of Cultural Heritage Sites: Tourism, Archaeology & Preservation in the Postmodern World"

Adjunct Professor, University of Maryland Baltimore County,
(UMBC), 1987

SELECT PUBLICATIONS

12/1983 The Great Baltimore Brewery Dig: Excavations at an Eighteenth-Nineteenth Century Baltimore Industry. .

2/1985 Rediscovering Mrs. Carroll's Orangery. Prepared for the National Society of Colonial Dames of America in the State of Maryland.

1990 "Mount Clare: An Interdisciplinary Approach to the Restoration of a Georgian Landscape," in William M. Kelso and Rachel Most, eds., Earth Patterns: Essays in Landscape Archaeology (Charlottesville, 1990): 135-152.

1990 Mount Clare: Introducing Baltimore to 18th Century Splendor," in Barbara J. Little and Richard J. Dent, eds., New Perspectives on Maryland Historical Archaeology (Archeological Society of Maryland, Inc. for Maryland Archaeology): 86-94).

5/1994 Phase I (Archaeological Survey) and Phase II (Archaeological Evaluation) Investigation at the Drug Enforcement Administration Justice Training Center, Quantico Marine Corps Reservation, Stafford County, Virginia. Prepared for Ellerbe Becket under contract to the Drug Enforcement Administration.

10/1997 Phase I Archaeological Survey at the National Institutes of Health, Bethesda, Campus Clinical Center Development Areas (18MO462, 18MO463, 18MO464, 18MO465), Montgomery County Maryland. Prepared for the National Institutes of Health.through Oudens + Knoop Architects, PC.

2/2001 Archaeological Monitoring Plan, Stabilization and Repair of Northwest Demi-Bastion Wall, Fort Washington (FOWA), National Capital Parks-East, Prince George's County, Maryland. Prepared for United States National Park Service, National Capital Region through architrave p.c., architects.

5/2001 Historic Resource Evaluation Services of 95 properties for the City of Baltimore East-West Transit Connector, Project # 766 (People Mover), Baltimore City, Maryland. Prepared for City of Baltimore Department of Public Works.

12/2001 Phase II and III Archaeological Investigations: Ulster Bridge, Bradford County, Pennsylvania. Prepared for Pennsylvania Department of Transportation.

4/2005 Phase II Archaeological Investigations at Route 40, Corrie House, New Castle County, Delaware. Prepared for Delaware Department of Transportation.

8/2006 Phase I Archeological Survey of The Proposed Mount Vernon Trail Extension, George Washington Memorial Parkway, Fairfax County Line to I495 Interchange, Fairfax County, Virginia. Prepared for US Dept of the Interior, National Park Service, Denver Service Center through Greenhorne & O'Mara, Inc.

2/2008 Historic Context for Evaluating Post-Bellum Archeological Resources. Prepared for Maryland-National Capital Park and Planning Commission through Greenhorne & O'Mara, Inc.

2/2009 Phase I Archaeological Investigation for the Proposed Extension of Runway 25, Newport News/Williamsburg International Airport, York County, Virginia. Prepared for Peninsula Airport Commission through HNTB Corporation.

12/2010 Phase I And II Investigations at the Haslup/Burns House Site (18HO266) Outside Savage, Howard County, Maryland. Prepared for Howard County, Maryland through Edmeades and Stromdahl, Ltd.

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EDUCATION

October 2006 -April 2010	**Ph.D. in Archaeology,** University of Leicester
August 2004-May 2006	**M.A. in Classical Archaeology,** Tufts University
August 1998-May 2002	**B.A. in Classical Archaeology, History,** University of Evansville

PROFESSIONAL EXPERIENCE

November 2011-present	**Archaeologist/GIS Specialist**, EAC/Archaeology, Baltimore, MD Provides archaeological services, including project management, execution of archival research, archaeological fieldwork, monitoring, artifact analysis, and technical report preparation.
August 2010-August 2011	**Museum Assistant**, County Museum of History and Art, Zalău, Romania Conducted post-excavation work on the American-Romanian Porolissum Forum Project, assisting with rescue excavations throughout Sălaj County, and participating in museum outreach activities.
August 2008	**Archaeologist,** University of Leicester, Hallaton, Leicestershire, U.K. Used a Barrington fluxgate gradiometer to conduct geophysical survey at an Iron Age settlement.
October 2007-April 2010	**Teaching Assistant,** University of Leicester, Leicester, U.K. Taught on the following courses: Language Tools for Ancient History: Latin; Introduction to Roman History Seminar; Language Tools for Ancient History: Greek; Introduction to Greek History Seminar; Late Antique North Africa.
June-July 2006/2007/2008/ 2009/2010/2011	**Associate Field Director,** Porolissum Forum Project, Moigrad, Romania Each season, contributed to planning excavations each season, supervised students and workers during the six-week excavations, mapped site with Total Station and AutoCAD, and conducted post-excavation work.
January 2006-May 2006	**Teaching Assistant,** Tufts University, Medford, MA Co-taught History of Rome course.

RECENT ARCHAEOLOGICAL / HISTORIC PRESERVATION INVESTIGATIONS

February-June 2016	Phase II Archaeological Survey of the Western Lands Area of IAD under the MWAA Archaeological/Architectural Historic Preservation Services contract, Arlington, Fairfax and Loudoun Counties, Virginia. Prepared for the Metropolitan Washington Airports Authority.
August 2015	Phase I Newark Regional Transportation Center. Prepared for the Delaware Department of Transportation.
July-December 2015	Phase I Archaeological Survey of the Western Lands Area of IAD under the MWAA Archaeological/Architectural Historic Preservation Services contract, Arlington, Fairfax and Loudoun Counties, Virginia. Prepared for the Metropolitan Washington Airports Authority.

August 2015	Arlington National Cemetery Southern Expansion Site – Viewshed Study, Arlington County, Virginia. Prepared for the U.S. Army Corps of Engineers, Norfolk District (NAVFAC).
February 2015	Phase I Archeological Survey For MD 355 At West Old Baltimore Road, and Phase II Archaeological Testing At The Neelsville Blacksmith Residence/Shop (18MO734), Montgomery County, Maryland. Prepared for the Maryland State Highway Association.
February 2015	Stage 1 - Phase IB Archeology Interim Report, Baltimore Red Line Light Rail Project, City Of Baltimore and Baltimore County, Maryland. Completed for the Maryland Transit Administration.
November 2014	Land Use Study For Downtown Tunnel Segment. Completed for the Baltimore Light Rail Red Line Project.
July 2014	Land Use Study For Cooks Lane Tunnel Segment. Completed for the Baltimore Light Rail Red Line Project.
July 2014	Catoctin Furnace Stone House 1, Thurmont, Maryland: A Phase I Archaeological Identification. Prepared for the Catoctin Furnace Historical Society.
June 2014	Phase I Archeology Technical Report For C18: Powder Mill Run Restoration Site. Completed for the Maryland Transit Administration.
June 2014	Phase I Archeology Technical Report For Cimaglia Park Reforestation Site, Baltimore City, Maryland. Completed for the Maryland Transit Administration.
June 2014	Crittenton Place, Hampden, Baltimore City, Maryland: A Phase II Archaeological Evaluation. Prepared for Crittenton Hill LLC and the Maryland Historical Trust.
May 2014	Curation and Storage of BCUA Artifacts from Shot Tower Metro Display. Completed for MTA through Southern Improvement Company, Inc.
May 2014	Phase I Archaeological Investigations for MD 231 at MD 765A, Prince Frederick, Calvert County, Maryland. Prepared for Maryland SHA through Skelly & Loy, Inc.
April 2014	Phase IB Archaeological Survey for the SR 1002, Section 651, Skinners Falls Bridge Rehabilitation, Milanville, Damascus Township, Wayne County, Pennsylvania. Prepared for Pennsylvania Department of Transportation
April 2014	Stage 2 Phase 2 Archeology Technical Report For Ward Farmstead (Site 18BA582). Completed for the Maryland Historical Trust

PEER-REVIEWED PUBLICATIONS

Wanner, R. Forthcoming (accepted 1 March 2011). Forests and Forts. Socioeconomic change on the Meseș frontier and beyond. In: *Proceedings from Defensive system, military infrastructure and the daily life on the borders of the Roman Empire, Târgu Mureș, Romania*.

Wanner, R. 2010. Animals and Grain on the Frontier: Some considerations of Roman land-use in the Meseș Gate of Roman Dacia. In: Pop, H. (ed.), *Identități culturale locale și regionale în context european. Studii de arheologie și antropologie istorică. In memoriam Alexandri V. Matei* [Local and regional cultural identity in the European context. Studies of archaeology and historical anthropology. In memoriam of Alexandru V. Matei.]. Cluj-Napoca: Mega.

Wanner, R. and De Sena, E. 2010. Three Dying Towns: Reflections on the immediate Post-Roman phase of Napoca, Potaissa and Porolissum. In: Sami, D. and Speed, G. (eds.), *Debating Urbanism: beyond the walls*. Leicester: Leicester University Press.

Wanner, R. 2008. The Natural Will: Community in Roman archaeology. In: Driessen, M., Heeren, S., Hendriks, J., Kemmers, F., and Visser, R. (eds.), *TRAC 2008. Proceedings of the Eighteenth Annual Theoretical Roman Archaeology Conference, Amsterdam 2008,* 157-172. Oxford: Oxbow.

RECENT PRESENTATIONS

26 March 2016 Heritage From the Ground Up: Using Technology to Study Enslaved and Free Workers in an Iron-making Community (co-authored with Elizabeth Comer and Jane Seiter). *MHT and ASM Workshop in Archaeology,* Crownsville, MD.

8 January 2016. Forest for the Trees: Remote Sensing Applications and Historic Production at Cunningham Falls State Park (co-authored with Bryce Davenport). *Society for Historical Archaeology Annual Meeting,* Washington, DC.

7 January 2016. Excavations at Historic Neelsville: Life as a Tenant Blacksmith (co-authored with Jane Seiter). *Society for Historical Archaeology Annual Meeting*, Washington DC.

1 November 2014. Mapping the Edges. Ground-penetrating radar survey at the Catoctin African American cemetery. *ESAF Annual Meeting.* Solomons, MD.

27 October 2011. Landscape of Decimation? The impact of Roman colonization on Northwest Transylvania. *Purdue University Brown Bag Lecture*. West Lafayette, IN.

CONFERENCE ACTIVITY

2012. Session organizer for colloquium entitled "Roman Dacia and Moesia: archaeology and heritage preservation in Romania" at Archaeological Institute of America Annual Meeting in Philadelphia, PA.

2008. Co-organized session entitled "Dealing with dichotomies in Roman archaeology" at Theoretical Roman Archaeology Conference/ Roman Archaeology Conference: Amsterdam, Netherlands.

PROFESSIONAL TRAINING

- **Aerial Archaeology Training School**, run by the Aerial Archaeology Research Group (AARG), Barth, Mecklenburg-Vorpommern, Germany, April 2007

Teresa (Tery) Harris
EAC/Archaeology, Inc.
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Baltimore, Maryland 21218-1054
tharris@eacarchaeology.com

Education
1992 M.A., Anthropology, Brandeis University
1988 B.A., Anthropology, University of Maryland

Experience
Ms. Harris has almost 30 years experience working in all phases of archaeological investigations in the Mid-Atlantic region. Her work experience includes all levels of expertise from field crew to Principal Investigator. Her responsibilities have included field and laboratory work and supervision, artifact analysis, archival research, report writing, and public education and interpretation.

Employment History

2005-present	Project Archaeologist, EAC/Archaeology, Inc., Baltimore, MD. Responsibilities include archival research, design and implementation of archeological investigations, field supervision, laboratory supervision, artifact analysis, some preparation of CAD graphics and report preparation. Duties also include proposal preparation work.
2003-2005	Principal Investigator, ARCH^2, Inc., Metuchen, NJ. Responsibilities include archival research, design and implementation of archeological investigations, field supervision, laboratory supervision, artifact analysis, some preparation of CAD graphics and report preparation. Duties also include proposal preparation work.
1996-2002	Project Archeologist, Joseph Hopkins Associates, Inc. Baltimore, MD. Job duties included archival research, design and implementation of archeological investigations, field supervision, laboratory supervision, artifact analysis, some preparation of CAD graphics, report preparation, and office management. Duties also included some proposal preparation work.
1995	Archeologist, Baltimore Center for Urban Archeology, Baltimore, MD. Job duties included management and preparation of an archival archeological assessment (Phase Ia), and subsequent design and implementation of a Phase II evaluation study utilizing both hand and mechanical excavation, artifact analysis, and report preparation.
1994-1995	Field Director, Kemron Environmental Sciences, Inc., McLean, VA. Job duties included archival research, management of field excavation, laboratory management, and partial drafting of reports.

Selected Project Experience with EAC/Archaeology, Inc.

8/2006 Phase I Archeological Survey of The Proposed Mount Vernon Trail Extension, George Washington Memorial Parkway, Fairfax County Line to I495 Interchange, Fairfax County, Virginia. Prepared for US Dept of the Interior, National Park Service, Denver Service Center through Greenhorne & O'Mara, Inc.

4/2007 Phase I Archaeological Identification Survey – District of Columbia Department of Youth Rehabilitation, Oak Hill Youth Center, Laurel, Anne Arundel County, Maryland. Prepared District of Columbia Government through Bell Architects, P.C.

12/2007 Archeological Monitoring of Streetscape Improvements; MD Route 19 Within the Church Hill Historic District, Town of Church Hill, Queen Anne's County, Maryland. Prepared for Maryland State Highway Administration Project Planning Division through John Milner Associates, Inc.

8/2008 Gettysburg Station – Phase I and II Archeological Investigations of Straban Township Parcels 123, 123A, And 124 Part of the Former Site of Camp Letterman, Gettysburg, Pennsylvania, The Union General Hospital with August 2008 Addendum. Prepared for Landmark Commercial Realty, Inc.

10/2008 Phase II Archaeological Evaluation Investigations at Sites 44FX3180 and 44FX3181, Fairfax County Parkway Widening from Route 50 to Dulles Toll Road, Chantilly, Fairfax County, Virginia. Prepared for Fairfax County Department of Public Works and Environmental Services.

7/2010 Phase I and Phase II Archaeological Investigations for the Propsed 11th Street Bridges Improvement Project, Washington, District of Columbia. Prepared for District of Columbia Department of Transportation Infrastructure Project Management Administration through HNTB Corporation.

12/2010 Phase I And II Investigations at the Haslup/Burns House Site (18HO266) Outside Savage, Howard County, Maryland. Prepared for Howard County, Maryland through Edmeades and Stromdahl, Ltd.

11/2011 Ground Penetrating Radar (GPR) and Phase I Archaeological Survey for Rose Hill, the Samuel Glass Farm, Frederick County, Virginia. Prepared for the Museum of the Shenandoah Valley.

8/2012 Phase I Archaeological Survey at MD 7 over James Run, Harford County, Maryland. Prepared for the Maryland State Highway Administration, as subcontractor for Skelly and Loy, Inc..

2014-2015 Archaeological Services for the Proposed Granite Line Phase II Gas Line Relocation Project, Franklintown Vicinity, Baltimore City, Maryland. Conducted for Baltimore Gas and Electric through Exploration Research, Inc.

2014-2015 Cultural Resources Services for the Proposed Phase I Improvements, Martin State Airport, Middle River, Baltimore County, Maryland. Conducted for the Maryland Aviation Administration through HNTB Corporation.

8/2015 Phase I Archaeological Investigations for the Proposed Improvements to the I-70/MD 144 Interchange, Frederick County, Maryland. Prepared for the Wilson T. Ballard Company.

11/2015 Phase I Archaeological Survey to Relocate the Mount St. Mary Site (18FR379) Prior to Improvements to US Route 15, Frederick County, Maryland. Conducted for the Maryland State Highways Administration through the Wilson T. Ballard Company.

1/2016 Phase IA Archaeological Reconnaissance of the Proposed Westside Regional Park, City of Frederick, Frederick County, Maryland. Prepared for Grace Fielder and Associates. and the City of Frederick.

Other Project Experience

- Project Archeologist, Phase I, Phase II, and Phase III investigations of the site of proposed BWI Facilities expansion near Hanover, Maryland. (Joseph Hopkins Associates, Inc. for the Maryland Aviation Administration).
- Project Archaeologist, Phase II investigations, Choptank Route 404 Project, Caroline County, Maryland. (Joseph Hopkins Associates, Inc. for SHA).
- Project Archeologist, Phase I and Phase II investigations of the Poulson-Englar House (18CA238), Carroll County, Md. (Joseph Hopkins and Associates, for The Arundel Corporation)
- Research Director and Project Archaeologist: Phase I archival assessment and Phase II field investigations, 18 BC 111 Hampstead Hill Site, Baltimore, MD. (Baltimore Center for Urban Archaeology, Baltimore City Life Museums, for the Johns Hopkins Hospital Facilities Department.)
- Field Director: Phase I and II investigations at the National Emergency Training Center, Emmitsburg, MD. (Kemron Environmental Services, for the National Emergency Training Center and the Army Corps of Engineers, Baltimore Division.)
- Field Director: Phase II investigations at the Ben Lomond House, Manassas, VA. (Kemron Environmental Services, for the Prince William County Park Authority.)

APPENDIX II

ARTIFACT CATALOG

Unit Number	Level	cription_	cboMaterial 1	cboDecoration	txtMaterial 2	txtType	cboPortion	txtCategory	cboColor	txtGroup	Count	Comments
N0W15	II	Coal	Coal			Fuel	Fragment	Fuel		Indefinite Use	4	
S15W15	II	Bottle	Glass			Misc Containers	Body	Misc Containers	Clear	Indefinite Use	1	Thick walled vessel, possible partial mold seam or shapping turn
N30E0	I	Tile	Earthenware	Akaline glaze	Ceramic	Materials	Fragment	Materials	Pink	Structural	1	Floor or possibly large wall tile
N45E0	I	Tile	Earthenware	Akaline glaze	Ceramic	Materials	Fragment	Materials	Pink	Structural	1	Floor or possibly large wall tile

Find Number	Artifact Number	Fragment Count	Material 1	Material 2	Description Number	Description	Type	Category	Group	Portion	TPQ	TAQ	Comments
1	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1920	1970	"Western, Made in USA, Super X 12ga", high brass
2	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		0	0	Montgomery Ward shotgun shell, "Hawthorne, Reliance, 12GA" low brass?
3	1	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	ring only
4	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1937	1964	"Winchester - Ranger, Made in USA"
5	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1898	1932	high brass, "Western, Super-X, Made in USA, 20GA"
6	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1937	1963	"Winchester Made in USA, Super Speed, No. 12"
7	1	1	Iron alloy	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	5lbs? Heavy fe alloy disk with hole in center, painted black, concave on one side, 15cm diameter, hole roughly 5cm diam.
8	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1937	0	"Remington Express 12 GA" High-brass
9	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1927	1963	"Western XPERT Made in USA No 12"
10	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1927	1963	"Western, Made in USA, Super- X, No. 12" High-brass
11	1	1	Iron alloy	Metal	Horseshoe	Horseshoe	Animal Husbandry	Animal Husbandry	Activities		0	0	Half of a horseshoe, with nail still attached, likely thrown
12	1	1	Iron alloy	Metal	Horseshoe	Horseshoe	Animal Husbandry	Animal Husbandry	Activities		0	0	horseshoe, likely the other half of Bag 11 horseshoe, partial nail, likely thrown
13	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1955	0	"Revelation, W.A., 16GA
14	1	1	Brass	Metal	Shell Casing	Shell Casing	Ammunition	Firearms	Activities	Base	1933	1933	"A A 33" likely 30-06 Frankfort Arsenal, phila. PA, 1933?
15	1	2	Zinc	Metal	Can Lid	Can Lid	Closure	Food/Food Storage	Domestic	Fragment	0	0	two pieces of a mason canning jar zinc lid
16	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1934	1963	"Remington Express 12Ga" high-brass

17	1	1	Brass	Metal	Shell Casing	Shell Casing	Ammunition	Firearms	Activities		1933	0	blank cartridge, "F A 33" same headstamp as Bag 14, likely same rounds
18	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1960	0	brass and plastic shotgun shell, rad with black writing, "Western Super X, 4, Mark 5" base stamped "W-W 12 Guage"
19	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1934	1963	"Western Xpress No. 12"
20	1	1	Iron alloy	Metal	Can	Can	Container	Food/Food Storage	Domestic		0	0	Can base
21	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1934	1963	"Western Made in USA, Super-X No. 20" 20 ga, high brass
22	1	1	Iron alloy	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	12cm long, iron object, 5cm diam loop at one end, 2.5cm wide, likely a old car piston.
23	1	1	Brass	Metal	Shotgun Shell	Shotgun Shell	Ammunition	Firearms	Activities		1900	1911	"U.M.C. Co. 12 New Club 12" star design around primer, early shell
24	1	1	Iron alloy	Metal	Wire Nail	Wire Nail	Fastener	Hardware	Structural		0	0	9cm long wire nail

Find Number	Artifact Number	Stratum	Fragment Count	Material 1	Material 2	Description Number	Description	Type	Category	Group	Portion	TPQ	TAQ	Comments
1	1	NA	1	Copper alloy	Metal	Dime	Dime	Coin	Commerce	Activities		1986	1986	
2	1	NA	1	Copper alloy	Metal	Penny	Penny	Coin	Commerce	Activities		1982	1982	
3	1	NA	1	Copper alloy	Metal	Penny	Penny	Coin	Commerce	Activities		1978	1978	
4	1	NA	1	Copper alloy	Metal	Dime	Dime	Coin	Commerce	Activities		1967	1967	
5	1	NA	1	Copper alloy	Metal	Penny	Penny	Coin	Commerce	Activities		1968	1968	
6	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	
7	1	NA	1	Aluminum	Metal	Bottle Cap	Bottle Cap	Closure	Food	Domestic		1987	1991	Twist-off Pepsi cap
8	1	NA	1	Aluminum	Metal	Foil	Foil	Misc. Metal Items	Misc. Metal Items	Indefinite Use		0	0	foil with rolled edge
9	1	NA	2	Iron alloy	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	5-10lbs
10	1	NA	1	Aluminum	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	ketchup packet
11	1	NA	21	Aluminum	Metal	Foil	Foil	Misc. Metal Items	Misc. Metal Items	Indefinite Use		0	0	
12	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	Heineken Buckhorn?
13	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	Heineken Buckhorn?
14	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	tab only, no ring
15	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	ring only, possible Heineken Buckhorn
16	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	
17	1	NA	1	Aluminum	Metal	Foil	Foil	Misc. Metal Items	Misc. Metal Items	Indefinite Use		0	0	thin foil
18	0	NA	1	Aluminum	Metal	Foil	Foil	Misc. Metal Items	Misc. Metal Items	Indefinite Use		0	0	thin foil
19	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	
20	1	NA	1	Indeterminate Metal	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	unknown metal alloy tab, 4cm long, 1.2cm wide, with 3 - .5cm diam holes.
21	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	Tab only
22	1	NA	0	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		0	0	-MISSING-*
23	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	ring only
24	1	NA	1	Iron alloy	Metal	Bottle Cap	Bottle Cap	Closure	Food	Domestic		1890		crown bottle cap, plastic liner
25	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	
26	1	NA	1	Aluminum	Metal	Bottle Cap	Bottle Cap	Closure	Food	Domestic		0	0	twist-off cap, not crown. Likely for a larger bottle of beer like a 22-40oz, plastic lined.
27	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1975	0	Sta-tab
28	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1975	0	Sta-tab
29	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	ring only
30	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1975	0	sta-tab
31	1	NA	1	Aluminum	Metal	Bottle Cap	Bottle Cap	Closure	Food	Domestic	Finish, Neck	0	0	aluminum twist-off cap, Budweiser Beer, attached glass top neck/finish

32	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	
33	1	NA	1	Aluminum	Metal	Beer Can	Beer Can	Container	Social Drugs-Alcohol	Personal		1965	1975	beer can top with pull-tab opening.
34	1	NA	1	Rubber	-	Insulated Wire	Insulated Wire	Electrical	Electrical	Structural		0	0	black rubber insulated aluminum wire
35	1	NA	1	Aluminum	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	thin aluminum triangle, likely can fragment
36	1	NA	1	Iron alloy	Metal	Cut Nail	Nail	Fastener	Hardware	Structural		0	0	Square nail, 4cm long
37	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1975	0	Sta-tab
38	1	NA	1	Aluminum	Metal	Beer Can	Beer Can	Container	Social Drugs-Alcohol	Personal		0	0	beer can top.
39	1	NA	1	Aluminum	Metal	Beer Can	Beer Can	Container	Social Drugs-Alcohol	Personal		0	0	beer can body fragment, gold wheat decoration
40	1	NA	1	Iron alloy	Metal	Sewer Pipe	Sewer Pipe	Materials	Materials	Structural		0	0	1cm thick iron sewer pipe
41	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		0	0	
42	1	NA	1	Aluminum	Metal	Beer Can	Beer Can	Container	Social Drugs-Alcohol	Personal		0	0	sta-tab beer can top
43	1	NA	1	Aluminum	Metal	Beer Can	Beer Can	Container	Social Drugs-Alcohol	Personal		0	0	Beer can top and body
44	1	NA	1	Iron alloy	Metal	Indefinite	Indefinite	Indefinite	Indefinite	Indefinite Use		0	0	Possible thermostat or car part? Found near surface debris and dumping
45	1	NA	1	Aluminum	Metal	Beverage Can Tab	Beverage Can Tab	Closure	Misc. Closures	Indefinite Use		1965	1975	

Attachment 2

U.S. Department of Transportation
Federal Aviation Administration

Beckley Airports Field Office
176 Airport Circle, Room 101
Beaver, West Virginia 25813
Telephone: (304) 252-6216
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May 5, 2017

Mr. Roger Kirchen
Director, Division of Review and Compliance
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221

Re: Visual Effects of Proposed West Corporate Development and East Parcel Development, Manassas Regional Airport, City of Manassas and Prince William County, Virginia

Dear Mr. Kirchen,

The Federal Aviation Administration hereby requests your review of the visual effects for the proposed West Corporate Redevelopment and East Parcel Development at Manassas Regional Airport in the City of Manassas and Prince William County, Virginia (Attachment A). RS&H's subconsultant, EAC/Archaeology, Inc. (EAC/A), prepared a viewshed study for the proposed West Corporate Redevelopment and East Development. The proposed project represents a federal undertaking under Federal Aviation Administration review and a state undertaking under the Virginia Department of Aviation review. The viewshed study identifies a Visual Area of Potential Effect (APE) and historic properties within that Visual APE. The potential visual impact of the project area was then evaluated for each of these historic properties. This letter report presents the findings of the potential visual impact assessment.

1. Study Purpose

An environmental assessment is being prepared to evaluate the potential effects of the West Corporate Redevelopment and East Parcel Development at Manassas Regional Airport (proposed project) under Section 106 of the National Historic Preservation Act of 1966, as amended and Virginia Code Section 10.1-1118. One of the considerations is the effect of the undertaking on historic resources which are evaluated under Section 106 of the National Historic Preservation Act of 1966 (NHPA). Section 106 of the NHPA outlines a historic preservation review process and requires Federal agencies to consider the direct and indirect effects of their projects on historic resources. The potential for the proposed project to affect the views to and from historic resources in close proximity to the airport prompted the need for a viewshed study and impact assessment.

The primary purpose of this study is to identify a Visual APE, or the APE for Visual Effects. In general, the Visual APE is defined in the regulations implementing the Section 106 review process as "the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" [36 CFR Part 800.16(d)].

The second purpose of this study is to identify all the properties listed in or eligible for listing in the National Register of Historic Places (NRHP) which are located within the Preliminary Visual APE, and hence may be visually affected by the project.

The final purpose is to examine and evaluate the impacts of the development on the historic properties within the Visual APE.

2. Proposed Project

The City of Manassas and the Manassas Regional Airport are proposing plans to redevelop existing support facilities along the western edge of the airport, and to develop new support facilities along the east airport boundary (Attachment B). All project elements are within airport owned property, although roughly 14 acres of the proposed development on the east side of that property is currently outside the City of Manassas limits.

The proposed project elements within the West Corporate Redevelopment include: improvements to the intersection of Observation Road and Piper Lane; realignment of Observation Road to the west; demolition of two existing FBO buildings and replacement by a 71,100 square-foot FBO building; new parking lots and expansion of the existing apron, construction of roughly 11 new 3,600 square-foot hangars and construction of adjoining parking lots, demolition and replacement of five existing T-hangars, construction of seven new T-hangars, construction of a new maintenance and storage building on the site of one demolished FBO building, extension of existing apron around the site of new T-hangar construction, construction of a wash-rack north of the T-hangars. Proposed plans also include extension of existing utilities as required to support construction, extension of the existing security fence to encompass the new facilities, and improvements to existing stormwater drainage systems to accommodate the increase in impervious surface resulting from propose construction.

Proposed development within the East Parcel Development includes realignment of Wakeman Drive, construction of new hangar and office structures, with adjoining parking lots. The existing adjacent taxilane would be extended to provide airfield access to the proposed development. Proposed plans also include extension of existing utilities as required to support construction, extension of the existing security fence to encompass the new facilities, and improvements to existing stormwater drainage systems to accommodate the increase in impervious surface resulting from proposed construction.

3. Methodology

The viewshed, also known as a line-of-sight map, is developed using cells in an elevation model (raster data) and observer points (vector data). A straight line is interpolated between the source (observer point) and every other cell within the elevation model. If the height of cells along this line exceeds the height at the source, the line of sight is interrupted.

Spatial data utilized in the viewshed analysis were collected from a few sources. High-resolution Digital Elevation Models (DEMs) were one of the primary tools used to conduct this study. A one-meter resolution digital elevation model (DEM) from the United States Geological Survey (USGS) Earth Explorer website was used for this study. This data source integrated disparate light detection and ranging (Lidar) and bathymetric data sources collected as part of the Coastal National Elevation Database Project. This was a pre-defined, bare-earth DEM which eliminated vegetation and structures. Computer-Aided Design (CAD) files for the planned project were sent to EAC/A in February of 2017. Shapefiles for sites and districts included in or eligible for the National Register of Historic Places were obtained from the National Park Service and V-CRIS websites. Additional data for historic properties eligible or not evaluated for the National Register were collected from the Virginia Cultural Resources Information System (V-CRIS).

The bare-earth surface model with the addition of buildings, but not vegetation, was used to generate the viewshed. Thus, the model represents an absolute worse-case-scenario, something which could only be replicated in winter months when trees and shrubs are bare.

The Visual APE was based on acuity of vision, or the ability of an individual to discern visual details. Visual acuity is dependent on a number of optical and neural factors, but normal visual acuity is usually defined as 20/20. Normal vision implies that at 20 feet (6 meters), a human eye is able to discern separate contours which are 1.75 mm apart. This translates to the discernment of details separated by a visual angle of one arc minute (or 1/60th of a degree), projected across the retina of the eye. Visual resolution, or the smallest number of visual degrees an eye can detect, can be derived from visual acuity. For the purposes of this study, the threshold of visual perception was set at 1.5 miles, as this is the distance that a person with normal (20/20) vision would be able to discern objects spaced 2.3 feet apart from one another. Beyond this threshold, objects, the spaces between them, and background are indistinguishable. Thus, all areas of the Visual APE beyond this 1.5-mile buffer from the boundaries of the project area were eliminated.

The next step was to identify observer viewpoints which would be used to generate the viewshed. For this study, only one viewpoint was selected in the southwest portion of the development. This viewpoint was chosen for several reasons. First of all, a larger quantity of new structures is proposed along the western edge of the airport than along the eastern edge. The western edge is also closer in proximity to a number of historic battlefields, structures, and districts to the west of the airport. Finally, the area to the west and south of the airport has been less affected by residential and industrial development than the areas to the north and east, making it more likely that development in this area could visually affect historic properties. This step utilized the visibility tool, an ability of many GIS platforms to calculate visibility of two given points on the surface of a DEM.

Additional conditions were factored into the viewshed analysis. Each viewshed factored in an observer height offset of 5.7 feet (1.75 meters), the height of an average person, and corrections for earth curvature and light refraction. As such, each resulting viewshed identifies every one-meter-square area an individual standing at an observer point can see. Finally, the height of the expected T-hangar was factored in as 61.0819 meters above mean sea level (200.4 feet above mean sea level), which is the same height as existing T-hangars. The visibility area remaining after these steps were taken served as the finalized Visual APE (Attachment C).

4. Historic Properties Identified

Historic properties, as outlined in the National Historic Preservation Act, are any properties including buildings, sites (both surface and subsurface), structures, and objects listed or determined eligible for listing in the NRHP. For the purposes of discussion, the term "historic properties" refers to standing buildings, sites, structures, objects, or districts. Since archaeological sites which are eligible for or listed in the NRHP are subsurface sites, they will not be impacted visually by the above-ground developments within the Visual APE. Nine historic properties that are eligible for or listed on the NRHP fall within the Visual APE for the proposed work. These are listed below and depicted in Attachment C.

Table 1: Historic Properties within Visual APE

Designation	Name	Status
076-0014	Moor Green	Listed in NRHP
076-0024 (076-5161)	Bristoe Station Battlefield	Eligible for NRHP
076-0024-0001 (076-0607)	10604 Bristow Road	Contributes to 076-5344 NRHP Eligibility
076-0024-0025	New Hope Baptist Church	Contributes to 076-0024 NRHP Eligibility
076-0024-0027	10741 Milford Road	Contributes to 076-0024 NRHP Eligibility
076-0149	Bloom Hill Farm	Eligible for NRHP
076-5036 (0076-5168)	Manassas Station Operations Battlefield (The Civil War in Virginia)	Eligible for NRHP
076-5344	Village of Bristoe Historic District	Eligible for NRHP
155-5020	The Wakeman Site / Cannon Branch Fort	Listed in NRHP

There are also several historic resources which have been determined not eligible for the NRHP. These include the Carr Family Cemetery (076-0294), 14502 Vint Hill Road (076-0519), 11712 Nokesville Road (076-0614), 11812 Nokesville Road (076-0615), 10215 Linton Hall Road (076-0658), Conner Farm (076-5042), Prince William LLC House (076-5043), M. Thomas House (076-5043), 11705 Nokesville Road (076-5349), 10905 Bristow Road (076-5394), Blue Grass Acres Farm (076-5395), 9850 Chevalle Road (076-5398), and Orange and Alexandria Railway (076-5399). Because these resources are not considered eligible for the National Register, their viewsheds need no further consideration.

5. Evaluation of Visual Impact

The viewsheds of the nine properties listed in Table 1 above are considered below. Standards for evaluating potential effects on historic properties are derived from the National Historic Preservation Act of 1966, as amended. The regulations define "effect" as "alteration to the characteristics of a historic property qualifying it for inclusion in or eligibility for the National register" (36 CFR

800.16(i)). Thus, while a historic property may be impacted visually, this may only constitute a negligible impact, meaning that there would not be any noticeable changes to the historic property, or its visual context. An "adverse effect" occurs "when an undertaking may alter, directly or indirectly, any of the characteristics of the historic property that qualify it for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association" (36 CFR 800.5(a)(1)). The following evaluations of visual impact on the historic properties listed above is based primarily on information derived from V-CRIS.

Moor Green (VDHR # 076-0014) is a dwelling that was constructed ca. 1800, and is listed in the NRHP in 1978. The viewshed encompasses a significant portion of the historic property. Several original domestic and farm outbuildings, as well as the original approach to the house, have been destroyed throughout the twentieth century, leaving the house as the only component of the site remaining with integrity. The property is surrounded by single-family residences, constructed in the twentieth century. Thus, because the landscape has been so drastically altered, the view does not contribute to the NRHP listing of this property. In addition, there is a thick wooded area buffer of nearly 2,000 feet separates the property from Manassas Regional Airport, which will likely eliminate all sights and sounds associated with the development even in the winter months. Therefore, the proposed development will have no effect on the historic property.

Bristoe Station Battlefield (VDHR # 076-0024) is a historic district comprising numerous privately-owned properties which was determined as eligible for the NRHP in its current form in 2009. It contains 1,352 acres of the core area of the 1863 Battle of Bristoe Station, which is now surrounded by residential development, a golf course, and Manassas Regional Airport. Because the roads and railroad beds maintain their historic alignment, and much of the district is either under cultivation or wooded, the Bristoe Station Battlefield possesses strong integrity of setting, feeling, and association, as well as location.

The Bristoe Station Battlefield historic district also encompasses several historic properties which contribute to its eligibility for the NRHP. Two of these, New Hope Baptist Church (VDHR # 076-0024-0025) and 10741 Milford Road (VDHR # 076-0024-0027) intersect with the viewshed. While the extant buildings on these properties are twentieth-century noncontributing elements, the surrounding parcels are contributing elements, encompassing the portion of the battlefield which retains integrity and upon which the heaviest fighting occurred. The views from these properties need to be considered within the context of the entire district rather than on an individual basis.

The eastern portion of the Bristoe Station Battlefield historic district, as well as a small, elevated area in the middle, fall within the viewshed of the proposed development. Views from the eastern area of the historic district have already been affected by the golf course and the existing airport buildings. This is also true of the high area in the center of the district along the railroad. This visual impact would only be apparent during the winter months for much of the district, except the area immediately adjacent to the airport property which is not buffered by vegetation (especially at the intersection of Observation Road and Piper Lane). Although the proposed work will be visible from these areas, it will not be substantially different from what is now visible in terms of building style and height. The core area of the district within the historic area of the Village of Bristoe will not be affected. Because the changes do not significantly alter the district's setting, feeling, or association, this may be interpreted as a negligible impact on the historic battlefield.

Bloom Hill Farm (VDHR # 076-0149) is rural dwelling determined eligible for the NRHP in 1993 under Criterion C. The house was constructed in the late eighteenth or early nineteenth century. Two

barns and two additional outbuildings, are recorded on the property. The new residential neighborhood across Lucasville Road is currently within view of the farmstead, and thus the rural landscape which once surrounded the property is no longer intact. The viewshed of the proposed project intersects with the house and one outbuilding, as well as several other portions of the property. Nevertheless, approximately 3,500 feet of forest separates the house from the airport, and thus it is unlikely that the proposed work will be visible from the house, even in the winter months. Thus, the proposed project will have no effect on the historic property.

The southeast corner of the Village of Bristoe Historic District (VDHR # 76-5344) falls within the viewshed of the proposed project. The historic resources previously surveyed within the proposed Village of Bristoe boundaries have been determined eligible for the NRHP under Criterion A for broad patterns of development as a community centered on and built because of the railroad reconstruction during a period of growth after the Civil War and under Criterion C for their collective architectural merit. This historic district is included within the Bristoe Station Battlefield District as a non-contributing resource because the dates of construction are outside the period of significance of the battlefield (1863). Due to the wooded area around the eastern perimeter of the district, it is unlikely that any of the proposed project would be visible from the district excepting possibly the winter months. Even then, because the proposed work closely resembles the building types and heights that would already be visible from the rural district, the proposed project would have a negligible impact on the district.

The individually surveyed historic property at 10604 Bristow Road (VDHR # 076-0024-0001) is a contributing resource within the Village of Bristoe Historic District. The building is within the period of significance of the district and contributes to the district's potential eligibility under NRHP Criterion A for Broad Patterns of development as a community centered on and built as a result of the railroad reconstruction during a period of growth after the Civil War and under Criterion C for architecture. Although the viewshed encompasses much of the historic property, approximately 3,000 feet of forest is situated between the property and the proposed project, making it unlikely that the project will be at all visible. The proposed project will have no effect on the property.

The Manassas Station Operations (VDHR # 076-5036), also known as Bristoe Station Battlefield, Bull Run Bridge, Kettle Run Battlefield, and Union Mills, is a historic battlefield associated with the Manassas Battlefield Historic District which is potentially eligible for the NRHP. The district extends into the Project APE. The historic property includes tracts of land associated with the battles and operations of Bristoe Station, Kettle Run, Bull Run Bridge, and Union Mills, which all took place from August 25 to 27, 1862. It was recommended eligible for listing on the NRHP under Criterion A for its association with the Civil War in Virginia. The NRHP eligible area of the historic property is located, just to the west of the airport, closely following the course of Broad Run. Much of this area is within the viewshed of the proposed project. In some places, as much as 1,000 feet of wooded area separates the airport from this portion of the historic property, making it unlikely that these areas will be visible to each other except during the winter months. However, the existing airport structures as well as the rail station to the north are all within the view of the same area. Given that the proposed structures will be similar in height and size to the structures which are already within view of this area, this work will constitute a negligible effect.

Cannon Branch Fort (VDHR # 155-5020), also known as the Wakeman Site (archaeological site # 44PW227), is a historic fortification listed in the NRHP, which lies to the north of the airport. The western third of the historic property, which is on higher ground, falls within the viewshed of the proposed project. The main components of the historic property are the archaeological remains of a

rectangular earthwork and a possible rifle pit. The site is covered by dense tree cover which shields most views to and from these core components, although this was most likely not the case during the nineteenth century usage of the fort. Because distant views from the archaeological remains do not contribute to its listing on the NRHP, the proposed project will have no effect on this historic property.

6. Conclusion

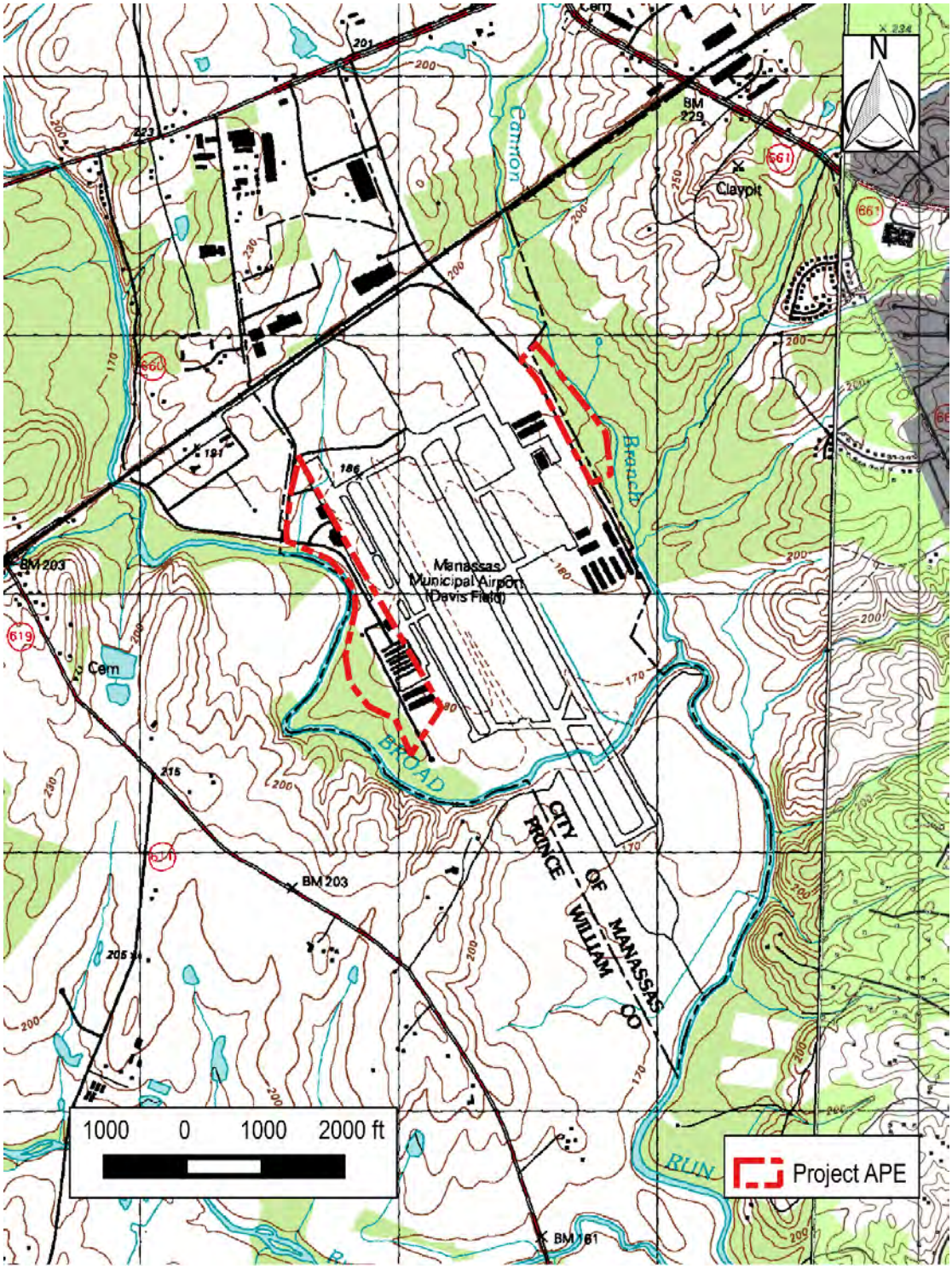
This report contains a comprehensive evaluation of the proposed development on historic properties that could potentially be visually affected in a worst-case scenario. The proposed project will not be visible from most locations in the nine historic properties identified. For those locations within historic properties where the development is visible, it will not adversely affect the eligibility of the sites.

We would be pleased to provide you with any additional information or documentation.

Sincerely,

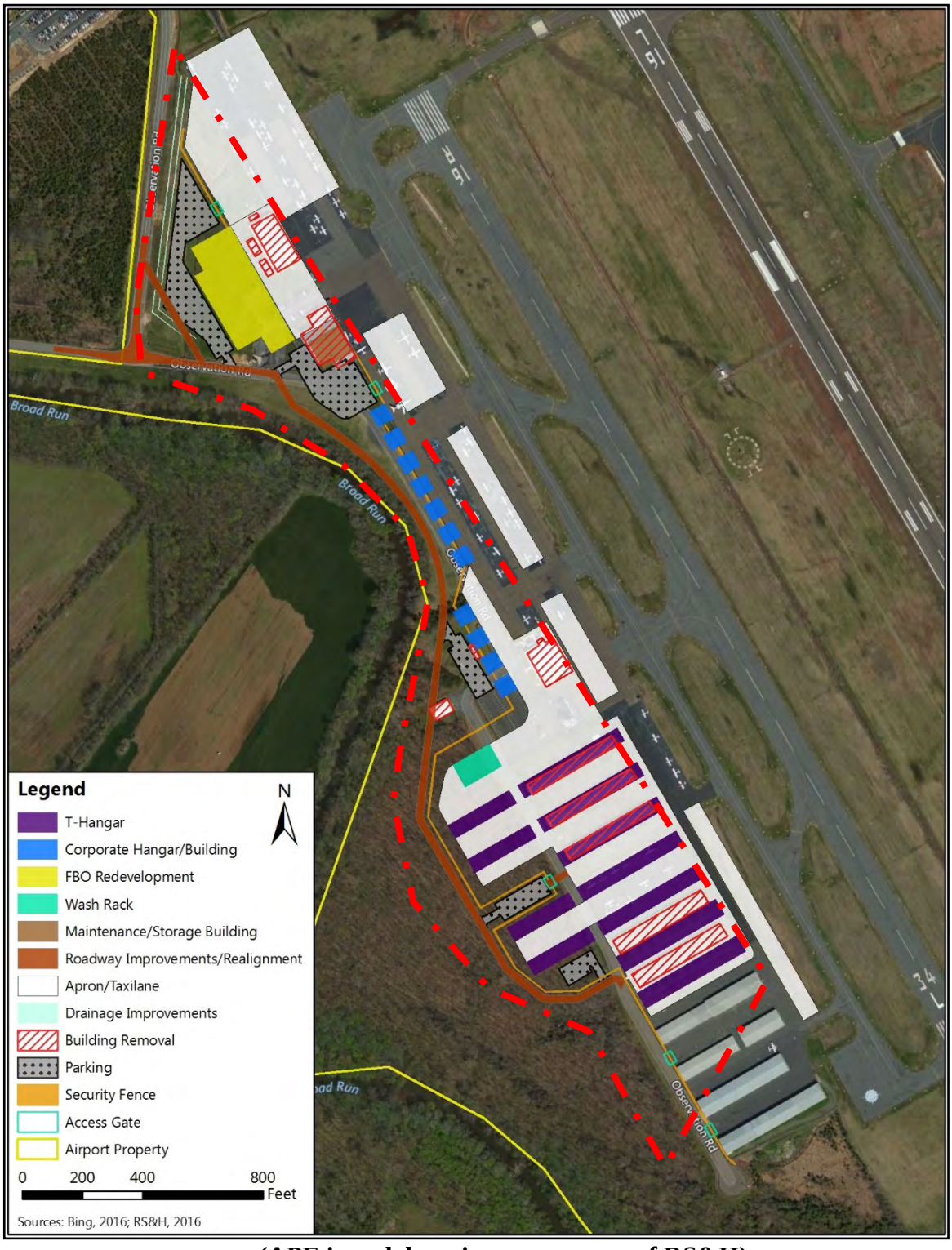
Susan Stafford
Environmental Protection Specialist

Attachment A



Project Location on 1994 Nokesville, VA and Independent Hill, VA USGS 7.5 Minute Quadrangle

Attachment B
Project APE, western survey area and proposed project elements.

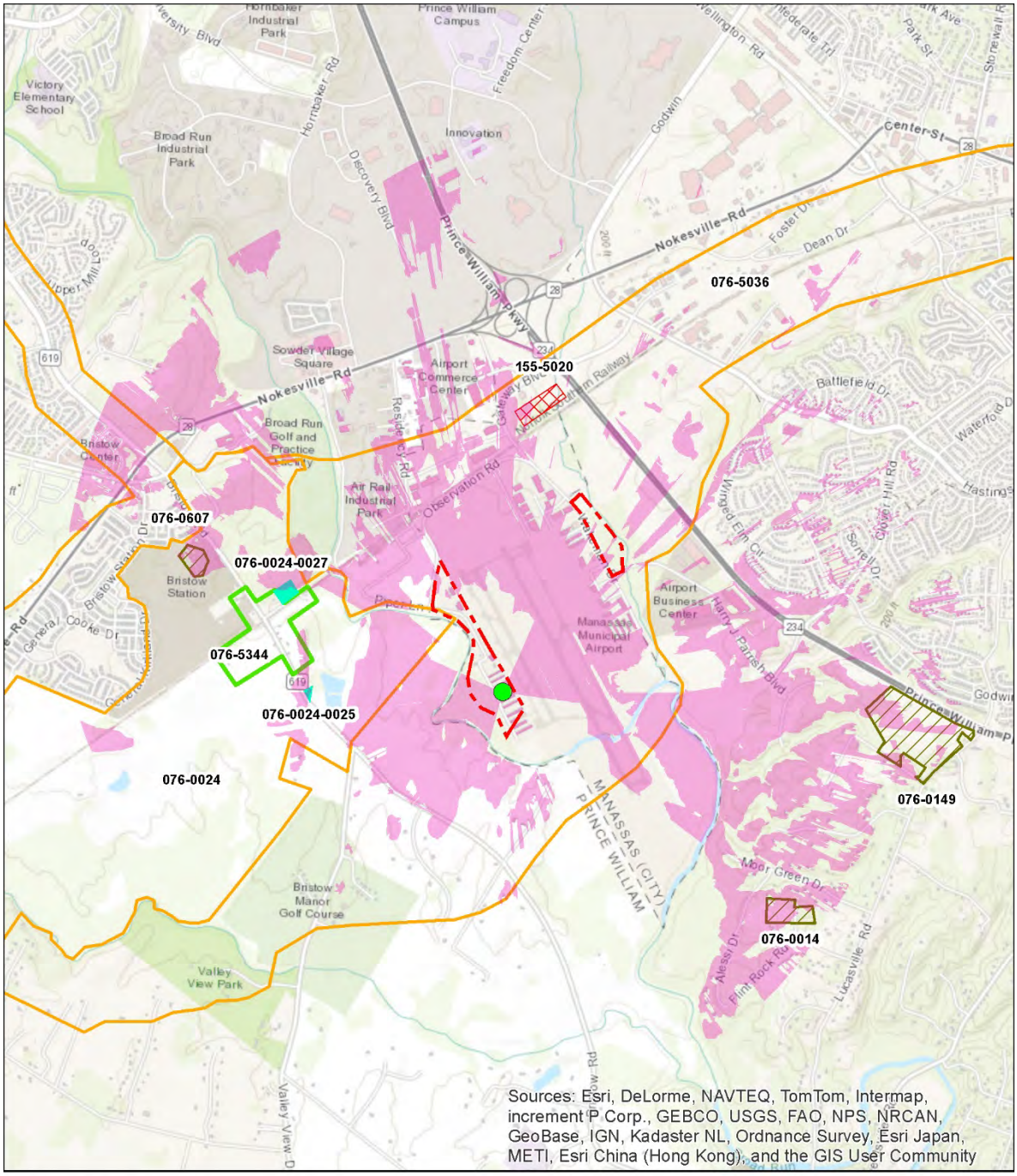


(APE in red, base image courtesy of RS&H).

Attachment B (continued)
Project APE, eastern survey area and proposed project elements.
(APE in red, base image courtesy of RS&H)



Attachment C



Historic Resources Within Visual APE for Proposed Work Manassas Regional Airport

0 500 1,000 2,000 Meters

Viewpoint
Project APE
Visual APE
Battlefield
Building
Building Complex
District
Site
N

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APPENDIX E

PRELIMINARY WETLAND DETERMINATION

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Mill Creek
Environmental Consultants, LTD



Wetland Delineation Report
Manassas Regional Airport (HEF)
Environmental Assessment for Corporate Development
Manassas, VA

Prepared for:
RS&H
10748 Deerwood Park Blvd South
Jacksonville, FL 32256-0597

Prepared by:
Matt Neely
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21 March 2017

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Appendix

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APPENDIX B USACE Jurisdictional Determination and Supporting Documentation
File: NAO 2017-00508

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1.0 INTRODUCTION

1.1 Background

RS&H recently hired Mill Creek Environmental Consultants, Ltd. to conduct a wetland delineation on ± 48 acres of land associated with an FAA mandated Environmental Assessment (EA) being conducted at the Manassas Regional Airport, in Manassas Virginia. The primary objective was to provide a delineation of waters of the US, including wetlands, within the ± 48 acres study area. This type of delineation is used to produce an accurate wetlands map and supporting data for the purpose of attaining a Jurisdictional Determination (JD) from the U.S. Army Corps of Engineers (USACE). The Office of the Norfolk District USACE handles and processes these requests.

1.2 Wetland Policy

One of the primary federal policies regarding aquatic resources is Section 404 of the Clean Water Act (CWA; Public Law 92-500). This act regulates the discharge of dredge or fill material into waters of the United States, including most wetlands.

In recent years the scope of Section 404 of the CWA has been impacted by multiple court cases concerning the type of waters over which it asserts it's jurisdiction. The decisions in these cases have set the standards by which a jurisditional determination can be made under the CWA. In 2015 the U.S. Environmental Protection Agency (EPA) issued a final Clean Water Rule, which outlines the definition of "Waters of the United States".

In addition to the federal policies discussed above, the Virginia Department of Environmental Quality (VDEQ) administers the Virginia Water Protection Permit Program (VWPP). This program regulates impacts to wetlands and streams in Virginia. The regulation guiding this program is the Virginia Water Protection Permit Regulation (9VAC-25-210 et seq.).

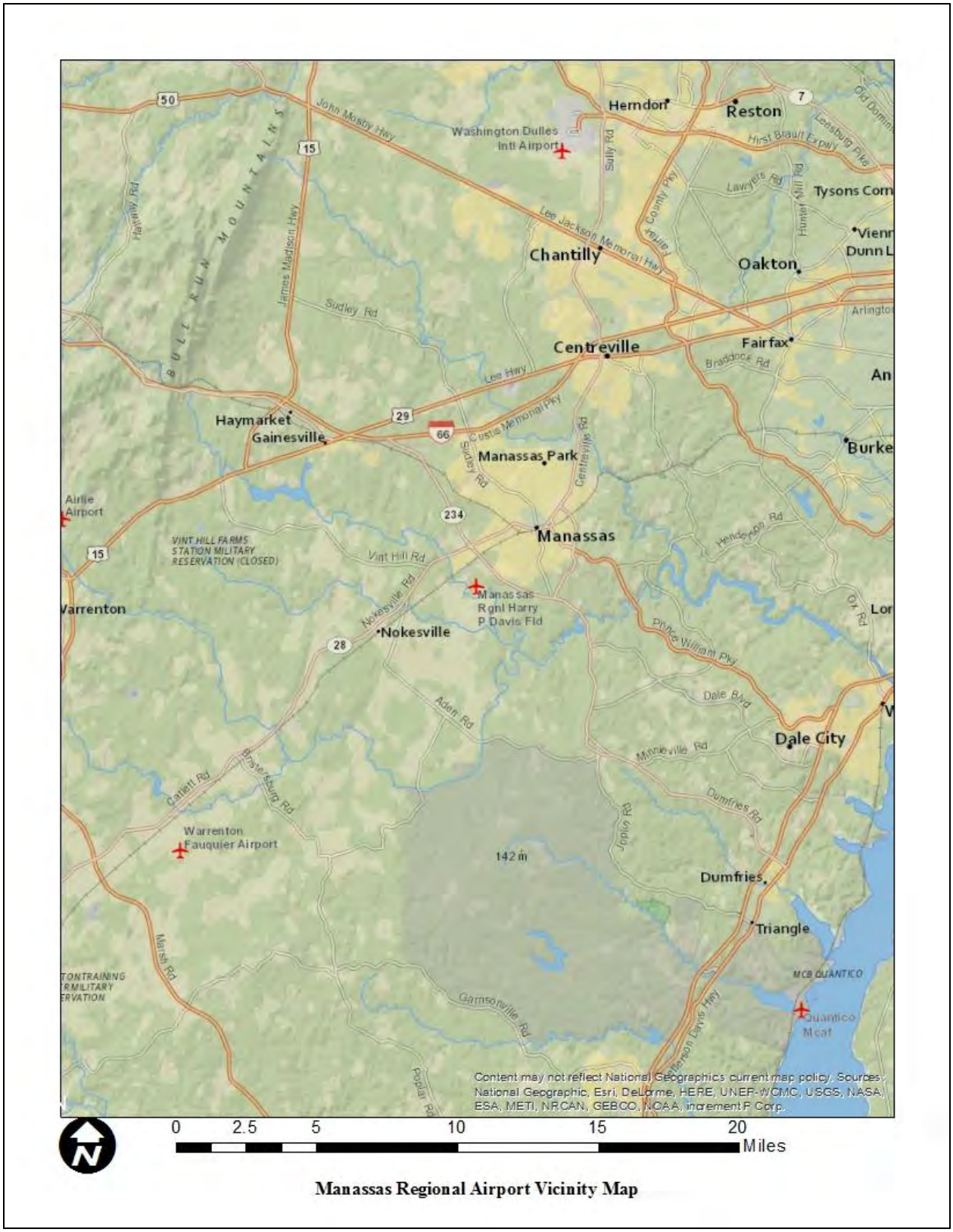


Figure 1-1. Manassas Regional Airport Vicinity Map

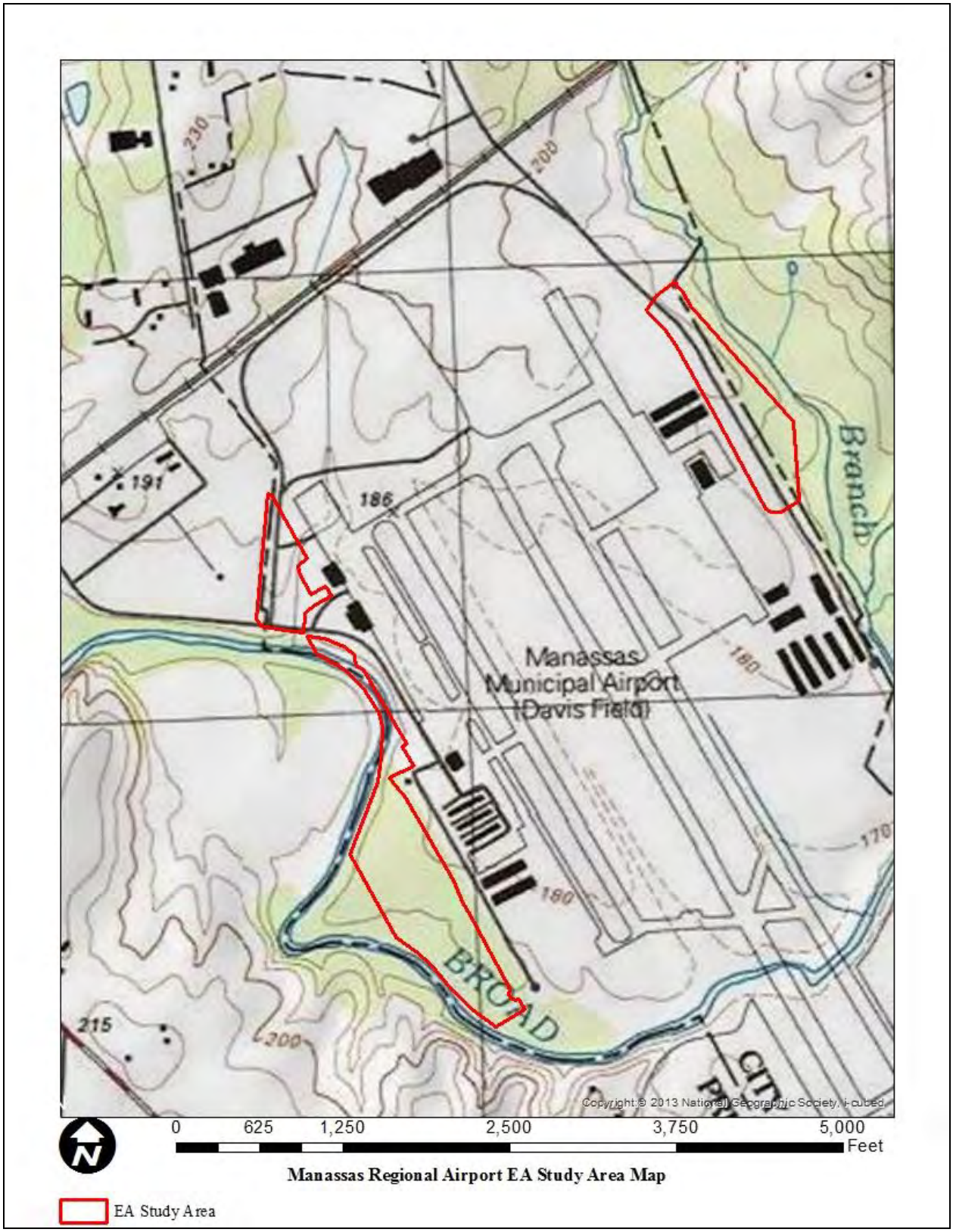


Figure 1-2. Manassas Regional Airport EA Study Area Map

2.0 EA STUDY AREA OVERVIEW

The EA study area is comprised of approximately ± 48 acres adjacent to the Manassas Regional Airport in Manassas, Virginia. The area is divided into three distinct parcels, two to the west (W) of the airport operations area (AOA) and one to the east (E).



Figure 2-1. Manassas Regional Airport EA Study Area Aerial Map

Area A (± 25 Acres)

The largest of the three parcels within the EA Study area is area A (± 25 acres). Area A is immediately adjacent to the hangar, apron, and parking spaces on the west (W) side of the AOA between the fence line and Broad Run.

The vast majority of area A (± 22 acres) consists of mature, mixed hardwood forest. Vegetation is comprised of a mature over-story containing species such as red maple (*Acer rubrum*), pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), boxelder maple (*Acer negundo*), sweetgum (*Liquidambar stryaciflua*), white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), and various species of Hickory (*Carya spp.*). Most of area A contains a limited shrub or

herbaceous strata. Areas with higher soil moisture content possess herbaceous species such as lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), shallow sedge (*Carex lurida*), and varying species of rushes (*Juncaceae spp.*).



Figure 2-2. Area A (± 25 Acres)



Figure 2-3. Mature Mixed Hardwood Over-story Limited Shrub and Herbaceous Layer



Figure 2-4. Mature Mixed Hardwood Over-story w/Shrub and Herbaceous Layer

Approximately ± 3 acres of area A consists of graded maintained/mowed grass lots immediately adjacent to observation road. The area is characterized as a level, compactly graded lot consistently cut and compacted by normal maintenance.



Figure 2-5. Maintained Grass Area Adjacent to Observation Road

Area B (± 7 Acres)

Area B consists of ± 7 acres on the west (W) side of the AOA between aircraft parking aprons, hangars, taxiway spaces, and observation road. It is characterized a by mostly level, compactly graded, grass surface that only changes in elevation as it slopes down to the significant storm-water ditch making its way through the area.



Figure 2-6. Area B (± 7 Acres)

The vegetation in this area consists of maintained fesuces (*festuca spp.*), and other weeds such as broom sedge (*Andropogon virginicus*).



Figure 2-7 Highly Compacted Grass Landscape



Figure 2-8. N/S Storm-water Ditch

Area C (± 16 Acres)

Area C consists of ± 16 acres on the east (E) side of the AOA, immediately east (E) of wakeman drive and west (W) of cannon branch.



Figure 2-9. Area C (± 16 Acres)

Almost all ± 16 acres consists of mature, mixed hardwood forest. Vegetation is comprised of a mature over-story containing species such as white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), tuliptree (*Liriodendron tulipifera*), American

beech (*Fagus grandifolia*), eastern redcedar (*Juniperus virginiana*), red maple (*Acer rubrum*), pin oak (*Quercus palustris*), willow oak (*Quercus phellos*), boxelder maple (*Acer negundo*), sweetgum (*Liquidambar stryaciflua*), and various species of hickories (*Carya spp*.). The limited Shrub strata contains saplings of the species listed above in addition to instances of deerberry (*vaccinium stamineum*). Areas with higher soil moisture content possess herbaceous species such as lizard's tail (*Saururus cernuus*), false nettle (*Boehmeria cylindrica*), shallow sedge (*Carex lurida*), and varying species of rushes (*Juncaceae spp.*).



Figure 2-10. Mature Forest w/Limited Shrub Layer



Figure 2-11. Mature Forest w/Thick Herbaceous

2.1 General Climate

According to NOAA's Dulles station, based on data collected since 1963, the coldest month on average is January with an average temperature of 33.2 °F. July is the warmest month on average with an average temperature of 76.7 °F. The normal annual precipitation is around 42 inches. From 1-31 October 2016, Manassas saw 50% of normal precipitation.

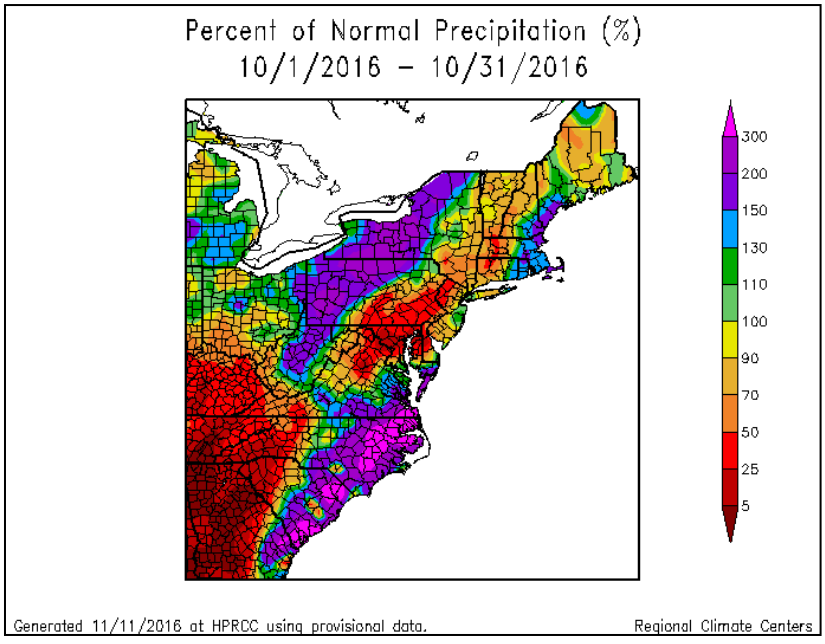


Figure 2-12. Percent of Normal Precipitation October 2016

This departure from normal is approximately 3" less than the normal amount of precipitation for October.

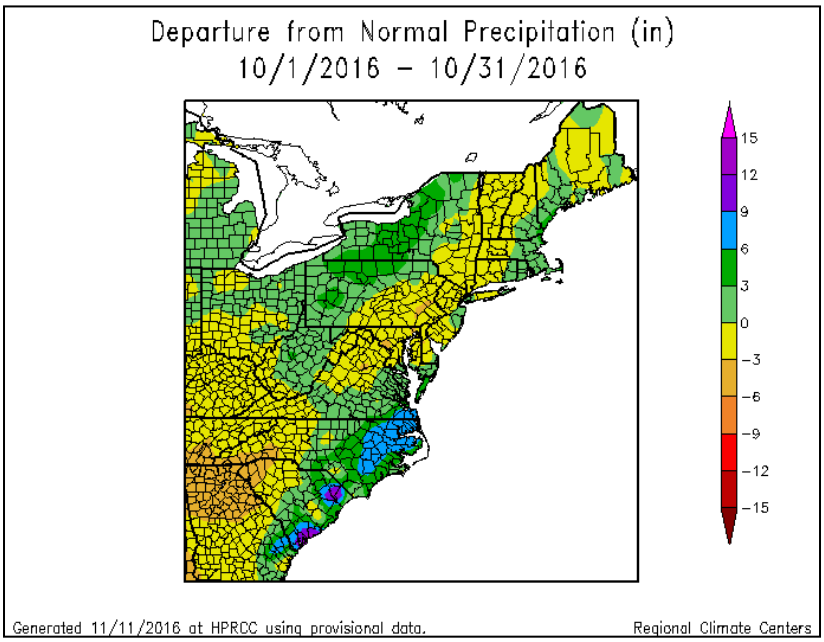


Figure 2-13. Departure from Normal Precipitation (in) October 2016

2.2 Watersheds



Figure 2-14. Manassas Regional Airport 8 Digit Watershed Map

All three distinct parcels sit between elevations of 160-180'. Precipitation falling within the two parcels to the west (W) of the AOA makes its way via overland sheet-flow and groundwater movement to Broad Run immediately to the west (W) and south (S). Precipitation falling within the parcel to the east (E) makes its way via overland sheet-flow and groundwater movement down slope to the north (N) into Cannon Branch and eventually into Broad Run, which flows into the Middle Potomac-Anacostia-Occoquan basin (HUC02070010).



Figure 2-15. Study Area Watershed and Flowline Map

2.3 Soil Base Mapping

According to the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, Prince William County, there are 5 mapped soil units located within the west (W) portion of the EA study area. Four of the mapped soils within the west (W) portion of the EA study area (Aden silt loams, Bermudian silt loams, Elsinboro sandy loams, and Rowland silt loams) were formed by alluvial deposits associated with floodplains and drainage ways. They range in USDA texture from silt loams to sandy loams and possess slopes from 0-7 percent. One mapped soil unit, Urban land-Udorthents complex, consists of soil that has experienced a significant amount of disturbance due to the grading and filling most likely associated with the Airport's Development.



#1, Prince William County, Virginia (VA153)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1A	Aden silt loam, 0 to 2 percent slopes	1.4	4.5%
7A	Bermudian silt loam, 0 to 2 percent slopes	1.1	3.4%
20B	Elsinboro sandy loam, 2 to 7 percent slopes	1.6	5.3%
54B	Urban land-Udorthents complex, 0 to 7 percent slopes	2.5	8.0%
Subtotals for #1		**6.6**	**21.3%**
Totals for Area of Interest		**31.0**	**100.0%**

#2, Prince William County, Virginia (VA153)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
1A	Aden silt loam, 0 to 2 percent slopes	11.9	38.3%
7A	Bermudian silt loam, 0 to 2 percent slopes	1.5	4.7%
16A	Delanco fine sandy loam, 0 to 4 percent slopes	3.2	10.2%
20B	Elsinboro sandy loam, 2 to 7 percent slopes	1.7	5.6%
49A	Rowland silt loam, 0 to 2 percent slopes	3.3	10.7%
54B	Urban land-Udorthents complex, 0 to 7 percent slopes	2.8	9.1%
Subtotals for #2		**24.4**	**78.7%**
Totals for Area of Interest		**31.0**	**100.0%**

Figure 2-16. Manassas Regional Airport EA Study Area Soil Base Map (West)

According to the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, Prince William County, there are 6 mapped soil units located within the east (E) portion of the EA study area. All six of the mapped units (Arcola, Dulles, Hatboro, Manassas, Panorama, and Rowland) possess a USDA texture of silt loam, and range from 0-7 percent slopes.



Prince William County, Virginia (VA153)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
4B	Arcola silt loam, 2 to 7 percent slopes	4.9	31.4%
17A	Dulles silt loam, 0 to 4 percent slopes	2.7	17.3%
26A	Hatboro silt loam, 0 to 2 percent slopes	0.1	0.7%
35B	Manassas silt loam, 2 to 7 percent slopes	0.4	2.7%
46B	Panorama silt loam, 2 to 7 percent slopes	3.9	25.4%
49A	Rowland silt loam, 0 to 2 percent slopes	3.5	22.4%
Totals for Area of Interest		**15.5**	**100.0%**

Figure 2-17. Manassas Regional Airport EA Study Area Soil Base Map (East)

3.0 METHODS

Prior to conducting the delineation of the EA study area provided by RS&H, extensive research based upon historical information available for the given area was conducted by Mill Creek Environmental Consultants. This allowed for the collection of data which in turn would be utilized to create a base map on which the final delineation information would be added to complete the detailed wetland mapping. Once created, this base map was then downloaded into Pathfinder Office and transferred to a Trimble GeoExplorer 6000 mapping unit that would capture the gps locations of the wetland boundaries collected in the field with sub-meter accuracy.

The field delineation was conducted utilizing the methods established in the *Corps of Engineers Wetlands Delineation Manual* (USACE 1987) as well as the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)*. These manuals provide detailed guidance regarding hydrology, vegetation, and soils, and the indicators of these for which a wetland determination is made.

3.1 Wetland Field Delineation

The field delineation was conducted between 24-26 October 2016. During this delineation 33 sampling locations, utilizing Wetland Determination forms for the Eastern Mountains and Piedmont Region were used to make wetland/non-wetland determinations (Appendix A). These determinations are based on the investigation of the required indicators associated with hydrology, vegetation, and soils.

In order to determine positive wetland hydrology, at least one of the 17 primary indicators or 2 of the 12 secondary indicators is required.

The plant species within each stratum (Tree, shrub, herbaceous, and woody vine) were investigated to determine the percent of hydrophytic vegetation present according to the wetland indicator status set forth in the 2016 National Wetland Plant List, Regional List for the Eastern Mountains and Piedmont Region.
(http://rsgisias.crrel.usace.army.mil/nwpl_static/data/DOC/lists_2016/Regions/pdf/reg_EMP_2016v1.pdf)
If the plant communities present passed either the Rapid Test for Hydrophytic Vegetation, the Dominance Test, or Prevalence Index, then it was given a “wetland vegetation present” status.

At each sampling location soil borings were taken to make a hydric/non-hydric soil determination. These locations were also investigated to determine whether or not they matched the mapped soil types. The Regional Supplement outlines 28 hydric soil indicators, only one of which is required to make a hydric soil determination. Of these, the most commonly found indicator is a depleted soil matrix.

3.2 Wetland Boundary Mapping

Wetland boundaries were marked in the field by pink wetland flagging imprinted with “wetland delineation” in black. The flags were marked with an alpha numeric designator and the location was logged with a Trimble GeoExplorer 6000. Waterways such as

streams or ditches were marked with blue and white "barber pole" tape and labeled with an alpha numeric. All sampling points where a wetland determination form was executed were marked in the field by red and white barber pole tape.

Location data was then downloaded into Pathfinder Office, and post-processed for accuracy. This location data was then exported into ArcGIS software and feature polygons were created to produce a map that would be submitted to the U.S. Army Corps of Engineers for a Preliminary Jurisdictional Determination (JD). This mapping can be found in Appendix A.

3.3 **Jurisdiciton**

A field confirmation of the wetland boundaries was conducted by Ms. Theresita Crockett-Augustine from the U.S. Army Corps of Engineers on 16 February 2016. The Preliminary Jurisdictional Determination letter associated with this confirmation, dated 3/14/2017 (File NAO-2017-00508, Manassas Regional Airport) can be found in Appendix B.

4.0 RESULTS & CONCLUSIONS

4.1 Results

The wetland delineation associated with the west (W) portion of the EA study area found 3.33 acres of wetlands and 104 linear feet of jurisdictional ditch within the study area boundaries. Of this 3.33 acres, 3.31 acres were determined to be palustrine forested (PFO) wetlands, while .02 acres were determined to be palustrine emergent (PEM) wetlands.

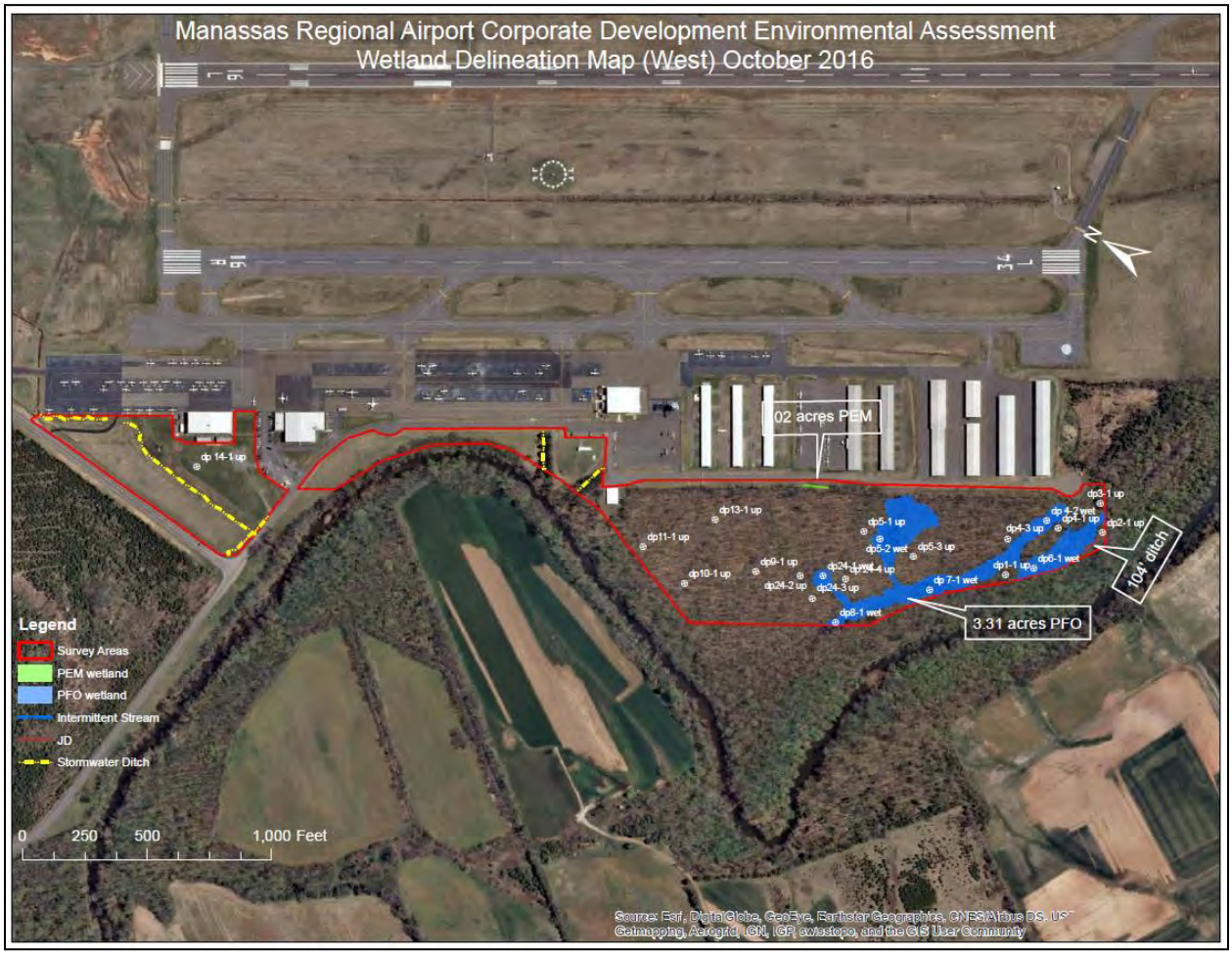


Figure 4-1. Manassas Regional Airport EA Study Area Wetland Delineation Map (West)

The wetland delineation associated with the east (E) portion of the EA study area found 1.514 acres of wetlands, and 10 linear feet of intermittent stream within the study area boundaries. Of this 1.514 acres, 1.51 were determined to be palustrine forested (PFO) wetlands, while .004 acres were determined to be palustrine emergent (PEM) wetlands.



Figure 4-2. Manassas Regional Airport EA Study Area Wetland Delineation Map (East)

Across both study areas a total of 4.84 acres of wetlands and 114 linear feet of RPW were delineated and confirmed by the Corps of Engineers. These totals and are outlined in the JD found in Appendix A.

Aquatic Resource	EA Study Area West	EA Study Area East	Total
PFO Wetlands (Acres)	3.31	1.51	4.82
PEM Wetlands (Acres)	0.02	0.004	0.024
Stream (linear feet)	0	10	10
Jurisdicitonal Ditch (linear feet)	104	0	104

Figure 4-3. Manassas Regional Airport EA Study Area Table of Aquatic Resources

4.2 Conclusions

In conclusion, any activity resulting in the dredging, filling, or altering of the jurisdictional waters of the US present may require a permit from the U.S. Army Corps of Engineers or the Virginia Department of Environmental Quality. Further coordination should be conducted prior to commencement of work in those areas.

5.0 REFERENCES

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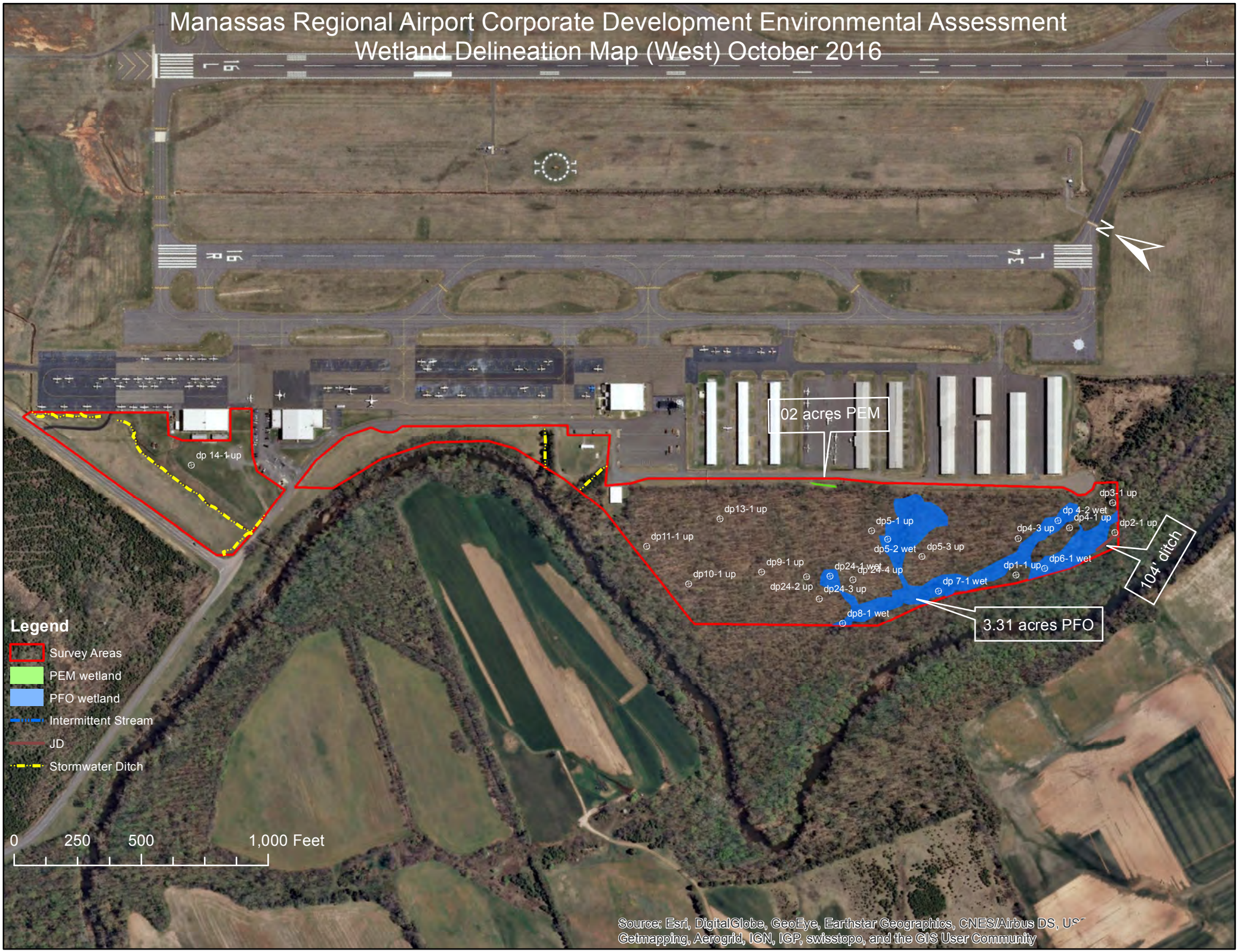
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APPENDIX A
Wetland Delineation Map and Wetland Determination Forms (EMP)

Manassas Regional Airport Corporate Development Environmental Assessment
Wetland Delineation Map (West) October 2016




Manassas Regional Airport Corporate Development Environmental Assessment
Wetland Delineation Map (East) October 2016
Legend
Survey Areas
PEM wetland
PFO wetland
Intermittent Stream
0
125
250
500 Feet
10' intermittent stream
dp18-2 wet
dp 18-1 up
dp 23-1 up
.004 acres PEM
.02 acres PFO
dp17-2 up
dp16-1 up
dp22-1 up
1.49 acres PFO
dp19-1 up
dp21-1up
dp 20-1 wet
dp15-2 wet
dp 20-2 up
dp15-1 up
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, U
Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **1-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** none **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'0.807"N **Long.:** 77°31'8.626"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 1-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya cordiformis	20	☑	80.0%	FACU
2. Acer negundo	5	☑	20.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	25	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Asimina triloba	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	5	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	5	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	20	x 3 =	60	
FACU species	25	x 4 =	100	
UPL species	0	x 5 =	0	
Column Totals:	45	(A)	160	(B)

Prevalence Index = B/A = 3.556

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 1-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-10	10YR	4/6	100					Silt Loam	
10-13	10YR	4/6	60					Silt Loam	
	10YR	4/3	40					Silt Loam	
13-16	10YR	4/6	90					Silt Loam	
	10YR	5/2	10					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **1-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3370.JPG** Orientation: South -facing

Lat/Long or UTM : Long/Easting: **77°31'8.626"W** Lat/Northing: **38°43'0.807"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **2-1 Up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°42'58.239"N **Long.:** 77°31'4.387"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 2-1 Up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	40	☑	72.7%	UPL
2. Ailanthus altissima	10	☐	18.2%	FACU
3. Juglans nigra	5	☐	9.1%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	55	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Carya tomentosa	5	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	5	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	15	x 4 =	60	
UPL species	45	x 5 =	225	
Column Totals:	60	(A)	285	(B)

Prevalence Index = B/A = 4.750

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 2-1 Up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Redox Features Loc²	Texture	Remarks
0-6	10YR 4/6	100					Silt Loam	
6-12	10YR 5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **2-1 Up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3371.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'4.387"W** Lat/Northing: **38°42'58.239"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **3-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°42'58.87"N **Long.:** 77°31'3.137"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 3-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus velutina	20	☑	25.0%	UPL
2. Acer rubrum	35	☑	43.8%	FAC
3. Carya tomentosa	25	☑	31.3%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	80		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Asimina triloba	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Rubus allegheniensis	5	☑	50.0%	FACU
2. Toxicodendron radicans	5	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	10		= Total Cover	
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 42.9% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	55	x 3 =	165	
FACU species	10	x 4 =	40	
UPL species	45	x 5 =	225	
Column Totals:	110	(A)	430	(B)

Prevalence Index = B/A = 3.909

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 3-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-6	10YR	4/6	100					Silt Loam	
6-12	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **3-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3372.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'3.137"W** Lat/Northing: **38°42'58.87"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **4-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°42'59.901"N **Long.:** 77°31'5.261"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 4-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	30	☑	60.0%	UPL
2. Quercus rubra	20	☑	40.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carpinus caroliniana	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0		= Total Cover	
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	20	☑	80.0%	FACU
2. Smilax rotundifolia	5	☑	20.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	25		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	15	x 3 =	45	
FACU species	40	x 4 =	160	
UPL species	30	x 5 =	150	
Column Totals:	85	(A)	355	(B)

Prevalence Index = B/A = 4.176

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 4-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-4	10YR	4/4	100					Silt Loam	
4-12	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **4-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3373.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'5.261"W** Lat/Northing: **38°42'59.901"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **4-2 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 1.0% / 0.6 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'0.419"N **Long.:** 77°31'5.195"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ◉ No ○ Depth (inches): 4

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 4-2 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	35	☑	58.3%	FAC
2. Ulmus americana	25	☑	41.7%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Carex intumescens	20	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	20		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	45	x 2 =	90	
FAC species	35	x 3 =	105	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	80	(A)	195	(B)

Prevalence Index = B/A = 2.438

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 4-2 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-5	10YR	4/1	70	5YR	4/6	30	C	M	Silt Loam	
5-8	10YR	4/1	85	5YR	4/6	15	C	M	Silt Loam	
8-14	10YR	5/1	80	7.5YR	4/6	20	C	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **4-2 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3374.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'5.195"W** Lat/Northing: **38°43'0.419"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **4-3 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Toeslope **Local relief (concave, convex, none):** none **Slope:** 4.0% / 2.3 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'1.376"N **Long.:** 77°31'6.978"W **Datum:** NAD 83

Soil Map Unit Name: Elsinboro silt laom **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 4-3 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	40	☑	66.7%	UPL
2. Quercus rubra	10	☐	16.7%	FACU
3. Acer rubrum	10	☐	16.7%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Asimina triloba	20	☑	66.7%	FAC
2. Carpinus caroliniana	10	☑	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	30	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	40	x 3 =	120	
FACU species	10	x 4 =	40	
UPL species	40	x 5 =	200	
Column Totals:	90	(A)	360	(B)

Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 4-3 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-3	10YR 4/4	100					Silt Loam	
3-12	10YR 5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **4-3 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3375.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'6.978"W** Lat/Northing: **38°43'1.376"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **5-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** none **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'6.507"N **Long.:** 77°31'10.228"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 5-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus rubra	25	☑	38.5%	FACU
2. Quercus phellos	10	☐	15.4%	FAC
3. Carya tomentosa	10	☐	15.4%	UPL
4. Acer rubrum	20	☑	30.8%	FAC
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	65	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Carya tomentosa	5	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	5	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	30	x 3 =	90	
FACU species	30	x 4 =	120	
UPL species	15	x 5 =	75	
Column Totals:	75	(A)	285	(B)

Prevalence Index = B/A = 3.800

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 5-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR 5/4	100					Silt Loam	
5-12	10YR 5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **5-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3384.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'10.228"** Lat/Northing: **38°43'6.507"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **5-2 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'5.823"N **Long.:** 77°31'10.192"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ◉ No ○ Depth (inches): 1

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 5-2 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	60	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Carex lurida	15	☑	42.9%	OBL
2. Leersia oryzoides	15	☑	42.9%	OBL
3. Carex intumescens	5	☐	14.3%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	35		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	30	x 1 =	30	
FACW species	5	x 2 =	10	
FAC species	60	x 3 =	180	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	220	(B)

Prevalence Index = B/A = 2.316

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 5-2 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-4	10YR	4/1	100						Silt Loam	
4-8	10YR	5/1	70	5YR	4/6	30	C	M	Silt Loam	
8-13	10YR	5/1	80	7.5YR	4/6	20	C	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **5-2 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3385.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'10.192"** Lat/Northing: **38°43'5.823"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 24-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **5-3 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** rolling **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'4.332"N **Long.:** 77°31'10.098"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 5-3 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus rubra	30	☑	60.0%	FACU
2. Carya tomentosa	20	☑	40.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Acer rubrum	10	☑	33.3%	FAC
2. Carpinus caroliniana	10	☑	33.3%	FAC
3. Asimina triloba	10	☑	33.3%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	30	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	30	x 3 =	90	
FACU species	30	x 4 =	120	
UPL species	20	x 5 =	100	
Column Totals:	80	(A)	310	(B)

Prevalence Index = B/A = 3.875

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 5-3 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR 5/4	100					Silt Loam	
5-12	10YR 5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **5-3 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3386.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'10.098"** Lat/Northing: **38°43'4.332"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **6-1 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°42'59.944"N **Long.:** 77°31'7.618"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☑ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 6-1 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer negundo	30	☑	60.0%	FAC
2. Carpinus caroliniana	20	☑	40.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Saururus cernuus	20	☑	50.0%	OBL
2. Boehmeria cylindrica	10	☑	25.0%	FACW
3. Dichanthelium acuminatum	10	☑	25.0%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	40	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Smilax rotundifolia	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	15	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 6 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	20	x 1 =	20	
FACW species	10	x 2 =	20	
FAC species	75	x 3 =	225	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	105	(A)	265	(B)

Prevalence Index = B/A = 2.524

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 6-1 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-3	10YR	5/2	90	5YR	4/6	10	C	M	Silt Loam	
3-8	10YR	5/2	70	5YR	4/6	30	C	M	Silty Clay Loam	
8-14	10YR	5/1	85	7.5YR	4/6	15	C	M	Silty Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **6-1 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3387.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'7.618"W** Lat/Northing: **38°42'59.944"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **7-1 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'3.14"N **Long.:** 77°31'11.214"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 6	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 7-1 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	25	☑	55.6%	FAC
2. Quercus palustris	20	☑	44.4%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	45	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carpinus caroliniana	10	☑	83.3%	FAC
2. Quercus alba	2	☐	16.7%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	12	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Boehmeria cylindrica	10	☑	50.0%	FACW
2. Carex lurida	10	☑	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	20	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	10	x 1 =	10	
FACW species	30	x 2 =	60	
FAC species	35	x 3 =	105	
FACU species	2	x 4 =	8	
UPL species	0	x 5 =	0	
Column Totals:	77	(A)	183	(B)

Prevalence Index = B/A = 2.377

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 7-1 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-6	10YR	4/1	80	7.5YR	4/6	20	C	M	Silt Loam	
6-10	10YR	5/1	80	7.5YR	4/6	20	C	M	Silt Loam	
10-14	10YR	5/1	85	7.5YR	5/6	15	C	M	Silty Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **7-1 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3388.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'11.214"** Lat/Northing: **38°43'3.14"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **8-1 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'5.727"N **Long.:** 77°31'14.929"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 8-1 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus palustris	30	☑	50.0%	FACW
2. Acer rubrum	20	☑	33.3%	FAC
3. Quercus montana	10	☐	16.7%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Carex lurida	25	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	25	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	25	x 1 =	25	
FACW species	30	x 2 =	60	
FAC species	20	x 3 =	60	
FACU species	0	x 4 =	0	
UPL species	10	x 5 =	50	
Column Totals:	85	(A)	195	(B)

Prevalence Index = B/A = 2.294

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 8-1 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-8	10YR	4/1	80	7.5YR	4/6	20	C	M	Silt Loam	
8-13	10YR	5/1	90	7.5YR	4/6	10	C	M	Silty Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **8-1 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3390.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'14.929"** Lat/Northing: **38°43'5.727"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **9-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'9.468"N **Long.:** 77°31'14.684"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 9-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	30	☑	75.0%	UPL
2. Quercus velutina	10	☑	25.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carya tomentosa	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	20	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	20	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	20	x 4 =	80	
UPL species	50	x 5 =	250	
Column Totals:	70	(A)	330	(B)

Prevalence Index = B/A = 4.714

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 9-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-4	10YR	4/4	100					Silt Loam	
4-12	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **9-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3391.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'14.684"** Lat/Northing: **38°43'9.468"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **10-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'11.683"N **Long.:** 77°31'16.968"W **Datum:** NAD 83

Soil Map Unit Name: Delanco fine sandy loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 10-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	30	☑	66.7%	UPL
2. Quercus velutina	15	☑	33.3%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	45	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Asimina triloba	20	☑	80.0%	FAC
2. Carpinus caroliniana	5	☑	20.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	25	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	25	x 3 =	75	
FACU species	0	x 4 =	0	
UPL species	45	x 5 =	225	
Column Totals:	70	(A)	300	(B)

Prevalence Index = B/A = 4.286

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 10-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	2.5Y	5/4	100					Fine Sandy Loam	
5-13	2.5Y	5/6	100					Fine Sandy Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **10-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3392.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'16.968"** Lat/Northing: **38°43'11.683"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **11-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'13.865"N **Long.:** 77°31'16.395"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 11-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus velutina	25	☑	38.5%	UPL
2. Carya tomentosa	20	☑	30.8%	UPL
3. Quercus alba	15	☑	23.1%	FACU
4. Quercus rubra	5	☐	7.7%	FACU
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	65	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carpinus caroliniana	5	☑	71.4%	FAC
2. Carya tomentosa	2	☑	28.6%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	7	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 20.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	5	x 3 =	15	
FACU species	20	x 4 =	80	
UPL species	47	x 5 =	235	
Column Totals:	72	(A)	330	(B)

Prevalence Index = B/A = 4.583

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 11-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-4	2.5Y	6/4	100					Silt Loam	
4-10	2.5Y	6/6	100					Silt Loam	
10-14	2.5Y	6/4	90					Silt Loam	
	2.5Y	6/3	10					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **11-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3393.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'16.395"** Lat/Northing: **38°43'13.865"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **13-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'11.903"N **Long.:** 77°31'13.416"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 13-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus velutina	25	☑	45.5%	UPL
2. Carya tomentosa	20	☑	36.4%	UPL
3. Acer rubrum	10	☐	18.2%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	55	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carpinus caroliniana	5	☑	50.0%	FAC
2. Quercus velutina	5	☑	50.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	15	x 3 =	45	
FACU species	0	x 4 =	0	
UPL species	50	x 5 =	250	
Column Totals:	65	(A)	295	(B)

Prevalence Index = B/A = 4.538

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 13-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	2.5Y	4/3	100					Silt Loam	
5-13	2.5Y	6/4	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **13-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3397.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'13.416"** Lat/Northing: **38°43'11.903"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **14-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Flat **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'30.864"N **Long.:** 77°31'23.974"W **Datum:** NAD 83

Soil Map Unit Name: Urban land udorthents **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 14-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1. Andropogon virginicus	10	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	10	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	10	x 4 =	40	
UPL species	0	x 5 =	0	
Column Totals:	10	(A)	40	(B)

Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

This area is a mowed/maintained lot adjacent to hangar space associated with the airport

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 14-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Fill material of mulitple colors and textures. No consistent measurable with the clay fill material.

Plot ID: **14-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3399.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'23.974"** Lat/Northing: **38°43'30.864"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **15-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 5.0% / 2.9 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'38.068"N **Long.:** 77°30'38.264"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 15-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	30	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	30	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Carya tomentosa	15	☑	75.0%	UPL
2. Cornus florida	5	☑	25.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	5	x 4 =	20	
UPL species	45	x 5 =	225	
Column Totals:	50	(A)	245	(B)

Prevalence Index = B/A = 4.900

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 15-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR 4/6						Silt Loam	
5-12	7.5YR 4/6						Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **15-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3401.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'38.264"** Lat/Northing: **38°43'38.068"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **15-2 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'38.498"N **Long.:** 77°30'37.29"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ◉ No ○ Depth (inches): 4

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 15-2 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	40	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Vaccinium corymbosum	5	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Saururus cernuus	50	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	50	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50	
FACW species	5	x 2 =	10	
FAC species	40	x 3 =	120	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	180	(B)

Prevalence Index = B/A = 1.895

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 15-2 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-2	10YR 2/1						Silt Loam	
2-12	N 4/						Silt Loam	gley indicates prolonged sat

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☑ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **15-2 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3400.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'37.29"W** Lat/Northing: **38°43'38.498"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **16-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** convex **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'42.946"N **Long.:** 77°30'41.291"W **Datum:** NAD 83

Soil Map Unit Name: Panorama silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 16-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	40	☑	66.7%	UPL
2. Acer rubrum	10	☐	16.7%	FAC
3. Quercus alba	10	☐	16.7%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Juniperus virginiana	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	10	x 3 =	30	
FACU species	15	x 4 =	60	
UPL species	40	x 5 =	200	
Column Totals:	65	(A)	290	(B)

Prevalence Index = B/A = 4.462

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 16-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	2.5Y	4/3	100					Silt Loam	
5-13	2.5Y	6/4	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **16-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3402.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.291"** Lat/Northing: **38°43'42.946"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **17-2 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 5.0% / 2.9 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'42.946"N **Long.:** 77°30'41.291"W **Datum:** NAD 83

Soil Map Unit Name: Arcola silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 17-2 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Juniperus virginiana	40	☑	61.5%	FACU
2. Pinus virginiana	20	☑	30.8%	UPL
3. Nyssa sylvatica	5	☐	7.7%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	65	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	25	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	25	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	30	x 3 =	90	
FACU species	40	x 4 =	160	
UPL species	20	x 5 =	100	
Column Totals:	90	(A)	350	(B)

Prevalence Index = B/A = 3.889

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 17-2 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Loc²	Texture	Remarks
0-12	5YR 4/6	100					Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **17-2 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3403.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.291"** Lat/Northing: **38°43'42.946"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **18-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Hatboro silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 18-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Juglans nigra	10	☑	50.0%	FACU
2. Ailanthus altissima	10	☑	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	20	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Juglans nigra	10	☑	50.0%	FACU
2. Quercus velutina	10	☑	50.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	75	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	75	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 16.7% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	75	x 3 =	225	
FACU species	35	x 4 =	140	
UPL species	10	x 5 =	50	
Column Totals:	120	(A)	415	(B)

Prevalence Index = B/A = 3.458

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 18-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-12	10YR 4/6						Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

soils in this area consist of heavily compacted coarse fill materials most likely due to construction fill for the sewer line right of way.

Plot ID: **18-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3405.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **18-2 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Hatboro silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 2	
Water Table Present?	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 18-2 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Salix nigra	15	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	25	☑	62.5%	FAC
2. Boehmeria cylindrica	15	☑	37.5%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	40	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	15	x 1 =	15	
FACW species	15	x 2 =	30	
FAC species	25	x 3 =	75	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	55	(A)	120	(B)

Prevalence Index = B/A = 2.182

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 18-2 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Loc²	Texture	Remarks
0-10	10YR 4/1	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **18-2 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3404.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **19-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** rolling **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 19-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus montana	20	☑	50.0%	UPL
2. Quercus phellos	15	☑	37.5%	FAC
3. Ulmus americana	5	☐	12.5%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Acer rubrum	20	☑	57.1%	FAC
2. Juniperus virginiana	15	☑	42.9%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	35	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	80	☑	88.9%	FAC
2. Lespedeza cuneata	10	☐	11.1%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	5	x 2 =	10	
FAC species	115	x 3 =	345	
FACU species	25	x 4 =	100	
UPL species	20	x 5 =	100	
Column Totals:	165	(A)	555	(B)

Prevalence Index = B/A = 3.364

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 19-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-7	10YR	4/4	100					Loam	
7-10	10YR	4/4	80					Silt Loam	
	10YR	4/3	20					Silt Loam	
	10YR	4/6	10					Silt Loam	
10-14	10YR	5/3	70					Loam	
	10YR	4/6	30					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **19-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3407.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **20-1 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Toeslope **Local relief (concave, convex, none):** concave **Slope:** 5.0% / 2.9 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 20-1 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	20	☑	50.0%	FAC
2. Ulmus americana	20	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	80	☑	88.9%	FAC
2. Boehmeria cylindrica	10	☐	11.1%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	30	x 2 =	60	
FAC species	100	x 3 =	300	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	130	(A)	360	(B)

Prevalence Index = B/A = 2.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 20-1 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-4	10YR	3/3	100						Silt Loam	
4-9	10YR	5/2	80	10YR	4/6	5	C	M	Silt Loam	
	10YR	4/3	15						Silt Loam	
9-14	10YR	6/2	80	10YR	4/6	20	C	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **20-1 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3410.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **20-2 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'40.159"N **Long.:** 77°30'39.711"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 20-2 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus falcata	40	☑	42.1%	FACU
2. Carya tomentosa	40	☑	42.1%	UPL
3. Quercus phellos	15	☐	15.8%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Asimina triloba	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	15	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	40	x 3 =	120	
FACU species	40	x 4 =	160	
UPL species	40	x 5 =	200	
Column Totals:	120	(A)	480	(B)

Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 20-2 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR	4/4	100					Silt Loam	
5-9	10YR	5/6	100					Silt Loam	
9-14	7.5YR	5/6						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **20-2 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3411.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'39.711"** Lat/Northing: **38°43'40.159"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **21-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'40.159"N **Long.:** 77°30'39.711"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 21-1 up

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Acer rubrum	30	☑	54.5%	FAC
2. Carya tomentosa	25	☑	45.5%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	55	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carya tomentosa	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	20	☑	90.9%	FAC
2. Polystichum acrostichoides	2	☐	9.1%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	22	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Smilax rotundifolia	2	☐	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	2	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	52	x 3 =	156	
FACU species	2	x 4 =	8	
UPL species	35	x 5 =	175	
Column Totals:	89	(A)	339	(B)

Prevalence Index = B/A = 3.809

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 21-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR	4/6	100					Silt Loam	
5-10	10YR	4/4	100					Silt Loam	
10-14	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **21-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3412.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'39.711"** Lat/Northing: **38°43'40.159"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **22-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 8.0% / 4.6 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'40.958"N **Long.:** 77°30'41.203"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 22-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	25	☑	50.0%	UPL
2. Acer rubrum	25	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carya tomentosa	5	☑	33.3%	UPL
2. Ulmus americana	10	☑	66.7%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0		= Total Cover	
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	22.7%	FACU
2. Smilax rotundifolia	15	☑	68.2%	FAC
3. Campsis radicans	2	☐	9.1%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	22		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	10	x 2 =	20	
FAC species	42	x 3 =	126	
FACU species	5	x 4 =	20	
UPL species	30	x 5 =	150	
Column Totals:	87	(A)	316	(B)

Prevalence Index = B/A = 3.632

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 22-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	5YR	3/4	100					Loam	
5-8	10YR	5/4	100					Coarse Sandy Loam	
8-14	10YR	5/3	50					Silt Loam	
	10YR	5/6	50					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

This data point sits in the vicinity of a stormwater pipe that moves water towards the stream to the east outside of the survey area. A data point was taken here to confirm the water moves through the area after storm events and does not sit long saturating the profile.

Plot ID: **22-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3413.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.203"** Lat/Northing: **38°43'40.958"N**

Description:



Photo File: **IMG_3415.JPG** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **23-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.811"N **Long.:** 77°30'47.894"W **Datum:** NAD 83

Soil Map Unit Name: Hatboro silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches): _____

Water Table Present? Yes ○ No ◉ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches): _____

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 23-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Prunus serotina	20	☑	40.0%	FACU
2. Juniperus virginiana	20	☑	40.0%	FACU
3. Juglans nigra	10	☑	20.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	20	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	20		= Total Cover	
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	0	☐	0.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	20	x 3 =	60	
FACU species	50	x 4 =	200	
UPL species	0	x 5 =	0	
Column Totals:	70	(A)	260	(B)

Prevalence Index = B/A = 3.714

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 23-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Loc²	Texture	Remarks
0-10	5YR 4/6	100					Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

soils are highly compacted. Very difficult to get auger into the ground.

Plot ID: **23-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3416.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.894"** Lat/Northing: **38°43'51.811"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **24-1 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Flat **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'7.092"N **Long.:** 77°31'13.214"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

This area is a low area surrounded by hight topography on all sides with a drainage way connecting to the larger wetlan system to the south. Subtle to notice in the fall.

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 24-1 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus palustris	30	☑	50.0%	FACW
2. Acer rubrum	30	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Acer rubrum	15	☑	75.0%	FAC
2. Ulmus americana	5	☑	25.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Smilax rotundifolia	2	☐	50.0%	FAC
2. Carex lurida	2	☐	50.0%	OBL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	4	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	2	x 1 =	2	
FACW species	35	x 2 =	70	
FAC species	47	x 3 =	141	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	84	(A)	213	(B)

Prevalence Index = B/A = 2.536

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 24-1 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-3	10YR	4/4	100						Silt Loam	
3-13	10YR	5/1	90	10YR	5/6	10	C	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **24-1 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3417.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'13.214"** Lat/Northing: **38°43'7.092"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **24-2 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Flat **Local relief (concave, convex, none):** flat **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'7.869"N **Long.:** 77°31'13.797"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 24-2 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	25	☑	45.5%	UPL
2. Acer rubrum	10	☑	18.2%	FAC
3. Quercus velutina	10	☑	18.2%	UPL
4. Quercus alba	10	☑	18.2%	FACU
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	55	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carya tomentosa	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 16.7% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	10	x 3 =	30	
FACU species	15	x 4 =	60	
UPL species	45	x 5 =	225	
Column Totals:	70	(A)	315	(B)

Prevalence Index = B/A = 4.500

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 24-2 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-6	10YR	4/4	100					Silt Loam	
6-12	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **24-2 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3418.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'13.797"** Lat/Northing: **38°43'7.869"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **24-3 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Flat **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'6.994"N **Long.:** 77°31'14.463"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	
Hydric Soil Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○ No ◉	

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 24-3 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus rubra	25	☑	50.0%	FACU
2. Carya tomentosa	25	☑	50.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Quercus rubra	25	☑	50.0%	FACU
2. Carya tomentosa	25	☑	50.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	50	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	50	x 4 =	200	
UPL species	50	x 5 =	250	
Column Totals:	100	(A)	450	(B)

Prevalence Index = B/A = 4.500

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 24-3 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-6	10YR	4/4	100					Silt Loam	
6-12	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **24-3 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3419.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'14.463"** Lat/Northing: **38°43'6.994"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **24-4 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Footslope **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'6.232"N **Long.:** 77°31'12.796"W **Datum:** NAD 83

Soil Map Unit Name: Aden Silt Loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 24-4 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus rubra	25	☑	41.7%	FACU
2. Acer rubrum	15	☑	25.0%	FAC
3. Carya tomentosa	10	☐	16.7%	UPL
4. Quercus alba	10	☐	16.7%	FACU
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carpinus caroliniana	5	☐	16.7%	FAC
2. Carya tomentosa	10	☑	33.3%	UPL
3. Asimina triloba	15	☑	50.0%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	30	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1. Smilax rotundifolia	2	☐	50.0%	FAC
2. Lonicera japonica	2	☐	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	4	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	37	x 3 =	111
FACU species	37	x 4 =	148
UPL species	20	x 5 =	100
Column Totals:	94 (A)		359 (B)

Prevalence Index = B/A = 3.819

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 24-4 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Redox Features Loc²	Texture	Remarks
0-6	10YR 4/4	100					Silt Loam	
6-12	10YR 5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **24-4 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3420.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°31'12.796"** Lat/Northing: **38°43'6.232"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

APPENDIX B
USACE Jurisdictional Determination and Supporting Documentation
File: NAO 2017-00508

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1011

March 14, 2017

PRELIMINARY JURISDICTIONAL DETERMINATION

Northern Virginia Regulatory Section
NAO-2017-00508 (Manassas Regional Airport)

Manassas Regional Airport
10600 Harry J. Parrish Boulevard
Manassas, VA 20110

Ladies and/or Gentlemen:

This letter is in regard to your request for a verification of a preliminary jurisdictional determination for waters of the U.S. (including wetlands) on property known as the Manassas Regional Airport, located on an approximately 47 acre parcel, at 10600 Harry J. Parrish Boulevard, in Manassas, Virginia.

The maps entitled "Manassas Regional Airport Corporate Development Environmental Assessment Wetland Delineation Map", by Mill Creek Environmental Consultants, LTD dated October 2016 (*copies enclosed)* provides the location of waters and/or wetlands on the property listed above. The basis for this delineation includes application of the Corps' 1987 Wetland Delineation Manual and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region*, and the positive indicators of wetland hydrology, hydric soils, and hydrophytic vegetation and the presence of an ordinary high water mark.

Discharges of dredged or fill material, including those associated with mechanized landclearing, into waters and/or wetlands on this site may require a Department of the Army permit and authorization by state and local authorities including a Virginia Water Protection Permit from the Virginia Department of Environmental Quality (DEQ), a permit from the Virginia Marine Resources Commission (VMRC) and/or a permit from your local wetlands board. This letter is a confirmation of the Corps preliminary jurisdiction for the waters and/or wetlands on the subject property and does not authorize any work in these areas. Please obtain all required permits before starting work in the delineated waters/wetland areas.

This is a preliminary jurisdictional determination and is therefore not a legally binding determination regarding whether Corps jurisdiction applies to the waters or wetlands in question. Accordingly, you may either consent to jurisdiction as set out in this preliminary jurisdictional determination and the attachments hereto if you agree with the determination, or you may request and obtain an approved jurisdictional determination.

“This preliminary jurisdictional determination and associated wetland delineation map may be submitted with a permit application.”

Enclosed is a copy of the “Preliminary Jurisdictional Determination Form”. Please review the document, sign, and return one copy to Ms. Theresita Crockett-Augustine either via email (**theresita.m.crockett-augustine@usace.army.mil**) or via standard mail to US Army Corps of Engineers, Northern Virginia Field Office at 18139 Triangle Plaza, Suite 213, Dumfries, Virginia 22026 within 30 days of receipt and keep one for your records. This delineation of waters and/or wetlands is valid for a period of five years from the date of this letter unless new information warrants revision prior to the expiration date.

If you have any questions, please contact Ms. Theresita Crockett-Augustine at (703) 221-9736 or **theresita.m.crockett-augustine@usace.army.mil**.

Sincerely,



Theresita Crockett-Augustine
Environmental Scientist
Northern Virginia Regulatory Section

Enclosures

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION:

A. REPORT COMPLETION DATE FOR PJD: March 14, 2017

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Manassas Regional Airport
10600 Harry J. Parrish Boulevard
Manassas, VA 20110

DISTRICT OFFICE, FILE NAME, AND NUMBER: NAO, Manassas Regional Airport, NAO-2017-00508

C. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: (USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: **VIRGINIA** County/parish/borough: City: Manassas

Center coordinates of site (lat/long in degree decimal format):

Latitude: 38.723 ° N Longitude: -77.517 ° W

Universal Transverse Mercator:

Name of nearest waterbody: Cannon Branch

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): 2/16/17

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
1			114 LF	RPW	Section 404
2			4.84 acre	Wetland	Section 404
3					

1. The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre- construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there "may be" waters of the U.S. and/or that there "may be" navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA: Data reviewed for preliminary JD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items.

☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
Map:

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report. Rationale:

☐ Data sheets prepared by the Corps:

☐ Corps navigable waters' study:

☐ U.S. Geological Survey Hydrologic Atlas: USGS

☐ NHD data.

☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name:

☒ Natural Resources Conservation Service Soil Survey. Citation:

☒ National wetlands inventory map(s). Cite name:

☐ State/Local wetland inventory map(s):

☐ FEMA/FIRM maps:

☐ 100-year Floodplain Elevation: (National Geodetic Vertical Datum of 1929)

☒ Photographs ☒ Aerial (Name & Date):

or ☒ Other (Name & Date):

☐ Previous determination(s):

File no. and date of response letter:

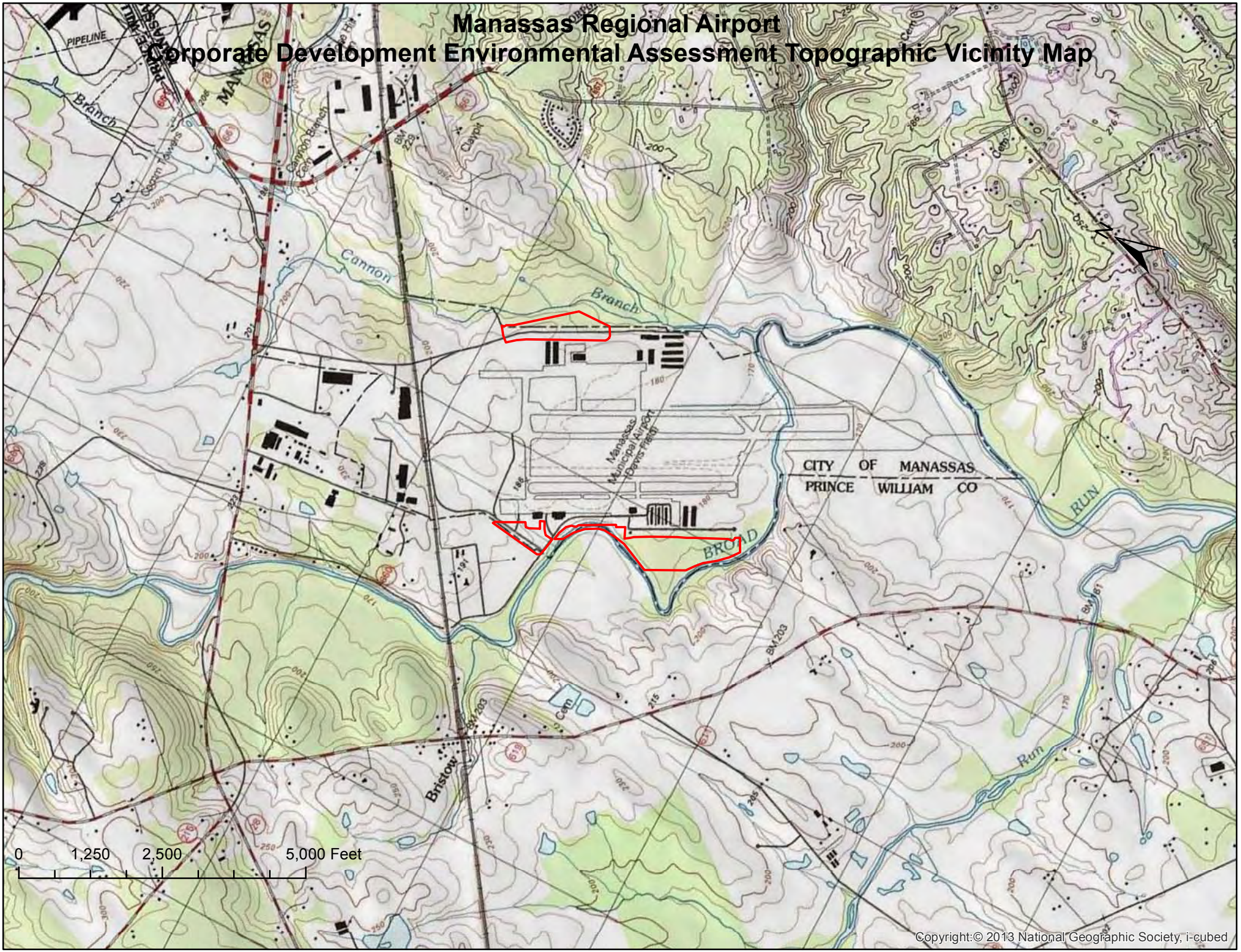
☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

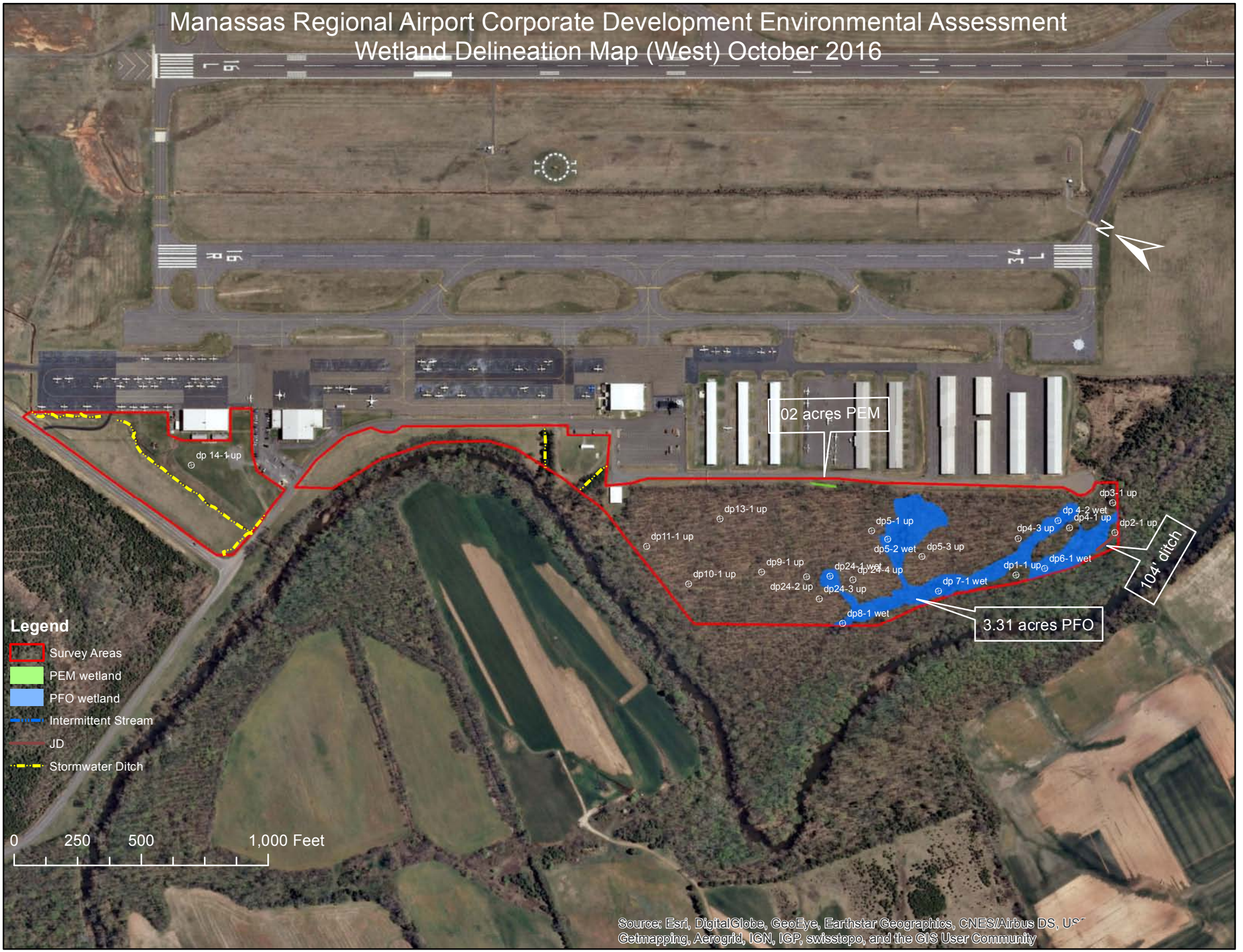
Signature and date of Regulatory staff member completing PJD	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

1 Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

Manassas Regional Airport
Corporate Development Environmental Assessment Topographic Vicinity Map



Manassas Regional Airport Corporate Development Environmental Assessment
Wetland Delineation Map (West) October 2016




Manassas Regional Airport Corporate Development Environmental Assessment
Wetland Delineation Map (East) October 2016
Legend
Survey Areas
PEM wetland
PFO wetland
Intermittent Stream
0
125
250
500 Feet
10' intermittent stream
dp18-2 wet
dp 18-1 up
dp 23-1 up
.004 acres PEM
.02 acres PFO
dp17-2 up
dp16-1 up
dp22-1 up
1.49 acres PFO
dp19-1 up
dp21-1up
dp 20-1 wet
dp15-2 wet
dp 20-2 up
dp15-1 up
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, U
Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VIRGINIA 23510-1011

MARCH 14, 2017

Supplemental Preapplication Information

Project Number: NAO-2017-00508 (Manassas Regional Airport)
Applicant: Manassas Regional Airport
Project Location: Manassas, Virginia

1. A search of the Virginia Department of Historic Resources data revealed the following:

☐ No known historic properties are located on the property.

☒ The following known architectural resources are located on the property:

DHR ID	Address	Restricted	Property Names
076-5036	Centreville Road - Alt Route 28, John Marshall Highway - Alt Route 55, Linton Hall Road - Alt Route 619, Sudley Road - Alt Route 234	Unrestricted	Bristoe Station Battlefield (Historic), Bull Run Bridge (Historic), Kettle Run Battlefield (Historic), Manassas Station Operations Battlefield (Historic), Union Mills (Historic)
076-5399	-	Unrestricted	Orange and Alexandria Railway section (Descriptive), Train Tracks, South of the Route 28 and 234 Intersection (Function/Location)

☒ The following known archaeological resources are located on the property:

DHR ID	Site Name	Site Category	Time Period	NR Eligible	Restricted
44PW0729	-	DSS Legacy	Middle Archaic (6500 - 3001 B.C.), Woodland (1200 B.C. - 1606 A.D.)	-	Restricted: No release

☐ The following known historic resources are located in the vicinity of the property (potential for effects to these resources from future development):

NOTE:

1) *The information above is for planning purposes only. In most cases, the property has not been surveyed for historic resources. Undiscovered historic resources may be located on the subject property or adjacent properties and this supplemental information is not intended to satisfy the Corps' requirements under Section 106 of the National Historic Preservation Act (NHPA).*
2) *Prospective permittees should be aware that Section 110k of the NHPA (16 U.S.C. 470h-2(k)) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of Section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant.*

2. A search of the data supplied by the U.S. Fish & Wildlife Service, the Virginia Department of Conservation and Recreation and the Virginia Department of Game and Inland Fisheries revealed the following:

☐ No known populations of threatened or endangered species are located on or within the vicinity of the subject property.

☒ The following federally-listed species may occur within the vicinity of the subject property. See attached.

☒ The following state-listed (or other) species may occur within the vicinity of the subject property:

Genus	Species	Subspecies	Common Name	Fedstatus	Statestatus
Alasmidonta	varicosa	-	Floater, brook	-	State Endangered

NHR ID	Site Description	Legal Status	Type	Site Name
S_1325	This SCU delineates riparian reaches that provide habitat for one or more rare aquatic plants or animals.	SL	SCU	BROAD RUN SCU

Please note this information is being provided to you based on the preliminary data you submitted to the Corps relative to project boundaries and project plans. Consequently, these findings and recommendations are subject to change if the project scope changes or new information becomes available and the accuracy of the data.

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

Location

Manassas and Prince William counties, Virginia



Local office

Virginia Ecological Services Field Office

(804) 693-6694
(804) 693-9032

6669 Short Lane
Gloucester, VA 23061-4410

http://www.fws.gov/northeast/virginiafield/

Not for consultation

Endangered species

This resource list is for informational purposes only and should not be used for planning or analyzing project level impacts.

Section 7 of the Endangered Species Act **requires** Federal agencies to *"request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action"* for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Review section in IPaC or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by creating a project and making a request from the Regulatory Review section.

Listed species

[1] are managed by the Endangered Species Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Flowering Plants

NAME	STATUS
Harperella *Ptilimnium nodosum* **No critical habitat** has been designated for this species. http://ecos.fws.gov/ecp/species/3739	Endangered

Mammals

NAME	STATUS
Northern Long-eared Bat *Myotis septentrionalis* **No critical habitat** has been designated for this species. http://ecos.fws.gov/ecp/species/9045	Threatened

Not for consultation

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Birds are protected under the Migratory Bird Treaty Act

[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service

[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

Not for consultation

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location, not a list of every bird species you may find in this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources.

NAME	SEASON(S)
American Bittern Botaurus lentiginosus http://ecos.fws.gov/ecp/species/6582	Wintering
Bald Eagle Haliaeetus leucocephalus http://ecos.fws.gov/ecp/species/1626	Year-round
Black-billed Cuckoo Coccyzus erythropthalmus http://ecos.fws.gov/ecp/species/9399	Breeding
Blue-winged Warbler Vermivora pinus	Breeding
Fox Sparrow Passerella iliaca	Wintering
Kentucky Warbler Oporornis formosus	Breeding
Least Bittern Ixobrychus exilis http://ecos.fws.gov/ecp/species/6175	Breeding
Pied-billed Grebe Podilymbus podiceps	Breeding
Prairie Warbler Dendroica discolor	Breeding
Prothonotary Warbler Protonotaria citrea	Breeding
Red-headed Woodpecker Melanerpes erythrocephalus	Year-round
Rusty Blackbird Euphagus carolinus	Wintering

Not for Consultation

Short-eared Owl Asio flammeus http://ecos.fws.gov/ecp/species/9295	Wintering
Snowy Egret Egretta thula	Breeding
Willow Flycatcher Empidonax traillii http://ecos.fws.gov/ecp/species/3482	Breeding
Wood Thrush Hylocichla mustelina	Breeding
Worm Eating Warbler Helmitheros vermivorum	Breeding

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

Ranges in IPaC for birds off the Atlantic coast are derived from species distribution models developed by the National Oceanic and Atmospheric Association (NOAA) National Centers for Coastal Ocean Science (NCCOS) using the best available seabird survey data for the offshore Atlantic Coastal region to date. NOAANCCOS assisted USFWS in developing seasonal species ranges from their models for specific use in IPaC. Some of these birds are not BCC species but were of interest for inclusion because they may occur in high abundance off the coast at different times throughout the year, which potentially makes them more susceptible to certain types of development and activities taking place in that area. For more refined details about the abundance and richness of bird species within your project area off the Atlantic Coast, see the Northeast Ocean Data Portal. The Portal also offers data and information about other types of taxa that may be helpful in your project review.

About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number

Not for consultation

of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

Landbirds:

The Avian Knowledge Network (AKN) provides a tool currently called the "Histogram Tool", which draws from the data within the AKN (latest,survey, point count, citizen science datasets) to create a view of relative abundance of species within a particular location over the course of the year. The results of the tool depict the frequency of detection of a species in survey events, averaged between multiple datasets within AKN in a particular week of the year. You may access the histogram tools through the Migratory Bird Programs AKN Histogram Tools webpage.

The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

Atlantic Seabirds:

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the Northeast Ocean Data Portal. The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the NOAANCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf project webpage.

Not for consultation

Facilities

Wildlife refuges

Any activity proposed on National Wildlife Refuge lands must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGES AT THIS LOCATION.

Fish hatcheries

THERE ARE NO FISH HATCHERIES AT THIS LOCATION.

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

FRESHWATER EMERGENT WETLAND

PEM1A

FRESHWATER FORESTED/SHRUB WETLAND

PFO1A

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

Not for consultation

Not for consultation

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tuberficid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

Not for consultation

IPaC **U.S. Fish & Wildlife Service**

IPaC resource list

Location

Manassas County, Virginia



Local office

Virginia Ecological Services Field Office

(804) 693-6694
(804) 693-9032

6669 Short Lane
Gloucester, VA 23061-4410

http://www.fws.gov/northeast/virginiafield/

Not for consultation

Endangered species

This resource list is for informational purposes only and should not be used for planning or analyzing project level impacts.

Section 7 of the Endangered Species Act **requires** Federal agencies to *"request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action"* for any project that is conducted, permitted, funded, or licensed by any Federal agency.

A letter from the local office and a species list which fulfills this requirement can only be obtained by requesting an official species list either from the Regulatory Review section in IPaC or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by creating a project and making a request from the Regulatory Review section.

Listed species

[1] are managed by the Endangered Species Program of the U.S. Fish and Wildlife Service.

1. Species listed under the Endangered Species Act are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the listing status page for more information.

The following species are potentially affected by activities in this location:

Clams

NAME	STATUS
Dwarf Wedgemussel Alasmidonta heterodon **No critical habitat** has been designated for this species. http://ecos.fws.gov/ecp/species/784	Endangered

Not for consultation

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

THERE ARE NO CRITICAL HABITATS AT THIS LOCATION.

Migratory birds

Birds are protected under the Migratory Bird Treaty Act

[1] and the Bald and Golden Eagle Protection Act[2].

Any activity that results in the take (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of migratory birds or eagles is prohibited unless authorized by the U.S. Fish and Wildlife Service

[3]. There are no provisions for allowing the take of migratory birds that are unintentionally killed or injured.

Any person or organization who plans or conducts activities that may result in the take of migratory birds is responsible for complying with the appropriate regulations and implementing appropriate conservation measures.

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

Additional information can be found using the following links:

- Birds of Conservation Concern http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php
- Conservation measures for birds http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php
- Year-round bird occurrence data http://www.birdscanada.org/birdmon/default/datasummaries.jsp

The migratory birds species listed below are species of particular conservation concern (e.g. Birds of Conservation Concern) that may be potentially affected by activities in this location, not a list of every bird species you may find in this location. Although it is important to try to avoid and minimize impacts to all birds, special attention should be made to avoid and minimize impacts to birds of priority concern. To view available data on other bird species that may occur in your project area, please visit the AKN Histogram Tools and Other Bird Data Resources.

NAME	SEASON(S)
American Bittern Botaurus lentiginosus http://ecos.fws.gov/ecp/species/6582	Wintering

Not for consultation

Bald Eagle Haliaeetus leucocephalus http://ecos.fws.gov/ecp/species/1626	Year-round
Black-billed Cuckoo Coccyzus erythropthalmus http://ecos.fws.gov/ecp/species/9399	Breeding
Blue-winged Warbler Vermivora pinus	Breeding
Fox Sparrow Passerella iliaca	Wintering
Kentucky Warbler Oporornis formosus	Breeding
Least Bittern Ixobrychus exilis http://ecos.fws.gov/ecp/species/6175	Breeding
Pied-billed Grebe Podilymbus podiceps	Breeding
Prairie Warbler Dendroica discolor	Breeding
Prothonotary Warbler Protonotaria citrea	Breeding
Red-headed Woodpecker Melanerpes erythrocephalus	Year-round
Rusty Blackbird Euphagus carolinus	Wintering
Short-eared Owl Asio flammeus http://ecos.fws.gov/ecp/species/9295	Wintering
Snowy Egret Egretta thula	Breeding
Willow Flycatcher Empidonax traillii http://ecos.fws.gov/ecp/species/3482	Breeding
Wood Thrush Hylocichla mustelina	Breeding

Not for consultation

Worm Eating Warbler	Helmitheros vermivorum	Breeding

What does IPaC use to generate the list of migratory bird species potentially occurring in my specified location?

Landbirds:

Migratory birds that are displayed on the IPaC species list are based on ranges in the latest edition of the National Geographic Guide, Birds of North America (6th Edition, 2011 by Jon L. Dunn, and Jonathan Alderfer). Although these ranges are coarse in nature, a number of U.S. Fish and Wildlife Service migratory bird biologists agree that these maps are some of the best range maps to date. These ranges were clipped to a specific Bird Conservation Region (BCR) or USFWS Region/Regions, if it was indicated in the 2008 list of Birds of Conservation Concern (BCC) that a species was a BCC species only in a particular Region/Regions. Additional modifications have been made to some ranges based on more local or refined range information and/or information provided by U.S. Fish and Wildlife Service biologists with species expertise. All migratory birds that show in areas on land in IPaC are those that appear in the 2008 Birds of Conservation Concern report.

Atlantic Seabirds:

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About the NOAANCCOS models: the models were developed as part of the NOAANCCOS project: Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf. The models resulting from this project are being used in a number of decision-support/mapping products in order to help guide decision-making on activities off the Atlantic Coast with the goal of reducing impacts to migratory birds. One such product is the Northeast Ocean Data Portal, which can be used to explore details about the relative occurrence and abundance of bird species in a particular area off the Atlantic Coast.

All migratory bird range maps within IPaC are continuously being updated as new and better information becomes available.

Can I get additional information about the levels of occurrence in my project area of specific birds or groups of birds listed in IPaC?

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The tool is currently available for 4 regions (California, Northeast U.S., Southeast U.S. and Midwest), which encompasses the following 32 states: Alabama, Arkansas, California, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, New Hampshire, New Jersey, New York, North, Carolina, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, West Virginia, and Wisconsin.

In the near future, there are plans to expand this tool nationwide within the AKN, and allow the graphs produced to appear with the list of trust resources generated by IPaC, providing you with an additional level of detail about the level of occurrence of the species of particular concern potentially occurring in your project area throughout the course of the year.

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Not for consultation

Facilities

Wildlife refuges and fish hatcheries

REFUGE AND FISH HATCHERY INFORMATION IS NOT AVAILABLE AT THIS TIME

Wetlands in the National Wetlands Inventory

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under

Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

This location overlaps the following wetlands:

FRESHWATER FORESTED/SHRUB WETLAND

PFO1C

RIVERINE

R2UBH

A full description for each wetland code can be found at the National Wetlands Inventory website: https://ecos.fws.gov/ipac/wetlands/decoder

Not for consultation

Data limitations

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Not for consultation

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

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APPENDIX F

FEDERAL CONSISTENCY CERTIFICATION

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FEDERAL CONSISTENCY CERTIFICATION FOR THE MANASSAS REGIONAL AIRPORT WEST CORPORATE DEVELOPMENT AND EAST PARCEL DEVELOPMENT



MAY 2017

This document provides the Commonwealth of Virginia with the City of Manassas's (City's) Consistency Certification and necessary data and information under the Coastal Zone Management Act (CZMA) §307(c)(3)(A) and 15 CFR Part 930, subpart D, for the proposed corporate development at the Manassas Regional Airport (Airport).

CERTIFICATION

The City certifies that the proposed activity complies with the enforceable policies of the Virginia Coastal Zone Management Program (VCP) and would be conducted in a manner consistent with the VCP.

NECESSARY DATA AND INFORMATION

The City owns and operates the Airport. The Airport is largely within the City of Manassas, with about 20 acres of land on the east side of the Airport within the limits of Prince William County. The Airport intersects the jurisdictional boundaries of the City of Manassas (an independent city) and Prince William County, Virginia. Figure 1 shows the Airport's location.

The City proposes to redevelop the west side corporate area and develop a parcel on the east side of the Airport (Proposed Project). The west side of the Proposed Project, which Figure 2 shows, includes:

- On-Airport roadway improvements
- FBO building and parking lot reconstruction
- Corporate hangar/building and parking lot construction
- T-hangars demolition/replacement and construction and T-hangar parking lot
- West aircraft apron and taxilane tie down parking expansion
- Taxilane extension
- Maintenance and storage building construction
- Wash rack construction
- Utilities extension and stormwater drainage improvements
- Security fence extension

The east side of the Proposed Project, which Figure 3 shows, includes:

- On-Airport roadway improvements
- Corporate hangar/building and parking lot construction
- Taxilane extension
- Utilities extension and stormwater drainage improvements
- Security fence extension

The project study area (about 160 acres) encompasses the area that construction and operation of the Proposed Project may affect. The project study area is primarily undeveloped and consists of mature, mixed hardwood forest; upland vegetation; forested wetlands; and compactly graded grass that the City regularly mows and maintains. There is Airport-related development within the project study area (e.g.,

perimeter road, small structures, navigational aids, and apron areas). The following paragraphs describe the environment characteristics of the project study area.

ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

Because the Airport is federally obligated and must meet Federal Aviation Administration (FAA) requirements, a Federal Consistency Certification (FCC) is being submitted to the Virginia Department of Environmental Quality (VDEQ). All National Environmental Policy Act (NEPA) environmental consequences of this project will be addressed in a FAA Environmental Assessment (EA). All applicable permits would be obtained and complied with throughout the duration of the Proposed Project.

A review of permits and/or approvals required for this Proposed Project under Enforceable Polices of the VCP has been prepared as follows:

A. **Fisheries Management**: This program is administered by the Marine Resources Commission (VMRC) (Virginia Code § 28.2-200 to § 28.2-713) and the Department of Game and Inland Fisheries (DGIF) (Virginia Code § 29.1-100 to § 29.1-570). The Proposed Project would not affect finfish or shellfish resources and would not affect the promotion of commercial or recreational fisheries. The project would not use tributyltin (TBT) in any form, nor would it simulate the use of that chemical by any product users. There are no commercial or recreational fisheries in the project study area.

B. **Subaqueous Land Management**: This program is administered by the VMRC (Virginia Code § 28.2-1200 to § 28.2-1213). The Proposed Project would make use of subaqueous lands managed by the Commonwealth (see Wetlands Management). There are no sole source aquifers in the project study area.

FIGURE 1
AIRPORT LOCATION



FIGURE 2
WEST SIDE OF PROPOSED PROJECT

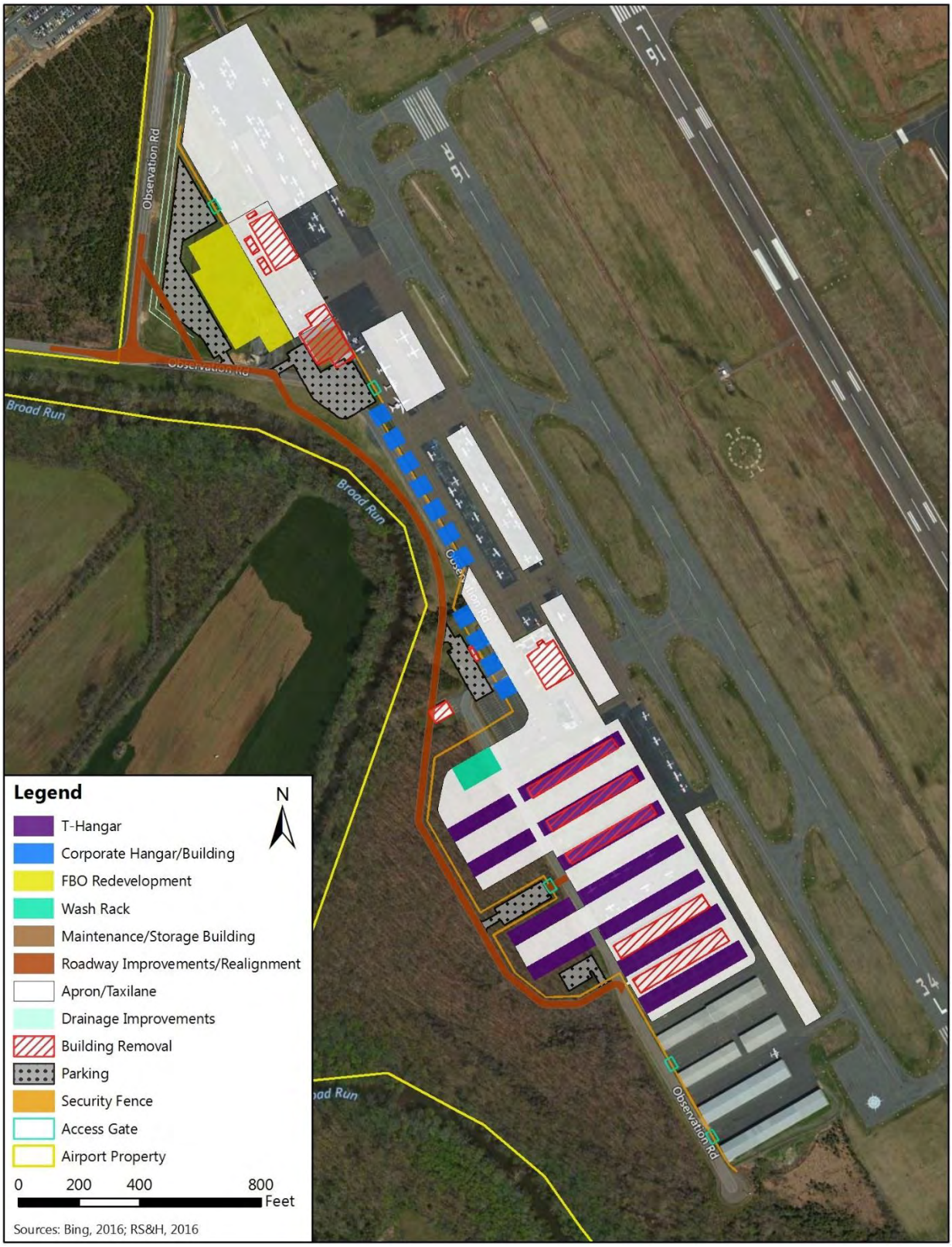


FIGURE 3
EAST SIDE OF PROPOSED PROJECT



C. **Wetlands Management**: The tidal wetlands program is administered by the VMRC (Virginia Code § 28.2-1301 through 28.2-1320) while the Virginia Water Protection (VWP) permit program administered by VDEQ includes protection of tidal and non-tidal wetlands (Virginia Code § 62.1-44.15:5) and Water Quality Certification pursuant to Section 401 of the Clean Water Act. There are about 114 linear feet of intermittent/perineal waterway, and about 4.84 acres of Palustrine Emergent wetlands and Palustrine Forested wetlands in the project study area. The intermittent/perineal waterway and wetlands were delineated during a field survey conducted between October 24 and 26 and has undergone a preliminary jurisdictional determination by the United States Army Corps of Engineers (USACE). Figure 4 shows the location of those surface waters and wetlands. Additionally, there are Resource Protection Areas or Resource Management Areas in the project study area (see Figure 5).

The Proposed Project would directly affect about 0.02-acre of nontidal wetlands on the west side of the Airport. No indirect effects to wetlands in this area are anticipated. The development of the east parcel of the project study area would directly affect about 0.70-acre of tidal wetlands and would indirectly affect about 0.8-acre of tidal wetlands. The potential indirect effect would be due to segmentation of the identified wetland area. In total, about 1.5 acres of wetlands would be affected as a result of the Proposed Project. The construction and operation of the Proposed Project would not have a direct or indirect affect the 89-acre parcel that is part of the wetland mitigation site for the construction of Route 234-Bypass.

The Proposed Project qualifies for a USACE Regional Joint Permit Application (JPA), specifically the Standard JPA, used by the USACE, the VDEQ, the VRMC, and the Local Wetlands Boards (LWB). According to the USACE, the Standard JPA authorizes "most commercial and noncommercial projects in tidal waters, tidal wetlands, and coastal primary sand dunes and beaches in Virginia." As required by the permit, the Proposed Project would cause the permanent loss of about 0.70-acre of tidal wetlands.

Wetland mitigation is generally required for projects that permanently impact over 0.10-acre of wetlands. All wetland mitigation would comply with the USACE-USEPA Compensatory Mitigation for Losses of Aquatic Resources, dated April 10, 2008 (33 CFR 325 and 332/40 CFR 230). As previously mentioned, the City would submit a JPA, which would include a design overlay showing the limits of wetland impacts, as well as the Jurisdictional Determination. As the lead agency for the permitting process, the VDEQ would contact the City to obtain any additional information that may be required to process the JPA. The City would send out an invitation for bid from a certified wetland banks servicing the appropriate hydrologic unit code for the project study area to determine who would be the source of compensatory mitigation. Once the bank is identified, a bill of sale and contract documents would be drafted to complete the credit transfer. After the mitigation is paid for, the City would send proof of transfer back to the VDEQ demonstrating that they have met the compensatory mitigation requirement set forth in the permit.

FIGURE 4
WETLANDS IN THE PROJECT STUDY AREA

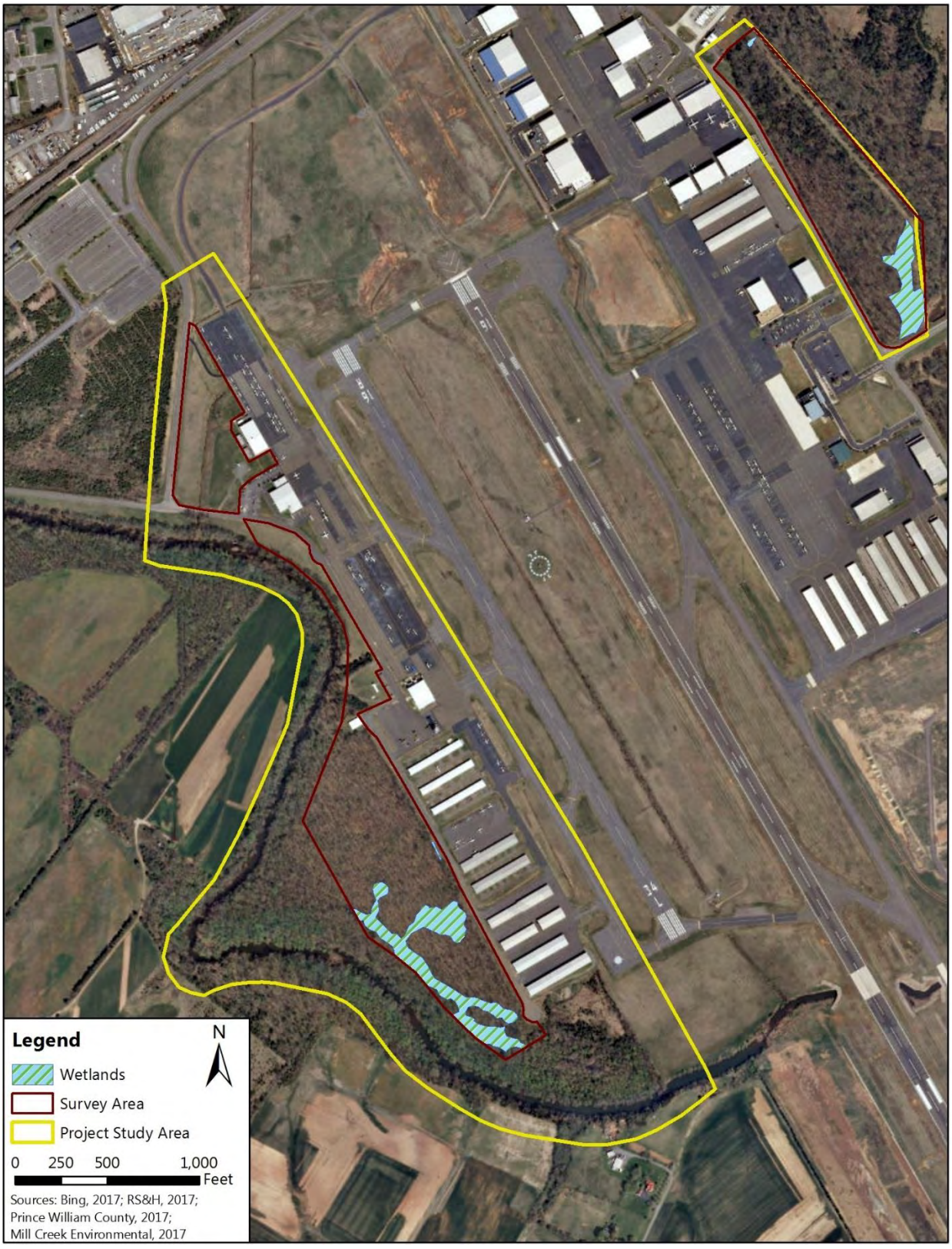
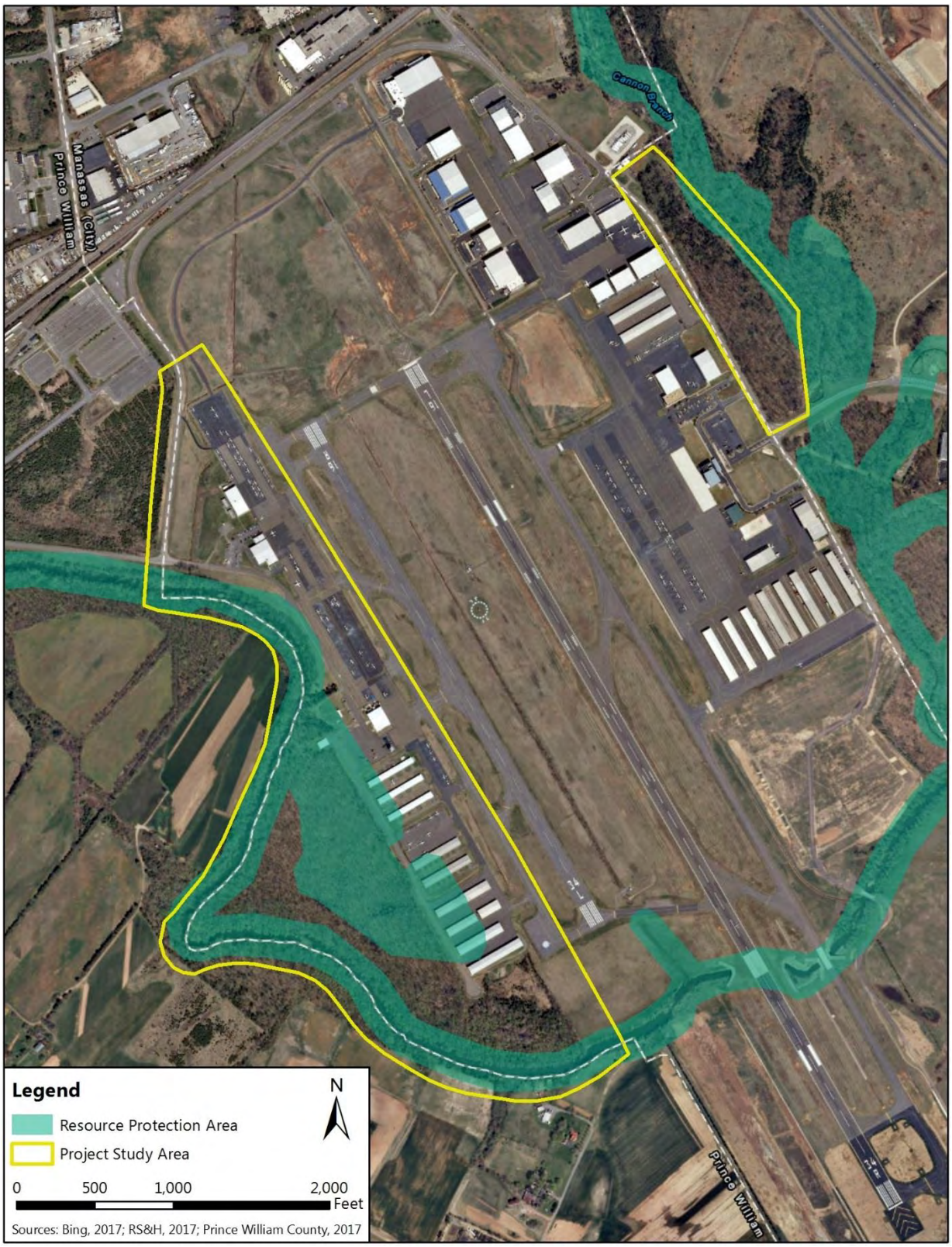


FIGURE 5
RESOURCES PROTECTION AREAS



D. **Dune Management**: This program is administered by VMRC (Virginia Code § 28.2-1400 through § 28.2-1420). No coastal primary sand dunes are present in the project study area.

E. **Non-point Source Pollution Control**: The Erosion and Sediment Control Law program is administered by VDEQ (Virginia Code § 62.1-44.15:51 *et seq.*) while the Coastal Lands Management is administered by VDEQ's Water Division and 84 localities in Tidewater Virginia (Virginia Code § 62.1-44.15:67 through 62.1-44.15:79 and Virginia Administrative Code 9 VAC 25-830-10 *et seq.*) The Proposed Project would be designed and constructed to minimize soil erosion and hinder the input of chemical nutrients and sediments into the Chesapeake Bay, its tributaries and other waters of the Commonwealth. The City would submit a project-specific erosion and sediment control (ESC) plan prior to the start of construction. Also, all erosion and sediment controls would be installed during mobilization in accordance with the *Virginia Erosion and Sediment Control Handbook* (VESCH, 3rd Edition) to prevent any erosion or introduction of chemical nutrients or sediments into rivers or tributaries that carry runoff from the Airport.

F. **Point Source Pollution Control**: This program is administered by the State Water Control Board (as delegated to VDEQ) pursuant to Virginia Code § 62.1-44.15. The Proposed Project would generate new point sources of pollution; however, best management practices (BMPs) would be taken to prevent spillage of oils or lubricants into the drainage system. All surface runoff would be properly treated through the use of BMPs in accordance with state and local requirements. The design would specify that all mobilization, setup, construction, and cleanup activities be carried out in conformance with regulatory provisions. The Proposed Project would be conducted in accordance with the VWP program issued pursuant to Section 401 of the Clean Water Act.

G. **Shoreline Sanitation**: This program is administered by the Department of Health (Virginia Code § 32.1-164 through § 32.1-165). The Proposed Project includes the construction of restroom facilities in the FBO building on the west side of the project study area, and possibly the corporate hangars on both the west side and east side of the project study area. These restroom facilities would be constructed in accordance with all federal and state building codes. Additionally, the restroom facilities will connect to existing sanitation infrastructure and will undergo all required inspections. The Proposed Project does not include to the construction of septic tanks. Overall, the Proposed Project is not anticipated to affect shoreline sanitation.

H. **Air Pollution Control**: This program is administered by the State Air Pollution Control Board (Virginia Code §10.1-1300 through 10.1-1320). The project study area, located in the City of Manassas, is classified as a maintenance area for the $PM_{2.5}$ standard and as marginal nonattainment for the 2008 O_3 standard. Construction of the Proposed Project would cause temporary increases in emissions, specifically from the use of construction equipment and construction-related vehicles. A construction emission inventory for the Proposed Project was prepared, using available information, in order to estimate temporary construction-related emissions. Construction is anticipated to occur over a five-year period. The temporary criteria pollutant emissions due to construction of the Proposed Project would not be significant because

they would not exceed the *de minimus* threasholds (see Table 1). Operation of the Proposed Project would increase surface traffic from the increase in employees at the Airport, estimated to be at about 30 employees. However, employees are likely to already reside in the area; and as such, the Proposed Project would not significantly change vehicle emissions in the area. Additionally, operation of the Proposed Project would not change aviation operations at the Airport. Overall, the Proposed Project would not adversely affect the $PM_{2.5}$ maintenance or O_3 marginal nonattainment status of the area. Therefore, construction and operation of the Proposed Project would comply with the Metropolitan Washington Air Quality Committee State Implementation Plan (SIP).

TABLE 1
ANNUAL CONSTRUCTION EMISSION INVENTORY SUMMARY (TONS)

	CO	NO_x	SO_x	PM_{10}	$PM_{2.5}$	VOC
Emission Quantity	5.93	9.77	0.03	0.64	0.57	15.11
USEPA Threshold	N/A	100	N/A	N/A	100	50

I. **Coastal Lands Management**: This program is administered by DEQ's Water Division and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act (Virginia Code §§ 62.1-44.15:67 through 62.1-44.15:79) and Chesapeake Bay Preservation Area Designation and Management Regulations (Virginia Administrative Code 9 VAC 25-830-10 *et seq*.).

The project study area is within the Virginia Coastal Zone. The eastern portion of the project study area, located in Prince William County, is subject to the requirements of the Chesapeake Bay Preservation Act. In addition, Broad Run, which intersects the western portion of the project study area, is within Prince William County and subject to the Chesapeake Bay Preservation Act.

The Proposed Project would affect about 0.20-acre of nontidal wetlands on the west side of the project study area, and directly affect about 0.70-acre of tidal wetlands and indirectly affect about 0.80-acre of tidal wetlands on the east side of the project study area. As previously described, wetlands within the project study area have undergone a preliminary jurisdictional determination by the USACE and the Proposed Project qualifies for a Standard JPA. Construction activities would occur with the designated floodway and the 100-year floodplain (see Figure 6). About 2.7-acres on the west side and about 0.25-acre on the east side of the project study area are within the designated floodway, and about 19.9-acres on the west side and about 3.1-acres on the east side of the project study area are within the 100-year floodplain. However, in compliance with USDOT Order 5650.2, *Floodplain Management and Protection*, a floodplain analysis was conducted using Hydrologic Engineering Center's River Analysis System (HEC-RAS), which concluded that the Proposed Project would not result in an increase in the 100-year flood elevation or change in flood boundaries.

The Proposed Project would increase impervious surface by about 25 acres. As previously described, the Proposed Project would affect wetlands, which are also considered surface waters, in the project study area (see Wetlands Management for a description of those resources).

Construction and operation of the Proposed Project would have a less than significant effect on surface water. The City would be responsible for ensuring that a VPDES permit for construction activities is obtained prior to the start of ground disturbing activities. In addition, the selected construction contractor would be responsible for adhering to the VPDES permit requirements and implementation of BMPs during construction.

The implementation of the Proposed Project would permanently increase the amount of impervious surface by about 25 acres, which would increase stormwater runoff in the area. VDEQ regulates surface water quality and quantity through the Virginia Stormwater Management Program (VSMP). To meet VSMP requirements for water quantity as identified in Virginia Administrative Code 9VAC25-870-66, the Proposed Project would include on-site stormwater management facilities for detention. Water quality compliance as identified in 9VAC25-870-65 requires that the Proposed Project include best management practices such as dry swales, bioretention, infiltration, and sheet flow to open space. In addition, the City would amend the Airport's VPDES general permit for stormwater discharges associated with industrial activities. This includes updating the Airport's SWPPP.

The increase in impervious surface, about 25-acres, due to the Proposed Project would not be significant as compliance with the VPDES construction and other permits will ensure that the Proposed Project would not adversely affect nearby surface water resources (e.g., wetlands, ground water).

FIGURE 6
FLOODPLAINS



SUMMARY OF FINDINGS

Although applicants are not required to make findings with respect to the coastal effects of the advisory policies, applicants should demonstrate adequate consideration of policies which are in the nature of recommendations (see 15 CFR 930.58(a)(3)). The Proposed Project is not located along a shorefront, so the advisory policies for shorefront access planning and protection are not applicable.

Pursuant to 15 CFR §930.41, the Virginia Coastal Zone Management Program has 60 days from the receipt of this letter in which to concur with or object to this Consistency Determination, or to request an extension under 15 CFR §930.41(b). Virginia's concurrence will be presumed if its response is not received by the FAA on the 60th day from receipt of this determination. The State's response should be sent to:

Mr. Juan Rivera
Manassas Regional Airport
8500 Public Works Drive
Manassas, VA 20110
(703) 257-8261
jrivera@manassasva.gov

Susan Stafford
Federal Aviation Administration
Beckley Airports Field Office
176 Airport Circle, Rm 101
Beaver, WV 25813
304-252-6216 x 130
susan.stafford@faa.gov

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Secretary of Natural Resources

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MEMORANDUM

TO: Janine Howard, DEQ Environmental Program Planner

FROM: Daniel Moore, DEQ Principal Environmental Planner

DATE: June 14, 2017

SUBJECT: DEQ #17-061F: Manassas Regional Airport Development, City of Manassas and Prince William County

We have reviewed the Consistency Certification application for the proposed Manassas Regional Airport West Corporate Development and East Parcel Development project in the City of Manassas and Prince William County and offer the following comments regarding consistency with the provisions of the *Chesapeake Bay Preservation Area Designation and Management Regulations* (Regulations):

The City of Manassas is not subject to the Chesapeake Bay Preservation Act or the Regulations. Our review of the submitted documentation shows that the proposed West Corporate Development project will occur solely within the confines of the city-owned airport property, and as such, the project is not subject to review for Bay Act compliance.

In Prince William County, the areas protected by the Chesapeake Bay Preservation Act, as locally implemented, require conformance with performance criteria. These areas include Resource Protection Areas (RPAs) and Resource Management Areas (RMAs) as designated by the local government. RPAs include tidal wetlands, certain non-tidal wetlands and tidal shores. RPAs also include a 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow. RMAs, which require less stringent performance criteria, include all areas of the County not designated as RPA.

The proposed East Parcel Development project will occur on approximately 20 acres of land within Prince William County. The project calls for on-site roadway improvements and taxi lane extensions, construction of three surface parking lots and several airplane hangar buildings, stormwater drainage improvements and the installation of additional security fencing. The

roadway improvements component of the East Parcel Development project would be considered exempt from the Regulations provided the road improvements are constructed in accordance with (i) regulations promulgated pursuant to the *Virginia Erosion and Sediment Control Law* and the *Virginia Stormwater Management Act*, (ii) an erosion and sediment control plan and a stormwater management plan approved by DEQ, or (iii) local water quality protection criteria at least as stringent as the above state requirements. The exemption of public roads is further conditioned on the following:

> Optimization of the road alignment and design, consistent with other applicable requirement, to prevent or otherwise minimize (i) encroachment into the RPA and (ii) adverse effects on water quality.

The application materials submitted do not indicate the exact nature of the roadway improvements for the north-south road at the east side of the East Parcel Development site. Based on DEQ review of the aerial maps provided and the County's online GIS Mapper, the current roadway in question appears to be an unimproved narrow dirt road that lies exclusively within the RPA designated by Prince William County and associated with Cannon Run. Widening or hardscaping (asphalt or concrete) this dirt road would constitute significant water quality impacts to Cannon Run and would not be considered consistent with the above-referenced requirement to minimize encroachment into the RPA by an otherwise exempt roadway.

9VAC25-830-110 of the *Chesapeake Bay Preservation Area Designation and Management Regulations* require that a site-specific evaluation be conducted, and a Water Quality Impact Assessment (WQIA) be submitted, for projects that propose land-disturbing activities on lands containing RPAs. Such site-specific evaluations are required in order to facilitate RPA boundary adjustments, as needed. Until such time as a site-specific evaluation has been conducted and the WQIA submitted for review, and without more specific information about the proposed improvements to the unimproved dirt road referenced above, we cannot determine if those portions of the proposed East Parcel Development project that lie within Prince William County would be consistent with the Act and the Regulations. It should be noted that the site-specific RPA boundary determination may also result in realignments to the proposed surface parking lots and/or the proposed hangar buildings, as some or all of these project components may encroach into the Cannon Run RPA buffer.

MEMORANDUM:

Date:	July 11, 2017
To:	Janine Howard, Virginia Department of Environmental Quality
From:	Natalie Heath, RS&H (on behalf of the City of Manassas)
Subject:	DEQ #17-061F Manassas Regional Airport Development, City of Manassas and Prince William County Update to Federal Consistency Certification

Dear Ms. Howard,

On 04 May 2017, RS&H, Inc. (RS&H), on behalf of the City of Manassas (City) submitted the Federal Consistency Certification for the Manassas Regional Airport (Airport) West Corporate Development and East Parcel Development (referred to as the FCC Report). Since that time, and based on additional information from your office on 15 June 2017, the proposed footprint of the Proposed Project, specifically with regards to the east parcel development, has been reduced to minimize potential environmental impacts. The purpose of this memorandum is to provide your agency with the updated information as it relates to the updated layout and change in potential effects.

NECESSARY DATA AND INFORMATION

The proposed east parcel development has been realigned to the west to completely avoid the identified Resource Protection Areas (RPA). Figure 3 of the FCC Report showed the preliminary layout of the east parcel development area. Figure 3R at the end of this memorandum shows the updated layout. The east parcel development includes the same components outlined in the original FCC Report.

ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

The reduced footprint of the proposed development in the east parcel has reduced the potential environmental effects. Those changes are identified below. Note that the west side of the Proposed Project has not changed; therefore, the effects on the west side of the Airport remain the same as those described in the FCC Report.

C. Wetlands Management: The reduced footprint of the development of the east parcel decreases the area of affected wetland from the roughly 1.5 acres stated in the FCC report to 0.60 acre. The change the proposed development footprint would not affect, directly or indirectly, the 89-acre parcel that is part of the wetlands mitigation site for the construction of Route 234-Bypass.

The project study area has undergone a preliminary jurisdictional determination by the USACE and the Proposed Project still qualifies for a USACE Regional Joint Permit Application (JPA), specifically the Standard JPA, used by the USACE, the VDEQ, the VRMC, and the Local Wetlands Boards (LWB). Additionally, all wetland mitigation would still comply with the USACE-USEPA Compensatory Mitigation for Losses of Aquatic Resources, dated April 10, 2008 (33 CFR 325 and 332/40 CFR 230).

Additionally, there are RPAs in the project study area; however, the Proposed Project is not located within those protection areas.

I. Coastal Lands Management: The reduced footprint of the development of the east parcel decreases the area of affected wetland to about 0.65-acre of wetlands. As previously described, wetlands within the project study area have undergone a preliminary jurisdictional determination by the USACE and the Proposed Project qualifies for a Standard JPA.

The FCC Report stated that about 0.25-acre of the proposed development in the east parcel were within the regulatory floodway and about 3.1-acres were within the 100-year floodplain. With the realignment of the development of the east parcel, construction activities would affect zero acres within the regulatory floodway and about 1.25-acres within the 100-year floodplain. In compliance with USDOT Order 5650.2, *Floodplain Management and Protection*, a floodplain analysis is being conducted using Hydrologic Engineering Center's River Analysis System (HEC-RAS), which concluded that the Proposed Project would not result in an increase in the 100-year flood elevation or change in flood boundaries.

SUMMARY OF FINDINGS

The Airport understands the importance of the RPA and has adjusted the design of the east portion of the Proposed Project to avoid any construction in the area. Overall, the reduced footprint of the east parcel development area reduces the potential environmental impacts associated with this portion of the Proposed Project. The review of other permits and/or approvals under Enforceable Polices of the VCP remains applicable, as well as the analysis related to the west side of the project study area.

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FIGURE 3R
EAST SIDE OF PROPOSED PROJECT



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July 25, 2017

Mr. Juan Rivera
Manassas Regional Airport
10600 Harry J. Parrish Blvd.
Manassas, VA 20110

RE: Federal Consistency Certification, 90-Day Status: Manassas Regional Airport West Corporate Development and East Parcel Development, City of Manassas and Prince William County, DEQ 17-061F

Dear Mr. Rivera,

The Department of Environmental Quality (DEQ) is responsible for coordinating the review of federal consistency certifications (FCCs) and responding to appropriate agencies and applicants on behalf of the Commonwealth. Pursuant to the Coastal Zone Management Act of 1972 (CZMA), as amended, all activities located within Virginia's designated coastal management area requiring a federal permit, license, or approval must be consistent with the Virginia Coastal Zone Management Program (CZMP). The CZMP is comprised of a network of environmental policies administered by several agencies of the Commonwealth. The FCC submitted by RS&H on behalf of the City of Manassas indicated that the proposed project will require approval from the Federal Aviation Administration (FAA). Accordingly, DEQ is coordinating the review of the Manassas Regional Airport West Corporate Development and East Parcel Development FCC with agencies administering the enforceable policies of the CZMP.

On May 2, 2017, DEQ's Office of Environmental Impact Review (OEIR) received the FCC for the proposed development. The six-month legal deadline for the Commonwealth's response to the FCC is **October 29, 2017**. This letter is sent as required under 15 CFR Part 930, sub-section 930.62(b), to provide an update on the status of the review and the basis for further delay within 90 days of receiving a FCC.

Project Description

The City of Manassas (applicant) is seeking approval from the Federal Aviation Administration (FAA) for the Manassas Regional Airport West Corporate Development and East Parcel Development project. The city owns and operates the airport which intersects the jurisdictional boundaries of the City of Manassas and Prince William County with approximately 20 acres of land on the east side of the airport being located within the limits of the county. The West Corporate Area development involves on-airport roadway improvements, reconstruction of the Fixed Based Operator (FBO) building and parking lot, construction of a corporate hangar, building and associated parking lots, T-hangar reconstruction, the expansion of the west aircraft apron and taxilane tie down parking, a taxilane extension, the construction of a maintenance building and wash rack, extension of utilities and stormwater drainage improvements, and a security fence extension. The East Parcel development includes roadway improvements, the construction of a corporate hangar, building, and parking lot, extension of a taxilane and utilities connections, stormwater drainage improvements, and a security fence extension. The project study area which encompasses the area that may be affected by the proposed project is 160 acres. The applicant certifies that the project is consistent with the enforceable policies of the CZMP.

Status of the Review

In accordance with the provision of CZMA federal consistency regulation § 930.62(a), at the earliest practicable time, DEQ shall notify the federal agency and the applicant whether the state concurs with or objects to a consistency certification. If DEQ has not issued a decision within three months following commencement of the review, it shall notify the applicant and the federal agency of the status of the matter and the basis for further delay (§ 930.62(b)). This letter constitutes the 90-day notification of the status of the consistency review of the proposed project.

Project Analysis and Proposed Resolution

Consistency with the CZMP depends on compliance with the applicable enforceable policies (attached) of the federally approved state coastal management program. In a memorandum dated June 14, 2017 (attached), the DEQ Chesapeake Bay and Local Government Assistance Programs Office (OLGP) indicated that, based on the information submitted, it is not possible for compliance with the Chesapeake Bay Preservation Act and the coastal lands management enforceable policy to be determined with respect to the east parcel development.

OLGP stated that portions of the east parcel development appear to occur within a Resource Protection Area (RPA) associated with Cannon Run. An on-site inspection must occur to determine he boundary of the RPA and a Water Quality Impact Assessment must be submitted for projects that propose land-disturbing activities on

lands that contain RPAs. This information is necessary for OLGP to determine the consistency of the project with the coastal lands management enforceable policy.

On June 15, 2017 DEQ sent the supplemental information request to the project consultant. Supplemental documentation was submitted to DEQ on July 11, 2017. DEQ OEIR has submitted this information to OLGP and the documentation is currently being reviewed.

Since consistency with the coastal lands management enforceable policy has not been determined at this time, DEQ OEIR is currently unable to complete its review of the FCC. DEQ is coordinating with the applicant's agent (RS&H) and OLGP to resolve this issue. Once OLGP is able to make a determination on the coastal lands management enforceable policy, DEQ OEIR will complete the Commonwealth's review of the FCC and respond.

If you have questions, please call Janine Howard at (804) 698-4299.

Sincerely,

Bettina Sullivan, Program Manager
Environmental Impact Review

ec: Natalie Heath, RS&H
Daniel Moore, OLGP
Juan Rivera, Manassas

MEMORANDUM:

Date:	August 17, 2017
To:	Janine Howard, Virginia Department of Environmental Quality
From:	Natalie Heath, RS&H (on behalf of the City of Manassas)
Subject:	DEQ #17-061F Manassas Regional Airport Development, City of Manassas and Prince William County Update to Federal Consistency Certification (Revised)

Dear Ms. Howard,

On May 4, 2017, RS&H, Inc. (RS&H), on behalf of the City of Manassas (City) submitted the Federal Consistency Certification for the Manassas Regional Airport (Airport) West Corporate Development and East Parcel Development Environmental Assessment (referred to as the FCC Report). Since that time, RS&H submitted an update via a memorandum dated July 11, 2017 based on additional information from your office on June 15, 2017. The purpose of this memorandum is to replace the July 11 memorandum with the most up-to-date project information as it relates to the layout and change in potential effects.

NECESSARY DATA AND INFORMATION

As described in the FCC Report, the west parcel development would affect the floodway and floodplain in the City of Manassas. Mitigation for these potential floodplain effects would occur in an area not previously analyzed for environmental impacts. Figure 2 of the FCC report showed the layout of the west parcel development. Figure 2R at the end of this memorandum includes the proposed floodplain mitigation area. In addition, the proposed east parcel development has been realigned to completely avoid the identified Resource Protection Areas (RPA), floodway, and floodplain. Figure 3 of the FCC Report showed the preliminary layout of the east parcel development area. Figure 3R at the end of this memorandum shows the updated layout, which reduces the development footprint. However, the east parcel development includes the same components outlined in the original FCC Report.

ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

The floodplain mitigation for the west parcel development and the reduced footprint of the proposed east parcel development changes the potential environmental effects. Those changes are described below. Note that the proposed west corporate development layout of the Proposed Project has not changed, with the exception of additional stormwater drainage improvements.

C. Wetlands Management: The floodplain mitigation for the west corporate development includes cutting in an area that has been delineated as a wetland. This would affect about 1.60 acres of Palustrine Forested

wetlands on the west side of the Airport. Because of the floodplain mitigation requirements, this wetland impact cannot be avoided. The total wetland impact from the west corporate development would be about 1.62 acres.

The reduced footprint of the east parcel development eliminates wetland impacts on the east side. In total, the Proposed Project would affect about 1.62 acres of wetlands. The change the proposed development footprint would not affect, directly or indirectly, the 89-acre parcel that is part of the wetlands mitigation site for the construction of Route 234-Bypass.

The wetlands within the project study area of the EA have undergone a jurisdictional determination by the USACE. The Airport will submit the Joint Permit Application for a USACE Individual Permit and a Virginia Water Protection Permit, along with a compensatory mitigation plan, to the Virginia Marine Resources Commission. Additionally, all wetland mitigation would still comply with the USACE-USEPA Compensatory Mitigation for Losses of Aquatic Resources, dated April 10, 2008 (33 CFR 325 and 332/40 CFR 230).

There are RPAs in the project study area; however, the Proposed Project within the east parcel is not located within those protection areas and would not affect them.

I. Coastal Lands Management: As the previous section describes, the Proposed Project would affect about 1.62 acres of wetlands, in total. As previously described, wetlands within the project study area have undergone a jurisdictional determination by the USACE and the Proposed Project qualifies for a USACE Individual Permit and a Virginia Water Protection Permit.

The floodplain impacts for the west corporate development remain the same as described in the FCC Report. Mitigation for the potential floodplain impacts would occur in an area southwest of the proposed west corporate development and would result in a no-rise condition. The FCC Report stated that about 0.25-acre of the proposed east parcel development were within the regulatory floodway and about 3.1-acres were within the 100-year floodplain. With the realignment of the east parcel development, construction activities would not affect any land within the regulatory floodway or 100-year floodplain.

SUMMARY OF FINDINGS

The Airport understands the importance of the RPA and has adjusted the layout of the east parcel development of the Proposed Project to avoid situating any proposed development in these areas. The Airport also understands the importance of floodplains and wetlands has also avoided or minimized potential floodplain and wetland impacts where feasible in both the west corporate and east parcel development areas. Overall, the review of other permits and/or approvals under Enforceable Polices of the VCP remains applicable.

FIGURE 2R
WEST SIDE OF PROPOSED PROJECT WITH FLOODPLAIN MITIGATION

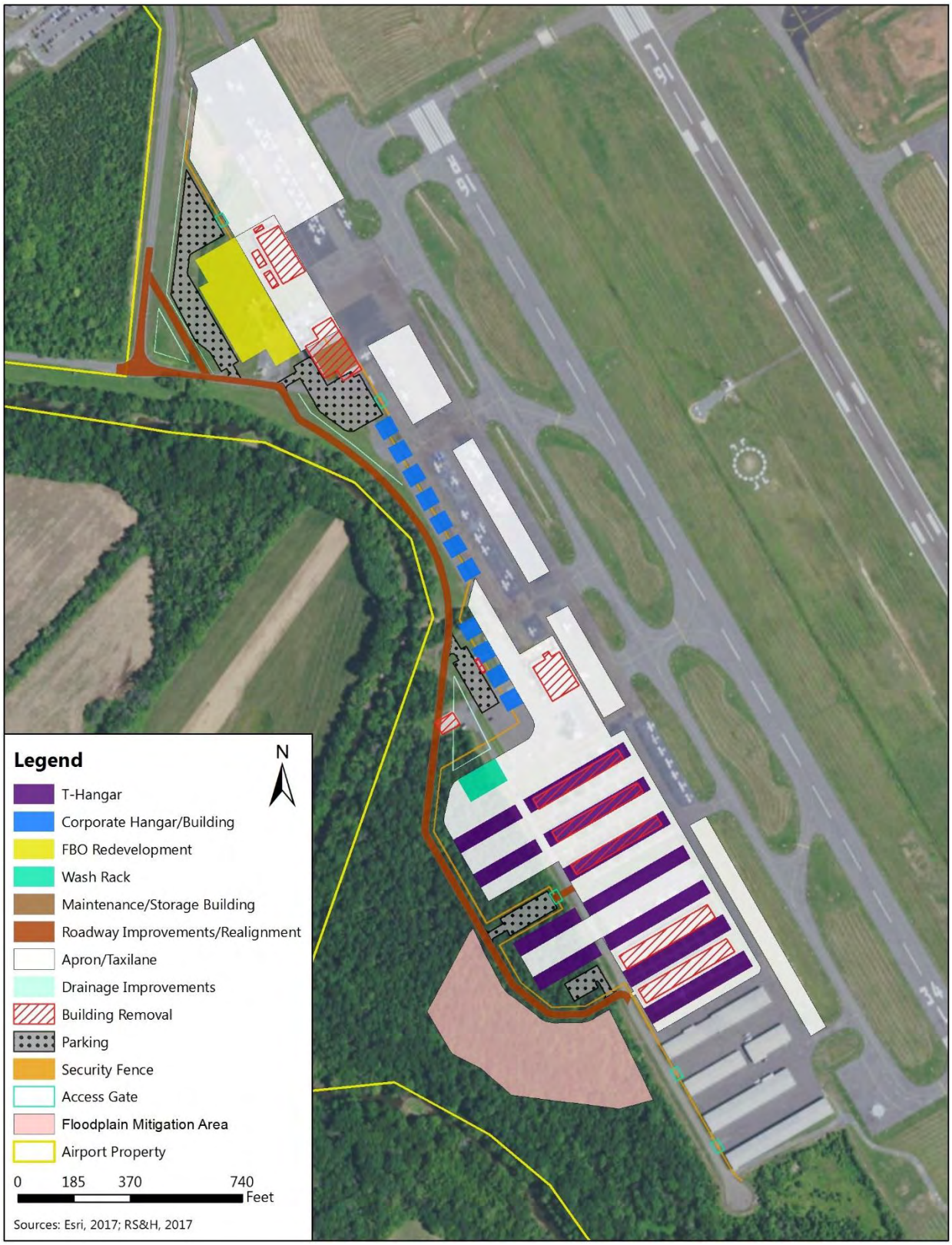


FIGURE 3R
EAST SIDE OF PROPOSED PROJECT



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MEMORANDUM

TO: Janine Howard, DEQ Environmental Program Planner

FROM: Daniel Moore, DEQ Principal Environmental Planner

DATE: October18, 2017

SUBJECT: DEQ #17-061F: Manassas Regional Airport Development, City of Manassas and Prince William County

We have reviewed the Consistency Certification application for the proposed Manassas Regional Airport West Corporate Development and East Parcel Development project in the City of Manassas and Prince William County and offer the following comments regarding consistency with the provisions of the *Chesapeake Bay Preservation Area Designation and Management Regulations* (Regulations):

The City of Manassas is not subject to the Chesapeake Bay Preservation Act or the Regulations. Our review of the submitted documentation shows that the proposed West Corporate Development project will occur solely within the confines of the city-owned airport property, and as such, the project is not subject to review for Bay Act compliance.

In Prince William County, the areas protected by the Chesapeake Bay Preservation Act, as locally implemented, require conformance with performance criteria. These areas include Resource Protection Areas (RPAs) and Resource Management Areas (RMAs) as designated by the local government. RPAs include tidal wetlands, certain non-tidal wetlands and tidal shores. RPAs also include a 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow. RMAs, which require less stringent performance criteria, include all areas of the County not designated as RPA.

The proposed East Parcel Development project will occur on approximately 20 acres of land within Prince William County. The project calls for on-site roadway improvements and taxi lane extensions, construction of three surface parking lots and several airplane hangar buildings, stormwater drainage improvements and the installation of additional security fencing. The

roadway improvements component of the East Parcel Development project would be considered exempt from the Regulations provided the road improvements are constructed in accordance with (i) regulations promulgated pursuant to the *Virginia Erosion and Sediment Control Law* and the *Virginia Stormwater Management Act*, (ii) an erosion and sediment control plan and a stormwater management plan approved by DEQ, or (iii) local water quality protection criteria at least as stringent as the above state requirements. The exemption of public roads is further conditioned on the following:

> Optimization of the road alignment and design, consistent with other applicable requirement, to prevent or otherwise minimize (i) encroachment into the RPA and (ii) adverse effects on water quality.

The roadway improvements for the proposed Wakeman Drive realignment on the east side of the East Parcel Development may result in impacts to the County-designated RPA associated with Cannon Run. It should be noted that the site-specific RPA boundary determination may also result in realignments to the proposed surface parking lots and/or the proposed hangar buildings, as some or all of these project components may encroach into the Cannon Run RPA buffer.

9VAC25-830-110 of the *Chesapeake Bay Preservation Area Designation and Management Regulations* require that a site-specific evaluation be conducted, and a Water Quality Impact Assessment (WQIA) be submitted, for projects that propose land-disturbing activities on lands containing RPAs. Such site-specific evaluations are required in order to facilitate RPA boundary adjustments, as needed. The applicant is required to contact the Prince William County Department of Public Works, Division of Watershed Management at 703-792-7070 to inquire about submittal requirements for the County's Preservation Area Site Assessment (PASA) process, including the requirement for a site-specific RPA evaluation and, if necessary, a WQIA.

Provided adherence to the above requirements, and approval by Prince William County of any potential impacts on County-designated RPA lands from the proposed East Parcel Development, the proposed activity would be consistent with the *Chesapeake Bay Preservation Act* and the Regulations.

COMMONWEALTH of VIRGINIA

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October 24, 2017

Mr. Juan Rivera
Manassas Regional Airport
8500 Public Works Drive
Manassas, VA 20110

RE: Federal Consistency Certification for the Manassas Regional Airport West Corporate Development and East Parcel Development, City of Manassas and Prince William County, DEQ 17-061F

Dear Mr. Rivera:

The Commonwealth of Virginia has completed its review of the above-referenced Federal Consistency Certification (FCC) submitted for the West Corporate Development and East Parcel Development project at the Manassas Regional Airport in the City of Manassas and Prince William County, Virginia. The Department of Environmental Quality is responsible for coordinating Virginia's review of FCCs and responding to appropriate officials on behalf of the Commonwealth. This letter is in response to the FCC submittal dated May 2017 and received on May 2, 2017 as well as the August 17, 2017 project update memorandum prepared by RS&H for the Manassas Regional Airport. The following agencies and locality participated in this review:

Department of Environmental Quality (DEQ)
Department of Game and Inland Fisheries (DGIF)
Department of Conservation and Recreation (DCR)
Virginia Department of Health (VDH)
Department of Transportation (VDOT)
Department of Historic Resources (DHR)
Department of Aviation (DOAV)
Prince William County

In addition, the Marine Resources Commission, Department of Forestry, the Northern Virginia Regional Commission and the City of Manassas were invited to comment on the proposal.

PROJECT DESCRIPTION

The City of Manassas (applicant) is seeking approval from the Federal Aviation Administration (FAA) for the Manassas Regional Airport West Corporate Development and East Parcel Development project. The city owns and operates the airport which intersects the jurisdictional boundaries of the City of Manassas and Prince William County with approximately 20 acres of land on the east side of the airport being located within the limits of the county. The West Corporate Area development involves on-airport roadway improvements, reconstruction of the Fixed Based Operator (FBO) building and parking lot, construction of a corporate hangar, building and associated parking lots, T-hangar reconstruction, the expansion of the west aircraft apron and taxilane tie down parking, a taxilane extension, the construction of a maintenance building and wash rack, extension of utilities and stormwater drainage improvements, and a security fence extension. The East Parcel development includes roadway improvements, the construction of a corporate hangar, building, and parking lot, extension of a taxilane and utilities connections, stormwater drainage improvements, and a security fence extension. The project study area which encompasses the area that may be affected by the proposed project is 160 acres. The applicant certifies that the project is consistent with the enforceable policies of the Virginia Coastal Zone Management Program.

PUBLIC PARTICIPATION

In accordance with 15 CFR §930.2, the public was invited to participate in the review of the proposal. Public notice of the proposed action was published in the Office of Environmental Impact Review (OEIR) Program Newsletter and on the DEQ website from May 3, 2017 to June 2, 2017. No public comments were received in response to the notice.

FEDERAL CONSISTENCY UNDER THE COASTAL ZONE MANAGEMENT ACT

Pursuant to the *Coastal Zone Management Act of 1972*, as amended and federal consistency regulations (15 CFR Part 930, Subpart D, § 930.50 *et seq.*), activities requiring a federal permit, license, or approval that can have reasonably foreseeable effects on Virginia's coastal uses or resources must be conducted in a manner which is consistent with the Coastal Zone Management (CZM) Program. The CZM Program is comprised of a network of programs administered by several agencies. In order to be consistent with the CZM Program, the applicant must obtain all the applicable permits and approvals listed under the enforceable policies of the CZM Program prior to commencing the project.

FEDERAL CONSISTENCY CONCURRENCE

The applicant certifies that the project is consistent with the enforceable policies of the CZM Program. Based on our review of the FCC, the August 17, 2017 project update memorandum and supporting documentation and the comments submitted by agencies

administering the enforceable policies of the CZM Program, DEQ concurs that the proposal is consistent with the CZM Program provided that prior to implementation of the project all applicable permits and approvals are obtained as described below. However, other state approvals which may apply to this project are not included in this concurrence. Therefore, the applicant must ensure that this project is constructed and operated in accordance with all applicable federal, state, and local laws and regulations.

FEDERAL CONSISTENCY ANALYSIS

According to information in the FCC, the proposed project would have no effect on the following enforceable policies: fisheries management; subaqueous lands management; dunes management; and shoreline sanitation. The agencies of the Commonwealth responsible for the administration of the enforceable policies of the CZM Program generally agree with the findings in the FCC. The applicant must ensure that the proposed action is consistent with all enforceable policies. The analysis which follows responds to the discussion of the enforceable policies of the CZM Program that apply to this project.

1. Nonpoint Source Pollution Control. According to the FCC (page 9), the project will be designed and constructed to minimize soil erosion and the input of nutrients and sediment into waterways. Prior to construction all erosion and sediment controls will be installed in accordance with the *Virginia Erosion and Sediment Control Handbook* (1992, 3rd Edition) and a project-specific erosion and sediment control plan will be developed.

1(a) Agency Jurisdiction. The DEQ Office of Stormwater Management (OSWM) administers the nonpoint source pollution control enforceable policy through the *Virginia Erosion and Sediment Control Law and Regulations* (*VESCL&R*) and *Virginia Stormwater Management Law and Regulations* (*VSWML&R*). In addition, DEQ is responsible for the issuance, denial, revocation, termination and enforcement of the Virginia Stormwater Management Program (VSMP) General Permit for Stormwater Discharges from Construction Activities related to municipal separate storm sewer systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land-disturbing activities under the Virginia Stormwater Management Program.

1(b) Requirements. DEQ OSWM did not respond to DEQ's request for comments. Regulatory guidance for the control of nonpoint source pollution is presented below.

1(b)(i) Erosion and Sediment Control Plan. The project sponsor is responsible for submitting a project-specific erosion and sediment control (ESC) plan to the locality in which the project is located for review and approval pursuant to the local ESC requirements, if the project involves a land-disturbing activity equal to or greater than 10,000 square feet (2,500 square feet in a Chesapeake Bay Preservation Area). Depending on local requirements the area of land disturbance requiring an ESC plan may be less. The ESC plan must be approved by the locality prior to any land-disturbing

activity at the project site. All regulated land-disturbing activities associated with the project, including on and off site access roads, staging areas, borrow areas, stockpiles, and soil intentionally transported from the project, must be covered by the project specific ESC plan. Local ESC program requirements must be requested through the locality.

1(b)(ii) Stormwater Management Plan. Depending on local requirements, a Stormwater Management (SWM) plan may be required. Local SWM program requirements must be requested through the locality.

1(b)(iii) General Permit for Stormwater Discharges from Construction Activities (VAR10). The operator or owner of a construction activity involving land disturbance of equal to or greater than 1 acre is required to register for coverage under the General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities and develop a project specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submission of the registration statement for coverage under the General Permit and the SWPPP must address water quality and quantity in accordance with the *Virginia Stormwater Management Program Regulations*. General information and registration forms for the General Permit are available on DEQ's website at: www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/ConstructionGeneralPermit.aspx.

1(c) Agency Recommendation. Consider utilizing permeable paving for walkways and parking areas, where appropriate. Revegetate denuded areas promptly following construction work.

1(d) Conclusion. The project, as proposed, is consistent with the nonpoint source pollution control enforceable policy of the CZM Program, provided it complies with the applicable ESC, SWM, and VPDES requirements.

2. Air Pollution Control. According to the FCC (page 9), a temporary increase in vehicular emissions from construction work is expected to occur. These temporary impacts will be minimal and will not affect regional air quality.

2(a) Agency Jurisdiction. DEQ's Air Quality Division, on behalf of the State Air Pollution Control Board, is responsible for the development of regulations that implement Virginia's Air Pollution Control Law. DEQ is charged to carry out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board at DEQ (Virginia Code §10-1.1300 through §10.1-1320).

2(b) Agency Finding. According to the DEQ Air Division, the project site is located in a designated ozone attainment area and an emission control area for oxides of nitrogen (NOx) and volatile organic compounds (VOCs).

2(c) Recommendation. Precautions should be taken to restrict the emissions of volatile organic compounds (VOCs) and oxides of nitrogen (NOx) during construction, principally by controlling or limiting the burning of fossil fuels.

2(d) Requirements.

2(d)(i) Fugitive Dust. During future construction, fugitive dust must be kept to a minimum by using control methods outlined in 9 VAC 5-50-60 *et seq.* of the *Regulations for the Control and Abatement of Air Pollution*. These precautions include, but are not limited to, the following:

- Use, where possible, of water or chemicals for dust control;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

2(d)(ii) Open Burning. If project activities include open burning or the use of special incineration devices, this activity must meet the requirements under 9 VAC 5-130-10 through 9 VAC 130-60 and 9 VAC 5-130-100 of the *Regulations* for open burning. In addition, the *Regulations* provide for, but do not require, the local adoption of a model ordinance concerning open burning. The applicant should contact local fire officials to determine what local requirements, if any, exist.

2(d)(iii) Asphalt Paving. A precaution, which typically applies to road construction and paving work (9 VAC 5-45-780 *et seq.*), places limitations on the use of "cut-back" (liquefied asphalt cement, blended with petroleum solvents), and may apply to the project. The asphalt must be "emulsified" (predominantly cement and water with a small amount of emulsifying agent) except when specified circumstances apply. Moreover, there are time-of-year restrictions on its use from April through October in VOC emission control areas.

2(d)(iv) Fuel Burning Equipment. Should the proposed project require the installation of fuel-burning equipment (boilers, generators, etc.), or other air pollution emitting equipment, the project may be subject to 9 VAC 5-80, Article 6, Permits for New and Modified sources.

2(e) Conclusion. The project, as proposed, is consistent with the air pollution control enforceable policy of the CZM Program, provided it adheres to the above requirements.

3. Coastal Lands Management. According to the FCC (page 10), the eastern side of the study area is within Prince William County which is subject to the requirements of the Chesapeake Bay Preservation Act. Additionally Broad Run which intersects the western portion of the study area is also within Prince William County and subject to the Chesapeake Bay Preservation Act. According to the August 17, 2017 project update memorandum, the redesigned and reduced footprint of the east parcel development eliminates wetlands impacts. The airport understands the importance of the nearby Resource Protection Area (RPA) and has adjusted the layout to avoid any encroachment into the RPA. The East Parcel Development and RPA map submitted via email (Alberts/Moore email, 9/22/17) shows the Wakeman Drive Realignment being located just outside of the RPA.

3(a) Agency Jurisdiction. The DEQ Office of Local Government Programs (OLGP) administers the coastal lands management enforceable policy through the Chesapeake Bay Preservation Act (Bay Act) (Virginia Code §62.1-44.15 *et seq.*) and *Chesapeake Bay Preservation Area Designation and Management Regulations* (*Regulations*) (9 VAC 25-830-10 *et seq.*).

3(b) Coordination. The DEQ OLGP and OEIR coordinated with the project consultant significantly regarding the east side development and potential impacts to the RPA. A 90-day status letter was issued on July 25, 2017 (attached) detailing supplemental information that was required in order to determine consistency with the Bay Act. This coordination resulted in the submittal of the August 17, 2017 project update memorandum as well as further documentation related to the RPA and discussions with Prince William County (see Item 9(b)).

3(b) Agency Findings. The City of Manassas is not subject to the Chesapeake Bay Preservation Act or the Regulations. OLGP's review of the submitted documentation shows that the proposed West Corporate Development project will occur solely within the confines of the city-owned airport property, and as such, the West Corporate Development portion of the project is not subject to review for Bay Act compliance.

In Prince William County, the areas protected by the Chesapeake Bay Preservation Act, as locally implemented, require conformance with performance criteria. These areas include RPAs and Resource Management Areas (RMAs) as designated by the local government. RPAs include tidal wetlands, certain non-tidal wetlands and tidal shores. RPAs also include a 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow. RMAs, which require less stringent performance criteria, include all areas of the County not designated as RPA.

The proposed East Parcel Development project will occur on approximately 20 acres of land within Prince William County. The project calls for on-site roadway improvements and taxi lane extensions, construction of three surface parking lots and several airplane hangar buildings, stormwater drainage improvements and the installation of additional security fencing.

The roadway improvements for the proposed Wakeman Drive realignment on the east side of the East Parcel Development may result in impacts to the County-designated RPA associated with Cannon Run. It should be noted that the site-specific RPA boundary determination may also result in realignments to the proposed surface parking lots and/or the proposed hangar buildings, as some or all of these project components may encroach into the Cannon Run RPA buffer.

3(c) Requirement. The roadway improvements component of the East Parcel Development project would be considered exempt from the Regulations provided the road improvements are constructed in accordance with (i) regulations promulgated pursuant to the *Virginia Erosion and Sediment Control Law* and the *Virginia Stormwater Management Act*, (ii) an erosion and sediment control plan and a stormwater management plan approved by DEQ, or (iii) local water quality protection criteria at least as stringent as the above state requirements. The exemption of public roads is further conditioned on the following:

> Optimization of the road alignment and design, consistent with other applicable requirement, to prevent or otherwise minimize (i) encroachment into the RPA and (ii) adverse effects on water quality.

9VAC25-830-110 of the *Chesapeake Bay Preservation Area Designation and Management Regulations* require that a site-specific evaluation be conducted, and a Water Quality Impact Assessment (WQIA) be submitted, for projects that propose land-disturbing activities on lands containing RPAs. Such site-specific evaluations are required in order to facilitate RPA boundary adjustments, as needed. The applicant is required to contact the Prince William County Department of Public Works, Division of Watershed Management at 703-792-7070 to inquire about submittal requirements for the County's Preservation Area Site Assessment (PASA) process, including the requirement for a site-specific RPA evaluation and, if necessary, a WQIA.

3(d) Conclusion. Provided adherence to the above requirements, and approval by Prince William County of any potential impacts on County-designated RPA lands from the proposed East Parcel Development, the proposed activity would be consistent with the *Chesapeake Bay Preservation Act* and the Regulations and the coastal lands enforceable policy of the CZM Program.

4. Wetlands Management. According to the August 17, 2017 project update memorandum (pages 1-2), mitigation for potential floodway and floodplain impacts in the City of Manassas associated with the west side development includes cutting in an area that has been designated as a wetland. Approximately 1.60-acres of Palustrine Forested Wetlands would be affected by this unavoidable impact.

The FCC found that the east side development would impact a total of 1.5-acres of wetlands. However, the east parcel development was subsequently redesigned to minimize potential RPA impacts and per the August 17, 2017 project update

memorandum (page 2), wetlands impacts will not result from the east side development portion of the project.

In total, the project will impact approximately 1.62 acres of wetlands.

4(a) Agency Jurisdiction. The wetlands management enforceable policy is administered by the Virginia Marine Resources Commission (tidal wetlands) (Virginia Code 28.2-1301 through 28.2-1320) and the Department of Environmental Quality through the Virginia Water Protection (VWP) Permit program (tidal and non-tidal wetlands) (Virginia Code §62.1-44.15:20 and Water Quality Certification pursuant to Section 401 of the Clean Water Act).

4(b) Agency Findings. The DEQ Northern Regional Office (NRO) confirmed that, as described, the project will impact surface waters or wetlands. Upon receipt of a Joint Permit Application for the proposed surface water impacts, DEQ VWP Permit staff will review the proposed project in accordance with the VWP permit program regulations and current VWP permit program guidance.

The VMRC did not comment on the proposal.

4(c) Agency Requirement. Submit a Joint Permit Application for the proposed impacts to non-tidal wetlands.

4(d) Agency Recommendation. Avoid and minimize impacts to surface waters and wetlands to the maximum extent practicable.

4(e) Conclusion. Provided a JPA is submitted and a VWP Permit is obtained, as necessary, the project is consistent with the wetlands management enforceable policy of the Virginia CZM Program.

5. Point Source Pollution Control. According to the FCC, the proposed project will generate new point sources of pollution. All runoff will be properly treated via the use of Best Management Practices (BMPs). According to supplemental information provided by the project consultant (Heath/Howard email, 6/14/17), new stormwater outfalls on the west side of the property will either connect to the existing stormwater conveyance system or directly to Broad Run. On the east side, new outfalls will connect to Cannon Branch. It is estimated that there will be two new outfalls on the west side of the airport and one on the east side, though the project design is still preliminary.

5(a) Agency Jurisdiction. The point source program is administered by the State Water Control Board pursuant to Virginia Code §62.1-44.15. Point source pollution control is accomplished through the implementation of the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to §402 of the federal Clean Water Act and administered in Virginia as the VPDES permit program. The Water Quality Certification requirements of §401 of the Clean Water Act of 1972 is administered under the Virginia Water Protection Permit program.

5(b) Agency Findings. The airport has an existing VPDES Industrial Stormwater General Permit (VAR050985) for discharges from the stormwater conveyance system. Based on information provided, new outfalls will be created as part of this project.

5(c) Agency Requirement. The new outfalls will require a permit modification for the facility's VPDES Industrial Stormwater General Permit (VAR050985). Coordinate with DEQ NRO regarding the new outfalls.

5(d) Conclusion. Provided a permit modification is obtained, as necessary, for the proposed new outfalls, the project is consistent with the point source pollution control enforceable policy of the Virginia CZM Program.

6. Subaqueous Lands Management. The FCC (page 2) indicates that subaqueous lands will be impacted.

6(a) Agency Jurisdiction. Pursuant to Section 28.2-1204 of the Code of Virginia, the Virginia Marine Resources Commission (VMRC) has jurisdiction over any encroachments in, on, or over any state-owned rivers, streams, or creeks in the Commonwealth. Accordingly, any portion of the project involving encroachments channelward of ordinary high water along natural rivers and streams may require a permit. In addition, VMRC generally requires permits for encroachments on non-tidal streams with a drainage area greater than five square miles or with an average instream flow of at least five cubic feet per second.

VMRC serves as the clearinghouse for the Joint Permit Application (JPA) used by:

- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands;
- U.S. Army Corps of Engineers (Corps) for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a Virginia Water Protection Permit; and
- local wetlands board for impacts to wetlands.

Any jurisdictional impacts would be reviewed by VMRC during the JPA process.

6(b) Agency Findings. VMRC did not comment on the FCC.

6(c) Agency Requirement. Submit a JPA to VMRC for the proposed impacts to subaqueous lands. Upon receipt of the JPA, VMRC will determine whether a permit is necessary.

6(d) Conclusion. Provided a JPA is submitted and a permit obtained, if required, the project is consistent with the subaqueous lands management enforceable policy of the Virginia CZM Program.

7. Fisheries Management. The FCC (page 2) states that commercial or recreational fisheries resources will not be impacted.

7(a) Agency Jurisdiction. The fisheries management enforceable policy is administered by the Virginia Marine Resources Commission (VMRC) (Virginia Code § 28.2-200 to § 28.2-713) and the Department of Game and Inland Fisheries (DGIF) (Virginia Code § 29.1-100 to § 29.1-570). In addition, the Virginia Department of Health (VDH) Division of Shellfish Sanitation (DSS) is responsible for protecting the health of the consumers of molluscan shellfish and crustacea by ensuring that shellfish growing waters are properly classified for harvesting, and that molluscan shellfish and crustacea processing facilities meet sanitation standards.

7(b) Agency Findings. Broad Run, which borders the airport on the southern side, is designated a Threatened and Endangered Species Water due to the presence of state Endangered brook floaters. It does not appear any instream work is proposed; therefore DGIF does not anticipate this project to result in significant adverse impacts upon this species.

7(c) Agency Recommendation. If instream work becomes necessary, the airport should coordinate further with DGIF (Amy Ewing, 804-367-2211).

7(d) Conclusion. Assuming adherence to erosion and sediment controls, DGIF finds this project consistent with the fisheries management enforceable policy of the CZM Program.

ADDITIONAL ENVIRONMENTAL CONSIDERATIONS

In addition to the enforceable policies of the CZM Program, comments were also provided with respect to other applicable requirements and recommendations. The applicant must ensure that this project is constructed and operated in accordance with all applicable federal, state, and local laws and regulations.

1. Solid and Hazardous Waste Management.

1(a) Agency Jurisdiction. On behalf of the Virginia Waste Management Board, the DEQ Division of Land Protection and Revitalization is responsible for carrying out the mandates of the Virginia Waste Management Act (Virginia Code §10.1-1400 *et seq.*), as well as meeting Virginia's federal obligations under the Resource Conservation and Recovery Act (CERCLA) and the Comprehensive Environmental Response Compensation Liability Act , commonly known as Superfund. The DEQ Division of Land Protection and Revitalization also administers those laws and regulations on behalf of the State Water Control Board governing Petroleum Storage Tanks (Virginia Code §62.1-44.34:8 *et seq.*), including Aboveground Storage Tanks (9VAC25-91 *et seq.*) and Underground Storage Tanks (9VAC25-580 *et seq.* and 9VAC25-580-370 *et seq.*), also

known as 'Virginia Tank Regulations', and § 62.1-44.34:14 *et seq.* which covers oil spills.

Virginia:

- Virginia Waste Management Act, Virginia Code § 10.1-1400 *et seq.*
- *Virginia Solid Waste Management Regulations*, 9 VAC 20-81
  - (9 VAC 20-81-620 applies to asbestos-containing materials)
- *Virginia Hazardous Waste Management Regulations*, 9 VAC 20-60
  - (9 VAC 20-60-261 applies to lead-based paints)
- *Virginia Regulations for the Transportation of Hazardous Materials*, 9 VAC 20-110.

Federal:

- Resource Conservation and Recovery Act (RCRA), 42 U.S. Code sections 6901 *et seq.*
- U.S. Department of Transportation *Rules for Transportation of Hazardous Materials*, 49 *Code of Federal Regulations*, Part 107
- Applicable rules contained in Title 40, *Code of Federal Regulations.*

1(b) Agency Findings. DEQ's Division of Land Protection and Revitalization (DLPR) conducted a search of its solid and hazardous waste databases (2,000-foot radius), including petroleum release sites, in the project area vicinity to identify waste sites in close proximity to the area. A number of sites of concern were identified in close proximity to the airport or within airport property.

Hazardous Waste/RCRA Facilities – located in close proximity to the project area

1. VAD988212643, Tri-State Tours, 10680 Wakeman Court, Manassas, VA 22110. Small quantity generator (SQG)
2. VA0000347922, Wilcox Woodworks, 10687 Wakeman Court, Manassas, VA 22110. SQG
3. VAR000506774, Corfu Contractors, 10599 Residence Road, Manassas, VA 20136. SQG

Petroleum Releases - two within the project area (*denotes the same address)

4. PC#20013062, Manassas Airport – New Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/25/2000. Status: Closed.

   *PC#19910187, Dulles Aviation Incorporated – Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 08/21/1990. Status: Closed.

*PC#19993317, Manassas Municipal Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 03/22/1999. Status: Closed.

*PC#19973688, Manassas Airport – Old Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/05/1996. Status: Closed.

*PC#19870385, Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 12/09/1986. Status: Closed.

5. PC#19900438, VDOT – Manassas Area Headquarters Shop, 10228 Residency Road, Manassas, VA 22110. Release Date: 10/16/1989. Status: Closed.

1(c) Requirements.

1(c)(i) Contaminated Waste. Any soil that is suspected of contamination or wastes that are generated during construction must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations. All construction and demolition debris must be characterized in accordance with the *Virginia Hazardous Waste Management Regulations* prior to disposal at an appropriate facility.

1(c)(ii) Petroleum Release Sites and Storage. If evidence of a petroleum release is discovered, it must be reported to DEQ, as authorized by Virginia Code § 62.1-44.34.8 through 9 and 9 VAC 25-580-10 *et seq*.

The installation and use of an aboveground storage tank (>660 gallons) for temporary fuel storage (>120 days) during the project must follow the requirements in 9 VAC 25-91-10 *et seq*.

1(c)(iii) Asbestos and/or Lead-based Paint. All structures being demolished/renovated/removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to federal waste-related regulations, state regulations 9 VAC 20-80-620 for ACM and 9 VAC 20-60-261 for LBP must be followed.

1(d) Pollution Prevention Recommendation. DEQ recommends that the applicant implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

The identified petroleum releases should be further evaluated to establish the location, nature and extent of the releases and the potential to impact the proposed project. Contact the NRO at (703) 583-3800 (Tanks Program) for further information about the petroleum release cases.

Questions or requests for further information may be directed to DEQ-DLPR, Katy Dacey at (804) 698-4274.

1(e) Petroleum Release Recommendation. The applicant should evaluate the location, nature, and extent of the identified petroleum release and the potential for it to impact the project. The facility representative should contact the DEQ's NRO at 703-583-3800 (Tanks Program) for further information and for access to the administrative records of the petroleum contamination case which was identified on the airport property.

2. Natural Heritage Resources.

2(a) Agency Jurisdiction.

2(a)(i) Natural Heritage Resources. The Virginia Department of Conservation and Recreation's (DCR) Division of Natural Heritage (DNH): DNH's mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act (Virginia Code §10.1-209 through 217), authorized DCR to maintain a statewide database for conservation planning and project review, protect land for the conservation of biodiversity, and the protect and ecologically manage the natural heritage resources of Virginia (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

2(a)(ii) Threatened and Endangered Plant and Insect Species. The Virginia Department of Agriculture and Consumer Services (VDACS): The Endangered Plant and Insect Species Act of 1979 (Virginia Code Chapter 39 §3.1-1020 through 1030) authorizes VDACS to conserve, protect and manage endangered and threatened species of plants and insects. Under a Memorandum of Agreement established between VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

2(b) Agency Findings. DCR DNH found that the Broad Run Stream Conservation Unit (SCU) is adjacent to the project site. The Broad Run SCU has been given a biodiversity ranking of B3, which represents a site of high significance. Natural heritage resources associated with this site are:

Alasmidonta varicosa	Brook floater	G3/S1/NL/LE
Elliptio lanceolata	Yellow lance	G2G3/S2S3/SOC/NL

The Brook floater is currently listed as endangered by the Department of Game and Inland Fisheries (DGIF). The Yellow lance is currently classified as a species of concern by the United States Fish and Wildlife Service (USFWS); however, this designation has no official legal status. In addition, Broad Run has been designated by the DGIF as a "Threatened and Endangered Species Water" for the Brook floater. According to DCR's species distribution model, the potential may exist for the Dwarf wedgemussel (*Alasmidonta heterodon*, G1G2/S1/LE/LE) adjacent to the project area.

Refer to the attached DCR memorandum dated June 1, 2017 for more details about the identified species.

2(b)(i) State-listed Plant and Insect Species. DCR finds that the current activity will not affect any documented state-listed plant and insect species.

2(b)(ii) State Natural Area Preserves. DCR finds that there are no State Natural Area Preserves under its jurisdiction in the project vicinity.

2(c) Recommendations. To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations.

Contact DCR-DNH to secure updated information on natural heritage resources if the scope of the project changes and/or six months has passed before it is utilized. New and updated information is continually added to the Biotics Data System.

3. Public Water Supply.

3(a) Agency Jurisdiction. The Virginia Department of Health (VDH), Office of Drinking Water (ODW) reviews projects for the potential to impact public drinking water sources (groundwater wells and surface water intakes). VDH administers both federal and state laws governing waterworks operation.

3(b) Agency Findings. VDH ODW identified two public groundwater wells within a 1-mile radius of the project site.

PWS ID Number	City/County	System Name	Facility Name
6153264	PRINCE WILLIAM	BROAD RUN GOLF	WELL
6153041	PRINCE WILLIAM	BRISTOW MANOR GOLF CLUB	WELL

Additionally, the project is within the watershed of the Fairfax County Water Authority's Occoquan Reservoir public surface water intake (PWS ID 6059501).

3(c) Recommendation.

- Best Management Practices should be employed on the project site including Erosion & Sedimentation Controls as well as Spill Prevention Controls & Countermeasures.
- Properly manage materials on site and during transport to prevent impacts to nearby surface water.

3(d) Requirement. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility as applicable.

4. Aviation.

4(a) Agency Jurisdiction. The Virginia Department of Aviation is a state agency that plans for the development of the state aviation system; promotes aviation; grants aircraft and airports licenses; and provides financial and technical assistance to cities, towns, counties and other governmental subdivisions for the planning, development, construction and operation of airports, and other aviation facilities.

4(b) Agency Findings. DOAV finds that the proposed project is consistent with the approved Airport Layout Plan. DOAV has been working with and providing comments on the project directly to the airport sponsor, in coordination with the FAA's Washington Airports District office.

5. Historic Structures and Architectural Resources.

5(a) Agency Jurisdiction. The Virginia Department of Historic Resources (DHR) conducts reviews of both federal and state projects to determine their effect on historic properties. Under the federal process, DHR is the State Historic Preservation Office, and ensures that federal undertakings – including licenses, permits, or funding – comply with Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulation at 36 CFR Part 800. Section 106 requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. For state projects or activities on state lands, DHR is afforded an opportunity to review and comment on (1) the demolition of state property; (2) major state projects requiring an EIR; (3) archaeological investigations on state-controlled land; (4) projects that involve a landmark listed in the Virginia Landmarks Register; (5) the sale or lease of surplus state property; (6) exploration and recovery of underwater historic properties; and (7) excavation or removal of archaeological or historic features from caves. See DHR's website for more information about applicable state and federal laws and how to submit an application for review: http://www.dhr.virginia.gov/StateStewardship/Index.htm.

5(b) Agency Finding. DHR received information for this project for review pursuant to Section 106 of the National Historic Preservation Act, including a Phase I Archeological Study. The new development will not cause any additional adverse impacts from the current conditions on the site, in areas where the development will be visible.

Based on its review DHR concurs with the FAA that the proposed airport improvement project will have no adverse effect on historic properties with the condition that protective measures are employed during construction for adjacent site 44PW0729.

6. Pesticides and Herbicides. Should maintenance of the property require the use of pesticides or herbicides for landscape maintenance, these chemicals should be in accordance with the principles of integrated pest management. The least toxic pesticides that are effective in controlling the target species should be used.

Contact the Department of Agriculture and Consumer Services at (804) 786-3501 for more information.

7. Transportation Impacts.

7(a) Agency Jurisdiction. The Virginia Department of Transportation (VDOT) provides comments pertaining to potential impacts to existing and future transportation systems.

7(b) Agency Findings. The VDOT Northern Virginia District Office did not have any transportation-related concerns related to the project.

8. Wildlife Resources.

8(a) Agency Jurisdiction. The Department of Game and Inland Fisheries, as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state or federally listed endangered or threatened species, but excluding listed insects (*Virginia Code* Title 29.1). The DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 *et seq.*), and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce, or compensate for those impacts.

8(b) Agency Findings. DGIF did not indicate that wildlife or threatened and endangered species would be impacted by this project.

8(c) Agency Recommendation. To minimize overall impacts to wildlife resources, DGIF offers the following comments about development activities:

- Avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable;
- Maintain naturally vegetated buffers of at least 100 feet in width around wetlands and on both sides of perennial and intermittent streams, where practicable;
- Conduct significant tree removal and ground clearing activities outside of the primary songbird nesting season of March 15 through August 15;
- Implement and maintain appropriate erosion and sediment controls throughout project construction and site restoration.

9. Locality Comments.

9(a) Agency Jurisdiction. In accordance with CFR 930, Subpart A, § 930.6(b) of the *Federal Consistency Regulations*, DEQ, on behalf of the state, is responsible for securing necessary review and comment from other state agencies, the public, regional government agencies, and local government agencies, in determining the Commonwealth's concurrence or objection to a federal consistency certification.

9(b) Locality Comments. Prince William County reviewed the FCC and provided a copy of a scoping response dated December 9, 2016 that the county sent to the project consultant. The letter indicated that Piper Lane provides the only access to the western development site.

Prince William County indicated that there is the potential for direct and indirect impacts to historic resources to occur and identified two Civil War battlefields (Bristoe Station and Kettle Run battlefields) that may be impacted. These battlefields should be taken into consideration in the Environmental Assessment for the project. Some archaeological surveying of the east parcel development area has occurred and the county indicated that the airport consulted with the Prince William County Archaeologist on the scope of work for further cultural resources surveying in January 2017.

The County indicated via discussions with DEQ's Office of Local Government Programs that it would require a Preservation Area Site Assessment for the east site development that is proposed in the near vicinity of a RPA. Refer to Item 3 in the Federal Consistency Analysis section above for more details.

9(c) Locality Recommendation. The County recommends an analysis of Piper Lane to assess its adequacy to handle the additional traffic associated with the new development on the west side. The analysis should take into consideration the width, pavement thickness, drainage and capacity of the roadway.

Archaeological surveying of undisturbed areas proposed for development should occur, including metal detector surveys by an archaeologist. Continue to coordinate with the county regarding their concerns related to cultural resources.

REGULATORY AND COORDINATION NEEDS

1. Nonpoint Source Pollution Control.

1(a) Erosion and Sediment Control and Stormwater Management. This project must comply with *Virginia's Erosion and Sediment Control Law* (Virginia Code § 62.1-44.15:61) and *Regulations* (9 VAC 25-840-30 *et seq.*) and *Stormwater Management Law* (Virginia Code § 62.1-44.15:31) and *Regulations* (9 VAC 25-870-210 *et seq.*) as locally administered. Land-disturbing activities of equal to or greater than 10,000 square feet (2,500 square feet in a Chesapeake Bay Preservation Area) would be regulated by *VESCL&R* and *VSWML&R*. Local erosion and sediment control, and stormwater management plan requirements should be coordinated with the locality.

Specific questions regarding Erosion and Sediment control requirements should be directed to DEQ, Larry Gavan at (804) 698-4040.

1(b) General Permit for Stormwater Discharges from Construction Activities (VAR10). For projects involving land-disturbing activities of equal to or greater than one acre the applicant is required to register for coverage under the Virginia Stormwater Management Program General Permit for Discharges of Stormwater from Construction Activities (9 VAC 25-870-1 *et seq.*). Specific questions regarding the Stormwater Management Program requirements should be directed to DEQ, Holly Sepety at (804) 698-4039.

2. Air Pollution Control. Activities associated with this project may be subject to air regulations administered by DEQ. The state air pollution regulations that may apply to the project are:

- fugitive dust and emissions control (9VAC5-50-60 et seq.);
- asphalt paving operations (9VAC5-45-760 *et seq.*);
- permits for fuel-burning equipment (9VAC5-80-1100 *et seq.*); and
- open burning restrictions (9VAC5-130 et seq.).

Contact DEQ NRO at (783) 583-3800 with questions.

3. Natural Heritage Resources. Contact DCR-DNH, Rene Hypes at (804) 786-7951 to secure updated information on natural heritage resources if six months passes before the project is implemented.

4. Solid and Hazardous Wastes. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations. Contact DEQ NRO (783-583-3800) for information on the location and availability of suitable waste management facilities in the project area or if free product, discolored soils, or other evidence of contaminated soils are encountered.

4(a) Asbestos-Containing Material. It is the responsibility of the owner or operator of a demolition activity to thoroughly inspect the affected part of the facility prior to demolition for the presence of asbestos, including Category I and Category II nonfriable asbestos-containing material. Upon classification as friable or non-friable, all asbestos-containing material shall be disposed of in accordance with the Virginia Solid Waste Management Regulations (9 VAC 20-80-640) and transported in accordance with the Virginia regulations governing Transportation of Hazardous Materials (9 VAC 20-110-10 *et seq.*). Contact the Department of Labor and Industry (804-371-2327) for additional information.

4(b) Lead-Based Paint. This project must comply with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations and with the Virginia Lead-Based Paint Activities Rules and Regulations. For additional information regarding these requirements, contact the Department of Professional and Occupational Regulation at (804) 367-8500.

5. Chesapeake Bay Preservation Act. Coordinate with the Prince William County Department of Public Works, Division of Watershed Management at 703-792-7070 regarding the submittal requirements for the County's Preservation Area Site Assessment (PASA) process, including the requirement for a site-specific RPA evaluation and, if necessary, a WQIA.

The project must be conducted in a manner that is consistent with the coastal lands management enforceable policy of the CZM Program as administered by DEQ pursuant to the Chesapeake Bay Preservation Act (Virginia Code 62.1-44.15 *et seq.*) and the Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC25-830 *et. seq.*). For additional information contact Daniel Moore (804-698-4520).

6. Historic Resources. Coordinate with DHR (Adrienne Birge-Wilson, 804-482-6092) as necessary with questions regarding its findings and the protective measures for adjacent site 44PW0729.

7. Wetlands and Subaqueous Lands Impacts. A Joint Permit Application must be submitted to VMRC for the proposed wetlands and subaqueous lands impacts. Contact VMRC (Tony Watkinson, 757-247-2250) with questions.

8. Point Source Pollution Control. Contact the DEQ NRO (Susan Mackert, 703-583-3853) regarding a permit modification to add new outfalls to the existing VPDES Industrial Stormwater General Permit (VAR050985) for the facility.

9. Potable and Sanitary Water Collection Systems. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility. Contact the VDH Office of Drinking Water with questions related to its recommendations (Arlene Fields Warren, 804-864-7781).

10. Wildlife Resources. Coordinate with DGIF (Amy Ewing, 804-367-2211) with questions regarding its recommendations to protect wildlife resources or to aid in the development of project-specific measures to minimize project impacts to wildlife.

11. Locality Coordination. Coordinate with Prince William County (Justin Patton, 703-792-5792) regarding the county's comments and recommendations related to cultural resources and the analysis of the adequacy of Piper Lane to handle the increased traffic associated with the proposed west side development. See also Item 5 Chesapeake Bay Preservation Act above.

Thank you for the opportunity to comment on the FCC submitted for the West Corporate Development and East Parcel Development project at the Manassas Regional Airport. Detailed comments of reviewing agencies are attached for your review. If you have questions, please do not hesitate to call me at (804) 698-4204 or Janine Howard at (804) 698-4299.

Sincerely,

Bettina Sullivan, Program Manager
Environmental Impact Review

Ec:

Robbie Rhur, DCR
Amy Ewing, DGIF
Tony Watkinson, VMRC
Roger Kirchen, DHR
Greg Evans, DOF
Arlene Warren, VDH
Elizabeth Jordan, VDOT
Robert Lazaro, Northern Virginia Regional Commission
William Patrick Pate, City of Manassas
Christopher E. Martino, Prince William County
Clay Morris, Prince William County
Susan Simmers, DOAV
Susan Stafford, FAA
Juan Rivera, Manassas Regional Airport
Natalie Heath, RS&H

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

ENVIRONMENTAL REVIEW COMMENTS APPLICABLE TO AIR QUALITY

TO: Janine L. Howard **DEQ - OEIA PROJECT NUMBER: DEQ #17-061F**

PROJECT TYPE: ☐ STATE EA / EIR **X FEDERAL EA / EIS** ☐ SCC

X CONSISTENCY CERTIFICATION

PROJECT TITLE: Manassas Regional Airport West Corporate Development and East Parcel Development

PROJECT SPONSOR: Federal Aviation Administration

PROJECT LOCATION: **X OZONE ATTAINMENT AND EMISSION CONTROL AREA FOR NOX & VOC**

REGULATORY REQUIREMENTSMAY BE APPLICABLE TO: **X CONSTRUCTION** ☐ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-45-760 et seq. – Asphalt Paving operations
3. **X 9 VAC 5-130 et seq. – Open Burning**
4. **X 9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
5. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to_____
6. ☐ 9 VAC 5-60-300 et seq. – Standards of Performance for Toxic Pollutants
7. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the_____
8. ☐ 9 VAC 5-80-1100 et seq. of the regulations – Permits for Stationary Sources
9. ☐ 9 VAC 5-80-1605 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the _____
10. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
11. ☐ 9 VAC 5-80-800 et seq. Of the regulations – State Operating Permits. This rule may be applicable to _____

COMMENTS SPECIFIC TO THE PROJECT:

All precautions are necessary to restrict the emissions of volatile organic compounds (VOC) and oxides of nitrogen (NO_X).

K. S. Narasimhan

(Kotur S. Narasimhan)
Office of Air Data Analysis

DATE: May 4, 2017

Molly Joseph Ward
Secretary of Natural Resources

Clyde E. Cristman
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

Rochelle Altholz
Deputy Director of Administration and Finance

David C. Dowling
Deputy Director of Soil and Water Conservation and Dam Safety

Thomas L. Smith
Deputy Director of Operations

MEMORANDUM

DATE: June 1, 2017

TO: Janine Howard, DEQ

FROM: Roberta Rhur, Environmental Impact Review Coordinator

SUBJECT: DEQ 17-061F, Manassas Regional Airport West & East Parcel Development

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Broad Run Stream Conservation Unit is adjacent to the project site. Stream Conservation Units (SCUs) identify stream reaches that contain aquatic natural heritage resources, including 2 miles upstream and 1 mile downstream of documented occurrences, and all tributaries within this reach. SCUs are also given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain. The Broad Run SCU has been given a biodiversity ranking of B3, which represents a site of high significance. Natural heritage resources associated with this site are:

Alasmidonta varicosa	Brook floater	G3/S1/NL/LE
Elliptio lanceolata	Yellow lance	G2G3/S2S3/SOC/NL

The Brook floater, a small freshwater mussel species, is known from the northeastern United States primarily in the Atlantic Slope drainages (NatureServe, 2009). In Virginia, it is recorded from the Potomac River basin with a possible record from the James River. Of 14 documented records in Virginia, only two are thought to be viable. Population declines have been documented throughout its range (NatureServe, 2009). The Brook floater typically inhabits flowing-water habitats in and near riffles and rapids of smaller creeks with rocky or gravelly substrates (Nedeau et al., 2000 per NatureServe, 2009). Many facets of its life history are unknown including its fish host. Threats for the Brook floater in particular include poor water quality as this species does not tolerate silt or nutrient pollution well (Stevenson and Bruenderman, 1995). Please note that this species is currently listed as endangered by the Virginia Department of Game and Inland Fisheries (VDGIF).

The Yellow lance occurs in mid-sized rivers and second and third order streams. To survive, it needs a silt-free, stable streambed and well-oxygenated water that is free of pollutants. This species has been the subject of taxonomic debate in recent years (NatureServe, 2009). Currently in Virginia, the Yellow lance is

recognized from populations in the Chowan, James, York, and Rappahannock drainages. Its range also extends into Neuse-Tar river system in North Carolina. In recent years, significant population declines have been noted across its range (NatureServe, 2009). The Yellow lance may be particularly sensitive to chemical pollutants and exposure to fine sediments from erosion (NatureServe, 2009). Please note that this species is currently classified as a species of concern by the United States Fish and Wildlife Service (USFWS); however, this designation has no official legal status.

Considered good indicators of the health of aquatic ecosystems, freshwater mussels are dependent on good water quality, good physical habitat conditions, and an environment that will support populations of host fish species (Williams et al., 1993). Because mussels are sedentary organisms, they are sensitive to water quality degradation related to increased sedimentation and pollution. They are also sensitive to habitat destruction through dam construction, channelization, and dredging, and the invasion of exotic mollusk species.

In addition, Broad Run has been designated by the VDGIF as a "Threatened and Endangered Species Water" for the Brook floater.

Please note according to DCR's species distribution model, potential may exist for the Dwarf wedgemussel (*Alasmidonta heterodon*, G1G2/S1/LE/LE) adjacent to the project area. To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. Due to the legal status of the Brook floater, DCR also recommends coordination with Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570).

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The Virginia Department of Game and Inland Fisheries (VDGIF) maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

Cc: Amy Ewing, DGIF
Troy Anderson, USFWS

Literature Cited

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 16, 2010 and April 5, 2010).

Nedeau, E.J., M.A. McCollough, and B.I. Swartz. 2000. The freshwater mussels of Maine. Maine Department of Inland Fisheries and Wildlife, Augusta, Maine. 118 pp.

Stevenson, Phillip H. and Sue A. Bruenderman 1995. A Guide to Endangered and Threatened Species of Virginia. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. p. 74.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993.
Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-9.

Howard, Janine (DEQ)

From: Ewing, Amy (DGIF)
Sent: Thursday, June 08, 2017 11:20 AM
To: Howard, Janine (DEQ)
Cc: nhreview (DCR)
Subject: ESSLog# 38126_17-061F_ManassasRegionalAirport_DGIF_AME20170608

Janine,
Broad Run, which borders the airport on the southern side, is designated a Threatened and Endangered Species Water due to the presence of state Endangered brook floaters. It does not appear any instream work is proposed in which case we do not anticipate this project to result in significant adverse impacts upon this species. If instream work becomes necessary, we recommend additional coordination with us.

This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend coordination with VDCR-DNH regarding the protection of these resources.

To minimize the adverse impacts of linear utility/road project development on wildlife resources, we offer the following general recommendations: avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable; maintain naturally vegetated buffers of at least 100 feet in width around wetlands and on both sides of perennial and intermittent streams, where practicable; conduct significant tree removal and ground clearing activities outside of the primary songbird nesting season of March 15 through August 15; and, implement and maintain appropriate erosion and sediment controls throughout project construction and site restoration. We understand that adherence to these general recommendations may be infeasible in some situations. We are happy to work with the applicant to develop project-specific measures as necessary to minimize project impacts upon the Commonwealth's wildlife resources.

Assuming adherence to erosion and sediment controls, we find this project consistent with the Fisheries Management Section of the CZMA.

Thanks, Amy

Amy M. Ewing

Environmental Services Biologist/FWIS Program Manager
Chair, Team WILD (Work, Innovate, Lead and Develop)
VA Department of Game and Inland Fisheries
7870 Villa Park Dr., Suite 400, PO Box 90778, Henrico, VA 23228
804-367-2211 ☯ Our mission is to: Conserve, Connect, and Protect ☯ www.dgif.virginia.gov

"That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics" **Aldo Leopold, 1948**

COMMONWEALTH of VIRGINIA

Department of Historic Resources

Molly Joseph Ward
Secretary of Natural Resources

2801 Kensington Avenue, Richmond, Virginia 23221

Julie V. Langan
Director

Tel: (804) 367-2323
Fax: (804) 367-2391
www.dhr.virginia.gov

June 2, 2017

Susan Stafford
Federal Aviation Administration
Washington Airports District Office
23723 Air Freight Lane, Suite 210
Dulles, VA 20166

Re: Manassas Regional Airport West Corporate Development and East Parcel Development
City of Manassas
DHR File No. 2017-0348

Dear Ms. Stafford,

The Virginia Department of Historic Resources (DHR) received the above referenced project for our review and comment pursuant to Section 106 (54 U.S.C. 306108) of the National Historic Preservation Act (54 U.S.C. 300101 et seq.) and it's implementing regulation, "Protection of Historic Properties" (36 CFR Part 800).

We have reviewed the report titled Phase I Archaeological Study for the Proposed West Corporate Development and East Parcel Development at Manassas Regional Airport, City of Manassas, Prince William County, Virginia prepared by Elizabeth Anderson Comer/Archaeology. It is our opinion that the fieldwork and report are consistent with applicable standards and guidelines. Much of the project area has either been previously surveyed or disturbed and the archaeological survey of roughly 18 acres of undisturbed land identified no intact sites. Based on the information provided, we find that impacts to archaeological properties are unlikely and no further archaeological survey is warranted in support of this project. We do, however, agree that protective measures should be employed during construction for adjacent site 44PW0729.

The proposed project will not be visible from most of the nine identified historic properties. Because of its scale and property type, the new development will not cause any additional

adverse impacts from what currently exists on the site, in areas where the development will be visible.

Based upon the sum of the review, DHR concurs with FAA that the proposed airport improvement project will have *no adverse effect on historic properties with the condition* that protective measures should be employed during construction for adjacent site 44PW0729.

If you have any questions regarding these comments or our review of this project, please do not hesitate to contact me via telephone at (804) 482-6092 or via email at adrienne.birge-wilson@dhr.virginia.gov.

Sincerely,

Adrienne Birge-Wilson

Adrienne Birge-Wilson, Architectural Historian
Review and Compliance Division

cc: Janine Howard, DEQ

COMMONWEALTH of VIRGINIA

Randall P. Burdette
Executive Director

Department of Aviation
5702 Gulfstream Road
Richmond, Virginia 23250-2422

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FAX • (804) 236-3635

ISO 9001:2008 Certified
IS-BAO Registered

Transmitted via Email

May 25, 2017

Ms. Janine Howard
Department of Environmental Quality
Office of Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, VA 23219

Re: Manassas Regional Airport
West Corporate Development and East Parcel Development
Project Number: 17-061F

Dear Mr. Fischer:

Thank you for the opportunity to comment on the West Corporate Development and East Parcel Development project at the Manassas Regional Airport in the City of Manassas and Prince William County. The project is consistent with the approved airport layout plan for the airport. The Virginia Department of Aviation has been working with and providing comments on the project directly to the airport sponsor, in coordination with the Federal Aviation Administration's Washington Airports District Office.

The Virginia Department of Aviation has no objection to the project as proposed at this time.

Please let me know if you have any questions on our comments.

Sincerely,

Susan H. Simmers
Senior Aviation Planner

ec: Juan Rivera, Airport Director

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Janine Howard, DEQ/EIR Environmental Program Planner

FROM: Katy Dacey, Division of Land Protection & Revitalization Review Coordinator

DATE: May 12, 2017

COPIES: Sanjay Thirunagari, Division of Land Protection & Revitalization Review Manager; file

SUBJECT: Environmental Impact Review: EIR Project No 17-061F Manassas Regional Airport West Corporate Development and East Parcel Development, City of Manassas, Prince William County, VA

The Division of Land Protection & Revitalization (DLPR) has completed its review of the May 2017 EIR for the Manassas Regional Airport West Corporate Development and East Parcel Development projects located 10600 Harry J. Parrish Boulevard to Manassas Regional Airport in Manassas, Virginia 20110

Project Scope: redevelopment and development of the west and east sides of airport to include: roadway improvements, building and parking lot reconstructions, T-hangers demolition, construction of hanger and parking lot, expansion of apron and taxilane tie down parking, wash rack construction, utilities and stormwater drainage improvements, taxilane extension and security fence extension

Solid and hazardous waste issues were not addressed in the submittal. The submittal did not indicate that a search of Federal or State environmental databases was conducted. DLPR staff conducted a search (2000 foot radius) of solid and hazardous waste databases (including petroleum releases) to identify waste sites in close proximity to the project corridor. DLPR search did identify five waste sites within the project area which might impact the project. Additionally, no waste sites of possible concern were located within the zip code of the project area, 22110. DLPR staff has reviewed the submittal and offers the following comments:

Hazardous Waste/RCRA Facilities* – *three in close proximity to project area.

1. ***VAD988212643, Tri-State Tours, 10680 Wakeman Court, Manassas, VA 22110. SQG***
2. ***VA0000347922, Wilcox Woodworks, 10687 Wakeman Court, Manassas, VA 22110. SQG***
3. ***VAR000506774, Corfu Contractors, 10599 Residence Road, Manassas, VA 20136. SQG***

CERCLA Sites* – *none in the same zip code of the project area

The above information related to hazardous wastes, RCRA/CERCLA sites can be accessed from EPA's websites at https://www3.epa.gov/enviro/, https://rcrainfopreprod.epa.gov/rcrainfoweb/action/main-menu/view and https://www.epa.gov/superfund

Formerly Used Defense Sites (FUDS) *– none in close proximity to project area*

Solid Waste *– none in close proximity to project area*

Virginia Remediation Program (VRP) *– none in close proximity to project area*

Petroleum Releases *- two within the project area (*denotes the same address)*

4. ***PC#20013062, Manassas Airport – New Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/25/2000. Status: Closed.***

   ****PC#19910187, Dulles Aviation Incorporated – Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 08/21/1990. Status: Closed.***

   ****PC#19993317, Manassas Municipal Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 03/22/1999. Status: Closed.***

   ****PC#19973688, Manassas Airport – Old Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/05/1996. Status: Closed.***

   ****PC#19870385, Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 12/09/1986. Status: Closed.***

5. ***PC#19900438, VDOT – Manassas Area Headquarters Shop, 10228 Residency Road, Manassas, VA 22110. Release Date: 10/16/1989. Status: Closed.***

   Please note that the DEQ's Pollution Complaint (PC) cases identified should be further evaluated by the project engineer or manager to establish the exact location, nature and extent of the petroleum release and the potential to impact the proposed project. Also, the project engineer or manager should contact the DEQ's Northern Virginia Regional Office at (703) 583-3800 (Tanks Program) for further information about the PC cases.

PROJECT SPECIFIC COMMENTS

None

GENERAL COMMENTS

Soil, Sediment, Groundwater, and Waste Management

Any soil, sediment or groundwater that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia

Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-81); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Part 107.

Asbestos and/or Lead-based Paint

All structures being demolished/renovated/removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-81-620 for ACM and 9VAC 20-60-261 for LBP must be followed. Questions may be directed to Jason Miller at the DEQ's Piedmont Regional Office at (804) 527-5028.

Pollution Prevention – Reuse - Recycling

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

If you have any questions or need further information, please contact Katy Dacey at (804) 698-4274.

Howard, Janine (DEQ)

From: Warren, Arlene (VDH)
Sent: Friday, May 19, 2017 10:05 AM
To: Howard, Janine (DEQ)
Subject: RE: NEW PROJECT FAA Manassas Airport 17-061F

Project Name: Manassas Regional Airport West Corporate Development and East Parcel Development
Project #: 17-061F
UPC #: N/A
Location: **City of Manassas, Prince William County**

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

The following public groundwater wells are located within a 1 mile radius of the project site:

PWS ID Number	City/County	System Name	Facility Name
6153264	PRINCE WILLIAM	BROAD RUN GOLF	WELL
6153041	PRINCE WILLIAM	BRISTOW MANOR GOLF CLUB	WELL

There are no surface water intakes located within a 5 mile radius of the project site.

The project is within the watershed of the following public surface water sources:

PWS ID Number	System Name	Facility Name
6059501	FAIRFAX CO WATER AUTHORITY	OCCOQUAN RESERVIOR INTAKE

- ***Comments from OEHS Division of Shellfish Sanitation, Mr. Eric Aschenbach, "We do not have any comments on the project."***

Best Management Practices should be employed, including Erosion & Sedimentation Controls and Spill Prevention Controls & Countermeasures on the project site.

Materials should be managed while on site and during transport to prevent impacts to nearby surface water.

Best Regards,

Arlene Fields Warren
GIS Program Support Technician
Office of Drinking Water
Virginia Department of Health
109 Governor Street
Richmond, VA 23220
(804) 864-7781

The Virginia Department of Health – Office of Drinking Water appreciates the opportunity to provide comments. If you have any questions, please let me know.

Howard, Janine (DEQ)

From: Dabestani, Cina (VDOT)
Sent: Friday, June 02, 2017 10:00 AM
To: Howard, Janine (DEQ)
Cc: Cromwell, James R. (VDOT); Jordan, Elizabeth (VDOT); Trivedi, Rahul, P.E. (VDOT)
Subject: NEW PROJECT FAA Manassas Airport 17-061F

Ms. Howard-

VDOT Northern Virginia District Office has carefully reviewed the subject project's documents and has no comment to offer at this time.

Thank you for providing the opportunity to review documents pertaining to this project.

Cina S. Dabestani
Sr. Transportation Engineer
Transportation Planning
Virginia Department of Transportation
703 . 259 . 2991
Cina.Dabestani@VDOT.Virginia.GOV


Please consider the environment before printing this email

Howard, Janine (DEQ)

From: Burstein, Daniel (DEQ)
Sent: Thursday, June 01, 2017 8:40 AM
To: Howard, Janine (DEQ)
Subject: Re: FAA - Manassas Regional Airport West Corporate Development and East Parcel Development, City of Manassas, Prince William County - DEQ #17-061F- Review

NRO comments regarding the Federal Consistency Determination for the FAA - Manassas Regional Airport West Corporate Development and East Parcel Development, located in Prince William, Virginia are as follows:

Land Protection Division – The project manager is reminded that if any solid or hazardous waste is generated/encountered during construction, the project manager would follow applicable federal, state, and county regulations for their disposal.

Air Compliance/Permitting - The project manager is reminded that during the construction phases that occur with this project; the project is subject to the Fugitive Dust/Fugitive Emissions Rule 9 VAC 5-50-60 through 9 VAC 5-50-120. Lastly, should any open burning or use of special incineration devices be employed in the disposal of land clearing debris during demolition and construction, the operation would be subject to the Open Burning Regulation 9 VAC 5-130-10 through 9 VAC 5-130-60 and 9 VAC 5-130-100.

Virginia Water Protection Permit (VWPP) Program – According to the submission, impacts to surface waters will be necessary. DEQ VWP staff recommends that the avoidance and minimization of surface water impacts to the maximum extent practicable as well as coordination with the US Army Corps of Engineers. Upon receipt of a Joint Permit Application for the proposed surface water impacts, DEQ VWP Permit staff will review the proposed project in accordance with the VWP permit program regulations and current VWP permit program guidance.

Erosion and Sediment Control and Storm Water Management: DEQ has regulatory authority for the Virginia Pollutant Discharge Elimination System (VPDES) programs related to municipal separate storm sewer systems (MS4s) and construction activities. Erosion and sediment control measures are addressed in local ordinances and State regulations. Additional information is available at http://www.deq.virginia.gov/Programs/Water/StormwaterManagement.aspx. Non-point source pollution resulting from this project should be minimized by using effective erosion and sediment control practices and structures. Consideration should also be given to using permeable paving for parking areas and walkways where appropriate, and denuded areas should be promptly revegetated following construction work. If the total land disturbance exceeds 10,000 square feet, an erosion and sediment control plan will be required. Some localities also require an E&S plan for disturbances less than 10,000 square feet. A stormwater management plan may also be required. For any land disturbing activities equal to one acre or more, you are required to apply for coverage under the VPDES General Permit for Discharges of Storm Water from Construction Activities. The Virginia Stormwater Management Permit Authority may be DEQ or the locality.

Daniel Burstein
Regional Enforcement Specialist, Senior II
Virginia Department of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193
Phone: (703) 583-3904
daniel.burstein@deq.virginia.gov.

Howard, Janine (DEQ)

From: Burstein, Daniel (DEQ)
Sent: Wednesday, June 14, 2017 1:42 PM
To: Howard, Janine (DEQ)
Subject: RE: Federal Consistency Certification - Manassas Regional Airport West Corporate Development and East Parcel Development (17-061F)

Thank you

Daniel Burstein
Regional Enforcement Specialist, Senior II
Virginia Department of Environmental Quality
Northern Virginia Regional Office
13901 Crown Court
Woodbridge, VA 22193
Phone: (703) 583-3904
daniel.burstein@deq.virginia.gov.

From: Howard, Janine (DEQ)
Sent: Wednesday, June 14, 2017 1:34 PM
To: Burstein, Daniel (DEQ)
Subject: FW: Federal Consistency Certification - Manassas Regional Airport West Corporate Development and East Parcel Development (17-061F)

Hi Daniel,

I did some follow-up with the consultant regarding the new outfalls that are mentioned on page 9 in the FCC for the Manassas Regional Airport project to confirm that the outfalls are stormwater related (for reference I've attached the FCC and your review). The site does already have a Stormwater GP (VAR050985) and based on the consultant's response below, that permit will most likely require a modification due to the new outfalls.

I will require that they consult with NRO regarding the additional outfalls and a possible permit modification as a condition for consistency with the point source pollution control enforceable policy. If anything else comes to mind please let me know.

Janine

Janine Howard
Environmental Impact Review Coordinator

Office of Environmental Impact Review
Division of Environmental Enhancement
Virginia Department of Environmental Quality
629 E. Main Street
Richmond, VA 23219

t: (804) 698-4299
f: (804) 698-4032

For program updates and public notices please subscribe to the OEIR News Feed

From: Heath, Natalie [mailto:Natalie.Heath@rsandh.com]
Sent: Wednesday, June 14, 2017 11:30 AM
To: Howard, Janine (DEQ)
Subject: RE: Federal Consistency Certification - Manassas Regional Airport West Corporate Development and East Parcel Development

Good morning Janine,

According to our water resources engineer, there will be new outfall(s) on the west side that will either connect to the existing storm sewer system or directly to Broad Run. On the east side, the new outfall(s) would connect to Cannon Branch because there is no existing system on that end. The designs for the area are still preliminary, so I do not have a specific number of outfalls. However, the our water resources engineer is estimating two on the west side and one on the east side.

Please let me know if you have any other questions,

Natalie

Natalie Heath, AICP
Environmental Specialist
115 Alma Blvd, Suite 101, Merritt Island, FL 32953
321-454-6117
natalie.heath@rsandh.com

Stay up-to-date with our latest news and insights.

RS&H

From: Howard, Janine (DEQ) [mailto:Janine.Howard@deq.virginia.gov]
Sent: Wednesday, June 14, 2017 9:40 AM
To: Heath, Natalie <Natalie.Heath@rsandh.com>
Subject: RE: Federal Consistency Certification - Manassas Regional Airport West Corporate Development and East Parcel Development

Thanks for your reply Natalie. Keep me posted on the outfalls.

Janine

Janine Howard
Environmental Impact Review Coordinator

Office of Environmental Impact Review
Division of Environmental Enhancement
Virginia Department of Environmental Quality
629 E. Main Street
Richmond, VA 23219

Mill Creek
Environmental Consultants, LTD



Manassas Regional Airport (HEF) East Corporate Development
Prince William County, Virginia

Preservation Area Site Assessment (PASA)

10500 Harry J Parrish Blvd.
Manassas, VA 20108
(GPIN: 7695-40-9012; Instrument No. 200712270137252)

30 October 2017

Prepared for:
Manassas Regional Airport
10600 Harry J. Parrish Blvd
Manassas, Virginia 20110

Prepared By
Mill Creek Environmental Consultants, Ltd.
Matthew A. Neely, President
Certified Professional Wetland Delineator, Commonwealth of Virginia
No. 3402000144

11400 Longtown Drive Midlothian Virginia 23112 (804) 739-2147 (757) 329-0573
millcreekenvironment@comcast.net

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File: NAO 2017-0050
APPENDIX C Wetland Data Forms Relevant to PASA

Background & Study Area Overview

In the fall of 2016 Mill Creek Environmental Consultants, Ltd. was hired by RS&H, Inc. to provide multiple environmental services for an FAA required Environmental Assessment (EA) associated with the development of three (3) parcels in the vicinity of the Manassas Regional Airport. One of the parcels evaluated during that study was a ±15.5 acres study area adjacent to the intersection of Wakeman Drive and Harry J. Parrish Blvd near the Manassas Regional Airport as seen below:



Manassas Regional Airport East Corporate Development Study Area

As required by the EA, a wetland delineation was conducted on all three parcels, and a preliminary jurisdictional determination (JD), was received from Ms. Theresita Crockett-Augustine of the U.S. Army Corps of Engineers on 14 March, 2017. The JD is included in this document (Appendix).

During that wetland delineation no waters of the US (WOUS) with perennial flow were determined to be within the boundaries of the study area parcels. However, during the review process the Virginia Department of Environmental Quality (DEQ) noted that because of its

proximity to Cannon Branch, (a verified perennial flow stream) portions of the East Corporate Development study area likely contain parts of a Resource Protection Area (RPA) associated with Cannon Branch. Due to this probability, Mill Creek was hired to conduct a Preservation Area Site Assessment (PASA) on the East Corporate Development study area, as well as a section of the land between the study area and the west (W) bank of Cannon Branch as shown below:



Additional Study Area Associated with Preservation Area Site Assessment

The size and location of the additional study area was determined based upon the confirmed delineation referenced above, in which 1.49 acres Palustrine Forested (PFO) wetlands connected to Cannon Branch were delineated within southeast (SE) corner of the East Corporate Development study area. Due to the regulations outlining those wetlands as a component of the RPA there was no reason to draw the additional study area further south (S), as the RPA buffer for the property under review would be established at the west (W) edge of those PFO wetlands. It was acknowledged that the RPA buffer associated with those PFO wetlands will extend well into the original study area boundary, as well as overlap with any RPA associated with the perennial Cannon Branch to the east (E).

This PASA was conducted to determine where the landward boundary of Cannon Branch's RPA overlaps with Manassas Regional Airport's East Corporate Development study area.

All WOUS delineated within the boundaries of the original East Corporate Development parcel have been confirmed by the US Army Corps of Engineers. The wetlands delineated between the boundary and Cannon Branch are "pending confirmation".

Preservation Area Components

According to the Design and Construction Standards Manual (DCSM) Section 740.03:

A. Resource Protection Areas (RPAs) consist of lands adjacent to water bodies with perennial flow that have an intrinsic water quality value due to the biological and ecological processes they perform and are sensitive to impacts which may cause significant degradation to the quality of state waters. In their natural condition, these lands provide for the removal, reduction or assimilation of sediments, nutrients, and potentially harmful or toxic substances in runoff entering the Bay and its tributaries and minimize the adverse effects of human activities on state waters and aquatic resources.

B. The Resource Protection Area shall consist of lands that would include:
1. Tidal wetlands.
2. Nontidal wetlands connected by surface flow and contiguous to tidal wetlands or water bodies with perennial flow.
3. Tidal shores.
4. Perennial water bodies.

5. An area of 100 feet in width shall be located adjacent to and landward of the components listed in subsections 1 thru 4 listed above and along both sides of a water body with perennial flow. Such area shall be designated as the landward component of RPA, notwithstanding the presence of permitted uses, encroachments, permitted vegetation clearing in compliance with Part IV (9 VAC 10-20- 130 et seq.) of the Chesapeake Bay Preservation Area Designation and Management Regulations.

RPA & Non RPA Waters of the U.S.

- "Tidal Wetlands" defined in DCSM 740.02 (AA), **are not present on-site.**

- "Tidal Shores" defined by DCSM 740.02 (Z) **are not present on-site.**

- "Perennial Water Bodies", defined in DCSM 740.02 (Q) **are present on-site**. Cannon Branch, a perennial stream, runs roughly parallel and adjacent to the study area associated with this PASA.

- "Nontidal Wetlands" defined in DCSM 740.02 (O) **are present on-site**. All nontidal wetlands within the original East Corporate Development study area boundary have been confirmed by the US Army Corps of Engineers. Any wetlands within the additional study area boundary have been delineated but their status is "pending confirmation".

Component Waters of the U.S. (WOUS) Associated with Cannon Branch RPA

a. ±1.49 acres Palustrine Forested (PFO) wetlands connected by surface flow and contiguous to Cannon Branch that possesses perennial flow.



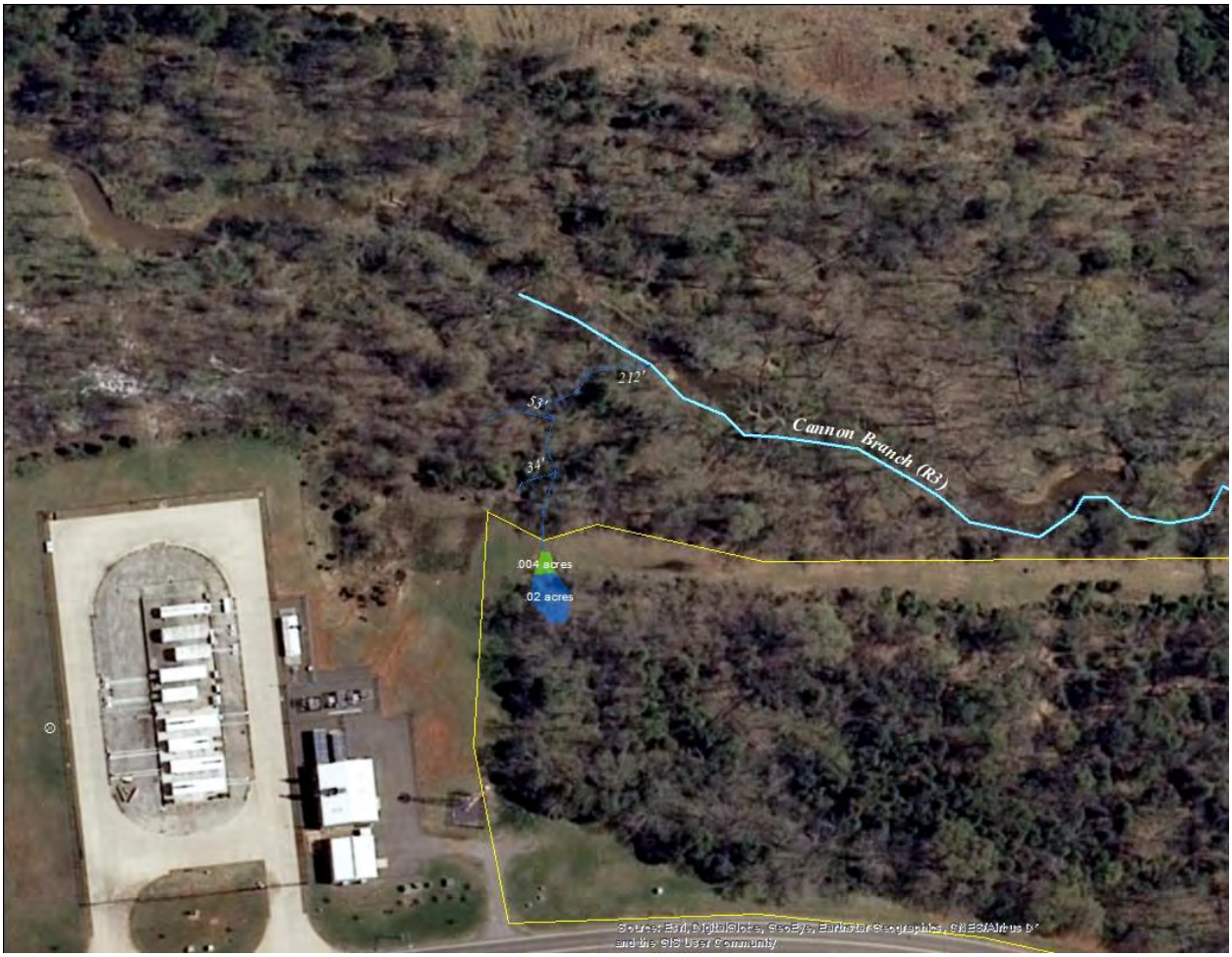
PFO wetlands connected to Cannon Branch (USACE Confirmed)

b. ±.02 acres Palustrine Forested (PFO) wetlands directly adjacent to Cannon Branch.



PFO wetlands adjacent and connected to Cannon Branch

Non RPA Component Waters of the US (WOUS)



Non-RPA component Waters of the U.S.

a. Combined ± 299' of small linear streams (R4) leading down slope towards Cannon Branch (R3)
b. ±.004 acres of PEM wetlands (confirmed by US Army Corps of Engineers)
c. ±.02 acres of PFO wetlands (confirmed by US Army Corps of Engineers)

RPA Buffer Determination

The required 100' buffer determination was made based upon the site as assessed in the field. The determined RPA was established by creating a 100' buffer landward from Cannon' Branch's west (W) bank for the majority of the assessment. However, where contiguous connected wetlands were present as discussed above (PFO), the buffer was established at their landward edge and measured 100' landward toward the original study area. The proposed RPA map can be seen in Appendix A.

The JD received from the US Army Corps of Engineers, as referenced earlier in this report, can be found in Appendix B. Relevant wetland data forms can be found in Appendix C.

APPENDIX A
Resource Protection Area Determination Map, East Corporate Development

Manassas Regional Airport East Corporate Development Area
Preservation Area Site Assessment (PASA) Map
October 2017

Legend

- Cannon Branch (west side) & Associated Wetlands RPA Buffer (100')
- PFO Wetlands
- PEM Wetlands
- Cannon Branch (west bank) (R3)
- Intermittent Stream (R4)
- Wetland Delineation Data Point Location
- EA East Study Area
- Additional PASA Study Area

Cannon Branch (R3)

1-2 wet
1-1 up
2-1 up
3-1 up
100'
212'
53'
34'
5-1 up
4-1 up
dp17-2 up
dp 18-1 up
dp18-2 wet
dp 23-1 up
dp16-1 up
dp21-1up
dp 20-1 wet
dp19-1 up
dp15-2 wet
100'
dp 20-2 up
dp15-1 up
100'
dp22-1 up

N E S W

0 125 250 500 Feet

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus

APPENDIX B
USACE Jurisdictional Determination and Supporting Documentation
File: NAO 2017-0050

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1011

March 14, 2017

PRELIMINARY JURISDICTIONAL DETERMINATION

Northern Virginia Regulatory Section
NAO-2017-00508 (Manassas Regional Airport)

Manassas Regional Airport
10600 Harry J. Parrish Boulevard
Manassas, VA 20110

Ladies and/or Gentlemen:

This letter is in regard to your request for a verification of a preliminary jurisdictional determination for waters of the U.S. (including wetlands) on property known as the Manassas Regional Airport, located on an approximately 47 acre parcel, at 10600 Harry J. Parrish Boulevard, in Manassas, Virginia.

The maps entitled "Manassas Regional Airport Corporate Development Environmental Assessment Wetland Delineation Map", by Mill Creek Environmental Consultants, LTD dated October 2016 (*copies enclosed)* provides the location of waters and/or wetlands on the property listed above. The basis for this delineation includes application of the Corps' 1987 Wetland Delineation Manual and *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region*, and the positive indicators of wetland hydrology, hydric soils, and hydrophytic vegetation and the presence of an ordinary high water mark.

Discharges of dredged or fill material, including those associated with mechanized landclearing, into waters and/or wetlands on this site may require a Department of the Army permit and authorization by state and local authorities including a Virginia Water Protection Permit from the Virginia Department of Environmental Quality (DEQ), a permit from the Virginia Marine Resources Commission (VMRC) and/or a permit from your local wetlands board. This letter is a confirmation of the Corps preliminary jurisdiction for the waters and/or wetlands on the subject property and does not authorize any work in these areas. Please obtain all required permits before starting work in the delineated waters/wetland areas.

This is a preliminary jurisdictional determination and is therefore not a legally binding determination regarding whether Corps jurisdiction applies to the waters or wetlands in question. Accordingly, you may either consent to jurisdiction as set out in this preliminary jurisdictional determination and the attachments hereto if you agree with the determination, or you may request and obtain an approved jurisdictional determination.

“This preliminary jurisdictional determination and associated wetland delineation map may be submitted with a permit application.”

Enclosed is a copy of the “Preliminary Jurisdictional Determination Form”. Please review the document, sign, and return one copy to Ms. Theresita Crockett-Augustine either via email (**theresita.m.crockett-augustine@usace.army.mil**) or via standard mail to US Army Corps of Engineers, Northern Virginia Field Office at 18139 Triangle Plaza, Suite 213, Dumfries, Virginia 22026 within 30 days of receipt and keep one for your records. This delineation of waters and/or wetlands is valid for a period of five years from the date of this letter unless new information warrants revision prior to the expiration date.

If you have any questions, please contact Ms. Theresita Crockett-Augustine at (703) 221-9736 or **theresita.m.crockett-augustine@usace.army.mil**.

Sincerely,



Theresita Crockett-Augustine
Environmental Scientist
Northern Virginia Regulatory Section

Enclosures

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION:

A. REPORT COMPLETION DATE FOR PJD: March 14, 2017

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Manassas Regional Airport
10600 Harry J. Parrish Boulevard
Manassas, VA 20110

DISTRICT OFFICE, FILE NAME, AND NUMBER: NAO, Manassas Regional Airport, NAO-2017-00508

C. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: (USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: **VIRGINIA** County/parish/borough: City: Manassas

Center coordinates of site (lat/long in degree decimal format):

Latitude: 38.723 ° N Longitude: -77.517 ° W

Universal Transverse Mercator:

Name of nearest waterbody: Cannon Branch

D. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): 2/16/17

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
1			114 LF	RPW	Section 404
2			4.84 acre	Wetland	Section 404
3					

1. The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre- construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there "may be" waters of the U.S. and/or that there "may be" navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA: Data reviewed for preliminary JD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items.

☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
Map:

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report. Rationale:

☐ Data sheets prepared by the Corps:

☐ Corps navigable waters' study:

☐ U.S. Geological Survey Hydrologic Atlas: USGS

☐ NHD data.

☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name:

☒ Natural Resources Conservation Service Soil Survey. Citation:

☒ National wetlands inventory map(s). Cite name:

☐ State/Local wetland inventory map(s):

☐ FEMA/FIRM maps:

☐ 100-year Floodplain Elevation: (National Geodetic Vertical Datum of 1929)

☒ Photographs ☒ Aerial (Name & Date):

or ☒ Other (Name & Date):

☐ Previous determination(s):

File no. and date of response letter:

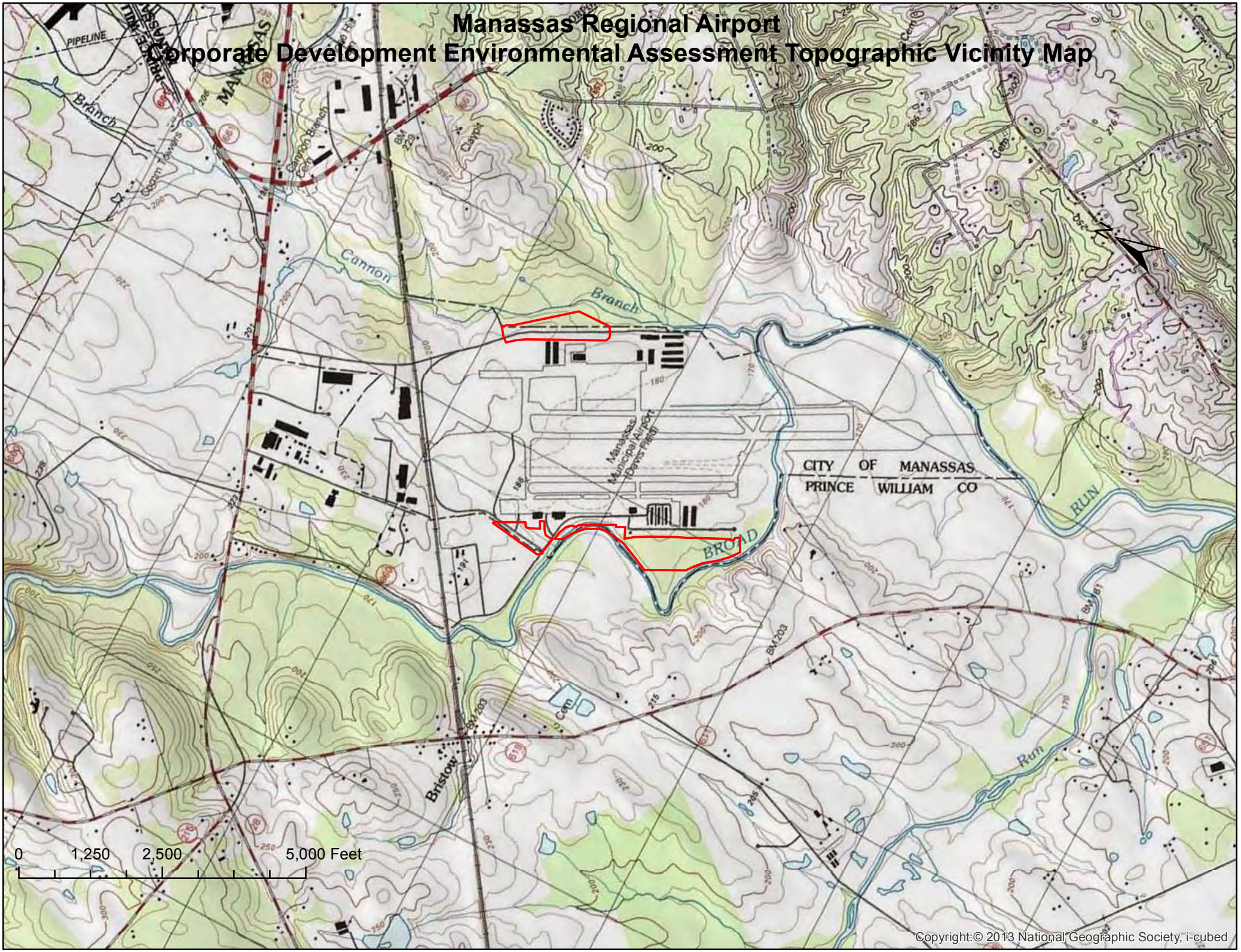
☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

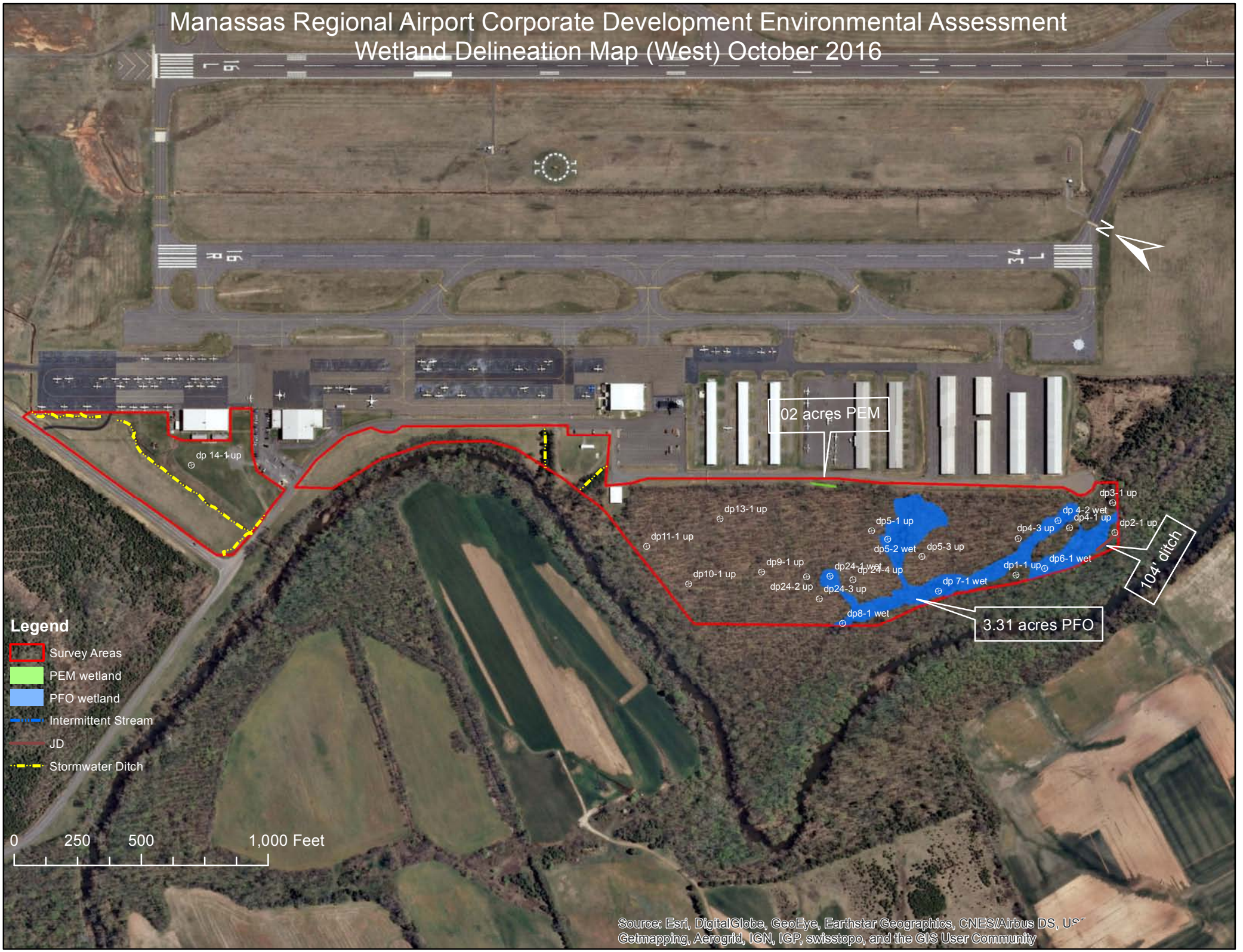
Signature and date of Regulatory staff member completing PJD	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

1 Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

Manassas Regional Airport
Corporate Development Environmental Assessment Topographic Vicinity Map



Manassas Regional Airport Corporate Development Environmental Assessment
Wetland Delineation Map (West) October 2016




Manassas Regional Airport Corporate Development Environmental Assessment
Wetland Delineation Map (East) October 2016
Legend
Survey Areas
PEM wetland
PFO wetland
Intermittent Stream
0
125
250
500 Feet
10' intermittent stream
dp18-2 wet
dp 18-1 up
dp 23-1 up
.004 acres PEM
.02 acres PFO
dp17-2 up
dp16-1 up
dp22-1 up
1.49 acres PFO
dp19-1 up
dp21-1up
dp 20-1 wet
dp15-2 wet
dp 20-2 up
dp15-1 up
N
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, U
Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

APPENDIX C
Wetland Data Forms Relevant to PASA

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport PASA **City/County:** Manassas **Sampling Date:** 16-Oct-17

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **1-1 Up PASA**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'43.379"N **Long.:** 77°30'36.398"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 1-1 Up PASA

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	20	☑	50.0%	UPL
2. Nyssa sylvatica	10	☑	25.0%	FAC
3. Quercus rubra	10	☑	25.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Ulmus americana	10	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	10		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	10	x 2 =	20	
FAC species	20	x 3 =	60	
FACU species	10	x 4 =	40	
UPL species	20	x 5 =	100	
Column Totals:	60	(A)	220	(B)

Prevalence Index = B/A = 3.667

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 1-1 Up PASA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-6	5YR 4/4	100					Loam	
6-12	5YR 6/4	100					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **1-1 Up PASA** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\addendum



Photo File: **IMG_5332.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'36.398"** Lat/Northing: **38°43'43.379"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport PASA **City/County:** Manassas **Sampling Date:** 16-Oct-17

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **1-2 Wet PASA**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'43.799"N **Long.:** 77°30'36.027"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 3	**Wetland Hydrology Present?** Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 1-2 Wet PASA

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Platanus occidentalis	25	☑	62.5%	FACW
2. Acer negundo	10	☑	25.0%	FAC
3. Ulmus americana	5	☐	12.5%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	10	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	30	x 2 =	60	
FAC species	20	x 3 =	60	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	50	(A)	120	(B)

Prevalence Index = B/A = 2.400

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 1-2 Wet PASA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-6	5YR	4/3	100						Loam	
6-12	5YR	4/2	75	2.5YR	4/6	25	C	M	Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **1-2 Wet PASA** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\addendum



Photo File: **IMG_5333.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'36.027"** Lat/Northing: **38°43'43.799"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport PASA **City/County:** Manassas **Sampling Date:** 16-Oct-17

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **2-1 Up PASA**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'43.799"N **Long.:** 77°30'36.027"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 2-1 Up PASA

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	30	☑	66.7%	UPL
2. Acer rubrum	10	☑	22.2%	FAC
3. Juniperus virginiana	5	☐	11.1%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	45		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	25	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	25		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 66.7% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	35	x 3 =	105	
FACU species	5	x 4 =	20	
UPL species	30	x 5 =	150	
Column Totals:	70	(A)	275	(B)

Prevalence Index = B/A = 3.929

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 2-1 Up PASA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-10	7.5YR	5/6	100					Loam	
10-14	7.5YR	5/6	100					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **2-1 Up PASA** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\addendum



Photo File: **IMG_5334.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'36.027"** Lat/Northing: **38°43'43.799"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport PASA **City/County:** Manassas **Sampling Date:** 16-Oct-17

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **3-1 Up PASA**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'47.518"N **Long.:** 77°30'41.298"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 3-1 Up PASA

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	25	☑	55.6%	FAC
2. Juniperus virginiana	20	☑	44.4%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	45	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Quercus montana	5	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Rubus allegheniensis	20	☑	66.7%	FACU
2. Microstegium vimineum	10	☑	33.3%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	30	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 40.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	35	x 3 =	105	
FACU species	40	x 4 =	160	
UPL species	5	x 5 =	25	
Column Totals:	80	(A)	290	(B)

Prevalence Index = B/A = 3.625

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 3-1 Up PASA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-8	5YR 4/6	100					Loam	
8-13	5YR 5/6	100					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **3-1 Up PASA** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\addendum



Photo File: **IMG_5335.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.298"** Lat/Northing: **38°43'47.518"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport PASA **City/County:** Manassas **Sampling Date:** 16-Oct-17

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **4-1 Up PASA**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'50.64"N **Long.:** 77°30'44.677"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 4-1 Up PASA

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus alba	15	☑	42.9%	FACU
2. Quercus montana	10	☑	28.6%	UPL
3. Quercus velutina	5	☐	14.3%	UPL
4. Juniperus virginiana	5	☐	14.3%	FACU
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	35	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Celtis occidentalis	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	30	x 4 =	120	
UPL species	15	x 5 =	75	
Column Totals:	45	(A)	195	(B)

Prevalence Index = B/A = 4.333

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 4-1 Up PASA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-8	5YR 4/6	100					Loam	
8-13	5YR 5/6	100					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **4-1 Up PASA** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\addendum



Photo File: **IMG_5337.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'44.677"** Lat/Northing: **38°43'50.64"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport PASA **City/County:** Manassas **Sampling Date:** 16-Oct-17

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **5-1 Up PASA**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'52.314"N **Long.:** 77°30'45.939"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 5-1 Up PASA

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Juniperus virginiana	20	☑	40.0%	FACU
2. Quercus palustris	20	☑	40.0%	FACW
3. Quercus coccinea	10	☑	20.0%	UPL
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Ulmus americana	10	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	40	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	40		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	30	x 2 =	60	
FAC species	40	x 3 =	120	
FACU species	20	x 4 =	80	
UPL species	10	x 5 =	50	
Column Totals:	100	(A)	310	(B)

Prevalence Index = B/A = 3.100

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 5-1 Up PASA

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-11	5YR 4/6	100					Loam	
11-13	5YR 5/6	100					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **5-1 Up PASA** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\addendum



Photo File: **IMG_5338.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'45.939"** Lat/Northing: **38°43'52.314"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **15-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 5.0% / 2.9 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'38.068"N **Long.:** 77°30'38.264"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 15-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	30	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	30	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1. Carya tomentosa	15	☑	75.0%	UPL
2. Cornus florida	5	☑	25.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	0	x 3 =	0	
FACU species	5	x 4 =	20	
UPL species	45	x 5 =	225	
Column Totals:	50	(A)	245	(B)

Prevalence Index = B/A = 4.900

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 15-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR 4/6						Silt Loam	
5-12	7.5YR 4/6						Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **15-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3401.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'38.264"** Lat/Northing: **38°43'38.068"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **15-2 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Floodplain **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'38.498"N **Long.:** 77°30'37.29"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☑ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ◉ No ○ Depth (inches): 4

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 15-2 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	40	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Vaccinium corymbosum	5	☑	100.0%	FACW
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Saururus cernuus	50	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	50	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	50	x 1 =	50	
FACW species	5	x 2 =	10	
FAC species	40	x 3 =	120	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	95	(A)	180	(B)

Prevalence Index = B/A = 1.895

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 15-2 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-2	10YR 2/1						Silt Loam	
2-12	N 4/						Silt Loam	gley indicates prolonged sat

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☑ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **15-2 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3400.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'37.29"W** Lat/Northing: **38°43'38.498"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **16-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** convex **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'42.946"N **Long.:** 77°30'41.291"W **Datum:** NAD 83

Soil Map Unit Name: Panorama silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 16-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	40	☑	66.7%	UPL
2. Acer rubrum	10	☐	16.7%	FAC
3. Quercus alba	10	☐	16.7%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	60	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Juniperus virginiana	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	5	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 0.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	10	x 3 =	30	
FACU species	15	x 4 =	60	
UPL species	40	x 5 =	200	
Column Totals:	65	(A)	290	(B)

Prevalence Index = B/A = 4.462

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 16-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	2.5Y	4/3	100					Silt Loam	
5-13	2.5Y	6/4	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **16-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3402.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.291"** Lat/Northing: **38°43'42.946"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 25-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **17-2 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 5.0% / 2.9 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'42.946"N **Long.:** 77°30'41.291"W **Datum:** NAD 83

Soil Map Unit Name: Arcola silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 17-2 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Juniperus virginiana	40	☑	61.5%	FACU
2. Pinus virginiana	20	☑	30.8%	UPL
3. Nyssa sylvatica	5	☐	7.7%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	65	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	25	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	25	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 33.3% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	30	x 3 =	90	
FACU species	40	x 4 =	160	
UPL species	20	x 5 =	100	
Column Totals:	90	(A)	350	(B)

Prevalence Index = B/A = 3.889

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 17-2 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Loc²	Texture	Remarks
0-12	5YR 4/6	100					Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **17-2 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3403.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.291"** Lat/Northing: **38°43'42.946"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **18-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Hatboro silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 18-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Juglans nigra	10	☑	50.0%	FACU
2. Ailanthus altissima	10	☑	50.0%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	20	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Juglans nigra	10	☑	50.0%	FACU
2. Quercus velutina	10	☑	50.0%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	20	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	75	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	75	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	100.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	5	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 16.7% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	75	x 3 =	225	
FACU species	35	x 4 =	140	
UPL species	10	x 5 =	50	
Column Totals:	120	(A)	415	(B)

Prevalence Index = B/A = 3.458

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 18-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-12	10YR 4/6						Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

soils in this area consist of heavily compacted coarse fill materials most likely due to construction fill for the sewer line right of way.

Plot ID: **18-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3405.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **18-2 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Swale **Local relief (concave, convex, none):** concave **Slope:** 0.0% / 0.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Hatboro silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☑ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☑ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☑ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 2	
Water Table Present?	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ◉ No ○
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0	

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 18-2 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	0	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Salix nigra	15	☑	100.0%	OBL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	25	☑	62.5%	FAC
2. Boehmeria cylindrica	15	☑	37.5%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	40	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	15	x 1 =	15	
FACW species	15	x 2 =	30	
FAC species	25	x 3 =	75	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	55	(A)	120	(B)

Prevalence Index = B/A = 2.182

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 18-2 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Loc²	Texture	Remarks
0-10	10YR 4/1	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **18-2 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3404.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **19-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Terrace **Local relief (concave, convex, none):** rolling **Slope:** 2.0% / 1.1 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Rowland silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉	No ○	
Hydric Soil Present?	Yes ○	No ◉	**Is the Sampled Area within a Wetland?** Yes ○ No ◉
Wetland Hydrology Present?	Yes ○	No ◉	

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 19-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus montana	20	☑	50.0%	UPL
2. Quercus phellos	15	☑	37.5%	FAC
3. Ulmus americana	5	☐	12.5%	FACW
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Acer rubrum	20	☑	57.1%	FAC
2. Juniperus virginiana	15	☑	42.9%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	35	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	80	☑	88.9%	FAC
2. Lespedeza cuneata	10	☐	11.1%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 60.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:	Multiply by:		
OBL species	0	x 1 =	0	
FACW species	5	x 2 =	10	
FAC species	115	x 3 =	345	
FACU species	25	x 4 =	100	
UPL species	20	x 5 =	100	
Column Totals:	165	(A)	555	(B)

Prevalence Index = B/A = 3.364

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 19-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-7	10YR	4/4	100					Loam	
7-10	10YR	4/4	80					Silt Loam	
	10YR	4/3	20					Silt Loam	
	10YR	4/6	10					Silt Loam	
10-14	10YR	5/3	70					Loam	
	10YR	4/6	30					Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **19-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3407.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **20-1 wet**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Toeslope **Local relief (concave, convex, none):** concave **Slope:** 5.0% / 2.9 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.898"N **Long.:** 77°30'47.144"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ◉ No ○	**Is the Sampled Area within a Wetland?**	Yes ◉ No ○
Hydric Soil Present?	Yes ◉ No ○		
Wetland Hydrology Present?	Yes ◉ No ○		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☑ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☑ Microtopographic Relief (D4)
- ☑ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ◉ No ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 20-1 wet

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Acer rubrum	20	☑	50.0%	FAC
2. Ulmus americana	20	☑	50.0%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	40		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	80	☑	88.9%	FAC
2. Boehmeria cylindrica	10	☐	11.1%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	90		= Total Cover	
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 100.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	30	x 2 =	60	
FAC species	100	x 3 =	300	
FACU species	0	x 4 =	0	
UPL species	0	x 5 =	0	
Column Totals:	130	(A)	360	(B)

Prevalence Index = B/A = 2.769

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☑ **Dominance Test is > 50%**
- ☑ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ◉ No ○

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 20-1 wet

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)		%	Type [1]	Loc²	Texture	Remarks
0-4	10YR	3/3	100						Silt Loam	
4-9	10YR	5/2	80	10YR	4/6	5	C	M	Silt Loam	
	10YR	4/3	15						Silt Loam	
9-14	10YR	6/2	80	10YR	4/6	20	C	M	Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ◉ No ○

Remarks:

Plot ID: **20-1 wet** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3410.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.144"** Lat/Northing: **38°43'51.898"**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **20-2 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'40.159"N **Long.:** 77°30'39.711"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 20-2 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Quercus falcata	40	☑	42.1%	FACU
2. Carya tomentosa	40	☑	42.1%	UPL
3. Quercus phellos	15	☐	15.8%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	95	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Asimina triloba	10	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	15	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	15	= Total Cover		
Woody Vine Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:		
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	40	x 3 =	120	
FACU species	40	x 4 =	160	
UPL species	40	x 5 =	200	
Column Totals:	120	(A)	480	(B)

Prevalence Index = B/A = 4.000

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 20-2 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR	4/4	100					Silt Loam	
5-9	10YR	5/6	100					Silt Loam	
9-14	7.5YR	5/6						Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **20-2 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3411.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'39.711"** Lat/Northing: **38°43'40.159"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **21-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'40.159"N **Long.:** 77°30'39.711"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ○	No ◉	Depth (inches):	
Water Table Present?	Yes ○	No ◉	Depth (inches):	
Saturation Present? (includes capillary fringe)	Yes ○	No ◉	Depth (inches):	**Wetland Hydrology Present?** Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 21-1 up

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
1. Acer rubrum	30	☑	54.5%	FAC
2. Carya tomentosa	25	☑	45.5%	UPL
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	55	= Total Cover		
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carya tomentosa	10	☑	100.0%	UPL
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	10	= Total Cover		
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0	= Total Cover		
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	20	☑	90.9%	FAC
2. Polystichum acrostichoides	2	☐	9.1%	FACU
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	22	= Total Cover		
Woody Vine Stratum (Plot size: 15)				
1. Smilax rotundifolia	2	☐	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	2	= Total Cover		

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	52	x 3 =	156	
FACU species	2	x 4 =	8	
UPL species	35	x 5 =	175	
Column Totals:	89	(A)	339	(B)

Prevalence Index = B/A = 3.809

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 21-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	10YR	4/6	100					Silt Loam	
5-10	10YR	4/4	100					Silt Loam	
10-14	10YR	5/6	100					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

Plot ID: **21-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3412.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'39.711"** Lat/Northing: **38°43'40.159"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **22-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 8.0% / 4.6 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'40.958"N **Long.:** 77°30'41.203"W **Datum:** NAD 83

Soil Map Unit Name: Dulles silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 22-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Carya tomentosa	25	☑	50.0%	UPL
2. Acer rubrum	25	☑	50.0%	FAC
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size: 15)				
1. Carya tomentosa	5	☑	33.3%	UPL
2. Ulmus americana	10	☑	66.7%	FACW
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	15		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	0		= Total Cover	
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	5	☑	22.7%	FACU
2. Smilax rotundifolia	15	☑	68.2%	FAC
3. Campsis radicans	2	☐	9.1%	FAC
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	22		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 50.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	10	x 2 =	20	
FAC species	42	x 3 =	126	
FACU species	5	x 4 =	20	
UPL species	30	x 5 =	150	
Column Totals:	87	(A)	316	(B)

Prevalence Index = B/A = 3.632

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.

Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 22-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)		%	Redox Features Color (moist)	%	Type [1]	Loc²	Texture	Remarks
0-5	5YR	3/4	100					Loam	
5-8	10YR	5/4	100					Coarse Sandy Loam	
8-14	10YR	5/3	50					Silt Loam	
	10YR	5/6	50					Silt Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

This data point sits in the vicinity of a stormwater pipe that moves water towards the stream to the east outside of the survey area. A data point was taken here to confirm the water moves through the area after storm events and does not sit long saturating the profile.

Plot ID: **22-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3413.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'41.203"** Lat/Northing: **38°43'40.958"N**

Description:



Photo File: **IMG_3415.JPG** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

WETLAND DETERMINATION DATA FORM - Eastern Mountains and Piedmont Region

Project/Site: Manassas Regional Airport **City/County:** Manassas **Sampling Date:** 26-Oct-16

Applicant/Owner: Manassas Regional Airport **State:** VA **Sampling Point:** **23-1 up**

Investigator(s): Matt Neely **Section, Township, Range: S** **T** **R**

Landform (hillslope, terrace, etc.): Hillside **Local relief (concave, convex, none):** flat **Slope:** 7.0% / 4.0 °

Subregion (LRR or MLRA): MLRA 148 in LRR S **Lat.:** 38°43'51.811"N **Long.:** 77°30'47.894"W **Datum:** NAD 83

Soil Map Unit Name: Hatboro silt loam **NWI classification:**

Are climatic/hydrologic conditions on the site typical for this time of year? Yes ◉ No ○ **(If no, explain in Remarks.)**

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **significantly disturbed?** **Are "Normal Circumstances" present?** Yes ◉ No ○

Are Vegetation ☐ **, Soil** ☐ **, or Hydrology** ☐ **naturally problematic?** **(If needed, explain any answers in Remarks.)**

Summary of Findings - Attach site map showing sampling point locations, transects, important features, etc

Hydrophytic Vegetation Present?	Yes ○ No ◉	**Is the Sampled Area within a Wetland?**	Yes ○ No ◉
Hydric Soil Present?	Yes ○ No ◉		
Wetland Hydrology Present?	Yes ○ No ◉		

Remarks:

Hydrology

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ True Aquatic Plants (B14)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Stunted or Stressed Plants (D1)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ Microtopographic Relief (D4)
- ☐ FAC-neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches): _____

Water Table Present? Yes ○ No ◉ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches): _____

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five/Four Strata)- Use scientific names of plants.

Sampling Point: 23-1 up

	Absolute % Cover	Dominant Species?	Rel.Strat. Cover	Indicator Status
Tree Stratum (Plot size: 30)				
1. Prunus serotina	20	☑	40.0%	FACU
2. Juniperus virginiana	20	☑	40.0%	FACU
3. Juglans nigra	10	☑	20.0%	FACU
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
	50		= Total Cover	
Sapling-Sapling/Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
	0		= Total Cover	
Shrub Stratum (Plot size:)				
1.	0	☐	0.0%	
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
	0		= Total Cover	
Herb Stratum (Plot size: 15)				
1. Microstegium vimineum	20	☑	100.0%	FAC
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
7.	0	☐	0.0%	
8.	0	☐	0.0%	
9.	0	☐	0.0%	
10.	0	☐	0.0%	
11.	0	☐	0.0%	
12.	0	☐	0.0%	
	20		= Total Cover	
Woody Vine Stratum (Plot size: 15)				
1. Lonicera japonica	0	☐	0.0%	FACU
2.	0	☐	0.0%	
3.	0	☐	0.0%	
4.	0	☐	0.0%	
5.	0	☐	0.0%	
6.	0	☐	0.0%	
	0		= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of dominant Species That Are OBL, FACW, or FAC: 25.0% (A/B)

Prevalence Index worksheet:

	Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0	
FACW species	0	x 2 =	0	
FAC species	20	x 3 =	60	
FACU species	50	x 4 =	200	
UPL species	0	x 5 =	0	
Column Totals:	70	(A)	260	(B)

Prevalence Index = B/A = 3.714

Hydrophytic Vegetation Indicators:

- ☐ **Rapid Test for Hydrophytic Vegetation**
- ☐ **Dominance Test is > 50%**
- ☐ **Prevalence Index is ≤3.0** [1]
- ☐ **Morphological Adaptations** [1] **(Provide supporting data in Remarks or on a separate sheet)**
- ☐ **Problematic Hydrophytic Vegetation** [1] **(Explain)**

[1] **Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.**

Definition of Vegetation Strata:

Four Vegetation Strata:

Tree stratum – Consists of woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/shrub stratum – Consists of woody plants, excluding vines, less than 3 in. DBH and greater than 3.28 ft (1 m) tall.

Herb stratum – Consists of all herbaceous (non-woody) plants, regardless of size, and all other plants less than 3.28 ft tall.
Woody vines – Consists of all woody vines greater than 3.28 ft in height.

Five Vegetation Strata:

Tree - Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling stratum – Consists of woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub stratum – Consists of woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb stratum – Consists of all herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody species, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vines – Consists of all woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ○ No ◉

Remarks: (Include photo numbers here or on a separate sheet.)

*Indicator suffix = National status or professional decision assigned because Regional status not defined by FWS.

Soil

Sampling Point: 23-1 up

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Redox Features Type [1]	Loc²	Texture	Remarks
0-10	5YR 4/6	100					Clay Loam	

[1] Type: C=Concentration. D=Depletion. RM=Reduced Matrix, CS=Covered or Coated Sand Grains ²Location: PL=Pore Lining. M=Matrix

Hydric Soil Indicators:

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ 2 cm Muck (A10) (LRR N)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Muck Mineral (S1) (LRR N, MLRA 147, 148)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7)
- ☐ Polyvalue Below Surface (S8) (MLRA 147,148)
- ☐ Thin Dark Surface (S9) (MLRA 147, 148)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- ☐ Umbric Surface (F13) (MLRA 136, 122)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 148)
- ☐ Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils[3]:

- ☐ 2 cm Muck (A10) (MLRA 147)
- ☐ Coast Prairie Redox (A16) (MLRA 147,148)
- ☐ Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3] Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ○ No ◉

Remarks:

soils are highly compacted. Very difficult to get auger into the ground.

Plot ID: **23-1 up** Photo Path: C:\Users\user\Desktop\Mill Creek Projects\Manassass\Photos\



Photo File: **IMG_3416.JPG** Orientation: -facing

Lat/Long or UTM : Long/Easting: **77°30'47.894"** Lat/Northing: **38°43'51.811"N**

Description:

No Photo

Photo File: **None.bmp** Orientation: -facing

Lat/Long or UTM: Long/Easting: **0** Lat/Northing: **0**

Description:

From: Morris, J. Clay [mailto:CMorris@pwcgov.org]
Sent: Thursday, November 30, 2017 2:10 PM
To: Matt Neely <millcreekenvironment@comcast.net>
Cc: Alberts, David <David.Alberts@rsandh.com>; Chanthakoune, Pon <pchanthakoune@pwcgov.org>
Subject: RE: Manassas Regional Airport

Good afternoon Matt,

I visited the study site and concur with your delineation and the extent of the Resource Protection Area as depicted.

Remember to reach out to Pon (pchanthakoune@pwcgov.org) should you decide to proceed with the Preservation Area Site Assessment submittal.

Clay Morris
Natural Resources Section Chief
Prince William County Public Works-Watershed Management
Office (703)792-4615
Cell (540)533-5383
cmorris@pwcgov.org

From: Matt Neely [mailto:millcreekenvironment@comcast.net]
Sent: Wednesday, November 29, 2017 9:45 AM
To: Morris, J. Clay <CMorris@pwcgov.org>
Cc: david.alberts@rsandh.com
Subject: Manassas Regional Airport

Good morning Clay

David Alberts from RS&H mentioned that after your discussion, and based upon their unique situation, that you had enough info to take a look at the RPA assessment and that you would go check out the site.

I was wondering if you have had the chance to take a look and how our submission compares to what you saw?

Hope you had a great Thanksgiving.

Matt Neely

Matt Neely
President, PWD
Mill Creek Environmental Consultants, Ltd.
11400 Longtown Drive
Midlothian, VA 23112
804-739-2147 Office
757-329-0573 Cell

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APPENDIX G

CONSTRUCTION EMISSIONS INVENTORY

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OVERVIEW			
Component	**Component Name**	**Project Type**	**Size**
1	On-Airport roadway improvements: 8,000 linear feet	Bit. Road	8000 LF
2	FBO redevelopment: 1.6 acres (2 stories)	Structural	69,696
3	Parking lot construction: 3.85 acres	Bit. Parking @grade	167,706
4	Corporate hangar/building construction: 4.40 acres (1 story)	Structural	191,664
5	Maintenance building construction: 0.27-acre (1 story)	Structural	11,761
6	Wash rack construction: 0.27-acre (1 story)	Tank - Pump station	11,761
7	T-hangar construction: 4.40 acres (1 story)	Structural	191,664
8	T-hangar demo: 3 acres	Structural Demo	130,680
9	Apron/Taxilane expansion: 29 acres	Bit. GA Apron	1,263,240
10	Security fence extension: 6,518 linear feet	Fencing	6518 LF
Definitions			
PCC	Portland Cement Concrete		
TXWY	Taxiway		
NAVAID	Navigational Aid		
Bit.	Bituminious		

Component			Building GSF
1		X	8000 LF

NONROAD

Structural

Equipment	Fuel Type	Activity Type	Activity Size	Activity Rate Hrs/SF	Est. Hours
Asphalt Paver	Diesel	Asphalt Placement	44,400.00 SY	8 Hours per 6,400 SY	55.5
Dump Truck	Diesel	Asphalt Placement	44,400.00 SY	8 Hours per 1,777 SY	199.9
Other General Equipment	Diesel	Asphalt Placement	44,400.00 SY	16 Hours per 6,400 SY	111
Pickup Truck	Diesel	Asphalt Placement	44,400.00 SY	8 Hours per 6,400 SY	55.5
Roller	Diesel	Asphalt Placement	44,400.00 SY	8 Hours per 6,400 SY	55.5
Skid Steer Loader	Diesel	Asphalt Placement	44,400.00 SY	8 Hours per 6,400 SY	55.5
Surfacing Equipment (Grooving)	Diesel	Asphalt Placement	44,400.00 SY	8 Hours per 5,000 SY	71
Chain Saw	Diesel	Clearing and Grubbing	11.10 Acre	12 Hours per 1 Acre	133.2
Chipper/Stump Grinder	Diesel	Clearing and Grubbing	11.10 Acre	12 Hours per 1 Acre	133.2
Pickup Truck	Diesel	Clearing and Grubbing	11.10 Acre	16 Hours per 1 Acre	177.6
Concrete Truck	Diesel	Curbing	16,000.00 LF	8 Hours per 400 LF	320
Curb/Gutter Paver	Diesel	Curbing	16,000.00 LF	8 Hours per 400 LF	320
Other General Equipment	Diesel	Curbing	16,000.00 LF	8 Hours per 400 LF	320
Pickup Truck	Diesel	Curbing	16,000.00 LF	8 Hours per 400 LF	320
Dozer	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Dump Truck	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Excavator	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Loader	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Other General Equipment	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Pickup Truck	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Roller	Diesel	Drainage - 24 inch SICPP	8,010.00 LF	8 Hours per 250 LF	256.3
Dump Truck	Diesel	Drainage - 6 inch Perforated Underdrain	16,020.00 LF	8 Hours per 900 LF	142.4
Loader	Diesel	Drainage - 6 inch Perforated Underdrain	16,020.00 LF	8 Hours per 900 LF	142.4
Other General Equipment	Diesel	Drainage - 6 inch Perforated Underdrain	16,020.00 LF	8 Hours per 900 LF	142.4
Pickup Truck	Diesel	Drainage - 6 inch Perforated Underdrain	16,020.00 LF	8 Hours per 900 LF	142.4
Tractors/Loader/Backhoe	Diesel	Drainage - 6 inch Perforated Underdrain	16,020.00 LF	8 Hours per 900 LF	142.4
Water Truck	Diesel	Dust Control	240.00 Day	8 Hours per 1 Day	1,920.00
Dozer	Diesel	Excavation (Borrow)	18,500.00 CY	8 Hours per 600 CY	246.7
Dump Truck (12 cy)	Diesel	Excavation (Borrow)	18,500.00 CY	8 Hours per 600 CY	246.7
Pickup Truck	Diesel	Excavation (Borrow)	18,500.00 CY	8 Hours per 600 CY	246.7
Roller	Diesel	Excavation (Borrow)	18,500.00 CY	8 Hours per 1,300 CY	113.8
Dozer	Diesel	Excavation (Cut to Fill)	18,500.00 CY	8 Hours per 800 CY	185
Dump Truck (12 cy)	Diesel	Excavation (Cut to Fill)	18,500.00 CY	8 Hours per 300 CY	493.3
Excavator	Diesel	Excavation (Cut to Fill)	18,500.00 CY	8 Hours per 1,000 CY	148
Pickup Truck	Diesel	Excavation (Cut to Fill)	18,500.00 CY	8 Hours per 1,000 CY	148
Roller	Diesel	Excavation (Cut to Fill)	18,500.00 CY	8 Hours per 1,000 CY	148
Scraper	Diesel	Excavation (Cut to Fill)	18,500.00 CY	8 Hours per 800 CY	185
Dozer	Diesel	Excavation (Topsoil Stripping)	44,400.00 SY	8 Hours per 5,100 SY	69.6
Concrete Truck	Diesel	Fencing	8,000.00 LF	2 Hours per 180 LF	88.9
Dump Truck	Diesel	Fencing	8,000.00 LF	8 Hours per 180 LF	355.6
Other General Equipment	Diesel	Fencing	8,000.00 LF	8 Hours per 180 LF	355.6
Pickup Truck	Diesel	Fencing	8,000.00 LF	8 Hours per 180 LF	355.6
Skid Steer Loader	Diesel	Fencing	8,000.00 LF	8 Hours per 180 LF	355.6
Tractors/Loader/Backhoe	Diesel	Fencing	8,000.00 LF	8 Hours per 180 LF	355.6
Dozer	Diesel	Grading	53,346.60 SY	8 Hours per 8,000 SY	53.3
Grader	Diesel	Grading	53,346.60 SY	8 Hours per 8,000 SY	53.3
Roller	Diesel	Grading	53,346.60 SY	8 Hours per 8,000 SY	53.3
Hydroseeder	Diesel	Hydroseeding	480,600.00 SF	8 Hours per 80,000 SF	48.1
Off-Road Truck	Diesel	Hydroseeding	480,600.00 SF	8 Hours per 80,000 SF	48.1
Flatbed Truck	Diesel	Markings	400,000.00 SF	8 Hours per 3,500 SF	914.3
Other General Equipment	Diesel	Markings	400,000.00 SF	8 Hours per 3,500 SF	914.3
Pickup Truck	Diesel	Markings	400,000.00 SF	8 Hours per 3,500 SF	914.3
Concrete Truck	Diesel	Sidewalks	48,000.00 SF	8 Hours per 600 SF	640
Dump Truck	Diesel	Sidewalks	48,000.00 SF	8 Hours per 600 SF	640
Pickup Truck	Diesel	Sidewalks	48,000.00 SF	8 Hours per 600 SF	640
Tractors/Loader/Backhoe	Diesel	Sidewalks	48,000.00 SF	8 Hours per 600 SF	640
Vibratory Compactor	Diesel	Sidewalks	48,000.00 SF	8 Hours per 600 SF	640
Other General Equipment	Diesel	Soil Erosion/Sediment Control	11.10 Acre	4 Hours per 1 Acre	44.4
Pickup Truck	Diesel	Soil Erosion/Sediment Control	11.10 Acre	8 Hours per 1 Acre	88.8
Pumps	Diesel	Soil Erosion/Sediment Control	11.10 Acre	4 Hours per 1 Acre	44.4
Tractors/Loader/Backhoe	Diesel	Soil Erosion/Sediment Control	11.10 Acre	4 Hours per 1 Acre	44.4
Dump Truck	Diesel	Street Lighting	80.00 Lights	8 Hours per 3 Lights	213.3
Loader	Diesel	Street Lighting	80.00 Lights	8 Hours per 3 Lights	213.3
Other General Equipment	Diesel	Street Lighting	80.00 Lights	8 Hours per 3 Lights	213.3
Pickup Truck	Diesel	Street Lighting	80.00 Lights	8 Hours per 3 Lights	213.3
Skid Steer Loader	Diesel	Street Lighting	80.00 Lights	8 Hours per 3 Lights	213.3
Tractors/Loader/Backhoe	Diesel	Street Lighting	80.00 Lights	8 Hours per 3 Lights	213.3
Dozer	Diesel	Subbase Placement	44,400.00 SY	8 Hours per 3,800 SY	93.5
Dump Truck (12 cy)	Diesel	Subbase Placement	14,800.00 CY	8 Hours per 180 CY	657.8
Pickup Truck	Diesel	Subbase Placement	44,400.00 SY	8 Hours per 3,800 SY	93.5
Roller	Diesel	Subbase Placement	14,800.00 CY	8 Hours per 1,300 CY	91.1
Dozer	Diesel	Topsoil Placement	8,891.10 CY	8 Hours per 600 CY	118.5
Dump Truck	Diesel	Topsoil Placement	8,891.10 CY	8 Hours per 600 CY	118.5
Pickup Truck	Diesel	Topsoil Placement	8,891.10 CY	8 Hours per 600 CY	118.5

ONROAD

	VMT
18-Wheeler	5800
Dump Truck	56000
Passenger Car	100000

Building Footprint	Floors	Building GSF
		69696

Construction Activity	Equipment	Fuel Type	Activity Size (SF)	Activity Rate Hr per SF	Activity Data	Activity Unit
Concrete Foundations	Backhoe	Diesel	30000.00 SF	0.01067 Hours per 1 SF	640.2	hours
Concrete Foundations	Concrete Ready Mix Trucks	Diesel	30000.00 SF	0.002 Hours per 1 SF	120	hours
Concrete Foundations	Fork Truck	Diesel	30000.00 SF	0.01067 Hours per 1 SF	640.2	hours
Concrete Foundations	Tool Truck	Diesel	30000.00 SF	0.00267 Hours per 1 SF	160.2	hours
Concrete Foundations	Tractor Trailer- Material Delivery	Diesel	30000.00 SF	0.00053 Hours per 1 SF	31.8	hours
Construction Mob & Layout	Survey Crew Trucks	Diesel	30000.00 SF	0.00033 Hours per 1 SF	19.8	hours
Construction Mob & Layout	Tractor Trailers Temp Fac.	Diesel	30000.00 SF	0.00013 Hours per 1 SF	7.8	hours
Exterior Wall Framing	Fork Truck	Diesel	30000.00 SF	0.02 Hours per 1 SF	1200	hours
Exterior Wall Framing	Generator	Diesel	30000.00 SF	0.01 Hours per 1 SF	600	hours
Exterior Wall Framing	Man Lift	Diesel	30000.00 SF	0.02 Hours per 1 SF	1200	hours
Exterior Wall Framing	Tool Truck	Diesel	30000.00 SF	0.005 Hours per 1 SF	300	hours
Exterior Wall Framing	Tractor Trailer- Material Delivery	Diesel	30000.00 SF	0.005 Hours per 1 SF	300	hours
Interior Build-Out/ Finishes	Fork Truck	Diesel	30000.00 SF	0.08 Hours per 1 SF	4800	hours
Interior Build-Out/ Finishes	Man Lift	Diesel	30000.00 SF	0.08 Hours per 1 SF	4800	hours
Interior Build-Out/ Finishes	Tool Truck	Diesel	30000.00 SF	0.01 Hours per 1 SF	600	hours
Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery	Diesel	30000.00 SF	0.02 Hours per 1 SF	1200	hours
Roofing	High Lift	Diesel	30000.00 SF	0.004 Hours per 1 SF	240	hours
Roofing	Man Lift (Fascia Construction)	Diesel	30000.00 SF	0.0008 Hours per 1 SF	48	hours
Roofing	Material Deliveries	Diesel	30000.00 SF	0.002 Hours per 1 SF	120	hours
Roofing	Tractor Trailer- Material Delivery	Diesel	30000.00 SF	0.002 Hours per 1 SF	120	hours
Security & Safety Systems	High Lift	Diesel	30000.00 SF	0.02667 Hours per 1 SF	1600.2	hours
Security & Safety Systems	Tool Truck	Diesel	30000.00 SF	0.00667 Hours per 1 SF	400.2	hours
Structural Steel Frame	90 Ton Crane	Diesel	30000.00 SF	0.01067 Hours per 1 SF	640.2	hours
Structural Steel Frame	Concrete Pump	Diesel	30000.00 SF	0.0004 Hours per 1 SF	24	hours
Structural Steel Frame	Concrete Truck	Diesel	30000.00 SF	0.0008 Hours per 1 SF	48	hours
Structural Steel Frame	Fork Truck	Diesel	30000.00 SF	0.00267 Hours per 1 SF	160.2	hours
Structural Steel Frame	Tool Truck	Diesel	30000.00 SF	0.0004 Hours per 1 SF	24	hours
Structural Steel Frame	Tractor Trailer- Steel Deliveries	Diesel	30000.00 SF	0.00133 Hours per 1 SF	79.8	hours
Structural Steel Frame	Trowel Machine	Diesel	30000.00 SF	0.0004 Hours per 1 SF	24	hours

ONROAD	
Cement Mixer	7000
Dump Truck	3700
Tractor Trailor	159
Passenger Car	85000

Component	X	X	Parkign Lot GSF
3	X	X	167706

NONROAD						
Equipment	Fuel Type	Activity	Activity Size	Activity Rate Hrs/SF	Activity Data	Activity Unit
Paving Machine	Diesel	Binder Coat of Pavement	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Ten Wheelers- Material Delivery	Diesel	Binder Coat of Pavement	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Survey Crew Trucks	Diesel	Construction Mob & Layout	167000 SF	0.0004 Hours per 1 SF	66.8	hours
Tractor Trailers Temp Fac.	Diesel	Construction Mob & Layout	167000 SF	0.0004 Hours per 1 SF	66.8	hours
Bob Cat	Diesel	Curbing	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Concrete Ready Mix Trucks	Diesel	Curbing	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Material Deliveries	Diesel	Curbing	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Tractor Trailer with Boom Hoist- Delivery	Diesel	Curbing	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Bulldozer	Diesel	Grub the site down 2 ft.	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Front Loader	Diesel	Grub the site down 2 ft.	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Ten Wheelers	Diesel	Grub the site down 2 ft.	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Auger Drill	Diesel	Lighting Pre-Cast Concrete Piers (10)	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Fork Truck	Diesel	Lighting Pre-Cast Concrete Piers (10)	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Front Loader	Diesel	Lighting Pre-Cast Concrete Piers (10)	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Tractor Trailer- Material Delivery	Diesel	Lighting Pre-Cast Concrete Piers (10)	167000 SF	0.0012 Hours per 1 SF	200.4	hours
Bulldozer	Diesel	Remove Trees and shrubs	167000 SF	0.004 Hours per 1 SF	668	hours
Chain Saws	Diesel	Remove Trees and shrubs	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Flat Bed or Dump Trucks	Diesel	Remove Trees and shrubs	167000 SF	0.004 Hours per 1 SF	668	hours
Log Chipper	Diesel	Remove Trees and shrubs	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Mulcher	Diesel	Remove Trees and shrubs	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Tractor	Diesel	Remove Trees and shrubs	167000 SF	0.004 Hours per 1 SF	668	hours
Compacting Equipment	Diesel	Rough Grading	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Small Dozer	Diesel	Rough Grading	167000 SF	0.0016 Hours per 1 SF	267.2	hours
40 Ton Rough Terrain Crane	Diesel	Set in-place Light Poles	167000 SF	0.0016 Hours per 1 SF	267.2	hours
High Lift	Diesel	Set in-place Light Poles	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Tractor Trailer- Material Delivery	Diesel	Set in-place Light Poles	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Line Painting Truck and Sprayer	Diesel	Stripping	167000 SF	0.0008 Hours per 1 SF	133.6	hours
Backhoe	Diesel	Subgrade Materials installed	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Roller	Diesel	Subgrade Materials installed	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Tractor Trailer- Material Delivery	Diesel	Subgrade Materials installed	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Paving Machine	Diesel	Top Coat of Asphalt	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Ten Wheelers- Material Delivery	Diesel	Top Coat of Asphalt	167000 SF	0.0016 Hours per 1 SF	267.2	hours
Backhoe	Diesel	Underground Conduits	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Fork Truck	Diesel	Underground Conduits	167000 SF	0.0024 Hours per 1 SF	400.8	hours
Tractor Trailer- Material Delivery	Diesel	Underground Conduits	167000 SF	0.0012 Hours per 1 SF	200.4	hours

ONROAD		
		VMT
	Dump Truck	19,200
	Passenger Car	112,000
	Tractor Trailor	1,920

Component		Floors	Hangar GSF
4		1	191664

NONROAD

Activity	Equipment	Fuel Type	Activity Size	Activity Rate Hrs/SF	Activity Data	Activity Unit
Construction Mob & Layout	Survey Crew Trucks	Diesel	10000.00 SF	0.001 Hours per 1 SF	190	hours
Construction Mob & Layout	Tractor Trailers Temp Fac.	Diesel	10000.00 SF	0.0004 Hours per 1 SF	76	hours
Erection of Pre-Engineered Metal Building	90 Ton Crane	Diesel	10000.00 SF	0.02 Hours per 1 SF	3800	hours
Erection of Pre-Engineered Metal Building	High Lift Fork Truck	Diesel	10000.00 SF	0.02 Hours per 1 SF	3800	hours
Erection of Pre-Engineered Metal Building	Man Lift	Diesel	10000.00 SF	0.005 Hours per 1 SF	950	hours
Erection of Pre-Engineered Metal Building	Tractor Trailer- Steel Deliveries	Diesel	10000.00 SF	0.006 Hours per 1 SF	1140	hours
Interior Build-Out/ Finishes	Fork Truck	Diesel	10000.00 SF	0.032 Hours per 1 SF	6080	hours
Interior Build-Out/ Finishes	Man Lift	Diesel	10000.00 SF	0.032 Hours per 1 SF	6080	hours
Interior Build-Out/ Finishes	Tool Truck	Diesel	10000.00 SF	0.004 Hours per 1 SF	760	hours
Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery	Diesel	10000.00 SF	0.008 Hours per 1 SF	1520	hours
Masonry Wall 4 ft.	Concrete Ready Mix Trucks	Diesel	10000.00 SF	0.0016 Hours per 1 SF	304	hours
Masonry Wall 4 ft.	Grout Mixer for Mortar	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Masonry Wall 4 ft.	Masonry Saw	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Masonry Wall 4 ft.	Tractor Trailer- Truck Delivery	Diesel	10000.00 SF	0.003 Hours per 1 SF	570	hours
Metal Panels	Fork Truck	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Metal Panels	Man Lift	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Metal Panels	Tool Truck	Diesel	10000.00 SF	0.003 Hours per 1 SF	570	hours
Metal Panels	Tractor Trailer- Material Delivery	Diesel	10000.00 SF	0.006 Hours per 1 SF	1140	hours
Roofing	High Lift	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Roofing	Man Lift (Fascia Construction)	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Roofing	Material Deliveries	Diesel	10000.00 SF	0.0008 Hours per 1 SF	152	hours
Roofing	Tractor Trailer- Material Delivery	Diesel	10000.00 SF	0.0024 Hours per 1 SF	456	hours
Security & Safety Systems	High Lift	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Security & Safety Systems	Tool Truck	Diesel	10000.00 SF	0.003 Hours per 1 SF	570	hours

ONROAD

	VMT
Cement Mixer	43,700
Dump Truck	22,800
Passenger Car	330,000
Tractor Trailer	15,200

Component			Building GSF
5a			125,000

NONROAD						
Equipment	Fuel Type	Activity	Activity Size	Activity Rate Hrs/SF	Activity Data	Activity Unit
Backhoe	Diesel	Concrete Foundations	11000	0.032 Hours per 1 SF	320	hours
Concrete Ready Mix Trucks	Diesel	Concrete Foundations	11000	0.006 Hours per 1 SF	60	hours
Fork Truck	Diesel	Concrete Foundations	11000	0.032 Hours per 1 SF	320	hours
Tool Truck	Diesel	Concrete Foundations	11000	0.008 Hours per 1 SF	80	hours
Tractor Trailer-Material Delivery	Diesel	Concrete Foundations	11000	0.0016 Hours per 1 SF	16	hours
Survey Crew Trucks	Diesel	Construction Mob & Layout	11000	0.001 Hours per 1 SF	10	hours
Tractor Trailers Temp Fac.	Diesel	Construction Mob & Layout	11000	0.0004 Hours per 1 SF	4	hours
Fork Truck	Diesel	Exterior Wall Framing	11000	0.024 Hours per 1 SF	240	hours
Man Lift	Diesel	Exterior Wall Framing	11000	0.024 Hours per 1 SF	240	hours
Tool Truck	Diesel	Exterior Wall Framing	11000	0.006 Hours per 1 SF	60	hours
Tractor Trailer-Material Delivery	Diesel	Exterior Wall Framing	11000	0.0024 Hours per 1 SF	24	hours
Fork Truck	Diesel	Interior Build-Out/ Finishes	11000	0.096 Hours per 1 SF	960	hours
Man Lift	Diesel	Interior Build-Out/ Finishes	11000	0.096 Hours per 1 SF	960	hours
Tool Truck	Diesel	Interior Build-Out/ Finishes	11000	0.012 Hours per 1 SF	120	hours
Tractor Trailer-Material Delivery	Diesel	Interior Build-Out/ Finishes	11000	0.012 Hours per 1 SF	120	hours
High Lift	Diesel	Roofing	11000	0.012 Hours per 1 SF	120	hours
Man Lift (Fascia Construction)	Diesel	Roofing	11000	0.012 Hours per 1 SF	120	hours
Material Deliveries	Diesel	Roofing	11000	0.0008 Hours per 1 SF	8	hours
Tractor Trailer-Material Delivery	Diesel	Roofing	11000	0.0012 Hours per 1 SF	12	hours
High Lift	Diesel	Security & Safety Systems	11000	0.032 Hours per 1 SF	320	hours
Tool Truck	Diesel	Security & Safety Systems	11000	0.008 Hours per 1 SF	80	hours
40 Ton Crane	Diesel	Structural Steel Erection	11000	0.024 Hours per 1 SF	240	hours
Fork Truck	Diesel	Structural Steel Erection	11000	0.012 Hours per 1 SF	120	hours
Tool Truck	Diesel	Structural Steel Erection	11000	0.006 Hours per 1 SF	60	hours
Tractor Trailer-Steel Deliveries	Diesel	Structural Steel Erection	11000	0.0016 Hours per 1 SF	16	hours

ONROAD	
VMT	
Cement Mixer	2300
Dump Truck	1200
Passenger Car	11000
Tractor Trailor	160

Component	Building Footprint	Floors	Building GSF
6	25000	G+2	75000

NONROAD						
Equipment	Fuel Type	Activity	Activity Size	Activity Rate Hrs/SF	Est. Hours	Units
Concrete Truck	Diesel	Concrete Placement	508.80 CY	8 Hours per 240 CY	17	hours
Other General Equipment	Diesel	Concrete Placement	508.80 CY	16 Hours per 1,000 CY	8.1	hours
Pickup Truck	Diesel	Concrete Placement	508.80 CY	24 Hours per 1,000 CY	12.2	hours
Rubber Tired Loader	Diesel	Concrete Placement	508.80 CY	8 Hours per 1,000 CY	4.1	hours
Slip Form Paver	Diesel	Concrete Placement	508.80 CY	8 Hours per 1,000 CY	4.1	hours
Surfacing Equipment (Grooving)	Diesel	Concrete Placement	508.80 CY	8 Hours per 1,000 CY	4.1	hours
Dozer	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Dump Truck	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Excavator	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Loader	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Other General Equipment	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Pickup Truck	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Roller	Diesel	Drainage - 24 inch SICPP	1,010.00 LF	8 Hours per 250 LF	32.3	hours
Dump Truck	Diesel	Drainage - 6 inch Perforated Underdrain	2,020.00 LF	8 Hours per 900 LF	18	hours
Loader	Diesel	Drainage - 6 inch Perforated Underdrain	2,020.00 LF	8 Hours per 900 LF	18	hours
Other General Equipment	Diesel	Drainage - 6 inch Perforated Underdrain	2,020.00 LF	8 Hours per 900 LF	18	hours
Pickup Truck	Diesel	Drainage - 6 inch Perforated Underdrain	2,020.00 LF	8 Hours per 900 LF	18	hours
Tractors/Loader/Backhoe	Diesel	Drainage - 6 inch Perforated Underdrain	2,020.00 LF	8 Hours per 900 LF	18	hours
Water Truck	Diesel	Dust Control	60.00 Day	8 Hours per 1 Day	480	hours
Dozer	Diesel	Excavation (Borrow)	508.80 CY	8 Hours per 600 CY	6.8	hours
Dump Truck (12 cy)	Diesel	Excavation (Borrow)	508.80 CY	8 Hours per 600 CY	6.8	hours
Pickup Truck	Diesel	Excavation (Borrow)	508.80 CY	8 Hours per 600 CY	6.8	hours
Roller	Diesel	Excavation (Borrow)	508.80 CY	8 Hours per 1,300 CY	3.1	hours
Dozer	Diesel	Excavation (Cut to Fill)	508.80 CY	8 Hours per 800 CY	5.1	hours
Dump Truck (12 cy)	Diesel	Excavation (Cut to Fill)	508.80 CY	8 Hours per 300 CY	13.6	hours
Excavator	Diesel	Excavation (Cut to Fill)	508.80 CY	8 Hours per 1,000 CY	4.1	hours
Pickup Truck	Diesel	Excavation (Cut to Fill)	508.80 CY	8 Hours per 1,000 CY	4.1	hours
Roller	Diesel	Excavation (Cut to Fill)	508.80 CY	8 Hours per 1,000 CY	4.1	hours
Scraper	Diesel	Excavation (Cut to Fill)	508.80 CY	8 Hours per 800 CY	5.1	hours
Dozer	Diesel	Excavation (Topsoil Stripping)	1,221.00 SY	8 Hours per 5,100 SY	1.9	hours
Concrete Truck	Diesel	Fencing	1,000.00 LF	2 Hours per 180 LF	11.1	hours
Dump Truck	Diesel	Fencing	1,000.00 LF	8 Hours per 180 LF	44.4	hours
Other General Equipment	Diesel	Fencing	1,000.00 LF	8 Hours per 180 LF	44.4	hours
Pickup Truck	Diesel	Fencing	1,000.00 LF	8 Hours per 180 LF	44.4	hours
Skid Steer Loader	Diesel	Fencing	1,000.00 LF	8 Hours per 180 LF	44.4	hours
Dozer	Diesel	Subbase Placement	1,221.00 SY	8 Hours per 3,800 SY	2.6	hours
Dump Truck (12 cy)	Diesel	Subbase Placement	407.00 CY	8 Hours per 180 CY	18.1	hours
Pickup Truck	Diesel	Subbase Placement	1,221.00 SY	8 Hours per 3,800 SY	2.6	hours
Roller	Diesel	Subbase Placement	407.00 CY	8 Hours per 1,300 CY	2.5	hours
Fork Truck	Diesel	Exterior Wall Framing	1000	0.024 Hours per 1 SF	240	hours
Man Lift	Diesel	Exterior Wall Framing	1000	0.024 Hours per 1 SF	240	hours
Tool Truck	Diesel	Exterior Wall Framing	1000	0.006 Hours per 1 SF	60	hours
Tractor Trailer- Material Delivery	Diesel	Exterior Wall Framing	1000	0.0024 Hours per 1 SF	24	hours
Fork Truck	Diesel	Interior Build-Out/ Finishes	1000	0.096 Hours per 1 SF	960	hours
Man Lift	Diesel	Interior Build-Out/ Finishes	1000	0.096 Hours per 1 SF	960	hours
Tool Truck	Diesel	Interior Build-Out/ Finishes	1000	0.012 Hours per 1 SF	120	hours
Tractor Trailer- Material Delivery	Diesel	Interior Build-Out/ Finishes	1000	0.012 Hours per 1 SF	120	hours
High Lift	Diesel	Roofing	1000	0.012 Hours per 1 SF	120	hours
Man Lift (Fascia Construction)	Diesel	Roofing	1000	0.012 Hours per 1 SF	120	hours
Material Deliveries	Diesel	Roofing	1000	0.0008 Hours per 1 SF	8	hours
Tractor Trailer- Material Delivery	Diesel	Roofing	1000	0.0012 Hours per 1 SF	12	hours
High Lift	Diesel	Security & Safety Systems	1000	0.032 Hours per 1 SF	320	hours
Tool Truck	Diesel	Security & Safety Systems	1000	0.008 Hours per 1 SF	80	hours
40 Ton Crane	Diesel	Structural Steel Erection	1000	0.024 Hours per 1 SF	240	hours
Fork Truck	Diesel	Structural Steel Erection	1000	0.012 Hours per 1 SF	120	hours
Tool Truck	Diesel	Structural Steel Erection	1000	0.006 Hours per 1 SF	60	hours
Tractor Trailer- Steel Deliveries	Diesel	Structural Steel Erection	1000	0.0016 Hours per 1 SF	16	hours

NONROAD		
	VMT	
Cement Mixer	5000	
Dump Truck	2500	
Passenger Car	86000	
Tractor Trailer	160	

Component	Building Footprint	Floors	Building GSF
7			130680

NONROAD						
Activity	Equipment	Fuel Type	Activity Size	Activity Rate Hrs/SF	Activity Data	Activity Unit
Construction Mob & Layout	Survey Crew Trucks	Diesel	10000.00 SF	0.001 Hours per 1 SF	190	hours
Construction Mob & Layout	Tractor Trailers Temp Fac.	Diesel	10000.00 SF	0.0004 Hours per 1 SF	76	hours
Erection of Pre-Engineered Metal Building	90 Ton Crane	Diesel	10000.00 SF	0.02 Hours per 1 SF	3800	hours
Erection of Pre-Engineered Metal Building	High Lift Fork Truck	Diesel	10000.00 SF	0.02 Hours per 1 SF	3800	hours
Erection of Pre-Engineered Metal Building	Man Lift	Diesel	10000.00 SF	0.005 Hours per 1 SF	950	hours
Erection of Pre-Engineered Metal Building	Tractor Trailer- Steel Deliveries	Diesel	10000.00 SF	0.006 Hours per 1 SF	1140	hours
Interior Build-Out/ Finishes	Fork Truck	Diesel	10000.00 SF	0.032 Hours per 1 SF	6080	hours
Interior Build-Out/ Finishes	Man Lift	Diesel	10000.00 SF	0.032 Hours per 1 SF	6080	hours
Interior Build-Out/ Finishes	Tool Truck	Diesel	10000.00 SF	0.004 Hours per 1 SF	760	hours
Interior Build-Out/ Finishes	Tractor Trailer- Material Delivery	Diesel	10000.00 SF	0.008 Hours per 1 SF	1520	hours
Masonry Wall 4 ft.	Concrete Ready Mix Trucks	Diesel	10000.00 SF	0.0016 Hours per 1 SF	304	hours
Masonry Wall 4 ft.	Grout Mixer for Mortar	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Masonry Wall 4 ft.	Masonry Saw	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Masonry Wall 4 ft.	Tractor Trailer- Truck Delivery	Diesel	10000.00 SF	0.003 Hours per 1 SF	570	hours
Metal Panels	Fork Truck	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Metal Panels	Man Lift	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Metal Panels	Tool Truck	Diesel	10000.00 SF	0.003 Hours per 1 SF	570	hours
Metal Panels	Tractor Trailer- Material Delivery	Diesel	10000.00 SF	0.006 Hours per 1 SF	1140	hours
Roofing	High Lift	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Roofing	Man Lift (Fascia Construction)	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Roofing	Material Deliveries	Diesel	10000.00 SF	0.0008 Hours per 1 SF	152	hours
Roofing	Tractor Trailer- Material Delivery	Diesel	10000.00 SF	0.0024 Hours per 1 SF	456	hours
Security & Safety Systems	High Lift	Diesel	10000.00 SF	0.012 Hours per 1 SF	2280	hours
Security & Safety Systems	Tool Truck	Diesel	10000.00 SF	0.003 Hours per 1 SF	570	hours

ONROAD	
	VMT
Cement Mixer	43,700
Dump Truck	22,800
Passenger Car	330,000
Tractor Trailer	15,200

Component	Building Footprint	Floors	Building GSF
8			0

NONROAD					
Equipment	**Fuel Type**	**Activity**	**Activity Size**	**Activity Rate Hrs/SF**	**Est. Hours**
Bob Cat	Diesel	Building Demolition	130,000.00 SF	0.0240 Hours per 1 SF	3,120.00
Dump Truck	Diesel	Building Demolition	130,000.00 SF	0.0240 Hours per 1 SF	3,120.00
Excavator with Bucket	Diesel	Building Demolition	130,000.00 SF	0.0120 Hours per 1 SF	1,560.00
Generator Sets	Diesel	Building Demolition	130,000.00 SF	0.0120 Hours per 1 SF	1,560.00
Pickup Truck	Diesel	Building Demolition	130,000.00 SF	0.0140 Hours per 1 SF	1,820.00
ONROAD					
			VMT		
		Dump Truck	72,000		
		Passenger Car	2800		

Component	X	Floors	Apron GSF
9	X	X	1263240

NONROAD

Construction Activity	Equipment	Fuel Type	Activity Size	Activity Rate Hr per SF	Activity Data	Activity Unit
Asphalt Placement	Asphalt Paver	Diesel	140,193.00 SY	8 Hours per 6,400 SY	175.2	hours
Asphalt Placement	Dump Truck	Diesel	140,193.00 SY	8 Hours per 1,777 SY	631.1	hours
Asphalt Placement	Other General Equipment	Diesel	140,193.00 SY	16 Hours per 6,400 SY	350.5	hours
Asphalt Placement	Pickup Truck	Diesel	140,193.00 SY	8 Hours per 6,400 SY	175.2	hours
Asphalt Placement	Roller	Diesel	140,193.00 SY	8 Hours per 6,400 SY	175.2	hours
Asphalt Placement	Skid Steer Loader	Diesel	140,193.00 SY	8 Hours per 6,400 SY	175.2	hours
Asphalt Placement	Surfacing Equipment (Grooving)	Diesel	140,193.00 SY	8 Hours per 5,000 SY	224.3	hours
Clearing and Grubbing	Chain Saw	Diesel	29.60 Acre	12 Hours per 1 Acre	355.2	hours
Clearing and Grubbing	Chipper/Stump Grinder	Diesel	29.60 Acre	12 Hours per 1 Acre	355.2	hours
Clearing and Grubbing	Pickup Truck	Diesel	29.60 Acre	16 Hours per 1 Acre	473.6	hours
Drainage - 24 inch SICPP	Dozer	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 24 inch SICPP	Dump Truck	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 24 inch SICPP	Excavator	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 24 inch SICPP	Loader	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 24 inch SICPP	Other General Equipment	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 24 inch SICPP	Pickup Truck	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 24 inch SICPP	Roller	Diesel	1,273.00 LF	8 Hours per 250 LF	40.7	hours
Drainage - 6 inch Perforated Underdrain	Dump Truck	Diesel	2,546.00 LF	8 Hours per 900 LF	22.6	hours
Drainage - 6 inch Perforated Underdrain	Loader	Diesel	2,546.00 LF	8 Hours per 900 LF	22.6	hours
Drainage - 6 inch Perforated Underdrain	Other General Equipment	Diesel	2,546.00 LF	8 Hours per 900 LF	22.6	hours
Drainage - 6 inch Perforated Underdrain	Pickup Truck	Diesel	2,546.00 LF	8 Hours per 900 LF	22.6	hours
Drainage - 6 inch Perforated Underdrain	Tractors/Loader/Backhoe	Diesel	2,546.00 LF	8 Hours per 900 LF	22.6	hours
Dust Control	Water Truck	Diesel	240.00 Day	8 Hours per 1 Day	1,920.00	hours
Excavation (Borrow)	Dozer	Diesel	58,413.80 CY	8 Hours per 600 CY	778.9	hours
Excavation (Borrow)	Dump Truck (12 cy)	Diesel	58,413.80 CY	8 Hours per 600 CY	778.9	hours
Excavation (Borrow)	Pickup Truck	Diesel	58,413.80 CY	8 Hours per 600 CY	778.9	hours
Excavation (Borrow)	Roller	Diesel	58,413.80 CY	8 Hours per 1,300 CY	359.5	hours
Excavation (Cut to Fill)	Dozer	Diesel	58,413.80 CY	8 Hours per 800 CY	584.1	hours
Excavation (Cut to Fill)	Dump Truck (12 cy)	Diesel	58,413.80 CY	8 Hours per 300 CY	1,557.70	hours
Excavation (Cut to Fill)	Excavator	Diesel	58,413.80 CY	8 Hours per 1,000 CY	467.3	hours
Excavation (Cut to Fill)	Pickup Truck	Diesel	58,413.80 CY	8 Hours per 1,000 CY	467.3	hours
Excavation (Cut to Fill)	Roller	Diesel	58,413.80 CY	8 Hours per 1,000 CY	467.3	hours
Excavation (Cut to Fill)	Scraper	Diesel	58,413.80 CY	8 Hours per 800 CY	584.1	hours
Excavation (Topsoil Stripping)	Dozer	Diesel	140,193.00 SY	8 Hours per 5,100 SY	219.9	hours
Fencing	Concrete Truck	Diesel	1,263.00 LF	2 Hours per 180 LF	14	hours
Fencing	Dump Truck	Diesel	1,263.00 LF	8 Hours per 180 LF	56.1	hours
Fencing	Other General Equipment	Diesel	1,263.00 LF	8 Hours per 180 LF	56.1	hours

Fencing	Pickup Truck	Diesel	1,263.00 LF	8 Hours per 180 LF	56.1	hours
Fencing	Skid Steer Loader	Diesel	1,263.00 LF	8 Hours per 180 LF	56.1	hours
Fencing	Tractors/Loader/Backhoe	Diesel	1,263.00 LF	8 Hours per 180 LF	56.1	hours
Grading	Dozer	Diesel	142,716.00 SY	8 Hours per 8,000 SY	142.7	hours
Grading	Grader	Diesel	142,716.00 SY	8 Hours per 8,000 SY	142.7	hours
Grading	Roller	Diesel	142,716.00 SY	8 Hours per 8,000 SY	142.7	hours
Hydroseeding	Hydroseeder	Diesel	1,285,730.00 SF	8 Hours per 80,000 SF	128.6	hours
Hydroseeding	Off-Road Truck	Diesel	1,285,730.00 SF	8 Hours per 80,000 SF	128.6	hours
Lighting	Dump Truck	Diesel	4,526.00 LF	8 Hours per 1,200 LF	30.2	hours
Lighting	Loader	Diesel	4,526.00 LF	8 Hours per 1,200 LF	30.2	hours
Lighting	Other General Equipment	Diesel	4,526.00 LF	8 Hours per 1,200 LF	30.2	hours
Lighting	Pickup Truck	Diesel	4,526.00 LF	8 Hours per 1,200 LF	30.2	hours
Lighting	Skid Steer Loader	Diesel	4,526.00 LF	8 Hours per 1,200 LF	30.2	hours
Lighting	Tractors/Loader/Backhoe	Diesel	4,526.00 LF	8 Hours per 1,200 LF	30.2	hours
Markings	Flatbed Truck	Diesel	1,263,000.00 SF	8 Hours per 3,500 SF	2,886.90	hours
Markings	Other General Equipment	Diesel	1,263,000.00 SF	8 Hours per 3,500 SF	2,886.90	hours
Markings	Pickup Truck	Diesel	1,263,000.00 SF	8 Hours per 3,500 SF	2,886.90	hours
Sealing/Fuel Resistant	Distributing Tanker	Diesel	140,193.00 SY	8 Hours per 3,000 SY	373.8	hours
Sealing/Fuel Resistant	Other General Equipment	Diesel	140,193.00 SY	8 Hours per 3,000 SY	373.8	hours
Sealing/Fuel Resistant	Pickup Truck	Diesel	140,193.00 SY	8 Hours per 3,000 SY	373.8	hours
Soil Erosion/Sediment Control	Other General Equipment	Diesel	29.60 Acre	4 Hours per 1 Acre	118.4	hours
Soil Erosion/Sediment Control	Pickup Truck	Diesel	29.60 Acre	8 Hours per 1 Acre	236.8	hours
Soil Erosion/Sediment Control	Pumps	Diesel	29.60 Acre	4 Hours per 1 Acre	118.4	hours
Soil Erosion/Sediment Control	Tractors/Loader/Backhoe	Diesel	29.60 Acre	4 Hours per 1 Acre	118.4	hours
Subbase Placement	Dozer	Diesel	140,193.00 SY	8 Hours per 3,800 SY	295.1	hours
Subbase Placement	Dump Truck (12 cy)	Diesel	46,731.00 CY	8 Hours per 180 CY	2,076.90	hours
Subbase Placement	Pickup Truck	Diesel	140,193.00 SY	8 Hours per 3,800 SY	295.1	hours
Subbase Placement	Roller	Diesel	46,731.00 CY	8 Hours per 1,300 CY	287.6	hours
Topsoil Placement	Dozer	Diesel	23,786.00 CY	8 Hours per 600 CY	317.1	hours
Topsoil Placement	Dump Truck	Diesel	23,786.00 CY	8 Hours per 600 CY	317.1	hours
Topsoil Placement	Pickup Truck	Diesel	23,786.00 CY	8 Hours per 600 CY	317.1	hours

	ONROAD	
	VMT	
	18-wheel	18326
	Dump Truck	175770
	Passenger Car	200,000

Component	X	X	Fencing LF
10	X	X	6500

NONROAD							
Project	Construction Activity	Equipment	Fuel Type	Activity Size (LF)	Activity Rate Hr per SF	Activity Data	Activity Unit
	Fencing	Concrete Truck	Diesel	6,518	2 Hours per 180 LF	72.42	Hour
	Fencing	Dump Truck	Diesel	6,518	8 Hours per 180 LF	289.69	hour
	Fencing	Other General Equipment	Diesel	6,518	8 Hours per 180 LF	289.69	Hour
	Fencing	Pickup Truck	Diesel	6,518	8 Hours per 180 LF	289.69	Hour
	Fencing	Skid Steer Loader	Diesel	6,518	8 Hours per 180 LF	289.69	Hour
	Fencing	Tractors/Loader/Backhoe	Diesel	6,518	8 Hours per 180 LF	289.69	Hour
ONROAD							
			VMT				
		Cement Truck	93				
		Passenger Car	7,700				

40 Ton Rough Terrain Crane	747
90 Ton Crane	8,240
Asphalt Paver	231
Auger Drill	401
Backhoe	1,628
Bob Cat	3,521
Bulldozer	935
Compacting Equipment	267
Concrete Pump	24
Concrete Ready Mix Trucks	1,189
Concrete Truck	1,211
Curb/Gutter Paver	320
Distributing Tanker	374
Dozer	3,450
Dump Truck (12 cy)	12,378
Excavator with Bucket	2,509
Flatbed Truck	4,469
Fork Truck	27,282
Front Loader	668
Generator Sets	2,160
Grader	196
Grout Mixer for Mortar	4,560
High Lift	12,107
High Lift Fork Truck	7,600
Hydroseeder	177
Line Painting Truck and Sprayer	134
Loader	756
Log Chipper	401
Man Lift	31,868
Masonry Saw	4,560
Material Deliveries	841
Mulcher	401
Off-Road Truck	177
Other General Equipment	6,629
Paving Machine	534
Pickup Truck	12,155
Pumps	163
Roller	2,500
Rubber Tired Loader	4
Scraper	774
Skid Steer Loader	1,220
Slip Form Paver	4
Small Dozer	267
Surfacing Equipment (Grooving)	299
Survey Crew Trucks	477
Ten Wheelers	267
Ten Wheelers- Material Delivery	534
Tool Truck	6,004
Tractors/Loader/Backhoe	15,909
Trowel Machine	24
Vibratory Compactor	640
Water Truck	4,320

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Equipment	Fuel Type	Avg Rated HP	Load Factor	CO (g/hp-hr)	NOx (g/hp-hr)	CO2 (g/hp-hr)	SO2 (g/hp-hr)	PM10 (g/hp-hr)	PM2.5 (g/hp-hr)	VOC Exhaust (g/hp-hr)	VOC Evaporative (g/equipment-day)	Hours	Hours	CO	NOX	CO2	SO2	PM10	PM2.5	VOC
40 Ton Rough Terrain	Diesel	300	0.43	0.316550925	1.431589626	530.5368177	0.002878767	0.063581977	0.058495419	0.166949686	0.464551326	40 Ton Rough Terrain Crane	747	30,511.96	137,989.21	51,137,807.22	277.48	6,128.59	5,638.30	16,092.08
90 Ton Crane	Diesel	300	0.43	0.316550925	1.431589626	530.5368177	0.002878767	0.063581977	0.058495419	0.166949686	0.464551326	90 Ton Crane	8,240	336,489.14	1,521,759.44	563,953,103.64	3,060.09	67,586.74	62,179.80	177,465.15
Aerial Lift	Diesel	75	0.21	4.477751685	5.081230722	693.2376418	0.004295731	0.62799751	0.577757709	0.911360345	0.221125086									
Air Compressor	Diesel	100	0.43	1.376675687	2.284886283	589.6476443	0.003374378	0.205106967	0.188698409	0.238055631	0.263090966									
Asphalt Deliveries/Ten Wheelers	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721									
Asphalt Paver	Diesel	175	0.59	0.581022268	1.348614811	536.312871	0.002920665	0.135015945	0.12421467	0.170888434	0.321556315	Asphalt Paver	230.7	13,839.82	32,123.70	12,774,851.92	69.57	3,216.05	2,958.77	4,070.52
Auger Drill	Diesel	175	0.43	0.995019514	3.571499987	530.0962543	0.003226884	0.219839979	0.20225278	0.312353444	0.447178698	Auger Drill	401	30,009.99	107,717.15	15,987,809.05	97.32	6,630.42	6,099.98	9,420.64
Backfill with Backhoe	Diesel	600	0.59	1.170567513	2.737275839	536.2077719	0.003163769	0.166505915	0.153185442	0.205546016	1.464577623	Backhoe	1628.2	674,694.98	1,577,718.71	309,060,936.92	1,823.54	95,971.15	88,293.45	118,473.19
Backhoe	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357									
Bob Cat	Diesel	75	0.21	4.902492433	4.97678879	693.0439557	0.004297767	0.731666697	0.673133362	0.975304602	0.568134479	Bob Cat	3,521	271,855.95	275,975.88	38,431,089.26	238.32	40,572.82	37,327.00	54,083.18
Boom Manlift	Diesel	75	0.21	4.477751685	5.081230722	693.2376418	0.004295731	0.62799751	0.577757709	0.911360345	0.221125086									
Bore/Drill Rig	Diesel	175	0.43	0.995019514	3.571499987	530.0962543	0.003226884	0.219839979	0.20225278	0.312353444	0.447178698									
Bulldozer	Diesel	175	0.59	0.492297191	1.155006653	536.3389947	0.002851584	0.111014157	0.102133024	0.162232759	0.283774593	Bulldozer	935	47,535.92	111,526.75	51,788,571.53	275.35	10,719.46	9,861.90	15,665.10
Caisson Drilling Rig	Diesel	175	0.43	0.995019514	3.571499987	530.0962543	0.003226884	0.219839979	0.20225278	0.312353444	0.447178698									
Chain Saw	Diesel	11	0.7	293.5350015	1.322992972	685.9963799	0.14019156	9.748189616	8.968334446	61.88835833	29.06708923									
Chipper/Stump Grinder	Diesel	100	0.43	1.929615963	3.464993168	589.1723771	0.003558005	0.342033118	0.314670468	0.394960088	0.505359396									
Cold Planer	Diesel	175	0.59	0.581022268	1.348614811	536.312871	0.002920665	0.135015945	0.12421467	0.170888434	0.321556315									
Compacting Equipment	Diesel	6	0.43	4.454041726	4.505787909	588.4781232	0.003966982	0.409876112	0.377086023	0.62410652	0.009376841	Compacting Equipment	267	3,070.51	3,106.18	405,682.69	2.73	282.56	259.95	430.24
Concrete Boom Pump	Diesel	11	0.43	4.464978441	4.708033203	588.3635706	0.003966193	0.447631488	0.411820969	0.661951648	0.018665835									
Concrete Pump	Diesel	11	0.43	4.464978441	4.708033203	588.3635706	0.003966193	0.447631488	0.411820969	0.661951648	0.018665835	Concrete Pump	24	506.86	534.46	66,791.03	0.45	50.82	46.75	75.14
Concrete Ready Mix Trucks	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Concrete Ready Mix Trucks	1,189	112,101.65	347,097.41	225,734,588.00	1,129.52	14,418.72	13,265.23	60,264.37
Concrete Saws	Diesel	40	0.59	0.678441678	3.483034319	595.5999792	0.003184605	0.100149627	0.092137657	0.183823668	0.005825695									
Concrete Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Concrete Truck	1,211	114,234.88	353,702.49	230,030,195.35	1,151.01	14,693.10	13,517.66	61,411.17
Concrete Truck Pump	Diesel	11	0.43	4.464978441	4.708033203	588.3635706	0.003966193	0.447631488	0.411820969	0.661951648	0.018665835									
Concrete Vibrator	Diesel	600	0.59	1.170567513	2.737275839	536.2077719	0.003163769	0.166505915	0.153185442	0.205546016	1.464577623									
Crack Cleaner	Diesel	40	0.59	0.678441678	3.483034319	595.5999792	0.003184605	0.100149627	0.092137657	0.183823668	0.005825695									
Crack Filler (Trailer Mounted)	Diesel	100	0.43	0.272043686	0.281980346	589.9443204	0.002847128	0.011493165	0.010573711	0.14015792	0									
Crane	Diesel	300	0.43	0.316550925	1.431589626	530.5368177	0.002878767	0.063581977	0.058495419	0.166949686	0.464551326									
Curb/Gutter Paver	Diesel	175	0.59	0.581022268	1.348614811	536.312871	0.002920665	0.135015945	0.12421467	0.170888434	0.321556315	Curb/Gutter Paver	320	19,196.98	44,558.23	17,719,777.26	96.50	4,460.93	4,104.05	5,646.15
Delivery of Tanks (3)	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721									
Distributing Tanker	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Distributing Tanker	374	35,248.65	109,139.48	70,978,792.90	355.16	4,533.75	4,171.05	18,949.21
Dozer	Diesel	175	0.59	0.492297191	1.155006653	536.3389947	0.002851584	0.111014157	0.102133024	0.162232759	0.283774593	Dozer	3,450	175,367.50	411,439.73	191,056,191.86	1,015.80	39,545.78	36,382.11	57,791.01
Dump Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Dump Truck (12 cy)	12,378	1,167,221.51	3,614,037.64	2,350,387,131.68	11,760.71	150,130.21	138,119.80	627,482.91
Excavator with Bucket	Diesel	175	0.59	0.380005047	0.939555707	536.3664871	0.002766357	0.079582519	0.073215917	0.153175538	0.217168991	Excavator with Bucket	2,509	98,430.15	243,366.80	138,931,404.10	716.55	20,613.72	18,964.63	39,676.03
Flat Bed or Dump Trucks	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Flatbed Truck	4469.2	421,437.31	1,304,885.40	848,631,410.42	4,246.32	54,206.06	49,869.57	226,559.15
Fork Truck	Diesel	100	0.59	0.509714417	0.485604153	595.7285281	0.002909958	0.029568732	0.027203234	0.141348615	0.029746696	Fork Truck	27,362	822,861.55	783,938.95	961,719,115.10	4,697.71	47,734.52	43,915.76	228,187.27
Forklift	Diesel	100	0.59	0.509714417	0.485604153	595.7285281	0.002909958	0.029568732	0.027203234	0.141348615	0.029746696									
Forktruck (Hoist)	Diesel	100	0.59	0.509714417	0.485604153	595.7285281	0.002909958	0.029568732	0.027203234	0.141348615	0.029746696									
Front Loader	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357	Front Loader	668	63,927.66	50,855.59	9,732,401.39	58.34	9,106.68	8,378.15	10,255.14
Front Loader for Subgrade Materials	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357									
Front Loader/Scraper (to clear lot)	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357									
Front Loader/Scraper (to clear lot)	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357									
Generator	Diesel	40	0.43	1.401663198	4.269644136	589.2645307	0.003541701	0.271978691	0.250220396	0.364489839	0.061588891	Generator Sets	2,160	52,074.59	158,625.82	21,892,355.85	131.58	10,104.55	9,296.19	13,541.53
Generator Sets	Diesel	40	0.43	1.401663198	4.269644136	589.2645307	0.003541701	0.271978691	0.250220396	0.364489839	0.061588891									
Grader	Diesel	300	0.59	0.310980707	1.005164092	536.3674174	0.002755175	0.052605418	0.048396985	0.152820468	0.306020679	Grader	196	10,788.54	34,871.15	18,607,658.45	95.58	1,824.99	1,678.99	5,301.65
Grout Mixer	Diesel	600	0.59	1.170567513	2.737275839	536.2077719	0.003163769	0.166505915	0.153185442	0.205546016	1.464577623	Grout Mixer for Mortar	4,560	1,889,576.90	4,418,620.15	865,568,033.64	5,107.08	268,780.51	247,278.07	331,800.60
Grout Wheel Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721									
High Lift	Diesel	100	0.59	0.509714417	0.485604153	595.7285281	0.002909958	0.029568732	0.027203234	0.141348615	0.029746696	High Lift	12,107	364,107.66	346,884.82	425,550,691.26	2,078.69	21,122.03	19,432.27	100,970.49
High Lift Fork Truck	Diesel	100	0.59	0.509714417	0.485604153	595.7285281	0.002909958	0.029568732	0.027203234	0.141348615	0.029746696	High Lift Fork Truck	7600	228,555.94	217,744.90	267,124,671.98	1,304.83	13,258.62	12,197.93	63,380.72
Hoist Equipment with 40 Ton Rig	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721									
Hydralic Hammer	Diesel	175	0.59	0.380005047	0.939555707	536.3664871	0.002766357	0.079582519	0.073215917	0.153175538	0.217168991									
Hydroseeder	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Hydroseeder	177	16,662.48	51,591.62	33,552,575.45	167.89	2,143.16	1,971.71	8,957.53
Line Painting Truck and Sprayer	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Line Painting Truck and Sprayer	5651.896	532,963.36	1,650,200.62	1,073,206,943.97	5,370.04	68,550.75	63,066.69	286,514.09
Loader	Diesel	175	0.59	0.634867812	1.479918189	536.2944607	0.002963106	0.149449424	0.13749347	0.176953425	0.348126673	Loader	1232	80,757.73	188,251.51	68,218,800.58	376.92	19,010.56	17,489.72	22,509.18
Log Chipper	Diesel	100	0.43	1.929615963	3.464993168	589.1723771	0.003558005	0.342033118	0.314670468	0.394960088	0.505359396	Log Chipper	2,118	175,737.84	315,570.79	53,658,285.08	324.04	31,150.32	28,658.30	35,970.60
Man Lift	Diesel	75	0.21	4.477751685	5.081230722	693.2376418	0.004295731	0.62799751	0.577757709	0.911360345	0.221125086	Man Lift	51,000	3,596,754.04	4,081,498.58	556,843,135.75	3,450.55	504,439.00	464,083.88	732,050.20
Man Lift (Fascia Construction)	Diesel	75	0.21	4.477751685	5.081230722	693.2376418	0.004295731	0.62799751	0.577757709	0.911360345	0.221125086			-	-	-	-	-	-	-
Masonry Saw	Diesel	40	0.59	0.678441678	3.483034319	595.5999792	0.003184605	0.100149627	0.092137657	0.183823668	0.005825695	Masonry Saw	4,560	73,011.18	374,830.22	64,096,087.37	342.71	10,777.70	9,915.49	19,782.37
Material Deliveries	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Material Deliveries	2628.6056	247,872.66	767,481.67	499,131,226.56	2,497.52	31,881.85	29,331.30	133,253.08
Mulcher	Diesel	100	0.43	1.929615963	3.464993168	589.1723771	0.003558005	0.342033118	0.314670468	0.394960088	0.505359396	Mulcher	2,100	174,244.32	312,888.88	53,202,265.66	321.29	30,885.59	28,414.74	35,664.90
Off-Road Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Off-Road Truck	198	18,671.03	57,810.64	37,597,113.41	188.13	2,401.50	2,209.38	10,037.30
Other General Equipment	Diesel	175	0.43	0.489976888	1.797357813	530.4648426	0.003009557	0.122123479	0.112353601	0.190729231	0.304444871	Other General Equipment	11,333	417,844.86	1,532,759.49	452,372,375.33	2,566.50	104,145.05	95,813.45	162,651.00
Paving Machine	Diesel	175	0.59	0.766736004	1.850666907	536.2255986	0.003054638	0.176842257	0.162694876	0.199686508	0.382431367	Paving Machine	2,770	219,316.79	529,363.85	153,381,704.68	873.75	50,583.87	46,537.16	57,118.23
Pickup Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Pickup Truck	23,998	2,262,920.34	7,006,621.47	4,556,751,916.68	22,800.76	291,061.05	267,776.17	1,216,516.18
Pile Driver	Diesel	175	0.43	0.995019514	3.571499987	530.0962543	0.003226884	0.219839979	0.20225278	0.312353444	0.447178698									
Pressure Washer	Diesel	25	0.43	3.068737574	5.512989237	587.8974894	0.003962979	0.47880457	0.440500204	0.815790015	0.040337855									
Pruning Saw/Chain Saw	Diesel	11	0.7	293.5350015	1.322992972	685.9963799	0.14019156	9.748189616	8.968334446	61.88835833	29.06708923									
Pumps	Diesel	11	0.43	4.464978441	4.708033203	588.3635706	0.003966193	0.447631488	0.411820969	0.661951648	0.018665835	Pumps	274	5,790.93	6,106.16	763,087.55	5.14	580.56	534.12	858.53
Roller	Diesel	100	0.59	1.727618137	1.748739164	595.5673436	0.003290897	0.224984469	0.206985712	0.194557484	0.258968307	Roller	5,135	523,405.71	529,804.61	180,435,329.36	997.02	68,162.14	62,709.17	58,943.87
Rubber Tired Loader	Diesel	175	0.59	0.634867812	1.479918189	536.2944607	0.002963106	0.149449424	0.13749347	0.176953425	0.348126673	Rubber Tired Loader	338	22,182.15	51,708.05	18,738,021.20	103.53	5,221.73	4,803.99	6,182.72
Scraper	Diesel	600	0.59	0.705200366	1.719860945	536.3431772	0.002996628	0.107454219	0.098857881	0.160858695	1.128266021	Scraper	1,477	368,644.76	899,060.40	280,374,361.29	1,566.49	56,171.89	51,678.14	84,089.17
Seed Truck Spreader	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721									
Set With Fork-Truck	Diesel	100	0.59	0.509714417	0.485604153	595.7285281	0.002909958	0.029568732	0.027203234	0.141348615	0.029746696			-	-	-	-	-	-	-
Skid Steer Loader	Diesel	75	0.21	4.902492433	4.97678879	693.0439557	0.004297767	0.731666697	0.673133362	0.975304602	0.568134479	Skid Steer Loader	599	46,235.90	46,936.59	6,536,166.85	40.53	6,900.42	6,348.39	9,198.20
Small Dozer	Diesel	175	0.59	0.492297191	1.155006653	536.3389947	0.002851584	0.111014157	0.102133024	0.162232759	0.283774593	Small Dozer	2,338	118,848.91	278,838.24	129,481,352.37	688.42	26,800.70	24,656.65	39,165.75
Stripping Machine & Truck	Diesel	600	0.59	1.170567513	2.737275839	536.2077719	0.003163769	0.166505915	0.153185442	0.205546016	1.464577623									

Surfacing Equipment (Grooving)	Diesel	25	0.59	2.395308746	4.457986672	594.7241942	0.004009162	0.352928772	0.32469447	0.472895529	0.007705337	Surfacing Equipment (Grooving)	664	23,459.65	43,661.52	5,824,728.76	39.27	3,456.58	3,180.06	4,631.54
Survey Crew Trucks	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Survey Crew Trucks	914	86,180.57	266,838.67	173,538,363.55	868.34	11,084.71	10,197.93	46,329.54
Sweepers	Diesel	175	0.43	0.343805302	1.20160073	530.5518076	0.00284204	0.081797091	0.075253324	0.162000767	0.237064319									
Ten Wheelers	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Ten Wheelers	4,241	399,874.87	1,238,122.17	805,211,985.24	4,029.06	51,432.65	47,318.04	214,967.46
Tool Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Tool Truck	12,050	1,136,305.97	3,518,314.64	2,288,133,738.46	11,449.21	146,153.80	134,461.50	610,863.12
Tower Crane	Diesel	300	0.43	0.316550925	1.431589626	530.5368177	0.002878767	0.063581977	0.058495419	0.166949686	0.464551326									
Tractor	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357	Tractors/Loader/Backhoe	16,835	1,611,063.25	1,281,629.48	245,269,627.54	1,470.16	229,500.62	211,140.57	258,443.31
Tractor Trailers Temp Fac.	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Tractor Trailer- Equipment Delivery	9,485	894,439.12	2,769,428.61	1,801,096,174.09	9,012.20	115,044.43	105,840.88	480,838.69
Tractors/Loader/Backhoe	Diesel	100	0.21	4.557147382	3.625291823	693.7839599	0.004158576	0.649178824	0.597244518	0.731047818	0.89787357									
Trenchers	Diesel	75	0.59	1.964489003	3.497462209	595.4006135	0.003494677	0.228941868	0.210626519	0.24961315	0.176592476	Trencher	250	21,732.16	38,690.68	6,586,619.29	38.66	2,532.67	2,330.06	2,761.35
Trowel Machine	Diesel	600	0.59	1.170567513	2.737275839	536.2077719	0.003163769	0.166505915	0.153185442	0.205546016	1.464577623	Trowel Machine	120	49,725.71	116,279.48	22,778,106.15	134.40	7,073.17	6,507.32	8,731.59
Truck for Topsoil & Seed Del&Spread	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Truck for Topsoil & Seed Del&Spread	14	1,282.45	3,970.83	2,582,427.99	12.92	164.95	151.76	689.43
Truck Tower (Mantiwoc type)	Diesel	300	0.43	0.316550925	1.431589626	530.5368177	0.002878767	0.063581977	0.058495419	0.166949686	0.464551326									
Vibratory Compactor	Diesel	6	0.43	4.454041726	4.505787909	588.4781232	0.003966982	0.409876112	0.377086023	0.62410652	0.009376841	Vibratory Compactor	915	10,516.95	10,639.14	1,389,523.96	9.37	967.81	890.38	1,473.65
Water Truck	Diesel	600	0.59	0.266378968	0.824782278	536.3966417	0.002683985	0.034262161	0.031521188	0.143201825	0.444220721	Water Truck	4,320	407,368.03	1,240.30	364,184.74	5.64	46,842.12	0.22	12.51
														20,527,460.35	44,178,358.97	21,258,387,291.38	109,540.70	2,830,814.14	2,561,254.47	6,796,197.70

NONROAD TOTAL

CO	NOX	CO2	Sox	PM10	PM2.5	VOC	
22.63	48.70	23,433.35	0.12	3.12	2.82	7.49	
						67.93	EVAP. E.
						75.42	

CO	NOX	CO2	Sox	PM10	PM2.5	VOC
5.1902	0.1915		0.0197	0.0363	0.0193	0.066
5.7251	0.2115		0.0216	0.0375	0.0204	0.0696
6.0971	0.2252		0.0228	0.0623	0.0272	0.0726
2.6309	0.0167		0.0068	0.0247	0.0112	0.0521

ONROAD TOTAL

Equipment	VMT	CO	NOX	CO2	SOx	PM10	PM2.5	VOC
Cement Mixer	101,793.00	528,326.03	19,493.36	-	2,005.32	3,695.09	1,964.60	6,718.34
Dump Truck	375,970.00	2,152,465.85	79,517.66	-	8,120.95	14,098.88	7,669.79	26,167.51
Material Delivery - Tractor Trailer	56,925.00	347,077.42	12,819.51	-	1,297.89	3,546.43	1,548.36	4,132.76
Passenger Car	1,264,500.00	3,326,773.05	21,117.15	-	8,598.60	31,233.15	14,162.40	65,880.45
		-	-	-	-	-	-	-
		7.00	0.15	-	0.02	0.06	0.03	0.11

GRAND TOTAL

CO	NOX	CO2	SOx	PM10	PM2.5	VOC
29.63	48.84	23,433.35	0.14	3.18	2.85	75.53

Componen	GSF			
EVAP. E.		**Variable**	**Values**	**Units**
A in M2=	170,100	AR = Application rate of liquefied asphalt over area	1.811	l/m2
VOC =	135,850.84	VD = Volume fraction of diluent in liquefied asphalt	0.35	fraction
	67.93	EF = Mass fraction of diluent which evaporates and becomes VOC	0.7	fraction
		D = Density of solvent utilized	1.8	lbs/l
		VOC = A x AR x VD x EF x D	7,419.50	lbs

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APPENDIX H

HYDRAULIC REPORT

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MANASSAS REGIONAL AIRPORT

HYDRAULIC REPORT
FOR
ENVIRONMENTAL ASSESSMENT FOR WEST CORPORATE DEVELOPMENT AND EAST PARCEL DEVELOPMENT

NOVEMBER 2017



HYDRAULIC REPORT FOR ENVIRONMENTAL ASSESSMENT FOR WEST CORPORATE DEVELOPMENT AND EAST PARCEL DEVELOPMENT

November 2017

City of Manassas,
Prince William County,
Virginia

City of Manassas
P.O. # 170270

RS&H No.:
222-0003-001

Prepared by RS&H, Inc. at the direction of Manassas Regional Airport

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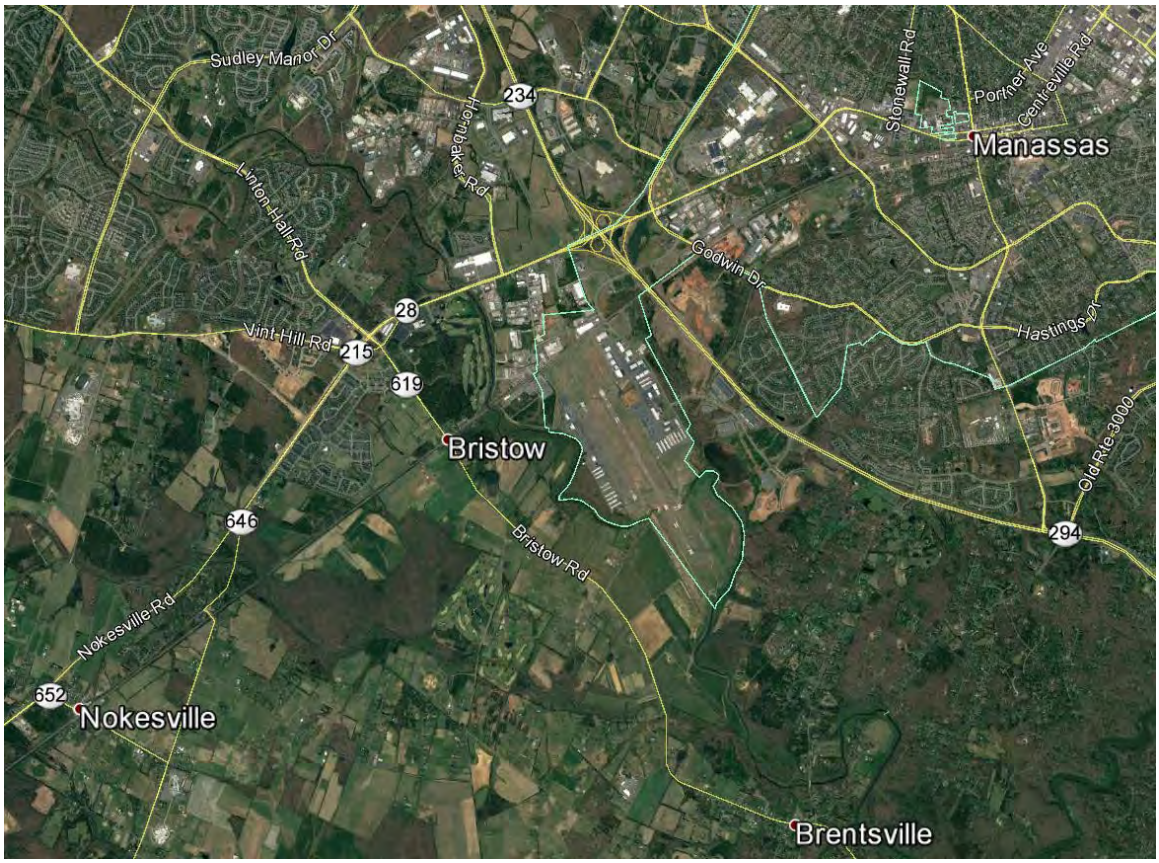
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1.1 PROJECT DESCRIPTION

The City of Manassas retained RS&H, Inc. to provide services for the Environmental Assessment for the West Corporate Development and East Parcel Development, pursuant to an agreement between the City and RS&H dated September 26, 2016. This includes an analysis of impacts to the floodplain and coordination with the City of Manassas, Prince William County, and the Federal Emergency Management Agency (FEMA).

The Manassas Regional Airport (HEF) is owned and operated by the City of Manassas in Prince William County, Virginia. It is located approximately 30 miles southwest of Washington D.C. HEF and the surrounding area are shown in **Figure 1.**

FIGURE 1:
AIRPORT LOCATION MAP



HEF conducted a study in coordination with the Federal Aviation Administration (FAA) to redevelop portions of the west corporate area and develop newly acquired land on the east side of the airport. A preliminary environmental analysis found the potential for impacts to multiple environmental categories described in FAA Order 1050.1F and *1050.1 Desk Reference*. These impacts include but are not limited to: air quality, biological resources, noise, and water resources.

FEMA has designated areas of HEF as floodplains associated with Broad Run and Cannon Branch. The project requires assessment of impacts to the 100-year floodplain and floodway for Broad Run. The east parcel development will not impact the 100-year floodplain for Cannon Branch. Additionally, any mitigation that may be required for the proposed development is evaluated.

The City of Manassas and Prince William County have jurisdiction over the floodplain in the vicinity of the Manassas Regional Airport. The City of Manassas and Prince William County review hydrologic and hydraulic floodplain analyses and will not permit encroachment in the floodplain unless a "no-rise" condition is achieved or a Conditional Letter of Map Revision (CLOMR) is approved by FEMA. A CLOMR is anticipated for the project because the Proposed Action is within the designated floodway. This document includes the technical hydraulic analysis based on preliminary site design to evaluate the proposed project's impacts to the regulatory floodplain of Broad Run.

1.2 PREVIOUS STUDIES

FEMA has published Flood Insurance Study (FIS) reports and Flood Insurance Rate Maps (FIRM) for Broad Run and Cannon Branch in Prince William County, Virginia. FIRM Panels 0517D and 0519D effective January 5, 1995 contain the floodplain and floodway boundaries for Broad Run and Cannon Branch in the vicinity of HEF. FEMA developed the effective hydraulic models for Broad Run and Cannon Branch using the United States Army Corps of Engineers (USACE) HEC-2 computer model. This model establishes the water surface elevations for 10-, 50-, 100-, 500-year floods and floodway, and also defines the floodplain and floodway boundaries along both streams. The following Letters of Map Change (LOMC) have been issued by FEMA for the surrounding area of HEF.

- FEMA Case No: 00-03-139P:
  The LOMR was issued on April 4, 2001, to reflect the placement of fill and excavation along Broad Run. The subject area is located from a point just upstream of Southern Railway to a point just downstream of State Route 28 (Nokesville Road). This LOMR reflects decreases in 1 % annual chance water-surface elevations and widening and narrowing of the 1% and 0.2% annual chance floodplains and floodway on FIRM Panels 0156 D and 0157 D.
- FEMA Case No: 01-03-113P:
  The LOMR was issued on September 12, 2001, to reflect more detailed topographic data for Broad Run from upstream to approximately 2300 feet upstream of Nokesville Road. As a result, this LOMR revises the floodplain and floodway boundaries for FIRM Panel number 0156 D.
- FEMA Case No: 01-03-207P:
  The LOMR was issued on June 21, 2002, to reflect the effects of a revised hydraulic analysis that incorporated more detailed topographic information of existing conditions for Broad Run in the vicinity of HEF. This request also included revised hydraulic analyses that incorporated the effects of an existing Observation Road cul-de-sac, a new channel identified as Broad Run Side Channel, the Runway 16L-34R and Taxiway bridges. As a result of this LOMR, FIRM Panels 0157 D and 0159 D were revised.
- FEMA Case no: 15-03-2702P:
  The LOMR was issued on August 11, 2016, to reflect the effects of a revised hydrologic and hydraulic analysis following the placement of fill and modified culverts under Gateway Boulevard,

Prince William Parkway (State Route 234), and Nokesville Road (State Route 28). The subject area is located along Cannon Branch from a point just downstream of Norfolk Southern Railroad to approximately 590 feet upstream of Nokesville Road. This LOMR reflects increases in 1 % annual chance water-surface elevations and widening and narrowing of the 1% and 0.2% annual chance floodplains and floodway on FIRM Panel 0157 D.

- *Pending* FEMA Case no: 17-03-2321P:
  A LOMR request to revise FIRM Panels 0157D and 0159D is being reviewed by FEMA for changes to Broad Run due to construction of the Runway 34R Extension program at Manassas Regional Airport. Correspondence with FEMA is included in **Appendix F**.

1.3 HYDROLOGIC METHODOLOGY

Standard hydrologic and hydraulic methods were used to determine the flood hazard data used in this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for floodplain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10-, 2-, 1-, and 0.2-percent chance, respectively, of being equaled or exceeded during any year.

The FIS for Prince William County, Virginia and Incorporated Areas No. 51153CV001A references that the hydrologic data used is based on either the Soil Conservation Service (SCS) TR-20 or the United States Army Corps of Engineers (USACE) HEC-1 flood hydrograph package. Each watershed was divided into subareas and the drainage areas, percent imperviousness, times of concentration, and routing times for each subarea were determined. The percent imperviousness was based on soil types and land uses that existed at the time of the study. Based on the above basin parameters and rainfall data from Technical Paper No. 40, Technical Paper No. 49, and NWS HYDR0-35, flood hydrographs were computed for each subarea, routing downstream and combined with other subareas using either the TR-20 or HEC-1 computer models.

1.4 HYDRAULIC ANALYSIS

The West Corporate Development will impact the 100-year floodplain and floodway and required in-depth hydraulic analysis of Broad Run. The East Parcel Development will not affect the 100-year floodplain for Cannon Branch and, therefore, did not require hydraulic analysis.

1.4.1 Vertical Datum

Cervantes & Associates performed survey for major drainage infrastructure in or near the project area in March 2017. The surveyed elevations are based on the NAVD88 datum.

The FEMA Flood Insurance Study for Prince William County, Virginia, the FEMA FIRM Map elevations, FEMA regulatory model and all figures and tables are based on the NGVD29 datum. In order to maintain vertical datum correlation all existing survey data incorporated into the modeling data has been adjusted by a correlation factor of +0.827 feet to obtain the corresponding NGVD29 datum elevation for modeling purposes. All results from the modeling software should therefore be adjusted by a factor of -0.827 feet to revert elevations to NAVD88 datum.

1.4.2 FEMA Effective Study

An excerpt copy of the current effective floodplain limits is included in **Appendix A**. This map reflects the 1% and 0.2% annual chance (100- and 500-year) floodplains and floodway for Broad Run and Cannon Branch. During the HEF Runway 34R Extension Program design, RS&H obtained a copy of the Broad Run effective HEC-2 hydraulic model, used in the Environmental Assessment (EA) phase of the project, from HNTB Corporation (HNTB). This effective HEC-2 hydraulic model was used as the basis for the issuance of LOMR 01-03-207P by FEMA. During the EA, HNTB reproduced the hydraulic model from approximately 7400 feet downstream of HEF Taxiway Bridge (XS-R) to Southern Railway Bridge crossing (XS-Z) using USACE HEC-2 hydraulic model, version 4.6.2, dated May 1991. A copy of the input/output data is included in **Appendix B**.

1.4.3 Duplicate Effective Model

The effective HEC-2 model was recreated by RS&H using USACE HEC-RAS software, version 5.0.1, dated April 2016. The downstream boundary condition for the 100-year event and floodway were set equal to the water surface elevation (WSEL) calculated in the effective HEC-2 model. For the 10-, 50-, and 500-year events, the energy slope from the effective model was used as the downstream boundary condition. The data was processed to determine discrepancies between computations from the HEC-RAS and HEC-2 software. The Duplicate Effective model produced similar results to the FEMA effective model for all cross sections. Discrepancies are mainly based on the use of different bridge/culvert modeling routines, different conveyance calculations and floodway computations between the HEC-2 and HEC-RAS models. A copy of input/output data for the duplicate effective model is included in **Appendix C**.

1.4.4 Existing Conditions Model

The existing conditions model was used for comparison purposes when quantifying any changes that would result from the proposed development. Note that the existing conditions model represents the pre-project conditions. The hydraulic model currently being reviewed by FEMA for the HEF Runway 34R Extension Program LOMR was used as the existing conditions model for Broad Run. The model includes as-built information and updated survey from the Runway 34R Extension Program. A copy of the input/output data from the LOMR model is included in **Appendix D**.

1.4.5 Proposed Project Analysis

The HEC-RAS model from the Runway 34R Extension Program LOMR was updated to reflect proposed project conditions based on a preliminary grading design. Efforts to minimize impacts on the floodway and 100-year floodplain were made during the design and grading of the proposed West Corporate Development. Observation Road was realigned to avoid the floodway to the maximum extent practicable at the intersection with Piper Lane. Roadway elevations were set at approximately the base flood elevation (BFE) as a safety measure to allow access to and from the airport during a major storm event. To mitigate for any increases in the BFE, a floodplain compensation area was created west of the development, between cross section 285 and 270, on HEF property to offset the effects of proposed fill. Cross sections 314.4 through 264 were updated with ground elevations from the proposed development. All remaining parameters in this HEC-RAS model computation remain the same as the existing conditions model. A copy of the input/output for the Proposed Project Conditions model is included in **Appendix E**. **Table 1** shows a comparison of BFEs between the existing and proposed project conditions. The Proposed Project

analysis is representative of a No-Rise condition, where there are no increases in BFE. A copy of the annotated FIRMs is included in **Appendix A**.

TABLE 1:
BFE COMPARISON FOR BROAD RUN

Cross Section	Existing 100-Year WSEL (ft NGVD29)	Proposed 100-Year WSEL (ft NGVD29)	Difference (ft)
Broad Run			
350	181.46	181.45	-0.01
344.95	181.29	181.28	-0.01
331.6	180.11	180.10	-0.01
320	179.56	179.54	-0.02
314.4	179.40	179.38	-0.02
300	179.16	179.13	-0.03
285	178.12	178.12	0.00
280.55	177.95	177.94	-0.01
270	176.52	176.52	0.00
264	175.98	175.98	0.00
250.12	175.41	175.41	0.00
Runway			
250	174.71	174.71	0.00
246	174.71	174.71	0.00
245	174.68	174.68	0.00
Taxiway			
243.38	174.57	174.57	0.00
243.2	174.57	174.57	0.00
243	174.57	174.57	0.00
190	174.56	174.56	0.00
182	174.54	174.54	0.00
180	174.52	174.52	0.00
170	174.47	174.47	0.00
Side Channel			
250.12	175.14	175.14	0.00
225	174.91	174.91	0.00
200	174.78	174.78	0.00
190	174.63	174.63	0.00

1.5 ENDANGERED SPECIES

The Endangered Species Act of 1973, as amended, regulates activities affecting plants and animals designated as threatened or endangered. It also provides measures to help alleviate the loss of species and their habitat to ensure their survival.

A wildlife assessment and coordination with the U.S. Department of Interior Fish and Wildlife Service (FWS), Virginia Fish and Wildlife Information Service (VAFWIS), and the Virginia Department of Conservation and Recreation (VDCR) was conducted to determine if there are any threatened or endangered species or their habitat on the Airport property. The assessment concluded that the proposed development is not likely to adversely affect endangered or threatened species.

1.6 REFERENCES

Federal Emergency Management Agency, Flood Insurance Rate Map, Prince William County, Virginia, January 5, 1995

Federal Emergency Management Agency, Flood Insurance Study, Prince William County, Virginia, August 3, 2015

HNTB Corporation, Draft Environmental Assessment for Runway 16L/34R Extension, Manassas, Virginia, April 2009

Reynolds, Smith & Hills, Letter of Map Revision (LOMR) Request for Runway 34R Extension Program, Alexandria, Virginia, June 5, 2017.

The US Army Corps of Engineers, Hydrologic Engineering Center, HEC-RAS River Analysis System, Version 5.0.1, April 2016.

The US Department of Commerce, National Geodetic survey, Vertcon 2.1 program, Version 2.1, September 2003

APPENDIX A

EXHIBITS

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program; It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

Coastal base flood elevations apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NVGD), and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index.

NOTE: The coordinate system used for the production of this Flood Insurance Rate Map (FIRM) is Universal Transverse Mercator (UTM), North American Datum of 1927 (NAD27), Clarke 1866 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the Transverse Mercator projection, NAD27. Differences in the datum and spheroid used in the production of FIRMS for adjacent communities may result in slight positional differences in map features at the community boundaries. These differences do not affect the accuracy of the information shown on the FIRM.

ATTENTION: Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, contact the National Geodetic Survey at the following address:

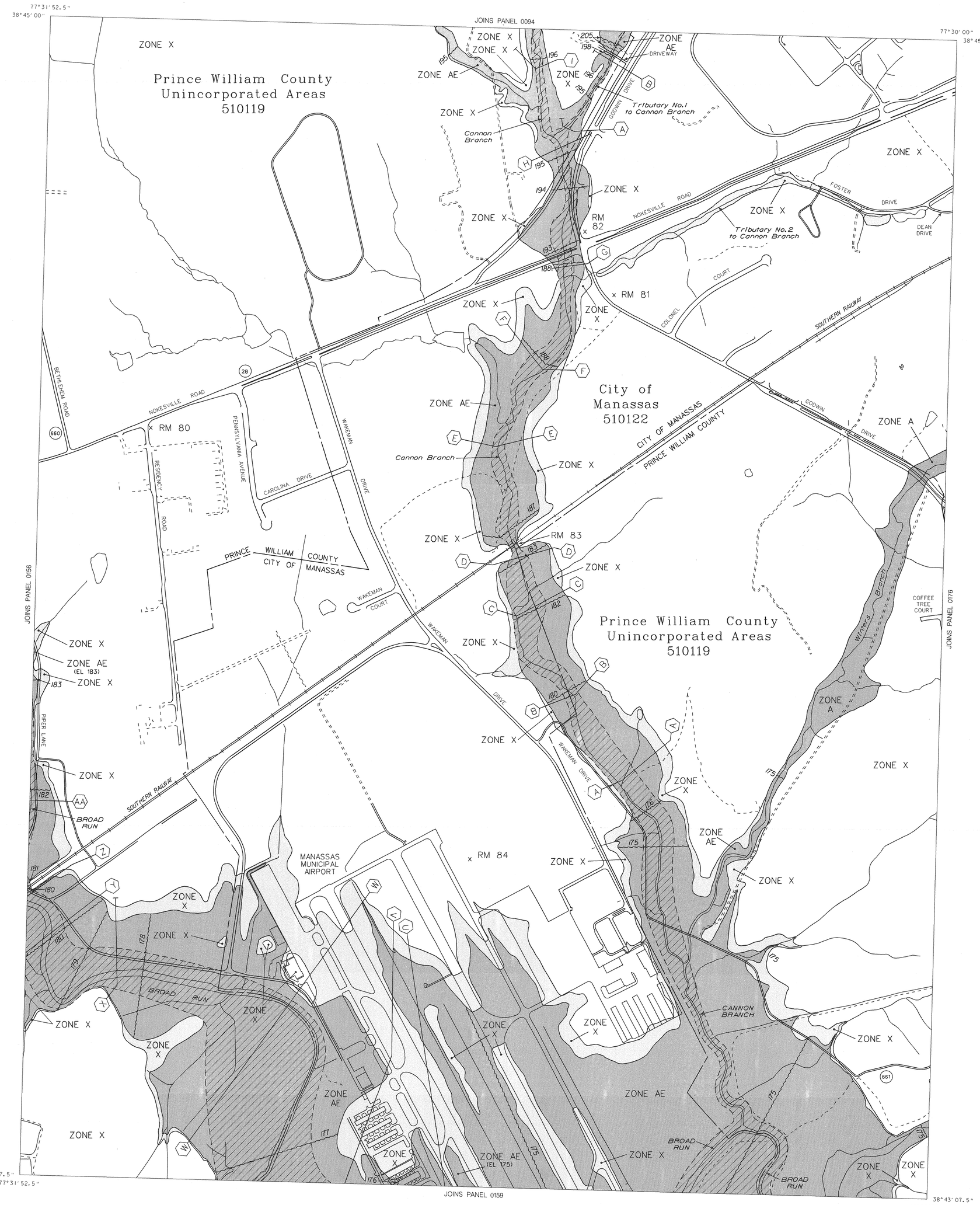
Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

Base Map Source: Base map information prepared by the Prince William County Office of Mapping. This information was compiled by photogrammetric methods from aerial photographs taken February 1987, and complies with U.S. National Map Accuracy Standards. Roads shown on this map represent edge of pavement. This map is based on the Transverse Mercator projection; the map edges represent parallels and meridians. the apparent tilt of the map is inherent in the use of this projection in a standardized map orientation.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 80	218.96	At intersection of State Route 28 (Nokesville Road) and Residency Road, chiseled square in north end of centerline of stop sign island.
RM 81	209.11	Nail on side of pole at northeast corner of the cemetery, approximately 800 feet south of State Route 28 (Nokesville Road) and approximately 75 feet north of Godwin Drive.
RM 82	196.24	Chiseled square in center of stop sign island of Godwin Drive, approximately 32 feet north of the centerline of Nokesville Road.
RM 83	200.63	Approximately 2.6 miles southwest along Southern Railway from station at Manassas, Prince William County, approximately 693 feet southwest of milepost 35, at south end of Cannon Branch bridge, in top of concrete wall of arch culvert, 8.5 feet east of northbound track, a standard monel metal rivet.
RM 84	197.24	Approximately one mile east along dirt road from its intersection with Piper Lane, approximately 1,400 feet east of northernmost end of runway at Manassas Municipal Airport, chiseled square in north side of round water trough, 2.4 feet above surface of ground.

[1]National Geodetic Vertical Datum of 1929.



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

- ZONE A — No base flood elevations determined.
- ZONE AE — Base flood elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

- ZONE X — Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile, and areas protected by levees from 100-year flood.

OTHER AREAS

- ZONE X — Areas determined to be outside 500-year floodplain.
- ZONE D — Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS*

Identified 1983 | Identified 1990 | Otherwise Protected Areas

*Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet**
- A — A — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone**
- RM7 x — Elevation Reference Mark
- •M1.5 — River Mile

**Referenced to the National Geodetic Vertical Datum of 1929

MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

JANUARY 5, 1995

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

Refer to the FLOOD INSURANCE RATE MAP effective date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE
500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

PRINCE WILLIAM COUNTY, VIRGINIA AND INCORPORATED AREAS

PANEL 157 OF 330

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
MANASSAS, CITY OF	510122	0157	D
UNINCORPORATED AREAS	510119	0157	D

Notice to User: The MAP NUMBER shown below should be used when placing map orders; the COMMUNITY NUMBER shown above should be used on insurance applications for the subject community.

MAP NUMBER
51153C0157 D

EFFECTIVE DATE:
JANUARY 5, 1995

Federal Emergency Management Agency

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside Special Flood Hazard Areas. The community map repository should be consulted for possible updated flood hazard information prior to use of this map for property purchase or construction purposes.

Coastal base flood elevations apply only landward of 0.0' National Geodetic Vertical Datum of 1929 (NVGD), and include the effects of wave action; these elevations may also differ significantly from those developed by the National Weather Service for hurricane evacuation planning.

Areas of special flood hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see section 6.0 of the Flood Insurance Study Report.

For adjoining map panels see separately printed Map Index.

NOTE: The coordinate system used for the production of this Flood Insurance Rate Map (FIRM) is Universal Transverse Mercator (UTM), North American Datum of 1927 (NAD27), Clarke 1866 spheroid. Corner coordinates shown on the FIRM are in latitude and longitude referenced to the Transverse Mercator projection, NAD27. Differences in the datum and spheroid used in the production of FIRMS for adjacent communities may result in slight positional differences in map features at the community boundaries. These differences do not affect the accuracy of the information shown on the FIRM.

ATTENTION: Flood elevations on this map are referenced to the National Geodetic Vertical Datum of 1929. These flood elevations must be compared to structure and ground elevations referenced to the same datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, contact the National Geodetic Survey at the following address:

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
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(301) 713-3191

Base Map Source: Base map information prepared by the Prince William County Office of Mapping. This information was compiled by photogrammetric methods from aerial photographs taken February 1987, and complies with U.S. National Map Accuracy Standards. Roads shown on this map represent edge of pavement. This map is based on the Transverse Mercator projection; the map edges represent parallels and meridians. the apparent tilt of the map is inherent in the use of this projection in a standardized map orientation.

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION IN FT. (NGVD)[1]	DESCRIPTION OF LOCATION
RM 85	203.30	Approximately 1.1 miles southeast along Secondary State Highway 619 (Bristow Road) from Southern Railway station at Bristow, Prince William County, approximately 0.2 mile west of large white house set back in field, approximately 32 feet north of centerline of highway and two feet south of north property line, a standard disk stamped L 115 1935 and set in top of concrete post.
RM 86	161.40	Approximately 2.2 miles southeast along Secondary State Highway 619 (Bristow Road) from Southern Railway station at Bristow, approximately 2,200 feet north of bridge over Kettle Run, and approximately 30 feet east of centerline of highway, standard disk stamped M115 RESET 1947 and set in top of concrete post projecting eight inches above ground.
RM 87	226.71	At Brentsville, approximately 0.9 mile northwest along State Route 619 (Bristow Road) from crossing over Cedar Run, cut nail in VEPCO pole 3-14-CL-8466, 27 feet west of centerline of private drive.

[1]National Geodetic Vertical Datum of 1929.



LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

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- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE A99 — To be protected from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.
- ZONE V — Coastal flood with velocity hazard (wave action); no base flood elevations determined.
- ZONE VE — Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

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UNDEVELOPED COASTAL BARRIERS*

Identified 1983 | Identified 1990 | Otherwise Protected Areas

*Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain Boundary
- Floodway Boundary
- Zone D Boundary
- Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.
- 513 — Base Flood Elevation Line; Elevation in Feet**
- A — A — Cross Section Line
- (EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone**
- RM7 — Elevation Reference Mark
- M1.5 — River Mile

**Referenced to the National Geodetic Vertical Datum of 1929

MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

JANUARY 5, 1995

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

Refer to the FLOOD INSURANCE RATE MAP effective date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE
500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

PRINCE WILLIAM COUNTY, VIRGINIA AND INCORPORATED AREAS

PANEL 159 OF 330

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

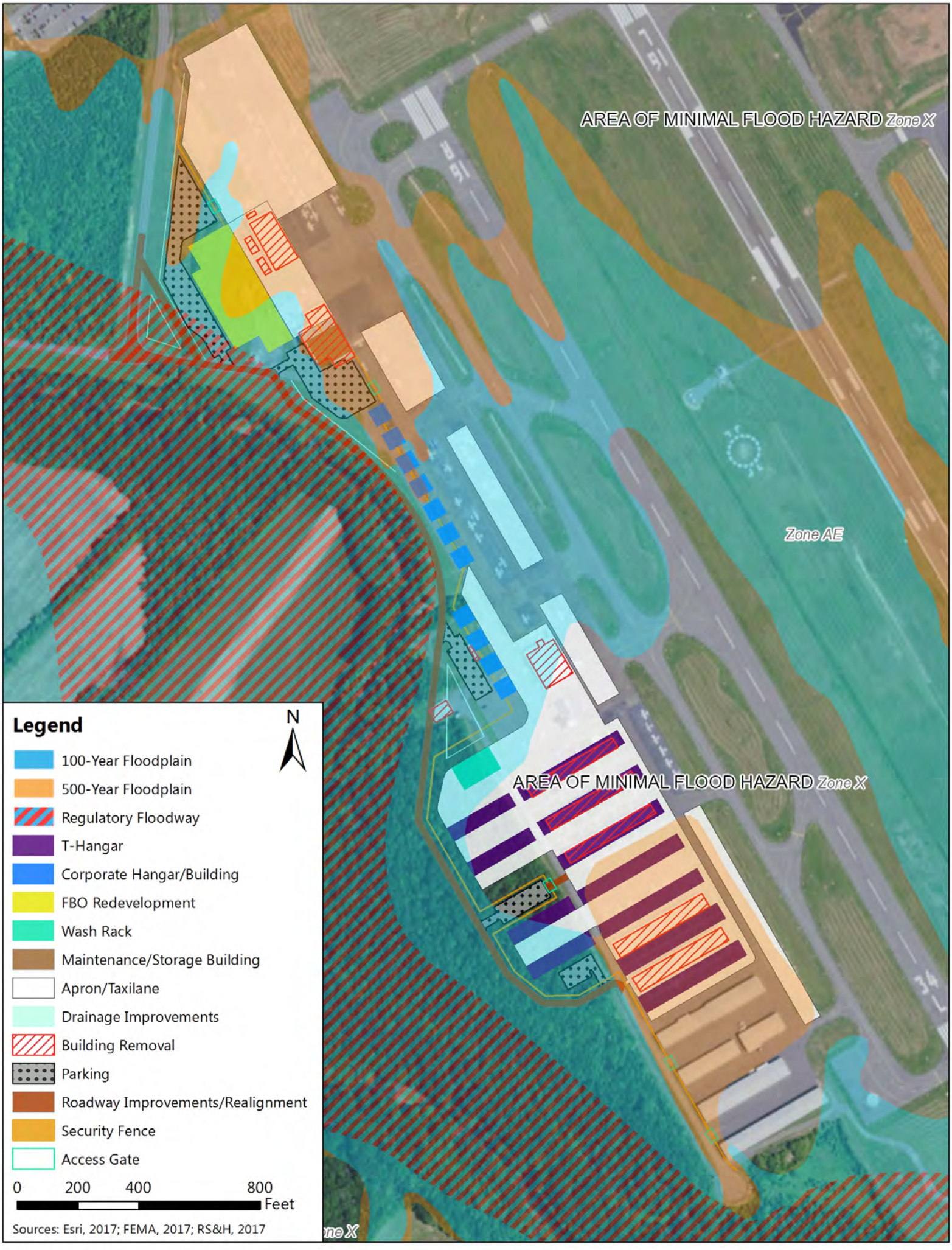
COMMUNITY	NUMBER	PANEL	SUFFIX
MANASSAS, CITY OF	510122	0159	D
UNINCORPORATED AREAS	510119	0159	D

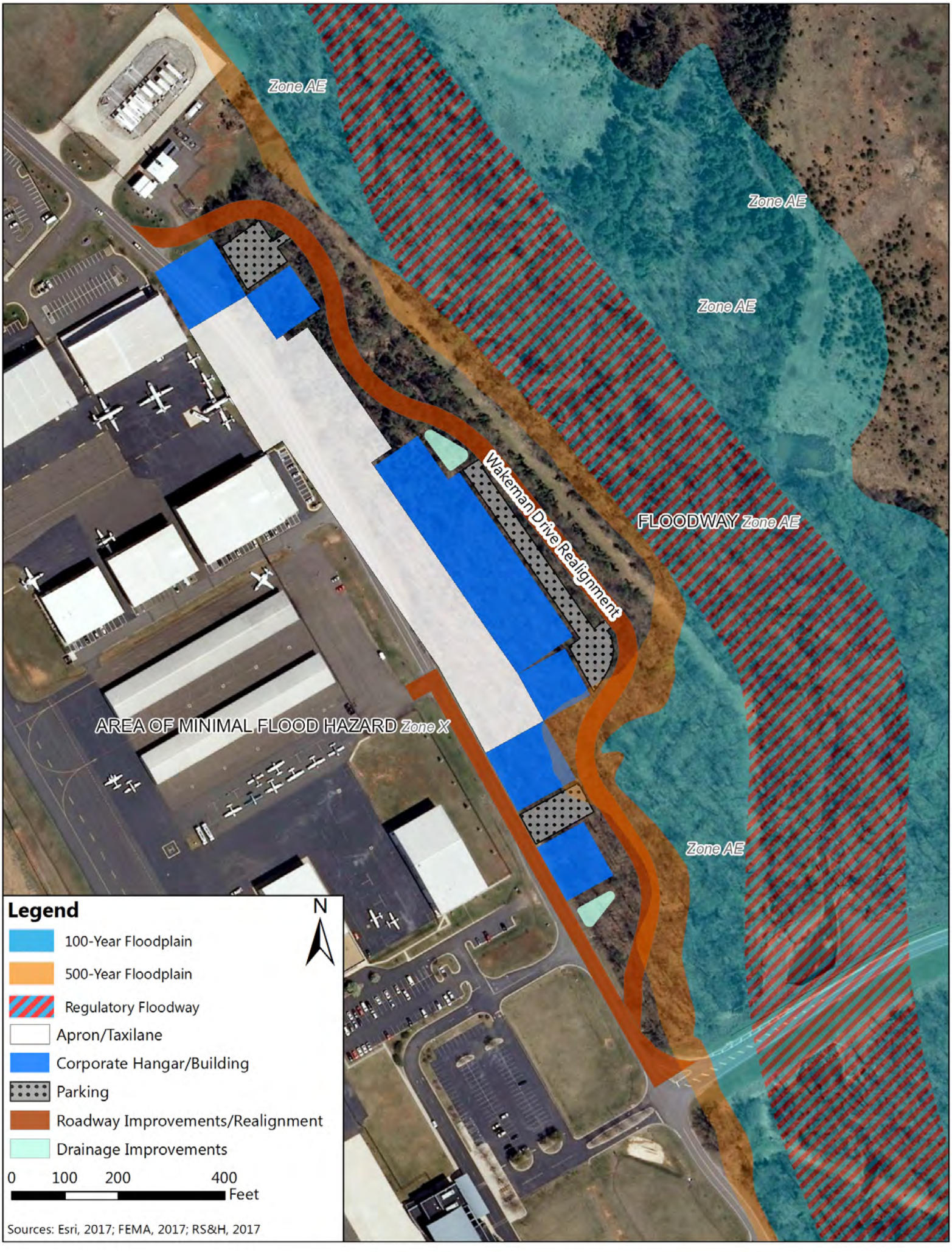
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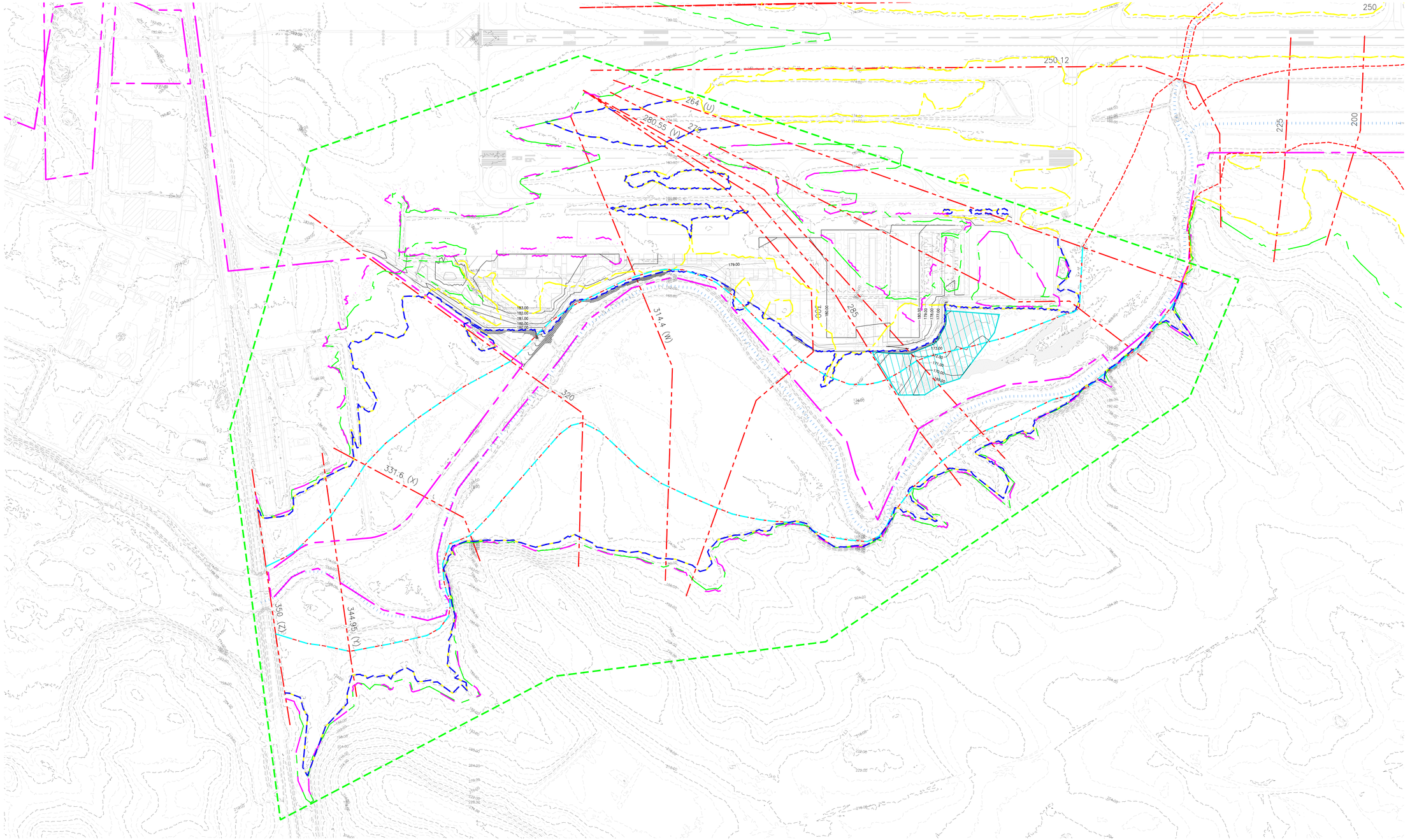
MAP NUMBER
51153C0159 D

EFFECTIVE DATE:
JANUARY 5, 1995

Federal Emergency Management Agency


AREA OF MINIMAL FLOOD HAZARD Zone X
Zone AE
AREA OF MINIMAL FLOOD HAZARD Zone X
Legend
N
100-Year Floodplain
500-Year Floodplain
Regulatory Floodway
T-Hangar
Corporate Hangar/Building
FBO Redevelopment
Wash Rack
Maintenance/Storage Building
Apron/Taxilane
Drainage Improvements
Building Removal
Parking
Roadway Improvements/Realignment
Security Fence
Access Gate
0
200
400
800
Feet
Sources: Esri, 2017; FEMA, 2017; RS&H, 2017


Zone AE
Zone AE
Zone AE
Wakeman Drive Realignment
FLOODWAY Zone AE
AREA OF MINIMAL FLOOD HAZARD Zone X
Zone AE
Legend
N
100-Year Floodplain
500-Year Floodplain
Regulatory Floodway
Apron/Taxilane
Corporate Hangar/Building
Parking
Roadway Improvements/Realignment
Drainage Improvements
0 100 200 400
Feet
Sources: Esri, 2017; FEMA, 2017; RS&H, 2017



LEGEND

- EXISTING CONTOUR (6')
- EXISTING CONTOUR (2')
- PROPOSED CONTOUR (2')
- PROPOSED CONTOUR (1')
- EXISTING AIRPORT PROPERTY LINE
- STREAM FLOWLINE
- EXISTING FLOODWAY
- PROPOSED FLOODWAY
- FLOODPLAIN COMPENSATION AREA
- CROSS SECTION
- EXISTING 100-YEAR FLOODPLAIN
- PROPOSED 100-YEAR FLOODPLAIN
- REVISED AREA
- EXISTING 500-YEAR FLOODPLAIN
- PROPOSED 500-YEAR FLOODPLAIN

NORTH

GRAPHIC SCALE
300' 150' 0 300'

VERTICAL DATUM: NAVD88

RS&H

909 N Washington Street, Suite 330
Alexandria, Virginia 22314
703-549-2472 FAX 703-549-2582

Alexandria VA - Virginia Registration No. 0411-000594

CITY OF MANASSAS, PRINCE WILLIAM COUNTY, VIRGINIA

MANASSAS REGIONAL AIRPORT

ENVIRONMENTAL ASSESSMENT FOR WEST CORPORATE AND EAST PARCEL DEVELOPMENT

CONSULTANTS

REVISIONS

NO.	DESCRIPTION	DATE

DATE ISSUED: 11-09-17
REVIEWED BY: LMM
DRAWN BY: SRW
DESIGNED BY: SRW

AEP PROJECT NUMBER
222-0003-001

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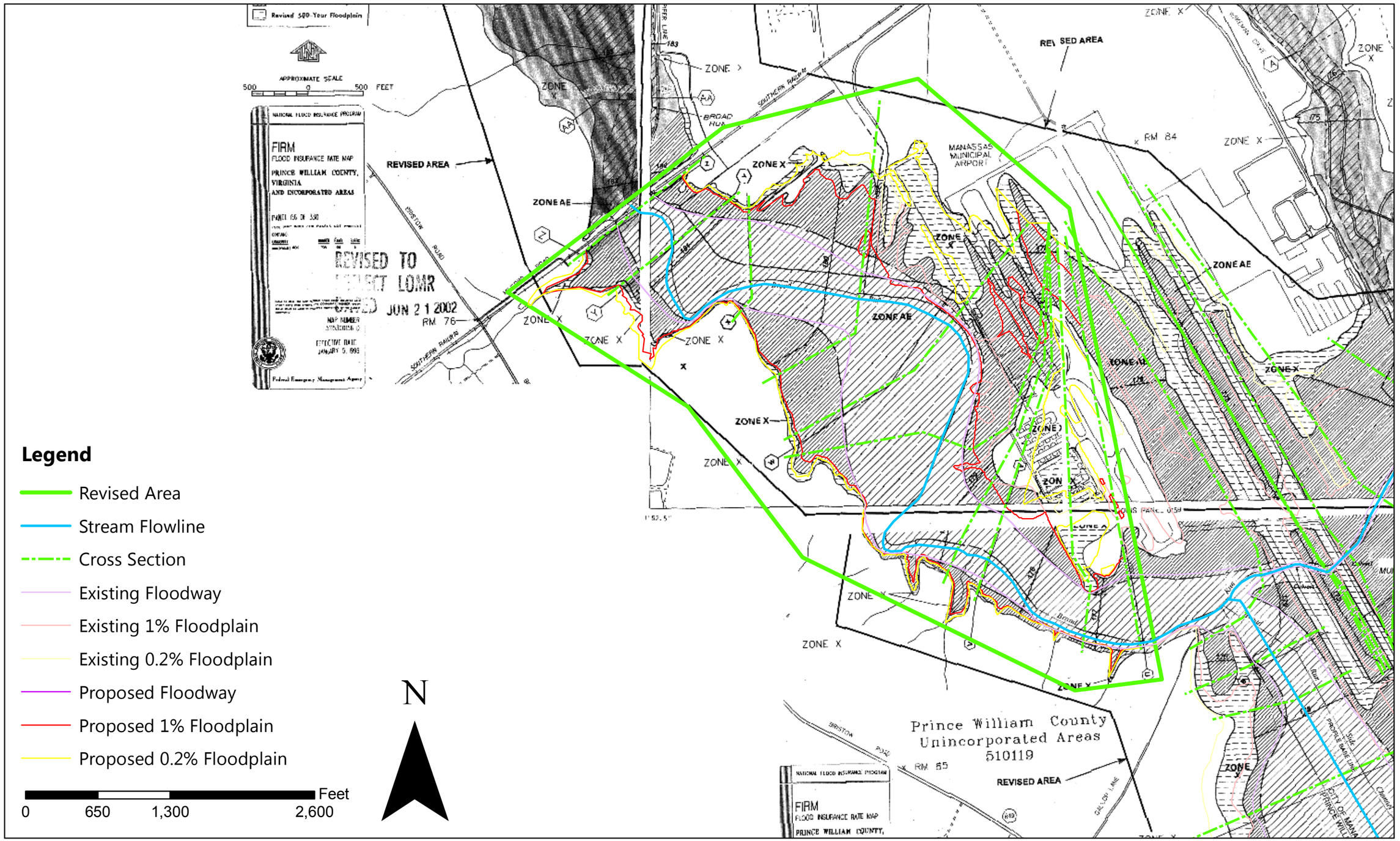
SHEET TITLE

WEST CORPORATE DEVELOPMENT (BROAD RUN) TOPOGRAPHIC WORK MAP

SHEET NUMBER

EXHIBIT

Drawing: C:\pw_work\rsh_pw\pw_user\d0133804\Topographic Map.dwg Plotted on: 11/9/2017 11:45PM Plotted by: Wilson, Steven


Revised 500-Year Floodplain
APPROXIMATE SCALE
500 0 500 FEET
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
PRINCE WILLIAM COUNTY, VIRGINIA AND INCORPORATED AREAS
PANEL 66 OF 550
REVISED TO REFLECT LOMR
JUN 21 2002
MAP NUMBER
EFFECTIVE DATE
JANUARY 5, 1995
Federal Emergency Management Agency
REVISED AREA
ZONE AE
ZONE X
ZONE A
ZONE AH
BROAD RUN
SOUTHERN RAILWAY
BRISTOW ROAD
RM 76
RM 84
RM 65
MANASSAS MUNICIPAL AIRPORT
Prince William County
Unincorporated Areas
510119
Legend
Revised Area
Stream Flowline
Cross Section
Existing Floodway
Existing 1% Floodplain
Existing 0.2% Floodplain
Proposed Floodway
Proposed 1% Floodplain
Proposed 0.2% Floodplain
N
0 650 1,300 2,600 Feet

APPENDIX B

BROAD RUN EFFECTIVE MODEL

```
1*****************************************                    ************************************
 *  HEC-2 WATER SURFACE PROFILES             *                *  U.S. ARMY CORPS OF ENGINEERS      *
 *                                           *                *  HYDROLOGIC ENGINEERING CENTER     *
 *  Version   4.6.2;  May 1991               *                *  609 SECOND STREET, SUITE D        *
 *                                           *                *  DAVIS, CALIFORNIA 95616-4687      *
 *  RUN DATE    04MAY11    TIME   12:33:46   *                *         (916) 756-1104             *
 *****************************************                    ************************************

                                        X     X  XXXXXXX   XXXXX             XXXXX
                                        X     X  X       X     X           X     X
                                        X     X  X       X                       X
                                        XXXXXXX  XXXX    X          XXXXX    XXXXX
                                        X     X  X       X                X
                                        X     X  X       X     X          X
                                        X     X  XXXXXXX   XXXXX           XXXXXXX
1
    04MAY11      12:33:46                                                                    PAGE    1


                                                                          THIS RUN EXECUTED 04MAY11    12:33:46
 ************************************
  HEC-2 WATER SURFACE PROFILES

  Version   4.6.2;  May 1991
 ************************************


 T1      PW COUNTY, VIRGINIA               HNTB CORP. ARLINGTON
 T2      MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY FIS ANALYSIS
 T3      BROAD RUN              100-YEAR FLOOD          FG   03/2010
 T4      DUPLICATE EFFECTIVE INCLUDING FEMA ISSUED LOMRS-DIVIDED FLOW REACH
 T5      MODEL BEGINS AT FEMA X/S "R" STA. 170.000

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                4                                                          174.47

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

       1                -1


 J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     110        150        200

 J5  LPRNT    NUMSEC                    ********REQUESTED SECTION NUMBERS********

     -10       -10

 NC      0.1        0.1      0.045        0.1         0.3
 QT        5       8930      15300      18100       26100       18100

     LETTERED CROSS-SECTION R

 ET                                                    7.11         925        3225
 X1   170.00         25       1965       2040           0           0          0
```

```
GR      185        610        180        635        175        660        170        720        165        865
GR    162.5       1165        161       1665        160       1865        155       1965      152.7       1970
GR    152.7       2000      152.7       2030        155       2040        160       2045        161       2090
GR      160       2140        159       2275        160       2460        165       2620      167.5       3025
GR      168       3325        170       3520        175       3810        180       4050        185       4270

    LETTERED CROSS-SECTION S


ET                                                                 7.11       1820       4235
X1   180.00         28       1970       2035       1000       1000       1000
GR      185       1140        180       1205        175       1285        170       1370        165       1480
GR      163       1570      162.5       1710        161       1860      160.0       1945        155       1970
GR    153.3       1975      153.3       2000      153.3       2030        155       2035        157       2075
GR      162       2270        164       3000        165       3285        166       3330        165       3380
GR      164       3680        165       3800        168       4000        170       4200        173       4500
GR      175       4630        180       4790        185       5000
1
   04MAY11      12:33:46                                                                                PAGE    2


   LETTERED CROSS SECTION T ON THE EFFECTIVE FIS
   MODIFIED LOCATION OF ROB AND ADJUSTED GR ACCORDINGLY
   ROB IS BLOCKED BECAUSE OF DIVIDED FLOW
   THE DIVIDED FLOW SECTION STARTS AS A TRIBUTARY WITH COMMON XS-180


QT        5       3025       2480       2220       5250       2220
ET                 7.1        7.1        7.1        7.1        9.1          0       4435     1937.39       2437
X1   190.00         28       1970       2020       1000       1000       1000
GR      185       1920        155       1970      153.8       2000        155       2020        160       2030
GR      161       2250      162.5       2455        163       2750      162.5       3000        160       3150
GR    162.5       3350      162.5       3625        160       3730        163       3915        165       4100
GR      168       4435        164       4625        160       4645        160       4665        164       4675
GR      166       4955        168       5060        170       5335        172       5665        174       5815
GR      176       5925        178       6135        180       6255

   JUST UPSTREAM OF CANNON BRANCH


NC     0.07       0.07      0.045        0.1        0.3
ET                 7.1        7.1        7.1        7.1        9.1       1080       2510       1250       1350
X1      243         19       1250       1350       4920       1480       3938
GR      180          0        178         20        176        100        174        215        172        330
GR      170        520        168        570        166        660        160        680        160       1250
GR    153.2       1300        160       1350        164       1360        166       2070        168       2120
GR      168       2340        166       2490        166       3170        176       3280

   INSERTED XS TO EVALUATE IMPACT OF PROPOSED SITE(5/21/01)


NC     0.07       0.07      0.045        0.1        0.3
ET                 7.1        7.1        7.1        7.1        9.1       3445       4145       3485       3560
X1    243.2         20       3485       3560        730        200        730
GR      184          0        180        220        178       1780        176       1990        174       2650
GR      172       2840        170       3045        166       3105        166       3450        160       3485
GR    155.1       3520        160       3560        164       3580        166       3600        168       3700
GR      168       3900        166       4100        165       4450        168       4750        176       4900

   MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY
   THIS THE DOWNSTREAM FACE OF THE SMALL RUNWAY FROM EFFECTIVE MODEL


NC                                    0.3        0.5
```

```
ET                                                    9.11                                  3835        3990
X1   243.38         13       3885       3940         600         300         600
X3       10                                                                    176         176
GR      180          0        175        400         172        1550         172        3800         170        3845
GR      160       3845      156.7       3910         160        3940         170        3980         170        4040
GR      168       4100        170       4470         176        4790
```

THIS IS SMALL RUNWAY CROSSING

1


```
SB                1.60        2.7         0.0          30                  423         0.0       156.8       156.7
```

THIS IS THE U/S FACE OF THE SMALL RUNWAY

```
ET                                                    9.11                                  3890        4050
X1       245          15       3940       3975         230         230         230
X2                             1      170.9       176.6
X3       10                                                                  176.9       176.6
BT      -10           0        180                    550       177.3                    1900       177.3
BT                 3100      176.9                   3940       176.6                 3944.99       176.6
BT                 3945      176.6       170.9       3975       176.6       170.9     3975.01       176.6
BT                 5030      176.6
GR      180           0        175        550         174        1900         175        3100         174        3500
GR      172        3570        170       3890         160        3940       156.8        3960         160        3975
GR      170        4020        174       4090         175        4260         175        4890       176.2        5030
```

THIS IS THE CROSS SECTION BETWEEN THE RUNWAYS

```
ET                 7.11       7.11       7.11                    9.11        3880        4040        3880        4040
X1       246          14       3930       3980            5         140          50
GR      180           0        175        550         174        1900         175        3100         174        3500
GR      172        3570        170       3880         160        3930       156.8        3955         160        3980
GR      170        4040        172       4050         174        4970       175.2        5030
```

THIS IS THE D/S FACE OF RUNWAY 34-R

```
ET                                                    9.11                                  3880        4030
X1       250          13       3930       3980            5          60          40
X3       10                                                                    177         177
GR      180           0        175        550         174        1900         175        3100         174        3500
GR      172        3570        170       3880         160        3930      156.84        3955         160        3980
GR      172        4035        174       4350       175.2        5030
```

```
SB                2.29        2.7         0.0          30                  375         0.0       157.0      156.84
```

THIS SECTION IS FROM EFFECTIVE MODEL
THE X2 MIN HIGH CORD WAS REVISED TO MATCH EXISTING CONDITIONS

```
ET                7.1        7.1         7.1         7.1         9.1        3330        3750        3540        3750
X1   250.12          18       3650       3695         482         482         482
X2                             1      169.5       177.4
X3       10                                                                  177.9       177.9
BT       -8           0        180                    450         180                    2850       178.6
BT              3659.99      177.9                   3660       177.9       169.5        3690       177.9       169.5
BT              3690.01      177.9                   5050       177.9
GR      180           0        175        450         174        2850         174        3270         172        3450
GR      170        3600        160       3650         157        3675         160        3695         168        3730
GR      168        3920      165.3       3980         168        4100         170        4225         172        4300
GR      168        4430        180       4700         194        5050
```

LETTERED CROSS-SECTION "U" ON EFFECTIVE FIS

1

THIS SECTION IS THE FIRST SECTION U/S OF THE DIVIDED FLOW INSERTED
AN INEFFECTIVE FLOW ENCROACHMENT AT 500' FROM LEFT CHANNEL BANK FOR THE
NATURAL RUN. INEFFECTIVE FLOW AREA DUE TO FILL PLACED IN FLOODPLAIN
AT CROSS-SECTION 270

NC	0.1	0.1	0.045	0.1	0.3					
QT	5	8780	15000	17700	25700	17700				
ET		7.11	7.11	7.11	7.11	9.11	4470	5070	4400	5052.91
X1	264.00	21	4970	5025	1338	1000	1338			
GR	185	840	180	1140	177	1490	177	1770	177	2310
GR	177	2570	177	2870	177	3100	177	3330	176	3530
GR	175	3650	170	3820	165	4410	164	4680	165	4900
GR	166	4925	165	4950	160	4970	157.5	5000	160	5025
GR	185	5070								

THIS CROSS SECTION IS THE INSERTED CROSS SECTION TO REPRESENT
FILL PLACED SINCE THE EFFECTIVE FIS WAS COMPLETED
THERE IS AN ENCR. IN THE NAT. RUN TO REFLECT EFFECTIVE FLOW

ET		7.1	7.1	7.1	7.1	9.1	3150	3710	3210	3700
X1	270	31	3550	3655	520	520	520			
GR	178	0	175	120	175	680	177	760	177	1840
GR	180	1900	180	1950	182.8	1970	182.8	2180	202.8	2180
GR	202.8	2240	182.8	2240	182.8	2325	202.8	2325	202.8	2385
GR	182.8	2385	181.4	2550	201.4	2550	201.4	2620	180.6	2620
GR	180.4	2710	200.4	2710	200.4	2770	182.8	2770	180.9	3150
GR	180	3200	170	3240	170	3550	157.7	3602.5	170	3655
GR	206	3710								

LETTERED CROSS-SECTION V ON EFFECTIVE FIS
INSERTED NEW GR TO ACCOUNT FOR EXTRA FILL PLACED

ET		7.1	7.1	7.1	7.1	9.1	3545	5280	4585	5185
X1	280.55	20	4945	5045	1140	1140	1140			
GR	185	1515	180	1785	177	2130	177	2270	177	2526
GR	177	2630	180	2745	182	3545	176	4305	174	4520
GR	172	4725	170	4925	165	4945	158	5000	165	5045
GR	166	5150	170	5250	175	5270	180	5280	185	5290

INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE (5/21/01)

ET		7.1	7.1	7.1	7.1	9.1	2040	3370	2635	3240
X1	285	17	3060	3130	220	320	320			
GR	180	0	177	100	175	300	178	1100	178	2000
GR	177	2100	177	2300	175	2460	170	2860	165	2990
GR	164	3060	158.2	3095	164	3130	165	3140	170	3250
GR	172	3290	188	3370						

INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE (5/21/01)

1

```
ET               7.1       7.1       7.1       7.1       9.1       1780       3520       2240       3320
X1      300       18      2400      2480      1000      1900       1900
GR      180        0       177       100       175       300        178       1100       178       2000
GR      177     2100       175      2350       170      2390        165       2400      158.7      2440
GR      165     2480       170      2500       170      2580        169       3000       170       3400
GR      175     3600       180      3790       185      3890

   LETTERED CROSS-SECTION W ON EFFECTIVE FIS


ET               7.1       7.1       7.1       7.1       9.1       1790       3855       1950       3335
X1   314.40       29      1975      2055       600       600       1252
GR      185      445       181       695       181       740        181        951       181        960
GR      181     1075       180      1095       178      1180        178       1275       178       1530
GR      180     1605       181      1715       181      1790        180       1820       175       1870
GR      170     1945       165      1975       165      1975      159.1       2000       165       2055
GR      165     2055       170      2120       171      2165        170       2225       169       2410
GR      170     3175       175      3705       180      3755        185       3855

   INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE (5/21/01)


ET                                                    9.1                             1500       2100
X1      320       11      1720      1810       900       550        900
GR      190      100       185       330       180       760        175       1430       170       1720
GR    159.4     1765       170      1810       170      1900        175       2140       180       2870
GR      200     3020

   LETTERED CROSS-SECTION X
   WIDENED FLOODWAY TO REDUCE U/S SURCHARGES


ET                                                   7.11       1400       2240
X1   331.60       17      1955      2040       820       820        820
GR      185     1280       180      1335       178      1480        175       1695       174       1725
GR      174     1825       170      1950       165      1955        165       1955      159.6      2000
GR      165     2040       165      2040       170      2050        173       2150       175       2215
GR      180     2240       185      2245

   LETTERED CROSS-SECTION Y
   WIDENED FLOODWAY TO REDUCE U/S SURCHARGES


ET                                                   7.11       1600       2450
X1   344.95       21      1950      2050      1335      1335       1335
GR      190     1290       185      1325       180      1370        177       1600       177       1750
GR      175     1855       170      1900       165      1950        165       1950       159       2000
GR      165     2050       165      2050       170      2090        173       2180       170       2250
GR      169     2265       170      2335       175      2410        180       2530       185       2625
GR      190     2810

   LETTERED CROSS-SECTION Z
   SOUTHERN RAILROAD
1
   04MAY11      12:33:46                                                                          PAGE    6


ET                                                   7.11       1840       2280
X1   350.00       14      1965      2030       505       505        505
GR      190     1230       185      1350       180      1590        175       1835       170       1940
GR      165     1965       165      1965       160      2000        165       2030       165       2030
GR      170     2055       175      2105       180      2600        185       2670
    DIVIDED FLOW REACH
```

```
 NC      0.1       0.07      0.045        0.1         0.3
 QT        5       8930      15300      18100       26100       18100
 ET                                                             7.11        1600        3900
 X1   -180.0         28       1970       2035        1000        1000        1000
 GR      185       1140        180       1205         175        1285         170        1370         165        1480
 GR      163       1570      162.5       1710         161        1860       160.0        1945         155        1970
 GR    153.3       1975      153.3       2000       153.3        2030         155        2035         157        2075
 GR      162       2270        164       3000         165        3285         166        3330         165        3380
 GR      164       3680        165       3800         168        4000         170        4200         173        4500
 GR      175       4630        180       4790         185        5000

    LETTERED CROSS SECTION T ON THE EFFECTIVE FIS
    MODIFIED LOCATION OF ROB AND ADJUSTED GR ACCORDINGLY


 QT        5       5905      12820      15880       20850       15880
    THE CHANNEL ROUGHNESS IS ESSENTIALLY THE SAME AS OB SINCE IT IS NOT NATURAL
    CHANNEL - ASLO lEFT IS BLOCKED BECAUSE OF DIVIDED FLOW
 NC      0.1       0.07      0.045        0.1         0.3
 ET                7.1         7.1         7.1         7.1         9.1        4435        6255        4485        5800
 X1   190.00         28       1970       2020        1100         550        1100
 GR      185       1920        155       1970       153.8        2000         155        2020         160        2030
 GR      161       2250      162.5       2455         163        2750       162.5        3000         160        3150
 GR    162.5       3350      162.5       3625         160        3730         163        3915         165        4100
 GR      168       4435        164       4625         160        4645         160        4665         164        4675
 GR      166       4955        168       5060         170        5335         172        5665         174        5815
 GR      176       5925        178       6135         180        6255


 NC     0.07       0.07       0.07
 ET                                                             9.1                                    220         685
 X1    200.0         14        220         430         820         890         820
 GR      200          0      177.6           1         176          90         174         150         170         200
 GR      168        220        164         260         166         430         167         750         172         760
 GR      174        910        176        1035         178        1200         180        1320


 ET                                                             9.1                                    200         710
 X1      225         13        240         280         460         460         460
 GR    177.9          0      177.1          50         176          95         174         160         172         180
 GR      170        205        168         240         166         260         168         280         168         475
 GR      170        710        172         730         177         810

1
    04MAY11      12:33:46                                                                                    PAGE    7


 NC     0.07       0.07       .045
 ET                7.1         7.1         7.1         7.1         9.1        3750        5050        3870        4400
 X1   250.12         18        3650       3695         490         260         490
 GR      180          0         175        450         174        2850         174        3270         172        3450
 GR      170       3600         160       3650         157        3675         160        3695         168        3730
 GR      168       3920       165.3       3980         168        4100         170        4225         172        4300
 GR      168       4430         180       4700         194        5050
1
    04MAY11      12:33:46                                                                                    PAGE    8


 T1      PW COUNTY, VIRGINIA              HNTB CORP. ARLINGTON
 T2      MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY FIS ANALYSIS
 T3      BROAD RUN        100-YEAR FLOODWAY            FG         04/2008

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ
```

```
                6                                                                  175.21

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM      ITRACE

       2                 -1

1
    04MAY11      12:33:46                                                                                    PAGE    9


 T1      PW COUNTY, VIRGINIA               HNTB CORP. ARLINGTON
 T2      MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY FIS ANALYSIS
 T3      BROAD RUN              10-YEAR             FG         04/2008

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                          .0006

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM      ITRACE

       3                 -1

1
    04MAY11      12:33:46                                                                                    PAGE   10


 T1      PW COUNTY, VIRGINIA               HNTB CORP. ARLINGTON
 T2      MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY FIS ANALYSIS
 T3      BROAD RUN              50-YEAR             FG         04/2008

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                3                          .0006

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM      ITRACE

       4                 -1

1
    04MAY11      12:33:46                                                                                    PAGE   11


 T1      PW COUNTY, VIRGINIA               HNTB CORP. ARLINGTON
 T2      MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY FIS ANALYSIS
 T3      BROAD RUN              500-YEAR            FG         04/2008

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                5                          .0006

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM      ITRACE

       5                 -1

1
    04MAY11      12:33:46                                                                                    PAGE   12



                                                                        THIS RUN EXECUTED 04MAY11    12:33:47
 ************************************
  HEC-2 WATER SURFACE PROFILES
```

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BROAD RUN

SUMMARY PRINTOUT TABLE 110

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	170.000	174.47	.00	174.48	3112.90	8136.63	2753.13	7210.25	.00	.00	1965.00	2040.00	.00
	170.000	175.21	.74	175.22	2300.00	8057.99	2875.35	7166.65	2300.00	925.00	1965.00	2040.00	3225.00
	170.000	164.64	.00	164.75	1699.67	2900.13	3628.58	2401.29	.00	.00	1965.00	2040.00	.00
	170.000	166.64	.00	166.75	2068.57	6111.35	4686.91	4501.74	.00	.00	1965.00	2040.00	.00
	170.000	168.96	.00	169.08	2668.49	11447.21	6159.08	8493.71	.00	.00	1965.00	2040.00	.00
	180.000	174.52	.00	174.53	3305.23	3788.54	2409.01	11902.45	.00	.00	1970.00	2035.00	.00
	180.000	175.26	.74	175.27	2415.00	1463.37	2711.42	13925.21	2415.00	1820.00	1970.00	2035.00	4235.00
	180.000	165.29	.00	165.44	2278.18	1641.26	3685.21	3603.53	.00	.00	1970.00	2035.00	.00
	180.000	167.26	.00	167.38	2520.32	3104.38	4353.12	7842.50	.00	.00	1970.00	2035.00	.00
	180.000	169.58	.00	169.68	2777.54	5437.45	5384.75	15277.81	.00	.00	1970.00	2035.00	.00
	190.000	174.54	.00	174.54	2497.59	17.22	217.08	1985.70	4435.00	.00	1970.00	2020.00	4435.00
*	190.000	175.31	.76	175.31	499.61	60.65	727.55	1431.80	499.61	1937.39	1970.00	2020.00	2437.00
	190.000	165.74	-9.57	165.75	2230.55	31.08	742.29	2251.63	4435.00	.00	1970.00	2020.00	4435.00
	190.000	167.58	1.84	167.58	2438.97	21.93	441.56	2016.51	4435.00	.00	1970.00	2020.00	4435.00
	190.000	169.88	2.31	169.89	2489.81	42.21	709.77	4498.02	4435.00	.00	1970.00	2020.00	4435.00
*	243.000	174.55	.00	174.55	1430.00	410.08	559.06	1250.86	1430.00	1080.00	1250.00	1350.00	2510.00
*	243.000	175.34	.80	175.36	100.00	.00	2220.00	.00	100.00	1250.00	1250.00	1350.00	1350.00
*	243.000	166.02	-9.32	166.06	1011.84	941.20	1848.01	235.79	1430.00	1080.00	1250.00	1350.00	2510.00
*	243.000	167.64	1.62	167.65	1173.59	702.91	1216.16	560.93	1430.00	1080.00	1250.00	1350.00	2510.00
*	243.000	169.96	2.32	169.97	1430.00	1246.46	1921.24	2082.30	1430.00	1080.00	1250.00	1350.00	2510.00
*	243.200	174.55	.00	174.55	700.00	147.75	901.31	1170.94	700.00	3445.00	3485.00	3560.00	4145.00
*	243.200	175.37	.82	175.41	75.00	.00	2220.00	.00	75.00	3485.00	3485.00	3560.00	3560.00
*	243.200	166.11	-9.25	166.37	217.14	150.68	2720.54	153.78	700.00	3445.00	3485.00	3560.00	4145.00
*	243.200	167.64	1.52	167.73	446.86	170.27	2034.59	275.14	700.00	3445.00	3485.00	3560.00	4145.00
*	243.200	169.95	2.31	170.07	700.00	386.01	3266.74	1597.26	700.00	3445.00	3485.00	3560.00	4145.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	243.380	174.54	.00	174.57	95.00	.00	2220.00	.00	.00	.00	3845.00	3940.00	.00
	243.380	175.42	.88	175.45	95.00	.00	2220.00	.00	155.00	3835.00	3845.00	3940.00	3990.00
	243.380	166.69	-8.73	166.91	95.00	.00	3025.00	.00	.00	.00	3845.00	3940.00	.00
	243.380	167.83	1.14	167.95	95.00	.00	2480.00	.00	.00	.00	3845.00	3940.00	.00
*	243.380	170.15	2.33	170.49	95.00	.00	5250.00	.00	.00	.00	3845.00	3940.00	.00
*	245.000	175.00	.00	175.23	35.00	.00	2220.00	.00	.00	.00	3940.00	3975.00	.00
*	245.000	175.90	.90	176.11	35.00	.00	2220.00	.00	160.00	3890.00	3940.00	3975.00	4050.00
*	245.000	166.31	-9.59	168.16	35.00	.00	3025.00	.00	.00	.00	3940.00	3975.00	.00
*	245.000	167.62	1.30	168.54	35.00	.00	2480.00	.00	.00	.00	3940.00	3975.00	.00
*	245.000	172.13	4.51	173.98	35.00	.00	5250.00	.00	.00	.00	3940.00	3975.00	.00
*	246.000	175.26	.00	175.29	160.00	367.16	1405.99	446.84	160.00	3880.00	3930.00	3980.00	4040.00
*	246.000	176.14	.88	176.16	160.00	376.82	1383.89	459.30	160.00	3880.00	3930.00	3980.00	4040.00
*	246.000	168.47	-7.67	168.74	143.12	301.00	2361.37	362.62	160.00	3880.00	3930.00	3980.00	4040.00

*	246.000	168.64	.17	168.82	145.10	251.94	1924.54	303.52	160.00	3880.00	3930.00	3980.00	4040.00
*	246.000	174.48	5.83	174.55	2893.05	1480.89	2430.92	1338.18	.00	.00	3930.00	3980.00	.00
*	250.000	175.23	.00	175.33	50.00	.00	2220.00	.00	.00	.00	3930.00	3980.00	.00
*	250.000	176.10	.88	176.20	50.00	.00	2220.00	.00	150.00	3880.00	3930.00	3980.00	4030.00
	250.000	168.37	-7.74	168.94	50.00	.00	3025.00	.00	.00	.00	3930.00	3980.00	.00
	250.000	168.57	.21	168.94	50.00	.00	2480.00	.00	.00	.00	3930.00	3980.00	.00
*	250.000	174.18	5.61	174.87	50.00	.00	5250.00	.00	.00	.00	3930.00	3980.00	.00
	250.120	176.35	.00	176.47	45.00	.00	2220.00	.00	420.00	3330.00	3650.00	3695.00	3750.00
	250.120	177.24	.89	177.35	45.00	.00	2220.00	.00	210.00	3540.00	3650.00	3695.00	3750.00
*	250.120	169.11	-8.13	169.74	45.00	.00	3025.00	.00	420.00	3330.00	3650.00	3695.00	3750.00
*	250.120	169.05	-.06	169.48	45.00	.00	2480.00	.00	420.00	3330.00	3650.00	3695.00	3750.00
*	250.120	178.28	9.23	178.33	420.00	2196.06	2244.64	809.30	420.00	3330.00	3650.00	3695.00	3750.00
*	264.000	176.94	.00	177.13	585.50	11842.56	5505.19	352.25	600.00	4470.00	4970.00	5025.00	5070.00
*	264.000	177.69	.75	177.82	652.91	12447.63	4916.29	336.08	652.91	4400.00	4970.00	5025.00	5052.91
*	264.000	170.97	-6.72	171.17	574.75	5075.10	3565.87	139.03	600.00	4470.00	4970.00	5025.00	5070.00
*	264.000	171.56	.59	172.04	575.81	8897.06	5860.15	242.79	600.00	4470.00	4970.00	5025.00	5070.00
*	264.000	178.76	7.20	179.04	588.76	17524.00	7629.52	546.48	600.00	4470.00	4970.00	5025.00	5070.00
*	270.000	177.05	.00	177.84	453.96	5792.48	11852.79	54.73	560.00	3150.00	3550.00	3655.00	3710.00
*	270.000	177.70	.65	178.37	456.76	6063.83	11573.78	62.38	490.00	3210.00	3550.00	3655.00	3700.00
*	270.000	170.85	-6.85	172.81	419.72	343.59	8436.01	.40	560.00	3150.00	3550.00	3655.00	3710.00
*	270.000	172.62	1.78	175.13	429.51	2317.01	12674.70	8.29	560.00	3150.00	3550.00	3655.00	3710.00
*	270.000	178.90	6.28	179.98	464.22	9430.69	16157.53	111.78	560.00	3150.00	3550.00	3655.00	3710.00
*	280.550	178.77	.00	178.97	1323.05	4571.72	8581.92	4546.36	1735.00	3545.00	4945.00	5045.00	5280.00
*	280.550	179.24	.48	179.53	600.00	4080.64	9841.32	3778.04	600.00	4585.00	4945.00	5045.00	5185.00
*	280.550	174.47	-4.77	174.67	798.87	885.08	5624.59	2270.33	1735.00	3545.00	4945.00	5045.00	5280.00
*	280.550	177.01	2.54	177.26	1097.15	2913.14	8145.19	3941.67	1735.00	3545.00	4945.00	5045.00	5280.00
*	280.550	181.02	4.01	181.25	1611.37	8560.36	10849.97	6289.67	1735.00	3545.00	4945.00	5045.00	5280.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
	285.000	178.95	.00	179.12	1284.76	8275.31	6421.78	3002.91	1330.00	2040.00	3060.00	3130.00	3370.00
	285.000	179.48	.53	179.71	605.00	7932.50	7215.36	2552.14	605.00	2635.00	3060.00	3130.00	3240.00
	285.000	174.67	-4.81	174.84	817.48	3050.34	4348.63	1381.03	1330.00	2040.00	3060.00	3130.00	3370.00
	285.000	177.25	2.58	177.46	1241.69	6302.46	6156.87	2540.68	1330.00	2040.00	3060.00	3130.00	3370.00
	285.000	181.22	3.97	181.41	1296.09	13330.84	8067.09	4302.08	1330.00	2040.00	3060.00	3130.00	3370.00
*	300.000	179.66	.00	179.73	1740.00	1126.19	5138.40	11435.41	1740.00	1780.00	2400.00	2480.00	3520.00
*	300.000	180.31	.65	180.40	1080.00	848.17	5716.89	11134.94	1080.00	2240.00	2400.00	2480.00	3320.00
*	300.000	175.50	-4.81	175.58	1233.05	143.68	3576.39	5059.93	1740.00	1780.00	2400.00	2480.00	3520.00
*	300.000	178.14	2.64	178.23	1740.00	563.79	4873.53	9562.68	1740.00	1780.00	2400.00	2480.00	3520.00
*	300.000	181.95	3.81	182.03	1740.00	2644.43	6464.91	16590.66	1740.00	1780.00	2400.00	2480.00	3520.00
	314.400	179.85	.00	179.88	1931.98	784.93	3948.30	12966.77	2065.00	1790.00	1975.00	2055.00	3855.00
	314.400	180.53	.68	180.57	1385.00	281.15	4351.59	13067.25	1385.00	1950.00	1975.00	2055.00	3335.00
	314.400	175.74	-4.79	175.78	1849.86	312.60	2816.82	5650.58	2065.00	1790.00	1975.00	2055.00	3855.00
	314.400	178.38	2.63	178.41	1902.52	622.33	3718.31	10659.35	2065.00	1790.00	1975.00	2055.00	3855.00
	314.400	182.15	3.78	182.20	2008.08	1266.32	5027.75	19405.93	2065.00	1790.00	1975.00	2055.00	3855.00
*	320.000	179.94	.00	180.14	2092.36	4527.93	7437.71	5734.35	.00	.00	1720.00	1810.00	.00
*	320.000	180.56	.62	180.90	600.00	3573.80	8920.66	5205.54	600.00	1500.00	1720.00	1810.00	2100.00
*	320.000	175.82	-4.74	176.17	939.65	1150.21	5775.07	1854.71	.00	.00	1720.00	1810.00	.00
*	320.000	178.46	2.64	178.75	1679.89	3259.42	7392.52	4348.06	.00	.00	1720.00	1810.00	.00
*	320.000	182.27	3.81	182.43	2322.37	7935.38	8319.55	9445.07	.00	.00	1720.00	1810.00	.00
	331.600	180.44	.00	180.89	910.26	4413.10	10548.72	2738.18	.00	.00	1955.00	2040.00	.00
	331.600	181.21	.77	181.57	840.00	4798.33	10064.48	2837.19	840.00	1400.00	1955.00	2040.00	2240.00

	331.600	176.63	-4.58	177.01	645.12	1048.79	6780.18	951.04	.00	.00	1955.00	2040.00	.00
	331.600	179.16	2.52	179.64	839.63	3097.87	9748.71	2153.42	.00	.00	1955.00	2040.00	.00
	331.600	182.63	3.48	183.15	936.60	8039.65	13363.76	4296.59	.00	.00	1955.00	2040.00	.00
*	344.950	181.48	.00	181.65	1201.31	3083.65	8893.77	5722.58	.00	.00	1950.00	2050.00	.00
*	344.950	182.06	.58	182.23	850.00	2890.15	8966.07	5843.78	850.00	1600.00	1950.00	2050.00	2450.00
*	344.950	177.53	-4.53	177.67	911.70	850.84	5582.54	2346.62	.00	.00	1950.00	2050.00	.00
*	344.950	180.27	2.73	180.44	1167.42	2224.76	8108.16	4667.08	.00	.00	1950.00	2050.00	.00
*	344.950	183.79	3.52	184.00	1266.10	5580.12	11390.04	8729.84	.00	.00	1950.00	2050.00	.00
*	350.000	181.56	.00	182.03	1106.62	4139.51	9241.63	4318.86	.00	.00	1965.00	2030.00	.00
*	350.000	182.01	.45	182.67	440.00	3241.78	10447.45	4010.77	440.00	1840.00	1965.00	2030.00	2280.00
*	350.000	177.56	-4.45	178.03	648.78	1392.16	6296.25	1091.59	.00	.00	1965.00	2030.00	.00
*	350.000	180.32	2.76	180.86	1030.01	3191.95	8761.46	3046.59	.00	.00	1965.00	2030.00	.00
*	350.000	183.93	3.60	184.38	1253.44	6869.01	11052.51	7778.49	.00	.00	1965.00	2030.00	.00
	-180.000	174.52	.00	174.52	3305.43	2955.54	1879.04	13265.42	.00	.00	1970.00	2035.00	.00
	-180.000	175.26	.74	175.27	2300.00	2367.65	2000.56	13731.79	2300.00	1600.00	1970.00	2035.00	3900.00
	-180.000	165.29	-9.97	165.39	2278.18	1399.27	3141.86	4388.87	.00	.00	1970.00	2035.00	.00
	-180.000	167.26	1.97	167.33	2520.32	2545.25	3569.09	9185.66	.00	.00	1970.00	2035.00	.00
	-180.000	169.58	2.32	169.64	2778.24	4346.86	4301.72	17451.43	.00	.00	1970.00	2035.00	.00

	SECNO	CWSEL	DIFKWS	EG	TOPWID	QLOB	QCH	QROB	PERENC	STENCL	STCHL	STCHR	STENCR
*	190.000	174.53	.00	174.58	1409.58	.00	.00	15880.00	1820.00	4435.00	1970.00	2020.00	6255.00
*	190.000	175.27	.74	175.32	1315.00	.00	.00	15880.00	1315.00	4485.00	1970.00	2020.00	5800.00
*	190.000	166.34	-8.94	167.26	458.83	.00	.00	5905.00	1820.00	4435.00	1970.00	2020.00	6255.00
*	190.000	167.60	1.27	168.86	585.43	.00	.00	12820.00	1820.00	4435.00	1970.00	2020.00	6255.00
*	190.000	169.70	2.09	170.49	858.96	.00	.00	20850.00	1820.00	4435.00	1970.00	2020.00	6255.00
*	200.000	175.10	.00	175.24	861.96	525.13	6741.29	8613.57	.00	.00	220.00	430.00	.00
*	200.000	175.75	.65	175.94	465.00	.00	7965.70	7914.30	465.00	220.00	220.00	430.00	685.00
*	200.000	170.78	-4.97	170.87	567.36	43.43	2955.84	2905.73	.00	.00	220.00	430.00	.00
*	200.000	173.07	2.28	173.24	677.73	254.53	5866.67	6698.81	.00	.00	220.00	430.00	.00
*	200.000	174.56	1.49	174.83	811.91	609.39	9040.58	11200.03	.00	.00	220.00	430.00	.00
*	225.000	175.76	.00	176.00	687.53	1426.59	1584.54	12868.88	.00	.00	240.00	280.00	.00
	225.000	176.47	.71	176.71	510.00	1039.66	1656.45	13183.89	510.00	200.00	240.00	280.00	710.00
*	225.000	171.82	-4.65	172.01	546.03	325.61	824.93	4754.46	.00	.00	240.00	280.00	.00
*	225.000	174.17	2.34	174.44	610.11	978.29	1411.46	10430.24	.00	.00	240.00	280.00	.00
	225.000	175.89	1.72	176.28	693.57	1896.78	2066.61	16886.62	.00	.00	240.00	280.00	.00
*	250.120	176.34	.00	176.45	867.70	.00	.00	15880.00	1300.00	3750.00	3650.00	3695.00	5050.00
	250.120	177.04	.69	177.23	530.00	.00	.00	15880.00	530.00	3870.00	3650.00	3695.00	4400.00
*	250.120	172.59	-4.45	172.65	783.06	.00	.00	5905.00	1300.00	3750.00	3650.00	3695.00	5050.00
*	250.120	174.95	2.36	175.05	836.25	.00	.00	12820.00	1300.00	3750.00	3650.00	3695.00	5050.00
*	250.120	176.79	1.85	176.95	877.80	.00	.00	20850.00	1300.00	3750.00	3650.00	3695.00	5050.00

BROAD RUN

SUMMARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
170.000	.00	.00	.00	152.70	18100.00	174.47	.00	174.48	.45	1.70	31921.84	26971.40
170.000	.00	.00	.00	152.70	18100.00	175.21	.00	175.22	.44	1.72	29608.68	27320.46

	170.000	.00	.00	.00	152.70	8930.00	164.64	.00	164.75	5.97	4.13	6551.53	3653.95
	170.000	.00	.00	.00	152.70	15300.00	166.64	.00	166.75	5.88	4.56	10318.94	6308.53
	170.000	.00	.00	.00	152.70	26100.00	168.96	.00	169.08	6.03	5.12	15863.91	10625.14
	180.000	1000.00	.00	.00	153.30	18100.00	174.52	.00	174.53	.49	1.76	32116.92	25805.23
	180.000	1000.00	.00	.00	153.30	18100.00	175.26	.00	175.27	.56	1.91	28153.52	24281.81
	180.000	1000.00	.00	.00	153.30	8930.00	165.29	.00	165.44	7.84	4.78	6111.48	3189.47
	180.000	1000.00	.00	.00	153.30	15300.00	167.26	.00	167.38	6.55	4.84	10879.82	5976.51
	180.000	1000.00	.00	.00	153.30	26100.00	169.58	.00	169.68	5.99	5.13	16981.36	10663.00
	190.000	1000.00	.00	.00	153.80	2220.00	174.54	.00	174.54	.01	.22	30055.76	25164.45
*	190.000	1000.00	.00	.00	153.80	2220.00	175.31	.00	175.31	.08	.70	7371.99	7988.70
	190.000	1000.00	.00	.00	153.80	3025.00	165.74	.00	165.75	.62	1.31	8416.90	3848.66
	190.000	1000.00	.00	.00	153.80	2480.00	167.58	.00	167.58	.13	.67	12710.64	6814.08
	190.000	1000.00	.00	.00	153.80	5250.00	169.88	.00	169.89	.20	.92	18435.77	11739.99
*	243.000	3938.00	.00	.00	153.20	2220.00	174.55	.00	174.55	.02	.31	14291.28	16034.25
*	243.000	3938.00	.00	.00	153.20	2220.00	175.34	.00	175.36	.37	1.18	1874.13	3636.37
*	243.000	3938.00	.00	.00	153.20	3025.00	166.02	.00	166.06	1.80	1.96	2728.65	2256.86
*	243.000	3938.00	.00	.00	153.20	2480.00	167.64	.00	167.65	.46	1.10	4496.04	3661.51
*	243.000	3938.00	.00	.00	153.20	5250.00	169.96	.00	169.97	.61	1.44	7728.31	6744.37
*	243.200	730.00	.00	.00	155.10	2220.00	174.55	.00	174.55	.11	.71	6124.63	6816.33
*	243.200	730.00	.00	.00	155.10	2220.00	175.37	.00	175.41	.87	1.66	1335.74	2383.40
*	243.200	730.00	.00	.00	155.10	3025.00	166.11	.00	166.37	9.49	4.24	865.48	981.73
*	243.200	730.00	.00	.00	155.10	2480.00	167.64	.00	167.73	3.07	2.69	1373.92	1415.72
*	243.200	730.00	.00	.00	155.10	5250.00	169.95	.00	170.07	3.99	3.51	2905.13	2628.64
*	243.380	600.00	.00	.00	156.70	2220.00	174.54	.00	174.57	.53	1.44	1538.90	3038.59
	243.380	600.00	.00	.00	156.70	2220.00	175.42	.00	175.45	.45	1.37	1621.72	3316.03
	243.380	600.00	.00	.00	156.70	3025.00	166.69	.00	166.91	8.69	3.82	792.04	1026.00
	243.380	600.00	.00	.00	156.70	2480.00	167.83	.00	167.95	3.87	2.75	900.34	1260.96
*	243.380	600.00	.00	.00	156.70	5250.00	170.15	.00	170.49	8.58	4.68	1121.31	1792.77
*	245.000	230.00	176.60	170.90	156.80	2220.00	175.00	.00	175.23	3.23	3.82	580.99	1234.71
*	245.000	230.00	176.60	170.90	156.80	2220.00	175.90	.00	176.11	2.71	3.62	612.54	1348.46
*	245.000	230.00	176.60	170.90	156.80	3025.00	166.31	.00	168.16	70.77	10.91	277.16	359.59
*	245.000	230.00	176.60	170.90	156.80	2480.00	167.62	.00	168.54	28.66	7.69	322.65	463.26
*	245.000	230.00	176.60	170.90	156.80	5250.00	172.13	.00	173.98	34.05	10.93	480.49	899.66
*	246.000	50.00	.00	.00	156.80	2220.00	175.26	.00	175.29	.60	1.67	1971.84	2875.17
*	246.000	50.00	.00	.00	156.80	2220.00	176.14	.00	176.16	.49	1.56	2111.98	3178.37
*	246.000	50.00	.00	.00	156.80	3025.00	168.47	.00	168.74	9.39	4.69	897.42	987.21
*	246.000	50.00	.00	.00	156.80	2480.00	168.64	.00	168.82	5.88	3.76	923.43	1022.90
*	246.000	50.00	.00	.00	156.80	5250.00	174.48	.00	174.55	2.09	3.02	4754.81	3631.40

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	250.000	40.00	.00	.00	156.84	2220.00	175.23	.00	175.33	1.50	2.64	840.30	1811.18
*	250.000	40.00	.00	.00	156.84	2220.00	176.10	.00	176.20	1.27	2.51	884.23	1971.73
	250.000	40.00	.00	.00	156.84	3025.00	168.37	.00	168.94	16.03	6.08	497.26	755.46
	250.000	40.00	.00	.00	156.84	2480.00	168.57	.00	168.94	10.06	4.89	507.66	781.96
*	250.000	40.00	.00	.00	156.84	5250.00	174.18	.00	174.87	10.41	6.66	788.03	1627.35
	250.120	482.00	177.40	169.50	157.00	2220.00	176.35	.00	176.47	1.52	2.76	803.41	1801.73
	250.120	482.00	177.40	169.50	157.00	2220.00	177.24	.00	177.35	1.29	2.63	843.44	1953.83
*	250.120	482.00	177.40	169.50	157.00	3025.00	169.11	.00	169.74	15.97	6.33	477.53	757.03
*	250.120	482.00	177.40	169.50	157.00	2480.00	169.05	.00	169.48	10.94	5.22	474.83	749.93
*	250.120	482.00	177.40	169.50	157.00	5250.00	178.28	.00	178.33	1.10	2.52	4025.60	4999.36
*	264.000	1338.00	.00	.00	157.50	17700.00	176.94	.00	177.13	5.83	5.50	7493.25	7328.48

*	264.000	1338.00	.00	.00	157.50	17700.00	177.69	.00	177.82	4.07	4.72	8821.66	8776.02
*	264.000	1338.00	.00	.00	157.50	8780.00	170.97	.00	171.17	9.21	5.30	4031.17	2893.13
*	264.000	1338.00	.00	.00	157.50	15000.00	171.56	.00	172.04	21.28	8.32	4368.60	3251.96
*	264.000	1338.00	.00	.00	157.50	25700.00	178.76	.00	179.04	8.16	6.93	8558.24	8995.93
*	270.000	520.00	.00	.00	157.70	17700.00	177.05	.00	177.84	22.29	8.55	3707.77	3749.21
*	270.000	520.00	.00	.00	157.70	17700.00	177.70	.00	178.37	18.11	7.96	4003.12	4159.03
*	270.000	520.00	.00	.00	157.70	8780.00	170.85	170.73	172.81	93.27	11.47	1002.45	909.12
*	270.000	520.00	.00	.00	157.70	15000.00	172.62	172.62	175.13	99.36	13.76	1753.95	1504.81
*	270.000	520.00	.00	.00	157.70	25700.00	178.90	.00	179.98	26.70	10.22	4560.45	4973.40
*	280.550	1140.00	.00	.00	158.00	17700.00	178.77	.00	178.97	5.14	4.97	8592.00	7806.11
*	280.550	1140.00	.00	.00	158.00	17700.00	179.24	.00	179.53	6.17	5.55	6459.22	7123.82
*	280.550	1140.00	.00	.00	158.00	8780.00	174.47	.00	174.67	5.73	4.34	4075.75	3668.94
*	280.550	1140.00	.00	.00	158.00	15000.00	177.01	.00	177.26	6.62	5.25	6467.46	5829.38
*	280.550	1140.00	.00	.00	158.00	25700.00	181.02	.00	181.25	5.46	5.56	11904.45	11001.80
	285.000	320.00	.00	.00	158.20	17700.00	178.95	.00	179.12	5.28	5.14	9135.84	7699.93
	285.000	320.00	.00	.00	158.20	17700.00	179.48	.00	179.71	6.05	5.61	7081.49	7196.11
	285.000	320.00	.00	.00	158.20	8780.00	174.67	.00	174.84	6.04	4.58	4526.35	3573.77
	285.000	320.00	.00	.00	158.20	15000.00	177.25	.00	177.46	6.78	5.44	6967.74	5761.86
	285.000	320.00	.00	.00	158.20	25700.00	181.22	.00	181.41	5.60	5.73	12059.41	10860.99
*	300.000	1900.00	.00	.00	158.70	17700.00	179.66	.00	179.73	2.61	3.61	13650.78	10961.45
*	300.000	1900.00	.00	.00	158.70	17700.00	180.31	.00	180.40	2.86	3.87	11564.88	10460.97
*	300.000	1900.00	.00	.00	158.70	8780.00	175.50	.00	175.58	3.06	3.27	7313.09	5018.34
*	300.000	1900.00	.00	.00	158.70	15000.00	178.14	.00	178.23	3.15	3.74	11014.63	8445.18
*	300.000	1900.00	.00	.00	158.70	25700.00	181.95	.00	182.03	2.75	4.02	17645.72	15483.70
	314.400	1252.00	.00	.00	159.10	17700.00	179.85	.00	179.88	1.54	2.77	18091.07	14252.08
	314.400	1252.00	.00	.00	159.10	17700.00	180.53	.00	180.57	1.65	2.94	15755.81	13765.39
	314.400	1252.00	.00	.00	159.10	8780.00	175.74	.00	175.78	1.88	2.57	10327.64	6400.82
	314.400	1252.00	.00	.00	159.10	15000.00	178.38	.00	178.41	1.82	2.85	15267.04	11105.39
	314.400	1252.00	.00	.00	159.10	25700.00	182.15	.00	182.20	1.67	3.13	22647.49	19908.17

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	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	320.000	900.00	.00	.00	159.40	17700.00	179.94	.00	180.14	7.40	5.42	9619.62	6505.84
*	320.000	900.00	.00	.00	159.40	17700.00	180.56	.00	180.90	9.31	6.25	5979.61	5799.53
*	320.000	900.00	.00	.00	159.40	8780.00	175.82	.00	176.17	12.75	5.77	3378.50	2458.79
*	320.000	900.00	.00	.00	159.40	15000.00	178.46	.00	178.75	10.26	5.97	6841.14	4682.41
*	320.000	900.00	.00	.00	159.40	25700.00	182.27	.00	182.43	5.76	5.26	14785.76	10709.80
	331.600	820.00	.00	.00	159.60	17700.00	180.44	.00	180.89	9.10	6.84	6054.46	5866.24
	331.600	820.00	.00	.00	159.60	17700.00	181.21	.00	181.57	7.21	6.26	6644.99	6591.38
	331.600	820.00	.00	.00	159.60	8780.00	176.63	.00	177.01	8.25	5.57	3047.75	3057.52
	331.600	820.00	.00	.00	159.60	15000.00	179.16	.00	179.64	9.93	6.80	4921.26	4761.01
	331.600	820.00	.00	.00	159.60	25700.00	182.63	.00	183.15	9.98	7.73	8082.06	8134.02
*	344.950	1335.00	.00	.00	159.00	17700.00	181.48	.00	181.65	3.68	4.57	9334.55	9221.77
*	344.950	1335.00	.00	.00	159.00	17700.00	182.06	.00	182.23	3.39	4.47	8864.64	9609.05
*	344.950	1335.00	.00	.00	159.00	8780.00	177.53	.00	177.67	3.08	3.59	5037.52	4999.02
*	344.950	1335.00	.00	.00	159.00	15000.00	180.27	.00	180.44	3.79	4.44	7900.94	7702.80
*	344.950	1335.00	.00	.00	159.00	25700.00	183.79	.00	184.00	4.16	5.23	12188.95	12606.37
*	350.000	505.00	.00	.00	160.00	17700.00	181.56	.00	182.03	10.18	7.46	6424.25	5546.99
*	350.000	505.00	.00	.00	160.00	17700.00	182.01	.00	182.67	12.03	8.24	4505.56	5103.51
*	350.000	505.00	.00	.00	160.00	8780.00	177.56	.00	178.03	10.36	6.43	2750.74	2727.56
*	350.000	505.00	.00	.00	160.00	15000.00	180.32	.00	180.86	11.44	7.56	5104.16	4434.31
*	350.000	505.00	.00	.00	160.00	25700.00	183.93	.00	184.38	9.86	7.94	9218.63	8186.16

-180.000	1000.00	.00	.00	153.30	18100.00	174.52	.00	174.52	.30	1.37	32124.94	33089.80
-180.000	1000.00	.00	.00	153.30	18100.00	175.26	.00	175.27	.30	1.41	28778.88	32920.34
-180.000	1000.00	.00	.00	153.30	8930.00	165.29	.00	165.39	5.70	4.08	6111.45	3741.05
-180.000	1000.00	.00	.00	153.30	15300.00	167.26	.00	167.33	4.41	3.97	10879.74	7289.35
-180.000	1000.00	.00	.00	153.30	26100.00	169.58	.00	169.64	3.82	4.10	16997.34	13355.51
* 190.000	1100.00	.00	.00	153.80	15880.00	174.53	.00	174.58	5.08	.00	8680.13	7043.47
* 190.000	1100.00	.00	.00	153.80	15880.00	175.27	.00	175.32	3.99	.00	9285.68	7950.65
* 190.000	1100.00	.00	.00	153.80	5905.00	166.34	166.34	167.26	411.11	.00	764.49	291.23
* 190.000	1100.00	.00	.00	153.80	12820.00	167.60	167.60	168.86	404.96	.00	1425.49	637.06
* 190.000	1100.00	.00	.00	153.80	20850.00	169.70	.00	170.49	156.23	.00	2927.51	1668.09
* 200.000	820.00	.00	.00	164.00	15880.00	175.10	.00	175.24	10.95	3.24	5538.90	4800.00
* 200.000	820.00	.00	.00	164.00	15880.00	175.75	.00	175.94	12.98	3.59	4603.37	4408.37
* 200.000	820.00	.00	.00	164.00	5905.00	170.78	.00	170.87	14.17	2.52	2599.11	1568.55
* 200.000	820.00	.00	.00	164.00	12820.00	173.07	.00	173.24	17.89	3.55	3969.11	3031.12
* 200.000	820.00	.00	.00	164.00	20850.00	174.56	.00	174.83	23.74	4.59	5086.04	4279.66
* 225.000	460.00	.00	.00	166.00	15880.00	175.76	.00	176.00	25.26	4.52	4124.05	3159.73
225.000	460.00	.00	.00	166.00	15880.00	176.47	.00	176.71	21.32	4.37	4078.69	3439.50
* 225.000	460.00	.00	.00	166.00	5905.00	171.82	.00	172.01	50.10	4.28	1738.20	834.22
* 225.000	460.00	.00	.00	166.00	12820.00	174.17	.00	174.44	39.18	4.92	3088.28	2048.15
225.000	460.00	.00	.00	166.00	20850.00	175.89	.00	176.28	40.99	5.81	4210.02	3256.57

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
*	250.120	490.00	.00	.00	157.00	15880.00	176.34	.00	176.45	10.47	.00	6088.66	4908.48
	250.120	490.00	.00	.00	157.00	15880.00	177.04	.00	177.23	16.58	.00	4435.51	3899.52
*	250.120	490.00	.00	.00	157.00	5905.00	172.59	.00	172.65	12.54	.00	2983.60	1667.49
*	250.120	490.00	.00	.00	157.00	12820.00	174.95	.00	175.05	13.26	.00	4897.72	3520.76
*	250.120	490.00	.00	.00	157.00	20850.00	176.79	.00	176.95	14.92	.00	6480.51	5398.68

BROAD RUN

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SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
170.000	18100.00	174.47	.00	.00	.00	3112.90	.00
170.000	18100.00	175.21	.74	.00	.74	2300.00	.00
170.000	8930.00	164.64	-10.57	.00	.00	1699.67	.00
170.000	15300.00	166.64	2.01	.00	.00	2068.57	.00
170.000	26100.00	168.96	2.32	.00	.00	2668.49	.00
180.000	18100.00	174.52	.00	.05	.00	3305.23	1000.00
180.000	18100.00	175.26	.74	.05	.74	2415.00	1000.00
180.000	8930.00	165.29	-9.97	.65	.00	2278.18	1000.00
180.000	15300.00	167.26	1.97	.62	.00	2520.32	1000.00
180.000	26100.00	169.58	2.32	.62	.00	2777.54	1000.00
190.000	2220.00	174.54	.00	.03	.00	2497.59	1000.00
* 190.000	2220.00	175.31	.76	.05	.76	499.61	1000.00
190.000	3025.00	165.74	-9.57	.45	-9.57	2230.55	1000.00
190.000	2480.00	167.58	1.84	.32	1.84	2438.97	1000.00
190.000	5250.00	169.88	2.31	.31	2.31	2489.81	1000.00

*	243.000	2220.00	174.55	.00	.00	.00	1430.00	3938.00
*	243.000	2220.00	175.34	.80	.03	.80	100.00	3938.00
*	243.000	3025.00	166.02	-9.32	.28	-9.32	1011.84	3938.00
*	243.000	2480.00	167.64	1.62	.06	1.62	1173.59	3938.00
*	243.000	5250.00	169.96	2.32	.07	2.32	1430.00	3938.00
*	243.200	2220.00	174.55	.00	.00	.00	700.00	730.00
*	243.200	2220.00	175.37	.82	.02	.82	75.00	730.00
*	243.200	3025.00	166.11	-9.25	.09	-9.25	217.14	730.00
*	243.200	2480.00	167.64	1.52	.00	1.52	446.86	730.00
*	243.200	5250.00	169.95	2.31	-.01	2.31	700.00	730.00
*	243.380	2220.00	174.54	.00	.00	.00	95.00	600.00
	243.380	2220.00	175.42	.88	.05	.88	95.00	600.00
	243.380	3025.00	166.69	-8.73	.57	-8.73	95.00	600.00
	243.380	2480.00	167.83	1.14	.19	1.14	95.00	600.00
*	243.380	5250.00	170.15	2.33	.21	2.33	95.00	600.00
*	245.000	2220.00	175.00	.00	.46	.00	35.00	230.00
*	245.000	2220.00	175.90	.90	.48	.90	35.00	230.00
*	245.000	3025.00	166.31	-9.59	-.37	-9.59	35.00	230.00
*	245.000	2480.00	167.62	1.30	-.21	1.30	35.00	230.00
*	245.000	5250.00	172.13	4.51	1.97	4.51	35.00	230.00
*	246.000	2220.00	175.26	.00	.26	.00	160.00	50.00
*	246.000	2220.00	176.14	.88	.24	.88	160.00	50.00
*	246.000	3025.00	168.47	-7.67	2.15	-7.67	143.12	50.00
*	246.000	2480.00	168.64	.17	1.02	.17	145.10	50.00
*	246.000	5250.00	174.48	5.83	2.35	5.83	2893.05	50.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	250.000	2220.00	175.23	.00	-.04	.00	50.00	40.00
*	250.000	2220.00	176.10	.88	-.03	.88	50.00	40.00
	250.000	3025.00	168.37	-7.74	-.10	-7.74	50.00	40.00
	250.000	2480.00	168.57	.21	-.07	.21	50.00	40.00
*	250.000	5250.00	174.18	5.61	-.29	5.61	50.00	40.00
	250.120	2220.00	176.35	.00	1.13	.00	45.00	482.00
	250.120	2220.00	177.24	.89	1.14	.89	45.00	482.00
*	250.120	3025.00	169.11	-8.13	.75	-8.13	45.00	482.00
*	250.120	2480.00	169.05	-.06	.48	-.06	45.00	482.00
*	250.120	5250.00	178.28	9.23	4.10	9.23	420.00	482.00
*	264.000	17700.00	176.94	.00	.59	.00	585.50	1338.00
*	264.000	17700.00	177.69	.75	.45	.75	652.91	1338.00
*	264.000	8780.00	170.97	-6.72	1.86	-6.72	574.75	1338.00
*	264.000	15000.00	171.56	.59	2.51	.59	575.81	1338.00
*	264.000	25700.00	178.76	7.20	.47	7.20	588.76	1338.00
*	270.000	17700.00	177.05	.00	.10	.00	453.96	520.00
*	270.000	17700.00	177.70	.65	.01	.65	456.76	520.00
*	270.000	8780.00	170.85	-6.85	-.13	-6.85	419.72	520.00
*	270.000	15000.00	172.62	1.78	1.06	1.78	429.51	520.00
*	270.000	25700.00	178.90	6.28	.15	6.28	464.22	520.00
*	280.550	17700.00	178.77	.00	1.72	.00	1323.05	1140.00
*	280.550	17700.00	179.24	.48	1.55	.48	600.00	1140.00
*	280.550	8780.00	174.47	-4.77	3.62	-4.77	798.87	1140.00
*	280.550	15000.00	177.01	2.54	4.39	2.54	1097.15	1140.00
*	280.550	25700.00	181.02	4.01	2.12	4.01	1611.37	1140.00

	285.000	17700.00	178.95	.00	.18	.00	1284.76	320.00
	285.000	17700.00	179.48	.53	.24	.53	605.00	320.00
	285.000	8780.00	174.67	-4.81	.20	-4.81	817.48	320.00
	285.000	15000.00	177.25	2.58	.24	2.58	1241.69	320.00
	285.000	25700.00	181.22	3.97	.19	3.97	1296.09	320.00
*	300.000	17700.00	179.66	.00	.71	.00	1740.00	1900.00
*	300.000	17700.00	180.31	.65	.83	.65	1080.00	1900.00
*	300.000	8780.00	175.50	-4.81	.83	-4.81	1233.05	1900.00
*	300.000	15000.00	178.14	2.64	.90	2.64	1740.00	1900.00
*	300.000	25700.00	181.95	3.81	.74	3.81	1740.00	1900.00
	314.400	17700.00	179.85	.00	.19	.00	1931.98	1252.00
	314.400	17700.00	180.53	.68	.22	.68	1385.00	1252.00
	314.400	8780.00	175.74	-4.79	.24	-4.79	1849.86	1252.00
	314.400	15000.00	178.38	2.63	.23	2.63	1902.52	1252.00
	314.400	25700.00	182.15	3.78	.20	3.78	2008.08	1252.00

1

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	320.000	17700.00	179.94	.00	.09	.00	2092.36	900.00
*	320.000	17700.00	180.56	.62	.03	.62	600.00	900.00
*	320.000	8780.00	175.82	-4.74	.08	-4.74	939.65	900.00
*	320.000	15000.00	178.46	2.64	.09	2.64	1679.89	900.00
*	320.000	25700.00	182.27	3.81	.12	3.81	2322.37	900.00
	331.600	17700.00	180.44	.00	.50	.00	910.26	820.00
	331.600	17700.00	181.21	.77	.65	.77	840.00	820.00
	331.600	8780.00	176.63	-4.58	.81	-4.58	645.12	820.00
	331.600	15000.00	179.16	2.52	.69	2.52	839.63	820.00
	331.600	25700.00	182.63	3.48	.36	3.48	936.60	820.00
*	344.950	17700.00	181.48	.00	1.04	.00	1201.31	1335.00
*	344.950	17700.00	182.06	.58	.85	.58	850.00	1335.00
*	344.950	8780.00	177.53	-4.53	.90	-4.53	911.70	1335.00
*	344.950	15000.00	180.27	2.73	1.11	2.73	1167.42	1335.00
*	344.950	25700.00	183.79	3.52	1.16	3.52	1266.10	1335.00
*	350.000	17700.00	181.56	.00	.08	.00	1106.62	505.00
*	350.000	17700.00	182.01	.45	-.05	.45	440.00	505.00
*	350.000	8780.00	177.56	-4.45	.02	-4.45	648.78	505.00
*	350.000	15000.00	180.32	2.76	.06	2.76	1030.01	505.00
*	350.000	25700.00	183.93	3.60	.14	3.60	1253.44	505.00
	-180.000	18100.00	174.52	.00	-7.04	.00	3305.43	1000.00
	-180.000	18100.00	175.26	.74	-6.75	.74	2300.00	1000.00
	-180.000	8930.00	165.29	-9.97	-12.27	-9.97	2278.18	1000.00
	-180.000	15300.00	167.26	1.97	-13.06	1.97	2520.32	1000.00
	-180.000	26100.00	169.58	2.32	-14.35	2.32	2778.24	1000.00
*	190.000	15880.00	174.53	.00	.01	.00	1409.58	1100.00
*	190.000	15880.00	175.27	.74	.02	.74	1315.00	1100.00
*	190.000	5905.00	166.34	-8.94	1.05	-8.94	458.83	1100.00
*	190.000	12820.00	167.60	1.27	.35	1.27	585.43	1100.00
*	190.000	20850.00	169.70	2.09	.12	2.09	858.96	1100.00
*	200.000	15880.00	175.10	.00	.57	.00	861.96	820.00
*	200.000	15880.00	175.75	.65	.48	.65	465.00	820.00
*	200.000	5905.00	170.78	-4.97	4.45	-4.97	567.36	820.00
*	200.000	12820.00	173.07	2.28	5.46	2.28	677.73	820.00

*	200.000	20850.00	174.56	1.49	4.86	1.49	811.91	820.00
*	225.000	15880.00	175.76	.00	.66	.00	687.53	460.00
	225.000	15880.00	176.47	.71	.72	.71	510.00	460.00
*	225.000	5905.00	171.82	-4.65	1.04	-4.65	546.03	460.00
*	225.000	12820.00	174.17	2.34	1.10	2.34	610.11	460.00
	225.000	20850.00	175.89	1.72	1.33	1.72	693.57	460.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	250.120	15880.00	176.34	.00	.58	.00	867.70	490.00
	250.120	15880.00	177.04	.69	.57	.69	530.00	490.00
*	250.120	5905.00	172.59	-4.45	.77	-4.45	783.06	490.00
*	250.120	12820.00	174.95	2.36	.78	2.36	836.25	490.00
*	250.120	20850.00	176.79	1.85	.91	1.85	877.80	490.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 190.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 243.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.000 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.000 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 243.200 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.200 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.200 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.200 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.200 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 243.380 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 243.380 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 245.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 245.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO= 245.000 PROFILE= 3 BRIDGE DECK DEFINITION ERROR
WARNING SECNO= 245.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO= 245.000 PROFILE= 4 BRIDGE DECK DEFINITION ERROR
WARNING SECNO= 245.000 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 245.000 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 246.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 246.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 246.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 246.000 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 246.000 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 250.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 250.000 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 250.000 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO= 250.120 PROFILE= 3 BRIDGE DECK DEFINITION ERROR

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 CAUTION SECNO=    250.120  PROFILE=  4  BRIDGE DECK DEFINITION ERROR
 WARNING SECNO=    250.120  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    264.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    264.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    264.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    264.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    264.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    270.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    270.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    270.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 CAUTION SECNO=    270.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
 CAUTION SECNO=    270.000  PROFILE=  4  PROBABLE MINIMUM SPECIFIC ENERGY
 CAUTION SECNO=    270.000  PROFILE=  4  20 TRIALS ATTEMPTED TO BALANCE WSEL
1
    04MAY11      12:33:46                                                                          PAGE   25


 WARNING SECNO=    270.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    280.550  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    280.550  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    280.550  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    280.550  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    280.550  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    300.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    300.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    300.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    300.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    300.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    320.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    320.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    320.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    320.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    320.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    344.950  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    344.950  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    344.950  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    344.950  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    344.950  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    350.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    350.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    350.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    350.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    350.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    190.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    190.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 CAUTION SECNO=    190.000  PROFILE=  3  CRITICAL DEPTH ASSUMED
 CAUTION SECNO=    190.000  PROFILE=  3  PROBABLE MINIMUM SPECIFIC ENERGY
 CAUTION SECNO=    190.000  PROFILE=  3  20 TRIALS ATTEMPTED TO BALANCE WSEL
 CAUTION SECNO=    190.000  PROFILE=  4  CRITICAL DEPTH ASSUMED
 CAUTION SECNO=    190.000  PROFILE=  4  PROBABLE MINIMUM SPECIFIC ENERGY
 CAUTION SECNO=    190.000  PROFILE=  4  20 TRIALS ATTEMPTED TO BALANCE WSEL
 WARNING SECNO=    190.000  PROFILE=  5  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

 WARNING SECNO=    200.000  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    200.000  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    200.000  PROFILE=  3  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
 WARNING SECNO=    200.000  PROFILE=  4  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
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WARNING SECNO= 200.000 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 225.000 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 225.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 225.000 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 250.120 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 250.120 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 250.120 PROFILE= 4 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 250.120 PROFILE= 5 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

FLOODWAY DATA, BROAD RUN
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
170.000	2300.	29609.	.6	175.2	174.5	.7
180.000	2415.	28154.	.6	175.2	174.5	.7
190.000	500.	7372.	.3	175.3	174.5	.8
243.000	100.	1874.	1.2	175.3	174.5	.8
243.200	75.	1336.	1.7	175.3	174.5	.8
243.380	95.	1622.	1.4	175.4	174.5	.9
245.000	35.	613.	3.6	175.9	175.0	.9
246.000	160.	2112.	1.1	176.2	175.3	.9
250.000	50.	884.	2.5	176.1	175.2	.9
250.120	45.	843.	2.6	177.3	176.4	.9
264.000	653.	8822.	2.0	177.6	176.9	.7
270.000	457.	4003.	4.4	177.6	177.0	.6
280.550	600.	6459.	2.7	179.3	178.8	.5
285.000	605.	7081.	2.5	179.5	179.0	.5
300.000	1080.	11565.	1.5	180.4	179.7	.7
314.400	1385.	15756.	1.1	180.5	179.8	.7
320.000	600.	5980.	3.0	180.5	179.9	.6
331.600	840.	6645.	2.7	181.2	180.4	.8
344.950	850.	8865.	2.0	182.1	181.5	.6
350.000	440.	4506.	3.9	182.1	181.6	.5
-180.000	2300.	28779.	.6	175.2	174.5	.7
190.000	1315.	9286.	1.7	175.2	174.5	.7
200.000	465.	4603.	3.4	175.8	175.1	.7
225.000	510.	4079.	3.9	176.5	175.8	.7
250.120	530.	4436.	3.6	177.0	176.3	.7

FLOODWAY DATA, BROAD RUN
PROFILE NO. 3

STATION	FLOODWAY WIDTH	FLOODWAY SECTION	FLOODWAY MEAN	WATER SURFACE ELEVATION WITH	WITHOUT	DIFFERENCE

		AREA	VELOCITY	FLOODWAY	FLOODWAY	
170.000	1700.	6552.	1.4	164.6	174.5	-9.9
180.000	2346.	6111.	1.5	165.3	174.5	-9.2
190.000	2231.	8417.	.4	165.7	174.5	-8.8
243.000	1430.	2729.	1.1	166.0	174.5	-8.5
243.200	700.	865.	3.5	166.1	174.5	-8.4
243.380	95.	792.	3.8	166.7	174.5	-7.8
245.000	35.	277.	10.9	166.3	175.0	-8.7
246.000	143.	897.	3.4	168.5	175.3	-6.8
250.000	50.	497.	6.1	168.4	175.2	-6.8
250.120	45.	478.	6.3	169.1	176.4	-7.3
264.000	575.	4031.	2.2	171.0	176.9	-5.9
270.000	420.	1002.	8.8	170.8	177.0	-6.2
280.550	799.	4076.	2.2	174.5	178.8	-4.3
285.000	817.	4526.	1.9	174.7	179.0	-4.3
300.000	1233.	7313.	1.2	175.5	179.7	-4.2
314.400	1850.	10328.	.9	175.7	179.8	-4.1
320.000	940.	3379.	2.6	175.8	179.9	-4.1
331.600	645.	3048.	2.9	176.6	180.4	-3.8
344.950	912.	5038.	1.7	177.5	181.5	-4.0
350.000	649.	2751.	3.2	177.6	181.6	-4.0
-180.000	2346.	6111.	1.5	165.3	174.5	-9.2
190.000	459.	764.	7.7	166.3	174.5	-8.2
200.000	567.	2599.	2.3	170.8	175.1	-4.3
225.000	546.	1738.	3.4	171.8	175.8	-4.0
250.120	783.	2984.	2.0	172.6	176.3	-3.7

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FLOODWAY DATA, BROAD RUN
PROFILE NO. 4

	FLOODWAY			WATER SURFACE ELEVATION		
STATION	WIDTH	SECTION AREA	MEAN VELOCITY	WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
170.000	2069.	10319.	1.5	166.6	174.5	-7.9
180.000	2520.	10880.	1.4	167.3	174.5	-7.2
190.000	2439.	12711.	.2	167.6	174.5	-6.9
243.000	1430.	4496.	.6	167.6	174.5	-6.9
243.200	700.	1374.	1.8	167.6	174.5	-6.9
243.380	95.	900.	2.8	167.8	174.5	-6.7
245.000	35.	323.	7.7	167.6	175.0	-7.4
246.000	145.	923.	2.7	168.6	175.3	-6.7
250.000	50.	508.	4.9	168.6	175.2	-6.6
250.120	45.	475.	5.2	169.1	176.4	-7.3
264.000	576.	4369.	3.4	171.6	176.9	-5.3
270.000	430.	1754.	8.6	172.6	177.0	-4.4
280.550	1097.	6467.	2.3	177.0	178.8	-1.8
285.000	1242.	6968.	2.2	177.2	179.0	-1.8
300.000	1740.	11015.	1.4	178.1	179.7	-1.6
314.400	1903.	15267.	1.0	178.4	179.8	-1.4
320.000	1680.	6841.	2.2	178.5	179.9	-1.4
331.600	840.	4921.	3.0	179.2	180.4	-1.2
344.950	1167.	7901.	1.9	180.3	181.5	-1.2
350.000	1030.	5104.	2.9	180.3	181.6	-1.3
-180.000	2520.	10880.	1.4	167.3	174.5	-7.2
190.000	585.	1425.	9.0	167.6	174.5	-6.9
200.000	678.	3969.	3.2	173.1	175.1	-2.0

225.000	610.	3088.	4.2	174.2	175.8	-1.6
250.120	836.	4898.	2.6	174.9	176.3	-1.4

1

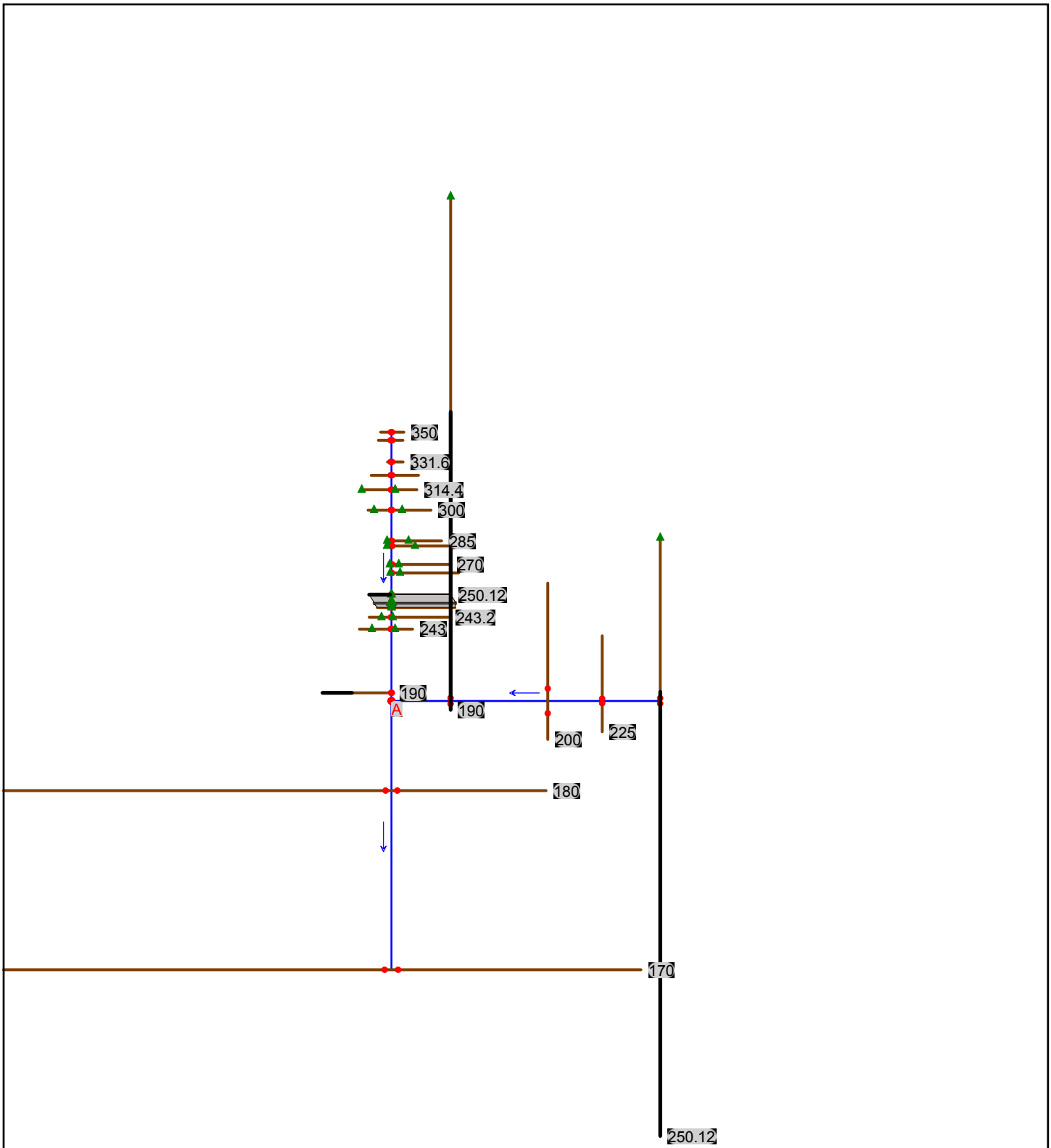
FLOODWAY DATA, BROAD RUN
PROFILE NO. 5

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
170.000	2668.	15864.	1.6	169.0	174.5	-5.5
180.000	2778.	16981.	1.5	169.6	174.5	-4.9
190.000	2490.	18436.	.3	169.9	174.5	-4.6
243.000	1430.	7728.	.7	170.0	174.5	-4.5
243.200	700.	2905.	1.8	169.9	174.5	-4.6
243.380	95.	1121.	4.7	170.2	174.5	-4.3
245.000	35.	480.	10.9	172.1	175.0	-2.9
246.000	3734.	4755.	1.1	174.5	175.3	-.8
250.000	50.	788.	6.7	174.2	175.2	-1.0
250.120	420.	4026.	1.3	178.3	176.4	1.9
264.000	589.	8558.	3.0	178.8	176.9	1.9
270.000	464.	4560.	5.6	178.9	177.0	1.9
280.550	1611.	11904.	2.2	181.0	178.8	2.2
285.000	1296.	12059.	2.1	181.2	179.0	2.2
300.000	1740.	17646.	1.5	182.0	179.7	2.3
314.400	2008.	22647.	1.1	182.2	179.8	2.4
320.000	2322.	14786.	1.7	182.3	179.9	2.4
331.600	937.	8082.	3.2	182.6	180.4	2.2
344.950	1266.	12189.	2.1	183.8	181.5	2.3
350.000	1253.	9219.	2.8	183.9	181.6	2.3
-180.000	2778.	16997.	1.5	169.6	174.5	-4.9
190.000	859.	2928.	7.1	169.7	174.5	-4.8
200.000	812.	5086.	4.1	174.6	175.1	-.5
225.000	694.	4210.	5.0	175.9	175.8	.1
250.120	878.	6481.	3.2	176.8	176.3	.5

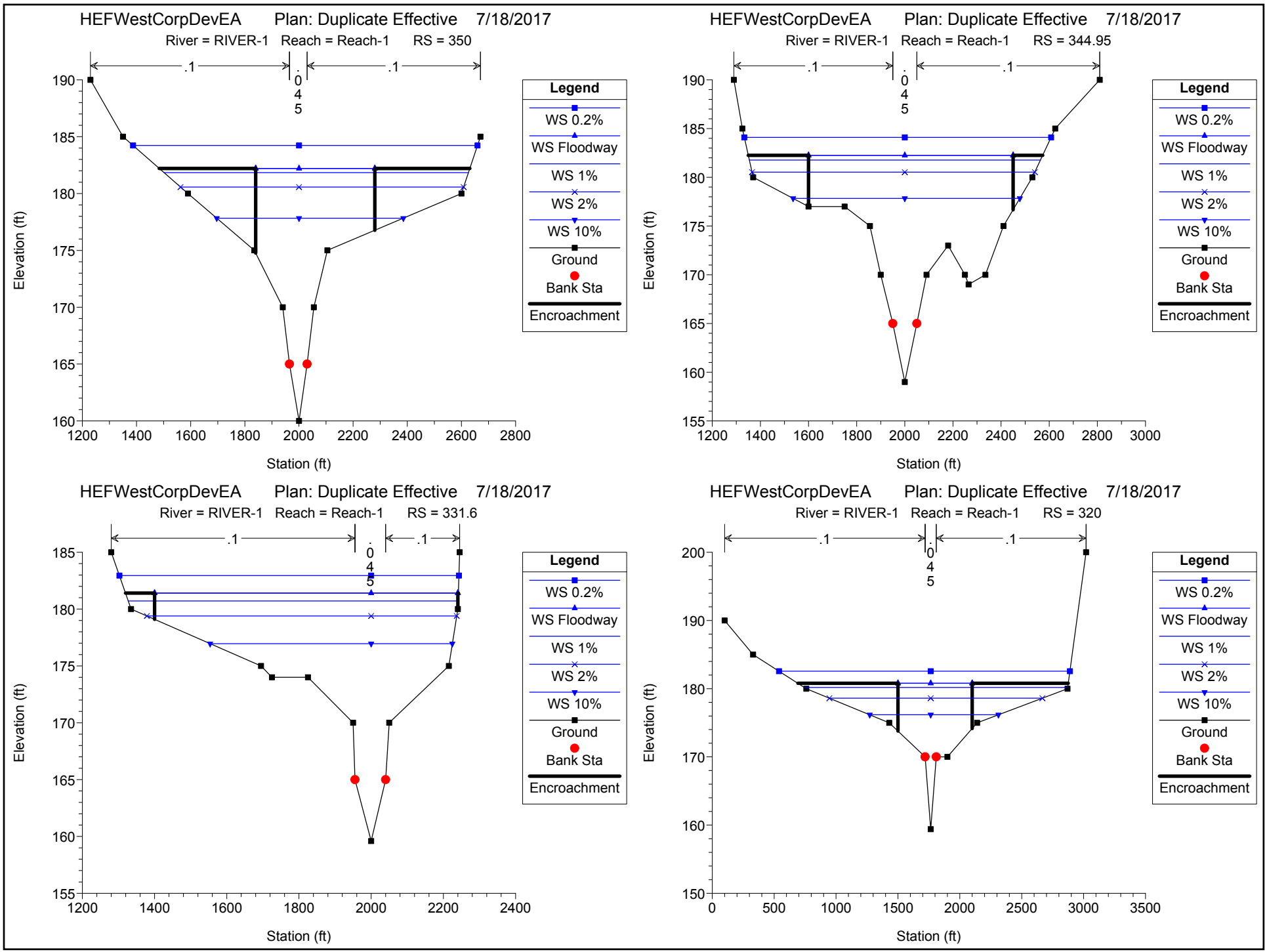
APPENDIX C

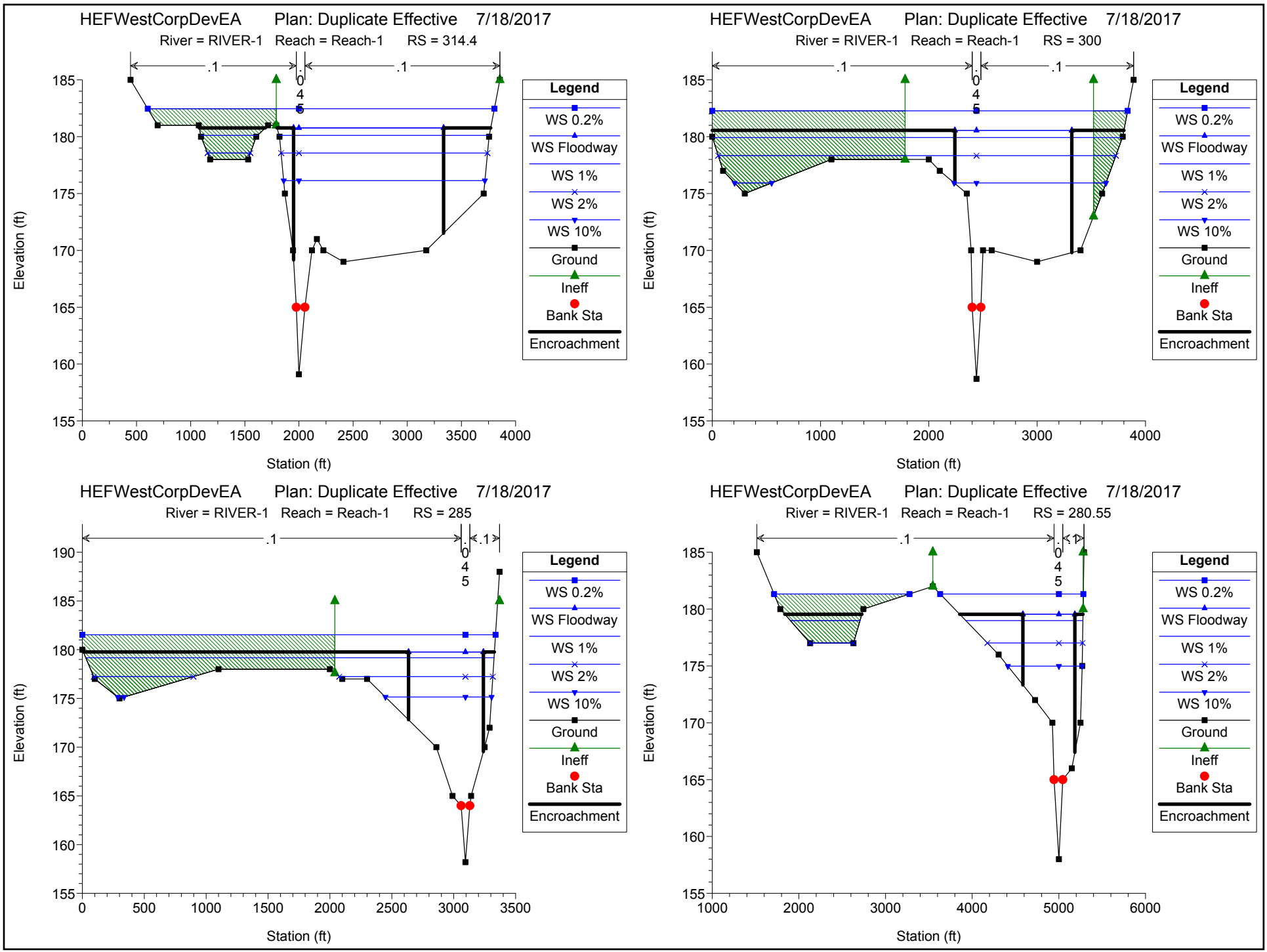
BROAD RUN

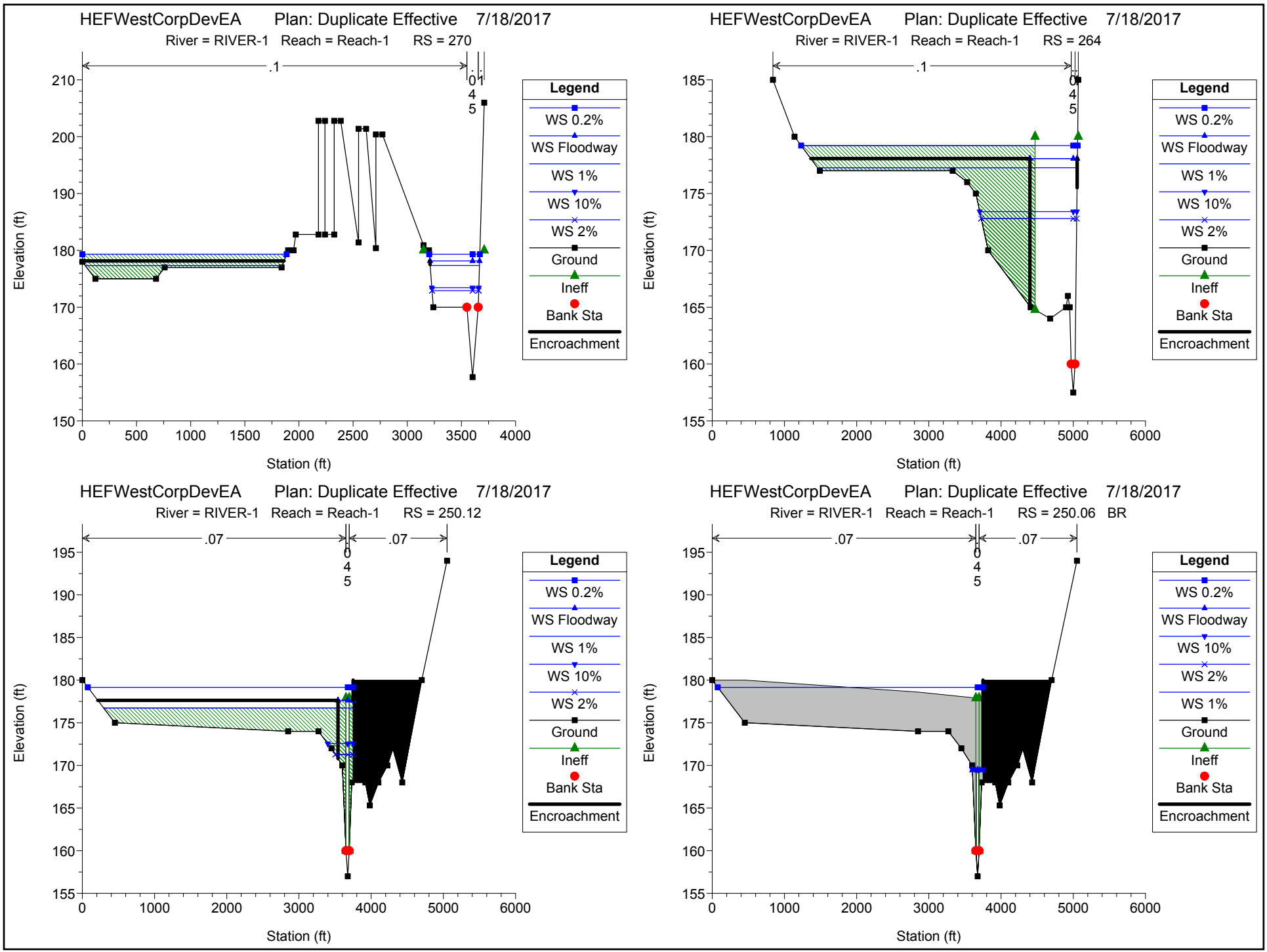
DUPLICATE EFFECTIVE MODEL

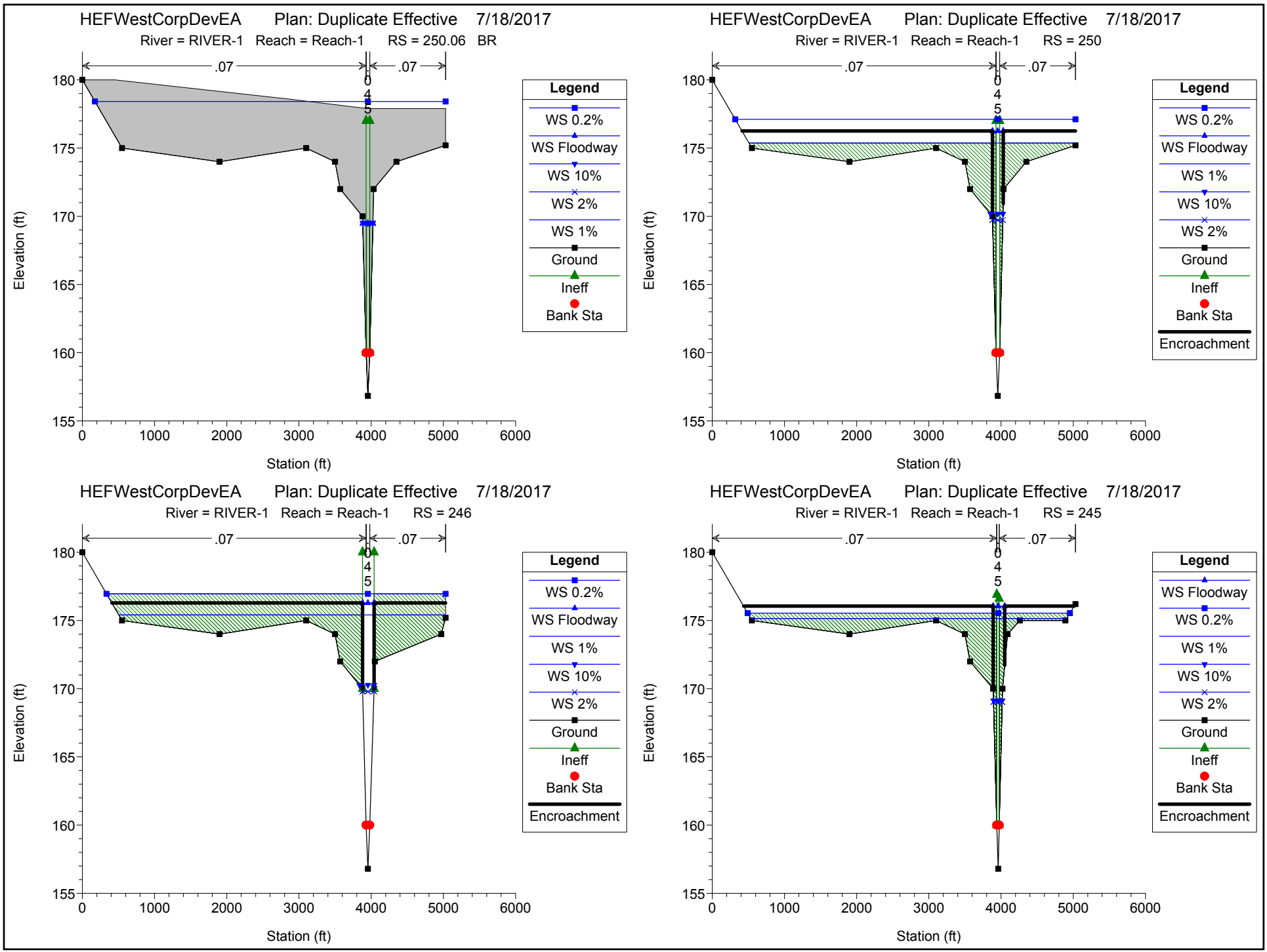


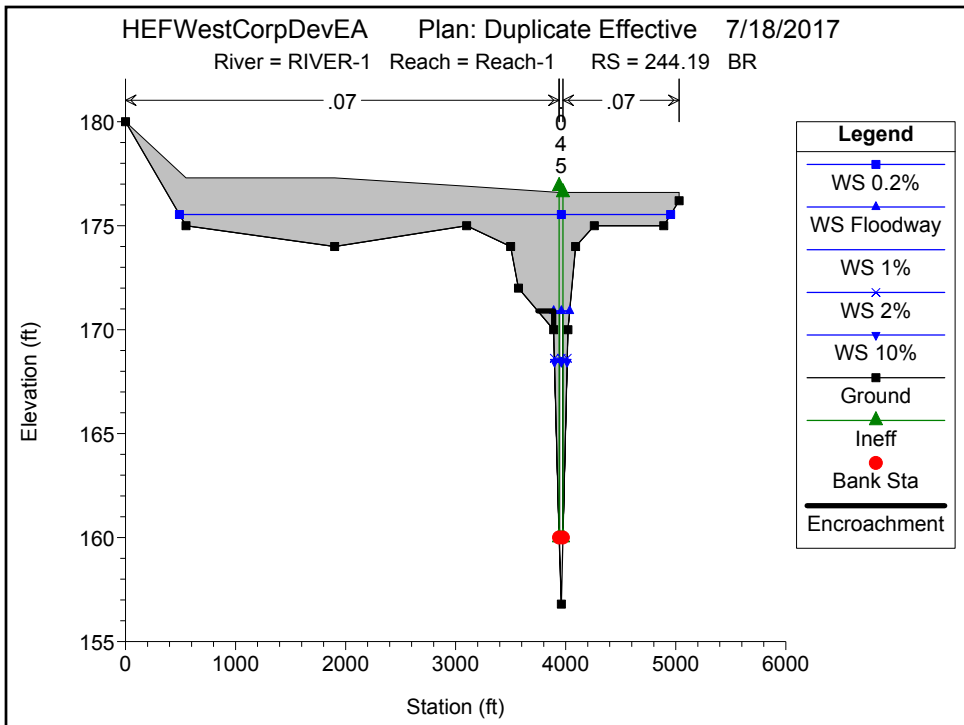
Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

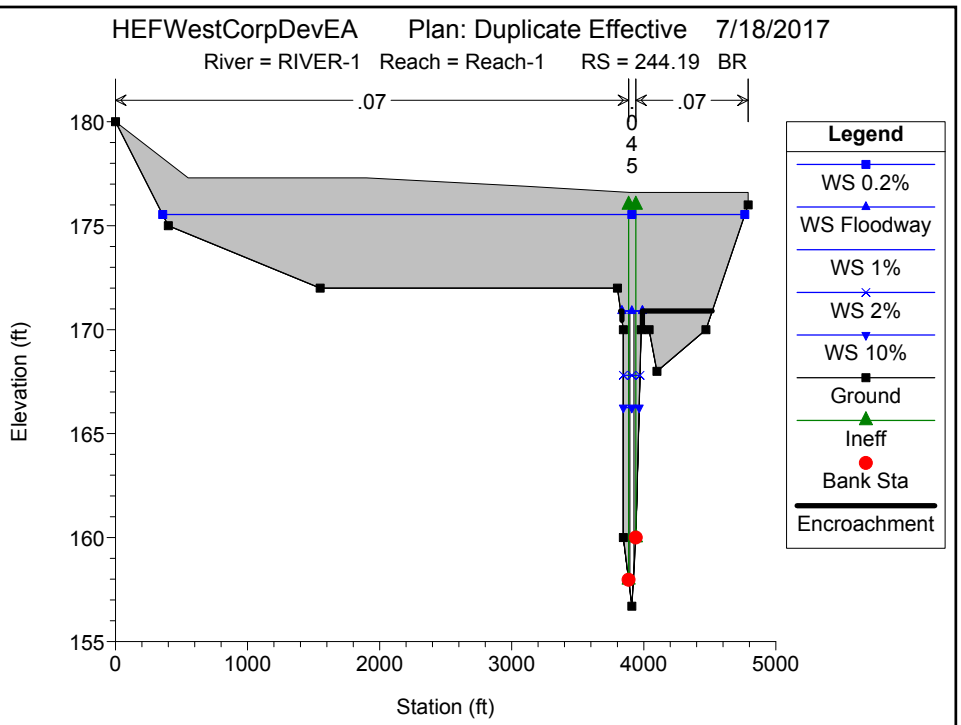

HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 350
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 344.95
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 331.6
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 320
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment

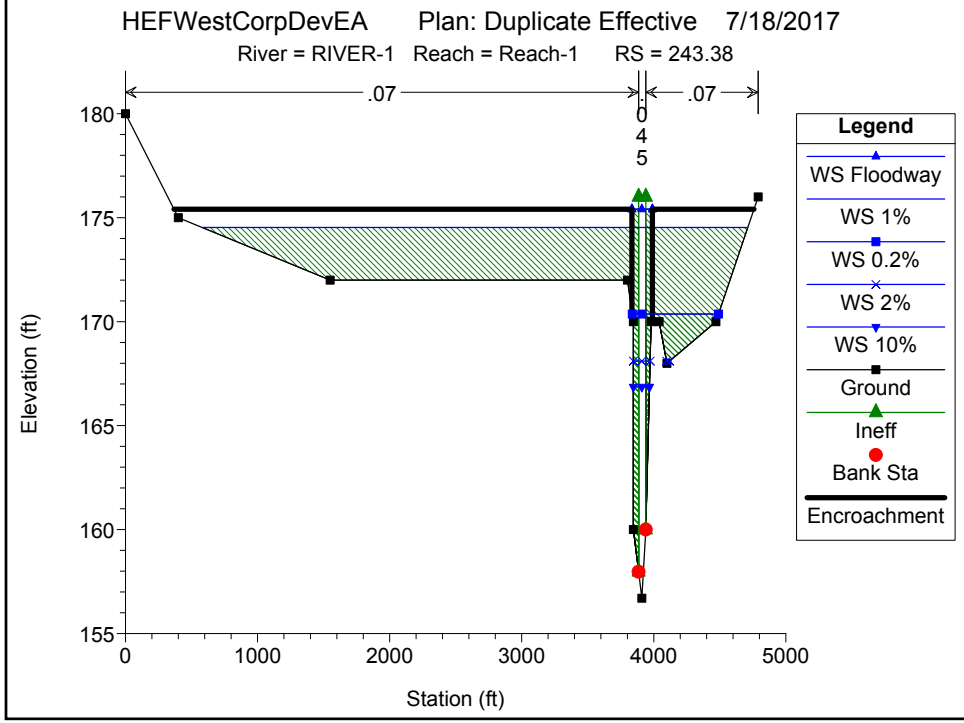

HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 314.4
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 300
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 285
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 280.55
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment

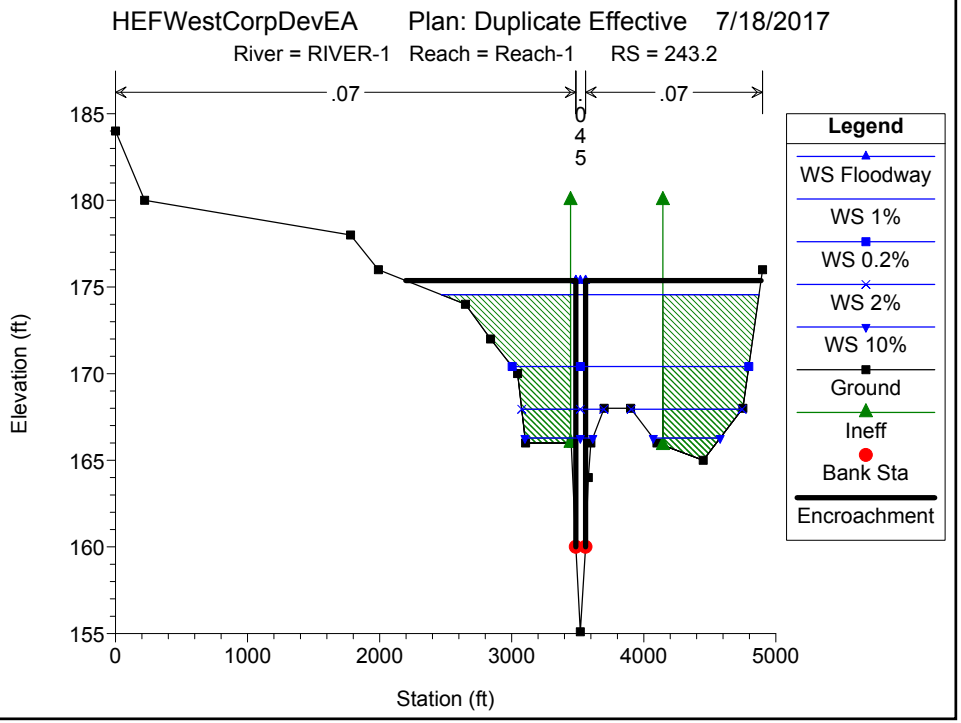

HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 270
.1
0
1
4
5
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 10%
WS 2%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 264
.1
0
4
5
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 10%
WS 2%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 250.12
.07
.07
0
4
5
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 10%
WS 2%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 250.06 BR
.07
.07
0
4
5
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 10%
WS 2%
Ground
Ineff
Bank Sta
Encroachment

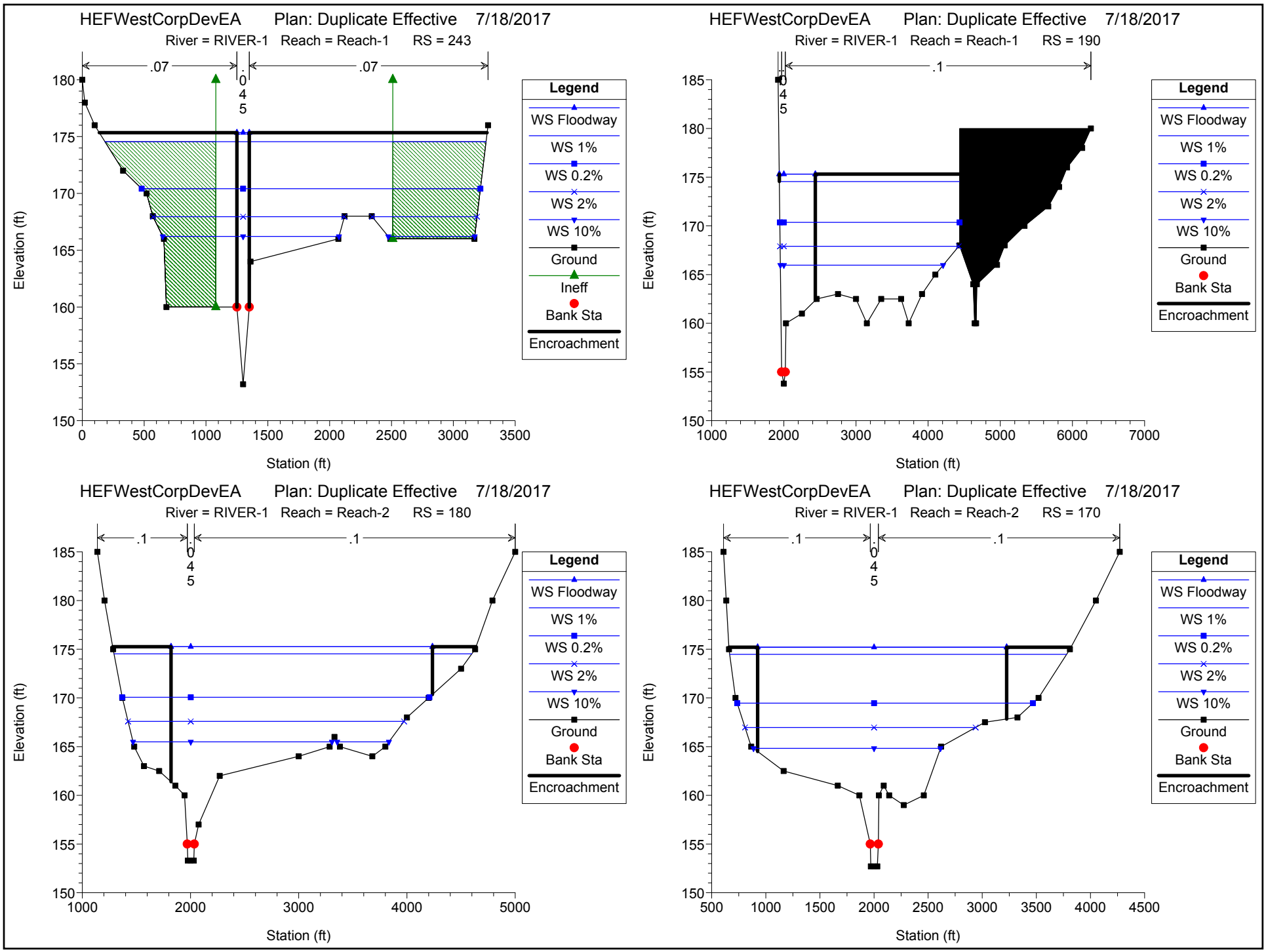

HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 250.06 BR
.07
.07
045
Legend
WS 0.2%
WS Floodway
WS 10%
WS 2%
WS 1%
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 250
Legend
WS 0.2%
WS Floodway
WS 1%
WS 10%
WS 2%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 246
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 245

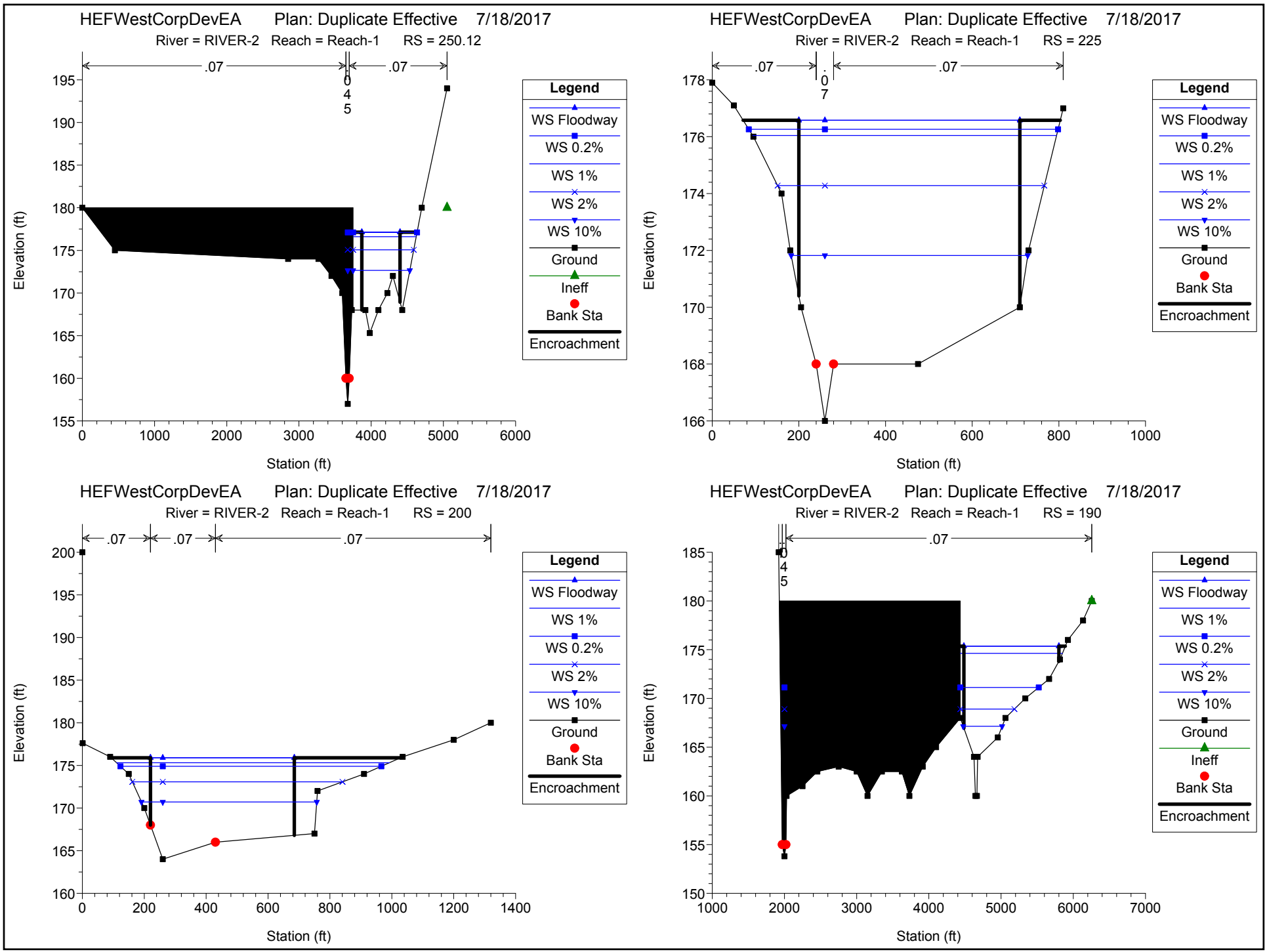

HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 244.19 BR
.07
.07
0.045
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 244.19 BR
.07
.07
0.045
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 243.38
.07
.07
0.045
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 243.2
.07
.07
0.045
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 243
.07
.07
0.045
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-1 RS = 190
.1
0.045
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-2 RS = 180
.1
.1
0.045
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-1 Reach = Reach-2 RS = 170
.1
.1
0.045
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-2 Reach = Reach-1 RS = 250.12
.07
.07
0
4
5
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-2 Reach = Reach-1 RS = 225
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 0.2%
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-2 Reach = Reach-1 RS = 200
.07
.07
.07
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Duplicate Effective 7/18/2017
River = RIVER-2 Reach = Reach-1 RS = 190
.07
0
4
5
Elevation (ft)
Station (ft)
Legend
WS Floodway
WS 1%
WS 0.2%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment

HEC-RAS HEC-RAS 5.0.1 April 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: HEFWestCorpDevEA
Project File : HEFWestCorpDevEA.prj
Run Date and Time: 7/18/2017 4:18:28 PM

Project in English units

Project Description:
All Elevations in NGVD 29
NGVD29 = NAVD88 + 0.827

Manassas, Prince William
County, Virginia
Manassas Regional Airport - West Corporate Development and
East Side Parcel CLOMR
Broad Run
Model beings at FEMA X/S "R" STA. 170
Model
ends at FEMA X/S "Z" STA. 350

Duplicate Effective Model:
Effective
including FEMA issued LOMRS - divided flow reach

Existing Conditions
Model:
2017 Manassas Regional Airport Runway 34R Extension Program LOMR -
Ongoing with FEMA

Proposed Conditions Model:
West Corporate Development
Proposed Layout
Revisions to X/S 314.4 through X/S 264

****

PLAN DATA

Plan Title: Duplicate Effective
Plan File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.p02

Geometry Title: Duplicate Effective

Duplicate Effective

Geometry File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.g01

Flow Title : Duplicate Effective
Flow File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.f01

Plan Summary Information:
Number of: Cross Sections = 24 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 2 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
350	Floodway	1	1840	2280
344.95	Floodway	1	1600	2450
331.6	Floodway	1	1400	2240
320	Floodway	1	1500	2100
314.4	Floodway	1	1950	3335
300	Floodway	1	2240	3320
285	Floodway	1	2635	3240
280.55	Floodway	1	4585	5185
270	Floodway	1	3210	3700
264	Floodway	1	4400	5052.91
250.12	Floodway	1	3540	3750
250	Floodway	1	3880	4030
246	Floodway	1	3880	4040
245	Floodway	1	3890	4050
243.38	Floodway	1	3835	3990
243.2	Floodway	1	3485	3560
243	Floodway	1	1250	1350
190	Floodway	1	1937.39	2437

River = RIVER-1 Reach = Reach-2

RS	Profile	Method	Value1	Value2
170	Floodway	1	925	3225
180	Floodway	1	1820	4235

River = RIVER-2 Reach = Reach-1

RS	Profile	Method	Value1	Value2
250.12	Floodway	1	3870	4400
225	Floodway	1	200	710
200	Floodway	1	220	685
190	Floodway	1	4485	5800

****

FLOW DATA

Flow Title: Duplicate Effective
Flow File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.f01

Flow Data (cfs)

River	Reach	RS	1%	Floodway	10%	2%	0.2%
RIVER-1	Reach-1	350	17700	17700	8780	15000	25700
RIVER-1	Reach-1	250.12	2220	2220	3025	2480	5250
RIVER-1	Reach-2	180	18100	18100	8930	15300	26100
RIVER-2	Reach-1	250.12	15880	15880	5905	12820	20850
RIVER-2	Reach-1	190	15880	15880	5905	12820	20850

Boundary Conditions

River	Reach	Profile	Upstream
RIVER-1	Reach-2	1%	Known WS = 174.47
RIVER-1	Reach-2	Floodway	Known WS = 175.21
RIVER-1	Reach-2	10%	Normal S = 0.0006
RIVER-1	Reach-2	2%	Normal S = 0.0006
RIVER-1	Reach-2	0.2%	Normal S = 0.0006

****

GEOMETRY DATA

Geometry Title: Duplicate Effective
Geometry File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.g01

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
RIVER-1	Reach-1		A
RIVER-1	Reach-2	A	
RIVER-2	Reach-1		A

JUNCTION INFORMATION

Name: A
Description: Junction at section 180
Energy computation Method

Length across Junction River	Reach		Tributary River	Reach	Length	Angle
RIVER-1	Reach-1	to	RIVER-1	Reach-2	1000	0
RIVER-2	Reach-1	to	RIVER-1	Reach-2	1000	0

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 350

INPUT
Description: XS 350 (LETTERED CROSS-SECTION Z)
SOUTHERN RAILROAD
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1230	190	1350	185	1590	180	1835	175	1940	170
1965	165	2000	160	2030	165	2055	170	2105	175
2600	180	2670	185						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1230	.1	1965	.045	2030	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1965	2030	505	505	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	182.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.53	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.84	Reach Len. (ft)	505.00	505.00	505.00
Crit W.S. (ft)		Flow Area (sq ft)	2483.02	1257.00	2996.55
E.G. Slope (ft/ft)	0.001074	Area (sq ft)	2483.02	1257.00	2996.55
Q Total (cfs)	17700.00	Flow (cfs)	3699.03	9721.90	4279.07
Top Width (ft)	1123.98	Top Width (ft)	463.24	65.00	595.74
Vel Total (ft/s)	2.63	Avg. Vel. (ft/s)	1.49	7.73	1.43
Max Chl Dpth (ft)	21.84	Hydr. Depth (ft)	5.36	19.34	5.03
Conv. Total (cfs)	540190.4	Conv. (cfs)	112891.5	296705.1	130593.8
Length Wtd. (ft)	505.00	Wetted Per. (ft)	463.93	65.77	596.57
Min Ch El (ft)	160.00	Shear (lb/sq ft)	0.36	1.28	0.34
Alpha	4.90	Stream Power (lb/ft s)	0.53	9.91	

```
   0.48  *
* Frctn Loss (ft)        *    0.30  * Cum Volume (acre-ft)   * 2069.68  *  528.72  *
2354.81  *
* C & E Loss (ft)        *    0.10  * Cum SA (acres)         *  455.71  *   27.82  *
 199.28  *
**************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Floodway
**************************************************************************************
***********
* E.G. Elev (ft)         *  182.87  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.66  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  182.21  * Reach Len. (ft)       *  505.00  *  505.00  *
 505.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1350.68  * 1281.16  *
1960.38  *
* E.G. Slope (ft/ft)     *0.001188  * Area (sq ft)          * 1350.68  * 1281.16  *
1960.38  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            * 3243.46  *10557.45  *
3899.09  *
* Top Width (ft)         *  440.00  * Top Width (ft)        *  125.00  *   65.00  *
 250.00  *
* Vel Total (ft/s)       *    3.85  * Avg. Vel. (ft/s)      *    2.40  *    8.24  *
   1.99  *
* Max Chl Dpth (ft)      *   22.21  * Hydr. Depth (ft)      *   10.81  *   19.71  *
   7.84  *
* Conv. Total (cfs)      *513479.0  * Conv. (cfs)           * 94093.1  *306272.8
*113113.1  *
* Length Wtd. (ft)       *  505.00  * Wetted Per. (ft)      *  133.06  *   65.77  *
 256.20  *
* Min Ch El (ft)         *  160.00  * Shear (lb/sq ft)      *    0.75  *    1.45  *
   0.57  *
* Alpha                  *    2.86  * Stream Power (lb/ft s) *    1.81  *   11.91  *
   1.13  *
* Frctn Loss (ft)        *    0.29  * Cum Volume (acre-ft)   *  607.80  *  548.97  *
1182.38  *
* C & E Loss (ft)        *    0.15  * Cum SA (acres)         *   63.67  *   27.82  *
  74.48  *
**************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10%
**************************************************************************************
***********
* E.G. Elev (ft)         *  178.38  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.54  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  177.83  * Reach Len. (ft)       *  505.00  *  505.00  *
 505.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1015.34  *  996.75  *
 922.81  *
```

			Duplicate Effective			
* E.G. Slope (ft/ft)	*0.001107	* Area (sq ft)	* 1015.34	* 996.75	* 922.81	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 1215.03	* 6704.87	* 860.11	*
* Top Width (ft)	* 689.51	* Top Width (ft)	* 268.89	* 65.00	* 355.62	*
* Vel Total (ft/s)	* 2.99	* Avg. Vel. (ft/s)	* 1.20	* 6.73	* 0.93	*
* Max Chl Dpth (ft)	* 17.83	* Hydr. Depth (ft)	* 3.78	* 15.33	* 2.59	*
* Conv. Total (cfs)	*263944.9	* Conv. (cfs)	* 36526.2	*201562.0	* 25856.7	*
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 269.54	* 65.77	* 356.38	*
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.26	* 1.05	* 0.18	*
* Alpha	* 3.89	* Stream Power (lb/ft s)	* 0.31	* 7.04	* 0.17	*
* Frctn Loss (ft)	* 0.27	* Cum Volume (acre-ft)	* 640.93	* 366.02	* 791.69	*
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 141.15	* 27.97	* 156.25	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 181.18	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.61	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 180.57	* Reach Len. (ft)	* 505.00	* 505.00	* 505.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1934.22	* 1174.58	* 2252.43	*
* E.G. Slope (ft/ft)	*0.001219	* Area (sq ft)	* 1934.22	* 1174.58	* 2252.43	*
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 2855.30	* 9253.18	* 2891.52	*
* Top Width (ft)	* 1045.37	* Top Width (ft)	* 402.38	* 65.00	* 577.99	*
* Vel Total (ft/s)	* 2.80	* Avg. Vel. (ft/s)	* 1.48	* 7.88	* 1.28	*
* Max Chl Dpth (ft)	* 20.57	* Hydr. Depth (ft)	* 4.81	* 18.07	* 3.90	*
* Conv. Total (cfs)	*429574.2	* Conv. (cfs)	* 81770.9	*264995.2	* 82808.0	*
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 403.05	* 65.77	* 578.78	*
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.37	* 1.36	* 0.30	*
* Alpha	* 4.98	* Stream Power (lb/ft s)	* 0.54	* 10.71	* 0.38	*
* Frctn Loss (ft)	* 0.33	* Cum Volume (acre-ft)	* 924.25	* 417.28	* 1245.62	*
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 228.08	* 27.97	* 177.84	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%
****

E.G. Elev (ft)	184.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.50	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	184.23	Reach Len. (ft)	505.00	505.00	505.00
Crit W.S. (ft)		Flow Area (sq ft)	3725.55	1412.15	4458.49
E.G. Slope (ft/ft)	0.001042	Area (sq ft)	3725.55	1412.15	4458.49
Q Total (cfs)	25700.00	Flow (cfs)	6186.40	11630.04	7883.56
Top Width (ft)	1271.98	Top Width (ft)	577.82	65.00	629.16
Vel Total (ft/s)	2.68	Avg. Vel. (ft/s)	1.66	8.24	1.77
Max Chl Dpth (ft)	24.23	Hydr. Depth (ft)	6.45	21.73	7.09
Conv. Total (cfs)	796018.8	Conv. (cfs)	191614.5	360223.1	244181.3
Length Wtd. (ft)	505.00	Wetted Per. (ft)	578.53	65.77	630.08
Min Ch El (ft)	160.00	Shear (lb/sq ft)	0.42	1.40	0.46
Alpha	4.51	Stream Power (lb/ft s)	0.70	11.51	0.81
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	2507.14	527.74	2015.77
C & E Loss (ft)	0.08	Cum SA (acres)	462.88	28.34	207.29

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 344.95

INPUT
Description: XS 344.95 (LETTERED CROSS-SECTION Y)
WIDENED FLOODWAY TO REDUCE
U/S SURCHARGES
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1290	190	1325	185	1370	180	1600	177	1750	177
1855	175	1900	170	1950	165	2000	159	2050	165
2090	170	2180	173	2250	170	2265	169	2335	170
2410	175	2530	180	2625	185	2810	190		

Duplicate Effective

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1290	.1	1950	.045	2050	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1950	2050	1335	1335	.1	.3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 181.96	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.19	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 181.77	* Reach Len. (ft)	* 1335.00	* 1335.00	* 1335.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 3218.40	* 1977.03	* 4494.54 *
* E.G. Slope (ft/ft)	*0.000382	* Area (sq ft)	* 3218.40	* 1977.03	* 4494.54 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 2875.52	* 9286.32	* 5538.16 *
* Top Width (ft)	* 1209.57	* Top Width (ft)	* 595.93	* 100.00	* 513.64 *
* Vel Total (ft/s)	* 1.83	* Avg. Vel. (ft/s)	* 0.89	* 4.70	* 1.23 *
* Max Chl Dpth (ft)	* 22.77	* Hydr. Depth (ft)	* 5.40	* 19.77	* 8.75 *
* Conv. Total (cfs)	*905453.8	* Conv. (cfs)	*147098.7	*475047.2	*283307.9 *
* Length Wtd. (ft)	* 1335.00	* Wetted Per. (ft)	* 596.60	* 100.72	* 514.42 *
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.13	* 0.47	* 0.21 *
* Alpha	* 3.65	* Stream Power (lb/ft s)	* 0.11	* 2.20	* 0.26 *
* Frctn Loss (ft)	* 0.75	* Cum Volume (acre-ft)	* 2036.63	* 509.97	* 2311.39 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 449.57	* 26.86	* 192.85 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 182.43	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.17	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 182.26	* Reach Len. (ft)	* 1335.00	* 1335.00	* 1335.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2623.00	* 2025.86	* 4385.09 *
* E.G. Slope (ft/ft)	*0.000339	* Area (sq ft)	* 2623.00	* 2025.86	* 4385.09 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 2720.19	* 9116.10	*

5863.71 *						
* Top Width (ft)	* 850.00	* Top Width (ft)	* 350.00	* 100.00	* 400.00 *	
* Vel Total (ft/s)	* 1.96	* Avg. Vel. (ft/s)	* 1.04	* 4.50	* 1.34 *	
* Max Chl Dpth (ft)	* 23.26	* Hydr. Depth (ft)	* 7.49	* 20.26	* 10.96 *	
* Conv. Total (cfs)	*960634.9	* Conv. (cfs)	*147633.3	*494759.5	*318242.1 *	
* Length Wtd. (ft)	* 1335.00	* Wetted Per. (ft)	* 355.80	* 100.72	* 406.26 *	
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.16	* 0.43	* 0.23 *	
* Alpha	* 2.91	* Stream Power (lb/ft s)	* 0.16	* 1.92	* 0.31 *	
* Frctn Loss (ft)	* 0.64	* Cum Volume (acre-ft)	* 584.76	* 529.80	* 1145.60 *	
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 60.92	* 26.86	* 70.71 *	

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

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* E.G. Elev (ft)	* 177.98	* Element	* Left OB	* Channel	* Right OB *	
* Vel Head (ft)	* 0.15	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *	
* W.S. Elev (ft)	* 177.84	* Reach Len. (ft)	* 1335.00	* 1335.00	* 1335.00 *	
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1102.44	* 1583.73	* 2633.04 *	
* E.G. Slope (ft/ft)	*0.000320	* Area (sq ft)	* 1102.44	* 1583.73	* 2633.04 *	
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 562.25	* 5871.03	* 2346.72 *	
* Top Width (ft)	* 942.29	* Top Width (ft)	* 414.19	* 100.00	* 428.10 *	
* Vel Total (ft/s)	* 1.65	* Avg. Vel. (ft/s)	* 0.51	* 3.71	* 0.89 *	
* Max Chl Dpth (ft)	* 18.84	* Hydr. Depth (ft)	* 2.66	* 15.84	* 6.15 *	
* Conv. Total (cfs)	*490866.6	* Conv. (cfs)	* 31434.0	*328233.5	*131199.0 *	
* Length Wtd. (ft)	* 1335.00	* Wetted Per. (ft)	* 414.75	* 100.72	* 428.79 *	
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.05	* 0.31	* 0.12 *	
* Alpha	* 3.46	* Stream Power (lb/ft s)	* 0.03	* 1.16	* 0.11 *	
* Frctn Loss (ft)	* 0.63	* Cum Volume (acre-ft)	* 628.65	* 351.06	* 771.07 *	
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 137.19	* 27.01	* 151.71 *	

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)

is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	180.73	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	180.53	Reach Len. (ft)	1335.00	1335.00	1335.00
Crit W.S. (ft)		Flow Area (sq ft)	2487.54	1853.24	3873.22
E.G. Slope (ft/ft)	0.000398	Area (sq ft)	2487.54	1853.24	3873.22
Q Total (cfs)	15000.00	Flow (cfs)	1935.35	8512.15	4552.50
Top Width (ft)	1174.91	Top Width (ft)	584.79	100.00	490.11
Vel Total (ft/s)	1.83	Avg. Vel. (ft/s)	0.78	4.59	1.18
Max Chl Dpth (ft)	21.53	Hydr. Depth (ft)	4.25	18.53	7.90
Conv. Total (cfs)	751592.4	Conv. (cfs)	96972.9	426511.4	228108.1
Length Wtd. (ft)	1335.00	Wetted Per. (ft)	585.39	100.72	490.87
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.11	0.46	0.20
Alpha	3.74	Stream Power (lb/ft s)	0.08	2.10	0.23
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	898.62	399.72	1210.11
C & E Loss (ft)	0.03	Cum SA (acres)	222.36	27.01	171.65

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	184.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	184.10	Reach Len. (ft)	1335.00	1335.00	1335.00
Crit W.S. (ft)		Flow Area (sq ft)	4630.53	2209.90	5742.14
E.G. Slope (ft/ft)	0.000430	Area (sq ft)	4630.53	2209.90	5742.14
Q Total (cfs)	25700.00	Flow (cfs)	5467.68	11865.01	8367.32
Top Width (ft)	1274.77	Top Width (ft)	616.89	100.00	557.88
Vel Total (ft/s)	2.04	Avg. Vel. (ft/s)	1.18	5.37	1.46
Max Chl Dpth (ft)	25.10	Hydr. Depth (ft)	7.51	22.10	

```
  10.29  *
* Conv. Total (cfs)      *1238795.0  * Conv. (cfs)            *263553.7  *571918.6
*403322.4  *
* Length Wtd. (ft)       * 1335.00  * Wetted Per. (ft)       *  617.68  *  100.72  *
 558.73  *
* Min Ch El (ft)         *  159.00  * Shear (lb/sq ft)       *    0.20  *    0.59  *
   0.28  *
* Alpha                  *    3.43  * Stream Power (lb/ft s) *    0.24  *    3.17  *
   0.40  *
* Frctn Loss (ft)        *    0.83  * Cum Volume (acre-ft)   * 2458.71  *  506.75  *
1956.64  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *  455.95  *   27.39  *
 200.41  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 331.6

INPUT
Description: XS 331.6 (LETTERED CROSS-SECTION X)
WIDENED FLOODWAY TO REDUCE
             U/S SURCHARGES
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1280     185    1335     180    1695     175    1725     174    1825     174
    1950     170    1955     165    2000   159.6    2040     165    2050     170
    2215     175    2240     180    2245     185

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
    1280      .1    1955    .045    2040      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
          1955    2040              820     820     820             .1       .3

CROSS SECTION OUTPUT  Profile #1%
*******************************************************************************
***********
* E.G. Elev (ft)         *  181.18  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.46  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.72  * Reach Len. (ft)        *  820.00  *  820.00  *
 820.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 3176.76  * 1565.70  *
1569.26  *
* E.G. Slope (ft/ft)     *0.000904  * Area (sq ft)           * 3176.76  * 1565.70  *
1569.26  *
* Q Total (cfs)          *17700.00  * Flow (cfs)             * 4172.87  *10784.03  *
2743.10  *
* Top Width (ft)         *  913.64  * Top Width (ft)         *  627.92  *   85.00  *
 200.72  *
* Vel Total (ft/s)       *    2.80  * Avg. Vel. (ft/s)       *    1.31  *    6.89  *
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```
   1.75  *
* Max Chl Dpth (ft)      *   21.12  * Hydr. Depth (ft)       *    5.06  *   18.42  *
   7.82  *
* Conv. Total (cfs)      *588686.8  * Conv. (cfs)            *138785.9  *358667.6  *
91233.3  *
* Length Wtd. (ft)       *  820.00  * Wetted Per. (ft)       *  630.14  *   85.69  *
 202.77  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)       *    0.28  *    1.03  *
   0.44  *
* Alpha                  *    3.79  * Stream Power (lb/ft s) *    0.37  *    7.10  *
   0.76  *
* Frctn Loss (ft)        *    0.70  * Cum Volume (acre-ft)   * 1938.63  *  455.68  *
2218.47  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)         *  430.81  *   24.03  *
 181.90  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #Floodway
*******************************************************************************
***********
* E.G. Elev (ft)         *  181.78  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.37  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  181.41  * Reach Len. (ft)        *  820.00  *  820.00  *
 820.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 3479.78  * 1624.21  *
1706.67  *
* E.G. Slope (ft/ft)     *0.000717  * Area (sq ft)           * 3479.78  * 1624.21  *
1706.67  *
* Q Total (cfs)          *17700.00  * Flow (cfs)             * 4682.99  *10210.58  *
2806.43  *
* Top Width (ft)         *  840.00  * Top Width (ft)         *  555.00  *   85.00  *
 200.00  *
* Vel Total (ft/s)       *    2.60  * Avg. Vel. (ft/s)       *    1.35  *    6.29  *
   1.64  *
* Max Chl Dpth (ft)      *   21.81  * Hydr. Depth (ft)       *    6.27  *   19.11  *
   8.53  *
* Conv. Total (cfs)      *660951.4  * Conv. (cfs)            *174871.6  *381282.2
*104797.5  *
* Length Wtd. (ft)       *  820.00  * Wetted Per. (ft)       *  559.49  *   85.69  *
 203.16  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)       *    0.28  *    0.85  *
   0.38  *
* Alpha                  *    3.51  * Stream Power (lb/ft s) *    0.37  *    5.34  *
   0.62  *
* Frctn Loss (ft)        *    0.65  * Cum Volume (acre-ft)   *  491.24  *  473.87  *
1052.25  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   47.05  *   24.03  *
  61.52  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  177.33  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.37  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  176.96  * Reach Len. (ft)        *  820.00  *  820.00  *
 820.00  *
```

		Duplicate Effective			
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1175.36	* 1246.09	* 840.09 *
* E.G. Slope (ft/ft)	*0.000778	* Area (sq ft)	* 1175.36	* 1246.09	* 840.09 *
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 993.70	* 6836.03	* 950.27 *
* Top Width (ft)	* 670.91	* Top Width (ft)	* 401.11	* 85.00	* 184.80 *
* Vel Total (ft/s)	* 2.69	* Avg. Vel. (ft/s)	* 0.85	* 5.49	* 1.13 *
* Max Chl Dpth (ft)	* 17.36	* Hydr. Depth (ft)	* 2.93	* 14.66	* 4.55 *
* Conv. Total (cfs)	*314860.8	* Conv. (cfs)	* 35635.1	*245147.7	* 34077.9 *
* Length Wtd. (ft)	* 820.00	* Wetted Per. (ft)	* 403.28	* 85.69	* 186.25 *
* Min Ch El (ft)	* 159.60	* Shear (lb/sq ft)	* 0.14	* 0.71	* 0.22 *
* Alpha	* 3.26	* Stream Power (lb/ft s)	* 0.12	* 3.87	* 0.25 *
* Frctn Loss (ft)	* 0.79	* Cum Volume (acre-ft)	* 593.75	* 307.70	* 717.85 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 124.70	* 24.17	* 142.32 *

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 179.90	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.50	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.39	* Reach Len. (ft)	* 820.00	* 820.00	* 820.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2364.56	* 1452.93	* 1304.57 *
* E.G. Slope (ft/ft)	*0.001000	* Area (sq ft)	* 2364.56	* 1452.93	* 1304.57 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 2839.74	*10011.10	* 2149.16 *
* Top Width (ft)	* 858.28	* Top Width (ft)	* 576.31	* 85.00	* 196.97 *
* Vel Total (ft/s)	* 2.93	* Avg. Vel. (ft/s)	* 1.20	* 6.89	* 1.65 *
* Max Chl Dpth (ft)	* 19.79	* Hydr. Depth (ft)	* 4.10	* 17.09	* 6.62 *
* Conv. Total (cfs)	*474451.8	* Conv. (cfs)	* 89821.3	*316652.2	* 67978.3 *
* Length Wtd. (ft)	* 820.00	* Wetted Per. (ft)	* 578.50	* 85.69	* 198.66 *
* Min Ch El (ft)	* 159.60	* Shear (lb/sq ft)	* 0.26	* 1.06	* 0.41 *
* Alpha	* 3.77	* Stream Power (lb/ft s)	* 0.31	* 7.29	* 0.68 *
* Frctn Loss (ft)	* 0.89	* Cum Volume (acre-ft)	* 824.27	* 349.06	* 1130.77 *
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 204.56	* 24.17	* 161.12 *

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	183.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	182.95	Reach Len. (ft)	820.00	820.00	820.00
Crit W.S. (ft)		Flow Area (sq ft)	4601.91	1754.93	2018.59
E.G. Slope (ft/ft)	0.000977	Area (sq ft)	4601.91	1754.93	2018.59
Q Total (cfs)	25700.00	Flow (cfs)	7843.95	13561.06	4294.99
Top Width (ft)	940.36	Top Width (ft)	652.41	85.00	202.95
Vel Total (ft/s)	3.07	Avg. Vel. (ft/s)	1.70	7.73	2.13
Max Chl Dpth (ft)	23.35	Hydr. Depth (ft)	7.05	20.65	9.95
Conv. Total (cfs)	822085.1	Conv. (cfs)	250910.3	433787.7	137387.1
Length Wtd. (ft)	820.00	Wetted Per. (ft)	654.73	85.69	205.92
Min Ch El (ft)	159.60	Shear (lb/sq ft)	0.43	1.25	0.60
Alpha	3.52	Stream Power (lb/ft s)	0.73	9.66	1.27
Frctn Loss (ft)	0.62	Cum Volume (acre-ft)	2317.23	445.99	1837.72
C & E Loss (ft)	0.10	Cum SA (acres)	436.50	24.55	188.75

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 320

INPUT
Description: XS 320
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
100	190	330	185	760	180	1430	175	1720	170
1765	159.4	1810	170	1900	170	2140	175	2870	180
3020	200								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
100	.1	1720	.045	1810	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1720	1810	900	900	550	.1 .3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 180.42	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.24	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 180.18	* Reach Len. (ft)	* 900.00	* 900.00	* 550.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 4021.23	* 1392.93	* 4712.69 *
* E.G. Slope (ft/ft)	*0.000806	* Area (sq ft)	* 4021.23	* 1392.93	* 4712.69 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 4362.51	* 7966.13	* 5371.37 *
* Top Width (ft)	* 2126.55	* Top Width (ft)	* 975.22	* 90.00	* 1061.33 *
* Vel Total (ft/s)	* 1.75	* Avg. Vel. (ft/s)	* 1.08	* 5.72	* 1.14 *
* Max Chl Dpth (ft)	* 20.78	* Hydr. Depth (ft)	* 4.12	* 15.48	* 4.44 *
* Conv. Total (cfs)	*623366.4	* Conv. (cfs)	*153640.6	*280554.5	*189171.3 *
* Length Wtd. (ft)	* 718.14	* Wetted Per. (ft)	* 975.28	* 92.46	* 1061.41 *
* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.21	* 0.76	* 0.22 *
* Alpha	* 5.04	* Stream Power (lb/ft s)	* 0.23	* 4.34	* 0.25 *
* Frctn Loss (ft)	* 0.21	* Cum Volume (acre-ft)	* 1870.88	* 427.84	* 2159.34 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 415.72	* 22.38	* 170.02 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 181.11	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.32	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 180.79	* Reach Len. (ft)	* 900.00	* 900.00	* 550.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1957.60	* 1448.53	* 2713.81 *
* E.G. Slope (ft/ft)	*0.000876	* Area (sq ft)	* 1957.60	* 1448.53	* 2713.81 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 3619.37	* 8861.46	* 5219.17 *
* Top Width (ft)	* 600.00	* Top Width (ft)	* 220.00	* 90.00	* 290.00 *
* Vel Total (ft/s)	* 2.89	* Avg. Vel. (ft/s)	* 1.85	* 6.12	* 1.92 *
* Max Chl Dpth (ft)	* 21.39	* Hydr. Depth (ft)	* 8.90	* 16.09	* 9.36 *
* Conv. Total (cfs)	*598158.6	* Conv. (cfs)	*122313.9	*299466.7	*176378.0 *
* Length Wtd. (ft)	* 718.82	* Wetted Per. (ft)	* 227.03	* 92.46	* 296.67 *

Duplicate Effective

* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.47	* 0.86	* 0.50	*
* Alpha	* 2.45	* Stream Power (lb/ft s)	* 0.87	* 5.24	* 0.96	*
* Frctn Loss (ft)	* 0.22	* Cum Volume (acre-ft)	* 440.07	* 444.95	* 1010.65	*
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	* 39.75	* 22.38	* 56.91	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 176.54	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.36	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 176.18	* Reach Len. (ft)	* 900.00	* 900.00	* 550.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1160.24	* 1033.15	* 1540.76	*
* E.G. Slope (ft/ft)	*0.001220	* Area (sq ft)	* 1160.24	* 1033.15	* 1540.76	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 1135.55	* 5956.01	* 1688.44	*
* Top Width (ft)	* 1040.24	* Top Width (ft)	* 448.04	* 90.00	* 502.20	*
* Vel Total (ft/s)	* 2.35	* Avg. Vel. (ft/s)	* 0.98	* 5.76	* 1.10	*
* Max Chl Dpth (ft)	* 16.78	* Hydr. Depth (ft)	* 2.59	* 11.48	* 3.07	*
* Conv. Total (cfs)	*251351.3	* Conv. (cfs)	* 32508.3	*170506.9	* 48336.1	*
* Length Wtd. (ft)	* 752.41	* Wetted Per. (ft)	* 448.09	* 92.46	* 502.25	*
* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.20	* 0.85	* 0.23	*
* Alpha	* 4.14	* Stream Power (lb/ft s)	* 0.19	* 4.91	* 0.26	*
* Frctn Loss (ft)	* 0.27	* Cum Volume (acre-ft)	* 571.77	* 286.25	* 695.44	*
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	* 116.71	* 22.53	* 135.85	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

****

* E.G. Elev (ft)	* 178.97	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.35	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 178.61	* Reach Len. (ft)	* 900.00	* 900.00	*	

```
 550.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 2646.06  * 1252.02  *
3193.76  *
* E.G. Slope (ft/ft)     *0.001172  * Area (sq ft)           * 2646.06  * 1252.02  *
3193.76  *
* Q Total (cfs)          *15000.00  * Flow (cfs)            * 3054.84  * 8040.80  *
3904.36  *
* Top Width (ft)         * 1721.16  * Top Width (ft)         *  773.91  *   90.00  *
 857.25  *
* Vel Total (ft/s)       *    2.12  * Avg. Vel. (ft/s)       *    1.15  *    6.42  *
   1.22  *
* Max Chl Dpth (ft)      *   19.21  * Hydr. Depth (ft)       *    3.42  *   13.91  *
   3.73  *
* Conv. Total (cfs)      *438140.1  * Conv. (cfs)            * 89229.9  *234866.4
*114043.8  *
* Length Wtd. (ft)       *  729.79  * Wetted Per. (ft)       *  773.97  *   92.46  *
 857.31  *
* Min Ch El (ft)         *  159.40  * Shear (lb/sq ft)       *    0.25  *    0.99  *
   0.27  *
* Alpha                  *    5.09  * Stream Power (lb/ft s) *    0.29  *    6.36  *
   0.33  *
* Frctn Loss (ft)        *    0.27  * Cum Volume (acre-ft)   *  777.11  *  323.60  *
1088.43  *
* C & E Loss (ft)        *    0.09  * Cum SA (acres)         *  191.85  *   22.53  *
 151.20  *
*******************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #0.2%
*******************************************************************************
**********
* E.G. Elev (ft)         *  182.74  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.17  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  182.57  * Reach Len. (ft)        *  900.00  *  900.00  *
 550.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 6601.36  * 1608.31  *
7274.11  *
* E.G. Slope (ft/ft)     *0.000598  * Area (sq ft)           * 6601.36  * 1608.31  *
7274.11  *
* Q Total (cfs)          *25700.00  * Flow (cfs)            * 7553.80  * 8717.55  *
9428.65  *
* Top Width (ft)         * 2350.31  * Top Width (ft)         * 1181.03  *   90.00  *
1079.28  *
* Vel Total (ft/s)       *    1.66  * Avg. Vel. (ft/s)       *    1.14  *    5.42  *
   1.30  *
* Max Chl Dpth (ft)      *   23.17  * Hydr. Depth (ft)       *    5.59  *   17.87  *
   6.74  *
* Conv. Total (cfs)      *1051057.0  * Conv. (cfs)           *308928.8  *356522.9
*385604.8  *
* Length Wtd. (ft)       *  703.32  * Wetted Per. (ft)       * 1181.11  *   92.46  *
1079.52  *
* Min Ch El (ft)         *  159.40  * Shear (lb/sq ft)       *    0.21  *    0.65  *
   0.25  *
* Alpha                  *    3.98  * Stream Power (lb/ft s) *    0.24  *    3.52  *
   0.33  *
* Frctn Loss (ft)        *    0.20  * Cum Volume (acre-ft)   * 2211.78  *  414.33  *
1750.25  *
```

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                                   Duplicate Effective
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *  419.25  *   22.90  *
 176.68  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 314.4

INPUT
Description: XS 314.4 (LETTERED CROSS-SECTION W)
Station Elevation Data    num=      23
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
     445     185     695     181    1075     181    1095     180    1180     178
    1530     178    1605     180    1715     181    1790     181    1820     180
    1870     175    1945     170    1975     165    2000   159.1    2055     165
    2120     170    2165     171    2225     170    2410     169    3175     170
    3705     175    3755     180    3855     185

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
     445      .1    1975    .045    2055      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          1975    2055              600    1252     600             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     445    1790     185       F
    3855    3855     185       F

CROSS SECTION OUTPUT  Profile #1%
*******************************************************************************
***********
* E.G. Elev (ft)         *  180.15  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.11  * Reach Len. (ft)       *  600.00  * 1252.00  *
 600.00  *
* Crit W.S. (ft)         *  172.28  * Flow Area (sq ft)     * 1079.93  * 1444.90
*16074.25  *
* E.G. Slope (ft/ft)     *0.000149  * Area (sq ft)          * 1997.47  * 1444.90
*16074.25  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            *  701.97  * 3975.73
*13022.30  *
* Top Width (ft)         * 2465.03  * Top Width (ft)        *  682.80  *   80.00  *
1702.23  *
* Vel Total (ft/s)       *    0.95  * Avg. Vel. (ft/s)      *    0.65  *    2.75  *
   0.81  *
* Max Chl Dpth (ft)      *   21.01  * Hydr. Depth (ft)      *    6.82  *   18.06  *
   9.44  *
* Conv. Total (cfs)      *1450121.0  * Conv. (cfs)           * 57510.7  *325722.4
*1066887.0  *
* Length Wtd. (ft)       *  766.87  * Wetted Per. (ft)      *  159.17  *   81.00  *
1702.72  *
```

Duplicate Effective

* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.06	* 0.17	* 0.09	*
* Alpha	* 2.43	* Stream Power (lb/ft s)	* 0.04	* 0.46	* 0.07	*
* Frctn Loss (ft)	* 0.14	* Cum Volume (acre-ft)	* 1808.71	* 398.52	* 2028.11	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 398.59	* 20.62	* 152.57	*

****

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 180.81	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.04	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 180.77	* Reach Len. (ft)	* 600.00	* 1252.00	* 600.00	*
* Crit W.S. (ft)	* 172.27	* Flow Area (sq ft)	* 342.10	* 1497.40	*14246.69	*
* E.G. Slope (ft/ft)	*0.000156	* Area (sq ft)	* 342.10	* 1497.40	*14246.69	*
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 279.76	* 4314.29	*13105.96	*
* Top Width (ft)	* 1385.00	* Top Width (ft)	* 25.00	* 80.00	* 1280.00	*
* Vel Total (ft/s)	* 1.10	* Avg. Vel. (ft/s)	* 0.82	* 2.88	* 0.92	*
* Max Chl Dpth (ft)	* 21.67	* Hydr. Depth (ft)	* 13.68	* 18.72	* 11.13	*
* Conv. Total (cfs)	*1418230.0	* Conv. (cfs)	* 22415.7	*345686.3	*1050128.0	*
* Length Wtd. (ft)	* 783.84	* Wetted Per. (ft)	* 36.95	* 81.00	* 1289.48	*
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.09	* 0.18	* 0.11	*
* Alpha	* 2.20	* Stream Power (lb/ft s)	* 0.07	* 0.52	* 0.10	*
* Frctn Loss (ft)	* 0.16	* Cum Volume (acre-ft)	* 416.31	* 414.51	* 903.57	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 37.22	* 20.62	* 46.99	*

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 176.17	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.03	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 176.14	* Reach Len. (ft)	* 600.00	* 1252.00	* 600.00	*

		Duplicate Effective			
* Crit W.S. (ft)	* 170.68	* Flow Area (sq ft)	* 538.42	* 1127.01	* 9393.52 *
* E.G. Slope (ft/ft)	*0.000167	* Area (sq ft)	* 538.42	* 1127.01	* 9393.52 *
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 285.63	* 2778.17	* 5716.20 *
* Top Width (ft)	* 1857.75	* Top Width (ft)	* 116.38	* 80.00	* 1661.38 *
* Vel Total (ft/s)	* 0.79	* Avg. Vel. (ft/s)	* 0.53	* 2.47	* 0.61 *
* Max Chl Dpth (ft)	* 17.04	* Hydr. Depth (ft)	* 4.63	* 14.09	* 5.65 *
* Conv. Total (cfs)	*680350.2	* Conv. (cfs)	* 22133.0	*215276.4	*442940.8 *
* Length Wtd. (ft)	* 832.04	* Wetted Per. (ft)	* 117.01	* 81.00	* 1661.67 *
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.05	* 0.14	* 0.06 *
* Alpha	* 3.45	* Stream Power (lb/ft s)	* 0.03	* 0.36	* 0.04 *
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 554.22	* 263.93	* 626.41 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 110.88	* 20.77	* 122.19 *

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 178.60	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.04	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 178.56	* Reach Len. (ft)	* 600.00	* 1252.00	* 600.00 *
* Crit W.S. (ft)	* 171.92	* Flow Area (sq ft)	* 849.86	* 1320.91	*13449.68 *
* E.G. Slope (ft/ft)	*0.000179	* Area (sq ft)	* 1058.95	* 1320.91	*13449.68 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 559.11	* 3756.08	*10684.81 *
* Top Width (ft)	* 2301.14	* Top Width (ft)	* 535.52	* 80.00	* 1685.61 *
* Vel Total (ft/s)	* 0.96	* Avg. Vel. (ft/s)	* 0.66	* 2.84	* 0.79 *
* Max Chl Dpth (ft)	* 19.46	* Hydr. Depth (ft)	* 6.04	* 16.51	* 7.98 *
* Conv. Total (cfs)	*1120116.0	* Conv. (cfs)	* 41751.0	*280482.9	*797881.6 *
* Length Wtd. (ft)	* 787.55	* Wetted Per. (ft)	* 141.37	* 81.00	* 1686.03 *
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.07	* 0.18	* 0.09 *
* Alpha	* 2.70	* Stream Power (lb/ft s)	* 0.04	* 0.52	* 0.07 *
* Frctn Loss (ft)	* 0.18	* Cum Volume (acre-ft)	* 738.83	* 297.02	* 983.36 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 178.33	* 20.77	* 135.15 *

****

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	182.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	182.46	Reach Len. (ft)	600.00	1252.00	600.00
Crit W.S. (ft)	173.13	Flow Area (sq ft)	1503.09	1633.01	20132.15
E.G. Slope (ft/ft)	0.000163	Area (sq ft)	4606.54	1633.01	20132.15
Q Total (cfs)	25700.00	Flow (cfs)	1148.35	5096.90	19454.75
Top Width (ft)	3200.67	Top Width (ft)	1371.42	80.00	1749.25
Vel Total (ft/s)	1.10	Avg. Vel. (ft/s)	0.76	3.12	0.97
Max Chl Dpth (ft)	23.36	Hydr. Depth (ft)	8.12	20.41	11.51
Conv. Total (cfs)	2014004.0	Conv. (cfs)	89991.4	399423.3	1524590.0
Length Wtd. (ft)	745.49	Wetted Per. (ft)	185.85	81.00	1749.80
Min Ch El (ft)	159.10	Shear (lb/sq ft)	0.08	0.20	0.12
Alpha	2.18	Stream Power (lb/ft s)	0.06	0.64	0.11
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	2096.00	380.85	1577.23
C & E Loss (ft)	0.00	Cum SA (acres)	392.88	21.15	158.82

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 300

INPUT
Description: XS 300
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	100	177	300	175	1100	178	2000	178
2100	177	2350	175	2390	170	2400	165	2440	158.7
2480	165	2500	170	2580	170	3000	169	3400	170
3600	175	3790	180	3890	185				

Duplicate Effective

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	2400	.045	2480	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2400	2480	1000	1900	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	1780	185	F
3520	3890	185	F

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	180.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.93	Reach Len. (ft)	1000.00	1900.00	1900.00
Crit W.S. (ft)	172.50	Flow Area (sq ft)	2072.25	1446.48	10608.29
E.G. Slope (ft/ft)	0.000243	Area (sq ft)	7059.59	1446.48	11544.76
Q Total (cfs)	17700.00	Flow (cfs)	1070.62	5084.28	11545.10
Top Width (ft)	3785.08	Top Width (ft)	2397.70	80.00	1307.38
Vel Total (ft/s)	1.25	Avg. Vel. (ft/s)	0.52	3.51	1.09
Max Chl Dpth (ft)	21.23	Hydr. Depth (ft)	3.34	18.08	10.20
Conv. Total (cfs)	1136166.0	Conv. (cfs)	68723.0	326361.0	741082.0
Length Wtd. (ft)	1678.56	Wetted Per. (ft)	621.50	80.99	1040.66
Min Ch El (ft)	158.70	Shear (lb/sq ft)	0.05	0.27	0.15
Alpha	2.76	Stream Power (lb/ft s)	0.03	0.95	0.17
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	1746.33	356.97	1837.90
C & E Loss (ft)	0.01	Cum SA (acres)	377.38	18.32	131.85

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	180.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	180.56	Reach Len. (ft)	1000.00	1900.00	

```
1900.00  *
* Crit W.S. (ft)         *  172.53  * Flow Area (sq ft)      * 1016.35  * 1496.87  *
9323.17  *
* E.G. Slope (ft/ft)     *0.000269  * Area (sq ft)           * 1016.35  * 1496.87  *
9323.17  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            *  828.38  * 5667.08
*11204.55  *
* Top Width (ft)         * 1080.00  * Top Width (ft)        *  160.00  *   80.00  *
 840.00  *
* Vel Total (ft/s)       *    1.50  * Avg. Vel. (ft/s)      *    0.82  *    3.79  *
   1.20  *
* Max Chl Dpth (ft)      *   21.86  * Hydr. Depth (ft)      *    6.35  *   18.71  *
  11.10  *
* Conv. Total (cfs)      *1079191.0  * Conv. (cfs)           * 50507.1  *345528.6
*683155.1  *
* Length Wtd. (ft)       * 1679.70  * Wetted Per. (ft)      *  166.18  *   80.99  *
 851.38  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)      *    0.10  *    0.31  *
   0.18  *
* Alpha                  *    2.47  * Stream Power (lb/ft s) *    0.08  *    1.18  *
   0.22  *
* Frctn Loss (ft)        *    0.64  * Cum Volume (acre-ft)  *  406.95  *  371.48  *
 741.25  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *   35.95  *   18.32  *
  32.39  *
*******************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
**********
* E.G. Elev (ft)         *  176.00  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.06  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.93  * Reach Len. (ft)       * 1000.00  * 1900.00  *
1900.00  *
* Crit W.S. (ft)         *  170.83  * Flow Area (sq ft)     *  276.03  * 1126.63  *
6450.18  *
* E.G. Slope (ft/ft)     *0.000260  * Area (sq ft)          *  435.57  * 1126.63  *
6621.34  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)            *   92.09  * 3471.13  *
5216.79  *
* Top Width (ft)         * 1744.11  * Top Width (ft)        *  508.66  *   80.00  *
1155.45  *
* Vel Total (ft/s)       *    1.12  * Avg. Vel. (ft/s)      *    0.33  *    3.08  *
   0.81  *
* Max Chl Dpth (ft)      *   17.23  * Hydr. Depth (ft)      *    1.66  *   14.08  *
   6.20  *
* Conv. Total (cfs)      *544295.6  * Conv. (cfs)           *  5708.8  *215184.3
*323402.5  *
* Length Wtd. (ft)       * 1752.31  * Wetted Per. (ft)      *  168.10  *   80.99  *
1040.66  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)      *    0.03  *    0.23  *
   0.10  *
* Alpha                  *    3.31  * Stream Power (lb/ft s) *    0.01  *    0.70  *
   0.08  *
```

```
                                   Duplicate Effective
* Frctn Loss (ft)        *    0.66  * Cum Volume (acre-ft)   *  547.51  *  231.54  *
 516.12  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *  106.57  *   18.47  *
 102.79  *
**************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**************************************************************************************
***********
* E.G. Elev (ft)         *  178.42  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.08  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  178.33  * Reach Len. (ft)       * 1000.00  * 1900.00  *
1900.00  *
* Crit W.S. (ft)         *  172.09  * Flow Area (sq ft)     * 1082.31  * 1318.75  *
8947.74  *
* E.G. Slope (ft/ft)     *0.000303  * Area (sq ft)          * 3273.72  * 1318.75  *
9505.73  *
* Q Total (cfs)          *15000.00  * Flow (cfs)            *  405.52  * 4873.52  *
9720.97  *
* Top Width (ft)         * 3671.19  * Top Width (ft)        * 2344.48  *   80.00  *
1246.71  *
* Vel Total (ft/s)       *    1.32  * Avg. Vel. (ft/s)      *    0.37  *    3.70  *
   1.09  *
* Max Chl Dpth (ft)      *   19.63  * Hydr. Depth (ft)      *    1.75  *   16.48  *
   8.60  *
* Conv. Total (cfs)      *861049.9  * Conv. (cfs)           * 23278.2  *279756.0
*558015.7  *
* Length Wtd. (ft)       * 1733.39  * Wetted Per. (ft)      *  621.50  *   80.99  *
1040.66  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)      *    0.03  *    0.31  *
   0.16  *
* Alpha                  *    2.98  * Stream Power (lb/ft s) *    0.01  *    1.14  *
   0.18  *
* Frctn Loss (ft)        *    0.84  * Cum Volume (acre-ft)   *  708.99  *  259.09  *
 825.26  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *  158.49  *   18.47  *
 114.95  *
**************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
**************************************************************************************
***********
* E.G. Elev (ft)         *  182.35  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.08  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
```

		Duplicate Effective			
* W.S. Elev (ft)	* 182.27	* Reach Len. (ft)	* 1000.00	* 1900.00	* 1900.00 *
* Crit W.S. (ft)	* 173.52	* Flow Area (sq ft)	* 3525.41	* 1633.99	*13045.85 *
* E.G. Slope (ft/ft)	*0.000254	* Area (sq ft)	*12684.66	* 1633.99	*14666.81 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 2655.35	* 6372.80	*16671.86 *
* Top Width (ft)	* 3835.50	* Top Width (ft)	* 2400.00	* 80.00	* 1355.50 *
* Vel Total (ft/s)	* 1.41	* Avg. Vel. (ft/s)	* 0.75	* 3.90	* 1.28 *
* Max Chl Dpth (ft)	* 23.57	* Hydr. Depth (ft)	* 5.69	* 20.42	* 12.54 *
* Conv. Total (cfs)	*1612602.0	* Conv. (cfs)	*166615.5	*399874.8	*1046112.0 *
* Length Wtd. (ft)	* 1626.30	* Wetted Per. (ft)	* 621.50	* 80.99	* 1040.66 *
* Min Ch El (ft)	* 158.70	* Shear (lb/sq ft)	* 0.09	* 0.32	* 0.20 *
* Alpha	* 2.45	* Stream Power (lb/ft s)	* 0.07	* 1.25	* 0.25 *
* Frctn Loss (ft)	* 0.60	* Cum Volume (acre-ft)	* 1976.91	* 333.90	* 1337.57 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 366.90	* 18.85	* 137.44 *

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 285

INPUT
Description: XS 285
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	100	177	300	175	1100	178	2000	178
2100	177	2300	177	2860	170	2990	165	3060	164
3095	158.2	3130	164	3140	165	3250	170	3290	172
3370	188								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3060	.045	3130	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3060	3130	220	320	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Duplicate Effective Permanent
0	2040	185	F
3370	3370	185	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 179.38	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.20	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.17	* Reach Len. (ft)	* 220.00	* 320.00	* 320.00 *
* Crit W.S. (ft)	* 171.61	* Flow Area (sq ft)	* 6269.73	* 1265.20	* 1886.55 *
* E.G. Slope (ft/ft)	*0.000597	* Area (sq ft)	*10234.54	* 1265.20	* 1886.55 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 7639.50	* 6968.79	* 3091.71 *
* Top Width (ft)	* 3298.35	* Top Width (ft)	* 3032.48	* 70.00	* 195.87 *
* Vel Total (ft/s)	* 1.88	* Avg. Vel. (ft/s)	* 1.22	* 5.51	* 1.64 *
* Max Chl Dpth (ft)	* 20.97	* Hydr. Depth (ft)	* 6.15	* 18.07	* 9.63 *
* Conv. Total (cfs)	*724227.9	* Conv. (cfs)	*312584.1	*285140.8	*126503.1 *
* Length Wtd. (ft)	* 286.70	* Wetted Per. (ft)	* 1020.15	* 70.95	* 196.79 *
* Min Ch El (ft)	* 158.20	* Shear (lb/sq ft)	* 0.23	* 0.66	* 0.36 *
* Alpha	* 3.70	* Stream Power (lb/ft s)	* 0.28	* 3.66	* 0.59 *
* Frctn Loss (ft)	* 0.16	* Cum Volume (acre-ft)	* 1547.82	* 297.83	* 1544.97 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 315.05	* 15.05	* 99.06 *

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 179.99	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.23	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.76	* Reach Len. (ft)	* 220.00	* 320.00	* 320.00 *
* Crit W.S. (ft)	* 171.52	* Flow Area (sq ft)	* 4543.69	* 1306.55	* 1401.87 *
* E.G. Slope (ft/ft)	*0.000585	* Area (sq ft)	* 4543.69	* 1306.55	* 1401.87 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 7836.79	* 7275.06	* 2588.15 *
* Top Width (ft)	* 605.00	* Top Width (ft)	* 425.00	* 70.00	* 110.00 *
* Vel Total (ft/s)	* 2.44	* Avg. Vel. (ft/s)	* 1.72	* 5.57	* 1.85 *
* Max Chl Dpth (ft)	* 21.56	* Hydr. Depth (ft)	* 10.69	* 18.66	*

```
  12.74  *
* Conv. Total (cfs)      *731935.6  * Conv. (cfs)            *324069.2  *300840.4
*107026.0  *
* Length Wtd. (ft)       *  286.14  * Wetted Per. (ft)       *  432.07  *   70.95  *
 120.37  *
* Min Ch El (ft)         *  158.20  * Shear (lb/sq ft)       *    0.38  *    0.67  *
   0.43  *
* Alpha                  *    2.44  * Stream Power (lb/ft s) *    0.66  *    3.74  *
   0.78  *
* Frctn Loss (ft)        *    0.17  * Cum Volume (acre-ft)   *  343.13  *  310.34  *
 507.34  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   29.23  *   15.05  *
  11.68  *
**************************************************************************************
***********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
**************************************************************************************
***********
* E.G. Elev (ft)         *  175.33  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.18  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.14  * Reach Len. (ft)        *  220.00  *  320.00  *
 320.00  *
* Crit W.S. (ft)         *  168.58  * Flow Area (sq ft)      * 2796.05  *  982.95  *
1137.41  *
* E.G. Slope (ft/ft)     *0.000594  * Area (sq ft)           * 2799.75  *  982.95  *
1137.41  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)             * 2789.45  * 4562.72  *
1427.83  *
* Top Width (ft)         *  909.17  * Top Width (ft)         *  663.46  *   70.00  *
 175.71  *
* Vel Total (ft/s)       *    1.79  * Avg. Vel. (ft/s)       *    1.00  *    4.64  *
   1.26  *
* Max Chl Dpth (ft)      *   16.94  * Hydr. Depth (ft)       *    4.57  *   14.04  *
   6.47  *
* Conv. Total (cfs)      *360259.5  * Conv. (cfs)            *114456.2  *187216.7  *
58586.6  *
* Length Wtd. (ft)       *  298.99  * Wetted Per. (ft)       *  611.50  *   70.95  *
 176.24  *
* Min Ch El (ft)         *  158.20  * Shear (lb/sq ft)       *    0.17  *    0.51  *
   0.24  *
* Alpha                  *    3.69  * Stream Power (lb/ft s) *    0.17  *    2.38  *
   0.30  *
* Frctn Loss (ft)        *    0.16  * Cum Volume (acre-ft)   *  510.37  *  185.54  *
 346.91  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   93.12  *   15.20  *
  73.76  *
**************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**************************************************************************************
***********
* E.G. Elev (ft)         *  177.55  * Element                *  Left OB *  Channel *
```

```
Right OB *
* Vel Head (ft)          *    0.31  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  177.24  * Reach Len. (ft)        *  220.00  *  320.00  *
 320.00  *
* Crit W.S. (ft)         *  170.44  * Flow Area (sq ft)      * 4302.33  * 1129.73  *
1516.86  *
* E.G. Slope (ft/ft)     *0.000907  * Area (sq ft)           * 5219.52  * 1129.73  *
1516.86  *
* Q Total (cfs)          *15000.00  * Flow (cfs)             * 5148.08  * 7110.68  *
2741.24  *
* Top Width (ft)         * 2045.14  * Top Width (ft)        * 1788.95  *   70.00  *
 186.20  *
* Vel Total (ft/s)       *    2.16  * Avg. Vel. (ft/s)      *    1.20  *    6.29  *
   1.81  *
* Max Chl Dpth (ft)      *   19.04  * Hydr. Depth (ft)      *    4.37  *   16.14  *
   8.15  *
* Conv. Total (cfs)      *498044.8  * Conv. (cfs)           *170931.6  *236095.8  *
91017.4  *
* Length Wtd. (ft)       *  294.40  * Wetted Per. (ft)      *  984.05  *   70.95  *
 186.93  *
* Min Ch El (ft)         *  158.20  * Shear (lb/sq ft)      *    0.25  *    0.90  *
   0.46  *
* Alpha                  *    4.26  * Stream Power (lb/ft s) *    0.30  *    5.68  *
   0.83  *
* Frctn Loss (ft)        *    0.24  * Cum Volume (acre-ft)  *  611.50  *  205.69  *
 584.87  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *  111.05  *   15.20  *
  83.70  *
********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
**********
* E.G. Elev (ft)         *  181.74  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.20  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  181.53  * Reach Len. (ft)        *  220.00  *  320.00  *
 320.00  *
* Crit W.S. (ft)         *  173.59  * Flow Area (sq ft)      * 8676.58  * 1430.37  *
2362.66  *
* E.G. Slope (ft/ft)     *0.000583  * Area (sq ft)           *17443.75  * 1430.37  *
2362.66  *
* Q Total (cfs)          *25700.00  * Flow (cfs)             *12975.82  * 8450.44  *
4273.74  *
* Top Width (ft)         * 3337.67  * Top Width (ft)        * 3060.00  *   70.00  *
 207.67  *
* Vel Total (ft/s)       *    2.06  * Avg. Vel. (ft/s)      *    1.50  *    5.91  *
   1.81  *
* Max Chl Dpth (ft)      *   23.33  * Hydr. Depth (ft)      *    8.51  *   20.43  *
  11.38  *
* Conv. Total (cfs)      *1063977.0  * Conv. (cfs)           *537197.5  *349847.0
*176932.4  *
* Length Wtd. (ft)       *  279.33  * Wetted Per. (ft)      * 1020.15  *   70.95  *
 208.83  *
* Min Ch El (ft)         *  158.20  * Shear (lb/sq ft)      *    0.31  *    0.73  *
   0.41  *
```

```
                                Duplicate Effective
* Alpha                  *    3.10  * Stream Power (lb/ft s) *    0.46  *    4.34  *
   0.75  *
* Frctn Loss (ft)        *    0.16  * Cum Volume (acre-ft)   * 1631.09  *  267.07  *
 966.18  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *  304.23  *   15.58  *
 103.35  *
*******************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 280.55

INPUT
Description: XS 280.55 (LETTERED CROSS-SECTION V)
INSERTED NEW GR TO ACCOUNT
            FOR EXTRA FILL PLACED
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
    1515     185    1785     180    2130     177    2630     177    2745     180
    3545     182    4305     176    4725     172    4925     170    4945     165
    5000     158    5045     165    5150     166    5250     170    5270     175
    5290     185

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
    1515      .1    4945    .045    5045      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          4945    5045             1140    1140    1140             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    1515    3545     185       F
    5280    5290     185       F

CROSS SECTION OUTPUT  Profile #1%
*******************************************************************************
***********
* E.G. Elev (ft)         *  179.21  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  178.99  * Reach Len. (ft)       * 1140.00  * 1140.00  *
1140.00  *
* Crit W.S. (ft)         *  170.94  * Flow Area (sq ft)     * 4493.34  * 1749.35  *
2661.98  *
* E.G. Slope (ft/ft)     *0.000534  * Area (sq ft)          * 5794.74  * 1749.35  *
2661.98  *
* Q Total (cfs)          *17700.00  * Flow (cfs)           * 4147.01  * 8937.45  *
4615.54  *
* Top Width (ft)         * 2157.83  * Top Width (ft)       * 1824.84  *  100.00  *
 232.99  *
* Vel Total (ft/s)       *    1.99  * Avg. Vel. (ft/s)     *    0.92  *    5.11  *
   1.73  *
```

		Duplicate Effective			
* Max Chl Dpth (ft)	* 20.99	* Hydr. Depth (ft)	* 4.41	* 17.49	* 11.43 *
* Conv. Total (cfs)	*765887.3	* Conv. (cfs)	*179442.9	*386727.8	*199716.6 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 1019.83	* 100.98	* 234.63 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.15	* 0.58	* 0.38 *
* Alpha	* 3.58	* Stream Power (lb/ft s)	* 0.14	* 2.95	* 0.66 *
* Frctn Loss (ft)	* 1.07	* Cum Volume (acre-ft)	* 1507.34	* 286.76	* 1528.27 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 302.78	* 14.43	* 97.49 *

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 179.82	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.27	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.55	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 170.67	* Flow Area (sq ft)	* 2912.95	* 1804.52	* 1924.33 *
* E.G. Slope (ft/ft)	*0.000580	* Area (sq ft)	* 2912.95	* 1804.52	* 1924.33 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 4150.15	* 9811.08	* 3738.77 *
* Top Width (ft)	* 600.00	* Top Width (ft)	* 360.00	* 100.00	* 140.00 *
* Vel Total (ft/s)	* 2.66	* Avg. Vel. (ft/s)	* 1.42	* 5.44	* 1.94 *
* Max Chl Dpth (ft)	* 21.55	* Hydr. Depth (ft)	* 8.09	* 18.05	* 13.75 *
* Conv. Total (cfs)	*734750.3	* Conv. (cfs)	*172278.4	*407270.8	*155201.2 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 366.84	* 100.98	* 152.18 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.29	* 0.65	* 0.46 *
* Alpha	* 2.49	* Stream Power (lb/ft s)	* 0.41	* 3.52	* 0.89 *
* Frctn Loss (ft)	* 1.03	* Cum Volume (acre-ft)	* 324.30	* 298.92	* 495.13 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 27.25	* 14.43	* 10.76 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	175.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.18	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.98	Reach Len. (ft)	1140.00	1140.00	1140.00
Crit W.S. (ft)	167.87	Flow Area (sq ft)	1412.60	1348.15	1743.33
E.G. Slope (ft/ft)	0.000502	Area (sq ft)	1412.60	1348.15	1743.33
Q Total (cfs)	8780.00	Flow (cfs)	899.75	5612.16	2268.09
Top Width (ft)	857.98	Top Width (ft)	533.05	100.00	224.93
Vel Total (ft/s)	1.95	Avg. Vel. (ft/s)	0.64	4.16	1.30
Max Chl Dpth (ft)	16.98	Hydr. Depth (ft)	2.65	13.48	7.75
Conv. Total (cfs)	391926.9	Conv. (cfs)	40163.6	250518.8	101244.5
Length Wtd. (ft)	1140.00	Wetted Per. (ft)	533.69	100.98	225.62
Min Ch El (ft)	158.00	Shear (lb/sq ft)	0.08	0.42	0.24
Alpha	3.04	Stream Power (lb/ft s)	0.05	1.74	0.31
Frctn Loss (ft)	1.06	Cum Volume (acre-ft)	499.74	176.97	336.33
C & E Loss (ft)	0.04	Cum SA (acres)	90.10	14.58	72.29

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	177.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.	0.100	0.045	

```
  0.100  *
* W.S. Elev (ft)         *  177.02  * Reach Len. (ft)        * 1140.00  * 1140.00  *
1140.00  *
* Crit W.S. (ft)         *  169.97  * Flow Area (sq ft)      * 2730.53  * 1552.24  *
2206.63  *
* E.G. Slope (ft/ft)     *0.000720  * Area (sq ft)           * 2741.76  * 1552.24  *
2206.63  *
* Q Total (cfs)          *15000.00  * Flow (cfs)             * 2530.75  * 8500.34  *
3968.91  *
* Top Width (ft)         * 1601.98  * Top Width (ft)        * 1272.93  *  100.00  *
 229.04  *
* Vel Total (ft/s)       *    2.31  * Avg. Vel. (ft/s)      *    0.93  *    5.48  *
   1.80  *
* Max Chl Dpth (ft)      *   19.02  * Hydr. Depth (ft)      *    3.55  *   15.52  *
   9.63  *
* Conv. Total (cfs)      *559153.8  * Conv. (cfs)           * 94338.5  *316866.4
*147948.8  *
* Length Wtd. (ft)       * 1140.00  * Wetted Per. (ft)      *  770.15  *  100.98  *
 230.22  *
* Min Ch El (ft)         *  158.00  * Shear (lb/sq ft)      *    0.16  *    0.69  *
   0.43  *
* Alpha                  *    3.37  * Stream Power (lb/ft s) *    0.15  *    3.78  *
   0.77  *
* Frctn Loss (ft)        *    1.97  * Cum Volume (acre-ft)  *  591.40  *  195.84  *
 571.19  *
* C & E Loss (ft)        *    0.19  * Cum SA (acres)        *  103.32  *   14.58  *
  82.18  *
*******************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
*******************************************************************************
**********
* E.G. Elev (ft)         *  181.57  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.24  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  181.33  * Reach Len. (ft)       * 1140.00  * 1140.00  *
1140.00  *
* Crit W.S. (ft)         *  172.95  * Flow Area (sq ft)     * 7219.01  * 1982.89  *
3209.80  *
* E.G. Slope (ft/ft)     *0.000565  * Area (sq ft)          *11085.66  * 1982.89  *
3211.56  *
* Q Total (cfs)          *25700.00  * Flow (cfs)            * 7931.08  *11326.11  *
6442.81  *
* Top Width (ft)         * 3215.98  * Top Width (ft)       * 2878.33  *  100.00  *
 237.66  *
* Vel Total (ft/s)       *    2.07  * Avg. Vel. (ft/s)      *    1.10  *    5.71  *
   2.01  *
* Max Chl Dpth (ft)      *   23.33  * Hydr. Depth (ft)      *    5.49  *   19.83  *
```

```
  13.66  *
* Conv. Total (cfs)      *1081341.0  * Conv. (cfs)           *333704.3  *476552.2
*271084.6  *
* Length Wtd. (ft)       * 1140.00  * Wetted Per. (ft)       * 1315.66  *  100.98  *
 236.88  *
* Min Ch El (ft)         *  158.00  * Shear (lb/sq ft)       *    0.19  *    0.69  *
   0.48  *
* Alpha                  *    3.68  * Stream Power (lb/ft s) *    0.21  *    3.96  *
   0.96  *
* Frctn Loss (ft)        *    1.17  * Cum Volume (acre-ft)   * 1559.04  *  254.53  *
 945.70  *
* C & E Loss (ft)        *    0.08  * Cum SA (acres)         *  289.24  *   14.95  *
 101.71  *
*******************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 270

INPUT
Description: XS 270
THIS CROSS SECTION IS THE INSERTED CROSS SECTION TO
             REPRESENT
FILL PLACED SINCE THE EFFECTIVE FIS WAS
             COMPLETED
THERE IS AN ENCR. IN THE NAT. RUN TO REFLECT EFFECTIVE
             FLOW
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0     178     120     175     680     175     760     177    1840     177
    1900     180    1950     180    1970   182.8    2180   182.8    2180   202.8
    2240   202.8    2240   182.8    2325   182.8    2325   202.8    2385   202.8
    2550   181.4    2550   201.4    2620   201.4    2710   180.4    2710   200.4
    2770   200.4    3150   180.9    3200     180    3240     170    3550     170
  3602.5   157.7    3655     170    3710     206

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0      .1    3550    .045    3655      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          3550    3655              520     520     520             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3150     180       F
```

Duplicate Effective
3710 3710 180 F

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	178.10	Element	Left OB	Channel / Right OB
Vel Head (ft)	0.74	Wt. n-Val.	0.100	0.045 / 0.100
W.S. Elev (ft)	177.35	Reach Len. (ft)	520.00	520.00 / 520.00
Crit W.S. (ft)	173.39	Flow Area (sq ft)	2387.03	1417.65 / 41.28
E.G. Slope (ft/ft)	0.002039	Area (sq ft)	4303.30	1417.65 / 41.28
Q Total (cfs)	17700.00	Flow (cfs)	5868.46	11772.96 / 58.58
Top Width (ft)	2276.72	Top Width (ft)	2160.49	105.00 / 11.23
Vel Total (ft/s)	4.60	Avg. Vel. (ft/s)	2.46	8.30 / 1.42
Max Chl Dpth (ft)	19.65	Hydr. Depth (ft)	7.03	13.50 / 3.68
Conv. Total (cfs)	392003.7	Conv. (cfs)	129969.4	260737.0 / 1297.3
Length Wtd. (ft)	520.00	Wetted Per. (ft)	340.31	107.84 / 13.42
Min Ch El (ft)	157.70	Shear (lb/sq ft)	0.89	1.67 / 0.39
Alpha	2.26	Stream Power (lb/ft s)	2.19	13.89 / 0.56
Frctn Loss (ft)	0.48	Cum Volume (acre-ft)	1375.21	245.31 / 1492.89
C & E Loss (ft)	0.17	Cum SA (acres)	250.63	11.74 / 94.29

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	178.76	Element	Left OB	Channel / Right OB
Vel Head (ft)	0.61	Wt. n-Val.	0.100	0.045 / 0.100
W.S. Elev (ft)	178.14	Reach Len. (ft)	520.00	520.00 / 520.00
Crit W.S. (ft)	173.39	Flow Area (sq ft)	2655.67	1500.63 / 50.64
E.G. Slope (ft/ft)	0.001595	Area (sq ft)	2655.67	1500.63 / 50.64
Q Total (cfs)	17700.00	Flow (cfs)	6184.50	11447.48 / 68.02

		Duplicate Effective				
* Top Width (ft)	* 457.44	* Top Width (ft)	* 340.00	* 105.00	* 12.44	*
* Vel Total (ft/s)	* 4.21	* Avg. Vel. (ft/s)	* 2.33	* 7.63	* 1.34	*
* Max Chl Dpth (ft)	* 20.44	* Hydr. Depth (ft)	* 7.81	* 14.29	* 4.07	*
* Conv. Total (cfs)	*443238.8	* Conv. (cfs)	*154870.6	*286664.9	* 1703.3	*
* Length Wtd. (ft)	* 520.00	* Wetted Per. (ft)	* 341.56	* 107.84	* 14.87	*
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.77	* 1.39	* 0.34	*
* Alpha	* 2.23	* Stream Power (lb/ft s)	* 1.80	* 10.57	* 0.46	*
* Frctn Loss (ft)	* 0.39	* Cum Volume (acre-ft)	* 251.43	* 255.67	* 469.28	*
* C & E Loss (ft)	* 0.14	* Cum SA (acres)	* 18.09	* 11.74	* 8.76	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 174.06	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.62	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 173.44	* Reach Len. (ft)	* 520.00	* 520.00	* 520.00	*
* Crit W.S. (ft)	* 170.74	* Flow Area (sq ft)	* 1090.72	* 1007.16	* 9.05	*
* E.G. Slope (ft/ft)	*0.002276	* Area (sq ft)	* 1090.72	* 1007.16	* 9.05	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 1735.98	* 7035.84	* 8.18	*
* Top Width (ft)	* 434.03	* Top Width (ft)	* 323.77	* 105.00	* 5.26	*
* Vel Total (ft/s)	* 4.17	* Avg. Vel. (ft/s)	* 1.59	* 6.99	* 0.90	*
* Max Chl Dpth (ft)	* 15.74	* Hydr. Depth (ft)	* 3.37	* 9.59	* 1.72	*
* Conv. Total (cfs)	*184048.4	* Conv. (cfs)	* 36390.1	*147486.8	* 171.5	*
* Length Wtd. (ft)	* 520.00	* Wetted Per. (ft)	* 324.19	* 107.84	* 6.28	*
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.48	* 1.33	* 0.20	*
* Alpha	* 2.28	* Stream Power (lb/ft s)	* 0.76	* 9.27	* 0.18	*
* Frctn Loss (ft)	* 0.40	* Cum Volume (acre-ft)	* 466.98	* 146.15	* 313.40	*
* C & E Loss (ft)	* 0.16	* Cum SA (acres)	* 78.88	* 11.89	* 69.28	*

****

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	175.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.22	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	172.91	Reach Len. (ft)	520.00	520.00	520.00
Crit W.S. (ft)	172.76	Flow Area (sq ft)	920.56	951.80	6.49
E.G. Slope (ft/ft)	*0.008585	Area (sq ft)	920.56	951.80	6.49
Q Total (cfs)	*15000.00	Flow (cfs)	2552.96	*12436.85	10.20
Top Width (ft)	431.11	Top Width (ft)	321.66	105.00	4.45
Vel Total (ft/s)	7.98	Avg. Vel. (ft/s)	2.77	13.07	1.57
Max Chl Dpth (ft)	15.21	Hydr. Depth (ft)	2.86	9.06	1.46
Conv. Total (cfs)	*161886.1	Conv. (cfs)	27552.5	*134223.5	110.1
Length Wtd. (ft)	520.00	Wetted Per. (ft)	322.02	107.84	5.32
Min Ch El (ft)	157.70	Shear (lb/sq ft)	1.53	4.73	0.65
Alpha	2.24	Stream Power (lb/ft s)	4.25	61.81	1.03
Frctn Loss (ft)	1.43	Cum Volume (acre-ft)	543.48	163.07	542.23
C & E Loss (ft)	0.57	Cum SA (acres)	82.45	11.89	79.12

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	180.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.00	Wt. n-Val.	0.100	0.045	

		Duplicate Effective			
0.100					
W.S. Elev (ft)	179.32	Reach Len. (ft)	520.00	520.00	520.00
Crit W.S. (ft)	174.95	Flow Area (sq ft)	3064.33	1624.78	66.41
E.G. Slope (ft/ft)	0.002408	Area (sq ft)	8654.60	1624.78	66.41
Q Total (cfs)	25700.00	Flow (cfs)	9519.98	16060.03	120.00
Top Width (ft)	2353.02	Top Width (ft)	2233.78	105.00	14.25
Vel Total (ft/s)	5.40	Avg. Vel. (ft/s)	3.11	9.88	1.81
Max Chl Dpth (ft)	21.62	Hydr. Depth (ft)	8.82	15.47	4.66
Conv. Total (cfs)	523717.2	Conv. (cfs)	193999.1	327272.8	2445.3
Length Wtd. (ft)	520.00	Wetted Per. (ft)	348.44	107.84	17.03
Min Ch El (ft)	157.70	Shear (lb/sq ft)	1.32	2.26	0.59
Alpha	2.21	Stream Power (lb/ft s)	4.11	22.39	1.06
Frctn Loss (ft)	0.63	Cum Volume (acre-ft)	1300.73	207.32	902.81
C & E Loss (ft)	0.22	Cum SA (acres)	222.34	12.27	98.42

****

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264

INPUT
Description: XS 264 (LETTERED CROSS-SECTION U)
THIS SECTION IS THE FIRST SECTION U/S OF THE DIVIDED FLOW INSERTED AN INEFFECTIVE FLOW ENCROACHMENT AT 500' FROM LEFT CHANNEL BANK FOR THE NATURAL RUN. INEFFECTIVE FLOW AREA DUE TO FILL PLACED IN FLOODPLAIN AT CROSS-SECTION 270
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
840	185	1140	180	1490	177	3330	177	3530	176
3650	175	3820	170	4410	165	4680	164	4900	165

```
                                  Duplicate Effective
    4925     166    4950     165    4970     160    5000   157.5    5025     160
    5070     185

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
     840      .1    4970    .045    5025      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          4970    5025             1338    1338    1000             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
     840    4470     180       F
    5070    5070     180       F

CROSS SECTION OUTPUT  Profile #1%
************************************************************************************
**********
* E.G. Elev (ft)         *  177.44  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.17  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  177.27  * Reach Len. (ft)       * 1338.00  * 1338.00  *
1000.00  *
* Crit W.S. (ft)         *  168.83  * Flow Area (sq ft)     * 6398.53  * 1018.62  *
 268.44  *
* E.G. Slope (ft/ft)     *0.000529  * Area (sq ft)          *14585.26  * 1018.62  *
 268.44  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            *11948.86  * 5398.25  *
 352.89  *
* Top Width (ft)         * 3597.63  * Top Width (ft)        * 3511.55  *   55.00  *
  31.09  *
* Vel Total (ft/s)       *    2.30  * Avg. Vel. (ft/s)      *    1.87  *    5.30  *
   1.31  *
* Max Chl Dpth (ft)      *   19.77  * Hydr. Depth (ft)      *   12.80  *   18.52  *
   8.64  *
* Conv. Total (cfs)      *769865.8  * Conv. (cfs)           *519718.4  *234798.3  *
15349.1  *
* Length Wtd. (ft)       * 1332.01  * Wetted Per. (ft)      *  500.66  *   55.23  *
  35.56  *
* Min Ch El (ft)         *  157.50  * Shear (lb/sq ft)      *    0.42  *    0.61  *
   0.25  *
* Alpha                  *    2.07  * Stream Power (lb/ft s) *    0.79  *    3.23  *
   0.33  *
* Frctn Loss (ft)        *    0.58  * Cum Volume (acre-ft)  * 1262.47  *  230.77  *
1491.04  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)        *  216.78  *   10.79  *
  94.04  *
************************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
************************************************************************************
**********
* E.G. Elev (ft)         *  178.22  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.15  * Wt. n-Val.            *   0.100  *   0.045  *
```

```
  0.100  *
* W.S. Elev (ft)         *  178.08  * Reach Len. (ft)        * 1338.00  * 1338.00  *
1000.00  *
* Crit W.S. (ft)         *  168.83  * Flow Area (sq ft)      * 6801.05  * 1062.90  *
 288.11  *
* E.G. Slope (ft/ft)     *0.000439  * Area (sq ft)           * 7722.58  * 1062.90  *
 288.11  *
* Q Total (cfs)          *17700.00  * Flow (cfs)             *12051.30  * 5279.58  *
 369.11  *
* Top Width (ft)         *  652.91  * Top Width (ft)        *  570.00  *   55.00  *
  27.91  *
* Vel Total (ft/s)       *    2.17  * Avg. Vel. (ft/s)      *    1.77  *    4.97  *
   1.28  *
* Max Chl Dpth (ft)      *   20.58  * Hydr. Depth (ft)      *   13.60  *   19.33  *
  10.32  *
* Conv. Total (cfs)      *845019.8  * Conv. (cfs)           *575344.1  *252053.8  *
17622.0  *
* Length Wtd. (ft)       * 1331.74  * Wetted Per. (ft)      *  500.66  *   55.23  *
  34.50  *
* Min Ch El (ft)         *  157.50  * Shear (lb/sq ft)      *    0.37  *    0.53  *
   0.23  *
* Alpha                  *    2.02  * Stream Power (lb/ft s) *    0.66  *    2.62  *
   0.29  *
* Frctn Loss (ft)        *    0.48  * Cum Volume (acre-ft)  *  189.49  *  240.37  *
 467.26  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *   12.66  *   10.79  *
   8.52  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  173.51  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.10  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  173.41  * Reach Len. (ft)       * 1338.00  * 1338.00  *
1000.00  *
* Crit W.S. (ft)         *  167.07  * Flow Area (sq ft)     * 4468.58  *  806.33  *
 161.86  *
* E.G. Slope (ft/ft)     *0.000376  * Area (sq ft)          * 8664.80  *  806.33  *
 161.86  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)            * 5542.75  * 3085.56  *
 151.68  *
* Top Width (ft)         * 1345.10  * Top Width (ft)       * 1265.96  *   55.00  *
  24.14  *
* Vel Total (ft/s)       *    1.61  * Avg. Vel. (ft/s)     *    1.24  *    3.83  *
   0.94  *
* Max Chl Dpth (ft)      *   15.91  * Hydr. Depth (ft)     *    8.94  *   14.66  *
   6.71  *
* Conv. Total (cfs)      *452569.7  * Conv. (cfs)          *285704.1  *159046.9  *
 7818.7  *
* Length Wtd. (ft)       * 1333.66  * Wetted Per. (ft)     *  500.66  *   55.23  *
  27.61  *
* Min Ch El (ft)         *  157.50  * Shear (lb/sq ft)     *    0.21  *    0.34  *
   0.14  *
```

```
                                   Duplicate Effective
* Alpha                  *    2.35  * Stream Power (lb/ft s) *    0.26  *    1.31  *
   0.13  *
* Frctn Loss (ft)        *    0.56  * Cum Volume (acre-ft)   *  408.75  *  135.33  *
 312.38  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *   69.39  *   10.94  *
  69.10  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  173.13  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.33  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  172.81  * Reach Len. (ft)       * 1338.00  * 1338.00  *
1000.00  *
* Crit W.S. (ft)         *  168.36  * Flow Area (sq ft)     * 4166.11  *  773.05  *
 147.58  *
* E.G. Slope (ft/ft)     *0.001343  * Area (sq ft)          * 7905.18  *  773.05  *
 147.58  *
* Q Total (cfs)          *15000.00  * Flow (cfs)            * 9314.32  * 5432.38  *
 253.30  *
* Top Width (ft)         * 1323.44  * Top Width (ft)        * 1245.39  *   55.00  *
  23.05  *
* Vel Total (ft/s)       *    2.95  * Avg. Vel. (ft/s)      *    2.24  *    7.03  *
   1.72  *
* Max Chl Dpth (ft)      *   15.31  * Hydr. Depth (ft)      *    8.33  *   14.06  *
   6.40  *
* Conv. Total (cfs)      *409378.1  * Conv. (cfs)           *254205.1  *148259.9  *
 6913.1  *
* Length Wtd. (ft)       * 1333.10  * Wetted Per. (ft)      *  500.66  *   55.23  *
  26.37  *
* Min Ch El (ft)         *  157.50  * Shear (lb/sq ft)      *    0.70  *    1.17  *
   0.47  *
* Alpha                  *    2.42  * Stream Power (lb/ft s) *    1.56  *    8.24  *
   0.81  *
* Frctn Loss (ft)        *    1.55  * Cum Volume (acre-ft)   *  490.80  *  152.78  *
 541.31  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   73.10  *   10.94  *
  78.96  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
**********************************************************************************
**********
```

	Duplicate Effective				
* E.G. Elev (ft)	* 179.48	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.26	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.22	* Reach Len. (ft)	* 1338.00	* 1338.00	* 1000.00 *
* Crit W.S. (ft)	* 170.02	* Flow Area (sq ft)	* 7372.05	* 1125.71	* 332.38 *
* E.G. Slope (ft/ft)	*0.000723	* Area (sq ft)	*21643.46	* 1125.71	* 332.38 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	*17693.83	* 7457.46	* 548.71 *
* Top Width (ft)	* 3828.29	* Top Width (ft)	* 3738.70	* 55.00	* 34.59 *
* Vel Total (ft/s)	* 2.91	* Avg. Vel. (ft/s)	* 2.40	* 6.62	* 1.65 *
* Max Chl Dpth (ft)	* 21.72	* Hydr. Depth (ft)	* 14.74	* 20.47	* 9.61 *
* Conv. Total (cfs)	*955854.6	* Conv. (cfs)	*658082.9	*277363.7	* 20407.9 *
* Length Wtd. (ft)	* 1328.59	* Wetted Per. (ft)	* 500.66	* 55.23	* 39.57 *
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.66	* 0.92	* 0.38 *
* Alpha	* 1.98	* Stream Power (lb/ft s)	* 1.59	* 6.09	* 0.63 *
* Frctn Loss (ft)	* 0.24	* Cum Volume (acre-ft)	* 1119.89	* 190.91	* 900.43 *
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	* 186.69	* 11.31	* 98.13 *

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 250.12

INPUT
Description: XS 250.12
THIS SECTION IS FROM EFFECTIVE MODEL
THE X2 MIN HIGH
CORD WAS REVISED TO MATCH EXISTING CONDITIONS

Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	450	175	2850	174	3270	174	3450	172
3600	170	3650	160	3675	157	3695	160	3730	168
3920	168	3980	165.3	4100	168	4225	170	4300	172
4430	168	4700	180	5050	194				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3650	.045	3695	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3650	3695	482	482	.3	.5

Ineffective Flow num= 2

			Duplicate Effective
Sta L	Sta R	Elev	Permanent
0	3650	177.9	F
3695	5050	177.9	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
3750	5050	180

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 176.85	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.11	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 176.73	* Reach Len. (ft)	* 0.50	* 0.50	* 0.50	*
* Crit W.S. (ft)	* 162.72	* Flow Area (sq ft)	*	* 820.40	*	*
* E.G. Slope (ft/ft)	*0.000142	* Area (sq ft)	* 8754.66	* 820.40	* 620.22	*
* Q Total (cfs)	* 2220.00	* Flow (cfs)	*	* 2220.00	*	*
* Top Width (ft)	* 3455.81	* Top Width (ft)	* 3355.81	* 45.00	* 55.00	*
* Vel Total (ft/s)	* 2.71	* Avg. Vel. (ft/s)	*	* 2.71	*	*
* Max Chl Dpth (ft)	* 19.73	* Hydr. Depth (ft)	*	* 18.23	*	*
* Conv. Total (cfs)	*186539.8	* Conv. (cfs)	*	*186539.8	*	*
* Length Wtd. (ft)	* 0.50	* Wetted Per. (ft)	*	* 45.40	*	*
* Min Ch El (ft)	* 157.00	* Shear (lb/sq ft)	*	* 0.16	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.43	*	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 904.01	* 202.53	* 1480.84	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 111.31	* 9.25	* 93.05	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 177.73	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.10	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 177.62	* Reach Len. (ft)	* 0.50	* 0.50	* 0.50	*
* Crit W.S. (ft)	* 162.72	* Flow Area (sq ft)	*	* 860.61	*	*
* E.G. Slope (ft/ft)	*0.000121	* Area (sq ft)	* 1064.72	* 860.61	* 669.36	*
* Q Total (cfs)	* 2220.00	* Flow (cfs)	*	* 2220.00	*	*
* Top Width (ft)	* 210.00	* Top Width (ft)	* 110.00	* 45.00	*	*

```
  55.00  *
* Vel Total (ft/s)       *    2.58  * Avg. Vel. (ft/s)       *          *    2.58  *
         *
* Max Chl Dpth (ft)      *   20.62  * Hydr. Depth (ft)       *          *   19.12  *
         *
* Conv. Total (cfs)      *202024.9  * Conv. (cfs)            *          *202024.9  *
         *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)       *          *   45.40  *
         *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *          *    0.14  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.37  *
         *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *   54.53  *  210.83  *
 456.27  *
* C & E Loss (ft)        *          * Cum SA (acres)         *    2.22  *    9.25  *
   7.57  *
*******************************************************************************
***********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  172.92  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.36  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  172.56  * Reach Len. (ft)        *    0.50  *    0.50  *
   0.50  *
* Crit W.S. (ft)         *  163.70  * Flow Area (sq ft)      *          *  632.68  *
         *
* E.G. Slope (ft/ft)     *0.000625  * Area (sq ft)           *  625.99  *  632.68  *
 390.77  *
* Q Total (cfs)          * 3025.00  * Flow (cfs)             *          * 3025.00  *
         *
* Top Width (ft)         *  350.35  * Top Width (ft)         *  250.35  *   45.00  *
  55.00  *
* Vel Total (ft/s)       *    4.78  * Avg. Vel. (ft/s)       *          *    4.78  *
         *
* Max Chl Dpth (ft)      *   15.56  * Hydr. Depth (ft)       *          *   14.06  *
         *
* Conv. Total (cfs)      *120975.2  * Conv. (cfs)            *          *120975.2  *
         *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)       *          *   45.40  *
         *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *          *    0.54  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    2.60  *
         *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *  266.06  *  113.23  *
 306.03  *
* C & E Loss (ft)        *          * Cum SA (acres)         *   46.11  *    9.40  *
  68.19  *
*******************************************************************************
***********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #2%
```

* E.G. Elev (ft)	* 171.57	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.29	* Wt. n-Val.	*	* 0.045	* *
* W.S. Elev (ft)	* 171.28	* Reach Len. (ft)	* 0.50	* 0.50	* 0.50 *
* Crit W.S. (ft)	* 163.06	* Flow Area (sq ft)	*	* 575.11	* *
* E.G. Slope (ft/ft)	*0.000578	* Area (sq ft)	* 375.46	* 575.11	* 320.41 *
* Q Total (cfs)	* 2480.00	* Flow (cfs)	*	* 2480.00	* *
* Top Width (ft)	* 246.01	* Top Width (ft)	* 146.01	* 45.00	* 55.00 *
* Vel Total (ft/s)	* 4.31	* Avg. Vel. (ft/s)	*	* 4.31	* *
* Max Chl Dpth (ft)	* 14.28	* Hydr. Depth (ft)	*	* 12.78	* *
* Conv. Total (cfs)	*103190.4	* Conv. (cfs)	*	*103190.4	* *
* Length Wtd. (ft)	* 0.50	* Wetted Per. (ft)	*	* 45.40	* *
* Min Ch El (ft)	* 157.00	* Shear (lb/sq ft)	*	* 0.46	* *
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 1.97	* *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 363.62	* 132.07	* 535.94 *
* C & E Loss (ft)	*	* Cum SA (acres)	* 51.73	* 9.40	* 78.06 *

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 179.16	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 179.16	* Reach Len. (ft)	* 0.50	* 0.50	* 0.50 *
* Crit W.S. (ft)	* 166.00	* Flow Area (sq ft)	*17161.38	* 929.58	* 753.66 *
* E.G. Slope (ft/ft)	*0.000015	* Area (sq ft)	*17161.38	* 929.58	* 753.66 *
* Q Total (cfs)	* 5250.00	* Flow (cfs)	* 4041.44	* 895.62	* 312.94 *
* Top Width (ft)	* 3674.16	* Top Width (ft)	* 3574.16	* 45.00	* 55.00 *
* Vel Total (ft/s)	* 0.28	* Avg. Vel. (ft/s)	* 0.24	* 0.96	* 0.42 *
* Max Chl Dpth (ft)	* 22.16	* Hydr. Depth (ft)	* 4.80	* 20.66	* 13.70 *
* Conv. Total (cfs)	*1346607.0	* Conv. (cfs)	*1036615.0	*229723.5	* 80268.2 *
* Length Wtd. (ft)	* 0.50	* Wetted Per. (ft)	* 3575.20	* 45.40	* 67.06 *

```
                                    Duplicate Effective
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *    0.00  *    0.02  *
   0.01  *
* Alpha                  *    2.72  * Stream Power (lb/ft s) *    0.00  *    0.02  *
   0.00  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *  523.92  *  159.34  *
 887.96  *
* C & E Loss (ft)        *          * Cum SA (acres)         *   74.38  *    9.78  *
  97.10  *
*******************************************************************************
***********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 250.06

INPUT
Description: Bridge #2

Distance from Upstream XS =      .5
Deck/Roadway Width        =     481
Weir Coefficient          =     2.7
Upstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
       0     180       0     450     180       0    2850   178.6       0
    3660   177.9       0    3660   177.9   169.5    3690   177.9   169.5
    3690   177.9       0    5050   177.9       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0     180     450     175    2850     174    3270     174    3450     172
    3600     170    3650     160    3675     157    3695     160    3730     168
    3920     168    3980   165.3    4100     168    4225     170    4300     172
    4430     168    4700     180    5050     194

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .07    3650    .045    3695     .07

Bank Sta: Left   Right    Coeff Contr.   Expan.
          3650    3695             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3650   177.9       F
    3695    5050   177.9       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    3750    5050     180

Downstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
```

```
                                  Duplicate Effective
       0     180       0     450     180       0    2850   178.6       0
    3940   177.9       0    3940   177.9   169.5    3970   177.9   169.5
    3970   177.9       0    5050   177.9       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     180     550     175    1900     174    3100     175    3500     174
    3570     172    3880     170    3930     160    3955  156.84    3980     160
    4035     172    4350     174    5030   175.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .07    3930    .045    3980     .07

Bank Sta: Left   Right    Coeff Contr.   Expan.
          3930    3980             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3930     177       F
    3980    5030     177       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   177.4
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Energy

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =.6608186
           Max Low Cord                =   169.5

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #1%
*********************************************************************************
*********
* E.G. US. (ft)          *     176.85  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     176.73  * E.G. Elev (ft)        *     176.85  *
175.48  *
* Q Total (cfs)          *    2220.00  * W.S. Elev (ft)        *     169.50  *
169.50  *
* Q Bridge (cfs)         *    2220.00  * Crit W.S. (ft)        *     163.56  *
163.33  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      12.50  *
```

12.66					
* Weir Sta Lft (ft)	*		* Vel Total (ft/s)	*	6.44 *
6.32					
* Weir Sta Rgt (ft)	*		* Flow Area (sq ft)	*	344.63 *
351.36					
* Weir Submerg	*		* Froude # Chl	*	0.32 *
0.31					
* Weir Max Depth (ft)	*		* Specif Force (cu ft)	*	2429.30 *
2498.02					
* Min El Weir Flow (ft)	*	177.91	* Hydr Depth (ft)	*	*
* Min El Prs (ft)	*	169.50	* W.P. Total (ft)	*	81.23 *
81.77					
* Delta EG (ft)	*	1.37	* Conv. Total (cfs)	*	29824.0 *
30665.7					
* Delta WS (ft)	*	1.36	* Top Width (ft)	*	*
* BR Open Area (sq ft)	*	344.63	* Frctn Loss (ft)	*	*
* BR Open Vel (ft/s)	*	6.44	* C & E Loss (ft)	*	*
* BR Sluice Coef	*		* Shear Total (lb/sq ft)	*	1.47 *
1.41					
* BR Sel Method	* Press Only		* Power Total (lb/ft s)	*	9.45 *
8.88					

****

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #Floodway

****

* E.G. US. (ft)	*	177.73	* Element	*Inside BR US	
*Inside BR DS *					
* W.S. US. (ft)	*	177.62	* E.G. Elev (ft)	*	177.73 *
176.35					
* Q Total (cfs)	*	2220.00	* W.S. Elev (ft)	*	169.50 *
169.50					
* Q Bridge (cfs)	*	2220.00	* Crit W.S. (ft)	*	163.56 *
163.33					
* Q Weir (cfs)	*		* Max Chl Dpth (ft)	*	12.50 *
12.66					
* Weir Sta Lft (ft)	*		* Vel Total (ft/s)	*	6.44 *
6.32					
* Weir Sta Rgt (ft)	*		* Flow Area (sq ft)	*	344.63 *
351.36					
* Weir Submerg	*		* Froude # Chl	*	0.32 *
0.31					
* Weir Max Depth (ft)	*		* Specif Force (cu ft)	*	2429.30 *
2498.02					
* Min El Weir Flow (ft)	*	177.91	* Hydr Depth (ft)	*	*
* Min El Prs (ft)	*	169.50	* W.P. Total (ft)	*	81.23 *
81.77					
* Delta EG (ft)	*	1.38	* Conv. Total (cfs)	*	29824.0 *
30665.7					

```
                                    Duplicate Effective
* Delta WS (ft)          *       1.37  * Top Width (ft)         *             *
       *
* BR Open Area (sq ft)   *     344.63  * Frctn Loss (ft)        *             *
       *
* BR Open Vel (ft/s)     *       6.44  * C & E Loss (ft)        *             *
       *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       1.47  *
 1.41  *
* BR Sel Method          * Press Only  * Power Total (lb/ft s)  *       9.45  *
 8.88  *
*********************************************************************************
*********

Note:    The downstream water surface is above the minimum elevation required for
orifice flow.  The orifice flow equation
         was used for pressure flow.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #10%
*********************************************************************************
*********
* E.G. US. (ft)          *     172.92  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     172.56  * E.G. Elev (ft)        *     172.91  *
170.59  *
* Q Total (cfs)          *    3025.00  * W.S. Elev (ft)        *     169.50  *
169.50  *
* Q Bridge (cfs)         *    3025.00  * Crit W.S. (ft)        *     164.82  *
164.60  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      12.50  *
12.66  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       8.78  *
 8.61  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     344.63  *
351.36  *
* Weir Submerg           *             * Froude # Chl          *       0.44  *
 0.43  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    2810.09  *
2871.52  *
* Min El Weir Flow (ft)  *     177.91  * Hydr Depth (ft)       *             *
       *
* Min El Prs (ft)        *     169.50  * W.P. Total (ft)       *      81.23  *
81.77  *
* Delta EG (ft)          *       2.33  * Conv. Total (cfs)     *    29824.0  *
30665.7  *
* Delta WS (ft)          *       2.38  * Top Width (ft)        *             *
       *
* BR Open Area (sq ft)   *     344.63  * Frctn Loss (ft)       *             *
       *
* BR Open Vel (ft/s)     *       8.78  * C & E Loss (ft)       *             *
       *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       2.73  *
 2.61  *
* BR Sel Method          * Press Only  * Power Total (lb/ft s)  *      23.92  *
22.47  *
*********************************************************************************
*********

Note:    The downstream water surface is above the minimum elevation required for
orifice flow.  The orifice flow equation
```

was used for pressure flow.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #2%

E.G. US. (ft)	171.57	Element	Inside BR US	Inside BR DS	
W.S. US. (ft)	171.28	E.G. Elev (ft)	171.57	170.03	
Q Total (cfs)	2480.00	W.S. Elev (ft)	169.50	169.50	
Q Bridge (cfs)	2480.00	Crit W.S. (ft)	163.98	163.76	
Q Weir (cfs)		Max Chl Dpth (ft)	12.50	12.66	
Weir Sta Lft (ft)		Vel Total (ft/s)	7.20	7.06	
Weir Sta Rgt (ft)		Flow Area (sq ft)	344.63	351.36	
Weir Submerg		Froude # Chl	0.36	0.35	
Weir Max Depth (ft)		Specif Force (cu ft)	2539.51	2606.12	
Min El Weir Flow (ft)	177.91	Hydr Depth (ft)			
Min El Prs (ft)	169.50	W.P. Total (ft)	81.23	81.77	
Delta EG (ft)	1.54	Conv. Total (cfs)	29824.0	30665.7	
Delta WS (ft)	1.55	Top Width (ft)			
BR Open Area (sq ft)	344.63	Frctn Loss (ft)			
BR Open Vel (ft/s)	7.20	C & E Loss (ft)			
BR Sluice Coef		Shear Total (lb/sq ft)	1.83	1.75	
BR Sel Method	Press Only	Power Total (lb/ft s)	13.18	12.38	

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation
was used for pressure flow.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #0.2%

E.G. US. (ft)	179.16	Element	Inside BR US	Inside BR DS	
W.S. US. (ft)	179.16	E.G. Elev (ft)	179.16	178.62	
Q Total (cfs)	5250.00	W.S. Elev (ft)	179.16	178.41	

		Duplicate Effective			
* Q Bridge (cfs)	* 2620.33	* Crit W.S. (ft)	* 167.85	* 167.63	*
* Q Weir (cfs)	* 2629.67	* Max Chl Dpth (ft)	* 22.16	* 21.57	*
* Weir Sta Lft (ft)	* 1888.88	* Vel Total (ft/s)	* 3.58	* 1.76	*
* Weir Sta Rgt (ft)	* 3750.00	* Flow Area (sq ft)	* 1465.15	* 2987.53	*
* Weir Submerg	* 0.00	* Froude # Chl	* 0.26	* 0.34	*
* Weir Max Depth (ft)	* 1.26	* Specif Force (cu ft)	* 6769.30	* 6685.18	*
* Min El Weir Flow (ft)	* 177.91	* Hydr Depth (ft)	* 0.79	* 1.58	*
* Min El Prs (ft)	* 169.50	* W.P. Total (ft)	* 1937.98	* 1971.39	*
* Delta EG (ft)	* 2.05	* Conv. Total (cfs)	*	*	*
* Delta WS (ft)	* 2.05	* Top Width (ft)	* 1855.50	* 1889.11	*
* BR Open Area (sq ft)	* 344.63	* Frctn Loss (ft)	*	*	*
* BR Open Vel (ft/s)	* 7.60	* C & E Loss (ft)	*	*	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	*	*	*
* BR Sel Method	* Press/Weir	* Power Total (lb/ft s)	*	*	*

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: For the cross section inside the bridge at the upstream end, the water surface and energy have been projected from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: For the cross section inside the bridge at the downstream end, the water surface and energy are based on critical depth over the weir.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 250

INPUT
Description: XS 250
THIS IS THE D/S FACE OF RUNWAY 34-R
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	550	175	1900	174	3100	175	3500	174
3570	172	3880	170	3930	160	3955	156.84	3980	160
4035	172	4350	174	5030	175.2				

Manning's n Values num= 3

```
                                   Duplicate Effective
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0     .07    3930    .045    3980     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          3930    3980                5      40      60             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3930     177       F
    3980    5030     177       F

CROSS SECTION OUTPUT  Profile #1%
************************************************************************************
***********
* E.G. Elev (ft)         *  175.48  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.11  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  175.37  * Reach Len. (ft)        *    5.00  *   40.00  *
  60.00  *
* Crit W.S. (ft)         *  162.37  * Flow Area (sq ft)      *          *  847.42  *
         *
* E.G. Slope (ft/ft)     *0.000146  * Area (sq ft)           * 4607.89  *  847.42  *
1783.89  *
* Q Total (cfs)          * 2220.00  * Flow (cfs)             *          * 2220.00  *
         *
* Top Width (ft)         * 4520.53  * Top Width (ft)        * 3420.53  *   50.00  *
1050.00  *
* Vel Total (ft/s)       *    2.62  * Avg. Vel. (ft/s)       *          *    2.62  *
         *
* Max Chl Dpth (ft)      *   18.53  * Hydr. Depth (ft)       *          *   16.95  *
         *
* Conv. Total (cfs)      *183657.7  * Conv. (cfs)           *          *183657.7  *
         *
* Length Wtd. (ft)       *   39.05  * Wetted Per. (ft)       *          *   50.40  *
         *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)       *          *    0.15  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.40  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  903.93  *  198.67  *
1480.83  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *  111.27  *    9.25  *
  93.04  *
************************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
************************************************************************************
***********
* E.G. Elev (ft)         *  176.35  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.10  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  176.25  * Reach Len. (ft)        *    5.00  *   40.00  *
```

```
  60.00  *
* Crit W.S. (ft)         *  162.37  * Flow Area (sq ft)      *          *  891.58  *
         *
* E.G. Slope (ft/ft)     *0.000123  * Area (sq ft)           *  562.58  *  891.58  *
 539.85  *
* Q Total (cfs)          * 2220.00  * Flow (cfs)             *          * 2220.00  *
         *
* Top Width (ft)         *  150.00  * Top Width (ft)         *   50.00  *   50.00  *
  50.00  *
* Vel Total (ft/s)       *    2.49  * Avg. Vel. (ft/s)       *          *    2.49  *
         *
* Max Chl Dpth (ft)      *   19.41  * Hydr. Depth (ft)       *          *   17.83  *
         *
* Conv. Total (cfs)      *199881.8  * Conv. (cfs)            *          *199881.8  *
         *
* Length Wtd. (ft)       *   39.10  * Wetted Per. (ft)       *          *   50.40  *
         *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)       *          *    0.14  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.34  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *   54.52  *  206.97  *
 456.26  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *    2.21  *    9.25  *
   7.57  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  170.59  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.41  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  170.18  * Reach Len. (ft)       *    5.00  *   40.00  *
  60.00  *
* Crit W.S. (ft)         *  163.27  * Flow Area (sq ft)      *          *  587.91  *
         *
* E.G. Slope (ft/ft)     *0.000918  * Area (sq ft)           *  261.37  *  587.91  *
 237.40  *
* Q Total (cfs)          * 3025.00  * Flow (cfs)             *          * 3025.00  *
         *
* Top Width (ft)         *  174.26  * Top Width (ft)         *   77.61  *   50.00  *
  46.65  *
* Vel Total (ft/s)       *    5.15  * Avg. Vel. (ft/s)       *          *    5.15  *
         *
* Max Chl Dpth (ft)      *   13.34  * Hydr. Depth (ft)       *          *   11.76  *
         *
* Conv. Total (cfs)      * 99851.7  * Conv. (cfs)            *          * 99851.7  *
         *
* Length Wtd. (ft)       *   39.34  * Wetted Per. (ft)       *          *   50.40  *
         *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)       *          *    0.67  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    3.44  *
         *
```

* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 266.06	* 109.38	* 306.03	*
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 46.10	* 9.40	* 68.19	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 170.03	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.30	* Wt. n-Val.	*	* 0.045	*	
* W.S. Elev (ft)	* 169.73	* Reach Len. (ft)	* 5.00	* 40.00	* 60.00	*
* Crit W.S. (ft)	* 162.67	* Flow Area (sq ft)	*	* 565.50	*	
* E.G. Slope (ft/ft)	*0.000702	* Area (sq ft)	* 236.68	* 565.50	* 216.96	*
* Q Total (cfs)	* 2480.00	* Flow (cfs)	*	* 2480.00	*	
* Top Width (ft)	* 143.25	* Top Width (ft)	* 48.65	* 50.00	* 44.60	*
* Vel Total (ft/s)	* 4.39	* Avg. Vel. (ft/s)	*	* 4.39	*	
* Max Chl Dpth (ft)	* 12.89	* Hydr. Depth (ft)	*	* 11.31	*	
* Conv. Total (cfs)	* 93588.9	* Conv. (cfs)	*	* 93588.9	*	
* Length Wtd. (ft)	* 39.38	* Wetted Per. (ft)	*	* 50.40	*	
* Min Ch El (ft)	* 156.84	* Shear (lb/sq ft)	*	* 0.49	*	
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 2.16	*	
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 363.62	* 128.22	* 535.94	*
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 51.73	* 9.40	* 78.06	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 177.11	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.070	* 0.045	* 0.070	*
* W.S. Elev (ft)	* 177.10	* Reach Len. (ft)	* 5.00	* 40.00	* 60.00	*
* Crit W.S. (ft)	* 165.42	* Flow Area (sq ft)	*10710.28	* 934.20	* 3606.29	*
* E.G. Slope (ft/ft)	*0.000037	* Area (sq ft)	*10710.28	* 934.20	* 3606.29	*
* Q Total (cfs)	* 5250.00	* Flow (cfs)	* 2867.08	* 1320.25	*	

* Top Width (ft)	* 4711.45	* Top Width (ft)	* 3611.45	* 50.00	* 1050.00	*	
* Vel Total (ft/s)	* 0.34	* Avg. Vel. (ft/s)	* 0.27	* 1.41	* 0.29	*	
* Max Chl Dpth (ft)	* 20.26	* Hydr. Depth (ft)	* 2.97	* 18.68	* 3.43	*	
* Conv. Total (cfs)	*859174.8	* Conv. (cfs)	*469203.9	*216061.8	*173909.0	*	
* Length Wtd. (ft)	* 31.47	* Wetted Per. (ft)	* 3612.49	* 50.40	* 1053.21	*	
* Min Ch El (ft)	* 156.84	* Shear (lb/sq ft)	* 0.01	* 0.04	* 0.01	*	
* Alpha	* 4.72	* Stream Power (lb/ft s)	* 0.00	* 0.06	* 0.00	*	
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 517.19	* 155.03	* 884.58	*	
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 60.28	* 9.25	* 90.98	*	

****

Warning: Multiple water surfaces were found that could balance the energy equation. The program selected the water
surface whose main channel velocity head was the closest to the previously computed cross section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 246

INPUT
Description: XS 246
THIS IS THE CROSS SECTION BETWEEN THE RUNWAY AND TAXIWAY
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	550	175	1900	174	3100	175	3500	174
3570	172	3880	170	3930	160	3955	156.8	3980	160
4040	170	4050	172	4970	174	5030	175.2		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3930	.045	3980	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3930	3980	5	50	140	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3880	180	F
4040	5030	180	F

CROSS SECTION OUTPUT Profile #1%

Duplicate Effective

E.G. Elev (ft)	175.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	175.40	Reach Len. (ft)	5.00	50.00	140.00
Crit W.S. (ft)	162.38	Flow Area (sq ft)	520.22	850.22	624.26
E.G. Slope (ft/ft)	0.000055	Area (sq ft)	4730.88	850.22	2928.62
Q Total (cfs)	2220.00	Flow (cfs)	385.46	1370.15	464.38
Top Width (ft)	4524.48	Top Width (ft)	3424.48	50.00	1050.00
Vel Total (ft/s)	1.11	Avg. Vel. (ft/s)	0.74	1.61	0.74
Max Chl Dpth (ft)	18.60	Hydr. Depth (ft)	10.40	17.00	10.40
Conv. Total (cfs)	299171.5	Conv. (cfs)	51946.0	184644.3	62581.3
Length Wtd. (ft)	55.51	Wetted Per. (ft)	50.99	50.41	60.83
Min Ch El (ft)	156.80	Shear (lb/sq ft)	0.04	0.06	0.04
Alpha	1.46	Stream Power (lb/ft s)	0.03	0.09	0.03
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	903.39	197.89	1477.58
C & E Loss (ft)	0.06	Cum SA (acres)	110.88	9.21	91.60

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	176.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	176.28	Reach Len. (ft)	5.00	50.00	140.00
Crit W.S. (ft)	162.38	Flow Area (sq ft)	564.20	894.20	677.04
E.G. Slope (ft/ft)	0.000047	Area (sq ft)	564.20	894.20	677.04
Q Total (cfs)	2220.00	Flow (cfs)	378.30	1380.48	461.22
Top Width (ft)	160.00	Top Width (ft)	50.00	50.00	60.00
Vel Total (ft/s)	1.04	Avg. Vel. (ft/s)	0.67	1.54	0.68
Max Chl Dpth (ft)	19.48	Hydr. Depth (ft)	11.28	17.88	

```
  11.28  *
* Conv. Total (cfs)      *322972.9  * Conv. (cfs)           * 55036.2  *200836.4  *
67100.3  *
* Length Wtd. (ft)       *   55.52  * Wetted Per. (ft)      *   57.27  *   50.41  *
  67.11  *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)      *    0.03  *    0.05  *
   0.03  *
* Alpha                  *    1.53  * Stream Power (lb/ft s) *    0.02  *    0.08  *
   0.02  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)  *   54.46  *  206.15  *
 455.43  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)        *    2.21  *    9.21  *
   7.49  *
**************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
**************************************************************************************
***********
* E.G. Elev (ft)         *  170.44  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.17  * Wt. n-Val.           *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  170.28  * Reach Len. (ft)      *    5.00  *   50.00  *
 140.00  *
* Crit W.S. (ft)         *  163.23  * Flow Area (sq ft)    *  263.75  *  593.75  *
 316.50  *
* E.G. Slope (ft/ft)     *0.000478  * Area (sq ft)         *  269.61  *  593.75  *
 316.69  *
* Q Total (cfs)          * 3025.00  * Flow (cfs)           *  365.96  * 2218.16  *
 440.88  *
* Top Width (ft)         *  203.99  * Top Width (ft)       *   92.62  *   50.00  *
  61.37  *
* Vel Total (ft/s)       *    2.58  * Avg. Vel. (ft/s)     *    1.39  *    3.74  *
   1.39  *
* Max Chl Dpth (ft)      *   13.47  * Hydr. Depth (ft)     *    5.27  *   11.87  *
   5.27  *
* Conv. Total (cfs)      *138415.8  * Conv. (cfs)          * 16745.1  *101497.2  *
20173.5  *
* Length Wtd. (ft)       *   53.84  * Wetted Per. (ft)      *   50.99  *   50.41  *
  60.83  *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)      *    0.15  *    0.35  *
   0.16  *
* Alpha                  *    1.62  * Stream Power (lb/ft s) *    0.21  *    1.31  *
   0.22  *
* Frctn Loss (ft)        *    0.05  * Cum Volume (acre-ft)  *  266.03  *  108.83  *
 305.65  *
* C & E Loss (ft)        *    0.25  * Cum SA (acres)        *   46.10  *    9.36  *
  68.12  *
**************************************************************************************
***********

Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
```

1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	169.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	169.80	Reach Len. (ft)	5.00	50.00	140.00
Crit W.S. (ft)	162.68	Flow Area (sq ft)	239.86	569.75	287.83
E.G. Slope (ft/ft)	*0.000383	Area (sq ft)	239.86	569.75	287.83
Q Total (cfs)	2480.00	Flow (cfs)	283.67	1854.59	341.75
Top Width (ft)	157.75	Top Width (ft)	48.98	50.00	58.77
Vel Total (ft/s)	2.26	Avg. Vel. (ft/s)	1.18	3.26	1.19
Max Chl Dpth (ft)	13.00	Hydr. Depth (ft)	4.90	11.40	4.90
Conv. Total (cfs)	*126706.9	Conv. (cfs)	14493.1	94753.6	17460.3
Length Wtd. (ft)	53.63	Wetted Per. (ft)	49.95	50.41	59.58
Min Ch El (ft)	156.80	Shear (lb/sq ft)	0.11	0.27	0.12
Alpha	1.62	Stream Power (lb/ft s)	0.14	0.88	0.14
Frctn Loss (ft)	0.04	Cum Volume (acre-ft)	363.59	127.70	535.59
C & E Loss (ft)	0.17	Cum SA (acres)	51.72	9.36	77.99

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	177.08	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	176.95	Reach Len. (ft)	5.00	50.00	140.00
Crit W.S. (ft)	165.16	Flow Area (sq ft)	597.72	927.72	717.27
E.G. Slope (ft/ft)	*0.000215	Area (sq ft)	*10171.20	927.72	4556.19
Q Total (cfs)	5250.00	Flow (cfs)	960.45	3132.45	

1157.10 *						
* Top Width (ft)	* 4694.99	* Top Width (ft)	* 3594.99	* 50.00	* 1050.00 *	
* Vel Total (ft/s)	* 2.34	* Avg. Vel. (ft/s)	* 1.61	* 3.38	* 1.61 *	
* Max Chl Dpth (ft)	* 20.15	* Hydr. Depth (ft)	* 11.95	* 18.55	* 11.95 *	
* Conv. Total (cfs)	*357895.4	* Conv. (cfs)	* 65474.7	*213540.9	* 78879.8 *	
* Length Wtd. (ft)	* 55.80	* Wetted Per. (ft)	* 50.99	* 50.41	* 60.83 *	
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	* 0.16	* 0.25	* 0.16 *	
* Alpha	* 1.43	* Stream Power (lb/ft s)	* 0.25	* 0.83	* 0.26 *	
* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 515.99	* 154.18	* 878.95 *	
* C & E Loss (ft)	* 0.32	* Cum SA (acres)	* 59.86	* 9.21	* 89.54 *	

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 245

INPUT
Description: XS 245
THIS IS THE U/S FACE OF THE TAXIWAY
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	550	175	1900	174	3100	175	3500	174
3570	172	3890	170	3940	160	3960	156.8	3975	160
4020	170	4090	174	4260	175	4890	175	5030	176.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3940	.045	3975	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3940	3975	230	230	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3940	176.9	F
3975	5030	176.6	F

CROSS SECTION OUTPUT Profile #1%
****

Duplicate Effective

* E.G. Elev (ft)	* 175.37	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.22	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 175.15	* Reach Len. (ft)	* 10.00	* 10.00	* 10.00	*
* Crit W.S. (ft)	* 163.40	* Flow Area (sq ft)	*	* 586.08	*	*
* E.G. Slope (ft/ft)	*0.000314	* Area (sq ft)	* 3888.03	* 586.08	* 878.99	*
* Q Total (cfs)	* 2220.00	* Flow (cfs)	*	* 2220.00	*	*
* Top Width (ft)	* 4372.89	* Top Width (ft)	* 3405.96	* 35.00	* 931.93	*
* Vel Total (ft/s)	* 3.79	* Avg. Vel. (ft/s)	*	* 3.79	*	*
* Max Chl Dpth (ft)	* 18.35	* Hydr. Depth (ft)	*	* 16.75	*	*
* Conv. Total (cfs)	*125258.8	* Conv. (cfs)	*	*125258.8	*	*
* Length Wtd. (ft)	* 10.00	* Wetted Per. (ft)	*	* 35.59	*	*
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.32	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 1.22	*	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 902.90	* 197.07	* 1471.47	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 110.48	* 9.16	* 88.41	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 176.25	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.20	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 176.05	* Reach Len. (ft)	* 10.00	* 10.00	* 10.00	*
* Crit W.S. (ft)	* 163.40	* Flow Area (sq ft)	*	* 617.80	*	*
* E.G. Slope (ft/ft)	*0.000264	* Area (sq ft)	* 552.57	* 617.80	* 653.14	*
* Q Total (cfs)	* 2220.00	* Flow (cfs)	*	* 2220.00	*	*
* Top Width (ft)	* 160.00	* Top Width (ft)	* 50.00	* 35.00	* 75.00	*
* Vel Total (ft/s)	* 3.59	* Avg. Vel. (ft/s)	*	* 3.59	*	*
* Max Chl Dpth (ft)	* 19.25	* Hydr. Depth (ft)	*	* 17.65	*	*
* Conv. Total (cfs)	*136760.8	* Conv. (cfs)	*	*136760.8	*	*
* Length Wtd. (ft)	* 10.00	* Wetted Per. (ft)	*	* 35.59	*	*
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.29	*	*

* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 1.03	*	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	* 54.40	* 205.28	* 453.29	*
* C & E Loss (ft)	*	* Cum SA (acres)	* 2.20	* 9.16	* 7.28	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 170.14	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 1.01	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 169.13	* Reach Len. (ft)	* 10.00	* 10.00	* 10.00	*
* Crit W.S. (ft)	* 164.55	* Flow Area (sq ft)	*	* 375.60	*	*
* E.G. Slope (ft/ft)	*0.002570	* Area (sq ft)	* 208.46	* 375.60	* 187.61	*
* Q Total (cfs)	* 3025.00	* Flow (cfs)	*	* 3025.00	*	*
* Top Width (ft)	* 121.75	* Top Width (ft)	* 45.66	* 35.00	* 41.09	*
* Vel Total (ft/s)	* 8.05	* Avg. Vel. (ft/s)	*	* 8.05	*	*
* Max Chl Dpth (ft)	* 12.33	* Hydr. Depth (ft)	*	* 10.73	*	*
* Conv. Total (cfs)	* 59670.8	* Conv. (cfs)	*	* 59670.8	*	*
* Length Wtd. (ft)	* 10.00	* Wetted Per. (ft)	*	* 35.59	*	*
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 1.69	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 13.64	*	*
* Frctn Loss (ft)	* 0.04	* Cum Volume (acre-ft)	* 266.00	* 108.28	* 304.84	*
* C & E Loss (ft)	* 0.15	* Cum SA (acres)	* 46.09	* 9.31	* 67.95	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 169.72	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.69	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 169.03	* Reach Len. (ft)	* 10.00	* 10.00	*	

```
  10.00  *
* Crit W.S. (ft)         *  163.78  * Flow Area (sq ft)      *          *  371.89  *
         *
* E.G. Slope (ft/ft)     *0.001785  * Area (sq ft)           *  203.65  *  371.89  *
 183.28  *
* Q Total (cfs)          * 2480.00  * Flow (cfs)             *          * 2480.00  *
         *
* Top Width (ft)         *  120.74  * Top Width (ft)         *   45.13  *   35.00  *
  40.61  *
* Vel Total (ft/s)       *    6.67  * Avg. Vel. (ft/s)       *          *    6.67  *
         *
* Max Chl Dpth (ft)      *   12.23  * Hydr. Depth (ft)       *          *   10.63  *
         *
* Conv. Total (cfs)      * 58691.5  * Conv. (cfs)            *          * 58691.5  *
         *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)       *          *   35.59  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    1.16  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    7.77  *
         *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *  363.57  *  127.16  *
 534.83  *
* C & E Loss (ft)        *    0.09  * Cum SA (acres)         *   51.71  *    9.31  *
  77.83  *
*********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #0.2%
*********************************************************************************
**********
* E.G. Elev (ft)         *  176.73  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    1.19  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  175.54  * Reach Len. (ft)       *   10.00  *   10.00  *
  10.00  *
* Crit W.S. (ft)         *  167.27  * Flow Area (sq ft)      *          *  599.89  *
         *
* E.G. Slope (ft/ft)     *0.001625  * Area (sq ft)           * 5241.14  *  599.89  *
1255.97  *
* Q Total (cfs)          * 5250.00  * Flow (cfs)             *          * 5250.00  *
         *
* Top Width (ft)         * 4462.37  * Top Width (ft)         * 3449.38  *   35.00  *
 977.98  *
* Vel Total (ft/s)       *    8.75  * Avg. Vel. (ft/s)       *          *    8.75  *
         *
* Max Chl Dpth (ft)      *   18.74  * Hydr. Depth (ft)       *          *   17.14  *
         *
* Conv. Total (cfs)      *130218.9  * Conv. (cfs)            *          *130218.9  *
         *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)       *          *   35.59  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    1.71  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *   14.97  *
         *
```

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                                   Duplicate Effective
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *  515.11  *  153.30  *
 869.61  *
* C & E Loss (ft)        *          * Cum SA (acres)         *   59.46  *    9.16  *
  86.28  *
*********************************************************************************
**********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 244.19

INPUT
Description: Bridge #1
THIS IS SMALL RUNWAY CROSSING

Distance from Upstream XS =      10
Deck/Roadway Width        =     200
Weir Coefficient          =     2.7
Upstream  Deck/Roadway Coordinates
    num=       10
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*********************************************************************
       0     180       0     550   177.3       0    1900   177.3       0
    3100   176.9       0    3940   176.6       0 3944.99   176.6       0
    3945   176.6   170.9    3975   176.6   170.9 3975.01   176.6       0
    5030   176.6       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=      15
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0     180     550     175    1900     174    3100     175    3500     174
    3570     172    3890     170    3940     160    3960   156.8    3975     160
    4020     170    4090     174    4260     175    4890     175    5030   176.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************
       0     .07    3940    .045    3975     .07

Bank Sta: Left   Right    Coeff Contr.   Expan.
          3940    3975             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3940   176.9       F
    3975    5030   176.6       F

Downstream  Deck/Roadway Coordinates
    num=       9
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*********************************************************************
       0     180       0     550   177.3       0    1900   177.3       0
    3100   176.9       0 3894.99   176.6       0    3895   176.6   170.9
    3925   176.6   170.9 3925.01   176.6       0    5030   176.6       0

Downstream Bridge Cross Section Data
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

Duplicate Effective

0	180	400	175	1550	172	3800	172	3845	170
3845	160	3885	157.969	3910	156.7	3940	160	3980	170
4040	170	4100	168	4470	170	4790	176		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3885	.045	3940	.07

Bank Sta: Left Right Coeff Contr. Expan.
3885 3940 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3885	176	F
3940	4790	176	F

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins = 176.6
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
Energy
Selected Low Flow Methods = Energy

High Flow Method
Pressure and Weir flow
Submerged Inlet Cd =
Submerged Inlet + Outlet Cd =.7905694
Max Low Cord = 170.9

Additional Bridge Parameters
Add Friction component to Momentum
Do not add Weight component to Momentum
Class B flow critical depth computations use critical depth
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #1%

E.G. US. (ft)	175.37	Element	Inside BR US	Inside BR DS	
W.S. US. (ft)	175.15	E.G. Elev (ft)	175.37	174.62	
Q Total (cfs)	2220.00	W.S. Elev (ft)	170.90	170.90	
Q Bridge (cfs)	2220.00	Crit W.S. (ft)	163.74	162.85	
Q Weir (cfs)		Max Chl Dpth (ft)	14.10	14.20	
Weir Sta Lft (ft)		Vel Total (ft/s)	5.83	5.44	
Weir Sta Rgt (ft)		Flow Area (sq ft)	381.01	407.93	
Weir Submerg		Froude # Chl	0.27	0.25	

Duplicate Effective

* Weir Max Depth (ft)	*	* Specif Force (cu ft)	*	2832.04	* 3151.68 *
* Min El Weir Flow (ft)	* 176.61	* Hydr Depth (ft)	*		*
* Min El Prs (ft)	* 170.90	* W.P. Total (ft)	*	72.23	* 73.55 *
* Delta EG (ft)	* 0.75	* Conv. Total (cfs)	*	38123.9	* 42206.5 *
* Delta WS (ft)	* 0.62	* Top Width (ft)	*		*
* BR Open Area (sq ft)	* 381.01	* Frctn Loss (ft)	*		*
* BR Open Vel (ft/s)	* 5.83	* C & E Loss (ft)	*		*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	*	1.12	* 0.96 *
* BR Sel Method	* Press Only	* Power Total (lb/ft s)	*	6.51	* 5.21 *

Note: The downstream water surface is above the minimum elevation required for orifice flow. The orifice flow equation was used for pressure flow.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #Floodway

* E.G. US. (ft)	* 176.25	* Element	*Inside BR US		*Inside BR DS *
* W.S. US. (ft)	* 176.05	* E.G. Elev (ft)	*	176.25	* 175.49 *
* Q Total (cfs)	* 2220.00	* W.S. Elev (ft)	*	170.90	* 170.90 *
* Q Bridge (cfs)	* 2220.00	* Crit W.S. (ft)	*	163.74	* 162.85 *
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	*	14.10	* 14.20 *
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	*	5.83	* 5.44 *
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	*	381.01	* 407.93 *
* Weir Submerg	*	* Froude # Chl	*	0.27	* 0.25 *
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	*	2832.04	* 3151.68 *
* Min El Weir Flow (ft)	* 176.61	* Hydr Depth (ft)	*		*
* Min El Prs (ft)	* 170.90	* W.P. Total (ft)	*	72.23	* 73.55 *
* Delta EG (ft)	* 0.76	* Conv. Total (cfs)	*	38123.9	* 42206.5 *
* Delta WS (ft)	* 0.64	* Top Width (ft)	*		*
* BR Open Area (sq ft)	* 381.01	* Frctn Loss (ft)	*		*
* BR Open Vel (ft/s)	* 5.83	* C & E Loss (ft)	*		*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	*	1.12	*

```
 0.96  *
* BR Sel Method          * Press Only  * Power Total (lb/ft s)  *       6.51  *
 5.21  *
*********************************************************************************
*********

Note:    The downstream water surface is above the minimum elevation required for
orifice flow.  The orifice flow equation
         was used for pressure flow.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #10%
*********************************************************************************
*********
* E.G. US. (ft)          *     170.14  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     169.13  * E.G. Elev (ft)        *     169.95  *
168.22  *
* Q Total (cfs)          *    3025.00  * W.S. Elev (ft)        *     168.45  *
166.25  *
* Q Bridge (cfs)         *    3025.00  * Crit W.S. (ft)        *     165.01  *
164.11  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      11.65  *
 9.55  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       9.84  *
11.27  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     307.43  *
268.37  *
* Weir Submerg           *             * Froude # Chl          *       0.51  *
 0.64  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    2510.90  *
2262.91  *
* Min El Weir Flow (ft)  *     176.61  * Hydr Depth (ft)       *      10.25  *
 8.95  *
* Min El Prs (ft)        *     170.90  * W.P. Total (ft)       *      39.30  *
48.09  *
* Delta EG (ft)          *       2.69  * Conv. Total (cfs)     *    40000.2  *
27881.3  *
* Delta WS (ft)          *       2.26  * Top Width (ft)        *      30.00  *
30.00  *
* BR Open Area (sq ft)   *     381.01  * Frctn Loss (ft)       *       1.59  *
 0.08  *
* BR Open Vel (ft/s)     *      11.27  * C & E Loss (ft)       *       0.14  *
 0.70  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       2.79  *
 4.10  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *      27.48  *
46.23  *
*********************************************************************************
*********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may
```

indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #2%

* E.G. US. (ft)	* 169.72	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 169.03	* E.G. Elev (ft)	* 169.61	* 168.77	*
* Q Total (cfs)	* 2480.00	* W.S. Elev (ft)	* 168.63	* 167.80	*
* Q Bridge (cfs)	* 2480.00	* Crit W.S. (ft)	* 164.17	* 163.27	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 11.83	* 11.10	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 7.93	* 7.87	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 312.90	* 315.04	*
* Weir Submerg	*	* Froude # Chl	* 0.41	* 0.42	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 2253.31	* 2263.74	*
* Min El Weir Flow (ft)	* 176.61	* Hydr Depth (ft)	* 10.43	* 10.50	*
* Min El Prs (ft)	* 170.90	* W.P. Total (ft)	* 39.30	* 49.60	*
* Delta EG (ft)	* 1.31	* Conv. Total (cfs)	* 41194.7	* 35677.7	*
* Delta WS (ft)	* 0.92	* Top Width (ft)	* 30.00	* 30.00	*
* BR Open Area (sq ft)	* 381.01	* Frctn Loss (ft)	* 0.83	* 0.03	*
* BR Open Vel (ft/s)	* 7.93	* C & E Loss (ft)	* 0.01	* 0.33	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 1.80	* 1.92	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 14.28	* 15.08	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #0.2%

* E.G. US. (ft)	* 176.73	* Element	*Inside BR US

Duplicate Effective

*Inside BR DS *					
* W.S. US. (ft)	* 175.54	* E.G. Elev (ft)	* 176.73	* 176.73	*
* Q Total (cfs)	* 5250.00	* W.S. Elev (ft)	* 175.54	* 175.54	*
* Q Bridge (cfs)	* 5129.04	* Crit W.S. (ft)	* 168.04	* 167.14	*
* Q Weir (cfs)	* 131.17	* Max Chl Dpth (ft)	* 18.74	* 18.84	*
* Weir Sta Lft (ft)	* 3940.00	* Vel Total (ft/s)	* 0.00	* 9.60	*
* Weir Sta Rgt (ft)	* 5030.00	* Flow Area (sq ft)	*	* 546.77	*
* Weir Submerg	* 0.00	* Froude # Chl	* 0.56	* 0.52	*
* Weir Max Depth (ft)	* 0.13	* Specif Force (cu ft)	* 6446.25	* 6768.94	*
* Min El Weir Flow (ft)	* 176.61	* Hydr Depth (ft)	*	*	
* Min El Prs (ft)	* 170.90	* W.P. Total (ft)	* 72.23	* 86.10	*
* Delta EG (ft)	* 5.46	* Conv. Total (cfs)	*	*	
* Delta WS (ft)	* 5.18	* Top Width (ft)	*	*	
* BR Open Area (sq ft)	* 381.01	* Frctn Loss (ft)	*	*	
* BR Open Vel (ft/s)	* 13.46	* C & E Loss (ft)	*	*	
* BR Sluice Coef	* 0.48	* Shear Total (lb/sq ft)	*	*	
* BR Sel Method	* Press/Weir	* Power Total (lb/ft s)	*	*	

****

Note: Momentum answer is not valid if the water surface is above the low chord or if there is weir flow. The momentum
answer has been disregarded.
Note: The downstream water surface is below the minimum elevation for pressure flow. The sluice gate equations were
used for pressure flow.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: For the cross section inside the bridge at the upstream end, the water surface and energy have been projected
from the upstream cross section. The selected bridge modeling method does not compute answers inside the bridge.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Note: For the cross section inside the bridge at the downstream end, the energy is based on critical depth over the weir.
The water surface has been projected.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243.38

INPUT
Description: XS 243.38

Duplicate Effective
THIS
THE DOWNSTREAM FACE OF THE TAXIWAY FROM EFFECTIVE MODEL
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	400	175	1550	172	3800	172	3845	170
3845	160	3885	157.969	3910	156.7	3940	160	3980	170
4040	170	4100	168	4470	170	4790	176		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3885	.045	3940	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3885	3940	600	600	300	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3885	176	F
3940	4790	176	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.62	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.09	* Wt. n-Val.	*	* 0.045	*
* W.S. Elev (ft)	* 174.53	* Reach Len. (ft)	* 600.00	* 600.00	* 300.00 *
* Crit W.S. (ft)	* 161.59	* Flow Area (sq ft)	*	* 915.03	*
* E.G. Slope (ft/ft)	*0.000128	* Area (sq ft)	* 7684.73	* 915.03	* 3574.56 *
* Q Total (cfs)	* 2220.00	* Flow (cfs)	*	* 2220.00	*
* Top Width (ft)	* 4129.41	* Top Width (ft)	* 3303.06	* 55.00	* 771.35 *
* Vel Total (ft/s)	* 2.43	* Avg. Vel. (ft/s)	*	* 2.43	*
* Max Chl Dpth (ft)	* 17.83	* Hydr. Depth (ft)	*	* 16.64	*
* Conv. Total (cfs)	*196403.6	* Conv. (cfs)	*	*196403.6	*
* Length Wtd. (ft)	* 521.11	* Wetted Per. (ft)	*	* 55.21	*
* Min Ch El (ft)	* 156.70	* Shear (lb/sq ft)	*	* 0.13	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.32	*
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 900.69	* 194.84	* 1470.54 *
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 109.34	* 9.14	* 88.13 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.		0.045	
W.S. Elev (ft)	175.41	Reach Len. (ft)	600.00	600.00	300.00
Crit W.S. (ft)	161.59	Flow Area (sq ft)		963.63	
E.G. Slope (ft/ft)	0.000108	Area (sq ft)	708.85	963.63	470.45
Q Total (cfs)	2220.00	Flow (cfs)		2220.00	
Top Width (ft)	155.00	Top Width (ft)	50.00	55.00	50.00
Vel Total (ft/s)	2.30	Avg. Vel. (ft/s)		2.30	
Max Chl Dpth (ft)	18.71	Hydr. Depth (ft)		17.52	
Conv. Total (cfs)	214094.9	Conv. (cfs)		214094.9	
Length Wtd. (ft)	600.00	Wetted Per. (ft)		55.21	
Min Ch El (ft)	156.70	Shear (lb/sq ft)		0.12	
Alpha	1.00	Stream Power (lb/ft s)		0.27	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	54.17	203.04	453.11
C & E Loss (ft)	0.02	Cum SA (acres)	2.19	9.14	7.26

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	167.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.58	Wt. n-Val.		0.045	
W.S. Elev (ft)	166.87	Reach Len. (ft)	600.00	600.00	300.00
Crit W.S. (ft)	162.43	Flow Area (sq ft)		493.80	
E.G. Slope (ft/ft)	0.001854	Area (sq ft)	315.28	493.80	94.30
Q Total (cfs)	3025.00	Flow (cfs)		3025.00	
Top Width (ft)	122.47	Top Width (ft)	40.00	55.00	27.47
Vel Total (ft/s)	6.13	Avg. Vel. (ft/s)		6.13	
Max Chl Dpth (ft)	10.17	Hydr. Depth (ft)		8.98	
Conv. Total (cfs)	70254.4	Conv. (cfs)		70254.4	
Length Wtd. (ft)	593.89	Wetted Per. (ft)		55.21	

* Min Ch El (ft)	* 156.70	* Shear (lb/sq ft)	*	* 1.04	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 6.34	*	*
* Frctn Loss (ft)	* 0.75	* Cum Volume (acre-ft)	* 265.90	* 106.70	* 304.79	*
* C & E Loss (ft)	* 0.17	* Cum SA (acres)	* 46.07	* 9.14	* 67.94	*

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 168.40	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.30	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 168.10	* Reach Len. (ft)	* 600.00	* 600.00	* 300.00	*
* Crit W.S. (ft)	* 161.87	* Flow Area (sq ft)	*	* 561.71	*	*
* E.G. Slope (ft/ft)	*0.000811	* Area (sq ft)	* 364.67	* 561.71	* 132.36	*
* Q Total (cfs)	* 2480.00	* Flow (cfs)	*	* 2480.00	*	*
* Top Width (ft)	* 149.18	* Top Width (ft)	* 40.00	* 55.00	* 54.18	*
* Vel Total (ft/s)	* 4.42	* Avg. Vel. (ft/s)	*	* 4.42	*	*
* Max Chl Dpth (ft)	* 11.40	* Hydr. Depth (ft)	*	* 10.21	*	*
* Conv. Total (cfs)	* 87083.8	* Conv. (cfs)	*	* 87083.8	*	*
* Length Wtd. (ft)	* 584.09	* Wetted Per. (ft)	*	* 55.21	*	*
* Min Ch El (ft)	* 156.70	* Shear (lb/sq ft)	*	* 0.52	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 2.27	*	*
* Frctn Loss (ft)	* 0.26	* Cum Volume (acre-ft)	* 363.46	* 125.43	* 534.78	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 51.70	* 9.14	* 77.81	*

****

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 171.27	* Element	* Left OB	* Channel	* Right OB	*

		Duplicate Effective			
* Vel Head (ft)	* 0.91	* Wt. n-Val.	*	* 0.045	*
* W.S. Elev (ft)	* 170.36	* Reach Len. (ft)	* 600.00	* 600.00	* 300.00 *
* Crit W.S. (ft)	* 164.45	* Flow Area (sq ft)	*	* 686.19	*
* E.G. Slope (ft/ft)	*0.001865	* Area (sq ft)	* 456.70	* 686.19	* 826.82 *
* Q Total (cfs)	* 5250.00	* Flow (cfs)	*	* 5250.00	*
* Top Width (ft)	* 652.65	* Top Width (ft)	* 48.21	* 55.00	* 549.45 *
* Vel Total (ft/s)	* 7.65	* Avg. Vel. (ft/s)	*	* 7.65	*
* Max Chl Dpth (ft)	* 13.66	* Hydr. Depth (ft)	*	* 12.48	*
* Conv. Total (cfs)	*121571.9	* Conv. (cfs)	*	*121571.9	*
* Length Wtd. (ft)	* 551.00	* Wetted Per. (ft)	*	* 55.21	*
* Min Ch El (ft)	* 156.70	* Shear (lb/sq ft)	*	* 1.45	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 11.07	*
* Frctn Loss (ft)	* 0.36	* Cum Volume (acre-ft)	* 514.40	* 151.12	* 869.28 *
* C & E Loss (ft)	* 0.40	* Cum SA (acres)	* 59.05	* 9.14	* 86.04 *

****

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243.2

INPUT
Description: XS 243.2
INSERTED XS TO EVALUATE IMPACT OF PROPOSED SITE(5/21/01)
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	184	220	180	1780	178	1990	176	2650	174
2840	172	3045	170	3105	166	3450	166	3485	160
3520	155.1	3560	160	3580	164	3600	166	3700	168
3900	168	4100	166	4450	165	4750	168	4900	176

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3485	.045	3560	.07

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
                                Duplicate Effective
          3485    3560              730     730     200             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3445     180       F
    4145    4900     180       F

CROSS SECTION OUTPUT  Profile #1%
*****************************************************************************
***********
* E.G. Elev (ft)         *  174.56  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  174.56  * Reach Len. (ft)       *  730.00  *  730.00  *
 200.00  *
* Crit W.S. (ft)         *  160.58  * Flow Area (sq ft)     *  447.24  * 1275.45  *
4408.12  *
* E.G. Slope (ft/ft)     *0.000011  * Area (sq ft)          * 4825.21  * 1275.45
*10009.51  *
* Q Total (cfs)          * 2220.00  * Flow (cfs)            *  152.90  *  899.57  *
1167.54  *
* Top Width (ft)         * 2406.38  * Top Width (ft)        * 1018.46  *   75.00  *
1312.92  *
* Vel Total (ft/s)       *    0.36  * Avg. Vel. (ft/s)      *    0.34  *    0.71  *
   0.26  *
* Max Chl Dpth (ft)      *   19.46  * Hydr. Depth (ft)      *   11.18  *   17.01  *
   7.54  *
* Conv. Total (cfs)      *683445.4  * Conv. (cfs)           * 47070.5  *276938.7
*359436.2  *
* Length Wtd. (ft)       *  443.36  * Wetted Per. (ft)      *   40.51  *   75.64  *
 585.53  *
* Min Ch El (ft)         *  155.10  * Shear (lb/sq ft)      *    0.01  *    0.01  *
   0.00  *
* Alpha                  *    1.88  * Stream Power (lb/ft s) *    0.00  *    0.01  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  814.53  *  179.76  *
1423.77  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   79.57  *    8.25  *
  80.95  *
*****************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
        1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
*****************************************************************************
***********
* E.G. Elev (ft)         *  175.41  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.04  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  175.37  * Reach Len. (ft)       *  730.00  *  730.00  *
 200.00  *
* Crit W.S. (ft)         *  160.56  * Flow Area (sq ft)     *          * 1336.58  *
         *
* E.G. Slope (ft/ft)     *0.000087  * Area (sq ft)          *          * 1336.58  *
         *
* Q Total (cfs)          * 2220.00  * Flow (cfs)            *          * 2220.00  *
         *
```

				Duplicate Effective					
* Top Width (ft)	*	75.00	* Top Width (ft)	*		*	75.00	*	
* Vel Total (ft/s)	*	1.66	* Avg. Vel. (ft/s)	*		*	1.66	*	
* Max Chl Dpth (ft)	*	20.27	* Hydr. Depth (ft)	*		*	17.82	*	
* Conv. Total (cfs)	*238520.9		* Conv. (cfs)	*		*238520.9		*	
* Length Wtd. (ft)	*	730.00	* Wetted Per. (ft)	*		*	106.38	*	
* Min Ch El (ft)	*	155.10	* Shear (lb/sq ft)	*		*	0.07	*	
* Alpha	*	1.00	* Stream Power (lb/ft s)	*		*	0.11	*	
* Frctn Loss (ft)	*	0.04	* Cum Volume (acre-ft)	*	49.29	*	187.20	*	451.49 *
* C & E Loss (ft)	*	0.01	* Cum SA (acres)	*	1.84	*	8.25	*	7.08 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	*	166.54	* Element	*	Left OB	*	Channel	*	Right OB *
* Vel Head (ft)	*	0.25	* Wt. n-Val.	*	0.070	*	0.045	*	0.070 *
* W.S. Elev (ft)	*	166.29	* Reach Len. (ft)	*	730.00	*	730.00	*	200.00 *
* Crit W.S. (ft)	*	161.30	* Flow Area (sq ft)	*	116.43	*	655.18	*	133.30 *
* E.G. Slope (ft/ft)	*0.000909		* Area (sq ft)	*	214.17	*	655.18	*	475.18 *
* Q Total (cfs)	* 3025.00		* Flow (cfs)	*	150.63	*	2751.08	*	123.29 *
* Top Width (ft)	* 1020.70		* Top Width (ft)	*	384.29	*	75.00	*	561.42 *
* Vel Total (ft/s)	*	3.34	* Avg. Vel. (ft/s)	*	1.29	*	4.20	*	0.92 *
* Max Chl Dpth (ft)	*	11.19	* Hydr. Depth (ft)	*	2.91	*	8.74	*	1.04 *
* Conv. Total (cfs)	*100330.3		* Conv. (cfs)	*	4995.8	*	91245.2	*	4089.3 *
* Length Wtd. (ft)	*	694.59	* Wetted Per. (ft)	*	40.51	*	75.64	*	128.35 *
* Min Ch El (ft)	*	155.10	* Shear (lb/sq ft)	*	0.16	*	0.49	*	0.06 *
* Alpha	*	1.45	* Stream Power (lb/ft s)	*	0.21	*	2.06	*	0.05 *
* Frctn Loss (ft)	*	0.22	* Cum Volume (acre-ft)	*	262.26	*	98.79	*	302.83 *
* C & E Loss (ft)	*	0.06	* Cum SA (acres)	*	43.15	*	8.25	*	65.91 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	168.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	167.95	Reach Len. (ft)	730.00	730.00	200.00
Crit W.S. (ft)	160.81	Flow Area (sq ft)	182.96	779.93	553.49
E.G. Slope (ft/ft)	*0.000279	Area (sq ft)	874.15	779.93	1754.93
Q Total (cfs)	2480.00	Flow (cfs)	177.39	2039.48	263.12
Top Width (ft)	1461.51	Top Width (ft)	409.24	75.00	977.27
Vel Total (ft/s)	1.64	Avg. Vel. (ft/s)	0.97	2.61	0.48
Max Chl Dpth (ft)	12.85	Hydr. Depth (ft)	4.57	10.40	1.47
Conv. Total (cfs)	*148356.5	Conv. (cfs)	10611.9	*122004.3	15740.3
Length Wtd. (ft)	636.83	Wetted Per. (ft)	40.51	75.64	377.89
Min Ch El (ft)	155.10	Shear (lb/sq ft)	0.08	0.18	0.03
Alpha	2.14	Stream Power (lb/ft s)	0.08	0.47	0.01
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	354.93	116.19	528.28
C & E Loss (ft)	0.02	Cum SA (acres)	48.61	8.25	74.26

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	170.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	170.41	Reach Len. (ft)	730.00	730.00	200.00
Crit W.S. (ft)	162.97	Flow Area (sq ft)	281.36	964.42	1982.13
E.G. Slope (ft/ft)	*0.000327	Area (sq ft)	1933.51	964.42	4726.06

	Duplicate Effective				
* Q Total (cfs)	* 5250.00	* Flow (cfs)	* 393.04	* 3142.05	* 1714.91 *
* Top Width (ft)	* 1792.09	* Top Width (ft)	* 481.92	* 75.00	* 1235.17 *
* Vel Total (ft/s)	* 1.63	* Avg. Vel. (ft/s)	* 1.40	* 3.26	* 0.87 *
* Max Chl Dpth (ft)	* 15.31	* Hydr. Depth (ft)	* 7.03	* 12.86	* 3.39 *
* Conv. Total (cfs)	*290405.4	* Conv. (cfs)	* 21741.2	*173803.5	* 94860.7 *
* Length Wtd. (ft)	* 535.37	* Wetted Per. (ft)	* 40.51	* 75.64	* 585.53 *
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.14	* 0.26	* 0.07 *
* Alpha	* 2.55	* Stream Power (lb/ft s)	* 0.20	* 0.85	* 0.06 *
* Frctn Loss (ft)	* 0.06	* Cum Volume (acre-ft)	* 497.94	* 139.76	* 850.16 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 55.40	* 8.25	* 79.90 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243

INPUT
Description: XS 243
JUST UPSTREAM OF CANNON BRANCH
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180	20	178	100	176	330	172	520	170
570	168	660	166	680	160	1250	160	1300	153.2
1350	160	1360	164	2070	166	2120	168	2340	168
2490	166	3170	166	3280	176				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	1250	.045	1350	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1250	1350	4920	3938	1480	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	1080	180	F
2510	3280	180	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.56	* Element	* Left OB *	Channel * Right OB *

			Duplicate Effective			
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.070	* 0.045	* 0.070	*
* W.S. Elev (ft)	* 174.56	* Reach Len. (ft)	* 4920.00	* 3938.00	* 1480.00	*
* Crit W.S. (ft)	* 158.84	* Flow Area (sq ft)	* 2474.61	* 1795.66	*10035.60	*
* E.G. Slope (ft/ft)	*0.000002	* Area (sq ft)	*10349.93	* 1795.66	*16085.60	*
* Q Total (cfs)	* 2220.00	* Flow (cfs)	* 430.59	* 555.63	* 1233.79	*
* Top Width (ft)	* 3081.12	* Top Width (ft)	* 1067.00	* 100.00	* 1914.12	*
* Vel Total (ft/s)	* 0.16	* Avg. Vel. (ft/s)	* 0.17	* 0.31	* 0.12	*
* Max Chl Dpth (ft)	* 21.36	* Hydr. Depth (ft)	* 14.56	* 17.96	* 8.65	*
* Conv. Total (cfs)	*1614621.0	* Conv. (cfs)	*313167.8	*404111.6	*897341.7	*
* Length Wtd. (ft)	* 2256.30	* Wetted Per. (ft)	* 170.00	* 100.92	* 1160.83	*
* Min Ch El (ft)	* 153.20	* Shear (lb/sq ft)	* 0.00	* 0.00	* 0.00	*
* Alpha	* 1.59	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00	*
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 687.38	* 154.02	* 1363.86	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 62.10	* 6.78	* 73.54	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 175.37	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.02	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 175.35	* Reach Len. (ft)	* 4920.00	* 3938.00	* 1480.00	*
* Crit W.S. (ft)	* 158.83	* Flow Area (sq ft)	*	* 1874.61	*	*
* E.G. Slope (ft/ft)	*0.000037	* Area (sq ft)	*	* 1874.61	*	*
* Q Total (cfs)	* 2220.00	* Flow (cfs)	*	* 2220.00	*	*
* Top Width (ft)	* 100.00	* Top Width (ft)	*	* 100.00	*	*
* Vel Total (ft/s)	* 1.18	* Avg. Vel. (ft/s)	*	* 1.18	*	*
* Max Chl Dpth (ft)	* 22.15	* Hydr. Depth (ft)	*	* 18.75	*	*
* Conv. Total (cfs)	*363722.1	* Conv. (cfs)	*	*363722.1	*	*
* Length Wtd. (ft)	* 3159.68	* Wetted Per. (ft)	*	* 131.61	*	*
* Min Ch El (ft)	* 153.20	* Shear (lb/sq ft)	*	* 0.03	*	*

* Alpha	*	1.00	* Stream Power (lb/ft s)	*	*	0.04	*	*
* Frctn Loss (ft)	*	0.05	* Cum Volume (acre-ft)	*	49.29	* 160.29	*	451.49 *
* C & E Loss (ft)	*	0.01	* Cum SA (acres)	*	1.84	* 6.78	*	7.08 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	*	166.25	* Element	*	Left OB	* Channel	*	Right OB *
* Vel Head (ft)	*	0.04	* Wt. n-Val.	*	0.070	* 0.045	*	0.070 *
* W.S. Elev (ft)	*	166.22	* Reach Len. (ft)	*	4920.00	* 3938.00	*	1480.00 *
* Crit W.S. (ft)	*	159.58	* Flow Area (sq ft)	*	1057.02	* 961.78	*	913.52 *
* E.G. Slope (ft/ft)	*	0.000158	* Area (sq ft)	*	3609.55	* 961.78	*	1057.52 *
* Q Total (cfs)	*	3025.00	* Flow (cfs)	*	952.28	* 1791.76	*	280.96 *
* Top Width (ft)	*	2123.97	* Top Width (ft)	*	599.80	* 100.00	*	1424.17 *
* Vel Total (ft/s)	*	1.03	* Avg. Vel. (ft/s)	*	0.90	* 1.86	*	0.31 *
* Max Chl Dpth (ft)	*	13.02	* Hydr. Depth (ft)	*	6.22	* 9.62	*	1.20 *
* Conv. Total (cfs)	*	241008.4	* Conv. (cfs)	*	75870.2	* 142753.7	*	22384.5 *
* Length Wtd. (ft)	*	3068.73	* Wetted Per. (ft)	*	170.00	* 100.92	*	762.56 *
* Min Ch El (ft)	*	153.20	* Shear (lb/sq ft)	*	0.06	* 0.09	*	0.01 *
* Alpha	*	2.18	* Stream Power (lb/ft s)	*	0.06	* 0.17	*	0.00 *
* Frctn Loss (ft)	*	0.28	* Cum Volume (acre-ft)	*	230.22	* 85.24	*	299.32 *
* C & E Loss (ft)	*	0.01	* Cum SA (acres)	*	34.90	* 6.78	*	61.36 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	*	167.96	* Element	*	Left OB	* Channel	*	

```
                                Duplicate Effective
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  167.95  * Reach Len. (ft)        * 4920.00  * 3938.00  *
1480.00  *
* Crit W.S. (ft)         *  159.08  * Flow Area (sq ft)      * 1351.99  * 1135.29  *
2385.82  *
* E.G. Slope (ft/ft)     *0.000038  * Area (sq ft)           * 4718.01  * 1135.29  *
3695.70  *
* Q Total (cfs)          * 2480.00  * Flow (cfs)             *  707.20  * 1164.03  *
 608.77  *
* Top Width (ft)         * 2394.65  * Top Width (ft)        *  677.88  *  100.00  *
1616.77  *
* Vel Total (ft/s)       *    0.51  * Avg. Vel. (ft/s)      *    0.52  *    1.03  *
   0.26  *
* Max Chl Dpth (ft)      *   14.75  * Hydr. Depth (ft)      *    7.95  *   11.35  *
   2.55  *
* Conv. Total (cfs)      *400986.1  * Conv. (cfs)           *114345.9  *188208.8  *
98431.3  *
* Length Wtd. (ft)       * 2783.49  * Wetted Per. (ft)      *  170.00  *  100.92  *
 936.11  *
* Min Ch El (ft)         *  153.20  * Shear (lb/sq ft)      *    0.02  *    0.03  *
   0.01  *
* Alpha                  *    2.27  * Stream Power (lb/ft s) *    0.01  *    0.03  *
   0.00  *
* Frctn Loss (ft)        *    0.06  * Cum Volume (acre-ft)  *  308.07  *  100.15  *
 515.77  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   39.50  *    6.78  *
  68.31  *
********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
***********
* E.G. Elev (ft)         *  170.43  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.           *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  170.42  * Reach Len. (ft)      * 4920.00  * 3938.00  *
1480.00  *
* Crit W.S. (ft)         *  161.29  * Flow Area (sq ft)    * 1771.07  * 1381.81  *
5234.95  *
* E.G. Slope (ft/ft)     *0.000050  * Area (sq ft)         * 6473.49  * 1381.81  *
8258.23  *
* Q Total (cfs)          * 5250.00  * Flow (cfs)           * 1265.79  * 1843.23  *
2140.98  *
* Top Width (ft)         * 2738.31  * Top Width (ft)      *  769.72  *  100.00  *
1868.60  *
* Vel Total (ft/s)       *    0.63  * Avg. Vel. (ft/s)    *    0.71  *    1.33  *
   0.41  *
* Max Chl Dpth (ft)      *   17.22  * Hydr. Depth (ft)    *   10.42  *   13.82  *
   4.51  *
* Conv. Total (cfs)      *743796.9  * Conv. (cfs)         *179332.0  *261141.0
*303324.0  *
* Length Wtd. (ft)       * 2503.56  * Wetted Per. (ft)    *  170.00  *  100.92  *
```

1160.83 *
* Min Ch El (ft) * 153.20 * Shear (lb/sq ft) * 0.03 * 0.04 * 0.01 *
* Alpha * 2.08 * Stream Power (lb/ft s) * 0.02 * 0.06 * 0.01 *
* Frctn Loss (ft) * 0.07 * Cum Volume (acre-ft) * 427.50 * 120.10 * 820.35 *
* C & E Loss (ft) * 0.00 * Cum SA (acres) * 44.91 * 6.78 * 72.77 *
****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 190

INPUT
Description: XS 190 (LETTERED CROSS SECTION T)
MODIFIED LOCATION OF ROB AND
ADJUSTED GR ACCORDINGLY
ROB IS BLOCKED BECAUSE OF DIVIDED
FLOW
THE DIVIDED FLOW SECTION STARTS AS A TRIBUTARY WITH COMMON
XS-180
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1920	185	1970	155	2000	153.8	2020	155	2030	160
2250	161	2455	162.5	2750	163	3000	162.5	3150	160
3350	162.5	3625	162.5	3730	160	3915	163	4100	165
4435	168	4625	164	4645	160	4665	160	4675	164
4955	166	5060	168	5335	170	5665	172	5815	174
5925	176	6135	178	6255	180				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1920	.1	1970	.045	2020	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
1970 2020 1000 1000 1000 .1 .3
Blocked Obstructions num= 1

Sta L	Sta R	Elev
4435	6255	180

CROSS SECTION OUTPUT Profile #1%
****
* E.G. Elev (ft) * 174.55 * Element * Left OB * Channel * Right OB *
* Vel Head (ft) * 0.00 * Wt. n-Val. * 0.100 * 0.045 * 0.100 *
* W.S. Elev (ft) * 174.55 * Reach Len. (ft) * 1000.00 * 1000.00 * 1000.00 *

Duplicate Effective

* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 318.64	* 1007.71	*28754.71 *
* E.G. Slope (ft/ft)	*0.000001	* Area (sq ft)	* 318.64	* 1007.71	*28754.71 *
* Q Total (cfs)	* 2220.00	* Flow (cfs)	* 17.43	* 219.63	* 1982.94 *
* Top Width (ft)	* 2497.59	* Top Width (ft)	* 32.59	* 50.00	* 2415.00 *
* Vel Total (ft/s)	* 0.07	* Avg. Vel. (ft/s)	* 0.05	* 0.22	* 0.07 *
* Max Chl Dpth (ft)	* 20.75	* Hydr. Depth (ft)	* 9.78	* 20.15	* 11.91 *
* Conv. Total (cfs)	*2488873.0	* Conv. (cfs)	* 19540.0	*246234.9	*2223098.0 *
* Length Wtd. (ft)	* 1000.00	* Wetted Per. (ft)	* 38.01	* 50.06	* 2422.86 *
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.00	* 0.00	* 0.00 *
* Alpha	* 1.65	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 84.88	* 27.30	* 602.11 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

****

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 175.32	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 175.31	* Reach Len. (ft)	* 1000.00	* 1000.00	* 1000.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 343.38	* 1045.65	* 5985.59 *
* E.G. Slope (ft/ft)	*0.000008	* Area (sq ft)	* 343.38	* 1045.65	* 5985.59 *
* Q Total (cfs)	* 2220.00	* Flow (cfs)	* 60.80	* 729.00	* 1430.20 *
* Top Width (ft)	* 499.61	* Top Width (ft)	* 32.61	* 50.00	* 417.00 *
* Vel Total (ft/s)	* 0.30	* Avg. Vel. (ft/s)	* 0.18	* 0.70	* 0.24 *
* Max Chl Dpth (ft)	* 21.51	* Hydr. Depth (ft)	* 10.53	* 20.91	* 14.35 *
* Conv. Total (cfs)	*797486.9	* Conv. (cfs)	* 21839.9	*261878.9	*513768.1 *
* Length Wtd. (ft)	* 1000.00	* Wetted Per. (ft)	* 38.78	* 50.06	* 431.13 *
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.00	* 0.01	* 0.01 *
* Alpha	* 2.18	* Stream Power (lb/ft s)	* 0.00	* 0.01	* 0.00 *
* Frctn Loss (ft)	* 0.04	* Cum Volume (acre-ft)	* 29.89	* 28.29	* 349.80 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

****

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	165.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	165.96	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	100.15	578.14	8238.23
E.G. Slope (ft/ft)	0.000058	Area (sq ft)	100.15	578.14	8238.23
Q Total (cfs)	3025.00	Flow (cfs)	31.75	741.51	2251.74
Top Width (ft)	2255.79	Top Width (ft)	18.27	50.00	2187.52
Vel Total (ft/s)	0.34	Avg. Vel. (ft/s)	0.32	1.28	0.27
Max Chl Dpth (ft)	12.16	Hydr. Depth (ft)	5.48	11.56	3.77
Conv. Total (cfs)	397911.5	Conv. (cfs)	4175.8	97539.5	296196.2
Length Wtd. (ft)	1000.00	Wetted Per. (ft)	21.31	50.06	2188.81
Min Ch El (ft)	153.80	Shear (lb/sq ft)	0.02	0.04	0.01
Alpha	4.00	Stream Power (lb/ft s)	0.01	0.05	0.00
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	20.72	15.63	141.40
C & E Loss (ft)	0.02	Cum SA (acres)			

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	167.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	167.90	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	138.72	675.11	12690.50
E.G. Slope (ft/ft)	0.000012	Area (sq ft)	138.72	675.11	12690.50
Q Total (cfs)	2480.00	Flow (cfs)	22.70	444.78	2012.52
Top Width (ft)	2475.58	Top Width (ft)	21.50	50.00	2404.08
Vel Total (ft/s)	0.18	Avg. Vel. (ft/s)	0.16	0.66	0.16
Max Chl Dpth (ft)	14.10	Hydr. Depth (ft)	6.45	13.50	5.28
Conv. Total (cfs)	704234.3	Conv. (cfs)	6447.4	126302.3	571484.6
Length Wtd. (ft)	1000.00	Wetted Per. (ft)	25.08	50.06	2405.38
Min Ch El (ft)	153.80	Shear (lb/sq ft)	0.00	0.01	0.00

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                                   Duplicate Effective
* Alpha                  *    2.92  * Stream Power (lb/ft s) *    0.00  *    0.01  *
   0.00  *
* Frctn Loss (ft)        *    0.18  * Cum Volume (acre-ft)   *   33.79  *   18.31  *
 237.40  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *          *          *
        *
*********************************************************************************
**********

CROSS SECTION OUTPUT  Profile #0.2%
*********************************************************************************
**********
* E.G. Elev (ft)         *  170.36  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  170.36  * Reach Len. (ft)        * 1000.00  * 1000.00  *
1000.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  196.51  *  797.81
*18616.55  *
* E.G. Slope (ft/ft)     *0.000017  * Area (sq ft)           *  196.51  *  797.81
*18616.55  *
* Q Total (cfs)          * 5250.00  * Flow (cfs)             *   42.89  *  697.65  *
4509.46  *
* Top Width (ft)         * 2490.59  * Top Width (ft)         *   25.59  *   50.00  *
2415.00  *
* Vel Total (ft/s)       *    0.27  * Avg. Vel. (ft/s)       *    0.22  *    0.87  *
   0.24  *
* Max Chl Dpth (ft)      *   16.56  * Hydr. Depth (ft)       *    7.68  *   15.96  *
   7.71  *
* Conv. Total (cfs)      *1255488.0  * Conv. (cfs)            * 10257.5  *166836.0
*1078394.0  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)       *   29.85  *   50.06  *
2418.66  *
* Min Ch El (ft)         *  153.80  * Shear (lb/sq ft)       *    0.01  *    0.02  *
   0.01  *
* Alpha                  *    2.13  * Stream Power (lb/ft s) *    0.00  *    0.02  *
   0.00  *
* Frctn Loss (ft)        *    0.18  * Cum Volume (acre-ft)   *   50.81  *   21.57  *
 363.80  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *          *          *
        *
*********************************************************************************
**********

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-2            RS: 180

INPUT
Description: XS 180 (LETTERED CROSS-SECTION S)
Station Elevation Data    num=      28
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
    1140     185    1205     180    1285     175    1370     170    1480     165
    1570     163    1710   162.5    1860     161    1945     160    1970     155
    1975   153.3    2000   153.3    2030   153.3    2035     155    2075     157
    2270     162    3000     164    3285     165    3330     166    3380     165
    3680     164    3800     165    4000     168    4200     170    4500     173
    4630     175    4790     180    5000     185
```

Duplicate Effective

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1140	.1	1970	.045	2035	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1970	2035	1000	1000	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.52	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	7076.26	1371.10	*23701.13
E.G. Slope (ft/ft)	*0.000057	Area (sq ft)	7076.26	1371.10	*23701.13
Q Total (cfs)	*18100.00	Flow (cfs)	3792.98	2594.96	*11712.06
Top Width (ft)	3306.02	Top Width (ft)	676.92	65.00	2564.10
Vel Total (ft/s)	0.56	Avg. Vel. (ft/s)	0.54	1.89	0.49
Max Chl Dpth (ft)	21.22	Hydr. Depth (ft)	10.45	21.09	9.24
Conv. Total (cfs)	*2397046.0	Conv. (cfs)	*502317.6	*343659.2	*1551069.0
Length Wtd. (ft)	1000.00	Wetted Per. (ft)	677.70	65.56	2564.30
Min Ch El (ft)	153.30	Shear (lb/sq ft)	0.04	0.07	0.03
Alpha	2.31	Stream Power (lb/ft s)	0.02	0.14	0.02
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	255.67	34.28	445.48
C & E Loss (ft)	0.00	Cum SA (acres)	22.68	1.61	49.40

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	175.26	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)		Flow Area (sq ft)	2261.05	1418.92	*24489.10
E.G. Slope (ft/ft)	*0.000058	Area (sq ft)	2261.05	1418.92	*24489.10
Q Total (cfs)	*18100.00	Flow (cfs)	1474.31	2781.15	*13844.55
Top Width (ft)	2415.00	Top Width (ft)	150.00	65.00	2200.00
Vel Total (ft/s)	0.64	Avg. Vel. (ft/s)	0.65	1.96	0.57

```
                                Duplicate Effective
* Max Chl Dpth (ft)      *   21.96  * Hydr. Depth (ft)       *   15.07  *   21.83  *
  11.13  *
* Conv. Total (cfs)      *2368096.0  * Conv. (cfs)            *192889.7  *363868.5
*1811337.0  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)       *  164.36  *   65.56  *
2205.09  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)       *    0.05  *    0.08  *
   0.04  *
* Alpha                  *    2.11  * Stream Power (lb/ft s) *    0.03  *    0.15  *
   0.02  *
* Frctn Loss (ft)        *    0.05  * Cum Volume (acre-ft)   *  189.56  *   35.47  *
 438.17  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   13.66  *    1.61  *
  38.85  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  165.67  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.18  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  165.49  * Reach Len. (ft)        * 1000.00  * 1000.00  *
1000.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1704.59  *  783.76  *
4080.42  *
* E.G. Slope (ft/ft)     *0.000840  * Area (sq ft)           * 1704.59  *  783.76  *
4080.42  *
* Q Total (cfs)          * 8930.00  * Flow (cfs)             * 1660.06  * 3921.76  *
3348.18  *
* Top Width (ft)         * 2314.76  * Top Width (ft)         *  500.75  *   65.00  *
1749.01  *
* Vel Total (ft/s)       *    1.36  * Avg. Vel. (ft/s)       *    0.97  *    5.00  *
   0.82  *
* Max Chl Dpth (ft)      *   12.19  * Hydr. Depth (ft)       *    3.40  *   12.06  *
   2.33  *
* Conv. Total (cfs)      *308101.6  * Conv. (cfs)            * 57275.1  *135308.0
*115518.5  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)       *  501.29  *   65.56  *
1749.14  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)       *    0.18  *    0.63  *
   0.12  *
* Alpha                  *    6.18  * Stream Power (lb/ft s) *    0.17  *    3.14  *
   0.10  *
* Frctn Loss (ft)        *    0.71  * Cum Volume (acre-ft)   *   59.25  *   19.23  *
  75.79  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *   18.13  *    1.61  *
  26.67  *
*******************************************************************************
***********

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT  Profile #2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  167.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.12  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  167.59  * Reach Len. (ft)        * 1000.00  * 1000.00  *
```

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1000.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 2805.25  *  920.33  *
7991.94  *
* E.G. Slope (ft/ft)     *0.000637  * Area (sq ft)           * 2805.25  *  920.33  *
7991.94  *
* Q Total (cfs)          *15300.00  * Flow (cfs)            * 3126.94  * 4463.94  *
7709.12  *
* Top Width (ft)         * 2549.62  * Top Width (ft)        *  546.97  *   65.00  *
1937.65  *
* Vel Total (ft/s)       *    1.31  * Avg. Vel. (ft/s)      *    1.11  *    4.85  *
   0.96  *
* Max Chl Dpth (ft)      *   14.29  * Hydr. Depth (ft)      *    5.13  *   14.16  *
   4.12  *
* Conv. Total (cfs)      *606124.1  * Conv. (cfs)           *123876.8  *176843.3
*305404.0  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)      *  547.56  *   65.56  *
1937.81  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)      *    0.20  *    0.56  *
   0.16  *
* Alpha                  *    4.45  * Stream Power (lb/ft s) *    0.23  *    2.71  *
   0.16  *
* Frctn Loss (ft)        *    0.62  * Cum Volume (acre-ft)  *   99.58  *   22.65  *
 138.56  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   19.56  *    1.61  *
  32.56  *
********************************************************************************
**********

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
**********
* E.G. Elev (ft)         *  170.17  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.10  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  170.07  * Reach Len. (ft)       * 1000.00  * 1000.00  *
1000.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 4230.49  * 1081.65
*13077.72  *
* E.G. Slope (ft/ft)     *0.000558  * Area (sq ft)           * 4230.49  * 1081.65
*13077.72  *
* Q Total (cfs)          *26100.00  * Flow (cfs)            * 5447.23  * 5466.23
*15186.54  *
* Top Width (ft)         * 2838.38  * Top Width (ft)        *  601.22  *   65.00  *
2172.16  *
* Vel Total (ft/s)       *    1.42  * Avg. Vel. (ft/s)      *    1.29  *    5.05  *
   1.16  *
* Max Chl Dpth (ft)      *   16.77  * Hydr. Depth (ft)      *    7.04  *   16.64  *
   6.02  *
* Conv. Total (cfs)      *1105213.0  * Conv. (cfs)           *230664.7  *231469.4
*643079.0  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)      *  601.86  *   65.56  *
2172.34  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)      *    0.24  *    0.57  *
   0.21  *
* Alpha                  *    3.22  * Stream Power (lb/ft s) *    0.32  *    2.90  *
   0.24  *
* Frctn Loss (ft)        *    0.58  * Cum Volume (acre-ft)  *  150.19  *   26.65  *
 232.07  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   21.01  *    1.61  *
  41.33  *
********************************************************************************
**********
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CROSS SECTION

RIVER: RIVER-1
REACH: Reach-2 RS: 170

INPUT
Description: XS 170 (LETTERED CROSS-SECTION R)
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
610	185	635	180	660	175	720	170	865	165
1165	162.5	1665	161	1865	160	1965	155	1970	152.7
2000	152.7	2030	152.7	2040	155	2045	160	2090	161
2140	160	2275	159	2460	160	2620	165	3025	167.5
3325	168	3520	170	3810	175	4050	180	4270	185

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
610	.1	1965	.045	2040	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1965	2040	0	0	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.47	Reach Len. (ft)			
Crit W.S. (ft)	163.32	Flow Area (sq ft)	15197.54	1615.50	15108.80
E.G. Slope (ft/ft)	0.000052	Area (sq ft)	15197.54	1615.50	15108.80
Q Total (cfs)	18100.00	Flow (cfs)	8352.65	2944.02	6803.33
Top Width (ft)	3112.90	Top Width (ft)	1298.64	75.00	1739.26
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.55	1.82	0.45
Max Chl Dpth (ft)	21.77	Hydr. Depth (ft)	11.70	21.54	8.69
Conv. Total (cfs)	2521860.0	Conv. (cfs)	1163768.0	410188.3	947903.3
Length Wtd. (ft)		Wetted Per. (ft)	1299.05	75.76	1741.49
Min Ch El (ft)	152.70	Shear (lb/sq ft)	0.04	0.07	0.03
Alpha	2.35	Stream Power (lb/ft s)	0.02	0.12	0.01
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION OUTPUT Profile #Floodway

Duplicate Effective

* E.G. Elev (ft)	* 175.22	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 175.21	* Reach Len. (ft)	*	*	* *
* Crit W.S. (ft)	* 163.32	* Flow Area (sq ft)	*14253.41	* 1671.00	*13684.28 *
* E.G. Slope (ft/ft)	*0.000046	* Area (sq ft)	*14253.41	* 1671.00	*13684.28 *
* Q Total (cfs)	*18100.00	* Flow (cfs)	* 8160.29	* 2939.71	* 7000.00 *
* Top Width (ft)	* 2300.00	* Top Width (ft)	* 1040.00	* 75.00	* 1185.00 *
* Vel Total (ft/s)	* 0.61	* Avg. Vel. (ft/s)	* 0.57	* 1.76	* 0.51 *
* Max Chl Dpth (ft)	* 22.51	* Hydr. Depth (ft)	* 13.71	* 22.28	* 11.55 *
* Conv. Total (cfs)	*2671816.0	* Conv. (cfs)	*1204574.0	*433942.9	*1033299.0 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1050.85	* 75.76	* 1194.56 *
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.04	* 0.06	* 0.03 *
* Alpha	* 2.01	* Stream Power (lb/ft s)	* 0.02	* 0.11	* 0.02 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	* *
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	* *

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 164.94	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.12	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 164.82	* Reach Len. (ft)	*	*	* *
* Crit W.S. (ft)	* 161.36	* Flow Area (sq ft)	* 3457.00	* 891.96	* 2522.74 *
* E.G. Slope (ft/ft)	*0.000601	* Area (sq ft)	* 3457.00	* 891.96	* 2522.74 *
* Q Total (cfs)	* 8930.00	* Flow (cfs)	* 2736.34	* 3735.71	* 2457.95 *
* Top Width (ft)	* 1728.07	* Top Width (ft)	* 1078.74	* 75.00	* 574.33 *
* Vel Total (ft/s)	* 1.30	* Avg. Vel. (ft/s)	* 0.79	* 4.19	* 0.97 *
* Max Chl Dpth (ft)	* 12.12	* Hydr. Depth (ft)	* 3.20	* 11.89	* 4.39 *
* Conv. Total (cfs)	*364357.0	* Conv. (cfs)	*111646.5	*152422.5	*100288.0 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1078.88	* 75.76	* 576.50 *
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.12	* 0.44	* 0.16 *
* Alpha	* 4.61	* Stream Power (lb/ft s)	* 0.10	* 1.85	*

```
   0.16  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
********************************************************************************
***********

CROSS SECTION OUTPUT  Profile #2%
********************************************************************************
***********
* E.G. Elev (ft)         *  167.09  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.12  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  166.97  * Reach Len. (ft)        *          *          *
          *
* Crit W.S. (ft)         *  162.94  * Flow Area (sq ft)      * 5870.40  * 1052.81  *
4079.72  *
* E.G. Slope (ft/ft)     *0.000600  * Area (sq ft)           * 5870.40  * 1052.81  *
4079.72  *
* Q Total (cfs)          *15300.00  * Flow (cfs)             * 6310.45  * 4923.68  *
4065.88  *
* Top Width (ft)         * 2130.80  * Top Width (ft)         * 1157.06  *   75.00  *
 898.74  *
* Vel Total (ft/s)       *    1.39  * Avg. Vel. (ft/s)       *    1.07  *    4.68  *
   1.00  *
* Max Chl Dpth (ft)      *   14.27  * Hydr. Depth (ft)       *    5.07  *   14.04  *
   4.54  *
* Conv. Total (cfs)      *624394.4  * Conv. (cfs)            *257529.8  *200935.9
*165928.7  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       * 1157.23  *   75.76  *
 900.92  *
* Min Ch El (ft)         *  152.70  * Shear (lb/sq ft)       *    0.19  *    0.52  *
   0.17  *
* Alpha                  *    4.02  * Stream Power (lb/ft s) *    0.20  *    2.44  *
   0.17  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
********************************************************************************
***********

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
***********
* E.G. Elev (ft)         *  169.59  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.12  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  169.47  * Reach Len. (ft)        *          *          *
          *
* Crit W.S. (ft)         *  164.19  * Flow Area (sq ft)      * 8854.02  * 1240.34  *
7139.91  *
* E.G. Slope (ft/ft)     *0.000601  * Area (sq ft)           * 8854.02  * 1240.34  *
7139.91  *
* Q Total (cfs)          *26100.00  * Flow (cfs)             *12027.56  * 6474.46  *
7597.98  *
* Top Width (ft)         * 2732.68  * Top Width (ft)         * 1229.57  *   75.00  *
1428.11  *
* Vel Total (ft/s)       *    1.51  * Avg. Vel. (ft/s)       *    1.36  *    5.22  *
   1.06  *
```

```
                                  Duplicate Effective
* Max Chl Dpth (ft)      *   16.77  * Hydr. Depth (ft)       *    7.20  *   16.54  *
   5.00  *
* Conv. Total (cfs)      *1064487.0  * Conv. (cfs)            *490543.3  *264060.6
*309882.9  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       * 1229.78  *   75.76  *
1430.30  *
* Min Ch El (ft)         *  152.70  * Shear (lb/sq ft)       *    0.27  *    0.61  *
   0.19  *
* Alpha                  *    3.46  * Stream Power (lb/ft s) *    0.37  *    3.21  *
   0.20  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
*******************************************************************************
***********

CROSS SECTION


RIVER: RIVER-2
REACH: Reach-1            RS: 250.12

INPUT
Description: SIDE CHANNEL XS 250.12
Station Elevation Data    num=      18
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0     180     450     175    2850     174    3270     174    3450     172
    3600     170    3650     160    3675     157    3695     160    3730     168
    3920     168    3980   165.3    4100     168    4225     170    4300     172
    4430     168    4700     180    5050     194

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0     .07    3650    .045    3695     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          3650    3695              490     490     260             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
    5050    5050     180       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
***********************
       0    3750     180

CROSS SECTION OUTPUT  Profile #1%
*******************************************************************************
***********
* E.G. Elev (ft)         *  176.70  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.10  * Wt. n-Val.             *          *          *
  0.070  *
* W.S. Elev (ft)         *  176.60  * Reach Len. (ft)        *  490.00  *  490.00  *
 260.00  *
* Crit W.S. (ft)         *  170.89  * Flow Area (sq ft)      *          *          *
6316.63  *
* E.G. Slope (ft/ft)     *0.001017  * Area (sq ft)           *          *          *
6316.63  *
* Q Total (cfs)          *15880.00  * Flow (cfs)             *          *
*15880.00  *
```

```
                                  Duplicate Effective
* Top Width (ft)         *  873.59  * Top Width (ft)         *          *          *
 873.59  *
* Vel Total (ft/s)       *    2.51  * Avg. Vel. (ft/s)       *          *          *
   2.51  *
* Max Chl Dpth (ft)      *   11.30  * Hydr. Depth (ft)       *          *          *
   7.23  *
* Conv. Total (cfs)      *497969.3  * Conv. (cfs)            *          *
*497969.3  *
* Length Wtd. (ft)       *  280.71  * Wetted Per. (ft)       *          *          *
 882.58  *
* Min Ch El (ft)         *  180.00  * Shear (lb/sq ft)       *          *          *
   0.45  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
   1.14  *
* Frctn Loss (ft)        *    0.43  * Cum Volume (acre-ft)   *   91.37  *   50.93  *
 561.24  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    3.21  *    3.52  *
  30.02  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
*******************************************************************************
***********
* E.G. Elev (ft)         *  177.33  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.19  * Wt. n-Val.            *          *          *
  0.070  *
* W.S. Elev (ft)         *  177.14  * Reach Len. (ft)       *  490.00  *  490.00  *
 260.00  *
* Crit W.S. (ft)         *  171.65  * Flow Area (sq ft)     *          *          *
4490.05  *
* E.G. Slope (ft/ft)     *0.001679  * Area (sq ft)          *          *          *
4490.05  *
* Q Total (cfs)          *15880.00  * Flow (cfs)            *          *
*15880.00  *
* Top Width (ft)         *  530.00  * Top Width (ft)        *          *          *
 530.00  *
* Vel Total (ft/s)       *    3.54  * Avg. Vel. (ft/s)       *          *          *
   3.54  *
* Max Chl Dpth (ft)      *   11.84  * Hydr. Depth (ft)       *          *          *
   8.47  *
* Conv. Total (cfs)      *387592.4  * Conv. (cfs)            *          *
*387592.4  *
* Length Wtd. (ft)       *  279.21  * Wetted Per. (ft)       *          *          *
 547.53  *
* Min Ch El (ft)         *          * Shear (lb/sq ft)       *          *          *
   0.86  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
   3.04  *
* Frctn Loss (ft)        *    0.52  * Cum Volume (acre-ft)   *   29.19  *   53.48  *
 564.23  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    0.44  *    3.52  *
```

```
  22.52  *
**********************************************************************************
***********

Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
**********************************************************************************
***********
* E.G. Elev (ft)         *  172.71  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.06  * Wt. n-Val.            *          *          *
  0.070  *
* W.S. Elev (ft)         *  172.65  * Reach Len. (ft)       *  490.00  *  490.00  *
 260.00  *
* Crit W.S. (ft)         *  169.34  * Flow Area (sq ft)     *          *          *
3037.93  *
* E.G. Slope (ft/ft)     *0.001391  * Area (sq ft)          *          *          *
3037.93  *
* Q Total (cfs)          * 5905.00  * Flow (cfs)           *          *          *
5905.00  *
* Top Width (ft)         *  784.62  * Top Width (ft)       *          *          *
 784.62  *
* Vel Total (ft/s)       *    1.94  * Avg. Vel. (ft/s)     *          *          *
   1.94  *
* Max Chl Dpth (ft)      *    7.35  * Hydr. Depth (ft)     *          *          *
   3.87  *
* Conv. Total (cfs)      *158343.8  * Conv. (cfs)          *          *
*158343.8  *
* Length Wtd. (ft)       *  282.34  * Wetted Per. (ft)     *          *          *
 789.56  *
* Min Ch El (ft)         *  180.00  * Shear (lb/sq ft)     *          *          *
   0.33  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
   0.65  *
* Frctn Loss (ft)        *    0.69  * Cum Volume (acre-ft)  *   21.42  *   28.14  *
 114.01  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *    1.05  *    3.52  *
  16.62  *
**********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
***********
* E.G. Elev (ft)         *  175.17  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.10  * Wt. n-Val.            *          *          *
```

```
  0.070  *
* W.S. Elev (ft)         *  175.07  * Reach Len. (ft)        *  490.00  *  490.00  *
 260.00  *
* Crit W.S. (ft)         *  170.49  * Flow Area (sq ft)      *          *          *
5003.38  *
* E.G. Slope (ft/ft)     *0.001363  * Area (sq ft)           *          *          *
5003.38  *
* Q Total (cfs)          *12820.00  * Flow (cfs)             *          *
*12820.00  *
* Top Width (ft)         *  839.09  * Top Width (ft)        *          *          *
 839.09  *
* Vel Total (ft/s)       *    2.56  * Avg. Vel. (ft/s)      *          *          *
   2.56  *
* Max Chl Dpth (ft)      *    9.77  * Hydr. Depth (ft)      *          *          *
   5.96  *
* Conv. Total (cfs)      *347202.0  * Conv. (cfs)           *          *
*347202.0  *
* Length Wtd. (ft)       *  280.95  * Wetted Per. (ft)      *          *          *
 846.51  *
* Min Ch El (ft)         *  180.00  * Shear (lb/sq ft)      *          *          *
   0.50  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
   1.29  *
* Frctn Loss (ft)        *    0.61  * Cum Volume (acre-ft)  *   37.47  *   38.06  *
 211.40  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)        *    1.83  *    3.52  *
  20.55  *
********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
***********
* E.G. Elev (ft)         *  177.26  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.15  * Wt. n-Val.            *          *          *
  0.070  *
* W.S. Elev (ft)         *  177.11  * Reach Len. (ft)       *  490.00  *  490.00  *
 260.00  *
* Crit W.S. (ft)         *  171.47  * Flow Area (sq ft)     *          *          *
6762.74  *
* E.G. Slope (ft/ft)     *0.001422  * Area (sq ft)          *          *          *
6762.74  *
* Q Total (cfs)          *20850.00  * Flow (cfs)            *          *
*20850.00  *
* Top Width (ft)         *  885.01  * Top Width (ft)       *          *          *
 885.01  *
* Vel Total (ft/s)       *    3.08  * Avg. Vel. (ft/s)     *          *          *
   3.08  *
* Max Chl Dpth (ft)      *   11.81  * Hydr. Depth (ft)     *          *          *
   7.64  *
* Conv. Total (cfs)      *552980.6  * Conv. (cfs)          *          *
*552980.6  *
```

```
                                   Duplicate Effective
* Length Wtd. (ft)       *  280.75  * Wetted Per. (ft)       *          *          *
 894.52  *
* Min Ch El (ft)         *  180.00  * Shear (lb/sq ft)       *          *          *
   0.67  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
   2.07  *
* Frctn Loss (ft)        *    0.62  * Cum Volume (acre-ft)   *   58.43  *   46.41  *
 340.54  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    3.12  *    3.52  *
  26.33  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION


RIVER: RIVER-2
REACH: Reach-1            RS: 225

INPUT
Description: SIDE CHANNEL XS 225
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0   177.9      50   177.1      95     176     160     174     180     172
     205     170     240     168     260     166     280     168     475     168
     710     170     730     172     810     177

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .07     240     .07     280     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          240     280               460     460     460             .1       .3

CROSS SECTION OUTPUT  Profile #1%
*******************************************************************************
***********
* E.G. Elev (ft)         *  176.26  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.             *   0.070  *   0.070  *
  0.070  *
* W.S. Elev (ft)         *  176.04  * Reach Len. (ft)        *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  501.30  *  361.73  *
3455.21  *
* E.G. Slope (ft/ft)     *0.002490  * Area (sq ft)           *  501.30  *  361.73  *
3455.21  *
* Q Total (cfs)          *15880.00  * Flow (cfs)             * 1202.79  * 1657.53
*13019.68  *
* Top Width (ft)         *  701.46  * Top Width (ft)        *  146.77  *   40.00  *
 514.69  *
```

Duplicate Effective

* Vel Total (ft/s)	* 3.68	* Avg. Vel. (ft/s)	* 2.40	* 4.58	* 3.77	*
* Max Chl Dpth (ft)	* 10.04	* Hydr. Depth (ft)	* 3.42	* 9.04	* 6.71	*
* Conv. Total (cfs)	*318255.1	* Conv. (cfs)	* 24105.4	* 33218.9	*260930.8	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 147.03	* 40.20	* 514.93	*
* Min Ch El (ft)	* 166.00	* Shear (lb/sq ft)	* 0.53	* 1.40	* 1.04	*
* Alpha	* 1.06	* Stream Power (lb/ft s)	* 1.27	* 6.41	* 3.93	*
* Frctn Loss (ft)	* 0.79	* Cum Volume (acre-ft)	* 88.55	* 48.89	* 532.07	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 2.38	* 3.30	* 25.88	*

****

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 176.81	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.23	* Wt. n-Val.	* 0.070	* 0.070	* 0.070	*
* W.S. Elev (ft)	* 176.58	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 297.17	* 383.17	* 3454.07	*
* E.G. Slope (ft/ft)	*0.002065	* Area (sq ft)	* 297.17	* 383.17	* 3454.07	*
* Q Total (cfs)	*15880.00	* Flow (cfs)	* 990.62	* 1661.47	*13227.92	*
* Top Width (ft)	* 510.00	* Top Width (ft)	* 40.00	* 40.00	* 430.00	*
* Vel Total (ft/s)	* 3.84	* Avg. Vel. (ft/s)	* 3.33	* 4.34	* 3.83	*
* Max Chl Dpth (ft)	* 10.58	* Hydr. Depth (ft)	* 7.43	* 9.58	* 8.03	*
* Conv. Total (cfs)	*349483.3	* Conv. (cfs)	* 21801.2	* 36565.2	*291116.9	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 46.25	* 40.20	* 436.59	*
* Min Ch El (ft)	* 166.00	* Shear (lb/sq ft)	* 0.83	* 1.23	* 1.02	*
* Alpha	* 1.01	* Stream Power (lb/ft s)	* 2.76	* 5.33	* 3.91	*
* Frctn Loss (ft)	* 0.72	* Cum Volume (acre-ft)	* 27.52	* 51.32	* 540.52	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 0.21	* 3.30	* 19.66	*

****

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 172.01	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.19	* Wt. n-Val.	* 0.070	* 0.070	* 0.070	*
* W.S. Elev (ft)	* 171.82	* Reach Len. (ft)	* 460.00	* 460.00	*	

460.00						
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 119.40	* 192.80	* 1424.16	*
* E.G. Slope (ft/ft)	*0.005304	* Area (sq ft)	* 119.40	* 192.80	* 1424.16	*
* Q Total (cfs)	* 5905.00	* Flow (cfs)	* 299.15	* 847.71	* 4758.14	*
* Top Width (ft)	* 545.95	* Top Width (ft)	* 57.75	* 40.00	* 448.20	*
* Vel Total (ft/s)	* 3.40	* Avg. Vel. (ft/s)	* 2.51	* 4.40	* 3.34	*
* Max Chl Dpth (ft)	* 5.82	* Hydr. Depth (ft)	* 2.07	* 4.82	* 3.18	*
* Conv. Total (cfs)	* 81077.2	* Conv. (cfs)	* 4107.4	* 11639.3	* 65330.5	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 57.88	* 40.20	* 448.30	*
* Min Ch El (ft)	* 166.00	* Shear (lb/sq ft)	* 0.68	* 1.59	* 1.05	*
* Alpha	* 1.05	* Stream Power (lb/ft s)	* 1.71	* 6.98	* 3.51	*
* Frctn Loss (ft)	* 1.18	* Cum Volume (acre-ft)	* 20.75	* 27.06	* 100.69	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 0.73	* 3.30	* 12.94	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 174.55	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.27	* Wt. n-Val.	* 0.070	* 0.070	* 0.070	*
* W.S. Elev (ft)	* 174.28	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 293.65	* 291.19	* 2572.45	*
* E.G. Slope (ft/ft)	*0.004003	* Area (sq ft)	* 293.65	* 291.19	* 2572.45	*
* Q Total (cfs)	*12820.00	* Flow (cfs)	* 871.91	* 1464.11	*10483.98	*
* Top Width (ft)	* 615.57	* Top Width (ft)	* 89.09	* 40.00	* 486.48	*
* Vel Total (ft/s)	* 4.06	* Avg. Vel. (ft/s)	* 2.97	* 5.03	* 4.08	*
* Max Chl Dpth (ft)	* 8.28	* Hydr. Depth (ft)	* 3.30	* 7.28	* 5.29	*
* Conv. Total (cfs)	*202623.1	* Conv. (cfs)	* 13780.8	* 23140.6	*165701.8	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 89.33	* 40.20	* 486.65	*
* Min Ch El (ft)	* 166.00	* Shear (lb/sq ft)	* 0.82	* 1.81	* 1.32	*
* Alpha	* 1.04	* Stream Power (lb/ft s)	* 2.44	* 9.10	*	

```
   5.38  *
* Frctn Loss (ft)        *    1.27  * Cum Volume (acre-ft)   *   35.81  *   36.42  *
 188.79  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    1.33  *    3.30  *
  16.59  *
**********************************************************************************
**********

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #0.2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  176.62  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.36  * Wt. n-Val.             *   0.070  *   0.070  *
  0.070  *
* W.S. Elev (ft)         *  176.26  * Reach Len. (ft)        *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *  534.15  *  370.42  *
3567.42  *
* E.G. Slope (ft/ft)     *0.003890  * Area (sq ft)           *  534.15  *  370.42  *
3567.42  *
* Q Total (cfs)          *20850.00  * Flow (cfs)             * 1607.07  * 2155.47
*17087.46  *
* Top Width (ft)         *  713.82  * Top Width (ft)         *  155.65  *   40.00  *
 518.17  *
* Vel Total (ft/s)       *    4.66  * Avg. Vel. (ft/s)       *    3.01  *    5.82  *
   4.79  *
* Max Chl Dpth (ft)      *   10.26  * Hydr. Depth (ft)       *    3.43  *    9.26  *
   6.88  *
* Conv. Total (cfs)      *334298.2  * Conv. (cfs)            * 25766.9  * 34559.8
*273971.5  *
* Length Wtd. (ft)       *  460.00  * Wetted Per. (ft)       *  155.93  *   40.20  *
 518.41  *
* Min Ch El (ft)         *  166.00  * Shear (lb/sq ft)       *    0.83  *    2.24  *
   1.67  *
* Alpha                  *    1.06  * Stream Power (lb/ft s) *    2.50  *   13.02  *
   8.00  *
* Frctn Loss (ft)        *    1.43  * Cum Volume (acre-ft)   *   55.42  *   44.33  *
 309.71  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    2.25  *    3.30  *
  22.14  *
**********************************************************************************
**********

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-2
REACH: Reach-1            RS: 200

INPUT
Description: SIDE CHANNEL XS 200
Station Elevation Data    num=      14
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
```

```
                                Duplicate Effective
       0     200       1   177.6      90     176     150     174     200     170
     220     168     260     164     430     166     750     167     760     172
     910     174    1035     176    1200     178    1320     180

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .07     220     .07     430     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           220     430              820     820     890             .1       .3

CROSS SECTION OUTPUT  Profile #1%
************************************************************************************
***********
* E.G. Elev (ft)         *  175.45  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.14  * Wt. n-Val.            *   0.070  *   0.070  *
  0.070  *
* W.S. Elev (ft)         *  175.32  * Reach Len. (ft)       *  820.00  *  820.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  318.29  * 2126.73  *
3281.79  *
* E.G. Slope (ft/ft)     *0.001243  * Area (sq ft)          *  318.29  * 2126.73  *
3281.79  *
* Q Total (cfs)          *15880.00  * Flow (cfs)            *  484.27  * 7445.62  *
7950.11  *
* Top Width (ft)         *  881.89  * Top Width (ft)        *  109.53  *  210.00  *
 562.36  *
* Vel Total (ft/s)       *    2.77  * Avg. Vel. (ft/s)      *    1.52  *    3.50  *
   2.42  *
* Max Chl Dpth (ft)      *   11.32  * Hydr. Depth (ft)      *    2.91  *   10.13  *
   5.84  *
* Conv. Total (cfs)      *450398.4  * Conv. (cfs)           * 13735.1  *211177.4
*225485.9  *
* Length Wtd. (ft)       *  872.52  * Wetted Per. (ft)      *  109.81  *  210.21  *
 563.57  *
* Min Ch El (ft)         *  164.00  * Shear (lb/sq ft)      *    0.22  *    0.79  *
   0.45  *
* Alpha                  *    1.14  * Stream Power (lb/ft s) *    0.34  *    2.75  *
   1.09  *
* Frctn Loss (ft)        *    0.75  * Cum Volume (acre-ft)  *   84.22  *   35.76  *
 496.50  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)        *    1.03  *    1.98  *
  20.19  *
************************************************************************************
***********

CROSS SECTION OUTPUT  Profile #Floodway
************************************************************************************
***********
* E.G. Elev (ft)         *  176.07  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.18  * Wt. n-Val.            *          *   0.070  *
  0.070  *
* W.S. Elev (ft)         *  175.89  * Reach Len. (ft)       *  820.00  *  820.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *          * 2246.85  *
2420.29  *
* E.G. Slope (ft/ft)     *0.001241  * Area (sq ft)          *          * 2246.85  *
2420.29  *
* Q Total (cfs)          *15880.00  * Flow (cfs)            *          * 7954.43  *
7925.57  *
```

			Duplicate Effective					
* Top Width (ft)	* 465.00	* Top Width (ft)	*	* 210.00	* 255.00	*		
* Vel Total (ft/s)	* 3.40	* Avg. Vel. (ft/s)	*	* 3.54	* 3.27	*		
* Max Chl Dpth (ft)	* 11.89	* Hydr. Depth (ft)	*	* 10.70	* 9.49	*		
* Conv. Total (cfs)	*450807.2	* Conv. (cfs)	*	*225813.3	*224993.8	*		
* Length Wtd. (ft)	* 872.47	* Wetted Per. (ft)	*	* 218.10	* 264.09	*		
* Min Ch El (ft)	* 164.00	* Shear (lb/sq ft)	*	* 0.80	* 0.71	*		
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 2.83	* 2.32	*		
* Frctn Loss (ft)	* 0.63	* Cum Volume (acre-ft)	* 25.95	* 37.44	* 509.50	*		
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	*	* 1.98	* 16.04	*		

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 170.80	* Element	* Left OB	* Channel	* Right OB	*		
* Vel Head (ft)	* 0.09	* Wt. n-Val.	* 0.070	* 0.070	* 0.070	*		
* W.S. Elev (ft)	* 170.72	* Reach Len. (ft)	* 820.00	* 820.00	* 890.00	*		
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 37.50	* 1160.15	* 1362.61	*		
* E.G. Slope (ft/ft)	*0.001498	* Area (sq ft)	* 37.50	* 1160.15	* 1362.61	*		
* Q Total (cfs)	* 5905.00	* Flow (cfs)	* 36.51	* 2977.01	* 2891.48	*		
* Top Width (ft)	* 566.37	* Top Width (ft)	* 28.94	* 210.00	* 327.43	*		
* Vel Total (ft/s)	* 2.31	* Avg. Vel. (ft/s)	* 0.97	* 2.57	* 2.12	*		
* Max Chl Dpth (ft)	* 6.72	* Hydr. Depth (ft)	* 1.30	* 5.52	* 4.16	*		
* Conv. Total (cfs)	*152554.5	* Conv. (cfs)	* 943.2	* 76910.4	* 74700.9	*		
* Length Wtd. (ft)	* 872.14	* Wetted Per. (ft)	* 29.07	* 210.21	* 328.31	*		
* Min Ch El (ft)	* 164.00	* Shear (lb/sq ft)	* 0.12	* 0.52	* 0.39	*		
* Alpha	* 1.04	* Stream Power (lb/ft s)	* 0.12	* 1.32	* 0.82	*		
* Frctn Loss (ft)	* 3.24	* Cum Volume (acre-ft)	* 19.92	* 19.92	* 85.98	*		
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 0.27	* 1.98	* 8.85	*		

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than

1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	173.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.070	0.070	0.070
W.S. Elev (ft)	173.07	Reach Len. (ft)	820.00	820.00	890.00
Crit W.S. (ft)		Flow Area (sq ft)	140.50	1655.39	2182.38
E.G. Slope (ft/ft)	0.002020	Area (sq ft)	140.50	1655.39	2182.38
Q Total (cfs)	12820.00	Flow (cfs)	239.98	6250.58	6329.44
Top Width (ft)	678.91	Top Width (ft)	58.42	210.00	410.50
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	1.71	3.78	2.90
Max Chl Dpth (ft)	9.07	Hydr. Depth (ft)	2.41	7.88	5.32
Conv. Total (cfs)	285273.7	Conv. (cfs)	5340.2	139089.4	140844.1
Length Wtd. (ft)	872.28	Wetted Per. (ft)	58.64	210.21	411.69
Min Ch El (ft)	164.00	Shear (lb/sq ft)	0.30	0.99	0.67
Alpha	1.07	Stream Power (lb/ft s)	0.52	3.75	1.94
Frctn Loss (ft)	3.82	Cum Volume (acre-ft)	33.52	26.15	163.69
C & E Loss (ft)	0.03	Cum SA (acres)	0.55	1.98	11.85

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	175.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.070	0.070	0.070
W.S. Elev (ft)	174.90	Reach Len. (ft)	820.00	820.00	890.00
Crit W.S. (ft)		Flow Area (sq ft)	275.09	2038.88	3052.00
E.G. Slope (ft/ft)	0.002527	Area (sq ft)	275.09	2038.88	3052.00
Q Total (cfs)	20850.00	Flow (cfs)	587.15	9895.63	10367.22

		Duplicate Effective			
* Top Width (ft)	* 843.20	* Top Width (ft)	* 96.98	* 210.00	* 536.21 *
* Vel Total (ft/s)	* 3.89	* Avg. Vel. (ft/s)	* 2.13	* 4.85	* 3.40 *
* Max Chl Dpth (ft)	* 10.90	* Hydr. Depth (ft)	* 2.84	* 9.71	* 5.69 *
* Conv. Total (cfs)	*414738.7	* Conv. (cfs)	* 11679.3	*196839.3	*206220.1 *
* Length Wtd. (ft)	* 872.40	* Wetted Per. (ft)	* 97.26	* 210.21	* 537.42 *
* Min Ch El (ft)	* 164.00	* Shear (lb/sq ft)	* 0.45	* 1.53	* 0.90 *
* Alpha	* 1.13	* Stream Power (lb/ft s)	* 0.95	* 7.43	* 3.04 *
* Frctn Loss (ft)	* 3.67	* Cum Volume (acre-ft)	* 51.15	* 31.61	* 274.76 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 0.91	* 1.98	* 16.57 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 190

INPUT
Description: SIDE CHANNEL XS 190 (LETTERED CROSS SECTION T)
MODIFIED LOCATION
OF ROB AND ADJUSTED GR ACCORDINGLY
THE CHANNEL ROUGHNESS IS
ESSENTIALLY THE SAME AS OB SINCE IT IS NOT NATURAL
CHANNEL - ASLO
LEFT IS BLOCKED BECAUSE OF DIVIDED FLOW
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
1920	185	1970	155	2000	153.8	2020	155	2030	160
2250	161	2455	162.5	2750	163	3000	162.5	3150	160
3350	162.5	3625	162.5	3730	160	3915	163	4100	165
4435	168	4625	164	4645	160	4665	160	4675	164
4955	166	5060	168	5335	170	5665	172	5815	174
5925	176	6135	178	6255	180				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
1920	.1	1970	.045	2020	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1970	2020	1100	1100	550	.1 .3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
6255	6255	180	F

Blocked Obstructions num= 1

Duplicate Effective

Sta L	Sta R	Elev
1920	4435	180

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.05	Wt. n-Val.			0.070
W.S. Elev (ft)	174.62	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)	168.07	Flow Area (sq ft)			8800.63
E.G. Slope (ft/ft)	0.000636	Area (sq ft)			8800.63
Q Total (cfs)	15880.00	Flow (cfs)			15880.00
Top Width (ft)	1414.27	Top Width (ft)			1414.27
Vel Total (ft/s)	1.80	Avg. Vel. (ft/s)			1.80
Max Chl Dpth (ft)	14.62	Hydr. Depth (ft)			6.22
Conv. Total (cfs)	629681.2	Conv. (cfs)			629681.2
Length Wtd. (ft)	1000.00	Wetted Per. (ft)			1422.16
Min Ch El (ft)	180.00	Shear (lb/sq ft)			0.25
Alpha	1.00	Stream Power (lb/ft s)			0.44
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	81.22	15.74	373.07
C & E Loss (ft)	0.01	Cum SA (acres)			

Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel,
a levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.			0.070
W.S. Elev (ft)	175.36	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)	168.04	Flow Area (sq ft)			9388.74
E.G. Slope (ft/ft)	0.000467	Area (sq ft)			9388.74
Q Total (cfs)	15880.00	Flow (cfs)			15880.00
Top Width (ft)	1315.00	Top Width (ft)			

```
1315.00  *
* Vel Total (ft/s)       *    1.69  * Avg. Vel. (ft/s)       *          *          *
   1.69  *
* Max Chl Dpth (ft)      *   15.36  * Hydr. Depth (ft)       *          *          *
   7.14  *
* Conv. Total (cfs)      *734794.7  * Conv. (cfs)            *          *
*734794.7  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)       *          *          *
1326.22  *
* Min Ch El (ft)         *          * Shear (lb/sq ft)       *          *          *
   0.21  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
   0.35  *
* Frctn Loss (ft)        *    0.12  * Cum Volume (acre-ft)   *   25.95   *   16.29  *
 388.86  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *          *          *
          *
*******************************************************************************
***********

Warning: There is no flow in the channel.  Check that the channel stations are
correctly coded. To force flow into the channel,
         a levee or ineffective flow may have to be added or the Manning's n of the
overbank could be increased.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  167.54  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.40  * Wt. n-Val.             *          *          *
  0.070  *
* W.S. Elev (ft)         *  167.14  * Reach Len. (ft)        * 1000.00  * 1000.00  *
1000.00  *
* Crit W.S. (ft)         *  166.41  * Flow Area (sq ft)      *          *          *
1162.58  *
* E.G. Slope (ft/ft)     *0.020588  * Area (sq ft)           *          *          *
1162.58  *
* Q Total (cfs)          * 5905.00  * Flow (cfs)            *          *          *
5905.00  *
* Top Width (ft)         *  538.65  * Top Width (ft)        *          *          *
 538.65  *
* Vel Total (ft/s)       *    5.08  * Avg. Vel. (ft/s)       *          *          *
   5.08  *
* Max Chl Dpth (ft)      *    7.14  * Hydr. Depth (ft)       *          *          *
   2.16  *
* Conv. Total (cfs)      * 41154.0  * Conv. (cfs)            *          *          *
41154.0  *
* Length Wtd. (ft)       * 1000.00  * Wetted Per. (ft)       *          *          *
 539.86  *
* Min Ch El (ft)         *  180.00  * Shear (lb/sq ft)       *          *          *
   2.77  *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *          *
  14.06  *
* Frctn Loss (ft)        *    1.80  * Cum Volume (acre-ft)   *   19.57   *    9.00  *
  60.18  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)         *          *          *
          *
*******************************************************************************
***********
```

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel,
a levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	169.40	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.49	Wt. n-Val.			0.070
W.S. Elev (ft)	168.91	Reach Len. (ft)	1000.00	1000.00	1000.00
Crit W.S. (ft)	167.63	Flow Area (sq ft)			2288.97
E.G. Slope (ft/ft)	0.015780	Area (sq ft)			2288.97
Q Total (cfs)	12820.00	Flow (cfs)			12820.00
Top Width (ft)	749.81	Top Width (ft)			749.81
Vel Total (ft/s)	5.60	Avg. Vel. (ft/s)			5.60
Max Chl Dpth (ft)	8.91	Hydr. Depth (ft)			3.05
Conv. Total (cfs)	102055.2	Conv. (cfs)			102055.2
Length Wtd. (ft)	1000.00	Wetted Per. (ft)			751.96
Min Ch El (ft)	180.00	Shear (lb/sq ft)			3.00
Alpha	1.00	Stream Power (lb/ft s)			16.80
Frctn Loss (ft)	1.58	Cum Volume (acre-ft)	32.20	10.56	118.01
C & E Loss (ft)	0.11	Cum SA (acres)			

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel,
a levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	171.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.36	Wt. n-Val.			0.070

		Duplicate	Effective		
* W.S. Elev (ft)	* 171.13	* Reach Len. (ft)	* 1000.00	* 1000.00	* 1000.00 *
* Crit W.S. (ft)	* 168.70	* Flow Area (sq ft)	*	*	* 4308.39 *
* E.G. Slope (ft/ft)	*0.008319	* Area (sq ft)	*	*	* 4308.39 *
* Q Total (cfs)	*20850.00	* Flow (cfs)	*	*	*20850.00 *
* Top Width (ft)	* 1085.85	* Top Width (ft)	*	*	* 1085.85 *
* Vel Total (ft/s)	* 4.84	* Avg. Vel. (ft/s)	*	*	* 4.84 *
* Max Chl Dpth (ft)	* 11.13	* Hydr. Depth (ft)	*	*	* 3.97 *
* Conv. Total (cfs)	*228601.6	* Conv. (cfs)	*	*	*228601.6 *
* Length Wtd. (ft)	* 1000.00	* Wetted Per. (ft)	*	*	* 1090.22 *
* Min Ch El (ft)	* 180.00	* Shear (lb/sq ft)	*	*	* 2.05 *
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	*	* 9.93 *
* Frctn Loss (ft)	* 1.24	* Cum Volume (acre-ft)	* 48.56	* 12.42	* 199.57 *
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	*	*	* *

****

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Warning: There is no flow in the channel. Check that the channel stations are correctly coded. To force flow into the channel,
a levee or ineffective flow may have to be added or the Manning's n of the overbank could be increased.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

****

SUMMARY OF MANNING'S N VALUES

River:RIVER-1

Reach	River Sta.	n1	n2	n3
Reach-1	350	.1	.045	.1
Reach-1	344.95	.1	.045	.1
Reach-1	331.6	.1	.045	.1
Reach-1	320	.1	.045	.1
Reach-1	314.4	.1	.045	.1
Reach-1	300	.1	.045	.1
Reach-1	285	.1	.045	.1
Reach-1	280.55	.1	.045	.1
Reach-1	270	.1	.045	.1
Reach-1	264	.1	.045	.1
Reach-1	250.12	.07	.045	.07
Reach-1	250.06	Bridge		
Reach-1	250	.07	.045	.07
Reach-1	246	.07	.045	.07
Reach-1	245	.07	.045	.07
Reach-1	244.19	Bridge		

		Duplicate Effective		
*Reach-1	* 243.38	* .07*	.045*	.07*
*Reach-1	* 243.2	* .07*	.045*	.07*
*Reach-1	* 243	* .07*	.045*	.07*
*Reach-1	* 190	* .1*	.045*	.1*
*Reach-2	* 180	* .1*	.045*	.1*
*Reach-2	* 170	* .1*	.045*	.1*

River:RIVER-2

* Reach	* River Sta.	* n1	* n2	* n3 *
*Reach-1	* 250.12	* .07*	.045*	.07*
*Reach-1	* 225	* .07*	.07*	.07*
*Reach-1	* 200	* .07*	.07*	.07*
*Reach-1	* 190	* .1*	.045*	.07*

SUMMARY OF REACH LENGTHS

River: RIVER-1

* Reach	* River Sta.	* Left	* Channel *	Right *
*Reach-1	* 350	* 505*	505*	505*
*Reach-1	* 344.95	* 1335*	1335*	1335*
*Reach-1	* 331.6	* 820*	820*	820*
*Reach-1	* 320	* 900*	900*	550*
*Reach-1	* 314.4	* 600*	1252*	600*
*Reach-1	* 300	* 1000*	1900*	1900*
*Reach-1	* 285	* 220*	320*	320*
*Reach-1	* 280.55	* 1140*	1140*	1140*
*Reach-1	* 270	* 520*	520*	520*
*Reach-1	* 264	* 1338*	1338*	1000*
*Reach-1	* 250.12	* 482*	482*	482*
*Reach-1	* 250.06	*Bridge *	*	*
*Reach-1	* 250	* 5*	40*	60*
*Reach-1	* 246	* 5*	50*	140*
*Reach-1	* 245	* 230*	230*	230*
*Reach-1	* 244.19	*Bridge *	*	*
*Reach-1	* 243.38	* 600*	600*	300*
*Reach-1	* 243.2	* 730*	730*	200*
*Reach-1	* 243	* 4920*	3938*	1480*
*Reach-1	* 190	* 1000*	1000*	1000*
*Reach-2	* 180	* 1000*	1000*	1000*
*Reach-2	* 170	* 0*	0*	0*

River: RIVER-2

* Reach	* River Sta.	* Left	* Channel *	Right *
*Reach-1	* 250.12	* 490*	490*	260*
*Reach-1	* 225	* 460*	460*	460*
*Reach-1	* 200	* 820*	820*	890*
*Reach-1	* 190	* 1100*	1100*	550*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

Duplicate Effective

River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	350	.1	.3
Reach-1	344.95	.1	.3
Reach-1	331.6	.1	.3
Reach-1	320	.1	.3
Reach-1	314.4	.1	.3
Reach-1	300	.1	.3
Reach-1	285	.1	.3
Reach-1	280.55	.1	.3
Reach-1	270	.1	.3
Reach-1	264	.1	.3
Reach-1	250.12	.3	.5
Reach-1	250.06	Bridge	
Reach-1	250	.3	.5
Reach-1	246	.3	.5
Reach-1	245	.3	.5
Reach-1	244.19	Bridge	
Reach-1	243.38	.3	.5
Reach-1	243.2	.1	.3
Reach-1	243	.1	.3
Reach-1	190	.1	.3
Reach-2	180	.1	.3
Reach-2	170	.1	.3

River: RIVER-2

Reach	River Sta.	Contr.	Expan.
Reach-1	250.12	.1	.3
Reach-1	225	.1	.3
Reach-1	200	.1	.3
Reach-1	190	.1	.3

Profile Output Table - Standard Table 1

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
RIVER-2	Reach-1	250.12	1%	15880.00	180.00	176.60	170.89	176.70	0.001017		6316.63	873.59	0.00
RIVER-2	Reach-1	250.12	Floodway	15880.00		177.14	171.65	177.33	0.001679		4490.05	530.00	0.00
RIVER-2	Reach-1	250.12	10%	5905.00	180.00	172.65	169.34	172.71	0.001391		3037.93	784.62	0.00
RIVER-2	Reach-1	250.12	2%	12820.00	180.00	175.07	170.49	175.17	0.001363		5003.38	839.09	

									0.00
RIVER-2	Reach-1	250.12		0.2%		20850.00		180.00	
177.11	171.47	177.26	0.001422			6762.74		885.01	0.00
RIVER-2	Reach-1	225		1%		15880.00		166.00	
176.04		176.26	0.002490		4.58	4318.24		701.46	0.27
RIVER-2	Reach-1	225		Floodway		15880.00		166.00	
176.58		176.81	0.002065		4.34	4134.40		510.00	0.25
RIVER-2	Reach-1	225		10%		5905.00		166.00	
171.82		172.01	0.005304		4.40	1736.36		545.95	0.35
RIVER-2	Reach-1	225		2%		12820.00		166.00	
174.28		174.55	0.004003		5.03	3157.28		615.57	0.33
RIVER-2	Reach-1	225		0.2%		20850.00		166.00	
176.26		176.62	0.003890		5.82	4471.99		713.82	0.34
RIVER-2	Reach-1	200		1%		15880.00		164.00	
175.32		175.45	0.001243		3.50	5726.81		881.89	0.19
RIVER-2	Reach-1	200		Floodway		15880.00		164.00	
175.89		176.07	0.001241		3.54	4667.14		465.00	0.19
RIVER-2	Reach-1	200		10%		5905.00		164.00	
170.72		170.80	0.001498		2.57	2560.25		566.37	0.19
RIVER-2	Reach-1	200		2%		12820.00		164.00	
173.07		173.25	0.002020		3.78	3978.27		678.91	0.24
RIVER-2	Reach-1	200		0.2%		20850.00		164.00	
174.90		175.16	0.002527		4.85	5365.97		843.20	0.27
RIVER-2	Reach-1	190		1%		15880.00		180.00	
174.62	168.07	174.67	0.000636			8800.63		1414.27	0.00
RIVER-2	Reach-1	190		Floodway		15880.00			
175.36	168.04	175.40	0.000467			9388.74		1315.00	0.00
RIVER-2	Reach-1	190		10%		5905.00		180.00	
167.14	166.41	167.54	0.020588			1162.58		538.65	0.00
RIVER-2	Reach-1	190		2%		12820.00		180.00	
168.91	167.63	169.40	0.015780			2288.97		749.81	0.00
RIVER-2	Reach-1	190		0.2%		20850.00		180.00	
171.13	168.70	171.49	0.008319			4308.39		1085.85	0.00
RIVER-1	Reach-1	350		1%		17700.00		160.00	
181.84		182.36	0.001074		7.73	6736.57		1123.98	

0.31								
* RIVER-1	* Reach-1	* 350	* Floodway	* 17700.00	* 160.00	*		
182.21	*	182.87	* 0.001188	* 8.24	* 4592.22	* 440.00	*	
0.33								
* RIVER-1	* Reach-1	* 350	* 10%	* 8780.00	* 160.00	*		
177.83	*	178.38	* 0.001107	* 6.73	* 2934.89	* 689.51	*	
0.30								
* RIVER-1	* Reach-1	* 350	* 2%	* 15000.00	* 160.00	*		
180.57	*	181.18	* 0.001219	* 7.88	* 5361.23	* 1045.37	*	
0.33								
* RIVER-1	* Reach-1	* 350	* 0.2%	* 25700.00	* 160.00	*		
184.23	*	184.73	* 0.001042	* 8.24	* 9596.19	* 1271.98	*	
0.31								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 344.95	* 1%	* 17700.00	* 159.00	*		
181.77	*	181.96	* 0.000382	* 4.70	* 9689.97	* 1209.57	*	
0.19								
* RIVER-1	* Reach-1	* 344.95	* Floodway	* 17700.00	* 159.00	*		
182.26	*	182.43	* 0.000339	* 4.50	* 9033.94	* 850.00	*	
0.18								
* RIVER-1	* Reach-1	* 344.95	* 10%	* 8780.00	* 159.00	*		
177.84	*	177.98	* 0.000320	* 3.71	* 5319.22	* 942.29	*	
0.16								
* RIVER-1	* Reach-1	* 344.95	* 2%	* 15000.00	* 159.00	*		
180.53	*	180.73	* 0.000398	* 4.59	* 8213.99	* 1174.91	*	
0.19								
* RIVER-1	* Reach-1	* 344.95	* 0.2%	* 25700.00	* 159.00	*		
184.10	*	184.32	* 0.000430	* 5.37	* 12582.56	* 1274.77	*	
0.20								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 331.6	* 1%	* 17700.00	* 159.60	*		
180.72	*	181.18	* 0.000904	* 6.89	* 6311.73	* 913.64	*	
0.28								
* RIVER-1	* Reach-1	* 331.6	* Floodway	* 17700.00	* 159.60	*		
181.41	*	181.78	* 0.000717	* 6.29	* 6810.65	* 840.00	*	
0.25								
* RIVER-1	* Reach-1	* 331.6	* 10%	* 8780.00	* 159.60	*		
176.96	*	177.33	* 0.000778	* 5.49	* 3261.54	* 670.91	*	
0.25								
* RIVER-1	* Reach-1	* 331.6	* 2%	* 15000.00	* 159.60	*		
179.39	*	179.90	* 0.001000	* 6.89	* 5122.05	* 858.28	*	
0.29								
* RIVER-1	* Reach-1	* 331.6	* 0.2%	* 25700.00	* 159.60	*		
182.95	*	183.46	* 0.000977	* 7.73	* 8375.43	* 940.36	*	
0.30								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 320	* 1%	* 17700.00	* 159.40	*		
180.18	*	180.42	* 0.000806	* 5.72	* 10126.84	* 2126.55	*	
0.26								
* RIVER-1	* Reach-1	* 320	* Floodway	* 17700.00	* 159.40	*		
180.79	*	181.11	* 0.000876	* 6.12	* 6119.94	* 600.00	*	
0.27								
* RIVER-1	* Reach-1	* 320	* 10%	* 8780.00	* 159.40	*		
176.18	*	176.54	* 0.001220	* 5.76	* 3734.14	* 1040.24	*	
0.30								
* RIVER-1	* Reach-1	* 320	* 2%	* 15000.00	* 159.40	*		
178.61	*	178.97	* 0.001172	* 6.42	* 7091.83	* 1721.16	*	

	0.30								
RIVER-1	Reach-1	320		0.2%		25700.00		159.40	
182.57		182.74	0.000598		5.42	15483.78		2350.31	
	0.23								
RIVER-1	Reach-1	314.4		1%		17700.00		159.10	
180.11	172.28	180.15	0.000149		2.75	18599.08		2465.03	
	0.11								
RIVER-1	Reach-1	314.4		Floodway		17700.00		159.10	
180.77	172.27	180.81	0.000156		2.88	16086.19		1385.00	
	0.12								
RIVER-1	Reach-1	314.4		10%		8780.00		159.10	
176.14	170.68	176.17	0.000167		2.47	11058.94		1857.75	
	0.12								
RIVER-1	Reach-1	314.4		2%		15000.00		159.10	
178.56	171.92	178.60	0.000179		2.84	15620.45		2301.14	
	0.12								
RIVER-1	Reach-1	314.4		0.2%		25700.00		159.10	
182.46	173.13	182.50	0.000163		3.12	23268.25		3200.67	
	0.12								
RIVER-1	Reach-1	300		1%		17700.00		158.70	
179.93	172.50	180.00	0.000243		3.51	14127.02		3785.08	
	0.15								
RIVER-1	Reach-1	300		Floodway		17700.00		158.70	
180.56	172.53	180.65	0.000269		3.79	11836.38		1080.00	
	0.15								
RIVER-1	Reach-1	300		10%		8780.00		158.70	
175.93	170.83	176.00	0.000260		3.08	7852.84		1744.11	
	0.14								
RIVER-1	Reach-1	300		2%		15000.00		158.70	
178.33	172.09	178.42	0.000303		3.70	11348.80		3671.19	
	0.16								
RIVER-1	Reach-1	300		0.2%		25700.00		158.70	
182.27	173.52	182.35	0.000254		3.90	18205.25		3835.50	
	0.15								
RIVER-1	Reach-1	285		1%		17700.00		158.20	
179.17	171.61	179.38	0.000597		5.51	9421.47		3298.35	
	0.23								
RIVER-1	Reach-1	285		Floodway		17700.00		158.20	
179.76	171.52	179.99	0.000585		5.57	7252.10		605.00	
	0.23								
RIVER-1	Reach-1	285		10%		8780.00		158.20	
175.14	168.58	175.33	0.000594		4.64	4916.41		909.17	
	0.22								
RIVER-1	Reach-1	285		2%		15000.00		158.20	
177.24	170.44	177.55	0.000907		6.29	6948.92		2045.14	
	0.28								
RIVER-1	Reach-1	285		0.2%		25700.00		158.20	
181.53	173.59	181.74	0.000583		5.91	12469.62		3337.67	
	0.23								
RIVER-1	Reach-1	280.55		1%		17700.00		158.00	
178.99	170.94	179.21	0.000534		5.11	8904.67		2157.83	

0.22									
* RIVER-1	* Reach-1	* 280.55	* Floodway	* 17700.00	*	158.00	*		
179.55 *	170.67 *	179.82 *	0.000580 *	5.44 *	6641.81 *	600.00 *			
0.23									
* RIVER-1	* Reach-1	* 280.55	* 10%	* 8780.00 *		158.00 *			
174.98 *	167.87 *	175.16 *	0.000502 *	4.16 *	4504.07 *	857.98 *			
0.20									
* RIVER-1	* Reach-1	* 280.55	* 2%	* 15000.00 *		158.00 *			
177.02 *	169.97 *	177.30 *	0.000720 *	5.48 *	6489.39 *	1601.98 *			
0.25									
* RIVER-1	* Reach-1	* 280.55	* 0.2%	* 25700.00 *		158.00 *			
181.33 *	172.95 *	181.57 *	0.000565 *	5.71 *	12411.70 *	3215.98 *			
0.23									
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*									
* RIVER-1	* Reach-1	* 270	* 1%	* 17700.00 *		157.70 *			
177.35 *	173.39 *	178.10 *	0.002039 *	8.30 *	3845.96 *	2276.72 *			
0.40									
* RIVER-1	* Reach-1	* 270	* Floodway	* 17700.00 *		157.70 *			
178.14 *	173.39 *	178.76 *	0.001595 *	7.63 *	4206.93 *	457.44 *			
0.36									
* RIVER-1	* Reach-1	* 270	* 10%	* 8780.00 *		157.70 *			
173.44 *	170.74 *	174.06 *	0.002276 *	6.99 *	2106.93 *	434.03 *			
0.40									
* RIVER-1	* Reach-1	* 270	* 2%	* 15000.00 *		157.70 *			
172.91 *	172.76 *	175.14 *	0.008585 *	13.07 *	1878.85 *	431.11 *			
0.77									
* RIVER-1	* Reach-1	* 270	* 0.2%	* 25700.00 *		157.70 *			
179.32 *	174.95 *	180.33 *	0.002408 *	9.88 *	4755.52 *	2353.02 *			
0.44									
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*									
* RIVER-1	* Reach-1	* 264	* 1%	* 17700.00 *		157.50 *			
177.27 *	168.83 *	177.44 *	0.000529 *	5.30 *	7685.60 *	3597.63 *			
0.22									
* RIVER-1	* Reach-1	* 264	* Floodway	* 17700.00 *		157.50 *			
178.08 *	168.83 *	178.22 *	0.000439 *	4.97 *	8152.06 *	652.91 *			
0.20									
* RIVER-1	* Reach-1	* 264	* 10%	* 8780.00 *		157.50 *			
173.41 *	167.07 *	173.51 *	0.000376 *	3.83 *	5436.77 *	1345.10 *			
0.18									
* RIVER-1	* Reach-1	* 264	* 2%	* 15000.00 *		157.50 *			
172.81 *	168.36 *	173.13 *	0.001343 *	7.03 *	5086.74 *	1323.44 *			
0.33									
* RIVER-1	* Reach-1	* 264	* 0.2%	* 25700.00 *		157.50 *			
179.22 *	170.02 *	179.48 *	0.000723 *	6.62 *	8830.13 *	3828.29 *			
0.26									
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*									
* RIVER-1	* Reach-1	* 250.12	* 1%	* 2220.00 *		157.00 *			
176.73 *	162.72 *	176.85 *	0.000142 *	2.71 *	820.40 *	3455.81 *			
0.11									
* RIVER-1	* Reach-1	* 250.12	* Floodway	* 2220.00 *		157.00 *			
177.62 *	162.72 *	177.73 *	0.000121 *	2.58 *	860.61 *	210.00 *			
0.10									
* RIVER-1	* Reach-1	* 250.12	* 10%	* 3025.00 *		157.00 *			
172.56 *	163.70 *	172.92 *	0.000625 *	4.78 *	632.68 *	350.35 *			
0.22									
* RIVER-1	* Reach-1	* 250.12	* 2%	* 2480.00 *		157.00 *			
171.28 *	163.06 *	171.57 *	0.000578 *	4.31 *	575.11 *	246.01 *			

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    0.21 *
* RIVER-1     * Reach-1     * 250.12      * 0.2%      *  5250.00 *    157.00 *
179.16 *    166.00 *    179.16 *   0.000015 *     0.96 *  18844.62 *   3674.16 *
    0.04 *
*             *             *             *           *           *           *
   *            *            *             *           *           *           *
     *
* RIVER-1     * Reach-1     * 250.06      *           *   Bridge  *           *
   *            *            *             *           *           *           *
     *
*             *             *             *           *           *           *
   *            *            *             *           *           *           *
     *
* RIVER-1     * Reach-1     * 250         * 1%        *  2220.00 *    156.84 *
175.37 *    162.37 *    175.48 *   0.000146 *     2.62 *    847.42 *   4520.53 *
    0.11 *
* RIVER-1     * Reach-1     * 250         * Floodway  *  2220.00 *    156.84 *
176.25 *    162.37 *    176.35 *   0.000123 *     2.49 *    891.58 *    150.00 *
    0.10 *
* RIVER-1     * Reach-1     * 250         * 10%       *  3025.00 *    156.84 *
170.18 *    163.27 *    170.59 *   0.000918 *     5.15 *    587.91 *    174.26 *
    0.26 *
* RIVER-1     * Reach-1     * 250         * 2%        *  2480.00 *    156.84 *
169.73 *    162.67 *    170.03 *   0.000702 *     4.39 *    565.50 *    143.25 *
    0.23 *
* RIVER-1     * Reach-1     * 250         * 0.2%      *  5250.00 *    156.84 *
177.10 *    165.42 *    177.11 *   0.000037 *     1.41 *  15250.77 *   4711.45 *
    0.06 *
*             *             *             *           *           *           *
   *            *            *             *           *           *           *
     *
* RIVER-1     * Reach-1     * 246         * 1%        *  2220.00 *    156.80 *
175.40 *    162.38 *    175.43 *   0.000055 *     1.61 *   1994.71 *   4524.48 *
    0.07 *
* RIVER-1     * Reach-1     * 246         * Floodway  *  2220.00 *    156.80 *
176.28 *    162.38 *    176.31 *   0.000047 *     1.54 *   2135.44 *    160.00 *
    0.06 *
* RIVER-1     * Reach-1     * 246         * 10%       *  3025.00 *    156.80 *
170.28 *    163.23 *    170.44 *   0.000478 *     3.74 *   1173.99 *    203.99 *
    0.19 *
* RIVER-1     * Reach-1     * 246         * 2%        *  2480.00 *    156.80 *
169.80 *    162.68 *    169.92 *   0.000383 *     3.26 *   1097.44 *    157.75 *
    0.17 *
* RIVER-1     * Reach-1     * 246         * 0.2%      *  5250.00 *    156.80 *
176.95 *    165.16 *    177.08 *   0.000215 *     3.38 *   2242.72 *   4694.99 *
    0.14 *
*             *             *             *           *           *           *
   *            *            *             *           *           *           *
     *
* RIVER-1     * Reach-1     * 245         * 1%        *  2220.00 *    156.80 *
175.15 *    163.40 *    175.37 *   0.000314 *     3.79 *    586.08 *   4372.89 *
    0.16 *
* RIVER-1     * Reach-1     * 245         * Floodway  *  2220.00 *    156.80 *
176.05 *    163.40 *    176.25 *   0.000264 *     3.59 *    617.80 *    160.00 *
    0.15 *
* RIVER-1     * Reach-1     * 245         * 10%       *  3025.00 *    156.80 *
169.13 *    164.55 *    170.14 *   0.002570 *     8.05 *    375.60 *    121.75 *
    0.43 *
* RIVER-1     * Reach-1     * 245         * 2%        *  2480.00 *    156.80 *
169.03 *    163.78 *    169.72 *   0.001785 *     6.67 *    371.89 *    120.74 *
    0.36 *
* RIVER-1     * Reach-1     * 245         * 0.2%      *  5250.00 *    156.80 *
175.54 *    167.27 *    176.73 *   0.001625 *     8.75 *    599.89 *   4462.37 *
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										0.37
RIVER-1	Reach-1	244.19			Bridge					
RIVER-1	Reach-1	243.38	1%		2220.00	156.70				
174.53	161.59	174.62	0.000128		2.43	915.03	4129.41			
										0.10
RIVER-1	Reach-1	243.38	Floodway		2220.00	156.70				
175.41	161.59	175.49	0.000108		2.30	963.63	155.00			
										0.10
RIVER-1	Reach-1	243.38	10%		3025.00	156.70				
166.87	162.43	167.45	0.001854		6.13	493.80	122.47			
										0.36
RIVER-1	Reach-1	243.38	2%		2480.00	156.70				
168.10	161.87	168.40	0.000811		4.42	561.71	149.18			
										0.24
RIVER-1	Reach-1	243.38	0.2%		5250.00	156.70				
170.36	164.45	171.27	0.001865		7.65	686.19	652.65			
										0.38
RIVER-1	Reach-1	243.2	1%		2220.00	155.10				
174.56	160.58	174.56	0.000011		0.71	6130.80	2406.38			
										0.03
RIVER-1	Reach-1	243.2	Floodway		2220.00	155.10				
175.37	160.56	175.41	0.000087		1.66	1336.58	75.00			
										0.07
RIVER-1	Reach-1	243.2	10%		3025.00	155.10				
166.29	161.30	166.54	0.000909		4.20	904.90	1020.70			
										0.25
RIVER-1	Reach-1	243.2	2%		2480.00	155.10				
167.95	160.81	168.04	0.000279		2.61	1516.39	1461.51			
										0.14
RIVER-1	Reach-1	243.2	0.2%		5250.00	155.10				
170.41	162.97	170.51	0.000327		3.26	3227.91	1792.09			
										0.16
RIVER-1	Reach-1	243	1%		2220.00	153.20				
174.56	158.84	174.56	0.000002		0.31	14305.87	3081.12			
										0.01
RIVER-1	Reach-1	243	Floodway		2220.00	153.20				
175.35	158.83	175.37	0.000037		1.18	1874.61	100.00			
										0.05
RIVER-1	Reach-1	243	10%		3025.00	153.20				
166.22	159.58	166.25	0.000158		1.86	2932.32	2123.97			
										0.11
RIVER-1	Reach-1	243	2%		2480.00	153.20				
167.95	159.08	167.96	0.000038		1.03	4873.10	2394.65			
										0.05
RIVER-1	Reach-1	243	0.2%		5250.00	153.20				
170.42	161.29	170.43	0.000050		1.33	8387.83	2738.31			
										0.06

*												
* RIVER-1	* Reach-1	* 190		* 1%		* 2220.00 *	153.80 *					
174.55 *	*	174.55 *	0.000001 *	0.22 *	30081.07 *	2497.59 *						
0.01 *												
* RIVER-1	* Reach-1	* 190		* Floodway *	2220.00 *	153.80 *						
175.31 *	*	175.32 *	0.000008 *	0.70 *	7374.63 *	499.61 *						
0.03 *												
* RIVER-1	* Reach-1	* 190		* 10%	* 3025.00 *	153.80 *						
165.96 *	*	165.97 *	0.000058 *	1.28 *	8916.52 *	2255.79 *						
0.07 *												
* RIVER-1	* Reach-1	* 190		* 2%	* 2480.00 *	153.80 *						
167.90 *	*	167.90 *	0.000012 *	0.66 *	13504.33 *	2475.58 *						
0.03 *												
* RIVER-1	* Reach-1	* 190		* 0.2%	* 5250.00 *	153.80 *						
170.36 *	*	170.36 *	0.000017 *	0.87 *	19610.87 *	2490.59 *						
0.04 *												
*	*	*	*	*	*	*						
*	*	*	*	*	*	*						
*												
* RIVER-1	* Reach-2	* 180		* 1%	* 18100.00 *	153.30 *						
174.52 *	*	174.54 *	0.000057 *	1.89 *	32148.49 *	3306.02 *						
0.07 *												
* RIVER-1	* Reach-2	* 180		* Floodway *	18100.00 *	153.30 *						
175.26 *	*	175.27 *	0.000058 *	1.96 *	28169.07 *	2415.00 *						
0.07 *												
* RIVER-1	* Reach-2	* 180		* 10%	* 8930.00 *	153.30 *						
165.49 *	*	165.67 *	0.000840 *	5.00 *	6568.77 *	2314.76 *						
0.25 *												
* RIVER-1	* Reach-2	* 180		* 2%	* 15300.00 *	153.30 *						
167.59 *	*	167.71 *	0.000637 *	4.85 *	11717.52 *	2549.62 *						
0.23 *												
* RIVER-1	* Reach-2	* 180		* 0.2%	* 26100.00 *	153.30 *						
170.07 *	*	170.17 *	0.000558 *	5.05 *	18389.87 *	2838.38 *						
0.22 *												
*	*	*	*	*	*	*						
*	*	*	*	*	*	*						
*												
* RIVER-1	* Reach-2	* 170		* 1%	* 18100.00 *	152.70 *						
174.47 *	163.32 *	174.48 *	0.000052 *	1.82 *	31921.84 *	3112.90 *						
0.07 *												
* RIVER-1	* Reach-2	* 170		* Floodway *	18100.00 *	152.70 *						
175.21 *	163.32 *	175.22 *	0.000046 *	1.76 *	29608.68 *	2300.00 *						
0.07 *												
* RIVER-1	* Reach-2	* 170		* 10%	* 8930.00 *	152.70 *						
164.82 *	161.36 *	164.94 *	0.000601 *	4.19 *	6871.70 *	1728.07 *						
0.21 *												
* RIVER-1	* Reach-2	* 170		* 2%	* 15300.00 *	152.70 *						
166.97 *	162.94 *	167.09 *	0.000600 *	4.68 *	11002.93 *	2130.80 *						
0.22 *												
* RIVER-1	* Reach-2	* 170		* 0.2%	* 26100.00 *	152.70 *						
169.47 *	164.19 *	169.59 *	0.000601 *	5.22 *	17234.27 *	2732.68 *						
0.23 *												

****

Profile Output Table - Encroachment 1

* River	* Reach	* River Sta	* Profile	* W.S. Elev *	Prof Delta WS *	E.G. Elev *	Top Wdth Act *	Q Left *	Q Channel *	Q Right *	Enc Sta L *	Ch Sta L *	Ch Sta R *	Enc Sta R *

					(ft)		(ft)	
(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)	(ft)		
(ft)	(ft)							
RIVER-2	Reach-1	250.12	1%		176.60			
176.70	873.59			15880.00		3650.00		
3695.00								
RIVER-2	Reach-1	250.12	Floodway		177.14		0.53	
177.33	530.00			15880.00	3870.00	3650.00		
3695.00	4400.00							
RIVER-2	Reach-1	250.12	10%		172.65		-3.95	
172.71	784.62			5905.00		3650.00		
3695.00								
RIVER-2	Reach-1	250.12	2%		175.07		-1.53	
175.17	839.09			12820.00		3650.00		
3695.00								
RIVER-2	Reach-1	250.12	0.2%		177.11		0.51	
177.26	885.01			20850.00		3650.00		
3695.00								
RIVER-2	Reach-1	225	1%		176.04			
176.26	701.46	1202.79	1657.53	13019.68		240.00		
280.00								
RIVER-2	Reach-1	225	Floodway		176.58		0.54	
176.81	510.00	990.62	1661.47	13227.92	200.00	240.00		
280.00	710.00							
RIVER-2	Reach-1	225	10%		171.82		-4.22	
172.01	545.95	299.15	847.71	4758.14		240.00		
280.00								
RIVER-2	Reach-1	225	2%		174.28		-1.76	
174.55	615.57	871.91	1464.11	10483.98		240.00		
280.00								
RIVER-2	Reach-1	225	0.2%		176.26		0.22	
176.62	713.82	1607.07	2155.47	17087.46		240.00		
280.00								
RIVER-2	Reach-1	200	1%		175.32			
175.45	881.89	484.27	7445.62	7950.11		220.00		
430.00								
RIVER-2	Reach-1	200	Floodway		175.89		0.57	
176.07	465.00		7954.43	7925.57	220.00	220.00		
430.00	685.00							
RIVER-2	Reach-1	200	10%		170.72		-4.60	
170.80	566.37	36.51	2977.01	2891.48		220.00		
430.00								
RIVER-2	Reach-1	200	2%		173.07		-2.24	
173.25	678.91	239.98	6250.58	6329.44		220.00		
430.00								
RIVER-2	Reach-1	200	0.2%		174.90		-0.42	
175.16	843.20	587.15	9895.63	10367.22		220.00		
430.00								
RIVER-2	Reach-1	190	1%		174.62			
174.67	1414.27			15880.00		1970.00		
2020.00								

* RIVER-2	* Reach-1	* 190		* Floodway *	175.36 *		0.74 *		
175.40 *	1315.00 *	*	*	15880.00 *	4485.00 *	1970.00 *			
2020.00 *	5800.00 *								
* RIVER-2	* Reach-1	* 190		* 10% *	167.14 *		-7.49 *		
167.54 *	538.65 *	*	*	5905.00 *	*	1970.00 *			
2020.00 *	*								
* RIVER-2	* Reach-1	* 190		* 2% *	168.91 *		-5.72 *		
169.40 *	749.81 *	*	*	12820.00 *	*	1970.00 *			
2020.00 *	*								
* RIVER-2	* Reach-1	* 190		* 0.2% *	171.13 *		-3.50 *		
171.49 *	1085.85 *	*	*	20850.00 *	*	1970.00 *			
2020.00 *	*								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*	*								
* RIVER-1	* Reach-1	* 350		* 1% *	181.84 *		*		
182.36 *	1123.98 *	3699.03 *	9721.90 *	4279.07 *	*	1965.00 *			
2030.00 *	*								
* RIVER-1	* Reach-1	* 350		* Floodway *	182.21 *		0.37 *		
182.87 *	440.00 *	3243.46 *	10557.45 *	3899.09 *	1840.00 *	1965.00 *			
2030.00 *	2280.00 *								
* RIVER-1	* Reach-1	* 350		* 10% *	177.83 *		-4.00 *		
178.38 *	689.51 *	1215.03 *	6704.87 *	860.11 *	*	1965.00 *			
2030.00 *	*								
* RIVER-1	* Reach-1	* 350		* 2% *	180.57 *		-1.27 *		
181.18 *	1045.37 *	2855.30 *	9253.18 *	2891.52 *	*	1965.00 *			
2030.00 *	*								
* RIVER-1	* Reach-1	* 350		* 0.2% *	184.23 *		2.39 *		
184.73 *	1271.98 *	6186.40 *	11630.04 *	7883.56 *	*	1965.00 *			
2030.00 *	*								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*	*								
* RIVER-1	* Reach-1	* 344.95		* 1% *	181.77 *		*		
181.96 *	1209.57 *	2875.52 *	9286.32 *	5538.16 *	*	1950.00 *			
2050.00 *	*								
* RIVER-1	* Reach-1	* 344.95		* Floodway *	182.26 *		0.49 *		
182.43 *	850.00 *	2720.19 *	9116.10 *	5863.71 *	1600.00 *	1950.00 *			
2050.00 *	2450.00 *								
* RIVER-1	* Reach-1	* 344.95		* 10% *	177.84 *		-3.93 *		
177.98 *	942.29 *	562.25 *	5871.03 *	2346.72 *	*	1950.00 *			
2050.00 *	*								
* RIVER-1	* Reach-1	* 344.95		* 2% *	180.53 *		-1.24 *		
180.73 *	1174.91 *	1935.35 *	8512.15 *	4552.50 *	*	1950.00 *			
2050.00 *	*								
* RIVER-1	* Reach-1	* 344.95		* 0.2% *	184.10 *		2.33 *		
184.32 *	1274.77 *	5467.68 *	11865.01 *	8367.32 *	*	1950.00 *			
2050.00 *	*								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*	*								
* RIVER-1	* Reach-1	* 331.6		* 1% *	180.72 *		*		
181.18 *	913.64 *	4172.87 *	10784.03 *	2743.10 *	*	1955.00 *			
2040.00 *	*								
* RIVER-1	* Reach-1	* 331.6		* Floodway *	181.41 *		0.69 *		
181.78 *	840.00 *	4682.99 *	10210.58 *	2806.43 *	1400.00 *	1955.00 *			
2040.00 *	2240.00 *								
* RIVER-1	* Reach-1	* 331.6		* 10% *	176.96 *		-3.76 *		
177.33 *	670.91 *	993.70 *	6836.03 *	950.27 *	*	1955.00 *			
2040.00 *	*								
* RIVER-1	* Reach-1	* 331.6		* 2% *	179.39 *		-1.33 *		
179.90 *	858.28 *	2839.74 *	10011.10 *	2149.16 *	*	1955.00 *			
2040.00 *	*								

* RIVER-1	* Reach-1	* 331.6	* 0.2%	*	182.95	*		*	2.23 *
183.46 *	940.36 *	7843.95 *	13561.06 *	4294.99 *		*	1955.00 *		
2040.00 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 320	* 1%	*	180.18	*			*
180.42 *	2126.55 *	4362.51 *	7966.13 *	5371.37 *		*	1720.00 *		
1810.00 *	*								
* RIVER-1	* Reach-1	* 320	* Floodway	*	180.79	*		*	0.62 *
181.11 *	600.00 *	3619.37 *	8861.46 *	5219.17 *	1500.00	*	1720.00 *		
1810.00 *	2100.00 *								
* RIVER-1	* Reach-1	* 320	* 10%	*	176.18	*		*	-4.00 *
176.54 *	1040.24 *	1135.55 *	5956.01 *	1688.44 *		*	1720.00 *		
1810.00 *	*								
* RIVER-1	* Reach-1	* 320	* 2%	*	178.61	*		*	-1.57 *
178.97 *	1721.16 *	3054.84 *	8040.80 *	3904.36 *		*	1720.00 *		
1810.00 *	*								
* RIVER-1	* Reach-1	* 320	* 0.2%	*	182.57	*		*	2.39 *
182.74 *	2350.31 *	7553.80 *	8717.55 *	9428.65 *		*	1720.00 *		
1810.00 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 314.4	* 1%	*	180.11	*			*
180.15 *	1940.56 *	701.97 *	3975.73 *	13022.30 *		*	1975.00 *		
2055.00 *	*								
* RIVER-1	* Reach-1	* 314.4	* Floodway	*	180.77	*		*	0.66 *
180.81 *	1385.00 *	279.76 *	4314.29 *	13105.96 *	1950.00	*	1975.00 *		
2055.00 *	3335.00 *								
* RIVER-1	* Reach-1	* 314.4	* 10%	*	176.14	*		*	-3.97 *
176.17 *	1857.75 *	285.63 *	2778.17 *	5716.20 *		*	1975.00 *		
2055.00 *	*								
* RIVER-1	* Reach-1	* 314.4	* 2%	*	178.56	*		*	-1.55 *
178.60 *	1906.23 *	559.11 *	3756.08 *	10684.81 *		*	1975.00 *		
2055.00 *	*								
* RIVER-1	* Reach-1	* 314.4	* 0.2%	*	182.46	*		*	2.35 *
182.50 *	2014.25 *	1148.35 *	5096.90 *	19454.75 *		*	1975.00 *		
2055.00 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 300	* 1%	*	179.93	*			*
180.00 *	1740.00 *	1070.62 *	5084.28 *	11545.10 *		*	2400.00 *		
2480.00 *	*								
* RIVER-1	* Reach-1	* 300	* Floodway	*	180.56	*		*	0.63 *
180.65 *	1080.00 *	828.38 *	5667.08 *	11204.55 *	2240.00	*	2400.00 *		
2480.00 *	3320.00 *								
* RIVER-1	* Reach-1	* 300	* 10%	*	175.93	*		*	-4.00 *
176.00 *	1286.61 *	92.09 *	3471.13 *	5216.79 *		*	2400.00 *		
2480.00 *	*								
* RIVER-1	* Reach-1	* 300	* 2%	*	178.33	*		*	-1.60 *
178.42 *	1740.00 *	405.52 *	4873.52 *	9720.97 *		*	2400.00 *		
2480.00 *	*								
* RIVER-1	* Reach-1	* 300	* 0.2%	*	182.27	*		*	2.34 *
182.35 *	1740.00 *	2655.35 *	6372.80 *	16671.86 *		*	2400.00 *		
2480.00 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 285	* 1%	*	179.17	*			*
179.38 *	1285.87 *	7639.50 *	6968.79 *	3091.71 *		*	3060.00 *		
3130.00 *	*								

* RIVER-1	* Reach-1	* 285	* Floodway	*	179.76	*		0.59 *
179.99 *	605.00 *	7836.79 *	7275.06 *	2588.15 *	2635.00	*	3060.00 *	
3130.00 *	3240.00 *							
* RIVER-1	* Reach-1	* 285	* 10%	*	175.14	*		-4.03 *
175.33 *	857.08 *	2789.45 *	4562.72 *	1427.83 *		*	3060.00 *	
3130.00 *	*							
* RIVER-1	* Reach-1	* 285	* 2%	*	177.24	*		-1.94 *
177.55 *	1240.10 *	5148.08 *	7110.68 *	2741.24 *		*	3060.00 *	
3130.00 *	*							
* RIVER-1	* Reach-1	* 285	* 0.2%	*	181.53	*		2.36 *
181.74 *	1297.67 *	12975.82 *	8450.44 *	4273.74 *		*	3060.00 *	
3130.00 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*		*
*	*							
* RIVER-1	* Reach-1	* 280.55	* 1%	*	178.99	*		*
179.21 *	1352.16 *	4147.01 *	8937.45 *	4615.54 *		*	4945.00 *	
5045.00 *	*							
* RIVER-1	* Reach-1	* 280.55	* Floodway	*	179.55	*		0.55 *
179.82 *	600.00 *	4150.15 *	9811.08 *	3738.77 *	4585.00	*	4945.00 *	
5045.00 *	5185.00 *							
* RIVER-1	* Reach-1	* 280.55	* 10%	*	174.98	*		-4.01 *
175.16 *	857.98 *	899.75 *	5612.16 *	2268.09 *		*	4945.00 *	
5045.00 *	*							
* RIVER-1	* Reach-1	* 280.55	* 2%	*	177.02	*		-1.97 *
177.30 *	1098.55 *	2530.75 *	8500.34 *	3968.91 *		*	4945.00 *	
5045.00 *	*							
* RIVER-1	* Reach-1	* 280.55	* 0.2%	*	181.33	*		2.34 *
181.57 *	1650.00 *	7931.08 *	11326.11 *	6442.81 *		*	4945.00 *	
5045.00 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*		*
*	*							
* RIVER-1	* Reach-1	* 270	* 1%	*	177.35	*		*
178.10 *	455.64 *	5868.46 *	11772.96 *	58.58 *		*	3550.00 *	
3655.00 *	*							
* RIVER-1	* Reach-1	* 270	* Floodway	*	178.14	*		0.79 *
178.76 *	457.44 *	6184.50 *	11447.48 *	68.02 *	3210.00	*	3550.00 *	
3655.00 *	3700.00 *							
* RIVER-1	* Reach-1	* 270	* 10%	*	173.44	*		-3.91 *
174.06 *	434.03 *	1735.98 *	7035.84 *	8.18 *		*	3550.00 *	
3655.00 *	*							
* RIVER-1	* Reach-1	* 270	* 2%	*	172.91	*		-4.44 *
175.14 *	431.11 *	2552.96 *	12436.85 *	10.20 *		*	3550.00 *	
3655.00 *	*							
* RIVER-1	* Reach-1	* 270	* 0.2%	*	179.32	*		1.97 *
180.33 *	466.54 *	9519.98 *	16060.03 *	120.00 *		*	3550.00 *	
3655.00 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*		*
*	*							
* RIVER-1	* Reach-1	* 264	* 1%	*	177.27	*		*
177.44 *	586.09 *	11948.86 *	5398.25 *	352.89 *		*	4970.00 *	
5025.00 *	*							
* RIVER-1	* Reach-1	* 264	* Floodway	*	178.08	*		0.81 *
178.22 *	582.91 *	12051.30 *	5279.58 *	369.11 *	4400.00	*	4970.00 *	
5025.00 *	5052.91 *							
* RIVER-1	* Reach-1	* 264	* 10%	*	173.41	*		-3.86 *
173.51 *	579.14 *	5542.75 *	3085.56 *	151.68 *		*	4970.00 *	
5025.00 *	*							
* RIVER-1	* Reach-1	* 264	* 2%	*	172.81	*		-4.46 *
173.13 *	578.05 *	9314.32 *	5432.38 *	253.30 *		*	4970.00 *	
5025.00 *	*							

* RIVER-1	* Reach-1	* 264		* 0.2%	*	179.22 *			1.95 *		
179.48 *	589.59 *	17693.83 *	7457.46 *	548.71 *		*	4970.00 *	5025.00 *			
*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*
* RIVER-1	* Reach-1	* 250.12		* 1%	*	176.73 *					
176.85 *	45.00 *	*	2220.00 *		*	*	3650.00 *	3695.00 *			
* RIVER-1	* Reach-1	* 250.12		* Floodway	*	177.62 *			0.89 *		
177.73 *	45.00 *	*	2220.00 *		*	3540.00 *	3650.00 *	3695.00 *	3750.00 *		
* RIVER-1	* Reach-1	* 250.12		* 10%	*	172.56 *			-4.17 *		
172.92 *	45.00 *	*	3025.00 *		*	*	3650.00 *	3695.00 *			
* RIVER-1	* Reach-1	* 250.12		* 2%	*	171.28 *			-5.45 *		
171.57 *	45.00 *	*	2480.00 *		*	*	3650.00 *	3695.00 *			
* RIVER-1	* Reach-1	* 250.12		* 0.2%	*	179.16 *			2.43 *		
179.16 *	3674.16 *	4041.44 *	895.62 *	312.94 *		*	3650.00 *	3695.00 *			
*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*
* RIVER-1	* Reach-1	* 250.06	BR U * 1%		*	169.50 *					
176.85 *	*	*	2220.00 *		*	*	3650.00 *	3695.00 *			
* RIVER-1	* Reach-1	* 250.06	BR U * Floodway		*	169.50 *			0.00 *		
177.73 *	*	*	2220.00 *		*	3540.00 *	3650.00 *	3695.00 *	3750.00 *		
* RIVER-1	* Reach-1	* 250.06	BR U * 10%		*	169.50 *			0.00 *		
172.91 *	*	*	3025.00 *		*	*	3650.00 *	3695.00 *			
* RIVER-1	* Reach-1	* 250.06	BR U * 2%		*	169.50 *			0.00 *		
171.57 *	*	*	2480.00 *		*	*	3650.00 *	3695.00 *			
* RIVER-1	* Reach-1	* 250.06	BR U * 0.2%		*	179.16 *			9.66 *		
179.16 *	1855.50 *	2285.71 *	2734.98 *	229.31 *		*	3650.00 *	3695.00 *			
*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*
* RIVER-1	* Reach-1	* 250.06	BR D * 1%		*	169.50 *					
175.48 *	*	*	2220.00 *		*	*	3930.00 *	3980.00 *			
* RIVER-1	* Reach-1	* 250.06	BR D * Floodway		*	169.50 *			0.00 *		
176.35 *	*	*	2220.00 *		*	3880.00 *	3930.00 *	3980.00 *	4030.00 *		
* RIVER-1	* Reach-1	* 250.06	BR D * 10%		*	169.50 *			0.00 *		
170.59 *	*	*	3025.00 *		*	*	3930.00 *	3980.00 *			
* RIVER-1	* Reach-1	* 250.06	BR D * 2%		*	169.50 *			0.00 *		
170.03 *	*	*	2480.00 *		*	*	3930.00 *	3980.00 *			
* RIVER-1	* Reach-1	* 250.06	BR D * 0.2%		*	178.41 *			8.91 *		
178.62 *	1889.11 *	2285.71 *	2734.98 *	229.31 *		*	3930.00 *	3980.00 *			
*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*
* RIVER-1	* Reach-1	* 250		* 1%	*	175.37 *					
175.48 *	50.00 *	*	2220.00 *		*	*	3930.00 *	3980.00 *			

* RIVER-1	* Reach-1	* 250		* Floodway	*	176.25	*	0.88	*
176.35 *	50.00 *		* 2220.00 *		*	3880.00	*	3930.00	*
3980.00 *	4030.00 *								
* RIVER-1	* Reach-1	* 250		* 10%	*	170.18	*	-5.19	*
170.59 *	50.00 *		* 3025.00 *		*		*	3930.00	*
3980.00 *	*								
* RIVER-1	* Reach-1	* 250		* 2%	*	169.73	*	-5.64	*
170.03 *	50.00 *		* 2480.00 *		*		*	3930.00	*
3980.00 *	*								
* RIVER-1	* Reach-1	* 250		* 0.2%	*	177.10	*	1.74	*
177.11 *	4711.45 *	2867.08 *	1320.25 *	1062.67 *			*	3930.00	*
3980.00 *	*								
*	*	*	*	*		*			*
*	*	*	*	*		*		*	
*	*								
* RIVER-1	* Reach-1	* 246		* 1%	*	175.40	*		*
175.43 *	160.00 *	385.46 *	1370.15 *	464.38 *			*	3930.00	*
3980.00 *	*								
* RIVER-1	* Reach-1	* 246		* Floodway	*	176.28	*	0.88	*
176.31 *	160.00 *	378.30 *	1380.48 *	461.22 *		3880.00	*	3930.00	*
3980.00 *	4040.00 *								
* RIVER-1	* Reach-1	* 246		* 10%	*	170.28	*	-5.13	*
170.44 *	160.00 *	365.96 *	2218.16 *	440.88 *			*	3930.00	*
3980.00 *	*								
* RIVER-1	* Reach-1	* 246		* 2%	*	169.80	*	-5.61	*
169.92 *	157.75 *	283.67 *	1854.59 *	341.75 *			*	3930.00	*
3980.00 *	*								
* RIVER-1	* Reach-1	* 246		* 0.2%	*	176.95	*	1.55	*
177.08 *	160.00 *	960.45 *	3132.45 *	1157.10 *			*	3930.00	*
3980.00 *	*								
*	*	*	*	*		*			*
*	*	*	*	*		*		*	
*	*								
* RIVER-1	* Reach-1	* 245		* 1%	*	175.15	*		*
175.37 *	35.00 *		* 2220.00 *		*		*	3940.00	*
3975.00 *	*								
* RIVER-1	* Reach-1	* 245		* Floodway	*	176.05	*	0.91	*
176.25 *	35.00 *		* 2220.00 *		*	3890.00	*	3940.00	*
3975.00 *	4050.00 *								
* RIVER-1	* Reach-1	* 245		* 10%	*	169.13	*	-6.01	*
170.14 *	35.00 *		* 3025.00 *		*		*	3940.00	*
3975.00 *	*								
* RIVER-1	* Reach-1	* 245		* 2%	*	169.03	*	-6.12	*
169.72 *	35.00 *		* 2480.00 *		*		*	3940.00	*
3975.00 *	*								
* RIVER-1	* Reach-1	* 245		* 0.2%	*	175.54	*	0.39	*
176.73 *	35.00 *		* 5250.00 *		*		*	3940.00	*
3975.00 *	*								
*	*	*	*	*		*			*
*	*	*	*	*		*		*	
*	*								
* RIVER-1	* Reach-1	* 244.19	BR U * 1%		*	170.90	*		*
175.37 *	*	*	2220.00 *		*		*	3940.00	*
3975.00 *	*								
* RIVER-1	* Reach-1	* 244.19	BR U * Floodway		*	170.90	*	0.00	*
176.25 *	*	*	2220.00 *		*	3890.00	*	3940.00	*
3975.00 *	4050.00 *								
* RIVER-1	* Reach-1	* 244.19	BR U * 10%		*	168.45	*	-2.45	*
169.95 *	30.00 *	*	3025.00 *		*		*	3940.00	*
3975.00 *	*								
* RIVER-1	* Reach-1	* 244.19	BR U * 2%		*	168.63	*	-2.27	*
169.61 *	30.00 *	*	2480.00 *		*		*	3940.00	*
3975.00 *	*								

RIVER-1	Reach-1	244.19	BR U	0.2%		175.54			4.64			
176.73			5133.47	133.64			3940.00	3975.00				
RIVER-1	Reach-1	244.19	BR D	1%		170.90						
174.62			2220.00				3885.00	3940.00				
RIVER-1	Reach-1	244.19	BR D	Floodway		170.90			0.00			
175.49			2220.00			3835.00	3885.00	3940.00	3990.00			
RIVER-1	Reach-1	244.19	BR D	10%		166.25			-4.65			
168.22	30.00		3025.00				3885.00	3940.00				
RIVER-1	Reach-1	244.19	BR D	2%		167.80			-3.10			
168.77	30.00		2480.00				3885.00	3940.00				
RIVER-1	Reach-1	244.19	BR D	0.2%		175.54			4.64			
176.73			5133.47	133.64			3885.00	3940.00				
RIVER-1	Reach-1	243.38		1%		174.53						
174.62	55.00		2220.00				3885.00	3940.00				
RIVER-1	Reach-1	243.38		Floodway		175.41			0.88			
175.49	55.00		2220.00			3835.00	3885.00	3940.00	3990.00			
RIVER-1	Reach-1	243.38		10%		166.87			-7.66			
167.45	55.00		3025.00				3885.00	3940.00				
RIVER-1	Reach-1	243.38		2%		168.10			-6.42			
168.40	55.00		2480.00				3885.00	3940.00				
RIVER-1	Reach-1	243.38		0.2%		170.36			-4.16			
171.27	55.00		5250.00				3885.00	3940.00				
RIVER-1	Reach-1	243.2		1%		174.56						
174.56	700.00	152.90	899.57	1167.54			3485.00	3560.00				
RIVER-1	Reach-1	243.2		Floodway		175.37			0.82			
175.41	75.00		2220.00			3485.00	3485.00	3560.00	3560.00			
RIVER-1	Reach-1	243.2		10%		166.29			-8.27			
166.54	242.85	150.63	2751.08	123.29			3485.00	3560.00				
RIVER-1	Reach-1	243.2		2%		167.95			-6.61			
168.04	492.36	177.39	2039.48	263.12			3485.00	3560.00				
RIVER-1	Reach-1	243.2		0.2%		170.41			-4.15			
170.51	700.00	393.04	3142.05	1714.91			3485.00	3560.00				
RIVER-1	Reach-1	243		1%		174.56						
174.56	1430.00	430.59	555.63	1233.79			1250.00	1350.00				

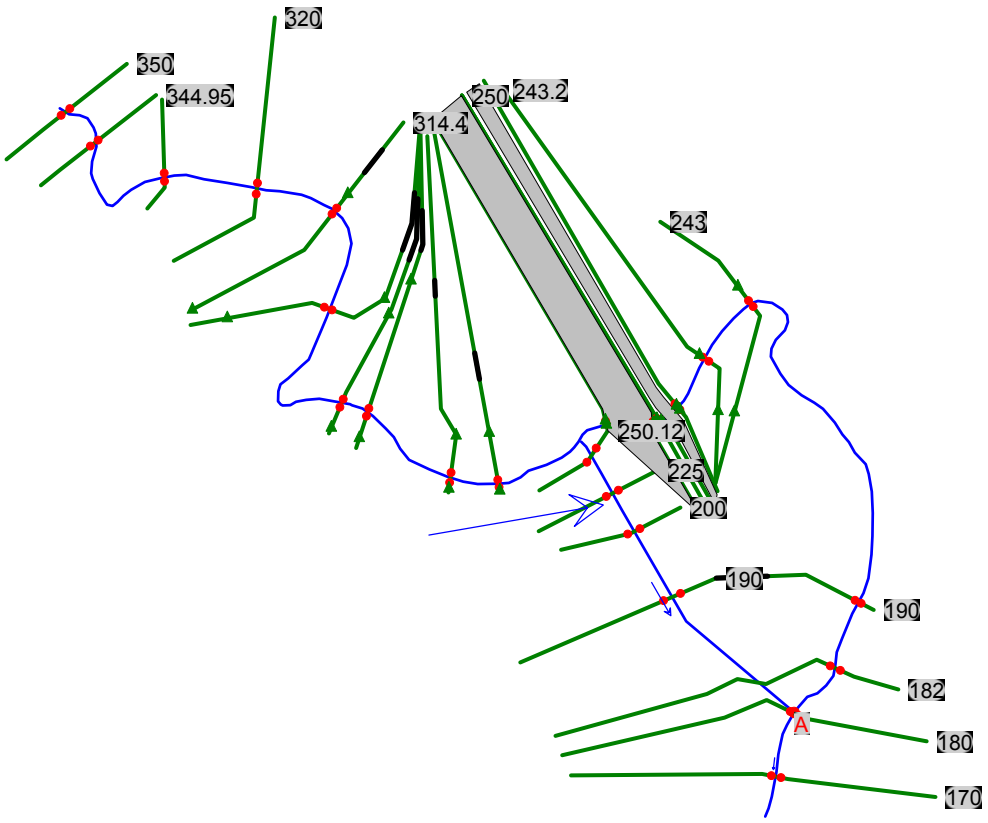
* RIVER-1	* Reach-1	* 243		* Floodway	*	175.35	*		0.79	*			
175.37	* 100.00	*	* 2220.00	*	*	1250.00	*	1250.00	*				
1350.00	* 1350.00	*											
* RIVER-1	* Reach-1	* 243		* 10%	*	166.22	*		-8.34	*			
166.25	* 1031.78	* 952.28	* 1791.76	* 280.96	*		*	1250.00	*				
1350.00	*												
* RIVER-1	* Reach-1	* 243		* 2%	*	167.95	*		-6.60	*			
167.96	* 1205.29	* 707.20	* 1164.03	* 608.77	*		*	1250.00	*				
1350.00	*												
* RIVER-1	* Reach-1	* 243		* 0.2%	*	170.42	*		-4.14	*			
170.43	* 1430.00	* 1265.79	* 1843.23	* 2140.98	*		*	1250.00	*				
1350.00	*												
*	*	*	*	*	*	*							
*	*	*	*	*	*	*							
*	*												
* RIVER-1	* Reach-1	* 190		* 1%	*	174.55	*			*			
174.55	* 2497.59	* 17.43	* 219.63	* 1982.94	*		*	1970.00	*				
2020.00	*												
* RIVER-1	* Reach-1	* 190		* Floodway	*	175.31	*		0.76	*			
175.32	* 499.61	* 60.80	* 729.00	* 1430.20	*	1937.39	*	1970.00	*				
2020.00	* 2437.00	*											
* RIVER-1	* Reach-1	* 190		* 10%	*	165.96	*		-8.59	*			
165.97	* 2255.79	* 31.75	* 741.51	* 2251.74	*		*	1970.00	*				
2020.00	*												
* RIVER-1	* Reach-1	* 190		* 2%	*	167.90	*		-6.65	*			
167.90	* 2475.58	* 22.70	* 444.78	* 2012.52	*		*	1970.00	*				
2020.00	*												
* RIVER-1	* Reach-1	* 190		* 0.2%	*	170.36	*		-4.20	*			
170.36	* 2490.59	* 42.89	* 697.65	* 4509.46	*		*	1970.00	*				
2020.00	*												
*	*	*	*	*	*	*							
*	*	*	*	*	*	*							
*	*												
* RIVER-1	* Reach-2	* 180		* 1%	*	174.52	*			*			
174.54	* 3306.02	* 3792.98	* 2594.96	* 11712.06	*		*	1970.00	*				
2035.00	*												
* RIVER-1	* Reach-2	* 180		* Floodway	*	175.26	*		0.74	*			
175.27	* 2415.00	* 1474.31	* 2781.15	* 13844.55	*	1820.00	*	1970.00	*				
2035.00	* 4235.00	*											
* RIVER-1	* Reach-2	* 180		* 10%	*	165.49	*		-9.04	*			
165.67	* 2314.76	* 1660.06	* 3921.76	* 3348.18	*		*	1970.00	*				
2035.00	*												
* RIVER-1	* Reach-2	* 180		* 2%	*	167.59	*		-6.93	*			
167.71	* 2549.62	* 3126.94	* 4463.94	* 7709.12	*		*	1970.00	*				
2035.00	*												
* RIVER-1	* Reach-2	* 180		* 0.2%	*	170.07	*		-4.45	*			
170.17	* 2838.38	* 5447.23	* 5466.23	* 15186.54	*		*	1970.00	*				
2035.00	*												
*	*	*	*	*	*	*							
*	*	*	*	*	*	*							
*	*												
* RIVER-1	* Reach-2	* 170		* 1%	*	174.47	*			*			
174.48	* 3112.90	* 8352.65	* 2944.02	* 6803.33	*		*	1965.00	*				
2040.00	*												
* RIVER-1	* Reach-2	* 170		* Floodway	*	175.21	*		0.74	*			
175.22	* 2300.00	* 8160.29	* 2939.71	* 7000.00	*	925.00	*	1965.00	*				
2040.00	* 3225.00	*											
* RIVER-1	* Reach-2	* 170		* 10%	*	164.82	*		-9.65	*			
164.94	* 1728.07	* 2736.34	* 3735.71	* 2457.95	*		*	1965.00	*				
2040.00	*												
* RIVER-1	* Reach-2	* 170		* 2%	*	166.97	*		-7.50	*			
167.09	* 2130.80	* 6310.45	* 4923.68	* 4065.88	*		*	1965.00	*				
2040.00	*												

```
                                  Duplicate Effective
* RIVER-1     * Reach-2     * 170          * 0.2%     *    169.47 *         -5.00 *
  169.59 *      2732.68 * 12027.56 *   6474.46 *  7597.98 *           *  1965.00 *
2040.00 *           *
*******************************************************************************
*******************************************************************************
**********************
```

APPENDIX D

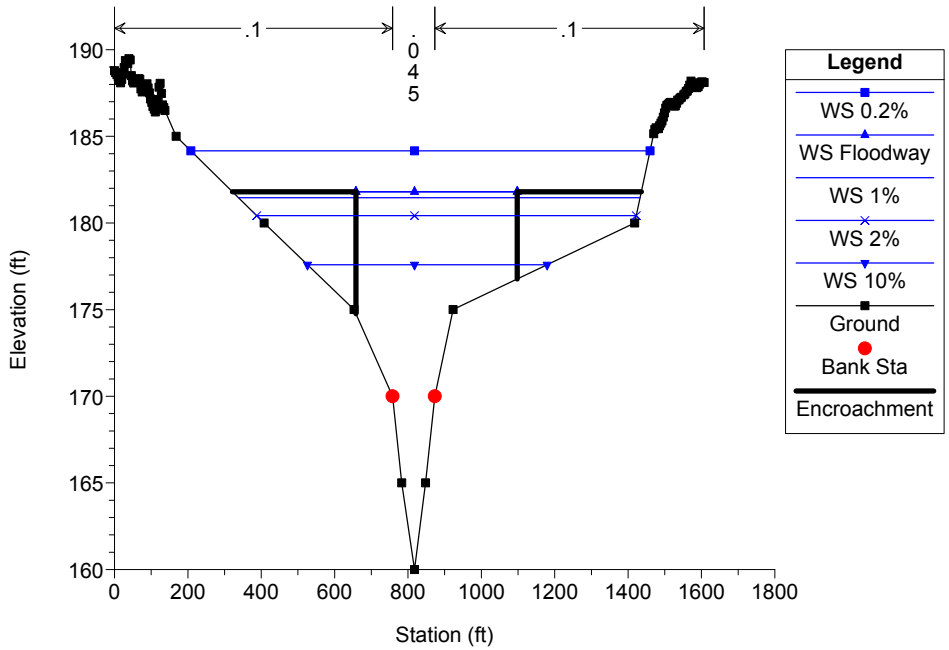
BROAD RUN

EXISTING CONDITIONS MODEL


320
350
344.95
250
243.2
314.4
243
250.12
225
200
190
190
182
A
180
170

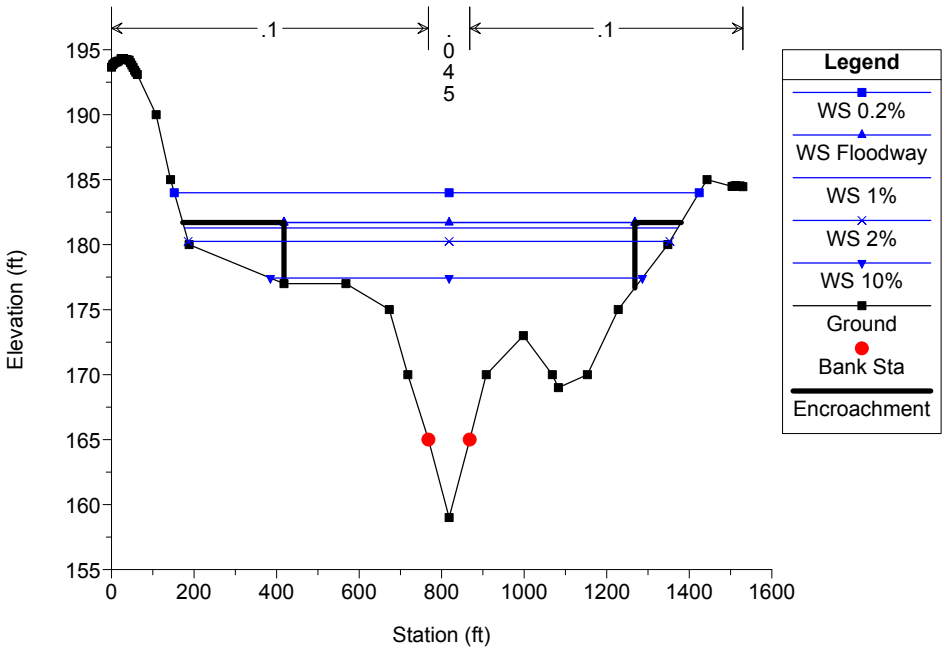
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017

River = RIVER-1 Reach = Reach-1 RS = 350



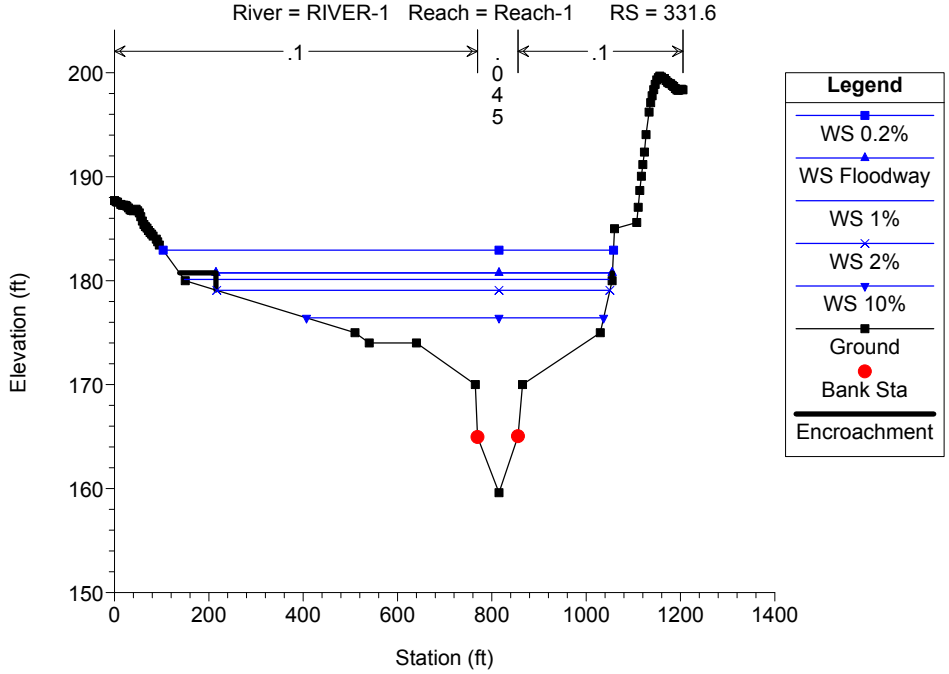
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017

River = RIVER-1 Reach = Reach-1 RS = 344.95



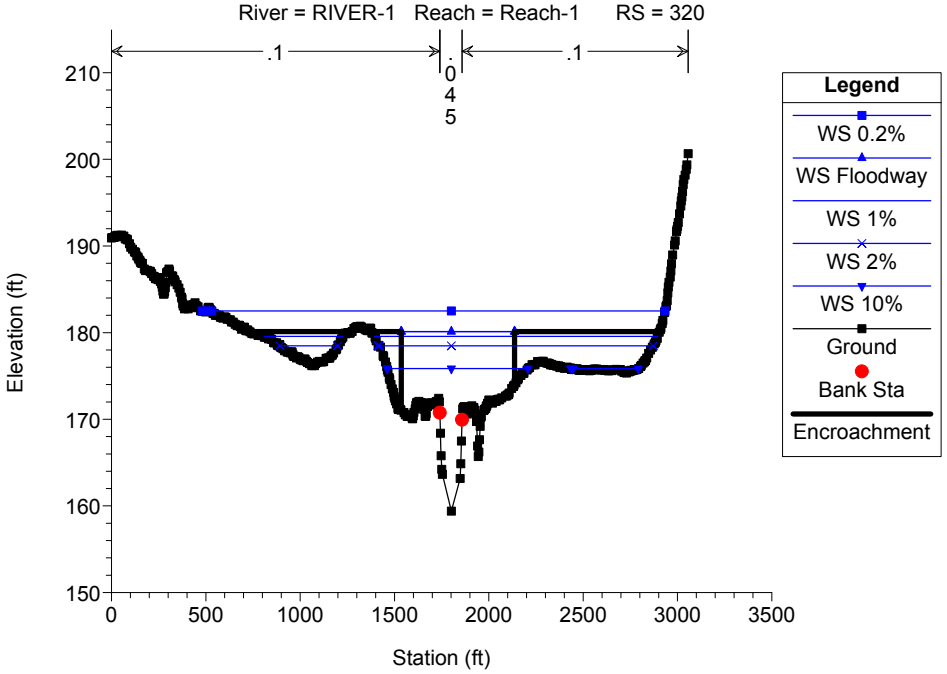
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017

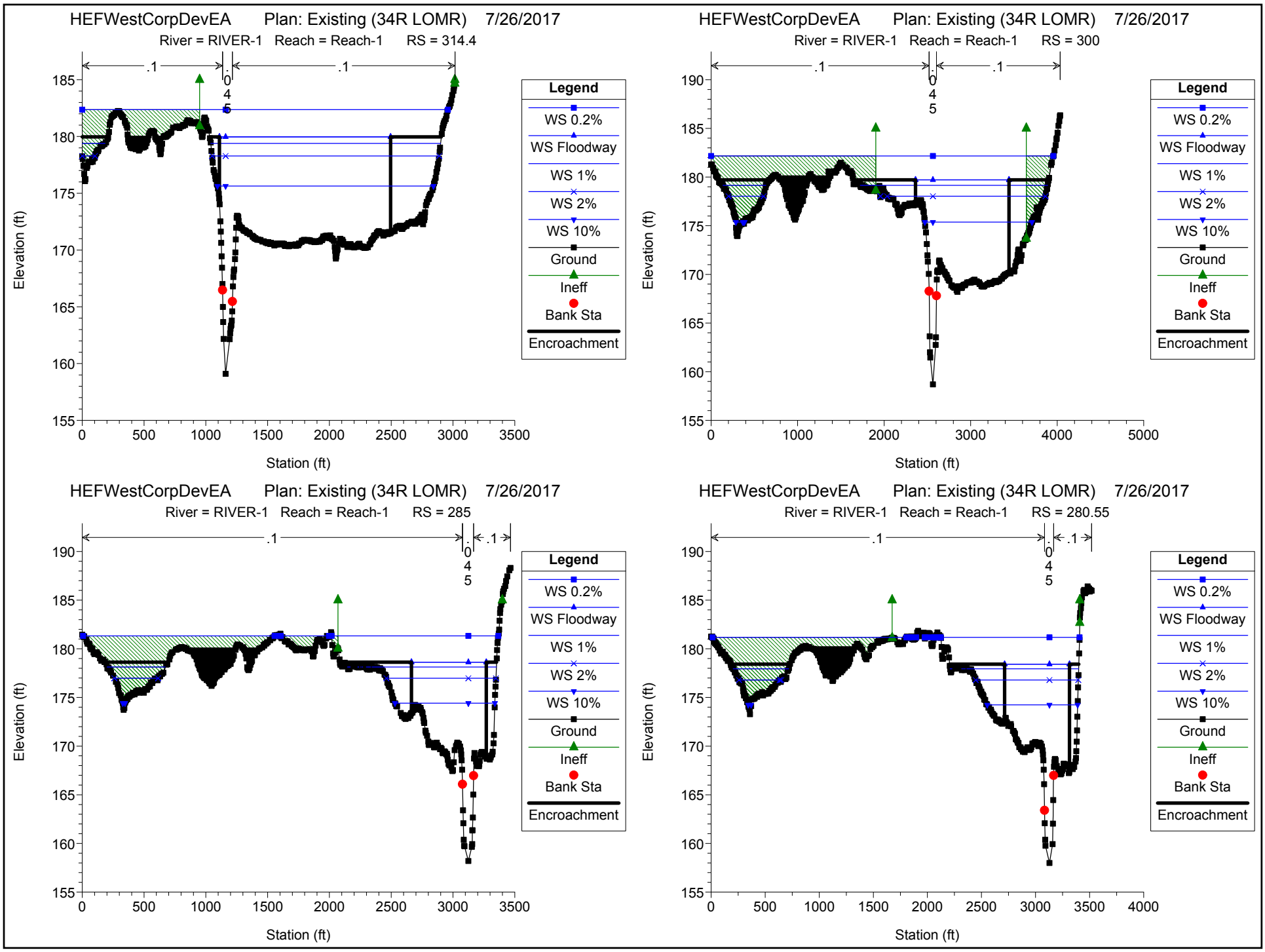
River = RIVER-1 Reach = Reach-1 RS = 331.6

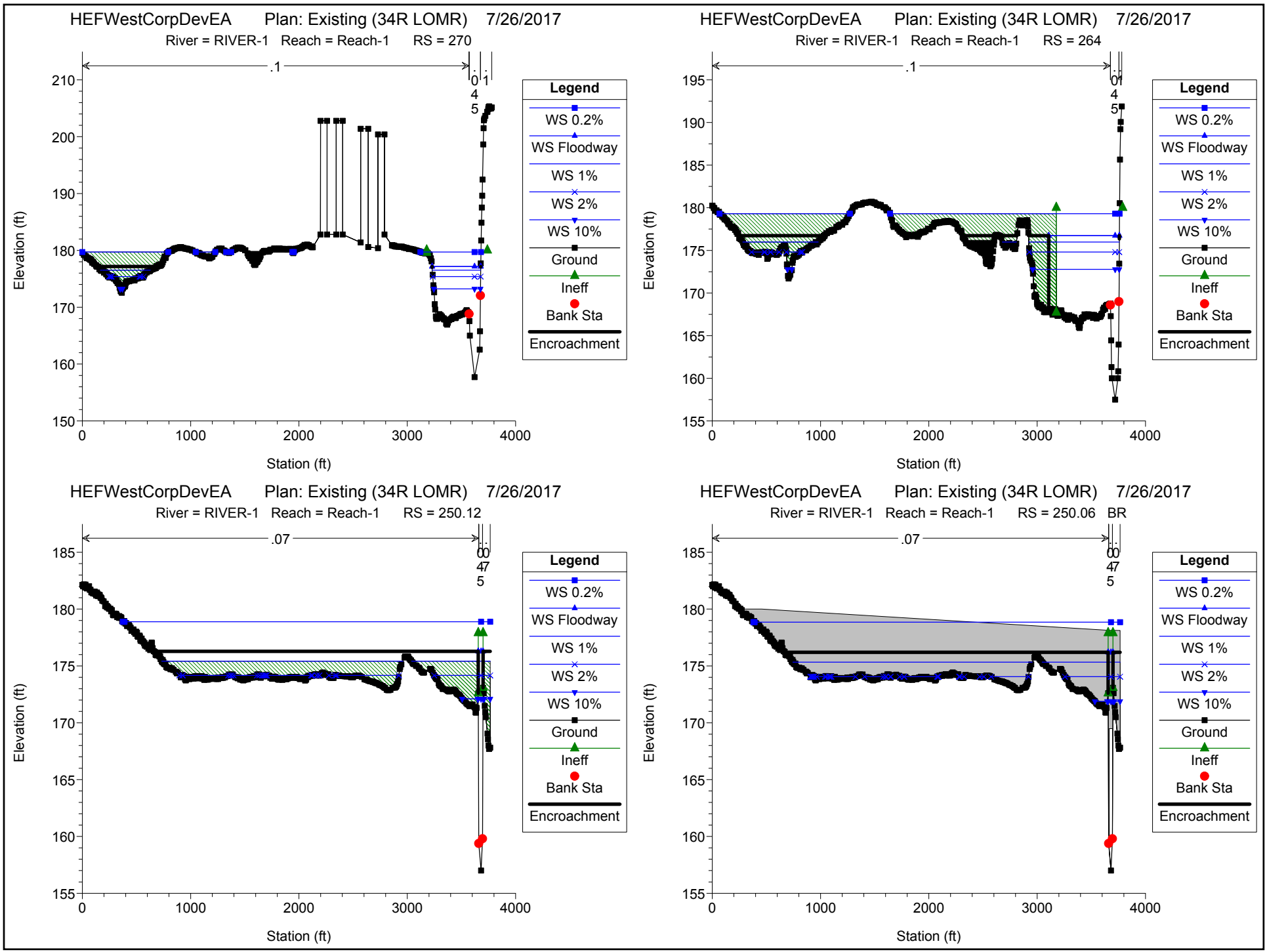


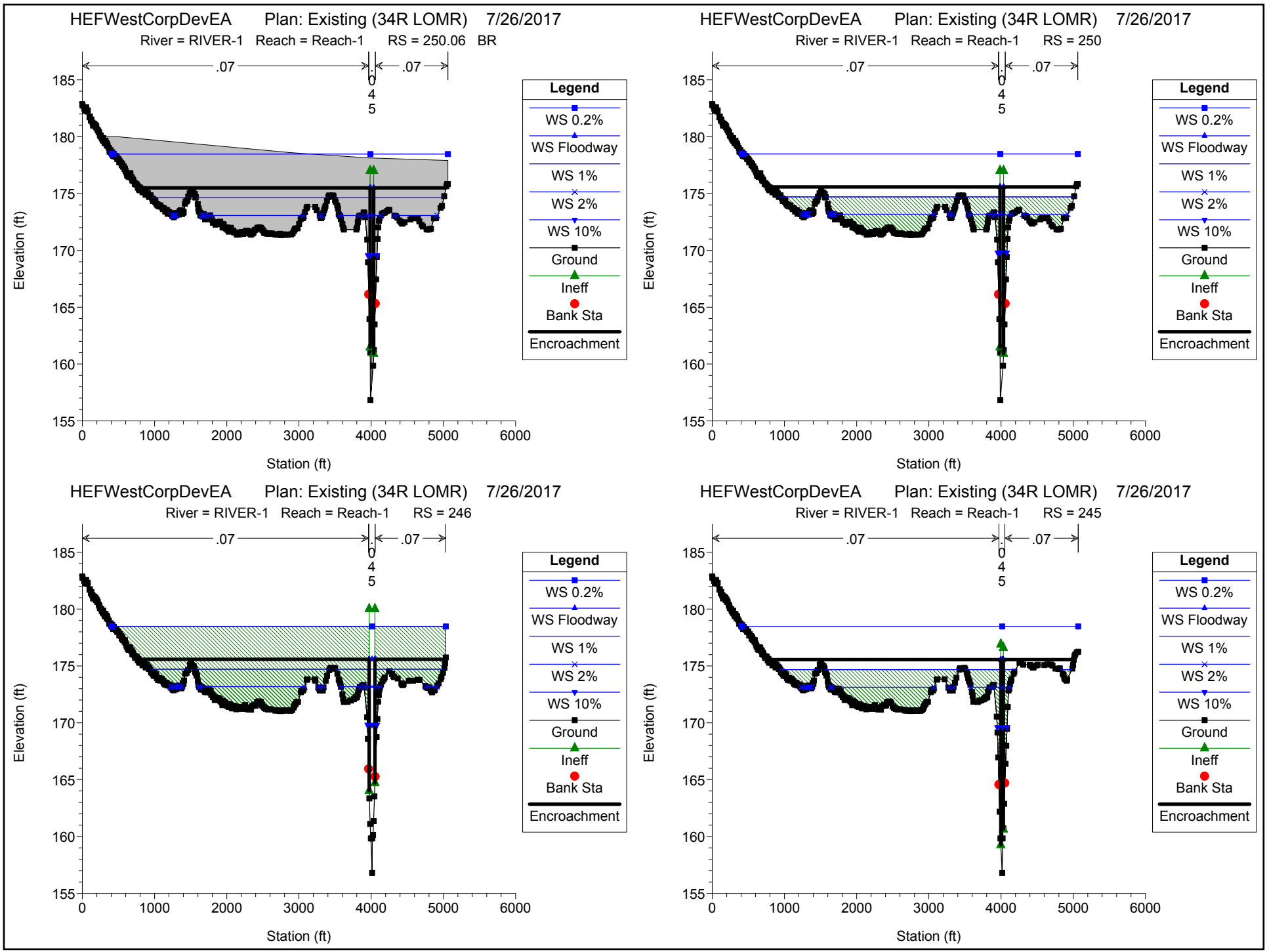
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017

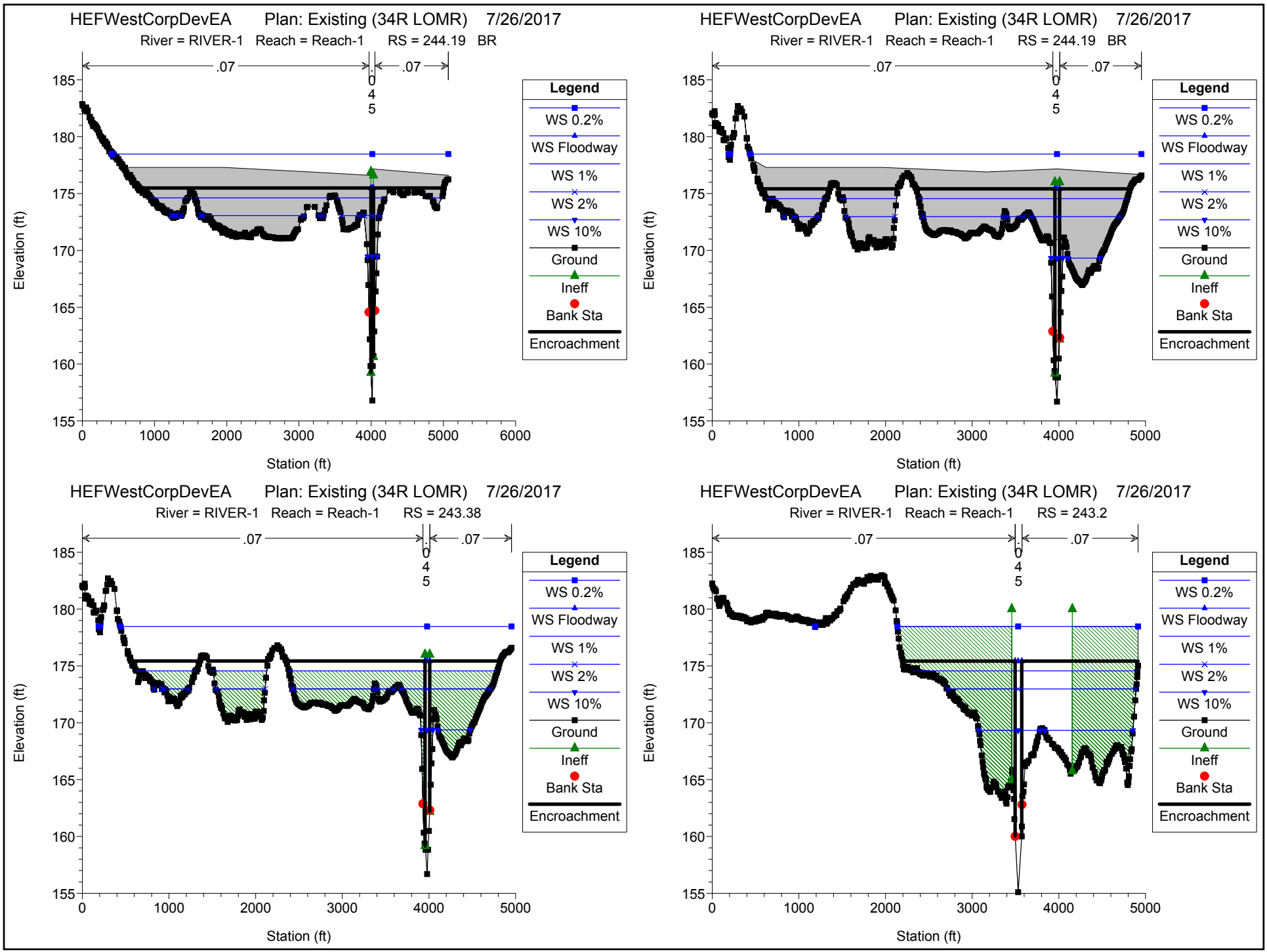
River = RIVER-1 Reach = Reach-1 RS = 320

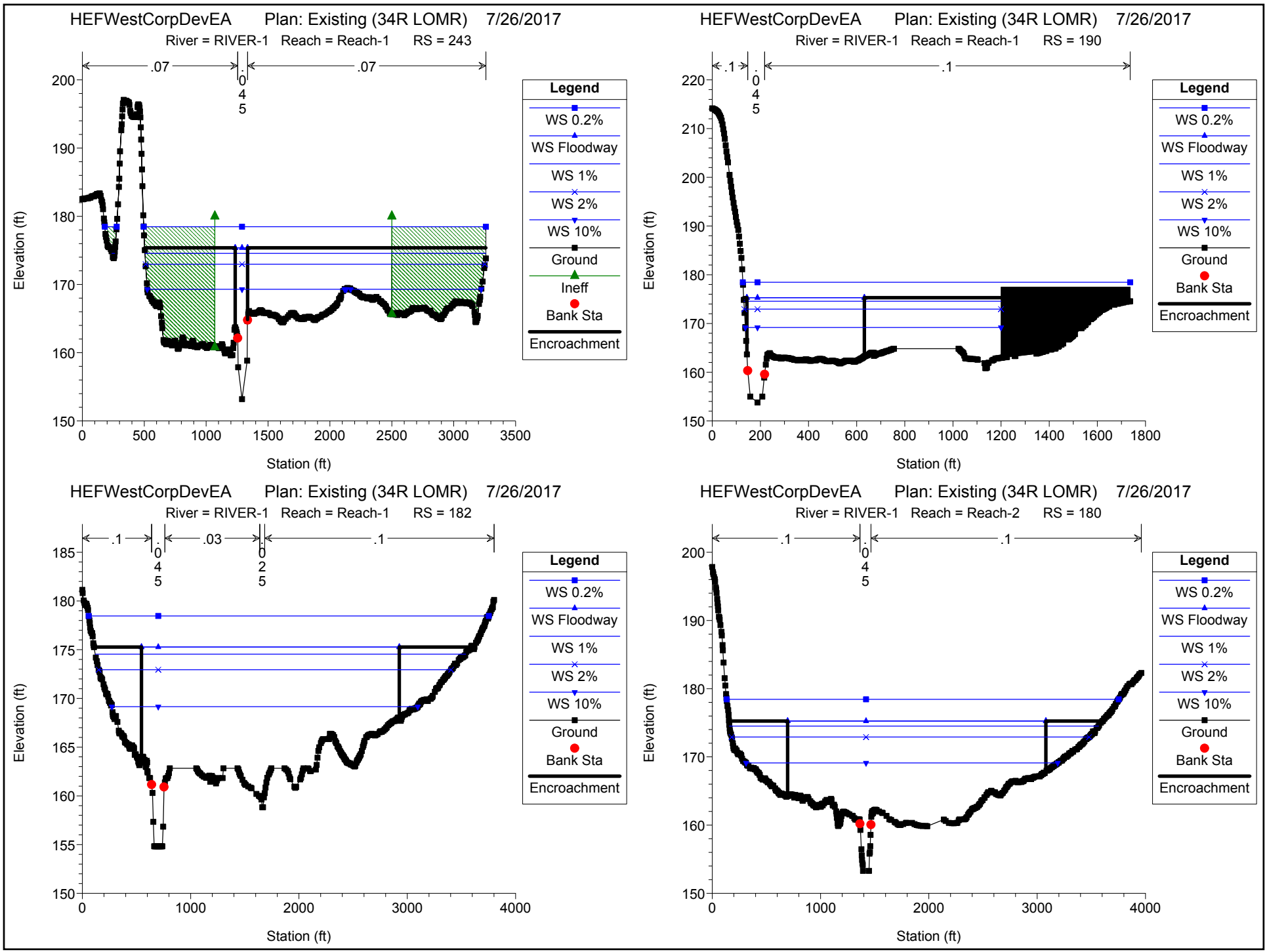


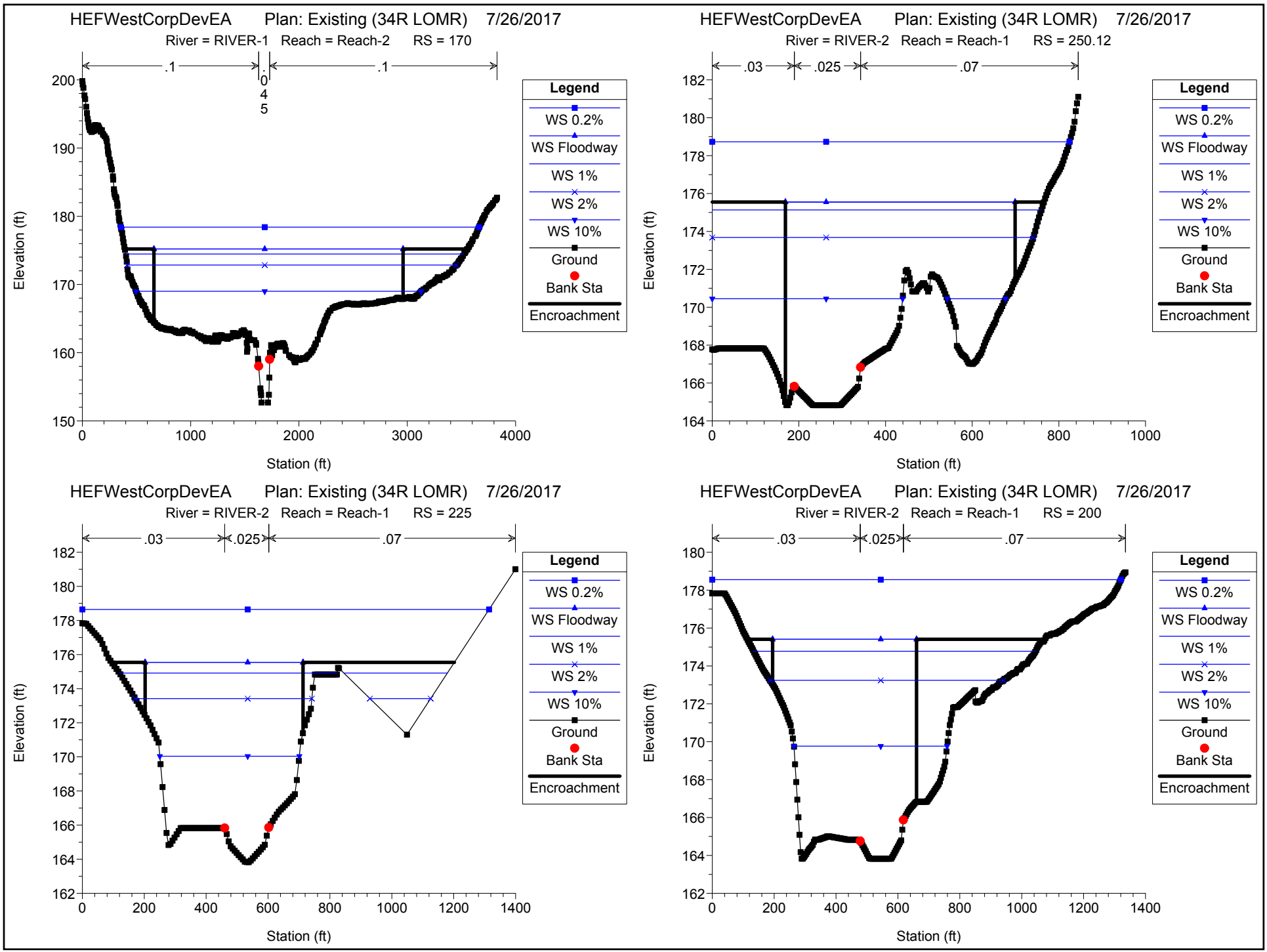

HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 314.4
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 300
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 285
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 280.55
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 270
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 264
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 250.12
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 250.06 BR
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment

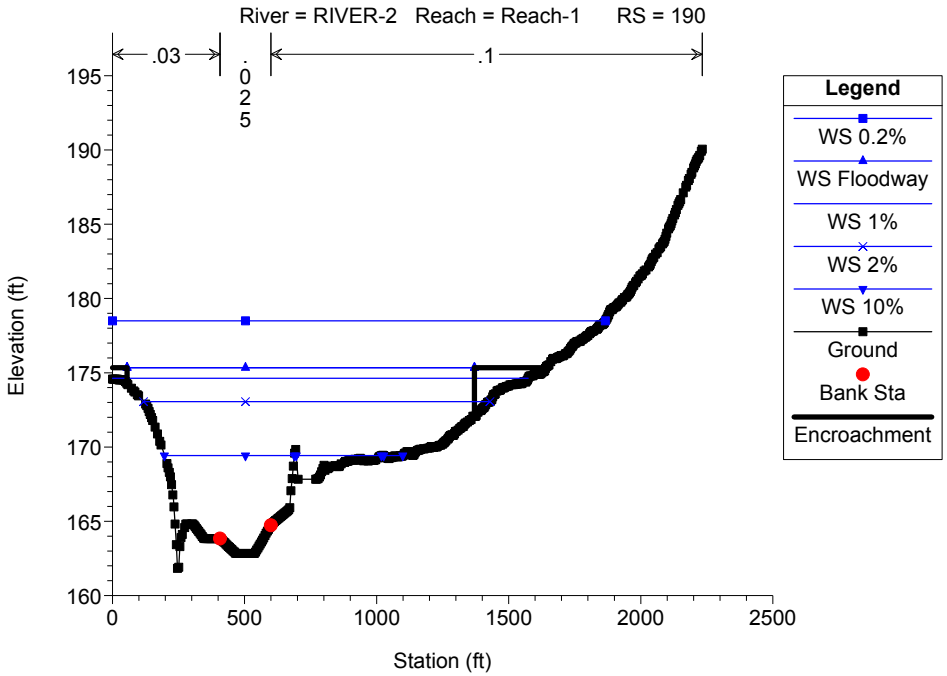

HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 250.06 BR
.07
.045
.07
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 250
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 246
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 245


HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 244.19 BR
.07
.045
.07
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 244.19 BR
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 243.38
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 243.2


HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 243
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 190
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-1 RS = 182
.1
.045
.03
.025
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-2 RS = 180
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-1 Reach = Reach-2 RS = 170
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-2 Reach = Reach-1 RS = 250.12
.03
.025
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-2 Reach = Reach-1 RS = 225
.03
.025
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017
River = RIVER-2 Reach = Reach-1 RS = 200
.03
.025
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment

HEFWestCorpDevEA Plan: Existing (34R LOMR) 7/26/2017



HEC-RAS HEC-RAS 5.0.1 April 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: HEFWestCorpDevEA
Project File : HEFWestCorpDevEA.prj
Run Date and Time: 7/26/2017 3:31:28 PM

Project in English units

Project Description:
All Elevations in NGVD 29
NGVD29 = NAVD88 + 0.827

Manassas, Prince William
County, Virginia
Manassas Regional Airport - West Corporate Development and
East Side Parcel CLOMR
Broad Run
Model beings at FEMA X/S "R" STA. 170
Model
ends at FEMA X/S "Z" STA. 350

Duplicate Effective Model:
Effective
including FEMA issued LOMRS - divided flow reach

Existing Conditions
Model:
2017 Manassas Regional Airport Runway 34R Extension Program LOMR -
Ongoing with FEMA

Proposed Conditions Model:
West Corporate Development
Proposed Layout
Revisions to X/S 314.4 through X/S 264

****

PLAN DATA

Plan Title: Existing (34R LOMR)
Plan File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.p03

Geometry Title: Existing (34R LOMR)

Existing - 34R LOMR

Geometry File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.g04

Flow Title : Existing (34R LOMR)
Flow File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.f03

Plan Summary Information:

Number of:	Cross Sections	= 25	Multiple Openings	=	0
	Culverts	= 0	Inline Structures	=	0
	Bridges	= 2	Lateral Structures	=	0

Computational Information

Water surface calculation tolerance	= 0.01
Critical depth calculation tolerance	= 0.01
Maximum number of iterations	= 20
Maximum difference tolerance	= 0.3
Flow tolerance factor	= 0.001

Computation Options

Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Subcritical Flow

Encroachment Data

Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
350	Floodway	1	658	1098
344.95	Floodway	1	418	1268
331.6	Floodway	1	215	1055
320	Floodway	1	1536	2136
314.4	Floodway	1	1110	2495
300	Floodway	1	2363	3443
285	Floodway	1	2664	3269
280.55	Floodway	1	2714	3314
270	Floodway	1	3229	3678
264	Floodway	1	3106.1	3759
250.12	Floodway	1	3655	3700
250	Floodway	1	3985	4035
246	Floodway	1	3972	4052
245	Floodway	1	3996	4031
243.38	Floodway	1	3954	4009
243.2	Floodway	1	3495.8	3571.1
243	Floodway	1	1235	1335
190	Floodway	1	144	632
182	Floodway	1	546	2926

River = RIVER-1 Reach = Reach-2

RS	Profile	Method	Value1	Value2
180	Floodway	1	696	3080
170	Floodway	1	661	2961

River = RIVER-2 Reach = Reach-1

RS	Profile	Method	Value1	Value2
250.12	Floodway	1	169	699
225	Floodway	1	203	713
200	Floodway	1	195	660
190	Floodway	1	55	1370

****

FLOW DATA

Flow Title: Existing (34R LOMR)
Flow File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.f03

Flow Data (cfs)

River	Reach	RS	1%	Floodway	10%	2%	0.2%
RIVER-1	Reach-1	350	17700	17700	8780	15000	25700
RIVER-1	Reach-1	250.12	800	800	1450	950	700
RIVER-1	Reach-1	243	2665	2665	3015	2805	2100
RIVER-1	Reach-1	182	19965	19965	10495	17155	27500
RIVER-1	Reach-2	180	19965	19965	10495	17155	27500
RIVER-2	Reach-1	250.12	17300	17300	7480	14350	25400

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-2	1%	Known WS = 174.47	
RIVER-1	Reach-2	Floodway	Known WS = 175.21	
RIVER-1	Reach-2	10%	Known WS = 169	
RIVER-1	Reach-2	2%	Known WS = 172.85	
RIVER-1	Reach-2	0.2%	Known WS = 178.41	

****

GEOMETRY DATA

Geometry Title: Existing (34R LOMR)
Geometry File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.g04

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
RIVER-1	Reach-1		A
RIVER-1	Reach-2	A	

* RIVER-2 Reach-1 * * A *

JUNCTION INFORMATION

Name: A
Description:
Energy computation Method

Length across Junction River	Reach		Tributary River	Reach	Length	Angle
RIVER-1	Reach-1	to	RIVER-1	Reach-2	635	
RIVER-2	Reach-1	to	RIVER-1	Reach-2	1760	

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 350

INPUT
Description: XS 350 (LETTERED CROSS-SECTION Z)
SOUTHERN RAILROAD
Station Elevation Data num= 95

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188.79	3.27	188.68	6.54	188.56	9.82	188.42	13.09	188.22
16.36	188.09	19.63	188.29	22.91	188.6	26.18	188.97	29.45	189.37
32.72	189.24	36	189.21	39.27	189.48	42.54	189.41	45.81	188.5
49.09	188.2	52.36	188.08	55.63	188.17	58.9	188.28	62.18	188.23
65.45	188.33	68.72	188.3	71.99	187.74	75.27	187.56	78.54	187.75
81.81	187.83	85.08	187.95	88.36	188.03	91.63	187.79	94.9	187.51
98.17	187.16	101.45	186.96	104.72	186.72	107.99	186.57	111.26	186.41
114.54	186.57	117.81	187.13	121.08	187.84	124.35	188.06	127.63	187.48
130.9	186.81	134.17	186.66	137.44	186.49	168	185	408	180
653	175	758	170	783	165	818	160	848	165
873	170	923	175	1418	180	1469.75	185.15	1473.03	185.4
1476.3	185.49	1479.58	185.45	1482.86	185.45	1486.13	185.61	1489.41	185.76
1492.68	185.89	1495.96	186.11	1499.24	186.35	1502.51	186.63	1505.79	186.79
1509.07	186.84	1512.34	186.92	1515.62	186.96	1518.9	186.9	1522.17	186.8
1525.45	186.75	1528.72	186.76	1532	186.92	1535.28	187.09	1538.55	187.11
1541.83	187.21	1545.11	187.26	1551.66	187.4	1554.94	187.45	1558.21	187.58
1561.49	187.63	1564.76	187.77	1568.04	187.96	1571.32	188.19	1574.59	188.09
1577.87	188.01	1581.15	187.95	1584.42	187.84	1587.7	187.81	1590.98	187.88
1594.25	188.01	1597.53	188.1	1600.8	188.14	1604.08	188.13	1607.36	188.11

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	758	.045	873	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
758	873	505	505	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	181.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.46	Reach Len. (ft)	505.00	505.00	505.00

* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1962.60	* 1930.52	* 2419.50 *
* E.G. Slope (ft/ft)	*0.000898	* Area (sq ft)	* 1962.60	* 1930.52	* 2419.50 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 2441.78	*12399.94	* 2858.28 *
* Top Width (ft)	* 1094.81	* Top Width (ft)	* 420.13	* 115.00	* 559.68 *
* Vel Total (ft/s)	* 2.80	* Avg. Vel. (ft/s)	* 1.24	* 6.42	* 1.18 *
* Max Chl Dpth (ft)	* 21.46	* Hydr. Depth (ft)	* 4.67	* 16.79	* 4.32 *
* Conv. Total (cfs)	*590563.6	* Conv. (cfs)	* 81470.3	*413726.2	* 95367.2 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 420.32	* 116.76	* 560.03 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.26	* 0.93	* 0.24 *
* Alpha	* 3.73	* Stream Power (lb/ft s)	* 0.33	* 5.96	* 0.29 *
* Frctn Loss (ft)	* 0.34	* Cum Volume (acre-ft)	* 1547.17	* 586.41	* 2052.13 *
* C & E Loss (ft)	* 0.07	* Cum SA (acres)	* 294.23	* 31.05	* 210.34 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 182.36	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.56	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 181.80	* Reach Len. (ft)	* 505.00	* 505.00	* 505.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 942.30	* 1969.96	* 1501.23 *
* E.G. Slope (ft/ft)	*0.000980	* Area (sq ft)	* 942.30	* 1969.96	* 1501.23 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 1867.46	*13395.68	* 2436.86 *
* Top Width (ft)	* 440.00	* Top Width (ft)	* 100.00	* 115.00	* 225.00 *
* Vel Total (ft/s)	* 4.01	* Avg. Vel. (ft/s)	* 1.98	* 6.80	* 1.62 *
* Max Chl Dpth (ft)	* 21.80	* Hydr. Depth (ft)	* 9.42	* 17.13	* 6.67 *
* Conv. Total (cfs)	*565403.8	* Conv. (cfs)	* 59653.7	*427907.8	* 77842.4 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 107.16	* 116.76	* 230.29 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.54	* 1.03	* 0.40 *
* Alpha	* 2.22	* Stream Power (lb/ft s)	* 1.07	* 7.02	* 0.65 *
* Frctn Loss (ft)	* 0.35	* Cum Volume (acre-ft)	* 510.21	* 602.85	* 1325.63 *
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 56.24	* 30.76	*

```
  94.78  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10%
**********************************************************************************
**********
* E.G. Elev (ft)         *  177.96  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.38  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  177.59  * Reach Len. (ft)       *  505.00  *  505.00  *
 505.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  698.42  * 1485.16  *
 586.05  *
* E.G. Slope (ft/ft)     *0.000844  * Area (sq ft)          *  698.42  * 1485.16  *
 586.05  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)            *  628.52  * 7761.83  *
 389.65  *
* Top Width (ft)         *  653.08  * Top Width (ft)        *  231.83  *  115.00  *
 306.25  *
* Vel Total (ft/s)       *    3.17  * Avg. Vel. (ft/s)      *    0.90  *    5.23  *
   0.66  *
* Max Chl Dpth (ft)      *   17.59  * Hydr. Depth (ft)      *    3.01  *   12.91  *
   1.91  *
* Conv. Total (cfs)      *302279.9  * Conv. (cfs)           * 21638.7  *267226.1  *
13415.1  *
* Length Wtd. (ft)       *  505.00  * Wetted Per. (ft)      *  231.98  *  116.76  *
 306.51  *
* Min Ch El (ft)         *  160.00  * Shear (lb/sq ft)      *    0.16  *    0.67  *
   0.10  *
* Alpha                  *    2.41  * Stream Power (lb/ft s) *    0.14  *    3.50  *
   0.07  *
* Frctn Loss (ft)        *    0.31  * Cum Volume (acre-ft)  *  660.50  *  446.30  *
 966.75  *
* C & E Loss (ft)        *    0.06  * Cum SA (acres)        *  122.40  *   31.18  *
 183.78  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  180.88  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.46  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.42  * Reach Len. (ft)       *  505.00  *  505.00  *
 505.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1552.36  * 1811.15  *
1843.96  *
* E.G. Slope (ft/ft)     *0.000924  * Area (sq ft)          * 1552.36  * 1811.15  *
1843.96  *
* Q Total (cfs)          *15000.00  * Flow (cfs)            * 1822.86  *11309.93  *
1867.21  *
```

* Top Width (ft)	* 1034.56	* Top Width (ft)	* 370.31	* 115.00	* 549.25 *
* Vel Total (ft/s)	* 2.88	* Avg. Vel. (ft/s)	* 1.17	* 6.24	* 1.01 *
* Max Chl Dpth (ft)	* 20.42	* Hydr. Depth (ft)	* 4.19	* 15.75	* 3.36 *
* Conv. Total (cfs)	*493337.5	* Conv. (cfs)	* 59952.5	*371974.2	* 61410.9 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 370.48	* 116.76	* 549.55 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.24	* 0.90	* 0.19 *
* Alpha	* 3.58	* Stream Power (lb/ft s)	* 0.28	* 5.59	* 0.20 *
* Frctn Loss (ft)	* 0.34	* Cum Volume (acre-ft)	* 1183.72	* 544.16	* 1716.34 *
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	* 236.78	* 31.05	* 205.28 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 184.60	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.43	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 184.17	* Reach Len. (ft)	* 505.00	* 505.00	* 505.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 3275.87	* 2241.85	* 3971.49 *
* E.G. Slope (ft/ft)	*0.000812	* Area (sq ft)	* 3275.87	* 2241.85	* 3971.49 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 4557.03	*15128.72	* 6014.25 *
* Top Width (ft)	* 1251.96	* Top Width (ft)	* 550.08	* 115.00	* 586.88 *
* Vel Total (ft/s)	* 2.71	* Avg. Vel. (ft/s)	* 1.39	* 6.75	* 1.51 *
* Max Chl Dpth (ft)	* 24.17	* Hydr. Depth (ft)	* 5.96	* 19.49	* 6.77 *
* Conv. Total (cfs)	*901701.9	* Conv. (cfs)	*159886.6	*530801.4	*211013.9 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 550.29	* 116.76	* 587.37 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.30	* 0.97	* 0.34 *
* Alpha	* 3.77	* Stream Power (lb/ft s)	* 0.42	* 6.57	* 0.52 *
* Frctn Loss (ft)	* 0.32	* Cum Volume (acre-ft)	* 2915.13	* 697.04	* 2960.66 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 490.26	* 32.28	* 244.72 *

****

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 344.95

INPUT
Description: XS 344.95 (LETTERED CROSS-SECTION Y)
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193.66	3.28	193.86	6.55	193.97	9.83	194.05	13.11	194.06
16.39	194.13	22.94	194.31	26.22	194.31	29.49	194.32	32.77	194.25
36.05	194.25	39.32	194.21	42.6	194.2	45.88	194	49.16	193.82
52.43	193.63	55.71	193.43	58.99	193.27	62.26	193.09	108	190
143	185	188	180	418	177	568	177	673	175
718	170	768	165	818	159	868	165	908	170
998	173	1068	170	1083	169	1153	170	1228	175
1348	180	1443	185	1503.55	184.49	1506.82	184.48	1510.08	184.51
1513.35	184.55	1523.16	184.52	1529.69	184.46				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	768	.045	868	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
768	868	700	1400	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	181.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.29	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	2933.74	1929.09	4250.48
E.G. Slope (ft/ft)	0.000440	Area (sq ft)	2933.74	1929.09	4250.48
Q Total (cfs)	17700.00	Flow (cfs)	2656.86	9564.12	5479.02
Top Width (ft)	1196.15	Top Width (ft)	591.62	100.00	504.53
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)	0.91	4.96	1.29
Max Chl Dpth (ft)	22.29	Hydr. Depth (ft)	4.96	19.29	8.42
Conv. Total (cfs)	843910.5	Conv. (cfs)	126675.1	456003.5	261231.9
Length Wtd. (ft)	1273.51	Wetted Per. (ft)	592.25	100.72	505.30
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.14	0.53	0.23
Alpha	3.69	Stream Power (lb/ft s)	0.12	2.61	0.30
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	1518.78	564.04	2013.47
C & E Loss (ft)	0.03	Cum SA (acres)	288.37	29.80	204.17

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	181.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.71	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	2430.73	1970.92	4165.35
E.G. Slope (ft/ft)	0.000391	Area (sq ft)	2430.73	1970.92	4165.35
Q Total (cfs)	17700.00	Flow (cfs)	2573.98	9344.85	5781.16
Top Width (ft)	850.00	Top Width (ft)	350.00	100.00	400.00
Vel Total (ft/s)	2.07	Avg. Vel. (ft/s)	1.06	4.74	1.39
Max Chl Dpth (ft)	22.71	Hydr. Depth (ft)	6.94	19.71	10.41
Conv. Total (cfs)	895150.6	Conv. (cfs)	130175.3	472601.8	292373.5
Length Wtd. (ft)	1264.15	Wetted Per. (ft)	355.25	100.72	405.71
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.17	0.48	0.25
Alpha	2.97	Stream Power (lb/ft s)	0.18	2.26	0.35
Frctn Loss (ft)	0.68	Cum Volume (acre-ft)	490.65	580.00	1292.78
C & E Loss (ft)	0.02	Cum SA (acres)	53.63	29.51	91.16

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	177.60	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	177.43	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	940.28	1543.05	2460.87
E.G. Slope (ft/ft)	0.000366	Area (sq ft)	940.28	1543.05	2460.87
Q Total (cfs)	8780.00	Flow (cfs)	486.19	6015.61	2278.19
Top Width (ft)	901.34	Top Width (ft)	383.01	100.00	418.33
Vel Total (ft/s)	1.78	Avg. Vel. (ft/s)	0.52	3.90	0.93

* Max Chl Dpth (ft)	* 18.43	* Hydr. Depth (ft)	* 2.46	* 15.43	* 5.88	*
* Conv. Total (cfs)	*458734.7	* Conv. (cfs)	* 25402.5	*314301.9	*119030.3	*
* Length Wtd. (ft)	* 1346.93	* Wetted Per. (ft)	* 383.55	* 100.72	* 419.02	*
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.06	* 0.35	* 0.13	*
* Alpha	* 3.38	* Stream Power (lb/ft s)	* 0.03	* 1.37	* 0.12	*
* Frctn Loss (ft)	* 0.71	* Cum Volume (acre-ft)	* 651.00	* 428.75	* 949.09	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 118.84	* 29.93	* 179.58	*

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 180.47	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.21	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 180.26	* Reach Len. (ft)	* 700.00	* 1400.00	* 1400.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2325.93	* 1825.54	* 3738.21 *
* E.G. Slope (ft/ft)	*0.000435	* Area (sq ft)	* 2325.93	* 1825.54	* 3738.21 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 1812.83	* 8672.01	* 4515.16 *
* Top Width (ft)	* 1167.15	* Top Width (ft)	* 582.30	* 100.00	* 484.85 *
* Vel Total (ft/s)	* 1.90	* Avg. Vel. (ft/s)	* 0.78	* 4.75	* 1.21 *
* Max Chl Dpth (ft)	* 21.26	* Hydr. Depth (ft)	* 3.99	* 18.26	* 7.71 *
* Conv. Total (cfs)	*719455.2	* Conv. (cfs)	* 86950.2	*415941.4	*216563.6 *
* Length Wtd. (ft)	* 1295.23	* Wetted Per. (ft)	* 582.88	* 100.72	* 485.60 *
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.11	* 0.49	* 0.21 *
* Alpha	* 3.75	* Stream Power (lb/ft s)	* 0.08	* 2.34	* 0.25 *
* Frctn Loss (ft)	* 0.81	* Cum Volume (acre-ft)	* 1161.24	* 523.08	* 1683.98 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 231.26	* 29.80	* 199.28 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	184.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	183.99	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	4565.40	2199.34	5683.30
E.G. Slope (ft/ft)	0.000442	Area (sq ft)	4565.40	2199.34	5683.30
Q Total (cfs)	25700.00	Flow (cfs)	5417.10	11927.97	8354.92
Top Width (ft)	1271.81	Top Width (ft)	615.94	100.00	555.87
Vel Total (ft/s)	2.06	Avg. Vel. (ft/s)	1.19	5.42	1.47
Max Chl Dpth (ft)	24.99	Hydr. Depth (ft)	7.41	21.99	10.22
Conv. Total (cfs)	1222452.0	Conv. (cfs)	257671.0	567368.7	397412.2
Length Wtd. (ft)	1220.46	Wetted Per. (ft)	616.73	100.72	556.72
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.20	0.60	0.28
Alpha	3.44	Stream Power (lb/ft s)	0.24	3.27	0.41
Frctn Loss (ft)	0.74	Cum Volume (acre-ft)	2869.67	671.30	2904.69
C & E Loss (ft)	0.03	Cum SA (acres)	483.50	31.03	238.09

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 331.6

INPUT
Description: XS 331.6 (LETTERED CROSS-SECTION X)
Station Elevation Data num= 70

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	187.7	3.28	187.6	6.55	187.55	13.1	187.33	16.38	187.26
19.66	187.26	22.93	187.24	26.21	187.16	29.49	187	32.76	186.81
36.04	186.76	39.31	186.72	42.59	186.77	45.87	186.88	49.14	186.72
52.42	186.52	55.69	186.15	58.97	185.73	62.25	185.39	65.52	185.19
68.8	185.05	72.07	184.82	75.35	184.62	78.63	184.47	81.9	184.28
88.45	184	91.73	183.74	95.01	183.43	150	180	510	175
540	174	640	174	765	170	769.81	164.96	815	159.6
855.37	165.04	865	170	1030	175	1055	180	1060	185
1107.14	185.59	1110.42	187.05	1113.69	188.68	1116.96	190.04	1120.24	191.16
1123.51	192.37	1126.78	194.05	1133.33	196.21	1136.6	197.12	1139.87	197.79
1143.15	198.37	1146.42	198.88	1149.69	199.31	1152.97	199.53	1156.24	199.68
1159.51	199.58	1162.78	199.44	1166.06	199.45	1169.33	199.24	1172.6	199.08
1175.88	198.99	1179.15	198.94	1182.42	198.79	1185.7	198.67	1188.97	198.47
1192.24	198.34	1195.51	198.31	1198.79	198.37	1202.06	198.41	1205.33	198.35

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0      .1  769.81    .045  855.37      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        769.81  855.37              980     980     980            .1       .3

CROSS SECTION OUTPUT  Profile #1%
*************************************************************************************
***********
* E.G. Elev (ft)         *  180.67  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.56  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.11  * Reach Len. (ft)       *  980.00  *  980.00  *
 980.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2793.54  * 1523.93  *
1442.16  *
* E.G. Slope (ft/ft)     *0.001100  * Area (sq ft)          * 2793.54  * 1523.93  *
1442.16  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            * 3739.84  *11321.37  *
2638.79  *
* Top Width (ft)         *  906.87  * Top Width (ft)       *  621.57  *   85.56  *
 199.74  *
* Vel Total (ft/s)       *    3.07  * Avg. Vel. (ft/s)     *    1.34  *    7.43  *
   1.83  *
* Max Chl Dpth (ft)      *   20.51  * Hydr. Depth (ft)     *    4.49  *   17.81  *
   7.22  *
* Conv. Total (cfs)      *533726.4  * Conv. (cfs)          *112771.4  *341384.8  *
79570.1  *
* Length Wtd. (ft)       *  980.00  * Wetted Per. (ft)     *  623.85  *   86.24  *
 201.56  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)     *    0.31  *    1.21  *
   0.49  *
* Alpha                  *    3.83  * Stream Power (lb/ft s) *  0.41  *    9.01  *
   0.90  *
* Frctn Loss (ft)        *    0.79  * Cum Volume (acre-ft) * 1472.77  *  508.55  *
1921.99  *
* C & E Loss (ft)        *    0.10  * Cum SA (acres)       *  278.62  *   26.82  *
 192.85  *
*************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
        1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Floodway
*************************************************************************************
***********
* E.G. Elev (ft)         *  181.20  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.45  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.75  * Reach Len. (ft)       *  980.00  *  980.00  *
 980.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 3113.53  * 1578.92  *
1570.46  *
* E.G. Slope (ft/ft)     *0.000873  * Area (sq ft)          * 3113.53  * 1578.92  *
1570.46  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            * 4296.15  *10699.60  *
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2704.25  *
* Top Width (ft)         *  840.00  * Top Width (ft)         *  554.81  *   85.56  *
 199.63  *
* Vel Total (ft/s)       *    2.83  * Avg. Vel. (ft/s)       *    1.38  *    6.78  *
   1.72  *
* Max Chl Dpth (ft)      *   21.15  * Hydr. Depth (ft)       *    5.61  *   18.45  *
   7.87  *
* Conv. Total (cfs)      *599113.0  * Conv. (cfs)            *145416.8  *362162.2  *
91534.0  *
* Length Wtd. (ft)       *  980.00  * Wetted Per. (ft)       *  558.73  *   86.24  *
 202.16  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)       *    0.30  *    1.00  *
   0.42  *
* Alpha                  *    3.59  * Stream Power (lb/ft s) *    0.42  *    6.76  *
   0.73  *
* Frctn Loss (ft)        *    0.73  * Cum Volume (acre-ft)   *  446.11  *  522.96  *
1200.61  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *   46.36  *   26.53  *
  81.52  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  176.86  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.43  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  176.43  * Reach Len. (ft)       *  980.00  *  980.00  *
 980.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  970.46  * 1208.86  *
 738.93  *
* E.G. Slope (ft/ft)     *0.000932  * Area (sq ft)          *  970.46  * 1208.86  *
 738.93  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)            *  845.23  * 7085.26  *
 849.51  *
* Top Width (ft)         *  629.93  * Top Width (ft)        *  362.60  *   85.56  *
 181.77  *
* Vel Total (ft/s)       *    3.01  * Avg. Vel. (ft/s)      *    0.87  *    5.86  *
   1.15  *
* Max Chl Dpth (ft)      *   16.83  * Hydr. Depth (ft)      *    2.68  *   14.13  *
   4.07  *
* Conv. Total (cfs)      *287563.9  * Conv. (cfs)           * 27683.1  *232057.6  *
27823.3  *
* Length Wtd. (ft)       *  980.00  * Wetted Per. (ft)      *  364.85  *   86.24  *
 183.19  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)      *    0.15  *    0.82  *
   0.23  *
* Alpha                  *    3.08  * Stream Power (lb/ft s) *    0.13  *    4.78  *
   0.27  *
* Frctn Loss (ft)        *    0.72  * Cum Volume (acre-ft)  *  635.65  *  384.52  *
 897.67  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)        *  112.85  *   26.95  *
 169.94  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  179.62  * Element               *  Left OB *  Channel *
Right OB *
```

* Vel Head (ft)	* 0.55	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 179.07	* Reach Len. (ft)	* 980.00	* 980.00	* 980.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2181.97	* 1435.25	* 1237.41	*
* E.G. Slope (ft/ft)	*0.001100	* Area (sq ft)	* 2181.97	* 1435.25	* 1237.41	*
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 2677.12	*10244.80	* 2078.08	*
* Top Width (ft)	* 833.67	* Top Width (ft)	* 553.12	* 85.56	* 195.00	*
* Vel Total (ft/s)	* 3.09	* Avg. Vel. (ft/s)	* 1.23	* 7.14	* 1.68	*
* Max Chl Dpth (ft)	* 19.47	* Hydr. Depth (ft)	* 3.94	* 16.77	* 6.35	*
* Conv. Total (cfs)	*452313.8	* Conv. (cfs)	* 80726.6	*308924.4	* 62662.8	*
* Length Wtd. (ft)	* 980.00	* Wetted Per. (ft)	* 555.38	* 86.24	* 196.68	*
* Min Ch El (ft)	* 159.60	* Shear (lb/sq ft)	* 0.27	* 1.14	* 0.43	*
* Alpha	* 3.71	* Stream Power (lb/ft s)	* 0.33	* 8.16	* 0.73	*
* Frctn Loss (ft)	* 0.82	* Cum Volume (acre-ft)	* 1125.02	* 470.68	* 1604.03	*
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 222.14	* 26.82	* 188.36	*

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CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 183.45	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.52	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 182.93	* Reach Len. (ft)	* 980.00	* 980.00	* 980.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 4608.99	* 1765.06	* 2009.06	*
* E.G. Slope (ft/ft)	*0.000981	* Area (sq ft)	* 4608.99	* 1765.06	* 2009.06	*
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 7765.95	*13659.35	* 4274.70	*
* Top Width (ft)	* 954.88	* Top Width (ft)	* 666.76	* 85.56	* 202.56	*
* Vel Total (ft/s)	* 3.07	* Avg. Vel. (ft/s)	* 1.68	* 7.74	* 2.13	*
* Max Chl Dpth (ft)	* 23.33	* Hydr. Depth (ft)	* 6.91	* 20.63	* 9.92	*
* Conv. Total (cfs)	*820490.0	* Conv. (cfs)	*247933.3	*436084.0	*136472.7	*
* Length Wtd. (ft)	* 980.00	* Wetted Per. (ft)	* 669.12	* 86.24	* 205.54	*
* Min Ch El (ft)	* 159.60	* Shear (lb/sq ft)	* 0.42	* 1.25	* 0.60	*
* Alpha	* 3.56	* Stream Power (lb/ft s)	* 0.71	* 9.70	* 1.27	*
* Frctn Loss (ft)	* 0.68	* Cum Volume (acre-ft)	* 2795.96	* 607.59	* 2781.08	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 473.20	* 28.05	*	

225.90 *
****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 320

INPUT
Description: XS 320
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 478

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	190.92	3.28	190.97	13.11	191	16.39	191.06	22.95	191.05
26.22	191.19	29.5	191.24	39.34	191.1	42.61	191.21	52.45	191.25
65.56	191.15	72.12	190.87	75.4	190.79	81.95	190.8	85.23	190.7
95.06	190.25	101.62	189.85	111.45	189.63	121.29	189.31	124.57	189.31
127.84	189.22	134.4	188.86	140.96	188.7	144.24	188.49	150.79	188.3
154.07	188.1	157.35	188.02	163.9	187.99	173.74	187.34	180.29	187.16
190.13	187.19	203.24	187.1	206.52	187.03	213.07	186.8	222.91	186.51
226.19	186.48	232.74	186.24	236.02	186.24	239.3	186.35	242.58	186.33
245.86	186.13	249.13	186.32	252.41	186.31	258.97	185.92	265.52	185.62
268.8	185.26	272.08	184.8	275.36	184.44	278.64	184.48	281.91	184.72
285.19	185.2	288.47	185.79	291.75	186.92	298.3	187.07	304.86	187.34
308.14	187.12	321.25	186.56	324.53	186.47	331.08	186.13	334.36	186.06
337.64	185.87	347.48	185.54	357.31	185.15	363.87	184.67	370.42	184.09
373.7	183.91	376.98	183.34	380.26	183.07	386.81	182.75	390.09	182.84
393.37	183.08	396.65	183.19	399.92	183.14	406.48	182.75	413.04	182.97
416.31	183	426.15	182.94	432.71	183.2	435.98	183.25	442.54	183.44
449.1	183.12	455.65	182.87	458.93	182.98	472.04	182.51	475.32	182.57
481.88	182.49	494.99	182.43	498.27	182.39	504.82	182.5	511.38	182.85
514.66	182.92	517.93	182.88	524.49	182.65	531.05	182.49	537.6	182.22
544.16	182.22	550.72	182	557.27	182.04	563.83	181.98	570.38	181.98
576.94	181.79	583.5	181.77	590.05	181.68	599.89	181.82	606.44	181.77
613	181.55	629.39	181.49	635.95	181.23	645.78	181.21	655.61	180.97
665.45	180.81	675.28	180.85	678.56	180.83	681.84	180.72	688.4	180.39
701.51	180.62	704.79	180.61	711.34	180.25	714.62	180.21	717.9	180.31
721.18	180.31	724.45	180.22	734.29	180.09	744.12	179.89	750.68	179.9
753.96	179.85	776.9	179.68	786.74	179.76	793.29	179.65	803.13	179.74
806.41	179.65	809.68	179.48	816.24	179.5	826.08	179.43	832.63	179.27
839.19	179.37	849.02	179.21	858.86	178.87	862.13	178.81	875.25	178.82
878.52	178.58	881.8	178.49	888.36	178.54	891.64	178.63	894.91	178.32
901.47	178.26	908.03	178.14	917.86	177.91	930.97	177.76	937.53	177.76
947.36	177.67	953.92	177.79	957.2	177.74	960.48	177.47	963.75	177.31
967.03	177.25	973.59	177.25	980.15	177.08	986.7	177.22	993.26	177.15
999.81	176.92	1006.37	176.86	1012.93	176.85	1016.2	176.76	1022.76	176.97
1026.04	176.93	1032.59	176.7	1039.15	176.55	1048.98	176.43	1055.54	176.41
1062.1	176.18	1065.37	176.23	1068.65	176.37	1075.21	176.18	1081.77	176.43
1091.6	176.6	1101.43	176.68	1111.27	176.62	1121.1	176.63	1124.38	176.67
1137.49	177.04	1144.05	177.04	1150.6	177.09	1157.16	177.05	1163.72	177.31
1170.27	177.4	1176.83	177.65	1189.94	178.01	1193.22	178.13	1199.77	178.53
1203.05	178.59	1212.89	178.96	1219.44	179.29	1226	179.48	1235.83	179.92
1239.11	179.94	1242.39	179.87	1252.22	180.01	1262.06	179.94	1265.34	179.95
1275.17	180.14	1285	180.49	1294.84	180.63	1301.39	180.69	1311.23	180.7
1317.79	180.74	1324.34	180.65	1327.62	180.49	1340.73	180.44	1347.29	180.32

1350.57	180.32	1357.12	180.23	1363.68	180.23	1366.96	180.33	1370.23	180.53
1373.51	180.49	1380.07	179.99	1383.35	179.93	1396.46	179.5	1399.74	179.36
1403.01	179.05	1412.85	178.45	1416.13	178.54	1425.96	178.32	1439.07	177.37
1442.35	177.22	1452.19	176.61	1458.74	176.07	1462.02	175.69	1465.3	175.43
1471.85	174.8	1475.13	174.59	1481.69	174	1488.24	173.5	1494.8	173.11
1498.08	172.67	1501.36	172.44	1504.63	172.13	1511.19	171.78	1517.75	171.25
1521.02	171.13	1530.86	171.14	1534.14	171.05	1550.53	170.77	1557.08	170.52
1566.92	170.34	1570.2	170.42	1576.75	170.36	1580.03	170.52	1586.59	170.45
1589.86	170.34	1593.14	170.11	1596.42	170.06	1599.7	170.38	1602.98	170.79
1609.53	171.2	1612.81	171.62	1616.09	171.87	1619.37	171.95	1629.2	172.07
1635.76	171.93	1642.31	171.92	1648.87	171.68	1652.15	171.47	1655.42	171.14
1661.98	170.36	1665.26	170.35	1668.54	170.66	1675.09	171.48	1678.37	171.77
1681.65	171.88	1694.76	171.89	1698.04	171.86	1704.6	171.64	1707.87	171.73
1714.43	171.79	1720.99	172.03	1727.54	172.09	1734.1	172.41	1737.38	172.02
1740.65	170.76	1743.93	168.4	1747.21	165.79	1750.49	164.22	1753.77	163.64
1801	159.41	1848.298	163.171	1851.575	164.86	1854.852	167.496	1858.129	169.936
1861.405	171.199	1864.682	171.365	1867.959	171.395	1871.236	171.461	1874.513	171.245
1877.79	170.878	1881.066	170.641	1884.312	170.614	1887.558	170.781	1890.803	170.954
1894.049	171.003	1897.294	170.999	1900.54	171.071	1903.786	171.243	1907.031	171.424
1910.277	171.558	1917.67	171.35	1920.95	171.35	1924.23	171.06	1930.78	170.59
1934.06	169.75	1940.62	166.92	1943.89	165.69	1947.17	166.22	1950.45	167.63
1953.73	169.18	1957.01	170.2	1960.28	170.34	1973.4	171.02	1976.67	171.14
1983.23	171.25	1986.51	171.47	1989.79	171.6	1993.06	171.85	1999.62	172.21
2002.9	172.19	2009.46	171.97	2016.01	172.02	2019.29	171.87	2032.4	172.08
2038.96	172.06	2045.51	172.28	2048.79	172.31	2055.35	172.24	2058.63	172.32
2068.46	172.47	2088.13	172.67	2094.68	172.69	2097.96	172.8	2104.52	172.85
2107.79	173.02	2120.87	173.56	2130.69	173.78	2133.96	173.94	2143.77	174.21
2153.58	174.57	2156.85	174.72	2169.93	175.06	2176.48	175.33	2183.02	175.3
2186.29	175.34	2202.64	175.68	2209.18	175.9	2215.72	175.97	2228.81	176.3
2238.62	176.28	2241.89	176.34	2245.16	176.29	2258.24	176.66	2268.06	176.57
2274.6	176.68	2277.87	176.64	2287.68	176.71	2307.31	176.48	2313.85	176.49
2320.39	176.45	2326.93	176.28	2333.47	176.33	2340.01	176.22	2353.1	176.22
2359.64	176.14	2369.45	176.16	2375.99	175.97	2379.26	176.09	2398.89	175.9
2405.43	175.91	2408.7	175.98	2415.24	176.02	2431.6	175.93	2438.14	175.74
2444.68	175.88	2451.22	175.76	2461.03	175.76	2467.57	175.84	2477.39	175.66
2483.93	175.69	2487.2	175.66	2493.74	175.74	2503.55	175.65	2510.09	175.63
2516.64	175.73	2526.45	175.7	2532.99	175.6	2536.26	175.69	2542.8	175.63
2552.61	175.72	2555.88	175.78	2559.16	175.74	2562.43	175.8	2565.7	175.75
2572.24	175.8	2575.51	175.7	2595.13	175.69	2598.4	175.73	2608.22	175.74
2614.76	175.63	2621.3	175.64	2624.57	175.71	2634.38	175.58	2640.92	175.63
2650.74	175.62	2657.28	175.71	2673.63	175.76	2680.17	175.72	2696.53	175.75
2703.07	175.57	2706.34	175.57	2716.15	175.4	2719.42	175.46	2725.96	175.44
2729.24	175.33	2742.32	175.46	2748.86	175.55	2752.13	175.66	2755.4	175.58
2761.94	175.65	2765.21	175.64	2771.76	175.74	2778.3	175.71	2784.84	175.74
2794.65	175.88	2804.46	176.09	2807.73	176.23	2817.55	176.49	2824.09	176.62
2827.36	176.75	2830.63	176.78	2837.17	177.07	2846.98	177.61	2856.79	178
2866.61	178.31	2876.42	178.69	2882.96	178.89	2886.23	179.09	2892.77	179.35
2902.59	180.05	2909.13	180.34	2912.4	180.53	2918.94	181.06	2922.21	181.42
2932.02	182.33	2938.56	183.01	2941.83	183.13	2945.11	183.7	2948.38	184.58
2951.65	185.28	2954.92	185.81	2961.46	186.41	2964.73	187.11	2968	187.95
2974.54	188.97	2984.35	190.11	2987.63	190.59	2994.17	191.67	2997.44	191.91
3000.71	192.27	3003.98	192.72	3010.52	193.72	3017.06	194.62	3020.33	195.21
3023.6	195.65	3026.88	196.29	3030.15	197.09	3033.42	197.68	3039.96	198.19
3046.5	198.85	3049.77	199.37	3056.31	200.65				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1740.65	.045	1858.129	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1740.65	1858.129	860	860	550	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	179.77	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.56	Reach Len. (ft)	860.00	860.00	550.00
Crit W.S. (ft)		Flow Area (sq ft)	3100.78	2019.51	4906.65
E.G. Slope (ft/ft)	0.000519	Area (sq ft)	3100.78	2019.51	4906.65
Q Total (cfs)	17700.00	Flow (cfs)	3168.38	9861.01	4670.61
Top Width (ft)	1920.86	Top Width (ft)	765.77	117.48	1037.61
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	1.02	4.88	0.95
Max Chl Dpth (ft)	20.16	Hydr. Depth (ft)	4.05	17.19	4.73
Conv. Total (cfs)	777252.9	Conv. (cfs)	139131.7	433022.6	205098.6
Length Wtd. (ft)	709.08	Wetted Per. (ft)	766.81	122.05	1039.95
Min Ch El (ft)	159.40	Shear (lb/sq ft)	0.13	0.54	0.15
Alpha	4.40	Stream Power (lb/ft s)	0.13	2.62	0.15
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1406.46	468.69	1850.57
C & E Loss (ft)	0.05	Cum SA (acres)	263.01	24.54	178.93

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	180.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	180.12	Reach Len. (ft)	860.00	860.00	550.00
Crit W.S. (ft)		Flow Area (sq ft)	1808.50	2085.22	2382.21
E.G. Slope (ft/ft)	0.000615	Area (sq ft)	1808.50	2085.22	2382.21
Q Total (cfs)	17700.00	Flow (cfs)	2763.10	11330.29	3606.61
Top Width (ft)	600.00	Top Width (ft)	204.65	117.48	277.87
Vel Total (ft/s)	2.82	Avg. Vel. (ft/s)	1.53	5.43	1.51
Max Chl Dpth (ft)	20.72	Hydr. Depth (ft)	8.84	17.75	8.57
Conv. Total (cfs)	713543.2	Conv. (cfs)	111389.4	456759.9	

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*145393.9  *
* Length Wtd. (ft)       *  721.31  * Wetted Per. (ft)       *  214.30  *  122.05  *
 286.17  *
* Min Ch El (ft)         *  159.40  * Shear (lb/sq ft)       *    0.32  *    0.66  *
   0.32  *
* Alpha                  *    2.48  * Stream Power (lb/ft s) *    0.50  *    3.57  *
   0.48  *
* Frctn Loss (ft)        *    0.32  * Cum Volume (acre-ft)   *  390.74  *  481.74  *
1156.15  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)         *   37.82  *   24.24  *
  76.15  *
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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10%
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***********
* E.G. Elev (ft)         *  176.07  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.86  * Reach Len. (ft)        *  860.00  *  860.00  *
 550.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1159.20  * 1584.35  *
1323.93  *
* E.G. Slope (ft/ft)     *0.000541  * Area (sq ft)           * 1159.20  * 1584.35  *
1323.93  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)             * 1031.42  * 6724.37  *
1024.21  *
* Top Width (ft)         * 1104.02  * Top Width (ft)         *  280.07  *  117.48  *
 706.46  *
* Vel Total (ft/s)       *    2.16  * Avg. Vel. (ft/s)       *    0.89  *    4.24  *
   0.77  *
* Max Chl Dpth (ft)      *   16.46  * Hydr. Depth (ft)       *    4.14  *   13.49  *
   1.87  *
* Conv. Total (cfs)      *377309.1  * Conv. (cfs)            * 44324.0  *288971.0  *
44014.1  *
* Length Wtd. (ft)       *  752.54  * Wetted Per. (ft)       *  280.82  *  122.05  *
 708.70  *
* Min Ch El (ft)         *  159.40  * Shear (lb/sq ft)       *    0.14  *    0.44  *
   0.06  *
* Alpha                  *    3.00  * Stream Power (lb/ft s) *    0.12  *    1.86  *
   0.05  *
* Frctn Loss (ft)        *    0.32  * Cum Volume (acre-ft)   *  611.69  *  353.10  *
 874.46  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *  105.62  *   24.66  *
 159.95  *
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Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT  Profile #2%
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***********
* E.G. Elev (ft)         *  178.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.24  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
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* W.S. Elev (ft)	* 178.47	* Reach Len. (ft)	* 860.00	* 860.00	* 550.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2343.32	* 1891.60	* 3789.09 *
* E.G. Slope (ft/ft)	*0.000574	* Area (sq ft)	* 2343.32	* 1891.60	* 3789.09 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 2454.85	* 9299.95	* 3245.20 *
* Top Width (ft)	* 1758.41	* Top Width (ft)	* 628.25	* 117.48	* 1012.68 *
* Vel Total (ft/s)	* 1.87	* Avg. Vel. (ft/s)	* 1.05	* 4.92	* 0.86 *
* Max Chl Dpth (ft)	* 19.07	* Hydr. Depth (ft)	* 3.73	* 16.10	* 3.74 *
* Conv. Total (cfs)	*626267.8	* Conv. (cfs)	*102492.8	*388283.9	*135491.1 *
* Length Wtd. (ft)	* 720.47	* Wetted Per. (ft)	* 629.19	* 122.05	* 1014.99 *
* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.13	* 0.56	* 0.13 *
* Alpha	* 4.39	* Stream Power (lb/ft s)	* 0.14	* 2.73	* 0.11 *
* Frctn Loss (ft)	* 0.30	* Cum Volume (acre-ft)	* 1074.12	* 433.26	* 1547.48 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 208.85	* 24.54	* 174.77 *

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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

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* E.G. Elev (ft)	* 182.67	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.16	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 182.50	* Reach Len. (ft)	* 860.00	* 860.00	* 550.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 6181.03	* 2365.09	* 8020.86 *
* E.G. Slope (ft/ft)	*0.000397	* Area (sq ft)	* 6181.03	* 2365.09	* 8020.86 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 5422.44	*11226.75	* 9050.81 *
* Top Width (ft)	* 2427.25	* Top Width (ft)	* 1234.22	* 117.48	* 1075.56 *
* Vel Total (ft/s)	* 1.55	* Avg. Vel. (ft/s)	* 0.88	* 4.75	* 1.13 *
* Max Chl Dpth (ft)	* 23.10	* Hydr. Depth (ft)	* 5.01	* 20.13	* 7.46 *
* Conv. Total (cfs)	*1289811.0	* Conv. (cfs)	*272137.1	*563438.9	*454234.4 *
* Length Wtd. (ft)	* 688.74	* Wetted Per. (ft)	* 1235.37	* 122.05	* 1078.02 *
* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.12	* 0.48	* 0.18 *
* Alpha	* 4.34	* Stream Power (lb/ft s)	* 0.11	* 2.28	* 0.21 *

* Frctn Loss (ft)	*	0.21	* Cum Volume (acre-ft)	* 2674.58	*	561.13	*	2668.25	*
* C & E Loss (ft)	*	0.03	* Cum SA (acres)	* 451.81	*	25.77	*	211.53	*

****

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 314.4

INPUT
Description: XS 314.4 (LETTERED CROSS-SECTION W)
Station Elevation Data num= 486

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	178.26	3.28	178.01	9.84	177.42	16.39	176.69	22.95	176.07
26.23	176.25	36.07	177.23	39.35	177.47	42.63	177.41	52.46	177.76
55.74	177.74	65.58	177.79	68.86	177.73	72.14	177.78	78.69	178.05
81.97	177.98	85.25	177.78	91.81	178.06	98.37	178.15	101.65	178.12
104.93	178.37	108.2	178.46	114.76	178.53	118.04	178.71	124.6	178.76
127.88	178.7	131.16	178.85	147.55	179.2	150.83	179.14	160.67	179.16
163.95	179.25	170.5	179.31	180.34	179.33	190.18	179.49	193.46	179.48
203.29	179.78	209.85	179.9	216.41	180.4	222.97	181.04	226.25	181.25
236.08	181.69	242.64	181.8	249.2	181.82	255.76	181.93	259.03	181.9
268.87	182.07	288.54	182.25	295.1	182.19	298.38	182.24	301.66	182.14
311.5	181.96	318.05	181.87	321.33	181.78	327.89	181.7	331.17	181.72
344.29	181.38	347.57	181.21	357.4	181	360.68	180.98	363.96	180.77
367.24	180.17	370.52	179.75	373.8	179.51	377.08	179.46	386.91	179.21
393.47	179.01	396.75	179.12	400.03	179.05	409.86	178.96	416.42	179.05
419.7	178.99	426.26	179.01	432.82	178.88	442.65	178.94	449.21	178.94
452.49	178.9	455.77	178.97	459.05	178.76	465.61	178.9	485.28	179.03
491.84	179.13	498.4	179.04	511.51	179.15	521.35	179.43	527.91	179.71
531.18	179.77	537.74	180.11	544.3	180.3	554.14	180.44	557.42	180.43
567.25	180.49	570.53	180.42	577.09	180.46	583.65	180.37	590.2	179.95
593.48	179.91	596.76	179.77	600.04	179.8	606.6	179.69	613.16	179.54
622.99	179.04	626.27	178.8	632.83	178.44	636.11	178.56	639.39	178.91
645.95	179.37	659.06	179.96	662.34	180.03	668.9	180.04	672.18	179.97
675.46	180.03	678.74	180	685.29	180.06	688.57	180.16	695.13	180.14
701.69	180.25	714.8	180.32	721.36	180.42	734.48	180.78	760.71	180.87
763.99	180.83	767.27	180.88	770.54	180.82	777.1	180.85	786.94	180.74
800.06	180.88	813.17	180.97	816.45	180.94	823.01	181.04	832.84	181.01
842.68	181.23	849.24	181.3	852.52	181.42	855.8	181.44	862.35	181.26
868.91	181.29	875.47	181.37	885.31	181.17	891.86	181.24	901.7	181.19
908.26	181.24	914.82	181.16	921.37	181.25	927.93	181.28	937.77	181.09
947.61	181.03	954.16	180.73	957.44	180.66	960.72	180.49	967.28	180.04
970.56	179.96	973.84	180.03	977.12	180.34	980.39	180.94	983.67	181.38
986.95	181.61	990.23	181.68	996.79	181.51	1003.35	181.4	1009.91	180.89
1013.18	180.72	1016.46	180.63	1019.74	180.63	1023.02	180.52	1032.86	179.85
1039.42	179.48	1045.97	178.72	1052.53	178.11	1055.81	177.71	1062.37	177.05
1068.93	176.86	1075.48	176.53	1078.76	176.28	1082.04	176.25	1088.6	175.84
1091.88	175.76	1098.44	175.43	1104.99	174.95	1108.27	174.54	1111.55	174.03
1118.11	172.53	1121.39	171.63	1124.67	170.63	1127.95	169.45	1131.23	168.44
1134.5	167.01	1135.36	166.48	1137.78	164.99	1141.06	163.66	1144.34	162.17
1160	159.1	1193.53	162.15	1196.8	162.66	1200.08	163.06	1203.36	163.31
1206.64	163.39	1209.92	163.79	1213.2	164.6	1215.54	165.47	1219.76	166.8
1223.04	167.62	1226.31	168.13	1229.59	168.3	1236.15	169.2	1239.43	169.79
1242.71	170.94	1245.99	171.96	1249.27	172.85	1252.55	173.02	1259.1	172.98
1262.38	172.89	1265.66	172.56	1272.22	172.18	1275.5	172.06	1285.34	171.99

1288.61	171.92	1291.89	171.95	1301.73	171.78	1308.29	171.7	1314.85	171.74
1321.4	171.66	1324.68	171.66	1334.52	171.52	1341.08	171.56	1344.36	171.49
1350.91	171.52	1357.47	171.38	1377.15	171.25	1380.42	171.17	1386.98	171.16
1393.54	171.04	1400.1	171.05	1403.38	170.98	1416.49	170.91	1419.77	170.94
1426.33	170.91	1442.72	170.89	1455.84	170.76	1462.4	170.74	1468.96	170.77
1485.35	170.66	1488.63	170.71	1498.47	170.6	1505.02	170.7	1511.58	170.62
1518.14	170.59	1521.42	170.53	1527.98	170.64	1547.65	170.55	1554.21	170.4
1557.49	170.48	1564.05	170.47	1567.32	170.51	1573.88	170.51	1577.16	170.58
1583.72	170.49	1587	170.53	1596.83	170.56	1603.39	170.51	1606.67	170.55
1616.51	170.52	1619.79	170.58	1623.07	170.53	1632.9	170.55	1636.18	170.41
1642.74	170.36	1646.02	170.44	1652.58	170.45	1665.69	170.41	1668.97	170.34
1675.53	170.35	1685.37	170.46	1691.92	170.42	1695.2	170.46	1701.76	170.4
1718.16	170.4	1724.72	170.5	1731.28	170.37	1737.83	170.45	1747.67	170.43
1754.23	170.58	1757.51	170.59	1773.91	170.72	1777.19	170.83	1783.74	170.81
1793.58	170.9	1800.14	170.85	1803.42	170.88	1813.26	170.87	1823.1	170.89
1829.66	170.83	1832.93	170.87	1836.21	170.82	1842.77	170.85	1849.33	170.78
1855.89	170.78	1859.17	170.74	1865.73	170.77	1875.57	170.76	1878.84	170.7
1885.4	170.74	1891.96	170.72	1895.24	170.78	1911.64	170.73	1918.2	170.79
1921.48	170.74	1924.75	170.8	1934.59	170.9	1941.15	170.87	1944.43	171.02
1947.71	171.02	1950.99	171.2	1957.55	171.15	1967.39	171.25	1973.94	171.17
1977.22	171.17	1980.5	171.27	1983.78	171.27	1987.06	171.13	1990.34	171.09
1993.62	171.13	2000.18	171.04	2006.74	171.3	2013.3	171.05	2019.85	170.98
2023.13	171	2026.41	170.93	2036.25	170.82	2042.81	170.28	2046.09	169.92
2049.37	169.45	2052.65	169.25	2055.93	169.42	2059.21	169.74	2062.49	169.97
2065.77	170.06	2078.88	170.56	2085.44	170.99	2088.72	170.98	2092	170.84
2095.28	170.81	2101.84	170.83	2105.12	170.9	2111.68	170.73	2114.96	170.52
2118.23	170.47	2131.35	170.53	2144.47	170.27	2147.75	170.29	2151.03	170.39
2160.87	170.53	2167.42	170.46	2170.7	170.52	2180.54	170.39	2187.1	170.26
2196.94	170.27	2200.22	170.23	2206.78	170.3	2213.34	170.27	2219.89	170.29
2226.45	170.36	2229.73	170.46	2236.29	170.53	2242.85	170.56	2249.41	170.38
2255.97	170.29	2265.8	170.32	2269.08	170.25	2275.64	170.3	2282.2	170.19
2285.48	170.23	2295.32	170.2	2298.6	170.25	2311.72	170.25	2324.83	170.49
2331.39	170.56	2337.95	170.82	2341.23	170.88	2347.79	170.91	2354.35	171.02
2360.91	171.26	2364.19	171.17	2370.74	171.32	2377.3	171.3	2383.86	171.5
2387.14	171.55	2390.42	171.51	2393.7	171.63	2400.26	171.67	2406.82	171.57
2416.65	171.58	2419.93	171.48	2429.77	171.44	2436.33	171.27	2442.89	171.38
2446.17	171.37	2452.73	171.54	2462.57	171.56	2472.4	171.41	2475.68	171.57
2482.24	171.59	2488.8	171.46	2498.64	171.54	2508.48	171.69	2511.76	171.65
2515.03	171.71	2528.15	171.67	2537.99	171.94	2541.27	171.99	2547.83	171.99
2551.11	172.05	2557.67	172.09	2560.95	172.01	2564.22	172.02	2570.78	172.15
2577.34	172.05	2583.9	171.86	2590.46	171.87	2597.02	172.03	2600.3	172.01
2606.86	172.1	2613.42	172.14	2623.25	172.12	2626.53	172.22	2636.37	172.31
2639.65	172.38	2642.93	172.33	2649.49	172.38	2659.33	172.41	2665.88	172.51
2682.28	172.42	2685.56	172.43	2692.12	172.32	2695.4	172.32	2701.96	172.52
2708.52	172.43	2711.8	172.47	2715.07	172.6	2721.63	172.72	2728.19	172.7
2734.75	172.89	2741.31	172.85	2744.59	173.06	2747.87	173.13	2751.15	172.87
2754.43	172.46	2757.71	172.28	2767.54	172.64	2770.82	172.89	2774.1	173.33
2780.66	173.95	2787.22	174.24	2790.5	174.21	2800.34	174.49	2803.62	174.51
2806.9	174.71	2813.45	174.85	2820.01	174.95	2833.13	175.28	2839.69	175.52
2846.25	175.87	2852.81	176.05	2859.37	176.37	2865.92	176.87	2872.48	177.19
2879.04	177.59	2885.6	178.05	2892.16	178.64	2895.44	179.03	2908.56	180.23
2915.11	180.73	2921.67	180.98	2924.95	181.17	2931.51	181.35	2941.35	181.53
2947.91	181.84	2954.47	182.25	2967.58	182.58	2974.14	182.71	2980.7	182.92
2987.26	183.23	2993.82	183.65	3003.66	184.02	3006.94	184.29	3010.22	184.48
3016.77	184.74								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1135.36	.045	1215.54	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1135.36	1215.54	600	1120 600	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	950	185	F
3015	3016.77	185	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
361.15	664.36	180.04

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	179.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.40	Reach Len. (ft)	600.00	1120.00	600.00
Crit W.S. (ft)	173.46	Flow Area (sq ft)	403.79	1410.64	*13443.44
E.G. Slope (ft/ft)	*0.000248	Area (sq ft)	630.92	1410.64	*13443.44
Q Total (cfs)	*17700.00	Flow (cfs)	245.11	4891.40	*12563.50
Top Width (ft)	2043.68	Top Width (ft)	279.60	80.18	1683.90
Vel Total (ft/s)	1.16	Avg. Vel. (ft/s)	0.61	3.47	0.93
Max Chl Dpth (ft)	20.30	Hydr. Depth (ft)	4.24	17.59	7.98
Conv. Total (cfs)	*1123475.0	Conv. (cfs)	15557.6	*310472.4	*797444.7
Length Wtd. (ft)	756.81	Wetted Per. (ft)	96.71	81.97	1685.46
Min Ch El (ft)	159.10	Shear (lb/sq ft)	0.06	0.27	0.12
Alpha	2.93	Stream Power (lb/ft s)	0.04	0.92	0.12
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	1369.62	434.83	1734.73
C & E Loss (ft)	0.00	Cum SA (acres)	252.69	22.59	161.75

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	180.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.97	Reach Len. (ft)	600.00	1120.00	600.00
Crit W.S. (ft)	173.38	Flow Area (sq ft)	227.92	1456.64	*11735.45
E.G. Slope (ft/ft)	*0.000259	Area (sq ft)	227.92	1456.64	

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*11735.45  *
* Q Total (cfs)          *17700.00  * Flow (cfs)              *  200.34  * 5269.14
*12230.52  *
* Top Width (ft)         * 1385.00  * Top Width (ft)          *   25.36  *   80.18  *
1279.46  *
* Vel Total (ft/s)       *    1.32  * Avg. Vel. (ft/s)       *    0.88  *    3.62  *
   1.04  *
* Max Chl Dpth (ft)      *   20.87  * Hydr. Depth (ft)       *    8.99  *   18.17  *
   9.17  *
* Conv. Total (cfs)      *1100238.0  * Conv. (cfs)            * 12453.1  *327531.5
*760253.0  *
* Length Wtd. (ft)       *  769.04  * Wetted Per. (ft)       *   32.32  *   81.97  *
1289.16  *
* Min Ch El (ft)         *  159.10  * Shear (lb/sq ft)       *    0.11  *    0.29  *
   0.15  *
* Alpha                  *    2.68  * Stream Power (lb/ft s) *    0.10  *    1.04  *
   0.15  *
* Frctn Loss (ft)        *    0.22  * Cum Volume (acre-ft)   *  370.64  *  446.78  *
1067.02  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   35.55  *   22.29  *
  66.32  *
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Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
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* E.G. Elev (ft)         *  175.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.07  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.64  * Reach Len. (ft)        *  600.00  * 1120.00  *
 600.00  *
* Crit W.S. (ft)         *  169.10  * Flow Area (sq ft)      *  126.48  * 1109.31  *
7205.45  *
* E.G. Slope (ft/ft)     *0.000308  * Area (sq ft)           *  126.48  * 1109.31  *
7205.45  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)             *   68.33  * 3648.63  *
5063.04  *
* Top Width (ft)         * 1747.59  * Top Width (ft)         *   41.05  *   80.18  *
1626.36  *
* Vel Total (ft/s)       *    1.04  * Avg. Vel. (ft/s)       *    0.54  *    3.29  *
   0.70  *
* Max Chl Dpth (ft)      *   16.54  * Hydr. Depth (ft)       *    3.08  *   13.84  *
   4.43  *
* Conv. Total (cfs)      *500553.8  * Conv. (cfs)            *  3895.7  *208011.0
*288647.1  *
* Length Wtd. (ft)       *  823.07  * Wetted Per. (ft)       *   42.38  *   81.97  *
1627.78  *
* Min Ch El (ft)         *  159.10  * Shear (lb/sq ft)       *    0.06  *    0.26  *
   0.09  *
* Alpha                  *    4.42  * Stream Power (lb/ft s) *    0.03  *    0.85  *
   0.06  *
* Frctn Loss (ft)        *    0.26  * Cum Volume (acre-ft)   *  599.00  *  326.51  *
 820.62  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *  102.45  *   22.71  *
 145.22  *
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Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	178.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	178.29	Reach Len. (ft)	600.00	1120.00	600.00
Crit W.S. (ft)	172.88	Flow Area (sq ft)	304.00	1322.00	11588.07
E.G. Slope (ft/ft)	0.000269	Area (sq ft)	383.45	1322.00	11588.07
Q Total (cfs)	15000.00	Flow (cfs)	171.66	4570.54	10257.80
Top Width (ft)	1941.57	Top Width (ft)	188.65	80.18	1672.73
Vel Total (ft/s)	1.14	Avg. Vel. (ft/s)	0.56	3.46	0.89
Max Chl Dpth (ft)	19.19	Hydr. Depth (ft)	3.59	16.49	6.93
Conv. Total (cfs)	914478.4	Conv. (cfs)	10465.3	278643.9	625369.1
Length Wtd. (ft)	771.64	Wetted Per. (ft)	86.21	81.97	1674.24
Min Ch El (ft)	159.10	Shear (lb/sq ft)	0.06	0.27	0.12
Alpha	3.25	Stream Power (lb/ft s)	0.03	0.94	0.10
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	1047.20	401.54	1450.41
C & E Loss (ft)	0.00	Cum SA (acres)	200.78	22.59	157.82

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	182.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	182.37	Reach Len. (ft)	600.00	1120.00	600.00
Crit W.S. (ft)	174.27	Flow Area (sq ft)	838.37	1648.85	18519.29
E.G. Slope (ft/ft)	0.000212	Area (sq ft)	2904.19	1648.85	18519.29
Q Total (cfs)	25700.00	Flow (cfs)	492.98	5862.21	19344.81
Top Width (ft)	2959.11	Top Width (ft)	1135.36	80.18	1743.57
Vel Total (ft/s)	1.22	Avg. Vel. (ft/s)	0.59	3.56	

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   1.04  *
* Max Chl Dpth (ft)      *   23.27  * Hydr. Depth (ft)       *    4.52  *   20.56  *
  10.62  *
* Conv. Total (cfs)      *1765378.0  * Conv. (cfs)            * 33863.8  *402685.3
*1328829.0  *
* Length Wtd. (ft)       *  729.02  * Wetted Per. (ft)       *  187.06  *   81.97  *
1745.22  *
* Min Ch El (ft)         *  159.10  * Shear (lb/sq ft)       *    0.06  *    0.27  *
   0.14  *
* Alpha                  *    2.48  * Stream Power (lb/ft s) *    0.03  *    0.95  *
   0.15  *
* Frctn Loss (ft)        *    0.17  * Cum Volume (acre-ft)   * 2584.90  *  521.51  *
2500.70  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *  428.42  *   23.82  *
 193.73  *
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Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 300

INPUT
Description: XS 300
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 488

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	181.3	9.84	181.29	22.95	180.94	29.51	180.64	32.79	180.6
49.18	180.55	55.74	180.2	59.01	180.11	68.85	180	78.69	179.94
91.8	179.47	98.36	179.57	104.91	179.39	108.19	179.57	124.58	179.27
131.14	179.26	137.7	179.13	147.53	178.8	160.65	178.8	173.76	178.62
183.6	178.29	186.88	178.29	190.16	178.13	196.71	178.14	203.27	177.96
209.83	177.63	222.94	177.54	226.22	177.28	229.5	177.18	236.06	177.22
242.61	177.03	252.45	176.86	259.01	176.41	265.56	176.27	268.84	176.11
275.4	175.94	281.96	175.86	285.23	175.68	288.51	174.8	291.79	174.26
295.07	174.27	298.35	173.96	304.91	173.95	311.46	174.46	314.74	174.55
318.02	174.8	321.3	174.79	324.58	175.02	331.13	175.01	344.25	175.26
350.8	175.15	357.36	175.33	363.92	175.35	370.48	175.46	373.75	175.44
380.31	175.21	393.43	175.53	399.98	175.75	406.54	175.68	419.65	175.71
422.93	175.54	426.21	175.69	432.77	175.79	436.05	175.72	439.33	175.81
445.88	175.8	455.72	175.9	459	175.79	472.11	176.04	478.67	175.87
485.22	176.12	488.5	176.33	495.06	176.57	504.9	176.69	508.17	176.59
514.73	176.56	521.29	176.69	527.85	176.65	540.96	176.82	544.24	176.79
547.52	176.93	554.07	176.91	560.63	177.23	570.47	177.38	577.02	177.55
580.3	177.41	586.86	177.63	599.97	177.83	609.81	178.12	616.37	178.46
629.48	178.95	632.76	179.15	639.32	179.31	649.15	179.4	658.99	179.58
668.82	179.62	675.38	179.71	688.5	179.78	698.33	179.9	701.61	179.89
711.45	180.05	721.28	180.05	727.84	180.17	737.67	180.19	747.38	180.23
760.62	180.07	773.74	180.06	786.85	179.85	793.41	179.85	803.24	179.73
819.64	179.74	826.19	179.49	839.31	179.28	852.42	178.89	855.7	178.7
858.98	178.71	865.54	178.2	872.09	178.03	878.65	177.73	895.04	177.12
901.6	177.05	914.72	176.83	931.11	176.46	937.67	176.39	950.78	176.1
957.34	175.83	963.89	175.79	970.45	175.63	977.01	175.87	980.29	175.84
986.84	176.23	990.12	176.21	996.68	176.44	1003.24	176.5	1006.51	176.61

1013.07	176.69	1016.35	176.91	1026.19	177.12	1036.02	177.2	1049.14	177.51
1062.25	177.57	1075.37	178.17	1081.94	178.4	1098.34	179.13	1104.9	179.32
1111.46	179.61	1121.3	179.81	1127.86	180.09	1131.14	180.07	1137.7	180.2
1150.83	180.3	1167.23	179.98	1173.79	179.99	1183.63	179.85	1193.47	179.62
1203.31	179.59	1209.88	179.49	1229.56	179.28	1232.84	179.32	1242.68	179.13
1245.96	178.99	1262.36	179.02	1268.93	178.93	1282.05	178.67	1291.89	178.77
1295.17	178.71	1305.01	178.76	1331.26	179.12	1344.38	179.22	1350.94	179.55
1357.5	180.57	1360.78	180.09	1364.06	179.92	1380.46	180.12	1423.11	180.58
1432.95	180.45	1439.51	180.61	1449.35	180.64	1459.2	180.95	1465.76	180.94
1478.88	181.08	1485.44	181.29	1492	181.34	1498.56	181.48	1505.12	181.2
1514.96	181.24	1521.53	181.18	1554.33	181.02	1570.73	180.91	1580.57	180.57
1587.14	180.49	1610.1	180.41	1616.66	180.62	1629.78	180.38	1636.34	180.11
1639.62	179.88	1646.19	179.27	1659.31	179.39	1665.87	179.28	1682.27	179.56
1698.67	179.28	1701.95	179.33	1711.8	179.33	1721.64	179.26	1724.92	179.08
1731.48	178.98	1741.32	179.02	1744.6	178.97	1751.16	179.18	1757.72	179.02
1767.56	179.02	1770.85	178.95	1780.69	178.92	1790.53	178.94	1793.81	178.85
1800.37	178.87	1803.65	178.73	1810.21	178.83	1816.77	178.67	1826.61	178.79
1836.46	178.56	1843.02	178.61	1849.58	178.85	1865.98	178.81	1872.54	178.76
1879.1	178.59	1892.22	178.77	1898.76	178.62	1905.3	178.63	1911.84	178.54
1915.11	178.68	1918.38	178.61	1924.91	178.88	1934.72	178.95	1944.53	179.09
1947.8	178.91	1954.33	178.03	1957.6	177.94	1964.14	178.46	1970.68	178.67
1977.22	178.59	1990.29	178.83	1996.83	178.49	2003.37	178.3	2009.9	178.31
2016.44	178.14	2022.98	178.1	2029.52	178.15	2045.86	177.78	2049.13	177.89
2055.67	177.82	2062.21	177.85	2068.75	177.73	2078.55	177.77	2081.82	177.71
2088.36	177.8	2098.17	177.78	2107.97	177.7	2127.59	177.22	2134.12	177.26
2137.39	177.13	2143.93	177.21	2147.2	177.14	2153.74	176.75	2163.54	176.33
2170.08	176.2	2179.89	176.09	2189.7	176.27	2196.23	176.25	2202.77	176.38
2219.12	176.9	2222.39	176.88	2235.46	177.1	2245.27	177.15	2251.81	177.03
2268.15	177.06	2271.42	177.15	2277.96	177.06	2291.04	177.28	2304.12	177.16
2307.4	177.22	2317.21	177.13	2327.02	177.3	2333.56	177.27	2340.1	177.09
2346.65	177.3	2356.46	177.27	2366.27	177.36	2379.35	177.39	2385.9	177.15
2395.71	177.38	2398.98	177.6	2405.52	177.51	2408.79	177.61	2415.33	177.51
2421.88	177.53	2425.15	177.63	2428.42	177.49	2431.69	177.1	2434.96	176.91
2441.5	177.2	2444.77	177.2	2448.04	177.01	2454.58	176.48	2457.85	176.4
2464.4	175.8	2467.67	175.62	2474.21	174.96	2484.02	174.3	2493.83	173.12
2500.38	171.96	2504.81	171.32	2516.73	170.05	2520	168.27	2526.54	163.64
2529.81	161.99	2533.08	161.45	2563	158.7	2595.23	162.76	2598.5	163.53
2605.04	167.81	2608.31	169.47	2611.58	170.29	2618.13	170.41	2624.67	170.23
2627.94	170.39	2634.48	171.3	2637.75	171.43	2641.02	171.37	2647.56	171.02
2654.11	170.96	2660.65	170.77	2673.73	170.64	2686.81	170.31	2699.9	170.24
2706.44	170.05	2716.25	169.93	2722.79	169.92	2729.34	169.68	2735.88	169.63
2745.7	169.41	2755.53	169.34	2775.21	168.86	2781.76	168.87	2794.88	168.74
2798.16	168.77	2811.27	168.63	2821.11	168.72	2837.5	168.36	2840.78	168.42
2847.33	168.21	2853.89	168.58	2860.45	168.78	2870.28	168.75	2880.12	168.62
2883.4	168.68	2893.24	168.59	2899.79	168.64	2909.63	168.84	2919.46	168.93
2932.58	168.88	2939.14	168.98	2958.81	169.17	2962.09	169.13	2978.48	169.2
2991.59	169.15	3004.71	169.17	3011.26	169.3	3017.82	169.3	3024.38	169.22
3030.94	169.39	3040.77	169.4	3044.05	169.46	3070.28	169.29	3073.56	169.2
3096.51	169.19	3103.07	169.01	3106.34	169.04	3122.74	168.82	3129.29	168.77
3135.85	168.8	3145.69	168.73	3155.52	168.78	3162.08	168.88	3191.59	168.94
3198.15	169.01	3207.98	169.01	3217.82	169.14	3227.65	169.01	3237.49	169.01
3250.6	169.13	3263.72	169.2	3276.83	169.31	3280.11	169.26	3286.67	169.33
3289.95	169.23	3296.5	169.2	3303.06	169.27	3319.45	169.3	3332.57	169.37
3352.24	169.55	3362.07	169.58	3375.19	169.77	3385.03	169.82	3394.86	169.97
3398.14	169.92	3414.53	170.05	3434.2	170.15	3450.6	170.12	3453.88	170.2
3460.43	170.1	3493.22	170.41	3503.05	170.3	3506.33	170.38	3516.17	170.86
3526	171.24	3535.84	171.4	3542.4	171.99	3548.96	172.41	3552.23	172.54
3558.79	172.55	3565.35	172.27	3571.91	171.57	3575.18	171.41	3578.46	171.39
3588.3	171.98	3601.41	173.07	3604.69	173.11	3607.97	172.99	3611.25	173.16
3624.36	173.52	3630.92	173.52	3637.48	173.68	3640.76	173.59	3650.59	173.96
3660.43	174.09	3666.98	174.27	3670.26	174.23	3673.54	174.42	3676.82	174.39
3686.66	174.75	3696.49	175.04	3703.05	175.31	3709.61	175.39	3712.89	175.52
3726	175.84	3732.56	175.8	3739.11	175.97	3745.67	175.8	3755.51	176.07

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 3762.06  176.81 3765.34  176.89 3768.62  176.69 3775.18  175.89 3778.46  175.62
 3781.74  175.79 3788.29  176.34 3794.85  176.34 3798.13  176.61 3804.69   176.8
 3807.96  176.97 3814.52  177.08  3817.8  177.01 3824.36  177.24 3830.91  177.57
 3840.75  177.37 3850.59  177.62 3857.14   177.7  3863.7  177.94 3870.26  178.34
 3880.09  178.77 3883.37  178.82 3893.21  179.28 3899.77  179.66 3906.32  179.92
 3929.27  181.24 3939.11   181.5 3952.22  182.11 3958.78  182.21 3968.62  182.73
 3981.73  183.27 3991.57  183.88 3994.84  183.99 4004.68  184.55 4014.52  185.27
 4024.35  185.75 4030.91  186.24 4034.19  186.35

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0      .1    2520    .045 2605.04      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          2520 2605.04              1000    1840    1840             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    1903     185        F
    3643 4034.19     185        F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
  737.32  1355.9  180.14

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
***********
* E.G. Elev (ft)         *  179.25  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  179.16  * Reach Len. (ft)       * 1000.00  * 1840.00  *
1840.00  *
* Crit W.S. (ft)         *  172.30  * Flow Area (sq ft)     * 1279.67  * 1502.11  *
9735.22  *
* E.G. Slope (ft/ft)     *0.000313  * Area (sq ft)          * 2598.30  * 1502.11
*10456.17  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            *  546.17  * 5783.96
*11369.87  *
* Top Width (ft)         * 2661.90  * Top Width (ft)       * 1291.35  *   85.04  *
1285.52  *
* Vel Total (ft/s)       *    1.41  * Avg. Vel. (ft/s)     *    0.43  *    3.85  *
   1.17  *
* Max Chl Dpth (ft)      *   20.46  * Hydr. Depth (ft)     *    2.07  *   17.66  *
   9.38  *
* Conv. Total (cfs)      *1000993.0  * Conv. (cfs)          * 30888.0  *327101.7
*643003.7  *
* Length Wtd. (ft)       * 1707.12  * Wetted Per. (ft)     *  618.10  *   88.70  *
1038.81  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)     *    0.04  *    0.33  *
   0.18  *
* Alpha                  *    2.86  * Stream Power (lb/ft s) *    0.02  *    1.27  *
   0.21  *
* Frctn Loss (ft)        *    0.76  * Cum Volume (acre-ft)  * 1347.38  *  397.38  *
1570.13  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)        *  241.87  *   20.46  *
 141.30  *
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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
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is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	179.82	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.71	Reach Len. (ft)	1000.00	1840.00	1840.00
Crit W.S. (ft)	172.28	Flow Area (sq ft)	629.31	1549.36	8693.12
E.G. Slope (ft/ft)	0.000328	Area (sq ft)	629.31	1549.36	8693.12
Q Total (cfs)	17700.00	Flow (cfs)	421.53	6238.78	11039.70
Top Width (ft)	1080.00	Top Width (ft)	157.00	85.04	837.96
Vel Total (ft/s)	1.63	Avg. Vel. (ft/s)	0.67	4.03	1.27
Max Chl Dpth (ft)	21.01	Hydr. Depth (ft)	4.01	18.22	10.37
Conv. Total (cfs)	977177.8	Conv. (cfs)	23271.5	344429.1	609477.2
Length Wtd. (ft)	1702.10	Wetted Per. (ft)	160.29	88.70	848.20
Min Ch El (ft)	158.70	Shear (lb/sq ft)	0.08	0.36	0.21
Alpha	2.54	Stream Power (lb/ft s)	0.05	1.44	0.27
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	364.73	408.13	926.33
C & E Loss (ft)	0.03	Cum SA (acres)	34.29	20.17	51.74

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	175.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	175.38	Reach Len. (ft)	1000.00	1840.00	1840.00
Crit W.S. (ft)	168.44	Flow Area (sq ft)	135.84	1180.58	5810.71
E.G. Slope (ft/ft)	0.000315	Area (sq ft)	181.27	1180.58	5868.08
Q Total (cfs)	8780.00	Flow (cfs)	69.09	3884.20	4826.71
Top Width (ft)	1328.79	Top Width (ft)	140.41	85.04	

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1103.34  *
* Vel Total (ft/s)       *    1.23  * Avg. Vel. (ft/s)       *    0.51  *    3.29  *
   0.83  *
* Max Chl Dpth (ft)      *   16.67  * Hydr. Depth (ft)       *    2.72  *   13.88  *
   5.60  *
* Conv. Total (cfs)      *494912.7  * Conv. (cfs)            *  3894.5  *218945.4
*272072.9  *
* Length Wtd. (ft)       * 1770.84  * Wetted Per. (ft)       *   50.68  *   88.70  *
1038.81  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)       *    0.05  *    0.26  *
   0.11  *
* Alpha                  *    3.41  * Stream Power (lb/ft s) *    0.03  *    0.86  *
   0.09  *
* Frctn Loss (ft)        *    0.76  * Cum Volume (acre-ft)   *  596.88  *  297.07  *
 730.58  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *  101.20  *   20.59  *
 126.42  *
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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
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**********
* E.G. Elev (ft)         *  178.12  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.           *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  178.03  * Reach Len. (ft)      * 1000.00  * 1840.00  *
1840.00  *
* Crit W.S. (ft)         *  171.87  * Flow Area (sq ft)    *  652.74  * 1406.57  *
8569.02  *
* E.G. Slope (ft/ft)     *0.000331  * Area (sq ft)         * 1406.51  * 1406.57  *
9027.11  *
* Q Total (cfs)          *15000.00  * Flow (cfs)           *  214.54  * 5331.66  *
9453.80  *
* Top Width (ft)         * 2241.16  * Top Width (ft)       *  895.95  *   85.04  *
1260.18  *
* Vel Total (ft/s)       *    1.41  * Avg. Vel. (ft/s)     *    0.33  *    3.79  *
   1.10  *
* Max Chl Dpth (ft)      *   19.33  * Hydr. Depth (ft)     *    1.33  *   16.54  *
   8.26  *
* Conv. Total (cfs)      *824785.1  * Conv. (cfs)          * 11796.6  *293165.0
*519823.6  *
* Length Wtd. (ft)       * 1724.42  * Wetted Per. (ft)     *  490.72  *   88.70  *
1038.81  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)     *    0.03  *    0.33  *
   0.17  *
* Alpha                  *    2.95  * Stream Power (lb/ft s) *    0.01  *    1.24  *
   0.19  *
* Frctn Loss (ft)        *    0.80  * Cum Volume (acre-ft) * 1034.87  *  366.46  *
1308.43  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)       *  193.31  *   20.46  *
 137.62  *
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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	182.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	182.17	Reach Len. (ft)	1000.00	1840.00	1840.00
Crit W.S. (ft)	173.33	Flow Area (sq ft)	3139.20	1758.41	12863.46
E.G. Slope (ft/ft)	0.000263	Area (sq ft)	8930.33	1758.41	14420.88
Q Total (cfs)	25700.00	Flow (cfs)	2233.05	6891.09	16575.86
Top Width (ft)	3956.14	Top Width (ft)	2520.00	85.04	1351.10
Vel Total (ft/s)	1.45	Avg. Vel. (ft/s)	0.71	3.92	1.29
Max Chl Dpth (ft)	23.47	Hydr. Depth (ft)	5.09	20.68	12.39
Conv. Total (cfs)	1586197.0	Conv. (cfs)	137823.5	425315.9	1023057.0
Length Wtd. (ft)	1643.44	Wetted Per. (ft)	618.10	88.70	1038.81
Min Ch El (ft)	158.70	Shear (lb/sq ft)	0.08	0.32	0.20
Alpha	2.50	Stream Power (lb/ft s)	0.06	1.27	0.26
Frctn Loss (ft)	0.61	Cum Volume (acre-ft)	2503.39	477.71	2273.84
C & E Loss (ft)	0.02	Cum SA (acres)	403.25	21.69	172.42

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 285

INPUT
Description: XS 285
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 480

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

****

0	181.45	13.12	181.21	16.4	181.28	32.8	180.96	36.08	180.75
42.64	180.53	52.48	180.55	59.04	180.47	65.6	180.13	72.16	179.95
75.44	180.04	82	180.01	91.84	179.61	98.4	179.46	101.68	179.47
108.24	179.63	118.08	179.65	121.36	179.51	131.2	179.37	144.32	179.01
154.16	178.78	157.44	178.87	167.28	178.8	170.56	178.88	180.4	178.63
183.68	178.68	196.8	178.4	203.37	177.99	213.21	178.08	216.49	177.92
226.33	177.75	232.89	177.57	249.29	177.25	272.25	176.61	275.53	176.61
285.37	176.36	291.93	175.97	298.49	175.45	311.61	175.23	318.17	174.77
324.73	174.64	328.01	174.43	331.29	173.98	334.57	173.73	341.13	173.92
347.69	174.48	354.25	174.69	357.53	174.87	364.09	174.82	367.37	174.87
370.65	175.09	373.93	175.15	380.49	175.08	387.05	175.24	390.33	175.2
396.89	175.3	403.45	175.28	410.01	175.48	423.13	175.32	429.69	175.5
432.97	175.47	436.25	175.6	442.81	175.7	455.93	175.76	462.49	175.49
469.05	175.53	472.33	175.64	485.45	175.72	492.01	175.56	498.57	175.49
508.41	175.81	511.69	175.87	518.25	175.78	524.81	175.81	534.65	176.06
541.21	176.18	547.77	176.14	554.33	176.52	564.17	176.56	567.45	176.49
574.01	176.73	587.13	176.95	593.69	176.84	603.54	176.84	610.1	176.77
616.66	177.12	623.22	177.24	629.78	177.17	639.62	177.42	646.18	177.44
656.02	177.55	678.98	178.38	688.82	178.41	705.22	178.91	711.78	179.28
721.62	179.55	731.46	179.66	757.7	179.91	764.26	179.91	770.82	179.99
780.66	180.01	787.22	180.11	793.78	180.09	800.34	180.17	806.9	180.18
820.02	180.08	826.58	180.13	836.42	179.99	842.98	180.03	852.82	179.86
859.38	179.82	869.22	179.83	875.78	179.75	888.9	179.7	902.02	179.47
908.58	179.3	918.42	179.23	924.98	178.9	934.82	178.47	941.38	178.31
947.94	178.02	954.5	177.87	964.34	177.57	967.62	177.35	970.9	177.26
977.46	177.25	980.74	177.13	987.31	177.01	993.87	176.98	1006.99	176.79
1013.55	176.8	1023.39	176.66	1029.95	176.48	1036.51	176.42	1046.35	176.19
1052.91	176.38	1062.75	176.49	1066.03	176.57	1072.59	176.94	1075.87	177.06
1088.99	177.16	1098.83	177.32	1105.39	177.3	1111.95	177.36	1118.51	177.59
1128.35	177.61	1148.03	177.88	1151.31	177.88	1157.87	178.09	1167.71	178.26
1170.99	178.23	1184.11	178.31	1200.51	178.45	1210.35	178.83	1216.91	178.97
1226.75	179.28	1239.86	179.91	1243.13	180.15	1249.69	180.34	1256.24	180.44
1259.52	180.37	1266.07	180.38	1279.18	180.33	1295.57	180.1	1302.12	180.17
1308.67	179.96	1315.23	179.85	1321.78	179.47	1328.33	179.01	1334.89	178.1
1338.17	177.94	1344.72	177.81	1348	177.84	1354.55	178.02	1361.1	178.37
1367.66	178.63	1374.21	178.78	1393.87	179.34	1397.15	179.36	1416.81	179.72
1429.92	179.99	1436.47	180.06	1456.13	180.14	1469.24	180.38	1472.52	180.33
1475.8	180.48	1488.9	180.54	1495.46	180.65	1502.01	180.68	1518.4	180.91
1521.67	180.89	1538.06	181.12	1541.33	181.08	1547.89	181.18	1559.91	181.38
1573.19	181.41	1582.64	181.35	1590.49	181.44	1600.32	181.26	1603.6	181.55
1610.15	181.16	1613.43	181.09	1619.98	181.2	1639.64	180.79	1646.2	180.74
1652.75	180.8	1662.58	180.76	1669.13	180.46	1675.69	180.44	1678.96	180.54
1682.24	180.48	1692.07	180.43	1695.35	180.29	1701.9	180.26	1708.46	180.16
1718.29	180.09	1724.84	179.92	1731.39	179.83	1744.5	179.97	1747.78	180.04
1754.33	179.98	1773.99	179.95	1780.55	179.86	1787.1	179.9	1796.93	179.83
1803.49	179.92	1810.04	179.89	1819.87	179.95	1826.43	179.91	1846.09	179.96
1855.92	179.74	1865.75	179.25	1869.03	179.21	1872.3	179.3	1878.86	179.75
1882.13	179.79	1888.69	180.34	1898.52	180.77	1905.07	180.93	1911.62	180.92
1921.46	181.01	1928.01	180.8	1937.84	180.68	1947.67	180.41	1954.22	180.29
1960.78	180.4	1973.89	181.06	1980.44	181.32	1990.27	181.21	1993.55	181.25
2013.21	181.71	2016.49	181.5	2023.04	180.38	2029.6	179.53	2032.88	179.23
2036.16	179.22	2042.71	179.58	2045.99	179.61	2055.83	180.02	2062.38	180.09
2068.94	180.04	2072.22	179.85	2082.05	178.9	2085.33	178.53	2088.61	178.37
2091.88	178.36	2101.72	178.19	2108.27	178.19	2118.11	178.39	2124.66	178.57
2131.22	178.29	2137.78	178.3	2144.33	178.22	2150.89	177.93	2154.17	177.89
2160.72	177.99	2164	177.93	2170.56	178.22	2177.11	178.32	2183.67	178.23
2193.5	178.25	2200.06	178.18	2203.34	178.24	2209.89	178.23	2219.73	178.13
2226.28	178.23	2229.56	178.12	2236.12	178.08	2245.95	178.31	2252.51	178.11
2259.06	178.16	2265.62	178.1	2272.18	178.14	2278.73	178.32	2288.57	178.47
2295.12	178.28	2301.68	177.97	2308.24	177.87	2314.79	178.18	2318.07	178.02
2324.63	177.96	2327.9	177.86	2334.46	178.14	2341.02	178.18	2350.85	177.98
2357.41	178.06	2363.96	178.01	2367.24	178.14	2370.52	178.12	2377.07	177.94

2383.63	178.09	2386.91	178	2400.02	177.85	2403.3	177.77	2409.85	178.01
2416.41	177.74	2422.97	177.87	2432.8	177.72	2445.91	177.35	2452.47	177.3
2459.03	177.1	2468.86	176.52	2475.42	176.46	2478.69	176.21	2481.97	176.21
2488.53	176.07	2501.64	175.52	2508.2	175.16	2511.47	174.88	2514.75	174.72
2518.03	174.77	2531.14	174.4	2534.42	174.35	2540.98	174.11	2547.53	174.09
2577.04	173.41	2586.87	173.1	2590.15	173.08	2599.98	173.19	2606.54	172.9
2616.37	172.8	2622.93	172.94	2636.04	172.88	2639.32	172.91	2642.6	173.09
2649.15	173.17	2655.71	173.12	2658.99	173.33	2662.26	173.39	2672.1	173.45
2675.38	173.69	2678.66	173.79	2681.93	173.7	2685.21	173.83	2691.77	174.23
2695.05	174.21	2704.88	173.81	2711.44	173.8	2717.99	174.02	2721.27	174.07
2724.55	173.92	2731.1	173.76	2737.66	173.93	2740.94	173.71	2750.77	173.49
2754.05	173.35	2760.61	172.9	2763.88	172.55	2767.16	172.38	2777	171.59
2780.27	171.38	2790.11	171.06	2799.94	170.47	2803.22	170.18	2806.5	170.11
2809.78	170.26	2816.33	170.31	2819.61	170.21	2829.45	170.32	2839.28	170.19
2845.84	169.9	2849.11	169.87	2862.23	170.15	2868.78	170.35	2875.34	170.06
2878.62	170.04	2895.01	169.68	2901.56	169.83	2908.12	169.72	2914.67	169.36
2917.95	169.26	2931.06	169.46	2937.62	169.37	2944.18	169.17	2950.73	169.21
2954.01	169.02	2957.29	168.61	2963.85	168.17	2970.4	168.02	2976.96	168.05
2986.79	167.82	2993.35	167.49	2996.63	167.43	2999.9	167.54	3006.46	168.35
3013.15	169.59	3024.36	170	3030.91	170.16	3034.19	170.36	3040.74	170.25
3047.29	170.24	3057.13	169.96	3063.68	169.56	3066.96	169.14	3070.23	168.54
3073.51	167.57	3076.79	166.09	3081.19	163.4	3083.34	162.08	3086.62	160.38
3089.9	159.76	3093.17	159.71	3124	158.2	3152.16	159.65	3155.44	159.93
3156.75	161.34	3157.2	161.36	3160.48	162.66	3163.75	165.02	3167.03	166.97
3170.31	168.72	3173.58	169.3	3180.14	168.72	3186.69	168.41	3193.25	167.97
3196.52	167.97	3203.08	168.14	3209.63	167.94	3212.91	168.12	3216.18	168.49
3222.74	169.1	3226.02	169.3	3232.57	169.4	3239.12	169.19	3245.68	169.23
3258.79	168.92	3271.89	168.7	3278.45	168.84	3285	168.76	3291.56	168.81
3298.11	168.63	3304.66	168.83	3307.94	169.04	3317.77	169.15	3321.05	169.42
3327.6	170.29	3330.88	171.15	3337.43	173.98	3340.71	175.26	3343.99	176.11
3347.26	176.83	3353.82	179.01	3357.09	179.87	3360.37	180.61	3363.65	181.12
3370.2	181.56	3373.48	181.97	3376.76	182.89	3380.03	183.68	3383.31	184.07
3389.86	184.53	3396.42	184.86	3402.97	185.63	3406.25	185.9	3412.8	186.17
3422.63	186.46	3429.19	186.96	3439.02	187.44	3455.4	188.07	3465.24	188.31

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3076.79	.045	3167.03	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

3076.79	3167.03	220	295	320	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	2069	185	F
3399	3465.24	185	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
807.14	1460.71	180.1

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 178.46	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.34	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 178.12	* Reach Len. (ft)	* 220.00	* 295.00	* 320.00 *
* Crit W.S. (ft)	* 171.92	* Flow Area (sq ft)	* 3937.86	* 1628.21	* 1583.36 *
* E.G. Slope (ft/ft)	*0.000763	* Area (sq ft)	* 4864.07	* 1628.21	*

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1583.36  *
* Q Total (cfs)         *17700.00  * Flow (cfs)             * 5053.99  * 9937.50  *
2708.51  *
* Top Width (ft)        * 1547.03  * Top Width (ft)        * 1272.67  *   90.24  *
 184.12  *
* Vel Total (ft/s)      *    2.48  * Avg. Vel. (ft/s)      *    1.28  *    6.10  *
   1.71  *
* Max Chl Dpth (ft)     *   19.92  * Hydr. Depth (ft)      *    4.91  *   18.04  *
   8.60  *
* Conv. Total (cfs)     *640664.2  * Conv. (cfs)           *182932.8  *359694.8  *
98036.5  *
* Length Wtd. (ft)      *  279.08  * Wetted Per. (ft)      *  803.22  *   94.09  *
 186.15  *
* Min Ch El (ft)        *  158.20  * Shear (lb/sq ft)      *    0.23  *    0.82  *
   0.41  *
* Alpha                 *    3.56  * Stream Power (lb/ft s) *    0.30  *    5.03  *
   0.69  *
* Frctn Loss (ft)       *    0.21  * Cum Volume (acre-ft)  * 1261.73  *  331.27  *
1315.85  *
* C & E Loss (ft)       *    0.01  * Cum SA (acres)        *  212.44  *   16.76  *
 110.26  *
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Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
*******************************************************************************
***********
* E.G. Elev (ft)        *  179.00  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.38  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)        *  178.62  * Reach Len. (ft)       *  220.00  *  295.00  *
 320.00  *
* Crit W.S. (ft)        *  171.93  * Flow Area (sq ft)     * 3290.90  * 1673.20  *
1010.10  *
* E.G. Slope (ft/ft)    *0.000778  * Area (sq ft)          * 3290.90  * 1673.20  *
1010.10  *
* Q Total (cfs)         *17700.00  * Flow (cfs)            * 5389.89  *10500.80  *
1809.31  *
* Top Width (ft)        *  605.00  * Top Width (ft)        *  412.79  *   90.24  *
 101.97  *
* Vel Total (ft/s)      *    2.96  * Avg. Vel. (ft/s)      *    1.64  *    6.28  *
   1.79  *
* Max Chl Dpth (ft)     *   20.42  * Hydr. Depth (ft)      *    7.97  *   18.54  *
   9.91  *
* Conv. Total (cfs)     *634476.6  * Conv. (cfs)           *193206.9  *376413.1  *
64856.7  *
* Length Wtd. (ft)      *  276.79  * Wetted Per. (ft)      *  419.03  *   94.09  *
 112.45  *
* Min Ch El (ft)        *  158.20  * Shear (lb/sq ft)      *    0.38  *    0.86  *
   0.44  *
* Alpha                 *    2.79  * Stream Power (lb/ft s) *    0.62  *    5.42  *
   0.78  *
* Frctn Loss (ft)       *    0.21  * Cum Volume (acre-ft)  *  319.74  *  340.07  *
 721.39  *
* C & E Loss (ft)       *    0.00  * Cum SA (acres)        *   27.75  *   16.47  *
  31.89  *
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Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	174.68	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.41	Reach Len. (ft)	220.00	295.00	320.00
Crit W.S. (ft)	166.72	Flow Area (sq ft)	1691.20	1292.87	922.97
E.G. Slope (ft/ft)	0.000666	Area (sq ft)	1698.89	1292.87	922.97
Q Total (cfs)	8780.00	Flow (cfs)	1376.79	6322.14	1081.07
Top Width (ft)	826.30	Top Width (ft)	564.57	90.24	171.49
Vel Total (ft/s)	2.25	Avg. Vel. (ft/s)	0.81	4.89	1.17
Max Chl Dpth (ft)	16.21	Hydr. Depth (ft)	3.10	14.33	5.38
Conv. Total (cfs)	340126.1	Conv. (cfs)	53335.3	244911.5	41879.3
Length Wtd. (ft)	287.79	Wetted Per. (ft)	546.97	94.09	172.97
Min Ch El (ft)	158.20	Shear (lb/sq ft)	0.13	0.57	0.22
Alpha	3.46	Stream Power (lb/ft s)	0.10	2.80	0.26
Frctn Loss (ft)	0.18	Cum Volume (acre-ft)	575.30	244.83	587.15
C & E Loss (ft)	0.01	Cum SA (acres)	93.10	16.89	99.49

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	177.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	176.98	Reach Len. (ft)	220.00	295.00	320.00
Crit W.S. (ft)	171.13	Flow Area (sq ft)	3186.23	1524.66	1374.08
E.G. Slope (ft/ft)	0.000765	Area (sq ft)	3637.82	1524.66	1374.08
Q Total (cfs)	15000.00	Flow (cfs)	3913.41	8917.19	2169.41
Top Width (ft)	1241.40	Top Width (ft)	970.49	90.24	180.67
Vel Total (ft/s)	2.47	Avg. Vel. (ft/s)	1.23	5.85	1.58

* Max Chl Dpth (ft)	* 18.78	* Hydr. Depth (ft)	* 5.18	* 16.90	* 7.61 *
* Conv. Total (cfs)	*542297.6	* Conv. (cfs)	*141482.0	*322384.7	* 78430.9 *
* Length Wtd. (ft)	* 280.89	* Wetted Per. (ft)	* 616.78	* 94.09	* 182.51 *
* Min Ch El (ft)	* 158.20	* Shear (lb/sq ft)	* 0.25	* 0.77	* 0.36 *
* Alpha	* 3.47	* Stream Power (lb/ft s)	* 0.30	* 4.53	* 0.57 *
* Frctn Loss (ft)	* 0.21	* Cum Volume (acre-ft)	* 976.97	* 304.55	* 1088.75 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 171.89	* 16.76	* 107.19 *

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

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* E.G. Elev (ft)	* 181.62	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.30	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 181.32	* Reach Len. (ft)	* 220.00	* 295.00	* 320.00 *
* Crit W.S. (ft)	* 173.49	* Flow Area (sq ft)	* 7117.96	* 1917.00	* 2191.49 *
* E.G. Slope (ft/ft)	*0.000634	* Area (sq ft)	*11406.21	* 1917.00	* 2191.49 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 9794.29	*11888.61	* 4017.10 *
* Top Width (ft)	* 3292.26	* Top Width (ft)	* 3002.37	* 90.24	* 199.65 *
* Vel Total (ft/s)	* 2.29	* Avg. Vel. (ft/s)	* 1.38	* 6.20	* 1.83 *
* Max Chl Dpth (ft)	* 23.12	* Hydr. Depth (ft)	* 7.06	* 21.24	* 10.98 *
* Conv. Total (cfs)	*1020762.0	* Conv. (cfs)	*389013.4	*472196.2	*159552.8 *
* Length Wtd. (ft)	* 272.21	* Wetted Per. (ft)	* 1009.10	* 94.09	* 202.06 *
* Min Ch El (ft)	* 158.20	* Shear (lb/sq ft)	* 0.28	* 0.81	* 0.43 *
* Alpha	* 3.63	* Stream Power (lb/ft s)	* 0.38	* 5.00	* 0.79 *
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 2269.96	* 400.08	* 1922.98 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 339.86	* 17.99	* 139.66 *

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 280.55

INPUT
Description: XS 280.55 (LETTERED CROSS-SECTION V)
Station Elevation Data num= 480

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	181.25	6.55	181.19	9.82	181.26	16.36	181.11	22.91	181.05
29.46	180.74	36	180.59	39.27	180.65	42.55	180.51	45.82	180.52
52.36	180.39	62.18	180.27	65.46	180.15	68.73	180.17	78.55	179.82
81.82	179.91	91.64	179.52	98.18	179.62	108	179.7	121.09	179.36
124.37	179.41	130.91	179.35	134.18	179.16	140.73	179.01	144	179.03
153.82	178.75	160.37	178.87	163.64	178.76	173.46	178.74	180	178.53
183.28	178.33	189.82	178.09	196.37	178.14	202.91	177.95	209.46	177.91
219.28	177.58	225.82	177.59	232.37	177.27	238.91	177.24	245.46	176.92
252.01	176.99	255.28	176.93	261.82	176.57	268.37	176.72	274.92	176.45
281.46	176.54	288.01	176.4	294.55	175.97	297.82	175.65	301.1	175.55
304.37	175.21	307.64	175.37	317.46	175.14	320.73	174.92	333.83	174.52
340.37	174.49	343.64	174.15	346.92	174.02	350.19	174.03	353.46	173.82
356.74	173.77	360.01	173.28	369.83	174.11	373.1	174.79	382.92	174.87
392.74	174.84	399.28	174.94	402.55	174.91	415.65	175.16	425.46	175.06
432.01	175.33	435.28	175.25	445.1	175.39	448.37	175.23	458.19	175.39
461.46	175.33	471.28	175.56	481.1	175.21	494.19	175.43	504.01	175.37
513.83	175.46	523.65	175.39	530.19	175.41	536.74	175.66	540.01	175.62
546.56	175.72	553.1	175.7	556.38	175.9	562.92	175.99	569.47	175.87
576.01	176.07	589.1	176.1	595.65	176.33	612.01	176.56	615.29	176.51
625.1	176.7	634.92	176.8	641.47	176.62	644.74	176.6	654.56	177.01
661.11	177.06	667.65	177.04	670.92	177.15	677.47	177.18	680.74	177
687.29	176.89	697.11	177.04	706.92	177.72	713.47	177.83	720.02	178.03
729.83	178.46	746.2	178.83	752.74	179.13	762.56	179.27	772.38	179.53
782.2	179.63	788.74	179.6	798.56	179.69	805.11	179.82	814.93	179.86
821.47	179.98	828.02	179.91	837.84	180.12	844.38	180.12	850.93	180.24
857.47	180.1	860.75	180.21	873.84	180.29	877.11	180.27	883.66	180.02
890.2	180.2	906.56	180.19	919.66	180.06	942.57	179.98	949.11	180
955.66	179.89	962.2	179.91	968.75	179.81	975.29	179.64	981.84	179.58
988.38	179.33	1004.75	179.05	1011.29	178.71	1017.84	178.62	1027.66	178.24
1030.93	178.07	1040.75	177.83	1050.57	177.69	1057.11	177.36	1060.39	177.26
1063.66	177.33	1086.57	177.39	1096.39	177.33	1102.93	177.15	1106.21	177.23
1122.57	176.72	1125.84	176.71	1129.11	176.86	1145.48	177.2	1152.02	177.16
1155.3	177.29	1174.93	177.41	1194.57	177.65	1201.12	177.59	1214.21	177.78
1224.03	177.97	1237.12	178.06	1256.75	178.26	1263.3	178.44	1269.85	178.47
1276.39	178.67	1282.95	178.95	1286.22	178.96	1299.33	179.53	1302.61	179.51
1318.99	179.83	1328.82	180.22	1348.49	180.52	1351.76	180.52	1358.32	180.38
1364.87	180.33	1371.43	180.21	1377.98	180.22	1384.54	180.09	1397.64	179.93
1414.03	179.46	1420.58	179.16	1423.86	179.16	1430.41	179	1436.97	178.93
1450.08	179.26	1459.91	179.35	1473.02	179.98	1482.85	180.22	1489.4	180.15
1495.96	180.31	1502.51	180.3	1535.28	180.64	1538.56	180.74	1545.11	180.62
1548.39	180.78	1554.94	180.77	1568.05	180.82	1571.33	180.78	1584.44	180.85
1587.71	180.82	1594.27	180.96	1597.55	180.91	1604.1	181.02	1610.65	180.95
1613.93	181.03	1630.32	180.97	1640.15	181.04	1653.26	181.03	1659.81	181.08
1666.36	181.04	1672.92	181.14	1676.2	181.06	1682.75	181.05	1689.3	181.11
1699.14	181.03	1722.08	180.67	1731.91	180.47	1748.29	180.49	1754.85	180.63
1758.12	180.53	1767.95	180.56	1774.51	180.49	1787.62	180.85	1790.89	180.87
1797.45	181.05	1810.56	181.25	1820.39	181.19	1826.94	181.2	1833.5	181.11
1849.88	181.27	1853.16	181.23	1859.71	180.99	1866.27	181.01	1872.82	180.94
1879.38	181.04	1885.93	181	1895.76	181.15	1899.04	181.27	1905.59	181.68
1914.04	181.84	1925.26	181.59	1935.09	181.38	1941.64	181.49	1944.92	181.3
1951.47	181.33	1961.3	181.63	1964.58	181.65	1971.13	181.41	1974.41	181.16
1977.69	181.05	1984.24	181.28	1994.07	181.41	1997.35	181.54	2007.18	181.63
2017.01	181.59	2023.57	181.49	2026.84	181.33	2036.68	180.5	2039.95	180.31
2046.51	180.28	2049.78	180.42	2056.34	180.93	2062.89	181.27	2069.45	181.17

2076	181.24	2082.56	181.39	2092.39	181.68	2108.77	181.43	2115.33	181.17
2121.88	181.28	2125.16	181.11	2131.71	180.19	2134.99	179.34	2138.27	178.97
2144.82	178.99	2157.93	179.73	2167.76	180.05	2177.59	180.15	2187.42	180.02
2190.7	179.91	2200.53	179.12	2207.08	178.25	2210.36	177.89	2216.92	177.58
2220.19	177.64	2226.75	177.92	2230.02	178.14	2236.58	178.19	2243.13	178.03
2256.24	177.96	2259.52	178.03	2269.35	178.07	2279.18	178.16	2289.01	178.1
2295.57	178.01	2302.12	178.11	2308.67	178.06	2311.95	177.96	2315.23	178.01
2318.51	177.81	2325.06	177.98	2328.34	178	2331.61	177.88	2338.17	178.05
2344.72	177.81	2354.55	178.06	2361.11	178.04	2364.38	177.94	2384.05	177.89
2390.6	177.8	2393.88	177.65	2397.16	177.65	2403.71	177.88	2410.26	177.66
2423.37	177.46	2433.2	177.15	2439.76	176.89	2443.03	176.97	2452.87	176.48
2459.42	176.63	2465.97	176.58	2472.53	176.16	2479.08	176.06	2485.64	175.83
2492.19	175.53	2495.47	175.49	2498.74	175.61	2502.02	175.38	2505.3	175.3
2511.85	175.3	2518.41	175.15	2524.96	174.79	2534.79	174.74	2544.62	174.32
2551.18	174.28	2564.29	173.95	2570.84	174.01	2580.67	173.68	2587.23	173.74
2590.5	173.56	2600.33	173.34	2606.89	173.28	2613.44	173.14	2620	173.13
2633.11	172.73	2639.66	172.62	2649.49	172.74	2652.77	172.6	2659.32	172.67
2665.88	172.49	2675.71	172.53	2682.26	172.35	2692.09	172.3	2698.65	172.36
2708.48	172.56	2715.03	172.48	2721.59	172.89	2724.86	172.89	2734.69	172.44
2747.8	172.07	2757.63	172.24	2770.74	172.27	2774.02	172.04	2790.41	171.57
2796.96	171.54	2803.51	171.36	2810.07	171.25	2816.62	170.72	2823.18	170.68
2829.73	170.57	2836.28	170.36	2842.84	170.32	2849.39	169.9	2862.5	169.87
2865.78	169.69	2875.61	169.63	2882.16	169.43	2888.72	169.55	2898.55	169.38
2911.66	169.64	2918.21	169.71	2924.77	169.88	2931.32	169.75	2941.15	169.73
2944.43	169.6	2950.98	169.73	2954.26	169.68	2960.81	169.88	2970.64	170.26
2973.92	170.17	2980.48	170.27	2990.31	170.33	2996.86	170.43	3003.42	170.38
3013.25	170.18	3026.36	170	3032.91	170.16	3036.19	170.36	3042.74	170.25
3049.29	170.24	3059.13	169.96	3065.68	169.56	3068.96	169.14	3072.23	168.54
3075.51	167.57	3078.79	166.09	3083.19	163.4	3085.34	162.08	3088.62	160.38
3091.9	159.76	3129	158	3157.44	159.93	3160.72	162.03	3163.99	164.46
3167.11	166.99	3170.55	167.88	3173.82	168.34	3177.1	168.63	3180.38	168.68
3186.93	168.56	3196.76	167.97	3209.87	167.65	3216.43	167.34	3222.98	167.17
3232.81	167.1	3239.37	167.2	3245.92	167.47	3252.47	167.65	3259.03	168.16
3262.3	168.19	3275.41	167.89	3285.24	167.94	3291.8	168.14	3298.35	167.99
3308.18	167.23	3311.46	167.35	3314.74	167.78	3318.02	168	3324.57	168.08
3334.4	167.81	3337.68	167.86	3344.23	167.64	3357.34	167.87	3370.45	168.42
3373.73	168.78	3377	169.48	3380.28	170.46	3383.56	171.61	3386.83	173.02
3390.11	174.63	3393.39	176.04	3396.67	177.3	3403.22	179.53	3406.5	180.92
3409.77	183.21	3413.05	183.68	3419.6	184.17	3422.88	184.7	3429.44	185.29
3442.54	185.92	3449.1	186.06	3455.65	185.73	3458.93	185.72	3465.48	185.84
3468.76	185.97	3472.04	185.9	3475.32	185.98	3481.87	186.41	3488.42	186.23
3494.98	186.19	3501.53	185.89	3508.09	186.06	3511.36	185.98	3517.92	185.97

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3083.19	.045	3167.11	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

3083.19	3167.11	1140	1140	1140	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	1674	185	F
3409	3517.92	185	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
922.45	1342.86	180.2296

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 178.25	* Element	* Left OB	* Channel

```
Right OB *
* Vel Head (ft)          *    0.30  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  177.95  * Reach Len. (ft)        * 1140.00  * 1140.00  *
1140.00  *
* Crit W.S. (ft)         *  171.78  * Flow Area (sq ft)      * 3861.77  * 1535.16  *
2210.54  *
* E.G. Slope (ft/ft)     *0.000707  * Area (sq ft)           * 4895.27  * 1535.16  *
2210.54  *
* Q Total (cfs)          *17700.00  * Flow (cfs)             * 4664.93  * 9125.33  *
3909.75  *
* Top Width (ft)         * 1586.14  * Top Width (ft)         * 1270.77  *   83.92  *
 231.46  *
* Vel Total (ft/s)       *    2.33  * Avg. Vel. (ft/s)       *    1.21  *    5.94  *
   1.77  *
* Max Chl Dpth (ft)      *   19.95  * Hydr. Depth (ft)       *    5.10  *   18.29  *
   9.55  *
* Conv. Total (cfs)      *665461.5  * Conv. (cfs)            *175385.8  *343082.2
*146993.6  *
* Length Wtd. (ft)       * 1140.00  * Wetted Per. (ft)       *  758.72  *   87.19  *
 233.50  *
* Min Ch El (ft)         *  158.00  * Shear (lb/sq ft)       *    0.22  *    0.78  *
   0.42  *
* Alpha                  *    3.56  * Stream Power (lb/ft s) *    0.27  *    4.62  *
   0.74  *
* Frctn Loss (ft)        *    1.10  * Cum Volume (acre-ft)   * 1237.08  *  320.56  *
1301.92  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *  206.02  *   16.17  *
 108.74  *
*******************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
*******************************************************************************
**********
* E.G. Elev (ft)         *  178.78  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.37  * Wt. n-Val.           *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  178.42  * Reach Len. (ft)      * 1140.00  * 1140.00  *
1140.00  *
* Crit W.S. (ft)         *  171.95  * Flow Area (sq ft)    * 2948.28  * 1574.65  *
1560.31  *
* E.G. Slope (ft/ft)     *0.000771  * Area (sq ft)         * 2948.28  * 1574.65  *
1560.31  *
* Q Total (cfs)          *17700.00  * Flow (cfs)           * 4796.61  * 9938.80  *
2964.59  *
* Top Width (ft)         *  600.00  * Top Width (ft)       *  369.19  *   83.92  *
 146.89  *
* Vel Total (ft/s)       *    2.91  * Avg. Vel. (ft/s)     *    1.63  *    6.31  *
   1.90  *
* Max Chl Dpth (ft)      *   20.42  * Hydr. Depth (ft)     *    7.99  *   18.76  *
  10.62  *
```

* Conv. Total (cfs)	*637419.1	* Conv. (cfs)	*172737.3	*357919.8	*106761.9	*
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 376.56	* 87.19	* 157.90	*
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.38	* 0.87	* 0.48	*
* Alpha	* 2.80	* Stream Power (lb/ft s)	* 0.61	* 5.49	* 0.90	*
* Frctn Loss (ft)	* 1.09	* Cum Volume (acre-ft)	* 303.98	* 329.08	* 711.95	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 25.78	* 15.88	* 30.97	*

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Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 174.49	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.24	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 174.24	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00	*
* Crit W.S. (ft)	* 166.65	* Flow Area (sq ft)	* 1605.28	* 1224.47	* 1371.76	*
* E.G. Slope (ft/ft)	*0.000617	* Area (sq ft)	* 1616.85	* 1224.47	* 1371.76	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 1237.09	* 5845.91	* 1697.01	*
* Top Width (ft)	* 864.43	* Top Width (ft)	* 558.30	* 83.92	* 222.21	*
* Vel Total (ft/s)	* 2.09	* Avg. Vel. (ft/s)	* 0.77	* 4.77	* 1.24	*
* Max Chl Dpth (ft)	* 16.24	* Hydr. Depth (ft)	* 3.03	* 14.59	* 6.17	*
* Conv. Total (cfs)	*353483.9	* Conv. (cfs)	* 49805.2	*235356.9	* 68321.8	*
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 532.05	* 87.19	* 223.54	*
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.12	* 0.54	* 0.24	*
* Alpha	* 3.56	* Stream Power (lb/ft s)	* 0.09	* 2.58	* 0.29	*
* Frctn Loss (ft)	* 0.90	* Cum Volume (acre-ft)	* 566.93	* 236.31	* 578.72	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 90.27	* 16.30	* 98.05	*

****

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 177.09	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.30	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 176.79	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 171.01	* Flow Area (sq ft)	* 3091.22	* 1438.15	* 1944.91 *
* E.G. Slope (ft/ft)	*0.000720	* Area (sq ft)	* 3590.64	* 1438.15	* 1944.91 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 3527.90	* 8254.92	* 3217.18 *
* Top Width (ft)	* 1338.78	* Top Width (ft)	* 1026.63	* 83.92	* 228.23 *
* Vel Total (ft/s)	* 2.32	* Avg. Vel. (ft/s)	* 1.14	* 5.74	* 1.65 *
* Max Chl Dpth (ft)	* 18.79	* Hydr. Depth (ft)	* 4.86	* 17.14	* 8.52 *
* Conv. Total (cfs)	*559151.5	* Conv. (cfs)	*131508.6	*307716.7	*119926.2 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 638.10	* 87.19	* 230.08 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.22	* 0.74	* 0.38 *
* Alpha	* 3.54	* Stream Power (lb/ft s)	* 0.25	* 4.25	* 0.63 *
* Frctn Loss (ft)	* 1.11	* Cum Volume (acre-ft)	* 958.72	* 294.52	* 1076.56 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 166.85	* 16.17	* 105.69 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 181.44	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.26	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 181.18	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 173.73	* Flow Area (sq ft)	* 6884.72	* 1806.53	* 2973.55 *
* E.G. Slope (ft/ft)	*0.000589	* Area (sq ft)	*10871.50	* 1806.53	* 2973.55 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 9068.40	*10926.00	* 5705.60 *
* Top Width (ft)	* 3171.94	* Top Width (ft)	* 2848.26	* 83.92	* 239.76 *
* Vel Total (ft/s)	* 2.20	* Avg. Vel. (ft/s)	* 1.32	* 6.05	* 1.92 *

* Max Chl Dpth (ft)	* 23.18	* Hydr. Depth (ft)	* 5.80	* 21.53	* 12.40 *
* Conv. Total (cfs)	*1058504.0	* Conv. (cfs)	*373499.4	*450008.2	*234996.1 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 1189.65	* 87.19	* 242.43 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.21	* 0.76	* 0.45 *
* Alpha	* 3.50	* Stream Power (lb/ft s)	* 0.28	* 4.61	* 0.87 *
* Frctn Loss (ft)	* 0.96	* Cum Volume (acre-ft)	* 2213.71	* 387.47	* 1904.01 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 325.09	* 17.40	* 138.05 *

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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270

INPUT
Description: XS 270
THIS CROSS SECTION IS THE INSERTED CROSS SECTION TO
REPRESENT
FILL PLACED SINCE THE EFFECTIVE FIS WAS
COMPLETED
THERE IS AN ENCR. IN THE NAT. RUN TO REFLECT EFFECTIVE
FLOW
Station Elevation Data num= 413

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	179.56	13.12	179.24	19.68	179.24	32.8	178.98	36.08	178.79
42.64	178.63	52.48	178.7	62.32	178.52	68.88	178.54	72.16	178.34
75.44	178.43	82	178.32	88.56	178.04	91.83	177.83	95.11	178.01
101.67	177.89	108.23	177.62	124.63	177.42	127.91	177.27	134.47	177.12
141.03	177.16	147.59	177.11	157.43	176.69	170.55	176.47	173.83	176.55
177.11	176.39	180.39	176.57	193.51	176.45	200.07	176.1	209.91	176.18
216.47	176.06	219.75	175.79	223.03	176	232.87	175.65	236.15	175.43
242.71	175.63	249.27	175.23	252.55	175.5	259.11	175.53	265.67	175.37
268.94	175.43	275.5	175.24	278.78	175.36	282.06	175.33	288.62	175.07
295.18	175.01	301.74	175.12	308.3	174.79	311.58	174.89	314.86	174.6
318.14	174.58	324.7	174.26	331.26	174.32	337.82	174.03	344.38	173.44
350.94	173.18	354.22	172.81	360.78	172.74	364.06	172.55	370.62	173.27
373.9	173.31	380.46	173.54	387.02	173.86	390.3	173.87	393.58	173.65
396.86	173.86	400.14	174.23	403.42	174.44	409.98	174.45	413.26	174.58
423.1	174.6	432.94	174.56	449.33	174.68	465.73	174.77	475.57	174.72
478.85	174.79	482.13	174.71	488.69	175.02	495.25	175	501.81	175.11
511.65	175.07	518.21	175.15	521.49	175.31	531.33	175.42	534.61	175.53
541.17	175.35	551.01	175.23	560.85	175.23	567.41	175.46	570.69	175.68
577.25	175.9	593.65	176.12	596.93	176.28	613.33	176.29	623.17	176.37

629.73	176.6	633	176.57	642.84	176.77	649.4	176.69	659.24	176.89
665.8	176.82	669.08	176.94	678.92	176.88	685.48	177.25	692.04	177.15
701.88	177.29	708.44	177.52	715	177.28	724.84	177.35	728.12	177.52
734.68	177.58	741.24	177.88	747.8	178.28	757.64	178.79	760.92	178.85
767.48	178.66	770.76	178.77	777.32	179.36	780.6	179.5	787.16	179.56
797	179.79	806.84	179.93	810.12	179.87	819.96	179.94	826.51	179.93
833.07	180.1	842.91	180.17	849.47	180.31	852.75	180.27	862.59	180.39
869.15	180.37	882.27	180.47	888.83	180.41	895.39	180.45	898.67	180.56
911.79	180.59	921.63	180.44	934.75	180.44	947.87	180.3	954.43	180.32
964.27	180.26	970.83	180.28	980.67	180.17	990.51	180.13	997.07	180.16
1010.19	179.97	1016.74	179.99	1039.7	179.75	1046.26	179.73	1059.38	179.48
1065.94	179.46	1072.5	179.58	1082.34	179.47	1088.9	179.25	1102.02	179.19
1105.3	179.11	1111.86	179.18	1124.98	178.95	1138.1	178.92	1144.66	178.98
1161.06	178.88	1170.9	178.62	1174.18	178.59	1187.3	178.75	1193.86	178.87
1200.42	178.91	1213.53	179.35	1220.09	179.43	1229.93	179.84	1243.05	180.11
1246.33	180.12	1262.73	180.32	1285.69	180.32	1302.09	180.03	1311.93	179.96
1318.49	179.81	1325.05	179.79	1331.61	179.63	1348.01	179.67	1354.57	179.52
1374.23	179.73	1387.33	180.02	1393.88	180.05	1400.43	180.16	1410.26	180.2
1416.81	180.37	1423.35	180.33	1433.18	180.51	1446.28	180.41	1452.83	180.51
1465.93	180.44	1472.48	180.32	1482.3	180.26	1501.95	180.02	1505.23	180.02
1524.88	179.5	1531.42	179.17	1537.97	178.99	1544.52	178.92	1551.07	178.61
1567.45	178.21	1570.72	178.17	1583.82	177.61	1590.37	177.43	1596.92	177.47
1603.47	177.81	1613.3	177.95	1619.85	178.12	1629.67	178.45	1632.95	178.47
1639.49	178.84	1646.04	179.11	1662.42	179.63	1668.97	179.69	1675.52	179.89
1682.07	179.87	1688.62	179.93	1691.89	179.76	1701.72	179.86	1711.54	179.86
1721.37	179.77	1731.19	179.96	1734.47	180.1	1741.02	180.14	1754.11	180.13
1770.49	180.35	1777.04	180.16	1786.86	180.26	1793.41	180.22	1806.51	180.22
1809.79	180.15	1816.34	180.35	1822.89	180.17	1826.16	180.31	1835.99	180.13
1839.26	180.25	1845.81	180.13	1852.36	180.27	1855.64	180.19	1862.18	180.27
1872.01	180.15	1885.11	180.24	1891.66	180.12	1894.93	180.2	1911.31	180.26
1914.58	180.19	1917.86	180.27	1930.96	180.21	1940.78	179.66	1947.33	179.51
1960.43	179.97	1966.98	180.14	1970.26	180.3	1980.08	180.22	1989.9	180.32
1996.45	180.32	2003	180.42	2009.55	180.36	2016.1	180.48	2022.65	180.46
2029.2	180.62	2039.03	180.74	2045.58	180.75	2052.13	180.97	2058.68	180.92
2075.05	181.03	2081.6	180.92	2091.43	180.91	2104.53	180.7	2114.35	180.71
2117.63	180.57	2127.45	180.54	2198.5	182.79	2199	202.8	2259	202.8
2259	182.8	2344	182.8	2344	202.8	2404	202.8	2404	182.8
2569	181.4	2569	201.4	2639	201.4	2639	180.6	2729	180.4
2729	200.4	2789	200.4	2789	182.8	2857.77	180.87	2861.05	180.93
2867.6	180.86	2877.44	180.86	2880.71	180.75	2890.55	180.74	2897.1	180.65
2900.38	180.71	2916.77	180.64	2926.61	180.68	2943	180.62	2949.55	180.67
2965.94	180.57	2969.22	180.51	2979.06	180.49	2985.61	180.42	2988.89	180.46
3002	180.39	3015.12	180.23	3021.67	180.31	3038.06	180.23	3054.45	180.18
3067.57	180.08	3074.12	179.99	3080.68	179.98	3083.96	179.9	3087.23	179.97
3097.07	179.84	3106.9	179.87	3110.18	179.79	3116.74	179.78	3123.29	179.69
3133.13	179.69	3136.41	179.58	3142.96	179.63	3152.8	179.58	3159.35	179.5
3162.63	179.56	3169.19	179.47	3178.98	179.6	3188.77	179.58	3201.83	179.32
3208.35	179.1	3218.15	178.61	3224.67	178.07	3234.47	175.7	3240.99	173.86
3244.26	173.33	3247.52	172.62	3254.05	170.53	3257.31	169.6	3263.84	168.38
3267.11	168.05	3270.37	167.97	3276.9	167.97	3280.16	168.21	3286.69	168.26
3289.95	168.37	3296.48	168.78	3303.01	168.61	3309.54	168.58	3316.06	168.33
3319.33	168.35	3325.86	168.09	3335.65	168.06	3338.91	167.88	3345.44	167.84
3358.5	167.12	3368.29	166.93	3374.82	167.27	3387.87	167.73	3400.93	167.95
3407.45	167.91	3413.98	168.17	3420.51	168.22	3427.04	168.36	3430.3	168.23
3436.83	168.21	3443.36	168.08	3449.89	168.18	3459.68	168.47	3469.47	168.48
3476	168.57	3485.79	168.6	3489.05	168.78	3498.84	168.86	3505.37	168.73
3515.17	168.9	3528.22	168.93	3531.48	169.05	3538.01	169.07	3541.28	169.3
3547.8	169.49	3551.07	169.39	3554.33	169.06	3557.6	168.98	3564.12	169.14
3570.65	168.82	3573.92	167.56	3577.18	165.02	3621.5	157.7	3668.57	162.54
3671.83	165.77	3675.1	172.07	3678.36	177.72	3681.63	181.75	3684.89	184.89
3688.15	187.54	3691.42	189.63	3694.68	192.46	3701.21	198.65	3704.47	201.51
3707.74	202.89	3711	203.18	3720.79	203.66	3737.11	204.34	3740.38	204.4
3746.9	204.86	3750.17	205.21	3753.43	205.04	3756.7	205.34	3759.96	204.92

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 3766.49  205.03 3773.02  204.97 3779.54  205.15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0      .1 3570.65    .045  3675.1      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       3570.65  3675.1              515     515     515             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3179     180       F
    3739 3779.54     180       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
 1509.55 1675.03  179.84

CROSS SECTION OUTPUT  Profile #1%
************************************************************************************
***********
* E.G. Elev (ft)         *  177.12  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.60  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  176.52  * Reach Len. (ft)       *  515.00  *  515.00  *
 515.00  *
* Crit W.S. (ft)         *  171.46  * Flow Area (sq ft)     * 2653.07  * 1569.80  *
   5.72  *
* E.G. Slope (ft/ft)     *0.001500  * Area (sq ft)          * 3313.63  * 1569.80  *
   5.72  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            * 5996.77  *11699.69  *
   3.53  *
* Top Width (ft)         *  898.81  * Top Width (ft)        *  791.80  *  104.45  *
   2.57  *
* Vel Total (ft/s)       *    4.19  * Avg. Vel. (ft/s)      *    2.26  *    7.45  *
   0.62  *
* Max Chl Dpth (ft)      *   18.82  * Hydr. Depth (ft)      *    7.81  *   15.03  *
   2.23  *
* Conv. Total (cfs)      *457063.9  * Conv. (cfs)           *154853.6  *302119.1  *
   91.2  *
* Length Wtd. (ft)       *  515.00  * Wetted Per. (ft)      *  340.79  *  111.56  *
   5.14  *
* Min Ch El (ft)         *  157.70  * Shear (lb/sq ft)      *    0.73  *    1.32  *
   0.10  *
* Alpha                  *    2.19  * Stream Power (lb/ft s) *    1.65  *    9.82  *
   0.06  *
* Frctn Loss (ft)        *    0.70  * Cum Volume (acre-ft)  * 1129.67  *  279.93  *
1272.92  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)        *  179.03  *   13.71  *
 105.67  *
************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
************************************************************************************
***********
* E.G. Elev (ft)         *  177.68  * Element               *  Left OB *  Channel *
Right OB *
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* Vel Head (ft)	* 0.52	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 177.16	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00	*
* Crit W.S. (ft)	* 171.45	* Flow Area (sq ft)	* 2870.94	* 1636.57	* 7.48	*
* E.G. Slope (ft/ft)	*0.001254	* Area (sq ft)	* 2870.94	* 1636.57	* 7.48	*
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 6227.21	*11468.17	* 4.62	*
* Top Width (ft)	* 449.00	* Top Width (ft)	* 341.65	* 104.45	* 2.90	*
* Vel Total (ft/s)	* 3.92	* Avg. Vel. (ft/s)	* 2.17	* 7.01	* 0.62	*
* Max Chl Dpth (ft)	* 19.46	* Hydr. Depth (ft)	* 8.40	* 15.67	* 2.58	*
* Conv. Total (cfs)	*499812.4	* Conv. (cfs)	*175843.9	*323837.9	* 130.6	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 343.06	* 111.56	* 5.87	*
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.66	* 1.15	* 0.10	*
* Alpha	* 2.18	* Stream Power (lb/ft s)	* 1.42	* 8.05	* 0.06	*
* Frctn Loss (ft)	* 0.57	* Cum Volume (acre-ft)	* 227.83	* 287.06	* 691.43	*
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 16.47	* 13.41	* 29.01	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 173.58	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.35	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 173.23	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00	*
* Crit W.S. (ft)	* 167.38	* Flow Area (sq ft)	* 1555.07	* 1225.56	* 0.39	*
* E.G. Slope (ft/ft)	*0.001095	* Area (sq ft)	* 1562.81	* 1225.56	* 0.39	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 2163.27	* 6616.65	* 0.08	*
* Top Width (ft)	* 451.48	* Top Width (ft)	* 346.36	* 104.45	* 0.67	*
* Vel Total (ft/s)	* 3.16	* Avg. Vel. (ft/s)	* 1.39	* 5.40	* 0.21	*
* Max Chl Dpth (ft)	* 15.53	* Hydr. Depth (ft)	* 4.77	* 11.73	* 0.58	*
* Conv. Total (cfs)	*265370.3	* Conv. (cfs)	* 65383.5	*199984.3	* 2.5	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 326.71	* 111.56	* 1.34	*
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.33	* 0.75	* 0.02	*
* Alpha	* 2.25	* Stream Power (lb/ft s)	* 0.45	* 4.05	* 0.00	*

* Frctn Loss (ft)	* 0.52	* Cum Volume (acre-ft)	* 525.32	* 204.25	* 560.77 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 78.43	* 13.83	* 95.13 *

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

****

* E.G. Elev (ft)	* 175.95	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.56	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 175.39	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	* 170.78	* Flow Area (sq ft)	* 2270.43	* 1451.30	* 3.18 *
* E.G. Slope (ft/ft)	*0.001513	* Area (sq ft)	* 2512.41	* 1451.30	* 3.18 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 4688.64	*10309.74	* 1.62 *
* Top Width (ft)	* 731.14	* Top Width (ft)	* 624.78	* 104.45	* 1.91 *
* Vel Total (ft/s)	* 4.03	* Avg. Vel. (ft/s)	* 2.07	* 7.10	* 0.51 *
* Max Chl Dpth (ft)	* 17.69	* Hydr. Depth (ft)	* 6.78	* 13.89	* 1.66 *
* Conv. Total (cfs)	*385661.9	* Conv. (cfs)	*120548.6	*265071.7	* 41.6 *
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 336.14	* 111.56	* 3.83 *
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.64	* 1.23	* 0.08 *
* Alpha	* 2.22	* Stream Power (lb/ft s)	* 1.32	* 8.73	* 0.04 *
* Frctn Loss (ft)	* 0.71	* Cum Volume (acre-ft)	* 878.86	* 256.71	* 1051.07 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 145.24	* 13.71	* 102.67 *

****

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 180.44	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.72	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.72	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	* 173.05	* Flow Area (sq ft)	* 3781.05	* 1904.07	* 17.36 *
* E.G. Slope (ft/ft)	*0.001466	* Area (sq ft)	* 6647.14	* 1904.07	*

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  17.36  *
* Q Total (cfs)          *25700.00  * Flow (cfs)             * 9728.57  *15956.24  *
  15.19  *
* Top Width (ft)         * 1592.99  * Top Width (ft)         * 1483.65  *  104.45  *
   4.88  *
* Vel Total (ft/s)       *    4.51  * Avg. Vel. (ft/s)       *    2.57  *    8.38  *
   0.88  *
* Max Chl Dpth (ft)      *   22.02  * Hydr. Depth (ft)       *    9.65  *   18.23  *
   3.55  *
* Conv. Total (cfs)      *671292.0  * Conv. (cfs)            *254113.2  *416782.0  *
  396.9  *
* Length Wtd. (ft)       *  515.00  * Wetted Per. (ft)       *  393.08  *  111.56  *
   9.10  *
* Min Ch El (ft)         *  157.70  * Shear (lb/sq ft)       *    0.88  *    1.56  *
   0.17  *
* Alpha                  *    2.27  * Stream Power (lb/ft s) *    2.26  *   13.09  *
   0.15  *
* Frctn Loss (ft)        *    0.65  * Cum Volume (acre-ft)   * 1984.47  *  338.92  *
1864.88  *
* C & E Loss (ft)        *    0.10  * Cum SA (acres)         *  268.40  *   14.94  *
 134.85  *
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Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264

INPUT
Description: XS 264 (LETTERED CROSS-SECTION U)
THIS SECTION IS THE FIRST
SECTION U/S OF THE DIVIDED FLOW INSERTED
AN INEFFECTIVE FLOW
ENCROACHMENT AT 500' FROM LEFT CHANNEL BANK FOR THE
NATURAL RUN.
INEFFECTIVE FLOW AREA DUE TO FILL PLACED IN FLOODPLAIN
Station Elevation Data num= 489

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180.25	3.28	180.24	13.12	180	19.68	179.94	29.51	179.65
39.35	179.7	49.19	179.48	62.31	179.52	68.87	179.23	72.15	179.18
81.98	179.21	91.82	178.97	98.38	179.04	104.94	178.84	108.22	178.83
114.78	178.64	131.17	178.53	141.01	178.39	147.57	178.13	157.41	178.04
160.69	178.12	170.53	177.78	180.36	177.66	186.92	177.81	196.76	177.64
203.32	177.64	209.88	177.41	216.44	177.45	223	177.2	226.28	177.19
232.83	176.94	239.39	177.03	249.23	176.44	255.79	176.43	262.35	176.31
275.47	176.15	285.3	175.9	291.86	175.63	298.42	175.6	304.98	175.45
311.54	175.43	314.82	175.56	318.1	175.49	324.66	175.17	331.21	175.01
334.49	175.11	341.05	174.95	347.61	174.89	350.89	174.94	360.73	174.84
367.29	174.7	373.85	174.67	400.08	174.65	406.64	174.57	413.2	174.76
419.76	174.7	429.59	174.48	439.43	174.77	445.99	174.72	462.39	174.8
475.51	174.75	482.06	174.84	491.9	174.68	501.74	174.8	505.02	174.6
508.3	174.01	514.86	174.13	518.14	174.47	521.42	174.64	527.97	174.52
537.81	174.81	541.09	174.73	550.93	174.75	564.05	174.54	570.61	174.64
580.44	174.6	587	174.64	590.28	174.51	596.84	174.47	613.24	174.62

619.8	174.89	623.08	174.94	629.63	175.21	639.47	175.38	646.03	175.41
659.15	175.55	665.71	175.53	668.99	175.61	675.54	175.52	682.1	175.08
685.38	174.62	688.66	173.36	691.94	173.13	698.5	172	705.06	171.71
711.62	171.92	714.9	172.13	721.46	172.15	734.57	172.67	741.13	173.54
744.41	173.86	750.97	174.25	754.25	174.22	760.81	174.35	770.65	174.23
773.92	174.36	787.04	174.35	793.6	174.52	800.16	174.5	806.72	174.7
810	174.72	816.56	174.92	819.84	174.93	829.67	174.74	839.51	174.99
859.19	175.06	865.75	174.99	869.02	175.15	878.86	175.22	885.42	175.33
891.98	175.31	905.1	175.52	914.94	175.54	921.49	175.66	924.77	175.62
928.05	175.74	944.45	175.69	954.29	175.98	957.57	175.94	964.13	175.7
970.68	175.92	977.24	175.93	987.08	176.16	1000.2	176.25	1006.76	176.39
1016.59	176.4	1023.15	176.5	1029.71	176.71	1036.27	176.67	1039.55	176.83
1052.67	177.01	1059.23	177.03	1075.62	177.26	1078.9	177.19	1085.46	177.25
1092.02	177.16	1101.86	177.41	1114.98	177.28	1121.53	177.41	1124.81	177.33
1144.49	177.73	1154.33	177.8	1160.89	177.77	1167.45	177.92	1170.72	177.89
1180.56	178.01	1190.4	178.04	1200.24	178.01	1210.08	178.27	1226.47	178.36
1229.75	178.3	1239.59	178.6	1249.43	178.78	1255.99	179	1259.27	179.02
1265.83	179.26	1278.94	179.39	1285.5	179.55	1292.06	179.61	1295.34	179.74
1298.62	180.05	1315.02	180.19	1318.3	180.14	1331.41	180.31	1341.25	180.37
1354.37	180.35	1360.93	180.41	1367.49	180.37	1380.6	180.4	1393.72	180.56
1410.12	180.61	1416.68	180.57	1446.19	180.66	1459.31	180.62	1462.59	180.7
1469.15	180.63	1472.42	180.72	1478.98	180.61	1485.54	180.65	1495.38	180.55
1498.66	180.62	1501.94	180.52	1511.78	180.47	1521.62	180.32	1534.73	180.39
1547.85	180.23	1554.41	180.34	1557.69	180.25	1580.64	180.06	1593.76	180.05
1603.6	179.89	1610.16	179.69	1623.28	179.73	1639.67	179.43	1649.51	178.86
1659.35	178.52	1669.19	177.93	1675.75	177.75	1688.86	177.94	1692.14	177.83
1701.98	177.79	1711.82	177.55	1724.94	177.42	1728.21	177.31	1738.05	177.19
1744.61	177.19	1754.45	177.09	1757.73	176.98	1767.57	176.94	1780.68	176.82
1790.52	176.54	1810.2	176.77	1813.48	176.84	1823.32	176.68	1833.15	176.73
1842.99	176.69	1846.27	176.75	1856.11	176.67	1859.39	176.78	1872.51	176.79
1875.79	176.88	1879.07	176.78	1885.62	176.78	1892.18	176.69	1895.46	176.76
1898.74	176.6	1905.3	176.89	1908.58	176.88	1915.14	177.03	1928.26	177.07
1931.53	177.15	1941.37	177.14	1944.65	177.2	1954.49	177.13	1970.89	177.27
1990.56	177.55	1993.84	177.49	2000.4	177.54	2006.96	177.46	2029.92	177.78
2039.75	177.79	2046.31	178.07	2052.87	178.24	2059.43	178.25	2069.27	178.18
2072.55	178.28	2085.67	178.22	2095.5	178.32	2098.78	178.23	2108.62	178.33
2118.46	178.29	2134.86	178.36	2138.14	178.3	2144.69	178.41	2151.25	178.44
2157.81	178.32	2167.65	178.34	2180.77	178.47	2187.33	178.41	2197.16	178.42
2203.72	178.35	2216.84	178.36	2220.12	178.28	2236.52	178.14	2239.8	178.2
2252.91	178.07	2262.75	177.67	2266.03	177.67	2269.31	177.5	2285.71	177.29
2295.55	177.3	2302.1	177.12	2311.94	176.6	2315.22	176.5	2325.06	176.36
2328.34	176.37	2338.18	176.14	2344.74	175.83	2361.13	175.8	2374.25	175.6
2380.81	175.6	2387.37	175.5	2393.93	175.51	2400.49	175.42	2407.05	175.51
2416.88	175.46	2420.16	175.32	2426.72	175.37	2433.28	175.28	2439.84	175.3
2449.68	175.15	2462.8	175.2	2472.63	174.98	2475.91	175.01	2482.47	174.82
2492.31	174.73	2508.71	174.65	2518.55	174.4	2525.1	173.74	2528.38	173.51
2534.94	173.55	2538.22	173.42	2544.78	173.59	2551.34	173.39	2561.18	173.37
2567.74	173.14	2577.57	173.32	2580.85	173.5	2587.41	174.02	2593.97	174.89
2600.53	175.67	2603.81	176.15	2610.37	176.64	2616.93	176.82	2626.77	176.76
2630.04	176.81	2639.88	176.79	2643.16	176.68	2649.72	176.64	2653	176.73
2662.84	176.65	2669.4	176.52	2679.24	175.88	2689.07	175.6	2695.63	175.76
2705.47	175.3	2715.31	175.45	2721.87	175.68	2734.98	175.65	2741.54	175.85
2744.82	175.87	2754.66	175.68	2761.22	175.62	2774.34	175.33	2780.9	175.67
2790.73	175.15	2797.29	175.18	2800.57	175.45	2807.13	175.8	2816.97	177.01
2826.81	177.98	2836.65	178.49	2843.2	178.52	2856.32	178.24	2859.6	177.97
2862.88	177.92	2866.16	178.46	2882.56	178.47	2895.68	178.44	2902.23	178.54
2908.79	178.54	2912.07	178.29	2915.35	177.8	2918.63	177.07	2925.19	175.26
2928.47	174.59	2931.75	174.15	2938.31	173.8	2951.42	173.54	2954.7	173.3
2957.98	172.89	2961.26	172.27	2967.82	170.8	2974.38	169.65	2977.66	169.56
2984.22	169.81	2990.78	169.55	2997.34	168.86	3000.62	168.65	3010.45	168.46
3017.01	168.49	3020.29	168.32	3026.85	168.34	3036.69	168.63	3046.53	168.18
3056.37	168.33	3062.92	167.77	3076.04	167.74	3082.6	168.02	3089.16	168.03
3095.72	167.83	3102.28	168.03	3108.84	168.01	3115.39	168.16	3118.67	168.14

3125.23	167.76	3135.07	167.71	3141.63	167.46	3144.91	167.49	3151.47	167.83
3161.31	167.93	3167.86	168.13	3174.42	167.76	3180.98	167.61	3187.54	167.34
3190.82	167.33	3197.38	167.66	3203.94	167.51	3213.78	167.94	3220.33	167.98
3223.61	167.9	3226.89	167.6	3240.01	167.36	3246.57	167.44	3253.13	167.15
3266.25	167.01	3276.08	167.12	3282.64	166.87	3285.92	166.91	3295.76	167.38
3302.32	167.19	3315.44	167.25	3322	167.2	3335.11	167	3341.67	167.14
3348.23	166.88	3354.79	166.73	3361.35	166.77	3374.47	166.67	3381.03	166.34
3384.3	166	3390.86	165.9	3394.14	166.17	3397.42	166.65	3403.98	166.71
3410.54	167.06	3417.1	167	3423.66	167.16	3426.94	167.08	3436.77	167.49
3443.33	167.44	3449.89	167.22	3456.45	167.23	3459.73	167.44	3463.01	167.49
3466.29	167.32	3476.13	167.49	3489.24	167.33	3499.08	167.27	3508.92	167.44
3515.48	167.08	3525.32	167.43	3541.72	167.3	3548.27	167	3558.11	167.26
3564.67	167.18	3574.51	167.28	3581.07	167.2	3587.63	167.31	3590.91	167.49
3597.46	167.58	3607.3	168.06	3610.58	168	3617.14	168.28	3626.98	168.13
3633.54	168.48	3640.1	168.58	3643.38	168.49	3646.66	168.6	3653.21	168.61
3666.33	168.72	3672.89	168.66	3676.17	168.77	3676.58	168.59	3679.45	167.29
3682.73	164.44	3686.01	161.31	3690	160	3720	157.5	3745	160
3748.32	160.82	3751.6	163.96	3754.88	169	3757.31	173.44	3761.43	180.53
3764.71	185.66	3767.99	189.21	3771.27	190.06	3781.11	191.88		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3676.58	.045	3754.88	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

3676.58	3754.88	1330	1300	1000	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3176.1	180	F
3790	3781.11	180	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
2326.42	2605.17	176.19

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	176.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	175.98	Reach Len. (ft)	1330.00	1300.00	1000.00
Crit W.S. (ft)	170.99	Flow Area (sq ft)	4302.67	1235.45	13.44
E.G. Slope (ft/ft)	0.001202	Area (sq ft)	6921.54	1235.45	13.44
Q Total (cfs)	17700.00	Flow (cfs)	9296.63	8393.59	9.79
Top Width (ft)	1664.30	Top Width (ft)	1582.10	78.30	3.91
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	2.16	6.79	0.73
Max Chl Dpth (ft)	18.48	Hydr. Depth (ft)	8.60	15.78	3.44
Conv. Total (cfs)	510630.5	Conv. (cfs)	268200.1	242148.1	282.3
Length Wtd. (ft)	1314.74	Wetted Per. (ft)	500.78	85.43	8.00
Min Ch El (ft)	157.50	Shear (lb/sq ft)	0.64	1.08	0.13

* Alpha	* 2.39	* Stream Power (lb/ft s)	* 1.39	* 7.37	* 0.09	*
* Frctn Loss (ft)	* 0.81	* Cum Volume (acre-ft)	* 1069.16	* 263.35	* 1272.80	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 165.00	* 12.63	* 105.64	*

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 177.05	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.32	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 176.73	* Reach Len. (ft)	* 1330.00	* 1300.00	* 1000.00	*
* Crit W.S. (ft)	* 170.99	* Flow Area (sq ft)	* 4679.99	* 1294.49	* 16.51	*
* E.G. Slope (ft/ft)	*0.000962	* Area (sq ft)	* 5301.66	* 1294.49	* 16.51	*
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 9569.99	* 8118.45	* 11.56	*
* Top Width (ft)	* 652.90	* Top Width (ft)	* 570.48	* 78.30	* 4.12	*
* Vel Total (ft/s)	* 2.95	* Avg. Vel. (ft/s)	* 2.04	* 6.27	* 0.70	*
* Max Chl Dpth (ft)	* 19.23	* Hydr. Depth (ft)	* 9.35	* 16.53	* 4.01	*
* Conv. Total (cfs)	*570645.0	* Conv. (cfs)	*308534.8	*261737.3	* 372.8	*
* Length Wtd. (ft)	* 1315.17	* Wetted Per. (ft)	* 500.78	* 85.43	* 8.81	*
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.56	* 0.91	* 0.11	*
* Alpha	* 2.33	* Stream Power (lb/ft s)	* 1.15	* 5.71	* 0.08	*
* Frctn Loss (ft)	* 0.65	* Cum Volume (acre-ft)	* 179.52	* 269.73	* 691.29	*
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 11.08	* 12.33	* 28.97	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 173.03	* Element	* Left OB	* Channel	* Right OB *

* Vel Head (ft)	* 0.25	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 172.78	* Reach Len. (ft)	* 1330.00	* 1300.00	* 1000.00 *
* Crit W.S. (ft)	* 168.90	* Flow Area (sq ft)	* 2701.05	* 984.88	* 3.91 *
* E.G. Slope (ft/ft)	*0.000920	* Area (sq ft)	* 3670.15	* 984.88	* 3.91 *
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 3744.23	* 5034.12	* 1.65 *
* Top Width (ft)	* 839.81	* Top Width (ft)	* 759.44	* 78.30	* 2.07 *
* Vel Total (ft/s)	* 2.38	* Avg. Vel. (ft/s)	* 1.39	* 5.11	* 0.42 *
* Max Chl Dpth (ft)	* 15.28	* Hydr. Depth (ft)	* 5.40	* 12.58	* 1.89 *
* Conv. Total (cfs)	*289455.3	* Conv. (cfs)	*123438.3	*165962.6	* 54.5 *
* Length Wtd. (ft)	* 1310.52	* Wetted Per. (ft)	* 500.78	* 85.43	* 4.31 *
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.31	* 0.66	* 0.05 *
* Alpha	* 2.79	* Stream Power (lb/ft s)	* 0.43	* 3.38	* 0.02 *
* Frctn Loss (ft)	* 0.76	* Cum Volume (acre-ft)	* 494.39	* 191.18	* 560.74 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 71.89	* 12.75	* 95.12 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 175.18	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.37	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 174.81	* Reach Len. (ft)	* 1330.00	* 1300.00	* 1000.00 *
* Crit W.S. (ft)	* 170.48	* Flow Area (sq ft)	* 3715.01	* 1143.51	* 9.26 *
* E.G. Slope (ft/ft)	*0.001257	* Area (sq ft)	* 5337.20	* 1143.51	* 9.26 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 7445.65	* 7548.27	* 6.09 *
* Top Width (ft)	* 1215.93	* Top Width (ft)	* 1134.40	* 78.30	* 3.22 *
* Vel Total (ft/s)	* 3.08	* Avg. Vel. (ft/s)	* 2.00	* 6.60	* 0.66 *
* Max Chl Dpth (ft)	* 17.31	* Hydr. Depth (ft)	* 7.42	* 14.60	* 2.87 *
* Conv. Total (cfs)	*423009.9	* Conv. (cfs)	*209972.2	*212866.1	* 171.6 *
* Length Wtd. (ft)	* 1313.68	* Wetted Per. (ft)	* 500.78	* 85.43	* 6.64 *

* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.58	* 1.05	* 0.11	*
* Alpha	* 2.52	* Stream Power (lb/ft s)	* 1.17	* 6.94	* 0.07	*
* Frctn Loss (ft)	* 0.87	* Cum Volume (acre-ft)	* 832.45	* 241.37	* 1051.00	*
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	* 134.84	* 12.63	* 102.64	*

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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 179.70	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.39	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 179.30	* Reach Len. (ft)	* 1330.00	* 1300.00	* 1000.00	*
* Crit W.S. (ft)	* 172.29	* Flow Area (sq ft)	* 5966.17	* 1495.71	* 29.63	*
* E.G. Slope (ft/ft)	*0.001042	* Area (sq ft)	*15407.79	* 1495.71	* 29.63	*
* Q Total (cfs)	*25700.00	* Flow (cfs)	*14925.76	*10748.04	* 26.20	*
* Top Width (ft)	* 3321.91	* Top Width (ft)	* 3237.77	* 78.30	* 5.84	*
* Vel Total (ft/s)	* 3.43	* Avg. Vel. (ft/s)	* 2.50	* 7.19	* 0.88	*
* Max Chl Dpth (ft)	* 21.80	* Hydr. Depth (ft)	* 11.92	* 19.10	* 5.08	*
* Conv. Total (cfs)	*796255.3	* Conv. (cfs)	*462440.3	*333003.3	* 811.6	*
* Length Wtd. (ft)	* 1316.94	* Wetted Per. (ft)	* 500.78	* 85.43	* 11.84	*
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.77	* 1.14	* 0.16	*
* Alpha	* 2.14	* Stream Power (lb/ft s)	* 1.94	* 8.18	* 0.14	*
* Frctn Loss (ft)	* 0.69	* Cum Volume (acre-ft)	* 1854.09	* 318.82	* 1864.60	*
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 240.49	* 13.86	* 134.79	*

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 250.12

INPUT
Description: XS 250.12
Broad Run Station 250.12
LOW CHORD ELEVATION REVISED
TO MATCH PROPOSED BRIDGE PLAN
Station Elevation Data num= 477

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.13	6.56	182	13.12	182.17	16.4	182.13	22.96	181.91
26.24	181.91	29.52	182.16	39.36	181.84	42.64	181.81	55.76	182
62.32	182.01	68.88	181.69	75.45	181.7	82.01	181.47	88.57	181.54
95.13	181.42	101.69	181.37	108.25	181.49	114.81	181.54	121.37	181.32
127.93	181.19	134.49	181.46	141.05	181.34	144.33	181.14	150.89	181.14
154.17	181.27	160.73	181.23	167.29	181	170.57	181.04	177.13	180.96
183.69	180.73	196.81	180.68	209.93	180.26	213.21	180.27	216.49	180.48
226.34	180.15	229.62	180.26	236.18	180.13	239.46	180.16	246.02	180.02
259.14	180.03	265.7	179.8	272.26	179.91	282.1	179.52	285.38	179.47
288.66	179.57	291.94	179.45	295.22	179.6	301.78	179.6	305.06	179.48
311.62	179.59	318.18	179.48	321.46	179.29	337.86	179.23	341.14	179.39
347.7	179.23	354.26	179.3	360.82	179.24	367.39	178.93	383.79	178.82
387.07	178.95	396.91	178.73	403.47	178.77	410.03	178.67	413.31	178.51
429.71	178.6	436.27	178.5	439.55	178.38	446.11	178.37	452.67	178.08
462.51	178.09	465.79	178.21	472.35	178.2	478.91	177.96	482.19	178.03
488.75	177.84	492.03	177.83	498.59	178.01	505.15	177.91	508.43	177.61
515	177.56	524.84	177.58	528.12	177.67	531.4	177.59	534.68	177.33
537.96	177.21	541.24	177.23	547.8	177.41	554.36	177.15	557.64	177.19
564.2	177.13	570.76	176.98	574.04	177.01	577.32	176.79	583.88	176.78
587.16	176.86	593.72	176.69	600.28	176.73	610.12	176.51	616.68	176.65
626.52	176.39	629.8	176.51	636.36	176.94	639.64	177.06	642.92	177.01
649.48	176.56	659.32	176.3	669.17	176.25	675.73	176	679.01	175.96
685.57	176.03	688.85	175.92	695.41	176.06	708.53	175.92	711.81	175.83
718.37	175.86	721.65	175.61	724.93	175.62	731.49	175.43	738.05	175.33
741.33	175.53	744.61	175.32	747.89	175.36	751.17	175.21	761.01	175.14
767.57	175.21	774.13	174.92	783.97	174.83	797.09	174.82	803.65	174.85
813.5	174.71	820.06	174.72	826.62	174.8	836.46	174.67	843.02	174.65
862.7	174.48	869.26	174.48	872.54	174.35	875.82	174.4	882.38	174.36
908.62	174	911.9	174.12	918.46	174.02	925.02	174.21	931.58	174.03
938.14	174.12	947.98	173.81	954.55	173.73	957.83	173.78	964.39	174.06
970.95	173.92	977.51	173.96	987.35	173.84	993.91	173.99	1000.47	173.88
1007.03	174.03	1010.31	173.91	1020.15	174.04	1026.71	173.88	1036.55	173.93
1043.11	174.09	1049.67	174.11	1056.23	173.95	1066.07	174.04	1072.63	173.9
1079.19	174.08	1085.75	173.94	1092.31	174.1	1098.88	174.1	1102.16	173.96
1108.72	173.87	1115.28	173.94	1125.12	173.77	1131.68	174.04	1138.24	173.83
1144.8	173.8	1148.08	173.88	1157.92	173.79	1167.76	173.93	1174.32	173.85
1184.16	173.94	1190.72	173.89	1197.28	173.92	1216.96	173.86	1233.36	173.89
1236.64	173.85	1246.49	173.98	1253.05	173.85	1259.61	173.94	1269.45	173.99
1282.57	173.93	1292.41	174.03	1298.97	173.95	1315.37	173.99	1325.21	174.08
1341.61	174.11	1354.73	174.24	1364.57	174.25	1367.85	174.14	1384.25	174.19
1387.53	174.25	1410.5	174.02	1420.34	173.99	1426.9	174.02	1433.46	173.91
1443.3	173.99	1453.14	173.93	1456.42	173.8	1466.26	173.87	1469.54	173.81
1476.1	173.85	1479.38	173.76	1485.94	173.73	1492.5	173.81	1495.78	173.78
1502.34	173.88	1508.9	173.8	1515.46	173.9	1522.02	173.92	1528.58	173.83
1535.14	173.96	1544.99	174.02	1551.55	173.96	1558.11	174.05	1571.23	173.97
1584.35	174.12	1597.47	174.08	1604.03	174	1617.15	174.26	1623.71	174.22
1630.27	174.25	1636.83	174.11	1643.39	174.16	1646.67	173.96	1653.23	174.16
1659.79	174.13	1666.35	174.18	1676.19	174.08	1682.75	174.19	1695.88	174.14
1699.16	174.23	1705.72	174.13	1712.28	174.1	1725.4	174.14	1735.24	173.96
1741.8	173.98	1751.64	173.87	1771.32	174.07	1777.88	173.98	1784.44	174.03
1791	173.88	1797.56	173.91	1804.12	173.82	1813.96	173.78	1827.08	173.85
1836.93	173.85	1846.77	173.77	1853.33	173.87	1859.89	173.84	1866.45	173.93
1876.29	173.94	1882.85	173.83	1889.41	173.92	1895.97	173.89	1905.81	173.93
1909.09	173.99	1915.65	173.97	1925.49	174.05	1938.61	174.03	1948.45	173.96

1958.29	174	1961.57	173.96	1977.97	174.05	1987.82	173.94	2004.22	173.89
2010.78	173.84	2017.34	173.96	2037.02	173.93	2046.86	173.88	2056.7	173.72
2063.26	173.82	2066.54	173.79	2073.1	174.01	2079.66	174.09	2086.22	174.02
2096.06	174.15	2102.62	174.12	2119.03	174.21	2122.31	174.12	2125.59	174.18
2138.71	174.23	2141.99	174.17	2155.11	174.28	2164.95	174.15	2168.23	174.19
2184.63	174.21	2187.91	174.14	2197.75	174.26	2201.03	174.17	2210.87	174.35
2220.71	174.43	2227.27	174.29	2233.84	174.35	2240.4	174.24	2260.08	174.2
2266.64	174.27	2273.2	174.25	2279.76	174.02	2286.32	174.06	2292.88	173.95
2296.16	173.99	2309.28	173.95	2312.56	174	2319.12	173.95	2335.11	174.2
2341.67	174.21	2350	174.14	2355	174.16	2365	174.16	2370	174.14
2375	174.13	2380	174.11	2415	174.1	2420	174.09	2435	174.09
2440	174.08	2450	174.1	2455	174.1	2465	174.08	2480	174
2495	174	2500	174.01	2515	174.1	2530	174.16	2535	174.16
2545	174.14	2555	174.13	2560	174.11	2565	174.1	2580	174.03
2605	173.83	2610	173.83	2620	173.79	2625	173.78	2640	173.71
2655	173.66	2660	173.66	2670	173.64	2675	173.64	2680	173.6
2690	173.58	2700	173.53	2705	173.52	2710	173.5	2715	173.49
2725	173.45	2740	173.36	2750	173.32	2755	173.31	2770	173.24
2775	173.21	2785	173.12	2795	173.06	2810	172.9	2820	172.87
2830	172.87	2845	172.9	2865	173.08	2885	173.09	2890	173.14
2895	173.17	2900	173.25	2905	173.38	2910	173.45	2915	173.63
2920	174.02	2930	174.72	2935	174.91	2945	175.14	2975	175.74
2980	175.83	3005	175.83	3010	175.77	3020	175.63	3030	175.52
3035	175.48	3045	175.34	3050	175.26	3055	175.19	3060	175.17
3080	175.02	3085	175	3105	174.86	3110	174.8	3115	174.73
3130	174.53	3135	174.47	3145	174.41	3155	174.42	3210	174.74
3215	174.74	3220	174.71	3225	174.63	3235	174.41	3245	174.21
3255	174.07	3260	173.98	3265	173.91	3270	173.88	3275	173.83
3280	173.83	3290	173.47	3295	173.33	3300	173.29	3305	173.26
3310	173.24	3315	173.18	3325	173.01	3330	172.97	3355	172.93
3365	172.9	3370	172.86	3375	172.8	3385	172.76	3390	172.77
3395	172.8	3400	172.81	3410	172.8	3415	172.83	3420	172.89
3425	172.91	3430	172.91	3435	172.86	3440	172.83	3445	172.79
3450	172.69	3455	172.61	3460	172.56	3465	172.52	3475	172.48
3480	172.45	3490	172.34	3500	172.18	3505	172.12	3515	172.02
3525	171.94	3530	171.91	3535	171.87	3545	171.71	3555	171.62
3560	171.62	3565	171.63	3570	171.54	3575	171.46	3585	171.5
3600	171.61	3605	171.57	3620	171.37	3625	171.33	3630	170.92
3635	170.89	3640	171.31	3655	172.6	3660	159.39	3681	157
3695	159.8	3700	173.08	3705	172.6	3715	171.48	3720	170.94
3725	170.49	3740	169.05	3745	168.55	3750	168	3755	167.7
3760	167.78	3765	167.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3660	.045	3695	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3660	3695	620	620	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3655	177.9	F
3700	3765	177.9	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 175.44	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.03	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 175.41	* Reach Len. (ft)	* 0.50	* 0.50	*

```
   0.50  *
* Crit W.S. (ft)         *  160.81  * Flow Area (sq ft)      *   47.10  *  599.80  *
  44.87  *
* E.G. Slope (ft/ft)     *0.000035  * Area (sq ft)           * 4536.27  *  599.80  *
 403.69  *
* Q Total (cfs)          *  800.00  * Flow (cfs)             *   13.23  *  774.60  *
  12.17  *
* Top Width (ft)         * 2947.76  * Top Width (ft)         * 2842.76  *   35.00  *
  70.00  *
* Vel Total (ft/s)       *    1.16  * Avg. Vel. (ft/s)       *    0.28  *    1.29  *
   0.27  *
* Max Chl Dpth (ft)      *   18.41  * Hydr. Depth (ft)       *    9.42  *   17.14  *
   8.97  *
* Conv. Total (cfs)      *134906.3  * Conv. (cfs)            *  2231.3  *130623.1  *
 2052.0  *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)       *   14.12  *   35.41  *
  14.19  *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *    0.01  *    0.04  *
   0.01  *
* Alpha                  *    1.21  * Stream Power (lb/ft s) *    0.00  *    0.05  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  894.24  *  235.96  *
1268.01  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *   97.45  *   10.94  *
 104.79  *
**************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
**************************************************************************************
***********
* E.G. Elev (ft)         *  176.31  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  176.29  * Reach Len. (ft)       *    0.50  *    0.50  *
   0.50  *
* Crit W.S. (ft)         *  160.81  * Flow Area (sq ft)     *   51.46  *  630.33  *
  49.23  *
* E.G. Slope (ft/ft)     *0.000030  * Area (sq ft)          *   51.46  *  630.33  *
  49.23  *
* Q Total (cfs)          *  800.00  * Flow (cfs)            *   12.12  *  776.43  *
  11.44  *
* Top Width (ft)         *   45.00  * Top Width (ft)        *    5.00  *   35.00  *
   5.00  *
* Vel Total (ft/s)       *    1.09  * Avg. Vel. (ft/s)      *    0.24  *    1.23  *
   0.23  *
* Max Chl Dpth (ft)      *   19.29  * Hydr. Depth (ft)      *   10.29  *   18.01  *
   9.85  *
* Conv. Total (cfs)      *146196.7  * Conv. (cfs)           *  2215.7  *141890.1  *
 2090.9  *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)      *   17.81  *   35.41  *
  17.40  *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)      *    0.01  *    0.03  *
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   0.01  *
* Alpha                 *    1.23  * Stream Power (lb/ft s) *    0.00  *    0.04  *
   0.00  *
* Frctn Loss (ft)       *    0.00  * Cum Volume (acre-ft)   *   97.80  *  241.01  *
 690.54  *
* C & E Loss (ft)       *    0.02  * Cum SA (acres)         *    2.30  *   10.64  *
  28.87  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #10%
**********************************************************************************
**********
* E.G. Elev (ft)        *  172.23  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.13  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)        *  172.10  * Reach Len. (ft)       *    0.50  *    0.50  *
   0.50  *
* Crit W.S. (ft)        *  162.04  * Flow Area (sq ft)     *   30.57  *  483.79  *
  28.48  *
* E.G. Slope (ft/ft)    *0.000241  * Area (sq ft)          *  101.36  *  483.79  *
 176.67  *
* Q Total (cfs)         * 1450.00  * Flow (cfs)            *   17.29  * 1417.00  *
  15.71  *
* Top Width (ft)        *  242.11  * Top Width (ft)        *  146.95  *   35.00  *
  60.16  *
* Vel Total (ft/s)      *    2.67  * Avg. Vel. (ft/s)      *    0.57  *    2.93  *
   0.55  *
* Max Chl Dpth (ft)     *   15.10  * Hydr. Depth (ft)      *    6.35  *   13.82  *
   6.15  *
* Conv. Total (cfs)     * 93419.5  * Conv. (cfs)           *  1114.1  * 91293.1  *
 1012.3  *
* Length Wtd. (ft)      *    0.50  * Wetted Per. (ft)      *   13.59  *   35.41  *
  13.14  *
* Min Ch El (ft)        *  157.00  * Shear (lb/sq ft)      *    0.03  *    0.21  *
   0.03  *
* Alpha                 *    1.18  * Stream Power (lb/ft s) *    0.02  *    0.60  *
   0.02  *
* Frctn Loss (ft)       *    0.00  * Cum Volume (acre-ft)   *  436.81  *  169.27  *
 558.67  *
* C & E Loss (ft)       *    0.05  * Cum SA (acres)         *   58.06  *   11.06  *
  94.40  *
**********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #2%
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* E.G. Elev (ft)	* 174.21	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.04	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 174.17	* Reach Len. (ft)	* 0.50	* 0.50	* 0.50 *
* Crit W.S. (ft)	* 161.11	* Flow Area (sq ft)	* 40.87	* 556.21	* 38.64 *
* E.G. Slope (ft/ft)	*0.000064	* Area (sq ft)	* 1252.22	* 556.21	* 316.51 *
* Q Total (cfs)	* 950.00	* Flow (cfs)	* 14.12	* 923.06	* 12.82 *
* Top Width (ft)	* 2298.34	* Top Width (ft)	* 2193.34	* 35.00	* 70.00 *
* Vel Total (ft/s)	* 1.49	* Avg. Vel. (ft/s)	* 0.35	* 1.66	* 0.33 *
* Max Chl Dpth (ft)	* 17.17	* Hydr. Depth (ft)	* 8.17	* 15.89	* 7.73 *
* Conv. Total (cfs)	*118548.7	* Conv. (cfs)	* 1761.5	*115187.5	* 1599.7 *
* Length Wtd. (ft)	* 0.50	* Wetted Per. (ft)	* 14.12	* 35.41	* 14.19 *
* Min Ch El (ft)	* 157.00	* Shear (lb/sq ft)	* 0.01	* 0.06	* 0.01 *
* Alpha	* 1.20	* Stream Power (lb/ft s)	* 0.00	* 0.10	* 0.00 *
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 731.86	* 216.01	* 1047.26 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 84.03	* 10.94	* 101.80 *

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 178.89	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 178.89	* Reach Len. (ft)	* 0.50	* 0.50	* 0.50 *
* Crit W.S. (ft)	* 160.59	* Flow Area (sq ft)	*15271.76	* 721.52	* 647.14 *
* E.G. Slope (ft/ft)	*0.000000	* Area (sq ft)	*15271.76	* 721.52	* 647.14 *
* Q Total (cfs)	* 700.00	* Flow (cfs)	* 558.65	* 109.85	* 31.51 *
* Top Width (ft)	* 3387.88	* Top Width (ft)	* 3282.88	* 35.00	* 70.00 *
* Vel Total (ft/s)	* 0.04	* Avg. Vel. (ft/s)	* 0.04	* 0.15	* 0.05 *
* Max Chl Dpth (ft)	* 21.89	* Hydr. Depth (ft)	* 4.65	* 20.61	*

```
   9.24  *
* Conv. Total (cfs)      *1132586.0  * Conv. (cfs)           *903881.1  *177729.6
* 50975.3  *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)       * 3292.52  *   35.41  *
  90.53  *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    2.72  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   * 1385.73  *  285.74  *
1856.83  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *  140.94  *   12.17  *
 133.92  *
*******************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 250.06

INPUT
Description: Bridge #2 - Runway
Distance from Upstream XS =      .5
Deck/Roadway Width        =   611.5
Weir Coefficient          =     2.7
Upstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
       0     180       0     456     180       0    2856   178.6       0
    3666  178.13     155    3666  178.13  169.49    3696  178.13  169.49
    3696  178.13     155    5056   177.9       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=     477
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  182.13    6.56     182   13.12  182.17    16.4  182.13   22.96  181.91
   26.24  181.91   29.52  182.16   39.36  181.84   42.64  181.81   55.76     182
   62.32  182.01   68.88  181.69   75.45   181.7   82.01  181.47   88.57  181.54
   95.13  181.42  101.69  181.37  108.25  181.49  114.81  181.54  121.37  181.32
  127.93  181.19  134.49  181.46  141.05  181.34  144.33  181.14  150.89  181.14
  154.17  181.27  160.73  181.23  167.29     181  170.57  181.04  177.13  180.96
  183.69  180.73  196.81  180.68  209.93  180.26  213.21  180.27  216.49  180.48
  226.34  180.15  229.62  180.26  236.18  180.13  239.46  180.16  246.02  180.02
  259.14  180.03   265.7   179.8  272.26  179.91   282.1  179.52  285.38  179.47
  288.66  179.57  291.94  179.45  295.22   179.6  301.78   179.6  305.06  179.48
  311.62  179.59  318.18  179.48  321.46  179.29  337.86  179.23  341.14  179.39
   347.7  179.23  354.26   179.3  360.82  179.24  367.39  178.93  383.79  178.82
  387.07  178.95  396.91  178.73  403.47  178.77  410.03  178.67  413.31  178.51
  429.71   178.6  436.27   178.5  439.55  178.38  446.11  178.37  452.67  178.08
  462.51  178.09  465.79  178.21  472.35   178.2  478.91  177.96  482.19  178.03
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488.75	177.84	492.03	177.83	498.59	178.01	505.15	177.91	508.43	177.61
515	177.56	524.84	177.58	528.12	177.67	531.4	177.59	534.68	177.33
537.96	177.21	541.24	177.23	547.8	177.41	554.36	177.15	557.64	177.19
564.2	177.13	570.76	176.98	574.04	177.01	577.32	176.79	583.88	176.78
587.16	176.86	593.72	176.69	600.28	176.73	610.12	176.51	616.68	176.65
626.52	176.39	629.8	176.51	636.36	176.94	639.64	177.06	642.92	177.01
649.48	176.56	659.32	176.3	669.17	176.25	675.73	176	679.01	175.96
685.57	176.03	688.85	175.92	695.41	176.06	708.53	175.92	711.81	175.83
718.37	175.86	721.65	175.61	724.93	175.62	731.49	175.43	738.05	175.33
741.33	175.53	744.61	175.32	747.89	175.36	751.17	175.21	761.01	175.14
767.57	175.21	774.13	174.92	783.97	174.83	797.09	174.82	803.65	174.85
813.5	174.71	820.06	174.72	826.62	174.8	836.46	174.67	843.02	174.65
862.7	174.48	869.26	174.48	872.54	174.35	875.82	174.4	882.38	174.36
908.62	174	911.9	174.12	918.46	174.02	925.02	174.21	931.58	174.03
938.14	174.12	947.98	173.81	954.55	173.73	957.83	173.78	964.39	174.06
970.95	173.92	977.51	173.96	987.35	173.84	993.91	173.99	1000.47	173.88
1007.03	174.03	1010.31	173.91	1020.15	174.04	1026.71	173.88	1036.55	173.93
1043.11	174.09	1049.67	174.11	1056.23	173.95	1066.07	174.04	1072.63	173.9
1079.19	174.08	1085.75	173.94	1092.31	174.1	1098.88	174.1	1102.16	173.96
1108.72	173.87	1115.28	173.94	1125.12	173.77	1131.68	174.04	1138.24	173.83
1144.8	173.8	1148.08	173.88	1157.92	173.79	1167.76	173.93	1174.32	173.85
1184.16	173.94	1190.72	173.89	1197.28	173.92	1216.96	173.86	1233.36	173.89
1236.64	173.85	1246.49	173.98	1253.05	173.85	1259.61	173.94	1269.45	173.99
1282.57	173.93	1292.41	174.03	1298.97	173.95	1315.37	173.99	1325.21	174.08
1341.61	174.11	1354.73	174.24	1364.57	174.25	1367.85	174.14	1384.25	174.19
1387.53	174.25	1410.5	174.02	1420.34	173.99	1426.9	174.02	1433.46	173.91
1443.3	173.99	1453.14	173.93	1456.42	173.8	1466.26	173.87	1469.54	173.81
1476.1	173.85	1479.38	173.76	1485.94	173.73	1492.5	173.81	1495.78	173.78
1502.34	173.88	1508.9	173.8	1515.46	173.9	1522.02	173.92	1528.58	173.83
1535.14	173.96	1544.99	174.02	1551.55	173.96	1558.11	174.05	1571.23	173.97
1584.35	174.12	1597.47	174.08	1604.03	174	1617.15	174.26	1623.71	174.22
1630.27	174.25	1636.83	174.11	1643.39	174.16	1646.67	173.96	1653.23	174.16
1659.79	174.13	1666.35	174.18	1676.19	174.08	1682.75	174.19	1695.88	174.14
1699.16	174.23	1705.72	174.13	1712.28	174.1	1725.4	174.14	1735.24	173.96
1741.8	173.98	1751.64	173.87	1771.32	174.07	1777.88	173.98	1784.44	174.03
1791	173.88	1797.56	173.91	1804.12	173.82	1813.96	173.78	1827.08	173.85
1836.93	173.85	1846.77	173.77	1853.33	173.87	1859.89	173.84	1866.45	173.93
1876.29	173.94	1882.85	173.83	1889.41	173.92	1895.97	173.89	1905.81	173.93
1909.09	173.99	1915.65	173.97	1925.49	174.05	1938.61	174.03	1948.45	173.96
1958.29	174	1961.57	173.96	1977.97	174.05	1987.82	173.94	2004.22	173.89
2010.78	173.84	2017.34	173.96	2037.02	173.93	2046.86	173.88	2056.7	173.72
2063.26	173.82	2066.54	173.79	2073.1	174.01	2079.66	174.09	2086.22	174.02
2096.06	174.15	2102.62	174.12	2119.03	174.21	2122.31	174.12	2125.59	174.18
2138.71	174.23	2141.99	174.17	2155.11	174.28	2164.95	174.15	2168.23	174.19
2184.63	174.21	2187.91	174.14	2197.75	174.26	2201.03	174.17	2210.87	174.35
2220.71	174.43	2227.27	174.29	2233.84	174.35	2240.4	174.24	2260.08	174.2
2266.64	174.27	2273.2	174.25	2279.76	174.02	2286.32	174.06	2292.88	173.95
2296.16	173.99	2309.28	173.95	2312.56	174	2319.12	173.95	2335.11	174.2
2341.67	174.21	2350	174.14	2355	174.16	2365	174.16	2370	174.14
2375	174.13	2380	174.11	2415	174.1	2420	174.09	2435	174.09
2440	174.08	2450	174.1	2455	174.1	2465	174.08	2480	174
2495	174	2500	174.01	2515	174.1	2530	174.16	2535	174.16
2545	174.14	2555	174.13	2560	174.11	2565	174.1	2580	174.03
2605	173.83	2610	173.83	2620	173.79	2625	173.78	2640	173.71
2655	173.66	2660	173.66	2670	173.64	2675	173.64	2680	173.6
2690	173.58	2700	173.53	2705	173.52	2710	173.5	2715	173.49
2725	173.45	2740	173.36	2750	173.32	2755	173.31	2770	173.24
2775	173.21	2785	173.12	2795	173.06	2810	172.9	2820	172.87
2830	172.87	2845	172.9	2865	173.08	2885	173.09	2890	173.14
2895	173.17	2900	173.25	2905	173.38	2910	173.45	2915	173.63
2920	174.02	2930	174.72	2935	174.91	2945	175.14	2975	175.74
2980	175.83	3005	175.83	3010	175.77	3020	175.63	3030	175.52
3035	175.48	3045	175.34	3050	175.26	3055	175.19	3060	175.17

3080	175.02	3085	175	3105	174.86	3110	174.8	3115	174.73
3130	174.53	3135	174.47	3145	174.41	3155	174.42	3210	174.74
3215	174.74	3220	174.71	3225	174.63	3235	174.41	3245	174.21
3255	174.07	3260	173.98	3265	173.91	3270	173.88	3275	173.83
3280	173.83	3290	173.47	3295	173.33	3300	173.29	3305	173.26
3310	173.24	3315	173.18	3325	173.01	3330	172.97	3355	172.93
3365	172.9	3370	172.86	3375	172.8	3385	172.76	3390	172.77
3395	172.8	3400	172.81	3410	172.8	3415	172.83	3420	172.89
3425	172.91	3430	172.91	3435	172.86	3440	172.83	3445	172.79
3450	172.69	3455	172.61	3460	172.56	3465	172.52	3475	172.48
3480	172.45	3490	172.34	3500	172.18	3505	172.12	3515	172.02
3525	171.94	3530	171.91	3535	171.87	3545	171.71	3555	171.62
3560	171.62	3565	171.63	3570	171.54	3575	171.46	3585	171.5
3600	171.61	3605	171.57	3620	171.37	3625	171.33	3630	170.92
3635	170.89	3640	171.31	3655	172.6	3660	159.39	3681	157
3695	159.8	3700	173.08	3705	172.6	3715	171.48	3720	170.94
3725	170.49	3740	169.05	3745	168.55	3750	168	3755	167.7
3760	167.78	3765	167.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3660	.045	3695	.07

Bank Sta: Left Right Coeff Contr. Expan.

3660	3695	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3655	177.9	F
3700	3765	177.9	F

Downstream Deck/Roadway Coordinates

num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	180	0	485	180	0	2885	178.6	0
3975	178.13	155	3975	178.13	169.49	4005	178.13	169.49
4005	178.13	155	5085	177.9	0			

Downstream Bridge Cross Section Data

Station Elevation Data num= 385

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.24	182.47	32.8	182.49	39.35	182.28
45.91	182.33	52.47	182.59	55.75	182.38	68.87	182.21	75.43	182.31
98.39	181.7	104.95	181.77	118.07	181.41	124.62	181.52	141.02	181.23
147.58	180.98	154.14	180.97	163.98	181.13	170.54	181.02	180.38	181.04
186.94	180.83	193.5	180.91	206.61	180.64	219.73	180.53	226.29	180.39
232.85	180.38	242.69	180.12	252.53	180.02	255.81	180.1	268.93	179.85
282.04	179.68	288.6	179.88	295.16	179.63	308.28	179.45	314.84	179.43
321.4	179.65	331.24	179.47	337.8	179.25	344.36	179.35	350.92	179.18
367.31	179.01	377.15	178.68	390.27	178.82	400.11	178.57	406.67	178.58
409.95	178.45	416.51	178.63	426.35	178.31	436.19	178.48	449.3	178.26
462.42	178.32	465.7	178.23	475.54	178.23	482.1	178.05	498.5	178.05
505.06	177.97	511.62	177.73	518.18	177.84	537.85	177.71	544.41	177.5
554.25	177.58	560.81	177.36	570.65	177.38	583.77	177.15	590.33	177.19
596.89	177	610	176.84	619.84	176.62	629.68	176.53	636.24	176.64
642.8	176.46	649.36	176.52	659.2	176.76	665.76	176.79	669.04	176.5
678.88	176.35	685.43	176.42	691.99	176.15	698.55	176.25	705.11	176.1
708.39	176.15	724.79	175.84	734.63	175.92	747.75	175.78	754.31	175.8
767.42	175.52	773.98	175.64	780.54	175.54	783.82	175.36	793.66	175.29
800.22	175.53	816.62	175.36	826.46	175.41	833.02	175.11	839.58	175.24
846.13	175.16	859.25	175.36	865.81	175.17	872.37	175.11	875.65	174.89

882.21	175.07	892.05	175.19	898.61	174.91	908.45	175.01	921.57	174.7
924.85	174.78	944.52	174.84	947.8	174.71	967.48	174.56	977.32	174.34
983.88	174.49	987.16	174.37	997	174.45	1006.84	174.27	1010.11	174.37
1023.23	174.12	1033.07	174.03	1039.63	174.06	1042.91	173.95	1052.75	173.98
1065.87	173.86	1075.71	173.86	1082.27	173.96	1108.5	173.76	1115.06	173.62
1121.62	173.73	1131.46	173.69	1147.86	173.41	1151.14	173.54	1164.26	173.48
1170.82	173.55	1180.65	173.22	1193.77	173.4	1203.61	173.36	1223.29	173.19
1242.97	173.17	1246.25	173.01	1265.92	172.91	1269.2	173.07	1275.76	173.02
1282.32	173.26	1288.88	173.27	1295.44	173.06	1305.28	173.21	1315.12	173.17
1318.4	173.28	1331.52	173.3	1338.08	173.15	1344.63	173.39	1351.19	173.48
1354.47	173.33	1361.03	173.53	1380.71	173.2	1393.83	173.29	1400.39	173.42
1403.67	173.35	1420.07	174.1	1429.9	174.31	1443.02	174.31	1456.14	174.44
1465.98	174.71	1472.54	174.72	1485.66	175.03	1492.22	175	1508.61	175.29
1525.01	175.08	1538.13	175.1	1547.97	174.96	1557.81	174.95	1564.37	174.65
1570.93	174.69	1597.16	174.09	1607	173.64	1610.28	173.68	1613.56	173.44
1620.12	173.44	1633.24	173.1	1636.52	173.31	1643.08	173.07	1649.64	173.19
1652.92	173.02	1659.48	173.06	1669.32	172.98	1672.59	173.18	1679.15	173.04
1682.43	173.19	1688.99	173.07	1698.83	172.73	1705.39	172.86	1711.95	172.76
1718.51	172.91	1731.63	172.79	1744.75	173.03	1764.42	173.01	1770.98	173.09
1780.82	172.78	1787.38	172.7	1793.94	172.75	1807.06	172.43	1813.62	172.52
1843.13	172.26	1846.41	172.38	1852.97	172.31	1866.09	172.44	1869.37	172.36
1879.21	172.49	1898.89	172.34	1908.73	172.53	1915.29	172.34	1941.52	172.01
1948.08	172.32	1957.92	172.26	1967.76	172.03	1977.6	172.02	1984.16	171.93
2000.55	172.02	2007.11	171.82	2016.95	171.81	2026.79	171.65	2030.07	171.93
2039.91	171.76	2043.19	171.9	2056.31	171.99	2062.87	171.84	2082.55	171.69
2089.1	171.73	2102.22	171.57	2112.06	171.59	2138.3	171.38	2141.58	171.48
2151.42	171.5	2167.82	171.39	2187.49	171.43	2194.05	171.56	2200.61	171.51
2203.89	171.61	2213.73	171.58	2220.29	171.45	2226.85	171.45	2233.41	171.58
2262.93	171.66	2266.21	171.74	2279.32	171.68	2285.88	171.73	2292.44	171.56
2295.72	171.64	2305.56	171.53	2312.12	171.58	2315.4	171.48	2325.24	171.48
2335.08	171.38	2341.64	171.53	2358.04	171.48	2367.88	171.54	2374.43	171.67
2387.55	171.792404.135		171.832424.423		1722454.855		172.032475.143		171.97
2485.287	171.892495.431		171.782505.575		171.752515.719		171.552525.863		171.57
2536.007	171.512546.151		171.492556.295		171.52566.439		171.472576.583		171.47
2586.727	171.512596.871		171.52607.015		171.462627.303		171.482667.879		171.42
2688.167	171.372728.744		171.432738.888		171.462749.031		171.352759.176		171.34
2779.464	171.412809.896		171.37 2820.04		171.42840.328		171.42850.472		171.37
2891.048	171.412911.336		171.492931.624		171.72941.768		171.842951.912		171.93
2982.344	171.943002.632		172.32 3022.92		172.743033.064		172.833053.353		172.83
3063.497	172.963083.784		173.363104.073		173.713114.217		173.833225.801		173.82
3246.089	173.523286.665		173.083296.809		172.873306.953		172.843317.097		172.95
3327.241	173.173337.385		173.313347.529		173.543357.673		173.713367.817		173.91
3388.105	174.353408.393		174.693418.537		174.833469.258		174.833479.402		174.75
3499.69	174.443509.834		174.253530.122		173.953540.266		173.68 3550.41		173.17
3560.554	173.073570.698		173.013580.842		172.75 3601.13		172.323611.274		171.99
3621.418	171.833793.866		171.83 3804.01		1723814.155		172.483824.299		172.83
3834.443	173.023854.731		173.083895.307		173.333905.451		173.333915.595		172.92
3946.027	170.963956.171		168.953966.315		166.143976.459		163.943986.603		161.01
3990	156.844027.179		159.874037.323		161.234047.467		163.494057.611		165.32
4067.755	167.454077.899		169.434088.043		1714098.188		172.024108.332		172.61
4118.476	172.844148.908		173.214169.195		173.294189.483		173.334219.916		173.46
4240.204	173.584250.348		173.544321.356		173.054341.644		173.014361.932		172.89
4392.364	172.634412.652		172.494422.796		172.39 4432.94		172.354463.373		172.47
4544.524	172.724564.813		172.834635.821		172.834645.965		172.814666.253		172.55
4696.685	172.254716.973		172.114767.693		171.864777.837		171.834798.125		171.83
4818.413	171.874828.557		171.924869.133		172.824899.565		172.85 4960.43		173.74
4980.718	173.92 5011.15		174.775041.582		175.655051.726		175.83 5061.87		175.83

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.073966.315		.0454057.611		.07

```
Bank Sta: Left   Right    Coeff Contr.   Expan.
      3966.3154057.611            .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3985     177       F
    4035 5061.87     177       F

Upstream Embankment side slope              =       4 horiz. to 1.0 vertical
Downstream Embankment side slope            =       4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   177.4
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #1%
********************************************************************************
*********
* E.G. US. (ft)          *     175.44  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     175.41  * E.G. Elev (ft)        *     175.42  *
174.82  *
* Q Total (cfs)          *     800.00  * W.S. Elev (ft)        *     175.33  *
174.63  *
* Q Bridge (cfs)         *     800.00  * Crit W.S. (ft)        *     160.99  *
161.69  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      18.33  *
17.79  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       2.37  *
 3.48  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     338.17  *
229.69  *
* Weir Submerg           *             * Froude # Chl          *       0.10  *
 0.15  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    3952.68  *
2601.09  *
* Min El Weir Flow (ft)  *     178.13  * Hydr Depth (ft)       *             *
       *
* Min El Prs (ft)        *     169.49  * W.P. Total (ft)       *      80.03  *
53.52  *
* Delta EG (ft)          *       0.72  * Conv. Total (cfs)     *    31004.0  *
20029.1  *
* Delta WS (ft)          *       0.71  * Top Width (ft)        *             *
       *
* BR Open Area (sq ft)   *     229.69  * Frctn Loss (ft)       *       0.57  *
 0.01  *
* BR Open Vel (ft/s)     *       3.48  * C & E Loss (ft)       *       0.03  *
```

```
 0.09  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.18  *
 0.43  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       0.42  *
 1.49  *
*********************************************************************************
*********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #Floodway
*********************************************************************************
*********
* E.G. US. (ft)          *     176.31  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     176.29  * E.G. Elev (ft)        *     176.29  *
175.69  *
* Q Total (cfs)          *     800.00  * W.S. Elev (ft)        *     176.20  *
175.50  *
* Q Bridge (cfs)         *     800.00  * Crit W.S. (ft)        *     160.99  *
161.69  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      19.20  *
18.66  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       2.37  *
 3.48  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     338.17  *
229.69  *
* Weir Submerg           *             * Froude # Chl          *       0.10  *
 0.14  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    4246.64  *
2800.76  *
* Min El Weir Flow (ft)  *     178.14  * Hydr Depth (ft)       *             *
      *
* Min El Prs (ft)        *     169.49  * W.P. Total (ft)       *      80.03  *
53.52  *
* Delta EG (ft)          *       0.72  * Conv. Total (cfs)     *    31004.0  *
20029.1  *
* Delta WS (ft)          *       0.71  * Top Width (ft)        *             *
      *
* BR Open Area (sq ft)   *     229.69  * Frctn Loss (ft)       *       0.57  *
 0.01  *
* BR Open Vel (ft/s)     *       3.48  * C & E Loss (ft)       *       0.03  *
 0.09  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.18  *
 0.43  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       0.42  *
 1.49  *
*********************************************************************************
*********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
```

with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #10%

E.G. US. (ft)	172.23	Element	Inside BR US	Inside BR DS	
W.S. US. (ft)	172.10	E.G. Elev (ft)	172.18	170.20	
Q Total (cfs)	1450.00	W.S. Elev (ft)	171.88	169.58	
Q Bridge (cfs)	1450.00	Crit W.S. (ft)	162.39	163.47	
Q Weir (cfs)		Max Chl Dpth (ft)	14.88	12.74	
Weir Sta Lft (ft)		Vel Total (ft/s)	4.29	6.31	
Weir Sta Rgt (ft)		Flow Area (sq ft)	338.17	229.69	
Weir Submerg		Froude # Chl	0.20	0.31	
Weir Max Depth (ft)		Specif Force (cu ft)	2924.08	1638.86	
Min El Weir Flow (ft)	178.13	Hydr Depth (ft)			
Min El Prs (ft)	169.49	W.P. Total (ft)	80.03	53.52	
Delta EG (ft)	2.31	Conv. Total (cfs)	31004.0	20029.1	
Delta WS (ft)	2.29	Top Width (ft)			
BR Open Area (sq ft)	229.69	Frctn Loss (ft)	1.89	0.02	
BR Open Vel (ft/s)	6.31	C & E Loss (ft)	0.10	0.26	
BR Sluice Coef		Shear Total (lb/sq ft)	0.58	1.40	
BR Sel Method	Energy only	Power Total (lb/ft s)	2.47	8.86	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #2%

* E.G. US. (ft)	* 174.21	* Element	*Inside BR US	*Inside BR DS *	
* W.S. US. (ft)	* 174.17	* E.G. Elev (ft)	* 174.18	* 173.33	*
* Q Total (cfs)	* 950.00	* W.S. Elev (ft)	* 174.06	* 173.07	*
* Q Bridge (cfs)	* 950.00	* Crit W.S. (ft)	* 161.33	* 162.12	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 17.06	* 16.23	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 2.81	* 4.14	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 338.17	* 229.69	*
* Weir Submerg	*	* Froude # Chl	* 0.12	* 0.18	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 3547.02	* 2278.25	*
* Min El Weir Flow (ft)	* 178.13	* Hydr Depth (ft)	*	*	
* Min El Prs (ft)	* 169.49	* W.P. Total (ft)	* 80.03	* 53.52	*
* Delta EG (ft)	* 1.01	* Conv. Total (cfs)	* 31004.0	* 20029.1	*
* Delta WS (ft)	* 0.99	* Top Width (ft)	*	*	
* BR Open Area (sq ft)	* 229.69	* Frctn Loss (ft)	* 0.81	* 0.01	*
* BR Open Vel (ft/s)	* 4.14	* C & E Loss (ft)	* 0.04	* 0.12	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.25	* 0.60	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.70	* 2.49	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #0.2%

* E.G. US. (ft)	* 178.89	* Element	*Inside BR US	*Inside BR DS *	
* W.S. US. (ft)	* 178.89	* E.G. Elev (ft)	* 178.88	* 178.50	*
* Q Total (cfs)	* 700.00	* W.S. Elev (ft)	* 178.85	* 178.47	*
* Q Bridge (cfs)	* 582.89	* Crit W.S. (ft)	* 160.74	* 161.34	*

* Q Weir (cfs)	*	* Max Chl Dpth (ft)	*	21.85	* 21.63 *
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	*	0.82	* 0.76 *
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	*	853.63	* 917.51 *
* Weir Submerg	*	* Froude # Chl	*	0.06	* 0.05 *
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	*	5244.87	* 4361.12 *
* Min El Weir Flow (ft)	* 178.13	* Hydr Depth (ft)	*	0.64	* 0.49 *
* Min El Prs (ft)	* 169.49	* W.P. Total (ft)	*	1414.93	* 1954.44 *
* Delta EG (ft)	* 0.41	* Conv. Total (cfs)	*	32252.2	* 23296.5 *
* Delta WS (ft)	* 0.41	* Top Width (ft)	*	1334.17	* 1874.73 *
* BR Open Area (sq ft)	* 229.69	* Frctn Loss (ft)	*	0.38	* 0.00 *
* BR Open Vel (ft/s)	* 1.97	* C & E Loss (ft)	*	0.00	* 0.01 *
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	*	0.02	* 0.03 *
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	*	0.01	* 0.02 *

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Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 250

INPUT
Description: XS 250
Broad Run Station 250
CHANNEL REACH DISTANCE ADJUSTED PER
PROPOSED RUNWAY BRIDGE
THIS IS THE D/S FACE OF RUNWAY 34-R
Station Elevation Data num= 385

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.24	182.47	32.8	182.49	39.35	182.28
45.91	182.33	52.47	182.59	55.75	182.38	68.87	182.21	75.43	182.31
98.39	181.7	104.95	181.77	118.07	181.41	124.62	181.52	141.02	181.23
147.58	180.98	154.14	180.97	163.98	181.13	170.54	181.02	180.38	181.04
186.94	180.83	193.5	180.91	206.61	180.64	219.73	180.53	226.29	180.39
232.85	180.38	242.69	180.12	252.53	180.02	255.81	180.1	268.93	179.85
282.04	179.68	288.6	179.88	295.16	179.63	308.28	179.45	314.84	179.43
321.4	179.65	331.24	179.47	337.8	179.25	344.36	179.35	350.92	179.18
367.31	179.01	377.15	178.68	390.27	178.82	400.11	178.57	406.67	178.58
409.95	178.45	416.51	178.63	426.35	178.31	436.19	178.48	449.3	178.26
462.42	178.32	465.7	178.23	475.54	178.23	482.1	178.05	498.5	178.05

505.06	177.97	511.62	177.73	518.18	177.84	537.85	177.71	544.41	177.5
554.25	177.58	560.81	177.36	570.65	177.38	583.77	177.15	590.33	177.19
596.89	177	610	176.84	619.84	176.62	629.68	176.53	636.24	176.64
642.8	176.46	649.36	176.52	659.2	176.76	665.76	176.79	669.04	176.5
678.88	176.35	685.43	176.42	691.99	176.15	698.55	176.25	705.11	176.1
708.39	176.15	724.79	175.84	734.63	175.92	747.75	175.78	754.31	175.8
767.42	175.52	773.98	175.64	780.54	175.54	783.82	175.36	793.66	175.29
800.22	175.53	816.62	175.36	826.46	175.41	833.02	175.11	839.58	175.24
846.13	175.16	859.25	175.36	865.81	175.17	872.37	175.11	875.65	174.89
882.21	175.07	892.05	175.19	898.61	174.91	908.45	175.01	921.57	174.7
924.85	174.78	944.52	174.84	947.8	174.71	967.48	174.56	977.32	174.34
983.88	174.49	987.16	174.37	997	174.45	1006.84	174.27	1010.11	174.37
1023.23	174.12	1033.07	174.03	1039.63	174.06	1042.91	173.95	1052.75	173.98
1065.87	173.86	1075.71	173.86	1082.27	173.96	1108.5	173.76	1115.06	173.62
1121.62	173.73	1131.46	173.69	1147.86	173.41	1151.14	173.54	1164.26	173.48
1170.82	173.55	1180.65	173.22	1193.77	173.4	1203.61	173.36	1223.29	173.19
1242.97	173.17	1246.25	173.01	1265.92	172.91	1269.2	173.07	1275.76	173.02
1282.32	173.26	1288.88	173.27	1295.44	173.06	1305.28	173.21	1315.12	173.17
1318.4	173.28	1331.52	173.3	1338.08	173.15	1344.63	173.39	1351.19	173.48
1354.47	173.33	1361.03	173.53	1380.71	173.2	1393.83	173.29	1400.39	173.42
1403.67	173.35	1420.07	174.1	1429.9	174.31	1443.02	174.31	1456.14	174.44
1465.98	174.71	1472.54	174.72	1485.66	175.03	1492.22	175	1508.61	175.29
1525.01	175.08	1538.13	175.1	1547.97	174.96	1557.81	174.95	1564.37	174.65
1570.93	174.69	1597.16	174.09	1607	173.64	1610.28	173.68	1613.56	173.44
1620.12	173.44	1633.24	173.1	1636.52	173.31	1643.08	173.07	1649.64	173.19
1652.92	173.02	1659.48	173.06	1669.32	172.98	1672.59	173.18	1679.15	173.04
1682.43	173.19	1688.99	173.07	1698.83	172.73	1705.39	172.86	1711.95	172.76
1718.51	172.91	1731.63	172.79	1744.75	173.03	1764.42	173.01	1770.98	173.09
1780.82	172.78	1787.38	172.7	1793.94	172.75	1807.06	172.43	1813.62	172.52
1843.13	172.26	1846.41	172.38	1852.97	172.31	1866.09	172.44	1869.37	172.36
1879.21	172.49	1898.89	172.34	1908.73	172.53	1915.29	172.34	1941.52	172.01
1948.08	172.32	1957.92	172.26	1967.76	172.03	1977.6	172.02	1984.16	171.93
2000.55	172.02	2007.11	171.82	2016.95	171.81	2026.79	171.65	2030.07	171.93
2039.91	171.76	2043.19	171.9	2056.31	171.99	2062.87	171.84	2082.55	171.69
2089.1	171.73	2102.22	171.57	2112.06	171.59	2138.3	171.38	2141.58	171.48
2151.42	171.5	2167.82	171.39	2187.49	171.43	2194.05	171.56	2200.61	171.51
2203.89	171.61	2213.73	171.58	2220.29	171.45	2226.85	171.45	2233.41	171.58
2262.93	171.66	2266.21	171.74	2279.32	171.68	2285.88	171.73	2292.44	171.56
2295.72	171.64	2305.56	171.53	2312.12	171.58	2315.4	171.48	2325.24	171.48
2335.08	171.38	2341.64	171.53	2358.04	171.48	2367.88	171.54	2374.43	171.67
2387.55	171.792404.135		171.832424.423		1722454.855		172.032475.143		171.97
2485.287	171.892495.431		171.782505.575		171.752515.719		171.552525.863		171.57
2536.007	171.512546.151		171.492556.295		171.52566.439		171.472576.583		171.47
2586.727	171.512596.871		171.52607.015		171.462627.303		171.482667.879		171.42
2688.167	171.372728.744		171.432738.888		171.462749.031		171.352759.176		171.34
2779.464	171.412809.896		171.37 2820.04		171.42840.328		171.42850.472		171.37
2891.048	171.412911.336		171.492931.624		171.72941.768		171.842951.912		171.93
2982.344	171.943002.632		172.32 3022.92		172.743033.064		172.833053.353		172.83
3063.497	172.963083.784		173.363104.073		173.713114.217		173.833225.801		173.82
3246.089	173.523286.665		173.083296.809		172.873306.953		172.843317.097		172.95
3327.241	173.173337.385		173.313347.529		173.543357.673		173.713367.817		173.91
3388.105	174.353408.393		174.693418.537		174.833469.258		174.833479.402		174.75
3499.69	174.443509.834		174.253530.122		173.953540.266		173.68 3550.41		173.17
3560.554	173.073570.698		173.013580.842		172.75 3601.13		172.323611.274		171.99
3621.418	171.833793.866		171.83 3804.01		1723814.155		172.483824.299		172.83
3834.443	173.023854.731		173.083895.307		173.333905.451		173.333915.595		172.92
3946.027	170.963956.171		168.953966.315		166.143976.459		163.943986.603		161.01
3990	156.844027.179		159.874037.323		161.234047.467		163.494057.611		165.32
4067.755	167.454077.899		169.434088.043		1714098.188		172.024108.332		172.61
4118.476	172.844148.908		173.214169.195		173.294189.483		173.334219.916		173.46
4240.204	173.584250.348		173.544321.356		173.054341.644		173.014361.932		172.89
4392.364	172.634412.652		172.494422.796		172.39 4432.94		172.354463.373		172.47
4544.524	172.724564.813		172.834635.821		172.834645.965		172.814666.253		172.55

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4696.685  172.254716.973  172.114767.693  171.864777.837  171.834798.125  171.83
4818.413  171.874828.557  171.924869.133  172.824899.565  172.85 4960.43  173.74
4980.718  173.92 5011.15  174.775041.582  175.655051.726  175.83 5061.87  175.83

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .073966.315    .0454057.611     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      3966.3154057.611                10      13      35             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3985     177       F
    4035 5061.87     177       F

CROSS SECTION OUTPUT  Profile #1%
**********************************************************************************
***********
* E.G. Elev (ft)         *  174.72  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  174.71  * Reach Len. (ft)       *   10.00  *   13.00  *
  35.00  *
* Crit W.S. (ft)         *  160.74  * Flow Area (sq ft)     *          *  795.09  *
         *
* E.G. Slope (ft/ft)     *0.000025  * Area (sq ft)          * 6076.27  * 1257.08  *
1948.73  *
* Q Total (cfs)          *  800.00  * Flow (cfs)            *          *  800.00  *
         *
* Top Width (ft)         * 3891.49  * Top Width (ft)        * 2848.91  *   91.30  *
 951.29  *
* Vel Total (ft/s)       *    1.01  * Avg. Vel. (ft/s)      *          *    1.01  *
         *
* Max Chl Dpth (ft)      *   17.87  * Hydr. Depth (ft)      *          *   15.90  *
         *
* Conv. Total (cfs)      *161241.3  * Conv. (cfs)           *          *161241.3  *
         *
* Length Wtd. (ft)       *   13.00  * Wetted Per. (ft)      *          *   52.24  *
         *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)      *          *    0.02  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.02  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  893.66  *  231.42  *
1267.77  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   97.17  *   10.93  *
 104.70  *
**********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
**********************************************************************************
***********
* E.G. Elev (ft)         *  175.59  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *          *   0.045  *
         *
```

* W.S. Elev (ft)	* 175.58	* Reach Len. (ft)	* 10.00	* 13.00	* 35.00	*
* Crit W.S. (ft)	* 160.74	* Flow Area (sq ft)	*	* 838.60	*	*
* E.G. Slope (ft/ft)	*0.000037	* Area (sq ft)	*	* 838.60	*	*
* Q Total (cfs)	* 800.00	* Flow (cfs)	*	* 800.00	*	*
* Top Width (ft)	* 50.00	* Top Width (ft)	*	* 50.00	*	*
* Vel Total (ft/s)	* 0.95	* Avg. Vel. (ft/s)	*	* 0.95	*	*
* Max Chl Dpth (ft)	* 18.74	* Hydr. Depth (ft)	*	* 16.77	*	*
* Conv. Total (cfs)	*131533.3	* Conv. (cfs)	*	*131533.3	*	*
* Length Wtd. (ft)	* 13.00	* Wetted Per. (ft)	*	* 81.00	*	*
* Min Ch El (ft)	* 156.84	* Shear (lb/sq ft)	*	* 0.02	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.02	*	*
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 97.80	* 236.98	* 690.48	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 2.30	* 10.64	* 28.87	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 169.92	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.11	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 169.81	* Reach Len. (ft)	* 10.00	* 13.00	* 35.00	*
* Crit W.S. (ft)	* 161.78	* Flow Area (sq ft)	*	* 550.24	*	*
* E.G. Slope (ft/ft)	*0.000276	* Area (sq ft)	* 24.84	* 809.99	* 49.11	*
* Q Total (cfs)	* 1450.00	* Flow (cfs)	*	* 1450.00	*	*
* Top Width (ft)	* 128.52	* Top Width (ft)	* 14.48	* 91.30	* 22.74	*
* Vel Total (ft/s)	* 2.64	* Avg. Vel. (ft/s)	*	* 2.64	*	*
* Max Chl Dpth (ft)	* 12.97	* Hydr. Depth (ft)	*	* 11.00	*	*
* Conv. Total (cfs)	* 87303.4	* Conv. (cfs)	*	* 87303.4	*	*
* Length Wtd. (ft)	* 13.00	* Wetted Per. (ft)	*	* 52.24	*	*
* Min Ch El (ft)	* 156.84	* Shear (lb/sq ft)	*	* 0.18	*	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.48	*	*

```
        *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  436.81  *  164.77  *
 558.60  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *   58.06  *   11.05  *
  94.40  *
**********************************************************************************
***********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
***********
* E.G. Elev (ft)         *  173.20  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.            *          *   0.045  *
        *
* W.S. Elev (ft)         *  173.18  * Reach Len. (ft)       *   10.00  *   13.00  *
  35.00  *
* Crit W.S. (ft)         *  161.00  * Flow Area (sq ft)     *          *  718.60  *
        *
* E.G. Slope (ft/ft)     *0.000049  * Area (sq ft)          * 2276.37  * 1117.40  *
 580.63  *
* Q Total (cfs)          *  950.00  * Flow (cfs)            *          *  950.00  *
        *
* Top Width (ft)         * 2722.11  * Top Width (ft)        * 1923.20  *   91.30  *
 707.61  *
* Vel Total (ft/s)       *    1.32  * Avg. Vel. (ft/s)      *          *    1.32  *
        *
* Max Chl Dpth (ft)      *   16.34  * Hydr. Depth (ft)      *          *   14.37  *
        *
* Conv. Total (cfs)      *136224.0  * Conv. (cfs)           *          *136224.0  *
        *
* Length Wtd. (ft)       *   13.00  * Wetted Per. (ft)      *          *   52.24  *
        *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)      *          *    0.04  *
        *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.06  *
        *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  731.64  *  211.48  *
1047.14  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   83.85  *   10.93  *
 101.74  *
**********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #0.2%
**********************************************************************************
***********
* E.G. Elev (ft)         *  178.48  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  178.48  * Reach Len. (ft)       *   10.00  *   13.00  *
  35.00  *
* Crit W.S. (ft)         *  160.54  * Flow Area (sq ft)     *18501.64  * 1601.44  *
5699.50  *
* E.G. Slope (ft/ft)     *0.000000  * Area (sq ft)          *18501.64  * 1601.44  *
```

```
5699.50  *
* Q Total (cfs)          *  700.00  * Flow (cfs)             *  432.47  *  127.32  *
 140.22  *
* Top Width (ft)         * 4642.40  * Top Width (ft)         * 3546.85  *   91.30  *
1004.26  *
* Vel Total (ft/s)       *    0.03  * Avg. Vel. (ft/s)       *    0.02  *    0.08  *
   0.02  *
* Max Chl Dpth (ft)      *   21.64  * Hydr. Depth (ft)       *    5.22  *   17.54  *
   5.68  *
* Conv. Total (cfs)      *1917480.0  * Conv. (cfs)            *1184633.0  *348749.2
*384097.9  *
* Length Wtd. (ft)       *   14.28  * Wetted Per. (ft)       * 3547.99  *   94.55  *
1007.57  *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)       *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    2.19  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   * 1379.92  *  280.77  *
1852.62  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *  126.42  *   11.26  *
 126.19  *
*******************************************************************************
***********
```

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 246

INPUT
Description: XS 246
CHANNEL REACH DISTANCE ADJUSTED PER PROPOSED RUNWAY
BRIDGE
THIS IS THE CROSS SECTION BETWEEN THE RUNWAYS
Station Elevation Data num= 390

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.25	182.47	32.81	182.48	39.37	182.27
45.93	182.32	52.49	182.57	68.89	182.21	75.46	182.31	98.42	181.7
104.98	181.75	118.1	181.4	124.67	181.5	137.79	181.21	141.07	181.22
147.63	180.96	154.19	180.94	164.03	181.1	170.59	181	180.44	181.01
187	180.79	193.56	180.87	203.4	180.77	206.68	180.63	213.24	180.62
226.37	180.39	236.21	180.29	242.77	180.09	262.45	179.99	269.01	179.82
282.14	179.68	288.7	179.86	295.26	179.61	311.66	179.38	321.51	179.57
331.35	179.41	337.91	179.19	344.47	179.36	351.03	179.14	367.43	178.98
374	178.7	390.4	178.75	400.24	178.52	406.8	178.58	410.08	178.44
413.36	178.62	426.49	178.25	436.33	178.44	446.17	178.27	459.29	178.26
465.85	178.16	472.42	178.2	482.26	177.99	498.66	178.02	511.78	177.68
518.35	177.79	538.03	177.63	544.59	177.4	547.87	177.53	554.43	177.51
560.99	177.29	567.56	177.31	583.96	177.13	590.52	177.26	597.08	177
610.2	176.83	613.48	176.71	629.89	176.5	636.45	176.54	643.01	176.42
656.13	176.64	662.69	176.53	665.98	176.6	669.26	176.41	679.1	176.28
685.66	176.36	692.22	176.05	698.78	176.17	705.34	175.99	708.62	176.09

725.03	175.86	731.59	175.7	734.87	175.86	744.71	175.71	751.27	175.82
757.83	175.76	767.68	175.49	777.52	175.62	784.08	175.37	790.64	175.28
800.48	175.45	810.32	175.36	826.73	175.36	833.29	175.06	846.41	175.11
856.25	175.25	866.1	175.07	869.38	175.16	875.94	174.87	889.06	174.99
892.34	175.11	898.9	174.88	908.74	174.94	921.87	174.74	928.43	174.85
944.83	174.67	951.39	174.46	957.95	174.41	964.52	174.51	977.64	174.28
980.92	174.32	987.48	174.13	997.32	174.4	1007.16	174.13	1017.01	174.26
1020.29	174.12	1026.85	174.11	1033.41	173.92	1043.25	173.95	1049.81	173.75
1062.94	173.94	1069.5	173.77	1076.06	173.73	1079.34	173.84	1099.02	173.88
1112.15	173.66	1121.99	173.68	1125.27	173.55	1135.11	173.43	1144.95	173.46
1148.23	173.35	1167.92	173.53	1177.76	173.28	1187.6	173.38	1207.29	173.28
1213.85	173.37	1220.41	173.17	1226.97	173.18	1233.53	173.04	1240.09	173.24
1249.93	172.91	1263.06	172.86	1279.46	173.02	1286.02	173.19	1292.58	172.93
1299.14	172.95	1305.71	173.15	1312.27	173.09	1322.11	173.14	1328.67	173.27
1335.23	173.07	1341.79	173.23	1348.35	173.07	1361.48	173.14	1371.32	173.03
1384.44	173.21	1391	173.49	1400.84	173.43	1407.41	173.73	1423.81	174.31
1443.49	174.4	1446.77	174.52	1463.18	174.63	1489.42	175.11	1499.27	175.09
1505.83	175.2	1522.23	175.07	1541.91	174.97	1548.48	174.72	1555.04	174.78
1561.6	174.46	1568.16	174.39	1574.72	174.45	1581.28	174.14	1587.84	174.18
1600.97	173.63	1607.53	173.29	1617.37	173.14	1620.65	173.26	1637.05	173.07
1640.33	172.92	1653.46	173.15	1666.58	172.94	1679.7	173.04	1682.98	172.89
1692.83	172.85	1699.39	172.72	1719.07	172.68	1725.63	172.78	1738.75	172.77
1745.32	173.01	1751.88	172.97	1755.16	172.81	1765	172.86	1771.56	172.65
1778.12	172.8	1784.68	172.45	1797.81	172.5	1807.65	172.26	1814.21	172.35
1827.33	172.24	1833.89	172	1840.46	172.1	1847.02	172.05	1856.86	172.21
1869.98	172.1	1876.54	172.19	1892.95	172	1896.23	172.12	1909.35	172.03
1912.63	171.88	1932.31	171.77	1938.88	171.55	1948.72	171.93	1955.28	171.8
1965.12	171.84	1968.4	171.74	1981.52	171.78	1991.37	171.63	2001.21	171.68
2007.77	171.47	2017.61	171.54	2027.45	171.39	2034.02	171.65	2040.58	171.49
2047.14	171.58	2056.98	171.38	2066.82	171.42	2073.38	171.26	2079.95	171.4
2089.79	171.35	2096.35	171.51	2102.91	171.29	2109.47	171.45	2129.16	171.28
2132.44	171.19	2142.28	171.22	2148.84	171.36	2155.4	171.24	2175.09	171.35
2184.93	171.28	2191.49	171.4	2204.61	171.29	2211.17	171.4	2230.86	171.22
2240.7	171.32	2253.82	171.56	2280.07	171.36	2286.63	171.2	2293.19	171.24
2306.31	171.17	2312.87	171.31	2322.72	171.2	2335.84	171.15	2352.24	171.47
2378.49	171.59	2388.33	171.49	2400.88	171.52	2410.96	171.61	2421.05	171.81
2431.144	171.86	2441.23	171.88	2461.40	171.87	2471.49	171.84	2481.58	171.69
2491.671	171.52	511.846	171.38	2521.93	171.29	2542.10	171.23	2572.37	171.17
2592.548	171.22	612.723	171.16	2622.81	171.18	2673.25	171.07	2703.51	171.1
2723.688	171.06	2743.86	171.08	2753.95	171.03	2794.30	171.09	2804.39	171.07
2814.478	171.09	2844.74	171.09	2885.09	171.06	2905.26	171.12	2925.44	171.33
2935.531	171.49	2945.61	171.61	2955.70	171.68	2965.79	171.83	2975.88	171.83
2985.97	171.86	3026.32	172.69	3036.40	172.83	3056.58	172.83	3066.67	172.97
3107.022	173.78	3117.11	173.83	3217.98	173.83	3228.07	173.71	3268.42	173.11
3278.514	172.99	3288.60	172.83	3328.95	172.83	3339.04	173.13	3369.30	173.7
3389.479	174.12	3419.74	174.62	3429.83	174.77	3439.91	174.83	3490.35	174.83
3500.444	174.76	3530.70	174.31	3550.88	173.79	3560.97	173.64	3571.05	173.45
3581.146	173.15	3601.32	172.51	3611.40	172.13	3621.49	171.83	3671.93	171.83
3712.287	171.96	3722.37	171.96	3762.72	172.08	3782.90	172.25	3792.98	172.22
3803.076	172.26	3813.16	172.49	3823.25	172.83	3833.34	172.97	3843.42	173.16
3853.515	173.12	3873.69	173.22	3883.77	173.29	3893.86	173.33	3903.95	173.11
3944.305	170.49	3954.39	168.58	3964.48	165.94	3974.56	163.35	3984.65	161.1
3994.743	159.83	4012	156.84	4014.91	159.83	4025.00	160.13	4035.09	161.35
4045.182	163.52	4055.27	165.27	4075.44	168.74	4085.53	170.34	4095.62	171.87
4105.708	172.44	4115.79	172.93	4125.88	173.19	4135.97	173.37	4156.14	173.66
4176.322	173.85	4186.41	174	4246.93	174.53	4257.02	174.53	4287.28	174.28
4307.463	174.09	4317.55	174.02	4367.98	173.94	4428.51	173.47	4428.51	173.36
4438.604	173.31	4448.69	173.39	4519.30	173.69	4529.39	173.72	4579.83	173.7
4640.358	173.78	4670.62	173.77	4751.32	173.23	4761.41	173.15	4771.49	173.13
4781.586	173.07	4791.67	173.11	4801.76	173.14	4821.93	172.85	4842.11	172.68
4872.376	172.83	4882.46	172.94	4912.72	173.26	4932.90	173.46	4963.16	173.85
4973.253	174.06	4993.42	174.41	5013.60	174.83	5023.69	175.25	5033.78	175.75

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .07 3964.48    .045 4055.27     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
       3964.48 4055.27                5      10      35             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3972     180       F
    4052 5033.78     180       F

CROSS SECTION OUTPUT  Profile #1%
*************************************************************************************
***********
* E.G. Elev (ft)         *  174.72  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  174.71  * Reach Len. (ft)        *    5.00  *   10.00  *
  35.00  *
* Crit W.S. (ft)         *  161.57  * Flow Area (sq ft)      *          * 1114.41  *
         *
* E.G. Slope (ft/ft)     *0.000015  * Area (sq ft)           * 6467.22  * 1219.42  *
1246.26  *
* Q Total (cfs)          *  800.00  * Flow (cfs)             *          *  800.00  *
         *
* Top Width (ft)         * 3899.97  * Top Width (ft)        * 2856.58  *   90.79  *
 952.60  *
* Vel Total (ft/s)       *    0.72  * Avg. Vel. (ft/s)      *          *    0.72  *
         *
* Max Chl Dpth (ft)      *   17.91  * Hydr. Depth (ft)      *          *   13.93  *
         *
* Conv. Total (cfs)      *208928.9  * Conv. (cfs)           *          *208928.9  *
         *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)      *          *   82.37  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)      *          *    0.01  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.01  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  892.22  *  231.05  *
1266.49  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *   96.51  *   10.90  *
 103.93  *
*************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
*************************************************************************************
***********
* E.G. Elev (ft)         *  175.59  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  175.58  * Reach Len. (ft)        *    5.00  *   10.00  *
```

```
  35.00  *
* Crit W.S. (ft)         *  161.57  * Flow Area (sq ft)      *          * 1183.98  *
         *
* E.G. Slope (ft/ft)     *0.000017  * Area (sq ft)           *          * 1183.98  *
         *
* Q Total (cfs)          *  800.00  * Flow (cfs)             *          *  800.00  *
         *
* Top Width (ft)         *   80.00  * Top Width (ft)         *          *   80.00  *
         *
* Vel Total (ft/s)       *    0.68  * Avg. Vel. (ft/s)       *          *    0.68  *
         *
* Max Chl Dpth (ft)      *   18.78  * Hydr. Depth (ft)       *          *   14.80  *
         *
* Conv. Total (cfs)      *196812.7  * Conv. (cfs)            *          *196812.7  *
         *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)       *          *  104.82  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    0.01  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.01  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *   97.80  *  236.67  *
 690.48  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    2.30  *   10.62  *
  28.87  *
*******************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  169.89  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.06  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  169.83  * Reach Len. (ft)       *    5.00  *   10.00  *
  35.00  *
* Crit W.S. (ft)         *  162.57  * Flow Area (sq ft)      *          *  723.93  *
         *
* E.G. Slope (ft/ft)     *0.000203  * Area (sq ft)           *   30.05  *  776.28  *
  60.73  *
* Q Total (cfs)          * 1450.00  * Flow (cfs)             *          * 1450.00  *
         *
* Top Width (ft)         *  134.52  * Top Width (ft)         *   16.69  *   90.79  *
  27.05  *
* Vel Total (ft/s)       *    2.00  * Avg. Vel. (ft/s)       *          *    2.00  *
         *
* Max Chl Dpth (ft)      *   13.03  * Hydr. Depth (ft)       *          *    9.05  *
         *
* Conv. Total (cfs)      *101800.5  * Conv. (cfs)            *          *101800.5  *
         *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)       *          *   82.37  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    0.11  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.22  *
         *
```

* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 436.80	* 164.54	* 558.56	*
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 58.05	* 11.03	* 94.38	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 173.20	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	*	* 0.045	*	
* W.S. Elev (ft)	* 173.18	* Reach Len. (ft)	* 5.00	* 10.00	* 35.00	*
* Crit W.S. (ft)	* 161.84	* Flow Area (sq ft)	*	* 992.20	*	
* E.G. Slope (ft/ft)	*0.000030	* Area (sq ft)	* 2639.10	* 1080.73	* 234.23	*
* Q Total (cfs)	* 950.00	* Flow (cfs)	*	* 950.00	*	
* Top Width (ft)	* 2341.40	* Top Width (ft)	* 2031.24	* 90.79	* 219.37	*
* Vel Total (ft/s)	* 0.96	* Avg. Vel. (ft/s)	*	* 0.96	*	
* Max Chl Dpth (ft)	* 16.38	* Hydr. Depth (ft)	*	* 12.40	*	
* Conv. Total (cfs)	*172156.2	* Conv. (cfs)	*	*172156.2	*	
* Length Wtd. (ft)	* 10.00	* Wetted Per. (ft)	*	* 82.37	*	
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.02	*	
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.02	*	
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 731.08	* 211.15	* 1046.82	*
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 83.39	* 10.90	* 101.36	*

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 178.48	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.00	* Wt. n-Val.	*	* 0.045	*	

* W.S. Elev (ft)	* 178.47	* Reach Len. (ft)	* 5.00	* 10.00	* 35.00	*			
* Crit W.S. (ft)	* 161.39	* Flow Area (sq ft)	*	* 1415.49	*				
* E.G. Slope (ft/ft)	*0.000005	* Area (sq ft)	*18889.58	* 1561.11	* 4917.20	*			
* Q Total (cfs)	* 700.00	* Flow (cfs)	*	* 700.00	*				
* Top Width (ft)	* 4616.67	* Top Width (ft)	* 3547.37	* 90.79	* 978.51	*			
* Vel Total (ft/s)	* 0.49	* Avg. Vel. (ft/s)	*	* 0.49	*				
* Max Chl Dpth (ft)	* 21.67	* Hydr. Depth (ft)	*	* 17.69	*				
* Conv. Total (cfs)	*311242.8	* Conv. (cfs)	*	*311242.8	*				
* Length Wtd. (ft)	* 9.75	* Wetted Per. (ft)	*	* 82.37	*				
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.01	*				
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.00	*				
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 1375.63	* 280.30	* 1848.35	*			
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 125.61	* 11.23	* 125.39	*			

****

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 245

INPUT
Description: XS 245
LOW CHORD ELEVATION REVISED TO MATCH PROPOSED BRIDGE
PLAN
THIS IS THE U/S FACE OF THE SMALL RUNWAY
Station Elevation Data num= 389

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.25	182.47	32.81	182.48	39.37	182.27
45.93	182.32	52.49	182.57	68.89	182.21	75.46	182.31	98.42	181.7
104.98	181.75	118.1	181.4	124.67	181.5	137.79	181.21	141.07	181.22
147.63	180.96	154.19	180.94	164.03	181.1	170.59	181	180.44	181.01
187	180.79	193.56	180.87	203.4	180.77	206.68	180.63	213.24	180.62
226.37	180.39	236.21	180.29	242.77	180.09	262.45	179.99	269.01	179.82
282.14	179.68	288.7	179.86	295.26	179.61	311.66	179.38	321.51	179.57
331.35	179.41	337.91	179.19	344.47	179.36	351.03	179.14	367.43	178.98
374	178.7	390.4	178.75	400.24	178.52	406.8	178.58	410.08	178.44
413.36	178.62	426.49	178.25	436.33	178.44	446.17	178.27	459.29	178.26
465.85	178.16	472.42	178.2	482.26	177.99	498.66	178.02	511.78	177.68

518.35	177.79	538.03	177.63	544.59	177.4	547.87	177.53	554.43	177.51
560.99	177.29	567.56	177.31	583.96	177.13	590.52	177.26	597.08	177
610.2	176.83	613.48	176.71	629.89	176.5	636.45	176.54	643.01	176.42
656.13	176.64	665.98	176.6	669.26	176.41	679.1	176.28	685.66	176.36
692.22	176.05	698.78	176.17	705.34	175.99	708.62	176.09	725.03	175.86
731.59	175.7	734.87	175.86	744.71	175.71	751.27	175.82	757.83	175.76
767.68	175.49	777.52	175.62	784.08	175.37	790.64	175.28	800.48	175.45
810.32	175.36	826.73	175.36	833.29	175.06	846.41	175.11	856.25	175.25
866.1	175.07	869.38	175.16	875.94	174.87	889.06	174.99	892.34	175.11
898.9	174.88	908.74	174.94	921.87	174.74	928.43	174.85	944.83	174.67
951.39	174.46	957.95	174.41	964.52	174.51	977.64	174.28	980.92	174.32
987.48	174.13	997.32	174.4	1007.16	174.13	1017.01	174.26	1020.29	174.12
1026.85	174.11	1033.41	173.92	1043.25	173.95	1049.81	173.75	1062.94	173.94
1076.06	173.73	1079.34	173.84	1099.02	173.88	1112.15	173.66	1121.99	173.68
1125.27	173.55	1135.11	173.43	1144.95	173.46	1148.23	173.35	1167.92	173.53
1177.76	173.28	1187.6	173.38	1207.29	173.28	1213.85	173.37	1220.41	173.17
1226.97	173.18	1233.53	173.04	1240.09	173.24	1249.93	172.91	1263.06	172.86
1279.46	173.02	1286.02	173.19	1292.58	172.93	1299.14	172.95	1305.71	173.15
1312.27	173.09	1322.11	173.14	1328.67	173.27	1335.23	173.07	1341.79	173.23
1348.35	173.07	1361.48	173.14	1371.32	173.03	1384.44	173.21	1391	173.49
1400.84	173.43	1407.41	173.73	1423.81	174.31	1443.49	174.4	1446.77	174.52
1463.18	174.63	1489.42	175.11	1499.27	175.09	1505.83	175.2	1522.23	175.07
1541.91	174.97	1548.48	174.72	1555.04	174.78	1561.6	174.46	1568.16	174.39
1574.72	174.45	1581.28	174.14	1587.84	174.18	1600.97	173.63	1607.53	173.29
1617.37	173.14	1620.65	173.26	1637.05	173.07	1640.33	172.92	1653.46	173.15
1666.58	172.94	1679.7	173.04	1682.98	172.89	1692.83	172.85	1699.39	172.72
1719.07	172.68	1725.63	172.78	1738.75	172.77	1745.32	173.01	1751.88	172.97
1755.16	172.81	1765	172.86	1771.56	172.65	1778.12	172.8	1784.68	172.45
1797.81	172.5	1807.65	172.26	1814.21	172.35	1827.33	172.24	1833.89	172
1840.46	172.1	1847.02	172.05	1856.86	172.21	1869.98	172.1	1876.54	172.19
1892.95	172	1896.23	172.12	1909.35	172.03	1912.63	171.88	1932.31	171.77
1938.88	171.55	1948.72	171.93	1955.28	171.8	1965.12	171.84	1968.4	171.74
1981.52	171.78	1991.37	171.63	2001.21	171.68	2007.77	171.47	2017.61	171.54
2027.45	171.39	2034.02	171.65	2040.58	171.49	2047.14	171.58	2056.98	171.38
2066.82	171.42	2073.38	171.26	2079.95	171.4	2089.79	171.35	2096.35	171.51
2102.91	171.29	2109.47	171.45	2129.16	171.28	2132.44	171.19	2142.28	171.22
2148.84	171.36	2155.4	171.24	2175.09	171.35	2184.93	171.28	2191.49	171.4
2204.61	171.29	2211.17	171.4	2230.86	171.22	2240.7	171.32	2253.82	171.56
2280.07	171.36	2286.63	171.2	2293.19	171.24	2306.31	171.17	2312.87	171.31
2322.72	171.2	2335.84	171.15	2352.24	171.47	2378.49	171.59	2388.33	171.49
2401.45	171.562406.918		171.542417.074		171.742427.229		171.852457.697		171.88
2467.853	171.852478.008		171.73	2498.32	171.432508.476		171.432518.631		171.29
2528.787	171.292538.943		171.232549.099		171.23	2569.41	171.172579.566		171.17
2589.722	171.22610.033		171.16	2640.5	171.162670.968		171.08	2691.28	171.08
2711.591	171.12721.747		171.062742.058		171.082752.214		171.042792.837		171.09
2802.993	171.062813.149		171.1	2833.46	171.072843.616		171.092884.239		171.06
2904.551	171.122914.707		171.212924.862		171.332935.018		171.482945.174		171.6
2955.33	171.682965.485		171.832975.641		171.832985.797		171.86	3026.42	172.69
3036.576	172.833056.887		172.833067.043		172.983107.666		173.793117.822		173.83
3219.38	173.833270.158		173.09	3290.47	172.833331.093		172.833341.249		173.15
3361.56	173.533381.872		173.973422.495		174.673432.651		174.813493.585		174.83
3503.741	174.713524.053		174.413534.208		174.223544.364		173.94	3554.52	173.72
3564.676	173.63574.832		173.343595.143		172.723605.299		172.373615.455		171.85
3666.234	171.833676.389		171.843686.545		171.893706.857		171.953727.168		171.97
3757.635	172.063767.791		172.113777.947		172.213788.103		172.253798.259		172.22
3808.414	172.27	3818.57	172.743828.726		172.853838.882		173.113859.193		173.13
3889.66	173.333899.816		173.33940.439		170.553950.595		169.153960.751		166.96
3970.907	164.573981.063		162.183991.218		159.83	4016	156.84021.686		159.83
4031.841	160.714041.997		162.884052.153		164.74062.309		166.394072.464		167.98
4082.62	169.464092.776		171.44102.932		172.834113.087		172.974123.243		173.39
4133.399	173.654143.555		173.834174.022		174.314184.178		174.494255.268		175.28
4265.424	175.34	4275.58	175.324306.047		175.114397.449		175.084417.761		174.99
4438.072	174.854448.228		174.854488.851		175.054509.163		175.14600.564		175.07

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4641.188  175.134691.966  175.124712.278  175.044752.901  174.774793.524  174.73
4813.836  174.794854.459  174.324864.615  174.234874.771  173.964884.926  173.83
4905.238  173.714915.394  173.794986.484  174.77 4996.64  175.085006.795  175.55
5016.951  175.885027.107  176.025047.418   176.2 5067.73  176.26

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .073970.907    .0454052.153     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      3970.9074052.153              230     230     230             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3996   176.9       F
    4031 5067.73   176.6       F

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
***********
* E.G. Elev (ft)         *  174.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  174.68  * Reach Len. (ft)        *   50.00  *   50.00  *
  50.00  *
* Crit W.S. (ft)         *  161.20  * Flow Area (sq ft)      *          *  560.75  *
         *
* E.G. Slope (ft/ft)     *0.000048  * Area (sq ft)           * 6449.75  * 1140.07  *
 456.54  *
* Q Total (cfs)          *  800.00  * Flow (cfs)             *          *  800.00  *
         *
* Top Width (ft)         * 3240.13  * Top Width (ft)        * 2853.20  *   81.25  *
 305.68  *
* Vel Total (ft/s)       *    1.43  * Avg. Vel. (ft/s)       *          *    1.43  *
         *
* Max Chl Dpth (ft)      *   17.88  * Hydr. Depth (ft)       *          *   16.02  *
         *
* Conv. Total (cfs)      *115611.3  * Conv. (cfs)            *          *115611.3  *
         *
* Length Wtd. (ft)       *   50.00  * Wetted Per. (ft)       *          *   35.94  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    0.05  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.07  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  891.48  *  230.78  *
1265.81  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   96.18  *   10.88  *
 103.43  *
*********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
*********************************************************************************
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* E.G. Elev (ft)	* 175.58	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.03	* Wt. n-Val.	*	* 0.045	*
* W.S. Elev (ft)	* 175.55	* Reach Len. (ft)	* 50.00	* 50.00	* 50.00 *
* Crit W.S. (ft)	* 161.19	* Flow Area (sq ft)	*	* 591.28	*
* E.G. Slope (ft/ft)	*0.000092	* Area (sq ft)	*	* 591.28	*
* Q Total (cfs)	* 800.00	* Flow (cfs)	*	* 800.00	*
* Top Width (ft)	* 35.00	* Top Width (ft)	*	* 35.00	*
* Vel Total (ft/s)	* 1.35	* Avg. Vel. (ft/s)	*	* 1.35	*
* Max Chl Dpth (ft)	* 18.75	* Hydr. Depth (ft)	*	* 16.89	*
* Conv. Total (cfs)	* 83244.4	* Conv. (cfs)	*	* 83244.4	*
* Length Wtd. (ft)	* 50.00	* Wetted Per. (ft)	*	* 67.16	*
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.05	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.07	*
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 97.80	* 236.47	* 690.48 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 2.30	* 10.60	* 28.87 *

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 169.84	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.22	* Wt. n-Val.	*	* 0.045	*
* W.S. Elev (ft)	* 169.62	* Reach Len. (ft)	* 50.00	* 50.00	* 50.00 *
* Crit W.S. (ft)	* 162.42	* Flow Area (sq ft)	*	* 383.62	*
* E.G. Slope (ft/ft)	*0.000558	* Area (sq ft)	* 55.83	* 728.91	* 75.29 *
* Q Total (cfs)	* 1450.00	* Flow (cfs)	*	* 1450.00	*
* Top Width (ft)	* 136.26	* Top Width (ft)	* 23.72	* 81.25	* 31.30 *
* Vel Total (ft/s)	* 3.78	* Avg. Vel. (ft/s)	*	* 3.78	*
* Max Chl Dpth (ft)	* 12.82	* Hydr. Depth (ft)	*	* 10.96	*
* Conv. Total (cfs)	* 61409.1	* Conv. (cfs)	*	* 61409.1	*
* Length Wtd. (ft)	* 50.00	* Wetted Per. (ft)	*	* 35.94	*

* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	*	0.37	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	*	1.40	*
* Frctn Loss (ft)	* 0.04	* Cum Volume (acre-ft)	* 436.80	*	164.36	* 558.50 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 58.05	*	11.01	* 94.36 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 173.18	* Element	* Left OB	* Channel	* Right OB *	
* Vel Head (ft)	* 0.05	* Wt. n-Val.	*	*	0.045	*
* W.S. Elev (ft)	* 173.13	* Reach Len. (ft)	* 50.00	*	50.00	* 50.00 *
* Crit W.S. (ft)	* 161.50	* Flow Area (sq ft)	*	*	506.51	*
* E.G. Slope (ft/ft)	*0.000095	* Area (sq ft)	* 2594.23	*	1014.16	* 222.57 *
* Q Total (cfs)	* 950.00	* Flow (cfs)	*	*	950.00	*
* Top Width (ft)	* 2117.41	* Top Width (ft)	* 1971.36	*	81.25	* 64.81 *
* Vel Total (ft/s)	* 1.88	* Avg. Vel. (ft/s)	*	*	1.88	*
* Max Chl Dpth (ft)	* 16.33	* Hydr. Depth (ft)	*	*	14.47	*
* Conv. Total (cfs)	* 97581.0	* Conv. (cfs)	*	*	97581.0	*
* Length Wtd. (ft)	* 50.00	* Wetted Per. (ft)	*	*	35.94	*
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	*	0.08	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	*	0.16	*
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 730.78	*	210.91	* 1046.63 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 83.16	*	10.88	* 101.25 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	178.48	Reach Len. (ft)	50.00	50.00	50.00
Crit W.S. (ft)	160.98	Flow Area (sq ft)	18991.26	1448.50	4003.43
E.G. Slope (ft/ft)	0.000000	Area (sq ft)	18991.26	1448.50	4003.43
Q Total (cfs)	700.00	Flow (cfs)	488.63	127.44	83.93
Top Width (ft)	4650.76	Top Width (ft)	3553.94	81.25	1015.58
Vel Total (ft/s)	0.03	Avg. Vel. (ft/s)	0.03	0.09	0.02
Max Chl Dpth (ft)	21.68	Hydr. Depth (ft)	5.34	17.83	3.94
Conv. Total (cfs)	1765311.0	Conv. (cfs)	1232263.0	321386.7	211660.7
Length Wtd. (ft)	50.00	Wetted Per. (ft)	3555.14	83.16	1018.51
Min Ch El (ft)	156.80	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	2.35	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1373.46	279.95	1844.77
C & E Loss (ft)	0.00	Cum SA (acres)	125.20	11.22	124.59

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE

RIVER: RIVER-1
REACH: Reach-1 RS: 244.19

INPUT
Description: Bridge #1 - Taxiway

Distance from Upstream XS = 50
Deck/Roadway Width = 133
Weir Coefficient = 2.7
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	180	0	606	177.3	0	1956	177.3	0
3156	176.9	0	3996	176.6	0	4000.99	177.16	0
4001	177.16	170.99	4031	177.16	170.99	4031.01	177.16	0
5086	176.6	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 389

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.25	182.47	32.81	182.48	39.37	182.27
45.93	182.32	52.49	182.57	68.89	182.21	75.46	182.31	98.42	181.7
104.98	181.75	118.1	181.4	124.67	181.5	137.79	181.21	141.07	181.22
147.63	180.96	154.19	180.94	164.03	181.1	170.59	181	180.44	181.01
187	180.79	193.56	180.87	203.4	180.77	206.68	180.63	213.24	180.62
226.37	180.39	236.21	180.29	242.77	180.09	262.45	179.99	269.01	179.82
282.14	179.68	288.7	179.86	295.26	179.61	311.66	179.38	321.51	179.57
331.35	179.41	337.91	179.19	344.47	179.36	351.03	179.14	367.43	178.98
374	178.7	390.4	178.75	400.24	178.52	406.8	178.58	410.08	178.44
413.36	178.62	426.49	178.25	436.33	178.44	446.17	178.27	459.29	178.26
465.85	178.16	472.42	178.2	482.26	177.99	498.66	178.02	511.78	177.68
518.35	177.79	538.03	177.63	544.59	177.4	547.87	177.53	554.43	177.51
560.99	177.29	567.56	177.31	583.96	177.13	590.52	177.26	597.08	177
610.2	176.83	613.48	176.71	629.89	176.5	636.45	176.54	643.01	176.42
656.13	176.64	665.98	176.6	669.26	176.41	679.1	176.28	685.66	176.36
692.22	176.05	698.78	176.17	705.34	175.99	708.62	176.09	725.03	175.86
731.59	175.7	734.87	175.86	744.71	175.71	751.27	175.82	757.83	175.76
767.68	175.49	777.52	175.62	784.08	175.37	790.64	175.28	800.48	175.45
810.32	175.36	826.73	175.36	833.29	175.06	846.41	175.11	856.25	175.25
866.1	175.07	869.38	175.16	875.94	174.87	889.06	174.99	892.34	175.11
898.9	174.88	908.74	174.94	921.87	174.74	928.43	174.85	944.83	174.67
951.39	174.46	957.95	174.41	964.52	174.51	977.64	174.28	980.92	174.32
987.48	174.13	997.32	174.4	1007.16	174.13	1017.01	174.26	1020.29	174.12
1026.85	174.11	1033.41	173.92	1043.25	173.95	1049.81	173.75	1062.94	173.94
1076.06	173.73	1079.34	173.84	1099.02	173.88	1112.15	173.66	1121.99	173.68
1125.27	173.55	1135.11	173.43	1144.95	173.46	1148.23	173.35	1167.92	173.53
1177.76	173.28	1187.6	173.38	1207.29	173.28	1213.85	173.37	1220.41	173.17
1226.97	173.18	1233.53	173.04	1240.09	173.24	1249.93	172.91	1263.06	172.86
1279.46	173.02	1286.02	173.19	1292.58	172.93	1299.14	172.95	1305.71	173.15
1312.27	173.09	1322.11	173.14	1328.67	173.27	1335.23	173.07	1341.79	173.23
1348.35	173.07	1361.48	173.14	1371.32	173.03	1384.44	173.21	1391	173.49
1400.84	173.43	1407.41	173.73	1423.81	174.31	1443.49	174.4	1446.77	174.52
1463.18	174.63	1489.42	175.11	1499.27	175.09	1505.83	175.2	1522.23	175.07
1541.91	174.97	1548.48	174.72	1555.04	174.78	1561.6	174.46	1568.16	174.39
1574.72	174.45	1581.28	174.14	1587.84	174.18	1600.97	173.63	1607.53	173.29
1617.37	173.14	1620.65	173.26	1637.05	173.07	1640.33	172.92	1653.46	173.15
1666.58	172.94	1679.7	173.04	1682.98	172.89	1692.83	172.85	1699.39	172.72
1719.07	172.68	1725.63	172.78	1738.75	172.77	1745.32	173.01	1751.88	172.97
1755.16	172.81	1765	172.86	1771.56	172.65	1778.12	172.8	1784.68	172.45
1797.81	172.5	1807.65	172.26	1814.21	172.35	1827.33	172.24	1833.89	172
1840.46	172.1	1847.02	172.05	1856.86	172.21	1869.98	172.1	1876.54	172.19
1892.95	172	1896.23	172.12	1909.35	172.03	1912.63	171.88	1932.31	171.77
1938.88	171.55	1948.72	171.93	1955.28	171.8	1965.12	171.84	1968.4	171.74
1981.52	171.78	1991.37	171.63	2001.21	171.68	2007.77	171.47	2017.61	171.54
2027.45	171.39	2034.02	171.65	2040.58	171.49	2047.14	171.58	2056.98	171.38
2066.82	171.42	2073.38	171.26	2079.95	171.4	2089.79	171.35	2096.35	171.51
2102.91	171.29	2109.47	171.45	2129.16	171.28	2132.44	171.19	2142.28	171.22
2148.84	171.36	2155.4	171.24	2175.09	171.35	2184.93	171.28	2191.49	171.4
2204.61	171.29	2211.17	171.4	2230.86	171.22	2240.7	171.32	2253.82	171.56
2280.07	171.36	2286.63	171.2	2293.19	171.24	2306.31	171.17	2312.87	171.31
2322.72	171.2	2335.84	171.15	2352.24	171.47	2378.49	171.59	2388.33	171.49
2401.45	171.562406.918		171.542417.074		171.742427.229		171.852457.697		171.88
2467.853	171.852478.008		171.73 2498.32		171.432508.476		171.432518.631		171.29
2528.787	171.292538.943		171.232549.099		171.23 2569.41		171.172579.566		171.17
2589.722	171.22610.033		171.16 2640.5		171.162670.968		171.08 2691.28		171.08
2711.591	171.12721.747		171.062742.058		171.082752.214		171.042792.837		171.09
2802.993	171.062813.149		171.1 2833.46		171.072843.616		171.092884.239		171.06
2904.551	171.122914.707		171.212924.862		171.332935.018		171.482945.174		171.6

2955.33	171.682965.485	171.832975.641	171.832985.797	171.86 3026.42	172.69
3036.576	172.833056.887	172.833067.043	172.983107.666	173.793117.822	173.83
3219.38	173.833270.158	173.09 3290.47	172.833331.093	172.833341.249	173.15
3361.56	173.533381.872	173.973422.495	174.673432.651	174.813493.585	174.83
3503.741	174.713524.053	174.413534.208	174.223544.364	173.94 3554.52	173.72
3564.676	173.63574.832	173.343595.143	172.723605.299	172.373615.455	171.85
3666.234	171.833676.389	171.843686.545	171.893706.857	171.953727.168	171.97
3757.635	172.063767.791	172.113777.947	172.213788.103	172.253798.259	172.22
3808.414	172.27 3818.57	172.743828.726	172.853838.882	173.113859.193	173.13
3889.66	173.333899.816	173.33940.439	170.553950.595	169.153960.751	166.96
3970.907	164.573981.063	162.183991.218	159.83 4016	156.84021.686	159.83
4031.841	160.714041.997	162.884052.153	164.74062.309	166.394072.464	167.98
4082.62	169.464092.776	171.44102.932	172.834113.087	172.974123.243	173.39
4133.399	173.654143.555	173.834174.022	174.314184.178	174.494255.268	175.28
4265.424	175.34 4275.58	175.324306.047	175.114397.449	175.084417.761	174.99
4438.072	174.854448.228	174.854488.851	175.054509.163	175.14600.564	175.07
4641.188	175.134691.966	175.124712.278	175.044752.901	174.774793.524	174.73
4813.836	174.794854.459	174.324864.615	174.234874.771	173.964884.926	173.83
4905.238	173.714915.394	173.794986.484	174.77 4996.64	175.085006.795	175.55
5016.951	175.885027.107	176.025047.418	176.2 5067.73	176.26	

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.073970.907	.0454052.153	.07		

Bank Sta: Left Right Coeff Contr. Expan.

3970.9074052.153		.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3996	176.9	F
4031	5067.73	176.6	F

Downstream Deck/Roadway Coordinates

num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	180	0	619	177.3	0	1969	177.3	0
3169	176.9	0	3964	177.16	0	3964	177.16	170.93
3994	177.16	170.93	3994	177.16	0	5099	176.6	0

Downstream Bridge Cross Section Data

Station Elevation Data num= 486

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.05	3.28	181.94	16.4	181.9	26.25	182.24	29.53	181.94
32.81	180.94	39.37	181.2	49.21	181.16	59.05	180.91	68.89	181.02
82.02	180.48	104.98	180.69	108.26	180.4	127.94	180.32	131.22	179.72
137.79	179.68	150.91	179.84	164.03	179.86	183.71	179.02	190.28	178.2
203.4	177.96	209.96	178.84	216.52	179.29	236.2	179.94	242.77	179.98
249.33	180.34	252.61	180.25	269.01	181.59	275.57	181.62	288.69	182.16
295.26	182.7	321.5	182.41	328.06	182.48	334.62	182.21	344.46	182.2
370.71	181.77	396.95	179.89	400.24	179.83	410.08	179.13	426.48	178.9
433.04	178.6	442.88	178.38	449.44	178.08	472.41	177.5	478.97	177.26
485.53	177.23	488.81	176.99	521.62	176.31	524.9	176.09	531.46	176.05
547.86	175.67	551.14	175.75	557.71	175.46	574.11	175.1	583.95	175.01
600.35	175.01	610.2	174.7	620.04	174.58	643	173.58	652.84	173.81
662.69	174.32	682.37	174.52	688.93	174.33	698.77	174.54	705.33	174.31
718.46	174.2	721.74	173.97	728.3	173.94	734.86	174.19	741.42	174.05
761.1	173.95	767.67	174.02	780.79	173.69	787.35	173.83	790.63	173.65
810.31	173.57	816.88	173.4	820.16	173.06	830	172.91	843.12	173.36
862.8	173.35	869.36	173.5	872.65	173.35	895.61	173.29	905.45	173.43
915.29	173.31	918.57	172.98	934.98	173.04	948.1	172.67	957.94	172.93

967.78	172.79	980.91	172.39	994.03	171.89 1007.15	172.28 1016.99	172.07
1030.12	172.14	1043.24	171.94	1049.8	172.14 1059.64	172.08 1062.92	171.92
1076.04	171.89	1082.61	171.69	1089.17	171.73 1095.73	171.47 1102.29	171.81
1108.85	171.66	1121.97	171.74	1135.1	172.4 1144.94	172.21 1158.06	172.33
1164.62	172.54	1174.46	172.6	1181.02	172.5 1194.15	172.72 1200.71	172.68
1213.83	172.94	1223.67	172.81	1233.51	173.1 1266.32	173.58 1276.16	173.96
1289.29	174.04	1299.13	174.5	1312.25	174.64 1318.81	174.52 1331.93	174.74
1341.78	175.2	1348.34	175.17	1361.46	175.5 1368.02	175.84 1377.86	175.72
1384.42	175.92	1390.98	175.84	1407.39	175.92 1413.95	175.76 1420.51	175.88
1436.91	175.77	1453.32	174.99	1469.72	174.61 1479.56	174.48 1486.12	174.56
1502.53	174.38	1505.81	174.68	1515.65	174.41 1525.49	173.46 1538.61	172.88
1561.58	172.72	1574.7	172.39	1581.26	171.87 1587.82	171.6 1600.95	171.32
1604.23	171.51	1610.79	171.24	1627.19	170.8 1640.31	170.59 1646.87	170.38
1676.4	170.08	1686.24	170.29	1699.36	170.24 1702.64	170.61 1712.49	170.63
1719.05	170.44	1725.61	170.52	1748.57	170.5 1761.7	170.2 1771.54	170.27
1778.1	170.47	1784.66	170.24	1797.78	170.6 1801.06	171.06 1814.19	171.18
1824.03	170.92	1837.15	170.79	1856.83	170.75 1863.4	170.91 1873.24	170.53
1876.52	170.6	1896.2	170.25	1899.48	170.75 1915.89	170.78 1925.73	170.44
1938.85	170.46	1942.13	170.31	1958.53	170.38 1965.09	170.76 1974.94	170.66
1978.22	170.76	1984.78	170.36	1994.62	170.43 1997.9	170.97 2011.02	170.99
2017.58	170.8	2020.87	170.93	2027.43	170.69 2033.99	170.81 2043.83	170.57
2047.11	170.66	2070.07	170.25	2073.35	170.41 2083.2	170.46 2093.04	171.03
2096.32	171.97	2106.16	172.65	2119.28	173.96 2135.68	175.02 2142.25	175.61
2152.09	175.61	2161.93	175.85	2168.49	175.7 2171.77	175.91 2181.61	176
2191.45	176.37	2214.42	176.57	2220.98	176.55 2250.5	176.81 2257.06	176.65
2270.19	176.64	2276.75	176.48	2293.15	176.48 2302.99	176.23 2312.83	175.8
2319.39	175.85	2335.8	175.74	2345.64	175.52 2358.76	175.4 2362.04	175.18
2378.44	174.72	2388.28	174.18	2391.56	174.53 2404.69	173.87 2411.25	173.33
2421.09	172.97	2429	173.16	2431.65	7 172.93	2441.58	2 172.58	2451.50	7 172.21
2461.43	2	1722	471.35	7 171.83	2481.28	2 171.73	2491.20	8 171.68	2501.13	3 171.63
2511.05	8 171.56	2520.98	3 171.52	530.908	171.47	2540.83	3 171.42	2550.75	9 171.38
2560.68	4 171.35	2570.60	9 171.37	2580.53	4 171.42	2590.45	9 171.47	2600.38	4 171.48
2610.30	9 171.53	2620.23	4 171.61	2630.15	9 171.69	2640.08	5 171.73	2650.01	171.75
2659.93	5 171.76	2669.86	171.77	2679.78	5 171.78	2689.71	171.82	699.635	171.76
2709.56	1 171.71	2719.48	6 171.66	2729.41	1 171.69	2739.33	6 171.73	2749.26	1 171.77
2759.18	6 171.71	2769.11	1 171.63	2779.03	6 171.58	2788.96	2 171.62	798.887	171.63
2808.81	2 171.63	2818.73	7 171.57	2828.66	2 171.52	838.587	171.48	2848.51	2 171.47
2858.43	8 171.46	2868.36	3 171.43	2878.28	8 171.34	2888.21	3 171.29	2898.13	8 171.29
2908.06	3 171.15	2917.98	8 171.05	2927.91	3 171.12	937.839	171.14	2947.76	4 171.17
2957.68	9 171.29	2967.61	4 171.38	2977.53	9 171.48	2987.46	4 171.56	2997.38	9 171.53
3007.31	4 171.55	3017.24	171.54	3027.16	5 171.53	3037.09	171.52	3047.01	5 171.5
3056.94	171.48	3066.86	5 171.52	3076.79	171.63	086.716	171.68	3096.64	1 171.76
3106.56	6 171.84	3116.49	1 171.93	3126.41	6 171.99	3136.34	1 172.11	3146.26	6 172.07
3156.19	1 172.01	3166.11	6 171.95	3176.04	2 171.89	3185.96	7 171.83	3195.89	2 171.84
3205.81	7 171.81	3215.74	2 171.76	3225.66	7 171.72	3235.59	3 171.73	245.518	171.55
3255.44	3 171.39	3265.36	8 171.31	3275.29	3 171.27	3285.21	8 171.28	3295.14	3 171.23
3305.06	8 171.19	3314.99	3 171.35	3324.91	9 171.41	3334.84	4 171.53	3344.76	9 171.88
3354.69	4 172.36	3364.61	9 172.94	3374.54	4 173.46	3384.46	9 173.32	3394.39	5 173.17
3404.32	172.69	3414.24	5 172.13	3424.17	171.96	3434.09	5 171.86	3444.02	171.91
3453.94	5 171.94	3463.87	171.95	3473.79	6 172.01	3483.72	1 172.09	3493.64	6 172.12
3503.57	1 172.22	3513.49	6 172.28	3523.42	1 172.53	533.346	172.73	543.271	172.8
3553.19	7 172.71	3563.12	2 172.69	3573.04	7 172.76	3582.97	2 172.86	3592.89	7 172.95
3602.82	2 173.02	3612.74	7 173.11	3622.67	3 173.18	3632.59	8 173.19	3642.52	3 173.33
3652.44	8 173.34	3662.37	3 173.22	3672.29	8 173.08	3682.22	3 172.92	3692.14	8 172.78
3702.07	3 172.66	3711.99	9 172.52	3721.92	4 172.33	3731.84	9 172.11	3741.77	4 171.9
3751.69	9 171.74	3761.62	4 171.56	3771.55	171.42	3781.47	5 171.27	3791.4	171.07
3801.32	5 170.94	3811.25	170.87	3821.17	5 170.88	3831.1	170.92	3841.02	5 170.98
3850.95	171.12	3860.87	6 171.24	3870.80	1 171.22	3880.72	6 171.11	3890.65	1 170.74
3900.57	6 170.64	3910.50	1 168.92	3920.42	7 165.94	3930.35	2 162.88	3940.27	7 160.34
3950.20	2 159.38	3960.12	7 158.83	3979	156.73	989.902	158.83	3999.82	7 160.49
4009.75	3 162.31	4019.67	8 164.56	4029.60	3 166.43	4039.52	8 167.74	4049.45	3 170.29
4059.37	8 171.13	4069.30	3 170.77	4079.22	9 170.67	4089.15	4 170.32	4099.07	9 169.69
4109.00	4 169.16	4118.92	9 168.82	4128.85	4 168.71	4138.77	9 168.64	4148.70	5 168.44

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4158.629  168.264168.555   168.1 4178.48  167.924188.405  167.73 4198.33  167.58
4208.255  167.47 4218.18  167.384228.105  167.314238.031  167.264247.956  167.18
4257.881  167.074267.806  166.954277.731  167.034287.656  167.144297.582  167.23
4307.506  167.334317.432  167.514327.357  167.734337.282     1684347.207  168.25
4357.132  168.244367.057  168.024376.982   168.24386.908  168.354396.833  168.48
4406.758  168.624416.683  168.644426.608  168.554436.533  168.464446.458  168.38
4456.383  168.484466.309  169.054476.234  169.364486.159  169.574496.084  169.73
4506.009  169.874515.934  170.014525.859  170.064535.785   170.34545.709  170.49
4555.635  170.68 4565.56  170.874575.485  171.05 4585.41  171.234595.335  171.42
 4605.26  171.624615.186  171.834625.111     1724635.036  172.164644.961  172.28
4654.886  172.374664.811  172.464674.736  172.564684.662  172.674694.586  172.82
4704.512  172.944714.437  173.044724.362  173.154734.287  173.274744.212  173.44
4754.137  173.674764.063  173.934773.988  174.194783.913  174.434793.838  174.67
4803.763  174.894813.688  175.214823.613  175.474833.539  175.664843.463  175.84
4853.389  175.914863.314  175.994873.239  176.124883.164   176.24893.089  176.25
4903.014  176.254912.939   176.24922.865  176.28 4932.79  176.394942.715  176.49
 4952.64   176.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .073930.352    .0454009.753     .07

Bank Sta: Left   Right    Coeff Contr.   Expan.
      3930.3524009.753             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3954     176       F
    4009 4952.64     176       F

Upstream Embankment side slope              =       4 horiz. to 1.0 vertical
Downstream Embankment side slope            =       4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   176.6
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #1%
*********************************************************************************
*********
* E.G. US. (ft)          *     174.71  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     174.68  * E.G. Elev (ft)        *     174.69  *
174.62  *
* Q Total (cfs)          *     800.00  * W.S. Elev (ft)        *     174.62  *
174.56  *
```

* Q Bridge (cfs)	* 800.00	* Crit W.S. (ft)	* 161.42	* 160.65	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 17.82	* 17.86	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 2.15	* 2.04	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 371.36	* 392.46	*
* Weir Submerg	*	* Froude # Chl	* 0.09	* 0.09	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 3724.05	* 4048.74	*
* Min El Weir Flow (ft)	* 176.68	* Hydr Depth (ft)	*	*	
* Min El Prs (ft)	* 170.99	* W.P. Total (ft)	* 83.61	* 84.31	*
* Delta EG (ft)	* 0.13	* Conv. Total (cfs)	* 33132.3	* 36128.9	*
* Delta WS (ft)	* 0.11	* Top Width (ft)	*	*	
* BR Open Area (sq ft)	* 371.36	* Frctn Loss (ft)	* 0.07	* 0.01	*
* BR Open Vel (ft/s)	* 2.15	* C & E Loss (ft)	* 0.00	* 0.03	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.16	* 0.14	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.35	* 0.29	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #Floodway

* E.G. US. (ft)	* 175.58	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 175.55	* E.G. Elev (ft)	* 175.56	* 175.48	*
* Q Total (cfs)	* 800.00	* W.S. Elev (ft)	* 175.49	* 175.42	*
* Q Bridge (cfs)	* 800.00	* Crit W.S. (ft)	* 161.42	* 160.65	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 18.69	* 18.72	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 2.15	* 2.04	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 371.36	* 392.46	*
* Weir Submerg	*	* Froude # Chl	* 0.09	* 0.08	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 4045.19	* 4388.13	*
* Min El Weir Flow (ft)	* 177.16	* Hydr Depth (ft)	*	*	
* Min El Prs (ft)	* 170.99	* W.P. Total (ft)	* 83.61	*	

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84.31  *
* Delta EG (ft)          *       0.13  * Conv. Total (cfs)      *    33132.3  *
36128.9  *
* Delta WS (ft)          *       0.12  * Top Width (ft)         *             *
       *
* BR Open Area (sq ft)   *     371.36  * Frctn Loss (ft)        *       0.07  *
 0.01  *
* BR Open Vel (ft/s)     *       2.15  * C & E Loss (ft)        *       0.00  *
 0.03  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.16  *
 0.14  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       0.35  *
 0.29  *
********************************************************************************
*********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #10%
********************************************************************************
*********
* E.G. US. (ft)          *     169.84  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     169.62  * E.G. Elev (ft)        *     169.78  *
169.60  *
* Q Total (cfs)          *    1450.00  * W.S. Elev (ft)        *     169.47  *
169.32  *
* Q Bridge (cfs)         *    1450.00  * Crit W.S. (ft)        *     162.78  *
162.03  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      12.67  *
12.62  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       4.45  *
 4.21  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     325.75  *
344.25  *
* Weir Submerg           *             * Froude # Chl          *       0.22  *
 0.21  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    1992.14  *
2173.20  *
* Min El Weir Flow (ft)  *     176.68  * Hydr Depth (ft)       *      10.86  *
11.47  *
* Min El Prs (ft)        *     170.99  * W.P. Total (ft)       *      41.74  *
51.10  *
* Delta EG (ft)          *       0.37  * Conv. Total (cfs)      *    42320.1  *
40549.0  *
* Delta WS (ft)          *       0.24  * Top Width (ft)         *      30.00  *
30.00  *
* BR Open Area (sq ft)   *     371.36  * Frctn Loss (ft)        *       0.16  *
 0.04  *
* BR Open Vel (ft/s)     *       4.45  * C & E Loss (ft)        *       0.02  *
 0.09  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.57  *
 0.54  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       2.55  *
 2.27  *
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Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #2%

* E.G. US. (ft)	* 173.18	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 173.13	* E.G. Elev (ft)	* 173.16	* 173.06	*
* Q Total (cfs)	* 950.00	* W.S. Elev (ft)	* 173.06	* 172.97	*
* Q Bridge (cfs)	* 950.00	* Crit W.S. (ft)	* 161.76	* 160.99	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 16.26	* 16.27	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 2.56	* 2.42	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 371.36	* 392.46	*
* Weir Submerg	*	* Froude # Chl	* 0.11	* 0.11	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 3165.88	* 3445.54	*
* Min El Weir Flow (ft)	* 176.68	* Hydr Depth (ft)	*	*	*
* Min El Prs (ft)	* 170.99	* W.P. Total (ft)	* 83.61	* 84.31	*
* Delta EG (ft)	* 0.18	* Conv. Total (cfs)	* 33132.3	* 36128.9	*
* Delta WS (ft)	* 0.15	* Top Width (ft)	*	*	*
* BR Open Area (sq ft)	* 371.36	* Frctn Loss (ft)	* 0.10	* 0.02	*
* BR Open Vel (ft/s)	* 2.56	* C & E Loss (ft)	* 0.01	* 0.03	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.23	* 0.20	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.58	* 0.49	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #0.2%

* E.G. US. (ft)	* 178.48	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 178.48	* E.G. Elev (ft)	* 178.48	*	

* Q Total (cfs)	700.00	* W.S. Elev (ft)	178.48	*	178.47 *
* Q Bridge (cfs)	111.40	* Crit W.S. (ft)	161.18	*	160.41 *
* Q Weir (cfs)		* Max Chl Dpth (ft)	21.68	*	21.77 *
* Weir Sta Lft (ft)		* Vel Total (ft/s)	0.10	*	0.11 *
* Weir Sta Rgt (ft)		* Flow Area (sq ft)	6874.81	*	6444.04 *
* Weir Submerg		* Froude # Chl	0.00	*	0.01 *
* Weir Max Depth (ft)		* Specif Force (cu ft)	9841.51	*	9696.78 *
* Min El Weir Flow (ft)	176.68	* Hydr Depth (ft)	1.48	*	1.43 *
* Min El Prs (ft)	170.99	* W.P. Total (ft)	4736.27	*	4600.08 *
* Delta EG (ft)	0.00	* Conv. Total (cfs)	203617.6	*	188487.8 *
* Delta WS (ft)	0.00	* Top Width (ft)	4650.74	*	4513.96 *
* BR Open Area (sq ft)	371.36	* Frctn Loss (ft)	0.00	*	0.00 *
* BR Open Vel (ft/s)	0.30	* C & E Loss (ft)	0.00	*	0.00 *
* BR Sluice Coef		* Shear Total (lb/sq ft)	0.00	*	0.00 *
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	0.00	*	0.00 *

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Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243.38

INPUT
Description: XS 243.38
MANASSAS MUNICIPAL AIRPORT - TAXIWAY AND RUNWAY
THIS
THE DOWNSTREAM FACE OF THE SMALL RUNWAY FROM EFFECTIVE MODEL
Station Elevation Data num= 486

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.05	3.28	181.94	16.4	181.9	26.25	182.24	29.53	181.94
32.81	180.94	39.37	181.2	49.21	181.16	59.05	180.91	68.89	181.02
82.02	180.48	104.98	180.69	108.26	180.4	127.94	180.32	131.22	179.72
137.79	179.68	150.91	179.84	164.03	179.86	183.71	179.02	190.28	178.2
203.4	177.96	209.96	178.84	216.52	179.29	236.2	179.94	242.77	179.98
249.33	180.34	252.61	180.25	269.01	181.59	275.57	181.62	288.69	182.16
295.26	182.7	321.5	182.41	328.06	182.48	334.62	182.21	344.46	182.2

370.71	181.77	396.95	179.89	400.24	179.83	410.08	179.13	426.48	178.9
433.04	178.6	442.88	178.38	449.44	178.08	472.41	177.5	478.97	177.26
485.53	177.23	488.81	176.99	521.62	176.31	524.9	176.09	531.46	176.05
547.86	175.67	551.14	175.75	557.71	175.46	574.11	175.1	583.95	175.01
600.35	175.01	610.2	174.7	620.04	174.58	643	173.58	652.84	173.81
662.69	174.32	682.37	174.52	688.93	174.33	698.77	174.54	705.33	174.31
718.46	174.2	721.74	173.97	728.3	173.94	734.86	174.19	741.42	174.05
761.1	173.95	767.67	174.02	780.79	173.69	787.35	173.83	790.63	173.65
810.31	173.57	816.88	173.4	820.16	173.06	830	172.91	843.12	173.36
862.8	173.35	869.36	173.5	872.65	173.35	895.61	173.29	905.45	173.43
915.29	173.31	918.57	172.98	934.98	173.04	948.1	172.67	957.94	172.93
967.78	172.79	980.91	172.39	994.03	171.89	1007.15	172.28	1016.99	172.07
1030.12	172.14	1043.24	171.94	1049.8	172.14	1059.64	172.08	1062.92	171.92
1076.04	171.89	1082.61	171.69	1089.17	171.73	1095.73	171.47	1102.29	171.81
1108.85	171.66	1121.97	171.74	1135.1	172.4	1144.94	172.21	1158.06	172.33
1164.62	172.54	1174.46	172.6	1181.02	172.5	1194.15	172.72	1200.71	172.68
1213.83	172.94	1223.67	172.81	1233.51	173.1	1266.32	173.58	1276.16	173.96
1289.29	174.04	1299.13	174.5	1312.25	174.64	1318.81	174.52	1331.93	174.74
1341.78	175.2	1348.34	175.17	1361.46	175.5	1368.02	175.84	1377.86	175.72
1384.42	175.92	1390.98	175.84	1407.39	175.92	1413.95	175.76	1420.51	175.88
1436.91	175.77	1453.32	174.99	1469.72	174.61	1479.56	174.48	1486.12	174.56
1502.53	174.38	1505.81	174.68	1515.65	174.41	1525.49	173.46	1538.61	172.88
1561.58	172.72	1574.7	172.39	1581.26	171.87	1587.82	171.6	1600.95	171.32
1604.23	171.51	1610.79	171.24	1627.19	170.8	1640.31	170.59	1646.87	170.38
1676.4	170.08	1686.24	170.29	1699.36	170.24	1702.64	170.61	1712.49	170.63
1719.05	170.44	1725.61	170.52	1748.57	170.5	1761.7	170.2	1771.54	170.27
1778.1	170.47	1784.66	170.24	1797.78	170.6	1801.06	171.06	1814.19	171.18
1824.03	170.92	1837.15	170.79	1856.83	170.75	1863.4	170.91	1873.24	170.53
1876.52	170.6	1896.2	170.25	1899.48	170.75	1915.89	170.78	1925.73	170.44
1938.85	170.46	1942.13	170.31	1958.53	170.38	1965.09	170.76	1974.94	170.66
1978.22	170.76	1984.78	170.36	1994.62	170.43	1997.9	170.97	2011.02	170.99
2017.58	170.8	2020.87	170.93	2027.43	170.69	2033.99	170.81	2043.83	170.57
2047.11	170.66	2070.07	170.25	2073.35	170.41	2083.2	170.46	2093.04	171.03
2096.32	171.97	2106.16	172.65	2119.28	173.96	2135.68	175.02	2142.25	175.61
2152.09	175.61	2161.93	175.85	2168.49	175.7	2171.77	175.91	2181.61	176
2191.45	176.37	2214.42	176.57	2220.98	176.55	2250.5	176.81	2257.06	176.65
2270.19	176.64	2276.75	176.48	2293.15	176.48	2302.99	176.23	2312.83	175.8
2319.39	175.85	2335.8	175.74	2345.64	175.52	2358.76	175.4	2362.04	175.18
2378.44	174.72	2388.28	174.18	2391.56	174.53	2404.69	173.87	2411.25	173.33
2421.09	172.97	2429	173.16	2431.657	172.93	2441.582	172.58	2451.507	172.21
2461.432		1722471.357	171.83	2481.282	171.73	2491.208	171.68	2501.133	171.63
2511.058	171.56	2520.983	171.5	2530.908	171.47	2540.833	171.42	2550.759	171.38
2560.684	171.35	2570.609	171.37	2580.534	171.42	2590.459	171.47	2600.384	171.48
2610.309	171.53	2620.234	171.61	2630.159	171.69	2640.085	171.73	2650.01	171.75
2659.935	171.76	2669.86	171.77	2679.785	171.78	2689.71	171.82	2699.635	171.76
2709.561	171.71	2719.486	171.66	2729.411	171.69	2739.336	171.73	2749.261	171.77
2759.186	171.71	2769.111	171.63	2779.036	171.58	2788.962	171.62	2798.887	171.63
2808.812	171.63	2818.737	171.57	2828.662	171.52	2838.587	171.48	2848.512	171.47
2858.438	171.46	2868.363	171.43	2878.288	171.34	2888.213	171.29	2898.138	171.29
2908.063	171.15	2917.988	171.05	2927.913	171.12	2937.839	171.14	2947.764	171.17
2957.689	171.29	2967.614	171.38	2977.539	171.48	2987.464	171.56	2997.389	171.53
3007.314	171.55	3017.24	171.54	3027.165	171.53	3037.09	171.52	3047.015	171.5
3056.94	171.48	3066.865	171.52	3076.79	171.63	3086.716	171.68	3096.641	171.76
3106.566	171.84	3116.491	171.93	3126.416	171.99	3136.341	172.11	3146.266	172.07
3156.191	172.01	3166.116	171.95	3176.042	171.89	3185.967	171.83	3195.892	171.84
3205.817	171.81	3215.742	171.76	3225.667	171.72	3235.593	171.73	3245.518	171.55
3255.443	171.39	3265.368	171.31	3275.293	171.27	3285.218	171.28	3295.143	171.23
3305.068	171.19	3314.993	171.35	3324.919	171.41	3334.844	171.53	3344.769	171.88
3354.694	172.36	3364.619	172.94	3374.544	173.46	3384.469	173.32	3394.395	173.17
3404.32	172.69	3414.245	172.13	3424.17	171.96	3434.095	171.86	3444.02	171.91
3453.945	171.94	3463.87	171.95	3473.796	172.01	3483.721	172.09	3493.646	172.12
3503.571	172.22	3513.496	172.28	3523.421	172.5	3533.346	172.7	3543.271	172.8
3553.197	172.71	3563.122	172.69	3573.047	172.76	3582.972	172.86	3592.897	172.95

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3602.822  173.023612.747  173.113622.673  173.183632.598  173.193642.523  173.33
3652.448  173.343662.373  173.223672.298  173.083682.223  172.923692.148  172.78
3702.073  172.663711.999  172.523721.924  172.333731.849  172.113741.774   171.9
3751.699  171.743761.624  171.56 3771.55  171.423781.475  171.27  3791.4  171.07
3801.325  170.94 3811.25  170.873821.175  170.88  3831.1  170.923841.025  170.98
 3850.95  171.123860.876  171.243870.801  171.223880.726  171.113890.651  170.74
3900.576  170.643910.501  168.923920.427  165.943930.352  162.883940.277  160.34
3950.202  159.383960.127  158.83    3979   156.73989.902  158.833999.827  160.49
4009.753  162.314019.678  164.564029.603  166.434039.528   167.74049.453  170.29
4059.378  171.134069.303  170.774079.229  170.674089.154  170.324099.079  169.69
4109.004  169.164118.929  168.824128.854  168.714138.779   168.64148.705  168.44
4158.629  168.264168.555   168.1 4178.48  167.924188.405  167.73 4198.33  167.58
4208.255  167.47 4218.18  167.384228.105  167.314238.031  167.264247.956  167.18
4257.881  167.074267.806  166.954277.731  167.034287.656  167.144297.582  167.23
4307.506  167.334317.432  167.514327.357  167.734337.282     1684347.207  168.25
4357.132  168.244367.057  168.024376.982   168.24386.908  168.354396.833  168.48
4406.758  168.624416.683  168.644426.608  168.554436.533  168.464446.458  168.38
4456.383  168.484466.309  169.054476.234  169.364486.159  169.574496.084  169.73
4506.009  169.874515.934  170.014525.859  170.064535.785   170.34545.709  170.49
4555.635  170.68 4565.56  170.874575.485  171.05 4585.41  171.234595.335  171.42
 4605.26  171.624615.186  171.834625.111     1724635.036  172.164644.961  172.28
4654.886  172.374664.811  172.464674.736  172.564684.662  172.674694.586  172.82
4704.512  172.944714.437  173.044724.362  173.154734.287  173.274744.212  173.44
4754.137  173.674764.063  173.934773.988  174.194783.913  174.434793.838  174.67
4803.763  174.894813.688  175.214823.613  175.474833.539  175.664843.463  175.84
4853.389  175.914863.314  175.994873.239  176.124883.164   176.24893.089  176.25
4903.014  176.254912.939   176.24922.865  176.28 4932.79  176.394942.715  176.49
 4952.64   176.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .073930.352    .0454009.753     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      3930.3524009.753               585     585     585             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3954     176       F
    4009 4952.64     176       F

CROSS SECTION OUTPUT  Profile #1%
*************************************************************************************
***********
* E.G. Elev (ft)         *  174.58  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  174.57  * Reach Len. (ft)       *  585.00  *  585.00  *
 585.00  *
* Crit W.S. (ft)         *  160.45  * Flow Area (sq ft)     *          *  865.13  *
         *
* E.G. Slope (ft/ft)     *0.000020  * Area (sq ft)          * 7460.92  * 1207.09  *
3829.18  *
* Q Total (cfs)          *  800.00  * Flow (cfs)            *          *  800.00  *
         *
* Top Width (ft)         * 3749.91  * Top Width (ft)        * 2890.61  *   79.40  *
 779.90  *
* Vel Total (ft/s)       *    0.92  * Avg. Vel. (ft/s)      *          *    0.92  *
         *
* Max Chl Dpth (ft)      *   17.87  * Hydr. Depth (ft)      *          *   15.73  *
         *
* Conv. Total (cfs)      *177989.9  * Conv. (cfs)           *          *177989.9  *
```

```
          *
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)       *          *   55.63  *
          *
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)       *          *    0.02  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.02  *
          *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *  883.75  *  227.89  *
1263.48  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   92.99  *   10.79  *
 102.83  *
**********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
**********************************************************************************
***********
* E.G. Elev (ft)         *  175.45  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.           *          *   0.045  *
          *
* W.S. Elev (ft)         *  175.43  * Reach Len. (ft)      *  585.00  *  585.00  *
 585.00  *
* Crit W.S. (ft)         *  160.45  * Flow Area (sq ft)    *          *  912.71  *
          *
* E.G. Slope (ft/ft)     *0.000030  * Area (sq ft)         *          *  912.71  *
          *
* Q Total (cfs)          *  800.00  * Flow (cfs)           *          *  800.00  *
          *
* Top Width (ft)         *   55.00  * Top Width (ft)       *          *   55.00  *
          *
* Vel Total (ft/s)       *    0.88  * Avg. Vel. (ft/s)     *          *    0.88  *
          *
* Max Chl Dpth (ft)      *   18.73  * Hydr. Depth (ft)     *          *   16.59  *
          *
* Conv. Total (cfs)      *146512.4  * Conv. (cfs)          *          *146512.4  *
          *
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)       *          *   85.15  *
          *
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)       *          *    0.02  *
          *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.02  *
          *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *   97.80  *  234.05  *
 690.48  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    2.30  *   10.55  *
  28.87  *
**********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
```

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	169.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.045	
W.S. Elev (ft)	169.38	Reach Len. (ft)	585.00	585.00	585.00
Crit W.S. (ft)	161.55	Flow Area (sq ft)		579.53	
E.G. Slope (ft/ft)	0.000252	Area (sq ft)	69.21	794.80	634.32
Q Total (cfs)	1450.00	Flow (cfs)		1450.00	
Top Width (ft)	510.13	Top Width (ft)	22.48	79.40	408.24
Vel Total (ft/s)	2.50	Avg. Vel. (ft/s)		2.50	
Max Chl Dpth (ft)	12.68	Hydr. Depth (ft)		10.54	
Conv. Total (cfs)	91283.7	Conv. (cfs)		91283.7	
Length Wtd. (ft)	585.00	Wetted Per. (ft)		55.63	
Min Ch El (ft)	156.70	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)		0.41	
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	436.73	162.12	558.12
C & E Loss (ft)	0.04	Cum SA (acres)	58.02	10.79	94.12

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	173.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.045	
W.S. Elev (ft)	172.98	Reach Len. (ft)	585.00	585.00	585.00
Crit W.S. (ft)	160.74	Flow Area (sq ft)		777.85	
E.G. Slope (ft/ft)	0.000041	Area (sq ft)	3323.64	1081.10	2645.25
Q Total (cfs)	950.00	Flow (cfs)		950.00	
Top Width (ft)	3037.64	Top Width (ft)	2259.32	79.40	698.92
Vel Total (ft/s)	1.22	Avg. Vel. (ft/s)		1.22	
Max Chl Dpth (ft)	16.28	Hydr. Depth (ft)		14.14	

```
         *
* Conv. Total (cfs)      *149080.9  * Conv. (cfs)            *          *149080.9  *
         *
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)       *          *   55.63  *
         *
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)       *          *    0.04  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.04  *
         *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *  727.50  *  208.16  *
1045.08  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   80.81  *   10.79  *
 100.84  *
**************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #0.2%
**************************************************************************************
***********
* E.G. Elev (ft)         *  178.47  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.             *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  178.47  * Reach Len. (ft)        *  585.00  *  585.00  *
 585.00  *
* Crit W.S. (ft)         *  160.25  * Flow Area (sq ft)      *20304.27  * 1517.15  *
7295.71  *
* E.G. Slope (ft/ft)     *0.000000  * Area (sq ft)           *20304.27  * 1517.15  *
7295.71  *
* Q Total (cfs)          *  700.00  * Flow (cfs)             *  414.40  *  105.66  *
 179.93  *
* Top Width (ft)         * 4533.10  * Top Width (ft)         * 3510.81  *   79.40  *
 942.89  *
* Vel Total (ft/s)       *    0.02  * Avg. Vel. (ft/s)       *    0.02  *    0.07  *
   0.02  *
* Max Chl Dpth (ft)      *   21.77  * Hydr. Depth (ft)       *    5.78  *   19.11  *
   7.74  *
* Conv. Total (cfs)      *2352110.0  * Conv. (cfs)            *1392457.0  *355047.4
*604606.3  *
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)       * 3513.24  *   80.41  *
 945.81  *
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)       *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    1.96  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   * 1332.36  *  276.24  *
1832.09  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *  106.59  *   10.79  *
 119.42  *
**************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
```

is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243.2

INPUT
Description: XS 243.2
INSERTED XS TO EVALUATE IMPACT OF PROPOSED SITE(5/21/01)
Station Elevation Data num= 483

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.26	9.84	181.89	22.96	181.71	29.53	181.75	42.65	181.57
55.77	180.93	62.33	180.94	68.89	180.83	75.46	180.48	82.02	180.27
88.58	180.41	95.14	180.68	118.1	180.99	121.38	180.9	127.95	180.97
131.23	180.86	160.75	180.56	173.88	180.38	180.44	180	190.28	179.85
196.84	179.86	203.4	179.55	216.52	179.64	229.65	179.41	236.21	179.5
246.05	179.36	259.17	179.3	262.45	179.38	275.58	179.35	282.14	179.44
291.98	179.33	301.82	179.42	308.38	179.31	318.22	179.39	324.79	179.23
334.63	179.37	354.31	179.17	364.15	179.31	374	179.16	393.68	179.2
400.24	178.97	406.8	178.92	426.49	179.04	433.05	178.93	449.45	178.82
469.13	179.04	475.7	178.94	482.26	179.06	495.38	178.91	508.5	179.15
518.34	178.97	534.75	179.21	541.31	179	557.71	179.21	567.55	179.17
574.12	179.26	580.68	179.07	590.52	179.34	597.08	179.25	606.92	179.35
620.05	179.65	626.61	179.44	633.17	179.64	639.73	179.69	649.57	179.47
656.13	179.63	665.97	179.52	685.66	179.45	698.78	179.46	705.34	179.58
711.9	179.44	725.03	179.49	731.59	179.61	738.15	179.43	744.71	179.37
747.99	179.48	757.83	179.51	767.68	179.46	777.52	179.32	784.08	179.4
807.04	179.37	823.45	179.47	830.01	179.4	833.29	179.49	852.97	179.36
862.81	179.4	872.66	179.19	882.5	179.28	885.78	179.21	902.18	179.23
912.02	179.05	921.87	179.26	925.15	179.21	938.27	179.25	944.83	179.15
951.39	179.2	961.24	179.11	974.36	179.36	987.48	179.12	994.04	179.27
1000.6	179.1	1017.01	179.08	1023.57	179.14	1033.41	178.98	1053.09	178.93
1059.66	179.04	1076.06	179.07	1082.62	178.97	1092.46	179.04	1099.02	178.91
1112.15	178.99	1121.99	178.78	1128.55	178.93	1135.11	178.84	1141.67	178.89
1148.23	178.79	1161.36	178.92	1174.48	178.8	1187.6	178.43	1190.88	178.57
1200.72	178.75	1213.85	178.84	1223.69	178.6	1243.37	178.77	1256.49	178.79
1259.77	178.71	1269.62	178.71	1272.9	178.8	1276.18	178.6	1286.02	178.84
1295.86	178.74	1305.7	178.97	1312.27	179.21	1318.83	179.08	1322.11	178.71
1335.23	178.9	1341.79	179.06	1358.19	179.13	1364.76	179.01	1371.32	179.18
1381.16	179.23	1387.72	179.17	1407.4	179.49	1410.68	179.37	1417.25	179.49
1427.09	179.54	1433.65	179.48	1443.49	179.8	1466.46	179.85	1476.3	180.03
1479.58	180	1515.67	180.69	1528.79	180.88	1532.07	181.04	1538.63	180.92
1548.47	181.14	1555.03	181.11	1561.59	181.31	1584.56	181.55	1600.96	181.86
1604.24	181.85	1627.21	182.19	1643.61	182.12	1656.73	182.17	1660.01	182.3
1673.14	182.27	1676.42	182.45	1682.98	182.57	1689.54	182.31	1696.1	182.3
1705.94	182.43	1728.91	182.49	1735.47	182.31	1745.31	182.42	1751.87	182.22
1765	182.51	1774.84	182.53	1791.24	182.81	1797.8	182.78	1810.92	182.52
1814.2	182.68	1820.77	182.72	1827.33	182.91	1843.73	182.69	1856.85	182.83
1866.7	182.61	1886.38	182.62	1892.94	182.83	1906.06	182.74	1912.62	182.58
1925.75	182.86	1955.27	182.98	1974.96	182.91	1988.08	182.82	1991.36	182.27
1997.92	182.34	2011.04	182.21	2020.89	181.99	2027.45	181.99	2040.57	181.65
2050.41	181.55	2056.97	181.3	2060.25	181.32	2070.1	181.1	2076.66	181.06
2079.94	180.91	2093.06	180.76	2116.02	179.89	2129.15	178.95	2132.43	178.83
2142.27	178.02	2152.11	177.41	2161.95	176.63	2178.36	176.16	2184.92	175.86
2194.76	175.59	2201.32	175.08	2211.16	174.71	2221	174.81	2230.85	174.67
2250.53	174.93	2257.09	174.9	2270.21	174.71	2289.9	174.72	2293.18	174.6
2299.74	174.81	2306.3	174.61	2309.58	174.68	2319.42	174.44	2322.7	174.56

2332.55	174.51	2342.39	174.56	2348.95	174.46	2358.79	174.79	2362.07	174.8
2375.19	174.5	2388.32	174.39	2391.6	174.46	2401.44	174.28	2414.56	174.4
2421.12	174.22	2427.68	174.25	2430.96	174.14	2437.52	174.32	2453.93	174.26
2463.77	174.35	2467.05	174.2	2473.61	174.36	2490.01	174.17	2499.86	174.29
2506.42	174.27	2512.98	174.06	2529.38	174.29	2542.5	174.34	2552.35	174.29
2565.47	173.98	2572.03	174.11	2581.87	174.04	2585.15	174.15	2591.71	173.97
2601.56	173.84	2604.84	173.91	2614.68	173.8	2621.24	173.86	2631.08	173.7
2640.92	173.79	2647.48	173.77	2663.89	173.55	2673.73	173.65	2680.29	173.44
2690.13	173.44	2703.26	173.03	2709.82	173.07	2732.78	172.62	2739.34	172.59
2749.18	172.38	2762.31	172.51	2768.87	172.51	2775.43	172.71	2781.99	172.32
2788.55	172.15	2795.11	172.24	2801.67	172.05	2808.24	171.98	2811.52	172.1
2824.64	171.92	2831.2	172.1	2847.6	171.89	2854.16	171.7	2867.29	171.58
2893.53	171.47	2900.09	171.23	2909.93	171.19	2919.78	171.35	2926.34	171.1
2946.02	170.98	2952.58	170.87	2965.7	170.78	2975.55	170.86	2995.23	170.63
3018.19	170.91	3028.04	170.86	3041.16	170.58	3044.44	170.44	3054.28	170.37
3067.4	169.71	3070.68	169.43	3083.81	169	3090.37	168.42	3096.93	168.03
3110.05	167.12	3119.89	166.57	3126.46	166.07	3136.3	165.55	3142.86	165.4
3149.42	165.13	3159.26	164.95	3165.82	164.41	3169.1	164.28	3182.23	164.11
3188.79	164.3	3198.63	164.03	3208.47	163.92	3221.59	164.3	3244.56	164.63
3251.12	164.83	3270.8	164.65	3277.36	164.34	3297.05	163.94	3303.61	163.93
3323.28	163.68	3333.12	163.68	3339.68	163.39	3346.24	163.47	3352.8	163.43
3359.35	163.74	3375.75	163.95	3382.31	163.78	3388.87	163.06	3395.43	162.89
3405.26	163.46	3411.82	164.31	3418.38	164.44	3421.66	164.36	3438.06	164.56
3447.9	164.86	3454.45	164.76	3461.01	165.6	3464.29	165.87	3470.85	165.36
3477.41	164.08	3480.55	163.3	3487.25	161.53	3496	160	3531	155.1
3571	160	3572.51	160.87	3575.79	162.8	3579.07	163.53	3592.18	163.93
3598.74	164.58	3608.58	166.18	3611.86	166.37	3618.42	166.49	3628.26	166.53
3634.82	166.46	3651.21	166.67	3680.73	167.15	3693.84	167.13	3703.68	167.26
3710.24	167.19	3726.63	167.74	3736.47	167.98	3743.03	168.26	3749.59	168.4
3759.42	168.75	3779.1	169.2	3785.65	169.47	3795.49	169.44	3808.61	169.52
3828.28	169.37	3834.84	169.36	3847.96	169.04	3857.79	168.7	3870.91	168.68
3880.74	168.51	3893.86	168.49	3920.09	168.15	3936.49	168.08	3952.88	167.81
3966	167.84	3969.28	167.76	3985.67	167.76	3992.23	167.71	4002.07	167.51
4015.18	167.36	4025.02	167.43	4034.86	167.16	4041.41	167.14	4054.53	166.95
4064.37	166.95	4074.2	166.75	4080.76	166.72	4097.16	166.34	4113.55	166.23
4126.67	165.88	4136.5	165.53	4152.9	165.73	4166.01	165.79	4172.57	165.76
4185.69	165.88	4198.8	166.15	4205.36	166.09	4211.92	166.23	4218.48	166.23
4231.59	166.5	4247.99	166.94	4254.55	167.02	4264.38	167.38	4284.06	167.67
4300.45	167.78	4313.57	167.69	4323.4	167.42	4333.24	167.37	4339.8	167.15
4356.19	167.23	4369.31	167.06	4375.87	166.62	4388.98	166.07	4392.26	166.05
4411.94	165.68	4421.77	165.22	4434.89	164.93	4464.4	164.73	4474.24	164.69
4480.79	164.86	4490.63	164.99	4497.19	165.27	4507.03	165.56	4520.14	165.8
4526.7	165.76	4533.26	165.87	4549.65	166.55	4556.21	166.34	4569.33	166.53
4575.88	166.76	4582.44	166.84	4589	167.04	4611.95	167.27	4625.07	167.5
4631.63	167.5	4641.46	167.71	4651.3	167.73	4657.86	167.98	4661.14	167.89
4670.97	167.89	4674.25	168.03	4700.48	167.78	4713.6	167.8	4720.16	167.87
4729.99	167.55	4736.55	167.23	4746.39	167.18	4756.23	166.89	4762.78	166.56
4766.06	166.54	4775.9	165.98	4789.02	164.75	4795.57	164.52	4802.13	164.76
4808.69	165.28	4818.53	166.2	4821.81	166.8	4834.92	167.48	4841.48	167.68
4851.32	169.05	4867.71	170.55	4880.83	171.98	4890.66	172.99	4897.22	173.39
4903.78	174.02	4907.06	174.49	4913.62	175.03				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3496	.045	3575.79	.07

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

3496	3575.79	760	760	200	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3456	180	F
4156	4913.62	180	F

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	174.57	Reach Len. (ft)	760.00	760.00	200.00
Crit W.S. (ft)	158.78	Flow Area (sq ft)	435.24	1339.52	4128.29
E.G. Slope (ft/ft)	0.000001	Area (sq ft)	5505.23	1339.52	9837.14
Q Total (cfs)	800.00	Flow (cfs)	54.76	349.80	395.43
Top Width (ft)	2573.90	Top Width (ft)	1161.88	79.79	1332.23
Vel Total (ft/s)	0.14	Avg. Vel. (ft/s)	0.13	0.26	0.10
Max Chl Dpth (ft)	19.47	Hydr. Depth (ft)	10.88	16.79	7.12
Conv. Total (cfs)	655595.1	Conv. (cfs)	44878.5	286661.0	324055.6
Length Wtd. (ft)	453.05	Wetted Per. (ft)	40.65	81.19	580.55
Min Ch El (ft)	155.10	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.93	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	796.69	210.79	1171.71
C & E Loss (ft)	0.00	Cum SA (acres)	65.78	9.72	88.65

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.045	
W.S. Elev (ft)	175.43	Reach Len. (ft)	760.00	760.00	200.00
Crit W.S. (ft)	158.78	Flow Area (sq ft)	3.08	1342.23	
E.G. Slope (ft/ft)	0.000009	Area (sq ft)	3.08	1342.23	
Q Total (cfs)	800.00	Flow (cfs)	0.07	799.93	
Top Width (ft)	75.30	Top Width (ft)	0.20	75.10	
Vel Total (ft/s)	0.59	Avg. Vel. (ft/s)	0.02	0.60	

* Max Chl Dpth (ft)	* 20.33	* Hydr. Depth (ft)	* 15.41	* 17.87	*
* Conv. Total (cfs)	*266343.9	* Conv. (cfs)	* 22.2	*266321.7	*
* Length Wtd. (ft)	* 759.92	* Wetted Per. (ft)	* 15.59	* 91.12	*
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.00	* 0.01	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	* 0.00	* 0.00	*
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 97.78	* 218.91	* 690.48 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 2.30	* 9.68	* 28.87 *

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 169.34	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.02	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 169.33	* Reach Len. (ft)	* 760.00	* 760.00	* 200.00 *
* Crit W.S. (ft)	* 159.77	* Flow Area (sq ft)	* 225.62	* 921.40	* 1093.84 *
* E.G. Slope (ft/ft)	*0.000049	* Area (sq ft)	* 1985.78	* 921.40	* 3001.66 *
* Q Total (cfs)	* 1450.00	* Flow (cfs)	* 105.28	* 1077.43	* 267.29 *
* Top Width (ft)	* 1726.67	* Top Width (ft)	* 422.22	* 79.79	* 1224.66 *
* Vel Total (ft/s)	* 0.65	* Avg. Vel. (ft/s)	* 0.47	* 1.17	* 0.24 *
* Max Chl Dpth (ft)	* 14.23	* Hydr. Depth (ft)	* 5.64	* 11.55	* 2.08 *
* Conv. Total (cfs)	*206780.0	* Conv. (cfs)	* 15013.1	*153649.6	* 38117.3 *
* Length Wtd. (ft)	* 603.38	* Wetted Per. (ft)	* 40.65	* 81.19	* 526.64 *
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.02	* 0.03	* 0.01 *
* Alpha	* 2.49	* Stream Power (lb/ft s)	* 0.01	* 0.04	* 0.00 *
* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 422.93	* 150.60	* 533.70 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 55.04	* 9.72	* 83.15 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	172.98	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	172.98	Reach Len. (ft)	760.00	760.00	200.00
Crit W.S. (ft)	159.05	Flow Area (sq ft)	371.68	1212.74	3206.38
E.G. Slope (ft/ft)	0.000004	Area (sq ft)	4074.42	1212.74	7732.13
Q Total (cfs)	950.00	Flow (cfs)	66.88	470.86	412.27
Top Width (ft)	2176.15	Top Width (ft)	781.58	79.79	1314.77
Vel Total (ft/s)	0.20	Avg. Vel. (ft/s)	0.18	0.39	0.13
Max Chl Dpth (ft)	17.88	Hydr. Depth (ft)	9.29	15.20	5.53
Conv. Total (cfs)	490044.5	Conv. (cfs)	34496.6	242884.1	212663.8
Length Wtd. (ft)	481.90	Wetted Per. (ft)	40.65	81.19	580.55
Min Ch El (ft)	155.10	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	2.14	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	677.82	192.75	975.39
C & E Loss (ft)	0.00	Cum SA (acres)	60.39	9.72	87.31

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	178.47	Reach Len. (ft)	760.00	760.00	200.00
Crit W.S. (ft)	158.60	Flow Area (sq ft)	591.42	1651.08	6393.82
E.G. Slope (ft/ft)	0.000000	Area (sq ft)	10656.68	1651.08	15059.64
Q Total (cfs)	700.00	Flow (cfs)	45.43	246.63	407.94
Top Width (ft)	2779.42	Top Width (ft)	1361.80	79.79	1337.83
Vel Total (ft/s)	0.08	Avg. Vel. (ft/s)	0.08	0.15	0.06
Max Chl Dpth (ft)	23.37	Hydr. Depth (ft)	14.79	20.69	11.02

* Conv. Total (cfs)	*1152855.0	* Conv. (cfs)	* 74816.0	*406191.4	*671847.1 *
* Length Wtd. (ft)	* 412.61	* Wetted Per. (ft)	* 40.65	* 81.19	* 580.55 *
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.00	* 0.00	* 0.00 *
* Alpha	* 1.62	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 1124.46	* 254.96	* 1681.98 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 73.87	* 9.72	* 104.10 *

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Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243

INPUT
Description: XS 243
JUST UPSTREAM OF CANNON BRANCH
Station Elevation Data num= 482

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.52	3.28	182.48	6.56	182.57	9.83	182.52	19.67	182.62
26.22	182.59	42.61	182.65	45.89	182.62	55.72	182.73	65.55	182.73
75.39	182.91	85.22	182.96	95.05	182.94	104.89	183.07	111.44	183.11
118	183.27	131.11	183.26	134.39	183.34	140.94	183.35	147.5	182.99
154.05	182.36	160.61	182.1	163.89	181.63	167.16	181.04	173.72	179.67
177	179.11	180.28	178.67	186.83	177.41	190.11	176.97	196.66	176.44
203.22	175.75	206.5	175.61	213.05	175.48	216.33	175.47	229.44	175.17
236	174.87	245.83	174.03	252.39	173.85	255.66	173.95	258.94	174.23
262.22	174.81	265.5	175.51	268.77	176.32	275.33	178.08	281.88	179.62
288.44	181.77	295	184.31	298.27	185.52	301.55	187.73	304.83	189.52
314.66	192.62	317.94	193.49	321.22	194.66	324.5	195.66	327.77	196.53
334.33	197.08	347.44	196.93	353.99	196.96	360.55	196.8	363.83	196.82
367.11	196.72	373.66	196.71	376.94	196.63	380.22	196.34	386.77	195.46
390.05	195.16	396.61	194.78	399.88	194.7	403.16	194.76	409.72	194.59
416.27	194.59	422.83	194.53	432.66	194.66	435.94	194.64	439.22	194.97
445.77	196.02	449.05	196.28	452.33	196.41	458.88	196.29	462.16	195.94
465.44	195.37	468.72	194.5	471.99	193.05	475.27	191.24	478.55	189.17
481.83	186.88	485.1	184.41	491.66	180.15	494.94	178.51	498.22	177.2
504.77	175.04	511.33	172.67	521.16	170.18	524.44	169.28	527.72	168.84
540.83	168.35	547.38	168.23	557.21	167.9	563.77	167.57	570.33	167.54
576.88	167.28	589.99	167.02	596.55	166.98	599.83	166.82	603.1	166.86
606.38	167.19	609.66	167.3	619.49	167.38	622.77	167.26	626.05	167.02
629.32	166.67	635.88	165.36	642.44	164.41	645.71	163.6	655.55	161.86
658.82	161.6	662.1	161.48	671.94	161.52	675.21	161.31	678.49	161.23
681.77	161.37	688.32	161.76	694.88	161.39	698.16	161.65	701.44	161.52
707.99	161.57	714.55	161.25	721.1	161.2	724.38	161.07	730.93	161.29
737.48	161.2	744.03	161.4	747.31	161.72	750.58	161.77	763.68	161.2

770.23	160.63	773.5	160.55	776.77	160.59	780.05	160.75	783.32	161.03
789.87	161.21	799.7	161.16	802.97	161.46	806.24	161.91	809.52	162.25
812.79	161.97	819.34	161.87	825.89	161.36	832.44	161.09	838.99	161.07
842.26	161.23	845.54	161.2	848.81	161.05	852.08	161.1	858.63	161.33
865.18	161.15	871.73	161.18	878.28	160.99	881.55	161	884.83	161.22
888.1	161.55	891.38	161.75	897.92	161.51	904.47	161.06	907.75	160.9
914.3	160.94	924.12	160.9	927.39	160.8	930.67	160.84	937.22	161.04
947.04	161.03	953.59	161.1	956.86	161.02	963.41	161.17	969.96	161.19
973.23	161.3	979.78	161.11	992.88	160.87	996.15	160.87	1005.98	160.7
1019.07	160.84	1028.9	161.04	1035.44	161.07	1038.72	161.16	1045.27	161.06
1051.82	161.11	1055.09	160.85	1058.37	160.82	1064.91	160.98	1068.19	160.84
1074.74	160.79	1078.01	160.87	1084.56	160.89	1087.83	160.84	1094.38	160.95
1097.66	160.74	1104.21	160.66	1117.3	160.97	1127.12	161.25	1130.4	161.17
1133.67	160.89	1146.77	160.41	1150.05	160.06	1153.32	159.9	1156.59	159.91
1163.14	160.24	1166.42	160.18	1169.69	160.24	1176.24	160.48	1182.79	160.26
1189.34	159.92	1195.88	159.86	1199.16	159.6	1212.26	159.65	1218.8	160.68
1222.08	161.47	1228.63	163.36	1231.9	163.67	1235.18	163.73	1241.72	163.42
1245	163.03	1248.27	162.82	1252.36	162.42	1254.82	162.14	1258.83	157.87
1290	153.2	1331.46	158.84	1333.4	164.63	1334.49	164.79	1339.95	165.64
1343.23	165.96	1346.5	166.11	1362.87	165.79	1369.42	165.84	1372.7	165.76
1379.24	165.8	1389.07	165.7	1395.62	165.83	1405.44	165.83	1408.71	165.9
1418.54	165.9	1425.08	165.99	1431.63	166.15	1438.18	166.23	1444.73	166.2
1451.28	166.05	1454.55	166.05	1464.38	165.82	1470.93	165.86	1480.76	165.86
1484.04	165.8	1493.87	165.85	1500.42	165.79	1506.97	165.8	1516.8	165.6
1523.35	165.51	1529.9	165.48	1539.73	165.59	1546.28	165.48	1549.56	165.53
1556.11	165.44	1559.39	165.46	1565.94	165.36	1572.49	165.32	1585.6	165.07
1588.87	164.91	1601.98	164.59	1611.81	164.54	1615.08	164.43	1621.63	164.46
1628.19	164.63	1631.46	164.91	1634.74	164.96	1644.57	165	1660.95	165.25
1670.78	165.51	1683.88	165.79	1690.43	165.78	1696.99	165.83	1700.26	165.78
1706.81	165.81	1713.37	165.71	1716.64	165.52	1723.19	165.43	1729.75	165.27
1742.85	165.04	1752.68	165.09	1765.78	164.95	1775.61	164.99	1778.89	164.94
1785.44	165.06	1791.99	164.96	1795.27	165.19	1801.82	165.23	1808.37	165.15
1821.48	165.22	1824.75	165.15	1831.31	165.29	1837.86	165.25	1844.41	165.15
1854.24	165.09	1867.34	164.86	1873.9	164.87	1880.45	164.78	1887	165.01
1893.55	164.98	1900.1	165.09	1903.38	165.2	1913.21	165.25	1926.31	165.27
1936.14	165.51	1942.69	165.59	1949.25	165.57	1959.07	165.63	1972.18	165.8
1985.28	166.02	1988.56	166	1998.39	166.08	2004.94	166.23	2011.49	166.25
2021.32	166.52	2027.87	166.52	2031.15	166.65	2040.98	166.83	2050.81	166.95
2054.08	167.09	2060.63	167.26	2073.74	167.86	2080.29	167.84	2083.57	168.08
2086.84	168.05	2090.12	168.38	2106.5	169.04	2119.6	169.34	2129.43	169.26
2139.26	169.46	2145.81	169.48	2158.92	169.4	2162.19	169.42	2172.02	169.23
2181.85	169.14	2194.95	169.09	2201.51	168.92	2208.06	168.94	2214.61	168.77
2221.16	168.76	2227.72	168.65	2237.54	168.64	2244.1	168.37	2253.92	168.27
2257.2	168.18	2267.03	168.24	2270.3	168.09	2283.41	168.12	2299.79	167.96
2303.07	167.98	2309.62	168.13	2322.72	168.13	2329.27	167.97	2332.55	167.97
2335.83	167.86	2342.38	167.76	2348.93	167.78	2362.04	168.05	2365.31	168.05
2375.14	168.17	2384.97	167.91	2391.52	167.9	2404.62	167.56	2411.18	167.56
2417.73	167.4	2427.56	167.23	2437.39	167.13	2447.21	166.88	2450.49	166.84
2453.77	166.68	2463.59	166.33	2470.15	166.17	2483.25	165.79	2493.08	165.79
2502.91	165.64	2516.01	165.82	2525.84	165.78	2532.39	165.59	2545.5	165.53
2555.33	165.8	2558.6	165.85	2571.71	165.78	2574.98	165.68	2581.53	165.77
2591.36	165.74	2601.19	165.49	2607.74	165.67	2614.3	165.71	2624.12	165.83
2630.68	166.02	2640.5	166.05	2643.78	166	2656.89	166.14	2663.44	166.41
2669.99	166.57	2676.54	166.55	2683.09	166.47	2692.92	166.45	2696.2	166.53
2702.75	166.38	2712.58	166.49	2719.13	166.44	2725.68	166.56	2732.24	166.48
2738.79	166.54	2745.34	166.43	2758.44	166.47	2765	166.6	2774.83	166.44
2784.65	166.21	2794.48	166.16	2801.03	166.09	2807.59	166.18	2810.86	166.13
2817.41	165.86	2827.24	165.6	2830.52	165.64	2837.07	165.53	2840.35	165.58
2843.62	165.5	2850.18	165.51	2853.45	165.42	2863.28	165.28	2869.83	165.11
2876.38	165.14	2886.21	165.06	2889.49	164.96	2896.04	164.93	2902.59	165.07
2909.15	165.51	2918.97	165.53	2928.8	165.82	2935.35	166.11	2938.63	166.18
2945.18	166.44	2951.74	166.52	2964.84	166.5	2974.67	166.61	2984.5	166.92
2991.05	166.91	2997.6	167.15	3004.15	167.25	3007.43	167.24	3013.98	167.55

3017.26	167.43	3027.09	167.27	3040.19	167.33	3043.47	167.42	3053.29	167.49
3066.4	167.26	3072.95	167.33	3095.88	167.41	3102.44	167.24	3112.26	167.23
3115.54	167.37	3125.37	167.34	3131.92	167.18	3138.47	167.16	3148.3	166.97
3151.58	166.85	3167.96	165.99	3171.23	165.5	3174.51	164.61	3177.79	164.48
3181.06	164.52	3184.34	164.76	3190.89	165.08	3194.17	165.4	3204	167.16
3210.55	167.74	3213.82	168.21	3223.65	169.39	3233.48	170.43	3246.58	172.4
3249.86	172.8	3259.69	173.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	1254.82	.045	1334.49	.07

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
1254.82	1334.49	4920	3930	1480	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	1070	180	F
2500	3259.69	180	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.57	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 174.57	* Reach Len. (ft)	* 4920.00	* 3930.00	* 1480.00 *
* Crit W.S. (ft)	* 159.29	* Flow Area (sq ft)	* 2521.56	* 1456.25	* 9413.18 *
* E.G. Slope (ft/ft)	*0.000003	* Area (sq ft)	* 9127.01	* 1456.25	*15497.25 *
* Q Total (cfs)	* 2665.00	* Flow (cfs)	* 570.20	* 590.99	* 1503.82 *
* Top Width (ft)	* 2774.92	* Top Width (ft)	* 770.05	* 79.67	* 1925.20 *
* Vel Total (ft/s)	* 0.20	* Avg. Vel. (ft/s)	* 0.23	* 0.41	* 0.16 *
* Max Chl Dpth (ft)	* 21.37	* Hydr. Depth (ft)	* 13.64	* 18.28	* 8.08 *
* Conv. Total (cfs)	*1425180.0	* Conv. (cfs)	*304928.5	*316045.5	*804205.9 *
* Length Wtd. (ft)	* 2469.02	* Wetted Per. (ft)	* 185.45	* 86.43	* 1165.83 *
* Min Ch El (ft)	* 153.20	* Shear (lb/sq ft)	* 0.00	* 0.00	* 0.00 *
* Alpha	* 1.56	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 669.04	* 186.40	* 1113.55 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 48.92	* 8.33	* 81.17 *

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	175.38	Reach Len. (ft)	4920.00	3930.00	1480.00
Crit W.S. (ft)	159.30	Flow Area (sq ft)	244.23	1520.65	5.38
E.G. Slope (ft/ft)	0.000055	Area (sq ft)	244.23	1520.65	5.38
Q Total (cfs)	2665.00	Flow (cfs)	150.19	2514.29	0.52
Top Width (ft)	100.00	Top Width (ft)	19.82	79.67	0.51
Vel Total (ft/s)	1.51	Avg. Vel. (ft/s)	0.61	1.65	0.10
Max Chl Dpth (ft)	22.18	Hydr. Depth (ft)	12.32	19.09	10.55
Conv. Total (cfs)	360041.6	Conv. (cfs)	20290.8	339680.0	70.8
Length Wtd. (ft)	3279.12	Wetted Per. (ft)	31.54	86.43	11.02
Min Ch El (ft)	153.20	Shear (lb/sq ft)	0.03	0.06	0.00
Alpha	1.15	Stream Power (lb/ft s)	0.02	0.10	0.00
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	95.62	193.93	690.47
C & E Loss (ft)	0.01	Cum SA (acres)	2.12	8.33	28.87

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	169.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	169.31	Reach Len. (ft)	4920.00	3930.00	1480.00
Crit W.S. (ft)	159.60	Flow Area (sq ft)	1549.13	1037.07	3285.02
E.G. Slope (ft/ft)	0.000042	Area (sq ft)	5222.48	1037.07	5455.72
Q Total (cfs)	3015.00	Flow (cfs)	874.34	1159.18	981.48
Top Width (ft)	2656.52	Top Width (ft)	730.47	79.67	1846.38
Vel Total (ft/s)	0.51	Avg. Vel. (ft/s)	0.56	1.12	0.30
Max Chl Dpth (ft)	16.11	Hydr. Depth (ft)	8.38	13.02	2.92
Conv. Total (cfs)	466840.8	Conv. (cfs)	135381.8	179487.1	

```
*151971.9  *
* Length Wtd. (ft)       * 2945.30  * Wetted Per. (ft)       *  185.45  *   86.43  *
1123.75  *
* Min Ch El (ft)         *  153.20  * Shear (lb/sq ft)       *    0.02  *    0.03  *
   0.01  *
* Alpha                  *    2.28  * Stream Power (lb/ft s) *    0.01  *    0.03  *
   0.00  *
* Frctn Loss (ft)        *    0.13  * Cum Volume (acre-ft)   *  360.05  *  133.51  *
 514.29  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   44.98  *    8.33  *
  76.10  *
********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
********************************************************************************
***********
* E.G. Elev (ft)         *  172.98  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.           *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  172.98  * Reach Len. (ft)      * 4920.00  * 3930.00  *
1480.00  *
* Crit W.S. (ft)         *  159.42  * Flow Area (sq ft)    * 2227.64  * 1329.56  *
7559.69  *
* E.G. Slope (ft/ft)     *0.000007  * Area (sq ft)         * 7929.91  * 1329.56
*12439.05  *
* Q Total (cfs)          * 2805.00  * Flow (cfs)           *  645.61  *  706.87  *
1452.52  *
* Top Width (ft)         * 2741.09  * Top Width (ft)       *  744.34  *   79.67  *
1917.08  *
* Vel Total (ft/s)       *    0.25  * Avg. Vel. (ft/s)     *    0.29  *    0.53  *
   0.19  *
* Max Chl Dpth (ft)      *   19.78  * Hydr. Depth (ft)     *   12.05  *   16.69  *
   6.49  *
* Conv. Total (cfs)      *1077598.0  * Conv. (cfs)          *248022.9  *271559.7
*558015.6  *
* Length Wtd. (ft)       * 2561.56  * Wetted Per. (ft)       *  185.45  *   86.43  *
1165.83  *
* Min Ch El (ft)         *  153.20  * Shear (lb/sq ft)       *    0.01  *    0.01  *
   0.00  *
* Alpha                  *    1.72  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *  573.10  *  170.58  *
 929.09  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   47.08  *    8.33  *
  79.90  *
********************************************************************************
***********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
***********
* E.G. Elev (ft)         *  178.47  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.           *   0.070  *   0.045  *
```

```
  0.070  *
* W.S. Elev (ft)         *  178.47  * Reach Len. (ft)        * 4920.00  * 3930.00  *
1480.00  *
* Crit W.S. (ft)         *  158.77  * Flow Area (sq ft)      * 3243.43  * 1767.43
*13965.41  *
* E.G. Slope (ft/ft)     *0.000001  * Area (sq ft)           *12339.78  * 1767.43
*23016.65  *
* Q Total (cfs)          * 2100.00  * Flow (cfs)             *  397.25  *  373.73  *
1329.02  *
* Top Width (ft)         * 2860.36  * Top Width (ft)        *  855.49  *   79.67  *
1925.20  *
* Vel Total (ft/s)       *    0.11  * Avg. Vel. (ft/s)      *    0.12  *    0.21  *
   0.10  *
* Max Chl Dpth (ft)      *   25.27  * Hydr. Depth (ft)      *   17.55  *   22.18  *
  11.98  *
* Conv. Total (cfs)      *2452352.0  * Conv. (cfs)           *463898.0  *436439.3
*1552015.0  *
* Length Wtd. (ft)       * 2385.05  * Wetted Per. (ft)      *  185.45  *   86.43  *
1165.83  *
* Min Ch El (ft)         *  153.20  * Shear (lb/sq ft)      *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    1.35  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  923.85  *  225.14  *
1594.56  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   54.53  *    8.33  *
  96.61  *
********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1           RS: 190

INPUT
Description: XS 190 (LETTERED CROSS SECTION T)
THE DIVIDED FLOW SECTION STARTS
            AS A TRIBUTARY WITH COMMON XS-180
Station Elevation Data    num=     307
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
********************************************************************************
       0  214.16    3.27  214.07    9.81  213.97   13.09  213.82   16.36  213.69
   19.63  213.58    22.9  213.43   26.17   213.2   29.44  212.87   32.72  212.56
   35.99  212.23   39.26  211.64   42.53  210.84    45.8  209.87   49.07  208.98
   52.34   207.9   55.62  206.58   58.89  205.31   62.16  204.17   65.43  203.07
   71.97  200.51   75.24  199.29   78.52  198.08   81.79  196.92   85.06  195.85
   88.33  194.77    91.6  193.72   94.87  192.91   98.15  191.86  101.42  190.85
  104.69  190.14  107.96  189.21  111.23  187.85   114.5  186.37  117.77  184.88
  121.05  183.46  124.32  181.12  127.59  177.94  130.86  174.85  134.13  172.17
   137.4  169.26  137.67  169.03  140.67  166.42  143.95  163.65  147.22  160.33
     158     155     188   153.8     208     155  215.92  158.89  217.68  159.56
  222.46  161.55  225.73  162.79  229.01  163.57  232.28  163.67  235.55  163.78
```

238.82	163.91	242.09	163.61	245.36	163.38	248.64	163.31	251.91	163.25
255.18	163.16	258.45	163.08	261.72	163.01	264.99	162.98	268.26	163.03
271.54	163.04	274.81	163.03	278.08	162.98	281.35	162.91	284.62	162.83
287.89	162.8	291.16	162.91	294.44	162.95	297.71	162.97	300.98	162.98
304.25	162.97	307.52	162.93	310.79	162.91	314.07	162.92	317.34	162.87
320.61	162.84	323.88	162.79	327.15	162.75	330.42	162.72	333.69	162.67
340.24	162.53	343.51	162.51	346.78	162.53	350.05	162.54	353.32	162.45
356.59	162.43	363.14	162.49	366.41	162.53	369.68	162.54	372.95	162.53
379.5	162.43	382.77	162.46	386.04	162.59	389.31	162.65	392.58	162.61
395.85	162.55	399.12	162.52	402.4	162.41	405.67	162.34	408.94	162.35
412.21	162.37	418.75	162.43	422.02	162.43	425.3	162.41	428.57	162.4
431.84	162.48	435.11	162.58	438.38	162.65	441.65	162.69	444.93	162.74
448.2	162.73	451.47	162.7	454.74	162.7	458.01	162.68	461.28	162.57
464.55	162.47	467.83	162.41	474.37	162.27	477.64	162.25	480.91	162.25
484.18	162.24	487.46	162.24	494	162.32	497.27	162.35	500.54	162.35
503.81	162.32	510.36	162.28	513.63	162.22	516.9	162.15	520.17	162.09
523.44	162.01	526.71	161.85	529.98	161.8	533.26	161.83	539.8	161.99
543.07	162.08	546.34	162.16	549.61	162.23	552.89	162.33	556.16	162.38
559.43	162.35	562.7	162.34	565.97	162.35	569.24	162.31	572.51	162.31
575.79	162.37	579.06	162.35	585.6	162.19	588.87	162.16	592.14	162.17
595.41	162.21	601.96	162.37	605.23	162.44	608.5	162.5	611.77	162.6
615.04	162.71	618.32	162.79	621.59	162.86	624.86	162.96	628.13	163.1
631.4	163.26	634.67	163.3	637.94	163.38	641.22	163.45	644.49	163.49
647.76	163.61	654.3	163.79	657.57	163.9	660.84	164	664.12	164.02
667.39	163.96	670.66	164	671.5897	163.36	675.0695	163.46	678.5492	163.57
682.0289	163.67	688.9884	163.81	692.4681	163.83	695.9479	163.83	699.4276	163.88
702.9073	163.95	706.3871	164.03	709.8669	164.09	713.3466	164.14	720.3061	164.26
723.7858	164.31	727.2656	164.35	734.225	164.45	741.1845	164.59	744.6642	164.65
751.6237	164.79	755.1035	164.83	1023.043	164.83	1026.523	164.72	1030.003	164.51
1033.483	164.33	1036.962	164.19	1040.442	164.04	1043.922	163.86	1047.402	163.41
1050.881	162.87	1054.361	162.83	1057.841	162.83	1061.321	162.81	1064.8	162.78
1068.28	162.76	1071.76	162.73	1075.24	162.71	1082.199	162.71	1085.679	162.69
1089.158	162.66	1096.118	162.64	1099.598	162.62	1103.077	162.56	1130.915	161.84
1134.395	160.83	1137.875	160.83	1141.354	160.95	1144.834	161.87	1148.314	161.96
1162.233	162.36	1165.713	162.47	1169.193	162.57	1176.152	162.79	1179.632	162.83
1183.111	162.84	1186.591	162.86	1190.071	162.89	1197.03	162.93	1200.51	162.96
1203.99	162.98	1207.47	163.01	1214.429	163.05	1217.909	163.08	1221.389	163.1
1224.868	163.13	1256.186	163.31	1259.666	163.32	1346.659	163.82	1350.139	163.88
1353.619	163.93	1357.098	163.97	1360.578	164.03	1364.058	164.06	1371.017	164.16
1374.497	164.19	1384.936	164.34	1388.416	164.38	1405.815	164.63	1409.294	164.67
1419.734	164.82	1423.214	164.83	1426.693	164.89	1437.132	165.22	1440.612	165.34
1451.051	165.67	1458.011	165.91	1478.889	166.69	1482.369	166.81	1485.849	166.96
1489.328	167.11	1492.808	167.25	1496.288	167.39	1499.768	167.54	1506.727	167.82
1534.565	169.02	1541.525	169.34	1548.484	169.64	1551.964	169.81	1558.923	170.22
1562.403	170.39	1572.842	170.87	1576.322	171	1579.802	171.14	1583.281	171.27
1586.761	171.43	1593.721	171.77	1600.68	172.05	1604.16	172.2	1607.64	172.34
1611.119	172.49	1618.079	172.77	1621.559	172.83	1625.038	172.91	1628.518	173.01
1631.998	173.11	1635.478	173.21	1638.957	173.28	1649.396	173.49	1670.275	173.85
1684.194	174.05	1687.674	174.09	1694.633	174.19	1698.113	174.22	1705.072	174.3
1708.552	174.33	1718.991	174.45	1722.471	174.48	1725.951	174.51	1729.431	174.53
1732.91	174.54	1736.39	174.57						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	147.22	.045	217.68	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
147.22	217.68	735	735	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
1200	1736.39	177.48

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.56	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 174.56	* Reach Len. (ft)	* 735.00	* 735.00	* 735.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 110.31	* 1356.35	*10977.24 *
* E.G. Slope (ft/ft)	*0.000006	* Area (sq ft)	* 110.31	* 1356.35	*10977.24 *
* Q Total (cfs)	* 2665.00	* Flow (cfs)	* 11.55	* 743.81	* 1909.64 *
* Top Width (ft)	* 1068.78	* Top Width (ft)	* 16.00	* 70.46	* 982.32 *
* Vel Total (ft/s)	* 0.21	* Avg. Vel. (ft/s)	* 0.10	* 0.55	* 0.17 *
* Max Chl Dpth (ft)	* 20.76	* Hydr. Depth (ft)	* 6.89	* 19.25	* 11.17 *
* Conv. Total (cfs)	*1127841.0	* Conv. (cfs)	* 4887.1	*314783.6	*808170.1 *
* Length Wtd. (ft)	* 735.00	* Wetted Per. (ft)	* 21.43	* 72.79	* 995.34 *
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.00	* 0.01	* 0.00 *
* Alpha	* 2.30	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 147.37	* 59.52	* 663.80 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 4.53	* 1.56	* 31.78 *

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 175.30	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 175.29	* Reach Len. (ft)	* 735.00	* 735.00	* 735.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 42.91	* 1408.05	* 5273.88 *
* E.G. Slope (ft/ft)	*0.000012	* Area (sq ft)	* 42.91	* 1408.05	* 5273.88 *
* Q Total (cfs)	* 2665.00	* Flow (cfs)	* 4.29	* 1182.80	* 1477.91 *
* Top Width (ft)	* 488.00	* Top Width (ft)	* 3.22	* 70.46	* 414.32 *
* Vel Total (ft/s)	* 0.40	* Avg. Vel. (ft/s)	* 0.10	* 0.84	* 0.28 *
* Max Chl Dpth (ft)	* 21.49	* Hydr. Depth (ft)	* 13.33	* 19.98	* 12.73 *
* Conv. Total (cfs)	*754871.2	* Conv. (cfs)	* 1216.5	*335032.1	

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*418622.6  *
* Length Wtd. (ft)       *  735.00  * Wetted Per. (ft)       *   16.28  *   72.79  *
 427.15  *
* Min Ch El (ft)         *  153.80  * Shear (lb/sq ft)       *    0.00  *    0.02  *
   0.01  *
* Alpha                  *    2.27  * Stream Power (lb/ft s) *    0.00  *    0.01  *
   0.00  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *   79.41  *   61.82  *
 600.78  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    0.82  *    1.56  *
  21.82  *
**************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10%
**************************************************************************************
***********
* E.G. Elev (ft)         *  169.19  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  169.18  * Reach Len. (ft)        *  735.00  *  735.00  *
 735.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *   41.48  *  977.49  *
5695.29  *
* E.G. Slope (ft/ft)     *0.000044  * Area (sq ft)           *   41.48  *  977.49  *
5695.29  *
* Q Total (cfs)          * 3015.00  * Flow (cfs)             *    8.77  * 1207.30  *
1798.93  *
* Top Width (ft)         * 1062.51  * Top Width (ft)         *    9.72  *   70.46  *
 982.32  *
* Vel Total (ft/s)       *    0.45  * Avg. Vel. (ft/s)       *    0.21  *    1.24  *
   0.32  *
* Max Chl Dpth (ft)      *   15.38  * Hydr. Depth (ft)       *    4.26  *   13.87  *
   5.80  *
* Conv. Total (cfs)      *455388.8  * Conv. (cfs)            *  1324.8  *182351.8
*271712.1  *
* Length Wtd. (ft)       *  735.00  * Wetted Per. (ft)       *   13.16  *   72.79  *
 989.96  *
* Min Ch El (ft)         *  153.80  * Shear (lb/sq ft)       *    0.01  *    0.04  *
   0.02  *
* Alpha                  *    3.33  * Stream Power (lb/ft s) *    0.00  *    0.05  *
   0.00  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft)   *   62.77  *   42.64  *
 324.85  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    3.18  *    1.56  *
  28.05  *
**************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #2%
**************************************************************************************
***********
* E.G. Elev (ft)         *  172.96  * Element                *  Left OB *  Channel *
Right OB *
```

* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 172.96	* Reach Len. (ft)	* 735.00	* 735.00	* 735.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 86.26	* 1243.59	* 9405.18	*
* E.G. Slope (ft/ft)	*0.000010	* Area (sq ft)	* 86.26	* 1243.59	* 9405.18	*
* Q Total (cfs)	* 2805.00	* Flow (cfs)	* 10.98	* 847.79	* 1946.23	*
* Top Width (ft)	* 1066.83	* Top Width (ft)	* 14.05	* 70.46	* 982.32	*
* Vel Total (ft/s)	* 0.26	* Avg. Vel. (ft/s)	* 0.13	* 0.68	* 0.21	*
* Max Chl Dpth (ft)	* 19.16	* Hydr. Depth (ft)	* 6.14	* 17.65	* 9.57	*
* Conv. Total (cfs)	*901219.0	* Conv. (cfs)	* 3526.8	*272387.5	*625304.8	*
* Length Wtd. (ft)	* 735.00	* Wetted Per. (ft)	* 18.90	* 72.79	* 993.74	*
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.00	* 0.01	* 0.01	*
* Alpha	* 2.49	* Stream Power (lb/ft s)	* 0.00	* 0.01	* 0.00	*
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 120.39	* 54.50	* 558.00	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 4.25	* 1.56	* 30.64	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 178.47	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 178.47	* Reach Len. (ft)	* 735.00	* 735.00	* 735.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 181.22	* 1632.14	*15353.23	*
* E.G. Slope (ft/ft)	*0.000002	* Area (sq ft)	* 181.22	* 1632.14	*15353.23	*
* Q Total (cfs)	* 2100.00	* Flow (cfs)	* 13.39	* 601.21	* 1485.40	*
* Top Width (ft)	* 1609.35	* Top Width (ft)	* 20.18	* 70.46	* 1518.71	*
* Vel Total (ft/s)	* 0.12	* Avg. Vel. (ft/s)	* 0.07	* 0.37	* 0.10	*
* Max Chl Dpth (ft)	* 24.67	* Hydr. Depth (ft)	* 8.98	* 23.16	* 10.11	*
* Conv. Total (cfs)	*1496851.0	* Conv. (cfs)	* 9546.4	*428535.2	*1058769.0	*
* Length Wtd. (ft)	* 735.00	* Wetted Per. (ft)	* 27.15	* 72.79	* 1535.65	*
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.00	* 0.00	* 0.00	*
* Alpha	* 3.04	* Stream Power (lb/ft s)	* 0.00	* 0.00	*	

```
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  216.74  *   71.79  *
 942.73  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    5.08  *    1.56  *
  38.11  *
**************************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 182

INPUT
Description: XS 182
CROSS SECTION XS-182 ADDED
             90
XS INSERTED TO EVALUATE IMPACT OF PROPOSED
             FILL IN THE FLOODWAY
Station Elevation Data    num=     434
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**************************************************************************************
       0  181.14    3.27  180.81   13.07  180.06    19.6  179.82   22.87   179.6
   26.14  179.65    29.4  179.59   35.94  179.72   39.21  179.66   42.47  179.48
   49.01   179.3   52.27  179.06   58.81  178.43   65.34  178.02   68.61  177.74
   71.88  177.29   75.14  176.96   78.41  176.91   84.95  176.74   91.48  176.69
   94.75  176.37  101.28  175.66  104.55  175.42  107.82  175.26  124.15   174.2
  133.95  173.82  140.49  173.42  150.29  172.93  156.82  172.82  160.09  172.69
  166.62   172.2  169.89  172.05  176.43  172.07  182.96  171.95  196.03  171.45
  202.56  171.11   209.1  170.92   218.9  170.52  222.17  170.43  231.97  170.46
   238.5  170.18  245.04  169.76   248.3  169.75  254.84  169.56  258.11  169.55
  264.64  169.28  267.91   169.4  271.17  169.33  277.71  168.59  280.98  168.34
  284.24  168.18  290.78  168.09  297.31  167.88  300.58  167.93  307.11   168.2
  310.38  168.18  323.45  167.59  336.52  166.69  339.78   166.5  343.05  166.41
  349.59  166.46  359.39  166.41  365.92  166.23  369.19   166.1  372.46  166.06
  378.99  166.14  382.26  166.08  385.52  165.95  392.06  165.56  395.33  165.47
  405.13  165.45  408.39  165.41  414.93  165.26  421.46   165.3     428  165.27
  431.26  165.15  434.53  164.95   437.8  164.86   447.6  164.83  454.13   165.1
   457.4  165.18  460.67  165.17   467.2  164.99  470.47  164.94  473.74  164.97
     477  164.86  483.54  164.22  490.07  164.22  493.33  164.26  503.12  164.01
  509.65  163.87  516.18  163.52  519.44  163.48   522.7  163.35  525.97  163.15
  529.23  163.22   532.5   163.4  535.76   163.5  542.29  163.41  545.55   163.5
  552.08  163.93  558.61  164.03  561.87  163.97   568.4  163.64  574.93   163.7
  578.19  163.55  584.72  163.01  587.98  162.96  591.24  163.24  594.51  163.61
  597.77  163.43  601.04  162.53601.8448   162.4617.0814  161.83624.6997  161.83
639.9363  161.16647.5546   160.3655.1729  157.34662.7912  154.83670.4095  154.83
678.0278  154.83685.6461  154.83693.2643  154.83700.8826  154.83708.5009  154.83
716.1192  154.83723.7375  154.83731.3558  154.83738.9741  154.83746.5923  156.84
754.2106  160.91761.8289  161.39769.4473  161.79777.0656  161.83784.6838  161.83
792.3021  162.05799.9204  162.34807.5387  162.831051.324  162.831058.942  162.73
1066.561  162.551074.179  162.421081.797  162.341089.415  162.281104.652  162.11
1119.889     1621127.507  161.961142.743  161.85 1157.98   161.91165.598  161.94
1173.217  162.081180.835  161.451188.453  161.541196.071  162.04 1203.69  161.89
1211.308   161.81218.926  161.691226.545  161.541234.163  161.281241.781  161.58
1249.399   161.81257.018  161.831295.109  161.831302.728  162.831432.238  162.83
1439.857  162.711447.475  162.421455.093  162.211462.712  162.041477.948  161.66
```

1493.185	161.33	1500.803	161.21	508.421	161.13	1531.276	160.97	1554.131	160.85		
1561.749	160.77	1607.459	160.21	630.314	160.01	1637.932	159.96	1645.551	159.89		
1653.169	159.63	1660.787	158.83	1668.405	158.83	1676.024	159.85	1683.642	160.28		
1691.26	160.86	1698.879	161.38	1706.497	161.85	1721.733	162.21	1729.352	162.39		
1736.97	162.63	1744.588	162.83	1866.481	162.83	1881.718	162.71	1896.954	162.55		
1904.572	162.29	1912.191	161.91	1919.809	161.71	1957.9	160.94	1965.519	160.83		
1973.137	160.91	2011.228	161.69	2018.847	161.86	2026.465	162.22	2034.083	162.6		
2041.702	162.83	2079.793	162.83	2087.411	162.78	2102.648	162.55	2110.266	162.55		
2155.976	162.72	2163.594	163.18	2171.212	163.92	2178.831	164.62	2186.449	164.98		
2201.686	165.42	2209.304	165.61	2216.922	165.77	2224.541	165.83	2260.31	165.83		
2265.3	165.84	2275.3	165.83	2280.3	165.89	2285.3	166.36	2290.3	166.37		
2300.29	166.35	2310.29	166.26	2315.29	166.23	2325.29	166.03	2335.28	165.63		
2340.28	165.49	2345.28	165.4	2355.28	165.09	2360.28	165.04	2365.27	164.96		
2370.27	164.82	2380.27	164.59	2385.27	164.46	2390.27	164.39	2395.26	164.27		
2400.26	164.18	2405.26	164.16	2410.26	164.04	2415.26	163.97	2420.26	163.82		
2425.26	163.74	2430.25	163.71	2435.25	163.61	2440.25	163.48	2445.25	163.41		
2450.25	163.39	2455.25	163.4	2460.24	163.35	2470.24	163.34	2475.24	163.26		
2480.24	163.22	2490.24	163.19	2500.23	163.11	2505.23	163.13	2510.23	163.05		
2515.23	163.02	2520.23	163.09	2530.22	163.41	2535.22	163.59	2540.22	163.67		
2545.22	163.72	2550.22	163.85	2555.22	163.93	2560.21	164.08	2565.21	164.15		
2570.21	164.27	2580.21	164.61	2590.2	165.03	2595.2	165.2	2600.2	165.45		
2605.2	165.64	2620.2	166.02	2625.19	166.04	2635.19	166.19	2645.19	166.24		
2650.19	166.29	2660.18	166.31	2670.18	166.37	2680.18	166.29	2685.18	166.28		
2690.17	166.24	2700.17	166.2	2705.17	166.22	2710.17	166.27	2720.16	166.33		
2725.16	166.34	2745.16	166.53	2750.16	166.6	2755.15	166.63	2760.15	166.59		
2765.15	166.58	2780.15	166.69	2790.14	166.82	2795.14	166.84	2805.14	166.98		
2810.14	167.03	2820.13	167.25	2825.13	167.26	2835.13	167.38	2845.13	167.45		
2850.13	167.47	2855.12	167.55	2865.12	167.65	2875.12	167.68	2885.11	167.68		
2890.11	167.75	2900.11	167.84	2910.11	167.98	2915.1	168.03	2920.1	168.02		
2930.1	167.88	2935.1	167.75	2940.1	167.7	2945.1	167.88	2950.09	168.11		
2955.09	168.25	2960.09	168.31	2975.09	168.35	2980.08	168.41	3000.08	168.47		
3010.08	168.55	3020.07	168.75	3025.07	168.81	3030.07	168.84	3040.07	168.94		
3050.06	168.87	3060.06	168.9	3070.06	168.96	3075.06	168.96	3085.05	169.05		
3090.05	169.06	3095.05	169.11	3100.05	169.26	3105.05	169.32	3110.04	169.48		
3115.04	169.38	3120.04	169.47	3125.04	169.63	3130.04	169.7	3135.04	169.72		
3140.04	169.78	3155.03	169.85	3175.02	169.9	3180.02	169.89	3190.02	169.73		
3215.01	169.96	3220.01	170.03	3230.01	170.12	3235.01	170.26	3255	170.68		
3265	170.98	3270	171	3274.99	171.08	3279.99	171.04	3284.99	171.1		
3294.99	171.33	3299.99	171.42	3309.98	171.65	3319.98	171.71	3329.98	171.9		
3334.98	171.93	3339.97	171.99	3344.97	172.09	3349.97	172.16	3354.97	172.28		
3364.97	172.32	3369.97	172.37	3374.96	172.49	3379.96	172.53	3384.96	172.61		
3389.96	172.73	3404.95	172.96	3409.95	173	3414.95	173.08	3419.95	173.12		
3429.95	173.32	3439.94	173.56	3444.94	173.51	3449.94	173.43	3459.94	173.59		
3474.93	173.94	3484.93	174.07	3489.93	174.07	3494.93	174.17	3499.93	174.23		
3504.92	174.25	3509.92	174.21	3514.92	174.29	3519.92	174.28	3529.92	174.4		
3534.91	174.41	3544.91	174.77	3554.91	174.9	3564.91	174.92	3574.9	175.01		
3579.9	175.04	3589.9	175.34	3594.9	175.41	3604.89	175.31	3609.89	175.23		
3614.89	175.07	3619.89	175.28	3634.88	175.71	3644.88	175.9	3649.88	175.98		
3654.88	176.1	3659.88	176.27	3664.87	176.39	3674.87	176.6	3679.87	176.77		
3689.87	177.01	3694.87	177.15	3699.86	177.25	3709.86	177.41	3714.86	177.58		
3719.86	177.8	3724.86	177.95	3734.85	178.31	3739.85	178.36	3744.85	178.19		
3749.85	178.33	3754.85	178.58	3764.84	178.74	3769.84	178.95	3779.84	179.17		
3784.84	179.31	3789.84	179.36	3794.94	179.94	3801.49	180.11				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.163	9.9363	.045	761.8289	.031	637.932	.025	1683.642	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
639.9363	754.2106	635	635	.1	.3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.55	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.045 *
* W.S. Elev (ft)	* 174.54	* Reach Len. (ft)	* 635.00	* 635.00	* 635.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 3987.76	* 2129.44	*26652.71 *
* E.G. Slope (ft/ft)	*0.000018	* Area (sq ft)	* 3987.76	* 2129.44	*26652.71 *
* Q Total (cfs)	*19965.00	* Flow (cfs)	* 962.12	* 2040.88	*16962.00 *
* Top Width (ft)	* 3419.79	* Top Width (ft)	* 521.09	* 114.27	* 2784.43 *
* Vel Total (ft/s)	* 0.61	* Avg. Vel. (ft/s)	* 0.24	* 0.96	* 0.64 *
* Max Chl Dpth (ft)	* 19.71	* Hydr. Depth (ft)	* 7.65	* 18.63	* 9.57 *
* Conv. Total (cfs)	*4771374.0	* Conv. (cfs)	*229933.8	*487743.9	*4053696.0 *
* Length Wtd. (ft)	* 635.00	* Wetted Per. (ft)	* 521.69	* 116.56	* 2785.19 *
* Min Ch El (ft)	* 154.83	* Shear (lb/sq ft)	* 0.01	* 0.02	* 0.01 *
* Alpha	* 1.19	* Stream Power (lb/ft s)	* 0.00	* 0.02	* 0.01 *
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 112.80	* 30.11	* 346.33 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 175.28	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.045 *
* W.S. Elev (ft)	* 175.28	* Reach Len. (ft)	* 635.00	* 635.00	* 635.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1168.15	* 2213.22	*25980.54 *
* E.G. Slope (ft/ft)	*0.000015	* Area (sq ft)	* 1168.15	* 2213.22	*25980.54 *
* Q Total (cfs)	*19965.00	* Flow (cfs)	* 338.54	* 2047.59	*17578.87 *
* Top Width (ft)	* 2380.00	* Top Width (ft)	* 93.94	* 114.27	* 2171.79 *
* Vel Total (ft/s)	* 0.68	* Avg. Vel. (ft/s)	* 0.29	* 0.93	* 0.68 *
* Max Chl Dpth (ft)	* 20.45	* Hydr. Depth (ft)	* 12.44	* 19.37	* 11.96 *
* Conv. Total (cfs)	*5071660.0	* Conv. (cfs)	* 85997.4	*520144.5	*4465518.0 *
* Length Wtd. (ft)	* 635.00	* Wetted Per. (ft)	* 105.93	* 116.56	* 2179.82 *
* Min Ch El (ft)	* 154.83	* Shear (lb/sq ft)	* 0.01	* 0.02	* 0.01 *
* Alpha	* 1.06	* Stream Power (lb/ft s)	* 0.00	* 0.02	*

```
   0.01  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *   69.19  *   31.27  *
 337.10  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *          *          *
        *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  169.16  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *   0.100  *   0.045  *
  0.041  *
* W.S. Elev (ft)         *  169.15  * Reach Len. (ft)       *  635.00  *  635.00  *
 635.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1541.47  * 1513.29
*12777.64  *
* E.G. Slope (ft/ft)     *0.000033  * Area (sq ft)          * 1541.47  * 1513.29
*12777.64  *
* Q Total (cfs)          *10495.00  * Flow (cfs)            *  342.94  * 1589.42  *
8562.64  *
* Top Width (ft)         * 2823.72  * Top Width (ft)        *  367.20  *  114.27  *
2342.25  *
* Vel Total (ft/s)       *    0.66  * Avg. Vel. (ft/s)      *    0.22  *    1.05  *
   0.67  *
* Max Chl Dpth (ft)      *   14.32  * Hydr. Depth (ft)      *    4.20  *   13.24  *
   5.46  *
* Conv. Total (cfs)      *1822617.0  * Conv. (cfs)          * 59556.3  *276027.1
*1487034.0  *
* Length Wtd. (ft)       *  635.00  * Wetted Per. (ft)      *  367.66  *  116.56  *
2342.96  *
* Min Ch El (ft)         *  154.83  * Shear (lb/sq ft)      *    0.01  *    0.03  *
   0.01  *
* Alpha                  *    1.22  * Stream Power (lb/ft s) *    0.00  *    0.03  *
   0.01  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft)   *   49.42  *   21.62  *
 169.00  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *          *          *
        *
*******************************************************************************
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CROSS SECTION OUTPUT  Profile #2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  172.95  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *   0.100  *   0.045  *
  0.044  *
* W.S. Elev (ft)         *  172.94  * Reach Len. (ft)       *  635.00  *  635.00  *
 635.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 3177.16  * 1946.24
*22303.35  *
* E.G. Slope (ft/ft)     *0.000021  * Area (sq ft)          * 3177.16  * 1946.24
*22303.35  *
* Q Total (cfs)          *17155.00  * Flow (cfs)            *  747.98  * 1914.05
*14492.97  *
* Top Width (ft)         * 3253.64  * Top Width (ft)        *  489.87  *  114.27  *
2649.50  *
* Vel Total (ft/s)       *    0.63  * Avg. Vel. (ft/s)      *    0.24  *    0.98  *
   0.65  *
```

* Max Chl Dpth (ft)	* 18.11	* Hydr. Depth (ft)	* 6.49	* 17.03	* 8.42 *
* Conv. Total (cfs)	*3762818.0	* Conv. (cfs)	*164063.6	*419831.8	*3178923.0 *
* Length Wtd. (ft)	* 635.00	* Wetted Per. (ft)	* 490.42	* 116.56	* 2650.25 *
* Min Ch El (ft)	* 154.83	* Shear (lb/sq ft)	* 0.01	* 0.02	* 0.01 *
* Alpha	* 1.19	* Stream Power (lb/ft s)	* 0.00	* 0.02	* 0.01 *
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 92.86	* 27.59	* 290.48 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

****

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 178.47	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.047 *
* W.S. Elev (ft)	* 178.46	* Reach Len. (ft)	* 635.00	* 635.00	* 635.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 6148.36	* 2577.09	*38040.36 *
* E.G. Slope (ft/ft)	*0.000013	* Area (sq ft)	* 6148.36	* 2577.09	*38040.36 *
* Q Total (cfs)	*27500.00	* Flow (cfs)	* 1562.89	* 2382.47	*23554.64 *
* Top Width (ft)	* 3694.00	* Top Width (ft)	* 581.45	* 114.27	* 2998.27 *
* Vel Total (ft/s)	* 0.59	* Avg. Vel. (ft/s)	* 0.25	* 0.92	* 0.62 *
* Max Chl Dpth (ft)	* 23.63	* Hydr. Depth (ft)	* 10.57	* 22.55	* 12.69 *
* Conv. Total (cfs)	*7737592.0	* Conv. (cfs)	*439746.2	*670347.3	*6627498.0 *
* Length Wtd. (ft)	* 635.00	* Wetted Per. (ft)	* 582.22	* 116.56	* 2999.11 *
* Min Ch El (ft)	* 154.83	* Shear (lb/sq ft)	* 0.01	* 0.02	* 0.01 *
* Alpha	* 1.17	* Stream Power (lb/ft s)	* 0.00	* 0.02	* 0.01 *
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 163.34	* 36.27	* 492.27 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

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CROSS SECTION

RIVER: RIVER-1
REACH: Reach-2 RS: 180

INPUT
Description: XS 180 (LETTERED CROSS-SECTION S)
Station Elevation Data num= 476

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	197.84	6.56	197.09	9.83	196.8	16.39	196.36	22.95	196.04
26.23	195.7	32.78	194.85	36.06	194.56	39.34	194.05	45.9	193.17
49.17	192.54	52.45	192.06	55.73	191.49	62.29	190.55	65.56	190.42
68.84	190.12	75.4	189.32	85.23	188.34	88.51	187.79	95.07	186.39
98.35	185.63	104.9	183.83	114.74	181.54	121.29	180.45	127.85	179.21
131.13	178.63	134.41	178.19	140.96	177.45	147.52	176.86	150.8	176.16
154.08	175.35	157.35	174.71	160.63	174.16	163.91	173.79	167.19	173.53
173.75	173.28	180.3	172.81	183.58	172.63	190.14	171.99	193.42	171.57
196.69	171.25	203.25	171.04	206.53	171.02	209.81	171.16	213.08	171.22
219.64	170.94	222.92	170.97	226.2	170.88	232.75	170.6	236.03	170.54
239.31	170.37	245.87	170.47	249.15	170.43	255.7	170.48	262.26	170.3
265.54	170.28	268.81	170.16	275.37	169.75	285.21	169.4	298.32	169.3
304.88	169.18	311.43	169.14	321.27	168.81	327.82	168.72	334.38	168.73
347.49	168.35	354.05	168.33	360.61	168.42	373.72	168.27	377	168.27
383.55	168.36	393.39	168.17	399.94	168.2	403.22	168.13	409.78	167.88
416.34	167.78	419.61	167.67	429.45	167.65	436	167.39	439.28	167.37
445.84	166.95	455.67	166.83	465.51	166.68	472.07	166.78	478.62	166.72
481.9	166.84	485.18	166.87	488.46	166.81	495.01	166.56	501.57	166.49
511.4	166.29	514.68	166.28	521.24	166.36	524.52	166.3	534.35	166.03
540.91	165.92	547.46	165.74	550.74	165.7	557.3	165.82	563.86	165.76
580.25	165.37	586.8	165.13	593.36	165.04	596.64	165.08	606.47	164.93
613.03	164.75	616.31	164.74	619.59	164.6	629.42	164.42	639.26	164.64
645.81	164.53	649.09	164.55	655.65	164.5	665.48	164.51	672.04	164.35
681.87	164.19	685.15	164.18	694.99	164.27	698.26	164.35	711.38	164.3
721.21	164.43	724.49	164.52	731.05	164.43	737.6	164.48	744.16	164.4
757.27	164.03	760.55	164.05	767.11	164.42	783.5	164.21	786.78	164.08
793.33	164.02	796.61	163.94	803.17	164.28	809.72	164.26	813	164.31
816.28	164.18	819.56	164.17	826.12	164.07	832.67	163.65	835.95	163.57
842.51	163.95	845.78	164.07	849.06	164	852.34	163.83	855.62	163.83
865.45	164	875.29	164.02	878.57	164.11	881.85	164.08	888.4	163.84
904.79	163.51	911.35	163.22	917.91	163.26	927.74	163.09	934.3	162.89
944.13	162.84	947.41	162.92	950.69	162.87	957.25	162.63	960.52	162.6
970.36	162.72	973.64	162.7	980.19	162.94	983.47	162.84	990.03	162.95
999.86	162.68	1003.14	162.72	1006.42	162.93	1009.7	163.06	1012.98	163.06
1016.25	163.14	1019.53	162.9	1032.64	163.19	1042.48	163.48	1055.59	163.69
1062.15	163.65	1068.71	163.65	1075.26	163.4	1078.54	163.4	1081.82	163.49
1088.37	163.58	1094.93	163.82	1098.21	163.82	1101.49	163.65	1111.32	162.97
1114.6	162.86	1121.16	163.01	1124.43	162.97	1130.99	162.7	1144.1	162
1147.38	161.67	1150.66	161.08	1157.22	160.28	1160.5	159.94	1163.77	159.87
1167.05	159.99	1170.33	160.3	1176.89	160.17	1180.16	160.24	1183.44	160.42
1186.72	160.87	1190	161.42	1193.28	161.35	1199.83	161.73	1206.39	161.94
1212.95	161.97	1219.5	161.94	1226.06	161.87	1235.89	161.82	1249.01	161.7
1265.4	161.57	1291.62	161.38	1298.18	161.32	1311.27	161.02	1321.08	160.82
1334.17	160.79	1343.98	160.83	1357.29	160.83	1360.56	160.8	1363.83	160.21
1367.1	159.29	1376.91	156.46	1380.18	155.56	1383.45	154.89	1386.72	154.39
1389.99	154.15	1392	153.3	1447	153.3	1452.11	155.82	1455.38	156.03
1458.65	156.91	1461.92	158.57	1465.19	160.07	1468.46	161.22	1471.73	161.82
1475	161.64	1478.27	162.03	1481.54	161.82	1484.81	161.77	1487.92	162.09
1497.74	162.23	1507.55	162.26	1517.37	162.21	1540.27	161.99	1566.44	161.84
1572.98	161.78	1608.97	161.35	1635.14	160.85	1651.5	160.76	1684.21	160.46
1694.03	160.36	1710.38	160.16	1720.2	160.07	1730.01	160.02	1739.83	160.03
1762.7	160.16	1788.85	160.32	1792.11	160.33	1844.4	160.33	1867.28	160.14
1886.88	160.02	1903.22	159.95	1922.83	159.89	1942.44	159.87	1971.85	159.88
1984.92	159.84	2138.51	160.82	2154.85	160.62	2184.26	160.33	2210.4	160.28
2230.06	160.27	2256.29	160.31	2262.85	160.34	2275.96	160.71	2282.52	160.83
2325.15	160.83	2334.99	160.88	2341.55	160.99	2348.11	161.14	2361.22	161.5
2367.78	161.62	2374.34	161.81	2384.18	161.97	2397.29	162.28	2403.85	162.39
2410.41	162.43	2413.69	162.38	2420.25	162.52	2430.09	162.53	2439.92	162.65
2446.48	162.67	2459.6	162.88	2466.16	163.03	2472.71	163.12	2482.55	163.46
2492.39	163.66	2495.67	163.65	2512.06	163.99	2515.34	164.1	2531.74	164.42
2541.58	164.65	2548.14	164.83	2574.37	165	2577.65	165.04	2584.21	164.86
2594.04	164.83	2600.6	164.78	2610.44	164.8	2620.28	164.57	2633.39	164.5

2643.23	164.4	2649.79	164.43	2656.35	164.41	2659.63	164.36	2662.91	164.39
2672.74	164.62	2682.58	164.74	2695.7	165.03	2705.54	165.21	2712.09	165.53
2718.65	165.57	2728.49	165.77	2735.05	166	2738.33	166.05	2748.16	166.1
2758	166.29	2767.84	166.4	2774.4	166.41	2777.68	166.35	2794.07	166.42
2800.63	166.49	2810.47	166.33	2820.31	166.28	2823.59	166.31	2833.42	166.32
2839.98	166.39	2853.1	166.32	2862.94	166.42	2869.49	166.44	2876.05	166.53
2885.89	166.73	2892.45	166.81	2899.01	166.77	2915.4	166.9	2921.96	166.78
2925.24	166.76	2931.8	166.86	2944.91	166.75	2958.03	166.94	2964.59	166.97
2971.15	167.05	2980.99	167.12	2994.1	167.14	3010.5	167.13	3017.06	167.17
3023.61	167.14	3036.73	167.32	3040.01	167.44	3046.57	167.51	3053.13	167.52
3059.69	167.65	3062.97	167.67	3069.52	167.63	3085.92	167.98	3092.48	167.99
3102.31	168.08	3112.15	168.14	3118.71	168.28	3128.55	168.43	3138.39	168.51
3148.22	168.65	3151.5	168.65	3158.06	168.8	3167.9	168.83	3177.74	168.94
3184.29	169.07	3197.41	169.16	3200.69	169.24	3213.81	169.4	3223.64	169.47
3230.2	169.48	3240.04	169.73	3246.6	169.82	3253.16	169.98	3259.72	170.06
3266.27	170.01	3272.83	170.06	3276.11	170.18	3285.95	170.22	3295.79	170.5
3299.07	170.46	3305.62	170.5	3308.9	170.59	3315.46	170.64	3325.3	170.88
3331.86	170.76	3351.53	171.08	3364.65	171.11	3367.93	171.16	3381.04	171.44
3387.6	171.49	3394.16	171.61	3397.44	171.72	3407.28	171.85	3410.56	171.82
3420.39	171.96	3426.95	172.12	3436.79	172.29	3449.91	172.62	3453.19	172.62
3459.74	172.75	3466.3	172.77	3472.86	172.87	3479.42	172.91	3489.26	173.07
3495.82	173.23	3502.37	173.28	3505.65	173.37	3515.49	173.73	3518.77	173.69
3522.05	173.54	3528.61	173.5	3531.89	173.56	3535.17	173.79	3548.28	174.24
3554.84	174.26	3564.68	174.46	3571.24	174.65	3587.63	175.03	3600.75	175.23
3607.31	175.28	3617.14	175.57	3623.7	175.66	3636.82	175.89	3646.66	176.02
3649.94	176.15	3659.77	176.12	3666.33	176.39	3669.61	176.43	3676.17	176.6
3679.45	176.55	3686.01	176.72	3689.29	176.75	3695.84	177	3708.96	177.34
3718.8	177.44	3725.36	177.76	3738.47	178.07	3741.75	178.2	3748.31	178.38
3758.15	178.52	3764.71	178.7	3774.55	179.03	3781.1	179.19	3784.38	179.22
3787.66	179.17	3797.5	179.28	3804.06	179.52	3810.62	179.71	3813.9	179.76
3823.73	180.09	3833.57	180.37	3849.97	180.64	3856.52	180.71	3863.08	180.71
3869.64	180.65	3882.76	180.9	3892.6	181.15	3899.15	181.24	3908.99	181.3
3918.83	181.53	3922.11	181.64	3931.95	181.77	3938.5	181.92	3945.06	182.13
3961.46	182.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1363.83	.045	1465.19	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1363.83	1465.19	700	700	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.52	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	11487.99	2001.89	20862.82
E.G. Slope (ft/ft)	0.000056	Area (sq ft)	11487.99	2001.89	20862.82
Q Total (cfs)	19965.00	Flow (cfs)	5726.09	3550.64	10688.27
Top Width (ft)	3408.33	Top Width (ft)	1205.36	101.36	2101.62
Vel Total (ft/s)	0.58	Avg. Vel. (ft/s)	0.50	1.77	0.51
Max Chl Dpth (ft)	21.22	Hydr. Depth (ft)	9.53	19.75	

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   9.93  *
* Conv. Total (cfs)      *2674274.0  * Conv. (cfs)           *766998.9  *475601.3
*1431673.0  *
* Length Wtd. (ft)       *  700.00  * Wetted Per. (ft)      * 1206.18  *  103.73  *
2102.13  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)      *    0.03  *    0.07  *
   0.03  *
* Alpha                  *    2.28  * Stream Power (lb/ft s) *    0.02  *    0.12  *
   0.02  *
* Frctn Loss (ft)        *    0.04  * Cum Volume (acre-ft)   *  197.56  *   32.99  *
 285.84  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   19.55  *    1.63  *
  31.30  *
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CROSS SECTION OUTPUT  Profile #Floodway
********************************************************************************
**********
* E.G. Elev (ft)         *  175.27  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.26  * Reach Len. (ft)       *  700.00  *  700.00  *
 700.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 8324.19  * 2076.39
*20268.52  *
* E.G. Slope (ft/ft)     *0.000051  * Area (sq ft)          * 8324.19  * 2076.39
*20268.52  *
* Q Total (cfs)          *19965.00  * Flow (cfs)            * 4714.23  * 3624.49
*11626.28  *
* Top Width (ft)         * 2384.00  * Top Width (ft)        *  667.83  *  101.36  *
1614.81  *
* Vel Total (ft/s)       *    0.65  * Avg. Vel. (ft/s)      *    0.57  *    1.75  *
   0.57  *
* Max Chl Dpth (ft)      *   21.96  * Hydr. Depth (ft)      *   12.46  *   20.49  *
  12.55  *
* Conv. Total (cfs)      *2784276.0  * Conv. (cfs)           *657436.3  *505463.4
*1621376.0  *
* Length Wtd. (ft)       *  700.00  * Wetted Per. (ft)      *  679.31  *  103.73  *
1622.64  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)      *    0.04  *    0.06  *
   0.04  *
* Alpha                  *    1.94  * Stream Power (lb/ft s) *    0.02  *    0.11  *
   0.02  *
* Frctn Loss (ft)        *    0.04  * Cum Volume (acre-ft)   *  164.64  *   34.19  *
 269.88  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   13.13  *    1.63  *
  22.87  *
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CROSS SECTION OUTPUT  Profile #10%
********************************************************************************
**********
* E.G. Elev (ft)         *  169.13  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  169.11  * Reach Len. (ft)       *  700.00  *  700.00  *
 700.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 5238.17  * 1453.17
*10409.28  *
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* E.G. Slope (ft/ft)     *0.000106  * Area (sq ft)           * 5238.17  * 1453.17
*10409.28  *
* Q Total (cfs)          *10495.00  * Flow (cfs)            * 2338.71  * 2873.50  *
5282.79  *
* Top Width (ft)         * 2877.45  * Top Width (ft)        * 1051.45  *  101.36  *
1724.64  *
* Vel Total (ft/s)       *    0.61  * Avg. Vel. (ft/s)      *    0.45  *    1.98  *
   0.51  *
* Max Chl Dpth (ft)      *   15.81  * Hydr. Depth (ft)      *    4.98  *   14.34  *
   6.04  *
* Conv. Total (cfs)      *1018457.0  * Conv. (cfs)           *226953.0  *278850.4
*512653.3  *
* Length Wtd. (ft)       *  700.00  * Wetted Per. (ft)      * 1052.05  *  103.73  *
1725.08  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)      *    0.03  *    0.09  *
   0.04  *
* Alpha                  *    3.30  * Stream Power (lb/ft s) *    0.01  *    0.18  *
   0.02  *
* Frctn Loss (ft)        *    0.09  * Cum Volume (acre-ft)  *   94.94  *   24.13  *
 130.30  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   17.54  *    1.63  *
  25.10  *
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CROSS SECTION OUTPUT  Profile #2%
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***********
* E.G. Elev (ft)         *  172.93  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.           *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  172.91  * Reach Len. (ft)      *  700.00  *  700.00  *
 700.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)    * 9563.10  * 1838.92
*17550.06  *
* E.G. Slope (ft/ft)     *0.000067  * Area (sq ft)         * 9563.10  * 1838.92
*17550.06  *
* Q Total (cfs)          *17155.00  * Flow (cfs)           * 4694.70  * 3391.42  *
9068.88  *
* Top Width (ft)         * 3300.79  * Top Width (ft)       * 1184.98  *  101.36  *
2014.46  *
* Vel Total (ft/s)       *    0.59  * Avg. Vel. (ft/s)      *    0.49  *    1.84  *
   0.52  *
* Max Chl Dpth (ft)      *   19.61  * Hydr. Depth (ft)      *    8.07  *   18.14  *
   8.71  *
* Conv. Total (cfs)      *2088281.0  * Conv. (cfs)           *571486.7  *412837.8
*1103957.0  *
* Length Wtd. (ft)       *  700.00  * Wetted Per. (ft)      * 1185.72  *  103.73  *
2014.94  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)      *    0.03  *    0.07  *
   0.04  *
* Alpha                  *    2.51  * Stream Power (lb/ft s) *    0.02  *    0.14  *
   0.02  *
* Frctn Loss (ft)        *    0.05  * Cum Volume (acre-ft)  *  166.20  *   30.36  *
 236.30  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   19.28  *    1.63  *
  30.03  *
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CROSS SECTION OUTPUT  Profile #0.2%
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E.G. Elev (ft)	178.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	178.45	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	16261.14	2399.62	29497.69
E.G. Slope (ft/ft)	0.000039	Area (sq ft)	16261.14	2399.62	29497.69
Q Total (cfs)	27500.00	Flow (cfs)	8428.02	4018.63	15053.35
Top Width (ft)	3620.41	Top Width (ft)	1231.32	101.36	2287.72
Vel Total (ft/s)	0.57	Avg. Vel. (ft/s)	0.52	1.67	0.51
Max Chl Dpth (ft)	25.15	Hydr. Depth (ft)	13.21	23.67	12.89
Conv. Total (cfs)	4402175.0	Conv. (cfs)	1349150.0	643298.6	2409726.0
Length Wtd. (ft)	700.00	Wetted Per. (ft)	1232.48	103.73	2288.29
Min Ch El (ft)	153.30	Shear (lb/sq ft)	0.03	0.06	0.03
Alpha	1.95	Stream Power (lb/ft s)	0.02	0.09	0.02
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	275.48	39.39	414.42
C & E Loss (ft)	0.00	Cum SA (acres)	20.12	1.63	33.91

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-2 RS: 170

INPUT
Description: XS 170 (LETTERED CROSS-SECTION R)
Station Elevation Data num= 490

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	199.81	3.28	199.32	9.84	198.83	19.67	197.73	26.23	197.18
36.07	196.05	42.63	195.12	49.18	194.27	55.74	193.75	59.02	193.3
62.3	193.06	68.86	192.73	72.14	192.63	78.69	192.58	85.25	192.36
88.53	192.41	91.81	192.79	95.09	192.88	101.65	192.73	104.93	192.49
108.2	192.58	111.48	192.84	114.76	193.22	118.04	193.39	121.32	193.34
131.16	192.96	134.44	192.98	137.72	193.21	140.99	193.32	144.27	193.29
147.55	193.14	154.11	193.03	160.67	192.73	163.95	192.68	167.23	192.46
170.5	192.39	180.34	192.62	190.18	192.07	193.46	191.95	206.57	191.72
219.69	191.42	226.25	191.01	232.8	190.25	236.08	189.58	239.36	189.27
242.64	189.11	252.48	188.31	259.04	187.84	265.59	187.25	272.15	186.85
281.99	185.85	285.27	185.36	291.83	183.96	295.1	183.51	298.38	183.2
304.94	182.83	311.5	182.82	314.78	182.55	321.34	181.89	324.61	181.51
331.17	180.53	337.73	179.72	341.01	179.38	350.85	178.77	357.4	178.26
360.68	178.07	367.24	177.53	373.8	176.74	380.36	176.21	386.91	175.53
393.47	175.08	403.31	174.18	409.87	173.34	416.42	172.21	422.98	171.45
426.26	171.16	432.82	171.03	436.1	171.06	439.38	171.2	445.93	171.2
449.21	171.02	452.49	170.72	462.33	170.38	465.61	170.12	472.17	169.9
478.72	169.81	488.56	169.49	491.84	169.32	495.12	169.03	504.96	168.7

511.51	168.37	514.79	168.27	518.07	168.31	524.63	167.89	531.19	167.66
534.47	167.44	541.02	167.48	544.3	167.42	550.86	167.16	557.42	166.97
563.98	166.99	570.53	166.88	580.37	166.37	583.65	166.42	593.49	165.96
600.05	165.56	609.88	165.53	616.44	165.27	623	165.22	629.56	164.9
632.83	164.81	639.39	164.82	645.95	164.78	655.79	164.65	662.35	164.4
672.18	164.33	682.02	164.06	688.58	164.04	698.41	163.91	704.97	163.77
721.37	163.75	727.92	163.57	734.48	163.52	741.04	163.63	747.6	163.55
754.16	163.59	760.71	163.54	767.27	163.43	777.11	163.36	783.67	163.48
793.5	163.34	800.06	163.37	806.62	163.33	816.46	163.49	826.29	163.27
832.85	163.31	845.97	163.19	852.52	163.24	855.8	163.12	859.08	163.22
865.64	163.02	872.2	163.06	875.48	162.98	882.04	163.03	888.59	162.88
891.87	162.9	898.43	163.06	908.27	162.88	911.55	162.91	914.82	163.04
921.38	162.88	924.66	162.98	927.94	163.24	934.5	163.14	941.06	163.35
944.34	163.39	954.17	163.19	973.85	163.2	977.12	163.14	983.68	163.26
986.96	163.26	993.52	163.08	1000.08	163.05	1006.64	162.92	1013.19	162.96
1016.47	163.07	1032.87	162.81	1039.42	162.8	1065.66	162.56	1078.77	162.38
1088.61	162.43	1091.89	162.4	1098.45	162.17	1101.72	162.11	1111.56	162.15
1118.12	162.23	1124.68	161.95	1131.23	161.96	1134.51	161.91	1141.07	161.69
1150.91	161.81	1157.47	162.02	1164.02	162.14	1170.58	162.05	1177.14	161.82
1180.42	161.82	1186.98	162.04	1190.26	161.96	1193.53	161.78	1200.09	161.6
1203.37	161.68	1209.93	162	1219.77	161.99	1223.04	162.14	1226.32	162.42
1229.6	162.54	1236.16	162.04	1242.72	161.99	1246	161.73	1249.28	161.6
1255.83	161.78	1262.39	162.04	1268.95	162.18	1275.51	162.53	1278.79	162.58
1282.06	162.52	1288.62	162.52	1291.9	162.46	1295.18	162.29	1301.74	162.13
1305.02	162.15	1311.57	162.34	1318.13	162.21	1324.69	162.23	1331.25	162.08
1334.53	162.2	1341.08	162.04	1344.36	162.17	1347.64	162.41	1350.92	162.23
1354.2	162.21	1357.48	162.3	1367.32	162.24	1377.15	162.39	1390.27	162.88
1393.55	162.74	1396.83	162.71	1400.11	162.89	1403.38	162.72	1409.94	162.74
1416.5	162.43	1419.78	162.4	1426.34	162.63	1432.89	162.6	1436.17	162.46
1439.45	162.67	1442.73	162.75	1449.29	162.67	1455.85	162.85	1468.96	163.15
1472.24	163.1	1482.08	163.1	1488.64	163.31	1495.19	163.05	1498.47	163.03
1505.03	162.62	1511.59	162.79	1517.39	161.43	1520.6	160.14	1523.81	160.62
1527.02	161.93	1533.45	162.64	1536.66	162.83	1539.87	162.73	1549.5	161.94
1552.72	161.83	1588.66	161.83	1601.74	161.42	1605	161.17	1621.34	159.1
1624.61	158.62	1627.88	158.03	1644.22	154.77	1647.49	154.19	1650.76	153.79
1654	152.7	1714	152.7	1722.65	153.83	1725.92	156.36	1729.19	159.03
1732.46	159.99	1742.26	161.11	1745.53	160.85	1748.8	159.68	1752.06	159.62
1768.4	160.39	1779.05	160.8	1784.74	160.98	1794.55	161.2	1801.08	161.29
1807.62	161.32	1814.16	161.24	1827.23	160.94	1830.49	160.9	1840.29	161.27
1846.82	161.39	1853.35	161.41	1863.15	161.21	1869.68	160.89	1876.21	160.39
1879.47	160.27	1908.86	159.65	1921.92	159.4	1928.45	159.33	1938.25	159.32
1944.78	159.18	1954.58	158.88	1961.11	158.63	1967.64	158.6	1974.17	159.27
1987.23	159.04	1997.03	158.93	2006.82	158.95	2016.62	159.04	2029.68	159.1
2035.27	159.22	2054.94	159.09	2058.22	159.12	2068.06	159.33	2074.61	159.4
2081.17	159.57	2094.28	159.73	2110.67	160.01	2117.23	160.2	2127.07	160.37
2140.18	160.77	2150.02	161.21	2156.57	161.37	2172.96	161.92	2192.63	162.7
2195.91	162.8	2202.47	163.12	2209.03	163.36	2215.58	163.66	2222.14	163.9
2231.98	164.39	2238.53	164.65	2245.09	164.85	2254.92	165.27	2261.48	165.45
2271.32	165.84	2284.43	166.16	2290.99	166.21	2310.66	166.56	2323.77	166.62
2333.61	166.75	2340.16	166.72	2346.72	166.83	2359.83	166.82	2366.39	166.9
2376.23	166.92	2386.06	167.02	2395.9	167.07	2415.57	167.13	2418.85	167.12
2445.07	167.27	2451.63	167.2	2458.19	167.23	2474.58	167.13	2487.69	167.11
2497.53	167.16	2504.08	167.05	2510.64	167.14	2520.48	167.16	2523.75	167.11
2540.15	167.11	2546.7	167.06	2553.26	167.1	2559.82	167.05	2569.65	167.16
2576.21	167.15	2589.32	167.22	2595.88	167.2	2602.44	167.27	2615.55	167.21
2625.39	167.1	2661.45	167.2	2668	167.18	2674.56	167.23	2677.84	167.2
2704.07	167.24	2710.62	167.3	2723.74	167.32	2736.85	167.48	2743.41	167.47
2749.96	167.53	2766.36	167.5	2776.19	167.44	2782.75	167.55	2789.31	167.49
2799.14	167.6	2812.25	167.58	2828.65	167.68	2841.76	167.72	2848.32	167.71
2854.87	167.76	2864.71	167.75	2874.54	167.78	2894.22	167.9	2904.05	168.02
2913.89	168.07	2920.44	168.01	2933.56	167.99	2943.39	167.89	2949.95	167.87
2959.78	167.9	2966.34	167.97	2969.62	167.94	2979.45	168.03	2986.01	167.99
2999.12	168.11	3008.96	168.06	3022.07	168.17	3031.91	167.93	3048.3	167.89

3061.41	167.93	3067.97	168.02	3077.81	168.26	3084.36	168.31	3090.92	168.42
3097.48	168.41	3110.59	168.68	3117.15	168.76	3123.7	168.92	3133.54	169.09
3149.93	169.26	3156.49	169.26	3166.32	169.37	3176.16	169.55	3195.83	169.79
3205.66	169.97	3218.78	170.09	3225.33	170.2	3231.89	170.17	3238.45	170.3
3245.01	170.31	3254.84	170.45	3261.4	170.66	3267.95	170.66	3274.51	170.82
3281.07	171.09	3287.62	171.04	3294.18	170.72	3297.46	170.63	3313.85	171.05
3323.69	171.07	3336.8	171.23	3343.36	171.24	3353.19	171.32	3363.03	171.45
3369.58	171.47	3385.98	171.75	3392.53	171.78	3412.2	172.09	3418.76	172.22
3428.6	172.32	3444.99	172.74	3454.82	172.89	3461.38	172.95	3467.94	173.1
3474.49	173.34	3484.33	173.51	3494.16	173.76	3500.72	173.85	3513.84	174.19
3526.95	174.59	3533.51	174.69	3540.06	174.89	3549.9	175.13	3556.45	175.18
3566.29	175.48	3572.85	175.72	3585.96	175.96	3599.07	176.34	3605.63	176.63
3625.3	177.08	3631.86	177.18	3638.41	177.44	3644.97	177.81	3654.81	178.13
3661.36	178.38	3667.92	178.58	3674.48	178.88	3684.31	179.1	3690.87	179.42
3697.43	179.65	3703.98	179.78	3710.54	180.07	3717.1	180.2	3730.21	180.66
3740.05	180.95	3756.44	181.16	3762.99	181.36	3772.83	181.51	3776.11	181.6
3785.94	181.72	3792.5	181.94	3808.89	182.31	3822.01	182.47	3828.56	182.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1627.88	.045	1729.19	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1627.88	1729.19	0	0	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.49	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.02	Wt. n-Val.	0.100	0.045	0.100	
W.S. Elev (ft)	174.47	Reach Len. (ft)				
Crit W.S. (ft)	164.09	Flow Area (sq ft)	13099.76	2104.20	14712.58	
E.G. Slope (ft/ft)	0.000072	Area (sq ft)	13099.76	2104.20	14712.58	
Q Total (cfs)	19965.00	Flow (cfs)	8014.20	4393.02	7557.78	
Top Width (ft)	3122.88	Top Width (ft)	1227.74	101.31	1793.83	
Vel Total (ft/s)	0.67	Avg. Vel. (ft/s)	0.61	2.09	0.51	
Max Chl Dpth (ft)	21.77	Hydr. Depth (ft)	10.67	20.77	8.20	
Conv. Total (cfs)	2348039.0	Conv. (cfs)	942531.6	516653.5	888854.0	
Length Wtd. (ft)		Wetted Per. (ft)	1229.44	103.78	1794.61	
Min Ch El (ft)	152.70	Shear (lb/sq ft)	0.05	0.09	0.04	
Alpha	2.72	Stream Power (lb/ft s)	0.03	0.19	0.02	
Frctn Loss (ft)		Cum Volume (acre-ft)				
C & E Loss (ft)		Cum SA (acres)				

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 175.23	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.02	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 175.21	* Reach Len. (ft)	*	*	* *
* Crit W.S. (ft)	* 164.08	* Flow Area (sq ft)	*12165.82	* 2179.17	*13320.13 *
* E.G. Slope (ft/ft)	*0.000065	* Area (sq ft)	*12165.82	* 2179.17	*13320.13 *
* Q Total (cfs)	*19965.00	* Flow (cfs)	* 7803.99	* 4406.88	* 7754.13 *
* Top Width (ft)	* 2300.00	* Top Width (ft)	* 966.88	* 101.31	* 1231.81 *
* Vel Total (ft/s)	* 0.72	* Avg. Vel. (ft/s)	* 0.64	* 2.02	* 0.58 *
* Max Chl Dpth (ft)	* 22.51	* Hydr. Depth (ft)	* 12.58	* 21.51	* 10.81 *
* Conv. Total (cfs)	*2481291.0	* Conv. (cfs)	*969895.5	*547695.9	*963699.1 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 978.95	* 103.78	* 1239.80 *
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.05	* 0.08	* 0.04 *
* Alpha	* 2.29	* Stream Power (lb/ft s)	* 0.03	* 0.17	* 0.03 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	* *
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	* *

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 169.04	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.04	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 169.00	* Reach Len. (ft)	*	*	* *
* Crit W.S. (ft)	* 161.22	* Flow Area (sq ft)	* 6577.77	* 1550.04	* 5807.59 *
* E.G. Slope (ft/ft)	*0.000153	* Area (sq ft)	* 6577.77	* 1550.04	* 5807.59 *
* Q Total (cfs)	*10495.00	* Flow (cfs)	* 3902.63	* 3837.78	* 2754.59 *
* Top Width (ft)	* 2632.32	* Top Width (ft)	* 1131.87	* 101.31	* 1399.14 *
* Vel Total (ft/s)	* 0.75	* Avg. Vel. (ft/s)	* 0.59	* 2.48	* 0.47 *
* Max Chl Dpth (ft)	* 16.30	* Hydr. Depth (ft)	* 5.81	* 15.30	* 4.15 *
* Conv. Total (cfs)	*848906.6	* Conv. (cfs)	*315671.3	*310425.2	*222810.1 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1133.28	* 103.78	* 1399.85 *
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.06	* 0.14	* 0.04 *
* Alpha	* 4.29	* Stream Power (lb/ft s)	* 0.03	* 0.35	*

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   0.02  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
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CROSS SECTION OUTPUT  Profile #2%
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***********
* E.G. Elev (ft)         *  172.87  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  172.85  * Reach Len. (ft)        *          *          *
          *
* Crit W.S. (ft)         *  163.61  * Flow Area (sq ft)      *11122.16  * 1940.08
*11859.25  *
* E.G. Slope (ft/ft)     *0.000090  * Area (sq ft)           *11122.16  * 1940.08
*11859.25  *
* Q Total (cfs)          *17155.00  * Flow (cfs)             * 6843.31  * 4274.11  *
6037.58  *
* Top Width (ft)         * 3039.49  * Top Width (ft)         * 1215.17  *  101.31  *
1723.01  *
* Vel Total (ft/s)       *    0.69  * Avg. Vel. (ft/s)       *    0.62  *    2.20  *
   0.51  *
* Max Chl Dpth (ft)      *   20.15  * Hydr. Depth (ft)       *    9.15  *   19.15  *
   6.88  *
* Conv. Total (cfs)      *1811196.0  * Conv. (cfs)            *722505.1  *451252.8
*637438.0  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       * 1216.76  *  103.78  *
1723.77  *
* Min Ch El (ft)         *  152.70  * Shear (lb/sq ft)       *    0.05  *    0.10  *
   0.04  *
* Alpha                  *    3.06  * Stream Power (lb/ft s) *    0.03  *    0.23  *
   0.02  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
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CROSS SECTION OUTPUT  Profile #0.2%
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***********
* E.G. Elev (ft)         *  178.42  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  178.41  * Reach Len. (ft)        *          *          *
          *
* Crit W.S. (ft)         *  164.95  * Flow Area (sq ft)      *18024.31  * 2503.36
*22080.14  *
* E.G. Slope (ft/ft)     *0.000049  * Area (sq ft)           *18024.31  * 2503.36
*22080.14  *
* Q Total (cfs)          *27500.00  * Flow (cfs)             *10988.85  * 4841.32
*11669.83  *
* Top Width (ft)         * 3306.87  * Top Width (ft)         * 1272.41  *  101.31  *
1933.15  *
* Vel Total (ft/s)       *    0.65  * Avg. Vel. (ft/s)       *    0.61  *    1.93  *
   0.53  *
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* Max Chl Dpth (ft)	* 25.71	* Hydr. Depth (ft)	* 14.17	* 24.71	* 11.42 *
* Conv. Total (cfs)	*3920088.0	* Conv. (cfs)	*1566446.0	*690123.3	*1663519.0 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1274.29	* 103.78	* 1934.00 *
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.04	* 0.07	* 0.04 *
* Alpha	* 2.22	* Stream Power (lb/ft s)	* 0.03	* 0.14	* 0.02 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	* *
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	* *

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CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 250.12

INPUT
Description: SIDE CHANNEL XS 250.12
Station Elevation Data num= 285

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	167.783.056567	167.756.113133	167.77 9.1697	167.7912.22627	167.82				
15.28283	167.83 18.3394	167.8321.39597	167.8324.45253	167.83 27.5091	167.83				
30.56567	167.8333.62223	167.83 36.6788	167.8339.73537	167.8342.79193	167.83				
45.8485	167.8348.90507	167.8351.96163	167.83 55.0182	167.8358.07477	167.83				
61.13133	167.83 64.1879	167.8367.24447	167.8370.30103	167.83 73.3576	167.83				
76.41417	167.8379.47073	167.83 82.5273	167.8385.58387	167.8388.64043	167.83				
91.697	167.8394.75356	167.8397.81013	167.83100.8667	167.83103.9233	167.83				
106.9798	167.83110.0364	167.83 113.093	167.83116.1495	167.83119.2061	167.82				
122.2627	167.73125.3192	167.62128.3758	167.51131.4324	167.38134.4889	167.24				
137.5455	167.1140.6021	166.95143.6586	166.82146.7152	166.66149.7718	166.49				
152.8283	166.32155.8849	166.12158.9415	165.91 161.998	165.63165.0546	165.32				
168.1112	165.01171.1677	164.83174.2243	164.83177.2809	164.98180.3374	165.23				
183.394	165.51186.4506	165.82189.5071	165.82192.5637	165.75195.6203	165.68				
198.6768	165.6201.7334	165.53 204.79	165.46207.8465	165.39210.9031	165.32				
213.9597	165.25217.0162	165.18220.0728	165.11223.1294	165.03226.1859	164.96				
229.2425	164.89232.2991	164.83235.3556	164.83238.4122	164.83241.4688	164.83				
244.5253	164.83247.5819	164.83250.6385	164.83 253.695	164.83256.7516	164.83				
259.8082	164.83262.8647	164.83265.9213	164.83268.9779	164.83272.0344	164.83				
275.091	164.83278.1476	164.83281.2041	164.83284.2607	164.83287.3173	164.83				
290.3738	164.83293.4304	164.83 296.487	164.84299.5435	164.91302.6001	164.98				
305.6567	165.05308.7132	165.13311.7698	165.2314.8264	165.28317.8829	165.35				
320.9395	165.42323.9961	165.5327.0526	165.57330.1092	165.65333.1658	165.72				
336.2223	165.8339.2789	166.24342.3355	166.83 345.392	166.93348.4486	167				
351.5052	167.08354.5617	167.13357.6183	167.17360.6749	167.22363.7314	167.26				
366.788	167.31369.8446	167.36372.9011	167.4375.9577	167.45379.0143	167.49				
382.0708	167.54385.1274	167.59 388.184	167.63391.2405	167.68394.2971	167.72				
397.3537	167.77400.4102	167.81403.4668	167.83406.5234	167.85409.5799	167.98				
412.6365	168.11415.6931	168.25418.7496	168.38421.8062	168.51424.8628	168.64				
427.9193	168.78430.9759	169.02434.0325	169.45 437.089	169.91440.1456	170.61				
443.2022	171.41446.2587	171.9449.3153	171.97452.3719	171.83455.4284	171.53				
458.485	171.2461.5416	170.84464.5981	170.83467.6547	170.83470.7113	170.83				
473.7678	170.95476.8244	171.06 479.881	171.13482.9375	171.2485.9941	171.27				
489.0507	171.27492.1072	171.15495.1638	171.02498.2204	170.83501.2769	171				
504.3335	171.62507.3901	171.74510.4466	171.67513.5032	171.62516.5598	171.58				
519.6163	171.57522.6729	171.47525.7295	171.33 528.786	171.19531.8426	171.04				

```
534.8992  170.88537.9557   170.7541.0123  170.52544.0688  170.34547.1254  170.16
 550.182  169.98553.2386   169.8556.2951  169.53559.3517  169.26562.4083  168.97
 564.588  167.96 567.411  167.86 570.243  167.75 573.075  167.62 575.907  167.52
  578.73  167.47 581.562  167.42 584.394  167.36 587.226  167.24 590.049  167.11
 592.881  167.03 595.713  167.03 598.536  167.01 601.368  167.01   604.2  167.07
 607.032  167.13 609.855  167.19 612.687  167.31 615.519  167.43 618.342  167.49
 621.174   167.6 624.006  167.77 626.838  167.96 629.661  168.14 632.493  168.29
 635.325  168.42 638.148  168.57  640.98   168.7 643.812  168.81 646.644  168.96
 649.467  169.08 652.299  169.18 655.131  169.35 657.963  169.56 660.786  169.68
 663.618  169.79  666.45  169.92 669.273  170.06 672.105  170.22 674.937  170.35
 677.769  170.47 680.592   170.6 683.424  170.68 686.256  170.73 689.079  170.86
 691.911  171.04 694.743  171.22 697.575  171.34 700.398  171.46  703.23   171.6
 706.062  171.72 708.894  171.84 711.717  171.98 714.549  172.11 717.381  172.25
 720.204  172.42 723.036  172.59 725.868  172.75   728.7  172.93 731.523   173.1
 734.355  173.25 737.187  173.42  740.01   173.6 742.842  173.82 745.674  174.02
 748.506  174.28 751.329  174.52 754.161  174.74 756.993  174.96 759.825  175.13
 762.648  175.34  765.48  175.54 768.312  175.74 771.135  175.92 773.967  176.08
 776.799  176.26 779.631   176.4 782.454  176.49 785.286   176.6 788.118   176.7
 790.941  176.84 793.773  176.95 796.605  177.05 799.437  177.16  802.26  177.28
 805.092  177.41 807.924  177.57 810.756  177.75 813.579  177.95 816.411  178.15
 819.243   178.3 822.066   178.5 824.898  178.74  827.73  178.98 830.562   179.2
 833.385  179.44 836.217  179.79 839.049  180.35 841.872  180.76 844.704   181.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .03189.5071    .025342.3355     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      189.5071342.3355               515     515     515             .1       .3
Skew Angle = 30

CROSS SECTION OUTPUT  Profile #1%
**********************************************************************************
***********
* E.G. Elev (ft)         *  175.46  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.32  * Wt. n-Val.             *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  175.14  * Reach Len. (ft)        *  515.00  *  515.00  *
 515.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1496.22  * 1526.15  *
2230.42  *
* E.G. Slope (ft/ft)     *0.000413  * Area (sq ft)           * 1496.22  * 1526.15  *
2230.42  *
* Q Total (cfs)          *17300.00  * Flow (cfs)             * 5819.56  * 8544.99  *
2935.46  *
* Top Width (ft)         *  759.92  * Top Width (ft)         *  189.51  *  152.83  *
 417.58  *
* Vel Total (ft/s)       *    3.29  * Avg. Vel. (ft/s)       *    3.89  *    5.60  *
   1.32  *
* Max Chl Dpth (ft)      *   10.31  * Hydr. Depth (ft)       *    7.90  *    9.99  *
   5.34  *
* Conv. Total (cfs)      *851217.6  * Conv. (cfs)            *286341.6  *420441.7
*144434.4  *
* Length Wtd. (ft)       *  515.00  * Wetted Per. (ft)       *  197.00  *  152.94  *
 418.61  *
* Min Ch El (ft)         *  164.83  * Shear (lb/sq ft)       *    0.20  *    0.26  *
   0.14  *
* Alpha                  *    1.92  * Stream Power (lb/ft s) *    0.76  *    1.44  *
   0.18  *
* Frctn Loss (ft)        *    0.21  * Cum Volume (acre-ft)   *  369.55  *  151.66  *
 614.28  *
```

* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 13.65	* 6.28	* 25.26	*

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 176.20	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.65	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 175.55	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 211.39	* 1589.24	* 2251.68	*
* E.G. Slope (ft/ft)	*0.000710	* Area (sq ft)	* 211.39	* 1589.24	* 2251.68	*
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 1000.41	*11988.62	* 4310.97	*
* Top Width (ft)	* 530.00	* Top Width (ft)	* 20.51	* 152.83	* 356.66	*
* Vel Total (ft/s)	* 4.27	* Avg. Vel. (ft/s)	* 4.73	* 7.54	* 1.91	*
* Max Chl Dpth (ft)	* 10.72	* Hydr. Depth (ft)	* 10.31	* 10.40	* 6.31	*
* Conv. Total (cfs)	*649082.5	* Conv. (cfs)	* 37534.7	*449803.8	*161744.0	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 31.15	* 152.94	* 361.72	*
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.30	* 0.46	* 0.28	*
* Alpha	* 2.28	* Stream Power (lb/ft s)	* 1.42	* 3.48	* 0.53	*
* Frctn Loss (ft)	* 0.26	* Cum Volume (acre-ft)	* 307.61	* 159.81	* 586.44	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 10.33	* 6.28	* 11.87	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 170.84	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.39	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 170.45	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 607.75	* 809.64	* 522.05	*
* E.G. Slope (ft/ft)	*0.001056	* Area (sq ft)	* 607.75	* 809.64	* 522.05	*
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 2106.67	* 4750.30	* 623.03	*

* Top Width (ft)	* 574.48	* Top Width (ft)	* 189.51	* 152.83	* 232.15	*
* Vel Total (ft/s)	* 3.86	* Avg. Vel. (ft/s)	* 3.47	* 5.87	* 1.19	*
* Max Chl Dpth (ft)	* 5.62	* Hydr. Depth (ft)	* 3.21	* 5.30	* 2.25	*
* Conv. Total (cfs)	*230167.8	* Conv. (cfs)	* 64824.6	*146172.0	* 19171.2	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 192.32	* 152.94	* 232.69	*
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.21	* 0.35	* 0.15	*
* Alpha	* 1.71	* Stream Power (lb/ft s)	* 0.72	* 2.05	* 0.18	*
* Frctn Loss (ft)	* 0.47	* Cum Volume (acre-ft)	* 162.74	* 89.02	* 239.73	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 8.50	* 6.28	* 9.61	*

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 174.04	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.35	* Wt. n-Val.	* 0.030	* 0.025	* 0.070 *
* W.S. Elev (ft)	* 173.68	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1221.04	* 1304.23	* 1638.12 *
* E.G. Slope (ft/ft)	*0.000540	* Area (sq ft)	* 1221.04	* 1304.23	* 1638.12 *
* Q Total (cfs)	*14350.00	* Flow (cfs)	* 4764.24	* 7517.01	* 2068.75 *
* Top Width (ft)	* 741.10	* Top Width (ft)	* 189.51	* 152.83	* 398.77 *
* Vel Total (ft/s)	* 3.45	* Avg. Vel. (ft/s)	* 3.90	* 5.76	* 1.26 *
* Max Chl Dpth (ft)	* 8.85	* Hydr. Depth (ft)	* 6.44	* 8.53	* 4.11 *
* Conv. Total (cfs)	*617692.0	* Conv. (cfs)	*205075.5	*323567.8	* 89048.6 *
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 195.55	* 152.94	* 399.73 *
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.21	* 0.29	* 0.14 *
* Alpha	* 1.91	* Stream Power (lb/ft s)	* 0.82	* 1.66	* 0.17 *
* Frctn Loss (ft)	* 0.27	* Cum Volume (acre-ft)	* 301.35	* 132.69	* 485.52 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 11.24	* 6.28	* 19.59 *

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	179.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.	0.030	0.025	0.070
W.S. Elev (ft)	178.73	Reach Len. (ft)	515.00	515.00	515.00
Crit W.S. (ft)		Flow Area (sq ft)	2177.22	2075.34	3849.17
E.G. Slope (ft/ft)	0.000266	Area (sq ft)	2177.22	2075.34	3849.17
Q Total (cfs)	25400.00	Flow (cfs)	8628.69	11454.53	5316.77
Top Width (ft)	824.79	Top Width (ft)	189.51	152.83	482.45
Vel Total (ft/s)	3.14	Avg. Vel. (ft/s)	3.96	5.52	1.38
Max Chl Dpth (ft)	13.90	Hydr. Depth (ft)	11.49	13.58	7.98
Conv. Total (cfs)	1556140.0	Conv. (cfs)	528639.9	701765.9	325733.9
Length Wtd. (ft)	515.00	Wetted Per. (ft)	200.60	152.94	483.58
Min Ch El (ft)	164.83	Shear (lb/sq ft)	0.18	0.23	0.13
Alpha	1.98	Stream Power (lb/ft s)	0.72	1.25	0.18
Frctn Loss (ft)	0.13	Cum Volume (acre-ft)	555.42	198.32	991.25
C & E Loss (ft)	0.02	Cum SA (acres)	16.93	6.28	34.64

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 225

INPUT
Description: SIDE CHANNEL XS 225
Station Elevation Data num= 132

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	177.836.477963	177.8312.95593	177.819.43389	177.6725.91185	177.53
32.38982	177.438.86778	177.2645.34574	177.13 51.8237	176.9958.30167	176.86
64.77963	176.6271.25759	176.3477.73556	176.0684.21352	175.890.69148	175.64
97.16944	175.48103.6474	175.32110.1254	175.16116.6033	175123.0813	174.84
129.5593	174.65136.0372	174.46142.5152	174.27148.9931	174.08155.4711	173.89
161.9491	173.69 168.427	173.49 174.905	173.29 181.383	173.08187.8609	172.88
194.3389	172.67200.8168	172.47207.2948	172.26213.7728	172.05220.2507	171.84
226.7287	171.59233.2067	171.34239.6846	171.09246.1626	170.84252.6405	169.57
259.1185	168.23265.5965	166.89272.0744	165.54278.5524	164.83285.0304	164.9
291.5083	165.09297.9863	165.27304.4643	165.46310.9422	165.65317.4202	165.83
323.8982	165.83330.3761	165.83336.8541	165.83 343.332	165.83 349.81	165.83
356.288	165.83362.7659	165.83369.2439	165.83375.7219	165.83382.1998	165.83

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388.6778  165.83395.1557  165.83401.6337  165.83408.1117  165.83414.5896  165.83
421.0676  165.83427.5456  165.83434.0235  165.83440.5015  165.83446.9794  165.83
453.4574  165.83459.9354  165.83466.4133  165.48472.8913  165.05479.3693  164.76
485.8472  164.63492.3252   164.5498.8032  164.37505.2811  164.24511.7591  164.11
518.2371  163.99 524.715  163.86 531.193  163.83537.6709  163.83544.1489  163.92
550.6268  164.05557.1048  164.18563.5828  164.31570.0607  164.44576.5387  164.57
583.0167   164.7589.4946  164.85595.9726  165.38602.4506  165.86608.9285  166.05
615.4065  166.25621.8845  166.44628.3624  166.62634.8404  166.79641.3184  166.92
647.7963  167.03654.2742  167.16660.7522  167.28667.2302  167.41673.7081  167.54
680.1861  167.67686.6641  167.81 693.142  168.64  699.62  169.77 706.098   170.9
712.5759  171.39719.0539  171.85725.5319  172.18732.0098   172.5738.4878  172.83
744.9658  174.06751.4437  174.83757.9217  174.83764.3997  174.83770.8776  174.83
777.3555  174.83783.8335  174.83790.3115  174.83796.7894  174.83803.2674  174.83
809.7454  174.83816.2233  174.83822.7013  174.83  825.98  175.22  829.25  175.19
    1049   171.3 1399.25     181

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*****************************************
       0     .03459.9354    .025602.4506     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      459.9354602.4506               460     460     460             .1       .3

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
**********
* E.G. Elev (ft)         *  175.25  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.33  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  174.91  * Reach Len. (ft)       *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2147.85  * 1484.76  *
1501.72  *
* E.G. Slope (ft/ft)     *0.000413  * Area (sq ft)          * 2147.85  * 1484.76  *
1501.72  *
* Q Total (cfs)          *17300.00  * Flow (cfs)            * 7379.90  * 8549.92  *
1370.18  *
* Top Width (ft)         * 1037.90  * Top Width (ft)        *  339.83  *  142.52  *
 555.56  *
* Vel Total (ft/s)       *    3.37  * Avg. Vel. (ft/s)      *    3.44  *    5.76  *
   0.91  *
* Max Chl Dpth (ft)      *   11.08  * Hydr. Depth (ft)      *    6.32  *   10.42  *
   2.70  *
* Conv. Total (cfs)      *851420.6  * Conv. (cfs)           *363202.1  *420785.0  *
67433.5  *
* Length Wtd. (ft)       *  460.00  * Wetted Per. (ft)      *  340.48  *  142.60  *
 556.14  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)      *    0.16  *    0.27  *
   0.07  *
* Alpha                  *    1.89  * Stream Power (lb/ft s) *    0.56  *    1.55  *
   0.06  *
* Frctn Loss (ft)        *    0.17  * Cum Volume (acre-ft)  *  348.01  *  133.86  *
 592.22  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)        *   10.52  *    4.53  *
  19.51  *
*********************************************************************************
**********

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT  Profile #Floodway
```

* E.G. Elev (ft)	* 175.83	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.29	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 175.54	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2207.06	* 1574.05	* 878.06	*
* E.G. Slope (ft/ft)	*0.000305	* Area (sq ft)	* 2207.06	* 1574.05	* 878.06	*
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 7933.71	* 8103.30	* 1262.99	*
* Top Width (ft)	* 510.00	* Top Width (ft)	* 256.94	* 142.52	* 110.55	*
* Vel Total (ft/s)	* 3.71	* Avg. Vel. (ft/s)	* 3.59	* 5.15	* 1.44	*
* Max Chl Dpth (ft)	* 11.71	* Hydr. Depth (ft)	* 8.59	* 11.04	* 7.94	*
* Conv. Total (cfs)	*990178.8	* Conv. (cfs)	*454091.8	*463798.5	* 72288.4	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 260.69	* 142.60	* 114.96	*
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.16	* 0.21	* 0.15	*
* Alpha	* 1.34	* Stream Power (lb/ft s)	* 0.58	* 1.08	* 0.21	*
* Frctn Loss (ft)	* 0.14	* Cum Volume (acre-ft)	* 293.31	* 141.11	* 567.94	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 8.69	* 4.53	* 9.11	*

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 170.35	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.31	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 170.04	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 864.42	* 789.75	* 279.57	*
* E.G. Slope (ft/ft)	*0.000775	* Area (sq ft)	* 864.42	* 789.75	* 279.57	*
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 3059.49	* 4090.22	* 330.29	*
* Top Width (ft)	* 450.89	* Top Width (ft)	* 209.68	* 142.52	* 98.70	*
* Vel Total (ft/s)	* 3.87	* Avg. Vel. (ft/s)	* 3.54	* 5.18	* 1.18	*
* Max Chl Dpth (ft)	* 6.21	* Hydr. Depth (ft)	* 4.12	* 5.54	* 2.83	*
* Conv. Total (cfs)	*268700.0	* Conv. (cfs)	*109904.2	*146930.9	* 11864.9	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 210.19	* 142.60	* 98.90	*
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.20	* 0.27	* 0.14	*
* Alpha	* 1.33	* Stream Power (lb/ft s)	* 0.70	* 1.39	*	

```
   0.16  *
* Frctn Loss (ft)        *    0.31  * Cum Volume (acre-ft)   *  154.04  *   79.56  *
 234.99  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    6.14  *    4.53  *
   7.65  *
********************************************************************************
***********

CROSS SECTION OUTPUT  Profile #2%
********************************************************************************
***********
* E.G. Elev (ft)         *  173.77  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.35  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  173.42  * Reach Len. (ft)       *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1679.04  * 1272.01  *
 884.72  *
* E.G. Slope (ft/ft)     *0.000504  * Area (sq ft)          * 1679.04  * 1272.01  *
 884.72  *
* Q Total (cfs)          *14350.00  * Flow (cfs)            * 6022.11  * 7301.10  *
1026.79  *
* Top Width (ft)         *  767.30  * Top Width (ft)        *  289.26  *  142.52  *
 335.52  *
* Vel Total (ft/s)       *    3.74  * Avg. Vel. (ft/s)      *    3.59  *    5.74  *
   1.16  *
* Max Chl Dpth (ft)      *    9.59  * Hydr. Depth (ft)      *    5.80  *    8.93  *
   2.64  *
* Conv. Total (cfs)      *639122.4  * Conv. (cfs)           *268213.6  *325177.5  *
45731.4  *
* Length Wtd. (ft)       *  460.00  * Wetted Per. (ft)      *  289.90  *  142.60  *
 335.96  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)      *    0.18  *    0.28  *
   0.08  *
* Alpha                  *    1.59  * Stream Power (lb/ft s) *    0.65  *    1.61  *
   0.10  *
* Frctn Loss (ft)        *    0.21  * Cum Volume (acre-ft)   *  284.20  *  117.47  *
 470.61  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    8.41  *    4.53  *
  15.25  *
********************************************************************************
***********

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
***********
* E.G. Elev (ft)         *  178.89  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.24  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  178.65  * Reach Len. (ft)       *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 3664.79  * 2016.79  *
3903.96  *
* E.G. Slope (ft/ft)     *0.000228  * Area (sq ft)          * 3664.79  * 2016.79  *
3903.96  *
* Q Total (cfs)          *25400.00  * Flow (cfs)            *10916.87  *10591.61  *
3891.52  *
* Top Width (ft)         * 1314.27  * Top Width (ft)        *  459.94  *  142.52  *
 711.82  *
```

* Vel Total (ft/s)	* 2.65	* Avg. Vel. (ft/s)	* 2.98	* 5.25	* 1.00	*	
* Max Chl Dpth (ft)	* 14.82	* Hydr. Depth (ft)	* 7.97	* 14.15	* 5.48	*	
* Conv. Total (cfs)	*1681153.0	* Conv. (cfs)	*722556.5	*701028.6	*257568.4	*	
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 461.45	* 142.60	* 712.48	*	
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.11	* 0.20	* 0.08	*	
* Alpha	* 2.20	* Stream Power (lb/ft s)	* 0.34	* 1.06	* 0.08	*	
* Frctn Loss (ft)	* 0.10	* Cum Volume (acre-ft)	* 520.88	* 174.13	* 945.42	*	
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 13.09	* 4.53	* 27.58	*	

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 200

INPUT
Description: SIDE CHANNEL XS 200
Station Elevation Data num= 388

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	177.833.569947	177.837.139893	177.8310.70984	177.8314.27979	177.83
17.84973	177.8321.41968	177.8324.98963	177.8328.55957	177.8332.12952	177.83
35.69947	177.8339.26941	177.8342.83936	177.7646.40931	177.6649.97925	177.55
53.5492	177.4457.11914	177.3360.68909	177.2264.25904	177.1267.82899	177.01
71.39893	176.974.96888	176.7878.53883	176.6582.10877	176.5185.67872	176.37
89.24866	176.2492.81861	176.196.38856	175.96 99.9585	175.82103.5285	175.71
107.0984	175.6110.6683	175.49114.2383	175.38117.8082	175.27121.3782	175.16
124.9481	175.05128.5181	174.94 132.088	174.83 135.658	174.71139.2279	174.6
142.7979	174.49146.3678	174.37149.9378	174.26153.5077	174.15157.0777	174.03
160.6476	173.92164.2175	173.81167.7875	173.72171.3574	173.63174.9274	173.54
178.4973	173.45182.0673	173.36185.6372	173.27189.2072	173.18192.7771	173.09
196.3471	172.99 199.917	172.9 203.487	172.81207.0569	172.68210.6268	172.56
214.1968	172.43217.7667	172.3221.3367	172.18224.9066	172.05228.4766	171.93
232.0465	171.8235.6165	171.64239.1864	171.49242.7564	171.33246.3263	171.18
249.8963	171.02253.4662	170.87257.0362	170.54260.6061	170.17264.1761	169.74
267.746	168.81271.3159	167.87274.8859	166.94278.4558	166.01282.0258	165.09
285.5957	164.17289.1657	163.83292.7356	163.83296.3056	163.9299.8755	163.99
303.4455	164.08307.0154	164.18310.5854	164.27314.1553	164.35317.7253	164.41
321.2952	164.48324.8651	164.56328.4351	164.72 332.005	164.83 335.575	164.83
339.1449	164.83342.7149	164.83346.2848	164.85349.8548	164.87353.4247	164.89
356.9947	164.91360.5646	164.93364.1346	164.95367.7045	164.97371.2744	165
374.8444	165.01378.4143	165381.9843	164.99385.5542	164.98389.1242	164.97
392.6941	164.96396.2641	164.95 399.834	164.94 403.404	164.93406.9739	164.92
410.5439	164.91414.1138	164.9417.6837	164.89421.2537	164.88424.8236	164.87
428.3936	164.86431.9635	164.85435.5335	164.83439.1034	164.83442.6734	164.83
446.2433	164.83449.8133	164.83453.3832	164.83456.9532	164.83460.5231	164.83
464.093	164.83 467.663	164.83471.2329	164.83474.8029	164.83478.3728	164.76
481.9428	164.65485.5127	164.54489.0827	164.43492.6526	164.32496.2226	164.21
499.7925	164.09503.3625	163.98506.9324	163.87510.5023	163.83514.0723	163.83
517.6423	163.83521.2122	163.83524.7822	163.83528.3521	163.83531.9221	163.83

535.492	163.83 539.062	163.83542.6319	163.83546.2018	163.83549.7718	163.83
553.3417	163.83556.9117	163.83560.4816	163.83564.0516	163.83567.6215	163.83
571.1915	163.83574.7614	163.83578.3314	163.83581.9013	163.92585.4713	164.03
589.0412	164.14592.6111	164.25596.1811	164.36 599.751	164.47 603.321	164.58
606.8909	164.69610.4609	164.79614.0308	165.36617.6008	165.87621.1707	165.97
624.7407	166.08628.3106	166.18631.8806	166.29635.4505	166.39639.0204	166.46
642.5904	166.53646.1603	166.6649.7303	166.66653.3002	166.73656.8702	166.8
660.4401	166.83664.0101	166.83 667.58	166.83 671.15	166.83674.7199	166.83
678.2899	166.83681.8598	166.83685.4297	166.83688.9997	166.83692.5696	166.83
696.1396	166.89699.7095	166.98703.2795	167.06706.8494	167.15710.4194	167.24
713.9893	167.32717.5593	167.41721.1292	167.5724.6992	167.59728.2691	167.68
731.8391	167.77 735.409	167.9738.9789	168.1742.5489	168.3746.1188	168.49
749.6888	168.68753.2587	168.95756.8287	169.49760.3986	170.01763.9686	170.46
767.5385	170.88771.1085	171.17774.6784	171.48778.2484	171.79781.8183	171.83
785.3882	171.83788.9582	171.83792.5281	171.83796.0981	171.88 799.668	171.94
803.238	171.99806.8079	172.04810.3779	172.1813.9478	172.15817.5178	172.21
821.0877	172.27824.6577	172.33828.2276	172.39831.7975	172.44835.3675	172.5
838.9374	172.55842.5074	172.61846.0773	172.67849.6473	172.72 850.67	172.13
853.94	172.07 857.21	172.06 860.49	172.1 863.76	172.14 867.03	172.14
870.31	172.15 873.58	172.22 876.86	172.36 880.13	172.45 883.4	172.53
886.68	172.55 889.95	172.58 893.22	172.65 896.5	172.69 899.77	172.73
903.04	172.74 906.32	172.83 909.59	172.88 912.87	172.86 916.14	172.89
919.41	172.93 922.69	172.97 925.96	173.05 929.23	173.15 932.51	173.19
935.78	173.18 939.05	173.21 942.33	173.28 945.6	173.32 948.88	173.33
952.15	173.37 955.42	173.4 958.7	173.45 961.97	173.52 965.24	173.54
968.52	173.57 971.79	173.62 975.06	173.63 978.34	173.62 981.61	173.67
984.89	173.79 988.16	173.84 991.43	173.82 994.71	173.82 997.98	173.91
1001.25	174 1004.53	174.08 1007.8	174.08 1011.07	174.1 1014.35	174.13
1017.62	174.12 1020.9	174.23 1024.17	174.32 1027.44	174.39 1030.72	174.46
1033.99	174.51 1037.26	174.56 1040.54	174.66 1043.81	174.74 1047.08	174.84
1050.36	174.97 1053.63	175.07 1056.91	175.14 1060.18	175.23 1063.45	175.29
1066.73	175.29 1070	175.28 1073.27	175.35 1076.55	175.47 1079.82	175.56
1083.09	175.61 1086.37	175.61 1089.64	175.6 1092.92	175.65 1096.19	175.69
1099.46	175.68 1102.74	175.72 1106.01	175.71 1109.28	175.69 1112.56	175.74
1115.83	175.77 1119.1	175.78 1122.38	175.84 1125.65	175.85 1128.93	175.87
1132.2	175.94 1135.47	175.95 1138.75	176.04 1142.02	176.08 1145.29	176.12
1148.57	176.17 1151.84	176.21 1155.11	176.27 1158.39	176.29 1161.66	176.33
1164.94	176.35 1168.21	176.35 1171.48	176.35 1174.76	176.35 1178.03	176.39
1181.3	176.44 1184.58	176.48 1187.85	176.52 1191.12	176.57 1194.4	176.61
1197.67	176.66 1200.95	176.72 1204.22	176.74 1207.49	176.77 1210.77	176.8
1214.04	176.84 1217.31	176.88 1220.59	176.91 1223.86	176.96 1227.13	177.01
1230.41	177.03 1233.68	177.04 1236.96	177.05 1240.23	177.09 1243.5	177.13
1246.78	177.13 1250.05	177.14 1253.32	177.17 1256.6	177.18 1259.87	177.21
1263.14	177.21 1266.42	177.27 1269.69	177.32 1272.97	177.34 1276.24	177.39
1279.51	177.45 1282.79	177.51 1286.06	177.58 1289.33	177.64 1292.61	177.68
1295.88	177.75 1299.15	177.86 1302.43	177.96 1305.7	178.05 1308.98	178.14
1312.25	178.24 1315.52	178.38 1318.8	178.5 1322.07	178.62 1325.34	178.75
1328.62	178.85 1331.89	178.91 1335.16	178.94		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	478.3728	.025	617.6008	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
478.3728	617.6008	800	890	.1	.3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 175.06	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.28	* Wt. n-Val.	* 0.030	* 0.025	*

```
  0.070  *
* W.S. Elev (ft)         *  174.78  * Reach Len. (ft)        *  800.00  *  800.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 2368.65  * 1484.13  *
1624.43  *
* E.G. Slope (ft/ft)     *0.000343  * Area (sq ft)           * 2368.65  * 1484.13  *
1624.43  *
* Q Total (cfs)          *17300.00  * Flow (cfs)             * 7838.60  * 7907.45  *
1553.96  *
* Top Width (ft)         *  911.39  * Top Width (ft)        *  344.72  *  139.23  *
 427.44  *
* Vel Total (ft/s)       *    3.16  * Avg. Vel. (ft/s)      *    3.31  *    5.33  *
   0.96  *
* Max Chl Dpth (ft)      *   10.95  * Hydr. Depth (ft)      *    6.87  *   10.66  *
   3.80  *
* Conv. Total (cfs)      *934269.6  * Conv. (cfs)           *423315.7  *427033.8  *
83920.1  *
* Length Wtd. (ft)       *  810.91  * Wetted Per. (ft)      *  345.59  *  139.34  *
 427.86  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)      *    0.15  *    0.23  *
   0.08  *
* Alpha                  *    1.81  * Stream Power (lb/ft s) *    0.49  *    1.21  *
   0.08  *
* Frctn Loss (ft)        *    0.22  * Cum Volume (acre-ft)  *  324.16  *  118.18  *
 575.71  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)        *    6.90  *    3.05  *
  14.32  *
********************************************************************************
**********

CROSS SECTION OUTPUT  Profile #Floodway
********************************************************************************
**********
* E.G. Elev (ft)         *  175.69  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.28  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  175.41  * Reach Len. (ft)       *  800.00  *  800.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 2490.37  * 1571.73  *
 381.21  *
* E.G. Slope (ft/ft)     *0.000286  * Area (sq ft)           * 2490.37  * 1571.73  *
 381.21  *
* Q Total (cfs)          *17300.00  * Flow (cfs)             * 8823.89  * 7952.47  *
 523.64  *
* Top Width (ft)         *  465.00  * Top Width (ft)        *  283.37  *  139.23  *
  42.40  *
* Vel Total (ft/s)       *    3.89  * Avg. Vel. (ft/s)      *    3.54  *    5.06  *
   1.37  *
* Max Chl Dpth (ft)      *   11.58  * Hydr. Depth (ft)      *    8.79  *   11.29  *
   8.99  *
* Conv. Total (cfs)      *1022158.0  * Conv. (cfs)           *521353.5  *469865.9
* 30939.1  *
* Length Wtd. (ft)       *  808.90  * Wetted Per. (ft)      *  286.60  *  139.34  *
  50.99  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)      *    0.16  *    0.20  *
   0.13  *
* Alpha                  *    1.20  * Stream Power (lb/ft s) *    0.55  *    1.02  *
   0.18  *
* Frctn Loss (ft)        *    0.17  * Cum Volume (acre-ft)  *  268.51  *  124.50  *
 561.29  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)        *    5.84  *    3.05  *
   8.30  *
```

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	170.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.24	Wt. n-Val.	0.030	0.025	0.070
W.S. Elev (ft)	169.77	Reach Len. (ft)	800.00	800.00	890.00
Crit W.S. (ft)		Flow Area (sq ft)	1031.65	786.90	369.18
E.G. Slope (ft/ft)	0.000588	Area (sq ft)	1031.65	786.90	369.18
Q Total (cfs)	7480.00	Flow (cfs)	3522.89	3596.58	360.54
Top Width (ft)	494.82	Top Width (ft)	214.44	139.23	141.15
Vel Total (ft/s)	3.42	Avg. Vel. (ft/s)	3.41	4.57	0.98
Max Chl Dpth (ft)	5.94	Hydr. Depth (ft)	4.81	5.65	2.62
Conv. Total (cfs)	308475.3	Conv. (cfs)	145283.9	148322.9	14868.6
Length Wtd. (ft)	803.86	Wetted Per. (ft)	215.19	139.34	141.27
Min Ch El (ft)	163.83	Shear (lb/sq ft)	0.18	0.21	0.10
Alpha	1.33	Stream Power (lb/ft s)	0.60	0.95	0.09
Frctn Loss (ft)	0.39	Cum Volume (acre-ft)	144.03	71.24	231.57
C & E Loss (ft)	0.02	Cum SA (acres)	3.91	3.05	6.39

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	173.54	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.30	Wt. n-Val.	0.030	0.025	0.070
W.S. Elev (ft)	173.24	Reach Len. (ft)	800.00	800.00	890.00
Crit W.S. (ft)		Flow Area (sq ft)	1877.80	1270.34	1036.66
E.G. Slope (ft/ft)	0.000422	Area (sq ft)	1877.80	1270.34	1036.66
Q Total (cfs)	14350.00	Flow (cfs)	6599.19	6768.09	982.72
Top Width (ft)	753.80	Top Width (ft)	291.62	139.23	322.95
Vel Total (ft/s)	3.43	Avg. Vel. (ft/s)	3.51	5.33	0.95
Max Chl Dpth (ft)	9.41	Hydr. Depth (ft)	6.44	9.12	

```
   3.21  *
* Conv. Total (cfs)      *698650.8  * Conv. (cfs)            *321291.4  *329514.4  *
47845.0  *
* Length Wtd. (ft)       *  808.47  * Wetted Per. (ft)       *  292.47  *  139.34  *
 323.35  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)       *    0.17  *    0.24  *
   0.08  *
* Alpha                  *    1.63  * Stream Power (lb/ft s) *    0.59  *    1.28  *
   0.08  *
* Frctn Loss (ft)        *    0.26  * Cum Volume (acre-ft)   *  265.42  *  104.04  *
 460.47  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *    5.34  *    3.05  *
  11.77  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #0.2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  178.78  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.23  * Wt. n-Val.             *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  178.55  * Reach Len. (ft)        *  800.00  *  800.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 3908.00  * 2009.79  *
3798.31  *
* E.G. Slope (ft/ft)     *0.000213  * Area (sq ft)           * 3908.00  * 2009.79  *
3798.31  *
* Q Total (cfs)          *25400.00  * Flow (cfs)             *11439.06  *10336.06  *
3624.88  *
* Top Width (ft)         * 1320.25  * Top Width (ft)         *  478.37  *  139.23  *
 702.65  *
* Vel Total (ft/s)       *    2.61  * Avg. Vel. (ft/s)       *    2.93  *    5.14  *
   0.95  *
* Max Chl Dpth (ft)      *   14.72  * Hydr. Depth (ft)       *    8.17  *   14.44  *
   5.41  *
* Conv. Total (cfs)      *1739423.0  * Conv. (cfs)            *783360.3  *707826.0
*248236.3  *
* Length Wtd. (ft)       *  815.34  * Wetted Per. (ft)       *  480.02  *  139.34  *
 703.11  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)       *    0.11  *    0.19  *
   0.07  *
* Alpha                  *    2.16  * Stream Power (lb/ft s) *    0.32  *    0.99  *
   0.07  *
* Frctn Loss (ft)        *    0.13  * Cum Volume (acre-ft)   *  480.90  *  152.86  *
 904.75  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    8.13  *    3.05  *
  20.12  *
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Warning: The cross-section end points had to be extended vertically for the computed
water surface.

CROSS SECTION


RIVER: RIVER-2
REACH: Reach-1            RS: 190

INPUT
Description: SIDE CHANNEL XS 190 ( LETTERED CROSS SECTION T)THE CHANNEL
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ROUGHNESS IS ESSENTIALLY THE SAME AS OB SINCE IT IS NOT NATURAL

Station Elevation Data num= 487

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	174.574.474503	174.568.949005	174.5713.42351	174.5617.89801	174.57				
22.37251	174.5326.84702	174.5131.32152	174.5335.79602	174.5340.27052	174.52				
44.74503	174.4849.21953	174.453.69403	174.2958.16853	174.271.59204	173.96				
80.54105	173.7885.01555	173.793.96455	173.5298.43906	173.44125.2861	172.9				
129.7606	172.79134.2351	172.6138.7096	172.39143.1841	172.19147.6586	171.98				
152.1331	171.78161.0821	171.34170.0311	170.88178.9801	170.38183.4546	170.14				
205.8271	168.89210.3016	168.6214.7761	168.29219.2506	167.99223.7251	167.47				
228.1996	166.78232.6741	165.97237.1486	164.82241.6231	163.43246.0976	161.83				
250.5721	161.91255.0466	163.3259.5211	163.9263.9957	164.12272.9447	164.58				
277.4192	164.8281.8937	164.83299.7917	164.83304.2662	164.81308.7407	164.74				
313.2152	164.63317.6897	164.52322.1642	164.42326.6387	164.31331.1132	164.2				
335.5877	164.09340.0622	163.98344.5367	163.87349.0112	163.83353.4857	163.83				
357.9602	163.83362.4347	163.83366.9092	163.83371.3837	163.83375.8582	163.83				
380.3327	163.83384.8072	163.83389.2817	163.83393.7562	163.83398.2307	163.83				
402.7052	163.83407.1797	163.83411.6542	163.78416.1288	163.7420.6032	163.62				
425.0778	163.55429.5522	163.47434.0268	163.39438.5013	163.31442.9758	163.24				
447.4503	163.16451.9248	163.09456.3993	163.01460.8738	162.94465.3483	162.86				
469.8228	162.83474.2973	162.83478.7718	162.83483.2463	162.83487.7208	162.83				
492.1953	162.83496.6698	162.83501.1443	162.83505.6188	162.83510.0933	162.83				
514.5678	162.83519.0423	162.83523.5168	162.83527.9913	162.83532.4658	162.83				
536.9403	162.83541.4148	162.93545.8893	163.07550.3638	163.2554.8383	163.34				
559.3128	163.47563.7874	163.61568.2618	163.74572.7363	163.88577.2108	164.04				
581.6854	164.2586.1599	164.34590.6343	164.46595.1088	164.6599.5834	164.73				
604.0579	164.85608.5323	164.91613.0068	164.98617.4814	165.05621.9559	165.11				
626.4304	165.18630.9048	165.24635.3794	165.31639.8539	165.38644.3284	165.44				
648.8029	165.5653.2774	165.57657.7519	165.63662.2264	165.7666.7009	165.77				
671.1754	165.91675.6499	167.06680.1244	167.87684.5989	168.72689.0734	169.59				
693.5479	169.83702.4969	167.83769.6144	167.83774.0889	167.84778.5635	167.88				
783.038	167.98787.5125	168.12791.9869	168.34796.4615	168.55 800.936	168.77				
804.2	168.43	809.2	168.57	814.19	168.54	819.19	168.6	832.79	168.71
842.62	168.75	845.9	168.7	849.18	168.68	855.74	168.68	859.02	168.72
865.58	168.87	878.69	168.96	881.97	169.03	888.53	169.03	891.8	169.06
895.08	169.08	901.64	169.15	904.92	169.16	911.48	169.12	914.76	169.14
918.03	169.18	921.31	169.11	924.59	169.13	931.15	169.21	937.71	169.24
940.98	169.19	947.54	169.13	950.82	169.07	954.1	169.1	960.66	169.12
963.94	169.14	967.21	169.06	970.49	169.08	973.77	169.14	977.05	169.13
983.61	169.13	986.89	169.1	990.17	169.1	996.72	169.15	1006.56	169.26
1009.84	169.34	1013.12	169.36	1016.39	169.41	1022.95	169.45	1026.23	169.43
1029.51	169.37	1032.79	169.33	1036.07	169.32	1039.35	169.28	1042.62	169.23
1045.9	169.22	1049.18	169.26	1055.74	169.29	1059.02	169.33	1062.3	169.33
1065.58	169.35	1068.85	169.4	1072.13	169.39	1078.69	169.34	1081.97	169.34
1085.25	169.36	1088.53	169.42	1091.81	169.39	1095.08	169.38	1098.36	169.41
1101.64	169.46	1104.92	169.55	1108.2	169.6	1114.76	169.68	1118.03	169.67
1121.31	169.67	1124.59	169.61	1127.87	169.59	1134.43	169.46	1137.71	169.44
1140.99	169.49	1144.26	169.6	1147.54	169.68	1154.1	169.76	1157.38	169.79
1160.66	169.79	1163.94	169.85	1167.22	169.85	1177.05	169.88	1180.33	169.88
1193.45	169.92	1200	169.93	1203.28	169.97	1206.56	170.03	1209.84	170.03
1213.12	170.01	1216.4	169.97	1226.23	170	1229.51	170.04	1236.07	170.1
1242.63	170.13	1249.18	170.19	1252.46	170.27	1255.74	170.3	1259.02	170.36
1262.3	170.43	1268.86	170.54	1272.13	170.6	1275.41	170.7	1278.69	170.77
1281.97	170.79	1285.25	170.83	1288.53	170.78	1291.81	170.8	1295.09	170.91
1298.36	171.04	1301.64	171.06	1308.2	171.14	1314.76	171.25	1318.04	171.29
1321.32	171.35	1324.59	171.38	1327.87	171.39	1331.15	171.49	1334.43	171.57
1337.71	171.62	1344.27	171.69	1350.82	171.79	1357.38	171.85	1363.94	172.06
1367.22	172.08	1370.5	172.05	1373.78	172.06	1377.05	172.13	1383.61	172.35
1386.89	172.44	1390.17	172.48	1393.45	172.45	1396.73	172.5	1400.01	172.58
1403.28	172.64	1406.56	172.67	1409.84	172.76	1413.12	172.87	1419.68	173
1422.96	173.03	1426.23	173.02	1429.51	173.07	1432.79	173.15	1436.07	173.21
1439.35	173.38	1442.63	173.52	1445.91	173.54	1449.19	173.58	1455.74	173.77

1459.02	173.81	1462.3	173.81	1465.58	173.82	1468.86	173.85	1475.42	173.97
1478.69	173.99	1481.97	173.98	1485.25	174.03	1491.81	174.08	1498.37	174.1
1504.92	174.19	1511.48	174.2	1514.76	174.21	1518.04	174.2	1524.6	174.22
1527.88	174.25	1531.15	174.24	1534.43	174.25	1537.71	174.28	1540.99	174.28
1544.27	174.26	1547.55	174.26	1550.83	174.3	1557.38	174.4	1563.94	174.37
1567.22	174.43	1570.5	174.51	1573.78	174.64	1577.06	174.74	1580.33	174.78
1583.61	174.79	1590.17	174.79	1593.45	174.83	1596.73	174.92	1600.01	174.96
1603.29	174.95	1609.84	174.89	1613.12	174.9	1616.4	174.9	1619.68	174.92
1622.96	174.97	1626.24	175.04	1629.52	175.08	1632.79	175.08	1636.07	175.14
1639.35	175.3	1642.63	175.42	1645.91	175.46	1649.19	175.48	1652.47	175.53
1659.02	175.75	1665.58	175.91	1668.86	175.96	1672.14	175.96	1675.42	175.95
1678.7	175.95	1681.98	175.98	1685.25	176.03	1688.53	176.06	1691.81	176.07
1695.09	176.1	1698.37	176.16	1704.93	176.14	1708.2	176.18	1714.76	176.28
1718.04	176.29	1721.32	176.32	1724.6	176.41	1727.88	176.46	1731.16	176.53
1734.43	176.64	1737.71	176.74	1740.99	176.78	1744.27	176.87	1747.55	176.97
1750.83	177	1754.11	177.01	1757.39	177.08	1760.66	177.11	1763.94	177.1
1767.22	177.13	1770.5	177.12	1773.78	177.2	1777.06	177.26	1780.34	177.27
1783.62	177.32	1790.17	177.39	1793.45	177.45	1796.73	177.49	1800.01	177.52
1806.57	177.64	1809.84	177.72	1813.12	177.78	1816.4	177.8	1819.68	177.81
1822.96	177.85	1832.8	177.93	1836.07	177.98	1839.35	178.05	1842.63	178.15
1845.91	178.21	1849.19	178.25	1852.47	178.24	1855.75	178.26	1859.03	178.31
1862.3	178.38	1868.86	178.58	1872.14	178.69	1875.42	178.82	1878.7	178.93
1881.98	179.1	1885.26	179.23	1888.53	179.26	1891.81	179.25	1895.09	179.34
1898.37	179.39	1904.93	179.43	1908.21	179.48	1911.49	179.55	1914.76	179.63
1918.04	179.7	1924.6	179.76	1927.88	179.85	1931.16	179.93	1937.72	180.06
1944.27	180.09	1947.55	180.16	1950.83	180.25	1954.11	180.31	1957.39	180.38
1960.67	180.48	1963.95	180.61	1967.22	180.75	1970.5	180.84	1973.78	180.89
1980.34	181.06	1983.62	181.16	1990.17	181.32	1996.73	181.5	2000.01	181.56
2003.29	181.58	2006.57	181.66	2013.13	181.85	2019.68	181.92	2029.52	182.13
2032.8	182.21	2036.08	182.31	2039.36	182.48	2042.63	182.61	2045.91	182.71
2049.19	182.77	2055.75	182.99	2062.31	183.09	2068.86	183.34	2072.14	183.43
2075.42	183.5	2081.98	183.68	2085.26	183.75	2088.54	183.84	2091.81	183.99
2095.09	184.18	2098.37	184.4	2104.93	184.69	2108.21	184.81	2111.49	184.9
2114.77	185.04	2118.04	185.22	2121.32	185.39	2127.88	185.63	2131.16	185.79
2134.44	185.98	2140.99	186.27	2144.27	186.4	2147.55	186.52	2150.83	186.66
2160.67	187.11	2170.5	187.5	2173.78	187.62	2180.34	187.94	2183.62	188.07
2190.17	188.36	2193.45	188.49	2200.01	188.79	2203.29	188.92	2206.57	189.06
2209.85	189.23	2213.12	189.34	2216.4	189.41	2219.68	189.51	2222.96	189.63
2229.52	189.91	2232.8	190.06						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.034	07.1797	.025	99.5834	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
407.1797	599.5834		1760	1760	.1	.3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.81	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.17	* Wt. n-Val.	* 0.030	* 0.025	* 0.100 *
* W.S. Elev (ft)	* 174.63	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2393.40	* 2181.83	* 4525.18 *
* E.G. Slope (ft/ft)	*0.000199	* Area (sq ft)	* 2393.40	* 2181.83	* 4525.18 *
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 5432.94	* 9228.49	* 2638.58 *

* Top Width (ft)	* 1573.58	* Top Width (ft)	* 407.18	* 192.40	* 973.99 *
* Vel Total (ft/s)	* 1.90	* Avg. Vel. (ft/s)	* 2.27	* 4.23	* 0.58 *
* Max Chl Dpth (ft)	* 12.80	* Hydr. Depth (ft)	* 5.88	* 11.34	* 4.65 *
* Conv. Total (cfs)	*1226894.0	* Conv. (cfs)	*385296.8	*654472.4	*187124.6 *
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 408.47	* 192.44	* 974.73 *
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.07	* 0.14	* 0.06 *
* Alpha	* 3.10	* Stream Power (lb/ft s)	* 0.17	* 0.60	* 0.03 *
* Frctn Loss (ft)	* 0.22	* Cum Volume (acre-ft)	* 280.43	* 84.52	* 512.89 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	*	*	* *

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Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 175.47	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.13	* Wt. n-Val.	* 0.030	* 0.025	* 0.100 *
* W.S. Elev (ft)	* 175.34	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2636.53	* 2318.32	* 4863.35 *
* E.G. Slope (ft/ft)	*0.000139	* Area (sq ft)	* 2636.53	* 2318.32	* 4863.35 *
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 5865.16	* 8535.37	* 2899.47 *
* Top Width (ft)	* 1315.00	* Top Width (ft)	* 352.18	* 192.40	* 770.42 *
* Vel Total (ft/s)	* 1.76	* Avg. Vel. (ft/s)	* 2.22	* 3.68	* 0.60 *
* Max Chl Dpth (ft)	* 13.51	* Hydr. Depth (ft)	* 7.49	* 12.05	* 6.31 *
* Conv. Total (cfs)	*1467692.0	* Conv. (cfs)	*497586.6	*724121.2	*245983.9 *
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 354.48	* 192.44	* 774.41 *
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.06	* 0.10	* 0.05 *
* Alpha	* 2.71	* Stream Power (lb/ft s)	* 0.14	* 0.38	* 0.03 *
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 221.43	* 88.78	* 507.71 *
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	*	*	* *

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CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 169.60	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.18	* Wt. n-Val.	* 0.030	* 0.025	* 0.100 *
* W.S. Elev (ft)	* 169.42	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 977.89	* 1179.42	* 575.57 *
* E.G. Slope (ft/ft)	*0.000381	* Area (sq ft)	* 977.89	* 1179.42	* 575.57 *
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 2618.66	* 4580.48	* 280.85 *
* Top Width (ft)	* 887.38	* Top Width (ft)	* 210.87	* 192.40	* 484.10 *
* Vel Total (ft/s)	* 2.74	* Avg. Vel. (ft/s)	* 2.68	* 3.88	* 0.49 *
* Max Chl Dpth (ft)	* 7.59	* Hydr. Depth (ft)	* 4.64	* 6.13	* 1.19 *
* Conv. Total (cfs)	*383379.6	* Conv. (cfs)	*134216.8	*234767.8	* 14394.9 *
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 212.00	* 192.44	* 484.71 *
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.11	* 0.15	* 0.03 *
* Alpha	* 1.57	* Stream Power (lb/ft s)	* 0.29	* 0.57	* 0.01 *
* Frctn Loss (ft)	* 0.43	* Cum Volume (acre-ft)	* 125.58	* 53.18	* 221.92 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	*	*	* *

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 173.24	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.18	* Wt. n-Val.	* 0.030	* 0.025	* 0.100 *
* W.S. Elev (ft)	* 173.06	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1871.27	* 1879.44	* 3133.97 *
* E.G. Slope (ft/ft)	*0.000231	* Area (sq ft)	* 1871.27	* 1879.44	* 3133.97 *
* Q Total (cfs)	*14350.00	* Flow (cfs)	* 4872.53	* 7760.55	* 1716.93 *
* Top Width (ft)	* 1311.56	* Top Width (ft)	* 289.86	* 192.40	* 829.29 *
* Vel Total (ft/s)	* 2.08	* Avg. Vel. (ft/s)	* 2.60	* 4.13	* 0.55 *
* Max Chl Dpth (ft)	* 11.23	* Hydr. Depth (ft)	* 6.46	* 9.77	* 3.78 *
* Conv. Total (cfs)	*943766.7	* Conv. (cfs)	*320455.1	*510393.4	*112918.2 *
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 291.07	* 192.44	* 830.01 *
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.09	* 0.14	* 0.05 *
* Alpha	* 2.66	* Stream Power (lb/ft s)	* 0.24	* 0.58	*

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   0.03  *
* Frctn Loss (ft)        *    0.26  * Cum Volume (acre-ft)   *  231.00  *   75.12  *
 417.86  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *          *          *
         *
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CROSS SECTION OUTPUT  Profile #0.2%
**************************************************************************************
***********
* E.G. Elev (ft)         *  178.62  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.13  * Wt. n-Val.            *   0.030  *   0.025  *
  0.100  *
* W.S. Elev (ft)         *  178.49  * Reach Len. (ft)       * 1760.00  * 1760.00  *
1760.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 3964.85  * 2924.38  *
8877.46  *
* E.G. Slope (ft/ft)     *0.000109  * Area (sq ft)          * 3964.85  * 2924.38  *
8877.46  *
* Q Total (cfs)          *25400.00  * Flow (cfs)            * 9254.12  *11112.79  *
5033.09  *
* Top Width (ft)         * 1865.95  * Top Width (ft)        *  407.18  *  192.40  *
1266.37  *
* Vel Total (ft/s)       *    1.61  * Avg. Vel. (ft/s)      *    2.33  *    3.80  *
   0.57  *
* Max Chl Dpth (ft)      *   16.66  * Hydr. Depth (ft)      *    9.74  *   15.20  *
   7.01  *
* Conv. Total (cfs)      *2437383.0  * Conv. (cfs)           *888024.7  *1066383.0
*482975.1  *
* Length Wtd. (ft)       * 1760.00  * Wetted Per. (ft)      *  412.32  *  192.44  *
1267.15  *
* Min Ch El (ft)         *  162.83  * Shear (lb/sq ft)      *    0.07  *    0.10  *
   0.05  *
* Alpha                  *    3.22  * Stream Power (lb/ft s) *    0.15  *    0.39  *
   0.03  *
* Frctn Loss (ft)        *    0.13  * Cum Volume (acre-ft)   *  408.61  *  107.56  *
 775.26  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *          *          *
         *
**************************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.

**************************************************************************************

SUMMARY OF MANNING'S N VALUES

River:RIVER-1
**************************************************************************************
*
*     Reach      *   River Sta.   *   n1    *   n2    *   n3    *   n4    *   n5
*
**************************************************************************************
*
*Reach-1         *    350         *       .1*     .045*       .1*         *
*
*Reach-1         *    344.95      *       .1*     .045*       .1*         *
*
*Reach-1         *    331.6       *       .1*     .045*       .1*         *
```

```
*
*Reach-1         *    320          *       .1*     .045*       .1*         *
*
*Reach-1         *    314.4        *       .1*     .045*       .1*         *
*
*Reach-1         *    300          *       .1*     .045*       .1*         *
*
*Reach-1         *    285          *       .1*     .045*       .1*         *
*
*Reach-1         *    280.55       *       .1*     .045*       .1*         *
*
*Reach-1         *    270          *       .1*     .045*       .1*         *
*
*Reach-1         *    264          *       .1*     .045*       .1*         *
*
*Reach-1         *    250.12       *      .07*     .045*      .07*         *
*
*Reach-1         *    250.06       *Bridge   *        *         *        *        *
*Reach-1         *    250          *      .07*     .045*      .07*         *
*
*Reach-1         *    246          *      .07*     .045*      .07*         *
*
*Reach-1         *    245          *      .07*     .045*      .07*         *
*
*Reach-1         *    244.19       *Bridge   *        *         *        *        *
*Reach-1         *    243.38       *      .07*     .045*      .07*         *
*
*Reach-1         *    243.2        *      .07*     .045*      .07*         *
*
*Reach-1         *    243          *      .07*     .045*      .07*         *
*
*Reach-1         *    190          *       .1*     .045*       .1*         *
*
*Reach-1         *    182          *       .1*     .045*      .03*     .025*
.1*
*Reach-2         *    180          *       .1*     .045*       .1*         *
*
*Reach-2         *    170          *       .1*     .045*       .1*         *
*
*******************************************************************************
*

River:RIVER-2
*****************************************************************
*     Reach      *   River Sta.    *   n1    *   n2    *   n3    *
*****************************************************************
*Reach-1         *    250.12       *      .03*     .025*      .07*
*Reach-1         *    225          *      .03*     .025*      .07*
*Reach-1         *    200          *      .03*     .025*      .07*
*Reach-1         *    190          *      .03*     .025*       .1*
*****************************************************************

*******************************************************************************

SUMMARY OF REACH LENGTHS

River: RIVER-1
*****************************************************************
*     Reach      *   River Sta.    *  Left   * Channel *  Right  *
*****************************************************************
*Reach-1         *    350          *      505*      505*      505*
*Reach-1         *    344.95       *      700*     1400*     1400*
*Reach-1         *    331.6        *      980*      980*      980*
```

Reach	River Sta.	Left	Channel	Right
Reach-1	320	860	860	550
Reach-1	314.4	600	1120	600
Reach-1	300	1000	1840	1840
Reach-1	285	220	295	320
Reach-1	280.55	1140	1140	1140
Reach-1	270	515	515	515
Reach-1	264	1330	1300	1000
Reach-1	250.12	620	620	620
Reach-1	250.06	Bridge		
Reach-1	250	10	13	35
Reach-1	246	5	10	35
Reach-1	245	230	230	230
Reach-1	244.19	Bridge		
Reach-1	243.38	585	585	585
Reach-1	243.2	760	760	200
Reach-1	243	4920	3930	1480
Reach-1	190	735	735	735
Reach-1	182	635	635	635
Reach-2	180	700	700	700
Reach-2	170	0	0	0

River: RIVER-2

Reach	River Sta.	Left	Channel	Right
Reach-1	250.12	515	515	515
Reach-1	225	460	460	460
Reach-1	200	800	800	890
Reach-1	190	1760	1760	1760

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	350	.1	.3
Reach-1	344.95	.1	.3
Reach-1	331.6	.1	.3
Reach-1	320	.1	.3
Reach-1	314.4	.1	.3
Reach-1	300	.1	.3
Reach-1	285	.1	.3
Reach-1	280.55	.1	.3
Reach-1	270	.1	.3
Reach-1	264	.1	.3
Reach-1	250.12	.3	.5
Reach-1	250.06	Bridge	
Reach-1	250	.3	.5
Reach-1	246	.3	.5
Reach-1	245	.3	.5
Reach-1	244.19	Bridge	
Reach-1	243.38	.3	.5
Reach-1	243.2	.1	.3
Reach-1	243	.1	.3
Reach-1	190	.1	.3
Reach-1	182	.1	.3
Reach-2	180	.1	.3
Reach-2	170	.1	.3

River: RIVER-2

Reach	River Sta.	Contr.	Expan.
Reach-1	250.12	.1	.3
Reach-1	225	.1	.3
Reach-1	200	.1	.3
Reach-1	190	.1	.3

Profile Output Table - Standard Table 1

River	Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
RIVER-2	Reach-1	250.12	1%	17300.00	164.83	175.14		175.46	0.000413	5.60	5252.80	759.92	0.31
RIVER-2	Reach-1	250.12	Floodway	17300.00	164.83	175.55		176.20	0.000710	7.54	4052.31	530.00	0.41
RIVER-2	Reach-1	250.12	10%	7480.00	164.83	170.45		170.84	0.001056	5.87	1939.44	574.48	0.45
RIVER-2	Reach-1	250.12	2%	14350.00	164.83	173.68		174.04	0.000540	5.76	4163.39	741.10	0.35
RIVER-2	Reach-1	250.12	0.2%	25400.00	164.83	178.73		179.03	0.000266	5.52	8101.73	824.79	0.26
RIVER-2	Reach-1	225	1%	17300.00	163.83	174.91		175.25	0.000413	5.76	5134.33	1037.90	0.31
RIVER-2	Reach-1	225	Floodway	17300.00	163.83	175.54		175.83	0.000305	5.15	4659.16	510.00	0.27
RIVER-2	Reach-1	225	10%	7480.00	163.83	170.04		170.35	0.000775	5.18	1933.74	450.89	0.39
RIVER-2	Reach-1	225	2%	14350.00	163.83	173.42		173.77	0.000504	5.74	3835.78	767.30	0.34
RIVER-2	Reach-1	225	0.2%	25400.00	163.83	178.65		178.89	0.000228	5.25	9585.54	1314.27	0.25
RIVER-2	Reach-1	200	1%	17300.00	163.83	174.78		175.06	0.000343	5.33	5477.21	911.39	

0.29								
RIVER-2	Reach-1	200		Floodway	17300.00		163.83	
175.41		175.69	0.000286	5.06	4443.31		465.00	
0.27								
RIVER-2	Reach-1	200		10%	7480.00		163.83	
169.77		170.01	0.000588	4.57	2187.73		494.82	
0.34								
RIVER-2	Reach-1	200		2%	14350.00		163.83	
173.24		173.54	0.000422	5.33	4184.79		753.80	
0.31								
RIVER-2	Reach-1	200		0.2%	25400.00		163.83	
178.55		178.78	0.000213	5.14	9716.10		1320.25	
0.24								
RIVER-2	Reach-1	190		1%	17300.00		162.83	
174.63		174.81	0.000199	4.23	9100.40		1573.58	
0.22								
RIVER-2	Reach-1	190		Floodway	17300.00		162.83	
175.34		175.47	0.000139	3.68	9818.19		1315.00	
0.19								
RIVER-2	Reach-1	190		10%	7480.00		162.83	
169.42		169.60	0.000381	3.88	2732.88		887.38	
0.28								
RIVER-2	Reach-1	190		2%	14350.00		162.83	
173.06		173.24	0.000231	4.13	6884.68		1311.56	
0.23								
RIVER-2	Reach-1	190		0.2%	25400.00		162.83	
178.49		178.62	0.000109	3.80	15766.68		1865.95	
0.17								
RIVER-1	Reach-1	350		1%	17700.00		160.00	
181.46		181.92	0.000898	6.42	6312.63		1094.81	
0.28								
RIVER-1	Reach-1	350		Floodway	17700.00		160.00	
181.80		182.36	0.000980	6.80	4413.49		440.00	
0.29								
RIVER-1	Reach-1	350		10%	8780.00		160.00	
177.59		177.96	0.000844	5.23	2769.64		653.08	
0.26								
RIVER-1	Reach-1	350		2%	15000.00		160.00	
180.42		180.88	0.000924	6.24	5207.48		1034.56	
0.28								
RIVER-1	Reach-1	350		0.2%	25700.00		160.00	
184.17		184.60	0.000812	6.75	9489.20		1251.96	
0.27								
RIVER-1	Reach-1	344.95		1%	17700.00		159.00	
181.29		181.51	0.000440	4.96	9113.30		1196.15	
0.20								
RIVER-1	Reach-1	344.95		Floodway	17700.00		159.00	
181.71		181.91	0.000391	4.74	8567.00		850.00	
0.19								
RIVER-1	Reach-1	344.95		10%	8780.00		159.00	
177.43		177.60	0.000366	3.90	4944.21		901.34	
0.17								
RIVER-1	Reach-1	344.95		2%	15000.00		159.00	
180.26		180.47	0.000435	4.75	7889.68		1167.15	

```
    0.20 *
* RIVER-1     * Reach-1     * 344.95       * 0.2%      * 25700.00 *    159.00 *
183.99 *           *    184.22 *   0.000442 *     5.42 *  12448.04 *   1271.81 *
    0.20 *
*               *             *             *           *          *           *
   *           *           *            *           *           *           *
     *
* RIVER-1     * Reach-1     * 331.6        * 1%        * 17700.00 *    159.60 *
180.11 *           *    180.67 *   0.001100 *     7.43 *   5759.62 *    906.87 *
    0.31 *
* RIVER-1     * Reach-1     * 331.6        * Floodway * 17700.00 *    159.60 *
180.75 *           *    181.20 *   0.000873 *     6.78 *   6262.90 *    840.00 *
    0.28 *
* RIVER-1     * Reach-1     * 331.6        * 10%       *  8780.00 *    159.60 *
176.43 *           *    176.86 *   0.000932 *     5.86 *   2918.25 *    629.93 *
    0.27 *
* RIVER-1     * Reach-1     * 331.6        * 2%        * 15000.00 *    159.60 *
179.07 *           *    179.62 *   0.001100 *     7.14 *   4854.63 *    833.67 *
    0.31 *
* RIVER-1     * Reach-1     * 331.6        * 0.2%      * 25700.00 *    159.60 *
182.93 *           *    183.45 *   0.000981 *     7.74 *   8383.11 *    954.88 *
    0.30 *
*               *             *             *           *          *           *
   *           *           *            *           *           *           *
     *
* RIVER-1     * Reach-1     * 320          * 1%        * 17700.00 *    159.40 *
179.56 *           *    179.77 *   0.000519 *     4.88 *  10026.93 *   1920.86 *
    0.21 *
* RIVER-1     * Reach-1     * 320          * Floodway * 17700.00 *    159.40 *
180.12 *           *    180.43 *   0.000615 *     5.43 *   6275.93 *    600.00 *
    0.23 *
* RIVER-1     * Reach-1     * 320          * 10%       *  8780.00 *    159.40 *
175.86 *           *    176.07 *   0.000541 *     4.24 *   4067.48 *   1104.02 *
    0.20 *
* RIVER-1     * Reach-1     * 320          * 2%        * 15000.00 *    159.40 *
178.47 *           *    178.71 *   0.000574 *     4.92 *   8024.00 *   1758.41 *
    0.22 *
* RIVER-1     * Reach-1     * 320          * 0.2%      * 25700.00 *    159.40 *
182.50 *           *    182.67 *   0.000397 *     4.75 *  16566.98 *   2427.25 *
    0.19 *
*               *             *             *           *          *           *
   *           *           *            *           *           *           *
     *
* RIVER-1     * Reach-1     * 314.4        * 1%        * 17700.00 *    159.10 *
179.40 *    173.46 *    179.46 *   0.000248 *     3.47 *  15257.87 *   2043.68 *
    0.15 *
* RIVER-1     * Reach-1     * 314.4        * Floodway * 17700.00 *    159.10 *
179.97 *    173.38 *    180.04 *   0.000259 *     3.62 *  13420.01 *   1385.00 *
    0.15 *
* RIVER-1     * Reach-1     * 314.4        * 10%       *  8780.00 *    159.10 *
175.64 *    169.10 *    175.71 *   0.000308 *     3.29 *   8441.24 *   1747.59 *
    0.16 *
* RIVER-1     * Reach-1     * 314.4        * 2%        * 15000.00 *    159.10 *
178.29 *    172.88 *    178.36 *   0.000269 *     3.46 *  13214.07 *   1941.57 *
    0.15 *
* RIVER-1     * Reach-1     * 314.4        * 0.2%      * 25700.00 *    159.10 *
182.37 *    174.27 *    182.42 *   0.000212 *     3.56 *  21006.51 *   2959.11 *
    0.14 *
*               *             *             *           *          *           *
   *           *           *            *           *           *           *
     *
* RIVER-1     * Reach-1     * 300          * 1%        * 17700.00 *    158.70 *
179.16 *    172.30 *    179.25 *   0.000313 *     3.85 *  12517.01 *   2661.90 *
```

```
    0.16 *
* RIVER-1     * Reach-1     * 300         * Floodway * 17700.00 *    158.70 *
179.71 *    172.28 *    179.82 *   0.000328 *     4.03 *  10871.79 *   1080.00 *
    0.17 *
* RIVER-1     * Reach-1     * 300         * 10%      *  8780.00 *    158.70 *
175.38 *    168.44 *    175.46 *   0.000315 *     3.29 *   7127.12 *   1328.79 *
    0.16 *
* RIVER-1     * Reach-1     * 300         * 2%       * 15000.00 *    158.70 *
178.03 *    171.87 *    178.12 *   0.000331 *     3.79 *  10628.32 *   2241.16 *
    0.16 *
* RIVER-1     * Reach-1     * 300         * 0.2%     * 25700.00 *    158.70 *
182.17 *    173.33 *    182.25 *   0.000263 *     3.92 *  17761.07 *   3956.14 *
    0.15 *
*             *             *             *          *           *           *
   *          *           *           *          *           *           *
     *
* RIVER-1     * Reach-1     * 285         * 1%       * 17700.00 *    158.20 *
178.12 *    171.92 *    178.46 *   0.000763 *     6.10 *   7149.43 *   1547.03 *
    0.25 *
* RIVER-1     * Reach-1     * 285         * Floodway * 17700.00 *    158.20 *
178.62 *    171.93 *    179.00 *   0.000778 *     6.28 *   5974.20 *    605.00 *
    0.26 *
* RIVER-1     * Reach-1     * 285         * 10%      *  8780.00 *    158.20 *
174.41 *    166.72 *    174.68 *   0.000666 *     4.89 *   3907.04 *    826.30 *
    0.23 *
* RIVER-1     * Reach-1     * 285         * 2%       * 15000.00 *    158.20 *
176.98 *    171.13 *    177.30 *   0.000765 *     5.85 *   6084.97 *   1241.40 *
    0.25 *
* RIVER-1     * Reach-1     * 285         * 0.2%     * 25700.00 *    158.20 *
181.32 *    173.49 *    181.62 *   0.000634 *     6.20 *  11226.45 *   3292.26 *
    0.24 *
*             *             *             *          *           *           *
   *          *           *           *          *           *           *
     *
* RIVER-1     * Reach-1     * 280.55      * 1%       * 17700.00 *    158.00 *
177.95 *    171.78 *    178.25 *   0.000707 *     5.94 *   7607.46 *   1586.14 *
    0.25 *
* RIVER-1     * Reach-1     * 280.55      * Floodway * 17700.00 *    158.00 *
178.42 *    171.95 *    178.78 *   0.000771 *     6.31 *   6083.25 *    600.00 *
    0.26 *
* RIVER-1     * Reach-1     * 280.55      * 10%      *  8780.00 *    158.00 *
174.24 *    166.65 *    174.49 *   0.000617 *     4.77 *   4201.51 *    864.43 *
    0.22 *
* RIVER-1     * Reach-1     * 280.55      * 2%       * 15000.00 *    158.00 *
176.79 *    171.01 *    177.09 *   0.000720 *     5.74 *   6474.28 *   1338.78 *
    0.24 *
* RIVER-1     * Reach-1     * 280.55      * 0.2%     * 25700.00 *    158.00 *
181.18 *    173.73 *    181.44 *   0.000589 *     6.05 *  11664.80 *   3171.94 *
    0.23 *
*             *             *             *          *           *           *
   *          *           *           *          *           *           *
     *
* RIVER-1     * Reach-1     * 270         * 1%       * 17700.00 *    157.70 *
176.52 *    171.46 *    177.12 *   0.001500 *     7.45 *   4228.59 *    898.81 *
    0.34 *
* RIVER-1     * Reach-1     * 270         * Floodway * 17700.00 *    157.70 *
177.16 *    171.45 *    177.68 *   0.001254 *     7.01 *   4514.99 *    449.00 *
    0.31 *
* RIVER-1     * Reach-1     * 270         * 10%      *  8780.00 *    157.70 *
173.23 *    167.38 *    173.58 *   0.001095 *     5.40 *   2781.02 *    451.48 *
    0.28 *
* RIVER-1     * Reach-1     * 270         * 2%       * 15000.00 *    157.70 *
175.39 *    170.78 *    175.95 *   0.001513 *     7.10 *   3724.90 *    731.14 *
```

```
    0.34 *
* RIVER-1     * Reach-1     * 270          * 0.2%      * 25700.00 *    157.70 *
179.72 *    173.05 *    180.44 *   0.001466 *     8.38 *   5702.49 *   1592.99 *
    0.35 *
*              *              *              *           *           *           *
   *            *            *              *           *           *           *
     *
* RIVER-1     * Reach-1     * 264          * 1%        * 17700.00 *    157.50 *
175.98 *    170.99 *    176.36 *   0.001202 *     6.79 *   5551.56 *   1664.30 *
    0.30 *
* RIVER-1     * Reach-1     * 264          * Floodway * 17700.00 *    157.50 *
176.73 *    170.99 *    177.05 *   0.000962 *     6.27 *   5990.98 *    652.90 *
    0.27 *
* RIVER-1     * Reach-1     * 264          * 10%       *  8780.00 *    157.50 *
172.78 *    168.90 *    173.03 *   0.000920 *     5.11 *   3689.84 *    839.81 *
    0.25 *
* RIVER-1     * Reach-1     * 264          * 2%        * 15000.00 *    157.50 *
174.81 *    170.48 *    175.18 *   0.001257 *     6.60 *   4867.78 *   1215.93 *
    0.30 *
* RIVER-1     * Reach-1     * 264          * 0.2%      * 25700.00 *    157.50 *
179.30 *    172.29 *    179.70 *   0.001042 *     7.19 *   7491.52 *   3321.91 *
    0.29 *
*              *              *              *           *           *           *
   *            *            *              *           *           *           *
     *
* RIVER-1     * Reach-1     * 250.12       * 1%        *   800.00 *    157.00 *
175.41 *    160.81 *    175.44 *   0.000035 *     1.29 *    691.77 *   2947.76 *
    0.05 *
* RIVER-1     * Reach-1     * 250.12       * Floodway *   800.00 *    157.00 *
176.29 *    160.81 *    176.31 *   0.000030 *     1.23 *    731.01 *     45.00 *
    0.05 *
* RIVER-1     * Reach-1     * 250.12       * 10%       *  1450.00 *    157.00 *
172.10 *    162.04 *    172.23 *   0.000241 *     2.93 *    542.84 *    242.11 *
    0.14 *
* RIVER-1     * Reach-1     * 250.12       * 2%        *   950.00 *    157.00 *
174.17 *    161.11 *    174.21 *   0.000064 *     1.66 *    635.72 *   2298.34 *
    0.07 *
* RIVER-1     * Reach-1     * 250.12       * 0.2%      *   700.00 *    157.00 *
178.89 *    160.59 *    178.89 *   0.000000 *     0.15 *  16640.42 *   3387.88 *
    0.01 *
*              *              *              *           *           *           *
   *            *            *              *           *           *           *
     *
* RIVER-1     * Reach-1     * 250.06       *           *   Bridge *            *
   *            *            *              *           *           *           *
     *
*              *              *              *           *           *           *
   *            *            *              *           *           *           *
     *
* RIVER-1     * Reach-1     * 250          * 1%        *   800.00 *    156.84 *
174.71 *    160.74 *    174.72 *   0.000025 *     1.01 *    795.09 *   3891.49 *
    0.04 *
* RIVER-1     * Reach-1     * 250          * Floodway *   800.00 *    156.84 *
175.58 *    160.74 *    175.59 *   0.000037 *     0.95 *    838.60 *     50.00 *
    0.04 *
* RIVER-1     * Reach-1     * 250          * 10%       *  1450.00 *    156.84 *
169.81 *    161.78 *    169.92 *   0.000276 *     2.64 *    550.24 *    128.52 *
    0.14 *
* RIVER-1     * Reach-1     * 250          * 2%        *   950.00 *    156.84 *
173.18 *    161.00 *    173.20 *   0.000049 *     1.32 *    718.60 *   2722.11 *
    0.06 *
* RIVER-1     * Reach-1     * 250          * 0.2%      *   700.00 *    156.84 *
178.48 *    160.54 *    178.48 *   0.000000 *     0.08 *  25802.58 *   4642.40 *
```

								0.00
RIVER-1	Reach-1	246		1%		800.00	156.80	
174.71	161.57	174.72	0.000015		0.72	1114.41	3899.97	
								0.03
RIVER-1	Reach-1	246		Floodway		800.00	156.80	
175.58	161.57	175.59	0.000017		0.68	1183.98	80.00	
								0.03
RIVER-1	Reach-1	246		10%		1450.00	156.80	
169.83	162.57	169.89	0.000203		2.00	723.93	134.52	
								0.12
RIVER-1	Reach-1	246		2%		950.00	156.80	
173.18	161.84	173.20	0.000030		0.96	992.20	2341.40	
								0.05
RIVER-1	Reach-1	246		0.2%		700.00	156.80	
178.47	161.39	178.48	0.000005		0.49	1415.49	4616.67	
								0.02
RIVER-1	Reach-1	245		1%		800.00	156.80	
174.68	161.20	174.71	0.000048		1.43	560.75	3240.13	
								0.06
RIVER-1	Reach-1	245		Floodway		800.00	156.80	
175.55	161.19	175.58	0.000092		1.35	591.28	35.00	
								0.06
RIVER-1	Reach-1	245		10%		1450.00	156.80	
169.62	162.42	169.84	0.000558		3.78	383.62	136.26	
								0.20
RIVER-1	Reach-1	245		2%		950.00	156.80	
173.13	161.50	173.18	0.000095		1.88	506.51	2117.41	
								0.09
RIVER-1	Reach-1	245		0.2%		700.00	156.80	
178.48	160.98	178.48	0.000000		0.09	24443.18	4650.76	
								0.00
RIVER-1	Reach-1	244.19				Bridge		
RIVER-1	Reach-1	243.38		1%		800.00	156.70	
174.57	160.45	174.58	0.000020		0.92	865.13	3749.91	
								0.04
RIVER-1	Reach-1	243.38		Floodway		800.00	156.70	
175.43	160.45	175.45	0.000030		0.88	912.71	55.00	
								0.04
RIVER-1	Reach-1	243.38		10%		1450.00	156.70	
169.38	161.55	169.47	0.000252		2.50	579.53	510.13	
								0.14
RIVER-1	Reach-1	243.38		2%		950.00	156.70	
172.98	160.74	173.01	0.000041		1.22	777.85	3037.64	
								0.06
RIVER-1	Reach-1	243.38		0.2%		700.00	156.70	
178.47	160.25	178.47	0.000000		0.07	29117.13	4533.10	
								0.00

```
     *
* RIVER-1     * Reach-1     * 243.2       * 1%        *   800.00 *    155.10 *
174.57 *    158.78 *    174.57 *   0.000001 *     0.26 *   5903.05 *   2573.90 *
    0.01 *
* RIVER-1     * Reach-1     * 243.2       * Floodway  *   800.00 *    155.10 *
175.43 *    158.78 *    175.43 *   0.000009 *     0.60 *   1345.31 *     75.30 *
    0.02 *
* RIVER-1     * Reach-1     * 243.2       * 10%       *  1450.00 *    155.10 *
169.33 *    159.77 *    169.34 *   0.000049 *     1.17 *   2240.86 *   1726.67 *
    0.06 *
* RIVER-1     * Reach-1     * 243.2       * 2%        *   950.00 *    155.10 *
172.98 *    159.05 *    172.98 *   0.000004 *     0.39 *   4790.80 *   2176.15 *
    0.02 *
* RIVER-1     * Reach-1     * 243.2       * 0.2%      *   700.00 *    155.10 *
178.47 *    158.60 *    178.47 *   0.000000 *     0.15 *   8636.32 *   2779.42 *
    0.01 *
*           *             *             *           *          *           *
   *          *           *             *           *          *           *
     *
* RIVER-1     * Reach-1     * 243         * 1%        *  2665.00 *    153.20 *
174.57 *    159.29 *    174.57 *   0.000003 *     0.41 *  13390.99 *   2774.92 *
    0.02 *
* RIVER-1     * Reach-1     * 243         * Floodway  *  2665.00 *    153.20 *
175.38 *    159.30 *    175.42 *   0.000055 *     1.65 *   1770.26 *    100.00 *
    0.07 *
* RIVER-1     * Reach-1     * 243         * 10%       *  3015.00 *    153.20 *
169.31 *    159.60 *    169.32 *   0.000042 *     1.12 *   5871.21 *   2656.52 *
    0.05 *
* RIVER-1     * Reach-1     * 243         * 2%        *  2805.00 *    153.20 *
172.98 *    159.42 *    172.98 *   0.000007 *     0.53 *  11116.88 *   2741.09 *
    0.02 *
* RIVER-1     * Reach-1     * 243         * 0.2%      *  2100.00 *    153.20 *
178.47 *    158.77 *    178.47 *   0.000001 *     0.21 *  18976.26 *   2860.36 *
    0.01 *
*           *             *             *           *          *           *
   *          *           *             *           *          *           *
     *
* RIVER-1     * Reach-1     * 190         * 1%        *  2665.00 *    153.80 *
174.56 *         *    174.56 *   0.000006 *     0.55 *  12443.90 *   1068.78 *
    0.02 *
* RIVER-1     * Reach-1     * 190         * Floodway  *  2665.00 *    153.80 *
175.29 *         *    175.30 *   0.000012 *     0.84 *   6724.83 *    488.00 *
    0.03 *
* RIVER-1     * Reach-1     * 190         * 10%       *  3015.00 *    153.80 *
169.18 *         *    169.19 *   0.000044 *     1.24 *   6714.25 *   1062.51 *
    0.06 *
* RIVER-1     * Reach-1     * 190         * 2%        *  2805.00 *    153.80 *
172.96 *         *    172.96 *   0.000010 *     0.68 *  10735.03 *   1066.83 *
    0.03 *
* RIVER-1     * Reach-1     * 190         * 0.2%      *  2100.00 *    153.80 *
178.47 *         *    178.47 *   0.000002 *     0.37 *  17166.59 *   1609.35 *
    0.01 *
*           *             *             *           *          *           *
   *          *           *             *           *          *           *
     *
* RIVER-1     * Reach-1     * 182         * 1%        * 19965.00 *    154.83 *
174.54 *         *    174.55 *   0.000018 *     0.96 *  32769.91 *   3419.79 *
    0.04 *
* RIVER-1     * Reach-1     * 182         * Floodway  * 19965.00 *    154.83 *
175.28 *         *    175.28 *   0.000015 *     0.93 *  29361.91 *   2380.00 *
    0.04 *
* RIVER-1     * Reach-1     * 182         * 10%       * 10495.00 *    154.83 *
169.15 *         *    169.16 *   0.000033 *     1.05 *  15832.40 *   2823.72 *
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```
    0.05 *
* RIVER-1     * Reach-1     * 182         * 2%       * 17155.00 *    154.83 *
172.94 *          *    172.95 *   0.000021 *     0.98 *  27426.74 *   3253.64 *
    0.04 *
* RIVER-1     * Reach-1     * 182         * 0.2%     * 27500.00 *    154.83 *
178.46 *          *    178.47 *   0.000013 *     0.92 *  46765.81 *   3694.00 *
    0.03 *
*             *             *             *          *          *          *
   *          *           *           *          *          *          *
     *
* RIVER-1     * Reach-2     * 180         * 1%       * 19965.00 *    153.30 *
174.52 *          *    174.53 *   0.000056 *     1.77 *  34352.70 *   3408.33 *
    0.07 *
* RIVER-1     * Reach-2     * 180         * Floodway * 19965.00 *    153.30 *
175.26 *          *    175.27 *   0.000051 *     1.75 *  30669.10 *   2384.00 *
    0.07 *
* RIVER-1     * Reach-2     * 180         * 10%      * 10495.00 *    153.30 *
169.11 *          *    169.13 *   0.000106 *     1.98 *  17100.62 *   2877.45 *
    0.09 *
* RIVER-1     * Reach-2     * 180         * 2%       * 17155.00 *    153.30 *
172.91 *          *    172.93 *   0.000067 *     1.84 *  28952.08 *   3300.79 *
    0.08 *
* RIVER-1     * Reach-2     * 180         * 0.2%     * 27500.00 *    153.30 *
178.45 *          *    178.46 *   0.000039 *     1.67 *  48158.45 *   3620.41 *
    0.06 *
*             *             *             *          *          *          *
   *          *           *           *          *          *          *
     *
* RIVER-1     * Reach-2     * 170         * 1%       * 19965.00 *    152.70 *
174.47 *    164.09 *    174.49 *   0.000072 *     2.09 *  29916.54 *   3122.88 *
    0.08 *
* RIVER-1     * Reach-2     * 170         * Floodway * 19965.00 *    152.70 *
175.21 *    164.08 *    175.23 *   0.000065 *     2.02 *  27665.11 *   2300.00 *
    0.08 *
* RIVER-1     * Reach-2     * 170         * 10%      * 10495.00 *    152.70 *
169.00 *    161.22 *    169.04 *   0.000153 *     2.48 *  13935.40 *   2632.32 *
    0.11 *
* RIVER-1     * Reach-2     * 170         * 2%       * 17155.00 *    152.70 *
172.85 *    163.61 *    172.87 *   0.000090 *     2.20 *  24921.49 *   3039.49 *
    0.09 *
* RIVER-1     * Reach-2     * 170         * 0.2%     * 27500.00 *    152.70 *
178.41 *    164.95 *    178.42 *   0.000049 *     1.93 *  42607.82 *   3306.87 *
    0.07 *
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Profile Output Table - Encroachment 1

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********************************************************************************
********************************************************************************
**********************
* River       * Reach       * River Sta    * Profile  * W.S. Elev * Prof Delta WS *
E.G. Elev * Top Wdth Act *   Q Left * Q Channel *  Q Right * Enc Sta L * Ch Sta L *
Ch Sta R * Enc Sta R *
*             *             *              *          *      (ft) *          (ft) *
    (ft) *         (ft) *    (cfs) *     (cfs) *    (cfs) *      (ft) *     (ft) *
  (ft) *      (ft) *
********************************************************************************
********************************************************************************
**********************
* RIVER-2     * Reach-1     * 250.12       * 1%       *    175.14 *               *
  175.46 *       759.92 *  5819.56 *   8544.99 *  2935.46 *           *   189.51 *
342.34 *          *
```

* RIVER-2	* Reach-1	* 250.12	* Floodway	*	175.55	*		0.41 *
176.20 *	530.00 *	1000.41 *	11988.62 *	4310.97 *		169.00 *	189.51 *	
342.34 *	699.00 *							
* RIVER-2	* Reach-1	* 250.12	* 10%	*	170.45 *			-4.69 *
170.84 *	574.48 *	2106.67 *	4750.30 *	623.03 *		*	189.51 *	
342.34 *	*							
* RIVER-2	* Reach-1	* 250.12	* 2%	*	173.68 *			-1.45 *
174.04 *	741.10 *	4764.24 *	7517.01 *	2068.75 *		*	189.51 *	
342.34 *	*							
* RIVER-2	* Reach-1	* 250.12	* 0.2%	*	178.73 *			3.59 *
179.03 *	824.79 *	8628.69 *	11454.53 *	5316.77 *		*	189.51 *	
342.34 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*	*	*
*	*							
* RIVER-2	* Reach-1	* 225	* 1%	*	174.91 *			*
175.25 *	1037.90 *	7379.90 *	8549.92 *	1370.18 *		*	459.94 *	
602.45 *	*							
* RIVER-2	* Reach-1	* 225	* Floodway	*	175.54 *			0.63 *
175.83 *	510.00 *	7933.71 *	8103.30 *	1262.99 *	203.00 *		459.94 *	
602.45 *	713.00 *							
* RIVER-2	* Reach-1	* 225	* 10%	*	170.04 *			-4.88 *
170.35 *	450.89 *	3059.49 *	4090.22 *	330.29 *		*	459.94 *	
602.45 *	*							
* RIVER-2	* Reach-1	* 225	* 2%	*	173.42 *			-1.49 *
173.77 *	767.30 *	6022.11 *	7301.10 *	1026.79 *		*	459.94 *	
602.45 *	*							
* RIVER-2	* Reach-1	* 225	* 0.2%	*	178.65 *			3.73 *
178.89 *	1314.27 *	10916.87 *	10591.61 *	3891.52 *		*	459.94 *	
602.45 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*	*	*
*	*							
* RIVER-2	* Reach-1	* 200	* 1%	*	174.78 *			*
175.06 *	911.39 *	7838.60 *	7907.45 *	1553.96 *		*	478.37 *	
617.60 *	*							
* RIVER-2	* Reach-1	* 200	* Floodway	*	175.41 *			0.63 *
175.69 *	465.00 *	8823.89 *	7952.47 *	523.64 *	195.00 *		478.37 *	
617.60 *	660.00 *							
* RIVER-2	* Reach-1	* 200	* 10%	*	169.77 *			-5.01 *
170.01 *	494.82 *	3522.89 *	3596.58 *	360.54 *		*	478.37 *	
617.60 *	*							
* RIVER-2	* Reach-1	* 200	* 2%	*	173.24 *			-1.54 *
173.54 *	753.80 *	6599.19 *	6768.09 *	982.72 *		*	478.37 *	
617.60 *	*							
* RIVER-2	* Reach-1	* 200	* 0.2%	*	178.55 *			3.78 *
178.78 *	1320.25 *	11439.06 *	10336.06 *	3624.88 *		*	478.37 *	
617.60 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*	*	*
*	*							
* RIVER-2	* Reach-1	* 190	* 1%	*	174.63 *			*
174.81 *	1573.58 *	5432.94 *	9228.49 *	2638.58 *		*	407.18 *	
599.58 *	*							
* RIVER-2	* Reach-1	* 190	* Floodway	*	175.34 *			0.71 *
175.47 *	1315.00 *	5865.16 *	8535.37 *	2899.47 *	55.00 *		407.18 *	
599.58 *	1370.00 *							
* RIVER-2	* Reach-1	* 190	* 10%	*	169.42 *			-5.21 *
169.60 *	887.38 *	2618.66 *	4580.48 *	280.85 *		*	407.18 *	
599.58 *	*							
* RIVER-2	* Reach-1	* 190	* 2%	*	173.06 *			-1.57 *
173.24 *	1311.56 *	4872.53 *	7760.55 *	1716.93 *		*	407.18 *	
599.58 *	*							

RIVER-2	Reach-1	190	0.2%		178.49			3.86
178.62	1865.95	9254.12	11112.79	5033.09			407.18	599.58
RIVER-1	Reach-1	350	1%		181.46			
181.92	1094.81	2441.78	12399.94	2858.28			758.00	873.00
RIVER-1	Reach-1	350	Floodway		181.80			0.34
182.36	440.00	1867.46	13395.68	2436.86	658.00		758.00	873.00	1098.00
RIVER-1	Reach-1	350	10%		177.59			-3.87
177.96	653.08	628.52	7761.83	389.65			758.00	873.00
RIVER-1	Reach-1	350	2%		180.42			-1.04
180.88	1034.56	1822.86	11309.93	1867.21			758.00	873.00
RIVER-1	Reach-1	350	0.2%		184.17			2.71
184.60	1251.96	4557.03	15128.72	6014.25			758.00	873.00
RIVER-1	Reach-1	344.95	1%		181.29			
181.51	1196.15	2656.86	9564.12	5479.02			768.00	868.00
RIVER-1	Reach-1	344.95	Floodway		181.71			0.42
181.91	850.00	2573.98	9344.85	5781.16	418.00		768.00	868.00	1268.00
RIVER-1	Reach-1	344.95	10%		177.43			-3.86
177.60	901.34	486.19	6015.61	2278.19			768.00	868.00
RIVER-1	Reach-1	344.95	2%		180.26			-1.04
180.47	1167.15	1812.83	8672.01	4515.16			768.00	868.00
RIVER-1	Reach-1	344.95	0.2%		183.99			2.70
184.22	1271.81	5417.10	11927.97	8354.92			768.00	868.00
RIVER-1	Reach-1	331.6	1%		180.11			
180.67	906.87	3739.84	11321.37	2638.79			769.81	855.37
RIVER-1	Reach-1	331.6	Floodway		180.75			0.64
181.20	840.00	4296.15	10699.60	2704.25	215.00		769.81	855.37	1055.00
RIVER-1	Reach-1	331.6	10%		176.43			-3.68
176.86	629.93	845.23	7085.26	849.51			769.81	855.37
RIVER-1	Reach-1	331.6	2%		179.07			-1.04
179.62	833.67	2677.12	10244.80	2078.08			769.81	855.37
RIVER-1	Reach-1	331.6	0.2%		182.93			2.82
183.45	954.88	7765.95	13659.35	4274.70			769.81	855.37
RIVER-1	Reach-1	320	1%		179.56			
179.77	1920.86	3168.38	9861.01	4670.61			1740.65	1858.13

* RIVER-1	* Reach-1	* 320	* Floodway	*	180.12	*	0.56	*
180.43 *	600.00 *	2763.10 *	11330.29 *	3606.61 *	1536.00 *	1740.65 *		
1858.13 *	2136.00 *							
* RIVER-1	* Reach-1	* 320	* 10%	*	175.86 *		-3.70	*
176.07 *	1104.02 *	1031.42 *	6724.37 *	1024.21 *	*	1740.65 *		
1858.13 *	*							
* RIVER-1	* Reach-1	* 320	* 2%	*	178.47 *		-1.09	*
178.71 *	1758.41 *	2454.85 *	9299.95 *	3245.20 *	*	1740.65 *		
1858.13 *	*							
* RIVER-1	* Reach-1	* 320	* 0.2%	*	182.50 *		2.94	*
182.67 *	2427.25 *	5422.44 *	11226.75 *	9050.81 *	*	1740.65 *		
1858.13 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 314.4	* 1%	*	179.40 *		*	
179.46 *	1859.29 *	245.11 *	4891.40 *	12563.50 *	*	1135.36 *		
1215.54 *	*							
* RIVER-1	* Reach-1	* 314.4	* Floodway	*	179.97 *		0.57	*
180.04 *	1385.00 *	200.34 *	5269.14 *	12230.52 *	1110.00 *	1135.36 *		
1215.54 *	2495.00 *							
* RIVER-1	* Reach-1	* 314.4	* 10%	*	175.64 *		-3.76	*
175.71 *	1747.59 *	68.33 *	3648.63 *	5063.04 *	*	1135.36 *		
1215.54 *	*							
* RIVER-1	* Reach-1	* 314.4	* 2%	*	178.29 *		-1.11	*
178.36 *	1837.68 *	171.66 *	4570.54 *	10257.80 *	*	1135.36 *		
1215.54 *	*							
* RIVER-1	* Reach-1	* 314.4	* 0.2%	*	182.37 *		2.97	*
182.42 *	2009.11 *	492.98 *	5862.21 *	19344.81 *	*	1135.36 *		
1215.54 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 300	* 1%	*	179.16 *		*	
179.25 *	1740.00 *	546.17 *	5783.96 *	11369.87 *	*	2520.00 *		
2605.04 *	*							
* RIVER-1	* Reach-1	* 300	* Floodway	*	179.71 *		0.56	*
179.82 *	1080.00 *	421.53 *	6238.78 *	11039.70 *	2363.00 *	2520.00 *		
2605.04 *	3443.00 *							
* RIVER-1	* Reach-1	* 300	* 10%	*	175.38 *		-3.78	*
175.46 *	1172.90 *	69.09 *	3884.20 *	4826.71 *	*	2520.00 *		
2605.04 *	*							
* RIVER-1	* Reach-1	* 300	* 2%	*	178.03 *		-1.12	*
178.12 *	1612.74 *	214.54 *	5331.66 *	9453.80 *	*	2520.00 *		
2605.04 *	*							
* RIVER-1	* Reach-1	* 300	* 0.2%	*	182.17 *		3.01	*
182.25 *	1740.00 *	2233.05 *	6891.09 *	16575.86 *	*	2520.00 *		
2605.04 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 285	* 1%	*	178.12 *		*	
178.46 *	1076.39 *	5053.99 *	9937.50 *	2708.51 *	*	3076.79 *		
3167.03 *	*							
* RIVER-1	* Reach-1	* 285	* Floodway	*	178.62 *		0.50	*
179.00 *	605.00 *	5389.89 *	10500.80 *	1809.31 *	2664.00 *	3076.79 *		
3167.03 *	3269.00 *							
* RIVER-1	* Reach-1	* 285	* 10%	*	174.41 *		-3.72	*
174.68 *	807.64 *	1376.79 *	6322.14 *	1081.07 *	*	3076.79 *		
3167.03 *	*							
* RIVER-1	* Reach-1	* 285	* 2%	*	176.98 *		-1.15	*
177.30 *	886.57 *	3913.41 *	8917.19 *	2169.41 *	*	3076.79 *		
3167.03 *	*							

* RIVER-1	* Reach-1	* 285	* 0.2%	*	181.32 *		3.20 *	
181.62 *	1297.68 *	9794.29 *	11888.61 *	4017.10 *		*	3076.79 *	
3167.03 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 280.55	* 1%	*	177.95 *		*	
178.25 *	1072.49 *	4664.93 *	9125.33 *	3909.75 *		*	3083.19 *	
3167.11 *	*							
* RIVER-1	* Reach-1	* 280.55	* Floodway *		178.42 *		0.47 *	
178.78 *	600.00 *	4796.61 *	9938.80 *	2964.59 *	2714.00 *		3083.19 *	
3167.11 *	3314.00 *							
* RIVER-1	* Reach-1	* 280.55	* 10%	*	174.24 *		-3.70 *	
174.49 *	836.70 *	1237.09 *	5845.91 *	1697.01 *		*	3083.19 *	
3167.11 *	*							
* RIVER-1	* Reach-1	* 280.55	* 2%	*	176.79 *		-1.16 *	
177.09 *	948.69 *	3527.90 *	8254.92 *	3217.18 *		*	3083.19 *	
3167.11 *	*							
* RIVER-1	* Reach-1	* 280.55	* 0.2%	*	181.18 *		3.23 *	
181.44 *	1511.27 *	9068.40 *	10926.00 *	5705.60 *		*	3083.19 *	
3167.11 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 270	* 1%	*	176.52 *		*	
177.12 *	446.60 *	5996.77 *	11699.69 *	3.53 *		*	3570.65 *	
3675.10 *	*							
* RIVER-1	* Reach-1	* 270	* Floodway *		177.16 *		0.64 *	
177.68 *	449.00 *	6227.21 *	11468.17 *	4.62 *	3229.00 *		3570.65 *	
3675.10 *	3678.00 *							
* RIVER-1	* Reach-1	* 270	* 10%	*	173.23 *		-3.30 *	
173.58 *	431.03 *	2163.27 *	6616.65 *	0.08 *		*	3570.65 *	
3675.10 *	*							
* RIVER-1	* Reach-1	* 270	* 2%	*	175.39 *		-1.13 *	
175.95 *	441.44 *	4688.64 *	10309.74 *	1.62 *		*	3570.65 *	
3675.10 *	*							
* RIVER-1	* Reach-1	* 270	* 0.2%	*	179.72 *		3.20 *	
180.44 *	500.98 *	9728.57 *	15956.24 *	15.19 *		*	3570.65 *	
3675.10 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 264	* 1%	*	175.98 *		*	
176.36 *	582.69 *	9296.63 *	8393.59 *	9.79 *		*	3676.58 *	
3754.88 *	*							
* RIVER-1	* Reach-1	* 264	* Floodway *		176.73 *		0.75 *	
177.05 *	582.90 *	9569.99 *	8118.45 *	11.56 *	3106.10 *		3676.58 *	
3754.88 *	3759.00 *							
* RIVER-1	* Reach-1	* 264	* 10%	*	172.78 *		-3.20 *	
173.03 *	580.85 *	3744.23 *	5034.12 *	1.65 *		*	3676.58 *	
3754.88 *	*							
* RIVER-1	* Reach-1	* 264	* 2%	*	174.81 *		-1.17 *	
175.18 *	582.00 *	7445.65 *	7548.27 *	6.09 *		*	3676.58 *	
3754.88 *	*							
* RIVER-1	* Reach-1	* 264	* 0.2%	*	179.30 *		3.32 *	
179.70 *	584.62 *	14925.76 *	10748.04 *	26.20 *		*	3676.58 *	
3754.88 *	*							
*	*	*	*	*	*		*	
*	*	*	*	*	*	*	*	
*	*							
* RIVER-1	* Reach-1	* 250.12	* 1%	*	175.41 *		*	
175.44 *	45.00 *	13.23 *	774.60 *	12.17 *		*	3660.00 *	
3695.00 *	*							

* RIVER-1	* Reach-1	* 250.12		* Floodway *	176.29 *		0.87 *	
176.31 *	45.00 *	12.12 *	776.43 *	11.44 *	3655.00 *	3660.00 *		
3695.00 *	3700.00 *							
* RIVER-1	* Reach-1	* 250.12		* 10% *	172.10 *		-3.31 *	
172.23 *	44.44 *	17.29 *	1417.00 *	15.71 *	*	3660.00 *		
3695.00 *	*							
* RIVER-1	* Reach-1	* 250.12		* 2% *	174.17 *		-1.25 *	
174.21 *	45.00 *	14.12 *	923.06 *	12.82 *	*	3660.00 *		
3695.00 *	*							
* RIVER-1	* Reach-1	* 250.12		* 0.2% *	178.89 *		3.48 *	
178.89 *	3387.88 *	558.65 *	109.85 *	31.51 *	*	3660.00 *		
3695.00 *	*							
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*	*							
* RIVER-1	* Reach-1	* 250.06	BR U * 1%	*	175.33 *		*	
175.42 *	*	*	796.16 *	3.84 *	*	3660.00 *		
3695.00 *	*							
* RIVER-1	* Reach-1	* 250.06	BR U * Floodway *		176.20 *		0.87 *	
176.29 *	*	*	796.16 *	3.84 *	3655.00 *	3660.00 *		
3695.00 *	3700.00 *							
* RIVER-1	* Reach-1	* 250.06	BR U * 10%	*	171.88 *		-3.45 *	
172.18 *	*	*	1443.03 *	6.97 *	*	3660.00 *		
3695.00 *	*							
* RIVER-1	* Reach-1	* 250.06	BR U * 2%	*	174.06 *		-1.27 *	
174.18 *	*	*	945.43 *	4.57 *	*	3660.00 *		
3695.00 *	*							
* RIVER-1	* Reach-1	* 250.06	BR U * 0.2%	*	178.85 *		3.52 *	
178.88 *	1334.17 *	102.07 *	576.01 *	21.92 *	*	3660.00 *		
3695.00 *	*							
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*	*							
* RIVER-1	* Reach-1	* 250.06	BR D * 1%	*	174.63 *		*	
174.82 *	*	*	800.00 *	*	*	3966.32 *		
4057.61 *	*							
* RIVER-1	* Reach-1	* 250.06	BR D * Floodway *		175.50 *		0.87 *	
175.69 *	*	*	800.00 *	*	3985.00 *	3966.32 *		
4057.61 *	4035.00 *							
* RIVER-1	* Reach-1	* 250.06	BR D * 10%	*	169.58 *		-5.05 *	
170.20 *	*	*	1450.00 *	*	*	3966.32 *		
4057.61 *	*							
* RIVER-1	* Reach-1	* 250.06	BR D * 2%	*	173.07 *		-1.56 *	
173.33 *	*	*	950.00 *	*	*	3966.32 *		
4057.61 *	*							
* RIVER-1	* Reach-1	* 250.06	BR D * 0.2%	*	178.47 *		3.84 *	
178.50 *	1874.73 *	25.42 *	500.42 *	174.16 *	*	3966.32 *		
4057.61 *	*							
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*	*							
* RIVER-1	* Reach-1	* 250		* 1% *	174.71 *		*	
174.72 *	50.00 *	*	800.00 *	*	*	3966.32 *		
4057.61 *	*							
* RIVER-1	* Reach-1	* 250		* Floodway *	175.58 *		0.87 *	
175.59 *	50.00 *	*	800.00 *	*	3985.00 *	3966.32 *		
4057.61 *	4035.00 *							
* RIVER-1	* Reach-1	* 250		* 10% *	169.81 *		-4.90 *	
169.92 *	50.00 *	*	1450.00 *	*	*	3966.32 *		
4057.61 *	*							
* RIVER-1	* Reach-1	* 250		* 2% *	173.18 *		-1.53 *	
173.20 *	50.00 *	*	950.00 *	*	*	3966.32 *		
4057.61 *	*							

* RIVER-1	* Reach-1	* 250		* 0.2%	*	178.48 *		3.77 *	
178.48 *	4642.40 *	432.47 *		127.32 *	140.22 *		*	3966.32 *	
4057.61 *									
*	*	*		*	*	*		*	
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 246		* 1%	*	174.71 *		*	
174.72 *	80.00 *	*		800.00 *		*	*	3964.48 *	
4055.27 *									
* RIVER-1	* Reach-1	* 246		* Floodway	*	175.58 *		0.87 *	
175.59 *	80.00 *	*		800.00 *		*	3972.00 *	3964.48 *	
4055.27 *	4052.00 *								
* RIVER-1	* Reach-1	* 246		* 10%	*	169.83 *		-4.88 *	
169.89 *	80.00 *	*		1450.00 *		*	*	3964.48 *	
4055.27 *									
* RIVER-1	* Reach-1	* 246		* 2%	*	173.18 *		-1.53 *	
173.20 *	80.00 *	*		950.00 *		*	*	3964.48 *	
4055.27 *									
* RIVER-1	* Reach-1	* 246		* 0.2%	*	178.47 *		3.76 *	
178.48 *	80.00 *	*		700.00 *		*	*	3964.48 *	
4055.27 *									
*	*	*		*	*	*		*	
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 245		* 1%	*	174.68 *		*	
174.71 *	35.00 *	*		800.00 *		*	*	3970.91 *	
4052.15 *									
* RIVER-1	* Reach-1	* 245		* Floodway	*	175.55 *		0.87 *	
175.58 *	35.00 *	*		800.00 *		*	3996.00 *	3970.91 *	
4052.15 *	4031.00 *								
* RIVER-1	* Reach-1	* 245		* 10%	*	169.62 *		-5.06 *	
169.84 *	35.00 *	*		1450.00 *		*	*	3970.91 *	
4052.15 *									
* RIVER-1	* Reach-1	* 245		* 2%	*	173.13 *		-1.55 *	
173.18 *	35.00 *	*		950.00 *		*	*	3970.91 *	
4052.15 *									
* RIVER-1	* Reach-1	* 245		* 0.2%	*	178.48 *		3.80 *	
178.48 *	4650.76 *	488.63 *		127.44 *	83.93 *		*	3970.91 *	
4052.15 *									
*	*	*		*	*	*		*	
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 244.19	BR U	* 1%	*	174.62 *		*	
174.69 *	*	*		800.00 *		*	*	3970.91 *	
4052.15 *									
* RIVER-1	* Reach-1	* 244.19	BR U	* Floodway	*	175.49 *		0.86 *	
175.56 *	*	*		800.00 *		*	3996.00 *	3970.91 *	
4052.15 *	4031.00 *								
* RIVER-1	* Reach-1	* 244.19	BR U	* 10%	*	169.47 *		-5.15 *	
169.78 *	30.00 *	*		1450.00 *		*	*	3970.91 *	
4052.15 *									
* RIVER-1	* Reach-1	* 244.19	BR U	* 2%	*	173.06 *		-1.56 *	
173.16 *	*	*		950.00 *		*	*	3970.91 *	
4052.15 *									
* RIVER-1	* Reach-1	* 244.19	BR U	* 0.2%	*	178.48 *		3.85 *	
178.48 *	4650.74 *	422.15 *		116.43 *	161.43 *		*	3970.91 *	
4052.15 *									
*	*	*		*	*	*		*	
*	*	*	*	*	*	*	*		
*	*								
* RIVER-1	* Reach-1	* 244.19	BR D	* 1%	*	174.56 *		*	
174.62 *	*	*		800.00 *		*	*	3930.35 *	
4009.75 *									

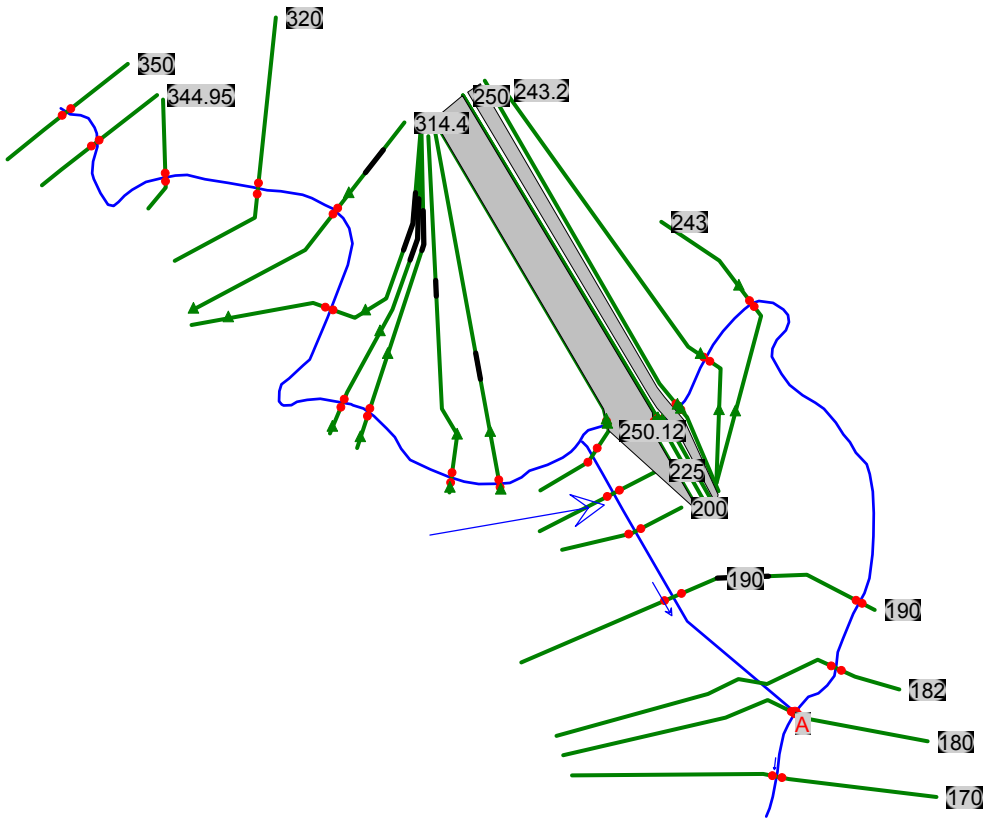
* RIVER-1	* Reach-1	* 244.19	BR D * Floodway *	175.42 *	0.86 *				
175.48 *	*	*	800.00 *	* 3954.00 *	3930.35 *				
4009.75 *	4009.00 *								
* RIVER-1	* Reach-1	* 244.19	BR D * 10% *	169.32 *	-5.23 *				
169.60 *	30.00 *	*	1450.00 *	*	* 3930.35 *				
4009.75 *	*								
* RIVER-1	* Reach-1	* 244.19	BR D * 2% *	172.97 *	-1.59 *				
173.06 *	*	*	950.00 *	*	* 3930.35 *				
4009.75 *	*								
* RIVER-1	* Reach-1	* 244.19	BR D * 0.2% *	178.47 *	3.92 *				
178.47 *	4513.96 *	416.28 *	127.80 *	155.92 *	* 3930.35 *				
4009.75 *	*								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*	*								
* RIVER-1	* Reach-1	* 243.38	* 1% *	174.57 *	*				
174.58 *	55.00 *	*	800.00 *	*	* 3930.35 *				
4009.75 *	*								
* RIVER-1	* Reach-1	* 243.38	* Floodway *	175.43 *	0.87 *				
175.45 *	55.00 *	*	800.00 *	* 3954.00 *	3930.35 *				
4009.75 *	4009.00 *								
* RIVER-1	* Reach-1	* 243.38	* 10% *	169.38 *	-5.19 *				
169.47 *	55.00 *	*	1450.00 *	*	* 3930.35 *				
4009.75 *	*								
* RIVER-1	* Reach-1	* 243.38	* 2% *	172.98 *	-1.59 *				
173.01 *	55.00 *	*	950.00 *	*	* 3930.35 *				
4009.75 *	*								
* RIVER-1	* Reach-1	* 243.38	* 0.2% *	178.47 *	3.90 *				
178.47 *	4533.10 *	414.40 *	105.66 *	179.93 *	* 3930.35 *				
4009.75 *	*								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*	*								
* RIVER-1	* Reach-1	* 243.2	* 1% *	174.57 *	*				
174.57 *	700.00 *	54.76 *	349.80 *	395.43 *	* 3496.00 *				
3575.79 *	*								
* RIVER-1	* Reach-1	* 243.2	* Floodway *	175.43 *	0.86 *				
175.43 *	75.30 *	0.07 *	799.93 *	* 3495.80 *	3496.00 *				
3575.79 *	3571.10 *								
* RIVER-1	* Reach-1	* 243.2	* 10% *	169.33 *	-5.24 *				
169.34 *	646.09 *	105.28 *	1077.43 *	267.29 *	* 3496.00 *				
3575.79 *	*								
* RIVER-1	* Reach-1	* 243.2	* 2% *	172.98 *	-1.59 *				
172.98 *	700.00 *	66.88 *	470.86 *	412.27 *	* 3496.00 *				
3575.79 *	*								
* RIVER-1	* Reach-1	* 243.2	* 0.2% *	178.47 *	3.90 *				
178.47 *	700.00 *	45.43 *	246.63 *	407.94 *	* 3496.00 *				
3575.79 *	*								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*	*								
* RIVER-1	* Reach-1	* 243	* 1% *	174.57 *	*				
174.57 *	1430.00 *	570.20 *	590.99 *	1503.82 *	* 1254.82 *				
1334.49 *	*								
* RIVER-1	* Reach-1	* 243	* Floodway *	175.38 *	0.81 *				
175.42 *	100.00 *	150.19 *	2514.29 *	0.52 *	1235.00 *	1254.82 *			
1334.49 *	1335.00 *								
* RIVER-1	* Reach-1	* 243	* 10% *	169.31 *	-5.26 *				
169.32 *	1387.92 *	874.34 *	1159.18 *	981.48 *	* 1254.82 *				
1334.49 *	*								
* RIVER-1	* Reach-1	* 243	* 2% *	172.98 *	-1.59 *				
172.98 *	1430.00 *	645.61 *	706.87 *	1452.52 *	* 1254.82 *				
1334.49 *	*								

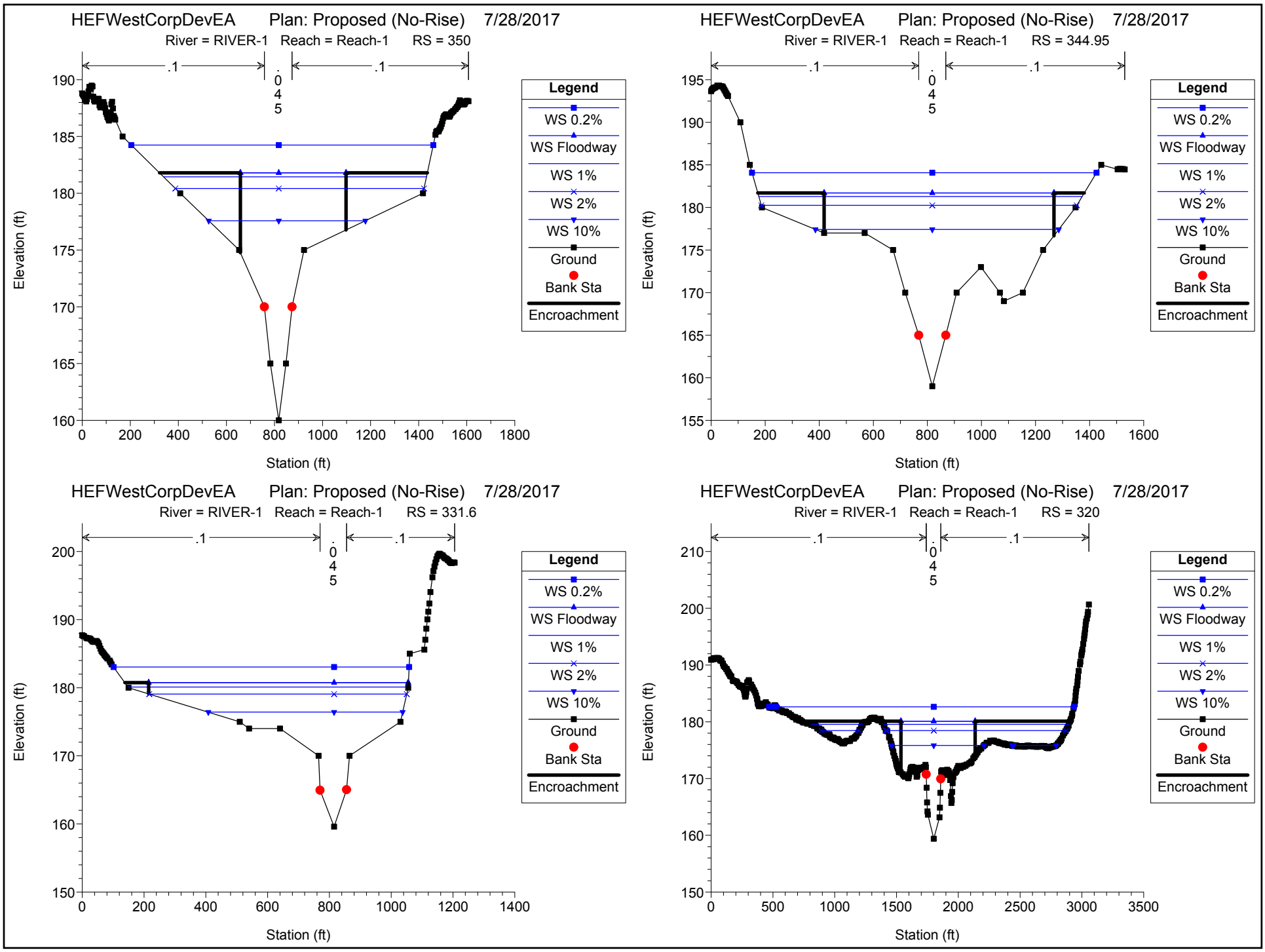
RIVER-1	Reach-1	243	0.2%	178.47	3.91	178.47	1430.00	397.25	373.73	1329.02		1254.82	1334.49
RIVER-1	Reach-1	190	1%	174.56		174.56	1068.78	11.55	743.81	1909.64		147.22	217.68
RIVER-1	Reach-1	190	Floodway	175.29	0.73	175.30	488.00	4.29	1182.80	1477.91	144.00	147.22	217.68 632.00
RIVER-1	Reach-1	190	10%	169.18	-5.38	169.19	1062.51	8.77	1207.30	1798.93		147.22	217.68
RIVER-1	Reach-1	190	2%	172.96	-1.60	172.96	1066.83	10.98	847.79	1946.23		147.22	217.68
RIVER-1	Reach-1	190	0.2%	178.47	3.91	178.47	1609.35	13.39	601.21	1485.40		147.22	217.68
RIVER-1	Reach-1	182	1%	174.54		174.55	3419.79	962.12	2040.88	16962.00		639.94	754.21
RIVER-1	Reach-1	182	Floodway	175.28	0.73	175.28	2380.00	338.54	2047.59	17578.87	546.00	639.94	754.21 2926.00
RIVER-1	Reach-1	182	10%	169.15	-5.39	169.16	2823.72	342.94	1589.42	8562.64		639.94	754.21
RIVER-1	Reach-1	182	2%	172.94	-1.60	172.95	3253.64	747.98	1914.05	14492.97		639.94	754.21
RIVER-1	Reach-1	182	0.2%	178.46	3.92	178.47	3694.00	1562.89	2382.47	23554.64		639.94	754.21
RIVER-1	Reach-2	180	1%	174.52		174.53	3408.33	5726.09	3550.64	10688.27		1363.83	1465.19
RIVER-1	Reach-2	180	Floodway	175.26	0.73	175.27	2384.00	4714.23	3624.49	11626.28	696.00	1363.83	1465.19 3080.00
RIVER-1	Reach-2	180	10%	169.11	-5.41	169.13	2877.45	2338.71	2873.50	5282.79		1363.83	1465.19
RIVER-1	Reach-2	180	2%	172.91	-1.61	172.93	3300.79	4694.70	3391.42	9068.88		1363.83	1465.19
RIVER-1	Reach-2	180	0.2%	178.45	3.92	178.46	3620.41	8428.02	4018.63	15053.35		1363.83	1465.19
RIVER-1	Reach-2	170	1%	174.47		174.49	3122.88	8014.20	4393.02	7557.78		1627.88	1729.19

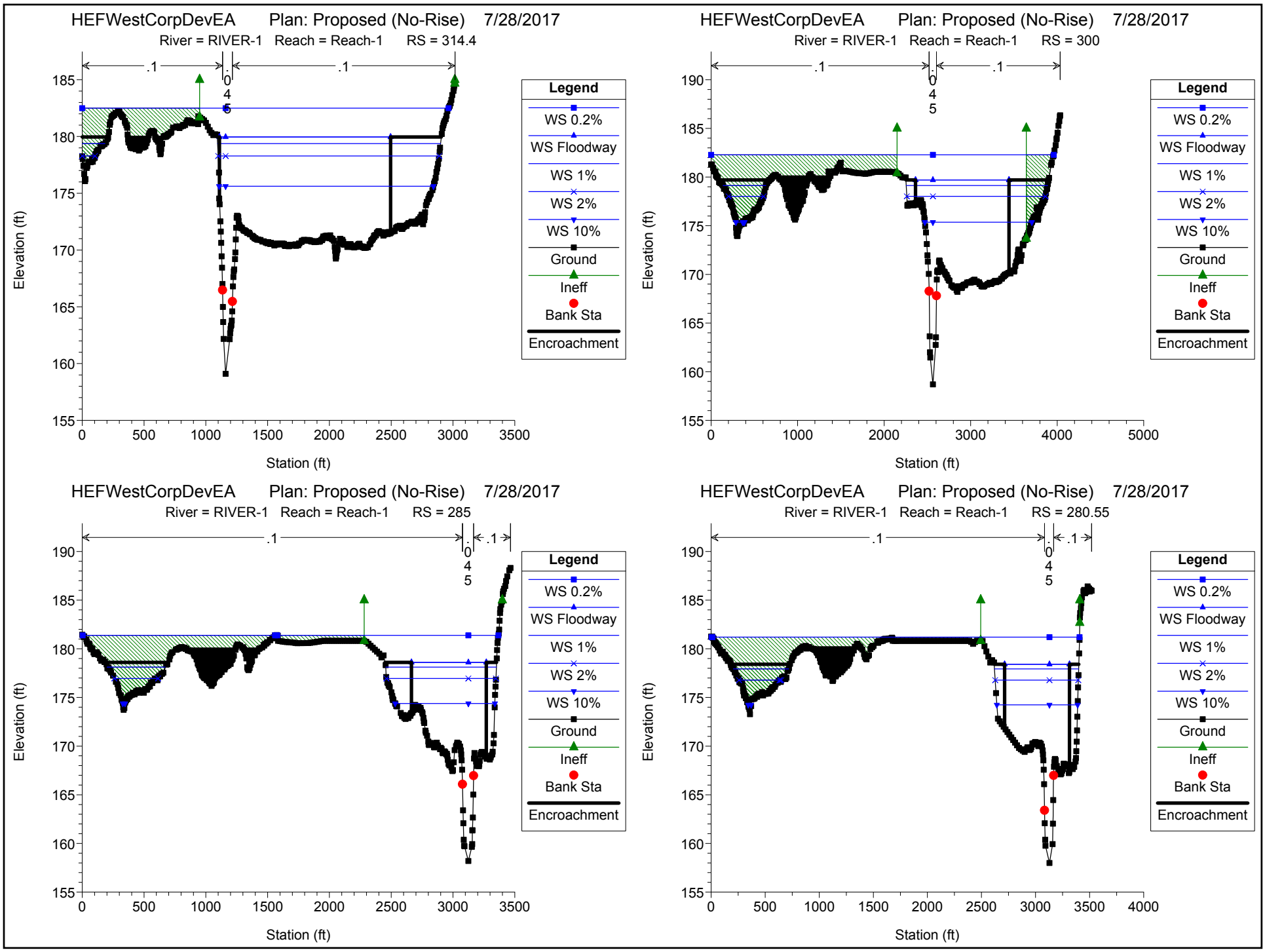
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* RIVER-1     * Reach-2     * 170          * Floodway *    175.21 *          0.74 *
  175.23 *      2300.00 *  7803.99 *   4406.88 *  7754.13 *     661.00 *  1627.88 *
1729.19 *   2961.00 *
* RIVER-1     * Reach-2     * 170          * 10%      *    169.00 *         -5.47 *
  169.04 *      2632.32 *  3902.63 *   3837.78 *  2754.59 *            *  1627.88 *
1729.19 *           *
* RIVER-1     * Reach-2     * 170          * 2%       *    172.85 *         -1.62 *
  172.87 *      3039.49 *  6843.31 *   4274.11 *  6037.58 *            *  1627.88 *
1729.19 *           *
* RIVER-1     * Reach-2     * 170          * 0.2%     *    178.41 *          3.94 *
  178.42 *      3306.87 * 10988.85 *   4841.32 * 11669.83 *            *  1627.88 *
1729.19 *           *
********************************************************************************
********************************************************************************
**********
```

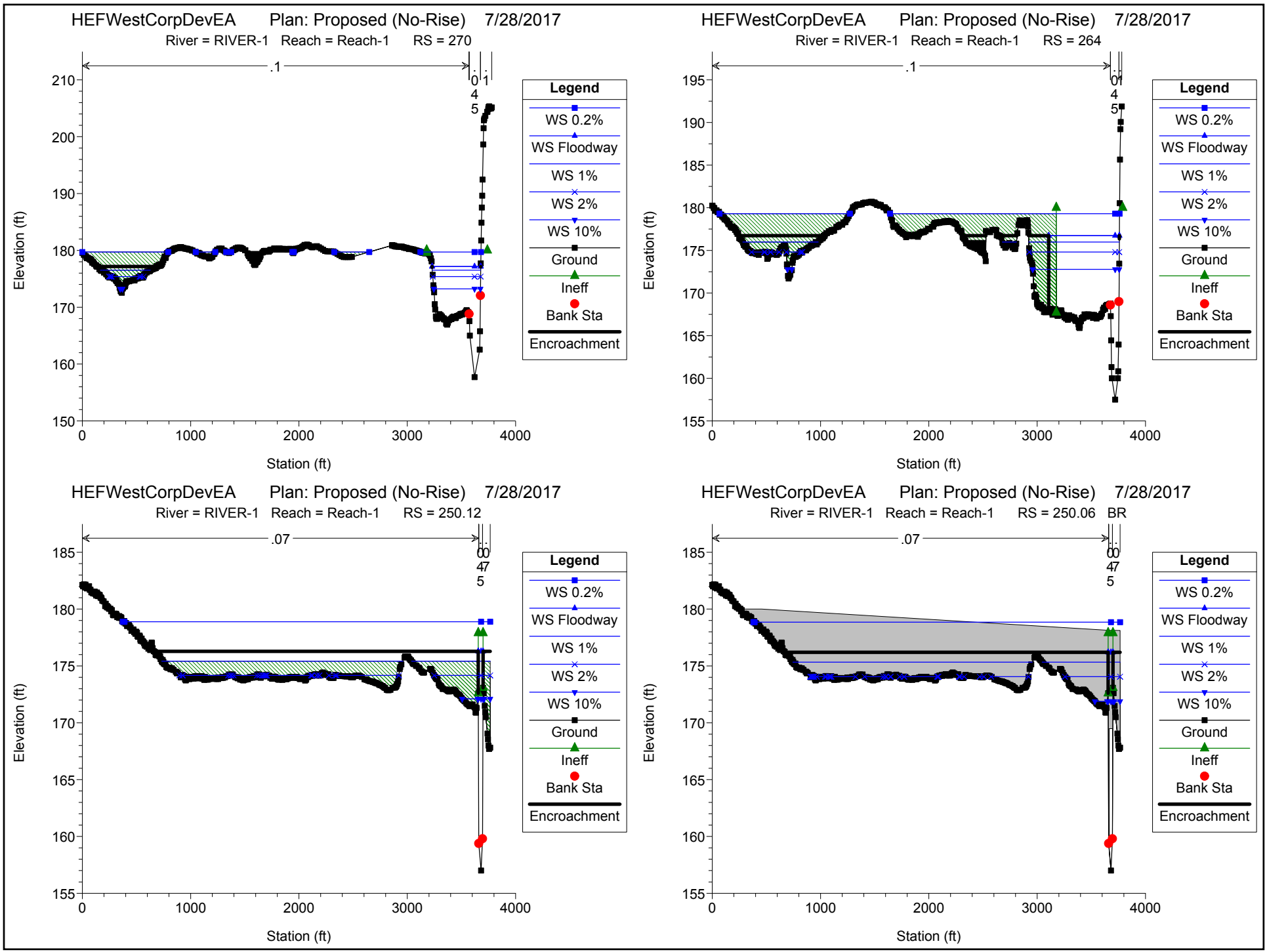
APPENDIX E

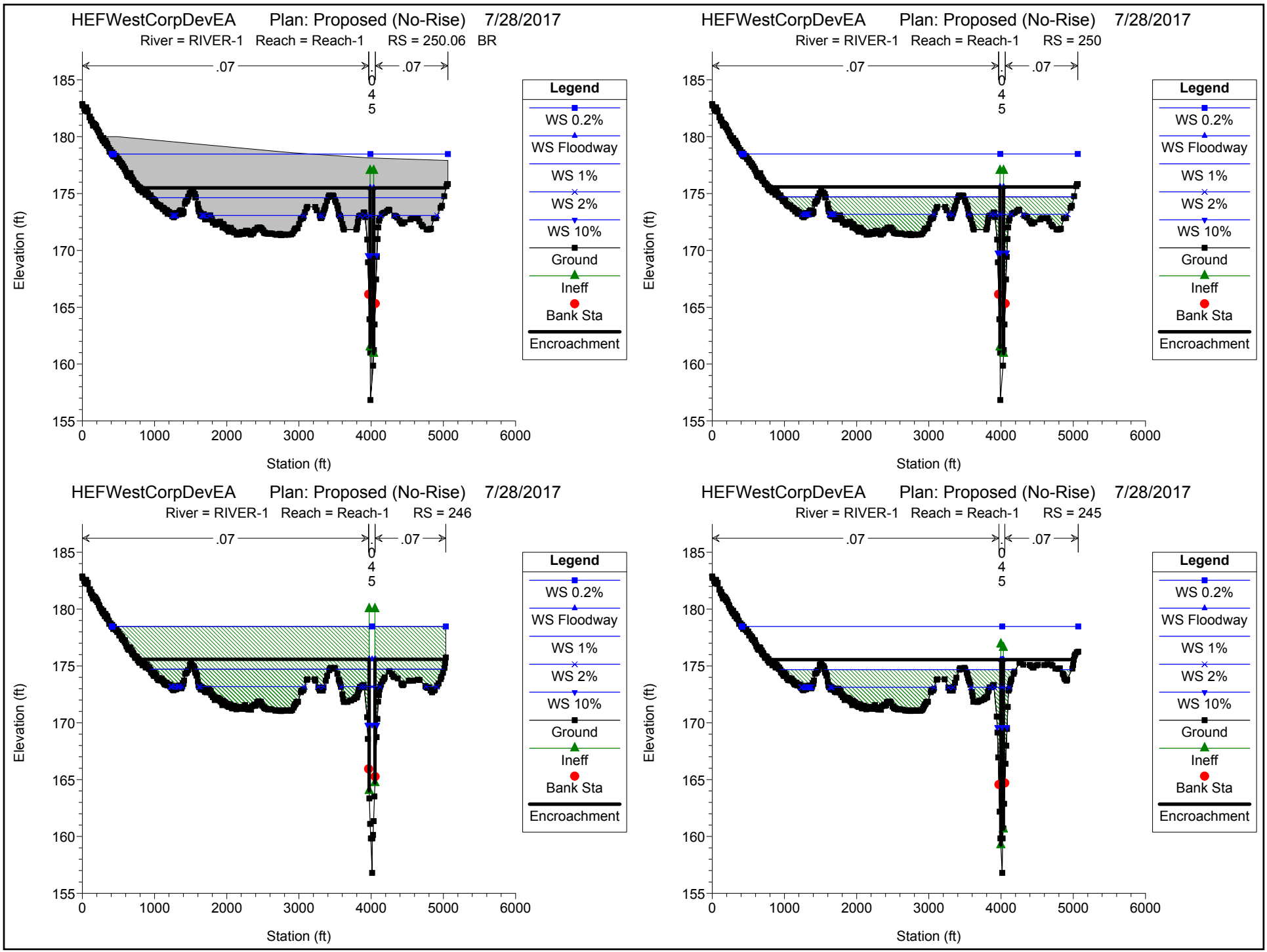
BROAD RUN PROPOSED CONDITIONS MODEL

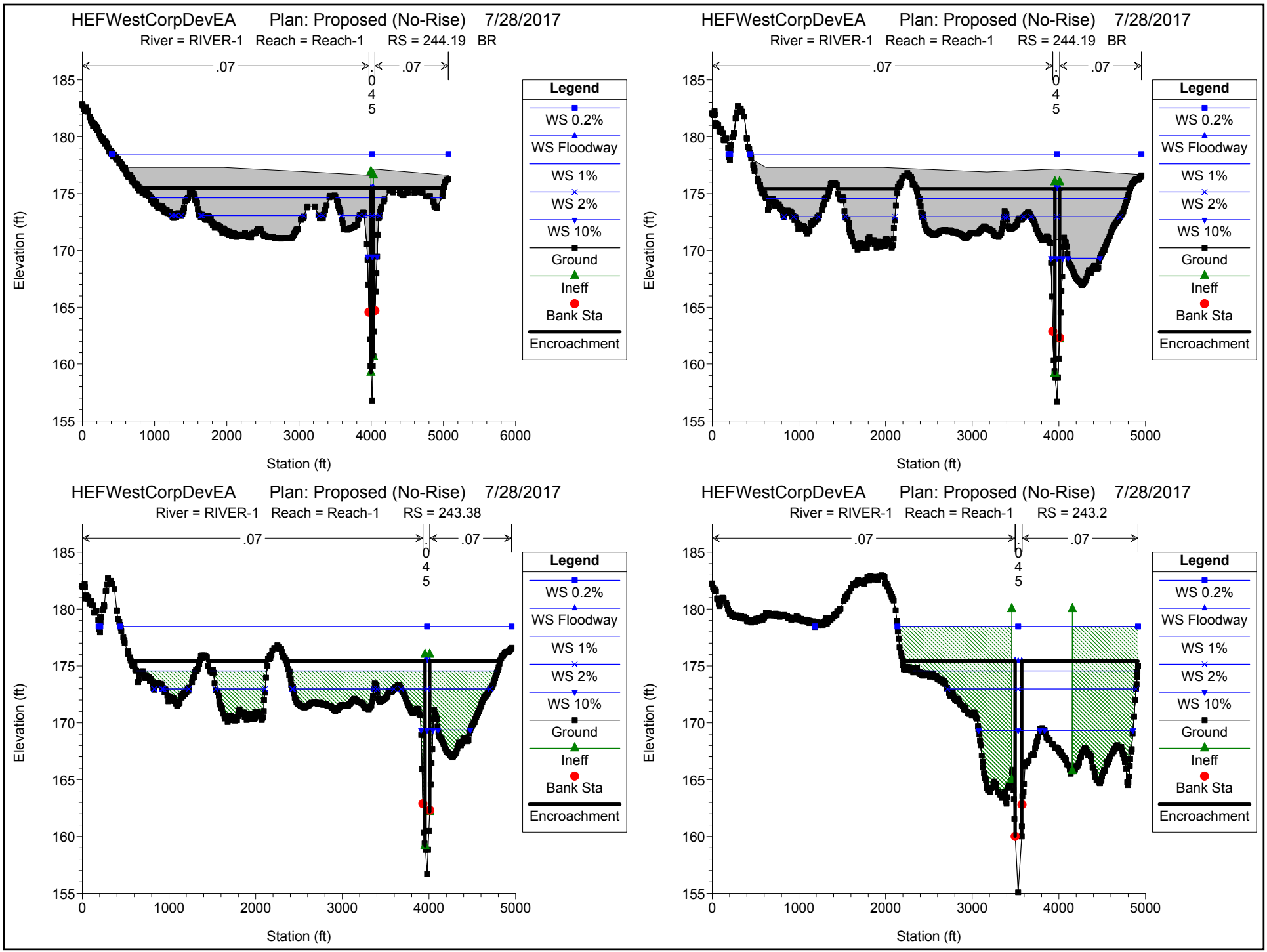

320
350
344.95
250
243.2
314.4
243
250.12
225
200
190
190
182
A
180
170

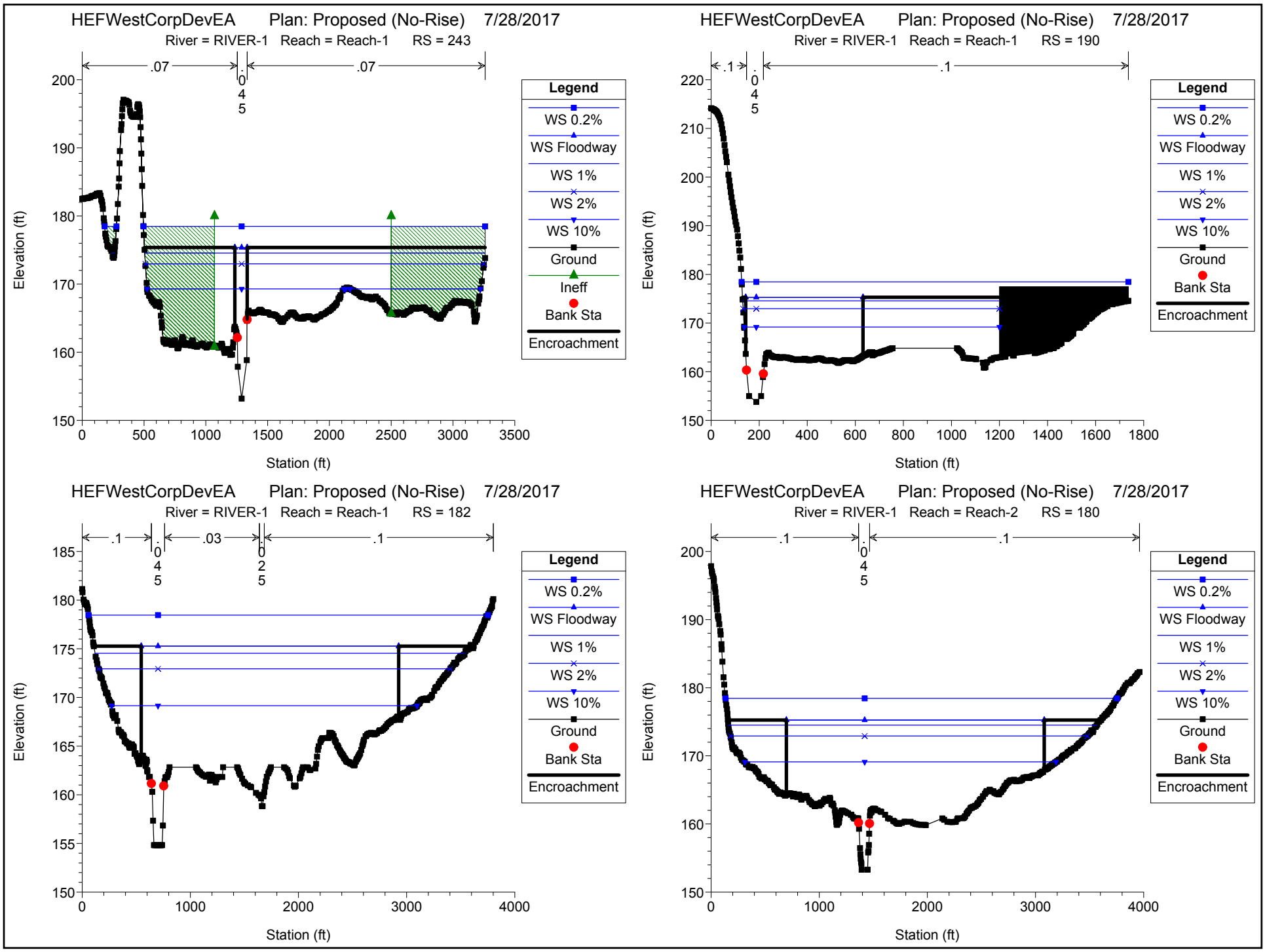

HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 350
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 344.95
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 331.6
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 320
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment

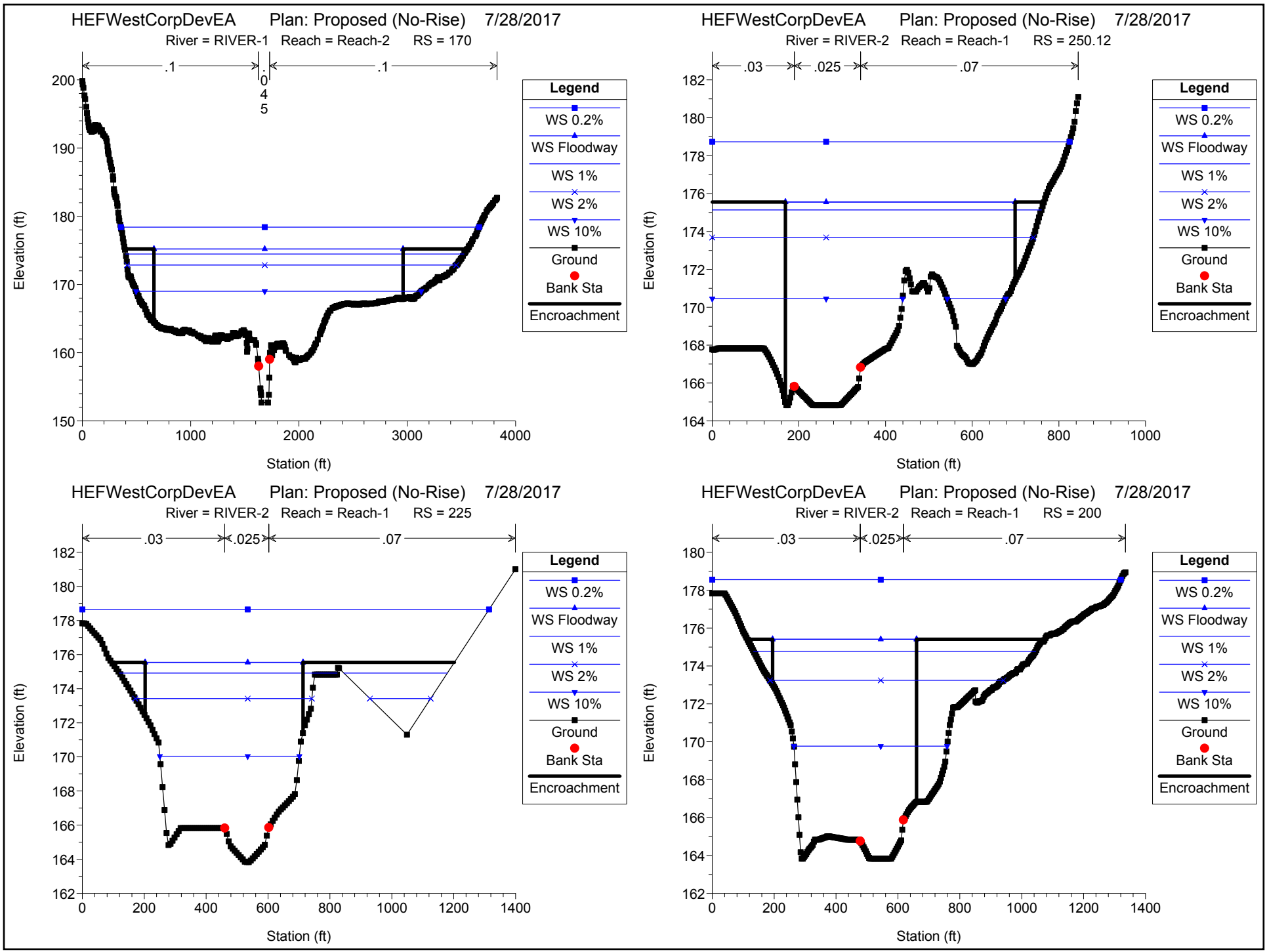

HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 314.4
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 300
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 285
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 280.55
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment

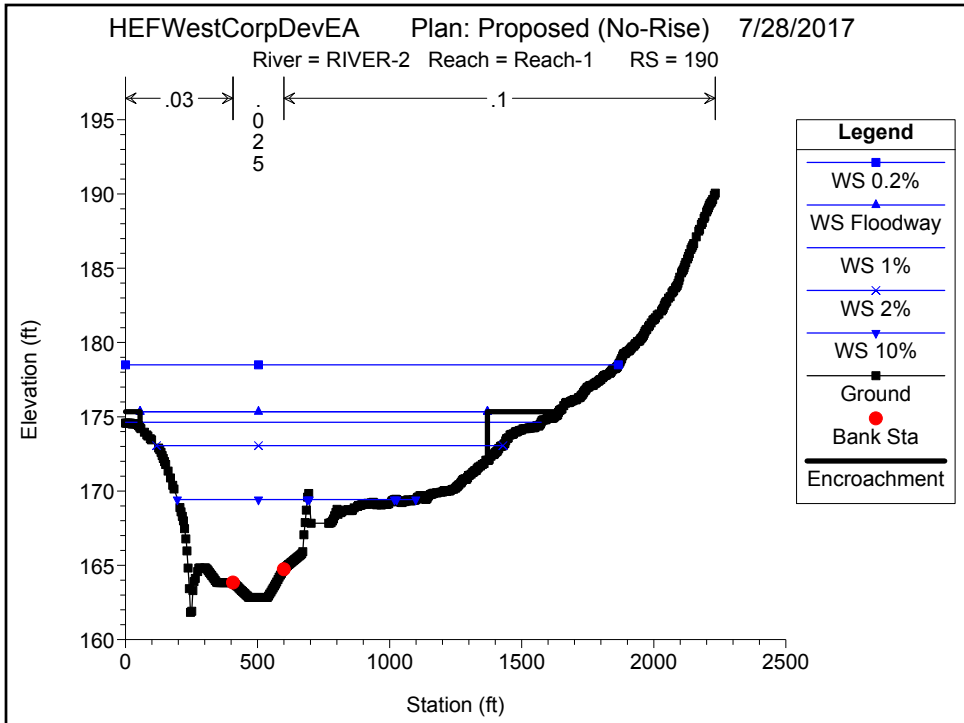

HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 270
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 264
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 250.12
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 250.06 BR
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 250.06 BR
.07
.045
.07
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 250
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 246
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 245


HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 244.19 BR
.07
.045
.07
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 244.19 BR
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 243.38
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 243.2


HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 243
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Ineff
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 190
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-1 RS = 182
.1
.045
.03
.025
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-2 RS = 180
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-1 Reach = Reach-2 RS = 170
.1
.045
.1
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-2 Reach = Reach-1 RS = 250.12
.03
.025
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-2 Reach = Reach-1 RS = 225
.03
.025
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment
HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-2 Reach = Reach-1 RS = 200
.03
.025
.07
Elevation (ft)
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment


HEFWestCorpDevEA Plan: Proposed (No-Rise) 7/28/2017
River = RIVER-2 Reach = Reach-1 RS = 190
.03
.025
.1
Elevation (ft)
195
190
185
180
175
170
165
160
0
500
1000
1500
2000
2500
Station (ft)
Legend
WS 0.2%
WS Floodway
WS 1%
WS 2%
WS 10%
Ground
Bank Sta
Encroachment

HEC-RAS HEC-RAS 5.0.1 April 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: HEFWestCorpDevEA
Project File : HEFWestCorpDevEA.prj
Run Date and Time: 7/28/2017 11:37:07 AM

Project in English units

Project Description:
All Elevations in NGVD 29
NGVD29 = NAVD88 + 0.827

Manassas, Prince William
County, Virginia
Manassas Regional Airport - West Corporate Development and
East Side Parcel CLOMR
Broad Run
Model beings at FEMA X/S "R" STA. 170
Model
ends at FEMA X/S "Z" STA. 350

Duplicate Effective Model:
Effective
including FEMA issued LOMRS - divided flow reach

Existing Conditions
Model:
2017 Manassas Regional Airport Runway 34R Extension Program LOMR -
Ongoing with FEMA

Proposed Conditions Model:
West Corporate Development
Proposed Layout
Revisions to X/S 314.4 through X/S 264

****

PLAN DATA

Plan Title: Proposed (No-Rise)
Plan File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.p05

Geometry Title: Proposed (No-Rise)

Proposed - No-Rise

Geometry File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.g05

Flow Title : Existing (34R LOMR)
Flow File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.f03

Plan Summary Information:
Number of: Cross Sections = 25 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 2 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Program Selects Appropriate method
Computational Flow Regime: Subcritical Flow

Encroachment Data
Equal Conveyance = True
Left Offset = 0
Right Offset = 0

River = RIVER-1 Reach = Reach-1

RS	Profile	Method	Value1	Value2
350	Floodway	1	658	1098
344.95	Floodway	1	418	1268
331.6	Floodway	1	215	1055
320	Floodway	1	1536	2136
314.4	Floodway	1	1110	2495
300	Floodway	1	2363	3443
285	Floodway	1	2664	3269
280.55	Floodway	1	2714	3314
270	Floodway	1	3229	3678
264	Floodway	1	3106.1	3759
250.12	Floodway	1	3655	3700
250	Floodway	1	3985	4035
246	Floodway	1	3972	4052
245	Floodway	1	3996	4031
243.38	Floodway	1	3954	4009
243.2	Floodway	1	3495.8	3571.1
243	Floodway	1	1235	1335
190	Floodway	1	144	632
182	Floodway	1	546	2926

River = RIVER-1 Reach = Reach-2

RS	Profile	Method	Value1	Value2
180	Floodway	1	696	3080
170	Floodway	1	661	2961

River = RIVER-2 Reach = Reach-1

RS	Profile	Method	Value1	Value2
250.12	Floodway	1	169	699
225	Floodway	1	203	713
200	Floodway	1	195	660
190	Floodway	1	55	1370

****

FLOW DATA

Flow Title: Existing (34R LOMR)
Flow File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.f03

Flow Data (cfs)

River	Reach	RS	1%	Floodway	10%	2%	0.2%
RIVER-1	Reach-1	350	17700	17700	8780	15000	25700
RIVER-1	Reach-1	250.12	800	800	1450	950	700
RIVER-1	Reach-1	243	2665	2665	3015	2805	2100
RIVER-1	Reach-1	182	19965	19965	10495	17155	27500
RIVER-1	Reach-2	180	19965	19965	10495	17155	27500
RIVER-2	Reach-1	250.12	17300	17300	7480	14350	25400

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
RIVER-1	Reach-2	1%		Known WS = 174.47
RIVER-1	Reach-2	Floodway		Known WS = 175.21
RIVER-1	Reach-2	10%		Known WS = 169
RIVER-1	Reach-2	2%		Known WS = 172.85
RIVER-1	Reach-2	0.2%		Known WS = 178.41

****

GEOMETRY DATA

Geometry Title: Proposed (No-Rise)
Geometry File : C:\Users\wilsons\Desktop\HEF EA\Broad Run HEC-RAS\HEFWestCorpDevEA.g05

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
RIVER-1	Reach-1		A
RIVER-1	Reach-2	A	

* RIVER-2 Reach-1 * * A *

JUNCTION INFORMATION

Name: A
Description:
Energy computation Method

Length across Junction River	Reach		Tributary River	Reach	Length	Angle
RIVER-1	Reach-1	to	RIVER-1	Reach-2	635	
RIVER-2	Reach-1	to	RIVER-1	Reach-2	1760	

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 350

INPUT
Description: XS 350 (LETTERED CROSS-SECTION Z)
SOUTHERN RAILROAD
Station Elevation Data num= 95

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	188.79	3.27	188.68	6.54	188.56	9.82	188.42	13.09	188.22
16.36	188.09	19.63	188.29	22.91	188.6	26.18	188.97	29.45	189.37
32.72	189.24	36	189.21	39.27	189.48	42.54	189.41	45.81	188.5
49.09	188.2	52.36	188.08	55.63	188.17	58.9	188.28	62.18	188.23
65.45	188.33	68.72	188.3	71.99	187.74	75.27	187.56	78.54	187.75
81.81	187.83	85.08	187.95	88.36	188.03	91.63	187.79	94.9	187.51
98.17	187.16	101.45	186.96	104.72	186.72	107.99	186.57	111.26	186.41
114.54	186.57	117.81	187.13	121.08	187.84	124.35	188.06	127.63	187.48
130.9	186.81	134.17	186.66	137.44	186.49	168	185	408	180
653	175	758	170	783	165	818	160	848	165
873	170	923	175	1418	180	1469.75	185.15	1473.03	185.4
1476.3	185.49	1479.58	185.45	1482.86	185.45	1486.13	185.61	1489.41	185.76
1492.68	185.89	1495.96	186.11	1499.24	186.35	1502.51	186.63	1505.79	186.79
1509.07	186.84	1512.34	186.92	1515.62	186.96	1518.9	186.9	1522.17	186.8
1525.45	186.75	1528.72	186.76	1532	186.92	1535.28	187.09	1538.55	187.11
1541.83	187.21	1545.11	187.26	1551.66	187.4	1554.94	187.45	1558.21	187.58
1561.49	187.63	1564.76	187.77	1568.04	187.96	1571.32	188.19	1574.59	188.09
1577.87	188.01	1581.15	187.95	1584.42	187.84	1587.7	187.81	1590.98	187.88
1594.25	188.01	1597.53	188.1	1600.8	188.14	1604.08	188.13	1607.36	188.11

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	758	.045	873	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
758	873	505	505	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	181.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.45	Reach Len. (ft)	505.00	505.00	505.00

* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1958.93	* 1929.52	* 2414.61 *
* E.G. Slope (ft/ft)	*0.000901	* Area (sq ft)	* 1958.93	* 1929.52	* 2414.61 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 2439.38	*12407.46	* 2853.16 *
* Top Width (ft)	* 1094.31	* Top Width (ft)	* 419.71	* 115.00	* 559.59 *
* Vel Total (ft/s)	* 2.81	* Avg. Vel. (ft/s)	* 1.25	* 6.43	* 1.18 *
* Max Chl Dpth (ft)	* 21.45	* Hydr. Depth (ft)	* 4.67	* 16.78	* 4.31 *
* Conv. Total (cfs)	*589693.6	* Conv. (cfs)	* 81270.5	*413367.1	* 95055.9 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 419.90	* 116.76	* 559.94 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.26	* 0.93	* 0.24 *
* Alpha	* 3.73	* Stream Power (lb/ft s)	* 0.33	* 5.98	* 0.29 *
* Frctn Loss (ft)	* 0.34	* Cum Volume (acre-ft)	* 1523.30	* 586.16	* 2050.11 *
* C & E Loss (ft)	* 0.07	* Cum SA (acres)	* 276.32	* 31.05	* 210.31 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 182.35	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.56	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 181.80	* Reach Len. (ft)	* 505.00	* 505.00	* 505.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 941.54	* 1969.08	* 1499.51 *
* E.G. Slope (ft/ft)	*0.000982	* Area (sq ft)	* 941.54	* 1969.08	* 1499.51 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 1866.82	*13398.57	* 2434.61 *
* Top Width (ft)	* 440.00	* Top Width (ft)	* 100.00	* 115.00	* 225.00 *
* Vel Total (ft/s)	* 4.01	* Avg. Vel. (ft/s)	* 1.98	* 6.80	* 1.62 *
* Max Chl Dpth (ft)	* 21.80	* Hydr. Depth (ft)	* 9.42	* 17.12	* 6.66 *
* Conv. Total (cfs)	*564863.1	* Conv. (cfs)	* 59576.2	*427590.8	* 77696.1 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 107.15	* 116.76	* 230.29 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.54	* 1.03	* 0.40 *
* Alpha	* 2.22	* Stream Power (lb/ft s)	* 1.07	* 7.03	* 0.65 *
* Frctn Loss (ft)	* 0.35	* Cum Volume (acre-ft)	* 511.61	* 602.65	* 1324.78 *
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 56.24	* 30.76	*

```
  94.78  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10%
**********************************************************************************
**********
* E.G. Elev (ft)         *  177.96  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.38  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  177.58  * Reach Len. (ft)       *  505.00  *  505.00  *
 505.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  696.80  * 1484.36  *
 583.91  *
* E.G. Slope (ft/ft)     *0.000846  * Area (sq ft)          *  696.80  * 1484.36  *
 583.91  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)            *  627.46  * 7764.20  *
 388.34  *
* Top Width (ft)         *  652.04  * Top Width (ft)        *  231.49  *  115.00  *
 305.56  *
* Vel Total (ft/s)       *    3.18  * Avg. Vel. (ft/s)      *    0.90  *    5.23  *
   0.67  *
* Max Chl Dpth (ft)      *   17.58  * Hydr. Depth (ft)      *    3.01  *   12.91  *
   1.91  *
* Conv. Total (cfs)      *301914.5  * Conv. (cfs)           * 21576.2  *266984.7  *
13353.6  *
* Length Wtd. (ft)       *  505.00  * Wetted Per. (ft)      *  231.63  *  116.76  *
 305.82  *
* Min Ch El (ft)         *  160.00  * Shear (lb/sq ft)      *    0.16  *    0.67  *
   0.10  *
* Alpha                  *    2.41  * Stream Power (lb/ft s) *    0.14  *    3.51  *
   0.07  *
* Frctn Loss (ft)        *    0.31  * Cum Volume (acre-ft)  *  660.56  *  446.07  *
 965.44  *
* C & E Loss (ft)        *    0.06  * Cum SA (acres)        *  120.68  *   31.18  *
 183.67  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  180.88  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.46  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.42  * Reach Len. (ft)       *  505.00  *  505.00  *
 505.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 1551.34  * 1810.83  *
1842.44  *
* E.G. Slope (ft/ft)     *0.000925  * Area (sq ft)          * 1551.34  * 1810.83  *
1842.44  *
* Q Total (cfs)          *15000.00  * Flow (cfs)            * 1822.19  *11312.19  *
1865.62  *
```

* Top Width (ft)	* 1034.40	* Top Width (ft)	* 370.17	* 115.00	* 549.22 *
* Vel Total (ft/s)	* 2.88	* Avg. Vel. (ft/s)	* 1.17	* 6.25	* 1.01 *
* Max Chl Dpth (ft)	* 20.42	* Hydr. Depth (ft)	* 4.19	* 15.75	* 3.35 *
* Conv. Total (cfs)	*493093.8	* Conv. (cfs)	* 59900.7	*371864.8	* 61328.3 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 370.35	* 116.76	* 549.52 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.24	* 0.90	* 0.19 *
* Alpha	* 3.58	* Stream Power (lb/ft s)	* 0.28	* 5.60	* 0.20 *
* Frctn Loss (ft)	* 0.34	* Cum Volume (acre-ft)	* 1172.96	* 544.04	* 1715.61 *
* C & E Loss (ft)	* 0.08	* Cum SA (acres)	* 228.81	* 31.05	* 205.26 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 184.67	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.42	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 184.25	* Reach Len. (ft)	* 505.00	* 505.00	* 505.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 3318.64	* 2250.76	* 4017.00 *
* E.G. Slope (ft/ft)	*0.000794	* Area (sq ft)	* 3318.64	* 2250.76	* 4017.00 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 4584.22	*15059.76	* 6056.02 *
* Top Width (ft)	* 1256.46	* Top Width (ft)	* 553.80	* 115.00	* 587.66 *
* Vel Total (ft/s)	* 2.68	* Avg. Vel. (ft/s)	* 1.38	* 6.69	* 1.51 *
* Max Chl Dpth (ft)	* 24.25	* Hydr. Depth (ft)	* 5.99	* 19.57	* 6.84 *
* Conv. Total (cfs)	*911840.9	* Conv. (cfs)	*162648.9	*534323.1	*214868.8 *
* Length Wtd. (ft)	* 505.00	* Wetted Per. (ft)	* 554.01	* 116.76	* 588.15 *
* Min Ch El (ft)	* 160.00	* Shear (lb/sq ft)	* 0.30	* 0.96	* 0.34 *
* Alpha	* 3.77	* Stream Power (lb/ft s)	* 0.41	* 6.40	* 0.51 *
* Frctn Loss (ft)	* 0.31	* Cum Volume (acre-ft)	* 2866.48	* 698.59	* 2972.87 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 501.14	* 32.28	* 244.99 *

****

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 344.95

INPUT
Description: XS 344.95 (LETTERED CROSS-SECTION Y)
Station Elevation Data num= 43

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	193.66	3.28	193.86	6.55	193.97	9.83	194.05	13.11	194.06
16.39	194.13	22.94	194.31	26.22	194.31	29.49	194.32	32.77	194.25
36.05	194.25	39.32	194.21	42.6	194.2	45.88	194	49.16	193.82
52.43	193.63	55.71	193.43	58.99	193.27	62.26	193.09	108	190
143	185	188	180	418	177	568	177	673	175
718	170	768	165	818	159	868	165	908	170
998	173	1068	170	1083	169	1153	170	1228	175
1348	180	1443	185	1503.55	184.49	1506.82	184.48	1510.08	184.51
1513.35	184.55	1523.16	184.52	1529.69	184.46				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	768	.045	868	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
768	868	700	1400	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	181.50	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.28	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	2928.27	1928.17	4245.82
E.G. Slope (ft/ft)	0.000441	Area (sq ft)	2928.27	1928.17	4245.82
Q Total (cfs)	17700.00	Flow (cfs)	2652.52	9569.66	5477.82
Top Width (ft)	1195.89	Top Width (ft)	591.54	100.00	504.35
Vel Total (ft/s)	1.94	Avg. Vel. (ft/s)	0.91	4.96	1.29
Max Chl Dpth (ft)	22.28	Hydr. Depth (ft)	4.95	19.28	8.42
Conv. Total (cfs)	842749.5	Conv. (cfs)	126294.2	455639.9	260815.5
Length Wtd. (ft)	1273.80	Wetted Per. (ft)	592.17	100.72	505.12
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.14	0.53	0.23
Alpha	3.69	Stream Power (lb/ft s)	0.12	2.62	0.30
Frctn Loss (ft)	0.80	Cum Volume (acre-ft)	1494.97	563.80	2011.50
C & E Loss (ft)	0.03	Cum SA (acres)	270.46	29.80	204.14

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	181.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	181.70	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	2427.94	1970.13	4162.17
E.G. Slope (ft/ft)	0.000392	Area (sq ft)	2427.94	1970.13	4162.17
Q Total (cfs)	17700.00	Flow (cfs)	2571.79	9348.31	5779.90
Top Width (ft)	850.00	Top Width (ft)	350.00	100.00	400.00
Vel Total (ft/s)	2.07	Avg. Vel. (ft/s)	1.06	4.75	1.39
Max Chl Dpth (ft)	22.70	Hydr. Depth (ft)	6.94	19.70	10.41
Conv. Total (cfs)	894218.5	Conv. (cfs)	129929.0	472284.1	292005.4
Length Wtd. (ft)	1264.32	Wetted Per. (ft)	355.25	100.72	405.70
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.17	0.48	0.25
Alpha	2.97	Stream Power (lb/ft s)	0.18	2.27	0.35
Frctn Loss (ft)	0.68	Cum Volume (acre-ft)	492.08	579.82	1291.96
C & E Loss (ft)	0.02	Cum SA (acres)	53.63	29.51	91.16

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	177.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	177.42	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	937.42	1542.30	2457.74
E.G. Slope (ft/ft)	0.000367	Area (sq ft)	937.42	1542.30	2457.74
Q Total (cfs)	8780.00	Flow (cfs)	484.82	6018.31	2276.87
Top Width (ft)	900.58	Top Width (ft)	382.43	100.00	418.15
Vel Total (ft/s)	1.78	Avg. Vel. (ft/s)	0.52	3.90	0.93

* Max Chl Dpth (ft)	* 18.42	* Hydr. Depth (ft)	* 2.45	* 15.42	* 5.88 *
* Conv. Total (cfs)	*458158.2	* Conv. (cfs)	* 25298.8	*314047.7	*118811.8 *
* Length Wtd. (ft)	* 1347.09	* Wetted Per. (ft)	* 382.98	* 100.72	* 418.84 *
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.06	* 0.35	* 0.13 *
* Alpha	* 3.38	* Stream Power (lb/ft s)	* 0.03	* 1.37	* 0.12 *
* Frctn Loss (ft)	* 0.71	* Cum Volume (acre-ft)	* 651.09	* 428.53	* 947.81 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 117.12	* 29.93	* 179.47 *

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

****

* E.G. Elev (ft)	* 180.46	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.21	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 180.25	* Reach Len. (ft)	* 700.00	* 1400.00	* 1400.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2324.21	* 1825.25	* 3736.79 *
* E.G. Slope (ft/ft)	*0.000435	* Area (sq ft)	* 2324.21	* 1825.25	* 3736.79 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 1811.51	* 8673.74	* 4514.75 *
* Top Width (ft)	* 1167.07	* Top Width (ft)	* 582.27	* 100.00	* 484.80 *
* Vel Total (ft/s)	* 1.90	* Avg. Vel. (ft/s)	* 0.78	* 4.75	* 1.21 *
* Max Chl Dpth (ft)	* 21.25	* Hydr. Depth (ft)	* 3.99	* 18.25	* 7.71 *
* Conv. Total (cfs)	*719117.9	* Conv. (cfs)	* 86846.0	*415829.6	*216442.4 *
* Length Wtd. (ft)	* 1295.31	* Wetted Per. (ft)	* 582.85	* 100.72	* 485.54 *
* Min Ch El (ft)	* 159.00	* Shear (lb/sq ft)	* 0.11	* 0.49	* 0.21 *
* Alpha	* 3.75	* Stream Power (lb/ft s)	* 0.08	* 2.34	* 0.25 *
* Frctn Loss (ft)	* 0.81	* Cum Volume (acre-ft)	* 1150.49	* 522.97	* 1683.27 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 223.29	* 29.80	* 199.27 *

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	184.30	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.22	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	184.07	Reach Len. (ft)	700.00	1400.00	1400.00
Crit W.S. (ft)		Flow Area (sq ft)	4615.29	2207.43	5728.36
E.G. Slope (ft/ft)	0.000433	Area (sq ft)	4615.29	2207.43	5728.36
Q Total (cfs)	25700.00	Flow (cfs)	5455.91	11879.65	8364.44
Top Width (ft)	1274.08	Top Width (ft)	616.67	100.00	557.41
Vel Total (ft/s)	2.05	Avg. Vel. (ft/s)	1.18	5.38	1.46
Max Chl Dpth (ft)	25.07	Hydr. Depth (ft)	7.48	22.07	10.28
Conv. Total (cfs)	1234963.0	Conv. (cfs)	262173.2	570853.3	401936.5
Length Wtd. (ft)	1218.93	Wetted Per. (ft)	617.46	100.72	558.26
Min Ch El (ft)	159.00	Shear (lb/sq ft)	0.20	0.59	0.28
Alpha	3.43	Stream Power (lb/ft s)	0.24	3.19	0.41
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	2820.49	672.75	2916.38
C & E Loss (ft)	0.03	Cum SA (acres)	494.36	31.03	238.35

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 331.6

INPUT
Description: XS 331.6 (LETTERED CROSS-SECTION X)
Station Elevation Data num= 70

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	187.7	3.28	187.6	6.55	187.55	13.1	187.33	16.38	187.26
19.66	187.26	22.93	187.24	26.21	187.16	29.49	187	32.76	186.81
36.04	186.76	39.31	186.72	42.59	186.77	45.87	186.88	49.14	186.72
52.42	186.52	55.69	186.15	58.97	185.73	62.25	185.39	65.52	185.19
68.8	185.05	72.07	184.82	75.35	184.62	78.63	184.47	81.9	184.28
88.45	184	91.73	183.74	95.01	183.43	150	180	510	175
540	174	640	174	765	170	769.81	164.96	815	159.6
855.37	165.04	865	170	1030	175	1055	180	1060	185
1107.14	185.59	1110.42	187.05	1113.69	188.68	1116.96	190.04	1120.24	191.16
1123.51	192.37	1126.78	194.05	1133.33	196.21	1136.6	197.12	1139.87	197.79
1143.15	198.37	1146.42	198.88	1149.69	199.31	1152.97	199.53	1156.24	199.68
1159.51	199.58	1162.78	199.44	1166.06	199.45	1169.33	199.24	1172.6	199.08
1175.88	198.99	1179.15	198.94	1182.42	198.79	1185.7	198.67	1188.97	198.47
1192.24	198.34	1195.51	198.31	1198.79	198.37	1202.06	198.41	1205.33	198.35

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Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0      .1  769.81    .045  855.37      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        769.81  855.37              980     980     980             .1       .3

CROSS SECTION OUTPUT  Profile #1%
*************************************************************************************
***********
* E.G. Elev (ft)         *  180.66  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.56  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.10  * Reach Len. (ft)       *  980.00  *  980.00  *
 980.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2784.58  * 1522.69  *
1439.28  *
* E.G. Slope (ft/ft)     *0.001105  * Area (sq ft)          * 2784.58  * 1522.69  *
1439.28  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            * 3729.85  *11333.57  *
2636.59  *
* Top Width (ft)         *  906.63  * Top Width (ft)        *  621.34  *   85.56  *
 199.73  *
* Vel Total (ft/s)       *    3.08  * Avg. Vel. (ft/s)      *    1.34  *    7.44  *
   1.83  *
* Max Chl Dpth (ft)      *   20.50  * Hydr. Depth (ft)      *    4.48  *   17.80  *
   7.21  *
* Conv. Total (cfs)      *532433.4  * Conv. (cfs)           *112197.5  *340924.8  *
79311.1  *
* Length Wtd. (ft)       *  980.00  * Wetted Per. (ft)      *  623.62  *   86.24  *
 201.54  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)      *    0.31  *    1.22  *
   0.49  *
* Alpha                  *    3.83  * Stream Power (lb/ft s) *    0.41  *    9.07  *
   0.90  *
* Frctn Loss (ft)        *    0.80  * Cum Volume (acre-ft)  * 1449.06  *  508.35  *
1920.14  *
* C & E Loss (ft)        *    0.11  * Cum SA (acres)        *  260.72  *   26.82  *
 192.83  *
*************************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
        1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Floodway
*************************************************************************************
***********
* E.G. Elev (ft)         *  181.19  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.45  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  180.74  * Reach Len. (ft)       *  980.00  *  980.00  *
 980.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 3107.41  * 1577.97  *
1568.26  *
* E.G. Slope (ft/ft)     *0.000876  * Area (sq ft)          * 3107.41  * 1577.97  *
1568.26  *
* Q Total (cfs)          *17700.00  * Flow (cfs)            * 4289.62  *10707.63  *
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2702.75  *
* Top Width (ft)         *  840.00  * Top Width (ft)         *  554.81  *   85.56  *
 199.63  *
* Vel Total (ft/s)       *    2.83  * Avg. Vel. (ft/s)       *    1.38  *    6.79  *
   1.72  *
* Max Chl Dpth (ft)      *   21.14  * Hydr. Depth (ft)       *    5.60  *   18.44  *
   7.86  *
* Conv. Total (cfs)      *598067.5  * Conv. (cfs)            *144942.6  *361801.5  *
91323.5  *
* Length Wtd. (ft)       *  980.00  * Wetted Per. (ft)       *  558.72  *   86.24  *
 202.14  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)       *    0.30  *    1.00  *
   0.42  *
* Alpha                  *    3.59  * Stream Power (lb/ft s) *    0.42  *    6.79  *
   0.73  *
* Frctn Loss (ft)        *    0.73  * Cum Volume (acre-ft)   *  447.60  *  522.80  *
1199.88  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *   46.36  *   26.53  *
  81.52  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  176.85  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.44  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  176.42  * Reach Len. (ft)       *  980.00  *  980.00  *
 980.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  966.50  * 1207.92  *
 736.95  *
* E.G. Slope (ft/ft)     *0.000936  * Area (sq ft)          *  966.50  * 1207.92  *
 736.95  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)            *  842.36  * 7090.08  *
 847.55  *
* Top Width (ft)         *  629.09  * Top Width (ft)        *  361.81  *   85.56  *
 181.71  *
* Vel Total (ft/s)       *    3.02  * Avg. Vel. (ft/s)      *    0.87  *    5.87  *
   1.15  *
* Max Chl Dpth (ft)      *   16.82  * Hydr. Depth (ft)      *    2.67  *   14.12  *
   4.06  *
* Conv. Total (cfs)      *286998.6  * Conv. (cfs)           * 27535.0  *231759.0  *
27704.6  *
* Length Wtd. (ft)       *  980.00  * Wetted Per. (ft)      *  364.06  *   86.24  *
 183.13  *
* Min Ch El (ft)         *  159.60  * Shear (lb/sq ft)      *    0.16  *    0.82  *
   0.24  *
* Alpha                  *    3.08  * Stream Power (lb/ft s) *    0.14  *    4.80  *
   0.27  *
* Frctn Loss (ft)        *    0.73  * Cum Volume (acre-ft)  *  635.79  *  384.33  *
 896.47  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)        *  111.14  *   26.95  *
 169.83  *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  179.62  * Element               *  Left OB *  Channel *
Right OB *
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* Vel Head (ft)	* 0.55	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 179.07	* Reach Len. (ft)	* 980.00	* 980.00	* 980.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2179.52	* 1434.87	* 1236.54	*
* E.G. Slope (ft/ft)	*0.001101	* Area (sq ft)	* 2179.52	* 1434.87	* 1236.54	*
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 2675.05	*10247.64	* 2077.31	*
* Top Width (ft)	* 833.33	* Top Width (ft)	* 552.80	* 85.56	* 194.98	*
* Vel Total (ft/s)	* 3.09	* Avg. Vel. (ft/s)	* 1.23	* 7.14	* 1.68	*
* Max Chl Dpth (ft)	* 19.47	* Hydr. Depth (ft)	* 3.94	* 16.77	* 6.34	*
* Conv. Total (cfs)	*451988.8	* Conv. (cfs)	* 80606.2	*308788.1	* 62594.6	*
* Length Wtd. (ft)	* 980.00	* Wetted Per. (ft)	* 555.06	* 86.24	* 196.66	*
* Min Ch El (ft)	* 159.60	* Shear (lb/sq ft)	* 0.27	* 1.14	* 0.43	*
* Alpha	* 3.71	* Stream Power (lb/ft s)	* 0.33	* 8.17	* 0.73	*
* Frctn Loss (ft)	* 0.82	* Cum Volume (acre-ft)	* 1114.30	* 470.58	* 1603.35	*
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 214.17	* 26.82	* 188.35	*

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CROSS SECTION OUTPUT Profile #0.2%

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* E.G. Elev (ft)	* 183.54	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.51	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 183.04	* Reach Len. (ft)	* 980.00	* 980.00	* 980.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 4682.82	* 1774.52	* 2031.46	*
* E.G. Slope (ft/ft)	*0.000952	* Area (sq ft)	* 4682.82	* 1774.52	* 2031.46	*
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 7840.07	*13573.43	* 4286.50	*
* Top Width (ft)	* 956.76	* Top Width (ft)	* 668.53	* 85.56	* 202.67	*
* Vel Total (ft/s)	* 3.03	* Avg. Vel. (ft/s)	* 1.67	* 7.65	* 2.11	*
* Max Chl Dpth (ft)	* 23.44	* Hydr. Depth (ft)	* 7.00	* 20.74	* 10.02	*
* Conv. Total (cfs)	*833073.3	* Conv. (cfs)	*254138.1	*439986.8	*138948.3	*
* Length Wtd. (ft)	* 980.00	* Wetted Per. (ft)	* 670.90	* 86.24	* 205.70	*
* Min Ch El (ft)	* 159.60	* Shear (lb/sq ft)	* 0.41	* 1.22	* 0.59	*
* Alpha	* 3.55	* Stream Power (lb/ft s)	* 0.69	* 9.35	* 1.24	*
* Frctn Loss (ft)	* 0.65	* Cum Volume (acre-ft)	* 2745.78	* 608.76	* 2791.69	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 484.03	* 28.05	*	

226.13 *
****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 320

INPUT
Description: XS 320
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 478

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	190.92	3.28	190.97	13.11	191	16.39	191.06	22.95	191.05
26.22	191.19	29.5	191.24	39.34	191.1	42.61	191.21	52.45	191.25
65.56	191.15	72.12	190.87	75.4	190.79	81.95	190.8	85.23	190.7
95.06	190.25	101.62	189.85	111.45	189.63	121.29	189.31	124.57	189.31
127.84	189.22	134.4	188.86	140.96	188.7	144.24	188.49	150.79	188.3
154.07	188.1	157.35	188.02	163.9	187.99	173.74	187.34	180.29	187.16
190.13	187.19	203.24	187.1	206.52	187.03	213.07	186.8	222.91	186.51
226.19	186.48	232.74	186.24	236.02	186.24	239.3	186.35	242.58	186.33
245.86	186.13	249.13	186.32	252.41	186.31	258.97	185.92	265.52	185.62
268.8	185.26	272.08	184.8	275.36	184.44	278.64	184.48	281.91	184.72
285.19	185.2	288.47	185.79	291.75	186.92	298.3	187.07	304.86	187.34
308.14	187.12	321.25	186.56	324.53	186.47	331.08	186.13	334.36	186.06
337.64	185.87	347.48	185.54	357.31	185.15	363.87	184.67	370.42	184.09
373.7	183.91	376.98	183.34	380.26	183.07	386.81	182.75	390.09	182.84
393.37	183.08	396.65	183.19	399.92	183.14	406.48	182.75	413.04	182.97
416.31	183	426.15	182.94	432.71	183.2	435.98	183.25	442.54	183.44
449.1	183.12	455.65	182.87	458.93	182.98	472.04	182.51	475.32	182.57
481.88	182.49	494.99	182.43	498.27	182.39	504.82	182.5	511.38	182.85
514.66	182.92	517.93	182.88	524.49	182.65	531.05	182.49	537.6	182.22
544.16	182.22	550.72	182	557.27	182.04	563.83	181.98	570.38	181.98
576.94	181.79	583.5	181.77	590.05	181.68	599.89	181.82	606.44	181.77
613	181.55	629.39	181.49	635.95	181.23	645.78	181.21	655.61	180.97
665.45	180.81	675.28	180.85	678.56	180.83	681.84	180.72	688.4	180.39
701.51	180.62	704.79	180.61	711.34	180.25	714.62	180.21	717.9	180.31
721.18	180.31	724.45	180.22	734.29	180.09	744.12	179.89	750.68	179.9
753.96	179.85	776.9	179.68	786.74	179.76	793.29	179.65	803.13	179.74
806.41	179.65	809.68	179.48	816.24	179.5	826.08	179.43	832.63	179.27
839.19	179.37	849.02	179.21	858.86	178.87	862.13	178.81	875.25	178.82
878.52	178.58	881.8	178.49	888.36	178.54	891.64	178.63	894.91	178.32
901.47	178.26	908.03	178.14	917.86	177.91	930.97	177.76	937.53	177.76
947.36	177.67	953.92	177.79	957.2	177.74	960.48	177.47	963.75	177.31
967.03	177.25	973.59	177.25	980.15	177.08	986.7	177.22	993.26	177.15
999.81	176.92	1006.37	176.86	1012.93	176.85	1016.2	176.76	1022.76	176.97
1026.04	176.93	1032.59	176.7	1039.15	176.55	1048.98	176.43	1055.54	176.41
1062.1	176.18	1065.37	176.23	1068.65	176.37	1075.21	176.18	1081.77	176.43
1091.6	176.6	1101.43	176.68	1111.27	176.62	1121.1	176.63	1124.38	176.67
1137.49	177.04	1144.05	177.04	1150.6	177.09	1157.16	177.05	1163.72	177.31
1170.27	177.4	1176.83	177.65	1189.94	178.01	1193.22	178.13	1199.77	178.53
1203.05	178.59	1212.89	178.96	1219.44	179.29	1226	179.48	1235.83	179.92
1239.11	179.94	1242.39	179.87	1252.22	180.01	1262.06	179.94	1265.34	179.95
1275.17	180.14	1285	180.49	1294.84	180.63	1301.39	180.69	1311.23	180.7
1317.79	180.74	1324.34	180.65	1327.62	180.49	1340.73	180.44	1347.29	180.32

Proposed - No-Rise

1350.57	180.32	1357.12	180.23	1363.68	180.23	1366.96	180.33	1370.23	180.53
1373.51	180.49	1380.07	179.99	1383.35	179.93	1396.46	179.5	1399.74	179.36
1403.01	179.05	1412.85	178.45	1416.13	178.54	1425.96	178.32	1439.07	177.37
1442.35	177.22	1452.19	176.61	1458.74	176.07	1462.02	175.69	1465.3	175.43
1471.85	174.8	1475.13	174.59	1481.69	174	1488.24	173.5	1494.8	173.11
1498.08	172.67	1501.36	172.44	1504.63	172.13	1511.19	171.78	1517.75	171.25
1521.02	171.13	1530.86	171.14	1534.14	171.05	1550.53	170.77	1557.08	170.52
1566.92	170.34	1570.2	170.42	1576.75	170.36	1580.03	170.52	1586.59	170.45
1589.86	170.34	1593.14	170.11	1596.42	170.06	1599.7	170.38	1602.98	170.79
1609.53	171.2	1612.81	171.62	1616.09	171.87	1619.37	171.95	1629.2	172.07
1635.76	171.93	1642.31	171.92	1648.87	171.68	1652.15	171.47	1655.42	171.14
1661.98	170.36	1665.26	170.35	1668.54	170.66	1675.09	171.48	1678.37	171.77
1681.65	171.88	1694.76	171.89	1698.04	171.86	1704.6	171.64	1707.87	171.73
1714.43	171.79	1720.99	172.03	1727.54	172.09	1734.1	172.41	1737.38	172.02
1740.65	170.76	1743.93	168.4	1747.21	165.79	1750.49	164.22	1753.77	163.64
1801	159.41	1848.298	163.171	1851.575	164.86	1854.852	167.496	1858.129	169.936
1861.405	171.199	1864.682	171.365	1867.959	171.395	1871.236	171.461	1874.513	171.245
1877.79	170.878	1881.066	170.641	1884.312	170.614	1887.558	170.781	1890.803	170.954
1894.049	171.003	1897.294	170.999	1900.54	171.071	1903.786	171.243	1907.031	171.424
1910.277	171.558	1917.67	171.35	1920.95	171.35	1924.23	171.06	1930.78	170.59
1934.06	169.75	1940.62	166.92	1943.89	165.69	1947.17	166.22	1950.45	167.63
1953.73	169.18	1957.01	170.2	1960.28	170.34	1973.4	171.02	1976.67	171.14
1983.23	171.25	1986.51	171.47	1989.79	171.6	1993.06	171.85	1999.62	172.21
2002.9	172.19	2009.46	171.97	2016.01	172.02	2019.29	171.87	2032.4	172.08
2038.96	172.06	2045.51	172.28	2048.79	172.31	2055.35	172.24	2058.63	172.32
2068.46	172.47	2088.13	172.67	2094.68	172.69	2097.96	172.8	2104.52	172.85
2107.79	173.02	2120.87	173.56	2130.69	173.78	2133.96	173.94	2143.77	174.21
2153.58	174.57	2156.85	174.72	2169.93	175.06	2176.48	175.33	2183.02	175.3
2186.29	175.34	2202.64	175.68	2209.18	175.9	2215.72	175.97	2228.81	176.3
2238.62	176.28	2241.89	176.34	2245.16	176.29	2258.24	176.66	2268.06	176.57
2274.6	176.68	2277.87	176.64	2287.68	176.71	2307.31	176.48	2313.85	176.49
2320.39	176.45	2326.93	176.28	2333.47	176.33	2340.01	176.22	2353.1	176.22
2359.64	176.14	2369.45	176.16	2375.99	175.97	2379.26	176.09	2398.89	175.9
2405.43	175.91	2408.7	175.98	2415.24	176.02	2431.6	175.93	2438.14	175.74
2444.68	175.88	2451.22	175.76	2461.03	175.76	2467.57	175.84	2477.39	175.66
2483.93	175.69	2487.2	175.66	2493.74	175.74	2503.55	175.65	2510.09	175.63
2516.64	175.73	2526.45	175.7	2532.99	175.6	2536.26	175.69	2542.8	175.63
2552.61	175.72	2555.88	175.78	2559.16	175.74	2562.43	175.8	2565.7	175.75
2572.24	175.8	2575.51	175.7	2595.13	175.69	2598.4	175.73	2608.22	175.74
2614.76	175.63	2621.3	175.64	2624.57	175.71	2634.38	175.58	2640.92	175.63
2650.74	175.62	2657.28	175.71	2673.63	175.76	2680.17	175.72	2696.53	175.75
2703.07	175.57	2706.34	175.57	2716.15	175.4	2719.42	175.46	2725.96	175.44
2729.24	175.33	2742.32	175.46	2748.86	175.55	2752.13	175.66	2755.4	175.58
2761.94	175.65	2765.21	175.64	2771.76	175.74	2778.3	175.71	2784.84	175.74
2794.65	175.88	2804.46	176.09	2807.73	176.23	2817.55	176.49	2824.09	176.62
2827.36	176.75	2830.63	176.78	2837.17	177.07	2846.98	177.61	2856.79	178
2866.61	178.31	2876.42	178.69	2882.96	178.89	2886.23	179.09	2892.77	179.35
2902.59	180.05	2909.13	180.34	2912.4	180.53	2918.94	181.06	2922.21	181.42
2932.02	182.33	2938.56	183.01	2941.83	183.13	2945.11	183.7	2948.38	184.58
2951.65	185.28	2954.92	185.81	2961.46	186.41	2964.73	187.11	2968	187.95
2974.54	188.97	2984.35	190.11	2987.63	190.59	2994.17	191.67	2997.44	191.91
3000.71	192.27	3003.98	192.72	3010.52	193.72	3017.06	194.62	3020.33	195.21
3023.6	195.65	3026.88	196.29	3030.15	197.09	3033.42	197.68	3039.96	198.19
3046.5	198.85	3049.77	199.37	3056.31	200.65				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1740.65	.045	1858.129	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1740.65	1858.129	860	860	550	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	179.76	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.21	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.54	Reach Len. (ft)	860.00	860.00	550.00
Crit W.S. (ft)		Flow Area (sq ft)	3087.00	2017.39	4887.96
E.G. Slope (ft/ft)	0.000522	Area (sq ft)	3087.00	2017.39	4887.96
Q Total (cfs)	17700.00	Flow (cfs)	3163.87	9878.17	4657.97
Top Width (ft)	1919.31	Top Width (ft)	764.48	117.48	1037.36
Vel Total (ft/s)	1.77	Avg. Vel. (ft/s)	1.02	4.90	0.95
Max Chl Dpth (ft)	20.14	Hydr. Depth (ft)	4.04	17.17	4.71
Conv. Total (cfs)	774549.1	Conv. (cfs)	138450.3	432266.9	203831.8
Length Wtd. (ft)	708.85	Wetted Per. (ft)	765.51	122.05	1039.69
Min Ch El (ft)	159.40	Shear (lb/sq ft)	0.13	0.54	0.15
Alpha	4.40	Stream Power (lb/ft s)	0.13	2.64	0.15
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1383.02	468.53	1848.97
C & E Loss (ft)	0.05	Cum SA (acres)	245.13	24.54	178.91

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	180.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.31	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	180.11	Reach Len. (ft)	860.00	860.00	550.00
Crit W.S. (ft)		Flow Area (sq ft)	1805.82	2083.69	2378.58
E.G. Slope (ft/ft)	0.000617	Area (sq ft)	1805.82	2083.69	2378.58
Q Total (cfs)	17700.00	Flow (cfs)	2761.03	11335.38	3603.59
Top Width (ft)	600.00	Top Width (ft)	204.65	117.48	277.87
Vel Total (ft/s)	2.82	Avg. Vel. (ft/s)	1.53	5.44	1.52
Max Chl Dpth (ft)	20.71	Hydr. Depth (ft)	8.82	17.74	8.56
Conv. Total (cfs)	712347.4	Conv. (cfs)	111119.4	456199.2	

```
*145028.8  *
* Length Wtd. (ft)       *  721.38  * Wetted Per. (ft)       *  214.29  *  122.05  *
 286.16  *
* Min Ch El (ft)         *  159.40  * Shear (lb/sq ft)       *    0.32  *    0.66  *
   0.32  *
* Alpha                  *    2.48  * Stream Power (lb/ft s) *    0.50  *    3.58  *
   0.49  *
* Frctn Loss (ft)        *    0.32  * Cum Volume (acre-ft)   *  392.34  *  481.61  *
1155.48  *
* C & E Loss (ft)        *    0.07  * Cum SA (acres)         *   37.82  *   24.24  *
  76.15  *
********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #10%
********************************************************************************
***********
* E.G. Elev (ft)         *  176.06  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.84  * Reach Len. (ft)        *  860.00  *  860.00  *
 550.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1155.34  * 1582.73  *
1314.20  *
* E.G. Slope (ft/ft)     *0.000544  * Area (sq ft)           * 1155.34  * 1582.73  *
1314.20  *
* Q Total (cfs)          * 8780.00  * Flow (cfs)             * 1028.74  * 6730.89  *
1020.37  *
* Top Width (ft)         * 1100.65  * Top Width (ft)         *  279.96  *  117.48  *
 703.21  *
* Vel Total (ft/s)       *    2.17  * Avg. Vel. (ft/s)       *    0.89  *    4.25  *
   0.78  *
* Max Chl Dpth (ft)      *   16.44  * Hydr. Depth (ft)       *    4.13  *   13.47  *
   1.87  *
* Conv. Total (cfs)      *376300.8  * Conv. (cfs)            * 44090.6  *288478.5  *
43731.7  *
* Length Wtd. (ft)       *  752.86  * Wetted Per. (ft)       *  280.70  *  122.05  *
 705.45  *
* Min Ch El (ft)         *  159.40  * Shear (lb/sq ft)       *    0.14  *    0.44  *
   0.06  *
* Alpha                  *    2.99  * Stream Power (lb/ft s) *    0.12  *    1.87  *
   0.05  *
* Frctn Loss (ft)        *    0.32  * Cum Volume (acre-ft)   *  611.92  *  352.94  *
 873.40  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *  103.92  *   24.66  *
 159.88  *
********************************************************************************
***********

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT  Profile #2%
********************************************************************************
***********
* E.G. Elev (ft)         *  178.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.24  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
```

* W.S. Elev (ft)	* 178.47	* Reach Len. (ft)	* 860.00	* 860.00	* 550.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2339.71	* 1890.92	* 3783.26 *
* E.G. Slope (ft/ft)	*0.000575	* Area (sq ft)	* 2339.71	* 1890.92	* 3783.26 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 2454.04	* 9305.05	* 3240.91 *
* Top Width (ft)	* 1757.54	* Top Width (ft)	* 627.53	* 117.48	* 1012.53 *
* Vel Total (ft/s)	* 1.87	* Avg. Vel. (ft/s)	* 1.05	* 4.92	* 0.86 *
* Max Chl Dpth (ft)	* 19.07	* Hydr. Depth (ft)	* 3.73	* 16.10	* 3.74 *
* Conv. Total (cfs)	*625552.2	* Conv. (cfs)	*102342.1	*388052.8	*135157.3 *
* Length Wtd. (ft)	* 720.38	* Wetted Per. (ft)	* 628.47	* 122.05	* 1014.85 *
* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.13	* 0.56	* 0.13 *
* Alpha	* 4.38	* Stream Power (lb/ft s)	* 0.14	* 2.74	* 0.11 *
* Frctn Loss (ft)	* 0.30	* Cum Volume (acre-ft)	* 1063.47	* 433.17	* 1546.88 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 200.89	* 24.54	* 174.76 *

****

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

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* E.G. Elev (ft)	* 182.79	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.16	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 182.63	* Reach Len. (ft)	* 860.00	* 860.00	* 550.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 6341.18	* 2380.19	* 8159.17 *
* E.G. Slope (ft/ft)	*0.000379	* Area (sq ft)	* 6341.18	* 2380.19	* 8159.17 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 5510.27	*11092.63	* 9097.11 *
* Top Width (ft)	* 2448.32	* Top Width (ft)	* 1254.05	* 117.48	* 1076.79 *
* Vel Total (ft/s)	* 1.52	* Avg. Vel. (ft/s)	* 0.87	* 4.66	* 1.11 *
* Max Chl Dpth (ft)	* 23.23	* Hydr. Depth (ft)	* 5.06	* 20.26	* 7.58 *
* Conv. Total (cfs)	*1319325.0	* Conv. (cfs)	*282873.0	*569446.9	*467005.5 *
* Length Wtd. (ft)	* 687.31	* Wetted Per. (ft)	* 1255.21	* 122.05	* 1079.26 *
* Min Ch El (ft)	* 159.40	* Shear (lb/sq ft)	* 0.12	* 0.46	* 0.18 *
* Alpha	* 4.30	* Stream Power (lb/ft s)	* 0.10	* 2.15	* 0.20 *

* Frctn Loss (ft)	*	0.20	* Cum Volume (acre-ft)	*	2621.78	*	562.02	*	2677.05 *
* C & E Loss (ft)	*	0.03	* Cum SA (acres)	*	462.41	*	25.77	*	211.74 *

****

Warning: Divided flow computed for this cross-section.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 314.4

INPUT
Description: XS 314.4 (LETTERED CROSS-SECTION W)
Station Elevation Data num= 465

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	178.26	3.28	178.01	9.84	177.42	16.39	176.69	22.95	176.07
26.23	176.25	36.07	177.23	39.35	177.47	42.63	177.41	52.46	177.76
55.74	177.74	65.58	177.79	68.86	177.73	72.14	177.78	78.69	178.05
81.97	177.98	85.25	177.78	91.81	178.06	98.37	178.15	101.65	178.12
104.93	178.37	108.2	178.46	114.76	178.53	118.04	178.71	124.6	178.76
127.88	178.7	131.16	178.85	147.55	179.2	150.83	179.14	160.67	179.16
163.95	179.25	170.5	179.31	180.34	179.33	190.18	179.49	193.46	179.48
203.29	179.78	209.85	179.9	216.41	180.4	222.97	181.04	226.25	181.25
236.08	181.69	242.64	181.8	249.2	181.82	255.76	181.93	259.03	181.9
268.87	182.07	288.54	182.25	295.1	182.19	298.38	182.24	301.66	182.14
311.5	181.96	318.05	181.87	321.33	181.78	327.89	181.7	331.17	181.72
344.29	181.38	347.57	181.21	357.4	181	360.68	180.98	363.96	180.77
367.24	180.17	370.52	179.75	373.8	179.51	377.08	179.46	386.91	179.21
393.47	179.01	396.75	179.12	400.03	179.05	409.86	178.96	416.42	179.05
419.7	178.99	426.26	179.01	432.82	178.88	442.65	178.94	449.21	178.94
452.49	178.9	455.77	178.97	459.05	178.76	465.61	178.9	485.28	179.03
491.84	179.13	498.4	179.04	511.51	179.15	521.35	179.43	527.91	179.71
531.18	179.77	537.74	180.11	544.3	180.3	554.14	180.44	557.42	180.43
567.25	180.49	570.53	180.42	577.09	180.46	583.65	180.37	590.2	179.95
593.48	179.91	596.76	179.77	600.04	179.8	606.6	179.69	613.16	179.54
622.99	179.04	626.27	178.8	632.83	178.44	636.11	178.56	639.39	178.91
645.95	179.37	659.06	179.96	662.34	180.03	668.9	180.04	672.18	179.97
675.46	180.03	678.74	180	685.29	180.06	688.57	180.16	695.13	180.14
701.69	180.25	714.8	180.32	721.36	180.42	734.48	180.78	760.71	180.87
763.99	180.83	767.27	180.88	770.54	180.82	777.1	180.85	786.94	180.74
800.06	180.88	813.17	180.97	816.45	180.94	823.01	181.04	832.84	181.01
842.68	181.23	849.24	181.3	852.52	181.42	855.8	181.44	862.35	181.26
868.91	181.29	875.47	181.37	885.31	181.17	891.86	181.24	901.7	181.19
908.26	181.24	914.82	181.16	921.37	181.25	927.93	181.28	937.77	181.09
939.8982	181.787	955.0579	181.667	970.2175	181.537	985.3771	181.417	1000.537	181.207
1015.696	180.877	1030.856	180.547	1046.016	180.317	1061.175	180.127	1076.335	180.197
1091.495	180.157	1106.654	176.827	1108.27	174.54	1111.55	174.03	1118.11	172.53
1121.39	171.63	1124.67	170.63	1127.95	169.45	1131.23	168.44	1134.5	167.01
1135.36	166.48	1137.78	164.99	1141.06	163.66	1144.34	162.17	1160	159.1
1193.53	162.15	1196.8	162.66	1200.08	163.06	1203.36	163.31	1206.64	163.39
1209.92	163.79	1213.2	164.6	1215.54	165.47	1219.76	166.8	1223.04	167.62
1226.31	168.13	1229.59	168.3	1236.15	169.2	1239.43	169.79	1242.71	170.94
1245.99	171.96	1249.27	172.85	1252.55	173.02	1259.1	172.98	1262.38	172.89
1265.66	172.56	1272.22	172.18	1275.5	172.06	1285.34	171.99	1288.61	171.92
1291.89	171.95	1301.73	171.78	1308.29	171.7	1314.85	171.74	1321.4	171.66
1324.68	171.66	1334.52	171.52	1341.08	171.56	1344.36	171.49	1350.91	171.52
1357.47	171.38	1377.15	171.25	1380.42	171.17	1386.98	171.16	1393.54	171.04
1400.1	171.05	1403.38	170.98	1416.49	170.91	1419.77	170.94	1426.33	170.91

1442.72	170.89	1455.84	170.76	1462.4	170.74	1468.96	170.77	1485.35	170.66
1488.63	170.71	1498.47	170.6	1505.02	170.7	1511.58	170.62	1518.14	170.59
1521.42	170.53	1527.98	170.64	1547.65	170.55	1554.21	170.4	1557.49	170.48
1564.05	170.47	1567.32	170.51	1573.88	170.51	1577.16	170.58	1583.72	170.49
1587	170.53	1596.83	170.56	1603.39	170.51	1606.67	170.55	1616.51	170.52
1619.79	170.58	1623.07	170.53	1632.9	170.55	1636.18	170.41	1642.74	170.36
1646.02	170.44	1652.58	170.45	1665.69	170.41	1668.97	170.34	1675.53	170.35
1685.37	170.46	1691.92	170.42	1695.2	170.46	1701.76	170.4	1718.16	170.4
1724.72	170.5	1731.28	170.37	1737.83	170.45	1747.67	170.43	1754.23	170.58
1757.51	170.59	1773.91	170.72	1777.19	170.83	1783.74	170.81	1793.58	170.9
1800.14	170.85	1803.42	170.88	1813.26	170.87	1823.1	170.89	1829.66	170.83
1832.93	170.87	1836.21	170.82	1842.77	170.85	1849.33	170.78	1855.89	170.78
1859.17	170.74	1865.73	170.77	1875.57	170.76	1878.84	170.7	1885.4	170.74
1891.96	170.72	1895.24	170.78	1911.64	170.73	1918.2	170.79	1921.48	170.74
1924.75	170.8	1934.59	170.9	1941.15	170.87	1944.43	171.02	1947.71	171.02
1950.99	171.2	1957.55	171.15	1967.39	171.25	1973.94	171.17	1977.22	171.17
1980.5	171.27	1983.78	171.27	1987.06	171.13	1990.34	171.09	1993.62	171.13
2000.18	171.04	2006.74	171.3	2013.3	171.05	2019.85	170.98	2023.13	171
2026.41	170.93	2036.25	170.82	2042.81	170.28	2046.09	169.92	2049.37	169.45
2052.65	169.25	2055.93	169.42	2059.21	169.74	2062.49	169.97	2065.77	170.06
2078.88	170.56	2085.44	170.99	2088.72	170.98	2092	170.84	2095.28	170.81
2101.84	170.83	2105.12	170.9	2111.68	170.73	2114.96	170.52	2118.23	170.47
2131.35	170.53	2144.47	170.27	2147.75	170.29	2151.03	170.39	2160.87	170.53
2167.42	170.46	2170.7	170.52	2180.54	170.39	2187.1	170.26	2196.94	170.27
2200.22	170.23	2206.78	170.3	2213.34	170.27	2219.89	170.29	2226.45	170.36
2229.73	170.46	2236.29	170.53	2242.85	170.56	2249.41	170.38	2255.97	170.29
2265.8	170.32	2269.08	170.25	2275.64	170.3	2282.2	170.19	2285.48	170.23
2295.32	170.2	2298.6	170.25	2311.72	170.25	2324.83	170.49	2331.39	170.56
2337.95	170.82	2341.23	170.88	2347.79	170.91	2354.35	171.02	2360.91	171.26
2364.19	171.17	2370.74	171.32	2377.3	171.3	2383.86	171.5	2387.14	171.55
2390.42	171.51	2393.7	171.63	2400.26	171.67	2406.82	171.57	2416.65	171.58
2419.93	171.48	2429.77	171.44	2436.33	171.27	2442.89	171.38	2446.17	171.37
2452.73	171.54	2462.57	171.56	2472.4	171.41	2475.68	171.57	2482.24	171.59
2488.8	171.46	2498.64	171.54	2508.48	171.69	2511.76	171.65	2515.03	171.71
2528.15	171.67	2537.99	171.94	2541.27	171.99	2547.83	171.99	2551.11	172.05
2557.67	172.09	2560.95	172.01	2564.22	172.02	2570.78	172.15	2577.34	172.05
2583.9	171.86	2590.46	171.87	2597.02	172.03	2600.3	172.01	2606.86	172.1
2613.42	172.14	2623.25	172.12	2626.53	172.22	2636.37	172.31	2639.65	172.38
2642.93	172.33	2649.49	172.38	2659.33	172.41	2665.88	172.51	2682.28	172.42
2685.56	172.43	2692.12	172.32	2695.4	172.32	2701.96	172.52	2708.52	172.43
2711.8	172.47	2715.07	172.6	2721.63	172.72	2728.19	172.7	2734.75	172.89
2741.31	172.85	2744.59	173.06	2747.87	173.13	2751.15	172.87	2754.43	172.46
2757.71	172.28	2767.54	172.64	2770.82	172.89	2774.1	173.33	2780.66	173.95
2787.22	174.24	2790.5	174.21	2800.34	174.49	2803.62	174.51	2806.9	174.71
2813.45	174.85	2820.01	174.95	2833.13	175.28	2839.69	175.52	2846.25	175.87
2852.81	176.05	2859.37	176.37	2865.92	176.87	2872.48	177.19	2879.04	177.59
2885.6	178.05	2892.16	178.64	2895.44	179.03	2908.56	180.23	2915.11	180.73
2921.67	180.98	2924.95	181.17	2931.51	181.35	2941.35	181.53	2947.91	181.84
2954.47	182.25	2967.58	182.58	2974.14	182.71	2980.7	182.92	2987.26	183.23
2993.82	183.65	3003.66	184.02	3006.94	184.29	3010.22	184.48	3016.77	184.74

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1135.36	.045	1215.54	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1135.36	1215.54	600	1120	600	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	950	185	F
3015	3016.77	185	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
361.15	664.36	180.04

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	179.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.38	Reach Len. (ft)	600.00	1120.00	600.00
Crit W.S. (ft)	173.46	Flow Area (sq ft)	242.21	1409.02	13409.48
E.G. Slope (ft/ft)	0.000252	Area (sq ft)	465.62	1409.02	13409.48
Q Total (cfs)	17700.00	Flow (cfs)	180.64	4917.29	12602.06
Top Width (ft)	1987.32	Top Width (ft)	223.46	80.18	1683.68
Vel Total (ft/s)	1.18	Avg. Vel. (ft/s)	0.75	3.49	0.94
Max Chl Dpth (ft)	20.28	Hydr. Depth (ft)	6.01	17.57	7.96
Conv. Total (cfs)	1115423.0	Conv. (cfs)	11383.7	309879.3	794160.1
Length Wtd. (ft)	758.12	Wetted Per. (ft)	43.06	81.97	1685.24
Min Ch El (ft)	159.10	Shear (lb/sq ft)	0.09	0.27	0.13
Alpha	2.91	Stream Power (lb/ft s)	0.07	0.94	0.12
Frctn Loss (ft)	0.21	Cum Volume (acre-ft)	1347.95	434.70	1733.45
C & E Loss (ft)	0.00	Cum SA (acres)	235.38	22.59	161.73

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	180.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.96	Reach Len. (ft)	600.00	1120.00	600.00
Crit W.S. (ft)	173.38	Flow Area (sq ft)	227.57	1455.53	11717.72
E.G. Slope (ft/ft)	0.000260	Area (sq ft)	227.57	1455.53	11717.72
Q Total (cfs)	17700.00	Flow (cfs)	200.31	5273.72	12225.97
Top Width (ft)	1385.00	Top Width (ft)	25.36	80.18	1279.46

* Vel Total (ft/s)	* 1.32	* Avg. Vel. (ft/s)	* 0.88	* 3.62	* 1.04	*
* Max Chl Dpth (ft)	* 20.86	* Hydr. Depth (ft)	* 8.97	* 18.15	* 9.16	*
* Conv. Total (cfs)	*1097886.0	* Conv. (cfs)	* 12424.7	*327115.3	*758345.4	*
* Length Wtd. (ft)	* 769.18	* Wetted Per. (ft)	* 32.31	* 81.97	* 1289.14	*
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.11	* 0.29	* 0.15	*
* Alpha	* 2.68	* Stream Power (lb/ft s)	* 0.10	* 1.04	* 0.15	*
* Frctn Loss (ft)	* 0.22	* Cum Volume (acre-ft)	* 372.26	* 446.67	* 1066.49	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 35.55	* 22.29	* 66.32	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 175.70	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.07	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 175.62	* Reach Len. (ft)	* 600.00	* 1120.00	* 600.00	*
* Crit W.S. (ft)	* 169.10	* Flow Area (sq ft)	* 120.20	* 1108.09	* 7180.79	*
* E.G. Slope (ft/ft)	*0.000309	* Area (sq ft)	* 120.20	* 1108.09	* 7180.79	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 79.77	* 3651.83	* 5048.40	*
* Top Width (ft)	* 1734.11	* Top Width (ft)	* 27.85	* 80.18	* 1626.07	*
* Vel Total (ft/s)	* 1.04	* Avg. Vel. (ft/s)	* 0.66	* 3.30	* 0.70	*
* Max Chl Dpth (ft)	* 16.52	* Hydr. Depth (ft)	* 4.32	* 13.82	* 4.42	*
* Conv. Total (cfs)	*499202.4	* Conv. (cfs)	* 4535.5	*207631.0	*287035.8	*
* Length Wtd. (ft)	* 823.36	* Wetted Per. (ft)	* 29.70	* 81.97	* 1627.49	*
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.08	* 0.26	* 0.09	*
* Alpha	* 4.41	* Stream Power (lb/ft s)	* 0.05	* 0.86	* 0.06	*
* Frctn Loss (ft)	* 0.26	* Cum Volume (acre-ft)	* 599.33	* 326.38	* 819.77	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 100.88	* 22.71	* 145.18	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 178.35	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.07	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 178.28	* Reach Len. (ft)	* 600.00	* 1120.00	* 600.00 *
* Crit W.S. (ft)	* 172.88	* Flow Area (sq ft)	* 200.90	* 1321.46	*11576.90 *
* E.G. Slope (ft/ft)	*0.000271	* Area (sq ft)	* 279.66	* 1321.46	*11576.90 *
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 149.12	* 4580.35	*10270.54 *
* Top Width (ft)	* 1891.97	* Top Width (ft)	* 139.13	* 80.18	* 1672.66 *
* Vel Total (ft/s)	* 1.15	* Avg. Vel. (ft/s)	* 0.74	* 3.47	* 0.89 *
* Max Chl Dpth (ft)	* 19.18	* Hydr. Depth (ft)	* 5.69	* 16.48	* 6.92 *
* Conv. Total (cfs)	*911903.9	* Conv. (cfs)	* 9065.3	*278455.7	*624383.0 *
* Length Wtd. (ft)	* 772.12	* Wetted Per. (ft)	* 37.97	* 81.97	* 1674.16 *
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.09	* 0.27	* 0.12 *
* Alpha	* 3.21	* Stream Power (lb/ft s)	* 0.07	* 0.94	* 0.10 *
* Frctn Loss (ft)	* 0.23	* Cum Volume (acre-ft)	* 1037.61	* 401.46	* 1449.91 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 193.32	* 22.59	* 157.81 *

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

* E.G. Elev (ft)	* 182.56	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.06	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 182.50	* Reach Len. (ft)	* 600.00	* 1120.00	* 600.00 *
* Crit W.S. (ft)	* 174.27	* Flow Area (sq ft)	* 614.50	* 1659.37	*18748.48 *
* E.G. Slope (ft/ft)	*0.000208	* Area (sq ft)	* 2797.06	* 1659.37	*18748.48 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 290.03	* 5873.63	*19536.34 *
* Top Width (ft)	* 2964.32	* Top Width (ft)	* 1135.36	* 80.18	* 1748.78 *
* Vel Total (ft/s)	* 1.22	* Avg. Vel. (ft/s)	* 0.47	* 3.54	* 1.04 *
* Max Chl Dpth (ft)	* 23.40	* Hydr. Depth (ft)	* 3.32	* 20.70	* 10.72 *
* Conv. Total (cfs)	*1780729.0	* Conv. (cfs)	* 20096.0	*406978.3	*1353655.0 *

* Length Wtd. (ft)	* 731.65	* Wetted Per. (ft)	* 188.20	* 81.97	* 1750.44 *
* Min Ch El (ft)	* 159.10	* Shear (lb/sq ft)	* 0.04	* 0.26	* 0.14 *
* Alpha	* 2.47	* Stream Power (lb/ft s)	* 0.02	* 0.93	* 0.15 *
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 2531.57	* 522.15	* 2507.18 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 438.82	* 23.82	* 193.90 *

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 300

INPUT
Description: XS 300
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE (5/21/01)
Station Elevation Data num= 435

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	181.3	9.84	181.29	22.95	180.94	29.51	180.64	32.79	180.6
49.18	180.55	55.74	180.2	59.01	180.11	68.85	180	78.69	179.94
91.8	179.47	98.36	179.57	104.91	179.39	108.19	179.57	124.58	179.27
131.14	179.26	137.7	179.13	147.53	178.8	160.65	178.8	173.76	178.62
183.6	178.29	186.88	178.29	190.16	178.13	196.71	178.14	203.27	177.96
209.83	177.63	222.94	177.54	226.22	177.28	229.5	177.18	236.06	177.22
242.61	177.03	252.45	176.86	259.01	176.41	265.56	176.27	268.84	176.11
275.4	175.94	281.96	175.86	285.23	175.68	288.51	174.8	291.79	174.26
295.07	174.27	298.35	173.96	304.91	173.95	311.46	174.46	314.74	174.55
318.02	174.8	321.3	174.79	324.58	175.02	331.13	175.01	344.25	175.26
350.8	175.15	357.36	175.33	363.92	175.35	370.48	175.46	373.75	175.44
380.31	175.21	393.43	175.53	399.98	175.75	406.54	175.68	419.65	175.71
422.93	175.54	426.21	175.69	432.77	175.79	436.05	175.72	439.33	175.81
445.88	175.8	455.72	175.9	459	175.79	472.11	176.04	478.67	175.87
485.22	176.12	488.5	176.33	495.06	176.57	504.9	176.69	508.17	176.59
514.73	176.56	521.29	176.69	527.85	176.65	540.96	176.82	544.24	176.79
547.52	176.93	554.07	176.91	560.63	177.23	570.47	177.38	577.02	177.55
580.3	177.41	586.86	177.63	599.97	177.83	609.81	178.12	616.37	178.46
629.48	178.95	632.76	179.15	639.32	179.31	649.15	179.4	658.99	179.58
668.82	179.62	675.38	179.71	688.5	179.78	698.33	179.9	701.61	179.89
711.45	180.05	721.28	180.05	727.84	180.17	737.67	180.19	747.38	180.23
760.62	180.07	773.74	180.06	786.85	179.85	793.41	179.85	803.24	179.73
819.64	179.74	826.19	179.49	839.31	179.28	852.42	178.89	855.7	178.7
858.98	178.71	865.54	178.2	872.09	178.03	878.65	177.73	895.04	177.12
901.6	177.05	914.72	176.83	931.11	176.46	937.67	176.39	950.78	176.1
957.34	175.83	963.89	175.79	970.45	175.63	977.01	175.87	980.29	175.84
986.84	176.23	990.12	176.21	996.68	176.44	1003.24	176.5	1006.51	176.61
1013.07	176.69	1016.35	176.91	1026.19	177.12	1036.02	177.2	1049.14	177.51
1062.25	177.57	1075.37	178.17	1081.94	178.4	1098.34	179.13	1104.9	179.32
1111.46	179.61	1121.3	179.81	1127.86	180.09	1131.14	180.07	1137.7	180.2
1150.83	180.3	1167.23	179.98	1173.79	179.99	1183.63	179.85	1193.47	179.62
1203.31	179.59	1209.88	179.49	1229.56	179.28	1232.84	179.32	1242.68	179.13

Proposed - No-Rise

1245.96	178.99	1262.36	179.02	1268.93	178.93	1282.05	178.67
1291.89	178.77	1295.17	178.71	1305.01	178.76	1331.26	179.12
1344.38	179.22	1350.94	179.55	1357.5	180.57	1360.78	180.09
1364.06	179.92	1380.46	180.12	1423.11	180.58	1432.95	180.45
1439.51	180.61	1449.35	180.64	1459.2	180.95	1465.76	180.94
1478.88	181.08	1485.44	181.29	1492	181.34	1498.56	181.48
1500.158	180.817	1520.431	180.597	1540.703	180.617	1560.976	180.637
1581.248	180.597	1601.521	180.557	1621.793	180.517	1642.065	180.477
1662.338	180.447	1682.61	180.427	1702.883	180.407	1723.155	180.397
1743.427	180.377	1763.7	180.357	1783.972	180.337	1804.245	180.367
1824.517	180.407	1844.79	180.447	1865.062	180.487	1885.334	180.527
1905.607	180.537	1925.879	180.537	1946.152	180.537	1966.424	180.547
1986.696	180.547	2006.969	180.547	2027.241	180.547	2047.514	180.547
2067.786	180.537	2088.058	180.517	2108.331	180.527	2128.603	180.477
2148.876	180.407	2169.148	180.327	2189.42	180.157	2209.693	179.967
2229.965	179.947	2250.238	179.957	2268.15	177.06	2271.42	177.15
2277.96	177.06	2291.04	177.28	2304.12	177.16	2307.4	177.22
2317.21	177.13	2327.02	177.3	2333.56	177.27	2340.1	177.09
2346.65	177.3	2356.46	177.27	2366.27	177.36	2379.35	177.39
2385.9	177.15	2395.71	177.38	2398.98	177.6	2405.52	177.51
2408.79	177.61	2415.33	177.51	2421.88	177.53	2425.15	177.63
2428.42	177.49	2431.69	177.1	2434.96	176.91	2441.5	177.2
2444.77	177.2	2448.04	177.01	2454.58	176.48	2457.85	176.4
2464.4	175.8	2467.67	175.62	2474.21	174.96	2484.02	174.3
2493.83	173.12	2500.38	171.96	2504.81	171.32	2516.73	170.05
2520	168.27	2526.54	163.64	2529.81	161.99	2533.08	161.45
2563	158.7	2595.23	162.76	2598.5	163.53	2605.04	167.81
2608.31	169.47	2611.58	170.29	2618.13	170.41	2624.67	170.23
2627.94	170.39	2634.48	171.3	2637.75	171.43	2641.02	171.37
2647.56	171.02	2654.11	170.96	2660.65	170.77	2673.73	170.64
2686.81	170.31	2699.9	170.24	2706.44	170.05	2716.25	169.93
2722.79	169.92	2729.34	169.68	2735.88	169.63	2745.7	169.41
2755.53	169.34	2775.21	168.86	2781.76	168.87	2794.88	168.74
2798.16	168.77	2811.27	168.63	2821.11	168.72	2837.5	168.36
2840.78	168.42	2847.33	168.21	2853.89	168.58	2860.45	168.78
2870.28	168.75	2880.12	168.62	2883.4	168.68	2893.24	168.59
2899.79	168.64	2909.63	168.84	2919.46	168.93	2932.58	168.88
2939.14	168.98	2958.81	169.17	2962.09	169.13	2978.48	169.2
2991.59	169.15	3004.71	169.17	3011.26	169.3	3017.82	169.3
3024.38	169.22	3030.94	169.39	3040.77	169.4	3044.05	169.46
3070.28	169.29	3073.56	169.2	3096.51	169.19	3103.07	169.01
3106.34	169.04	3122.74	168.82	3129.29	168.77	3135.85	168.8
3145.69	168.73	3155.52	168.78	3162.08	168.88	3191.59	168.94
3198.15	169.01	3207.98	169.01	3217.82	169.14	3227.65	169.01
3237.49	169.01	3250.6	169.13	3263.72	169.2	3276.83	169.31
3280.11	169.26	3286.67	169.33	3289.95	169.23	3296.5	169.2
3303.06	169.27	3319.45	169.3	3332.57	169.37	3352.24	169.55
3362.07	169.58	3375.19	169.77	3385.03	169.82	3394.86	169.97
3398.14	169.92	3414.53	170.05	3434.2	170.15	3450.6	170.12
3453.88	170.2	3460.43	170.1	3493.22	170.41	3503.05	170.3
3506.33	170.38	3516.17	170.86	3526	171.24	3535.84	171.4
3542.4	171.99	3548.96	172.41	3552.23	172.54	3558.79	172.55
3565.35	172.27	3571.91	171.57	3575.18	171.41	3578.46	171.39
3588.3	171.98	3601.41	173.07	3604.69	173.11	3607.97	172.99
3611.25	173.16	3624.36	173.52	3630.92	173.52	3637.48	173.68
3640.76	173.59	3650.59	173.96	3660.43	174.09	3666.98	174.27
3670.26	174.23	3673.54	174.42	3676.82	174.39	3686.66	174.75
3696.49	175.04	3703.05	175.31	3709.61	175.39	3712.89	175.52
3726	175.84	3732.56	175.8	3739.11	175.97	3745.67	175.8
3755.51	176.07	3762.06	176.81	3765.34	176.89	3768.62	176.69
3775.18	175.89	3778.46	175.62	3781.74	175.79	3788.29	176.34
3794.85	176.34	3798.13	176.61	3804.69	176.8	3807.96	176.97
3814.52	177.08	3817.8	177.01	3824.36	177.24	3830.91	177.57
3840.75	177.37	3850.59	177.62	3857.14	177.7	3863.7	177.94
3870.26	178.34	3880.09	178.77	3883.37	178.82	3893.21	179.28
3899.77	179.66	3906.32	179.92	3929.27	181.24	3939.11	181.5
3952.22	182.11	3958.78	182.21	3968.62	182.73	3981.73	183.27
3991.57	183.88	3994.84	183.99	4004.68	184.55	4014.52	185.27
4024.35	185.75	4030.91	186.24	4034.19	186.35		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	2520	.045	2605.04	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
2520	2605.04	1000	1840	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
	02148.876	185	F
3643	4034.19	185	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
737.32	1355.9	180.14

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	179.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.13	Reach Len. (ft)	1000.00	1840.00	1840.00
Crit W.S. (ft)	172.30	Flow Area (sq ft)	733.34	1499.81	9707.15
E.G. Slope (ft/ft)	0.000321	Area (sq ft)	1981.38	1499.81	10421.41
Q Total (cfs)	17700.00	Flow (cfs)	384.22	5847.31	11468.47
Top Width (ft)	2129.30	Top Width (ft)	759.32	85.04	1284.94
Vel Total (ft/s)	1.48	Avg. Vel. (ft/s)	0.52	3.90	1.18
Max Chl Dpth (ft)	20.43	Hydr. Depth (ft)	2.77	17.64	9.35
Conv. Total (cfs)	987622.4	Conv. (cfs)	21438.9	326267.2	639916.3
Length Wtd. (ft)	1704.74	Wetted Per. (ft)	265.73	88.70	1038.81
Min Ch El (ft)	158.70	Shear (lb/sq ft)	0.06	0.34	0.19
Alpha	2.70	Stream Power (lb/ft s)	0.03	1.32	0.22
Frctn Loss (ft)	0.76	Cum Volume (acre-ft)	1331.09	397.31	1569.33
C & E Loss (ft)	0.02	Cum SA (acres)	228.61	20.46	141.29

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	179.80	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.70	Reach Len. (ft)	1000.00	1840.00	1840.00
Crit W.S. (ft)	172.28	Flow Area (sq ft)	626.96	1548.09	8680.58

* E.G. Slope (ft/ft)	*0.000329	* Area (sq ft)	* 626.96	* 1548.09	* 8680.58	*
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 419.82	* 6243.48	*11036.70	*
* Top Width (ft)	* 1080.00	* Top Width (ft)	* 157.00	* 85.04	* 837.96	*
* Vel Total (ft/s)	* 1.63	* Avg. Vel. (ft/s)	* 0.67	* 4.03	* 1.27	*
* Max Chl Dpth (ft)	* 21.00	* Hydr. Depth (ft)	* 3.99	* 18.20	* 10.36	*
* Conv. Total (cfs)	*975105.1	* Conv. (cfs)	* 23128.3	*343957.6	*608019.3	*
* Length Wtd. (ft)	* 1702.34	* Wetted Per. (ft)	* 160.28	* 88.70	* 848.18	*
* Min Ch El (ft)	* 158.70	* Shear (lb/sq ft)	* 0.08	* 0.36	* 0.21	*
* Alpha	* 2.54	* Stream Power (lb/ft s)	* 0.05	* 1.45	* 0.27	*
* Frctn Loss (ft)	* 0.79	* Cum Volume (acre-ft)	* 366.38	* 408.06	* 926.00	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 34.29	* 20.17	* 51.74	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 175.44	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.08	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 175.36	* Reach Len. (ft)	* 1000.00	* 1840.00	* 1840.00	*
* Crit W.S. (ft)	* 168.44	* Flow Area (sq ft)	* 134.98	* 1179.12	* 5792.87	*
* E.G. Slope (ft/ft)	*0.000317	* Area (sq ft)	* 178.88	* 1179.12	* 5849.14	*
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 68.78	* 3890.92	* 4820.30	*
* Top Width (ft)	* 1324.93	* Top Width (ft)	* 137.96	* 85.04	* 1101.93	*
* Vel Total (ft/s)	* 1.24	* Avg. Vel. (ft/s)	* 0.51	* 3.30	* 0.83	*
* Max Chl Dpth (ft)	* 16.66	* Hydr. Depth (ft)	* 2.71	* 13.87	* 5.58	*
* Conv. Total (cfs)	*493039.0	* Conv. (cfs)	* 3862.3	*218494.0	*270682.7	*
* Length Wtd. (ft)	* 1771.32	* Wetted Per. (ft)	* 50.51	* 88.70	* 1038.81	*
* Min Ch El (ft)	* 158.70	* Shear (lb/sq ft)	* 0.05	* 0.26	* 0.11	*
* Alpha	* 3.41	* Stream Power (lb/ft s)	* 0.03	* 0.87	* 0.09	*
* Frctn Loss (ft)	* 0.76	* Cum Volume (acre-ft)	* 597.27	* 296.97	* 730.03	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 99.74	* 20.59	*	

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 126.39  *
**********************************************************************************
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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  178.12  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  178.02  * Reach Len. (ft)       * 1000.00  * 1840.00  *
1840.00  *
* Crit W.S. (ft)         *  171.87  * Flow Area (sq ft)     *  444.55  * 1405.80  *
8559.66  *
* E.G. Slope (ft/ft)     *0.000334  * Area (sq ft)          * 1194.66  * 1405.80  *
9015.74  *
* Q Total (cfs)          *15000.00  * Flow (cfs)            *  173.04  * 5349.75  *
9477.21  *
* Top Width (ft)         * 2008.45  * Top Width (ft)        *  663.38  *   85.04  *
1260.03  *
* Vel Total (ft/s)       *    1.44  * Avg. Vel. (ft/s)      *    0.39  *    3.81  *
   1.11  *
* Max Chl Dpth (ft)      *   19.32  * Hydr. Depth (ft)      *    1.72  *   16.53  *
   8.25  *
* Conv. Total (cfs)      *821250.1  * Conv. (cfs)           *  9474.2  *292898.7
*518877.3  *
* Length Wtd. (ft)       * 1725.83  * Wetted Per. (ft)      *  258.81  *   88.70  *
1038.81  *
* Min Ch El (ft)         *  158.70  * Shear (lb/sq ft)      *    0.04  *    0.33  *
   0.17  *
* Alpha                  *    2.86  * Stream Power (lb/ft s) *    0.01  *    1.26  *
   0.19  *
* Frctn Loss (ft)        *    0.80  * Cum Volume (acre-ft)  * 1027.46  *  366.39  *
1308.08  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)        *  187.80  *   20.46  *
 137.61  *
**********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  182.38  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.09  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  182.29  * Reach Len. (ft)       * 1000.00  * 1840.00  *
1840.00  *
```

* Crit W.S. (ft)	* 173.33	* Flow Area (sq ft)	* 1804.00	* 1768.56	*12987.32 *
* E.G. Slope (ft/ft)	*0.000276	* Area (sq ft)	* 7911.26	* 1768.56	*14582.44 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 1276.28	* 7139.76	*17283.96 *
* Top Width (ft)	* 3960.28	* Top Width (ft)	* 2520.00	* 85.04	* 1355.24 *
* Vel Total (ft/s)	* 1.55	* Avg. Vel. (ft/s)	* 0.71	* 4.04	* 1.33 *
* Max Chl Dpth (ft)	* 23.59	* Hydr. Depth (ft)	* 4.86	* 20.80	* 12.51 *
* Conv. Total (cfs)	*1545705.0	* Conv. (cfs)	* 76760.7	*429415.0	*1039529.0 *
* Length Wtd. (ft)	* 1667.17	* Wetted Per. (ft)	* 372.28	* 88.70	* 1038.81 *
* Min Ch El (ft)	* 158.70	* Shear (lb/sq ft)	* 0.08	* 0.34	* 0.22 *
* Alpha	* 2.38	* Stream Power (lb/ft s)	* 0.06	* 1.39	* 0.29 *
* Frctn Loss (ft)	* 0.65	* Cum Volume (acre-ft)	* 2457.82	* 478.08	* 2277.63 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 413.64	* 21.69	* 172.53 *

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Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 285

INPUT
Description: XS 285
INSERTED CROSS-SECTION TO EVALUATE IMPACT OF PROP. SITE
(5/21/01)
Station Elevation Data num= 408

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	181.45	13.12	181.21	16.4	181.28	32.8	180.96	36.08	180.75
42.64	180.53	52.48	180.55	59.04	180.47	65.6	180.13	72.16	179.95
75.44	180.04	82	180.01	91.84	179.61	98.4	179.46	101.68	179.47
108.24	179.63	118.08	179.65	121.36	179.51	131.2	179.37	144.32	179.01
154.16	178.78	157.44	178.87	167.28	178.8	170.56	178.88	180.4	178.63
183.68	178.68	196.8	178.4	203.37	177.99	213.21	178.08	216.49	177.92
226.33	177.75	232.89	177.57	249.29	177.25	272.25	176.61	275.53	176.61
285.37	176.36	291.93	175.97	298.49	175.45	311.61	175.23	318.17	174.77
324.73	174.64	328.01	174.43	331.29	173.98	334.57	173.73	341.13	173.92
347.69	174.48	354.25	174.69	357.53	174.87	364.09	174.82	367.37	174.87
370.65	175.09	373.93	175.15	380.49	175.08	387.05	175.24	390.33	175.2
396.89	175.3	403.45	175.28	410.01	175.48	423.13	175.32	429.69	175.5
432.97	175.47	436.25	175.6	442.81	175.7	455.93	175.76	462.49	175.49
469.05	175.53	472.33	175.64	485.45	175.72	492.01	175.56	498.57	175.49
508.41	175.81	511.69	175.87	518.25	175.78	524.81	175.81	534.65	176.06

541.21	176.18	547.77	176.14	554.33	176.52	564.17	176.56	567.45	176.49
574.01	176.73	587.13	176.95	593.69	176.84	603.54	176.84	610.1	176.77
616.66	177.12	623.22	177.24	629.78	177.17	639.62	177.42	646.18	177.44
656.02	177.55	678.98	178.38	688.82	178.41	705.22	178.91	711.78	179.28
721.62	179.55	731.46	179.66	757.7	179.91	764.26	179.91	770.82	179.99
780.66	180.01	787.22	180.11	793.78	180.09	800.34	180.17	806.9	180.18
820.02	180.08	826.58	180.13	836.42	179.99	842.98	180.03	852.82	179.86
859.38	179.82	869.22	179.83	875.78	179.75	888.9	179.7	902.02	179.47
908.58	179.3	918.42	179.23	924.98	178.9	934.82	178.47	941.38	178.31
947.94	178.02	954.5	177.87	964.34	177.57	967.62	177.35	970.9	177.26
977.46	177.25	980.74	177.13	987.31	177.01	993.87	176.98	1006.99	176.79
1013.55	176.8	1023.39	176.66	1029.95	176.48	1036.51	176.42	1046.35	176.19
1052.91	176.38	1062.75	176.49	1066.03	176.57	1072.59	176.94	1075.87	177.06
1088.99	177.16	1098.83	177.32	1105.39	177.3	1111.95	177.36	1118.51	177.59
1128.35	177.61	1148.03	177.88	1151.31	177.88	1157.87	178.09	1167.71	178.26
1170.99	178.23	1184.11	178.31	1200.51	178.45	1210.35	178.83	1216.91	178.97
1226.75	179.28	1239.86	179.91	1243.13	180.15	1249.69	180.34	1256.24	180.44
1259.52	180.37	1266.07	180.38	1279.18	180.33	1295.57	180.1	1302.12	180.17
1308.67	179.96	1315.23	179.85	1321.78	179.47	1328.33	179.01	1334.89	178.1
1338.17	177.94	1344.72	177.81	1348	177.84	1354.55	178.02	1361.1	178.37
1367.66	178.63	1374.21	178.78	1393.87	179.34	1397.15	179.36	1416.81	179.72
1429.92	179.99	1436.47	180.06	1456.13	180.14	1469.24	180.38	1472.52	180.33
1475.8	180.48	1488.9	180.54	1495.46	180.65	1502.01	180.68	1518.4	180.91
1521.67	180.89	1538.06	181.12	1541.33	181.08	1547.89	181.18	1559.91	181.38
1573.19	181.41	1582.64	181.35	1584.607	180.817	1602.021	180.787	1619.434	180.747
1636.847	180.717	1654.26	180.697	1671.674	180.677	1689.087	180.657	1706.5	180.637
1723.913	180.607	1741.327	180.577	1758.74	180.587	1776.153	180.587	1793.566	180.587
1810.98	180.597	1828.393	180.597	1845.806	180.617	1863.219	180.647	1880.633	180.687
1898.046	180.717	1915.459	180.747	1932.873	180.787	1950.286	180.817	1967.699	180.827
1985.112	180.827	2002.526	180.827	2019.939	180.827	2037.352	180.827	2054.765	180.827
2072.179	180.827	2089.592	180.827	2107.005	180.827	2124.418	180.827	2141.832	180.827
2159.245	180.827	2176.658	180.827	2194.072	180.827	2211.485	180.827	2228.898	180.827
2246.311	180.827	2263.725	180.827	2281.138	180.827	2298.551	180.727	2315.964	180.527
2333.378	180.317	2350.791	180.117	2368.204	179.907	2385.617	179.707	2403.031	179.497
2420.444	179.117	2437.857	179.327	2455.271	178.327	2459.03	177.1	2468.86	176.52
2475.42	176.46	2478.69	176.21	2481.97	176.21	2488.53	176.07	2501.64	175.52
2508.2	175.16	2511.47	174.88	2514.75	174.72	2518.03	174.77	2531.14	174.4
2534.42	174.35	2540.98	174.11	2547.53	174.09	2577.04	173.41	2586.87	173.1
2590.15	173.08	2599.98	173.19	2606.54	172.9	2616.37	172.8	2622.93	172.94
2636.04	172.88	2639.32	172.91	2642.6	173.09	2649.15	173.17	2655.71	173.12
2658.99	173.33	2662.26	173.39	2672.1	173.45	2675.38	173.69	2678.66	173.79
2681.93	173.7	2685.21	173.83	2691.77	174.23	2695.05	174.21	2704.88	173.81
2711.44	173.8	2717.99	174.02	2721.27	174.07	2724.55	173.92	2731.1	173.76
2737.66	173.93	2740.94	173.71	2750.77	173.49	2754.05	173.35	2760.61	172.9
2763.88	172.55	2767.16	172.38	2777	171.59	2780.27	171.38	2790.11	171.06
2799.94	170.47	2803.22	170.18	2806.5	170.11	2809.78	170.26	2816.33	170.31
2819.61	170.21	2829.45	170.32	2839.28	170.19	2845.84	169.9	2849.11	169.87
2862.23	170.15	2868.78	170.35	2875.34	170.06	2878.62	170.04	2895.01	169.68
2901.56	169.83	2908.12	169.72	2914.67	169.36	2917.95	169.26	2931.06	169.46
2937.62	169.37	2944.18	169.17	2950.73	169.21	2954.01	169.02	2957.29	168.61
2963.85	168.17	2970.4	168.02	2976.96	168.05	2986.79	167.82	2993.35	167.49
2996.63	167.43	2999.9	167.54	3006.46	168.35	3013.15	169.59	3024.36	170
3030.91	170.16	3034.19	170.36	3040.74	170.25	3047.29	170.24	3057.13	169.96
3063.68	169.56	3066.96	169.14	3070.23	168.54	3073.51	167.57	3076.79	166.09
3081.19	163.4	3083.34	162.08	3086.62	160.38	3089.9	159.76	3093.17	159.71
3124	158.2	3152.16	159.65	3155.44	159.93	3156.75	161.34	3157.2	161.36
3160.48	162.66	3163.75	165.02	3167.03	166.97	3170.31	168.72	3173.58	169.3
3180.14	168.72	3186.69	168.41	3193.25	167.97	3196.52	167.97	3203.08	168.14
3209.63	167.94	3212.91	168.12	3216.18	168.49	3222.74	169.1	3226.02	169.3
3232.57	169.4	3239.12	169.19	3245.68	169.23	3258.79	168.92	3271.89	168.7
3278.45	168.84	3285	168.76	3291.56	168.81	3298.11	168.63	3304.66	168.83
3307.94	169.04	3317.77	169.15	3321.05	169.42	3327.6	170.29	3330.88	171.15
3337.43	173.98	3340.71	175.26	3343.99	176.11	3347.26	176.83	3353.82	179.01

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 3357.09  179.87 3360.37  180.61 3363.65  181.12  3370.2  181.56 3373.48  181.97
 3376.76  182.89 3380.03  183.68 3383.31  184.07 3389.86  184.53 3396.42  184.86
 3402.97  185.63 3406.25   185.9  3412.8  186.17 3422.63  186.46 3429.19  186.96
 3439.02  187.44  3455.4  188.07 3465.24  188.31

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0      .1 3076.79    .045 3167.03      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       3076.79 3167.03             220     295     320             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       02281.138     185       F
    3399 3465.24     185       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
  807.14 1460.71   180.1
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CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	178.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.32	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	178.12	Reach Len. (ft)	220.00	295.00	320.00
Crit W.S. (ft)	171.92	Flow Area (sq ft)	3891.90	1627.53	1581.99
E.G. Slope (ft/ft)	0.000733	Area (sq ft)	4814.60	1627.53	1581.99
Q Total (cfs)	17700.00	Flow (cfs)	5316.19	9732.85	2650.95
Top Width (ft)	1365.53	Top Width (ft)	1091.19	90.24	184.10
Vel Total (ft/s)	2.49	Avg. Vel. (ft/s)	1.37	5.98	1.68
Max Chl Dpth (ft)	19.92	Hydr. Depth (ft)	6.27	18.04	8.59
Conv. Total (cfs)	653684.0	Conv. (cfs)	196334.0	359446.9	97903.1
Length Wtd. (ft)	278.13	Wetted Per. (ft)	622.16	94.09	186.13
Min Ch El (ft)	158.20	Shear (lb/sq ft)	0.29	0.79	0.39
Alpha	3.32	Stream Power (lb/ft s)	0.39	4.73	0.65
Frctn Loss (ft)	0.20	Cum Volume (acre-ft)	1253.09	331.26	1315.81
C & E Loss (ft)	0.01	Cum SA (acres)	207.37	16.76	110.26

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 178.98	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.38	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 178.60	* Reach Len. (ft)	* 220.00	* 295.00	* 320.00 *
* Crit W.S. (ft)	* 171.93	* Flow Area (sq ft)	* 3282.56	* 1671.38	* 1008.04 *
* E.G. Slope (ft/ft)	*0.000782	* Area (sq ft)	* 3282.56	* 1671.38	* 1008.04 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 5381.78	*10509.98	* 1808.24 *
* Top Width (ft)	* 605.00	* Top Width (ft)	* 412.79	* 90.24	* 101.97 *
* Vel Total (ft/s)	* 2.97	* Avg. Vel. (ft/s)	* 1.64	* 6.29	* 1.79 *
* Max Chl Dpth (ft)	* 20.40	* Hydr. Depth (ft)	* 7.95	* 18.52	* 9.89 *
* Conv. Total (cfs)	*632771.6	* Conv. (cfs)	*192397.7	*375729.8	* 64644.1 *
* Length Wtd. (ft)	* 276.30	* Wetted Per. (ft)	* 419.01	* 94.09	* 112.43 *
* Min Ch El (ft)	* 158.20	* Shear (lb/sq ft)	* 0.38	* 0.87	* 0.44 *
* Alpha	* 2.79	* Stream Power (lb/ft s)	* 0.63	* 5.46	* 0.79 *
* Frctn Loss (ft)	* 0.21	* Cum Volume (acre-ft)	* 321.50	* 340.06	* 721.37 *
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 27.75	* 16.47	* 31.89 *

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 174.66	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.27	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 174.38	* Reach Len. (ft)	* 220.00	* 295.00	* 320.00 *
* Crit W.S. (ft)	* 166.72	* Flow Area (sq ft)	* 1677.03	* 1290.52	* 918.51 *
* E.G. Slope (ft/ft)	*0.000673	* Area (sq ft)	* 1684.23	* 1290.52	* 918.51 *
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 1366.96	* 6334.93	* 1078.11 *
* Top Width (ft)	* 824.26	* Top Width (ft)	* 562.59	* 90.24	* 171.43 *
* Vel Total (ft/s)	* 2.26	* Avg. Vel. (ft/s)	* 0.82	* 4.91	* 1.17 *
* Max Chl Dpth (ft)	* 16.18	* Hydr. Depth (ft)	* 3.08	* 14.30	* 5.36 *
* Conv. Total (cfs)	*338413.0	* Conv. (cfs)	* 52687.7	*244171.2	* 41554.1 *
* Length Wtd. (ft)	* 286.97	* Wetted Per. (ft)	* 545.48	* 94.09	* 172.90 *
* Min Ch El (ft)	* 158.20	* Shear (lb/sq ft)	* 0.13	* 0.58	*

```
   0.22  *
* Alpha                 *    3.46  * Stream Power (lb/ft s) *    0.11  *    2.83  *
   0.26  *
* Frctn Loss (ft)       *    0.18  * Cum Volume (acre-ft)   *  575.88  *  244.81  *
 587.10  *
* C & E Loss (ft)       *    0.01  * Cum SA (acres)         *   91.70  *   16.89  *
  99.49  *
**************************************************************************************
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Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**************************************************************************************
***********
* E.G. Elev (ft)        *  177.29  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.33  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)        *  176.96  * Reach Len. (ft)       *  220.00  *  295.00  *
 320.00  *
* Crit W.S. (ft)        *  171.13  * Flow Area (sq ft)     * 3176.02  * 1523.17  *
1371.08  *
* E.G. Slope (ft/ft)    *0.000769  * Area (sq ft)          * 3621.74  * 1523.17  *
1371.08  *
* Q Total (cfs)         *15000.00  * Flow (cfs)            * 3904.59  * 8927.44  *
2167.98  *
* Top Width (ft)        * 1240.17  * Top Width (ft)        *  969.31  *   90.24  *
 180.62  *
* Vel Total (ft/s)      *    2.47  * Avg. Vel. (ft/s)      *    1.23  *    5.86  *
   1.58  *
* Max Chl Dpth (ft)     *   18.76  * Hydr. Depth (ft)      *    5.16  *   16.88  *
   7.59  *
* Conv. Total (cfs)     *540790.1  * Conv. (cfs)           *140770.7  *321857.9  *
78161.4  *
* Length Wtd. (ft)      *  280.53  * Wetted Per. (ft)      *  616.50  *   94.09  *
 182.46  *
* Min Ch El (ft)        *  158.20  * Shear (lb/sq ft)      *    0.25  *    0.78  *
   0.36  *
* Alpha                 *    3.47  * Stream Power (lb/ft s) *    0.30  *    4.56  *
   0.57  *
* Frctn Loss (ft)       *    0.21  * Cum Volume (acre-ft)   *  972.17  *  304.53  *
1088.71  *
* C & E Loss (ft)       *    0.01  * Cum SA (acres)         *  169.06  *   16.76  *
 107.19  *
**************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
**************************************************************************************
***********
* E.G. Elev (ft)        *  181.70  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.32  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)        *  181.38  * Reach Len. (ft)       *  220.00  *  295.00  *
 320.00  *
```

* Crit W.S. (ft)	* 173.49	* Flow Area (sq ft)	* 6181.72	* 1922.13	* 2202.85 *
* E.G. Slope (ft/ft)	*0.000668	* Area (sq ft)	*10547.09	* 1922.13	* 2202.85 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 9299.07	*12254.49	* 4146.45 *
* Top Width (ft)	* 3345.95	* Top Width (ft)	* 3055.21	* 90.24	* 200.50 *
* Vel Total (ft/s)	* 2.49	* Avg. Vel. (ft/s)	* 1.50	* 6.38	* 1.88 *
* Max Chl Dpth (ft)	* 23.18	* Hydr. Depth (ft)	* 7.77	* 21.30	* 10.99 *
* Conv. Total (cfs)	*994699.8	* Conv. (cfs)	*359913.6	*474300.9	*160485.3 *
* Length Wtd. (ft)	* 274.67	* Wetted Per. (ft)	* 797.02	* 94.09	* 202.91 *
* Min Ch El (ft)	* 158.20	* Shear (lb/sq ft)	* 0.32	* 0.85	* 0.45 *
* Alpha	* 3.34	* Stream Power (lb/ft s)	* 0.49	* 5.43	* 0.85 *
* Frctn Loss (ft)	* 0.18	* Cum Volume (acre-ft)	* 2245.95	* 400.13	* 1923.12 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 349.65	* 17.99	* 139.67 *

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 280.55

INPUT
Description: XS 280.55 (LETTERED CROSS-SECTION V)
Station Elevation Data num= 382

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	181.25	6.55	181.19	9.82	181.26	16.36	181.11	22.91	181.05
29.46	180.74	36	180.59	39.27	180.65	42.55	180.51	45.82	180.52
52.36	180.39	62.18	180.27	65.46	180.15	68.73	180.17	78.55	179.82
81.82	179.91	91.64	179.52	98.18	179.62	108	179.7	121.09	179.36
124.37	179.41	130.91	179.35	134.18	179.16	140.73	179.01	144	179.03
153.82	178.75	160.37	178.87	163.64	178.76	173.46	178.74	180	178.53
183.28	178.33	189.82	178.09	196.37	178.14	202.91	177.95	209.46	177.91
219.28	177.58	225.82	177.59	232.37	177.27	238.91	177.24	245.46	176.92
252.01	176.99	255.28	176.93	261.82	176.57	268.37	176.72	274.92	176.45
281.46	176.54	288.01	176.4	294.55	175.97	297.82	175.65	301.1	175.55
304.37	175.21	307.64	175.37	317.46	175.14	320.73	174.92	333.83	174.52
340.37	174.49	343.64	174.15	346.92	174.02	350.19	174.03	353.46	173.82
356.74	173.77	360.01	173.28	369.83	174.11	373.1	174.79	382.92	174.87
392.74	174.84	399.28	174.94	402.55	174.91	415.65	175.16	425.46	175.06
432.01	175.33	435.28	175.25	445.1	175.39	448.37	175.23	458.19	175.39
461.46	175.33	471.28	175.56	481.1	175.21	494.19	175.43	504.01	175.37
513.83	175.46	523.65	175.39	530.19	175.41	536.74	175.66	540.01	175.62
546.56	175.72	553.1	175.7	556.38	175.9	562.92	175.99	569.47	175.87
576.01	176.07	589.1	176.1	595.65	176.33	612.01	176.56	615.29	176.51
625.1	176.7	634.92	176.8	641.47	176.62	644.74	176.6	654.56	177.01
661.11	177.06	667.65	177.04	670.92	177.15	677.47	177.18	680.74	177

687.29	176.89	697.11	177.04	706.92	177.72	713.47	177.83	720.02	178.03
729.83	178.46	746.2	178.83	752.74	179.13	762.56	179.27	772.38	179.53
782.2	179.63	788.74	179.6	798.56	179.69	805.11	179.82	814.93	179.86
821.47	179.98	828.02	179.91	837.84	180.12	844.38	180.12	850.93	180.24
857.47	180.1	860.75	180.21	873.84	180.29	877.11	180.27	883.66	180.02
890.2	180.2	906.56	180.19	919.66	180.06	942.57	179.98	949.11	180
955.66	179.89	962.2	179.91	968.75	179.81	975.29	179.64	981.84	179.58
988.38	179.33	1004.75	179.05	1011.29	178.71	1017.84	178.62	1027.66	178.24
1030.93	178.07	1040.75	177.83	1050.57	177.69	1057.11	177.36	1060.39	177.26
1063.66	177.33	1086.57	177.39	1096.39	177.33	1102.93	177.15	1106.21	177.23
1122.57	176.72	1125.84	176.71	1129.11	176.86	1145.48	177.2	1152.02	177.16
1155.3	177.29	1174.93	177.41	1194.57	177.65	1201.12	177.59	1214.21	177.78
1224.03	177.97	1237.12	178.06	1256.75	178.26	1263.3	178.44	1269.85	178.47
1276.39	178.67	1282.95	178.95	1286.22	178.96	1299.33	179.53	1302.61	179.51
1318.99	179.83	1328.82	180.22	1348.49	180.52	1351.76	180.52	1358.32	180.38
1364.87	180.33	1371.43	180.21	1377.98	180.22	1384.54	180.09	1397.64	179.93
1414.03	179.46	1420.58	179.16	1423.86	179.16	1430.41	179	1436.97	178.93
1450.08	179.26	1459.91	179.35	1473.02	179.98	1482.85	180.22	1489.4	180.15
1495.96	180.31	1502.51	180.3	1535.28	180.64	1538.56	180.74	1545.11	180.62
1548.39	180.78	1554.94	180.77	1568.05	180.82	1571.33	180.78	1584.44	180.85
1587.71	180.82	1594.27	180.96	1597.55	180.91	1604.1	181.02	1610.65	180.95
1613.93	181.03	1630.32	180.97	1640.15	181.04	1653.26	181.03	1659.81	181.08
1666.36	181.04	1672.92	181.14	1676.2	181.061679.428		180.8171697.106		180.807
1714.785	180.8071732.463		180.8171750.141		180.8171767.819		180.8271785.497		180.827
1803.176	180.8271820.854		180.8271838.532		180.827	1856.21	180.8271873.888		180.827
1891.566	180.8271909.245		180.8271926.923		180.8271944.601		180.8271962.279		180.827
1979.957	180.8271997.636		180.8272015.314		180.8272032.992		180.827	2050.67	180.827
2068.348	180.8272086.027		180.8272103.705		180.8272121.383		180.8272139.061		180.827
2156.739	180.8272174.417		180.8272192.096		180.8272209.774		180.8272227.452		180.827
2245.13	180.8272262.808		180.8272280.487		180.8272298.165		180.8272315.843		180.827
2333.521	180.8272351.199		180.8272368.878		180.8272386.556		180.8272404.234		180.707
2421.912	180.507	2439.59	180.6972457.269		180.8272474.947		180.8272492.625		180.827
2510.303	180.8072527.981		180.2772545.659		179.7372563.338		179.2072581.016		178.587
2598.694	178.8272616.372		178.6072634.051		175.4472651.729		172.8172669.407		172.547
2687.085	172.2672704.763		171.9972722.441		171.717	2740.12	171.4472757.798		171.177
2775.476	170.8972793.154		170.6272810.832		170.357	2828.51	170.0772846.189		169.817
2863.867	169.6772881.545		169.5372899.223		169.407	2918.21	169.71	2924.77	169.88
2931.32	169.75	2941.15	169.73	2944.43	169.6	2950.98	169.73	2954.26	169.68
2960.81	169.88	2970.64	170.26	2973.92	170.17	2980.48	170.27	2990.31	170.33
2996.86	170.43	3003.42	170.38	3013.25	170.18	3026.36	170	3032.91	170.16
3036.19	170.36	3042.74	170.25	3049.29	170.24	3059.13	169.96	3065.68	169.56
3068.96	169.14	3072.23	168.54	3075.51	167.57	3078.79	166.09	3083.19	163.4
3085.34	162.08	3088.62	160.38	3091.9	159.76	3129	158	3157.44	159.93
3160.72	162.03	3163.99	164.46	3167.11	166.99	3170.55	167.88	3173.82	168.34
3177.1	168.63	3180.38	168.68	3186.93	168.56	3196.76	167.97	3209.87	167.65
3216.43	167.34	3222.98	167.17	3232.81	167.1	3239.37	167.2	3245.92	167.47
3252.47	167.65	3259.03	168.16	3262.3	168.19	3275.41	167.89	3285.24	167.94
3291.8	168.14	3298.35	167.99	3308.18	167.23	3311.46	167.35	3314.74	167.78
3318.02	168	3324.57	168.08	3334.4	167.81	3337.68	167.86	3344.23	167.64
3357.34	167.87	3370.45	168.42	3373.73	168.78	3377	169.48	3380.28	170.46
3383.56	171.61	3386.83	173.02	3390.11	174.63	3393.39	176.04	3396.67	177.3
3403.22	179.53	3406.5	180.92	3409.77	183.21	3413.05	183.68	3419.6	184.17
3422.88	184.7	3429.44	185.29	3442.54	185.92	3449.1	186.06	3455.65	185.73
3458.93	185.72	3465.48	185.84	3468.76	185.97	3472.04	185.9	3475.32	185.98
3481.87	186.41	3488.42	186.23	3494.98	186.19	3501.53	185.89	3508.09	186.06
3511.36	185.98	3517.92	185.97						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3083.19	.045	3167.11	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
      3083.19 3167.11            1140    1140    1140             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       02492.625     185       F
    3409 3517.92     185       F
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
**********************
  922.45 1342.86180.2296
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CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 178.23	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.29	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 177.94	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 171.80	* Flow Area (sq ft)	* 3320.62	* 1534.43	* 2208.53 *
* E.G. Slope (ft/ft)	*0.000693	* Area (sq ft)	* 4349.66	* 1534.43	* 2208.53 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 4816.07	* 9021.27	* 3862.66 *
* Top Width (ft)	* 1290.37	* Top Width (ft)	* 975.02	* 83.92	* 231.43 *
* Vel Total (ft/s)	* 2.51	* Avg. Vel. (ft/s)	* 1.45	* 5.88	* 1.75 *
* Max Chl Dpth (ft)	* 19.94	* Hydr. Depth (ft)	* 7.17	* 18.28	* 9.54 *
* Conv. Total (cfs)	*672603.9	* Conv. (cfs)	*183011.8	*342810.3	*146781.9 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 464.86	* 87.19	* 233.48 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.31	* 0.76	* 0.41 *
* Alpha	* 3.00	* Stream Power (lb/ft s)	* 0.45	* 4.47	* 0.72 *
* Frctn Loss (ft)	* 1.08	* Cum Volume (acre-ft)	* 1229.94	* 320.55	* 1301.89 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 202.15	* 16.17	* 108.74 *

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 178.76	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.35	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *

* W.S. Elev (ft)	* 178.41	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 172.03	* Flow Area (sq ft)	* 3062.89	* 1574.36	* 1559.81 *
* E.G. Slope (ft/ft)	*0.000745	* Area (sq ft)	* 3062.89	* 1574.36	* 1559.81 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 5019.80	* 9767.38	* 2912.82 *
* Top Width (ft)	* 600.00	* Top Width (ft)	* 369.19	* 83.92	* 146.89 *
* Vel Total (ft/s)	* 2.86	* Avg. Vel. (ft/s)	* 1.64	* 6.20	* 1.87 *
* Max Chl Dpth (ft)	* 20.41	* Hydr. Depth (ft)	* 8.30	* 18.76	* 10.62 *
* Conv. Total (cfs)	*648408.1	* Conv. (cfs)	*183891.5	*357810.6	*106706.0 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 377.12	* 87.19	* 157.90 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.38	* 0.84	* 0.46 *
* Alpha	* 2.77	* Stream Power (lb/ft s)	* 0.62	* 5.21	* 0.86 *
* Frctn Loss (ft)	* 1.07	* Cum Volume (acre-ft)	* 305.48	* 329.07	* 711.94 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 25.78	* 15.88	* 30.97 *

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 174.46	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.23	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 174.23	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 166.65	* Flow Area (sq ft)	* 1645.28	* 1223.71	* 1369.74 *
* E.G. Slope (ft/ft)	*0.000588	* Area (sq ft)	* 1656.60	* 1223.71	* 1369.74 *
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 1423.38	* 5703.26	* 1653.36 *
* Top Width (ft)	* 774.71	* Top Width (ft)	* 468.59	* 83.92	* 222.19 *
* Vel Total (ft/s)	* 2.07	* Avg. Vel. (ft/s)	* 0.87	* 4.66	* 1.21 *
* Max Chl Dpth (ft)	* 16.23	* Hydr. Depth (ft)	* 3.73	* 14.58	* 6.16 *
* Conv. Total (cfs)	*361948.4	* Conv. (cfs)	* 58677.7	*235112.4	* 68158.4 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 442.47	* 87.19	* 223.52 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.14	* 0.52	* 0.23 *
* Alpha	* 3.38	* Stream Power (lb/ft s)	* 0.12	* 2.40	*

```
   0.27  *
* Frctn Loss (ft)        *    0.87  * Cum Volume (acre-ft)   *  567.45  *  236.30  *
 578.69  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   89.10  *   16.30  *
  98.05  *
**********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  177.07  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.29  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  176.78  * Reach Len. (ft)       * 1140.00  * 1140.00  *
1140.00  *
* Crit W.S. (ft)         *  171.02  * Flow Area (sq ft)     * 2789.51  * 1437.50  *
1943.14  *
* E.G. Slope (ft/ft)     *0.000704  * Area (sq ft)          * 3285.90  * 1437.50  *
1943.14  *
* Q Total (cfs)          *15000.00  * Flow (cfs)           * 3665.79  * 8157.30  *
3176.91  *
* Top Width (ft)         * 1157.46  * Top Width (ft)       *  845.33  *   83.92  *
 228.21  *
* Vel Total (ft/s)       *    2.43  * Avg. Vel. (ft/s)     *    1.31  *    5.67  *
   1.63  *
* Max Chl Dpth (ft)      *   18.78  * Hydr. Depth (ft)     *    6.11  *   17.13  *
   8.51  *
* Conv. Total (cfs)      *565415.3  * Conv. (cfs)          *138179.5  *307484.2
*119751.6  *
* Length Wtd. (ft)       * 1140.00  * Wetted Per. (ft)     *  458.30  *   87.19  *
 230.05  *
* Min Ch El (ft)         *  158.00  * Shear (lb/sq ft)     *    0.27  *    0.72  *
   0.37  *
* Alpha                  *    3.13  * Stream Power (lb/ft s) *    0.35  *    4.11  *
   0.61  *
* Frctn Loss (ft)        *    1.10  * Cum Volume (acre-ft)   *  954.73  *  294.51  *
1076.54  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *  164.47  *   16.17  *
 105.68  *
**********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and
previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
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**********
* E.G. Elev (ft)         *  181.52  * Element               *  Left OB *  Channel *
Right OB *
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* Vel Head (ft)	* 0.32	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 181.20	* Reach Len. (ft)	* 1140.00	* 1140.00	* 1140.00 *
* Crit W.S. (ft)	* 173.52	* Flow Area (sq ft)	* 5042.79	* 1808.47	* 2979.08 *
* E.G. Slope (ft/ft)	*0.000662	* Area (sq ft)	* 9385.58	* 1808.47	* 2979.08 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	* 8037.02	*11598.78	* 6064.20 *
* Top Width (ft)	* 3396.53	* Top Width (ft)	* 3072.82	* 83.92	* 239.79 *
* Vel Total (ft/s)	* 2.61	* Avg. Vel. (ft/s)	* 1.59	* 6.41	* 2.04 *
* Max Chl Dpth (ft)	* 23.20	* Hydr. Depth (ft)	* 8.54	* 21.55	* 12.42 *
* Conv. Total (cfs)	*998885.5	* Conv. (cfs)	*312376.0	*450811.3	*235698.1 *
* Length Wtd. (ft)	* 1140.00	* Wetted Per. (ft)	* 592.45	* 87.19	* 242.47 *
* Min Ch El (ft)	* 158.00	* Shear (lb/sq ft)	* 0.35	* 0.86	* 0.51 *
* Alpha	* 2.98	* Stream Power (lb/ft s)	* 0.56	* 5.50	* 1.03 *
* Frctn Loss (ft)	* 1.04	* Cum Volume (acre-ft)	* 2195.61	* 387.50	* 1904.08 *
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	* 334.17	* 17.40	* 138.05 *

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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 270

INPUT
Description: XS 270
THIS CROSS SECTION IS THE INSERTED CROSS SECTION TO
REPRESENT
FILL PLACED SINCE THE EFFECTIVE FIS WAS
COMPLETED
THERE IS AN ENCR. IN THE NAT. RUN TO REFLECT EFFECTIVE
FLOW
Station Elevation Data num= 415

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	179.56	13.12	179.24	19.68	179.24	32.8	178.98	36.08	178.79
42.64	178.63	52.48	178.7	62.32	178.52	68.88	178.54	72.16	178.34
75.44	178.43	82	178.32	88.56	178.04	91.83	177.83	95.11	178.01
101.67	177.89	108.23	177.62	124.63	177.42	127.91	177.27	134.47	177.12
141.03	177.16	147.59	177.11	157.43	176.69	170.55	176.47	173.83	176.55

177.11	176.39	180.39	176.57	193.51	176.45	200.07	176.1	209.91	176.18
216.47	176.06	219.75	175.79	223.03	176	232.87	175.65	236.15	175.43
242.71	175.63	249.27	175.23	252.55	175.5	259.11	175.53	265.67	175.37
268.94	175.43	275.5	175.24	278.78	175.36	282.06	175.33	288.62	175.07
295.18	175.01	301.74	175.12	308.3	174.79	311.58	174.89	314.86	174.6
318.14	174.58	324.7	174.26	331.26	174.32	337.82	174.03	344.38	173.44
350.94	173.18	354.22	172.81	360.78	172.74	364.06	172.55	370.62	173.27
373.9	173.31	380.46	173.54	387.02	173.86	390.3	173.87	393.58	173.65
396.86	173.86	400.14	174.23	403.42	174.44	409.98	174.45	413.26	174.58
423.1	174.6	432.94	174.56	449.33	174.68	465.73	174.77	475.57	174.72
478.85	174.79	482.13	174.71	488.69	175.02	495.25	175	501.81	175.11
511.65	175.07	518.21	175.15	521.49	175.31	531.33	175.42	534.61	175.53
541.17	175.35	551.01	175.23	560.85	175.23	567.41	175.46	570.69	175.68
577.25	175.9	593.65	176.12	596.93	176.28	613.33	176.29	623.17	176.37
629.73	176.6	633	176.57	642.84	176.77	649.4	176.69	659.24	176.89
665.8	176.82	669.08	176.94	678.92	176.88	685.48	177.25	692.04	177.15
701.88	177.29	708.44	177.52	715	177.28	724.84	177.35	728.12	177.52
734.68	177.58	741.24	177.88	747.8	178.28	757.64	178.79	760.92	178.85
767.48	178.66	770.76	178.77	777.32	179.36	780.6	179.5	787.16	179.56
797	179.79	806.84	179.93	810.12	179.87	819.96	179.94	826.51	179.93
833.07	180.1	842.91	180.17	849.47	180.31	852.75	180.27	862.59	180.39
869.15	180.37	882.27	180.47	888.83	180.41	895.39	180.45	898.67	180.56
911.79	180.59	921.63	180.44	934.75	180.44	947.87	180.3	954.43	180.32
964.27	180.26	970.83	180.28	980.67	180.17	990.51	180.13	997.07	180.16
1010.19	179.97	1016.74	179.99	1039.7	179.75	1046.26	179.73	1059.38	179.48
1065.94	179.46	1072.5	179.58	1082.34	179.47	1088.9	179.25	1102.02	179.19
1105.3	179.11	1111.86	179.18	1124.98	178.95	1138.1	178.92	1144.66	178.98
1161.06	178.88	1170.9	178.62	1174.18	178.59	1187.3	178.75	1193.86	178.87
1200.42	178.91	1213.53	179.35	1220.09	179.43	1229.93	179.84	1243.05	180.11
1246.33	180.12	1262.73	180.32	1285.69	180.32	1302.09	180.03	1311.93	179.96
1318.49	179.81	1325.05	179.79	1331.61	179.63	1348.01	179.67	1354.57	179.52
1374.23	179.73	1387.33	180.02	1393.88	180.05	1400.43	180.16	1410.26	180.2
1416.81	180.37	1423.35	180.33	1433.18	180.51	1446.28	180.41	1452.83	180.51
1465.93	180.44	1472.48	180.32	1482.3	180.26	1501.95	180.02	1505.23	180.02
1524.88	179.5	1531.42	179.17	1537.97	178.99	1544.52	178.92	1551.07	178.61
1567.45	178.21	1570.72	178.17	1583.82	177.61	1590.37	177.43	1596.92	177.47
1603.47	177.81	1613.3	177.95	1619.85	178.12	1629.67	178.45	1632.95	178.47
1639.49	178.84	1646.04	179.11	1662.42	179.63	1668.97	179.69	1675.52	179.89
1682.07	179.87	1688.62	179.93	1691.89	179.76	1701.72	179.86	1711.54	179.86
1721.37	179.77	1731.19	179.96	1734.47	180.1	1741.02	180.14	1754.11	180.13
1770.49	180.35	1777.04	180.16	1786.86	180.26	1793.41	180.22	1806.51	180.22
1809.79	180.15	1816.34	180.35	1822.89	180.17	1826.16	180.31	1835.99	180.13
1839.26	180.25	1845.81	180.13	1852.36	180.27	1855.64	180.19	1862.18	180.27
1872.01	180.15	1885.11	180.24	1891.66	180.12	1894.93	180.2	1911.31	180.26
1914.58	180.19	1917.86	180.27	1930.96	180.21	1940.78	179.66	1947.33	179.51
1960.43	179.97	1966.98	180.14	1970.26	180.3	1980.08	180.22	1989.9	180.32
1996.45	180.32	2003	180.42	2009.55	180.36	2016.1	180.48	2022.65	180.46
2029.2	180.62	2039.03	180.74	2045.58	180.75	2052.13	180.97	2058.68	180.92
2075.05	181.03	2081.6	180.92	2091.43	180.91	2104.53	180.7	2114.35	180.71
2117.63	180.57	2127.45	180.542165.169		180.7472184.162		180.5372203.155		180.327
2222.147	180.117	2241.14	179.9072260.133		179.8272279.126		179.8272298.118		179.827
2317.111	179.8172336.104		179.5972355.096		179.3872374.089		179.1772393.082		178.967
2412.075	178.8272431.067		178.827	2450.06	178.8272469.053		178.8272488.045		178.837
2857.77	180.87	2861.05	180.93	2867.6	180.86	2877.44	180.86	2880.71	180.75
2890.55	180.74	2897.1	180.65	2900.38	180.71	2916.77	180.64	2926.61	180.68
2943	180.62	2949.55	180.67	2965.94	180.57	2969.22	180.51	2979.06	180.49
2985.61	180.42	2988.89	180.46	3002	180.39	3015.12	180.23	3021.67	180.31
3038.06	180.23	3054.45	180.18	3067.57	180.08	3074.12	179.99	3080.68	179.98
3083.96	179.9	3087.23	179.97	3097.07	179.84	3106.9	179.87	3110.18	179.79
3116.74	179.78	3123.29	179.69	3133.13	179.69	3136.41	179.58	3142.96	179.63
3152.8	179.58	3159.35	179.5	3162.63	179.56	3169.19	179.47	3178.98	179.6
3188.77	179.58	3201.83	179.32	3208.35	179.1	3218.15	178.61	3224.67	178.07
3234.47	175.7	3240.99	173.86	3244.26	173.33	3247.52	172.62	3254.05	170.53

3257.31	169.6	3263.84	168.38	3267.11	168.05	3270.37	167.97	3276.9	167.97
3280.16	168.21	3286.69	168.26	3289.95	168.37	3296.48	168.78	3303.01	168.61
3309.54	168.58	3316.06	168.33	3319.33	168.35	3325.86	168.09	3335.65	168.06
3338.91	167.88	3345.44	167.84	3358.5	167.12	3368.29	166.93	3374.82	167.27
3387.87	167.73	3400.93	167.95	3407.45	167.91	3413.98	168.17	3420.51	168.22
3427.04	168.36	3430.3	168.23	3436.83	168.21	3443.36	168.08	3449.89	168.18
3459.68	168.47	3469.47	168.48	3476	168.57	3485.79	168.6	3489.05	168.78
3498.84	168.86	3505.37	168.73	3515.17	168.9	3528.22	168.93	3531.48	169.05
3538.01	169.07	3541.28	169.3	3547.8	169.49	3551.07	169.39	3554.33	169.06
3557.6	168.98	3564.12	169.14	3570.65	168.82	3573.92	167.56	3577.18	165.02
3621.5	157.7	3668.57	162.54	3671.83	165.77	3675.1	172.07	3678.36	177.72
3681.63	181.75	3684.89	184.89	3688.15	187.54	3691.42	189.63	3694.68	192.46
3701.21	198.65	3704.47	201.51	3707.74	202.89	3711	203.18	3720.79	203.66
3737.11	204.34	3740.38	204.4	3746.9	204.86	3750.17	205.21	3753.43	205.04
3756.7	205.34	3759.96	204.92	3766.49	205.03	3773.02	204.97	3779.54	205.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3570.65	.045	3675.1	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

3570.65	3675.1		515	515	515	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3179	180	F
3739	3779.54	180	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
1509.55	1675.03	179.84

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	177.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.60	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	176.52	Reach Len. (ft)	515.00	515.00	515.00
Crit W.S. (ft)	171.46	Flow Area (sq ft)	2653.07	1569.80	5.72
E.G. Slope (ft/ft)	0.001500	Area (sq ft)	3313.63	1569.80	5.72
Q Total (cfs)	17700.00	Flow (cfs)	5996.77	11699.69	3.53
Top Width (ft)	898.81	Top Width (ft)	791.80	104.45	2.57
Vel Total (ft/s)	4.19	Avg. Vel. (ft/s)	2.26	7.45	0.62
Max Chl Dpth (ft)	18.82	Hydr. Depth (ft)	7.81	15.03	2.23
Conv. Total (cfs)	457063.9	Conv. (cfs)	154853.6	302119.1	91.2
Length Wtd. (ft)	515.00	Wetted Per. (ft)	340.79	111.56	5.14
Min Ch El (ft)	157.70	Shear (lb/sq ft)	0.73	1.32	0.10
Alpha	2.19	Stream Power (lb/ft s)	1.65	9.82	0.06
Frctn Loss (ft)	0.70	Cum Volume (acre-ft)	1129.67	279.93	1272.92

* C & E Loss (ft)	* 0.07	* Cum SA (acres)	* 179.03	* 13.71	* 105.67 *

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

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* E.G. Elev (ft)	* 177.68	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.52	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 177.16	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	* 171.45	* Flow Area (sq ft)	* 2870.94	* 1636.57	* 7.48 *
* E.G. Slope (ft/ft)	*0.001254	* Area (sq ft)	* 2870.94	* 1636.57	* 7.48 *
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 6227.21	*11468.17	* 4.62 *
* Top Width (ft)	* 449.00	* Top Width (ft)	* 341.65	* 104.45	* 2.90 *
* Vel Total (ft/s)	* 3.92	* Avg. Vel. (ft/s)	* 2.17	* 7.01	* 0.62 *
* Max Chl Dpth (ft)	* 19.46	* Hydr. Depth (ft)	* 8.40	* 15.67	* 2.58 *
* Conv. Total (cfs)	*499812.4	* Conv. (cfs)	*175843.9	*323837.9	* 130.6 *
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 343.06	* 111.56	* 5.87 *
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.66	* 1.15	* 0.10 *
* Alpha	* 2.18	* Stream Power (lb/ft s)	* 1.42	* 8.05	* 0.06 *
* Frctn Loss (ft)	* 0.57	* Cum Volume (acre-ft)	* 227.83	* 287.06	* 691.43 *
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 16.47	* 13.41	* 29.01 *

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Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

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* E.G. Elev (ft)	* 173.58	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.35	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 173.23	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	* 167.38	* Flow Area (sq ft)	* 1555.07	* 1225.56	* 0.39 *
* E.G. Slope (ft/ft)	*0.001095	* Area (sq ft)	* 1562.81	* 1225.56	* 0.39 *
* Q Total (cfs)	* 8780.00	* Flow (cfs)	* 2163.27	* 6616.65	* 0.08 *

* Top Width (ft)	* 451.48	* Top Width (ft)	* 346.36	* 104.45	* 0.67	*
* Vel Total (ft/s)	* 3.16	* Avg. Vel. (ft/s)	* 1.39	* 5.40	* 0.21	*
* Max Chl Dpth (ft)	* 15.53	* Hydr. Depth (ft)	* 4.77	* 11.73	* 0.58	*
* Conv. Total (cfs)	*265370.3	* Conv. (cfs)	* 65383.5	*199984.3	* 2.5	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 326.71	* 111.56	* 1.34	*
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.33	* 0.75	* 0.02	*
* Alpha	* 2.25	* Stream Power (lb/ft s)	* 0.45	* 4.05	* 0.00	*
* Frctn Loss (ft)	* 0.52	* Cum Volume (acre-ft)	* 525.32	* 204.25	* 560.77	*
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 78.43	* 13.83	* 95.13	*

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

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* E.G. Elev (ft)	* 175.95	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.56	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 175.39	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00	*
* Crit W.S. (ft)	* 170.78	* Flow Area (sq ft)	* 2270.43	* 1451.30	* 3.18	*
* E.G. Slope (ft/ft)	*0.001513	* Area (sq ft)	* 2512.41	* 1451.30	* 3.18	*
* Q Total (cfs)	*15000.00	* Flow (cfs)	* 4688.64	*10309.74	* 1.62	*
* Top Width (ft)	* 731.14	* Top Width (ft)	* 624.78	* 104.45	* 1.91	*
* Vel Total (ft/s)	* 4.03	* Avg. Vel. (ft/s)	* 2.07	* 7.10	* 0.51	*
* Max Chl Dpth (ft)	* 17.69	* Hydr. Depth (ft)	* 6.78	* 13.89	* 1.66	*
* Conv. Total (cfs)	*385661.9	* Conv. (cfs)	*120548.6	*265071.7	* 41.6	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 336.14	* 111.56	* 3.83	*
* Min Ch El (ft)	* 157.70	* Shear (lb/sq ft)	* 0.64	* 1.23	* 0.08	*
* Alpha	* 2.22	* Stream Power (lb/ft s)	* 1.32	* 8.73	* 0.04	*
* Frctn Loss (ft)	* 0.71	* Cum Volume (acre-ft)	* 878.86	* 256.71	* 1051.07	*
* C & E Loss (ft)	* 0.06	* Cum SA (acres)	* 145.24	* 13.71	* 102.67	*

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth

with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	180.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.72	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	179.72	Reach Len. (ft)	515.00	515.00	515.00
Crit W.S. (ft)	173.05	Flow Area (sq ft)	3781.05	1904.07	17.36
E.G. Slope (ft/ft)	0.001466	Area (sq ft)	6827.77	1904.07	17.36
Q Total (cfs)	25700.00	Flow (cfs)	9728.57	15956.24	15.19
Top Width (ft)	1916.75	Top Width (ft)	1807.41	104.45	4.88
Vel Total (ft/s)	4.51	Avg. Vel. (ft/s)	2.57	8.38	0.88
Max Chl Dpth (ft)	22.02	Hydr. Depth (ft)	9.65	18.23	3.55
Conv. Total (cfs)	671292.0	Conv. (cfs)	254113.2	416782.0	396.9
Length Wtd. (ft)	515.00	Wetted Per. (ft)	393.08	111.56	9.10
Min Ch El (ft)	157.70	Shear (lb/sq ft)	0.88	1.56	0.17
Alpha	2.27	Stream Power (lb/ft s)	2.26	13.09	0.15
Frctn Loss (ft)	0.65	Cum Volume (acre-ft)	1983.45	338.92	1864.88
C & E Loss (ft)	0.10	Cum SA (acres)	270.31	14.94	134.85

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 264

INPUT
Description: XS 264 (LETTERED CROSS-SECTION U)
THIS SECTION IS THE FIRST
SECTION U/S OF THE DIVIDED FLOW INSERTED
AN INEFFECTIVE FLOW
ENCROACHMENT AT 500' FROM LEFT CHANNEL BANK FOR THE
NATURAL RUN.
INEFFECTIVE FLOW AREA DUE TO FILL PLACED IN FLOODPLAIN
Station Elevation Data num= 480

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	180.25	3.28	180.24	13.12	180	19.68	179.94	29.51	179.65
39.35	179.7	49.19	179.48	62.31	179.52	68.87	179.23	72.15	179.18

81.98	179.21	91.82	178.97	98.38	179.04	104.94	178.84	108.22	178.83
114.78	178.64	131.17	178.53	141.01	178.39	147.57	178.13	157.41	178.04
160.69	178.12	170.53	177.78	180.36	177.66	186.92	177.81	196.76	177.64
203.32	177.64	209.88	177.41	216.44	177.45	223	177.2	226.28	177.19
232.83	176.94	239.39	177.03	249.23	176.44	255.79	176.43	262.35	176.31
275.47	176.15	285.3	175.9	291.86	175.63	298.42	175.6	304.98	175.45
311.54	175.43	314.82	175.56	318.1	175.49	324.66	175.17	331.21	175.01
334.49	175.11	341.05	174.95	347.61	174.89	350.89	174.94	360.73	174.84
367.29	174.7	373.85	174.67	400.08	174.65	406.64	174.57	413.2	174.76
419.76	174.7	429.59	174.48	439.43	174.77	445.99	174.72	462.39	174.8
475.51	174.75	482.06	174.84	491.9	174.68	501.74	174.8	505.02	174.6
508.3	174.01	514.86	174.13	518.14	174.47	521.42	174.64	527.97	174.52
537.81	174.81	541.09	174.73	550.93	174.75	564.05	174.54	570.61	174.64
580.44	174.6	587	174.64	590.28	174.51	596.84	174.47	613.24	174.62
619.8	174.89	623.08	174.94	629.63	175.21	639.47	175.38	646.03	175.41
659.15	175.55	665.71	175.53	668.99	175.61	675.54	175.52	682.1	175.08
685.38	174.62	688.66	173.36	691.94	173.13	698.5	172	705.06	171.71
711.62	171.92	714.9	172.13	721.46	172.15	734.57	172.67	741.13	173.54
744.41	173.86	750.97	174.25	754.25	174.22	760.81	174.35	770.65	174.23
773.92	174.36	787.04	174.35	793.6	174.52	800.16	174.5	806.72	174.7
810	174.72	816.56	174.92	819.84	174.93	829.67	174.74	839.51	174.99
859.19	175.06	865.75	174.99	869.02	175.15	878.86	175.22	885.42	175.33
891.98	175.31	905.1	175.52	914.94	175.54	921.49	175.66	924.77	175.62
928.05	175.74	944.45	175.69	954.29	175.98	957.57	175.94	964.13	175.7
970.68	175.92	977.24	175.93	987.08	176.16	1000.2	176.25	1006.76	176.39
1016.59	176.4	1023.15	176.5	1029.71	176.71	1036.27	176.67	1039.55	176.83
1052.67	177.01	1059.23	177.03	1075.62	177.26	1078.9	177.19	1085.46	177.25
1092.02	177.16	1101.86	177.41	1114.98	177.28	1121.53	177.41	1124.81	177.33
1144.49	177.73	1154.33	177.8	1160.89	177.77	1167.45	177.92	1170.72	177.89
1180.56	178.01	1190.4	178.04	1200.24	178.01	1210.08	178.27	1226.47	178.36
1229.75	178.3	1239.59	178.6	1249.43	178.78	1255.99	179	1259.27	179.02
1265.83	179.26	1278.94	179.39	1285.5	179.55	1292.06	179.61	1295.34	179.74
1298.62	180.05	1315.02	180.19	1318.3	180.14	1331.41	180.31	1341.25	180.37
1354.37	180.35	1360.93	180.41	1367.49	180.37	1380.6	180.4	1393.72	180.56
1410.12	180.61	1416.68	180.57	1446.19	180.66	1459.31	180.62	1462.59	180.7
1469.15	180.63	1472.42	180.72	1478.98	180.61	1485.54	180.65	1495.38	180.55
1498.66	180.62	1501.94	180.52	1511.78	180.47	1521.62	180.32	1534.73	180.39
1547.85	180.23	1554.41	180.34	1557.69	180.25	1580.64	180.06	1593.76	180.05
1603.6	179.89	1610.16	179.69	1623.28	179.73	1639.67	179.43	1649.51	178.86
1659.35	178.52	1669.19	177.93	1675.75	177.75	1688.86	177.94	1692.14	177.83
1701.98	177.79	1711.82	177.55	1724.94	177.42	1728.21	177.31	1738.05	177.19
1744.61	177.19	1754.45	177.09	1757.73	176.98	1767.57	176.94	1780.68	176.82
1790.52	176.54	1810.2	176.77	1813.48	176.84	1823.32	176.68	1833.15	176.73
1842.99	176.69	1846.27	176.75	1856.11	176.67	1859.39	176.78	1872.51	176.79
1875.79	176.88	1879.07	176.78	1885.62	176.78	1892.18	176.69	1895.46	176.76
1898.74	176.6	1905.3	176.89	1908.58	176.88	1915.14	177.03	1928.26	177.07
1931.53	177.15	1941.37	177.14	1944.65	177.2	1954.49	177.13	1970.89	177.27
1990.56	177.55	1993.84	177.49	2000.4	177.54	2006.96	177.46	2029.92	177.78
2039.75	177.79	2046.31	178.07	2052.87	178.24	2059.43	178.25	2069.27	178.18
2072.55	178.28	2085.67	178.22	2095.5	178.32	2098.78	178.23	2108.62	178.33
2118.46	178.29	2134.86	178.36	2138.14	178.3	2144.69	178.41	2151.25	178.44
2157.81	178.32	2167.65	178.34	2180.77	178.47	2187.33	178.41	2197.16	178.42
2203.72	178.35	2216.84	178.36	2220.12	178.28	2236.52	178.14	2239.8	178.2
2252.91	178.07	2262.75	177.67	2266.03	177.67	2269.31	177.5	2285.71	177.29
2295.55	177.3	2302.1	177.12	2311.94	176.6	2315.22	176.5	2325.06	176.36
2328.34	176.37	2338.18	176.14	2344.74	175.83	2361.13	175.8	2374.25	175.6
2380.81	175.6	2387.37	175.5	2393.93	175.51	2400.49	175.42	2407.05	175.51
2416.88	175.46	2420.16	175.32	2426.72	175.37	2433.28	175.28	2439.84	175.3
2449.68	175.15	2462.8	175.2	2472.63	174.98	2475.91	175.01	2482.47	174.82
2492.31	174.73	2508.71	174.65	2518.55	174.4	2525.1	173.74	2527.06	177.287
2546.061	177.157	2565.061	177.137	2584.062	177.397	2603.062	177.427	2622.063	177.387
2626.77	176.76	2630.04	176.81	2639.88	176.79	2643.16	176.68	2649.72	176.64
2653	176.73	2662.84	176.65	2669.4	176.52	2679.24	175.88	2689.07	175.6

2695.63	175.76	2705.47	175.3	2715.31	175.45	2721.87	175.68	2734.98	175.65
2741.54	175.85	2744.82	175.87	2754.66	175.68	2761.22	175.62	2774.34	175.33
2780.9	175.67	2790.73	175.15	2797.29	175.18	2800.57	175.45	2807.13	175.8
2816.97	177.01	2826.81	177.98	2836.65	178.49	2843.2	178.52	2856.32	178.24
2859.6	177.97	2862.88	177.92	2866.16	178.46	2882.56	178.47	2895.68	178.44
2902.23	178.54	2908.79	178.54	2912.07	178.29	2915.35	177.8	2918.63	177.07
2925.19	175.26	2928.47	174.59	2931.75	174.15	2938.31	173.8	2951.42	173.54
2954.7	173.3	2957.98	172.89	2961.26	172.27	2967.82	170.8	2974.38	169.65
2977.66	169.56	2984.22	169.81	2990.78	169.55	2997.34	168.86	3000.62	168.65
3010.45	168.46	3017.01	168.49	3020.29	168.32	3026.85	168.34	3036.69	168.63
3046.53	168.18	3056.37	168.33	3062.92	167.77	3076.04	167.74	3082.6	168.02
3089.16	168.03	3095.72	167.83	3102.28	168.03	3108.84	168.01	3115.39	168.16
3118.67	168.14	3125.23	167.76	3135.07	167.71	3141.63	167.46	3144.91	167.49
3151.47	167.83	3161.31	167.93	3167.86	168.13	3174.42	167.76	3180.98	167.61
3187.54	167.34	3190.82	167.33	3197.38	167.66	3203.94	167.51	3213.78	167.94
3220.33	167.98	3223.61	167.9	3226.89	167.6	3240.01	167.36	3246.57	167.44
3253.13	167.15	3266.25	167.01	3276.08	167.12	3282.64	166.87	3285.92	166.91
3295.76	167.38	3302.32	167.19	3315.44	167.25	3322	167.2	3335.11	167
3341.67	167.14	3348.23	166.88	3354.79	166.73	3361.35	166.77	3374.47	166.67
3381.03	166.34	3384.3	166	3390.86	165.9	3394.14	166.17	3397.42	166.65
3403.98	166.71	3410.54	167.06	3417.1	167	3423.66	167.16	3426.94	167.08
3436.77	167.49	3443.33	167.44	3449.89	167.22	3456.45	167.23	3459.73	167.44
3463.01	167.49	3466.29	167.32	3476.13	167.49	3489.24	167.33	3499.08	167.27
3508.92	167.44	3515.48	167.08	3525.32	167.43	3541.72	167.3	3548.27	167
3558.11	167.26	3564.67	167.18	3574.51	167.28	3581.07	167.2	3587.63	167.31
3590.91	167.49	3597.46	167.58	3607.3	168.06	3610.58	168	3617.14	168.28
3626.98	168.13	3633.54	168.48	3640.1	168.58	3643.38	168.49	3646.66	168.6
3653.21	168.61	3666.33	168.72	3672.89	168.66	3676.17	168.77	3676.58	168.59
3679.45	167.29	3682.73	164.44	3686.01	161.31	3690	160	3720	157.5
3745	160	3748.32	160.82	3751.6	163.96	3754.88	169	3757.31	173.44
3761.43	180.53	3764.71	185.66	3767.99	189.21	3771.27	190.06	3781.11	191.88

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	3676.58	.045	3754.88	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

3676.58	3754.88		1330	1300	1000	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3176.1	180	F
3790	3781.11	180	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
2326.42	2605.17	176.19

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	176.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.38	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	175.98	Reach Len. (ft)	1330.00	1300.00	1000.00
Crit W.S. (ft)	170.99	Flow Area (sq ft)	4302.67	1235.45	13.44
E.G. Slope (ft/ft)	0.001202	Area (sq ft)	6921.54	1235.45	13.44
Q Total (cfs)	17700.00	Flow (cfs)	9296.63	8393.59	9.79

* Top Width (ft)	* 1664.30	* Top Width (ft)	* 1582.10	* 78.30	* 3.91	*
* Vel Total (ft/s)	* 3.19	* Avg. Vel. (ft/s)	* 2.16	* 6.79	* 0.73	*
* Max Chl Dpth (ft)	* 18.48	* Hydr. Depth (ft)	* 8.60	* 15.78	* 3.44	*
* Conv. Total (cfs)	*510630.5	* Conv. (cfs)	*268200.1	*242148.1	* 282.3	*
* Length Wtd. (ft)	* 1314.74	* Wetted Per. (ft)	* 500.78	* 85.43	* 8.00	*
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.64	* 1.08	* 0.13	*
* Alpha	* 2.39	* Stream Power (lb/ft s)	* 1.39	* 7.37	* 0.09	*
* Frctn Loss (ft)	* 0.81	* Cum Volume (acre-ft)	* 1069.16	* 263.35	* 1272.80	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 165.00	* 12.63	* 105.64	*

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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 177.05	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.32	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 176.73	* Reach Len. (ft)	* 1330.00	* 1300.00	* 1000.00	*
* Crit W.S. (ft)	* 170.99	* Flow Area (sq ft)	* 4679.99	* 1294.49	* 16.51	*
* E.G. Slope (ft/ft)	*0.000962	* Area (sq ft)	* 5301.66	* 1294.49	* 16.51	*
* Q Total (cfs)	*17700.00	* Flow (cfs)	* 9569.99	* 8118.45	* 11.56	*
* Top Width (ft)	* 652.90	* Top Width (ft)	* 570.48	* 78.30	* 4.12	*
* Vel Total (ft/s)	* 2.95	* Avg. Vel. (ft/s)	* 2.04	* 6.27	* 0.70	*
* Max Chl Dpth (ft)	* 19.23	* Hydr. Depth (ft)	* 9.35	* 16.53	* 4.01	*
* Conv. Total (cfs)	*570645.0	* Conv. (cfs)	*308534.8	*261737.3	* 372.8	*
* Length Wtd. (ft)	* 1315.17	* Wetted Per. (ft)	* 500.78	* 85.43	* 8.81	*
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.56	* 0.91	* 0.11	*
* Alpha	* 2.33	* Stream Power (lb/ft s)	* 1.15	* 5.71	* 0.08	*
* Frctn Loss (ft)	* 0.65	* Cum Volume (acre-ft)	* 179.52	* 269.73	* 691.29	*
* C & E Loss (ft)	* 0.09	* Cum SA (acres)	* 11.08	* 12.33	* 28.97	*

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	173.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	172.78	Reach Len. (ft)	1330.00	1300.00	1000.00
Crit W.S. (ft)	168.90	Flow Area (sq ft)	2701.05	984.88	3.91
E.G. Slope (ft/ft)	*0.000920	Area (sq ft)	3670.15	984.88	3.91
Q Total (cfs)	8780.00	Flow (cfs)	3744.23	5034.12	1.65
Top Width (ft)	839.81	Top Width (ft)	759.44	78.30	2.07
Vel Total (ft/s)	2.38	Avg. Vel. (ft/s)	1.39	5.11	0.42
Max Chl Dpth (ft)	15.28	Hydr. Depth (ft)	5.40	12.58	1.89
Conv. Total (cfs)	*289455.3	Conv. (cfs)	*123438.3	*165962.6	54.5
Length Wtd. (ft)	1310.52	Wetted Per. (ft)	500.78	85.43	4.31
Min Ch El (ft)	157.50	Shear (lb/sq ft)	0.31	0.66	0.05
Alpha	2.79	Stream Power (lb/ft s)	0.43	3.38	0.02
Frctn Loss (ft)	0.76	Cum Volume (acre-ft)	494.39	191.18	560.74
C & E Loss (ft)	0.03	Cum SA (acres)	71.89	12.75	95.12

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	175.18	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.37	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.81	Reach Len. (ft)	1330.00	1300.00	1000.00
Crit W.S. (ft)	170.48	Flow Area (sq ft)	3715.01	1143.51	9.26
E.G. Slope (ft/ft)	*0.001257	Area (sq ft)	5337.20	1143.51	9.26

* Q Total (cfs)	*15000.00	* Flow (cfs)	* 7445.65	* 7548.27	* 6.09 *
* Top Width (ft)	* 1215.93	* Top Width (ft)	* 1134.40	* 78.30	* 3.22 *
* Vel Total (ft/s)	* 3.08	* Avg. Vel. (ft/s)	* 2.00	* 6.60	* 0.66 *
* Max Chl Dpth (ft)	* 17.31	* Hydr. Depth (ft)	* 7.42	* 14.60	* 2.87 *
* Conv. Total (cfs)	*423009.9	* Conv. (cfs)	*209972.2	*212866.1	* 171.6 *
* Length Wtd. (ft)	* 1313.68	* Wetted Per. (ft)	* 500.78	* 85.43	* 6.64 *
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.58	* 1.05	* 0.11 *
* Alpha	* 2.52	* Stream Power (lb/ft s)	* 1.17	* 6.94	* 0.07 *
* Frctn Loss (ft)	* 0.87	* Cum Volume (acre-ft)	* 832.45	* 241.37	* 1051.00 *
* C & E Loss (ft)	* 0.10	* Cum SA (acres)	* 134.84	* 12.63	* 102.64 *

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Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

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* E.G. Elev (ft)	* 179.70	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.39	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 179.30	* Reach Len. (ft)	* 1330.00	* 1300.00	* 1000.00 *
* Crit W.S. (ft)	* 172.29	* Flow Area (sq ft)	* 5966.17	* 1495.71	* 29.63 *
* E.G. Slope (ft/ft)	*0.001042	* Area (sq ft)	*15309.51	* 1495.71	* 29.63 *
* Q Total (cfs)	*25700.00	* Flow (cfs)	*14925.76	*10748.04	* 26.20 *
* Top Width (ft)	* 3321.91	* Top Width (ft)	* 3237.77	* 78.30	* 5.84 *
* Vel Total (ft/s)	* 3.43	* Avg. Vel. (ft/s)	* 2.50	* 7.19	* 0.88 *
* Max Chl Dpth (ft)	* 21.80	* Hydr. Depth (ft)	* 11.92	* 19.10	* 5.08 *
* Conv. Total (cfs)	*796255.3	* Conv. (cfs)	*462440.3	*333003.3	* 811.6 *
* Length Wtd. (ft)	* 1316.94	* Wetted Per. (ft)	* 500.78	* 85.43	* 11.84 *
* Min Ch El (ft)	* 157.50	* Shear (lb/sq ft)	* 0.77	* 1.14	* 0.16 *
* Alpha	* 2.14	* Stream Power (lb/ft s)	* 1.94	* 8.18	* 0.14 *
* Frctn Loss (ft)	* 0.69	* Cum Volume (acre-ft)	* 1852.59	* 318.82	* 1864.60 *
* C & E Loss (ft)	* 0.12	* Cum SA (acres)	* 240.49	* 13.86	* 134.79 *

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Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 250.12

INPUT
Description: XS 250.12
Broad Run Station 250.12
LOW CHORD ELEVATION REVISED
TO MATCH PROPOSED BRIDGE PLAN
Station Elevation Data num= 477

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.13	6.56	182	13.12	182.17	16.4	182.13	22.96	181.91
26.24	181.91	29.52	182.16	39.36	181.84	42.64	181.81	55.76	182
62.32	182.01	68.88	181.69	75.45	181.7	82.01	181.47	88.57	181.54
95.13	181.42	101.69	181.37	108.25	181.49	114.81	181.54	121.37	181.32
127.93	181.19	134.49	181.46	141.05	181.34	144.33	181.14	150.89	181.14
154.17	181.27	160.73	181.23	167.29	181	170.57	181.04	177.13	180.96
183.69	180.73	196.81	180.68	209.93	180.26	213.21	180.27	216.49	180.48
226.34	180.15	229.62	180.26	236.18	180.13	239.46	180.16	246.02	180.02
259.14	180.03	265.7	179.8	272.26	179.91	282.1	179.52	285.38	179.47
288.66	179.57	291.94	179.45	295.22	179.6	301.78	179.6	305.06	179.48
311.62	179.59	318.18	179.48	321.46	179.29	337.86	179.23	341.14	179.39
347.7	179.23	354.26	179.3	360.82	179.24	367.39	178.93	383.79	178.82
387.07	178.95	396.91	178.73	403.47	178.77	410.03	178.67	413.31	178.51
429.71	178.6	436.27	178.5	439.55	178.38	446.11	178.37	452.67	178.08
462.51	178.09	465.79	178.21	472.35	178.2	478.91	177.96	482.19	178.03
488.75	177.84	492.03	177.83	498.59	178.01	505.15	177.91	508.43	177.61
515	177.56	524.84	177.58	528.12	177.67	531.4	177.59	534.68	177.33
537.96	177.21	541.24	177.23	547.8	177.41	554.36	177.15	557.64	177.19
564.2	177.13	570.76	176.98	574.04	177.01	577.32	176.79	583.88	176.78
587.16	176.86	593.72	176.69	600.28	176.73	610.12	176.51	616.68	176.65
626.52	176.39	629.8	176.51	636.36	176.94	639.64	177.06	642.92	177.01
649.48	176.56	659.32	176.3	669.17	176.25	675.73	176	679.01	175.96
685.57	176.03	688.85	175.92	695.41	176.06	708.53	175.92	711.81	175.83
718.37	175.86	721.65	175.61	724.93	175.62	731.49	175.43	738.05	175.33
741.33	175.53	744.61	175.32	747.89	175.36	751.17	175.21	761.01	175.14
767.57	175.21	774.13	174.92	783.97	174.83	797.09	174.82	803.65	174.85
813.5	174.71	820.06	174.72	826.62	174.8	836.46	174.67	843.02	174.65
862.7	174.48	869.26	174.48	872.54	174.35	875.82	174.4	882.38	174.36
908.62	174	911.9	174.12	918.46	174.02	925.02	174.21	931.58	174.03
938.14	174.12	947.98	173.81	954.55	173.73	957.83	173.78	964.39	174.06
970.95	173.92	977.51	173.96	987.35	173.84	993.91	173.99	1000.47	173.88
1007.03	174.03	1010.31	173.91	1020.15	174.04	1026.71	173.88	1036.55	173.93
1043.11	174.09	1049.67	174.11	1056.23	173.95	1066.07	174.04	1072.63	173.9
1079.19	174.08	1085.75	173.94	1092.31	174.1	1098.88	174.1	1102.16	173.96
1108.72	173.87	1115.28	173.94	1125.12	173.77	1131.68	174.04	1138.24	173.83
1144.8	173.8	1148.08	173.88	1157.92	173.79	1167.76	173.93	1174.32	173.85
1184.16	173.94	1190.72	173.89	1197.28	173.92	1216.96	173.86	1233.36	173.89
1236.64	173.85	1246.49	173.98	1253.05	173.85	1259.61	173.94	1269.45	173.99
1282.57	173.93	1292.41	174.03	1298.97	173.95	1315.37	173.99	1325.21	174.08
1341.61	174.11	1354.73	174.24	1364.57	174.25	1367.85	174.14	1384.25	174.19
1387.53	174.25	1410.5	174.02	1420.34	173.99	1426.9	174.02	1433.46	173.91
1443.3	173.99	1453.14	173.93	1456.42	173.8	1466.26	173.87	1469.54	173.81

1476.1	173.85	1479.38	173.76	1485.94	173.73	1492.5	173.81	1495.78	173.78
1502.34	173.88	1508.9	173.8	1515.46	173.9	1522.02	173.92	1528.58	173.83
1535.14	173.96	1544.99	174.02	1551.55	173.96	1558.11	174.05	1571.23	173.97
1584.35	174.12	1597.47	174.08	1604.03	174	1617.15	174.26	1623.71	174.22
1630.27	174.25	1636.83	174.11	1643.39	174.16	1646.67	173.96	1653.23	174.16
1659.79	174.13	1666.35	174.18	1676.19	174.08	1682.75	174.19	1695.88	174.14
1699.16	174.23	1705.72	174.13	1712.28	174.1	1725.4	174.14	1735.24	173.96
1741.8	173.98	1751.64	173.87	1771.32	174.07	1777.88	173.98	1784.44	174.03
1791	173.88	1797.56	173.91	1804.12	173.82	1813.96	173.78	1827.08	173.85
1836.93	173.85	1846.77	173.77	1853.33	173.87	1859.89	173.84	1866.45	173.93
1876.29	173.94	1882.85	173.83	1889.41	173.92	1895.97	173.89	1905.81	173.93
1909.09	173.99	1915.65	173.97	1925.49	174.05	1938.61	174.03	1948.45	173.96
1958.29	174	1961.57	173.96	1977.97	174.05	1987.82	173.94	2004.22	173.89
2010.78	173.84	2017.34	173.96	2037.02	173.93	2046.86	173.88	2056.7	173.72
2063.26	173.82	2066.54	173.79	2073.1	174.01	2079.66	174.09	2086.22	174.02
2096.06	174.15	2102.62	174.12	2119.03	174.21	2122.31	174.12	2125.59	174.18
2138.71	174.23	2141.99	174.17	2155.11	174.28	2164.95	174.15	2168.23	174.19
2184.63	174.21	2187.91	174.14	2197.75	174.26	2201.03	174.17	2210.87	174.35
2220.71	174.43	2227.27	174.29	2233.84	174.35	2240.4	174.24	2260.08	174.2
2266.64	174.27	2273.2	174.25	2279.76	174.02	2286.32	174.06	2292.88	173.95
2296.16	173.99	2309.28	173.95	2312.56	174	2319.12	173.95	2335.11	174.2
2341.67	174.21	2350	174.14	2355	174.16	2365	174.16	2370	174.14
2375	174.13	2380	174.11	2415	174.1	2420	174.09	2435	174.09
2440	174.08	2450	174.1	2455	174.1	2465	174.08	2480	174
2495	174	2500	174.01	2515	174.1	2530	174.16	2535	174.16
2545	174.14	2555	174.13	2560	174.11	2565	174.1	2580	174.03
2605	173.83	2610	173.83	2620	173.79	2625	173.78	2640	173.71
2655	173.66	2660	173.66	2670	173.64	2675	173.64	2680	173.6
2690	173.58	2700	173.53	2705	173.52	2710	173.5	2715	173.49
2725	173.45	2740	173.36	2750	173.32	2755	173.31	2770	173.24
2775	173.21	2785	173.12	2795	173.06	2810	172.9	2820	172.87
2830	172.87	2845	172.9	2865	173.08	2885	173.09	2890	173.14
2895	173.17	2900	173.25	2905	173.38	2910	173.45	2915	173.63
2920	174.02	2930	174.72	2935	174.91	2945	175.14	2975	175.74
2980	175.83	3005	175.83	3010	175.77	3020	175.63	3030	175.52
3035	175.48	3045	175.34	3050	175.26	3055	175.19	3060	175.17
3080	175.02	3085	175	3105	174.86	3110	174.8	3115	174.73
3130	174.53	3135	174.47	3145	174.41	3155	174.42	3210	174.74
3215	174.74	3220	174.71	3225	174.63	3235	174.41	3245	174.21
3255	174.07	3260	173.98	3265	173.91	3270	173.88	3275	173.83
3280	173.83	3290	173.47	3295	173.33	3300	173.29	3305	173.26
3310	173.24	3315	173.18	3325	173.01	3330	172.97	3355	172.93
3365	172.9	3370	172.86	3375	172.8	3385	172.76	3390	172.77
3395	172.8	3400	172.81	3410	172.8	3415	172.83	3420	172.89
3425	172.91	3430	172.91	3435	172.86	3440	172.83	3445	172.79
3450	172.69	3455	172.61	3460	172.56	3465	172.52	3475	172.48
3480	172.45	3490	172.34	3500	172.18	3505	172.12	3515	172.02
3525	171.94	3530	171.91	3535	171.87	3545	171.71	3555	171.62
3560	171.62	3565	171.63	3570	171.54	3575	171.46	3585	171.5
3600	171.61	3605	171.57	3620	171.37	3625	171.33	3630	170.92
3635	170.89	3640	171.31	3655	172.6	3660	159.39	3681	157
3695	159.8	3700	173.08	3705	172.6	3715	171.48	3720	170.94
3725	170.49	3740	169.05	3745	168.55	3750	168	3755	167.7
3760	167.78	3765	167.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3660	.045	3695	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3660	3695	620	620	.3	.5

Ineffective Flow num= 2

Proposed - No-Rise

Sta L	Sta R	Elev	Permanent
0	3655	177.9	F
3700	3765	177.9	F

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	175.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	175.41	Reach Len. (ft)	0.50	0.50	0.50
Crit W.S. (ft)	160.81	Flow Area (sq ft)	47.10	599.80	44.87
E.G. Slope (ft/ft)	0.000035	Area (sq ft)	4536.27	599.80	403.69
Q Total (cfs)	800.00	Flow (cfs)	13.23	774.60	12.17
Top Width (ft)	2947.76	Top Width (ft)	2842.76	35.00	70.00
Vel Total (ft/s)	1.16	Avg. Vel. (ft/s)	0.28	1.29	0.27
Max Chl Dpth (ft)	18.41	Hydr. Depth (ft)	9.42	17.14	8.97
Conv. Total (cfs)	134906.3	Conv. (cfs)	2231.3	130623.1	2052.0
Length Wtd. (ft)	0.50	Wetted Per. (ft)	14.12	35.41	14.19
Min Ch El (ft)	157.00	Shear (lb/sq ft)	0.01	0.04	0.01
Alpha	1.21	Stream Power (lb/ft s)	0.00	0.05	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	894.24	235.96	1268.01
C & E Loss (ft)	0.02	Cum SA (acres)	97.45	10.94	104.79

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	176.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	176.29	Reach Len. (ft)	0.50	0.50	0.50
Crit W.S. (ft)	160.81	Flow Area (sq ft)	51.46	630.33	49.23
E.G. Slope (ft/ft)	0.000030	Area (sq ft)	51.46	630.33	49.23
Q Total (cfs)	800.00	Flow (cfs)	12.12	776.43	

```
  11.44  *
* Top Width (ft)         *   45.00  * Top Width (ft)         *    5.00  *   35.00  *
   5.00  *
* Vel Total (ft/s)       *    1.09  * Avg. Vel. (ft/s)       *    0.24  *    1.23  *
   0.23  *
* Max Chl Dpth (ft)      *   19.29  * Hydr. Depth (ft)       *   10.29  *   18.01  *
   9.85  *
* Conv. Total (cfs)      *146196.7  * Conv. (cfs)            *  2215.7  *141890.1  *
2090.9  *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)       *   17.81  *   35.41  *
  17.40  *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *    0.01  *    0.03  *
   0.01  *
* Alpha                  *    1.23  * Stream Power (lb/ft s) *    0.00  *    0.04  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *   97.80  *  241.01  *
690.54  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    2.30  *   10.64  *
  28.87  *
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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
        1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  172.23  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.13  * Wt. n-Val.           *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  172.10  * Reach Len. (ft)      *    0.50  *    0.50  *
   0.50  *
* Crit W.S. (ft)         *  162.04  * Flow Area (sq ft)    *   30.57  *  483.79  *
  28.48  *
* E.G. Slope (ft/ft)     *0.000241  * Area (sq ft)         *  101.36  *  483.79  *
176.67  *
* Q Total (cfs)          * 1450.00  * Flow (cfs)           *   17.29  * 1417.00  *
  15.71  *
* Top Width (ft)         *  242.11  * Top Width (ft)       *  146.95  *   35.00  *
  60.16  *
* Vel Total (ft/s)       *    2.67  * Avg. Vel. (ft/s)     *    0.57  *    2.93  *
   0.55  *
* Max Chl Dpth (ft)      *   15.10  * Hydr. Depth (ft)     *    6.35  *   13.82  *
   6.15  *
* Conv. Total (cfs)      * 93419.5  * Conv. (cfs)          *  1114.1  * 91293.1  *
1012.3  *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)     *   13.59  *   35.41  *
  13.14  *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)     *    0.03  *    0.21  *
   0.03  *
* Alpha                  *    1.18  * Stream Power (lb/ft s) *    0.02  *    0.60  *
   0.02  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  436.81  *  169.27  *
558.67  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *   58.06  *   11.06  *
  94.40  *
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Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	174.21	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.04	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	174.17	Reach Len. (ft)	0.50	0.50	0.50
Crit W.S. (ft)	161.11	Flow Area (sq ft)	40.87	556.21	38.64
E.G. Slope (ft/ft)	0.000064	Area (sq ft)	1252.22	556.21	316.51
Q Total (cfs)	950.00	Flow (cfs)	14.12	923.06	12.82
Top Width (ft)	2298.34	Top Width (ft)	2193.34	35.00	70.00
Vel Total (ft/s)	1.49	Avg. Vel. (ft/s)	0.35	1.66	0.33
Max Chl Dpth (ft)	17.17	Hydr. Depth (ft)	8.17	15.89	7.73
Conv. Total (cfs)	118548.7	Conv. (cfs)	1761.5	115187.5	1599.7
Length Wtd. (ft)	0.50	Wetted Per. (ft)	14.12	35.41	14.19
Min Ch El (ft)	157.00	Shear (lb/sq ft)	0.01	0.06	0.01
Alpha	1.20	Stream Power (lb/ft s)	0.00	0.10	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	731.86	216.01	1047.26
C & E Loss (ft)	0.03	Cum SA (acres)	84.03	10.94	101.80

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	178.89	Reach Len. (ft)	0.50	0.50	

```
   0.50  *
* Crit W.S. (ft)         *  160.59  * Flow Area (sq ft)      *15271.76  *  721.52  *
 647.14  *
* E.G. Slope (ft/ft)     *0.000000  * Area (sq ft)           *15271.76  *  721.52  *
 647.14  *
* Q Total (cfs)          *  700.00  * Flow (cfs)             *  558.65  *  109.85  *
  31.51  *
* Top Width (ft)         * 3387.88  * Top Width (ft)         * 3282.88  *   35.00  *
  70.00  *
* Vel Total (ft/s)       *    0.04  * Avg. Vel. (ft/s)       *    0.04  *    0.15  *
   0.05  *
* Max Chl Dpth (ft)      *   21.89  * Hydr. Depth (ft)       *    4.65  *   20.61  *
   9.24  *
* Conv. Total (cfs)      *1132586.0  * Conv. (cfs)            *903881.1  *177729.6
* 50975.3  *
* Length Wtd. (ft)       *    0.50  * Wetted Per. (ft)       * 3292.52  *   35.41  *
  90.53  *
* Min Ch El (ft)         *  157.00  * Shear (lb/sq ft)       *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    2.72  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   * 1385.73  *  285.74  *
1856.83  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *  140.94  *   12.17  *
 133.92  *
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Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1           RS: 250.06

INPUT
Description: Bridge #2 - Runway
Distance from Upstream XS =      .5
Deck/Roadway Width        =   611.5
Weir Coefficient          =     2.7
Upstream  Deck/Roadway Coordinates
    num=       8
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************
       0     180       0     456     180       0    2856   178.6       0
    3666  178.13     155    3666  178.13  169.49    3696  178.13  169.49
    3696  178.13     155    5056   177.9       0

Upstream Bridge Cross Section Data
Station Elevation Data    num=     477
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  182.13    6.56     182   13.12  182.17    16.4  182.13   22.96  181.91
   26.24  181.91   29.52  182.16   39.36  181.84   42.64  181.81   55.76     182
   62.32  182.01   68.88  181.69   75.45   181.7   82.01  181.47   88.57  181.54
```

95.13	181.42	101.69	181.37	108.25	181.49	114.81	181.54	121.37	181.32
127.93	181.19	134.49	181.46	141.05	181.34	144.33	181.14	150.89	181.14
154.17	181.27	160.73	181.23	167.29	181	170.57	181.04	177.13	180.96
183.69	180.73	196.81	180.68	209.93	180.26	213.21	180.27	216.49	180.48
226.34	180.15	229.62	180.26	236.18	180.13	239.46	180.16	246.02	180.02
259.14	180.03	265.7	179.8	272.26	179.91	282.1	179.52	285.38	179.47
288.66	179.57	291.94	179.45	295.22	179.6	301.78	179.6	305.06	179.48
311.62	179.59	318.18	179.48	321.46	179.29	337.86	179.23	341.14	179.39
347.7	179.23	354.26	179.3	360.82	179.24	367.39	178.93	383.79	178.82
387.07	178.95	396.91	178.73	403.47	178.77	410.03	178.67	413.31	178.51
429.71	178.6	436.27	178.5	439.55	178.38	446.11	178.37	452.67	178.08
462.51	178.09	465.79	178.21	472.35	178.2	478.91	177.96	482.19	178.03
488.75	177.84	492.03	177.83	498.59	178.01	505.15	177.91	508.43	177.61
515	177.56	524.84	177.58	528.12	177.67	531.4	177.59	534.68	177.33
537.96	177.21	541.24	177.23	547.8	177.41	554.36	177.15	557.64	177.19
564.2	177.13	570.76	176.98	574.04	177.01	577.32	176.79	583.88	176.78
587.16	176.86	593.72	176.69	600.28	176.73	610.12	176.51	616.68	176.65
626.52	176.39	629.8	176.51	636.36	176.94	639.64	177.06	642.92	177.01
649.48	176.56	659.32	176.3	669.17	176.25	675.73	176	679.01	175.96
685.57	176.03	688.85	175.92	695.41	176.06	708.53	175.92	711.81	175.83
718.37	175.86	721.65	175.61	724.93	175.62	731.49	175.43	738.05	175.33
741.33	175.53	744.61	175.32	747.89	175.36	751.17	175.21	761.01	175.14
767.57	175.21	774.13	174.92	783.97	174.83	797.09	174.82	803.65	174.85
813.5	174.71	820.06	174.72	826.62	174.8	836.46	174.67	843.02	174.65
862.7	174.48	869.26	174.48	872.54	174.35	875.82	174.4	882.38	174.36
908.62	174	911.9	174.12	918.46	174.02	925.02	174.21	931.58	174.03
938.14	174.12	947.98	173.81	954.55	173.73	957.83	173.78	964.39	174.06
970.95	173.92	977.51	173.96	987.35	173.84	993.91	173.99	1000.47	173.88
1007.03	174.03	1010.31	173.91	1020.15	174.04	1026.71	173.88	1036.55	173.93
1043.11	174.09	1049.67	174.11	1056.23	173.95	1066.07	174.04	1072.63	173.9
1079.19	174.08	1085.75	173.94	1092.31	174.1	1098.88	174.1	1102.16	173.96
1108.72	173.87	1115.28	173.94	1125.12	173.77	1131.68	174.04	1138.24	173.83
1144.8	173.8	1148.08	173.88	1157.92	173.79	1167.76	173.93	1174.32	173.85
1184.16	173.94	1190.72	173.89	1197.28	173.92	1216.96	173.86	1233.36	173.89
1236.64	173.85	1246.49	173.98	1253.05	173.85	1259.61	173.94	1269.45	173.99
1282.57	173.93	1292.41	174.03	1298.97	173.95	1315.37	173.99	1325.21	174.08
1341.61	174.11	1354.73	174.24	1364.57	174.25	1367.85	174.14	1384.25	174.19
1387.53	174.25	1410.5	174.02	1420.34	173.99	1426.9	174.02	1433.46	173.91
1443.3	173.99	1453.14	173.93	1456.42	173.8	1466.26	173.87	1469.54	173.81
1476.1	173.85	1479.38	173.76	1485.94	173.73	1492.5	173.81	1495.78	173.78
1502.34	173.88	1508.9	173.8	1515.46	173.9	1522.02	173.92	1528.58	173.83
1535.14	173.96	1544.99	174.02	1551.55	173.96	1558.11	174.05	1571.23	173.97
1584.35	174.12	1597.47	174.08	1604.03	174	1617.15	174.26	1623.71	174.22
1630.27	174.25	1636.83	174.11	1643.39	174.16	1646.67	173.96	1653.23	174.16
1659.79	174.13	1666.35	174.18	1676.19	174.08	1682.75	174.19	1695.88	174.14
1699.16	174.23	1705.72	174.13	1712.28	174.1	1725.4	174.14	1735.24	173.96
1741.8	173.98	1751.64	173.87	1771.32	174.07	1777.88	173.98	1784.44	174.03
1791	173.88	1797.56	173.91	1804.12	173.82	1813.96	173.78	1827.08	173.85
1836.93	173.85	1846.77	173.77	1853.33	173.87	1859.89	173.84	1866.45	173.93
1876.29	173.94	1882.85	173.83	1889.41	173.92	1895.97	173.89	1905.81	173.93
1909.09	173.99	1915.65	173.97	1925.49	174.05	1938.61	174.03	1948.45	173.96
1958.29	174	1961.57	173.96	1977.97	174.05	1987.82	173.94	2004.22	173.89
2010.78	173.84	2017.34	173.96	2037.02	173.93	2046.86	173.88	2056.7	173.72
2063.26	173.82	2066.54	173.79	2073.1	174.01	2079.66	174.09	2086.22	174.02
2096.06	174.15	2102.62	174.12	2119.03	174.21	2122.31	174.12	2125.59	174.18
2138.71	174.23	2141.99	174.17	2155.11	174.28	2164.95	174.15	2168.23	174.19
2184.63	174.21	2187.91	174.14	2197.75	174.26	2201.03	174.17	2210.87	174.35
2220.71	174.43	2227.27	174.29	2233.84	174.35	2240.4	174.24	2260.08	174.2
2266.64	174.27	2273.2	174.25	2279.76	174.02	2286.32	174.06	2292.88	173.95
2296.16	173.99	2309.28	173.95	2312.56	174	2319.12	173.95	2335.11	174.2
2341.67	174.21	2350	174.14	2355	174.16	2365	174.16	2370	174.14
2375	174.13	2380	174.11	2415	174.1	2420	174.09	2435	174.09
2440	174.08	2450	174.1	2455	174.1	2465	174.08	2480	174

2495	174	2500	174.01	2515	174.1	2530	174.16	2535	174.16
2545	174.14	2555	174.13	2560	174.11	2565	174.1	2580	174.03
2605	173.83	2610	173.83	2620	173.79	2625	173.78	2640	173.71
2655	173.66	2660	173.66	2670	173.64	2675	173.64	2680	173.6
2690	173.58	2700	173.53	2705	173.52	2710	173.5	2715	173.49
2725	173.45	2740	173.36	2750	173.32	2755	173.31	2770	173.24
2775	173.21	2785	173.12	2795	173.06	2810	172.9	2820	172.87
2830	172.87	2845	172.9	2865	173.08	2885	173.09	2890	173.14
2895	173.17	2900	173.25	2905	173.38	2910	173.45	2915	173.63
2920	174.02	2930	174.72	2935	174.91	2945	175.14	2975	175.74
2980	175.83	3005	175.83	3010	175.77	3020	175.63	3030	175.52
3035	175.48	3045	175.34	3050	175.26	3055	175.19	3060	175.17
3080	175.02	3085	175	3105	174.86	3110	174.8	3115	174.73
3130	174.53	3135	174.47	3145	174.41	3155	174.42	3210	174.74
3215	174.74	3220	174.71	3225	174.63	3235	174.41	3245	174.21
3255	174.07	3260	173.98	3265	173.91	3270	173.88	3275	173.83
3280	173.83	3290	173.47	3295	173.33	3300	173.29	3305	173.26
3310	173.24	3315	173.18	3325	173.01	3330	172.97	3355	172.93
3365	172.9	3370	172.86	3375	172.8	3385	172.76	3390	172.77
3395	172.8	3400	172.81	3410	172.8	3415	172.83	3420	172.89
3425	172.91	3430	172.91	3435	172.86	3440	172.83	3445	172.79
3450	172.69	3455	172.61	3460	172.56	3465	172.52	3475	172.48
3480	172.45	3490	172.34	3500	172.18	3505	172.12	3515	172.02
3525	171.94	3530	171.91	3535	171.87	3545	171.71	3555	171.62
3560	171.62	3565	171.63	3570	171.54	3575	171.46	3585	171.5
3600	171.61	3605	171.57	3620	171.37	3625	171.33	3630	170.92
3635	170.89	3640	171.31	3655	172.6	3660	159.39	3681	157
3695	159.8	3700	173.08	3705	172.6	3715	171.48	3720	170.94
3725	170.49	3740	169.05	3745	168.55	3750	168	3755	167.7
3760	167.78	3765	167.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3660	.045	3695	.07

Bank Sta: Left Right Coeff Contr. Expan.

Left	Right	Coeff Contr.	Expan.
3660	3695	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3655	177.9	F
3700	3765	177.9	F

Downstream Deck/Roadway Coordinates

num= 8

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	180	0	485	180	0	2885	178.6	0
3975	178.13	155	3975	178.13	169.49	4005	178.13	169.49
4005	178.13	155	5085	177.9	0			

Downstream Bridge Cross Section Data

Station Elevation Data num= 385

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.24	182.47	32.8	182.49	39.35	182.28
45.91	182.33	52.47	182.59	55.75	182.38	68.87	182.21	75.43	182.31
98.39	181.7	104.95	181.77	118.07	181.41	124.62	181.52	141.02	181.23
147.58	180.98	154.14	180.97	163.98	181.13	170.54	181.02	180.38	181.04
186.94	180.83	193.5	180.91	206.61	180.64	219.73	180.53	226.29	180.39
232.85	180.38	242.69	180.12	252.53	180.02	255.81	180.1	268.93	179.85
282.04	179.68	288.6	179.88	295.16	179.63	308.28	179.45	314.84	179.43
321.4	179.65	331.24	179.47	337.8	179.25	344.36	179.35	350.92	179.18

Proposed - No-Rise

367.31	179.01	377.15	178.68	390.27	178.82	400.11	178.57	406.67	178.58
409.95	178.45	416.51	178.63	426.35	178.31	436.19	178.48	449.3	178.26
462.42	178.32	465.7	178.23	475.54	178.23	482.1	178.05	498.5	178.05
505.06	177.97	511.62	177.73	518.18	177.84	537.85	177.71	544.41	177.5
554.25	177.58	560.81	177.36	570.65	177.38	583.77	177.15	590.33	177.19
596.89	177	610	176.84	619.84	176.62	629.68	176.53	636.24	176.64
642.8	176.46	649.36	176.52	659.2	176.76	665.76	176.79	669.04	176.5
678.88	176.35	685.43	176.42	691.99	176.15	698.55	176.25	705.11	176.1
708.39	176.15	724.79	175.84	734.63	175.92	747.75	175.78	754.31	175.8
767.42	175.52	773.98	175.64	780.54	175.54	783.82	175.36	793.66	175.29
800.22	175.53	816.62	175.36	826.46	175.41	833.02	175.11	839.58	175.24
846.13	175.16	859.25	175.36	865.81	175.17	872.37	175.11	875.65	174.89
882.21	175.07	892.05	175.19	898.61	174.91	908.45	175.01	921.57	174.7
924.85	174.78	944.52	174.84	947.8	174.71	967.48	174.56	977.32	174.34
983.88	174.49	987.16	174.37	997	174.45	1006.84	174.27	1010.11	174.37
1023.23	174.12	1033.07	174.03	1039.63	174.06	1042.91	173.95	1052.75	173.98
1065.87	173.86	1075.71	173.86	1082.27	173.96	1108.5	173.76	1115.06	173.62
1121.62	173.73	1131.46	173.69	1147.86	173.41	1151.14	173.54	1164.26	173.48
1170.82	173.55	1180.65	173.22	1193.77	173.4	1203.61	173.36	1223.29	173.19
1242.97	173.17	1246.25	173.01	1265.92	172.91	1269.2	173.07	1275.76	173.02
1282.32	173.26	1288.88	173.27	1295.44	173.06	1305.28	173.21	1315.12	173.17
1318.4	173.28	1331.52	173.3	1338.08	173.15	1344.63	173.39	1351.19	173.48
1354.47	173.33	1361.03	173.53	1380.71	173.2	1393.83	173.29	1400.39	173.42
1403.67	173.35	1420.07	174.1	1429.9	174.31	1443.02	174.31	1456.14	174.44
1465.98	174.71	1472.54	174.72	1485.66	175.03	1492.22	175	1508.61	175.29
1525.01	175.08	1538.13	175.1	1547.97	174.96	1557.81	174.95	1564.37	174.65
1570.93	174.69	1597.16	174.09	1607	173.64	1610.28	173.68	1613.56	173.44
1620.12	173.44	1633.24	173.1	1636.52	173.31	1643.08	173.07	1649.64	173.19
1652.92	173.02	1659.48	173.06	1669.32	172.98	1672.59	173.18	1679.15	173.04
1682.43	173.19	1688.99	173.07	1698.83	172.73	1705.39	172.86	1711.95	172.76
1718.51	172.91	1731.63	172.79	1744.75	173.03	1764.42	173.01	1770.98	173.09
1780.82	172.78	1787.38	172.7	1793.94	172.75	1807.06	172.43	1813.62	172.52
1843.13	172.26	1846.41	172.38	1852.97	172.31	1866.09	172.44	1869.37	172.36
1879.21	172.49	1898.89	172.34	1908.73	172.53	1915.29	172.34	1941.52	172.01
1948.08	172.32	1957.92	172.26	1967.76	172.03	1977.6	172.02	1984.16	171.93
2000.55	172.02	2007.11	171.82	2016.95	171.81	2026.79	171.65	2030.07	171.93
2039.91	171.76	2043.19	171.9	2056.31	171.99	2062.87	171.84	2082.55	171.69
2089.1	171.73	2102.22	171.57	2112.06	171.59	2138.3	171.38	2141.58	171.48
2151.42	171.5	2167.82	171.39	2187.49	171.43	2194.05	171.56	2200.61	171.51
2203.89	171.61	2213.73	171.58	2220.29	171.45	2226.85	171.45	2233.41	171.58
2262.93	171.66	2266.21	171.74	2279.32	171.68	2285.88	171.73	2292.44	171.56
2295.72	171.64	2305.56	171.53	2312.12	171.58	2315.4	171.48	2325.24	171.48
2335.08	171.38	2341.64	171.53	2358.04	171.48	2367.88	171.54	2374.43	171.67
2387.55	171.792404.135		171.832424.423		1722454.855		172.032475.143		171.97
2485.287	171.892495.431		171.782505.575		171.752515.719		171.552525.863		171.57
2536.007	171.512546.151		171.492556.295		171.52566.439		171.472576.583		171.47
2586.727	171.512596.871		171.52607.015		171.462627.303		171.482667.879		171.42
2688.167	171.372728.744		171.432738.888		171.462749.031		171.352759.176		171.34
2779.464	171.412809.896		171.37 2820.04		171.42840.328		171.42850.472		171.37
2891.048	171.412911.336		171.492931.624		171.72941.768		171.842951.912		171.93
2982.344	171.943002.632		172.32 3022.92		172.743033.064		172.833053.353		172.83
3063.497	172.963083.784		173.363104.073		173.713114.217		173.833225.801		173.82
3246.089	173.523286.665		173.083296.809		172.873306.953		172.843317.097		172.95
3327.241	173.173337.385		173.313347.529		173.543357.673		173.713367.817		173.91
3388.105	174.353408.393		174.693418.537		174.833469.258		174.833479.402		174.75
3499.69	174.443509.834		174.253530.122		173.953540.266		173.68 3550.41		173.17
3560.554	173.073570.698		173.013580.842		172.75 3601.13		172.323611.274		171.99
3621.418	171.833793.866		171.83 3804.01		1723814.155		172.483824.299		172.83
3834.443	173.023854.731		173.083895.307		173.333905.451		173.333915.595		172.92
3946.027	170.963956.171		168.953966.315		166.143976.459		163.943986.603		161.01
3990	156.844027.179		159.874037.323		161.234047.467		163.494057.611		165.32
4067.755	167.454077.899		169.434088.043		1714098.188		172.024108.332		172.61
4118.476	172.844148.908		173.214169.195		173.294189.483		173.334219.916		173.46

4240.204 173.584250.348 173.544321.356 173.054341.644 173.014361.932 172.89
4392.364 172.634412.652 172.494422.796 172.39 4432.94 172.354463.373 172.47
4544.524 172.724564.813 172.834635.821 172.834645.965 172.814666.253 172.55
4696.685 172.254716.973 172.114767.693 171.864777.837 171.834798.125 171.83
4818.413 171.874828.557 171.924869.133 172.824899.565 172.85 4960.43 173.74
4980.718 173.92 5011.15 174.775041.582 175.655051.726 175.83 5061.87 175.83

Manning's n Values   num=   3
     Sta   n Val   Sta   n Val   Sta   n Val
****
       0   .073966.315   .0454057.611   .07

Bank Sta: Left   Right   Coeff Contr.   Expan.
      3966.3154057.611   .3   .5
Ineffective Flow   num=   2
   Sta L   Sta R   Elev Permanent
       0   3985   177   F
    4035 5061.87   177   F

Upstream Embankment side slope   =   4 horiz. to 1.0 vertical
Downstream Embankment side slope   =   4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =   .98
Elevation at which weir flow begins   =   177.4
Energy head used in spillway design   =
Spillway height used in design   =
Weir crest shape   = Broad Crested

Number of Bridge Coefficient Sets = 1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #1%
****
****
* E.G. US. (ft)   *   175.44 * Element   *Inside BR US
*Inside BR DS *
* W.S. US. (ft)   *   175.41 * E.G. Elev (ft)   *   175.42 *
174.82 *
* Q Total (cfs)   *   800.00 * W.S. Elev (ft)   *   175.33 *
174.63 *
* Q Bridge (cfs)   *   800.00 * Crit W.S. (ft)   *   160.99 *
161.69 *
* Q Weir (cfs)   *   * Max Chl Dpth (ft)   *   18.33 *
17.79 *
* Weir Sta Lft (ft)   *   * Vel Total (ft/s)   *   2.37 *
 3.48 *
* Weir Sta Rgt (ft)   *   * Flow Area (sq ft)   *   338.17 *
229.69 *
* Weir Submerg   *   * Froude # Chl   *   0.10 *
 0.15 *
* Weir Max Depth (ft)   *   * Specif Force (cu ft) *   3952.68 *

```
2601.09  *
* Min El Weir Flow (ft)  *     178.13  * Hydr Depth (ft)        *             *
      *
* Min El Prs (ft)        *     169.49  * W.P. Total (ft)        *      80.03  *
53.52  *
* Delta EG (ft)          *       0.72  * Conv. Total (cfs)      *    31004.0  *
20029.1  *
* Delta WS (ft)          *       0.71  * Top Width (ft)         *             *
      *
* BR Open Area (sq ft)   *     229.69  * Frctn Loss (ft)        *       0.57  *
 0.01  *
* BR Open Vel (ft/s)     *       3.48  * C & E Loss (ft)        *       0.03  *
 0.09  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.18  *
 0.43  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       0.42  *
 1.49  *
*********************************************************************************
*********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #Floodway
*********************************************************************************
*********
* E.G. US. (ft)          *     176.31  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     176.29  * E.G. Elev (ft)        *     176.29  *
175.69  *
* Q Total (cfs)          *     800.00  * W.S. Elev (ft)        *     176.20  *
175.50  *
* Q Bridge (cfs)         *     800.00  * Crit W.S. (ft)        *     160.99  *
161.69  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      19.20  *
18.66  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       2.37  *
 3.48  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     338.17  *
229.69  *
* Weir Submerg           *             * Froude # Chl          *       0.10  *
 0.14  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    4246.64  *
2800.76  *
* Min El Weir Flow (ft)  *     178.14  * Hydr Depth (ft)        *             *
      *
* Min El Prs (ft)        *     169.49  * W.P. Total (ft)        *      80.03  *
53.52  *
* Delta EG (ft)          *       0.72  * Conv. Total (cfs)      *    31004.0  *
20029.1  *
* Delta WS (ft)          *       0.71  * Top Width (ft)         *             *
      *
* BR Open Area (sq ft)   *     229.69  * Frctn Loss (ft)        *       0.57  *
 0.01  *
* BR Open Vel (ft/s)     *       3.48  * C & E Loss (ft)        *       0.03  *
```

```
 0.09  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.18  *
 0.43  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       0.42  *
 1.49  *
**********************************************************************************
*********
```

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #10%

```
**********************************************************************************
*********
* E.G. US. (ft)          *     172.23  * Element               *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     172.10  * E.G. Elev (ft)        *     172.18  *
170.20  *
* Q Total (cfs)          *    1450.00  * W.S. Elev (ft)        *     171.88  *
169.58  *
* Q Bridge (cfs)         *    1450.00  * Crit W.S. (ft)        *     162.39  *
163.47  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)     *      14.88  *
12.74  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)      *       4.29  *
 6.31  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)     *     338.17  *
229.69  *
* Weir Submerg           *             * Froude # Chl          *       0.20  *
 0.31  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)  *    2924.08  *
1638.86  *
* Min El Weir Flow (ft)  *     178.13  * Hydr Depth (ft)       *             *
      *
* Min El Prs (ft)        *     169.49  * W.P. Total (ft)       *      80.03  *
53.52  *
* Delta EG (ft)          *       2.31  * Conv. Total (cfs)     *    31004.0  *
20029.1  *
* Delta WS (ft)          *       2.29  * Top Width (ft)        *             *
      *
* BR Open Area (sq ft)   *     229.69  * Frctn Loss (ft)       *       1.89  *
 0.02  *
* BR Open Vel (ft/s)     *       6.31  * C & E Loss (ft)       *       0.10  *
 0.26  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.58  *
 1.40  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       2.47  *
 8.86  *
**********************************************************************************
*********
```

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and

previous cross section. This may indicate
the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross
sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #2%

E.G. US. (ft)	174.21	Element	Inside BR US	Inside BR DS	
W.S. US. (ft)	174.17	E.G. Elev (ft)	174.18	173.33	
Q Total (cfs)	950.00	W.S. Elev (ft)	174.06	173.07	
Q Bridge (cfs)	950.00	Crit W.S. (ft)	161.33	162.12	
Q Weir (cfs)		Max Chl Dpth (ft)	17.06	16.23	
Weir Sta Lft (ft)		Vel Total (ft/s)	2.81	4.14	
Weir Sta Rgt (ft)		Flow Area (sq ft)	338.17	229.69	
Weir Submerg		Froude # Chl	0.12	0.18	
Weir Max Depth (ft)		Specif Force (cu ft)	3547.02	2278.25	
Min El Weir Flow (ft)	178.13	Hydr Depth (ft)			
Min El Prs (ft)	169.49	W.P. Total (ft)	80.03	53.52	
Delta EG (ft)	1.01	Conv. Total (cfs)	31004.0	20029.1	
Delta WS (ft)	0.99	Top Width (ft)			
BR Open Area (sq ft)	229.69	Frctn Loss (ft)	0.81	0.01	
BR Open Vel (ft/s)	4.14	C & E Loss (ft)	0.04	0.12	
BR Sluice Coef		Shear Total (lb/sq ft)	0.25	0.60	
BR Sel Method	Energy only	Power Total (lb/ft s)	0.70	2.49	

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #0.2%

* E.G. US. (ft)	* 178.89	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 178.89	* E.G. Elev (ft)	* 178.88	* 178.50	*
* Q Total (cfs)	* 700.00	* W.S. Elev (ft)	* 178.85	* 178.47	*
* Q Bridge (cfs)	* 582.89	* Crit W.S. (ft)	* 160.74	* 161.34	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 21.85	* 21.63	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 0.82	* 0.76	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 853.63	* 917.51	*
* Weir Submerg	*	* Froude # Chl	* 0.06	* 0.05	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 5244.87	* 4361.12	*
* Min El Weir Flow (ft)	* 178.13	* Hydr Depth (ft)	* 0.64	* 0.49	*
* Min El Prs (ft)	* 169.49	* W.P. Total (ft)	* 1414.93	* 1954.44	*
* Delta EG (ft)	* 0.41	* Conv. Total (cfs)	* 32252.2	* 23296.5	*
* Delta WS (ft)	* 0.41	* Top Width (ft)	* 1334.17	* 1874.73	*
* BR Open Area (sq ft)	* 229.69	* Frctn Loss (ft)	* 0.38	* 0.00	*
* BR Open Vel (ft/s)	* 1.97	* C & E Loss (ft)	* 0.00	* 0.01	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.02	* 0.03	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.01	* 0.02	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 250

INPUT
Description: XS 250
Broad Run Station 250
CHANNEL REACH DISTANCE ADJUSTED PER
PROPOSED RUNWAY BRIDGE
THIS IS THE D/S FACE OF RUNWAY 34-R
Station Elevation Data num= 385

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	182.87	3.28	182.74	26.24	182.47	32.8	182.49	39.35	182.28
45.91	182.33	52.47	182.59	55.75	182.38	68.87	182.21	75.43	182.31
98.39	181.7	104.95	181.77	118.07	181.41	124.62	181.52	141.02	181.23
147.58	180.98	154.14	180.97	163.98	181.13	170.54	181.02	180.38	181.04
186.94	180.83	193.5	180.91	206.61	180.64	219.73	180.53	226.29	180.39
232.85	180.38	242.69	180.12	252.53	180.02	255.81	180.1	268.93	179.85
282.04	179.68	288.6	179.88	295.16	179.63	308.28	179.45	314.84	179.43
321.4	179.65	331.24	179.47	337.8	179.25	344.36	179.35	350.92	179.18
367.31	179.01	377.15	178.68	390.27	178.82	400.11	178.57	406.67	178.58
409.95	178.45	416.51	178.63	426.35	178.31	436.19	178.48	449.3	178.26
462.42	178.32	465.7	178.23	475.54	178.23	482.1	178.05	498.5	178.05
505.06	177.97	511.62	177.73	518.18	177.84	537.85	177.71	544.41	177.5
554.25	177.58	560.81	177.36	570.65	177.38	583.77	177.15	590.33	177.19
596.89	177	610	176.84	619.84	176.62	629.68	176.53	636.24	176.64
642.8	176.46	649.36	176.52	659.2	176.76	665.76	176.79	669.04	176.5
678.88	176.35	685.43	176.42	691.99	176.15	698.55	176.25	705.11	176.1
708.39	176.15	724.79	175.84	734.63	175.92	747.75	175.78	754.31	175.8
767.42	175.52	773.98	175.64	780.54	175.54	783.82	175.36	793.66	175.29
800.22	175.53	816.62	175.36	826.46	175.41	833.02	175.11	839.58	175.24
846.13	175.16	859.25	175.36	865.81	175.17	872.37	175.11	875.65	174.89
882.21	175.07	892.05	175.19	898.61	174.91	908.45	175.01	921.57	174.7
924.85	174.78	944.52	174.84	947.8	174.71	967.48	174.56	977.32	174.34
983.88	174.49	987.16	174.37	997	174.45	1006.84	174.27	1010.11	174.37
1023.23	174.12	1033.07	174.03	1039.63	174.06	1042.91	173.95	1052.75	173.98
1065.87	173.86	1075.71	173.86	1082.27	173.96	1108.5	173.76	1115.06	173.62
1121.62	173.73	1131.46	173.69	1147.86	173.41	1151.14	173.54	1164.26	173.48
1170.82	173.55	1180.65	173.22	1193.77	173.4	1203.61	173.36	1223.29	173.19
1242.97	173.17	1246.25	173.01	1265.92	172.91	1269.2	173.07	1275.76	173.02
1282.32	173.26	1288.88	173.27	1295.44	173.06	1305.28	173.21	1315.12	173.17
1318.4	173.28	1331.52	173.3	1338.08	173.15	1344.63	173.39	1351.19	173.48
1354.47	173.33	1361.03	173.53	1380.71	173.2	1393.83	173.29	1400.39	173.42
1403.67	173.35	1420.07	174.1	1429.9	174.31	1443.02	174.31	1456.14	174.44
1465.98	174.71	1472.54	174.72	1485.66	175.03	1492.22	175	1508.61	175.29
1525.01	175.08	1538.13	175.1	1547.97	174.96	1557.81	174.95	1564.37	174.65
1570.93	174.69	1597.16	174.09	1607	173.64	1610.28	173.68	1613.56	173.44
1620.12	173.44	1633.24	173.1	1636.52	173.31	1643.08	173.07	1649.64	173.19
1652.92	173.02	1659.48	173.06	1669.32	172.98	1672.59	173.18	1679.15	173.04
1682.43	173.19	1688.99	173.07	1698.83	172.73	1705.39	172.86	1711.95	172.76
1718.51	172.91	1731.63	172.79	1744.75	173.03	1764.42	173.01	1770.98	173.09
1780.82	172.78	1787.38	172.7	1793.94	172.75	1807.06	172.43	1813.62	172.52
1843.13	172.26	1846.41	172.38	1852.97	172.31	1866.09	172.44	1869.37	172.36
1879.21	172.49	1898.89	172.34	1908.73	172.53	1915.29	172.34	1941.52	172.01
1948.08	172.32	1957.92	172.26	1967.76	172.03	1977.6	172.02	1984.16	171.93
2000.55	172.02	2007.11	171.82	2016.95	171.81	2026.79	171.65	2030.07	171.93
2039.91	171.76	2043.19	171.9	2056.31	171.99	2062.87	171.84	2082.55	171.69
2089.1	171.73	2102.22	171.57	2112.06	171.59	2138.3	171.38	2141.58	171.48
2151.42	171.5	2167.82	171.39	2187.49	171.43	2194.05	171.56	2200.61	171.51
2203.89	171.61	2213.73	171.58	2220.29	171.45	2226.85	171.45	2233.41	171.58
2262.93	171.66	2266.21	171.74	2279.32	171.68	2285.88	171.73	2292.44	171.56
2295.72	171.64	2305.56	171.53	2312.12	171.58	2315.4	171.48	2325.24	171.48
2335.08	171.38	2341.64	171.53	2358.04	171.48	2367.88	171.54	2374.43	171.67
2387.55	171.792404.135		171.832424.423		1722454.855		172.032475.143		171.97
2485.287	171.892495.431		171.782505.575		171.752515.719		171.552525.863		171.57
2536.007	171.512546.151		171.492556.295		171.52566.439		171.472576.583		171.47
2586.727	171.512596.871		171.52607.015		171.462627.303		171.482667.879		171.42
2688.167	171.372728.744		171.432738.888		171.462749.031		171.352759.176		171.34
2779.464	171.412809.896		171.37 2820.04		171.42840.328		171.42850.472		171.37
2891.048	171.412911.336		171.492931.624		171.72941.768		171.842951.912		171.93
2982.344	171.943002.632		172.32 3022.92		172.743033.064		172.833053.353		172.83
3063.497	172.963083.784		173.363104.073		173.713114.217		173.833225.801		173.82
3246.089	173.523286.665		173.083296.809		172.873306.953		172.843317.097		172.95
3327.241	173.173337.385		173.313347.529		173.543357.673		173.713367.817		173.91

3388.105 174.353408.393 174.693418.537 174.833469.258 174.833479.402 174.75
3499.69 174.443509.834 174.253530.122 173.953540.266 173.68 3550.41 173.17
3560.554 173.073570.698 173.013580.842 172.75 3601.13 172.323611.274 171.99
3621.418 171.833793.866 171.83 3804.01 1723814.155 172.483824.299 172.83
3834.443 173.023854.731 173.083895.307 173.333905.451 173.333915.595 172.92
3946.027 170.963956.171 168.953966.315 166.143976.459 163.943986.603 161.01
3990 156.844027.179 159.874037.323 161.234047.467 163.494057.611 165.32
4067.755 167.454077.899 169.434088.043 1714098.188 172.024108.332 172.61
4118.476 172.844148.908 173.214169.195 173.294189.483 173.334219.916 173.46
4240.204 173.584250.348 173.544321.356 173.054341.644 173.014361.932 172.89
4392.364 172.634412.652 172.494422.796 172.39 4432.94 172.354463.373 172.47
4544.524 172.724564.813 172.834635.821 172.834645.965 172.814666.253 172.55
4696.685 172.254716.973 172.114767.693 171.864777.837 171.834798.125 171.83
4818.413 171.874828.557 171.924869.133 172.824899.565 172.85 4960.43 173.74
4980.718 173.92 5011.15 174.775041.582 175.655051.726 175.83 5061.87 175.83

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.073	966.315	.045	4057.611	.07

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
3966.3154057.611 10 13 35 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3985	177	F
4035	5061.87	177	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.72	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.02	* Wt. n-Val.	*	* 0.045	*
* W.S. Elev (ft)	* 174.71	* Reach Len. (ft)	* 10.00	* 13.00	* 35.00 *
* Crit W.S. (ft)	* 160.74	* Flow Area (sq ft)	*	* 795.09	*
* E.G. Slope (ft/ft)	*0.000025	* Area (sq ft)	* 6076.27	* 1257.08	* 1948.73 *
* Q Total (cfs)	* 800.00	* Flow (cfs)	*	* 800.00	*
* Top Width (ft)	* 3891.49	* Top Width (ft)	* 2848.91	* 91.30	* 951.29 *
* Vel Total (ft/s)	* 1.01	* Avg. Vel. (ft/s)	*	* 1.01	*
* Max Chl Dpth (ft)	* 17.87	* Hydr. Depth (ft)	*	* 15.90	*
* Conv. Total (cfs)	*161241.3	* Conv. (cfs)	*	*161241.3	*
* Length Wtd. (ft)	* 13.00	* Wetted Per. (ft)	*	* 52.24	*
* Min Ch El (ft)	* 156.84	* Shear (lb/sq ft)	*	* 0.02	*
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.02	*
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 893.66	* 231.42	* 1267.77 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 97.17	* 10.93	* 104.70 *

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.045	
W.S. Elev (ft)	175.58	Reach Len. (ft)	10.00	13.00	35.00
Crit W.S. (ft)	160.74	Flow Area (sq ft)		838.60	
E.G. Slope (ft/ft)	0.000037	Area (sq ft)		838.60	
Q Total (cfs)	800.00	Flow (cfs)		800.00	
Top Width (ft)	50.00	Top Width (ft)		50.00	
Vel Total (ft/s)	0.95	Avg. Vel. (ft/s)		0.95	
Max Chl Dpth (ft)	18.74	Hydr. Depth (ft)		16.77	
Conv. Total (cfs)	131533.3	Conv. (cfs)		131533.3	
Length Wtd. (ft)	13.00	Wetted Per. (ft)		81.00	
Min Ch El (ft)	156.84	Shear (lb/sq ft)		0.02	
Alpha	1.00	Stream Power (lb/ft s)		0.02	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	97.80	236.98	690.48
C & E Loss (ft)	0.00	Cum SA (acres)	2.30	10.64	28.87

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	169.92	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.045	
W.S. Elev (ft)	169.81	Reach Len. (ft)	10.00	13.00	35.00
Crit W.S. (ft)	161.78	Flow Area (sq ft)		550.24	
E.G. Slope (ft/ft)	0.000276	Area (sq ft)	24.84	809.99	49.11
Q Total (cfs)	1450.00	Flow (cfs)		1450.00	
Top Width (ft)	128.52	Top Width (ft)	14.48	91.30	

```
  22.74  *
* Vel Total (ft/s)       *    2.64  * Avg. Vel. (ft/s)       *          *    2.64  *
         *
* Max Chl Dpth (ft)      *   12.97  * Hydr. Depth (ft)       *          *   11.00  *
         *
* Conv. Total (cfs)      * 87303.4  * Conv. (cfs)            *          * 87303.4  *
         *
* Length Wtd. (ft)       *   13.00  * Wetted Per. (ft)       *          *   52.24  *
         *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)       *          *    0.18  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.48  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  436.81  *  164.77  *
 558.60  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *   58.06  *   11.05  *
  94.40  *
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Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #2%
*********************************************************************************
**********
* E.G. Elev (ft)         *  173.20  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  173.18  * Reach Len. (ft)        *   10.00  *   13.00  *
  35.00  *
* Crit W.S. (ft)         *  161.00  * Flow Area (sq ft)      *          *  718.60  *
         *
* E.G. Slope (ft/ft)     *0.000049  * Area (sq ft)           * 2276.37  * 1117.40  *
 580.63  *
* Q Total (cfs)          *  950.00  * Flow (cfs)             *          *  950.00  *
         *
* Top Width (ft)         * 2722.11  * Top Width (ft)         * 1923.20  *   91.30  *
 707.61  *
* Vel Total (ft/s)       *    1.32  * Avg. Vel. (ft/s)       *          *    1.32  *
         *
* Max Chl Dpth (ft)      *   16.34  * Hydr. Depth (ft)       *          *   14.37  *
         *
* Conv. Total (cfs)      *136224.0  * Conv. (cfs)            *          *136224.0  *
         *
* Length Wtd. (ft)       *   13.00  * Wetted Per. (ft)       *          *   52.24  *
         *
* Min Ch El (ft)         *  156.84  * Shear (lb/sq ft)       *          *    0.04  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.06  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  731.64  *  211.48  *
1047.14  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   83.85  *   10.93  *
 101.74  *
*********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
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CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	178.48	Reach Len. (ft)	10.00	13.00	35.00
Crit W.S. (ft)	160.54	Flow Area (sq ft)	18501.64	1601.44	5699.50
E.G. Slope (ft/ft)	0.000000	Area (sq ft)	18501.64	1601.44	5699.50
Q Total (cfs)	700.00	Flow (cfs)	432.47	127.32	140.22
Top Width (ft)	4642.40	Top Width (ft)	3546.85	91.30	1004.26
Vel Total (ft/s)	0.03	Avg. Vel. (ft/s)	0.02	0.08	0.02
Max Chl Dpth (ft)	21.64	Hydr. Depth (ft)	5.22	17.54	5.68
Conv. Total (cfs)	1917480.0	Conv. (cfs)	1184633.0	348749.2	384097.9
Length Wtd. (ft)	14.28	Wetted Per. (ft)	3547.99	94.55	1007.57
Min Ch El (ft)	156.84	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	2.19	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1379.92	280.77	1852.62
C & E Loss (ft)	0.00	Cum SA (acres)	126.42	11.26	126.19

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 246

INPUT
Description: XS 246
CHANNEL REACH DISTANCE ADJUSTED PER PROPOSED RUNWAY
BRIDGE
THIS IS THE CROSS SECTION BETWEEN THE RUNWAYS
Station Elevation Data num= 390

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.25	182.47	32.81	182.48	39.37	182.27
45.93	182.32	52.49	182.57	68.89	182.21	75.46	182.31	98.42	181.7
104.98	181.75	118.1	181.4	124.67	181.5	137.79	181.21	141.07	181.22
147.63	180.96	154.19	180.94	164.03	181.1	170.59	181	180.44	181.01

187	180.79	193.56	180.87	203.4	180.77	206.68	180.63	213.24	180.62
226.37	180.39	236.21	180.29	242.77	180.09	262.45	179.99	269.01	179.82
282.14	179.68	288.7	179.86	295.26	179.61	311.66	179.38	321.51	179.57
331.35	179.41	337.91	179.19	344.47	179.36	351.03	179.14	367.43	178.98
374	178.7	390.4	178.75	400.24	178.52	406.8	178.58	410.08	178.44
413.36	178.62	426.49	178.25	436.33	178.44	446.17	178.27	459.29	178.26
465.85	178.16	472.42	178.2	482.26	177.99	498.66	178.02	511.78	177.68
518.35	177.79	538.03	177.63	544.59	177.4	547.87	177.53	554.43	177.51
560.99	177.29	567.56	177.31	583.96	177.13	590.52	177.26	597.08	177
610.2	176.83	613.48	176.71	629.89	176.5	636.45	176.54	643.01	176.42
656.13	176.64	662.69	176.53	665.98	176.6	669.26	176.41	679.1	176.28
685.66	176.36	692.22	176.05	698.78	176.17	705.34	175.99	708.62	176.09
725.03	175.86	731.59	175.7	734.87	175.86	744.71	175.71	751.27	175.82
757.83	175.76	767.68	175.49	777.52	175.62	784.08	175.37	790.64	175.28
800.48	175.45	810.32	175.36	826.73	175.36	833.29	175.06	846.41	175.11
856.25	175.25	866.1	175.07	869.38	175.16	875.94	174.87	889.06	174.99
892.34	175.11	898.9	174.88	908.74	174.94	921.87	174.74	928.43	174.85
944.83	174.67	951.39	174.46	957.95	174.41	964.52	174.51	977.64	174.28
980.92	174.32	987.48	174.13	997.32	174.4	1007.16	174.13	1017.01	174.26
1020.29	174.12	1026.85	174.11	1033.41	173.92	1043.25	173.95	1049.81	173.75
1062.94	173.94	1069.5	173.77	1076.06	173.73	1079.34	173.84	1099.02	173.88
1112.15	173.66	1121.99	173.68	1125.27	173.55	1135.11	173.43	1144.95	173.46
1148.23	173.35	1167.92	173.53	1177.76	173.28	1187.6	173.38	1207.29	173.28
1213.85	173.37	1220.41	173.17	1226.97	173.18	1233.53	173.04	1240.09	173.24
1249.93	172.91	1263.06	172.86	1279.46	173.02	1286.02	173.19	1292.58	172.93
1299.14	172.95	1305.71	173.15	1312.27	173.09	1322.11	173.14	1328.67	173.27
1335.23	173.07	1341.79	173.23	1348.35	173.07	1361.48	173.14	1371.32	173.03
1384.44	173.21	1391	173.49	1400.84	173.43	1407.41	173.73	1423.81	174.31
1443.49	174.4	1446.77	174.52	1463.18	174.63	1489.42	175.11	1499.27	175.09
1505.83	175.2	1522.23	175.07	1541.91	174.97	1548.48	174.72	1555.04	174.78
1561.6	174.46	1568.16	174.39	1574.72	174.45	1581.28	174.14	1587.84	174.18
1600.97	173.63	1607.53	173.29	1617.37	173.14	1620.65	173.26	1637.05	173.07
1640.33	172.92	1653.46	173.15	1666.58	172.94	1679.7	173.04	1682.98	172.89
1692.83	172.85	1699.39	172.72	1719.07	172.68	1725.63	172.78	1738.75	172.77
1745.32	173.01	1751.88	172.97	1755.16	172.81	1765	172.86	1771.56	172.65
1778.12	172.8	1784.68	172.45	1797.81	172.5	1807.65	172.26	1814.21	172.35
1827.33	172.24	1833.89	172	1840.46	172.1	1847.02	172.05	1856.86	172.21
1869.98	172.1	1876.54	172.19	1892.95	172	1896.23	172.12	1909.35	172.03
1912.63	171.88	1932.31	171.77	1938.88	171.55	1948.72	171.93	1955.28	171.8
1965.12	171.84	1968.4	171.74	1981.52	171.78	1991.37	171.63	2001.21	171.68
2007.77	171.47	2017.61	171.54	2027.45	171.39	2034.02	171.65	2040.58	171.49
2047.14	171.58	2056.98	171.38	2066.82	171.42	2073.38	171.26	2079.95	171.4
2089.79	171.35	2096.35	171.51	2102.91	171.29	2109.47	171.45	2129.16	171.28
2132.44	171.19	2142.28	171.22	2148.84	171.36	2155.4	171.24	2175.09	171.35
2184.93	171.28	2191.49	171.4	2204.61	171.29	2211.17	171.4	2230.86	171.22
2240.7	171.32	2253.82	171.56	2280.07	171.36	2286.63	171.2	2293.19	171.24
2306.31	171.17	2312.87	171.31	2322.72	171.2	2335.84	171.15	2352.24	171.47
2378.49	171.59	2388.33	171.49	2400.88	171.52	2410.96	171.61	2421.05	171.81
2431.144	171.86	2441.23	171.88	2461.40	171.87	2471.49	171.84	2481.58	171.69
2491.671	171.52	511.846	171.38	2521.93	171.29	2542.10	171.23	2572.37	171.17
2592.548	171.22	612.723	171.16	2622.81	171.18	2673.25	171.07	2703.51	171.1
2723.688	171.06	2743.86	171.08	2753.95	171.03	2794.30	171.09	2804.39	171.07
2814.478	171.09	2844.74	171.09	2885.09	171.06	2905.26	171.12	2925.44	171.33
2935.531	171.49	2945.61	171.61	2955.70	171.68	2965.79	171.83	2975.88	171.83
2985.97	171.86	3026.32	172.69	3036.40	172.83	3056.58	172.83	3066.67	172.97
3107.022	173.78	3117.11	173.83	3217.98	173.83	3228.07	173.71	3268.42	173.11
3278.514	172.99	3288.60	172.83	3328.95	172.83	3339.04	173.13	3369.30	173.7
3389.479	174.12	3419.74	174.62	3429.83	174.77	3439.91	174.83	3490.35	174.83
3500.444	174.76	3530.70	174.31	3550.88	173.79	3560.97	173.64	3571.05	173.45
3581.146	173.15	3601.32	172.51	3611.40	172.13	3621.49	171.83	3671.93	171.83
3712.287	171.96	3722.37	171.96	3762.72	172.08	3782.90	172.25	3792.98	172.22
3803.076	172.26	3813.16	172.49	3823.25	172.83	3833.34	172.97	3843.42	173.16
3853.515	173.12	3873.69	173.22	3883.77	173.29	3893.86	173.33	3903.95	173.11

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3944.305  170.493954.392  168.58 3964.48  165.943974.568  163.353984.656   161.1
3994.743  159.83    4012   156.84014.919  159.834025.006  160.134035.094  161.35
4045.182  163.52 4055.27  165.274075.445  168.744085.533  170.344095.621  171.87
4105.708  172.444115.796  172.934125.884  173.194135.972  173.374156.147  173.66
4176.322  173.85 4186.41     1744246.937  174.534257.024  174.534287.288  174.28
4307.463  174.094317.551  174.024367.989   173.94418.428  173.474428.516  173.36
4438.604  173.314448.691  173.394519.306  173.694529.393  173.724579.832   173.7
4640.358  173.784670.622  173.774751.323  173.234761.411  173.154771.499  173.13
4781.586  173.074791.674  173.114801.762   173.14821.938  172.854842.113  172.68
4872.376  172.834882.464   172.94912.727  173.264932.903  173.464963.166  173.85
4973.253  174.064993.429  174.415013.604  174.835023.692  175.25 5033.78  175.75

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0     .07 3964.48    .045 4055.27     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
       3964.48 4055.27                5      10      35             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3972     180       F
    4052 5033.78     180       F

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
***********
* E.G. Elev (ft)         *  174.72  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  174.71  * Reach Len. (ft)       *    5.00  *   10.00  *
  35.00  *
* Crit W.S. (ft)         *  161.57  * Flow Area (sq ft)     *          * 1114.41  *
         *
* E.G. Slope (ft/ft)     *0.000015  * Area (sq ft)          * 6467.22  * 1219.42  *
1246.26  *
* Q Total (cfs)          *  800.00  * Flow (cfs)            *          *  800.00  *
         *
* Top Width (ft)         * 3899.97  * Top Width (ft)        * 2856.58  *   90.79  *
 952.60  *
* Vel Total (ft/s)       *    0.72  * Avg. Vel. (ft/s)      *          *    0.72  *
         *
* Max Chl Dpth (ft)      *   17.91  * Hydr. Depth (ft)      *          *   13.93  *
         *
* Conv. Total (cfs)      *208928.9  * Conv. (cfs)           *          *208928.9  *
         *
* Length Wtd. (ft)       *   10.00  * Wetted Per. (ft)      *          *   82.37  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)      *          *    0.01  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.01  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  892.22  *  231.05  *
1266.49  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *   96.51  *   10.90  *
 103.93  *
*********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
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1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

E.G. Elev (ft)	175.59	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.045	
W.S. Elev (ft)	175.58	Reach Len. (ft)	5.00	10.00	35.00
Crit W.S. (ft)	161.57	Flow Area (sq ft)		1183.98	
E.G. Slope (ft/ft)	*0.000017	Area (sq ft)		1183.98	
Q Total (cfs)	800.00	Flow (cfs)		800.00	
Top Width (ft)	80.00	Top Width (ft)		80.00	
Vel Total (ft/s)	0.68	Avg. Vel. (ft/s)		0.68	
Max Chl Dpth (ft)	18.78	Hydr. Depth (ft)		14.80	
Conv. Total (cfs)	*196812.7	Conv. (cfs)		*196812.7	
Length Wtd. (ft)	10.00	Wetted Per. (ft)		104.82	
Min Ch El (ft)	156.80	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)		0.01	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	97.80	236.67	690.48
C & E Loss (ft)	0.01	Cum SA (acres)	2.30	10.62	28.87

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	169.89	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.06	Wt. n-Val.		0.045	
W.S. Elev (ft)	169.83	Reach Len. (ft)	5.00	10.00	35.00
Crit W.S. (ft)	162.57	Flow Area (sq ft)		723.93	
E.G. Slope (ft/ft)	*0.000203	Area (sq ft)	30.05	776.28	60.73
Q Total (cfs)	1450.00	Flow (cfs)		1450.00	
Top Width (ft)	134.52	Top Width (ft)	16.69	90.79	27.05

* Vel Total (ft/s)	* 2.00	* Avg. Vel. (ft/s)	*	* 2.00	*			
* Max Chl Dpth (ft)	* 13.03	* Hydr. Depth (ft)	*	* 9.05	*			
* Conv. Total (cfs)	*101800.5	* Conv. (cfs)	*	*101800.5	*			
* Length Wtd. (ft)	* 10.00	* Wetted Per. (ft)	*	* 82.37	*			
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.11	*			
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.22	*			
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 436.80	* 164.54	* 558.56	*		
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 58.05	* 11.03	* 94.38	*		

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 173.20	* Element	* Left OB	* Channel	* Right OB	*		
* Vel Head (ft)	* 0.01	* Wt. n-Val.	*	* 0.045	*			
* W.S. Elev (ft)	* 173.18	* Reach Len. (ft)	* 5.00	* 10.00	* 35.00	*		
* Crit W.S. (ft)	* 161.84	* Flow Area (sq ft)	*	* 992.20	*			
* E.G. Slope (ft/ft)	*0.000030	* Area (sq ft)	* 2639.10	* 1080.73	* 234.23	*		
* Q Total (cfs)	* 950.00	* Flow (cfs)	*	* 950.00	*			
* Top Width (ft)	* 2341.40	* Top Width (ft)	* 2031.24	* 90.79	* 219.37	*		
* Vel Total (ft/s)	* 0.96	* Avg. Vel. (ft/s)	*	* 0.96	*			
* Max Chl Dpth (ft)	* 16.38	* Hydr. Depth (ft)	*	* 12.40	*			
* Conv. Total (cfs)	*172156.2	* Conv. (cfs)	*	*172156.2	*			
* Length Wtd. (ft)	* 10.00	* Wetted Per. (ft)	*	* 82.37	*			
* Min Ch El (ft)	* 156.80	* Shear (lb/sq ft)	*	* 0.02	*			
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.02	*			
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 731.08	* 211.15	* 1046.82	*		
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 83.39	* 10.90	* 101.36	*		

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)

is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.		0.045	
W.S. Elev (ft)	178.47	Reach Len. (ft)	5.00	10.00	35.00
Crit W.S. (ft)	161.39	Flow Area (sq ft)		1415.49	
E.G. Slope (ft/ft)	0.000005	Area (sq ft)	18889.58	1561.11	4917.20
Q Total (cfs)	700.00	Flow (cfs)		700.00	
Top Width (ft)	4616.67	Top Width (ft)	3547.37	90.79	978.51
Vel Total (ft/s)	0.49	Avg. Vel. (ft/s)		0.49	
Max Chl Dpth (ft)	21.67	Hydr. Depth (ft)		17.69	
Conv. Total (cfs)	311242.8	Conv. (cfs)		311242.8	
Length Wtd. (ft)	9.75	Wetted Per. (ft)		82.37	
Min Ch El (ft)	156.80	Shear (lb/sq ft)		0.01	
Alpha	1.00	Stream Power (lb/ft s)		0.00	
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1375.63	280.30	1848.35
C & E Loss (ft)	0.00	Cum SA (acres)	125.61	11.23	125.39

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 245

INPUT
Description: XS 245
LOW CHORD ELEVATION REVISED TO MATCH PROPOSED BRIDGE
PLAN
THIS IS THE U/S FACE OF THE SMALL RUNWAY
Station Elevation Data num= 389

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	182.87	3.28	182.74	26.25	182.47	32.81	182.48	39.37	182.27
45.93	182.32	52.49	182.57	68.89	182.21	75.46	182.31	98.42	181.7
104.98	181.75	118.1	181.4	124.67	181.5	137.79	181.21	141.07	181.22
147.63	180.96	154.19	180.94	164.03	181.1	170.59	181	180.44	181.01
187	180.79	193.56	180.87	203.4	180.77	206.68	180.63	213.24	180.62
226.37	180.39	236.21	180.29	242.77	180.09	262.45	179.99	269.01	179.82
282.14	179.68	288.7	179.86	295.26	179.61	311.66	179.38	321.51	179.57
331.35	179.41	337.91	179.19	344.47	179.36	351.03	179.14	367.43	178.98
374	178.7	390.4	178.75	400.24	178.52	406.8	178.58	410.08	178.44
413.36	178.62	426.49	178.25	436.33	178.44	446.17	178.27	459.29	178.26
465.85	178.16	472.42	178.2	482.26	177.99	498.66	178.02	511.78	177.68
518.35	177.79	538.03	177.63	544.59	177.4	547.87	177.53	554.43	177.51
560.99	177.29	567.56	177.31	583.96	177.13	590.52	177.26	597.08	177
610.2	176.83	613.48	176.71	629.89	176.5	636.45	176.54	643.01	176.42
656.13	176.64	665.98	176.6	669.26	176.41	679.1	176.28	685.66	176.36
692.22	176.05	698.78	176.17	705.34	175.99	708.62	176.09	725.03	175.86
731.59	175.7	734.87	175.86	744.71	175.71	751.27	175.82	757.83	175.76
767.68	175.49	777.52	175.62	784.08	175.37	790.64	175.28	800.48	175.45
810.32	175.36	826.73	175.36	833.29	175.06	846.41	175.11	856.25	175.25
866.1	175.07	869.38	175.16	875.94	174.87	889.06	174.99	892.34	175.11
898.9	174.88	908.74	174.94	921.87	174.74	928.43	174.85	944.83	174.67
951.39	174.46	957.95	174.41	964.52	174.51	977.64	174.28	980.92	174.32
987.48	174.13	997.32	174.4	1007.16	174.13	1017.01	174.26	1020.29	174.12
1026.85	174.11	1033.41	173.92	1043.25	173.95	1049.81	173.75	1062.94	173.94
1076.06	173.73	1079.34	173.84	1099.02	173.88	1112.15	173.66	1121.99	173.68
1125.27	173.55	1135.11	173.43	1144.95	173.46	1148.23	173.35	1167.92	173.53
1177.76	173.28	1187.6	173.38	1207.29	173.28	1213.85	173.37	1220.41	173.17
1226.97	173.18	1233.53	173.04	1240.09	173.24	1249.93	172.91	1263.06	172.86
1279.46	173.02	1286.02	173.19	1292.58	172.93	1299.14	172.95	1305.71	173.15
1312.27	173.09	1322.11	173.14	1328.67	173.27	1335.23	173.07	1341.79	173.23
1348.35	173.07	1361.48	173.14	1371.32	173.03	1384.44	173.21	1391	173.49
1400.84	173.43	1407.41	173.73	1423.81	174.31	1443.49	174.4	1446.77	174.52
1463.18	174.63	1489.42	175.11	1499.27	175.09	1505.83	175.2	1522.23	175.07
1541.91	174.97	1548.48	174.72	1555.04	174.78	1561.6	174.46	1568.16	174.39
1574.72	174.45	1581.28	174.14	1587.84	174.18	1600.97	173.63	1607.53	173.29
1617.37	173.14	1620.65	173.26	1637.05	173.07	1640.33	172.92	1653.46	173.15
1666.58	172.94	1679.7	173.04	1682.98	172.89	1692.83	172.85	1699.39	172.72
1719.07	172.68	1725.63	172.78	1738.75	172.77	1745.32	173.01	1751.88	172.97
1755.16	172.81	1765	172.86	1771.56	172.65	1778.12	172.8	1784.68	172.45
1797.81	172.5	1807.65	172.26	1814.21	172.35	1827.33	172.24	1833.89	172
1840.46	172.1	1847.02	172.05	1856.86	172.21	1869.98	172.1	1876.54	172.19
1892.95	172	1896.23	172.12	1909.35	172.03	1912.63	171.88	1932.31	171.77
1938.88	171.55	1948.72	171.93	1955.28	171.8	1965.12	171.84	1968.4	171.74
1981.52	171.78	1991.37	171.63	2001.21	171.68	2007.77	171.47	2017.61	171.54
2027.45	171.39	2034.02	171.65	2040.58	171.49	2047.14	171.58	2056.98	171.38
2066.82	171.42	2073.38	171.26	2079.95	171.4	2089.79	171.35	2096.35	171.51
2102.91	171.29	2109.47	171.45	2129.16	171.28	2132.44	171.19	2142.28	171.22
2148.84	171.36	2155.4	171.24	2175.09	171.35	2184.93	171.28	2191.49	171.4
2204.61	171.29	2211.17	171.4	2230.86	171.22	2240.7	171.32	2253.82	171.56
2280.07	171.36	2286.63	171.2	2293.19	171.24	2306.31	171.17	2312.87	171.31
2322.72	171.2	2335.84	171.15	2352.24	171.47	2378.49	171.59	2388.33	171.49
2401.45	171.562406.918		171.542417.074		171.742427.229		171.852457.697		171.88
2467.853	171.852478.008		171.73	2498.32	171.432508.476		171.432518.631		171.29
2528.787	171.292538.943		171.232549.099		171.23	2569.41	171.172579.566		171.17
2589.722	171.22610.033		171.16	2640.5	171.162670.968		171.08	2691.28	171.08
2711.591	171.12721.747		171.062742.058		171.082752.214		171.042792.837		171.09
2802.993	171.062813.149		171.1	2833.46	171.072843.616		171.092884.239		171.06
2904.551	171.122914.707		171.212924.862		171.332935.018		171.482945.174		171.6
2955.33	171.682965.485		171.832975.641		171.832985.797		171.86	3026.42	172.69
3036.576	172.833056.887		172.833067.043		172.983107.666		173.793117.822		173.83
3219.38	173.833270.158		173.09	3290.47	172.833331.093		172.833341.249		173.15
3361.56	173.533381.872		173.973422.495		174.673432.651		174.813493.585		174.83

```
3503.741  174.713524.053  174.413534.208  174.223544.364  173.94 3554.52  173.72
3564.676   173.63574.832  173.343595.143  172.723605.299  172.373615.455  171.85
3666.234  171.833676.389  171.843686.545  171.893706.857  171.953727.168  171.97
3757.635  172.063767.791  172.113777.947  172.213788.103  172.253798.259  172.22
3808.414  172.27 3818.57  172.743828.726  172.853838.882  173.113859.193  173.13
 3889.66  173.333899.816   173.33940.439  170.553950.595  169.153960.751  166.96
3970.907  164.573981.063  162.183991.218  159.83    4016   156.84021.686  159.83
4031.841  160.714041.997  162.884052.153   164.74062.309  166.394072.464  167.98
 4082.62  169.464092.776   171.44102.932  172.834113.087  172.974123.243  173.39
4133.399  173.654143.555  173.834174.022  174.314184.178  174.494255.268  175.28
4265.424  175.34 4275.58  175.324306.047  175.114397.449  175.084417.761  174.99
4438.072  174.854448.228  174.854488.851  175.054509.163   175.14600.564  175.07
4641.188  175.134691.966  175.124712.278  175.044752.901  174.774793.524  174.73
4813.836  174.794854.459  174.324864.615  174.234874.771  173.964884.926  173.83
4905.238  173.714915.394  173.794986.484  174.77 4996.64  175.085006.795  175.55
5016.951  175.885027.107  176.025047.418   176.2 5067.73  176.26

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*****************************************
       0     .073970.907    .0454052.153     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      3970.9074052.153              230     230     230             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3996   176.9       F
    4031 5067.73   176.6       F

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
***********
* E.G. Elev (ft)         *  174.71  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  174.68  * Reach Len. (ft)        *   50.00  *   50.00  *
  50.00  *
* Crit W.S. (ft)         *  161.20  * Flow Area (sq ft)      *          *  560.75  *
         *
* E.G. Slope (ft/ft)     *0.000048  * Area (sq ft)           * 6449.75  * 1140.07  *
 456.54  *
* Q Total (cfs)          *  800.00  * Flow (cfs)             *          *  800.00  *
         *
* Top Width (ft)         * 3240.13  * Top Width (ft)        * 2853.20  *   81.25  *
 305.68  *
* Vel Total (ft/s)       *    1.43  * Avg. Vel. (ft/s)       *          *    1.43  *
         *
* Max Chl Dpth (ft)      *   17.88  * Hydr. Depth (ft)       *          *   16.02  *
         *
* Conv. Total (cfs)      *115611.3  * Conv. (cfs)            *          *115611.3  *
         *
* Length Wtd. (ft)       *   50.00  * Wetted Per. (ft)       *          *   35.94  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    0.05  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.07  *
         *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  891.48  *  230.78  *
1265.81  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   96.18  *   10.88  *
 103.43  *
*********************************************************************************
```

```
**********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
********************************************************************************
**********
* E.G. Elev (ft)         *  175.58  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.03  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  175.55  * Reach Len. (ft)       *   50.00  *   50.00  *
  50.00  *
* Crit W.S. (ft)         *  161.19  * Flow Area (sq ft)     *          *  591.28  *
         *
* E.G. Slope (ft/ft)     *0.000092  * Area (sq ft)          *          *  591.28  *
         *
* Q Total (cfs)          *  800.00  * Flow (cfs)            *          *  800.00  *
         *
* Top Width (ft)         *   35.00  * Top Width (ft)        *          *   35.00  *
         *
* Vel Total (ft/s)       *    1.35  * Avg. Vel. (ft/s)      *          *    1.35  *
         *
* Max Chl Dpth (ft)      *   18.75  * Hydr. Depth (ft)      *          *   16.89  *
         *
* Conv. Total (cfs)      * 83244.4  * Conv. (cfs)           *          * 83244.4  *
         *
* Length Wtd. (ft)       *   50.00  * Wetted Per. (ft)      *          *   67.16  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)      *          *    0.05  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.07  *
         *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)  *   97.80  *  236.47  *
 690.48  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)        *    2.30  *   10.60  *
  28.87  *
********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #10%
********************************************************************************
**********
* E.G. Elev (ft)         *  169.84  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.22  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  169.62  * Reach Len. (ft)       *   50.00  *   50.00  *
  50.00  *
* Crit W.S. (ft)         *  162.42  * Flow Area (sq ft)     *          *  383.62  *
         *
* E.G. Slope (ft/ft)     *0.000558  * Area (sq ft)          *   55.83  *  728.91  *
```

```
  75.29  *
* Q Total (cfs)          * 1450.00  * Flow (cfs)              *          * 1450.00  *
         *
* Top Width (ft)         *  136.26  * Top Width (ft)         *   23.72  *   81.25  *
  31.30  *
* Vel Total (ft/s)       *    3.78  * Avg. Vel. (ft/s)       *          *    3.78  *
         *
* Max Chl Dpth (ft)      *   12.82  * Hydr. Depth (ft)       *          *   10.96  *
         *
* Conv. Total (cfs)      * 61409.1  * Conv. (cfs)            *          * 61409.1  *
         *
* Length Wtd. (ft)       *   50.00  * Wetted Per. (ft)       *          *   35.94  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    0.37  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    1.40  *
         *
* Frctn Loss (ft)        *    0.04  * Cum Volume (acre-ft)   *  436.80  *  164.36  *
 558.50  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *   58.05  *   11.01  *
  94.36  *
*********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #2%
*********************************************************************************
***********
* E.G. Elev (ft)         *  173.18  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.05  * Wt. n-Val.             *          *   0.045  *
         *
* W.S. Elev (ft)         *  173.13  * Reach Len. (ft)        *   50.00  *   50.00  *
  50.00  *
* Crit W.S. (ft)         *  161.50  * Flow Area (sq ft)      *          *  506.51  *
         *
* E.G. Slope (ft/ft)     *0.000095  * Area (sq ft)           * 2594.23  * 1014.16  *
 222.57  *
* Q Total (cfs)          *  950.00  * Flow (cfs)             *          *  950.00  *
         *
* Top Width (ft)         * 2117.41  * Top Width (ft)         * 1971.36  *   81.25  *
  64.81  *
* Vel Total (ft/s)       *    1.88  * Avg. Vel. (ft/s)       *          *    1.88  *
         *
* Max Chl Dpth (ft)      *   16.33  * Hydr. Depth (ft)       *          *   14.47  *
         *
* Conv. Total (cfs)      * 97581.0  * Conv. (cfs)            *          * 97581.0  *
         *
* Length Wtd. (ft)       *   50.00  * Wetted Per. (ft)       *          *   35.94  *
         *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)       *          *    0.08  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.16  *
         *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *  730.78  *  210.91  *
1046.63  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   83.16  *   10.88  *
 101.25  *
```

```
**********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #0.2%
**********
* E.G. Elev (ft)         *  178.48  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  178.48  * Reach Len. (ft)       *   50.00  *   50.00  *
  50.00  *
* Crit W.S. (ft)         *  160.98  * Flow Area (sq ft)     *18991.26  * 1448.50  *
4003.43  *
* E.G. Slope (ft/ft)     *0.000000  * Area (sq ft)          *18991.26  * 1448.50  *
4003.43  *
* Q Total (cfs)          *  700.00  * Flow (cfs)            *  488.63  *  127.44  *
  83.93  *
* Top Width (ft)         * 4650.76  * Top Width (ft)        * 3553.94  *   81.25  *
1015.58  *
* Vel Total (ft/s)       *    0.03  * Avg. Vel. (ft/s)      *    0.03  *    0.09  *
   0.02  *
* Max Chl Dpth (ft)      *   21.68  * Hydr. Depth (ft)      *    5.34  *   17.83  *
   3.94  *
* Conv. Total (cfs)      *1765311.0  * Conv. (cfs)           *1232263.0  *321386.7
*211660.7  *
* Length Wtd. (ft)       *   50.00  * Wetted Per. (ft)      * 3555.14  *   83.16  *
1018.51  *
* Min Ch El (ft)         *  156.80  * Shear (lb/sq ft)      *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    2.35  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  * 1373.46  *  279.95  *
1844.77  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *  125.20  *   11.22  *
 124.59  *
**********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE


RIVER: RIVER-1
REACH: Reach-1            RS: 244.19

INPUT
Description: Bridge #1 - Taxiway
```

Distance from Upstream XS = 50
Deck/Roadway Width = 133
Weir Coefficient = 2.7
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	180	0	606	177.3	0	1956	177.3	0
3156	176.9	0	3996	176.6	0	4000.99	177.16	0
4001	177.16	170.99	4031	177.16	170.99	4031.01	177.16	0
5086	176.6	0						

Upstream Bridge Cross Section Data
Station Elevation Data num= 389

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.87	3.28	182.74	26.25	182.47	32.81	182.48	39.37	182.27
45.93	182.32	52.49	182.57	68.89	182.21	75.46	182.31	98.42	181.7
104.98	181.75	118.1	181.4	124.67	181.5	137.79	181.21	141.07	181.22
147.63	180.96	154.19	180.94	164.03	181.1	170.59	181	180.44	181.01
187	180.79	193.56	180.87	203.4	180.77	206.68	180.63	213.24	180.62
226.37	180.39	236.21	180.29	242.77	180.09	262.45	179.99	269.01	179.82
282.14	179.68	288.7	179.86	295.26	179.61	311.66	179.38	321.51	179.57
331.35	179.41	337.91	179.19	344.47	179.36	351.03	179.14	367.43	178.98
374	178.7	390.4	178.75	400.24	178.52	406.8	178.58	410.08	178.44
413.36	178.62	426.49	178.25	436.33	178.44	446.17	178.27	459.29	178.26
465.85	178.16	472.42	178.2	482.26	177.99	498.66	178.02	511.78	177.68
518.35	177.79	538.03	177.63	544.59	177.4	547.87	177.53	554.43	177.51
560.99	177.29	567.56	177.31	583.96	177.13	590.52	177.26	597.08	177
610.2	176.83	613.48	176.71	629.89	176.5	636.45	176.54	643.01	176.42
656.13	176.64	665.98	176.6	669.26	176.41	679.1	176.28	685.66	176.36
692.22	176.05	698.78	176.17	705.34	175.99	708.62	176.09	725.03	175.86
731.59	175.7	734.87	175.86	744.71	175.71	751.27	175.82	757.83	175.76
767.68	175.49	777.52	175.62	784.08	175.37	790.64	175.28	800.48	175.45
810.32	175.36	826.73	175.36	833.29	175.06	846.41	175.11	856.25	175.25
866.1	175.07	869.38	175.16	875.94	174.87	889.06	174.99	892.34	175.11
898.9	174.88	908.74	174.94	921.87	174.74	928.43	174.85	944.83	174.67
951.39	174.46	957.95	174.41	964.52	174.51	977.64	174.28	980.92	174.32
987.48	174.13	997.32	174.4	1007.16	174.13	1017.01	174.26	1020.29	174.12
1026.85	174.11	1033.41	173.92	1043.25	173.95	1049.81	173.75	1062.94	173.94
1076.06	173.73	1079.34	173.84	1099.02	173.88	1112.15	173.66	1121.99	173.68
1125.27	173.55	1135.11	173.43	1144.95	173.46	1148.23	173.35	1167.92	173.53
1177.76	173.28	1187.6	173.38	1207.29	173.28	1213.85	173.37	1220.41	173.17
1226.97	173.18	1233.53	173.04	1240.09	173.24	1249.93	172.91	1263.06	172.86
1279.46	173.02	1286.02	173.19	1292.58	172.93	1299.14	172.95	1305.71	173.15
1312.27	173.09	1322.11	173.14	1328.67	173.27	1335.23	173.07	1341.79	173.23
1348.35	173.07	1361.48	173.14	1371.32	173.03	1384.44	173.21	1391	173.49
1400.84	173.43	1407.41	173.73	1423.81	174.31	1443.49	174.4	1446.77	174.52
1463.18	174.63	1489.42	175.11	1499.27	175.09	1505.83	175.2	1522.23	175.07
1541.91	174.97	1548.48	174.72	1555.04	174.78	1561.6	174.46	1568.16	174.39
1574.72	174.45	1581.28	174.14	1587.84	174.18	1600.97	173.63	1607.53	173.29
1617.37	173.14	1620.65	173.26	1637.05	173.07	1640.33	172.92	1653.46	173.15
1666.58	172.94	1679.7	173.04	1682.98	172.89	1692.83	172.85	1699.39	172.72
1719.07	172.68	1725.63	172.78	1738.75	172.77	1745.32	173.01	1751.88	172.97
1755.16	172.81	1765	172.86	1771.56	172.65	1778.12	172.8	1784.68	172.45
1797.81	172.5	1807.65	172.26	1814.21	172.35	1827.33	172.24	1833.89	172
1840.46	172.1	1847.02	172.05	1856.86	172.21	1869.98	172.1	1876.54	172.19
1892.95	172	1896.23	172.12	1909.35	172.03	1912.63	171.88	1932.31	171.77
1938.88	171.55	1948.72	171.93	1955.28	171.8	1965.12	171.84	1968.4	171.74
1981.52	171.78	1991.37	171.63	2001.21	171.68	2007.77	171.47	2017.61	171.54
2027.45	171.39	2034.02	171.65	2040.58	171.49	2047.14	171.58	2056.98	171.38
2066.82	171.42	2073.38	171.26	2079.95	171.4	2089.79	171.35	2096.35	171.51

2102.91	171.29	2109.47	171.45	2129.16	171.28	2132.44	171.19	2142.28	171.22
2148.84	171.36	2155.4	171.24	2175.09	171.35	2184.93	171.28	2191.49	171.4
2204.61	171.29	2211.17	171.4	2230.86	171.22	2240.7	171.32	2253.82	171.56
2280.07	171.36	2286.63	171.2	2293.19	171.24	2306.31	171.17	2312.87	171.31
2322.72	171.2	2335.84	171.15	2352.24	171.47	2378.49	171.59	2388.33	171.49
2401.45	171.56	2406.918	171.54	2417.074	171.74	2427.229	171.85	2457.697	171.88
2467.853	171.85	2478.008	171.73	2498.32	171.43	2508.476	171.43	2518.631	171.29
2528.787	171.29	2538.943	171.23	2549.099	171.23	2569.41	171.17	2579.566	171.17
2589.722	171.22	2610.033	171.16	2640.5	171.16	2670.968	171.08	2691.28	171.08
2711.591	171.12	2721.747	171.06	2742.058	171.08	2752.214	171.04	2792.837	171.09
2802.993	171.06	2813.149	171.1	2833.46	171.07	2843.616	171.09	2884.239	171.06
2904.551	171.12	2914.707	171.21	2924.862	171.33	2935.018	171.48	2945.174	171.6
2955.33	171.68	2965.485	171.83	2975.641	171.83	2985.797	171.86	3026.42	172.69
3036.576	172.83	3056.887	172.83	3067.043	172.98	3107.666	173.79	3117.822	173.83
3219.38	173.83	3270.158	173.09	3290.47	172.83	3331.093	172.83	3341.249	173.15
3361.56	173.53	3381.872	173.97	3422.495	174.67	3432.651	174.81	3493.585	174.83
3503.741	174.71	3524.053	174.41	3534.208	174.22	3544.364	173.94	3554.52	173.72
3564.676	173.63	3574.832	173.34	3595.143	172.72	3605.299	172.37	3615.455	171.85
3666.234	171.83	3676.389	171.84	3686.545	171.89	3706.857	171.95	3727.168	171.97
3757.635	172.06	3767.791	172.11	3777.947	172.21	3788.103	172.25	3798.259	172.22
3808.414	172.27	3818.57	172.74	3828.726	172.85	3838.882	173.11	3859.193	173.13
3889.66	173.33	3899.816	173.33	3940.439	170.55	3950.595	169.15	3960.751	166.96
3970.907	164.57	3981.063	162.18	3991.218	159.83	4016	156.84	4021.686	159.83
4031.841	160.71	4041.997	162.88	4052.153	164.74	4062.309	166.39	4072.464	167.98
4082.62	169.46	4092.776	171.44	4102.932	172.83	4113.087	172.97	4123.243	173.39
4133.399	173.65	4143.555	173.83	4174.022	174.31	4184.178	174.49	4255.268	175.28
4265.424	175.34	4275.58	175.32	4306.047	175.11	4397.449	175.08	4417.761	174.99
4438.072	174.85	4448.228	174.85	4488.851	175.05	4509.163	175.14	4600.564	175.07
4641.188	175.13	4691.966	175.12	4712.278	175.04	4752.901	174.77	4793.524	174.73
4813.836	174.79	4854.459	174.32	4864.615	174.23	4874.771	173.96	4884.926	173.83
4905.238	173.71	4915.394	173.79	4986.484	174.77	4996.64	175.08	5006.795	175.55
5016.951	175.88	5027.107	176.02	5047.418	176.2	5067.73	176.26		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3970.907	.045	4052.153	.07

Bank Sta: Left Right Coeff Contr. Expan.

3970.907	4052.153	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3996	176.9	F
4031	5067.73	176.6	F

Downstream Deck/Roadway Coordinates

num= 9

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
0	180	0	619	177.3	0	1969	177.3	0
3169	176.9	0	3964	177.16	0	3964	177.16	170.93
3994	177.16	170.93	3994	177.16	0	5099	176.6	0

Downstream Bridge Cross Section Data

Station Elevation Data num= 486

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.05	3.28	181.94	16.4	181.9	26.25	182.24	29.53	181.94
32.81	180.94	39.37	181.2	49.21	181.16	59.05	180.91	68.89	181.02
82.02	180.48	104.98	180.69	108.26	180.4	127.94	180.32	131.22	179.72
137.79	179.68	150.91	179.84	164.03	179.86	183.71	179.02	190.28	178.2
203.4	177.96	209.96	178.84	216.52	179.29	236.2	179.94	242.77	179.98
249.33	180.34	252.61	180.25	269.01	181.59	275.57	181.62	288.69	182.16

295.26	182.7	321.5	182.41	328.06	182.48	334.62	182.21	344.46	182.2
370.71	181.77	396.95	179.89	400.24	179.83	410.08	179.13	426.48	178.9
433.04	178.6	442.88	178.38	449.44	178.08	472.41	177.5	478.97	177.26
485.53	177.23	488.81	176.99	521.62	176.31	524.9	176.09	531.46	176.05
547.86	175.67	551.14	175.75	557.71	175.46	574.11	175.1	583.95	175.01
600.35	175.01	610.2	174.7	620.04	174.58	643	173.58	652.84	173.81
662.69	174.32	682.37	174.52	688.93	174.33	698.77	174.54	705.33	174.31
718.46	174.2	721.74	173.97	728.3	173.94	734.86	174.19	741.42	174.05
761.1	173.95	767.67	174.02	780.79	173.69	787.35	173.83	790.63	173.65
810.31	173.57	816.88	173.4	820.16	173.06	830	172.91	843.12	173.36
862.8	173.35	869.36	173.5	872.65	173.35	895.61	173.29	905.45	173.43
915.29	173.31	918.57	172.98	934.98	173.04	948.1	172.67	957.94	172.93
967.78	172.79	980.91	172.39	994.03	171.89	1007.15	172.28	1016.99	172.07
1030.12	172.14	1043.24	171.94	1049.8	172.14	1059.64	172.08	1062.92	171.92
1076.04	171.89	1082.61	171.69	1089.17	171.73	1095.73	171.47	1102.29	171.81
1108.85	171.66	1121.97	171.74	1135.1	172.4	1144.94	172.21	1158.06	172.33
1164.62	172.54	1174.46	172.6	1181.02	172.5	1194.15	172.72	1200.71	172.68
1213.83	172.94	1223.67	172.81	1233.51	173.1	1266.32	173.58	1276.16	173.96
1289.29	174.04	1299.13	174.5	1312.25	174.64	1318.81	174.52	1331.93	174.74
1341.78	175.2	1348.34	175.17	1361.46	175.5	1368.02	175.84	1377.86	175.72
1384.42	175.92	1390.98	175.84	1407.39	175.92	1413.95	175.76	1420.51	175.88
1436.91	175.77	1453.32	174.99	1469.72	174.61	1479.56	174.48	1486.12	174.56
1502.53	174.38	1505.81	174.68	1515.65	174.41	1525.49	173.46	1538.61	172.88
1561.58	172.72	1574.7	172.39	1581.26	171.87	1587.82	171.6	1600.95	171.32
1604.23	171.51	1610.79	171.24	1627.19	170.8	1640.31	170.59	1646.87	170.38
1676.4	170.08	1686.24	170.29	1699.36	170.24	1702.64	170.61	1712.49	170.63
1719.05	170.44	1725.61	170.52	1748.57	170.5	1761.7	170.2	1771.54	170.27
1778.1	170.47	1784.66	170.24	1797.78	170.6	1801.06	171.06	1814.19	171.18
1824.03	170.92	1837.15	170.79	1856.83	170.75	1863.4	170.91	1873.24	170.53
1876.52	170.6	1896.2	170.25	1899.48	170.75	1915.89	170.78	1925.73	170.44
1938.85	170.46	1942.13	170.31	1958.53	170.38	1965.09	170.76	1974.94	170.66
1978.22	170.76	1984.78	170.36	1994.62	170.43	1997.9	170.97	2011.02	170.99
2017.58	170.8	2020.87	170.93	2027.43	170.69	2033.99	170.81	2043.83	170.57
2047.11	170.66	2070.07	170.25	2073.35	170.41	2083.2	170.46	2093.04	171.03
2096.32	171.97	2106.16	172.65	2119.28	173.96	2135.68	175.02	2142.25	175.61
2152.09	175.61	2161.93	175.85	2168.49	175.7	2171.77	175.91	2181.61	176
2191.45	176.37	2214.42	176.57	2220.98	176.55	2250.5	176.81	2257.06	176.65
2270.19	176.64	2276.75	176.48	2293.15	176.48	2302.99	176.23	2312.83	175.8
2319.39	175.85	2335.8	175.74	2345.64	175.52	2358.76	175.4	2362.04	175.18
2378.44	174.72	2388.28	174.18	2391.56	174.53	2404.69	173.87	2411.25	173.33
2421.09	172.97	2429	173.16	2431.65	172.93	2441.58	172.58	2451.50	172.21
2461.43	2	1722	471.35	7	171.83	2481.28	2	171.73	2491.208
171.682	2501.133	171.63	2511.058	171.56	2520.983	171.52	2530.908	171.47	2540.833
171.422	2550.759	171.38	2560.684	171.35	2570.609	171.37	2580.534	171.42	2590.459
171.472	2600.384	171.48	2610.309	171.53	2620.234	171.61	2630.159	171.69	2640.085
171.73	2650.01	171.75	2659.935	171.76	2669.86	171.77	2679.785	171.78	2689.71
171.82	2699.635	171.76	2709.561	171.71	2719.486	171.66	2729.411	171.69	2739.336
171.732	2749.261	171.77	2759.186	171.71	2769.111	171.63	2779.036	171.58	2788.962
171.62	2798.887	171.63	2808.812	171.63	2818.737	171.57	2828.662	171.52	2838.587
171.482	2848.512	171.47	2858.438	171.46	2868.363	171.43	2878.288	171.34	2888.213
171.292	2898.138	171.29	2908.063	171.15	2917.988	171.05	2927.913	171.12	2937.839
171.142	2947.764	171.17	2957.689	171.29	2967.614	171.38	2977.539	171.48	2987.464
171.562	2997.389	171.53	3007.314	171.55	3017.24	171.54	3027.165	171.53	3037.09
171.523	3047.015	171.5	3056.94	171.48	3066.865	171.52	3076.79	171.63	3086.716
171.683	3096.641	171.76	3106.566	171.84	3116.491	171.93	3126.416	171.99	3136.341
172.113	3146.266	172.07	3156.191	172.01	3166.116	171.95	3176.042	171.89	3185.967
171.833	3195.892	171.84	3205.817	171.81	3215.742	171.76	3225.667	171.72	3235.593
171.73	3245.518	171.55	3255.443	171.39	3265.368	171.31	3275.293	171.27	3285.218
171.283	3295.143	171.23	3305.068	171.19	3314.993	171.35	3324.919	171.41	3334.844
171.533	3344.769	171.88	3354.694	172.36	3364.619	172.94	3374.544	173.46	3384.469
173.323	3394.395	173.17	3404.32	172.69	3414.245	172.13	3424.17	171.96	3434.095
171.86	3444.02	171.91	3453.945	171.94	3463.87	171.95	3473.796	172.01	3483.721
172.093	3493.646	172.12	3503.571	172.22	3513.496	172.28	3523.421	172.53	3533.346
172.73	3543.271	172.8							

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3553.197  172.713563.122  172.693573.047  172.763582.972  172.863592.897  172.95
3602.822  173.023612.747  173.113622.673  173.183632.598  173.193642.523  173.33
3652.448  173.343662.373  173.223672.298  173.083682.223  172.923692.148  172.78
3702.073  172.663711.999  172.523721.924  172.333731.849  172.113741.774   171.9
3751.699  171.743761.624  171.56 3771.55  171.423781.475  171.27  3791.4  171.07
3801.325  170.94 3811.25  170.873821.175  170.88  3831.1  170.923841.025  170.98
 3850.95  171.123860.876  171.243870.801  171.223880.726  171.113890.651  170.74
3900.576  170.643910.501  168.923920.427  165.943930.352  162.883940.277  160.34
3950.202  159.383960.127  158.83    3979   156.73989.902  158.833999.827  160.49
4009.753  162.314019.678  164.564029.603  166.434039.528   167.74049.453  170.29
4059.378  171.134069.303  170.774079.229  170.674089.154  170.324099.079  169.69
4109.004  169.164118.929  168.824128.854  168.714138.779   168.64148.705  168.44
4158.629  168.264168.555   168.1 4178.48  167.924188.405  167.73 4198.33  167.58
4208.255  167.47 4218.18  167.384228.105  167.314238.031  167.264247.956  167.18
4257.881  167.074267.806  166.954277.731  167.034287.656  167.144297.582  167.23
4307.506  167.334317.432  167.514327.357  167.734337.282     1684347.207  168.25
4357.132  168.244367.057  168.024376.982   168.24386.908  168.354396.833  168.48
4406.758  168.624416.683  168.644426.608  168.554436.533  168.464446.458  168.38
4456.383  168.484466.309  169.054476.234  169.364486.159  169.574496.084  169.73
4506.009  169.874515.934  170.014525.859  170.064535.785   170.34545.709  170.49
4555.635  170.68 4565.56  170.874575.485  171.05 4585.41  171.234595.335  171.42
 4605.26  171.624615.186  171.834625.111     1724635.036  172.164644.961  172.28
4654.886  172.374664.811  172.464674.736  172.564684.662  172.674694.586  172.82
4704.512  172.944714.437  173.044724.362  173.154734.287  173.274744.212  173.44
4754.137  173.674764.063  173.934773.988  174.194783.913  174.434793.838  174.67
4803.763  174.894813.688  175.214823.613  175.474833.539  175.664843.463  175.84
4853.389  175.914863.314  175.994873.239  176.124883.164   176.24893.089  176.25
4903.014  176.254912.939   176.24922.865  176.28 4932.79  176.394942.715  176.49
 4952.64   176.6

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .073930.352    .0454009.753     .07

Bank Sta: Left   Right    Coeff Contr.   Expan.
      3930.3524009.753             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3954     176       F
    4009 4952.64     176       F

Upstream Embankment side slope              =       4 horiz. to 1.0 vertical
Downstream Embankment side slope            =       4 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =   176.6
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
```

Proposed - No-Rise
inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #1%

* E.G. US. (ft)	* 174.71	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 174.68	* E.G. Elev (ft)	* 174.69	* 174.62	*
* Q Total (cfs)	* 800.00	* W.S. Elev (ft)	* 174.62	* 174.56	*
* Q Bridge (cfs)	* 800.00	* Crit W.S. (ft)	* 161.42	* 160.65	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 17.82	* 17.86	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 2.15	* 2.04	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 371.36	* 392.46	*
* Weir Submerg	*	* Froude # Chl	* 0.09	* 0.09	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 3724.05	* 4048.74	*
* Min El Weir Flow (ft)	* 176.68	* Hydr Depth (ft)	*	*	
* Min El Prs (ft)	* 170.99	* W.P. Total (ft)	* 83.61	* 84.31	*
* Delta EG (ft)	* 0.13	* Conv. Total (cfs)	* 33132.3	* 36128.9	*
* Delta WS (ft)	* 0.11	* Top Width (ft)	*	*	
* BR Open Area (sq ft)	* 371.36	* Frctn Loss (ft)	* 0.07	* 0.01	*
* BR Open Vel (ft/s)	* 2.15	* C & E Loss (ft)	* 0.00	* 0.03	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.16	* 0.14	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.35	* 0.29	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #Floodway

* E.G. US. (ft)	* 175.58	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 175.55	* E.G. Elev (ft)	* 175.56	* 175.48	*
* Q Total (cfs)	* 800.00	* W.S. Elev (ft)	* 175.49	* 175.42	*
* Q Bridge (cfs)	* 800.00	* Crit W.S. (ft)	* 161.42	* 160.65	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 18.69	*	

```
18.72  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)       *       2.15  *
 2.04  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)      *     371.36  *
392.46  *
* Weir Submerg           *             * Froude # Chl           *       0.09  *
 0.08  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)   *    4045.19  *
4388.13  *
* Min El Weir Flow (ft)  *     177.16  * Hydr Depth (ft)        *             *
       *
* Min El Prs (ft)        *     170.99  * W.P. Total (ft)        *      83.61  *
84.31  *
* Delta EG (ft)          *       0.13  * Conv. Total (cfs)      *    33132.3  *
36128.9  *
* Delta WS (ft)          *       0.12  * Top Width (ft)         *             *
       *
* BR Open Area (sq ft)   *     371.36  * Frctn Loss (ft)        *       0.07  *
 0.01  *
* BR Open Vel (ft/s)     *       2.15  * C & E Loss (ft)        *       0.00  *
 0.03  *
* BR Sluice Coef         *             * Shear Total (lb/sq ft) *       0.16  *
 0.14  *
* BR Sel Method          *Energy only  * Power Total (lb/ft s)  *       0.35  *
 0.29  *
********************************************************************************
*********

Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

BRIDGE OUTPUT  Profile #10%
********************************************************************************
*********
* E.G. US. (ft)          *     169.84  * Element                *Inside BR US
*Inside BR DS *
* W.S. US. (ft)          *     169.62  * E.G. Elev (ft)         *     169.78  *
169.60  *
* Q Total (cfs)          *    1450.00  * W.S. Elev (ft)         *     169.47  *
169.32  *
* Q Bridge (cfs)         *    1450.00  * Crit W.S. (ft)         *     162.78  *
162.03  *
* Q Weir (cfs)           *             * Max Chl Dpth (ft)      *      12.67  *
12.62  *
* Weir Sta Lft (ft)      *             * Vel Total (ft/s)       *       4.45  *
 4.21  *
* Weir Sta Rgt (ft)      *             * Flow Area (sq ft)      *     325.75  *
344.25  *
* Weir Submerg           *             * Froude # Chl           *       0.22  *
 0.21  *
* Weir Max Depth (ft)    *             * Specif Force (cu ft)   *    1992.14  *
2173.20  *
* Min El Weir Flow (ft)  *     176.68  * Hydr Depth (ft)        *      10.86  *
11.47  *
* Min El Prs (ft)        *     170.99  * W.P. Total (ft)        *      41.74  *
51.10  *
* Delta EG (ft)          *       0.37  * Conv. Total (cfs)      *    42320.1  *
40549.0  *
```

* Delta WS (ft)	* 0.24	* Top Width (ft)	* 30.00	* 30.00	*
* BR Open Area (sq ft)	* 371.36	* Frctn Loss (ft)	* 0.16	* 0.04	*
* BR Open Vel (ft/s)	* 4.45	* C & E Loss (ft)	* 0.02	* 0.09	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.57	* 0.54	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 2.55	* 2.27	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #2%

* E.G. US. (ft)	* 173.18	* Element	*Inside BR US	*Inside BR DS	*
* W.S. US. (ft)	* 173.13	* E.G. Elev (ft)	* 173.16	* 173.06	*
* Q Total (cfs)	* 950.00	* W.S. Elev (ft)	* 173.06	* 172.97	*
* Q Bridge (cfs)	* 950.00	* Crit W.S. (ft)	* 161.76	* 160.99	*
* Q Weir (cfs)	*	* Max Chl Dpth (ft)	* 16.26	* 16.27	*
* Weir Sta Lft (ft)	*	* Vel Total (ft/s)	* 2.56	* 2.42	*
* Weir Sta Rgt (ft)	*	* Flow Area (sq ft)	* 371.36	* 392.46	*
* Weir Submerg	*	* Froude # Chl	* 0.11	* 0.11	*
* Weir Max Depth (ft)	*	* Specif Force (cu ft)	* 3165.88	* 3445.54	*
* Min El Weir Flow (ft)	* 176.68	* Hydr Depth (ft)	*	*	
* Min El Prs (ft)	* 170.99	* W.P. Total (ft)	* 83.61	* 84.31	*
* Delta EG (ft)	* 0.18	* Conv. Total (cfs)	* 33132.3	* 36128.9	*
* Delta WS (ft)	* 0.15	* Top Width (ft)	*	*	
* BR Open Area (sq ft)	* 371.36	* Frctn Loss (ft)	* 0.10	* 0.02	*
* BR Open Vel (ft/s)	* 2.56	* C & E Loss (ft)	* 0.01	* 0.03	*
* BR Sluice Coef	*	* Shear Total (lb/sq ft)	* 0.23	* 0.20	*
* BR Sel Method	*Energy only	* Power Total (lb/ft s)	* 0.58	* 0.49	*

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE OUTPUT Profile #0.2%

E.G. US. (ft)	178.48	Element	Inside BR US	Inside BR DS	
W.S. US. (ft)	178.48	E.G. Elev (ft)	178.48	178.47	
Q Total (cfs)	700.00	W.S. Elev (ft)	178.48	178.47	
Q Bridge (cfs)	111.40	Crit W.S. (ft)	161.18	160.41	
Q Weir (cfs)		Max Chl Dpth (ft)	21.68	21.77	
Weir Sta Lft (ft)		Vel Total (ft/s)	0.10	0.11	
Weir Sta Rgt (ft)		Flow Area (sq ft)	6874.81	6444.04	
Weir Submerg		Froude # Chl	0.00	0.01	
Weir Max Depth (ft)		Specif Force (cu ft)	9841.51	9696.78	
Min El Weir Flow (ft)	176.68	Hydr Depth (ft)	1.48	1.43	
Min El Prs (ft)	170.99	W.P. Total (ft)	4736.27	4600.08	
Delta EG (ft)	0.00	Conv. Total (cfs)	203617.6	188487.8	
Delta WS (ft)	0.00	Top Width (ft)	4650.74	4513.96	
BR Open Area (sq ft)	371.36	Frctn Loss (ft)	0.00	0.00	
BR Open Vel (ft/s)	0.30	C & E Loss (ft)	0.00	0.00	
BR Sluice Coef		Shear Total (lb/sq ft)	0.00	0.00	
BR Sel Method	Energy only	Power Total (lb/ft s)	0.00	0.00	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243.38

INPUT
Description: XS 243.38

THIS THE DOWNSTREAM FACE OF THE SMALL RUNWAY FROM EFFECTIVE MODEL

Station Elevation Data num= 486

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.05	3.28	181.94	16.4	181.9	26.25	182.24	29.53	181.94
32.81	180.94	39.37	181.2	49.21	181.16	59.05	180.91	68.89	181.02
82.02	180.48	104.98	180.69	108.26	180.4	127.94	180.32	131.22	179.72
137.79	179.68	150.91	179.84	164.03	179.86	183.71	179.02	190.28	178.2
203.4	177.96	209.96	178.84	216.52	179.29	236.2	179.94	242.77	179.98
249.33	180.34	252.61	180.25	269.01	181.59	275.57	181.62	288.69	182.16
295.26	182.7	321.5	182.41	328.06	182.48	334.62	182.21	344.46	182.2
370.71	181.77	396.95	179.89	400.24	179.83	410.08	179.13	426.48	178.9
433.04	178.6	442.88	178.38	449.44	178.08	472.41	177.5	478.97	177.26
485.53	177.23	488.81	176.99	521.62	176.31	524.9	176.09	531.46	176.05
547.86	175.67	551.14	175.75	557.71	175.46	574.11	175.1	583.95	175.01
600.35	175.01	610.2	174.7	620.04	174.58	643	173.58	652.84	173.81
662.69	174.32	682.37	174.52	688.93	174.33	698.77	174.54	705.33	174.31
718.46	174.2	721.74	173.97	728.3	173.94	734.86	174.19	741.42	174.05
761.1	173.95	767.67	174.02	780.79	173.69	787.35	173.83	790.63	173.65
810.31	173.57	816.88	173.4	820.16	173.06	830	172.91	843.12	173.36
862.8	173.35	869.36	173.5	872.65	173.35	895.61	173.29	905.45	173.43
915.29	173.31	918.57	172.98	934.98	173.04	948.1	172.67	957.94	172.93
967.78	172.79	980.91	172.39	994.03	171.89	1007.15	172.28	1016.99	172.07
1030.12	172.14	1043.24	171.94	1049.8	172.14	1059.64	172.08	1062.92	171.92
1076.04	171.89	1082.61	171.69	1089.17	171.73	1095.73	171.47	1102.29	171.81
1108.85	171.66	1121.97	171.74	1135.1	172.4	1144.94	172.21	1158.06	172.33
1164.62	172.54	1174.46	172.6	1181.02	172.5	1194.15	172.72	1200.71	172.68
1213.83	172.94	1223.67	172.81	1233.51	173.1	1266.32	173.58	1276.16	173.96
1289.29	174.04	1299.13	174.5	1312.25	174.64	1318.81	174.52	1331.93	174.74
1341.78	175.2	1348.34	175.17	1361.46	175.5	1368.02	175.84	1377.86	175.72
1384.42	175.92	1390.98	175.84	1407.39	175.92	1413.95	175.76	1420.51	175.88
1436.91	175.77	1453.32	174.99	1469.72	174.61	1479.56	174.48	1486.12	174.56
1502.53	174.38	1505.81	174.68	1515.65	174.41	1525.49	173.46	1538.61	172.88
1561.58	172.72	1574.7	172.39	1581.26	171.87	1587.82	171.6	1600.95	171.32
1604.23	171.51	1610.79	171.24	1627.19	170.8	1640.31	170.59	1646.87	170.38
1676.4	170.08	1686.24	170.29	1699.36	170.24	1702.64	170.61	1712.49	170.63
1719.05	170.44	1725.61	170.52	1748.57	170.5	1761.7	170.2	1771.54	170.27
1778.1	170.47	1784.66	170.24	1797.78	170.6	1801.06	171.06	1814.19	171.18
1824.03	170.92	1837.15	170.79	1856.83	170.75	1863.4	170.91	1873.24	170.53
1876.52	170.6	1896.2	170.25	1899.48	170.75	1915.89	170.78	1925.73	170.44
1938.85	170.46	1942.13	170.31	1958.53	170.38	1965.09	170.76	1974.94	170.66
1978.22	170.76	1984.78	170.36	1994.62	170.43	1997.9	170.97	2011.02	170.99
2017.58	170.8	2020.87	170.93	2027.43	170.69	2033.99	170.81	2043.83	170.57
2047.11	170.66	2070.07	170.25	2073.35	170.41	2083.2	170.46	2093.04	171.03
2096.32	171.97	2106.16	172.65	2119.28	173.96	2135.68	175.02	2142.25	175.61
2152.09	175.61	2161.93	175.85	2168.49	175.7	2171.77	175.91	2181.61	176
2191.45	176.37	2214.42	176.57	2220.98	176.55	2250.5	176.81	2257.06	176.65
2270.19	176.64	2276.75	176.48	2293.15	176.48	2302.99	176.23	2312.83	175.8
2319.39	175.85	2335.8	175.74	2345.64	175.52	2358.76	175.4	2362.04	175.18
2378.44	174.72	2388.28	174.18	2391.56	174.53	2404.69	173.87	2411.25	173.33
2421.09	172.97	2429	173.162431.657		172.932441.582		172.582451.507		172.21
2461.432		1722471.357		171.832481.282		171.732491.208		171.682501.133	171.63
2511.058	171.562520.983		171.52530.908		171.472540.833		171.422550.759		171.38
2560.684	171.352570.609		171.372580.534		171.422590.459		171.472600.384		171.48
2610.309	171.532620.234		171.612630.159		171.692640.085		171.73 2650.01		171.75
2659.935	171.76 2669.86		171.772679.785		171.78 2689.71		171.82699.635		171.76
2709.561	171.712719.486		171.662729.411		171.692739.336		171.732749.261		171.77
2759.186	171.712769.111		171.632779.036		171.582788.962		171.62798.887		171.63
2808.812	171.632818.737		171.572828.662		171.52838.587		171.482848.512		171.47
2858.438	171.462868.363		171.432878.288		171.342888.213		171.292898.138		171.29
2908.063	171.152917.988		171.052927.913		171.12937.839		171.142947.764		171.17
2957.689	171.292967.614		171.382977.539		171.482987.464		171.562997.389		171.53

3007.314	171.55 3017.24	171.543027.165	171.53 3037.09	171.523047.015	171.5
3056.94	171.483066.865	171.52 3076.79	171.63086.716	171.683096.641	171.76
3106.566	171.843116.491	171.933126.416	171.993136.341	172.113146.266	172.07
3156.191	172.013166.116	171.953176.042	171.893185.967	171.833195.892	171.84
3205.817	171.813215.742	171.763225.667	171.723235.593	171.73245.518	171.55
3255.443	171.393265.368	171.313275.293	171.273285.218	171.283295.143	171.23
3305.068	171.193314.993	171.353324.919	171.413334.844	171.533344.769	171.88
3354.694	172.363364.619	172.943374.544	173.463384.469	173.323394.395	173.17
3404.32	172.693414.245	172.13 3424.17	171.963434.095	171.86 3444.02	171.91
3453.945	171.94 3463.87	171.953473.796	172.013483.721	172.093493.646	172.12
3503.571	172.223513.496	172.283523.421	172.53533.346	172.73543.271	172.8
3553.197	172.713563.122	172.693573.047	172.763582.972	172.863592.897	172.95
3602.822	173.023612.747	173.113622.673	173.183632.598	173.193642.523	173.33
3652.448	173.343662.373	173.223672.298	173.083682.223	172.923692.148	172.78
3702.073	172.663711.999	172.523721.924	172.333731.849	172.113741.774	171.9
3751.699	171.743761.624	171.56 3771.55	171.423781.475	171.27 3791.4	171.07
3801.325	170.94 3811.25	170.873821.175	170.88 3831.1	170.923841.025	170.98
3850.95	171.123860.876	171.243870.801	171.223880.726	171.113890.651	170.74
3900.576	170.643910.501	168.923920.427	165.943930.352	162.883940.277	160.34
3950.202	159.383960.127	158.83 3979	156.73989.902	158.833999.827	160.49
4009.753	162.314019.678	164.564029.603	166.434039.528	167.74049.453	170.29
4059.378	171.134069.303	170.774079.229	170.674089.154	170.324099.079	169.69
4109.004	169.164118.929	168.824128.854	168.714138.779	168.64148.705	168.44
4158.629	168.264168.555	168.1 4178.48	167.924188.405	167.73 4198.33	167.58
4208.255	167.47 4218.18	167.384228.105	167.314238.031	167.264247.956	167.18
4257.881	167.074267.806	166.954277.731	167.034287.656	167.144297.582	167.23
4307.506	167.334317.432	167.514327.357	167.734337.282	1684347.207	168.25
4357.132	168.244367.057	168.024376.982	168.24386.908	168.354396.833	168.48
4406.758	168.624416.683	168.644426.608	168.554436.533	168.464446.458	168.38
4456.383	168.484466.309	169.054476.234	169.364486.159	169.574496.084	169.73
4506.009	169.874515.934	170.014525.859	170.064535.785	170.34545.709	170.49
4555.635	170.68 4565.56	170.874575.485	171.05 4585.41	171.234595.335	171.42
4605.26	171.624615.186	171.834625.111	1724635.036	172.164644.961	172.28
4654.886	172.374664.811	172.464674.736	172.564684.662	172.674694.586	172.82
4704.512	172.944714.437	173.044724.362	173.154734.287	173.274744.212	173.44
4754.137	173.674764.063	173.934773.988	174.194783.913	174.434793.838	174.67
4803.763	174.894813.688	175.214823.613	175.474833.539	175.664843.463	175.84
4853.389	175.914863.314	175.994873.239	176.124883.164	176.24893.089	176.25
4903.014	176.254912.939	176.24922.865	176.28 4932.79	176.394942.715	176.49
4952.64	176.6				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	3930.352	.045	4009.753	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3930.352	4009.753	585	585	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	3954	176	F
4009	4952.64	176	F

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.58	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	*	* 0.045	*	*
* W.S. Elev (ft)	* 174.57	* Reach Len. (ft)	* 585.00	* 585.00	* 585.00	*
* Crit W.S. (ft)	* 160.45	* Flow Area (sq ft)	*	* 865.13	*	

```
*
* E.G. Slope (ft/ft)     *0.000020  * Area (sq ft)           * 7460.92  * 1207.09  *
3829.18  *
* Q Total (cfs)          *  800.00  * Flow (cfs)             *          *  800.00  *
*
* Top Width (ft)         * 3749.91  * Top Width (ft)         * 2890.61  *   79.40  *
 779.90  *
* Vel Total (ft/s)       *    0.92  * Avg. Vel. (ft/s)       *          *    0.92  *
*
* Max Chl Dpth (ft)      *   17.87  * Hydr. Depth (ft)       *          *   15.73  *
*
* Conv. Total (cfs)      *177989.9  * Conv. (cfs)            *          *177989.9  *
*
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)       *          *   55.63  *
*
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)       *          *    0.02  *
*
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.02  *
*
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *  883.75  *  227.89  *
1263.48  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *   92.99  *   10.79  *
 102.83  *
*************************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #Floodway
*************************************************************************************
***********
* E.G. Elev (ft)         *  175.45  * Element              *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.           *          *   0.045  *
*
* W.S. Elev (ft)         *  175.43  * Reach Len. (ft)      *  585.00  *  585.00  *
 585.00  *
* Crit W.S. (ft)         *  160.45  * Flow Area (sq ft)    *          *  912.71  *
*
* E.G. Slope (ft/ft)     *0.000030  * Area (sq ft)         *          *  912.71  *
*
* Q Total (cfs)          *  800.00  * Flow (cfs)           *          *  800.00  *
*
* Top Width (ft)         *   55.00  * Top Width (ft)       *          *   55.00  *
*
* Vel Total (ft/s)       *    0.88  * Avg. Vel. (ft/s)     *          *    0.88  *
*
* Max Chl Dpth (ft)      *   18.73  * Hydr. Depth (ft)     *          *   16.59  *
*
* Conv. Total (cfs)      *146512.4  * Conv. (cfs)          *          *146512.4  *
*
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)     *          *   85.15  *
*
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)     *          *    0.02  *
*
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.02  *
*
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)   *   97.80  *  234.05  *
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```
 690.48  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    2.30  *   10.55  *
  28.87  *
**********************************************************************************
***********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #10%
**********************************************************************************
***********
* E.G. Elev (ft)         *  169.47  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.10  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  169.38  * Reach Len. (ft)       *  585.00  *  585.00  *
 585.00  *
* Crit W.S. (ft)         *  161.55  * Flow Area (sq ft)     *          *  579.53  *
         *
* E.G. Slope (ft/ft)     *0.000252  * Area (sq ft)          *   69.21  *  794.80  *
 634.32  *
* Q Total (cfs)          * 1450.00  * Flow (cfs)            *          * 1450.00  *
         *
* Top Width (ft)         *  510.13  * Top Width (ft)        *   22.48  *   79.40  *
 408.24  *
* Vel Total (ft/s)       *    2.50  * Avg. Vel. (ft/s)      *          *    2.50  *
         *
* Max Chl Dpth (ft)      *   12.68  * Hydr. Depth (ft)      *          *   10.54  *
         *
* Conv. Total (cfs)      * 91283.7  * Conv. (cfs)           *          * 91283.7  *
         *
* Length Wtd. (ft)       *  585.00  * Wetted Per. (ft)      *          *   55.63  *
         *
* Min Ch El (ft)         *  156.70  * Shear (lb/sq ft)      *          *    0.16  *
         *
* Alpha                  *    1.00  * Stream Power (lb/ft s) *          *    0.41  *
         *
* Frctn Loss (ft)        *    0.09  * Cum Volume (acre-ft)  *  436.73  *  162.12  *
 558.12  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)        *   58.02  *   10.79  *
  94.12  *
**********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
***********
* E.G. Elev (ft)         *  173.01  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.            *          *   0.045  *
         *
* W.S. Elev (ft)         *  172.98  * Reach Len. (ft)       *  585.00  *  585.00  *
```

585.00						
* Crit W.S. (ft)	* 160.74	* Flow Area (sq ft)	*	* 777.85	*	
* E.G. Slope (ft/ft)	*0.000041	* Area (sq ft)	* 3323.64	* 1081.10	*	
2645.25						
* Q Total (cfs)	* 950.00	* Flow (cfs)	*	* 950.00	*	
* Top Width (ft)	* 3037.64	* Top Width (ft)	* 2259.32	* 79.40	*	
698.92						
* Vel Total (ft/s)	* 1.22	* Avg. Vel. (ft/s)	*	* 1.22	*	
* Max Chl Dpth (ft)	* 16.28	* Hydr. Depth (ft)	*	* 14.14	*	
* Conv. Total (cfs)	*149080.9	* Conv. (cfs)	*	*149080.9	*	
* Length Wtd. (ft)	* 585.00	* Wetted Per. (ft)	*	* 55.63	*	
* Min Ch El (ft)	* 156.70	* Shear (lb/sq ft)	*	* 0.04	*	
* Alpha	* 1.00	* Stream Power (lb/ft s)	*	* 0.04	*	
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 727.50	* 208.16	*	
1045.08						
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 80.81	* 10.79	*	
100.84						

****

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 178.47	* Element	* Left OB	* Channel	*	
Right OB						
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.070	* 0.045	*	
0.070						
* W.S. Elev (ft)	* 178.47	* Reach Len. (ft)	* 585.00	* 585.00	*	
585.00						
* Crit W.S. (ft)	* 160.25	* Flow Area (sq ft)	*20304.27	* 1517.15	*	
7295.71						
* E.G. Slope (ft/ft)	*0.000000	* Area (sq ft)	*20304.27	* 1517.15	*	
7295.71						
* Q Total (cfs)	* 700.00	* Flow (cfs)	* 414.40	* 105.66	*	
179.93						
* Top Width (ft)	* 4533.10	* Top Width (ft)	* 3510.81	* 79.40	*	
942.89						
* Vel Total (ft/s)	* 0.02	* Avg. Vel. (ft/s)	* 0.02	* 0.07	*	
0.02						
* Max Chl Dpth (ft)	* 21.77	* Hydr. Depth (ft)	* 5.78	* 19.11	*	
7.74						
* Conv. Total (cfs)	*2352110.0	* Conv. (cfs)	*1392457.0	*355047.4		
*604606.3						
* Length Wtd. (ft)	* 585.00	* Wetted Per. (ft)	* 3513.24	* 80.41	*	
945.81						
* Min Ch El (ft)	* 156.70	* Shear (lb/sq ft)	* 0.00	* 0.00	*	
0.00						
* Alpha	* 1.96	* Stream Power (lb/ft s)	* 0.00	* 0.00	*	

```
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   * 1332.36  *  276.24  *
1832.09  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *  106.59  *   10.79  *
 119.42  *
*******************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, water surface was used.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 243.2

INPUT
Description: XS 243.2
INSERTED XS TO EVALUATE IMPACT OF PROPOSED SITE(5/21/01)
Station Elevation Data    num=     483
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  182.26    9.84  181.89   22.96  181.71   29.53  181.75   42.65  181.57
   55.77  180.93   62.33  180.94   68.89  180.83   75.46  180.48   82.02  180.27
   88.58  180.41   95.14  180.68   118.1  180.99  121.38   180.9  127.95  180.97
  131.23  180.86  160.75  180.56  173.88  180.38  180.44     180  190.28  179.85
  196.84  179.86   203.4  179.55  216.52  179.64  229.65  179.41  236.21   179.5
  246.05  179.36  259.17   179.3  262.45  179.38  275.58  179.35  282.14  179.44
  291.98  179.33  301.82  179.42  308.38  179.31  318.22  179.39  324.79  179.23
  334.63  179.37  354.31  179.17  364.15  179.31     374  179.16  393.68   179.2
  400.24  178.97   406.8  178.92  426.49  179.04  433.05  178.93  449.45  178.82
  469.13  179.04   475.7  178.94  482.26  179.06  495.38  178.91   508.5  179.15
  518.34  178.97  534.75  179.21  541.31     179  557.71  179.21  567.55  179.17
  574.12  179.26  580.68  179.07  590.52  179.34  597.08  179.25  606.92  179.35
  620.05  179.65  626.61  179.44  633.17  179.64  639.73  179.69  649.57  179.47
  656.13  179.63  665.97  179.52  685.66  179.45  698.78  179.46  705.34  179.58
   711.9  179.44  725.03  179.49  731.59  179.61  738.15  179.43  744.71  179.37
  747.99  179.48  757.83  179.51  767.68  179.46  777.52  179.32  784.08   179.4
  807.04  179.37  823.45  179.47  830.01   179.4  833.29  179.49  852.97  179.36
  862.81   179.4  872.66  179.19   882.5  179.28  885.78  179.21  902.18  179.23
  912.02  179.05  921.87  179.26  925.15  179.21  938.27  179.25  944.83  179.15
  951.39   179.2  961.24  179.11  974.36  179.36  987.48  179.12  994.04  179.27
  1000.6   179.1 1017.01  179.08 1023.57  179.14 1033.41  178.98 1053.09  178.93
 1059.66  179.04 1076.06  179.07 1082.62  178.97 1092.46  179.04 1099.02  178.91
 1112.15  178.99 1121.99  178.78 1128.55  178.93 1135.11  178.84 1141.67  178.89
 1148.23  178.79 1161.36  178.92 1174.48   178.8  1187.6  178.43 1190.88  178.57
 1200.72  178.75 1213.85  178.84 1223.69   178.6 1243.37  178.77 1256.49  178.79
 1259.77  178.71 1269.62  178.71  1272.9   178.8 1276.18   178.6 1286.02  178.84
 1295.86  178.74  1305.7  178.97 1312.27  179.21 1318.83  179.08 1322.11  178.71
 1335.23   178.9 1341.79  179.06 1358.19  179.13 1364.76  179.01 1371.32  179.18
 1381.16  179.23 1387.72  179.17  1407.4  179.49 1410.68  179.37 1417.25  179.49
 1427.09  179.54 1433.65  179.48 1443.49   179.8 1466.46  179.85  1476.3  180.03
 1479.58     180 1515.67  180.69 1528.79  180.88 1532.07  181.04 1538.63  180.92
 1548.47  181.14 1555.03  181.11 1561.59  181.31 1584.56  181.55 1600.96  181.86
 1604.24  181.85 1627.21  182.19 1643.61  182.12 1656.73  182.17 1660.01   182.3
 1673.14  182.27 1676.42  182.45 1682.98  182.57 1689.54  182.31  1696.1   182.3
```

1705.94	182.43	1728.91	182.49	1735.47	182.31	1745.31	182.42	1751.87	182.22
1765	182.51	1774.84	182.53	1791.24	182.81	1797.8	182.78	1810.92	182.52
1814.2	182.68	1820.77	182.72	1827.33	182.91	1843.73	182.69	1856.85	182.83
1866.7	182.61	1886.38	182.62	1892.94	182.83	1906.06	182.74	1912.62	182.58
1925.75	182.86	1955.27	182.98	1974.96	182.91	1988.08	182.82	1991.36	182.27
1997.92	182.34	2011.04	182.21	2020.89	181.99	2027.45	181.99	2040.57	181.65
2050.41	181.55	2056.97	181.3	2060.25	181.32	2070.1	181.1	2076.66	181.06
2079.94	180.91	2093.06	180.76	2116.02	179.89	2129.15	178.95	2132.43	178.83
2142.27	178.02	2152.11	177.41	2161.95	176.63	2178.36	176.16	2184.92	175.86
2194.76	175.59	2201.32	175.08	2211.16	174.71	2221	174.81	2230.85	174.67
2250.53	174.93	2257.09	174.9	2270.21	174.71	2289.9	174.72	2293.18	174.6
2299.74	174.81	2306.3	174.61	2309.58	174.68	2319.42	174.44	2322.7	174.56
2332.55	174.51	2342.39	174.56	2348.95	174.46	2358.79	174.79	2362.07	174.8
2375.19	174.5	2388.32	174.39	2391.6	174.46	2401.44	174.28	2414.56	174.4
2421.12	174.22	2427.68	174.25	2430.96	174.14	2437.52	174.32	2453.93	174.26
2463.77	174.35	2467.05	174.2	2473.61	174.36	2490.01	174.17	2499.86	174.29
2506.42	174.27	2512.98	174.06	2529.38	174.29	2542.5	174.34	2552.35	174.29
2565.47	173.98	2572.03	174.11	2581.87	174.04	2585.15	174.15	2591.71	173.97
2601.56	173.84	2604.84	173.91	2614.68	173.8	2621.24	173.86	2631.08	173.7
2640.92	173.79	2647.48	173.77	2663.89	173.55	2673.73	173.65	2680.29	173.44
2690.13	173.44	2703.26	173.03	2709.82	173.07	2732.78	172.62	2739.34	172.59
2749.18	172.38	2762.31	172.51	2768.87	172.51	2775.43	172.71	2781.99	172.32
2788.55	172.15	2795.11	172.24	2801.67	172.05	2808.24	171.98	2811.52	172.1
2824.64	171.92	2831.2	172.1	2847.6	171.89	2854.16	171.7	2867.29	171.58
2893.53	171.47	2900.09	171.23	2909.93	171.19	2919.78	171.35	2926.34	171.1
2946.02	170.98	2952.58	170.87	2965.7	170.78	2975.55	170.86	2995.23	170.63
3018.19	170.91	3028.04	170.86	3041.16	170.58	3044.44	170.44	3054.28	170.37
3067.4	169.71	3070.68	169.43	3083.81	169	3090.37	168.42	3096.93	168.03
3110.05	167.12	3119.89	166.57	3126.46	166.07	3136.3	165.55	3142.86	165.4
3149.42	165.13	3159.26	164.95	3165.82	164.41	3169.1	164.28	3182.23	164.11
3188.79	164.3	3198.63	164.03	3208.47	163.92	3221.59	164.3	3244.56	164.63
3251.12	164.83	3270.8	164.65	3277.36	164.34	3297.05	163.94	3303.61	163.93
3323.28	163.68	3333.12	163.68	3339.68	163.39	3346.24	163.47	3352.8	163.43
3359.35	163.74	3375.75	163.95	3382.31	163.78	3388.87	163.06	3395.43	162.89
3405.26	163.46	3411.82	164.31	3418.38	164.44	3421.66	164.36	3438.06	164.56
3447.9	164.86	3454.45	164.76	3461.01	165.6	3464.29	165.87	3470.85	165.36
3477.41	164.08	3480.55	163.3	3487.25	161.53	3496	160	3531	155.1
3571	160	3572.51	160.87	3575.79	162.8	3579.07	163.53	3592.18	163.93
3598.74	164.58	3608.58	166.18	3611.86	166.37	3618.42	166.49	3628.26	166.53
3634.82	166.46	3651.21	166.67	3680.73	167.15	3693.84	167.13	3703.68	167.26
3710.24	167.19	3726.63	167.74	3736.47	167.98	3743.03	168.26	3749.59	168.4
3759.42	168.75	3779.1	169.2	3785.65	169.47	3795.49	169.44	3808.61	169.52
3828.28	169.37	3834.84	169.36	3847.96	169.04	3857.79	168.7	3870.91	168.68
3880.74	168.51	3893.86	168.49	3920.09	168.15	3936.49	168.08	3952.88	167.81
3966	167.84	3969.28	167.76	3985.67	167.76	3992.23	167.71	4002.07	167.51
4015.18	167.36	4025.02	167.43	4034.86	167.16	4041.41	167.14	4054.53	166.95
4064.37	166.95	4074.2	166.75	4080.76	166.72	4097.16	166.34	4113.55	166.23
4126.67	165.88	4136.5	165.53	4152.9	165.73	4166.01	165.79	4172.57	165.76
4185.69	165.88	4198.8	166.15	4205.36	166.09	4211.92	166.23	4218.48	166.23
4231.59	166.5	4247.99	166.94	4254.55	167.02	4264.38	167.38	4284.06	167.67
4300.45	167.78	4313.57	167.69	4323.4	167.42	4333.24	167.37	4339.8	167.15
4356.19	167.23	4369.31	167.06	4375.87	166.62	4388.98	166.07	4392.26	166.05
4411.94	165.68	4421.77	165.22	4434.89	164.93	4464.4	164.73	4474.24	164.69
4480.79	164.86	4490.63	164.99	4497.19	165.27	4507.03	165.56	4520.14	165.8
4526.7	165.76	4533.26	165.87	4549.65	166.55	4556.21	166.34	4569.33	166.53
4575.88	166.76	4582.44	166.84	4589	167.04	4611.95	167.27	4625.07	167.5
4631.63	167.5	4641.46	167.71	4651.3	167.73	4657.86	167.98	4661.14	167.89
4670.97	167.89	4674.25	168.03	4700.48	167.78	4713.6	167.8	4720.16	167.87
4729.99	167.55	4736.55	167.23	4746.39	167.18	4756.23	166.89	4762.78	166.56
4766.06	166.54	4775.9	165.98	4789.02	164.75	4795.57	164.52	4802.13	164.76
4808.69	165.28	4818.53	166.2	4821.81	166.8	4834.92	167.48	4841.48	167.68
4851.32	169.05	4867.71	170.55	4880.83	171.98	4890.66	172.99	4897.22	173.39
4903.78	174.02	4907.06	174.49	4913.62	175.03				

```
Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0     .07    3496    .045 3575.79     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          3496 3575.79               760     760     200             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0    3456     180       F
    4156 4913.62     180       F

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
***********
* E.G. Elev (ft)         *  174.57  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  174.57  * Reach Len. (ft)       *  760.00  *  760.00  *
 200.00  *
* Crit W.S. (ft)         *  158.78  * Flow Area (sq ft)     *  435.24  * 1339.52  *
4128.29  *
* E.G. Slope (ft/ft)     *0.000001  * Area (sq ft)          * 5505.23  * 1339.52  *
9837.14  *
* Q Total (cfs)          *  800.00  * Flow (cfs)            *   54.76  *  349.80  *
 395.43  *
* Top Width (ft)         * 2573.90  * Top Width (ft)        * 1161.88  *   79.79  *
1332.23  *
* Vel Total (ft/s)       *    0.14  * Avg. Vel. (ft/s)      *    0.13  *    0.26  *
   0.10  *
* Max Chl Dpth (ft)      *   19.47  * Hydr. Depth (ft)      *   10.88  *   16.79  *
   7.12  *
* Conv. Total (cfs)      *655595.1  * Conv. (cfs)           * 44878.5  *286661.0
*324055.6  *
* Length Wtd. (ft)       *  453.05  * Wetted Per. (ft)      *   40.65  *   81.19  *
 580.55  *
* Min Ch El (ft)         *  155.10  * Shear (lb/sq ft)      *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    1.93  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  796.69  *  210.79  *
1171.71  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   65.78  *    9.72  *
  88.65  *
*********************************************************************************
***********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #Floodway
*********************************************************************************
***********
* E.G. Elev (ft)         *  175.43  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *   0.070  *   0.045  *
         *
```

* W.S. Elev (ft)	* 175.43	* Reach Len. (ft)	* 760.00	* 760.00	* 200.00 *
* Crit W.S. (ft)	* 158.78	* Flow Area (sq ft)	* 3.08	* 1342.23	* *
* E.G. Slope (ft/ft)	*0.000009	* Area (sq ft)	* 3.08	* 1342.23	* *
* Q Total (cfs)	* 800.00	* Flow (cfs)	* 0.07	* 799.93	* *
* Top Width (ft)	* 75.30	* Top Width (ft)	* 0.20	* 75.10	* *
* Vel Total (ft/s)	* 0.59	* Avg. Vel. (ft/s)	* 0.02	* 0.60	* *
* Max Chl Dpth (ft)	* 20.33	* Hydr. Depth (ft)	* 15.41	* 17.87	* *
* Conv. Total (cfs)	*266343.9	* Conv. (cfs)	* 22.2	*266321.7	* *
* Length Wtd. (ft)	* 759.92	* Wetted Per. (ft)	* 15.59	* 91.12	* *
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.00	* 0.01	* *
* Alpha	* 1.00	* Stream Power (lb/ft s)	* 0.00	* 0.00	* *
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 97.78	* 218.91	* 690.48 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 2.30	* 9.68	* 28.87 *

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 169.34	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.02	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 169.33	* Reach Len. (ft)	* 760.00	* 760.00	* 200.00 *
* Crit W.S. (ft)	* 159.77	* Flow Area (sq ft)	* 225.62	* 921.40	* 1093.84 *
* E.G. Slope (ft/ft)	*0.000049	* Area (sq ft)	* 1985.78	* 921.40	* 3001.66 *
* Q Total (cfs)	* 1450.00	* Flow (cfs)	* 105.28	* 1077.43	* 267.29 *
* Top Width (ft)	* 1726.67	* Top Width (ft)	* 422.22	* 79.79	* 1224.66 *
* Vel Total (ft/s)	* 0.65	* Avg. Vel. (ft/s)	* 0.47	* 1.17	* 0.24 *
* Max Chl Dpth (ft)	* 14.23	* Hydr. Depth (ft)	* 5.64	* 11.55	* 2.08 *
* Conv. Total (cfs)	*206780.0	* Conv. (cfs)	* 15013.1	*153649.6	* 38117.3 *
* Length Wtd. (ft)	* 603.38	* Wetted Per. (ft)	* 40.65	* 81.19	* 526.64 *
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.02	* 0.03	* 0.01 *
* Alpha	* 2.49	* Stream Power (lb/ft s)	* 0.01	* 0.04	* 0.00 *
* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 422.93	* 150.60	* 533.70 *

```
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   55.04  *    9.72  *
  83.15  *
**********************************************************************************
**********

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  172.98  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  172.98  * Reach Len. (ft)       *  760.00  *  760.00  *
 200.00  *
* Crit W.S. (ft)         *  159.05  * Flow Area (sq ft)     *  371.68  * 1212.74  *
3206.38  *
* E.G. Slope (ft/ft)     *0.000004  * Area (sq ft)          * 4074.42  * 1212.74  *
7732.13  *
* Q Total (cfs)          *  950.00  * Flow (cfs)            *   66.88  *  470.86  *
 412.27  *
* Top Width (ft)         * 2176.15  * Top Width (ft)        *  781.58  *   79.79  *
1314.77  *
* Vel Total (ft/s)       *    0.20  * Avg. Vel. (ft/s)      *    0.18  *    0.39  *
   0.13  *
* Max Chl Dpth (ft)      *   17.88  * Hydr. Depth (ft)      *    9.29  *   15.20  *
   5.53  *
* Conv. Total (cfs)      *490044.5  * Conv. (cfs)           * 34496.6  *242884.1
*212663.8  *
* Length Wtd. (ft)       *  481.90  * Wetted Per. (ft)      *   40.65  *   81.19  *
 580.55  *
* Min Ch El (ft)         *  155.10  * Shear (lb/sq ft)      *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    2.14  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)  *  677.82  *  192.75  *
 975.39  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *   60.39  *    9.72  *
  87.31  *
**********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth
with the lowest, valid, energy was used.

CROSS SECTION OUTPUT  Profile #0.2%
**********************************************************************************
**********
* E.G. Elev (ft)         *  178.47  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.070  *   0.045  *
  0.070  *
* W.S. Elev (ft)         *  178.47  * Reach Len. (ft)       *  760.00  *  760.00  *
 200.00  *
```

* Crit W.S. (ft)	* 158.60	* Flow Area (sq ft)	* 591.42	* 1651.08	* 6393.82 *
* E.G. Slope (ft/ft)	*0.000000	* Area (sq ft)	*10656.68	* 1651.08	*15059.64 *
* Q Total (cfs)	* 700.00	* Flow (cfs)	* 45.43	* 246.63	* 407.94 *
* Top Width (ft)	* 2779.42	* Top Width (ft)	* 1361.80	* 79.79	* 1337.83 *
* Vel Total (ft/s)	* 0.08	* Avg. Vel. (ft/s)	* 0.08	* 0.15	* 0.06 *
* Max Chl Dpth (ft)	* 23.37	* Hydr. Depth (ft)	* 14.79	* 20.69	* 11.02 *
* Conv. Total (cfs)	*1152855.0	* Conv. (cfs)	* 74816.0	*406191.4	*671847.1 *
* Length Wtd. (ft)	* 412.61	* Wetted Per. (ft)	* 40.65	* 81.19	* 580.55 *
* Min Ch El (ft)	* 155.10	* Shear (lb/sq ft)	* 0.00	* 0.00	* 0.00 *
* Alpha	* 1.62	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.00	* Cum Volume (acre-ft)	* 1124.46	* 254.96	* 1681.98 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 73.87	* 9.72	* 104.10 *

****

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 243

INPUT
Description: XS 243
JUST UPSTREAM OF CANNON BRANCH
Station Elevation Data num= 482

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	182.52	3.28	182.48	6.56	182.57	9.83	182.52	19.67	182.62
26.22	182.59	42.61	182.65	45.89	182.62	55.72	182.73	65.55	182.73
75.39	182.91	85.22	182.96	95.05	182.94	104.89	183.07	111.44	183.11
118	183.27	131.11	183.26	134.39	183.34	140.94	183.35	147.5	182.99
154.05	182.36	160.61	182.1	163.89	181.63	167.16	181.04	173.72	179.67
177	179.11	180.28	178.67	186.83	177.41	190.11	176.97	196.66	176.44
203.22	175.75	206.5	175.61	213.05	175.48	216.33	175.47	229.44	175.17
236	174.87	245.83	174.03	252.39	173.85	255.66	173.95	258.94	174.23
262.22	174.81	265.5	175.51	268.77	176.32	275.33	178.08	281.88	179.62
288.44	181.77	295	184.31	298.27	185.52	301.55	187.73	304.83	189.52
314.66	192.62	317.94	193.49	321.22	194.66	324.5	195.66	327.77	196.53
334.33	197.08	347.44	196.93	353.99	196.96	360.55	196.8	363.83	196.82
367.11	196.72	373.66	196.71	376.94	196.63	380.22	196.34	386.77	195.46
390.05	195.16	396.61	194.78	399.88	194.7	403.16	194.76	409.72	194.59
416.27	194.59	422.83	194.53	432.66	194.66	435.94	194.64	439.22	194.97

445.77	196.02	449.05	196.28	452.33	196.41	458.88	196.29	462.16	195.94
465.44	195.37	468.72	194.5	471.99	193.05	475.27	191.24	478.55	189.17
481.83	186.88	485.1	184.41	491.66	180.15	494.94	178.51	498.22	177.2
504.77	175.04	511.33	172.67	521.16	170.18	524.44	169.28	527.72	168.84
540.83	168.35	547.38	168.23	557.21	167.9	563.77	167.57	570.33	167.54
576.88	167.28	589.99	167.02	596.55	166.98	599.83	166.82	603.1	166.86
606.38	167.19	609.66	167.3	619.49	167.38	622.77	167.26	626.05	167.02
629.32	166.67	635.88	165.36	642.44	164.41	645.71	163.6	655.55	161.86
658.82	161.6	662.1	161.48	671.94	161.52	675.21	161.31	678.49	161.23
681.77	161.37	688.32	161.76	694.88	161.39	698.16	161.65	701.44	161.52
707.99	161.57	714.55	161.25	721.1	161.2	724.38	161.07	730.93	161.29
737.48	161.2	744.03	161.4	747.31	161.72	750.58	161.77	763.68	161.2
770.23	160.63	773.5	160.55	776.77	160.59	780.05	160.75	783.32	161.03
789.87	161.21	799.7	161.16	802.97	161.46	806.24	161.91	809.52	162.25
812.79	161.97	819.34	161.87	825.89	161.36	832.44	161.09	838.99	161.07
842.26	161.23	845.54	161.2	848.81	161.05	852.08	161.1	858.63	161.33
865.18	161.15	871.73	161.18	878.28	160.99	881.55	161	884.83	161.22
888.1	161.55	891.38	161.75	897.92	161.51	904.47	161.06	907.75	160.9
914.3	160.94	924.12	160.9	927.39	160.8	930.67	160.84	937.22	161.04
947.04	161.03	953.59	161.1	956.86	161.02	963.41	161.17	969.96	161.19
973.23	161.3	979.78	161.11	992.88	160.87	996.15	160.87	1005.98	160.7
1019.07	160.84	1028.9	161.04	1035.44	161.07	1038.72	161.16	1045.27	161.06
1051.82	161.11	1055.09	160.85	1058.37	160.82	1064.91	160.98	1068.19	160.84
1074.74	160.79	1078.01	160.87	1084.56	160.89	1087.83	160.84	1094.38	160.95
1097.66	160.74	1104.21	160.66	1117.3	160.97	1127.12	161.25	1130.4	161.17
1133.67	160.89	1146.77	160.41	1150.05	160.06	1153.32	159.9	1156.59	159.91
1163.14	160.24	1166.42	160.18	1169.69	160.24	1176.24	160.48	1182.79	160.26
1189.34	159.92	1195.88	159.86	1199.16	159.6	1212.26	159.65	1218.8	160.68
1222.08	161.47	1228.63	163.36	1231.9	163.67	1235.18	163.73	1241.72	163.42
1245	163.03	1248.27	162.82	1252.36	162.42	1254.82	162.14	1258.83	157.87
1290	153.2	1331.46	158.84	1333.4	164.63	1334.49	164.79	1339.95	165.64
1343.23	165.96	1346.5	166.11	1362.87	165.79	1369.42	165.84	1372.7	165.76
1379.24	165.8	1389.07	165.7	1395.62	165.83	1405.44	165.83	1408.71	165.9
1418.54	165.9	1425.08	165.99	1431.63	166.15	1438.18	166.23	1444.73	166.2
1451.28	166.05	1454.55	166.05	1464.38	165.82	1470.93	165.86	1480.76	165.86
1484.04	165.8	1493.87	165.85	1500.42	165.79	1506.97	165.8	1516.8	165.6
1523.35	165.51	1529.9	165.48	1539.73	165.59	1546.28	165.48	1549.56	165.53
1556.11	165.44	1559.39	165.46	1565.94	165.36	1572.49	165.32	1585.6	165.07
1588.87	164.91	1601.98	164.59	1611.81	164.54	1615.08	164.43	1621.63	164.46
1628.19	164.63	1631.46	164.91	1634.74	164.96	1644.57	165	1660.95	165.25
1670.78	165.51	1683.88	165.79	1690.43	165.78	1696.99	165.83	1700.26	165.78
1706.81	165.81	1713.37	165.71	1716.64	165.52	1723.19	165.43	1729.75	165.27
1742.85	165.04	1752.68	165.09	1765.78	164.95	1775.61	164.99	1778.89	164.94
1785.44	165.06	1791.99	164.96	1795.27	165.19	1801.82	165.23	1808.37	165.15
1821.48	165.22	1824.75	165.15	1831.31	165.29	1837.86	165.25	1844.41	165.15
1854.24	165.09	1867.34	164.86	1873.9	164.87	1880.45	164.78	1887	165.01
1893.55	164.98	1900.1	165.09	1903.38	165.2	1913.21	165.25	1926.31	165.27
1936.14	165.51	1942.69	165.59	1949.25	165.57	1959.07	165.63	1972.18	165.8
1985.28	166.02	1988.56	166	1998.39	166.08	2004.94	166.23	2011.49	166.25
2021.32	166.52	2027.87	166.52	2031.15	166.65	2040.98	166.83	2050.81	166.95
2054.08	167.09	2060.63	167.26	2073.74	167.86	2080.29	167.84	2083.57	168.08
2086.84	168.05	2090.12	168.38	2106.5	169.04	2119.6	169.34	2129.43	169.26
2139.26	169.46	2145.81	169.48	2158.92	169.4	2162.19	169.42	2172.02	169.23
2181.85	169.14	2194.95	169.09	2201.51	168.92	2208.06	168.94	2214.61	168.77
2221.16	168.76	2227.72	168.65	2237.54	168.64	2244.1	168.37	2253.92	168.27
2257.2	168.18	2267.03	168.24	2270.3	168.09	2283.41	168.12	2299.79	167.96
2303.07	167.98	2309.62	168.13	2322.72	168.13	2329.27	167.97	2332.55	167.97
2335.83	167.86	2342.38	167.76	2348.93	167.78	2362.04	168.05	2365.31	168.05
2375.14	168.17	2384.97	167.91	2391.52	167.9	2404.62	167.56	2411.18	167.56
2417.73	167.4	2427.56	167.23	2437.39	167.13	2447.21	166.88	2450.49	166.84
2453.77	166.68	2463.59	166.33	2470.15	166.17	2483.25	165.79	2493.08	165.79
2502.91	165.64	2516.01	165.82	2525.84	165.78	2532.39	165.59	2545.5	165.53
2555.33	165.8	2558.6	165.85	2571.71	165.78	2574.98	165.68	2581.53	165.77

2591.36	165.74	2601.19	165.49	2607.74	165.67	2614.3	165.71	2624.12	165.83
2630.68	166.02	2640.5	166.05	2643.78	166	2656.89	166.14	2663.44	166.41
2669.99	166.57	2676.54	166.55	2683.09	166.47	2692.92	166.45	2696.2	166.53
2702.75	166.38	2712.58	166.49	2719.13	166.44	2725.68	166.56	2732.24	166.48
2738.79	166.54	2745.34	166.43	2758.44	166.47	2765	166.6	2774.83	166.44
2784.65	166.21	2794.48	166.16	2801.03	166.09	2807.59	166.18	2810.86	166.13
2817.41	165.86	2827.24	165.6	2830.52	165.64	2837.07	165.53	2840.35	165.58
2843.62	165.5	2850.18	165.51	2853.45	165.42	2863.28	165.28	2869.83	165.11
2876.38	165.14	2886.21	165.06	2889.49	164.96	2896.04	164.93	2902.59	165.07
2909.15	165.51	2918.97	165.53	2928.8	165.82	2935.35	166.11	2938.63	166.18
2945.18	166.44	2951.74	166.52	2964.84	166.5	2974.67	166.61	2984.5	166.92
2991.05	166.91	2997.6	167.15	3004.15	167.25	3007.43	167.24	3013.98	167.55
3017.26	167.43	3027.09	167.27	3040.19	167.33	3043.47	167.42	3053.29	167.49
3066.4	167.26	3072.95	167.33	3095.88	167.41	3102.44	167.24	3112.26	167.23
3115.54	167.37	3125.37	167.34	3131.92	167.18	3138.47	167.16	3148.3	166.97
3151.58	166.85	3167.96	165.99	3171.23	165.5	3174.51	164.61	3177.79	164.48
3181.06	164.52	3184.34	164.76	3190.89	165.08	3194.17	165.4	3204	167.16
3210.55	167.74	3213.82	168.21	3223.65	169.39	3233.48	170.43	3246.58	172.4
3249.86	172.8	3259.69	173.82						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.07	1254.82	.045	1334.49	.07

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1254.82	1334.49	4920	3930	1480 .1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	1070	180	F
2500	3259.69	180	F

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.57	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	174.57	Reach Len. (ft)	4920.00	3930.00	1480.00
Crit W.S. (ft)	159.29	Flow Area (sq ft)	2521.56	1456.25	9413.18
E.G. Slope (ft/ft)	0.000003	Area (sq ft)	9127.01	1456.25	15497.25
Q Total (cfs)	2665.00	Flow (cfs)	570.20	590.99	1503.82
Top Width (ft)	2774.92	Top Width (ft)	770.05	79.67	1925.20
Vel Total (ft/s)	0.20	Avg. Vel. (ft/s)	0.23	0.41	0.16
Max Chl Dpth (ft)	21.37	Hydr. Depth (ft)	13.64	18.28	8.08
Conv. Total (cfs)	1425180.0	Conv. (cfs)	304928.5	316045.5	804205.9
Length Wtd. (ft)	2469.02	Wetted Per. (ft)	185.45	86.43	1165.83
Min Ch El (ft)	153.20	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.56	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	669.04	186.40	1113.55

* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 48.92	* 8.33	* 81.17	*	

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Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 175.42	* Element	* Left OB	* Channel	* Right OB	*	
* Vel Head (ft)	* 0.04	* Wt. n-Val.	* 0.070	* 0.045	* 0.070	*	
* W.S. Elev (ft)	* 175.38	* Reach Len. (ft)	* 4920.00	* 3930.00	* 1480.00	*	
* Crit W.S. (ft)	* 159.30	* Flow Area (sq ft)	* 244.23	* 1520.65	* 5.38	*	
* E.G. Slope (ft/ft)	*0.000055	* Area (sq ft)	* 244.23	* 1520.65	* 5.38	*	
* Q Total (cfs)	* 2665.00	* Flow (cfs)	* 150.19	* 2514.29	* 0.52	*	
* Top Width (ft)	* 100.00	* Top Width (ft)	* 19.82	* 79.67	* 0.51	*	
* Vel Total (ft/s)	* 1.51	* Avg. Vel. (ft/s)	* 0.61	* 1.65	* 0.10	*	
* Max Chl Dpth (ft)	* 22.18	* Hydr. Depth (ft)	* 12.32	* 19.09	* 10.55	*	
* Conv. Total (cfs)	*360041.6	* Conv. (cfs)	* 20290.8	*339680.0	* 70.8	*	
* Length Wtd. (ft)	* 3279.12	* Wetted Per. (ft)	* 31.54	* 86.43	* 11.02	*	
* Min Ch El (ft)	* 153.20	* Shear (lb/sq ft)	* 0.03	* 0.06	* 0.00	*	
* Alpha	* 1.15	* Stream Power (lb/ft s)	* 0.02	* 0.10	* 0.00	*	
* Frctn Loss (ft)	* 0.11	* Cum Volume (acre-ft)	* 95.62	* 193.93	* 690.47	*	
* C & E Loss (ft)	* 0.01	* Cum SA (acres)	* 2.12	* 8.33	* 28.87	*	

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 169.32	* Element	* Left OB	* Channel	* Right OB	*	
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.070	* 0.045	* 0.070	*	
* W.S. Elev (ft)	* 169.31	* Reach Len. (ft)	* 4920.00	* 3930.00	* 1480.00	*	
* Crit W.S. (ft)	* 159.60	* Flow Area (sq ft)	* 1549.13	* 1037.07	*		

* E.G. Slope (ft/ft)	*0.000042	* Area (sq ft)	* 5222.48	* 1037.07	* 3285.02	*
* Q Total (cfs)	* 3015.00	* Flow (cfs)	* 874.34	* 1159.18	* 5455.72	*
* Top Width (ft)	* 2656.52	* Top Width (ft)	* 730.47	* 79.67	* 981.48	*
* Vel Total (ft/s)	* 0.51	* Avg. Vel. (ft/s)	* 0.56	* 1.12	* 1846.38	*
* Max Chl Dpth (ft)	* 16.11	* Hydr. Depth (ft)	* 8.38	* 13.02	* 0.30	*
* Conv. Total (cfs)	*466840.8	* Conv. (cfs)	*135381.8	*179487.1	*151971.9	*
* Length Wtd. (ft)	* 2945.30	* Wetted Per. (ft)	* 185.45	* 86.43	* 1123.75	*
* Min Ch El (ft)	* 153.20	* Shear (lb/sq ft)	* 0.02	* 0.03	* 0.01	*
* Alpha	* 2.28	* Stream Power (lb/ft s)	* 0.01	* 0.03	* 0.00	*
* Frctn Loss (ft)	* 0.13	* Cum Volume (acre-ft)	* 360.05	* 133.51	* 514.29	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 44.98	* 8.33	* 76.10	*

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 172.98	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.00	* Wt. n-Val.	* 0.070	* 0.045	* 0.070 *
* W.S. Elev (ft)	* 172.98	* Reach Len. (ft)	* 4920.00	* 3930.00	* 1480.00 *
* Crit W.S. (ft)	* 159.42	* Flow Area (sq ft)	* 2227.64	* 1329.56	* 7559.69 *
* E.G. Slope (ft/ft)	*0.000007	* Area (sq ft)	* 7929.91	* 1329.56	*12439.05 *
* Q Total (cfs)	* 2805.00	* Flow (cfs)	* 645.61	* 706.87	* 1452.52 *
* Top Width (ft)	* 2741.09	* Top Width (ft)	* 744.34	* 79.67	* 1917.08 *
* Vel Total (ft/s)	* 0.25	* Avg. Vel. (ft/s)	* 0.29	* 0.53	* 0.19 *
* Max Chl Dpth (ft)	* 19.78	* Hydr. Depth (ft)	* 12.05	* 16.69	* 6.49 *
* Conv. Total (cfs)	*1077598.0	* Conv. (cfs)	*248022.9	*271559.7	*558015.6 *
* Length Wtd. (ft)	* 2561.56	* Wetted Per. (ft)	* 185.45	* 86.43	* 1165.83 *
* Min Ch El (ft)	* 153.20	* Shear (lb/sq ft)	* 0.01	* 0.01	* 0.00 *
* Alpha	* 1.72	* Stream Power (lb/ft s)	* 0.00	* 0.00	* 0.00 *
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 573.10	* 170.58	* 929.09 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 47.08	* 8.33	* 79.90 *

****

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.070	0.045	0.070
W.S. Elev (ft)	178.47	Reach Len. (ft)	4920.00	3930.00	1480.00
Crit W.S. (ft)	158.77	Flow Area (sq ft)	3243.43	1767.43	*13965.41
E.G. Slope (ft/ft)	*0.000001	Area (sq ft)	*12339.78	1767.43	*23016.65
Q Total (cfs)	2100.00	Flow (cfs)	397.25	373.73	1329.02
Top Width (ft)	2860.36	Top Width (ft)	855.49	79.67	1925.20
Vel Total (ft/s)	0.11	Avg. Vel. (ft/s)	0.12	0.21	0.10
Max Chl Dpth (ft)	25.27	Hydr. Depth (ft)	17.55	22.18	11.98
Conv. Total (cfs)	*2452352.0	Conv. (cfs)	*463898.0	*436439.3	*1552015.0
Length Wtd. (ft)	2385.05	Wetted Per. (ft)	185.45	86.43	1165.83
Min Ch El (ft)	153.20	Shear (lb/sq ft)	0.00	0.00	0.00
Alpha	1.35	Stream Power (lb/ft s)	0.00	0.00	0.00
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	923.85	225.14	1594.56
C & E Loss (ft)	0.00	Cum SA (acres)	54.53	8.33	96.61

****

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-1 RS: 190

INPUT
Description: XS 190 (LETTERED CROSS SECTION T)
THE DIVIDED FLOW SECTION STARTS
AS A TRIBUTARY WITH COMMON XS-180
Station Elevation Data num= 307

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

****

0	214.16	3.27	214.07	9.81	213.97	13.09	213.82	16.36	213.69
19.63	213.58	22.9	213.43	26.17	213.2	29.44	212.87	32.72	212.56
35.99	212.23	39.26	211.64	42.53	210.84	45.8	209.87	49.07	208.98
52.34	207.9	55.62	206.58	58.89	205.31	62.16	204.17	65.43	203.07
71.97	200.51	75.24	199.29	78.52	198.08	81.79	196.92	85.06	195.85
88.33	194.77	91.6	193.72	94.87	192.91	98.15	191.86	101.42	190.85
104.69	190.14	107.96	189.21	111.23	187.85	114.5	186.37	117.77	184.88
121.05	183.46	124.32	181.12	127.59	177.94	130.86	174.85	134.13	172.17
137.4	169.26	137.67	169.03	140.67	166.42	143.95	163.65	147.22	160.33
158	155	188	153.8	208	155	215.92	158.89	217.68	159.56
222.46	161.55	225.73	162.79	229.01	163.57	232.28	163.67	235.55	163.78
238.82	163.91	242.09	163.61	245.36	163.38	248.64	163.31	251.91	163.25
255.18	163.16	258.45	163.08	261.72	163.01	264.99	162.98	268.26	163.03
271.54	163.04	274.81	163.03	278.08	162.98	281.35	162.91	284.62	162.83
287.89	162.8	291.16	162.91	294.44	162.95	297.71	162.97	300.98	162.98
304.25	162.97	307.52	162.93	310.79	162.91	314.07	162.92	317.34	162.87
320.61	162.84	323.88	162.79	327.15	162.75	330.42	162.72	333.69	162.67
340.24	162.53	343.51	162.51	346.78	162.53	350.05	162.54	353.32	162.45
356.59	162.43	363.14	162.49	366.41	162.53	369.68	162.54	372.95	162.53
379.5	162.43	382.77	162.46	386.04	162.59	389.31	162.65	392.58	162.61
395.85	162.55	399.12	162.52	402.4	162.41	405.67	162.34	408.94	162.35
412.21	162.37	418.75	162.43	422.02	162.43	425.3	162.41	428.57	162.4
431.84	162.48	435.11	162.58	438.38	162.65	441.65	162.69	444.93	162.74
448.2	162.73	451.47	162.7	454.74	162.7	458.01	162.68	461.28	162.57
464.55	162.47	467.83	162.41	474.37	162.27	477.64	162.25	480.91	162.25
484.18	162.24	487.46	162.24	494	162.32	497.27	162.35	500.54	162.35
503.81	162.32	510.36	162.28	513.63	162.22	516.9	162.15	520.17	162.09
523.44	162.01	526.71	161.85	529.98	161.8	533.26	161.83	539.8	161.99
543.07	162.08	546.34	162.16	549.61	162.23	552.89	162.33	556.16	162.38
559.43	162.35	562.7	162.34	565.97	162.35	569.24	162.31	572.51	162.31
575.79	162.37	579.06	162.35	585.6	162.19	588.87	162.16	592.14	162.17
595.41	162.21	601.96	162.37	605.23	162.44	608.5	162.5	611.77	162.6
615.04	162.71	618.32	162.79	621.59	162.86	624.86	162.96	628.13	163.1
631.4	163.26	634.67	163.3	637.94	163.38	641.22	163.45	644.49	163.49
647.76	163.61	654.3	163.79	657.57	163.9	660.84	164	664.12	164.02
667.39	163.96	670.66	164	671.5897	163.36	675.0695	163.46	678.5492	163.57
682.0289	163.67	688.9884	163.81	692.4681	163.83	695.9479	163.83	699.4276	163.88
702.9073	163.95	706.3871	164.03	709.8669	164.09	713.3466	164.14	720.3061	164.26
723.7858	164.31	727.2656	164.35	734.225	164.45	741.1845	164.59	744.6642	164.65
751.6237	164.79	755.1035	164.83	1023.043	164.83	1026.523	164.72	1030.003	164.51
1033.483	164.33	1036.962	164.19	1040.442	164.04	1043.922	163.86	1047.402	163.41
1050.881	162.87	1054.361	162.83	1057.841	162.83	1061.321	162.81	1064.8	162.78
1068.28	162.76	1071.76	162.73	1075.24	162.71	1082.199	162.71	1085.679	162.69
1089.158	162.66	1096.118	162.64	1099.598	162.62	1103.077	162.56	1130.915	161.84
1134.395	160.83	1137.875	160.83	1141.354	160.95	1144.834	161.87	1148.314	161.96
1162.233	162.36	1165.713	162.47	1169.193	162.57	1176.152	162.79	1179.632	162.83
1183.111	162.84	1186.591	162.86	1190.071	162.89	1197.03	162.93	1200.51	162.96
1203.99	162.98	1207.47	163.01	1214.429	163.05	1217.909	163.08	1221.389	163.1
1224.868	163.13	1256.186	163.31	1259.666	163.32	1346.659	163.82	1350.139	163.88
1353.619	163.93	1357.098	163.97	1360.578	164.03	1364.058	164.06	1371.017	164.16
1374.497	164.19	1384.936	164.34	1388.416	164.38	1405.815	164.63	1409.294	164.67
1419.734	164.82	1423.214	164.83	1426.693	164.89	1437.132	165.22	1440.612	165.34
1451.051	165.67	1458.011	165.91	1478.889	166.69	1482.369	166.81	1485.849	166.96
1489.328	167.11	1492.808	167.25	1496.288	167.39	1499.768	167.54	1506.727	167.82
1534.565	169.02	1541.525	169.34	1548.484	169.64	1551.964	169.81	1558.923	170.22
1562.403	170.39	1572.842	170.87	1576.322	171	1579.802	171.14	1583.281	171.27
1586.761	171.43	1593.721	171.77	1600.68	172.05	1604.16	172.2	1607.64	172.34
1611.119	172.49	1618.079	172.77	1621.559	172.83	1625.038	172.91	1628.518	173.01
1631.998	173.11	1635.478	173.21	1638.957	173.28	1649.396	173.49	1670.275	173.85
1684.194	174.05	1687.674	174.09	1694.633	174.19	1698.113	174.22	1705.072	174.3
1708.552	174.33	1718.991	174.45	1722.471	174.48	1725.951	174.51	1729.431	174.53
1732.91	174.54	1736.39	174.57						

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*******************************************
       0      .1  147.22    .045  217.68      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        147.22  217.68              735     735     735             .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
    1200 1736.39  177.48

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
**********
* E.G. Elev (ft)         *  174.56  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.00  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  174.56  * Reach Len. (ft)       *  735.00  *  735.00  *
 735.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *  110.31  * 1356.35
*10977.24  *
* E.G. Slope (ft/ft)     *0.000006  * Area (sq ft)          *  110.31  * 1356.35
*10977.24  *
* Q Total (cfs)          * 2665.00  * Flow (cfs)            *   11.55  *  743.81  *
1909.64  *
* Top Width (ft)         * 1068.78  * Top Width (ft)        *   16.00  *   70.46  *
 982.32  *
* Vel Total (ft/s)       *    0.21  * Avg. Vel. (ft/s)      *    0.10  *    0.55  *
   0.17  *
* Max Chl Dpth (ft)      *   20.76  * Hydr. Depth (ft)      *    6.89  *   19.25  *
  11.17  *
* Conv. Total (cfs)      *1127841.0  * Conv. (cfs)          *  4887.1  *314783.6
*808170.1  *
* Length Wtd. (ft)       *  735.00  * Wetted Per. (ft)      *   21.43  *   72.79  *
 995.34  *
* Min Ch El (ft)         *  153.80  * Shear (lb/sq ft)      *    0.00  *    0.01  *
   0.00  *
* Alpha                  *    2.30  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.01  * Cum Volume (acre-ft)  *  147.37  *   59.52  *
 663.80  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *    4.53  *    1.56  *
  31.78  *
*********************************************************************************
**********

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT  Profile #Floodway
*********************************************************************************
**********
* E.G. Elev (ft)         *  175.30  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.29  * Reach Len. (ft)       *  735.00  *  735.00  *
 735.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     *   42.91  * 1408.05  *
```

* E.G. Slope (ft/ft)	*0.000012	* Area (sq ft)	* 42.91	* 1408.05	* 5273.88	*
* Q Total (cfs)	* 2665.00	* Flow (cfs)	* 4.29	* 1182.80	* 1477.91	*
* Top Width (ft)	* 488.00	* Top Width (ft)	* 3.22	* 70.46	* 414.32	*
* Vel Total (ft/s)	* 0.40	* Avg. Vel. (ft/s)	* 0.10	* 0.84	* 0.28	*
* Max Chl Dpth (ft)	* 21.49	* Hydr. Depth (ft)	* 13.33	* 19.98	* 12.73	*
* Conv. Total (cfs)	*754871.2	* Conv. (cfs)	* 1216.5	*335032.1	*418622.6	*
* Length Wtd. (ft)	* 735.00	* Wetted Per. (ft)	* 16.28	* 72.79	* 427.15	*
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.00	* 0.02	* 0.01	*
* Alpha	* 2.27	* Stream Power (lb/ft s)	* 0.00	* 0.01	* 0.00	*
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 79.41	* 61.82	* 600.78	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 0.82	* 1.56	* 21.82	*

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 169.19	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 169.18	* Reach Len. (ft)	* 735.00	* 735.00	* 735.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 41.48	* 977.49	* 5695.29	*
* E.G. Slope (ft/ft)	*0.000044	* Area (sq ft)	* 41.48	* 977.49	* 5695.29	*
* Q Total (cfs)	* 3015.00	* Flow (cfs)	* 8.77	* 1207.30	* 1798.93	*
* Top Width (ft)	* 1062.51	* Top Width (ft)	* 9.72	* 70.46	* 982.32	*
* Vel Total (ft/s)	* 0.45	* Avg. Vel. (ft/s)	* 0.21	* 1.24	* 0.32	*
* Max Chl Dpth (ft)	* 15.38	* Hydr. Depth (ft)	* 4.26	* 13.87	* 5.80	*
* Conv. Total (cfs)	*455388.8	* Conv. (cfs)	* 1324.8	*182351.8	*271712.1	*
* Length Wtd. (ft)	* 735.00	* Wetted Per. (ft)	* 13.16	* 72.79	* 989.96	*
* Min Ch El (ft)	* 153.80	* Shear (lb/sq ft)	* 0.01	* 0.04	* 0.02	*
* Alpha	* 3.33	* Stream Power (lb/ft s)	* 0.00	* 0.05	* 0.00	*
* Frctn Loss (ft)	* 0.03	* Cum Volume (acre-ft)	* 62.77	* 42.64	* 324.85	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 3.18	* 1.56	* 28.05	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	172.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	172.96	Reach Len. (ft)	735.00	735.00	735.00
Crit W.S. (ft)		Flow Area (sq ft)	86.26	1243.59	9405.18
E.G. Slope (ft/ft)	0.000010	Area (sq ft)	86.26	1243.59	9405.18
Q Total (cfs)	2805.00	Flow (cfs)	10.98	847.79	1946.23
Top Width (ft)	1066.83	Top Width (ft)	14.05	70.46	982.32
Vel Total (ft/s)	0.26	Avg. Vel. (ft/s)	0.13	0.68	0.21
Max Chl Dpth (ft)	19.16	Hydr. Depth (ft)	6.14	17.65	9.57
Conv. Total (cfs)	901219.0	Conv. (cfs)	3526.8	272387.5	625304.8
Length Wtd. (ft)	735.00	Wetted Per. (ft)	18.90	72.79	993.74
Min Ch El (ft)	153.80	Shear (lb/sq ft)	0.00	0.01	0.01
Alpha	2.49	Stream Power (lb/ft s)	0.00	0.01	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	120.39	54.50	558.00
C & E Loss (ft)	0.00	Cum SA (acres)	4.25	1.56	30.64

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #0.2%

E.G. Elev (ft)	178.47	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.00	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	178.47	Reach Len. (ft)	735.00	735.00	735.00
Crit W.S. (ft)		Flow Area (sq ft)	181.22	1632.14	15353.23
E.G. Slope (ft/ft)	0.000002	Area (sq ft)	181.22	1632.14	15353.23
Q Total (cfs)	2100.00	Flow (cfs)	13.39	601.21	1485.40
Top Width (ft)	1609.35	Top Width (ft)	20.18	70.46	

```
1518.71  *
* Vel Total (ft/s)       *    0.12  * Avg. Vel. (ft/s)       *    0.07  *    0.37  *
   0.10  *
* Max Chl Dpth (ft)      *   24.67  * Hydr. Depth (ft)       *    8.98  *   23.16  *
  10.11  *
* Conv. Total (cfs)      *1496851.0  * Conv. (cfs)            *  9546.4  *428535.2
*1058769.0  *
* Length Wtd. (ft)       *  735.00  * Wetted Per. (ft)       *   27.15  *   72.79  *
1535.65  *
* Min Ch El (ft)         *  153.80  * Shear (lb/sq ft)       *    0.00  *    0.00  *
   0.00  *
* Alpha                  *    3.04  * Stream Power (lb/ft s) *    0.00  *    0.00  *
   0.00  *
* Frctn Loss (ft)        *    0.00  * Cum Volume (acre-ft)   *  216.74  *   71.79  *
 942.73  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *    5.08  *    1.56  *
  38.11  *
**********************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance)
is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.

CROSS SECTION


RIVER: RIVER-1
REACH: Reach-1            RS: 182

INPUT
Description: XS 182
CROSS SECTION XS-182 ADDED
             90
XS INSERTED TO EVALUATE IMPACT OF PROPOSED
             FILL IN THE FLOODWAY
Station Elevation Data    num=     434
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
       0  181.14    3.27  180.81   13.07  180.06    19.6  179.82   22.87   179.6
   26.14  179.65    29.4  179.59   35.94  179.72   39.21  179.66   42.47  179.48
   49.01   179.3   52.27  179.06   58.81  178.43   65.34  178.02   68.61  177.74
   71.88  177.29   75.14  176.96   78.41  176.91   84.95  176.74   91.48  176.69
   94.75  176.37  101.28  175.66  104.55  175.42  107.82  175.26  124.15   174.2
  133.95  173.82  140.49  173.42  150.29  172.93  156.82  172.82  160.09  172.69
  166.62   172.2  169.89  172.05  176.43  172.07  182.96  171.95  196.03  171.45
  202.56  171.11   209.1  170.92   218.9  170.52  222.17  170.43  231.97  170.46
   238.5  170.18  245.04  169.76   248.3  169.75  254.84  169.56  258.11  169.55
  264.64  169.28  267.91   169.4  271.17  169.33  277.71  168.59  280.98  168.34
  284.24  168.18  290.78  168.09  297.31  167.88  300.58  167.93  307.11   168.2
  310.38  168.18  323.45  167.59  336.52  166.69  339.78   166.5  343.05  166.41
  349.59  166.46  359.39  166.41  365.92  166.23  369.19   166.1  372.46  166.06
  378.99  166.14  382.26  166.08  385.52  165.95  392.06  165.56  395.33  165.47
  405.13  165.45  408.39  165.41  414.93  165.26  421.46   165.3     428  165.27
  431.26  165.15  434.53  164.95   437.8  164.86   447.6  164.83  454.13   165.1
   457.4  165.18  460.67  165.17   467.2  164.99  470.47  164.94  473.74  164.97
     477  164.86  483.54  164.22  490.07  164.22  493.33  164.26  503.12  164.01
  509.65  163.87  516.18  163.52  519.44  163.48   522.7  163.35  525.97  163.15
  529.23  163.22   532.5   163.4  535.76   163.5  542.29  163.41  545.55   163.5
  552.08  163.93  558.61  164.03  561.87  163.97   568.4  163.64  574.93   163.7
  578.19  163.55  584.72  163.01  587.98  162.96  591.24  163.24  594.51  163.61
```

597.77	163.43 601.04	162.53601.8448	162.4617.0814	161.83624.6997	161.83
639.9363	161.16647.5546	160.3655.1729	157.34662.7912	154.83670.4095	154.83
678.0278	154.83685.6461	154.83693.2643	154.83700.8826	154.83708.5009	154.83
716.1192	154.83723.7375	154.83731.3558	154.83738.9741	154.83746.5923	156.84
754.2106	160.91761.8289	161.39769.4473	161.79777.0656	161.83784.6838	161.83
792.3021	162.05799.9204	162.34807.5387	162.831051.324	162.831058.942	162.73
1066.561	162.551074.179	162.421081.797	162.341089.415	162.281104.652	162.11
1119.889	1621127.507	161.961142.743	161.85 1157.98	161.91165.598	161.94
1173.217	162.081180.835	161.451188.453	161.541196.071	162.04 1203.69	161.89
1211.308	161.81218.926	161.691226.545	161.541234.163	161.281241.781	161.58
1249.399	161.81257.018	161.831295.109	161.831302.728	162.831432.238	162.83
1439.857	162.711447.475	162.421455.093	162.211462.712	162.041477.948	161.66
1493.185	161.331500.803	161.21508.421	161.131531.276	160.971554.131	160.85
1561.749	160.771607.459	160.21630.314	160.011637.932	159.961645.551	159.89
1653.169	159.631660.787	158.831668.405	158.831676.024	159.851683.642	160.28
1691.26	160.861698.879	161.381706.497	161.851721.733	162.21729.352	162.39
1736.97	162.631744.588	162.831866.481	162.831881.718	162.71896.954	162.55
1904.572	162.291912.191	161.911919.809	161.71 1957.9	160.941965.519	160.83
1973.137	160.912011.228	161.692018.847	161.862026.465	162.222034.083	162.6
2041.702	162.832079.793	162.832087.411	162.782102.648	162.552110.266	162.55
2155.976	162.72163.594	163.182171.212	163.922178.831	164.622186.449	164.98
2201.686	165.422209.304	165.612216.922	165.772224.541	165.83 2260.31	165.83
2265.3	165.84 2275.3	165.83 2280.3	165.89 2285.3	166.36 2290.3	166.37
2300.29	166.35 2310.29	166.26 2315.29	166.23 2325.29	166.03 2335.28	165.63
2340.28	165.49 2345.28	165.4 2355.28	165.09 2360.28	165.04 2365.27	164.96
2370.27	164.82 2380.27	164.59 2385.27	164.46 2390.27	164.39 2395.26	164.27
2400.26	164.18 2405.26	164.16 2410.26	164.04 2415.26	163.97 2420.26	163.82
2425.26	163.74 2430.25	163.71 2435.25	163.61 2440.25	163.48 2445.25	163.41
2450.25	163.39 2455.25	163.4 2460.24	163.35 2470.24	163.34 2475.24	163.26
2480.24	163.22 2490.24	163.19 2500.23	163.11 2505.23	163.13 2510.23	163.05
2515.23	163.02 2520.23	163.09 2530.22	163.41 2535.22	163.59 2540.22	163.67
2545.22	163.72 2550.22	163.85 2555.22	163.93 2560.21	164.08 2565.21	164.15
2570.21	164.27 2580.21	164.61 2590.2	165.03 2595.2	165.2 2600.2	165.45
2605.2	165.64 2620.2	166.02 2625.19	166.04 2635.19	166.19 2645.19	166.24
2650.19	166.29 2660.18	166.31 2670.18	166.37 2680.18	166.29 2685.18	166.28
2690.17	166.24 2700.17	166.2 2705.17	166.22 2710.17	166.27 2720.16	166.33
2725.16	166.34 2745.16	166.53 2750.16	166.6 2755.15	166.63 2760.15	166.59
2765.15	166.58 2780.15	166.69 2790.14	166.82 2795.14	166.84 2805.14	166.98
2810.14	167.03 2820.13	167.25 2825.13	167.26 2835.13	167.38 2845.13	167.45
2850.13	167.47 2855.12	167.55 2865.12	167.65 2875.12	167.68 2885.11	167.68
2890.11	167.75 2900.11	167.84 2910.11	167.98 2915.1	168.03 2920.1	168.02
2930.1	167.88 2935.1	167.75 2940.1	167.7 2945.1	167.88 2950.09	168.11
2955.09	168.25 2960.09	168.31 2975.09	168.35 2980.08	168.41 3000.08	168.47
3010.08	168.55 3020.07	168.75 3025.07	168.81 3030.07	168.84 3040.07	168.94
3050.06	168.87 3060.06	168.9 3070.06	168.96 3075.06	168.96 3085.05	169.05
3090.05	169.06 3095.05	169.11 3100.05	169.26 3105.05	169.32 3110.04	169.48
3115.04	169.38 3120.04	169.47 3125.04	169.63 3130.04	169.7 3135.04	169.72
3140.04	169.78 3155.03	169.85 3175.02	169.9 3180.02	169.89 3190.02	169.73
3215.01	169.96 3220.01	170.03 3230.01	170.12 3235.01	170.26 3255	170.68
3265	170.98 3270	171 3274.99	171.08 3279.99	171.04 3284.99	171.1
3294.99	171.33 3299.99	171.42 3309.98	171.65 3319.98	171.71 3329.98	171.9
3334.98	171.93 3339.97	171.99 3344.97	172.09 3349.97	172.16 3354.97	172.28
3364.97	172.32 3369.97	172.37 3374.96	172.49 3379.96	172.53 3384.96	172.61
3389.96	172.73 3404.95	172.96 3409.95	173 3414.95	173.08 3419.95	173.12
3429.95	173.32 3439.94	173.56 3444.94	173.51 3449.94	173.43 3459.94	173.59
3474.93	173.94 3484.93	174.07 3489.93	174.07 3494.93	174.17 3499.93	174.23
3504.92	174.25 3509.92	174.21 3514.92	174.29 3519.92	174.28 3529.92	174.4
3534.91	174.41 3544.91	174.77 3554.91	174.9 3564.91	174.92 3574.9	175.01
3579.9	175.04 3589.9	175.34 3594.9	175.41 3604.89	175.31 3609.89	175.23
3614.89	175.07 3619.89	175.28 3634.88	175.71 3644.88	175.9 3649.88	175.98
3654.88	176.1 3659.88	176.27 3664.87	176.39 3674.87	176.6 3679.87	176.77
3689.87	177.01 3694.87	177.15 3699.86	177.25 3709.86	177.41 3714.86	177.58
3719.86	177.8 3724.86	177.95 3734.85	178.31 3739.85	178.36 3744.85	178.19

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 3749.85  178.33 3754.85  178.58 3764.84  178.74 3769.84  178.95 3779.84  179.17
 3784.84  179.31 3789.84  179.36 3794.94  179.94 3801.49  180.11

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************************************************
       0      .1639.9363    .045761.8289     .031637.932    .0251683.642      .1

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      639.9363754.2106              635     635     635             .1       .3

CROSS SECTION OUTPUT  Profile #1%
*********************************************************************************
***********
* E.G. Elev (ft)         *  174.55  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.045  *
* W.S. Elev (ft)         *  174.54  * Reach Len. (ft)        *  635.00  *  635.00  *
 635.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 3987.76  * 2129.44
*26652.71  *
* E.G. Slope (ft/ft)     *0.000018  * Area (sq ft)           * 3987.76  * 2129.44
*26652.71  *
* Q Total (cfs)          *19965.00  * Flow (cfs)             *  962.12  * 2040.88
*16962.00  *
* Top Width (ft)         * 3419.79  * Top Width (ft)        *  521.09  *  114.27  *
2784.43  *
* Vel Total (ft/s)       *    0.61  * Avg. Vel. (ft/s)      *    0.24  *    0.96  *
   0.64  *
* Max Chl Dpth (ft)      *   19.71  * Hydr. Depth (ft)      *    7.65  *   18.63  *
   9.57  *
* Conv. Total (cfs)      *4771374.0  * Conv. (cfs)           *229933.8  *487743.9
*4053696.0  *
* Length Wtd. (ft)       *  635.00  * Wetted Per. (ft)      *  521.69  *  116.56  *
2785.19  *
* Min Ch El (ft)         *  154.83  * Shear (lb/sq ft)      *    0.01  *    0.02  *
   0.01  *
* Alpha                  *    1.19  * Stream Power (lb/ft s) *    0.00  *    0.02  *
   0.01  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)  *  112.80  *   30.11  *
 346.33  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)        *          *          *
         *
*********************************************************************************
***********

CROSS SECTION OUTPUT  Profile #Floodway
*********************************************************************************
***********
* E.G. Elev (ft)         *  175.28  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.045  *
* W.S. Elev (ft)         *  175.28  * Reach Len. (ft)        *  635.00  *  635.00  *
 635.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1168.15  * 2213.22
*25980.54  *
* E.G. Slope (ft/ft)     *0.000015  * Area (sq ft)           * 1168.15  * 2213.22
*25980.54  *
* Q Total (cfs)          *19965.00  * Flow (cfs)             *  338.54  * 2047.59
*17578.87  *
* Top Width (ft)         * 2380.00  * Top Width (ft)        *   93.94  *  114.27  *
```

```
2171.79  *
* Vel Total (ft/s)       *    0.68  * Avg. Vel. (ft/s)       *    0.29  *    0.93  *
   0.68  *
* Max Chl Dpth (ft)      *   20.45  * Hydr. Depth (ft)       *   12.44  *   19.37  *
  11.96  *
* Conv. Total (cfs)      *5071660.0  * Conv. (cfs)           * 85997.4  *520144.5
*4465518.0  *
* Length Wtd. (ft)       *  635.00  * Wetted Per. (ft)       *  105.93  *  116.56  *
2179.82  *
* Min Ch El (ft)         *  154.83  * Shear (lb/sq ft)       *    0.01  *    0.02  *
   0.01  *
* Alpha                  *    1.06  * Stream Power (lb/ft s) *    0.00  *    0.02  *
   0.01  *
* Frctn Loss (ft)        *    0.02  * Cum Volume (acre-ft)   *   69.19  *   31.27  *
 337.10  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *          *          *
          *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #10%
*******************************************************************************
***********
* E.G. Elev (ft)         *  169.16  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.041  *
* W.S. Elev (ft)         *  169.15  * Reach Len. (ft)        *  635.00  *  635.00  *
 635.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1541.47  * 1513.29
*12777.64  *
* E.G. Slope (ft/ft)     *0.000033  * Area (sq ft)           * 1541.47  * 1513.29
*12777.64  *
* Q Total (cfs)          *10495.00  * Flow (cfs)             *  342.94  * 1589.42  *
8562.64  *
* Top Width (ft)         * 2823.72  * Top Width (ft)         *  367.20  *  114.27  *
2342.25  *
* Vel Total (ft/s)       *    0.66  * Avg. Vel. (ft/s)       *    0.22  *    1.05  *
   0.67  *
* Max Chl Dpth (ft)      *   14.32  * Hydr. Depth (ft)       *    4.20  *   13.24  *
   5.46  *
* Conv. Total (cfs)      *1822617.0  * Conv. (cfs)           * 59556.3  *276027.1
*1487034.0  *
* Length Wtd. (ft)       *  635.00  * Wetted Per. (ft)       *  367.66  *  116.56  *
2342.96  *
* Min Ch El (ft)         *  154.83  * Shear (lb/sq ft)       *    0.01  *    0.03  *
   0.01  *
* Alpha                  *    1.22  * Stream Power (lb/ft s) *    0.00  *    0.03  *
   0.01  *
* Frctn Loss (ft)        *    0.03  * Cum Volume (acre-ft)   *   49.42  *   21.62  *
 169.00  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *          *          *
          *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  172.95  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.044  *
```

* W.S. Elev (ft)	* 172.94	* Reach Len. (ft)	* 635.00	* 635.00	* 635.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 3177.16	* 1946.24	*22303.35 *
* E.G. Slope (ft/ft)	*0.000021	* Area (sq ft)	* 3177.16	* 1946.24	*22303.35 *
* Q Total (cfs)	*17155.00	* Flow (cfs)	* 747.98	* 1914.05	*14492.97 *
* Top Width (ft)	* 3253.64	* Top Width (ft)	* 489.87	* 114.27	* 2649.50 *
* Vel Total (ft/s)	* 0.63	* Avg. Vel. (ft/s)	* 0.24	* 0.98	* 0.65 *
* Max Chl Dpth (ft)	* 18.11	* Hydr. Depth (ft)	* 6.49	* 17.03	* 8.42 *
* Conv. Total (cfs)	*3762818.0	* Conv. (cfs)	*164063.6	*419831.8	*3178923.0 *
* Length Wtd. (ft)	* 635.00	* Wetted Per. (ft)	* 490.42	* 116.56	* 2650.25 *
* Min Ch El (ft)	* 154.83	* Shear (lb/sq ft)	* 0.01	* 0.02	* 0.01 *
* Alpha	* 1.19	* Stream Power (lb/ft s)	* 0.00	* 0.02	* 0.01 *
* Frctn Loss (ft)	* 0.02	* Cum Volume (acre-ft)	* 92.86	* 27.59	* 290.48 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

****

CROSS SECTION OUTPUT Profile #0.2%

****

* E.G. Elev (ft)	* 178.47	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.047 *
* W.S. Elev (ft)	* 178.46	* Reach Len. (ft)	* 635.00	* 635.00	* 635.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 6148.36	* 2577.09	*38040.36 *
* E.G. Slope (ft/ft)	*0.000013	* Area (sq ft)	* 6148.36	* 2577.09	*38040.36 *
* Q Total (cfs)	*27500.00	* Flow (cfs)	* 1562.89	* 2382.47	*23554.64 *
* Top Width (ft)	* 3694.00	* Top Width (ft)	* 581.45	* 114.27	* 2998.27 *
* Vel Total (ft/s)	* 0.59	* Avg. Vel. (ft/s)	* 0.25	* 0.92	* 0.62 *
* Max Chl Dpth (ft)	* 23.63	* Hydr. Depth (ft)	* 10.57	* 22.55	* 12.69 *
* Conv. Total (cfs)	*7737592.0	* Conv. (cfs)	*439746.2	*670347.3	*6627498.0 *
* Length Wtd. (ft)	* 635.00	* Wetted Per. (ft)	* 582.22	* 116.56	* 2999.11 *
* Min Ch El (ft)	* 154.83	* Shear (lb/sq ft)	* 0.01	* 0.02	* 0.01 *
* Alpha	* 1.17	* Stream Power (lb/ft s)	* 0.00	* 0.02	* 0.01 *
* Frctn Loss (ft)	* 0.01	* Cum Volume (acre-ft)	* 163.34	* 36.27	* 492.27 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	*	*	* *

****

CROSS SECTION

RIVER: RIVER-1
REACH: Reach-2 RS: 180

INPUT
Description: XS 180 (LETTERED CROSS-SECTION S)
Station Elevation Data num= 476

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	197.84	6.56	197.09	9.83	196.8	16.39	196.36	22.95	196.04
26.23	195.7	32.78	194.85	36.06	194.56	39.34	194.05	45.9	193.17
49.17	192.54	52.45	192.06	55.73	191.49	62.29	190.55	65.56	190.42
68.84	190.12	75.4	189.32	85.23	188.34	88.51	187.79	95.07	186.39
98.35	185.63	104.9	183.83	114.74	181.54	121.29	180.45	127.85	179.21
131.13	178.63	134.41	178.19	140.96	177.45	147.52	176.86	150.8	176.16
154.08	175.35	157.35	174.71	160.63	174.16	163.91	173.79	167.19	173.53
173.75	173.28	180.3	172.81	183.58	172.63	190.14	171.99	193.42	171.57
196.69	171.25	203.25	171.04	206.53	171.02	209.81	171.16	213.08	171.22
219.64	170.94	222.92	170.97	226.2	170.88	232.75	170.6	236.03	170.54
239.31	170.37	245.87	170.47	249.15	170.43	255.7	170.48	262.26	170.3
265.54	170.28	268.81	170.16	275.37	169.75	285.21	169.4	298.32	169.3
304.88	169.18	311.43	169.14	321.27	168.81	327.82	168.72	334.38	168.73
347.49	168.35	354.05	168.33	360.61	168.42	373.72	168.27	377	168.27
383.55	168.36	393.39	168.17	399.94	168.2	403.22	168.13	409.78	167.88
416.34	167.78	419.61	167.67	429.45	167.65	436	167.39	439.28	167.37
445.84	166.95	455.67	166.83	465.51	166.68	472.07	166.78	478.62	166.72
481.9	166.84	485.18	166.87	488.46	166.81	495.01	166.56	501.57	166.49
511.4	166.29	514.68	166.28	521.24	166.36	524.52	166.3	534.35	166.03
540.91	165.92	547.46	165.74	550.74	165.7	557.3	165.82	563.86	165.76
580.25	165.37	586.8	165.13	593.36	165.04	596.64	165.08	606.47	164.93
613.03	164.75	616.31	164.74	619.59	164.6	629.42	164.42	639.26	164.64
645.81	164.53	649.09	164.55	655.65	164.5	665.48	164.51	672.04	164.35
681.87	164.19	685.15	164.18	694.99	164.27	698.26	164.35	711.38	164.3
721.21	164.43	724.49	164.52	731.05	164.43	737.6	164.48	744.16	164.4
757.27	164.03	760.55	164.05	767.11	164.42	783.5	164.21	786.78	164.08
793.33	164.02	796.61	163.94	803.17	164.28	809.72	164.26	813	164.31
816.28	164.18	819.56	164.17	826.12	164.07	832.67	163.65	835.95	163.57
842.51	163.95	845.78	164.07	849.06	164	852.34	163.83	855.62	163.83
865.45	164	875.29	164.02	878.57	164.11	881.85	164.08	888.4	163.84
904.79	163.51	911.35	163.22	917.91	163.26	927.74	163.09	934.3	162.89
944.13	162.84	947.41	162.92	950.69	162.87	957.25	162.63	960.52	162.6
970.36	162.72	973.64	162.7	980.19	162.94	983.47	162.84	990.03	162.95
999.86	162.68	1003.14	162.72	1006.42	162.93	1009.7	163.06	1012.98	163.06
1016.25	163.14	1019.53	162.9	1032.64	163.19	1042.48	163.48	1055.59	163.69
1062.15	163.65	1068.71	163.65	1075.26	163.4	1078.54	163.4	1081.82	163.49
1088.37	163.58	1094.93	163.82	1098.21	163.82	1101.49	163.65	1111.32	162.97
1114.6	162.86	1121.16	163.01	1124.43	162.97	1130.99	162.7	1144.1	162
1147.38	161.67	1150.66	161.08	1157.22	160.28	1160.5	159.94	1163.77	159.87
1167.05	159.99	1170.33	160.3	1176.89	160.17	1180.16	160.24	1183.44	160.42
1186.72	160.87	1190	161.42	1193.28	161.35	1199.83	161.73	1206.39	161.94
1212.95	161.97	1219.5	161.94	1226.06	161.87	1235.89	161.82	1249.01	161.7
1265.4	161.57	1291.62	161.38	1298.18	161.32	1311.27	161.02	1321.08	160.82
1334.17	160.79	1343.98	160.83	1357.29	160.83	1360.56	160.8	1363.83	160.21
1367.1	159.29	1376.91	156.46	1380.18	155.56	1383.45	154.89	1386.72	154.39
1389.99	154.15	1392	153.3	1447	153.3	1452.11	155.82	1455.38	156.03
1458.65	156.91	1461.92	158.57	1465.19	160.07	1468.46	161.22	1471.73	161.82
1475	161.64	1478.27	162.03	1481.54	161.82	1484.81	161.77	1487.92	162.09
1497.74	162.23	1507.55	162.26	1517.37	162.21	1540.27	161.99	1566.44	161.84
1572.98	161.78	1608.97	161.35	1635.14	160.85	1651.5	160.76	1684.21	160.46

1694.03	160.36	1710.38	160.16	1720.2	160.07	1730.01	160.02	1739.83	160.03
1762.7	160.16	1788.85	160.32	1792.11	160.33	1844.4	160.33	1867.28	160.14
1886.88	160.02	1903.22	159.95	1922.83	159.89	1942.44	159.87	1971.85	159.88
1984.92	159.84	2138.51	160.82	2154.85	160.62	2184.26	160.33	2210.4	160.28
2230.06	160.27	2256.29	160.31	2262.85	160.34	2275.96	160.71	2282.52	160.83
2325.15	160.83	2334.99	160.88	2341.55	160.99	2348.11	161.14	2361.22	161.5
2367.78	161.62	2374.34	161.81	2384.18	161.97	2397.29	162.28	2403.85	162.39
2410.41	162.43	2413.69	162.38	2420.25	162.52	2430.09	162.53	2439.92	162.65
2446.48	162.67	2459.6	162.88	2466.16	163.03	2472.71	163.12	2482.55	163.46
2492.39	163.66	2495.67	163.65	2512.06	163.99	2515.34	164.1	2531.74	164.42
2541.58	164.65	2548.14	164.83	2574.37	165	2577.65	165.04	2584.21	164.86
2594.04	164.83	2600.6	164.78	2610.44	164.8	2620.28	164.57	2633.39	164.5
2643.23	164.4	2649.79	164.43	2656.35	164.41	2659.63	164.36	2662.91	164.39
2672.74	164.62	2682.58	164.74	2695.7	165.03	2705.54	165.21	2712.09	165.53
2718.65	165.57	2728.49	165.77	2735.05	166	2738.33	166.05	2748.16	166.1
2758	166.29	2767.84	166.4	2774.4	166.41	2777.68	166.35	2794.07	166.42
2800.63	166.49	2810.47	166.33	2820.31	166.28	2823.59	166.31	2833.42	166.32
2839.98	166.39	2853.1	166.32	2862.94	166.42	2869.49	166.44	2876.05	166.53
2885.89	166.73	2892.45	166.81	2899.01	166.77	2915.4	166.9	2921.96	166.78
2925.24	166.76	2931.8	166.86	2944.91	166.75	2958.03	166.94	2964.59	166.97
2971.15	167.05	2980.99	167.12	2994.1	167.14	3010.5	167.13	3017.06	167.17
3023.61	167.14	3036.73	167.32	3040.01	167.44	3046.57	167.51	3053.13	167.52
3059.69	167.65	3062.97	167.67	3069.52	167.63	3085.92	167.98	3092.48	167.99
3102.31	168.08	3112.15	168.14	3118.71	168.28	3128.55	168.43	3138.39	168.51
3148.22	168.65	3151.5	168.65	3158.06	168.8	3167.9	168.83	3177.74	168.94
3184.29	169.07	3197.41	169.16	3200.69	169.24	3213.81	169.4	3223.64	169.47
3230.2	169.48	3240.04	169.73	3246.6	169.82	3253.16	169.98	3259.72	170.06
3266.27	170.01	3272.83	170.06	3276.11	170.18	3285.95	170.22	3295.79	170.5
3299.07	170.46	3305.62	170.5	3308.9	170.59	3315.46	170.64	3325.3	170.88
3331.86	170.76	3351.53	171.08	3364.65	171.11	3367.93	171.16	3381.04	171.44
3387.6	171.49	3394.16	171.61	3397.44	171.72	3407.28	171.85	3410.56	171.82
3420.39	171.96	3426.95	172.12	3436.79	172.29	3449.91	172.62	3453.19	172.62
3459.74	172.75	3466.3	172.77	3472.86	172.87	3479.42	172.91	3489.26	173.07
3495.82	173.23	3502.37	173.28	3505.65	173.37	3515.49	173.73	3518.77	173.69
3522.05	173.54	3528.61	173.5	3531.89	173.56	3535.17	173.79	3548.28	174.24
3554.84	174.26	3564.68	174.46	3571.24	174.65	3587.63	175.03	3600.75	175.23
3607.31	175.28	3617.14	175.57	3623.7	175.66	3636.82	175.89	3646.66	176.02
3649.94	176.15	3659.77	176.12	3666.33	176.39	3669.61	176.43	3676.17	176.6
3679.45	176.55	3686.01	176.72	3689.29	176.75	3695.84	177	3708.96	177.34
3718.8	177.44	3725.36	177.76	3738.47	178.07	3741.75	178.2	3748.31	178.38
3758.15	178.52	3764.71	178.7	3774.55	179.03	3781.1	179.19	3784.38	179.22
3787.66	179.17	3797.5	179.28	3804.06	179.52	3810.62	179.71	3813.9	179.76
3823.73	180.09	3833.57	180.37	3849.97	180.64	3856.52	180.71	3863.08	180.71
3869.64	180.65	3882.76	180.9	3892.6	181.15	3899.15	181.24	3908.99	181.3
3918.83	181.53	3922.11	181.64	3931.95	181.77	3938.5	181.92	3945.06	182.13
3961.46	182.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1363.83	.045	1465.19	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1363.83	1465.19	700	700	.1	.3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.53	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.01	* Wt. n-Val.	* 0.100	* 0.045	* 0.100 *
* W.S. Elev (ft)	* 174.52	* Reach Len. (ft)	* 700.00	* 700.00	*

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 700.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      *11487.99  * 2001.89
*20862.82  *
* E.G. Slope (ft/ft)     *0.000056  * Area (sq ft)           *11487.99  * 2001.89
*20862.82  *
* Q Total (cfs)          *19965.00  * Flow (cfs)             * 5726.09  * 3550.64
*10688.27  *
* Top Width (ft)         * 3408.33  * Top Width (ft)         * 1205.36  *  101.36  *
2101.62  *
* Vel Total (ft/s)       *    0.58  * Avg. Vel. (ft/s)       *    0.50  *    1.77  *
   0.51  *
* Max Chl Dpth (ft)      *   21.22  * Hydr. Depth (ft)       *    9.53  *   19.75  *
   9.93  *
* Conv. Total (cfs)      *2674274.0  * Conv. (cfs)            *766998.9  *475601.3
*1431673.0  *
* Length Wtd. (ft)       *  700.00  * Wetted Per. (ft)       * 1206.18  *  103.73  *
2102.13  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)       *    0.03  *    0.07  *
   0.03  *
* Alpha                  *    2.28  * Stream Power (lb/ft s) *    0.02  *    0.12  *
   0.02  *
* Frctn Loss (ft)        *    0.04  * Cum Volume (acre-ft)   *  197.56  *   32.99  *
 285.84  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   19.55  *    1.63  *
  31.30  *
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CROSS SECTION OUTPUT  Profile #Floodway
********************************************************************************
**********
* E.G. Elev (ft)         *  175.27  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  175.26  * Reach Len. (ft)       *  700.00  *  700.00  *
 700.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 8324.19  * 2076.39
*20268.52  *
* E.G. Slope (ft/ft)     *0.000051  * Area (sq ft)           * 8324.19  * 2076.39
*20268.52  *
* Q Total (cfs)          *19965.00  * Flow (cfs)             * 4714.23  * 3624.49
*11626.28  *
* Top Width (ft)         * 2384.00  * Top Width (ft)         *  667.83  *  101.36  *
1614.81  *
* Vel Total (ft/s)       *    0.65  * Avg. Vel. (ft/s)       *    0.57  *    1.75  *
   0.57  *
* Max Chl Dpth (ft)      *   21.96  * Hydr. Depth (ft)       *   12.46  *   20.49  *
  12.55  *
* Conv. Total (cfs)      *2784276.0  * Conv. (cfs)            *657436.3  *505463.4
*1621376.0  *
* Length Wtd. (ft)       *  700.00  * Wetted Per. (ft)       *  679.31  *  103.73  *
1622.64  *
* Min Ch El (ft)         *  153.30  * Shear (lb/sq ft)       *    0.04  *    0.06  *
   0.04  *
* Alpha                  *    1.94  * Stream Power (lb/ft s) *    0.02  *    0.11  *
   0.02  *
* Frctn Loss (ft)        *    0.04  * Cum Volume (acre-ft)   *  164.64  *   34.19  *
 269.88  *
* C & E Loss (ft)        *    0.00  * Cum SA (acres)         *   13.13  *    1.63  *
  22.87  *
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CROSS SECTION OUTPUT Profile #10%

E.G. Elev (ft)	169.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	169.11	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	5238.17	1453.17	10409.28
E.G. Slope (ft/ft)	0.000106	Area (sq ft)	5238.17	1453.17	10409.28
Q Total (cfs)	10495.00	Flow (cfs)	2338.71	2873.50	5282.79
Top Width (ft)	2877.45	Top Width (ft)	1051.45	101.36	1724.64
Vel Total (ft/s)	0.61	Avg. Vel. (ft/s)	0.45	1.98	0.51
Max Chl Dpth (ft)	15.81	Hydr. Depth (ft)	4.98	14.34	6.04
Conv. Total (cfs)	1018457.0	Conv. (cfs)	226953.0	278850.4	512653.3
Length Wtd. (ft)	700.00	Wetted Per. (ft)	1052.05	103.73	1725.08
Min Ch El (ft)	153.30	Shear (lb/sq ft)	0.03	0.09	0.04
Alpha	3.30	Stream Power (lb/ft s)	0.01	0.18	0.02
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	94.94	24.13	130.30
C & E Loss (ft)	0.00	Cum SA (acres)	17.54	1.63	25.10

CROSS SECTION OUTPUT Profile #2%

E.G. Elev (ft)	172.93	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	172.91	Reach Len. (ft)	700.00	700.00	700.00
Crit W.S. (ft)		Flow Area (sq ft)	9563.10	1838.92	17550.06
E.G. Slope (ft/ft)	0.000067	Area (sq ft)	9563.10	1838.92	17550.06
Q Total (cfs)	17155.00	Flow (cfs)	4694.70	3391.42	9068.88
Top Width (ft)	3300.79	Top Width (ft)	1184.98	101.36	2014.46
Vel Total (ft/s)	0.59	Avg. Vel. (ft/s)	0.49	1.84	0.52
Max Chl Dpth (ft)	19.61	Hydr. Depth (ft)	8.07	18.14	8.71
Conv. Total (cfs)	2088281.0	Conv. (cfs)	571486.7	412837.8	1103957.0
Length Wtd. (ft)	700.00	Wetted Per. (ft)	1185.72	103.73	2014.94
Min Ch El (ft)	153.30	Shear (lb/sq ft)	0.03	0.07	

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   0.04  *
* Alpha                 *    2.51  * Stream Power (lb/ft s) *    0.02  *    0.14  *
   0.02  *
* Frctn Loss (ft)       *    0.05  * Cum Volume (acre-ft)   *  166.20  *   30.36  *
 236.30  *
* C & E Loss (ft)       *    0.00  * Cum SA (acres)         *   19.28  *    1.63  *
  30.03  *
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CROSS SECTION OUTPUT  Profile #0.2%
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**********
* E.G. Elev (ft)        *  178.46  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.01  * Wt. n-Val.            *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)        *  178.45  * Reach Len. (ft)       *  700.00  *  700.00  *
 700.00  *
* Crit W.S. (ft)        *          * Flow Area (sq ft)     *16261.14  * 2399.62
*29497.69  *
* E.G. Slope (ft/ft)    *0.000039  * Area (sq ft)          *16261.14  * 2399.62
*29497.69  *
* Q Total (cfs)         *27500.00  * Flow (cfs)            * 8428.02  * 4018.63
*15053.35  *
* Top Width (ft)        * 3620.41  * Top Width (ft)        * 1231.32  *  101.36  *
2287.72  *
* Vel Total (ft/s)      *    0.57  * Avg. Vel. (ft/s)      *    0.52  *    1.67  *
   0.51  *
* Max Chl Dpth (ft)     *   25.15  * Hydr. Depth (ft)      *   13.21  *   23.67  *
  12.89  *
* Conv. Total (cfs)     *4402175.0  * Conv. (cfs)           *1349150.0  *643298.6
*2409726.0  *
* Length Wtd. (ft)      *  700.00  * Wetted Per. (ft)      * 1232.48  *  103.73  *
2288.29  *
* Min Ch El (ft)        *  153.30  * Shear (lb/sq ft)      *    0.03  *    0.06  *
   0.03  *
* Alpha                 *    1.95  * Stream Power (lb/ft s) *    0.02  *    0.09  *
   0.02  *
* Frctn Loss (ft)       *    0.03  * Cum Volume (acre-ft)   *  275.48  *   39.39  *
 414.42  *
* C & E Loss (ft)       *    0.00  * Cum SA (acres)         *   20.12  *    1.63  *
  33.91  *
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CROSS SECTION


RIVER: RIVER-1
REACH: Reach-2           RS: 170

INPUT
Description: XS 170 (LETTERED CROSS-SECTION R)
Station Elevation Data    num=     490
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
       0  199.81    3.28  199.32    9.84  198.83   19.67  197.73   26.23  197.18
   36.07  196.05   42.63  195.12   49.18  194.27   55.74  193.75   59.02   193.3
    62.3  193.06   68.86  192.73   72.14  192.63   78.69  192.58   85.25  192.36
   88.53  192.41   91.81  192.79   95.09  192.88  101.65  192.73  104.93  192.49
   108.2  192.58  111.48  192.84  114.76  193.22  118.04  193.39  121.32  193.34
  131.16  192.96  134.44  192.98  137.72  193.21  140.99  193.32  144.27  193.29
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147.55	193.14	154.11	193.03	160.67	192.73	163.95	192.68	167.23	192.46
170.5	192.39	180.34	192.62	190.18	192.07	193.46	191.95	206.57	191.72
219.69	191.42	226.25	191.01	232.8	190.25	236.08	189.58	239.36	189.27
242.64	189.11	252.48	188.31	259.04	187.84	265.59	187.25	272.15	186.85
281.99	185.85	285.27	185.36	291.83	183.96	295.1	183.51	298.38	183.2
304.94	182.83	311.5	182.82	314.78	182.55	321.34	181.89	324.61	181.51
331.17	180.53	337.73	179.72	341.01	179.38	350.85	178.77	357.4	178.26
360.68	178.07	367.24	177.53	373.8	176.74	380.36	176.21	386.91	175.53
393.47	175.08	403.31	174.18	409.87	173.34	416.42	172.21	422.98	171.45
426.26	171.16	432.82	171.03	436.1	171.06	439.38	171.2	445.93	171.2
449.21	171.02	452.49	170.72	462.33	170.38	465.61	170.12	472.17	169.9
478.72	169.81	488.56	169.49	491.84	169.32	495.12	169.03	504.96	168.7
511.51	168.37	514.79	168.27	518.07	168.31	524.63	167.89	531.19	167.66
534.47	167.44	541.02	167.48	544.3	167.42	550.86	167.16	557.42	166.97
563.98	166.99	570.53	166.88	580.37	166.37	583.65	166.42	593.49	165.96
600.05	165.56	609.88	165.53	616.44	165.27	623	165.22	629.56	164.9
632.83	164.81	639.39	164.82	645.95	164.78	655.79	164.65	662.35	164.4
672.18	164.33	682.02	164.06	688.58	164.04	698.41	163.91	704.97	163.77
721.37	163.75	727.92	163.57	734.48	163.52	741.04	163.63	747.6	163.55
754.16	163.59	760.71	163.54	767.27	163.43	777.11	163.36	783.67	163.48
793.5	163.34	800.06	163.37	806.62	163.33	816.46	163.49	826.29	163.27
832.85	163.31	845.97	163.19	852.52	163.24	855.8	163.12	859.08	163.22
865.64	163.02	872.2	163.06	875.48	162.98	882.04	163.03	888.59	162.88
891.87	162.9	898.43	163.06	908.27	162.88	911.55	162.91	914.82	163.04
921.38	162.88	924.66	162.98	927.94	163.24	934.5	163.14	941.06	163.35
944.34	163.39	954.17	163.19	973.85	163.2	977.12	163.14	983.68	163.26
986.96	163.26	993.52	163.08	1000.08	163.05	1006.64	162.92	1013.19	162.96
1016.47	163.07	1032.87	162.81	1039.42	162.8	1065.66	162.56	1078.77	162.38
1088.61	162.43	1091.89	162.4	1098.45	162.17	1101.72	162.11	1111.56	162.15
1118.12	162.23	1124.68	161.95	1131.23	161.96	1134.51	161.91	1141.07	161.69
1150.91	161.81	1157.47	162.02	1164.02	162.14	1170.58	162.05	1177.14	161.82
1180.42	161.82	1186.98	162.04	1190.26	161.96	1193.53	161.78	1200.09	161.6
1203.37	161.68	1209.93	162	1219.77	161.99	1223.04	162.14	1226.32	162.42
1229.6	162.54	1236.16	162.04	1242.72	161.99	1246	161.73	1249.28	161.6
1255.83	161.78	1262.39	162.04	1268.95	162.18	1275.51	162.53	1278.79	162.58
1282.06	162.52	1288.62	162.52	1291.9	162.46	1295.18	162.29	1301.74	162.13
1305.02	162.15	1311.57	162.34	1318.13	162.21	1324.69	162.23	1331.25	162.08
1334.53	162.2	1341.08	162.04	1344.36	162.17	1347.64	162.41	1350.92	162.23
1354.2	162.21	1357.48	162.3	1367.32	162.24	1377.15	162.39	1390.27	162.88
1393.55	162.74	1396.83	162.71	1400.11	162.89	1403.38	162.72	1409.94	162.74
1416.5	162.43	1419.78	162.4	1426.34	162.63	1432.89	162.6	1436.17	162.46
1439.45	162.67	1442.73	162.75	1449.29	162.67	1455.85	162.85	1468.96	163.15
1472.24	163.1	1482.08	163.1	1488.64	163.31	1495.19	163.05	1498.47	163.03
1505.03	162.62	1511.59	162.79	1517.39	161.43	1520.6	160.14	1523.81	160.62
1527.02	161.93	1533.45	162.64	1536.66	162.83	1539.87	162.73	1549.5	161.94
1552.72	161.83	1588.66	161.83	1601.74	161.42	1605	161.17	1621.34	159.1
1624.61	158.62	1627.88	158.03	1644.22	154.77	1647.49	154.19	1650.76	153.79
1654	152.7	1714	152.7	1722.65	153.83	1725.92	156.36	1729.19	159.03
1732.46	159.99	1742.26	161.11	1745.53	160.85	1748.8	159.68	1752.06	159.62
1768.4	160.39	1779.05	160.8	1784.74	160.98	1794.55	161.2	1801.08	161.29
1807.62	161.32	1814.16	161.24	1827.23	160.94	1830.49	160.9	1840.29	161.27
1846.82	161.39	1853.35	161.41	1863.15	161.21	1869.68	160.89	1876.21	160.39
1879.47	160.27	1908.86	159.65	1921.92	159.4	1928.45	159.33	1938.25	159.32
1944.78	159.18	1954.58	158.88	1961.11	158.63	1967.64	158.6	1974.17	159.27
1987.23	159.04	1997.03	158.93	2006.82	158.95	2016.62	159.04	2029.68	159.1
2035.27	159.22	2054.94	159.09	2058.22	159.12	2068.06	159.33	2074.61	159.4
2081.17	159.57	2094.28	159.73	2110.67	160.01	2117.23	160.2	2127.07	160.37
2140.18	160.77	2150.02	161.21	2156.57	161.37	2172.96	161.92	2192.63	162.7
2195.91	162.8	2202.47	163.12	2209.03	163.36	2215.58	163.66	2222.14	163.9
2231.98	164.39	2238.53	164.65	2245.09	164.85	2254.92	165.27	2261.48	165.45
2271.32	165.84	2284.43	166.16	2290.99	166.21	2310.66	166.56	2323.77	166.62
2333.61	166.75	2340.16	166.72	2346.72	166.83	2359.83	166.82	2366.39	166.9
2376.23	166.92	2386.06	167.02	2395.9	167.07	2415.57	167.13	2418.85	167.12

2445.07	167.27	2451.63	167.2	2458.19	167.23	2474.58	167.13	2487.69	167.11
2497.53	167.16	2504.08	167.05	2510.64	167.14	2520.48	167.16	2523.75	167.11
2540.15	167.11	2546.7	167.06	2553.26	167.1	2559.82	167.05	2569.65	167.16
2576.21	167.15	2589.32	167.22	2595.88	167.2	2602.44	167.27	2615.55	167.21
2625.39	167.1	2661.45	167.2	2668	167.18	2674.56	167.23	2677.84	167.2
2704.07	167.24	2710.62	167.3	2723.74	167.32	2736.85	167.48	2743.41	167.47
2749.96	167.53	2766.36	167.5	2776.19	167.44	2782.75	167.55	2789.31	167.49
2799.14	167.6	2812.25	167.58	2828.65	167.68	2841.76	167.72	2848.32	167.71
2854.87	167.76	2864.71	167.75	2874.54	167.78	2894.22	167.9	2904.05	168.02
2913.89	168.07	2920.44	168.01	2933.56	167.99	2943.39	167.89	2949.95	167.87
2959.78	167.9	2966.34	167.97	2969.62	167.94	2979.45	168.03	2986.01	167.99
2999.12	168.11	3008.96	168.06	3022.07	168.17	3031.91	167.93	3048.3	167.89
3061.41	167.93	3067.97	168.02	3077.81	168.26	3084.36	168.31	3090.92	168.42
3097.48	168.41	3110.59	168.68	3117.15	168.76	3123.7	168.92	3133.54	169.09
3149.93	169.26	3156.49	169.26	3166.32	169.37	3176.16	169.55	3195.83	169.79
3205.66	169.97	3218.78	170.09	3225.33	170.2	3231.89	170.17	3238.45	170.3
3245.01	170.31	3254.84	170.45	3261.4	170.66	3267.95	170.66	3274.51	170.82
3281.07	171.09	3287.62	171.04	3294.18	170.72	3297.46	170.63	3313.85	171.05
3323.69	171.07	3336.8	171.23	3343.36	171.24	3353.19	171.32	3363.03	171.45
3369.58	171.47	3385.98	171.75	3392.53	171.78	3412.2	172.09	3418.76	172.22
3428.6	172.32	3444.99	172.74	3454.82	172.89	3461.38	172.95	3467.94	173.1
3474.49	173.34	3484.33	173.51	3494.16	173.76	3500.72	173.85	3513.84	174.19
3526.95	174.59	3533.51	174.69	3540.06	174.89	3549.9	175.13	3556.45	175.18
3566.29	175.48	3572.85	175.72	3585.96	175.96	3599.07	176.34	3605.63	176.63
3625.3	177.08	3631.86	177.18	3638.41	177.44	3644.97	177.81	3654.81	178.13
3661.36	178.38	3667.92	178.58	3674.48	178.88	3684.31	179.1	3690.87	179.42
3697.43	179.65	3703.98	179.78	3710.54	180.07	3717.1	180.2	3730.21	180.66
3740.05	180.95	3756.44	181.16	3762.99	181.36	3772.83	181.51	3776.11	181.6
3785.94	181.72	3792.5	181.94	3808.89	182.31	3822.01	182.47	3828.56	182.73

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.1	1627.88	.045	1729.19	.1

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
1627.88	1729.19	0	0	.1	.3

CROSS SECTION OUTPUT Profile #1%

E.G. Elev (ft)	174.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.100	0.045	0.100
W.S. Elev (ft)	174.47	Reach Len. (ft)			
Crit W.S. (ft)	164.09	Flow Area (sq ft)	13099.76	2104.20	14712.58
E.G. Slope (ft/ft)	0.000072	Area (sq ft)	13099.76	2104.20	14712.58
Q Total (cfs)	19965.00	Flow (cfs)	8014.20	4393.02	7557.78
Top Width (ft)	3122.88	Top Width (ft)	1227.74	101.31	1793.83
Vel Total (ft/s)	0.67	Avg. Vel. (ft/s)	0.61	2.09	0.51
Max Chl Dpth (ft)	21.77	Hydr. Depth (ft)	10.67	20.77	8.20
Conv. Total (cfs)	2348039.0	Conv. (cfs)	942531.6	516653.5	888854.0
Length Wtd. (ft)		Wetted Per. (ft)	1229.44	103.78	1794.61

* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.05	* 0.09	* 0.04	*
* Alpha	* 2.72	* Stream Power (lb/ft s)	* 0.03	* 0.19	* 0.02	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	*	*

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CROSS SECTION OUTPUT Profile #Floodway

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* E.G. Elev (ft)	* 175.23	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.02	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 175.21	* Reach Len. (ft)	*	*	*	*
* Crit W.S. (ft)	* 164.08	* Flow Area (sq ft)	*12165.82	* 2179.17	*13320.13	*
* E.G. Slope (ft/ft)	*0.000065	* Area (sq ft)	*12165.82	* 2179.17	*13320.13	*
* Q Total (cfs)	*19965.00	* Flow (cfs)	* 7803.99	* 4406.88	* 7754.13	*
* Top Width (ft)	* 2300.00	* Top Width (ft)	* 966.88	* 101.31	* 1231.81	*
* Vel Total (ft/s)	* 0.72	* Avg. Vel. (ft/s)	* 0.64	* 2.02	* 0.58	*
* Max Chl Dpth (ft)	* 22.51	* Hydr. Depth (ft)	* 12.58	* 21.51	* 10.81	*
* Conv. Total (cfs)	*2481291.0	* Conv. (cfs)	*969895.5	*547695.9	*963699.1	*
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 978.95	* 103.78	* 1239.80	*
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.05	* 0.08	* 0.04	*
* Alpha	* 2.29	* Stream Power (lb/ft s)	* 0.03	* 0.17	* 0.03	*
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	*	*

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CROSS SECTION OUTPUT Profile #10%

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* E.G. Elev (ft)	* 169.04	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.04	* Wt. n-Val.	* 0.100	* 0.045	* 0.100	*
* W.S. Elev (ft)	* 169.00	* Reach Len. (ft)	*	*	*	*
* Crit W.S. (ft)	* 161.22	* Flow Area (sq ft)	* 6577.77	* 1550.04	* 5807.59	*
* E.G. Slope (ft/ft)	*0.000153	* Area (sq ft)	* 6577.77	* 1550.04	* 5807.59	*
* Q Total (cfs)	*10495.00	* Flow (cfs)	* 3902.63	* 3837.78	* 2754.59	*
* Top Width (ft)	* 2632.32	* Top Width (ft)	* 1131.87	* 101.31	*	

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1399.14  *
* Vel Total (ft/s)       *    0.75  * Avg. Vel. (ft/s)       *    0.59  *    2.48  *
   0.47  *
* Max Chl Dpth (ft)      *   16.30  * Hydr. Depth (ft)       *    5.81  *   15.30  *
   4.15  *
* Conv. Total (cfs)      *848906.6  * Conv. (cfs)            *315671.3  *310425.2
*222810.1  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       * 1133.28  *  103.78  *
1399.85  *
* Min Ch El (ft)         *  152.70  * Shear (lb/sq ft)       *    0.06  *    0.14  *
   0.04  *
* Alpha                  *    4.29  * Stream Power (lb/ft s) *    0.03  *    0.35  *
   0.02  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
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CROSS SECTION OUTPUT  Profile #2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  172.87  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.02  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
* W.S. Elev (ft)         *  172.85  * Reach Len. (ft)        *          *          *
          *
* Crit W.S. (ft)         *  163.61  * Flow Area (sq ft)      *11122.16  * 1940.08
*11859.25  *
* E.G. Slope (ft/ft)     *0.000090  * Area (sq ft)           *11122.16  * 1940.08
*11859.25  *
* Q Total (cfs)          *17155.00  * Flow (cfs)             * 6843.31  * 4274.11  *
6037.58  *
* Top Width (ft)         * 3039.49  * Top Width (ft)         * 1215.17  *  101.31  *
1723.01  *
* Vel Total (ft/s)       *    0.69  * Avg. Vel. (ft/s)       *    0.62  *    2.20  *
   0.51  *
* Max Chl Dpth (ft)      *   20.15  * Hydr. Depth (ft)       *    9.15  *   19.15  *
   6.88  *
* Conv. Total (cfs)      *1811196.0  * Conv. (cfs)           *722505.1  *451252.8
*637438.0  *
* Length Wtd. (ft)       *          * Wetted Per. (ft)       * 1216.76  *  103.78  *
1723.77  *
* Min Ch El (ft)         *  152.70  * Shear (lb/sq ft)       *    0.05  *    0.10  *
   0.04  *
* Alpha                  *    3.06  * Stream Power (lb/ft s) *    0.03  *    0.23  *
   0.02  *
* Frctn Loss (ft)        *          * Cum Volume (acre-ft)   *          *          *
          *
* C & E Loss (ft)        *          * Cum SA (acres)         *          *          *
          *
*******************************************************************************
***********

CROSS SECTION OUTPUT  Profile #0.2%
*******************************************************************************
***********
* E.G. Elev (ft)         *  178.42  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.01  * Wt. n-Val.             *   0.100  *   0.045  *
  0.100  *
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* W.S. Elev (ft)	* 178.41	* Reach Len. (ft)	*	*	*
* Crit W.S. (ft)	* 164.95	* Flow Area (sq ft)	*18024.31	* 2503.36	*22080.14 *
* E.G. Slope (ft/ft)	*0.000049	* Area (sq ft)	*18024.31	* 2503.36	*22080.14 *
* Q Total (cfs)	*27500.00	* Flow (cfs)	*10988.85	* 4841.32	*11669.83 *
* Top Width (ft)	* 3306.87	* Top Width (ft)	* 1272.41	* 101.31	* 1933.15 *
* Vel Total (ft/s)	* 0.65	* Avg. Vel. (ft/s)	* 0.61	* 1.93	* 0.53 *
* Max Chl Dpth (ft)	* 25.71	* Hydr. Depth (ft)	* 14.17	* 24.71	* 11.42 *
* Conv. Total (cfs)	*3920088.0	* Conv. (cfs)	*1566446.0	*690123.3	*1663519.0 *
* Length Wtd. (ft)	*	* Wetted Per. (ft)	* 1274.29	* 103.78	* 1934.00 *
* Min Ch El (ft)	* 152.70	* Shear (lb/sq ft)	* 0.04	* 0.07	* 0.04 *
* Alpha	* 2.22	* Stream Power (lb/ft s)	* 0.03	* 0.14	* 0.02 *
* Frctn Loss (ft)	*	* Cum Volume (acre-ft)	*	*	*
* C & E Loss (ft)	*	* Cum SA (acres)	*	*	*

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CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 250.12

INPUT
Description: SIDE CHANNEL XS 250.12
Station Elevation Data num= 285

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	167.783.056567	167.756.113133	167.77 9.1697	167.7912.22627	167.82				
15.28283	167.83 18.3394	167.8321.39597	167.8324.45253	167.83 27.5091	167.83				
30.56567	167.8333.62223	167.83 36.6788	167.8339.73537	167.8342.79193	167.83				
45.8485	167.8348.90507	167.8351.96163	167.83 55.0182	167.8358.07477	167.83				
61.13133	167.83 64.1879	167.8367.24447	167.8370.30103	167.83 73.3576	167.83				
76.41417	167.8379.47073	167.83 82.5273	167.8385.58387	167.8388.64043	167.83				
91.697	167.8394.75356	167.8397.81013	167.83100.8667	167.83103.9233	167.83				
106.9798	167.83110.0364	167.83 113.093	167.83116.1495	167.83119.2061	167.82				
122.2627	167.73125.3192	167.62128.3758	167.51131.4324	167.38134.4889	167.24				
137.5455	167.1140.6021	166.95143.6586	166.82146.7152	166.66149.7718	166.49				
152.8283	166.32155.8849	166.12158.9415	165.91 161.998	165.63165.0546	165.32				
168.1112	165.01171.1677	164.83174.2243	164.83177.2809	164.98180.3374	165.23				
183.394	165.51186.4506	165.82189.5071	165.82192.5637	165.75195.6203	165.68				
198.6768	165.6201.7334	165.53 204.79	165.46207.8465	165.39210.9031	165.32				
213.9597	165.25217.0162	165.18220.0728	165.11223.1294	165.03226.1859	164.96				
229.2425	164.89232.2991	164.83235.3556	164.83238.4122	164.83241.4688	164.83				
244.5253	164.83247.5819	164.83250.6385	164.83 253.695	164.83256.7516	164.83				
259.8082	164.83262.8647	164.83265.9213	164.83268.9779	164.83272.0344	164.83				
275.091	164.83278.1476	164.83281.2041	164.83284.2607	164.83287.3173	164.83				
290.3738	164.83293.4304	164.83 296.487	164.84299.5435	164.91302.6001	164.98				
305.6567	165.05308.7132	165.13311.7698	165.2314.8264	165.28317.8829	165.35				
320.9395	165.42323.9961	165.5327.0526	165.57330.1092	165.65333.1658	165.72				
336.2223	165.8339.2789	166.24342.3355	166.83 345.392	166.93348.4486	167				

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351.5052  167.08354.5617  167.13357.6183  167.17360.6749  167.22363.7314  167.26
 366.788  167.31369.8446  167.36372.9011   167.4375.9577  167.45379.0143  167.49
382.0708  167.54385.1274  167.59 388.184  167.63391.2405  167.68394.2971  167.72
397.3537  167.77400.4102  167.81403.4668  167.83406.5234  167.85409.5799  167.98
412.6365  168.11415.6931  168.25418.7496  168.38421.8062  168.51424.8628  168.64
427.9193  168.78430.9759  169.02434.0325  169.45 437.089  169.91440.1456  170.61
443.2022  171.41446.2587   171.9449.3153  171.97452.3719  171.83455.4284  171.53
 458.485   171.2461.5416  170.84464.5981  170.83467.6547  170.83470.7113  170.83
473.7678  170.95476.8244  171.06 479.881  171.13482.9375   171.2485.9941  171.27
489.0507  171.27492.1072  171.15495.1638  171.02498.2204  170.83501.2769     171
504.3335  171.62507.3901  171.74510.4466  171.67513.5032  171.62516.5598  171.58
519.6163  171.57522.6729  171.47525.7295  171.33 528.786  171.19531.8426  171.04
534.8992  170.88537.9557   170.7541.0123  170.52544.0688  170.34547.1254  170.16
 550.182  169.98553.2386   169.8556.2951  169.53559.3517  169.26562.4083  168.97
 564.588  167.96 567.411  167.86 570.243  167.75 573.075  167.62 575.907  167.52
  578.73  167.47 581.562  167.42 584.394  167.36 587.226  167.24 590.049  167.11
 592.881  167.03 595.713  167.03 598.536  167.01 601.368  167.01   604.2  167.07
 607.032  167.13 609.855  167.19 612.687  167.31 615.519  167.43 618.342  167.49
 621.174   167.6 624.006  167.77 626.838  167.96 629.661  168.14 632.493  168.29
 635.325  168.42 638.148  168.57  640.98   168.7 643.812  168.81 646.644  168.96
 649.467  169.08 652.299  169.18 655.131  169.35 657.963  169.56 660.786  169.68
 663.618  169.79  666.45  169.92 669.273  170.06 672.105  170.22 674.937  170.35
 677.769  170.47 680.592   170.6 683.424  170.68 686.256  170.73 689.079  170.86
 691.911  171.04 694.743  171.22 697.575  171.34 700.398  171.46  703.23   171.6
 706.062  171.72 708.894  171.84 711.717  171.98 714.549  172.11 717.381  172.25
 720.204  172.42 723.036  172.59 725.868  172.75   728.7  172.93 731.523   173.1
 734.355  173.25 737.187  173.42  740.01   173.6 742.842  173.82 745.674  174.02
 748.506  174.28 751.329  174.52 754.161  174.74 756.993  174.96 759.825  175.13
 762.648  175.34  765.48  175.54 768.312  175.74 771.135  175.92 773.967  176.08
 776.799  176.26 779.631   176.4 782.454  176.49 785.286   176.6 788.118   176.7
 790.941  176.84 793.773  176.95 796.605  177.05 799.437  177.16  802.26  177.28
 805.092  177.41 807.924  177.57 810.756  177.75 813.579  177.95 816.411  178.15
 819.243   178.3 822.066   178.5 824.898  178.74  827.73  178.98 830.562   179.2
 833.385  179.44 836.217  179.79 839.049  180.35 841.872  180.76 844.704   181.1

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*****************************************
       0     .03189.5071    .025342.3355     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
      189.5071342.3355              515     515     515             .1       .3
Skew Angle = 30

CROSS SECTION OUTPUT  Profile #1%
*************************************************************************************
***********
* E.G. Elev (ft)         *  175.46  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.32  * Wt. n-Val.             *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  175.14  * Reach Len. (ft)        *  515.00  *  515.00  *
 515.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1496.22  * 1526.15  *
2230.42  *
* E.G. Slope (ft/ft)     *0.000413  * Area (sq ft)           * 1496.22  * 1526.15  *
2230.42  *
* Q Total (cfs)          *17300.00  * Flow (cfs)             * 5819.56  * 8544.99  *
2935.46  *
* Top Width (ft)         *  759.92  * Top Width (ft)         *  189.51  *  152.83  *
 417.58  *
* Vel Total (ft/s)       *    3.29  * Avg. Vel. (ft/s)       *    3.89  *    5.60  *
   1.32  *
```

* Max Chl Dpth (ft)	* 10.31	* Hydr. Depth (ft)	* 7.90	* 9.99	* 5.34	*
* Conv. Total (cfs)	*851217.6	* Conv. (cfs)	*286341.6	*420441.7	*144434.4	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 197.00	* 152.94	* 418.61	*
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.20	* 0.26	* 0.14	*
* Alpha	* 1.92	* Stream Power (lb/ft s)	* 0.76	* 1.44	* 0.18	*
* Frctn Loss (ft)	* 0.21	* Cum Volume (acre-ft)	* 369.55	* 151.66	* 614.28	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 13.65	* 6.28	* 25.26	*

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 176.20	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.65	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 175.55	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 211.39	* 1589.24	* 2251.68	*
* E.G. Slope (ft/ft)	*0.000710	* Area (sq ft)	* 211.39	* 1589.24	* 2251.68	*
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 1000.41	*11988.62	* 4310.97	*
* Top Width (ft)	* 530.00	* Top Width (ft)	* 20.51	* 152.83	* 356.66	*
* Vel Total (ft/s)	* 4.27	* Avg. Vel. (ft/s)	* 4.73	* 7.54	* 1.91	*
* Max Chl Dpth (ft)	* 10.72	* Hydr. Depth (ft)	* 10.31	* 10.40	* 6.31	*
* Conv. Total (cfs)	*649082.5	* Conv. (cfs)	* 37534.7	*449803.8	*161744.0	*
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 31.15	* 152.94	* 361.72	*
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.30	* 0.46	* 0.28	*
* Alpha	* 2.28	* Stream Power (lb/ft s)	* 1.42	* 3.48	* 0.53	*
* Frctn Loss (ft)	* 0.26	* Cum Volume (acre-ft)	* 307.61	* 159.81	* 586.44	*
* C & E Loss (ft)	* 0.11	* Cum SA (acres)	* 10.33	* 6.28	* 11.87	*

****

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 170.84	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.39	* Wt. n-Val.	* 0.030	* 0.025	* 0.070 *
* W.S. Elev (ft)	* 170.45	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 607.75	* 809.64	* 522.05 *
* E.G. Slope (ft/ft)	*0.001056	* Area (sq ft)	* 607.75	* 809.64	* 522.05 *
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 2106.67	* 4750.30	* 623.03 *
* Top Width (ft)	* 574.48	* Top Width (ft)	* 189.51	* 152.83	* 232.15 *
* Vel Total (ft/s)	* 3.86	* Avg. Vel. (ft/s)	* 3.47	* 5.87	* 1.19 *
* Max Chl Dpth (ft)	* 5.62	* Hydr. Depth (ft)	* 3.21	* 5.30	* 2.25 *
* Conv. Total (cfs)	*230167.8	* Conv. (cfs)	* 64824.6	*146172.0	* 19171.2 *
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 192.32	* 152.94	* 232.69 *
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.21	* 0.35	* 0.15 *
* Alpha	* 1.71	* Stream Power (lb/ft s)	* 0.72	* 2.05	* 0.18 *
* Frctn Loss (ft)	* 0.47	* Cum Volume (acre-ft)	* 162.74	* 89.02	* 239.73 *
* C & E Loss (ft)	* 0.03	* Cum SA (acres)	* 8.50	* 6.28	* 9.61 *

Warning: Divided flow computed for this cross-section.
Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 174.04	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.35	* Wt. n-Val.	* 0.030	* 0.025	* 0.070 *
* W.S. Elev (ft)	* 173.68	* Reach Len. (ft)	* 515.00	* 515.00	* 515.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1221.04	* 1304.23	* 1638.12 *
* E.G. Slope (ft/ft)	*0.000540	* Area (sq ft)	* 1221.04	* 1304.23	* 1638.12 *
* Q Total (cfs)	*14350.00	* Flow (cfs)	* 4764.24	* 7517.01	* 2068.75 *
* Top Width (ft)	* 741.10	* Top Width (ft)	* 189.51	* 152.83	* 398.77 *
* Vel Total (ft/s)	* 3.45	* Avg. Vel. (ft/s)	* 3.90	* 5.76	* 1.26 *
* Max Chl Dpth (ft)	* 8.85	* Hydr. Depth (ft)	* 6.44	* 8.53	* 4.11 *
* Conv. Total (cfs)	*617692.0	* Conv. (cfs)	*205075.5	*323567.8	* 89048.6 *
* Length Wtd. (ft)	* 515.00	* Wetted Per. (ft)	* 195.55	* 152.94	* 399.73 *
* Min Ch El (ft)	* 164.83	* Shear (lb/sq ft)	* 0.21	* 0.29	*

```
   0.14  *
* Alpha                 *    1.91  * Stream Power (lb/ft s) *    0.82  *    1.66  *
   0.17  *
* Frctn Loss (ft)       *    0.27  * Cum Volume (acre-ft)   *  301.35  *  132.69  *
 485.52  *
* C & E Loss (ft)       *    0.00  * Cum SA (acres)         *   11.24  *    6.28  *
  19.59  *
*******************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.

CROSS SECTION OUTPUT  Profile #0.2%
*******************************************************************************
***********
* E.G. Elev (ft)        *  179.03  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)         *    0.30  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)        *  178.73  * Reach Len. (ft)       *  515.00  *  515.00  *
 515.00  *
* Crit W.S. (ft)        *          * Flow Area (sq ft)     * 2177.22  * 2075.34  *
3849.17  *
* E.G. Slope (ft/ft)    *0.000266  * Area (sq ft)          * 2177.22  * 2075.34  *
3849.17  *
* Q Total (cfs)         *25400.00  * Flow (cfs)            * 8628.69  *11454.53  *
5316.77  *
* Top Width (ft)        *  824.79  * Top Width (ft)        *  189.51  *  152.83  *
 482.45  *
* Vel Total (ft/s)      *    3.14  * Avg. Vel. (ft/s)      *    3.96  *    5.52  *
   1.38  *
* Max Chl Dpth (ft)     *   13.90  * Hydr. Depth (ft)      *   11.49  *   13.58  *
   7.98  *
* Conv. Total (cfs)     *1556140.0  * Conv. (cfs)           *528639.9  *701765.9
*325733.9  *
* Length Wtd. (ft)      *  515.00  * Wetted Per. (ft)      *  200.60  *  152.94  *
 483.58  *
* Min Ch El (ft)        *  164.83  * Shear (lb/sq ft)      *    0.18  *    0.23  *
   0.13  *
* Alpha                 *    1.98  * Stream Power (lb/ft s) *    0.72  *    1.25  *
   0.18  *
* Frctn Loss (ft)       *    0.13  * Cum Volume (acre-ft)   *  555.42  *  198.32  *
 991.25  *
* C & E Loss (ft)       *    0.02  * Cum SA (acres)         *   16.93  *    6.28  *
  34.64  *
*******************************************************************************
***********

Warning: The cross-section end points had to be extended vertically for the computed
water surface.

CROSS SECTION


RIVER: RIVER-2
REACH: Reach-1           RS: 225

INPUT
Description: SIDE CHANNEL XS 225
Station Elevation Data    num=     132
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
```

```
       0  177.836.477963  177.8312.95593   177.819.43389  177.6725.91185  177.53
32.38982   177.438.86778  177.2645.34574  177.13 51.8237  176.9958.30167  176.86
64.77963  176.6271.25759  176.3477.73556  176.0684.21352   175.890.69148  175.64
97.16944  175.48103.6474  175.32110.1254  175.16116.6033     175123.0813  174.84
129.5593  174.65136.0372  174.46142.5152  174.27148.9931  174.08155.4711  173.89
161.9491  173.69 168.427  173.49 174.905  173.29 181.383  173.08187.8609  172.88
194.3389  172.67200.8168  172.47207.2948  172.26213.7728  172.05220.2507  171.84
226.7287  171.59233.2067  171.34239.6846  171.09246.1626  170.84252.6405  169.57
259.1185  168.23265.5965  166.89272.0744  165.54278.5524  164.83285.0304   164.9
291.5083  165.09297.9863  165.27304.4643  165.46310.9422  165.65317.4202  165.83
323.8982  165.83330.3761  165.83336.8541  165.83 343.332  165.83  349.81  165.83
 356.288  165.83362.7659  165.83369.2439  165.83375.7219  165.83382.1998  165.83
388.6778  165.83395.1557  165.83401.6337  165.83408.1117  165.83414.5896  165.83
421.0676  165.83427.5456  165.83434.0235  165.83440.5015  165.83446.9794  165.83
453.4574  165.83459.9354  165.83466.4133  165.48472.8913  165.05479.3693  164.76
485.8472  164.63492.3252   164.5498.8032  164.37505.2811  164.24511.7591  164.11
518.2371  163.99 524.715  163.86 531.193  163.83537.6709  163.83544.1489  163.92
550.6268  164.05557.1048  164.18563.5828  164.31570.0607  164.44576.5387  164.57
583.0167   164.7589.4946  164.85595.9726  165.38602.4506  165.86608.9285  166.05
615.4065  166.25621.8845  166.44628.3624  166.62634.8404  166.79641.3184  166.92
647.7963  167.03654.2742  167.16660.7522  167.28667.2302  167.41673.7081  167.54
680.1861  167.67686.6641  167.81 693.142  168.64  699.62  169.77 706.098   170.9
712.5759  171.39719.0539  171.85725.5319  172.18732.0098   172.5738.4878  172.83
744.9658  174.06751.4437  174.83757.9217  174.83764.3997  174.83770.8776  174.83
777.3555  174.83783.8335  174.83790.3115  174.83796.7894  174.83803.2674  174.83
809.7454  174.83816.2233  174.83822.7013  174.83  825.98  175.22  829.25  175.19
    1049   171.3 1399.25     181

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0     .03459.9354    .025602.4506     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      459.9354602.4506               460     460     460             .1       .3

CROSS SECTION OUTPUT  Profile #1%
*************************************************************************************
***********
* E.G. Elev (ft)         *  175.25  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.33  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  174.91  * Reach Len. (ft)       *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2147.85  * 1484.76  *
1501.72  *
* E.G. Slope (ft/ft)     *0.000413  * Area (sq ft)          * 2147.85  * 1484.76  *
1501.72  *
* Q Total (cfs)          *17300.00  * Flow (cfs)            * 7379.90  * 8549.92  *
1370.18  *
* Top Width (ft)         * 1037.90  * Top Width (ft)        *  339.83  *  142.52  *
 555.56  *
* Vel Total (ft/s)       *    3.37  * Avg. Vel. (ft/s)      *    3.44  *    5.76  *
   0.91  *
* Max Chl Dpth (ft)      *   11.08  * Hydr. Depth (ft)      *    6.32  *   10.42  *
   2.70  *
* Conv. Total (cfs)      *851420.6  * Conv. (cfs)           *363202.1  *420785.0  *
67433.5  *
* Length Wtd. (ft)       *  460.00  * Wetted Per. (ft)      *  340.48  *  142.60  *
 556.14  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)      *    0.16  *    0.27  *
   0.07  *
```

* Alpha	* 1.89	* Stream Power (lb/ft s)	* 0.56	* 1.55	* 0.06	*
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 348.01	* 133.86	* 592.22	*
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 10.52	* 4.53	* 19.51	*

****

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #Floodway

* E.G. Elev (ft)	* 175.83	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.29	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 175.54	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2207.06	* 1574.05	* 878.06	*
* E.G. Slope (ft/ft)	*0.000305	* Area (sq ft)	* 2207.06	* 1574.05	* 878.06	*
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 7933.71	* 8103.30	* 1262.99	*
* Top Width (ft)	* 510.00	* Top Width (ft)	* 256.94	* 142.52	* 110.55	*
* Vel Total (ft/s)	* 3.71	* Avg. Vel. (ft/s)	* 3.59	* 5.15	* 1.44	*
* Max Chl Dpth (ft)	* 11.71	* Hydr. Depth (ft)	* 8.59	* 11.04	* 7.94	*
* Conv. Total (cfs)	*990178.8	* Conv. (cfs)	*454091.8	*463798.5	* 72288.4	*
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 260.69	* 142.60	* 114.96	*
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.16	* 0.21	* 0.15	*
* Alpha	* 1.34	* Stream Power (lb/ft s)	* 0.58	* 1.08	* 0.21	*
* Frctn Loss (ft)	* 0.14	* Cum Volume (acre-ft)	* 293.31	* 141.11	* 567.94	*
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 8.69	* 4.53	* 9.11	*

****

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 170.35	* Element	* Left OB	* Channel	* Right OB	*
* Vel Head (ft)	* 0.31	* Wt. n-Val.	* 0.030	* 0.025	* 0.070	*
* W.S. Elev (ft)	* 170.04	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 864.42	* 789.75	* 279.57	*
* E.G. Slope (ft/ft)	*0.000775	* Area (sq ft)	* 864.42	* 789.75	* 279.57	*
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 3059.49	* 4090.22	* 330.29	*
* Top Width (ft)	* 450.89	* Top Width (ft)	* 209.68	* 142.52	*	

```
  98.70  *
* Vel Total (ft/s)       *    3.87  * Avg. Vel. (ft/s)       *    3.54  *    5.18  *
   1.18  *
* Max Chl Dpth (ft)      *    6.21  * Hydr. Depth (ft)       *    4.12  *    5.54  *
   2.83  *
* Conv. Total (cfs)      *268700.0  * Conv. (cfs)            *109904.2  *146930.9  *
11864.9  *
* Length Wtd. (ft)       *  460.00  * Wetted Per. (ft)       *  210.19  *  142.60  *
  98.90  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)       *    0.20  *    0.27  *
   0.14  *
* Alpha                  *    1.33  * Stream Power (lb/ft s) *    0.70  *    1.39  *
   0.16  *
* Frctn Loss (ft)        *    0.31  * Cum Volume (acre-ft)   *  154.04  *   79.56  *
 234.99  *
* C & E Loss (ft)        *    0.02  * Cum SA (acres)         *    6.14  *    4.53  *
   7.65  *
********************************************************************************
**********

CROSS SECTION OUTPUT  Profile #2%
********************************************************************************
**********
* E.G. Elev (ft)         *  173.77  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.35  * Wt. n-Val.             *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  173.42  * Reach Len. (ft)        *  460.00  *  460.00  *
 460.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1679.04  * 1272.01  *
 884.72  *
* E.G. Slope (ft/ft)     *0.000504  * Area (sq ft)           * 1679.04  * 1272.01  *
 884.72  *
* Q Total (cfs)          *14350.00  * Flow (cfs)             * 6022.11  * 7301.10  *
1026.79  *
* Top Width (ft)         *  767.30  * Top Width (ft)         *  289.26  *  142.52  *
 335.52  *
* Vel Total (ft/s)       *    3.74  * Avg. Vel. (ft/s)       *    3.59  *    5.74  *
   1.16  *
* Max Chl Dpth (ft)      *    9.59  * Hydr. Depth (ft)       *    5.80  *    8.93  *
   2.64  *
* Conv. Total (cfs)      *639122.4  * Conv. (cfs)            *268213.6  *325177.5  *
45731.4  *
* Length Wtd. (ft)       *  460.00  * Wetted Per. (ft)       *  289.90  *  142.60  *
 335.96  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)       *    0.18  *    0.28  *
   0.08  *
* Alpha                  *    1.59  * Stream Power (lb/ft s) *    0.65  *    1.61  *
   0.10  *
* Frctn Loss (ft)        *    0.21  * Cum Volume (acre-ft)   *  284.20  *  117.47  *
 470.61  *
* C & E Loss (ft)        *    0.01  * Cum SA (acres)         *    8.41  *    4.53  *
  15.25  *
********************************************************************************
**********

Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
**********
* E.G. Elev (ft)         *  178.89  * Element                *  Left OB *  Channel *
Right OB *
```

* Vel Head (ft)	* 0.24	* Wt. n-Val.	* 0.030	* 0.025	* 0.070 *
* W.S. Elev (ft)	* 178.65	* Reach Len. (ft)	* 460.00	* 460.00	* 460.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 3664.79	* 2016.79	* 3903.96 *
* E.G. Slope (ft/ft)	*0.000228	* Area (sq ft)	* 3664.79	* 2016.79	* 3903.96 *
* Q Total (cfs)	*25400.00	* Flow (cfs)	*10916.87	*10591.61	* 3891.52 *
* Top Width (ft)	* 1314.27	* Top Width (ft)	* 459.94	* 142.52	* 711.82 *
* Vel Total (ft/s)	* 2.65	* Avg. Vel. (ft/s)	* 2.98	* 5.25	* 1.00 *
* Max Chl Dpth (ft)	* 14.82	* Hydr. Depth (ft)	* 7.97	* 14.15	* 5.48 *
* Conv. Total (cfs)	*1681153.0	* Conv. (cfs)	*722556.5	*701028.6	*257568.4 *
* Length Wtd. (ft)	* 460.00	* Wetted Per. (ft)	* 461.45	* 142.60	* 712.48 *
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.11	* 0.20	* 0.08 *
* Alpha	* 2.20	* Stream Power (lb/ft s)	* 0.34	* 1.06	* 0.08 *
* Frctn Loss (ft)	* 0.10	* Cum Volume (acre-ft)	* 520.88	* 174.13	* 945.42 *
* C & E Loss (ft)	* 0.00	* Cum SA (acres)	* 13.09	* 4.53	* 27.58 *

****

Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 200

INPUT
Description: SIDE CHANNEL XS 200
Station Elevation Data num= 388

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	177.833.569947	177.837.139893	177.8310.70984	177.8314.27979	177.83
17.84973	177.8321.41968	177.8324.98963	177.8328.55957	177.8332.12952	177.83
35.69947	177.8339.26941	177.8342.83936	177.7646.40931	177.6649.97925	177.55
53.5492	177.4457.11914	177.3360.68909	177.2264.25904	177.1267.82899	177.01
71.39893	176.974.96888	176.7878.53883	176.6582.10877	176.5185.67872	176.37
89.24866	176.2492.81861	176.196.38856	175.96 99.9585	175.82103.5285	175.71
107.0984	175.6110.6683	175.49114.2383	175.38117.8082	175.27121.3782	175.16
124.9481	175.05128.5181	174.94 132.088	174.83 135.658	174.71139.2279	174.6
142.7979	174.49146.3678	174.37149.9378	174.26153.5077	174.15157.0777	174.03
160.6476	173.92164.2175	173.81167.7875	173.72171.3574	173.63174.9274	173.54
178.4973	173.45182.0673	173.36185.6372	173.27189.2072	173.18192.7771	173.09
196.3471	172.99 199.917	172.9 203.487	172.81207.0569	172.68210.6268	172.56
214.1968	172.43217.7667	172.3221.3367	172.18224.9066	172.05228.4766	171.93
232.0465	171.8235.6165	171.64239.1864	171.49242.7564	171.33246.3263	171.18
249.8963	171.02253.4662	170.87257.0362	170.54260.6061	170.17264.1761	169.74
267.746	168.81271.3159	167.87274.8859	166.94278.4558	166.01282.0258	165.09
285.5957	164.17289.1657	163.83292.7356	163.83296.3056	163.9299.8755	163.99
303.4455	164.08307.0154	164.18310.5854	164.27314.1553	164.35317.7253	164.41

321.2952	164.48324.8651	164.56328.4351	164.72 332.005	164.83 335.575	164.83
339.1449	164.83342.7149	164.83346.2848	164.85349.8548	164.87353.4247	164.89
356.9947	164.91360.5646	164.93364.1346	164.95367.7045	164.97371.2744	165
374.8444	165.01378.4143	165381.9843	164.99385.5542	164.98389.1242	164.97
392.6941	164.96396.2641	164.95 399.834	164.94 403.404	164.93406.9739	164.92
410.5439	164.91414.1138	164.9417.6837	164.89421.2537	164.88424.8236	164.87
428.3936	164.86431.9635	164.85435.5335	164.83439.1034	164.83442.6734	164.83
446.2433	164.83449.8133	164.83453.3832	164.83456.9532	164.83460.5231	164.83
464.093	164.83 467.663	164.83471.2329	164.83474.8029	164.83478.3728	164.76
481.9428	164.65485.5127	164.54489.0827	164.43492.6526	164.32496.2226	164.21
499.7925	164.09503.3625	163.98506.9324	163.87510.5023	163.83514.0723	163.83
517.6423	163.83521.2122	163.83524.7822	163.83528.3521	163.83531.9221	163.83
535.492	163.83 539.062	163.83542.6319	163.83546.2018	163.83549.7718	163.83
553.3417	163.83556.9117	163.83560.4816	163.83564.0516	163.83567.6215	163.83
571.1915	163.83574.7614	163.83578.3314	163.83581.9013	163.92585.4713	164.03
589.0412	164.14592.6111	164.25596.1811	164.36 599.751	164.47 603.321	164.58
606.8909	164.69610.4609	164.79614.0308	165.36617.6008	165.87621.1707	165.97
624.7407	166.08628.3106	166.18631.8806	166.29635.4505	166.39639.0204	166.46
642.5904	166.53646.1603	166.6649.7303	166.66653.3002	166.73656.8702	166.8
660.4401	166.83664.0101	166.83 667.58	166.83 671.15	166.83674.7199	166.83
678.2899	166.83681.8598	166.83685.4297	166.83688.9997	166.83692.5696	166.83
696.1396	166.89699.7095	166.98703.2795	167.06706.8494	167.15710.4194	167.24
713.9893	167.32717.5593	167.41721.1292	167.5724.6992	167.59728.2691	167.68
731.8391	167.77 735.409	167.9738.9789	168.1742.5489	168.3746.1188	168.49
749.6888	168.68753.2587	168.95756.8287	169.49760.3986	170.01763.9686	170.46
767.5385	170.88771.1085	171.17774.6784	171.48778.2484	171.79781.8183	171.83
785.3882	171.83788.9582	171.83792.5281	171.83796.0981	171.88 799.668	171.94
803.238	171.99806.8079	172.04810.3779	172.1813.9478	172.15817.5178	172.21
821.0877	172.27824.6577	172.33828.2276	172.39831.7975	172.44835.3675	172.5
838.9374	172.55842.5074	172.61846.0773	172.67849.6473	172.72 850.67	172.13
853.94	172.07 857.21	172.06 860.49	172.1 863.76	172.14 867.03	172.14
870.31	172.15 873.58	172.22 876.86	172.36 880.13	172.45 883.4	172.53
886.68	172.55 889.95	172.58 893.22	172.65 896.5	172.69 899.77	172.73
903.04	172.74 906.32	172.83 909.59	172.88 912.87	172.86 916.14	172.89
919.41	172.93 922.69	172.97 925.96	173.05 929.23	173.15 932.51	173.19
935.78	173.18 939.05	173.21 942.33	173.28 945.6	173.32 948.88	173.33
952.15	173.37 955.42	173.4 958.7	173.45 961.97	173.52 965.24	173.54
968.52	173.57 971.79	173.62 975.06	173.63 978.34	173.62 981.61	173.67
984.89	173.79 988.16	173.84 991.43	173.82 994.71	173.82 997.98	173.91
1001.25	174 1004.53	174.08 1007.8	174.08 1011.07	174.1 1014.35	174.13
1017.62	174.12 1020.9	174.23 1024.17	174.32 1027.44	174.39 1030.72	174.46
1033.99	174.51 1037.26	174.56 1040.54	174.66 1043.81	174.74 1047.08	174.84
1050.36	174.97 1053.63	175.07 1056.91	175.14 1060.18	175.23 1063.45	175.29
1066.73	175.29 1070	175.28 1073.27	175.35 1076.55	175.47 1079.82	175.56
1083.09	175.61 1086.37	175.61 1089.64	175.6 1092.92	175.65 1096.19	175.69
1099.46	175.68 1102.74	175.72 1106.01	175.71 1109.28	175.69 1112.56	175.74
1115.83	175.77 1119.1	175.78 1122.38	175.84 1125.65	175.85 1128.93	175.87
1132.2	175.94 1135.47	175.95 1138.75	176.04 1142.02	176.08 1145.29	176.12
1148.57	176.17 1151.84	176.21 1155.11	176.27 1158.39	176.29 1161.66	176.33
1164.94	176.35 1168.21	176.35 1171.48	176.35 1174.76	176.35 1178.03	176.39
1181.3	176.44 1184.58	176.48 1187.85	176.52 1191.12	176.57 1194.4	176.61
1197.67	176.66 1200.95	176.72 1204.22	176.74 1207.49	176.77 1210.77	176.8
1214.04	176.84 1217.31	176.88 1220.59	176.91 1223.86	176.96 1227.13	177.01
1230.41	177.03 1233.68	177.04 1236.96	177.05 1240.23	177.09 1243.5	177.13
1246.78	177.13 1250.05	177.14 1253.32	177.17 1256.6	177.18 1259.87	177.21
1263.14	177.21 1266.42	177.27 1269.69	177.32 1272.97	177.34 1276.24	177.39
1279.51	177.45 1282.79	177.51 1286.06	177.58 1289.33	177.64 1292.61	177.68
1295.88	177.75 1299.15	177.86 1302.43	177.96 1305.7	178.05 1308.98	178.14
1312.25	178.24 1315.52	178.38 1318.8	178.5 1322.07	178.62 1325.34	178.75
1328.62	178.85 1331.89	178.91 1335.16	178.94		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

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**********************************************
       0     .03478.3728    .025617.6008     .07

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
      478.3728617.6008               800     800     890             .1       .3

CROSS SECTION OUTPUT  Profile #1%
********************************************************************************
**********
* E.G. Elev (ft)         *  175.06  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.28  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  174.78  * Reach Len. (ft)       *  800.00  *  800.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2368.65  * 1484.13  *
1624.43  *
* E.G. Slope (ft/ft)     *0.000343  * Area (sq ft)          * 2368.65  * 1484.13  *
1624.43  *
* Q Total (cfs)          *17300.00  * Flow (cfs)            * 7838.60  * 7907.45  *
1553.96  *
* Top Width (ft)         *  911.39  * Top Width (ft)        *  344.72  *  139.23  *
 427.44  *
* Vel Total (ft/s)       *    3.16  * Avg. Vel. (ft/s)      *    3.31  *    5.33  *
   0.96  *
* Max Chl Dpth (ft)      *   10.95  * Hydr. Depth (ft)      *    6.87  *   10.66  *
   3.80  *
* Conv. Total (cfs)      *934269.6  * Conv. (cfs)           *423315.7  *427033.8  *
83920.1  *
* Length Wtd. (ft)       *  810.91  * Wetted Per. (ft)      *  345.59  *  139.34  *
 427.86  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)      *    0.15  *    0.23  *
   0.08  *
* Alpha                  *    1.81  * Stream Power (lb/ft s) *    0.49  *    1.21  *
   0.08  *
* Frctn Loss (ft)        *    0.22  * Cum Volume (acre-ft)  *  324.16  *  118.18  *
 575.71  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)        *    6.90  *    3.05  *
  14.32  *
********************************************************************************
**********

CROSS SECTION OUTPUT  Profile #Floodway
********************************************************************************
**********
* E.G. Elev (ft)         *  175.69  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.28  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  175.41  * Reach Len. (ft)       *  800.00  *  800.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)     * 2490.37  * 1571.73  *
 381.21  *
* E.G. Slope (ft/ft)     *0.000286  * Area (sq ft)          * 2490.37  * 1571.73  *
 381.21  *
* Q Total (cfs)          *17300.00  * Flow (cfs)            * 8823.89  * 7952.47  *
 523.64  *
* Top Width (ft)         *  465.00  * Top Width (ft)        *  283.37  *  139.23  *
  42.40  *
* Vel Total (ft/s)       *    3.89  * Avg. Vel. (ft/s)      *    3.54  *    5.06  *
   1.37  *
* Max Chl Dpth (ft)      *   11.58  * Hydr. Depth (ft)      *    8.79  *   11.29  *
   8.99  *
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* Conv. Total (cfs)	*1022158.0	* Conv. (cfs)	*521353.5	*469865.9	* 30939.1 *
* Length Wtd. (ft)	* 808.90	* Wetted Per. (ft)	* 286.60	* 139.34	* 50.99 *
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.16	* 0.20	* 0.13 *
* Alpha	* 1.20	* Stream Power (lb/ft s)	* 0.55	* 1.02	* 0.18 *
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 268.51	* 124.50	* 561.29 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	* 5.84	* 3.05	* 8.30 *

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Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
1.4. This may indicate the need for additional cross sections.

CROSS SECTION OUTPUT Profile #10%

* E.G. Elev (ft)	* 170.01	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.24	* Wt. n-Val.	* 0.030	* 0.025	* 0.070 *
* W.S. Elev (ft)	* 169.77	* Reach Len. (ft)	* 800.00	* 800.00	* 890.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1031.65	* 786.90	* 369.18 *
* E.G. Slope (ft/ft)	*0.000588	* Area (sq ft)	* 1031.65	* 786.90	* 369.18 *
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 3522.89	* 3596.58	* 360.54 *
* Top Width (ft)	* 494.82	* Top Width (ft)	* 214.44	* 139.23	* 141.15 *
* Vel Total (ft/s)	* 3.42	* Avg. Vel. (ft/s)	* 3.41	* 4.57	* 0.98 *
* Max Chl Dpth (ft)	* 5.94	* Hydr. Depth (ft)	* 4.81	* 5.65	* 2.62 *
* Conv. Total (cfs)	*308475.3	* Conv. (cfs)	*145283.9	*148322.9	* 14868.6 *
* Length Wtd. (ft)	* 803.86	* Wetted Per. (ft)	* 215.19	* 139.34	* 141.27 *
* Min Ch El (ft)	* 163.83	* Shear (lb/sq ft)	* 0.18	* 0.21	* 0.10 *
* Alpha	* 1.33	* Stream Power (lb/ft s)	* 0.60	* 0.95	* 0.09 *
* Frctn Loss (ft)	* 0.39	* Cum Volume (acre-ft)	* 144.03	* 71.24	* 231.57 *
* C & E Loss (ft)	* 0.02	* Cum SA (acres)	* 3.91	* 3.05	* 6.39 *

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CROSS SECTION OUTPUT Profile #2%

* E.G. Elev (ft)	* 173.54	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.30	* Wt. n-Val.	* 0.030	* 0.025	* 0.070 *
* W.S. Elev (ft)	* 173.24	* Reach Len. (ft)	* 800.00	* 800.00	*

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 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 1877.80  * 1270.34  *
1036.66  *
* E.G. Slope (ft/ft)     *0.000422  * Area (sq ft)           * 1877.80  * 1270.34  *
1036.66  *
* Q Total (cfs)          *14350.00  * Flow (cfs)             * 6599.19  * 6768.09  *
 982.72  *
* Top Width (ft)         *  753.80  * Top Width (ft)         *  291.62  *  139.23  *
 322.95  *
* Vel Total (ft/s)       *    3.43  * Avg. Vel. (ft/s)       *    3.51  *    5.33  *
   0.95  *
* Max Chl Dpth (ft)      *    9.41  * Hydr. Depth (ft)       *    6.44  *    9.12  *
   3.21  *
* Conv. Total (cfs)      *698650.8  * Conv. (cfs)            *321291.4  *329514.4  *
47845.0  *
* Length Wtd. (ft)       *  808.47  * Wetted Per. (ft)       *  292.47  *  139.34  *
 323.35  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)       *    0.17  *    0.24  *
   0.08  *
* Alpha                  *    1.63  * Stream Power (lb/ft s) *    0.59  *    1.28  *
   0.08  *
* Frctn Loss (ft)        *    0.26  * Cum Volume (acre-ft)   *  265.42  *  104.04  *
 460.47  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *    5.34  *    3.05  *
  11.77  *
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CROSS SECTION OUTPUT  Profile #0.2%
********************************************************************************
**********
* E.G. Elev (ft)         *  178.78  * Element               *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.23  * Wt. n-Val.            *   0.030  *   0.025  *
  0.070  *
* W.S. Elev (ft)         *  178.55  * Reach Len. (ft)       *  800.00  *  800.00  *
 890.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 3908.00  * 2009.79  *
3798.31  *
* E.G. Slope (ft/ft)     *0.000213  * Area (sq ft)           * 3908.00  * 2009.79  *
3798.31  *
* Q Total (cfs)          *25400.00  * Flow (cfs)             *11439.06  *10336.06  *
3624.88  *
* Top Width (ft)         * 1320.25  * Top Width (ft)         *  478.37  *  139.23  *
 702.65  *
* Vel Total (ft/s)       *    2.61  * Avg. Vel. (ft/s)       *    2.93  *    5.14  *
   0.95  *
* Max Chl Dpth (ft)      *   14.72  * Hydr. Depth (ft)       *    8.17  *   14.44  *
   5.41  *
* Conv. Total (cfs)      *1739423.0  * Conv. (cfs)            *783360.3  *707826.0
*248236.3  *
* Length Wtd. (ft)       *  815.34  * Wetted Per. (ft)       *  480.02  *  139.34  *
 703.11  *
* Min Ch El (ft)         *  163.83  * Shear (lb/sq ft)       *    0.11  *    0.19  *
   0.07  *
* Alpha                  *    2.16  * Stream Power (lb/ft s) *    0.32  *    0.99  *
   0.07  *
* Frctn Loss (ft)        *    0.13  * Cum Volume (acre-ft)   *  480.90  *  152.86  *
 904.75  *
* C & E Loss (ft)        *    0.03  * Cum SA (acres)         *    8.13  *    3.05  *
  20.12  *
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Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION

RIVER: RIVER-2
REACH: Reach-1 RS: 190

INPUT
Description: SIDE CHANNEL XS 190 (LETTERED CROSS SECTION T)THE CHANNEL ROUGHNESS IS ESSENTIALLY THE SAME AS OB SINCE IT IS NOT NATURAL
Station Elevation Data num= 487

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	174.574.474503	174.568.949005	174.5713.42351	174.5617.89801	174.57				
22.37251	174.5326.84702	174.5131.32152	174.5335.79602	174.5340.27052	174.52				
44.74503	174.4849.21953	174.453.69403	174.2958.16853	174.271.59204	173.96				
80.54105	173.7885.01555	173.793.96455	173.5298.43906	173.44125.2861	172.9				
129.7606	172.79134.2351	172.6138.7096	172.39143.1841	172.19147.6586	171.98				
152.1331	171.78161.0821	171.34170.0311	170.88178.9801	170.38183.4546	170.14				
205.8271	168.89210.3016	168.6214.7761	168.29219.2506	167.99223.7251	167.47				
228.1996	166.78232.6741	165.97237.1486	164.82241.6231	163.43246.0976	161.83				
250.5721	161.91255.0466	163.3259.5211	163.9263.9957	164.12272.9447	164.58				
277.4192	164.8281.8937	164.83299.7917	164.83304.2662	164.81308.7407	164.74				
313.2152	164.63317.6897	164.52322.1642	164.42326.6387	164.31331.1132	164.2				
335.5877	164.09340.0622	163.98344.5367	163.87349.0112	163.83353.4857	163.83				
357.9602	163.83362.4347	163.83366.9092	163.83371.3837	163.83375.8582	163.83				
380.3327	163.83384.8072	163.83389.2817	163.83393.7562	163.83398.2307	163.83				
402.7052	163.83407.1797	163.83411.6542	163.78416.1288	163.7420.6032	163.62				
425.0778	163.55429.5522	163.47434.0268	163.39438.5013	163.31442.9758	163.24				
447.4503	163.16451.9248	163.09456.3993	163.01460.8738	162.94465.3483	162.86				
469.8228	162.83474.2973	162.83478.7718	162.83483.2463	162.83487.7208	162.83				
492.1953	162.83496.6698	162.83501.1443	162.83505.6188	162.83510.0933	162.83				
514.5678	162.83519.0423	162.83523.5168	162.83527.9913	162.83532.4658	162.83				
536.9403	162.83541.4148	162.93545.8893	163.07550.3638	163.2554.8383	163.34				
559.3128	163.47563.7874	163.61568.2618	163.74572.7363	163.88577.2108	164.04				
581.6854	164.2586.1599	164.34590.6343	164.46595.1088	164.6599.5834	164.73				
604.0579	164.85608.5323	164.91613.0068	164.98617.4814	165.05621.9559	165.11				
626.4304	165.18630.9048	165.24635.3794	165.31639.8539	165.38644.3284	165.44				
648.8029	165.5653.2774	165.57657.7519	165.63662.2264	165.7666.7009	165.77				
671.1754	165.91675.6499	167.06680.1244	167.87684.5989	168.72689.0734	169.59				
693.5479	169.83702.4969	167.83769.6144	167.83774.0889	167.84778.5635	167.88				
783.038	167.98787.5125	168.12791.9869	168.34796.4615	168.55 800.936	168.77				
804.2	168.43	809.2	168.57	814.19	168.54	819.19	168.6	832.79	168.71
842.62	168.75	845.9	168.7	849.18	168.68	855.74	168.68	859.02	168.72
865.58	168.87	878.69	168.96	881.97	169.03	888.53	169.03	891.8	169.06
895.08	169.08	901.64	169.15	904.92	169.16	911.48	169.12	914.76	169.14
918.03	169.18	921.31	169.11	924.59	169.13	931.15	169.21	937.71	169.24
940.98	169.19	947.54	169.13	950.82	169.07	954.1	169.1	960.66	169.12
963.94	169.14	967.21	169.06	970.49	169.08	973.77	169.14	977.05	169.13
983.61	169.13	986.89	169.1	990.17	169.1	996.72	169.15	1006.56	169.26
1009.84	169.34	1013.12	169.36	1016.39	169.41	1022.95	169.45	1026.23	169.43
1029.51	169.37	1032.79	169.33	1036.07	169.32	1039.35	169.28	1042.62	169.23
1045.9	169.22	1049.18	169.26	1055.74	169.29	1059.02	169.33	1062.3	169.33
1065.58	169.35	1068.85	169.4	1072.13	169.39	1078.69	169.34	1081.97	169.34
1085.25	169.36	1088.53	169.42	1091.81	169.39	1095.08	169.38	1098.36	169.41
1101.64	169.46	1104.92	169.55	1108.2	169.6	1114.76	169.68	1118.03	169.67
1121.31	169.67	1124.59	169.61	1127.87	169.59	1134.43	169.46	1137.71	169.44
1140.99	169.49	1144.26	169.6	1147.54	169.68	1154.1	169.76	1157.38	169.79
1160.66	169.79	1163.94	169.85	1167.22	169.85	1177.05	169.88	1180.33	169.88
1193.45	169.92	1200	169.93	1203.28	169.97	1206.56	170.03	1209.84	170.03

1213.12	170.01	1216.4	169.97	1226.23	170	1229.51	170.04	1236.07	170.1
1242.63	170.13	1249.18	170.19	1252.46	170.27	1255.74	170.3	1259.02	170.36
1262.3	170.43	1268.86	170.54	1272.13	170.6	1275.41	170.7	1278.69	170.77
1281.97	170.79	1285.25	170.83	1288.53	170.78	1291.81	170.8	1295.09	170.91
1298.36	171.04	1301.64	171.06	1308.2	171.14	1314.76	171.25	1318.04	171.29
1321.32	171.35	1324.59	171.38	1327.87	171.39	1331.15	171.49	1334.43	171.57
1337.71	171.62	1344.27	171.69	1350.82	171.79	1357.38	171.85	1363.94	172.06
1367.22	172.08	1370.5	172.05	1373.78	172.06	1377.05	172.13	1383.61	172.35
1386.89	172.44	1390.17	172.48	1393.45	172.45	1396.73	172.5	1400.01	172.58
1403.28	172.64	1406.56	172.67	1409.84	172.76	1413.12	172.87	1419.68	173
1422.96	173.03	1426.23	173.02	1429.51	173.07	1432.79	173.15	1436.07	173.21
1439.35	173.38	1442.63	173.52	1445.91	173.54	1449.19	173.58	1455.74	173.77
1459.02	173.81	1462.3	173.81	1465.58	173.82	1468.86	173.85	1475.42	173.97
1478.69	173.99	1481.97	173.98	1485.25	174.03	1491.81	174.08	1498.37	174.1
1504.92	174.19	1511.48	174.2	1514.76	174.21	1518.04	174.2	1524.6	174.22
1527.88	174.25	1531.15	174.24	1534.43	174.25	1537.71	174.28	1540.99	174.28
1544.27	174.26	1547.55	174.26	1550.83	174.3	1557.38	174.4	1563.94	174.37
1567.22	174.43	1570.5	174.51	1573.78	174.64	1577.06	174.74	1580.33	174.78
1583.61	174.79	1590.17	174.79	1593.45	174.83	1596.73	174.92	1600.01	174.96
1603.29	174.95	1609.84	174.89	1613.12	174.9	1616.4	174.9	1619.68	174.92
1622.96	174.97	1626.24	175.04	1629.52	175.08	1632.79	175.08	1636.07	175.14
1639.35	175.3	1642.63	175.42	1645.91	175.46	1649.19	175.48	1652.47	175.53
1659.02	175.75	1665.58	175.91	1668.86	175.96	1672.14	175.96	1675.42	175.95
1678.7	175.95	1681.98	175.98	1685.25	176.03	1688.53	176.06	1691.81	176.07
1695.09	176.1	1698.37	176.16	1704.93	176.14	1708.2	176.18	1714.76	176.28
1718.04	176.29	1721.32	176.32	1724.6	176.41	1727.88	176.46	1731.16	176.53
1734.43	176.64	1737.71	176.74	1740.99	176.78	1744.27	176.87	1747.55	176.97
1750.83	177	1754.11	177.01	1757.39	177.08	1760.66	177.11	1763.94	177.1
1767.22	177.13	1770.5	177.12	1773.78	177.2	1777.06	177.26	1780.34	177.27
1783.62	177.32	1790.17	177.39	1793.45	177.45	1796.73	177.49	1800.01	177.52
1806.57	177.64	1809.84	177.72	1813.12	177.78	1816.4	177.8	1819.68	177.81
1822.96	177.85	1832.8	177.93	1836.07	177.98	1839.35	178.05	1842.63	178.15
1845.91	178.21	1849.19	178.25	1852.47	178.24	1855.75	178.26	1859.03	178.31
1862.3	178.38	1868.86	178.58	1872.14	178.69	1875.42	178.82	1878.7	178.93
1881.98	179.1	1885.26	179.23	1888.53	179.26	1891.81	179.25	1895.09	179.34
1898.37	179.39	1904.93	179.43	1908.21	179.48	1911.49	179.55	1914.76	179.63
1918.04	179.7	1924.6	179.76	1927.88	179.85	1931.16	179.93	1937.72	180.06
1944.27	180.09	1947.55	180.16	1950.83	180.25	1954.11	180.31	1957.39	180.38
1960.67	180.48	1963.95	180.61	1967.22	180.75	1970.5	180.84	1973.78	180.89
1980.34	181.06	1983.62	181.16	1990.17	181.32	1996.73	181.5	2000.01	181.56
2003.29	181.58	2006.57	181.66	2013.13	181.85	2019.68	181.92	2029.52	182.13
2032.8	182.21	2036.08	182.31	2039.36	182.48	2042.63	182.61	2045.91	182.71
2049.19	182.77	2055.75	182.99	2062.31	183.09	2068.86	183.34	2072.14	183.43
2075.42	183.5	2081.98	183.68	2085.26	183.75	2088.54	183.84	2091.81	183.99
2095.09	184.18	2098.37	184.4	2104.93	184.69	2108.21	184.81	2111.49	184.9
2114.77	185.04	2118.04	185.22	2121.32	185.39	2127.88	185.63	2131.16	185.79
2134.44	185.98	2140.99	186.27	2144.27	186.4	2147.55	186.52	2150.83	186.66
2160.67	187.11	2170.5	187.5	2173.78	187.62	2180.34	187.94	2183.62	188.07
2190.17	188.36	2193.45	188.49	2200.01	188.79	2203.29	188.92	2206.57	189.06
2209.85	189.23	2213.12	189.34	2216.4	189.41	2219.68	189.51	2222.96	189.63
2229.52	189.91	2232.8	190.06						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.034	07.1797	.025	599.5834	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Coeff Contr.	Expan.
407.1797	599.5834	1760	1760	1760	.1	.3

CROSS SECTION OUTPUT Profile #1%

* E.G. Elev (ft)	* 174.81	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.17	* Wt. n-Val.	* 0.030	* 0.025	* 0.100 *
* W.S. Elev (ft)	* 174.63	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2393.40	* 2181.83	* 4525.18 *
* E.G. Slope (ft/ft)	*0.000199	* Area (sq ft)	* 2393.40	* 2181.83	* 4525.18 *
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 5432.94	* 9228.49	* 2638.58 *
* Top Width (ft)	* 1573.58	* Top Width (ft)	* 407.18	* 192.40	* 973.99 *
* Vel Total (ft/s)	* 1.90	* Avg. Vel. (ft/s)	* 2.27	* 4.23	* 0.58 *
* Max Chl Dpth (ft)	* 12.80	* Hydr. Depth (ft)	* 5.88	* 11.34	* 4.65 *
* Conv. Total (cfs)	*1226894.0	* Conv. (cfs)	*385296.8	*654472.4	*187124.6 *
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 408.47	* 192.44	* 974.73 *
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.07	* 0.14	* 0.06 *
* Alpha	* 3.10	* Stream Power (lb/ft s)	* 0.17	* 0.60	* 0.03 *
* Frctn Loss (ft)	* 0.22	* Cum Volume (acre-ft)	* 280.43	* 84.52	* 512.89 *
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	*	*	* *

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Warning: The cross-section end points had to be extended vertically for the computed water surface.

CROSS SECTION OUTPUT Profile #Floodway

****

* E.G. Elev (ft)	* 175.47	* Element	* Left OB	* Channel	* Right OB *
* Vel Head (ft)	* 0.13	* Wt. n-Val.	* 0.030	* 0.025	* 0.100 *
* W.S. Elev (ft)	* 175.34	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00 *
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 2636.53	* 2318.32	* 4863.35 *
* E.G. Slope (ft/ft)	*0.000139	* Area (sq ft)	* 2636.53	* 2318.32	* 4863.35 *
* Q Total (cfs)	*17300.00	* Flow (cfs)	* 5865.16	* 8535.37	* 2899.47 *
* Top Width (ft)	* 1315.00	* Top Width (ft)	* 352.18	* 192.40	* 770.42 *
* Vel Total (ft/s)	* 1.76	* Avg. Vel. (ft/s)	* 2.22	* 3.68	* 0.60 *
* Max Chl Dpth (ft)	* 13.51	* Hydr. Depth (ft)	* 7.49	* 12.05	* 6.31 *
* Conv. Total (cfs)	*1467692.0	* Conv. (cfs)	*497586.6	*724121.2	*245983.9 *
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 354.48	* 192.44	* 774.41 *
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.06	* 0.10	* 0.05 *

* Alpha	* 2.71	* Stream Power (lb/ft s)	* 0.14	* 0.38	* 0.03	*
* Frctn Loss (ft)	* 0.17	* Cum Volume (acre-ft)	* 221.43	* 88.78	* 507.71	*
* C & E Loss (ft)	* 0.04	* Cum SA (acres)	*	*	*	*

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CROSS SECTION OUTPUT Profile #10%

****

* E.G. Elev (ft)	* 169.60	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.18	* Wt. n-Val.	* 0.030	* 0.025	* 0.100	*
* W.S. Elev (ft)	* 169.42	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 977.89	* 1179.42	* 575.57	*
* E.G. Slope (ft/ft)	*0.000381	* Area (sq ft)	* 977.89	* 1179.42	* 575.57	*
* Q Total (cfs)	* 7480.00	* Flow (cfs)	* 2618.66	* 4580.48	* 280.85	*
* Top Width (ft)	* 887.38	* Top Width (ft)	* 210.87	* 192.40	* 484.10	*
* Vel Total (ft/s)	* 2.74	* Avg. Vel. (ft/s)	* 2.68	* 3.88	* 0.49	*
* Max Chl Dpth (ft)	* 7.59	* Hydr. Depth (ft)	* 4.64	* 6.13	* 1.19	*
* Conv. Total (cfs)	*383379.6	* Conv. (cfs)	*134216.8	*234767.8	* 14394.9	*
* Length Wtd. (ft)	* 1760.00	* Wetted Per. (ft)	* 212.00	* 192.44	* 484.71	*
* Min Ch El (ft)	* 162.83	* Shear (lb/sq ft)	* 0.11	* 0.15	* 0.03	*
* Alpha	* 1.57	* Stream Power (lb/ft s)	* 0.29	* 0.57	* 0.01	*
* Frctn Loss (ft)	* 0.43	* Cum Volume (acre-ft)	* 125.58	* 53.18	* 221.92	*
* C & E Loss (ft)	* 0.05	* Cum SA (acres)	*	*	*	*

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Warning: Divided flow computed for this cross-section.

CROSS SECTION OUTPUT Profile #2%

****

* E.G. Elev (ft)	* 173.24	* Element	* Left OB	* Channel	Right OB	*
* Vel Head (ft)	* 0.18	* Wt. n-Val.	* 0.030	* 0.025	* 0.100	*
* W.S. Elev (ft)	* 173.06	* Reach Len. (ft)	* 1760.00	* 1760.00	* 1760.00	*
* Crit W.S. (ft)	*	* Flow Area (sq ft)	* 1871.27	* 1879.44	* 3133.97	*
* E.G. Slope (ft/ft)	*0.000231	* Area (sq ft)	* 1871.27	* 1879.44	* 3133.97	*
* Q Total (cfs)	*14350.00	* Flow (cfs)	* 4872.53	* 7760.55	* 1716.93	*
* Top Width (ft)	* 1311.56	* Top Width (ft)	* 289.86	* 192.40	*	

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 829.29  *
* Vel Total (ft/s)       *    2.08  * Avg. Vel. (ft/s)       *    2.60  *    4.13  *
   0.55  *
* Max Chl Dpth (ft)      *   11.23  * Hydr. Depth (ft)       *    6.46  *    9.77  *
   3.78  *
* Conv. Total (cfs)      *943766.7  * Conv. (cfs)            *320455.1  *510393.4
*112918.2  *
* Length Wtd. (ft)       * 1760.00  * Wetted Per. (ft)       *  291.07  *  192.44  *
 830.01  *
* Min Ch El (ft)         *  162.83  * Shear (lb/sq ft)       *    0.09  *    0.14  *
   0.05  *
* Alpha                  *    2.66  * Stream Power (lb/ft s) *    0.24  *    0.58  *
   0.03  *
* Frctn Loss (ft)        *    0.26  * Cum Volume (acre-ft)   *  231.00  *   75.12  *
 417.86  *
* C & E Loss (ft)        *    0.05  * Cum SA (acres)         *          *          *
          *
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CROSS SECTION OUTPUT  Profile #0.2%
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***********
* E.G. Elev (ft)         *  178.62  * Element                *  Left OB *  Channel *
Right OB *
* Vel Head (ft)          *    0.13  * Wt. n-Val.             *   0.030  *   0.025  *
  0.100  *
* W.S. Elev (ft)         *  178.49  * Reach Len. (ft)        * 1760.00  * 1760.00  *
1760.00  *
* Crit W.S. (ft)         *          * Flow Area (sq ft)      * 3964.85  * 2924.38  *
8877.46  *
* E.G. Slope (ft/ft)     *0.000109  * Area (sq ft)           * 3964.85  * 2924.38  *
8877.46  *
* Q Total (cfs)          *25400.00  * Flow (cfs)             * 9254.12  *11112.79  *
5033.09  *
* Top Width (ft)         * 1865.95  * Top Width (ft)         *  407.18  *  192.40  *
1266.37  *
* Vel Total (ft/s)       *    1.61  * Avg. Vel. (ft/s)       *    2.33  *    3.80  *
   0.57  *
* Max Chl Dpth (ft)      *   16.66  * Hydr. Depth (ft)       *    9.74  *   15.20  *
   7.01  *
* Conv. Total (cfs)      *2437383.0  * Conv. (cfs)            *888024.7  *1066383.0
*482975.1  *
* Length Wtd. (ft)       * 1760.00  * Wetted Per. (ft)       *  412.32  *  192.44  *
1267.15  *
* Min Ch El (ft)         *  162.83  * Shear (lb/sq ft)       *    0.07  *    0.10  *
   0.05  *
* Alpha                  *    3.22  * Stream Power (lb/ft s) *    0.15  *    0.39  *
   0.03  *
* Frctn Loss (ft)        *    0.13  * Cum Volume (acre-ft)   *  408.61  *  107.56  *
 775.26  *
* C & E Loss (ft)        *    0.04  * Cum SA (acres)         *          *          *
          *
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Warning: The cross-section end points had to be extended vertically for the computed
water surface.

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SUMMARY OF MANNING'S N VALUES
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River:RIVER-1

Reach	River Sta.	n1	n2	n3	n4	n5
Reach-1	350	.1	.045	.1		
Reach-1	344.95	.1	.045	.1		
Reach-1	331.6	.1	.045	.1		
Reach-1	320	.1	.045	.1		
Reach-1	314.4	.1	.045	.1		
Reach-1	300	.1	.045	.1		
Reach-1	285	.1	.045	.1		
Reach-1	280.55	.1	.045	.1		
Reach-1	270	.1	.045	.1		
Reach-1	264	.1	.045	.1		
Reach-1	250.12	.07	.045	.07		
Reach-1	250.06	Bridge				
Reach-1	250	.07	.045	.07		
Reach-1	246	.07	.045	.07		
Reach-1	245	.07	.045	.07		
Reach-1	244.19	Bridge				
Reach-1	243.38	.07	.045	.07		
Reach-1	243.2	.07	.045	.07		
Reach-1	243	.07	.045	.07		
Reach-1	190	.1	.045	.1		
Reach-1	182	.1	.045	.03	.025	.1
Reach-2	180	.1	.045	.1		
Reach-2	170	.1	.045	.1		

River:RIVER-2

Reach	River Sta.	n1	n2	n3
Reach-1	250.12	.03	.025	.07
Reach-1	225	.03	.025	.07
Reach-1	200	.03	.025	.07
Reach-1	190	.03	.025	.1

SUMMARY OF REACH LENGTHS

River: RIVER-1

Reach	River Sta.	Left	Channel	Right
Reach-1	350	505	505	505
Reach-1	344.95	700	1400	1400
Reach-1	331.6	980	980	980
Reach-1	320	860	860	550
Reach-1	314.4	600	1120	600
Reach-1	300	1000	1840	1840
Reach-1	285	220	295	320
Reach-1	280.55	1140	1140	1140
Reach-1	270	515	515	515
Reach-1	264	1330	1300	1000
Reach-1	250.12	620	620	620
Reach-1	250.06	Bridge		
Reach-1	250	10	13	35
Reach-1	246	5	10	35
Reach-1	245	230	230	230
Reach-1	244.19	Bridge		
Reach-1	243.38	585	585	585
Reach-1	243.2	760	760	200
Reach-1	243	4920	3930	1480
Reach-1	190	735	735	735
Reach-1	182	635	635	635
Reach-2	180	700	700	700
Reach-2	170	0	0	0

River: RIVER-2

Reach	River Sta.	Left	Channel	Right
Reach-1	250.12	515	515	515
Reach-1	225	460	460	460
Reach-1	200	800	800	890
Reach-1	190	1760	1760	1760

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: RIVER-1

Reach	River Sta.	Contr.	Expan.
Reach-1	350	.1	.3
Reach-1	344.95	.1	.3
Reach-1	331.6	.1	.3
Reach-1	320	.1	.3
Reach-1	314.4	.1	.3
Reach-1	300	.1	.3
Reach-1	285	.1	.3
Reach-1	280.55	.1	.3
Reach-1	270	.1	.3
Reach-1	264	.1	.3
Reach-1	250.12	.3	.5

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                                  Proposed - No-Rise
*Reach-1         *    250.06  *Bridge    *          *
*Reach-1         *    250     *       .3*        .5*
*Reach-1         *    246     *       .3*        .5*
*Reach-1         *    245     *       .3*        .5*
*Reach-1         *    244.19  *Bridge    *          *
*Reach-1         *    243.38  *       .3*        .5*
*Reach-1         *    243.2   *       .1*        .3*
*Reach-1         *    243     *       .1*        .3*
*Reach-1         *    190     *       .1*        .3*
*Reach-1         *    182     *       .1*        .3*
*Reach-2         *    180     *       .1*        .3*
*Reach-2         *    170     *       .1*        .3*
**************************************************
River: RIVER-2

**************************************************
*     Reach      *   River Sta.   * Contr.  * Expan.  *
**************************************************
*Reach-1         *    250.12  *       .1*        .3*
*Reach-1         *    225     *       .1*        .3*
*Reach-1         *    200     *       .1*        .3*
*Reach-1         *    190     *       .1*        .3*
**************************************************

Profile Output Table - Standard Table 1
********************************************************************************
********************************************************************************
********
* River       * Reach       * River Sta   * Profile  *  Q Total * Min Ch El * W.S.
Elev * Crit W.S. * E.G. Elev * E.G. Slope * Vel Chnl * Flow Area * Top Width *
Froude # Chl *
*             *             *             *          *    (cfs) *      (ft) *
(ft) *      (ft) *      (ft) *    (ft/ft) *   (ft/s) *   (sq ft) *      (ft) *
      *
********************************************************************************
********************************************************************************
********
* RIVER-2     * Reach-1     * 250.12      * 1%       * 17300.00 *    164.83 *
175.14 *           *    175.46 *   0.000413 *     5.60 *   5252.80 *    759.92 *
    0.31 *
* RIVER-2     * Reach-1     * 250.12      * Floodway * 17300.00 *    164.83 *
175.55 *           *    176.20 *   0.000710 *     7.54 *   4052.31 *    530.00 *
    0.41 *
* RIVER-2     * Reach-1     * 250.12      * 10%      *  7480.00 *    164.83 *
170.45 *           *    170.84 *   0.001056 *     5.87 *   1939.44 *    574.48 *
    0.45 *
* RIVER-2     * Reach-1     * 250.12      * 2%       * 14350.00 *    164.83 *
173.68 *           *    174.04 *   0.000540 *     5.76 *   4163.39 *    741.10 *
    0.35 *
* RIVER-2     * Reach-1     * 250.12      * 0.2%     * 25400.00 *    164.83 *
178.73 *           *    179.03 *   0.000266 *     5.52 *   8101.73 *    824.79 *
    0.26 *
*             *             *             *          *          *           *
   *          *           *             *          *          *           *
    *
* RIVER-2     * Reach-1     * 225         * 1%       * 17300.00 *    163.83 *
174.91 *           *    175.25 *   0.000413 *     5.76 *   5134.33 *   1037.90 *
    0.31 *
* RIVER-2     * Reach-1     * 225         * Floodway * 17300.00 *    163.83 *
175.54 *           *    175.83 *   0.000305 *     5.15 *   4659.16 *    510.00 *
    0.27 *
* RIVER-2     * Reach-1     * 225         * 10%      *  7480.00 *    163.83 *
170.04 *           *    170.35 *   0.000775 *     5.18 *   1933.74 *    450.89 *
```

								0.39
RIVER-2	Reach-1	225		2%		14350.00	163.83	
173.42		173.77	0.000504		5.74	3835.78	767.30	
								0.34
RIVER-2	Reach-1	225		0.2%		25400.00	163.83	
178.65		178.89	0.000228		5.25	9585.54	1314.27	
								0.25
RIVER-2	Reach-1	200		1%		17300.00	163.83	
174.78		175.06	0.000343		5.33	5477.21	911.39	
								0.29
RIVER-2	Reach-1	200		Floodway		17300.00	163.83	
175.41		175.69	0.000286		5.06	4443.31	465.00	
								0.27
RIVER-2	Reach-1	200		10%		7480.00	163.83	
169.77		170.01	0.000588		4.57	2187.73	494.82	
								0.34
RIVER-2	Reach-1	200		2%		14350.00	163.83	
173.24		173.54	0.000422		5.33	4184.79	753.80	
								0.31
RIVER-2	Reach-1	200		0.2%		25400.00	163.83	
178.55		178.78	0.000213		5.14	9716.10	1320.25	
								0.24
RIVER-2	Reach-1	190		1%		17300.00	162.83	
174.63		174.81	0.000199		4.23	9100.40	1573.58	
								0.22
RIVER-2	Reach-1	190		Floodway		17300.00	162.83	
175.34		175.47	0.000139		3.68	9818.19	1315.00	
								0.19
RIVER-2	Reach-1	190		10%		7480.00	162.83	
169.42		169.60	0.000381		3.88	2732.88	887.38	
								0.28
RIVER-2	Reach-1	190		2%		14350.00	162.83	
173.06		173.24	0.000231		4.13	6884.68	1311.56	
								0.23
RIVER-2	Reach-1	190		0.2%		25400.00	162.83	
178.49		178.62	0.000109		3.80	15766.68	1865.95	
								0.17
RIVER-1	Reach-1	350		1%		17700.00	160.00	
181.45		181.91	0.000901		6.43	6303.06	1094.31	
								0.28
RIVER-1	Reach-1	350		Floodway		17700.00	160.00	
181.80		182.35	0.000982		6.80	4410.14	440.00	
								0.29
RIVER-1	Reach-1	350		10%		8780.00	160.00	
177.58		177.96	0.000846		5.23	2765.07	652.04	
								0.26
RIVER-1	Reach-1	350		2%		15000.00	160.00	
180.42		180.88	0.000925		6.25	5204.60	1034.40	
								0.28
RIVER-1	Reach-1	350		0.2%		25700.00	160.00	
184.25		184.67	0.000794		6.69	9586.40	1256.46	
								0.27

* RIVER-1	* Reach-1	* 344.95	* 1%	* 17700.00 *	159.00 *			
181.28 *	*	181.50 *	0.000441 *	4.96 *	9102.26 *	1195.89 *		
0.20 *								
* RIVER-1	* Reach-1	* 344.95	* Floodway *	17700.00 *	159.00 *			
181.70 *	*	181.90 *	0.000392 *	4.75 *	8560.24 *	850.00 *		
0.19 *								
* RIVER-1	* Reach-1	* 344.95	* 10%	* 8780.00 *	159.00 *			
177.42 *	*	177.59 *	0.000367 *	3.90 *	4937.46 *	900.58 *		
0.18 *								
* RIVER-1	* Reach-1	* 344.95	* 2%	* 15000.00 *	159.00 *			
180.25 *	*	180.46 *	0.000435 *	4.75 *	7886.24 *	1167.07 *		
0.20 *								
* RIVER-1	* Reach-1	* 344.95	* 0.2%	* 25700.00 *	159.00 *			
184.07 *	*	184.30 *	0.000433 *	5.38 *	12551.08 *	1274.08 *		
0.20 *								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
* RIVER-1	* Reach-1	* 331.6	* 1%	* 17700.00 *	159.60 *			
180.10 *	*	180.66 *	0.001105 *	7.44 *	5746.56 *	906.63 *		
0.31 *								
* RIVER-1	* Reach-1	* 331.6	* Floodway *	17700.00 *	159.60 *			
180.74 *	*	181.19 *	0.000876 *	6.79 *	6253.64 *	840.00 *		
0.28 *								
* RIVER-1	* Reach-1	* 331.6	* 10%	* 8780.00 *	159.60 *			
176.42 *	*	176.85 *	0.000936 *	5.87 *	2911.38 *	629.09 *		
0.28 *								
* RIVER-1	* Reach-1	* 331.6	* 2%	* 15000.00 *	159.60 *			
179.07 *	*	179.62 *	0.001101 *	7.14 *	4850.93 *	833.33 *		
0.31 *								
* RIVER-1	* Reach-1	* 331.6	* 0.2%	* 25700.00 *	159.60 *			
183.04 *	*	183.54 *	0.000952 *	7.65 *	8488.80 *	956.76 *		
0.30 *								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
* RIVER-1	* Reach-1	* 320	* 1%	* 17700.00 *	159.40 *			
179.54 *	*	179.76 *	0.000522 *	4.90 *	9992.36 *	1919.31 *		
0.21 *								
* RIVER-1	* Reach-1	* 320	* Floodway *	17700.00 *	159.40 *			
180.11 *	*	180.42 *	0.000617 *	5.44 *	6268.09 *	600.00 *		
0.23 *								
* RIVER-1	* Reach-1	* 320	* 10%	* 8780.00 *	159.40 *			
175.84 *	*	176.06 *	0.000544 *	4.25 *	4052.28 *	1100.65 *		
0.20 *								
* RIVER-1	* Reach-1	* 320	* 2%	* 15000.00 *	159.40 *			
178.47 *	*	178.71 *	0.000575 *	4.92 *	8013.89 *	1757.54 *		
0.22 *								
* RIVER-1	* Reach-1	* 320	* 0.2%	* 25700.00 *	159.40 *			
182.63 *	*	182.79 *	0.000379 *	4.66 *	16880.54 *	2448.32 *		
0.18 *								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
* RIVER-1	* Reach-1	* 314.4	* 1%	* 17700.00 *	159.10 *			
179.38 *	173.46 *	179.44 *	0.000252 *	3.49 *	15060.70 *	1987.32 *		
0.15 *								
* RIVER-1	* Reach-1	* 314.4	* Floodway *	17700.00 *	159.10 *			
179.96 *	173.38 *	180.03 *	0.000260 *	3.62 *	13400.82 *	1385.00 *		
0.15 *								
* RIVER-1	* Reach-1	* 314.4	* 10%	* 8780.00 *	159.10 *			
175.62 *	169.10 *	175.70 *	0.000309 *	3.30 *	8409.08 *	1734.11 *		

	0.16								
* RIVER-1	* Reach-1	* 314.4	* 2%	* 15000.00	* 159.10	*			
178.28	* 172.88	* 178.35	* 0.000271	* 3.47	* 13099.26	* 1891.97	*		
	0.15								
* RIVER-1	* Reach-1	* 314.4	* 0.2%	* 25700.00	* 159.10	*			
182.50	* 174.27	* 182.56	* 0.000208	* 3.54	* 21022.35	* 2964.32	*		
	0.14								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*									
* RIVER-1	* Reach-1	* 300	* 1%	* 17700.00	* 158.70	*			
179.13	* 172.30	* 179.22	* 0.000321	* 3.90	* 11940.29	* 2129.30	*		
	0.16								
* RIVER-1	* Reach-1	* 300	* Floodway	* 17700.00	* 158.70	*			
179.70	* 172.28	* 179.80	* 0.000329	* 4.03	* 10855.62	* 1080.00	*		
	0.17								
* RIVER-1	* Reach-1	* 300	* 10%	* 8780.00	* 158.70	*			
175.36	* 168.44	* 175.44	* 0.000317	* 3.30	* 7106.97	* 1324.93	*		
	0.16								
* RIVER-1	* Reach-1	* 300	* 2%	* 15000.00	* 158.70	*			
178.02	* 171.87	* 178.12	* 0.000334	* 3.81	* 10410.01	* 2008.45	*		
	0.17								
* RIVER-1	* Reach-1	* 300	* 0.2%	* 25700.00	* 158.70	*			
182.29	* 173.33	* 182.38	* 0.000276	* 4.04	* 16559.88	* 3960.28	*		
	0.16								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*									
* RIVER-1	* Reach-1	* 285	* 1%	* 17700.00	* 158.20	*			
178.12	* 171.92	* 178.44	* 0.000733	* 5.98	* 7101.43	* 1365.53	*		
	0.25								
* RIVER-1	* Reach-1	* 285	* Floodway	* 17700.00	* 158.20	*			
178.60	* 171.93	* 178.98	* 0.000782	* 6.29	* 5961.98	* 605.00	*		
	0.26								
* RIVER-1	* Reach-1	* 285	* 10%	* 8780.00	* 158.20	*			
174.38	* 166.72	* 174.66	* 0.000673	* 4.91	* 3886.06	* 824.26	*		
	0.23								
* RIVER-1	* Reach-1	* 285	* 2%	* 15000.00	* 158.20	*			
176.96	* 171.13	* 177.29	* 0.000769	* 5.86	* 6070.28	* 1240.17	*		
	0.25								
* RIVER-1	* Reach-1	* 285	* 0.2%	* 25700.00	* 158.20	*			
181.38	* 173.49	* 181.70	* 0.000668	* 6.38	* 10306.69	* 3345.95	*		
	0.24								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
*									
* RIVER-1	* Reach-1	* 280.55	* 1%	* 17700.00	* 158.00	*			
177.94	* 171.80	* 178.23	* 0.000693	* 5.88	* 7063.57	* 1290.37	*		
	0.24								
* RIVER-1	* Reach-1	* 280.55	* Floodway	* 17700.00	* 158.00	*			
178.41	* 172.03	* 178.76	* 0.000745	* 6.20	* 6197.06	* 600.00	*		
	0.25								
* RIVER-1	* Reach-1	* 280.55	* 10%	* 8780.00	* 158.00	*			
174.23	* 166.65	* 174.46	* 0.000588	* 4.66	* 4238.73	* 774.71	*		
	0.22								
* RIVER-1	* Reach-1	* 280.55	* 2%	* 15000.00	* 158.00	*			
176.78	* 171.02	* 177.07	* 0.000704	* 5.67	* 6170.14	* 1157.46	*		
	0.24								
* RIVER-1	* Reach-1	* 280.55	* 0.2%	* 25700.00	* 158.00	*			
181.20	* 173.52	* 181.52	* 0.000662	* 6.41	* 9830.33	* 3396.53	*		
	0.24								
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			

*								
* RIVER-1	* Reach-1	* 270	* 1%	* 17700.00 *	157.70 *			
176.52 *	171.46 *	177.12 *	0.001500 *	7.45 *	4228.59 *	898.81 *		
0.34 *								
* RIVER-1	* Reach-1	* 270	* Floodway *	17700.00 *	157.70 *			
177.16 *	171.45 *	177.68 *	0.001254 *	7.01 *	4514.99 *	449.00 *		
0.31 *								
* RIVER-1	* Reach-1	* 270	* 10%	* 8780.00 *	157.70 *			
173.23 *	167.38 *	173.58 *	0.001095 *	5.40 *	2781.02 *	451.48 *		
0.28 *								
* RIVER-1	* Reach-1	* 270	* 2%	* 15000.00 *	157.70 *			
175.39 *	170.78 *	175.95 *	0.001513 *	7.10 *	3724.90 *	731.14 *		
0.34 *								
* RIVER-1	* Reach-1	* 270	* 0.2%	* 25700.00 *	157.70 *			
179.72 *	173.05 *	180.44 *	0.001466 *	8.38 *	5702.49 *	1916.75 *		
0.35 *								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 264	* 1%	* 17700.00 *	157.50 *			
175.98 *	170.99 *	176.36 *	0.001202 *	6.79 *	5551.56 *	1664.30 *		
0.30 *								
* RIVER-1	* Reach-1	* 264	* Floodway *	17700.00 *	157.50 *			
176.73 *	170.99 *	177.05 *	0.000962 *	6.27 *	5990.98 *	652.90 *		
0.27 *								
* RIVER-1	* Reach-1	* 264	* 10%	* 8780.00 *	157.50 *			
172.78 *	168.90 *	173.03 *	0.000920 *	5.11 *	3689.84 *	839.81 *		
0.25 *								
* RIVER-1	* Reach-1	* 264	* 2%	* 15000.00 *	157.50 *			
174.81 *	170.48 *	175.18 *	0.001257 *	6.60 *	4867.78 *	1215.93 *		
0.30 *								
* RIVER-1	* Reach-1	* 264	* 0.2%	* 25700.00 *	157.50 *			
179.30 *	172.29 *	179.70 *	0.001042 *	7.19 *	7491.52 *	3321.91 *		
0.29 *								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 250.12	* 1%	* 800.00 *	157.00 *			
175.41 *	160.81 *	175.44 *	0.000035 *	1.29 *	691.77 *	2947.76 *		
0.05 *								
* RIVER-1	* Reach-1	* 250.12	* Floodway *	800.00 *	157.00 *			
176.29 *	160.81 *	176.31 *	0.000030 *	1.23 *	731.01 *	45.00 *		
0.05 *								
* RIVER-1	* Reach-1	* 250.12	* 10%	* 1450.00 *	157.00 *			
172.10 *	162.04 *	172.23 *	0.000241 *	2.93 *	542.84 *	242.11 *		
0.14 *								
* RIVER-1	* Reach-1	* 250.12	* 2%	* 950.00 *	157.00 *			
174.17 *	161.11 *	174.21 *	0.000064 *	1.66 *	635.72 *	2298.34 *		
0.07 *								
* RIVER-1	* Reach-1	* 250.12	* 0.2%	* 700.00 *	157.00 *			
178.89 *	160.59 *	178.89 *	0.000000 *	0.15 *	16640.42 *	3387.88 *		
0.01 *								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 250.06	*	*	Bridge *	*		
*	*	*	*	*	*	*		
*								
*	*	*	*	*	*	*		
*	*	*	*	*	*	*		
*								
* RIVER-1	* Reach-1	* 250	* 1%	* 800.00 *	156.84 *			
174.71 *	160.74 *	174.72 *	0.000025 *	1.01 *	795.09 *	3891.49 *		

									0.04
RIVER-1	Reach-1	250		Floodway		800.00		156.84	
175.58	160.74	175.59	0.000037		0.95	838.60		50.00	
									0.04
RIVER-1	Reach-1	250		10%		1450.00		156.84	
169.81	161.78	169.92	0.000276		2.64	550.24		128.52	
									0.14
RIVER-1	Reach-1	250		2%		950.00		156.84	
173.18	161.00	173.20	0.000049		1.32	718.60		2722.11	
									0.06
RIVER-1	Reach-1	250		0.2%		700.00		156.84	
178.48	160.54	178.48	0.000000		0.08	25802.58		4642.40	
									0.00
RIVER-1	Reach-1	246		1%		800.00		156.80	
174.71	161.57	174.72	0.000015		0.72	1114.41		3899.97	
									0.03
RIVER-1	Reach-1	246		Floodway		800.00		156.80	
175.58	161.57	175.59	0.000017		0.68	1183.98		80.00	
									0.03
RIVER-1	Reach-1	246		10%		1450.00		156.80	
169.83	162.57	169.89	0.000203		2.00	723.93		134.52	
									0.12
RIVER-1	Reach-1	246		2%		950.00		156.80	
173.18	161.84	173.20	0.000030		0.96	992.20		2341.40	
									0.05
RIVER-1	Reach-1	246		0.2%		700.00		156.80	
178.47	161.39	178.48	0.000005		0.49	1415.49		4616.67	
									0.02
RIVER-1	Reach-1	245		1%		800.00		156.80	
174.68	161.20	174.71	0.000048		1.43	560.75		3240.13	
									0.06
RIVER-1	Reach-1	245		Floodway		800.00		156.80	
175.55	161.19	175.58	0.000092		1.35	591.28		35.00	
									0.06
RIVER-1	Reach-1	245		10%		1450.00		156.80	
169.62	162.42	169.84	0.000558		3.78	383.62		136.26	
									0.20
RIVER-1	Reach-1	245		2%		950.00		156.80	
173.13	161.50	173.18	0.000095		1.88	506.51		2117.41	
									0.09
RIVER-1	Reach-1	245		0.2%		700.00		156.80	
178.48	160.98	178.48	0.000000		0.09	24443.18		4650.76	
									0.00
RIVER-1	Reach-1	244.19				Bridge			
RIVER-1	Reach-1	243.38		1%		800.00		156.70	
174.57	160.45	174.58	0.000020		0.92	865.13		3749.91	
									0.04
RIVER-1	Reach-1	243.38		Floodway		800.00		156.70	
175.43	160.45	175.45	0.000030		0.88	912.71		55.00	

```
    0.04 *
* RIVER-1     * Reach-1     * 243.38      * 10%       *  1450.00 *    156.70 *
169.38 *    161.55 *    169.47 *   0.000252 *     2.50 *    579.53 *    510.13 *
    0.14 *
* RIVER-1     * Reach-1     * 243.38      * 2%        *   950.00 *    156.70 *
172.98 *    160.74 *    173.01 *   0.000041 *     1.22 *    777.85 *   3037.64 *
    0.06 *
* RIVER-1     * Reach-1     * 243.38      * 0.2%      *   700.00 *    156.70 *
178.47 *    160.25 *    178.47 *   0.000000 *     0.07 *  29117.13 *   4533.10 *
    0.00 *
*             *             *             *           *          *           *
   *           *           *             *           *          *           *
     *
* RIVER-1     * Reach-1     * 243.2       * 1%        *   800.00 *    155.10 *
174.57 *    158.78 *    174.57 *   0.000001 *     0.26 *   5903.05 *   2573.90 *
    0.01 *
* RIVER-1     * Reach-1     * 243.2       * Floodway  *   800.00 *    155.10 *
175.43 *    158.78 *    175.43 *   0.000009 *     0.60 *   1345.31 *     75.30 *
    0.02 *
* RIVER-1     * Reach-1     * 243.2       * 10%       *  1450.00 *    155.10 *
169.33 *    159.77 *    169.34 *   0.000049 *     1.17 *   2240.86 *   1726.67 *
    0.06 *
* RIVER-1     * Reach-1     * 243.2       * 2%        *   950.00 *    155.10 *
172.98 *    159.05 *    172.98 *   0.000004 *     0.39 *   4790.80 *   2176.15 *
    0.02 *
* RIVER-1     * Reach-1     * 243.2       * 0.2%      *   700.00 *    155.10 *
178.47 *    158.60 *    178.47 *   0.000000 *     0.15 *   8636.32 *   2779.42 *
    0.01 *
*             *             *             *           *          *           *
   *           *           *             *           *          *           *
     *
* RIVER-1     * Reach-1     * 243         * 1%        *  2665.00 *    153.20 *
174.57 *    159.29 *    174.57 *   0.000003 *     0.41 *  13390.99 *   2774.92 *
    0.02 *
* RIVER-1     * Reach-1     * 243         * Floodway  *  2665.00 *    153.20 *
175.38 *    159.30 *    175.42 *   0.000055 *     1.65 *   1770.26 *    100.00 *
    0.07 *
* RIVER-1     * Reach-1     * 243         * 10%       *  3015.00 *    153.20 *
169.31 *    159.60 *    169.32 *   0.000042 *     1.12 *   5871.21 *   2656.52 *
    0.05 *
* RIVER-1     * Reach-1     * 243         * 2%        *  2805.00 *    153.20 *
172.98 *    159.42 *    172.98 *   0.000007 *     0.53 *  11116.88 *   2741.09 *
    0.02 *
* RIVER-1     * Reach-1     * 243         * 0.2%      *  2100.00 *    153.20 *
178.47 *    158.77 *    178.47 *   0.000001 *     0.21 *  18976.26 *   2860.36 *
    0.01 *
*             *             *             *           *          *           *
   *           *           *             *           *          *           *
     *
* RIVER-1     * Reach-1     * 190         * 1%        *  2665.00 *    153.80 *
174.56 *         *    174.56 *   0.000006 *     0.55 *  12443.90 *   1068.78 *
    0.02 *
* RIVER-1     * Reach-1     * 190         * Floodway  *  2665.00 *    153.80 *
175.29 *         *    175.30 *   0.000012 *     0.84 *   6724.83 *    488.00 *
    0.03 *
* RIVER-1     * Reach-1     * 190         * 10%       *  3015.00 *    153.80 *
169.18 *         *    169.19 *   0.000044 *     1.24 *   6714.25 *   1062.51 *
    0.06 *
* RIVER-1     * Reach-1     * 190         * 2%        *  2805.00 *    153.80 *
172.96 *         *    172.96 *   0.000010 *     0.68 *  10735.03 *   1066.83 *
    0.03 *
* RIVER-1     * Reach-1     * 190         * 0.2%      *  2100.00 *    153.80 *
178.47 *         *    178.47 *   0.000002 *     0.37 *  17166.59 *   1609.35 *
```

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    0.01 *
*               *               *               *           *           *           *
   *            *             *             *           *           *             *
     *
* RIVER-1      * Reach-1      * 182          * 1%        * 19965.00 *    154.83 *
174.54 *            *    174.55 *   0.000018 *     0.96 *  32769.91 *   3419.79 *
    0.04 *
* RIVER-1      * Reach-1      * 182          * Floodway  * 19965.00 *    154.83 *
175.28 *            *    175.28 *   0.000015 *     0.93 *  29361.91 *   2380.00 *
    0.04 *
* RIVER-1      * Reach-1      * 182          * 10%       * 10495.00 *    154.83 *
169.15 *            *    169.16 *   0.000033 *     1.05 *  15832.40 *   2823.72 *
    0.05 *
* RIVER-1      * Reach-1      * 182          * 2%        * 17155.00 *    154.83 *
172.94 *            *    172.95 *   0.000021 *     0.98 *  27426.74 *   3253.64 *
    0.04 *
* RIVER-1      * Reach-1      * 182          * 0.2%      * 27500.00 *    154.83 *
178.46 *            *    178.47 *   0.000013 *     0.92 *  46765.81 *   3694.00 *
    0.03 *
*               *               *               *           *           *           *
   *            *             *             *           *           *             *
     *
* RIVER-1      * Reach-2      * 180          * 1%        * 19965.00 *    153.30 *
174.52 *            *    174.53 *   0.000056 *     1.77 *  34352.70 *   3408.33 *
    0.07 *
* RIVER-1      * Reach-2      * 180          * Floodway  * 19965.00 *    153.30 *
175.26 *            *    175.27 *   0.000051 *     1.75 *  30669.10 *   2384.00 *
    0.07 *
* RIVER-1      * Reach-2      * 180          * 10%       * 10495.00 *    153.30 *
169.11 *            *    169.13 *   0.000106 *     1.98 *  17100.62 *   2877.45 *
    0.09 *
* RIVER-1      * Reach-2      * 180          * 2%        * 17155.00 *    153.30 *
172.91 *            *    172.93 *   0.000067 *     1.84 *  28952.08 *   3300.79 *
    0.08 *
* RIVER-1      * Reach-2      * 180          * 0.2%      * 27500.00 *    153.30 *
178.45 *            *    178.46 *   0.000039 *     1.67 *  48158.45 *   3620.41 *
    0.06 *
*               *               *               *           *           *           *
   *            *             *             *           *           *             *
     *
* RIVER-1      * Reach-2      * 170          * 1%        * 19965.00 *    152.70 *
174.47 *    164.09 *    174.49 *   0.000072 *     2.09 *  29916.54 *   3122.88 *
    0.08 *
* RIVER-1      * Reach-2      * 170          * Floodway  * 19965.00 *    152.70 *
175.21 *    164.08 *    175.23 *   0.000065 *     2.02 *  27665.11 *   2300.00 *
    0.08 *
* RIVER-1      * Reach-2      * 170          * 10%       * 10495.00 *    152.70 *
169.00 *    161.22 *    169.04 *   0.000153 *     2.48 *  13935.40 *   2632.32 *
    0.11 *
* RIVER-1      * Reach-2      * 170          * 2%        * 17155.00 *    152.70 *
172.85 *    163.61 *    172.87 *   0.000090 *     2.20 *  24921.49 *   3039.49 *
    0.09 *
* RIVER-1      * Reach-2      * 170          * 0.2%      * 27500.00 *    152.70 *
178.41 *    164.95 *    178.42 *   0.000049 *     1.93 *  42607.82 *   3306.87 *
    0.07 *
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Profile Output Table - Encroachment 1

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River	Reach	River Sta	Profile	W.S. Elev (ft)	Prof Delta WS (ft)	E.G. Elev (ft)	Top Wdth Act (ft)	Q Left (cfs)	Q Channel (cfs)	Q Right (cfs)	Enc Sta L (ft)	Ch Sta L (ft)	Ch Sta R (ft)	Enc Sta R (ft)
RIVER-2	Reach-1	250.12	1%	175.14		175.46	759.92	5819.56	8544.99	2935.46		189.51	342.34	
RIVER-2	Reach-1	250.12	Floodway	175.55	0.41	176.20	530.00	1000.41	11988.62	4310.97	169.00	189.51	342.34	699.00
RIVER-2	Reach-1	250.12	10%	170.45	-4.69	170.84	574.48	2106.67	4750.30	623.03		189.51	342.34	
RIVER-2	Reach-1	250.12	2%	173.68	-1.45	174.04	741.10	4764.24	7517.01	2068.75		189.51	342.34	
RIVER-2	Reach-1	250.12	0.2%	178.73	3.59	179.03	824.79	8628.69	11454.53	5316.77		189.51	342.34	
RIVER-2	Reach-1	225	1%	174.91		175.25	1037.90	7379.90	8549.92	1370.18		459.94	602.45	
RIVER-2	Reach-1	225	Floodway	175.54	0.63	175.83	510.00	7933.71	8103.30	1262.99	203.00	459.94	602.45	713.00
RIVER-2	Reach-1	225	10%	170.04	-4.88	170.35	450.89	3059.49	4090.22	330.29		459.94	602.45	
RIVER-2	Reach-1	225	2%	173.42	-1.49	173.77	767.30	6022.11	7301.10	1026.79		459.94	602.45	
RIVER-2	Reach-1	225	0.2%	178.65	3.73	178.89	1314.27	10916.87	10591.61	3891.52		459.94	602.45	
RIVER-2	Reach-1	200	1%	174.78		175.06	911.39	7838.60	7907.45	1553.96		478.37	617.60	
RIVER-2	Reach-1	200	Floodway	175.41	0.63	175.69	465.00	8823.89	7952.47	523.64	195.00	478.37	617.60	660.00
RIVER-2	Reach-1	200	10%	169.77	-5.01	170.01	494.82	3522.89	3596.58	360.54		478.37	617.60	
RIVER-2	Reach-1	200	2%	173.24	-1.54	173.54	753.80	6599.19	6768.09	982.72		478.37	617.60	
RIVER-2	Reach-1	200	0.2%	178.55	3.78	178.78	1320.25	11439.06	10336.06	3624.88		478.37	617.60	

* RIVER-2	* Reach-1	* 190		* 1%	*	174.63 *			*
174.81 *	1573.58 *	5432.94 *	9228.49 *	2638.58 *		*	407.18 *		
599.58 *	*								
* RIVER-2	* Reach-1	* 190		* Floodway *		175.34 *		0.71 *	
175.47 *	1315.00 *	5865.16 *	8535.37 *	2899.47 *		55.00 *	407.18 *		
599.58 *	1370.00 *								
* RIVER-2	* Reach-1	* 190		* 10%	*	169.42 *		-5.21 *	
169.60 *	887.38 *	2618.66 *	4580.48 *	280.85 *		*	407.18 *		
599.58 *	*								
* RIVER-2	* Reach-1	* 190		* 2%	*	173.06 *		-1.57 *	
173.24 *	1311.56 *	4872.53 *	7760.55 *	1716.93 *		*	407.18 *		
599.58 *	*								
* RIVER-2	* Reach-1	* 190		* 0.2%	*	178.49 *		3.86 *	
178.62 *	1865.95 *	9254.12 *	11112.79 *	5033.09 *		*	407.18 *		
599.58 *	*								
*	*	*	*	*	*	*			*
*	*	*	*	*	*	*	*		
* RIVER-1	* Reach-1	* 350		* 1%	*	181.45 *			*
181.91 *	1094.31 *	2439.38 *	12407.46 *	2853.16 *		*	758.00 *		
873.00 *	*								
* RIVER-1	* Reach-1	* 350		* Floodway *		181.80 *		0.34 *	
182.35 *	440.00 *	1866.82 *	13398.57 *	2434.61 *		658.00 *	758.00 *		
873.00 *	1098.00 *								
* RIVER-1	* Reach-1	* 350		* 10%	*	177.58 *		-3.87 *	
177.96 *	652.04 *	627.46 *	7764.20 *	388.34 *		*	758.00 *		
873.00 *	*								
* RIVER-1	* Reach-1	* 350		* 2%	*	180.42 *		-1.03 *	
180.88 *	1034.40 *	1822.19 *	11312.19 *	1865.62 *		*	758.00 *		
873.00 *	*								
* RIVER-1	* Reach-1	* 350		* 0.2%	*	184.25 *		2.79 *	
184.67 *	1256.46 *	4584.22 *	15059.76 *	6056.02 *		*	758.00 *		
873.00 *	*								
*	*	*	*	*	*	*			*
*	*	*	*	*	*	*	*		
* RIVER-1	* Reach-1	* 344.95		* 1%	*	181.28 *			*
181.50 *	1195.89 *	2652.52 *	9569.66 *	5477.82 *		*	768.00 *		
868.00 *	*								
* RIVER-1	* Reach-1	* 344.95		* Floodway *		181.70 *		0.42 *	
181.90 *	850.00 *	2571.79 *	9348.31 *	5779.90 *		418.00 *	768.00 *		
868.00 *	1268.00 *								
* RIVER-1	* Reach-1	* 344.95		* 10%	*	177.42 *		-3.86 *	
177.59 *	900.58 *	484.82 *	6018.31 *	2276.87 *		*	768.00 *		
868.00 *	*								
* RIVER-1	* Reach-1	* 344.95		* 2%	*	180.25 *		-1.03 *	
180.46 *	1167.07 *	1811.51 *	8673.74 *	4514.75 *		*	768.00 *		
868.00 *	*								
* RIVER-1	* Reach-1	* 344.95		* 0.2%	*	184.07 *		2.79 *	
184.30 *	1274.08 *	5455.91 *	11879.65 *	8364.44 *		*	768.00 *		
868.00 *	*								
*	*	*	*	*	*	*			*
*	*	*	*	*	*	*	*		
* RIVER-1	* Reach-1	* 331.6		* 1%	*	180.10 *			*
180.66 *	906.63 *	3729.85 *	11333.57 *	2636.59 *		*	769.81 *		
855.37 *	*								
* RIVER-1	* Reach-1	* 331.6		* Floodway *		180.74 *		0.65 *	
181.19 *	840.00 *	4289.62 *	10707.63 *	2702.75 *		215.00 *	769.81 *		
855.37 *	1055.00 *								
* RIVER-1	* Reach-1	* 331.6		* 10%	*	176.42 *		-3.68 *	
176.85 *	629.09 *	842.36 *	7090.08 *	847.55 *		*	769.81 *		
855.37 *	*								

* RIVER-1	* Reach-1	* 331.6	* 2%	*	179.07 *		*	-1.03 *	
179.62 *	833.33 *	2675.05 *	10247.64 *	2077.31 *		*	769.81 *	855.37 *	
* RIVER-1	* Reach-1	* 331.6	* 0.2%	*	183.04 *		*	2.94 *	
183.54 *	956.76 *	7840.07 *	13573.43 *	4286.50 *		*	769.81 *	855.37 *	
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
* RIVER-1	* Reach-1	* 320	* 1%	*	179.54 *		*		
179.76 *	1919.31 *	3163.87 *	9878.17 *	4657.97 *		*	1740.65 *	1858.13 *	
* RIVER-1	* Reach-1	* 320	* Floodway	*	180.11 *		*	0.56 *	
180.42 *	600.00 *	2761.03 *	11335.38 *	3603.59 *	1536.00 *		1740.65 *	1858.13 *	2136.00 *
* RIVER-1	* Reach-1	* 320	* 10%	*	175.84 *		*	-3.70 *	
176.06 *	1100.65 *	1028.74 *	6730.89 *	1020.37 *		*	1740.65 *	1858.13 *	
* RIVER-1	* Reach-1	* 320	* 2%	*	178.47 *		*	-1.08 *	
178.71 *	1757.54 *	2454.04 *	9305.05 *	3240.91 *		*	1740.65 *	1858.13 *	
* RIVER-1	* Reach-1	* 320	* 0.2%	*	182.63 *		*	3.09 *	
182.79 *	2448.32 *	5510.27 *	11092.63 *	9097.11 *		*	1740.65 *	1858.13 *	
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
* RIVER-1	* Reach-1	* 314.4	* 1%	*	179.38 *		*		
179.44 *	1804.17 *	180.64 *	4917.29 *	12602.06 *		*	1135.36 *	1215.54 *	
* RIVER-1	* Reach-1	* 314.4	* Floodway	*	179.96 *		*	0.58 *	
180.03 *	1385.00 *	200.31 *	5273.72 *	12225.97 *	1110.00 *		1135.36 *	1215.54 *	2495.00 *
* RIVER-1	* Reach-1	* 314.4	* 10%	*	175.62 *		*	-3.75 *	
175.70 *	1734.11 *	79.77 *	3651.83 *	5048.40 *		*	1135.36 *	1215.54 *	
* RIVER-1	* Reach-1	* 314.4	* 2%	*	178.28 *		*	-1.09 *	
178.35 *	1788.18 *	149.12 *	4580.35 *	10270.54 *		*	1135.36 *	1215.54 *	
* RIVER-1	* Reach-1	* 314.4	* 0.2%	*	182.50 *		*	3.12 *	
182.56 *	2014.32 *	290.03 *	5873.63 *	19536.34 *		*	1135.36 *	1215.54 *	
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			
* RIVER-1	* Reach-1	* 300	* 1%	*	179.13 *		*		
179.22 *	1387.64 *	384.22 *	5847.31 *	11468.47 *		*	2520.00 *	2605.04 *	
* RIVER-1	* Reach-1	* 300	* Floodway	*	179.70 *		*	0.57 *	
179.80 *	1080.00 *	419.82 *	6243.48 *	11036.70 *	2363.00 *		2520.00 *	2605.04 *	3443.00 *
* RIVER-1	* Reach-1	* 300	* 10%	*	175.36 *		*	-3.77 *	
175.44 *	1172.73 *	68.78 *	3890.92 *	4820.30 *		*	2520.00 *	2605.04 *	
* RIVER-1	* Reach-1	* 300	* 2%	*	178.02 *		*	-1.11 *	
178.12 *	1380.81 *	173.04 *	5349.75 *	9477.21 *		*	2520.00 *	2605.04 *	
* RIVER-1	* Reach-1	* 300	* 0.2%	*	182.29 *		*	3.16 *	
182.38 *	1494.12 *	1276.28 *	7139.76 *	17283.96 *		*	2520.00 *	2605.04 *	
*	*	*	*	*	*	*			
*	*	*	*	*	*	*			

* RIVER-1	* Reach-1	* 285	* 1%	*	178.12 *		*	
178.44 *	895.21 *	5316.19 *	9732.85 *	2650.95 *		*	3076.79 *	
3167.03 *	*							
* RIVER-1	* Reach-1	* 285	* Floodway *		178.60 *		0.49 *	
178.98 *	605.00 *	5381.78 *	10509.98 *	1808.24 *	2664.00 *		3076.79 *	
3167.03 *	3269.00 *							
* RIVER-1	* Reach-1	* 285	* 10%	*	174.38 *		-3.73 *	
174.66 *	806.09 *	1366.96 *	6334.93 *	1078.11 *		*	3076.79 *	
3167.03 *	*							
* RIVER-1	* Reach-1	* 285	* 2%	*	176.96 *		-1.16 *	
177.29 *	886.23 *	3904.59 *	8927.44 *	2167.98 *		*	3076.79 *	
3167.03 *	*							
* RIVER-1	* Reach-1	* 285	* 0.2%	*	181.38 *		3.26 *	
181.70 *	1086.39 *	9299.07 *	12254.49 *	4146.45 *		*	3076.79 *	
3167.03 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*		*
*	*							
* RIVER-1	* Reach-1	* 280.55	* 1%	*	177.94 *			*
178.23 *	778.42 *	4816.07 *	9021.27 *	3862.66 *		*	3083.19 *	
3167.11 *	*							
* RIVER-1	* Reach-1	* 280.55	* Floodway *		178.41 *		0.48 *	
178.76 *	600.00 *	5019.80 *	9767.38 *	2912.82 *	2714.00 *		3083.19 *	
3167.11 *	3314.00 *							
* RIVER-1	* Reach-1	* 280.55	* 10%	*	174.23 *		-3.70 *	
174.46 *	747.10 *	1423.38 *	5703.26 *	1653.36 *		*	3083.19 *	
3167.11 *	*							
* RIVER-1	* Reach-1	* 280.55	* 2%	*	176.78 *		-1.15 *	
177.07 *	768.74 *	3665.79 *	8157.30 *	3176.91 *		*	3083.19 *	
3167.11 *	*							
* RIVER-1	* Reach-1	* 280.55	* 0.2%	*	181.20 *		3.27 *	
181.52 *	914.28 *	8037.02 *	11598.78 *	6064.20 *		*	3083.19 *	
3167.11 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*		*
*	*							
* RIVER-1	* Reach-1	* 270	* 1%	*	176.52 *			*
177.12 *	446.60 *	5996.77 *	11699.69 *	3.53 *		*	3570.65 *	
3675.10 *	*							
* RIVER-1	* Reach-1	* 270	* Floodway *		177.16 *		0.64 *	
177.68 *	449.00 *	6227.21 *	11468.17 *	4.62 *	3229.00 *		3570.65 *	
3675.10 *	3678.00 *							
* RIVER-1	* Reach-1	* 270	* 10%	*	173.23 *		-3.30 *	
173.58 *	431.03 *	2163.27 *	6616.65 *	0.08 *		*	3570.65 *	
3675.10 *	*							
* RIVER-1	* Reach-1	* 270	* 2%	*	175.39 *		-1.13 *	
175.95 *	441.44 *	4688.64 *	10309.74 *	1.62 *		*	3570.65 *	
3675.10 *	*							
* RIVER-1	* Reach-1	* 270	* 0.2%	*	179.72 *		3.20 *	
180.44 *	500.98 *	9728.57 *	15956.24 *	15.19 *		*	3570.65 *	
3675.10 *	*							
*	*	*	*	*	*			*
*	*	*	*	*	*	*		*
*	*							
* RIVER-1	* Reach-1	* 264	* 1%	*	175.98 *			*
176.36 *	582.69 *	9296.63 *	8393.59 *	9.79 *		*	3676.58 *	
3754.88 *	*							
* RIVER-1	* Reach-1	* 264	* Floodway *		176.73 *		0.75 *	
177.05 *	582.90 *	9569.99 *	8118.45 *	11.56 *	3106.10 *		3676.58 *	
3754.88 *	3759.00 *							
* RIVER-1	* Reach-1	* 264	* 10%	*	172.78 *		-3.20 *	
173.03 *	580.85 *	3744.23 *	5034.12 *	1.65 *		*	3676.58 *	
3754.88 *	*							

* RIVER-1	* Reach-1	* 264		* 2%	*	174.81 *		-1.17 *		
175.18 *	582.00 *	7445.65 *	7548.27 *	6.09 *		*	3676.58 *	3754.88 *		
* RIVER-1	* Reach-1	* 264		* 0.2%	*	179.30 *		3.32 *		
179.70 *	584.62 *	14925.76 *	10748.04 *	26.20 *		*	3676.58 *	3754.88 *		
*	*	*	*	*	*			*		
*	*	*	*	*	*	*		*		
* RIVER-1	* Reach-1	* 250.12		* 1%	*	175.41 *		*		
175.44 *	45.00 *	13.23 *	774.60 *	12.17 *		*	3660.00 *	3695.00 *		
* RIVER-1	* Reach-1	* 250.12		* Floodway	*	176.29 *		0.87 *		
176.31 *	45.00 *	12.12 *	776.43 *	11.44 *	3655.00 *		3660.00 *	3695.00 *	3700.00 *	
* RIVER-1	* Reach-1	* 250.12		* 10%	*	172.10 *		-3.31 *		
172.23 *	44.44 *	17.29 *	1417.00 *	15.71 *		*	3660.00 *	3695.00 *		
* RIVER-1	* Reach-1	* 250.12		* 2%	*	174.17 *		-1.25 *		
174.21 *	45.00 *	14.12 *	923.06 *	12.82 *		*	3660.00 *	3695.00 *		
* RIVER-1	* Reach-1	* 250.12		* 0.2%	*	178.89 *		3.48 *		
178.89 *	3387.88 *	558.65 *	109.85 *	31.51 *		*	3660.00 *	3695.00 *		
*	*	*	*	*	*			*		
*	*	*	*	*	*	*		*		
* RIVER-1	* Reach-1	* 250.06	BR U * 1%	*	175.33 *		*			
175.42 *	*	*	796.16 *	3.84 *		*	3660.00 *	3695.00 *		
* RIVER-1	* Reach-1	* 250.06	BR U * Floodway	*	176.20 *		0.87 *			
176.29 *	*	*	796.16 *	3.84 *	3655.00 *		3660.00 *	3695.00 *	3700.00 *	
* RIVER-1	* Reach-1	* 250.06	BR U * 10%	*	171.88 *		-3.45 *			
172.18 *	*	*	1443.03 *	6.97 *		*	3660.00 *	3695.00 *		
* RIVER-1	* Reach-1	* 250.06	BR U * 2%	*	174.06 *		-1.27 *			
174.18 *	*	*	945.43 *	4.57 *		*	3660.00 *	3695.00 *		
* RIVER-1	* Reach-1	* 250.06	BR U * 0.2%	*	178.85 *		3.52 *			
178.88 *	1334.17 *	102.07 *	576.01 *	21.92 *		*	3660.00 *	3695.00 *		
*	*	*	*	*	*			*		
*	*	*	*	*	*	*		*		
* RIVER-1	* Reach-1	* 250.06	BR D * 1%	*	174.63 *		*			
174.82 *	*	*	800.00 *	*		*	3966.32 *	4057.61 *		
* RIVER-1	* Reach-1	* 250.06	BR D * Floodway	*	175.50 *		0.87 *			
175.69 *	*	*	800.00 *	*	3985.00 *		3966.32 *	4057.61 *	4035.00 *	
* RIVER-1	* Reach-1	* 250.06	BR D * 10%	*	169.58 *		-5.05 *			
170.20 *	*	*	1450.00 *	*		*	3966.32 *	4057.61 *		
* RIVER-1	* Reach-1	* 250.06	BR D * 2%	*	173.07 *		-1.56 *			
173.33 *	*	*	950.00 *	*		*	3966.32 *	4057.61 *		
* RIVER-1	* Reach-1	* 250.06	BR D * 0.2%	*	178.47 *		3.84 *			
178.50 *	1874.73 *	25.42 *	500.42 *	174.16 *		*	3966.32 *	4057.61 *		
*	*	*	*	*	*			*		
*	*	*	*	*	*	*		*		

* RIVER-1	* Reach-1	* 250		* 1%	*	174.71 *			*
174.72 *	50.00 *		* 800.00 *		*		*	3966.32 *	
4057.61 *	*								
* RIVER-1	* Reach-1	* 250		* Floodway	*	175.58 *		0.87 *	
175.59 *	50.00 *		* 800.00 *		*	3985.00 *		3966.32 *	
4057.61 *	4035.00 *								
* RIVER-1	* Reach-1	* 250		* 10%	*	169.81 *		-4.90 *	
169.92 *	50.00 *		* 1450.00 *		*		*	3966.32 *	
4057.61 *	*								
* RIVER-1	* Reach-1	* 250		* 2%	*	173.18 *		-1.53 *	
173.20 *	50.00 *		* 950.00 *		*		*	3966.32 *	
4057.61 *	*								
* RIVER-1	* Reach-1	* 250		* 0.2%	*	178.48 *		3.77 *	
178.48 *	4642.40 *	432.47 *	127.32 *	140.22 *			*	3966.32 *	
4057.61 *	*								
*	*	*	*	*		*			*
*	*	*	*	*		*	*	*	
*	*								
* RIVER-1	* Reach-1	* 246		* 1%	*	174.71 *			*
174.72 *	80.00 *		* 800.00 *		*		*	3964.48 *	
4055.27 *	*								
* RIVER-1	* Reach-1	* 246		* Floodway	*	175.58 *		0.87 *	
175.59 *	80.00 *		* 800.00 *		*	3972.00 *		3964.48 *	
4055.27 *	4052.00 *								
* RIVER-1	* Reach-1	* 246		* 10%	*	169.83 *		-4.88 *	
169.89 *	80.00 *		* 1450.00 *		*		*	3964.48 *	
4055.27 *	*								
* RIVER-1	* Reach-1	* 246		* 2%	*	173.18 *		-1.53 *	
173.20 *	80.00 *		* 950.00 *		*		*	3964.48 *	
4055.27 *	*								
* RIVER-1	* Reach-1	* 246		* 0.2%	*	178.47 *		3.76 *	
178.48 *	80.00 *		* 700.00 *		*		*	3964.48 *	
4055.27 *	*								
*	*	*	*	*		*			*
*	*	*	*	*		*	*	*	
*	*								
* RIVER-1	* Reach-1	* 245		* 1%	*	174.68 *			*
174.71 *	35.00 *		* 800.00 *		*		*	3970.91 *	
4052.15 *	*								
* RIVER-1	* Reach-1	* 245		* Floodway	*	175.55 *		0.87 *	
175.58 *	35.00 *		* 800.00 *		*	3996.00 *		3970.91 *	
4052.15 *	4031.00 *								
* RIVER-1	* Reach-1	* 245		* 10%	*	169.62 *		-5.06 *	
169.84 *	35.00 *		* 1450.00 *		*		*	3970.91 *	
4052.15 *	*								
* RIVER-1	* Reach-1	* 245		* 2%	*	173.13 *		-1.55 *	
173.18 *	35.00 *		* 950.00 *		*		*	3970.91 *	
4052.15 *	*								
* RIVER-1	* Reach-1	* 245		* 0.2%	*	178.48 *		3.80 *	
178.48 *	4650.76 *	488.63 *	127.44 *	83.93 *			*	3970.91 *	
4052.15 *	*								
*	*	*	*	*		*			*
*	*	*	*	*		*	*	*	
*	*								
* RIVER-1	* Reach-1	* 244.19	BR U	* 1%	*	174.62 *			*
174.69 *	*	*	800.00 *		*		*	3970.91 *	
4052.15 *	*								
* RIVER-1	* Reach-1	* 244.19	BR U	* Floodway	*	175.49 *		0.86 *	
175.56 *	*	*	800.00 *		*	3996.00 *		3970.91 *	
4052.15 *	4031.00 *								
* RIVER-1	* Reach-1	* 244.19	BR U	* 10%	*	169.47 *		-5.15 *	
169.78 *	30.00 *	*	1450.00 *		*		*	3970.91 *	
4052.15 *	*								

RIVER-1	Reach-1	244.19	BR U	2%		173.06		-1.56	173.16		
			950.00					3970.91	4052.15		
RIVER-1	Reach-1	244.19	BR U	0.2%		178.48		3.85	178.48	4650.74	
422.15	116.43	161.43						3970.91	4052.15		
RIVER-1	Reach-1	244.19	BR D	1%		174.56			174.62		
			800.00					3930.35	4009.75		
RIVER-1	Reach-1	244.19	BR D	Floodway		175.42		0.86	175.48		
			800.00			3954.00		3930.35	4009.75	4009.00	
RIVER-1	Reach-1	244.19	BR D	10%		169.32		-5.23	169.60	30.00	
			1450.00					3930.35	4009.75		
RIVER-1	Reach-1	244.19	BR D	2%		172.97		-1.59	173.06		
			950.00					3930.35	4009.75		
RIVER-1	Reach-1	244.19	BR D	0.2%		178.47		3.92	178.47	4513.96	
416.28	127.80	155.92						3930.35	4009.75		
RIVER-1	Reach-1	243.38		1%		174.57			174.58	55.00	
			800.00					3930.35	4009.75		
RIVER-1	Reach-1	243.38		Floodway		175.43		0.87	175.45	55.00	
			800.00			3954.00		3930.35	4009.75	4009.00	
RIVER-1	Reach-1	243.38		10%		169.38		-5.19	169.47	55.00	
			1450.00					3930.35	4009.75		
RIVER-1	Reach-1	243.38		2%		172.98		-1.59	173.01	55.00	
			950.00					3930.35	4009.75		
RIVER-1	Reach-1	243.38		0.2%		178.47		3.90	178.47	4533.10	
414.40	105.66	179.93						3930.35	4009.75		
RIVER-1	Reach-1	243.2		1%		174.57			174.57	700.00	54.76
			349.80		395.43			3496.00	3575.79		
RIVER-1	Reach-1	243.2		Floodway		175.43		0.86	175.43	75.30	0.07
			799.93			3495.80		3496.00	3575.79	3571.10	
RIVER-1	Reach-1	243.2		10%		169.33		-5.24	169.34	646.09	105.28
			1077.43		267.29			3496.00	3575.79		
RIVER-1	Reach-1	243.2		2%		172.98		-1.59	172.98	700.00	66.88
			470.86		412.27			3496.00	3575.79		
RIVER-1	Reach-1	243.2		0.2%		178.47		3.90	178.47	700.00	45.43
			246.63		407.94			3496.00	3575.79		

* RIVER-1	* Reach-1	* 243		* 1%	*	174.57 *			*
174.57 *	1430.00 *	570.20 *	590.99 *	1503.82 *		*	1254.82 *		
1334.49 *	*								
* RIVER-1	* Reach-1	* 243		* Floodway *		175.38 *		0.81 *	
175.42 *	100.00 *	150.19 *	2514.29 *	0.52 *		1235.00 *	1254.82 *		
1334.49 *	1335.00 *								
* RIVER-1	* Reach-1	* 243		* 10%	*	169.31 *		-5.26 *	
169.32 *	1387.92 *	874.34 *	1159.18 *	981.48 *		*	1254.82 *		
1334.49 *	*								
* RIVER-1	* Reach-1	* 243		* 2%	*	172.98 *		-1.59 *	
172.98 *	1430.00 *	645.61 *	706.87 *	1452.52 *		*	1254.82 *		
1334.49 *	*								
* RIVER-1	* Reach-1	* 243		* 0.2%	*	178.47 *		3.91 *	
178.47 *	1430.00 *	397.25 *	373.73 *	1329.02 *		*	1254.82 *		
1334.49 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*				*
*	*								
* RIVER-1	* Reach-1	* 190		* 1%	*	174.56 *			*
174.56 *	1068.78 *	11.55 *	743.81 *	1909.64 *		*	147.22 *		
217.68 *	*								
* RIVER-1	* Reach-1	* 190		* Floodway *		175.29 *		0.73 *	
175.30 *	488.00 *	4.29 *	1182.80 *	1477.91 *		144.00 *	147.22 *		
217.68 *	632.00 *								
* RIVER-1	* Reach-1	* 190		* 10%	*	169.18 *		-5.38 *	
169.19 *	1062.51 *	8.77 *	1207.30 *	1798.93 *		*	147.22 *		
217.68 *	*								
* RIVER-1	* Reach-1	* 190		* 2%	*	172.96 *		-1.60 *	
172.96 *	1066.83 *	10.98 *	847.79 *	1946.23 *		*	147.22 *		
217.68 *	*								
* RIVER-1	* Reach-1	* 190		* 0.2%	*	178.47 *		3.91 *	
178.47 *	1609.35 *	13.39 *	601.21 *	1485.40 *		*	147.22 *		
217.68 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*				*
*	*								
* RIVER-1	* Reach-1	* 182		* 1%	*	174.54 *			*
174.55 *	3419.79 *	962.12 *	2040.88 *	16962.00 *		*	639.94 *		
754.21 *	*								
* RIVER-1	* Reach-1	* 182		* Floodway *		175.28 *		0.73 *	
175.28 *	2380.00 *	338.54 *	2047.59 *	17578.87 *		546.00 *	639.94 *		
754.21 *	2926.00 *								
* RIVER-1	* Reach-1	* 182		* 10%	*	169.15 *		-5.39 *	
169.16 *	2823.72 *	342.94 *	1589.42 *	8562.64 *		*	639.94 *		
754.21 *	*								
* RIVER-1	* Reach-1	* 182		* 2%	*	172.94 *		-1.60 *	
172.95 *	3253.64 *	747.98 *	1914.05 *	14492.97 *		*	639.94 *		
754.21 *	*								
* RIVER-1	* Reach-1	* 182		* 0.2%	*	178.46 *		3.92 *	
178.47 *	3694.00 *	1562.89 *	2382.47 *	23554.64 *		*	639.94 *		
754.21 *	*								
*	*	*	*	*	*				*
*	*	*	*	*	*				*
*	*								
* RIVER-1	* Reach-2	* 180		* 1%	*	174.52 *			*
174.53 *	3408.33 *	5726.09 *	3550.64 *	10688.27 *		*	1363.83 *		
1465.19 *	*								
* RIVER-1	* Reach-2	* 180		* Floodway *		175.26 *		0.73 *	
175.27 *	2384.00 *	4714.23 *	3624.49 *	11626.28 *		696.00 *	1363.83 *		
1465.19 *	3080.00 *								
* RIVER-1	* Reach-2	* 180		* 10%	*	169.11 *		-5.41 *	
169.13 *	2877.45 *	2338.71 *	2873.50 *	5282.79 *		*	1363.83 *		
1465.19 *	*								

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* RIVER-1     * Reach-2     * 180          * 2%       *    172.91 *         -1.61 *
  172.93 *      3300.79 *  4694.70 *   3391.42 *  9068.88 *           *  1363.83 *
1465.19 *           *
* RIVER-1     * Reach-2     * 180          * 0.2%     *    178.45 *          3.92 *
  178.46 *      3620.41 *  8428.02 *   4018.63 * 15053.35 *           *  1363.83 *
1465.19 *           *
*             *             *             *          *          *               *
        *             *          *           *          *          *           *
       *          *
* RIVER-1     * Reach-2     * 170          * 1%       *    174.47 *               *
  174.49 *      3122.88 *  8014.20 *   4393.02 *  7557.78 *           *  1627.88 *
1729.19 *           *
* RIVER-1     * Reach-2     * 170          * Floodway *    175.21 *          0.74 *
  175.23 *      2300.00 *  7803.99 *   4406.88 *  7754.13 *    661.00 *  1627.88 *
1729.19 *   2961.00 *
* RIVER-1     * Reach-2     * 170          * 10%      *    169.00 *         -5.47 *
  169.04 *      2632.32 *  3902.63 *   3837.78 *  2754.59 *           *  1627.88 *
1729.19 *           *
* RIVER-1     * Reach-2     * 170          * 2%       *    172.85 *         -1.62 *
  172.87 *      3039.49 *  6843.31 *   4274.11 *  6037.58 *           *  1627.88 *
1729.19 *           *
* RIVER-1     * Reach-2     * 170          * 0.2%     *    178.41 *          3.94 *
  178.42 *      3306.87 * 10988.85 *   4841.32 * 11669.83 *           *  1627.88 *
1729.19 *           *
*********************************************************************************
*********************************************************************************
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APPENDIX F

AGENCY COORDINATION

Maron, Lindsey

From: Bobby Kiani <mkiani@leonardjackson.net>
Sent: Monday, August 28, 2017 10:43 AM
To: Maron, Lindsey
Cc: Bidari, Raj; jrivera@ci.manassas.va.us; Hannan, Cheryl; Pitney, Eleanore J.
Subject: Revision Request Received- Unincorporated Areas of Prince William County, VA (Case Number 17-03-2321P) - Response Required

Follow Up Flag: Follow up
Flag Status: Completed

Dear Ms. Maron:

We have received your request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the flood hazard information on the applicable National Flood Insurance Program (NFIP) map for Unincorporated Areas of Prince William County, Virginia. This e-mail is being sent to officially acknowledge the receipt of your request and replaces the paper copy acknowledgement letters previously issued by FEMA. We ask that you please respond directly to this e-mail to verify that it has been received.

The case number assigned to your request is 17-03-2321P, and the project identifier is Manassas Regional Airport-Runway 34R Extension Program.

We are reviewing your submitted data and will contact you if additional information is required to process your request. If additional information is not required, we will issue a final letter of determination within 90 days of receiving your request.

If you have general questions about your request, FEMA policy, or the NFIP, please contact the FEMA Map Information eXchange (FMIX), toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, the case reviewer's contact information is listed below, or please contacts the Revisions Coordinator for your State, Ms. Ellie Pitney, at pitneyej@cdmsmith.com or at (303) 383-2318.

Please be assured we will do our best to respond to all inquiries in a timely manner.

Thanks,

Bobby Kiani
Revisions Analyst
LJA, a member of Compass PTS JV
Telephone (347) 670-4616
mkiani@leonardjackson.net

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APPENDIX I

DRAFT EA PUBLIC INVOLVEMENT AND RESPONSES TO COMMENTS

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I.1 NOTICE OF AVAILABILITY

The notice of availability was published in the local newspaper on January 31, 2018. A notice for the availability of the Draft EA was also provided on the Airport's main website, as well as a third party website specific to projects occurring at the Airport.

Fauquier Times | Prince William Times | Gainesville Times
39 CULPEPER ST. WARRENTON, VA 20186 | 540.347.4222 F: 540.349.8676

MANASSAS REGIONAL AIRPORT
10600 HARRY J. PARRISH BLVD
2ND FLOOR
MANASSAS VA 20110
(703)257-8271

Account:	330319
Ad Number:	4763590
Source:	EMAIL
Size:	3 X 9.29
Sales Rep:	JCLG
Words:	476
Lines:	270

Cost of Ad	*Payments*	*Total Due*
233.00	0.00	233.00

Class: LGS LEGALS | *SubClass:* 492 PUBLIC NOTICES

Description: environmental assess

GVTC and PWTC Class	Jan 31
Web Ads Class	Jan 31

AD MAKEUP NOTES



NOTICE OF AVAILABILITY OF DRAFT ENVIRONMENTAL ASSESSMENT (EA)

Pursuant to Title 49, United States Code, § 47106(c)(1)(A), notice is hereby given that the City of Manassas (City), in coordination with the Federal Aviation Administration (FAA), intends to redevelop the west corporate side area and develop a parcel on the east side of the Manassas Regional Airport (Proposed Action). The Proposed Action includes, but is not limited to, development of corporate hangars, t-hangars, apron expansion, maintenance and storage building, wash rack, and extension of utilities and security fence. A Draft Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) has been prepared to disclose the potential economic, social, and environmental impacts of the Proposed Action.

Pursuant to FAA Order 1050.1F and Executive Order 11990, notice is given that the Proposed Action would affect wetlands. Potential impacts and mitigation measures to wetlands are described in the Draft EA. A portion of the Proposed Action is within a 100-year floodplain. Pursuant to FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, and Executive Order 11988, Floodplain Management, notice is given that the Proposed Action constitutes an encroachment into the 100-year floodplain. The potential impacts are described in the Draft EA. While no impacts to historic or cultural resources have been identified, the FAA initiated consultation with the Virginia Department of Historic Resources in compliance with Section 106 of the National Historic Preservation Act. This notice also fulfills any consultation requirements under Section 106.

Copies of the Draft EA will be available for public examination for a 30-day period beginning January 31, 2018 at the following locations: the Manassas Regional Airport Administrative Office, 10600 Harry J. Parish Boulevard, Manassas, VA 20110; the Manassas Regional Airport website http://www.manassasregionalairportprojects.com/; the Central Community Library, 8601 Mathis Avenue, Manassas, VA 20110; and City Hall, 9027 Center Street, Manassas, VA 20110.

Written comments on the information in the Draft EA may be sent to David.Alberts@rsandh.com or addressed to: Mr. David Alberts, RS&H, 10748 Deerwood Park Boulevard South, Jacksonville, FL 32256 or Mr. Juan Rivera, Airport Director, Manassas Regional Airport, 10600 Harry J. Parish Boulevard, Manassas, VA 20110. Electronic and hand-delivered comments must be received no later than 5:00 pm Eastern Time on March 3, 2018. Mailed comments must be postmarked no later than March 3, 2018. Be advised that all comments received including personal identifying information may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

A public workshop to review the project and summary of potential effects and the opportunity to provide comments will be held on Tuesday, February 20, 2018 from 5:00PM to 7:00 PM Eastern Time, in the Manassas Regional Airport Administrative Office Lobby and Conference Room 1 (10600 Harry J. Parish Boulevard, Manassas, VA 20110).

AFFIDAVIT OF PUBLISHER
PURSUANT TO SECTION 8.01-415
OF THE 1950 CODE OF VIRGINIA
AD AMENDED

I *Evelyn Cobert*, being duly sworn deposes and says that the attached order of publication was published in the Gainesville / Prince William Times, a newspaper published in the County of Prince William, State of Virginia, on

1-31-18, _____, _____, _____, _____,

and that deponent is duly authorized agent of the Publisher of said newspaper

Evelyn Cobert

Evelyn Cobert
Advertising Representative
State of Virginia
County of Prince William

COMMONWEALTH of VIRGINIA
IN THE COUNTY OF PRINCE WILLIAM, to-wit:

on 2-5, 2018

Evelyn Cobert
who is known to me and whose name as *Advertising Representative in the County Prince William, State of Virginia,* is signed to the foregoing affidavit, personally appeared before me, a Notary Public in and for the jurisdiction aforesaid, to affirm that the foregoing affidavit was sworn & subscribed to in front of me and executed the same by proper authority.

Jean E Cobert

Notary Public
Notary Registration No. **7274066**
My commission expires: **October 31, 2021**

JEAN E. COBERT COMMONWEALTH OF VIRGINIA NOTARY PUBLIC

Jean E. Cobert
NOTARY PUBLIC
Commonwealth of Virginia
Reg. #7274066
My Commission Expires
October 31, 2021

Public Notices



NOTICE OF AVAILABILITY OF DRAFT ENVIRONMENTAL ASSESSMENT (EA)

Pursuant to Title 49, United States Code, § 47106(c)(1)(A), notice is hereby given that the City of Manassas (City), in coordination with the Federal Aviation Administration (FAA), intends to redevelop the west corporate side area and develop a parcel on the east side of the Manassas Regional Airport (Proposed Action). The Proposed Action includes, but is not limited to, development of corporate hangars, t-hangars, apron expansion, maintenance and storage building, wash rack, and extension of utilities and security fence. A Draft Environmental Assessment (EA) under the National Environmental Policy Act (NEPA) has been prepared to disclose the potential economic, social, and environmental impacts of the Proposed Action.

Pursuant to FAA Order 1050.1F and Executive Order 11990, notice is given that the Proposed Action would affect wetlands. Potential impacts and mitigation measures to wetlands are described in the Draft EA. A portion of the Proposed Action is within a 100-year floodplain. Pursuant to FAA Order 1050.1F, Environmental Impacts: Policies and Procedures, and Executive Order 11988, Floodplain Management, notice is given that the Proposed Action constitutes an encroachment into the 100-year floodplain. The potential impacts are described in the Draft EA. While no impacts to historic or cultural resources have been identified, the FAA initiated consultation with the Virginia Department of Historic Resources in compliance with Section 106 of the National Historic Preservation Act. This notice also fulfills any consultation requirements under Section 106.

Copies of the Draft EA will be available for public examination for a 30-day period beginning January 31, 2018 at the following locations: the Manassas Regional Airport Administrative Office, 10600 Harry J. Parish Boulevard, Manassas, VA 20110; the Manassas Regional Airport website http://www.manassasregionalairportprojects.com/; the Central Community Library, 8601 Mathis Avenue, Manassas, VA 20110; and City Hall, 9027 Center Street, Manassas, VA 20110.

Written comments on the information in the Draft EA may be sent to David.Alberts@rsandh.com or addressed to: Mr. David Alberts, RS&H, 10748 Deerwood Park Boulevard

GROW YOUR BU$INESS

This ad could be working for you.

West Corporate Redevelopment & Eastside Parcel Environmental Assessment

ABOUT THE PROJECT

This Environmental Assessment will analyze impacts associated with the proposed development layout of the Airport's recent West Corporate Redevelopment Study and a 12 acre parcel on the east side of the Airport. The proposed developments include both aviation and non-aviation related elements. Upon completion of this Environmental Assessment and approval from FAA, the Airport will be able to move forward with implementing the proposed improvements.

An electronic version of the Draft EA for the West Corporate Development and East Parcel Development at Manassas Regional Airport is now available. Written comments on the information in the Draft EA may be sent to David.Alberts@rsandh.com or addressed to:

10748 Deerwood Park Boulevard South
Jacksonville, FL 32256

or

Mr. Juan Rivera
Airport Director
Manassas Regional Airport
10600 Harry J. Parish Boulevard
Manassas, VA 20110

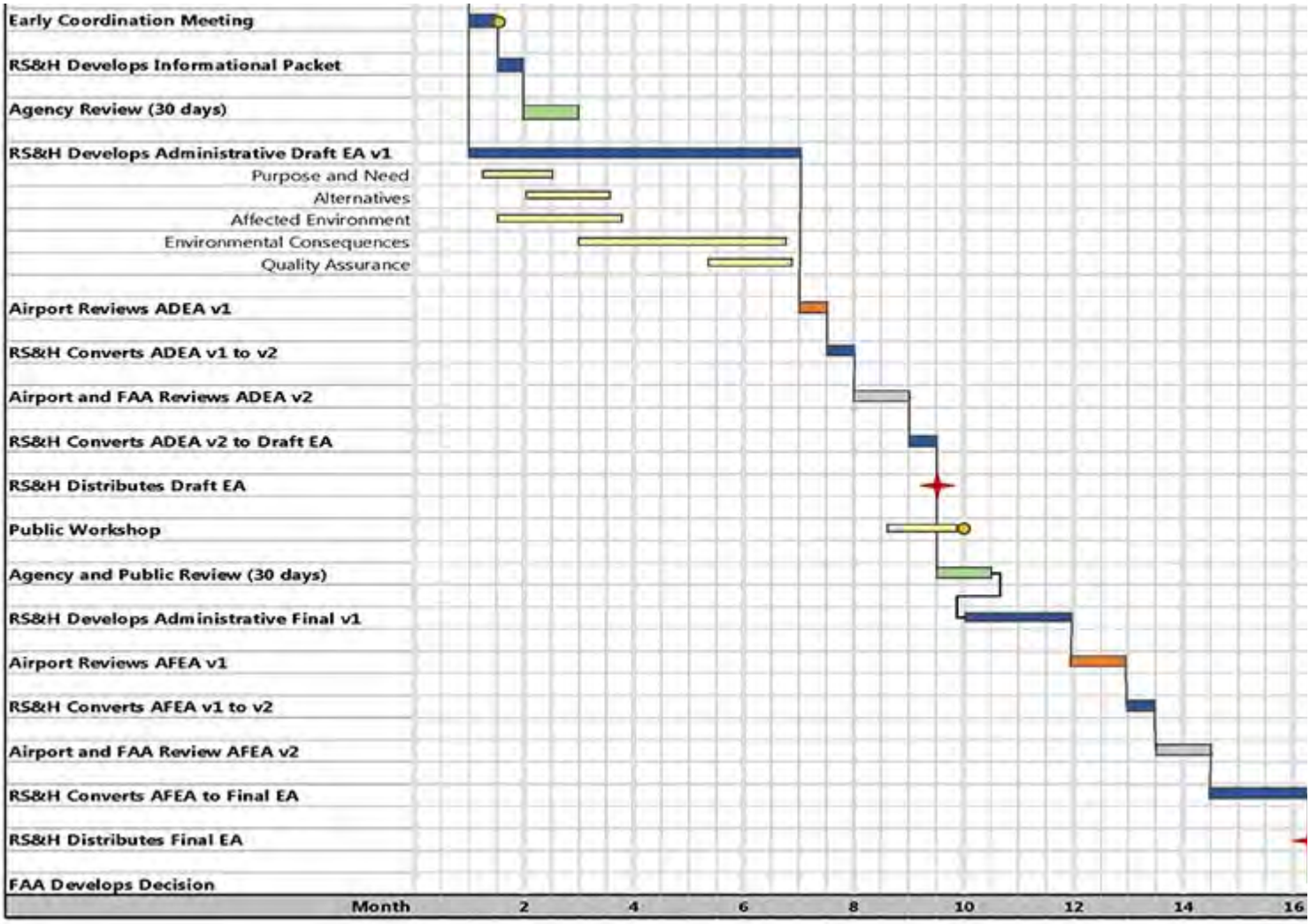
Electronic and hand-delivered comments must be received no later than **5:00 pm Eastern Time on March 3, 2018**. Mailed comments must be postmarked no later than **March 3, 2018**. Be advised that all comments received, including personally identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold your personally identifying information from public review, we cannot guarantee that we will be able to do so.

Manassas Regional Airport Projects

A public workshop will be held on Tuesday, February 20, 2018 from 5:00pm to 7:00pm (EST) to review the project and summary of potential effects, as well as provide the opportunity for the public to submit comments. It will be held in the Manassas Regional Airport Administrative Office Lobby and Conference Room 1 (10600 Harry J. Parish Boulevard, Manassas, VA 20110).



PROJECT SCHEDULE


Early Coordination Meeting
RS&H Develops Informational Packet
Agency Review (30 days)
RS&H Develops Administrative Draft EA v1
Purpose and Need
Alternatives
Affected Environment
Environmental Consequences
Quality Assurance
Airport Reviews ADEA v1
RS&H Converts ADEA v1 to v2
Airport and FAA Reviews ADEA v2
RS&H Converts ADEA v2 to Draft EA
RS&H Distributes Draft EA
Public Workshop
Agency and Public Review (30 days)
RS&H Develops Administrative Final v1
Airport Reviews AFEA v1
RS&H Converts AFEA v1 to v2
Airport and FAA Review AFEA v2
RS&H Converts AFEA to Final EA
RS&H Distributes Final EA
FAA Develops Decision
Month
2
4
6
8
10
12
14
16

I.2 DRAFT EA DISTRIBUTION

The distribution list for the Draft EA is provided below. A copy of the letter provided with each package is also provided in this section.

FEDERAL AGENCIES

FAA (1 CD)
Ms. Susan B. Stafford
Environmental Protection Specialist
Beckley Airports Field Office
176 Airport Circle, Rm 101
Beaver, WV 25813
304-252-6216 x 130

FAA (1 Hardcopy)
Mr. Matthew Thys
Manager
Washington Airports District Office
23723 Air Freight Ln., Suite 210
Dulles, VA 20166
(703) 661-1355

USEPA (1 hardcopy + 1 CD)
Ms. Barbara Okorn
NEPA Reviewer
USEPA Region 3 (3EA30)
1650 Arch Street
Philadelphia, PA 19103
(215) 814-3330

FEMA (1 hardcopy + 1 CD)
Ms. Amanda Ciampolillo
Environment & Historic Preservation Contact
FEMA Region III
615 Chestnut Street
One Independence Mall, Sixth Floor
Philadelphia, PA 19106
(215) 931-5500

USACE (1 hardcopy + 1 CD)
Mr. Tucker Smith
Chief, Northern Section
United States Army Corps of Engineers
803 Front Street
Norfolk, VA 23510
(757) 201-7727

STATE AGENCIES

VDEQ (1 hardcopy + electronic submittal)
Ms. Valerie Fulcher
Office of Environmental Impact Review
Virginia Department of Environmental Quality
629 East Main Street, 6th Floor
Richmond, VA 23219
(804) 698-4330

Virginia Department of Aviation (1 hardcopy + 1 CD)
Ms. Susan Simmers
Airport Services Division
Virginia Department of Aviation
5702 Gulfstream Road
Richmond, VA 23250
804-236-3627

LOCAL AGENCIES

Manassas Regional Airport (2 hardcopies + 10 comment forms + 1 CD)
Mr. Juan Rivera
Airport Director
10600 Harry J. Parish Blvd.
Manassas, VA 20110
(703) 361-1882

City of Manassas City Hall (1 hardcopy + 10 comment forms)
Andrea P. Madden
9027 Center Street
Manassas, VA 20110
703-257-8200

Central Community Library (1 hardcopy + 10 comment forms)
Ms. Donna Horning
8601 Mathis Avenue
Manassas, VA 20110
(703) 792-8360

Prince William County (1 hardcopy + 1 CD)
Mr. David J. McGettigan, AICP
Long Range Planning Manager
Planning Division
Prince William County
5 County Complex Court, Suite 210
Prince William, VA 22192
(703) 792-7615

Prince William County (1 hardcopy + 1 CD)
Mr. Raj Bidari
Department of Public Works
Prince William County
5 County Complex Court
Prince William, Virginia 22192
(703) 792-7078

Prince William County (1 hardcopy + 1 CD)
Jacob Renaud, P.E.
Stormwater Program Manager
City of Manassas
8500 Public Works Drive
Manassas, Virginia 20110
(703) 257-8228

10748 Deerwood Park Boulevard S
Jacksonville, Florida 32256

O 904-256-2500
F 904-256-2501
rsandh.com

[DATE]

[NAME]
[ADDRESS]
[ADDRESS LINE 2]

RE: Manassas Regional Airport
Draft Environmental Assessment for West Corporate Development and East Parcel Development

Dear [Mr./Ms.],

In compliance with Federal Aviation Administration (FAA) policy and procedures (FAA Orders 1050.1F and 5050.4B) for implementing the National Environmental Policy Act, as amended (42 United States Code 4321 et seq.), the City of Manassas (City), is announcing the availability of, and requesting comments on, the *Draft Environmental Assessment (EA) for West Corporate Development and East Parcel Development at Manassas Regional Airport*. The Draft EA was prepared to analyze the potential environmental impacts of the City's proposal to redevelop the west corporate side area and develop a parcel on the east side of the Manassas Regional Airport (Proposed Action). The Proposed Action includes, but is not limited to, development of corporate hangars, t-hangars, apron expansion, maintenance and storage building, wash rack, and extension of utilities and security fence.

Pursuant to FAA Order 1050.1F and Executive Order 11990, notice is given that the Proposed Action would affect wetlands. Potential impacts and mitigation measures to wetlands are described in the Draft EA. A portion of the Proposed Action is within a 100-year floodplain. Pursuant to FAA Order 1050.1F, *Environmental Impacts: Policies and Procedures*, and Executive Order 11988, Floodplain Management, notice is given that the Proposed Action constitutes an encroachment into the 100-year floodplain. The potential impacts are described in the Draft EA. While no impacts to historic or cultural resources have been identified, the FAA initiated consultation with the Virginia Department of Historic Resources in compliance with Section 106 of the National Historic Preservation Act. This notice also fulfills any consultation requirements under Section 106.

All interested parties are invited to provide comments concerning the content of the Draft EA by March 3, 2018. Comments should be as specific as possible and should address the analysis of potential environmental impacts and the adequacy of the Proposed Action or merits of alternatives being considered. Reviewers should organize their comments to be meaningful and inform the City of their interest and concerns by quoting or providing specific references to the text of the Draft EA. Matters that could have been raised with specificity during the comment period on the Draft EA may not be considered if they are raised for the first time later in the decision process. This commenting procedure is intended to ensure that substantive comments and concerns are made available to the City in a timely manner so that the City has an opportunity to address them.

Written comments may be submitted to the Airport, Attn. Mr. Juan Rivera, Airport Director, Manassas Regional Airport, 10600 Harry J. Parish Boulevard, Manassas, VA 20110 or mailed to RS&H, Inc. Attn. Mr. David Alberts, 10748 Deerwood Park Boulevard South, Jacksonville, FL 32256. Comments may also be submitted by email to david.alberts@rsandh.com.

A public workshop to review the project and summary of potential effects and the opportunity to provide comments will be held on Tuesday, February 20, 2018 from 5:00PM to 7:00 PM Eastern Time, in the Manassas Regional Airport Administrative Office Lobby and Conference Room 1 (10600 Harry J. Parish Boulevard, Manassas, VA 20110).

Sincerely,

David Alberts, Project Manager

I.3 PUBLIC WORKSHOP MATERIALS

The following pages show the sign-in sheet for the public workshop, as well as the poster boards and comment form.

Manassas Regional Airport
West Corporate Development
Draft Environmental Assessment

Public Workshop

Location: Manassas Regional Airport

Date: February 20, 2018

Name (Please Print)	Organization	Address	EMAIL
Natalie Heath	RS&H		natalie.heath@rsandh.com
Lindsey Maron	RS+H		lindsey.maron@rsandh.com
DAVID ARSENTS	RS+H		DAVID.ARSENTS@RSANDH.COM
Jim PORTER	FREEDOM MUSEUM		freedommuseum@gmail.com
Danny Miller	EAA	West Side	president@eaa186.org
Joe Gardner	Dulles Aviation	10501 OBSERVATION RD MANASSAS	JOE@DULLESAVIATION.COM
Jolene Berry	Airport		jberry@manassasva.gov
Amanda Sheridan	RS+H		amanda.sheridan@rsandh.com

West Corporate Development and East Parcel Development

MANASSAS REGIONAL AIRPORT



PUBLIC WORKSHOP HANDOUT

MANASSAS REGIONAL AIRPORT

RS&H

Purpose and Need

- Purpose
  - Develop and maintain safe and modern facilities
  - Improve financial self-sustainability
- Need
  - On-Airport roadway and airfield pavement deficiencies
  - Insufficient building/hangar space
  - Underutilization of Airport property

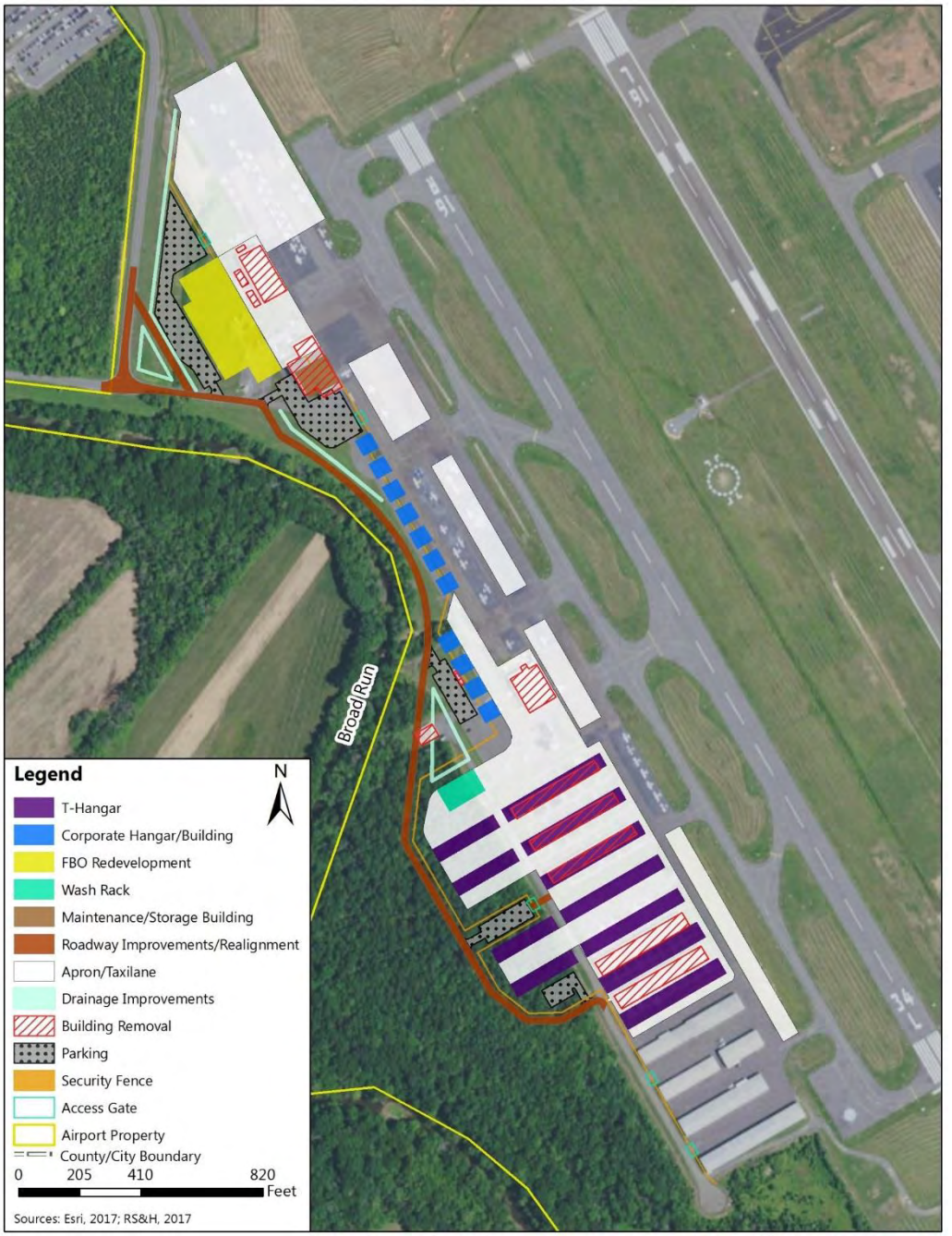






Proposed Action

- West Corporate Development Area
  - On-Airport roadway improvements
  - FBO building and parking lot reconstruction
  - Corporate hangar/building and parking lot construction
  - T-hangar demolition/replacement and construction and T-hangar parking lot
  - Aircraft apron expansion
  - Maintenance and storage building expansion
  - Wash rack construction
  - Utilities extension and stormwater drainage improvements
  - Security fence extension

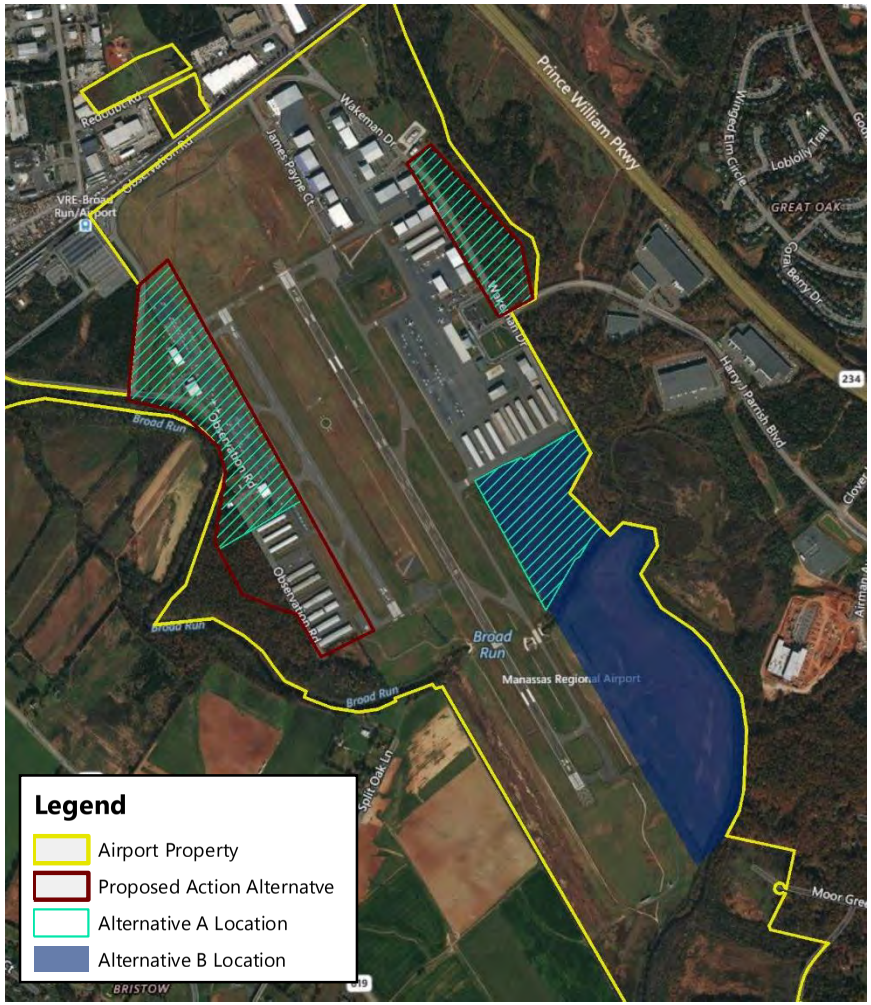


Proposed Action

- East Parcel Development Area:
  - On-Airport roadway improvements
  - Corporate hangar/building and parking lot construction
  - Taxilane Extension
  - Utilities extension and stormwater drainage improvements
  - Security fence extension



Alternatives Analysis



This figure is for graphic purposes only and is not to scale.

- Alternative Location Considerations
  - Developable on-Airport land
    - *Avoidance of Part 77 surfaces and runway protection zone*
  - Avoidance / minimization of 100-year floodplain
    - *Avoid, to the greatest extent possible, the long- and short-term adverse effects associated with use and/or modification of the 100-year floodplain*
- Alternatives retained for analysis
  - Proposed Action
  - No Action Alternative
- Alternatives dismissed
  - Alternative A (greater floodplain impact than the Proposed Action Alternative)
  - Alternative B (greater floodplain impact than the Proposed Action Alternative)

NEPA Environmental Resource Categories and Summary of Environmental Findings

- Air Quality
  - Implementation of best management practices during construction
  - Emissions would remain below *de minimis* thresholds
- Biological Resources (including Fish, Wildlife, and Plants)
  - No impacts to any protected species
- Climate
  - Implementation of best management practices
- Coastal Resources
  - Wakeman Drive realignment potentially intersects Resource Protection Area
- Department of Transportation Act, Section 4(f)
  - No impact to Section 4(f) resources
- Farmlands
  - No impact to farmland
- Hazardous Materials, Solid Waste, and Pollution Prevention
  - Short-term, temporary increase in the storage and use of hazardous materials (e.g., diesel fuel)
  - Implementation of best management practices during construction and operation
- Historical, Architectural, Archaeological, and Cultural Resources
  - No impact to historical, architectural, archaeological, or cultural resources
- Land Use
  - No impact to land use
- Natural Resources and Energy Supply
  - Short-term increase in consumable material use during construction
  - Long-term increase in energy requirements
  - Sustainable design considerations

MANASSAS REGIONAL AIRPORT

RS&H

NEPA Environmental Resource Categories and Summary of Environmental Findings (Continued)

- Noise and Noise-Compatible Land Use
  - No impact to noise or noise-compatible land use
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks
  - Short-term, temporary increase in traffic from construction-related vehicles
  - No disproportionate effects to any population
  - No impact to children's environmental health and safety risks
- Visual Effects (including Light Emissions)
  - No visual effects
- Water Resources
  - Wetlands:
    - *1.62 acres affected (Obtain appropriate permits from federal and state agencies)*
    - *Purchase mitigation credits (anticipated 3.2 credits)*
- Water Resources (continued)
  - Floodplains:
    - *2.7 acres of the 100-year floodplain affected*
    - *19.9 acres of the regulatory floodway affected*
    - *Establishment of a floodplain mitigation area*
    - *Ongoing coordination with the Federal Emergency Management Agency to obtain a Conditional Letter of Map Revision*
  - Surface Water & Groundwater
    - *Obtain a Virginia Pollutant Discharge Elimination System permit for construction and operation activities to reduce surface water and groundwater impacts*
  - Wild & Scenic Rivers
    - *No impact to wild and scenic rivers*
  - Implementation of best management practices during construction to reduce effects to water resources
- Cumulative
  - No increase in effects when considered with other past, present, and reasonably foreseeable future projects

MANASSAS REGIONAL AIRPORT

RS&H

How to Provide Comments on the Draft EA

- Fill out comment form this evening
- Send written comments via U.S. mail (must be postmarked March 3, 2018) to:

Mr. David Alberts
RS&H, Inc.
10748 Deerwood Park Blvd South
Jacksonville, FL 32256

or

Mr. Juan Rivera
Airport Director
10600 Harry J. Parish Blvd
Manassas, VA 20110

- Send written comments via email to:

Mr. David Alberts
david.alberts@rsandh.com

City of Manassas / Manassas Regional Airport
West Corporate Development and
East Parcel Development Environmental Assessment
Public Workshop - Comment Form

The City of Manassas (City) has prepared the Draft Environmental Assessment (EA) for West Corporate Development and East Parcel Development at Manassas Regional Airport. The Draft EA analyzes the potential environmental impacts of the City's proposal to redevelop the west corporate side area and develop a parcel on the east side of the Manassas Regional Airport (Proposed Action). The Proposed Action includes, but is not limited to, development of corporate hangars, t-hangars, apron expansion, maintenance and storage building, wash rack, and extension of utilities and security fence.

Comments:

Comments are not limited to this form. Please attach any additional sheets as necessary.

Name: _____

Address: _____

City, State, Zip: _____

Email: _____

Comments on the Draft EA will be accepted through March 3, 2018.

Before including your address, phone number, e-mail address, or other personal identifying information in your comment, be advised that your entire comment – including your personal identifying information – may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so. Written comments may be mailed to the Airport, Attn. Mr. Juan Rivera, Airport Director, Manassas Regional Airport, 10600 Harry J. Parish Boulevard, Manassas, VA 20110 or mailed to RS&H, Inc. Attn. Mr. David Alberts, 10748 Deerwood Park Boulevard South, Jacksonville, FL 32256. Comments may also be submitted by email to david.alberts@rsandh.com. A public workshop to review the project and summary of potential effects and the opportunity to provide comments will be held on Tuesday, February 20, 2018 from 5:00PM to 7:00 PM Eastern Time, in the Manassas Regional Airport Administrative Office Lobby and Conference Room 1 (10600 Harry J. Parish Boulevard, Manassas, VA 20110).

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I.4 COMMENTS RECEIVED AND RESPONSES TO COMMENTS

Letter 1

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 1111 East Main Street, Suite 1400, Richmond, VA 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

February 28, 2018

Mr. Juan Rivera, Director
Manassas Regional Airport
10600 Harry J. Parrish Blvd.
Manassas, VA 20110

RE: Comments on the Draft Environmental Assessment for the Manassas Regional Airport West Corporate Development and East Parcel Development, City of Manassas and Prince William County, DEQ 18-022F

Dear Mr. Rivera:

The Commonwealth of Virginia has completed its review of the above-referenced document. The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents submitted under the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. This is in response to the January 2018 Draft Environmental Assessment (EA) for the above-referenced project. The following agencies participated in the review of this proposal:

Department of Environmental Quality (DEQ)
Department of Conservation and Recreation (DCR)
Department of Historic Resources (DHR)
Department of Health (VDH)
Department of Aviation (DOAV)

In addition, Department of Game and Inland Fisheries (DGIF), Department of Forestry, Marine Resources Commission, Department of Transportation, the Northern Virginia Regional Commission, the City of Manassas and Prince William County were invited to comment on the proposal.

Letter 1 Continued (Page 2/33)

Manassas Regional Airport
West Corporate Development and East Parcel Development
DEQ #18-022F

PROJECT DESCRIPTION

The City of Manassas is seeking approval from the Federal Aviation Administration (FAA) for the Manassas Regional Airport West Corporate Development and East Parcel Development project. The city owns and operates the airport which intersects the jurisdictional boundaries of the City of Manassas and Prince William County with approximately 20 acres of land on the east side of the airport being located within the limits of the county. The airport has a terminal building, fixed base operator (FBO) hangars/buildings and various corporate and general aviation hangars. The airport has two runways, Runway 16L/34R (6,000 feet long by 100 feet wide) and Runway 16R/34L (3,704 feet long by 100 feet wide). The West Corporate Area development involves on-airport roadway improvements, reconstruction of the FBO building and parking lot, construction of eleven new corporate hangars, buildings and associated parking lots, the demolition and replacement of five T-hangars, the expansion of the west aircraft apron and taxilane tie down parking, a taxilane extension, the construction of a maintenance and storage building and a wash rack, extension of utilities and stormwater drainage improvements, and a security fence extension. The East Parcel development includes on-airport roadway improvements (Wakeman Drive realignment), the construction of a corporate hangar, building, and parking lot, extension of a taxilane and utilities connections, stormwater drainage improvements, and a security fence extension. The project study area which encompasses the area that may be affected by the proposed project is 160 acres.

This project was previously reviewed for federal consistency under DEQ project #17-061F. The Federal Consistency Certification and DEQ's response is included in Appendix F of the Draft EA. DEQ concurred that the proposal is consistent with the enforceable policies of the Virginia Coastal Zone Management Program provided the City obtained all required permits and authorizations with respect to erosion and sediment control, coastal lands management, wetlands impacts and air pollution control.

ENVIRONMENTAL IMPACTS AND MITIGATION

1. Water Quality and Wetlands. According to the Draft EA (page 5-23), the proposed west side corporate development would affect 0.02-acre of palustrine emergent wetlands and 1.60 acres of palustrine forested wetlands on the west side of the airport. The impact to the 1.60 acres of palustrine forested wetlands is associated with mitigation for potential floodway and floodplain impacts in the City of Manassas. The City will purchase 3.2 wetland bank credits to mitigate the impacts. All required permits would be obtained prior to the start of ground disturbance.

1(a) Agency Jurisdiction. The State Water Control Board promulgates Virginia's water regulations covering a variety of permits to include the Virginia Pollutant Discharge Elimination System Permit (VPDES) regulating point source discharges to surface waters, Virginia Pollution Abatement Permit regulating sewage sludge, storage and land

2

Letter 1 Continued (Page 3/33)

application of biosolids, industrial wastes (sludge and wastewater), municipal wastewater, and animal wastes, the Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit regulating impacts to streams, wetlands, and other surface waters. The VWP permit is a state permit which governs wetlands, surface water, and surface water withdrawals and impoundments. It also serves as §401 certification of the federal Clean Water Act §404 permits for dredge and fill activities in waters of the U.S. The VWP Permit Program is under the Office of Wetlands and Stream Protection, within the DEQ Division of Water Permitting. In addition to central office staff that review and issue VWP permits for transportation and water withdrawal projects, the six DEQ regional offices perform permit application reviews and issue permits for the covered activities:

- Clean Water Act, §401;
- Section 404(b)(i) Guidelines Mitigation Memorandum of Agreement (2/90);
- State Water Control Law, Virginia Code section 62.1-44.15:20 *et seq.*; and
- State Water Control *Regulations*, 9 VAC 25-210-10.

1 **1(b) Agency Findings.** The DEQ Northern Regional Office (NRO) states that upon receipt of a Joint Permit Application for the proposed surface water impacts, DEQ VWP Permit staff will review the proposed project in accordance with the VWP permit program regulations and current VWP permit program guidance.

The VMRC did not comment on the proposal.

2 **1(c) Agency Recommendation.** DEQ VWP Program staff recommends that the project sponsor:

- Avoid and minimize impacts to surface waters to the maximum extent practicable; and
- Coordinate with the U.S. Army Corp of Engineers on wetlands impacts.

3 To minimize unavoidable impacts to wetlands and waterways, DEQ recommends the following practices:

- Operate machinery and construction vehicles outside of stream-beds and wetlands; use synthetic mats when in-stream work is unavoidable.
- Preserve the top 12 inches of trench material removed from wetlands for use as wetland seed and root-stock in the excavated area.
- Design erosion and sedimentation controls in accordance with the most current edition of the Virginia Erosion and Sediment Control Handbook. These controls should be in place prior to clearing and grading, and maintained in good working order to minimize impacts to State waters. The controls should remain in place until the area is stabilized.
- Place heavy equipment, located in temporarily impacted wetland areas, on mats, geotextile fabric, or use other suitable measures to minimize soil disturbance, to

Letter 1 Continued (Page 4/33)

3 (continued)

the maximum extent practicable.

- Restore all temporarily disturbed wetland areas to pre-construction conditions and plant or seed with appropriate wetlands vegetation in accordance with the cover type (emergent, scrub-shrub, or forested). The applicant should take all appropriate measures to promote revegetation of these areas. Stabilization and restoration efforts should occur immediately after the temporary disturbance of each wetland area instead of waiting until the entire project has been completed.
- Place all materials which are temporarily stockpiled in wetlands, designated for use for the immediate stabilization of wetlands, on mats, geotextile fabric in order to prevent entry in State waters. These materials should be managed in a manner that prevents leachates from entering state waters and must be entirely removed within thirty days following completion of that construction activity. The disturbed areas should be returned to their original contours, stabilized within thirty days following removal of the stockpile, and restored to the original vegetated state.
- Flag or clearly mark all non-impacted surface waters within the project or right-of-way limits that are within 50 feet of any clearing, grading, or filling activities for the life of the construction activity within that area. The project proponent should notify all contractors that these marked areas are surface waters where no activities are to occur.
- Employ measures to prevent spills of fuels or lubricants into state waters.

4

1(d) Requirement. Submit a Joint Permit Application (JPA) to VMRC (see Item 2(c) below for information on the JPA process) for the proposed impacts to surface waters and wetlands to obtain a VWP permit, as necessary.

2. Subaqueous Lands and Tidal Wetlands. Documentation in Appendix F (Federal Consistency Certification) of the Draft EA indicates that subaqueous lands will be impacted.

2(a) Agency Jurisdiction. The Virginia Marine Resources Commission (VMRC) regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands pursuant to Virginia Code §28.2-1200 through 1400. For nontidal waterways, VMRC states that it has been the policy of the Habitat Management Division to exert jurisdiction only over the beds of perennial streams where the upstream drainage area is 5 square miles or greater. The beds of such waterways are considered public below the ordinary high water line.

2(b) Agency Findings. VMRC did not comment on the draft EA.

5

2(c) Requirement. Submit a JPA to VMRC for the proposed impacts to subaqueous lands. The VMRC serves as the clearinghouse for the JPA used by the:

- Corps for issuing permits pursuant to Section 404 of the Clean Water Act and

Letter 1 Continued (Page 5/33)

5 (continued)

Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a VWP permit;
- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands; and
- local wetlands board for impacts to wetlands.

The VMRC will distribute the completed JPA to the appropriate agencies. Each agency will conduct its review and respond. Upon receipt of the JPA, VMRC will determine whether a permit is necessary.

3. Erosion and Sediment Control and Stormwater Management. The Draft EA (page 5-29) states that the project would increase impervious surfaces on the property by approximately 25 acres. The project will comply with Virginia's Erosion and Sediment Control law and Stormwater Management Law, as locally administered. Best Management Practices (BMPs) including dry swales, bioretention, infiltration and sheet flow to open space would be utilized to minimize impacts to surface waters.

3(a) Agency Jurisdiction. The DEQ Office of Stormwater Management administers the following laws and regulations governing construction activities:
- Virginia Erosion and Sediment Control (ECS) Law (§ 62.1-44.15:51 *et seq.*) and Regulations (9VAC25-840) (VESCL&R);
- Virginia Stormwater Management Act (§ 62.1-44.15:24 *et seq.*) (VSWML);
- Virginia Stormwater Management Program (VSMP) regulation (9VAC25-870) (VSWMR); and
- 2014 General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities (9VAC25-880).

In addition, DEQ is responsible for the Virginia Stormwater Management Program (VSMP) General Permit for Stormwater Discharges from Construction Activities related to Municipal Separate Storm Sewer Systems (MS4s) and construction activities for the control of stormwater discharges from MS4s and land disturbing activities under the Virginia Stormwater Management Program (9VAC25-890-40).

3(b) Requirements.

6

3(b)(i) Erosion and Sediment Control Plan. The City of Manassas is responsible for submitting a project-specific erosion and sediment control (ESC) plan to the locality in which the project is located for review and approval pursuant to the local ESC requirements, if the project involves a land-disturbing activity equal to or greater than 10,000 square feet (2,500 square feet in a Chesapeake Bay Preservation Area). Depending on local requirements the area of land disturbance requiring an ESC plan may be less. The ESC plan must be approved by the locality prior to any land-disturbing activity at the project site. All regulated land-disturbing activities associated with the project, including on and off site access roads, staging areas, borrow areas, stockpiles,

Letter 1 Continued (Page 6/33)

6 (continued) and soil intentionally transported from the project, must be covered by the project specific ESC plan. Local ESC program requirements must be requested through the locality.

7 **3(b)(ii) Stormwater Management Plan.** Depending on local requirements, a Stormwater Management (SWM) plan may be required. Local SWM program requirements must be requested through the locality.

8 **3(b)(iii) General Permit for Stormwater Discharges from Construction Activities (VAR10).** The operator or owner of a construction activity involving land disturbance of equal to or greater than 1 acre is required to register for coverage under the General Virginia Pollutant Discharge Elimination System (VPDES) Permit for Discharges of Stormwater from Construction Activities and develop a project specific stormwater pollution prevention plan (SWPPP). The SWPPP must be prepared prior to submission of the registration statement for coverage under the General Permit and the SWPPP must address water quality and quantity in accordance with the *Virginia Stormwater Management Program Regulations*. General information and registration forms for the General Permit are available on DEQ's website at: www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/ConstructionGeneralPermit.aspx.

9 **3(c) Agency Recommendations.** Consider utilizing permeable paving for parking areas and walkways, where appropriate. Denuded areas should be promptly revegetated following construction.

4. Air Pollution Control. The Draft EA (page 5-2) indicates a temporary increase in emissions from construction equipment, demolition and paving activities is expected to occur. These temporary impacts are not expected to have a significant impact on air quality. Long-term vehicular traffic to the airport is expected to increase as a result of the project due to increased employment at the airport, though the anticipated new employees likely already reside and commute within the region.

4(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that implement Virginia's Air Pollution Control Law (Virginia Code §10.1-1300 *et seq.*). DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate DEQ regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for compliance. In the case of certain projects,

Letter 1 Continued (Page 7/33)

additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

The Air Division regulates emissions of air pollutants from industries and facilities and implements programs designed to ensure that Virginia meets national air quality standards. The most common regulations associated with major projects are:

- Open burning: 9 VAC 5-130 *et seq.*
- Fugitive dust control: 9 VAC 5-50-60 *et seq.*
- Permits for fuel-burning equipment: 9 VAC 5-80-1100 *et seq.*

10 **4(b) Agency Findings.** According to the DEQ Air Division, the project site is located in a designated ozone nonattainment area and an emission control area for oxides of nitrogen (NO_x) and volatile organic compounds (VOCs).

11 **4(c) Recommendation.** Precautions should be taken to restrict the emissions of VOCs and NOx during construction.

4(d) Requirements.

12 **4(d)(i) Fugitive Dust.** During construction, fugitive dust must be kept to a minimum by using control methods outlined in 9 VAC 5-50-60 *et seq.* of the *Regulations for the Control and Abatement of Air Pollution*. These precautions include, but are not limited to, the following:

- Use, where possible, of water or chemicals for dust control;
- Installation and use of hoods, fans, and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

13 **4(d)(ii) Open Burning.** If project activities include the open burning of construction material or the use of special incineration devices, this activity must meet the requirements under 9 VAC 5-130 *et seq.* of the *Regulations* for open burning, and may require a permit. The *Regulations* provide for, but do not require, the local adoption of a model ordinance concerning open burning. The applicant should contact locality officials to determine what local requirements, if any, exist.

14 **4(d)(iii) Fuel-Burning Equipment.** Installation/ operation/ modification of fuel-burning equipment (boilers, generators, compressors, etc.) or any other air-pollution-emitting equipment may be subject to registration or permitting requirements (9 VAC 5-80-1100 *et seq*).

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15 **4(d)(iv) Asphalt Paving.** A precaution, which typically applies to road construction and paving work (9 VAC 5-45-780 *et seq.*), places limitations on the use of "cut-back" (liquefied asphalt cement, blended with petroleum solvents), and may apply to the project. The asphalt must be "emulsified" (predominantly cement and water with a small amount of emulsifying agent) except when specified circumstances apply. Moreover, there are time-of-year restrictions on its use from April through October in VOC emission control areas.

5. Solid and Hazardous Wastes and Hazardous Materials. The Draft EA (page 5-12) states that construction activities would temporarily increase on-site hazardous waste storage, primarily consisting of diesel fuel. The construction would result in a short-term, temporary increase in the quantity of solid waste generated at the airport. The contractor would be responsible for disposing of any waste in accordance with federal state, and local laws and regulations.

5(a) Agency Jurisdiction. On behalf of the Virginia Waste Management Board, the DEQ Division of Land Protection and Revitalization is responsible for carrying out the mandates of the Virginia Waste Management Act (Virginia Code §10.1-1400 *et seq.*), as well as meeting Virginia's federal obligations under the Resource Conservation and Recovery Act and the Comprehensive Environmental Response Compensation Liability Act , commonly known as Superfund. The DEQ Division of Land Protection and Revitalization also administers those laws and regulations on behalf of the State Water Control Board governing Petroleum Storage Tanks (Virginia Code §62.1-44.34:8 *et seq.*), including Aboveground Storage Tanks (9VAC25-91 *et seq.*) and Underground Storage Tanks (9VAC25-580 *et seq.* and 9VAC25-580-370 *et seq.*), also known as 'Virginia Tank Regulations', and § 62.1-44.34:14 et. seq. which covers oil spills.

Virginia:

- Virginia Waste Management Act, Virginia Code § 10.1-1400 *et seq.*
- *Virginia Solid Waste Management Regulations*, 9 VAC 20-81
  - (9 VAC 20-81-620 applies to asbestos-containing materials)
- *Virginia Hazardous Waste Management Regulations*, 9 VAC 20-60
  - (9 VAC 20-60-261 applies to lead-based paints)
- *Virginia Regulations for the Transportation of Hazardous Materials*, 9 VAC 20-110.

Federal:

- Resource Conservation and Recovery Act (RCRA), 42 U.S. Code sections 6901 *et seq.*
- U.S. Department of Transportation *Rules for Transportation of Hazardous Materials*, 49 *Code of Federal Regulations*, Part 107
- Applicable rules contained in Title 40, *Code of Federal Regulations*.

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5(b) Agency Findings. DEQ's Division of Land Protection and Revitalization (DLPR) conducted a search of its solid and hazardous waste databases (2,000-foot radius), including petroleum release sites, in the project area vicinity to identify waste sites in close proximity to the area. A number of sites of concern were identified in close proximity to the airport or within airport property.

Hazardous Waste/RCRA Facilities

1. VAD988212643, Tri-State Tours, 10680 Wakeman Court, Manassas, VA 22110. Small quantity generator (SQG)
2. VA0000347922, Wilcox Woodworks, 10687 Wakeman Court, Manassas, VA 22110. SQG
3. VAR000506774, Corfu Contractors, 10599 Residence Road, Manassas, VA 20136. SQG

Petroleum Releases

16

1. PC#20013062, Manassas Airport – New Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/25/2000. Status: Closed.

   *PC#19910187, Dulles Aviation Incorporated – Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 08/21/1990. Status: Closed.

   *PC#19993317, Manassas Municipal Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 03/22/1999. Status: Closed.

   *PC#19973688, Manassas Airport – Old Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/05/1996. Status: Closed.

   *PC#19870385, Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 12/09/1986. Status: Closed.

2. PC#19900438, VDOT – Manassas Area Headquarters Shop, 10228 Residency Road, Manassas, VA 22110. Release Date: 10/16/1989. Status: Closed.

*denotes the same address

5(c) Requirements.

17

5(c)(i) Contaminated Waste. Any soil that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable federal, state, and local laws and regulations. All construction and demolition debris must be

9

Letter 1 Continued (Page 10/33)

17 (continued) characterized in accordance with the *Virginia Hazardous Waste Management Regulations* prior to disposal at an appropriate facility.

18 **5(c)(ii) Petroleum Release Sites and Storage.** If evidence of a petroleum release is discovered, it must be reported to DEQ, as authorized by Virginia Code § 62.1-44.34.8 through 9 and 9 VAC 25-580-10 *et seq*.

The installation and use of an aboveground storage tank (>660 gallons) for temporary fuel storage (>120 days) during the project must follow the requirements in 9 VAC 25-91-10 *et seq*.

19 **5(c)(iii) Asbestos and Lead-Based Paint.** All structures being demolished/renovated/removed must be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP materials are identified all federal and state requirements must be followed.

20 **5(d) Agency Recommendation.** DEQ recommends that the applicant implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

The DEQ's Pollution Complaint (PC) cases identified above (petroleum releases) should be further evaluated by the project engineer or manager to establish the exact location, nature and extent of the petroleum release and the potential to impact the proposed project. The project engineer or manager may contact the DEQ's Northern Virginia Regional Office at (703) 583-3800 (Tanks Program) for further information about the PC cases.

6. Natural Heritage Resources. The Draft EA (page 5-4) states that approximately 17 acres of previously undeveloped habitat will be disturbed. Some of the habitat is previously graded and mowed grassland. No evidence of federal-listed or state-listed species have been observed in the proposed area of disturbance.

6(a) Agency Jurisdiction.

(i) The Virginia Department of Conservation and Recreation's (DCR) Division of Natural Heritage (DNH). DNH's mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act (Virginia Code §10.1-209 through 217), authorized DCR to maintain a statewide database for conservation planning and project review, protect land for the conservation of biodiversity, and the protect and ecologically manage the natural heritage resources of Virginia (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

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(ii) The Virginia Department of Agriculture and Consumer Services (VDACS): The Endangered Plant and Insect Species Act of 1979 (Virginia Code Chapter 39 §3.1-1020 through 1030) authorizes VDACS to conserve, protect and manage endangered and threatened species of plants and insects. Under a Memorandum of Agreement established between VDACS and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species.

6(b) Agency Findings. DCR DNH found that the Broad Run Stream Conservation Unit (SCU) is adjacent to the project site. The Broad Run SCU has been given a biodiversity ranking of B3, which represents a site of high significance. Natural heritage resources associated with this site are:

Alasmidonta varicosa	Brook floater	G3/S1/NL/LE
Elliptio lanceolata	Yellow lance	G2G3/S2S3/SOC/NL

21 The Brook floater is currently listed as endangered by DGIF. The Yellow lance is currently classified as a species of concern by the United States Fish and Wildlife Service (USFWS); however, this designation has no official legal status. In addition, Broad Run has been designated by the DGIF as a "Threatened and Endangered Species Water" for the Brook floater. According to DCR's species distribution model, the potential may exist for the Dwarf wedgemussel (*Alasmidonta heterodon*, G1G2/S1/LE/LE) adjacent to the project area.

Refer to the attached DCR memorandum dated February 15, 2018 for more details about the identified species.

22 **6(b)(i) State-listed Plant and Insect Species.** The current activity will not affect any documented state-listed plants or insects.

23 **6(b)(ii) State Natural Area Preserves.** There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

24 **6(c) Recommendations.** To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations.

Contact DCR DNH to secure updated information on natural heritage resources if the scope of the project changes and/or six months has passed before it is utilized. New and updated information is continually added to the Biotics Data System.

6(d) Additional Information. The DGIF maintains a database of wildlife locations,

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including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

7. Historic Impacts. The Draft EA (page 5-13) indicates that DHR concurred with the FAA that the proposed action would have no adverse effect on historic properties with the condition that protective measures be employed during construction for Site 44PW0729, located immediately west of the archaeological survey area.

7(a) Agency Jurisdiction. The Department of Historic Resources (DHR) conducts reviews of projects to determine their effect on historic structures or cultural resources under its jurisdiction. DHR, as the designated State's Historic Preservation Office, ensures that federal actions comply with Section 106 of the National Historic Preservation Act of 1962 (NHPA), as amended, and its implementing regulation at 36 CFR Part 800. The NHPA requires federal agencies to consider the effects of federal projects on properties that are listed or eligible for listing on the National Register of Historic Places. Section 106 also applies if there are any federal involvements, such as licenses, permits, approvals or funding. DHR also provides comments to DEQ through the state environmental impact report review process.

25 **7(b) Agency Findings.** DHR confirmed that the FAA has consulted directly with DHR regarding the project. DHR provided concurrence on June 2, 2017 (Appendix D of the Draft EA) that the project will have no adverse effect, provided that protective measures are employed during construction for adjacent site 44PWO729 (DHR File No. 2017-0348).

26 **7(c) Agency Recommendation.** Utilize protective measures during construction for adjacent site 44PWO729 (DHR File No. 2017-0348).

8. Aviation Impacts. The Draft EA (page 1-7) indicates that the project components are shown on the conditional-approved Airport Layout Plan (ALP) and that the City of Manassas will request the FAA's unconditional approval for the project.

8(a) Agency Jurisdiction. The Virginia Department of Aviation is a state agency that plans for the development of the state aviation system; promotes aviation; grants aircraft and airports licenses; and provides financial and technical assistance to cities, towns, counties and other governmental subdivisions for the planning, development, construction and operation of airports, and other aviation facilities.

27 **8(b) Agency Finding.** DOAV finds that the proposed project is consistent with the approved ALP for the airport. DOAV has been working with and providing comments on the project directly to the airport sponsor, in coordination with the FAA's Washington Airports District Office.

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9. Pollution Prevention. DEQ advocates that principles of pollution prevention and sustainability be used in all construction projects as well as in facility operations. Effective siting, planning, and on-site Best Management Practices (BMPs) will help to ensure that environmental impacts are minimized. However, pollution prevention and sustainability techniques also include decisions related to construction materials, design, and operational procedures that will facilitate the reduction of wastes at the source.

28

9(a) Recommendations. We have several pollution prevention recommendations that may be helpful for this project and future activities on the airport:

- Consider development of an effective Environmental Management System (EMS). An effective EMS will ensure that the proposed facility is committed to complying with environmental regulations, reducing risk, minimizing environmental impacts, setting environmental goals, and achieving improvements in its environmental performance. DEQ offers EMS development assistance and recognizes facilities with effective Environmental Management Systems through its Virginia Environmental Excellence Program (VEEP). VEEP provides recognition, annual permit fee discounts, and the possibility for alternative compliance methods.
- Consider environmental attributes when purchasing materials. For example, the extent of recycled material content, toxicity level, and amount of packaging should be considered and can be specified in purchasing contracts.
- Consider energy efficiency when choosing materials and products, like insulation, fixtures, and HVAC systems.
- Consider contractors' commitment to the environment when choosing contractors. Specifications regarding raw materials and construction practices can be included in contract documents and requests for proposals.
- Choose sustainable materials and practices for building construction and design.
- Integrate pollution prevention techniques into the facility maintenance and operation, to include inventory control for centralized storage of hazardous materials. Maintenance facilities should have sufficient and suitable space to allow for effective inventory control and preventive maintenance.

DEQ's Office of Pollution Prevention provides information and technical assistance relating to pollution prevention techniques and EMS. For more information, contact DEQ's Office of Pollution Prevention, Meghann Quinn at (804) 698-4021.

29

10. Pesticides and Herbicides. Should construction or maintenance activities require the use of pesticides or herbicides for landscape maintenance, these chemicals should be in accordance with the principles of integrated pest management. The least toxic

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29 (continued) pesticides that are effective in controlling the target species should be used. Contact the Department of Agriculture and Consumer Services at (804) 786-3501 for more information.

11. Chesapeake Bay Preservation Areas. According to the Draft EA (page 5-9), the west parcel development is located entirely within the City of Manassas which is outside of the coastal zone. The east parcel development area is located within Virginia's coastal zone and an on-site delineation of the Cannon Branch Resource Protection Area (RPA) was reviewed and approved by Prince William County. Aside from the Wakeman Road realignment, the remainder of the east parcel development will not impact the Cannon Branch RPA. The Draft EA notes that road improvements are considered exempt from the requirements of the Chesapeake Bay Preservation Act provided that certain conditions are met.

11(a) Agency Jurisdiction. The DEQ Office of Local Government Programs administers the Chesapeake Bay Preservation Act (Virginia Code §62.1-44.15:67 *et seq.*) and Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 25-830-10 *et seq.*). Each Tidewater locality must adopt a program based on the Chesapeake Bay Preservation Act and the Chesapeake Bay Preservation Area Designation and Management Regulations. The Act and regulations recognize local government responsibility for land use decisions and are designed to establish a framework for compliance without dictating precisely what local programs must look like. Local governments have flexibility to develop water quality preservation programs that reflect unique local characteristics and embody other community goals. Such flexibility also facilitates innovative and creative approaches in achieving program objectives. The regulations address nonpoint source pollution by identifying and protecting certain lands called Chesapeake Bay Preservation Areas. The regulations use a resource-based approach that recognizes differences between various land forms and treats them differently.

30 **11(b) Agency Findings.** The City of Manassas is not subject to the Chesapeake Bay Preservation Act or the Regulations. OLGP's review of the submitted documentation shows that the proposed West Corporate Development project will occur solely within the confines of the city-owned airport property, and as such, the West Corporate Development portion of the project is not subject to review for Bay Act compliance.

31 In Prince William County, the areas protected by the Chesapeake Bay Preservation Act, as locally implemented, require conformance with performance criteria. These areas include RPAs and Resource Management Areas (RMAs) as designated by the local government. RPAs include tidal wetlands, certain non-tidal wetlands and tidal shores. RPAs also include a 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow. RMAs, which require less stringent performance criteria, include all areas of the County not designated as RPA.

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31 (continued)

The proposed East Parcel Development project will occur on approximately 20 acres of land within Prince William County and calls for the realignment of Wakeman Drive, taxi lane extensions, construction of three surface parking lots and several airplane hangar buildings, stormwater drainage improvements and the installation of additional security fencing. The proposed Wakeman Drive Realignment will result in an encroachment of impervious roadway into the Cannon Branch RPA, at the south end of the project, where the proposed road will intersect with Harry J. Parrish Boulevard.

32

11(c) Requirement. The Wakeman Drive realignment component of the East Parcel Development project would be considered exempt from the Regulations provided the road improvements are constructed in accordance with (i) regulations promulgated pursuant to the *Virginia Erosion and Sediment Control Law* and the *Virginia Stormwater Management Act*, (ii) an erosion and sediment control plan and a stormwater management plan approved by DEQ, or (iii) local water quality protection criteria at least as stringent as the above state requirements. The exemption of public roads is further conditioned on the following:

> Optimization of the road alignment and design, consistent with other applicable requirement, to prevent or otherwise minimize (i) encroachment into the RPA and (ii) adverse effects on water quality.

9VAC25-830-110 of the *Chesapeake Bay Preservation Area Designation and Management Regulations* require that a site-specific RPA determination and a Water Quality Impact Assessment (WQIA) be submitted for projects that propose land-disturbing activities on lands containing RPAs.

Per 9VAC25-830-140 of the Regulations, the WQIA is required for any proposed land development in a RPA.

33

11(d) Conclusion. Results of the site-specific determination for the East Parcel Development have been submitted (see Appendix C: Wetland Data Forms Relevant to the Preservation Area Site Assessment (PASA), Figure 32 - October 16, 2017 located within Appendix F- Federal Consistency Certification of the Draft EA) and Prince William County staff have concurred with the RPA delineation findings referenced in that document. To date, OLGP staff has not received the required WQIA for this project.

Provided adherence to the above requirements, the proposed activity would be in accordance with the Chesapeake Bay Preservation Act and Regulations.

34

12. Public Water Supply. The Draft EA does not address anticipated impacts to public water supplies.

12(a) Agency Jurisdiction. The Virginia Department of Health (VDH), Office of Drinking Water (ODW) reviews projects for the potential to impact public drinking water

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sources (groundwater wells and surface water intakes). VDH administers both federal and state laws governing waterworks operation.

12(b) Agency Findings. VDH ODW identified two public groundwater wells within a 1-mile radius of the project site.

35

PWS ID Number	City/County	System Name	Facility Name
6153264	PRINCE WILLIAM	BROAD RUN GOLF	WELL
6153041	PRINCE WILLIAM	BRISTOW MANOR GOLF CLUB	WELL

Additionally, the project is within the watershed of the Fairfax County Water Authority's Occoquan Reservoir public surface water intake (PWS ID 6059501).

36

12(c) Recommendation.

- BMPs should be employed on the project site including erosion and sedimentation controls as well as spill prevention controls and countermeasures.
- Properly manage materials on site and during transport to prevent impacts to nearby surface water.

37

12(d) Requirement. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility as applicable.

REGULATORY AND COORDINATION NEEDS

38

1. Wetlands and Subaqueous Lands. A Joint Permit Application must be submitted to VMRC for the proposed wetlands and subaqueous lands impacts. Contact VMRC (Tony Watkinson, 757-247-2250) with questions.

2. Erosion and Sediment Control and Stormwater Management.

39

2(a) Erosion and Sediment Control and Stormwater Management. This project must comply with *Virginia's Erosion and Sediment Control Law* (Virginia Code § 62.1-44.15:61) and *Regulations* (9 VAC 25-840-30 *et seq.*) and *Stormwater Management Law* (Virginia Code § 62.1-44.15:31) and *Regulations* (9 VAC 25-870-210 *et seq.*) as locally administered. Land-disturbing activities of equal to or greater than 10,000 square feet (2,500 square feet in a Chesapeake Bay Preservation Area) would be regulated by *VESCL&R* and *VSWML&R*. Local erosion and sediment control, and stormwater management plan requirements should be coordinated with the locality.

Specific questions regarding Erosion and Sediment control requirements should be directed to DEQ, Larry Gavan at (804) 698-4040.

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40 **2(b) General Permit for Stormwater Discharges from Construction Activities (VAR10).** For projects involving land-disturbing activities of equal to or greater than one acre the applicant is required to register for coverage under the Virginia Stormwater Management Program General Permit for Discharges of Stormwater from Construction Activities (9 VAC 25-870-1 *et seq.*). Specific questions regarding the Stormwater Management Program requirements should be directed to DEQ, Holly Sepety at (804) 698-4039.

41 **3. Air Quality Regulations**. Activities associated with this project may be subject to air regulations administered by DEQ. The state air pollution regulations that may apply to the project are:

- fugitive dust and emissions control (9VAC5-50-60 et seq.);
- asphalt paving operations (9VAC5-45-760 *et seq.*);
- permits for fuel-burning equipment (9VAC5-80-1100 *et seq.*); and
- open burning restrictions (9VAC5-130 et seq.).

The installation, operation and/or modification of stationary or portable fuel-burning equipment or other sources of air pollutants may be subject to registration requirements. Guidance on permitting requirements may be obtained by contacting DEQ-NRO (703-583-3800).

Guidance on minimizing the emission of VOCs and NO_x during construction may be obtained from DEQ NRO (703-583-3800).

42 **4. Solid and Hazardous Wastes**. All solid waste, hazardous waste, and hazardous materials must be managed in accordance with all applicable federal, state, and local environmental regulations.

If evidence of a petroleum release is discovered during construction, it must be reported to DEQ-NRO Tanks Program (703-583-3800). Contact DEQ-NRO (703-583-3800), for information on the location and availability of suitable waste management facilities in the project area or if free product, discolored soils, or other evidence of contaminated soils are encountered.

43 **4(a) Asbestos Containing Material.** It is the responsibility of the owner or operator to thoroughly inspect affected structures for the presence of asbestos, including Category I and Category II nonfriable asbestos containing material (ACM). Upon classification as friable or non-friable, all waste ACM shall be disposed of in accordance with the Virginia Solid Waste Management Regulations (9 VAC 20-80-640), and transported in accordance with the Virginia regulations governing Transportation of Hazardous Materials (9 VAC 20-110-10 *et seq.*). Contact DEQ-NRO (703-583-3800) and/or the Department of Labor and Industry (804-371-2327) for additional information.

Letter 1 Continued (Page 18/33)

44 **4(b) Lead-Based Paint.** If applicable, this project must comply with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) regulations, and with the Virginia Lead-Based Paint Activities Rules and Regulations. For additional information regarding these requirements, contact the Department of Professional and Occupational Regulation (804-367-8500).

45 **5. Natural Heritage Resources.** Contact DCR DNH, Rene Hypes at (804) 371-2708, to secure updated information on natural heritage resources if the scope of the project changes and/or six months has passed before the project is implemented, since new and updated information is continually added to the Biotics Data System.

46 **6. Chesapeake Bay Preservation Act.** The project must be conducted in a manner that is consistent with the coastal lands management enforceable policy of the CZM Program as administered by DEQ pursuant to the Chesapeake Bay Preservation Act (Virginia Code 62.1-44.15 *et seq.*) and the Chesapeake Bay Preservation Area Designation and Management Regulations (9VAC25-830 *et. seq.*). Per 9VAC25-830-140 of the Regulations, a WQIA is required for any proposed land development in a RPA (applicable to the Wakeman Road realignment portion of the east parcel development).

For additional information contact Daniel Moore (804-698-4520).

47 **7. Historic Resources**. Coordinate with DHR (Adrienne Birge-Wilson, 804-482-6092) as necessary with questions regarding its findings and the protective measures for adjacent site 44PW0729.

48 **8. Potable and Sanitary Water Collection Systems**. Potential impacts to public water distribution systems or sanitary sewage collection systems must be verified by the local utility. Contact the VDH Office of Drinking Water with questions related to its recommendations (Arlene Fields Warren, 804-864-7781).

Thank you for the opportunity to review and respond to the Draft Environmental Assessment for the Manassas Regional Airport West Corporate Development and East Parcel Development. Detailed comments of reviewing agencies are attached for your review. Please contact me at (804) 698-4204 or Janine Howard at (804) 698-4299 for clarification of these comments.

Letter 1 Continued (Page 19/33)

Manassas Regional Airport
West Corporate Development and East Parcel Developmemt
DEQ #18-022F

Sincerely,

Bettina Rayfield, Program Manager
Environmental Impact Review

Ec:

Robbie Rhur, DCR
Amy Ewing, DGIF
Tony Watkinson, VMRC
Roger Kirchen, DHR
Greg Evans, DOF
Arlene Warren, VDH
Elizabeth Jordan, VDOT
Robert Lazaro, Northern Virginia Regional Commission
William Patrick Pate, City of Manassas
Christopher E. Martino, Prince William County
Clay Morris, Prince William County
Susan Simmers, DOAV
Susan Stafford, FAA
Juan Rivera, Manassas Regional Airport
Natalie Heath, RS&H
David Alberts, RS&H

19

DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF AIR PROGRAM COORDINATION

ENVIRONMENTAL REVIEW COMMENTS APPLICABLE TO AIR QUALITY

TO: Janine L. Howard **DEQ - OEIR PROJECT NUMBER: DEQ #18-022F**

PROJECT TYPE: ☐ STATE EA / EIR **X FEDERAL EA / EIS** ☐ SCC

☐ CONSISTENCY DETERMINATION

PROJECT TITLE: Manassas Regional Airport West Corporate Development and East Parcel Development

PROJECT SPONSOR: Federal Aviation Administration

PROJECT LOCATION: **X OZONE NONATTAINMENT AND EMISSION CONTROL AREA FOR NOX & VOC**

REGULATORY REQUIREMENTSMAY BE APPLICABLE TO: **X CONSTRUCTION** ☐ OPERATION

STATE AIR POLLUTION CONTROL BOARD REGULATIONS THAT MAY APPLY:

1. ☐ 9 VAC 5-40-5200 C & 9 VAC 5-40-5220 E – STAGE I
2. ☐ 9 VAC 5-45-760 et seq. – Asphalt Paving operations
3. **X 9 VAC 5-130 et seq. – Open Burning**
4. **X 9 VAC 5-50-60 et seq. Fugitive Dust Emissions**
5. ☐ 9 VAC 5-50-130 et seq. - Odorous Emissions; Applicable to_____
6. ☐ 9 VAC 5-60-300 et seq. – Standards of Performance for Toxic Pollutants
7. ☐ 9 VAC 5-50-400 Subpart_____, Standards of Performance for New Stationary Sources, designates standards of performance for the_____
8. ☐ 9 VAC 5-80-1100 et seq. of the regulations – Permits for Stationary Sources
9. ☐ 9 VAC 5-80-1605 et seq. Of the regulations – Major or Modified Sources located in PSD areas. This rule may be applicable to the _____
10. ☐ 9 VAC 5-80-2000 et seq. of the regulations – New and modified sources located in non-attainment areas
11. ☐ 9 VAC 5-80-800 et seq. Of the regulations – State Operating Permits. This rule may be applicable to _____

49

COMMENTS SPECIFIC TO THE PROJECT:

All precautions are necessary to restrict the emissions of volatile organic compounds (VOC) and oxides of nitrogen (NO_X).

K. S. Narasimhan

(Kotur S. Narasimhan)
Office of Air Data Analysis

DATE: February 5, 2018

Letter 1 Continued (Page 21/33)

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Janine Howard, DEQ/EIR Environmental Program Planner

FROM: Katy Dacey, Division of Land Protection & Revitalization Review Coordinator

DATE: May 12, 2017

COPIES: Sanjay Thirunagari, Division of Land Protection & Revitalization Review Manager; file

SUBJECT: Environmental Impact Review: EIR Project No 17-061F Manassas Regional Airport West Corporate Development and East Parcel Development, City of Manassas, Prince William County, VA

The Division of Land Protection & Revitalization (DLPR) has completed its review of the May 2017 EIR for the Manassas Regional Airport West Corporate Development and East Parcel Development projects located at 10600 Harry J. Parrish Boulevard at the Manassas Regional Airport in Manassas, Virginia 20110

Project Scope: redevelopment and development of the west and east sides of airport to include: roadway improvements, building and parking lot reconstructions, T-hangers demolition, construction of hanger and parking lot, expansion of apron and taxilane tie down parking, wash rack construction, utilities and stormwater drainage improvements, taxilane extension and security fence extension

50

Solid and hazardous waste issues were not addressed in the submittal. The submittal did not indicate that a search of Federal or State environmental databases was conducted. DLPR staff conducted a search (2000 foot radius) of solid and hazardous waste databases (including petroleum releases) to identify waste sites in close proximity to the project corridor. DLPR search did identify five waste sites within the project area which might impact the project. Additionally, no waste sites of possible concern were located within the zip code of the project area, 22110. DLPR staff has reviewed the submittal and offers the following comments:

Hazardous Waste/RCRA Facilities – three in close proximity to project area.

1. ***VAD988212643, Tri-State Tours, 10680 Wakeman Court, Manassas, VA 22110. SQG***
2. ***VA0000347922, Wilcox Woodworks, 10687 Wakeman Court, Manassas, VA 22110. SQG***
3. ***VAR000506774, Corfu Contractors, 10599 Residence Road, Manassas, VA 20136. SQG***

50 (continued)

CERCLA Sites* – *none in the same zip code of the project area

The above information related to hazardous wastes, RCRA/CERCLA sites can be accessed from EPA's websites at https://www3.epa.gov/enviro/, https://rcrainfopreprod.epa.gov/rcrainfoweb/action/main-menu/view and https://www.epa.gov/superfund

Formerly Used Defense Sites (FUDS)* – *none in close proximity to project area

Solid Waste* – *none in close proximity to project area

Virginia Remediation Program (VRP)* – *none in close proximity to project area

Petroleum Releases* - *two within the project area (*denotes the same address)

4. ***PC#20013062, Manassas Airport – New Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/25/2000. Status: Closed.***

   PC#19910187, Dulles Aviation Incorporated – Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 08/21/1990. Status: Closed.

   PC#19993317, Manassas Municipal Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 03/22/1999. Status: Closed.

   PC#19973688, Manassas Airport – Old Control Tower, 10522 Terminal Road, Manassas, VA 22110. Release Date: 09/05/1996. Status: Closed.

   PC#19870385, Manassas Airport, 10522 Terminal Road, Manassas, VA 22110. Release Date: 12/09/1986. Status: Closed.

5. ***PC#19900438, VDOT – Manassas Area Headquarters Shop, 10228 Residency Road, Manassas, VA 22110. Release Date: 10/16/1989. Status: Closed.***

Please note that the DEQ's Pollution Complaint (PC) cases identified should be further evaluated by the project engineer or manager to establish the exact location, nature and extent of the petroleum release and the potential to impact the proposed project. Also, the project engineer or manager should contact the DEQ's Northern Virginia Regional Office at (703) 583-3800 (Tanks Program) for further information about the PC cases.

PROJECT SPECIFIC COMMENTS

None

GENERAL COMMENTS

Soil, Sediment, Groundwater, and Waste Management

Any soil, sediment or groundwater that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some

50 (continued)

of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-81); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110). Some of the applicable Federal laws and regulations are: the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Part 107.

Asbestos and/or Lead-based Paint

All structures being demolished/renovated/removed should be checked for asbestos-containing materials (ACM) and lead-based paint (LBP) prior to demolition. If ACM or LBP are found, in addition to the federal waste-related regulations mentioned above, State regulations 9VAC 20-81-620 for ACM and 9VAC 20-60-261 for LBP must be followed. Questions may be directed to Jason Miller at the DEQ's Piedmont Regional Office at (804) 527-5028.

Pollution Prevention – Reuse - Recycling

Please note that DEQ encourages all construction projects and facilities to implement pollution prevention principles, including the reduction, reuse, and recycling of all solid wastes generated. All generation of hazardous wastes should be minimized and handled appropriately.

If you have any questions or need further information, please contact Katy Dacey at (804) 698-4274.

Letter 1 Continued (Page 24/33)

Howard, Janine (DEQ)

From: Miller, Mark (DEQ)
Sent: Monday, February 05, 2018 10:57 AM
To: Howard, Janine (DEQ)
Subject: FW: NEW PROJECT FAA Manassas Airport 18-022F

Importance: High

Northern Regional Office comments regarding the Draft EA for the *Manassas Regional Airport West Corporate Development and East Parcel Development*, *18-022F, Manassas City/Prince William County*, are as follows:

Land Protection Division – The project manager is reminded that if any solid or hazardous waste is generated/encountered during construction, the project manager would follow applicable federal, state, and county regulations for their disposal.

Air Compliance/Permitting - The project manager is reminded that during the construction phases that occur with this project; the project is subject to the Fugitive Dust/Fugitive Emissions Rule 9 VAC 5-50-60 through 9 VAC 5-50-120. In addition, should any open burning or use of special incineration devices be employed in the disposal of land clearing debris during demolition and construction, the operation would be subject to the Open Burning Regulation 9 VAC 5-130-10 through 9 VAC 5-130-60 and 9 VAC 5-130-100.

51 **Virginia Water Protection Permit (VWPP) Program** – The project manager is reminded that a VWP permit from DEQ may be required should impacts to surface waters be necessary. DEQ VWP staff recommends that the avoidance and minimization of surface water impacts to the maximum extent practicable as well as coordination with the US Army Corps of Engineers. Upon receipt of a Joint Permit Application for the proposed surface water impacts, DEQ VWP Permit staff will review the proposed project in accordance with the VWP permit program regulations and current VWP permit program guidance.

Erosion and Sediment Control and Storm Water Management: DEQ has regulatory authority for the Virginia Pollutant Discharge Elimination System (VPDES) programs related to municipal separate storm sewer systems (MS4s) and construction activities. Erosion and sediment control measures are addressed in local ordinances and State regulations. Additional information is available at http://www.deq.virginia.gov/Programs/Water/StormwaterManagement.aspx. Non-point source pollution resulting from this project should be minimized by using effective erosion and sediment control practices and structures. Consideration should also be given to using permeable paving for parking areas and walkways where appropriate, and denuded areas should be promptly revegetated following construction work. If the total land disturbance exceeds 10,000 square feet, an erosion and sediment control plan will be required. Some localities also require an E&S plan for disturbances less than 10,000 square feet. A stormwater management plan may also be required. For any land disturbing activities equal to one acre or more, you are required to apply for coverage under the VPDES General Permit for Discharges of Storm Water from Construction Activities. The Virginia Stormwater Management Permit Authority may be DEQ or the locality.

Mark L. Miller
Environmental Manager-Enforcement, Pollution Response, & Environmental Review
Department of Environmental Quality - Northern Regional Office
13901 Crown Court, Woodbridge, Virginia 22193
(O) 703-583-3850
E-mail:Mark.Miller@deq.virginia.gov
http://www.deq.virginia.gov/Programs/PollutionResponsePreparedness.aspx

1

Letter 1 Continued (Page 25/33)

Matthew J. Strickler
Secretary of Natural Resources

Clyde E. Cristman
Director

Rochelle Altholz
Deputy Director of Administration and Finance

Russell W. Baxter
Deputy Director of Dam Safety & Floodplain Management and Soil & Water Conservation

Thomas L. Smith
Deputy Director of Operations

COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

MEMORANDUM

DATE: February 15, 2018

TO: Janine Howard, DEQ

FROM: Roberta Rhur, Environmental Impact Review Coordinator

SUBJECT: DEQ 18-022F, Manassas Regional Airport West Corporate Development and East Parcel Development

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

According to the information currently in our files, the Broad Run Stream Conservation Unit (SCU) is located adjacent to the project site. SCUs identify stream reaches that contain aquatic natural heritage resources, including 2 miles upstream and 1 mile downstream of documented occurrences, and all tributaries within this reach. SCUs are also given a biodiversity significance ranking based on the rarity, quality, and number of element occurrences they contain. The Broad Run SCU has been given a biodiversity significance ranking of B3, which represents a site of high significance. The natural heritage resources of concern associated with this SCU are:

52

Alasmidonta varicosa	Brook floater	G3/S1/NL/LE
Elliptio lanceolata	Yellow lance	G2G3/S2S3/SOC/NL

The Brook floater, a small freshwater mussel species, is known from the northeastern United States primarily in the Atlantic Slope drainages (NatureServe, 2009). In Virginia, it is recorded from the Potomac River basin with a possible record from the James River. Of 14 documented records in Virginia, only two are thought to be viable. Population declines have been documented throughout its range (NatureServe, 2009). The Brook floater typically inhabits flowing-water habitats in and near riffles and rapids of smaller creeks with rocky or gravelly substrates (Nedeau et al., 2000 per NatureServe, 2009). Many facets of its life history are unknown including its fish host. Threats for the Brook floater in particular include poor water quality as this species does not tolerate silt or nutrient pollution well (Stevenson and Bruenderman, 1995). Please note that this species is currently listed as endangered by the Virginia Department of Game and Inland Fisheries (VDGIF).

The Yellow lance occurs in mid-sized rivers and second and third order streams. To survive, it needs a silt-free, stable streambed and well-oxygenated water that is free of pollutants. This species has been the subject of taxonomic debate in recent years (NatureServe, 2009). Currently in Virginia, the Yellow lance is

600 East Main Street, 24th Floor | Richmond, Virginia 23219 | 804-786-6124

State Parks • Soil and Water Conservation • Outdoor Recreation Planning
Natural Heritage • Dam Safety and Floodplain Management • Land Conservation

52 (continued)

recognized from populations in the Chowan, James, York, and Rappahannock drainages. Its range also extends into Neuse-Tar river system in North Carolina. In recent years, significant population declines have been noted across its range (NatureServe, 2009). The Yellow lance may be particularly sensitive to chemical pollutants and exposure to fine sediments from erosion (NatureServe, 2009). Please note that this species is currently classified as a species of concern by the United States Fish and Wildlife Service (USFWS); however, this designation has no official legal status.

Considered good indicators of the health of aquatic ecosystems, freshwater mussels are dependent on good water quality, good physical habitat conditions, and an environment that will support populations of host fish species (Williams et al., 1993). Because mussels are sedentary organisms, they are sensitive to water quality degradation related to increased sedimentation and pollution. They are also sensitive to habitat destruction through dam construction, channelization, and dredging, and the invasion of exotic mollusk species.

In addition, Broad Run has been designated by the VDGIF as a "Threatened and Endangered Species Water" for the Brook floater.

Please note according to DCR's species distribution model, potential may exist for the Dwarf wedgemussel (*Alasmidonta heterodon*, G1G2/S1/LE/LE) to occur adjacent to the project site.

To minimize adverse impacts to the aquatic ecosystem as a result of the proposed activities, DCR recommends the implementation of and strict adherence to applicable state and local erosion and sediment control/storm water management laws and regulations. Due to the legal status of the Brook floater, DCR also recommends coordination with Virginia's regulatory authority for the management and protection of this species, the VDGIF, to ensure compliance with the Virginia Endangered Species Act (VA ST §§ 29.1-563 – 570).

There are no State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the DCR, DCR represents VDACS in comments regarding potential impacts on state-listed threatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please re-submit project information and map for an update on this natural heritage information if the scope of the project changes and/or six months has passed before it is utilized.

The VDGIF maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Ernie Aschenbach at 804-367-2733 or Ernie.Aschenbach@dgif.virginia.gov.

The remaining DCR divisions have no comments regarding the scope of this project. Thank you for the opportunity to comment.

CC: Amy Ewing, VDGIF
Troy Andersen, USFWS

Literature Cited

NatureServe. 2009. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available http://www.natureserve.org/explorer. (Accessed: March 16, 2010 and April 5, 2010).

Nedeau, E.J., M.A. McCollough, and B.I. Swartz. 2000. The freshwater mussels of Maine. Maine Department of Inland Fisheries and Wildlife, Augusta, Maine. 118 pp.

Stevenson, Phillip H. and Sue A. Bruenderman 1995. A Guide to Endangered and Threatened Species of Virginia. K. Terwilliger ed. The McDonald and Woodward Publishing Company, Blacksburg, Virginia. p. 74.

Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries 18: 6-9.

Letter 1 Continued (Page 28/33)

Howard, Janine (DEQ)

From: Birge-wilson, Adrienne (DHR)
Sent: Wednesday, February 07, 2018 1:19 PM
To: Howard, Janine (DEQ)
Subject: RE: NEW PROJECT FAA Manassas Airport 18-022F - DHR File No. 2017-0348

Janine,

Good afternoon.

53 As noted in Appendix D (D-1) of the Draft EA, FAA has consulted directly with DHR regarding this undertaking. DHR provided concurrence on 2 JUN 2017 that the project will have *no adverse effect with the condition* that protective measures be employed during construction for adjacent site 44PWO729 (DHR File No. 2017-0348).

V/R.

Adrienne Birge-Wilson
Review and Compliance Division
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, VA 23221
(804) 482-6092
adrienne.birge-wilson@dhr.virginia.gov

From: Fulcher, Valerie (DEQ)
Sent: Tuesday, January 30, 2018 2:38 PM
To: dgif-ESS Projects (DGIF); Rhur, Robbie (DCR); odwreview (VDH); Dacey, Katy (DEQ); Narasimhan, Kotur (DEQ); Moore, Daniel (DEQ); Miller, Mark (DEQ); Kirchen, Roger (DHR); Evans, Gregory (DOF); Watkinson, Tony (MRC); Cromwell, James R. (VDOT); Jordan, Elizabeth (VDOT); rlazaro@novaregion.org; citymanager@ci.manassas.va.us; Patton, Justin S.; Simmers, Susan H. (DOAV)
Cc: Howard, Janine (DEQ)
Subject: NEW PROJECT FAA Manassas Airport 18-022F
Importance: High

Good afternoon - this is a new OEIR review request/project:

Document Type: Draft EA
Project Sponsor: Federal Aviation Administration
Project Title: Manassas Regional Airport West Corporate Development and East Parcel Development
Location: City of Manassas, Prince William County
Project Number: DEQ #18-022F

The document is available at www.deq.virginia.gov/fileshare/oeir in the FAA folder.

The due date for comments is FEBRUARY 16, 2018. You can send your comments either directly to JANINE HOWARD by email (Janine.Howard@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, 1111 East Main St., Richmond, VA 23219 (please note new address).

1

Letter 1 Continued (Page 29/33)

COMMONWEALTH OF VIRGINIA

Mark K. Flynn
Director

Department of Aviation
5702 Gulfstream Road
Richmond, Virginia 23250-2422

VTDD – (804) 236-3624
FAX – (804) 236-3635

Transmitted via Email

February 2, 2018

Ms. Janine Howard
Department of Environmental Quality
Office of Environmental Impact Review
1111 East Main Street
Richmond, VA 23219

Re: Manassas Regional Airport
West Corporate Development & East Parcel Development
Project Number: 18-22F

Dear Ms. Howard:

54 Thank you for the opportunity to comment on the West Corporate Development & East Parcel Development project at the Manassas Regional Airport. The project is consistent with the approved airport layout plan for the airport. The Virginia Department of Aviation has been working with and providing comments on the project directly to the airport sponsor, in coordination with the Federal Aviation Administration's Washington Airports District Office.

The Virginia Department of Aviation has no objection to the project as proposed.

Please let me know if you have any questions on our comments.

Sincerely,

Susan H. Simmers

Susan H. Simmers
Senior Aviation Planner

ec: Juan Rivera, Director, Manassas Regional Airport

100 DOAVAS 20180202 DEQ 18-022F HEF West Corp-East Parcel Development

Letter 1 Continued (Page 30/33)

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY

Street address: 1111 East Main Street, Suite 1400, Richmond, VA 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
www.deq.virginia.gov

Matthew J. Strickler
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

MEMORANDUM

TO: Janine Howard, DEQ Environmental Program Planner

FROM: Daniel Moore, DEQ Principal Environmental Planner

DATE: February 21, 2018

SUBJECT: DEQ #18-022F: Manassas Regional Airport Development, City of Manassas and Prince William County

We have reviewed the Draft EA application for the proposed Manassas Regional Airport West Corporate Development and East Parcel Development project in the City of Manassas and Prince William County and offer the following comments regarding consistency with the provisions of the *Chesapeake Bay Preservation Area Designation and Management Regulations* (Regulations):

The City of Manassas is not subject to the Chesapeake Bay Preservation Act or the Regulations. Our review of the submitted documentation shows that the proposed West Corporate Development project will occur solely within the confines of the city-owned airport property, and as such, the project is not subject to review for Bay Act compliance.

55

In Prince William County, the areas protected by the Chesapeake Bay Preservation Act, as locally implemented, require conformance with performance criteria. These areas include Resource Protection Areas (RPAs) and Resource Management Areas (RMAs) as designated by the local government. RPAs include tidal wetlands, certain non-tidal wetlands and tidal shores. RPAs also include a 100-foot vegetated buffer area located adjacent to and landward of these features and along both sides of any water body with perennial flow. RMAs, which require less stringent performance criteria, include all areas of the County not designated as RPA.

The proposed East Parcel Development project will occur on approximately 20 acres of land within Prince William County and calls for the realignment of Wakeman Drive, taxi lane extensions, construction of three surface parking lots and several airplane hangar buildings, stormwater drainage improvements and the installation of additional security fencing. The Wakeman Drive Realignment component of the East Parcel Development project would be considered exempt from the Regulations provided the realignment is constructed in accordance with (i) regulations promulgated pursuant to the *Virginia Erosion and Sediment Control Law* and

55 (continued)

the *Virginia Stormwater Management Act*, (ii) an erosion and sediment control plan and a stormwater management plan approved by DEQ, or (iii) local water quality protection criteria at least as stringent as the above state requirements. The exemption of public roads is further conditioned on the following:

> Optimization of the road alignment and design, consistent with other applicable requirement, to prevent or otherwise minimize (i) encroachment into the RPA and (ii) adverse effects on water quality.

As noted in previous memorandums from the DEQ Office of Local Government Programs (OLGP) staff regarding this project, 9VAC25-830-110 of the *Chesapeake Bay Preservation Area Designation and Management Regulations* require that a site-specific RPA determination and a Water Quality Impact Assessment (WQIA) be submitted for projects that propose land-disturbing activities on lands containing RPAs. Results of the site-specific determination for the East Parcel Development have been submitted (see Appendix C: Wetland Data Forms Relevant to the PASA, Figure 32 - October 16, 2017) and Prince William County staff have concurred with the RPA delineation findings referenced in that document. To date, OLGP staff has not received the required WQIA for this project. The proposed Wakeman Drive Realignment will result in an encroachment of impervious roadway into the Cannon Branch RPA, at the south end of the project, where the proposed road will intersect with Harry J. Parrish Boulevard. Per 9VAC25-830-140 of the Regulations, the WQIA is required for any proposed land development in a RPA.

Provided adherence to the above requirements, the proposed activity would be consistent with the *Chesapeake Bay Preservation Act* and the Regulations.

2

Letter 1 Continued (Page 32/33)

Howard, Janine (DEQ)

From: Warren, Arlene (VDH)
Sent: Thursday, February 01, 2018 10:00 AM
To: Howard, Janine (DEQ)
Subject: RE: NEW PROJECT FAA Manassas Airport 18-022F
Attachments: 17-061F FAA Manassas Airport Project Response.pdf

56 FYI –

Noting that the project area has change slightly from DEQ 17-061F review; the Office of Drinking Water's project previous comments are still valid. Attached is 17-061F Project review response.

Best Regards,

Arlene Fields Warren
GIS Program Support Technician
Office of Drinking Water
Virginia Department of Health
109 Governor Street
Richmond, VA 23220
(804) 864-7781

From: Fulcher, Valerie (DEQ)
Sent: Tuesday, January 30, 2018 2:38 PM
To: dgif-ESS Projects (DGIF) <ESSProjects@dgif.virginia.gov>; Rhur, Robbie (DCR) <Robbie.Rhur@dcr.virginia.gov>; odwreview (VDH) <odwreview@vdh.virginia.gov>; Dacey, Katy (DEQ) <Katy.Dacey@deq.virginia.gov>; Narasimhan, Kotur (DEQ) <Kotur.Narasimhan@deq.virginia.gov>; Moore, Daniel (DEQ) <Daniel.Moore@deq.virginia.gov>; Miller, Mark (DEQ) <Mark.Miller@deq.virginia.gov>; Kirchen, Roger (DHR) <Roger.Kirchen@dhr.virginia.gov>; Evans, Gregory (DOF) <Gregory.Evans@dof.virginia.gov>; Watkinson, Tony (MRC) <Tony.Watkinson@mrc.virginia.gov>; Cromwell, James R. (VDOT) <James.Cromwell@VDOT.Virginia.gov>; Jordan, Elizabeth (VDOT) <Elizabeth.Jordan@VDOT.Virginia.gov>; rlazaro@novaregion.org; citymanager@ci.manassas.va.us; Patton, Justin S. <jspatton@pwcgov.org>; Simmers, Susan H. (DOAV) <susan.simmers@doav.virginia.gov>
Cc: Howard, Janine (DEQ) <Janine.Howard@deq.virginia.gov>
Subject: NEW PROJECT FAA Manassas Airport 18-022F
Importance: High

Good afternoon - this is a new OEIR review request/project:

Document Type: Draft EA
Project Sponsor: Federal Aviation Administration
Project Title: Manassas Regional Airport West Corporate Development and East Parcel Development
Location: City of Manassas, Prince William County
Project Number: DEQ #18-022F

The document is available at www.deq.virginia.gov/fileshare/oeir in the FAA folder.

The due date for comments is FEBRUARY 16, 2018. You can send your comments either directly to JANINE HOWARD by email (Janine.Howard@deq.virginia.gov), or you can send your comments by regular interagency/U.S. mail to the Department of Environmental Quality, Office of Environmental Impact Review, 1111 East Main St., Richmond, VA 23219 (please note new address).

1

From: Warren, Arlene (VDH)
To: Howard, Janine (DEQ)
Subject: RE: NEW PROJECT FAA Manassas Airport 17-061F
Date: Friday, May 19, 2017 10:05:00 AM

Project Name: Manassas Regional Airport West Corporate Development and East Parcel Development
Project #: 17-061F
UPC #: N/A
Location: **City of Manassas, Prince William County**

VDH – Office of Drinking Water has reviewed the above project. Below are our comments as they relate to proximity to **public drinking water sources** (groundwater wells, springs and surface water intakes). Potential impacts to public water distribution systems or sanitary sewage collection systems **must be verified by the local utility.**

The following public groundwater wells are located within a 1 mile radius of the project site:

PWS ID Number	City/County	System Name	Facility Name
6153264	PRINCE WILLIAM	BROAD RUN GOLF	WELL
6153041	PRINCE WILLIAM	BRISTOW MANOR GOLF CLUB	WELL

There are no surface water intakes located within a 5 mile radius of the project site.

The project is within the watershed of the following public surface water sources:

PWS ID Number	System Name	Facility Name
6059501	FAIRFAX CO WATER AUTHORITY	OCCOQUAN RESERVIOR INTAKE

- ***Comments from OEHS Division of Shellfish Sanitation, Mr. Eric Aschenbach, "We do not have any comments on the project."***

Best Management Practices should be employed, including Erosion & Sedimentation Controls and Spill Prevention Controls & Countermeasures on the project site.

Materials should be managed while on site and during transport to prevent impacts to nearby surface water.

Best Regards,

Arlene Fields Warren
GIS Program Support Technician
Office of Drinking Water
Virginia Department of Health
109 Governor Street

Responses to Letter 1: Commonwealth of Virginia Department of Environmental Quality (Febrary 28, 2018)

1: Section 5.11.3.2 of the Draft EA and Final EA describes that a Joint Permit is likely to be required for the Proposed Action, and that the City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission regarding this permit.

2: The implementation of various best management practices during construction and operation of the Proposed Action, as described throughout Chapter 5 of the Draft EA and Final EA, would minimize impacts to surface waters. Additionally, coordination with the USACE regarding the Proposed Action and potential wetland impacts has occurred (see Section 5.11.3.2 of the Draft EA and Final EA). As Section 5.11.3.2 of the Draft EA and Final EA states, the City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission during the design phase of the Proposed Action to determine the appropriate permit(s) and mitigation measures for the Proposed Action. No changes were made to the document.

3: Recommendations 1, 2, 3, and 7 have been added to Section 5.11.3.2 of the Final EA. The Proposed Action would not temporarily affect any wetlands; therefore, recommendations 4, 5, and 6 are not applicable to the Proposed Action. In addition, Section 5.11.3.2 of the Draft and Final EA discusses measures that could be used to prevent spills of fuels or lubricants (recommendation 8); therefore, no additional information has been added regarding recommendation 8.

4: Section 5.11.3.2 of the Draft EA and Final EA describes that a Joint Permit is likely to be required for the Proposed Action, and that the City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission regarding this permit.

5: Section 5.11.3.2 of the Draft EA and Final EA describes that a Joint Permit is likely to be required for the Proposed Action, and that the City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission regarding this permit.

6: Section 5.11.3.2 of the Draft EA and Final EA describes that the Proposed Action would comply with *Virginia's Erosion and Sediment Control Law* and that the City would ensure a project-specific erosion and sediment control plan is submitted to the City and County for review prior to the start of ground disturbing activities associated with the Proposed Action.

7: The City acknowledges that the locality may request that the Proposed Action meet local Stormwater Management Plan requirements.

8: Section 5.11.3.2 of the Draft EA and Final EA describes that the City would register for coverage under the Virginia Stormwater Management Program General Permit for Discharges of Stormwater from Construction Activities and would amend the Airport's VPDES Industrial Stormwater General Permit (VAR050985) for stormwater discharges associated with industrial activities. This update includes updating the Airport's SWPPP.

9: Section 5.11.3.2 of the Draft EA and Final EA describes that the City could consider utilizing permeable paving for walkways and parking areas, where appropriate, to reduce potential stormwater runoff effects.

10: Section 4.1 of Draft EA and Final EA describes that the project study area is in a nonattainment are for ozone and is an emission control area for oxides of nitrogen and VOCs.

11: Section 5.1.3.3 of the Draft EA and Final EA describes that construction contractor would conduct construction activities, in accordance with 9 VAC 5-50-60 *et seq*. of the *Regulations for the Control and Abatement of Air Pollution* and FAA AC 150/5370-10G, *Standards for Specifying Construction of Airports* and describes that other BMPs could be used during construction, which would help to reduce the emissions of VOCs and NO_x.

12: Section 5.1.3.3 of the Draft EA and Final EA describes the control measures that the selected construction contractor may use to minimize fugitive dust emission.

13: Section 5.1.3.3 of the Draft EA and Final EA describes that if open burning or use of special incineration devices were determined to be necessary, the activity would meet the requirements under 9 VAC 5-130-10 through 9 VAC 130-60 and 9 VAC 5-130-100 of the *Regulations for Open Burning*.

14: Section 5.1.3.2 of the Draft EA and Final EA describes that the City would ensure that the installation of a generator(s) complies with 9 VAC 5-80, Article 6, Permits for New and Modified Sources.

15: Section 5.1.3.3 of the Draft EA and Final EA describes that the City would ensure the selected construction contractor is aware of 9 VAC 5-45-780 *et seq*., including the limitations on the use of "cut back," that asphalt must be emulsified except when specific circumstances apply, and the time-of-year restrictions on the use of asphalt.

16: Section 4.6 of the Draft EA and Final EA describes that a physical inspection of the survey area was conducted in 2016, as well as an Environmental Phase I report. The information from the physical inspection and Environmental Phase I report are included in Appendix C of the Draft EA and Final EA. The hazardous waste/RCRA facilities listed in comment 16 are outside of the project study area for this EA and would not be affected by the Proposed Action. In addition, the petroleum release sites identified in comment 16 have a "closed" status.

17: Section 5.6.3.2 of the Draft EA and Final EA describes that construction would not occur at sites known or suspected to be contaminated. Language regarding the characterization of construction and demolition debris prior to disposal has been added to the first paragraph of Section 5.6.3.2 in the Final EA.

18: Language regarding the unlikely discovery of a petroleum release and use of temporary above ground fuel storage has been added to Section 5.6.3.2, paragraph 2, of the Final EA.

19: Section 5.6.3.2 of the Draft EA and Final EA describes that all structures being demolished/renovated/removed would be checked for, and cleared of, asbestos-containing materials and lead-based paint prior to demolition/renovation/removal.

20: Section 5.6.3.2 of the Draft EA and Final EA describes the potential for the reuse and/or recycling of waste. The response to Comment 16 answers the portion of Comment 20 that relates to petroleum release sites.

21: Section 4.2 of the Draft EA and Final EA describes the biodiversity ranking of Broad Run, as well as the natural heritage resources associated with the area.

22: Section 5.2.3.2 of the Draft EA and Final EA includes this finding regarding state-listed plant and insect species.

23: The City acknowledges that there are no State Natural Area Preserves under DCR's jurisdiction near the Proposed Action.

24: Section 5.2.3.3 of the Draft EA and Final EA includes a description of the best management practices that the selected construction contractor may implement during construction of the Proposed Action.

25: Section 5.7.3.2 of the Draft EA and Final EA describes VDHR's finding.

26: Sections 5.7.3.2 and 5.7.3.3 of the Draft EA and Final EA describe that protective measures would be utilized during construction for site 44PW0729.

27: The City acknowledges that the DOAV finds the Proposed Action consistent with the approved ALP for the Airport.

28: The listed recommendations have been added to Section 5.6.3.3 of the Final EA.

29: Text regarding the use of pesticides and herbicides has been added to Section 5.6.3.2, paragraph 4, of the Final EA.

30: Section 4.4 of the Draft EA and Final EA describes that the City of Manassas is not subject to the Chesapeake Bay Preservation Act or Regulations, and, therefore, the West Corporate Development portion of the Proposed Action is not subject to review for Chesapeake Bay Preservation Act compliance.

31: Section 4.4 of the Draft EA and Final EA describes that the East Parcel Development portion of the Proposed Action is within Prince William County, which is subject to review for the Chesapeake Bay Preservation Act compliance. Section 5.4.3.2 describes that the proposed realignment of Wakeman Drive would occur within the Cannon Branch RPA.

32: Language regarding the Chesapeake Bay Preservation Act and Water Quality Impact Assessment from Comment 32 has been added to Section 5.4.3.2, paragraph 1, of the Final EA.

33: Language regarding the Water Quality Impact Assessment for the proposed realignment of Wakeman Drive has been added to Section 5.4.3.2, paragraph 2 of the Final EA.

34: Language specific to public water supplies has been added to Section 5.11.3.2, under the surface water subsection, of the Final EA.

35: Section 4.11 of the Draft EA and Final EA describes the two public groundwater wells that are within one mile of the project study area.

36: Sections 5.2.3.3, 5.11.3.2, and 5.11.3.3 of the Draft EA and Final EA describe that erosion and sediment controls would be in place during construction. Section 5.11.3.2 of the Draft EA and Final EA also describes the various BMPs that the selected construction contractor may use during construction to reduce the potential effects to surface waters.

37: Language specific to public water supplies has been added to Section 5.11.3.2, under the surface water subsection, of the Final EA.

38: Section 5.11.3.2 of the Draft EA and Final EA describes that a Joint Permit is likely to be required for the Proposed Action, and that the City would coordinate with the USACE, VDEQ, and Virginia Marine Resources Commission regarding this permit.

39: Section 5.11.3.2 of the Draft EA and Final EA describes that the Proposed Action would comply with *Virginia's Erosion and Sediment Control Law* and that the City would ensure a project-specific erosion and sediment control plan is submitted to the City and County for review prior to the start of ground disturbing activities associated with the Proposed Action.

40: Section 5.11.3.2 describes that the City would register for coverage under the Virginia Stormwater Management Program General Permit for Discharges of Stormwater from Construction Activities (9 VAC 25-870-1 *et seq.*) and would amend the Airport's VPDES Industrial Stormwater General Permit (VAR050985) for stormwater discharges associated with industrial activities.

41: Section 5.1.3.3 of the Draft EA and Final EA describes the state air pollution regulations that may apply to the Proposed Action.

42: Section 5.6.3.2 of the Draft EA and Final EA describes that waste would be managed in accordance with applicable federal, state, and local environmental regulations. In addition, language regarding the unlikely discovery of a petroleum release and use of temporary above ground fuel storage has been added to Section 5.6.3.2, paragraph 2, of the Final EA.

43: Section 5.6.3.2 of the Draft EA and Final EA describes that all structures being demolished/renovated/removed would be checked for, and cleared of, asbestos-containing materials and lead-based paint prior to demolition/renovation/removal.

44: The City acknowledges that the construction and operation of the Proposed Action must comply with the U.S. Department of Labor, Occupational Safety and Health Administration regulations, and with the Virginia Lead-Based Paint Activities Rules and Regulations, as applicable.

45: The City would contact the VDCR to secure updated information on natural heritage resources if the scope of the project changes and/or six months has passed before the project is implemented.

46: As Section 5.4.3.2 of the Draft EA and Final EA describes, the City would ensure that the Proposed Action is consistent with the enforceable policies of the VCP to the maximum extent practicable.

47: The City will coordinate with VDHR regarding the protective measures for site 44PW0729, as necessary.

48: Section 5.11.3.2 of the Final EA describes that the extension of utilities, including water and sewer lines, associated with the Proposed Action would be coordinated with, and verified by, the local utility entities.

49: See responses to Comments 10 through 15.

50: See responses to Comments 16 through 20.

51: See responses to Comments 1 through 6, 8, 12, 13, 39, 40, and 42.

52: See responses to Comments 21 through 26 and 45.

53: See responses to Comments 25, 26, and 47.

54: See response to Comment 27.

55: See responses to Comments 30 through 33, and 46.

56: See responses to Comments 34 through 37, and 48.

Letter 2 (Page 1/3)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

March 1, 2018

Ms. Susan Stafford
Federal Aviation Administration
Beckley Airports District Office
176 Airport Circle; Room 101
Beaver, West Virginia 25813-9350

Subject: Draft Environmental Assessment for the West Corporate Development and East Parcel Development at the Manassas Regional Airport in Manassas, Virginia January 2018

Dear Ms. Stafford:

In accordance with the National Environmental Policy Act (NEPA), Section 309 of the Clean Air Act, and the Council on Environmental Quality regulations 40 CFR Parts 1500-1508, the United States Environmental Protection Agency (EPA), has reviewed the Draft Environmental Assessment (EA) for the West Corporate Development and East Parcel Development at Manassas Regional Airport in the City of Manassas, Virginia. The EA discusses the Proposed Action, which includes development of corporate hangars, t-hangars, apron expansion, maintenance and storage building, wash rack, road improvements, and extension of utilities and security fence. The EA states that the purpose of the Proposed Action is to meet the need to develop and maintain safe and modern facilities and the need to improve the Airport's ability to be financially self-sustaining.

The Proposed Action could potentially affect 1.62 acres of palustrine emergent and palustrine forested wetlands on the west side of the Airport. The EA explains that 1.60 acres of forested wetland impacts would be to meet floodplain mitigation requirements. While we understand the constraints at the Airport, we encourage the project team to continue efforts to avoid and minimize impacts to aquatic resources. Please see the attached technical enclosure for detailed comments.

Thank you for the opportunity to provide comments on this EA. For any questions or assistance EPA can provide, please contact Ms. Barbara Okorn (okorn.barbara@epa.gov, 215-814-3330).

Sincerely,

Barbara Rudnick
NEPA Team Leader
Office of Environmental Programs

Enclosure

Letter 2 Continued (Page 2/3)

Technical Comments
Draft EA for the West Corporate Development and East Parcel Development
at the Manassas Regional Airport

1
- An overview map of the entire airport, including labelling for roads, would be helpful to documentation in the EA. Figure 1-2 does not indicate the names of roads referenced in the text. Page 2-1 states that Piper Lane and Observation Road are within the Broad Run floodway and 100-year floodplain and indicates Wakeman Drive separates the east parcel of the airport. We recommend the document clarify the location of the roads in relation to each other and impacts associated with the improvements. The EA states that Wakeman Drive is a public roadway; please clarify if Piper Lane and Observation Road are also public.

2
- We suggest that additional clarification related to purpose and need would provide a more informative NEPA document. As presented, the purpose and needs section may be confusing to the reader. This section identifies two needs for the Proposed Action in Section 2.1 but introduces additional needs in Section 2.1.1, as a result of the Airport's Master Plan Updates and the 2032 Comprehensive Plan Manassas Next. The needs should be clearly explained and presented in the EA to ensure that alternatives can be discussed and evaluated in regard to addressing need.

3
- We suggest that the EA discuss any coordination with local, state, or public entities that may be necessary during the proposed road improvements.

4
- Page 4-8 states that there is the potential for three federally listed species to occur in the area, but none were observed during field surveys. Page 5-5 states that Virginia Department of Game and Inland Fisheries did not indicate that wildlife or threatened and endangered species would be affected by the Proposed Action. The project team should continue coordination with the state and federal agencies to ensure that the conclusions related to potential project impacts in this EA are supported. It would be helpful if the document indicated qualifications of the personnel participating in the surveys and protocols followed.

5
- The EA states that the project is in the floodplain of Broad Run. We recommend the EA discuss, and the design of the proposed alternative accommodate, extreme weather events.

6
- Stormwater management should not be placed in waters of the US. In addition, we recommend the EA address stormwater management and spill containment on an airport-wide basis. Explanation of the purpose of the wash rack and handling of liquids there would also be important to the EA. The proposed project would permanently increase the amount of impervious surface by 25 acres, which would increase the volume stormwater runoff in the area. To control this increase stormwater runoff volume, it is proposed to construct on-site detention facilities. While detention facilities can control peak flows at the airport, these discharges can lead to downstream flooding problems. To reduce the runoff volume and improve water quality, EPA recommends where possible the incorporation of Low Impact Development (LID) design features into the overall project stormwater management including redevelopment of the existing airport facilities. The Virginia Stormwater Management Handbook provides guidance on the function and application of LIDs for stormwater management.

7
- We suggest LID options be considered for design of other features such as parking, paving, and landscaping. Technical guidance in implementing green infrastructure practices can be found at:

Letter 2 Continued (Page 3/3)

7 (continued)

https://19january2017snapshot.epa.gov/sites/production/files/2015-09/documents/eisa-438.pdf. For these measures to be effective, they should be incorporated early in the design phase of the project. Other information can be found at: U.S. EPA's Low Impact Development Website: www.epa.gov/nps/lid ; U.S. EPA's Smart Growth Website: www.epa.gov/smartgrowth ; and the International Stormwater BMP Database: http://www.bmpdatabase.org

8

- We recommend a discussion of wetland function be provided in the EA. As the project area is prone to flooding, these wetlands may provide an important ecosystem service to buffer high water conditions. The EA states that the project would impact wetlands. All efforts should be made to avoid and minimize these impacts.

9

- We suggest the secondary and cumulative impacts section analyze the potential effects of the loss of the wetland functions in the watershed. As stated above, further avoidance and minimization of impacts to aquatic resources should be evaluated. Selection of appropriate mitigation should consider loss of these functions to the watershed.

10

- We suggest the EA discuss how any demolition material will be handled.

11

- We note that the proposed alternative does not trigger air thresholds for general conformity, though the project location does lie in a nonattainment areas for ozone and is a maintenance area for fine particulates (PM2.5). The study methodology averages annual construction and other direct/indirect emissions over the 5-year project life, rather than determining actual emissions for each year. Though not a concern for this project, we recommend future analysis provide yearly data.

12

- The documentation of the MOVES model analysis to support air emissions estimates is limited. Though not a concern for this project, we suggest future analysis include the MOVES files, modeling assumptions, a project construction schedule with annual information, more detailed annual breakdown of emissions and a construction equipment and activity list.

Responses to Letter 2: U.S. Environmental Protection Agency (March 1, 2018)

1: The roadway names have been added to Figures 1-2 and 1-3 in the Final EA. Clarification has been added that Observation Road and Piper Lane are public roadways (Section 2.1.1, paragraph 2, of the Final EA).

2: Section 2.1 of the Draft EA and Final EA provides the reader an overview of the two purposes of the Proposed Action. Section 2.1.1 provides details on one purpose of the Proposed Action (i.e., to develop and maintain safe and modern facilities), while Section 2.1.2 provides details on the second purpose of the Proposed Action (i.e., to improve financial self-sustainability). With regards to Section 2.1.1, the West Corporate Redevelopment Study, Airport Master Plan Update, and 2032 Comprehensive Plan Manassas Next directly support the purpose and need to develop and maintain safe and modern facilities at the Airport. As such, the information in Section 2.1 is applicable to the more detailed description of the City's purpose and need for the Proposed Action.

3: Coordination with the Virginia Department of Transportation is described in Section 5.9.3.2, paragraph 10, of the Draft EA and Final EA. Text describing that the City would coordinate with the appropriate local entities during the design and construction of the proposed roadway improvements has been added to Section 5.9.3.2, paragraph 10, of the Final EA.

4: Coordination with the VDGIF and VDCR occurred throughout the preparation of the Draft and Final EA (see Appendices B and F of the Draft EA and Final EA). Appendix B of the Draft EA and Final EA includes the USFWS certification for the determination for federally-listed species as it related to the Proposed Action. The qualifications of the personnel involved in the field survey is included in Section 7.2.3 of the Draft and Final EA, with additional details regarding the individual's qualifications added to the Final EA. A description of the protocols followed during the survey has been added to the third paragraph of Section 4.2 of the Final EA.

5: The floodplain analysis prepared for this EA follows the requirements and guidance of FAA Order 1050.1F and FAA Order 5050.4B. During design of the Proposed Action, the City may consider measures to accommodate extreme weather events.

6: Stormwater management would not be placed in in Waters of the U.S. Sections 5.6.3.2 and 5.11.3.2 of the Draft EA and Final EA describes, in detail, that the City would be responsible for obtaining a VPDES construction permit prior to the start of ground disturbing activities. The permit includes the development of a SWPPP to address any hazardous material issues, as necessary, associated with the Proposed Action. Section 5.11.3.2 also describes that the City would meet VSMP requirements for water quality and that the City would amend the Airport's VPDES Industrial Stormwater General Permit for stormwater discharges associated with the Proposed Action, as necessary. The stormwater management associated with the Proposed Action would be designed in a manner that does not cause downstream flooding. The selected design contractor may consider Low Impact Development techniques in the design of the Proposed Action.

7: The selected design contractor may consider Low Impact Development techniques in the design of the Proposed Action.

8: Section 5.11.3.2 of the Draft EA and Final EA describes why the impact to 1.62 acres of wetlands cannot be avoided. A discussion of the wetlands' functions has been added to Section 4.11 of the Final EA. In addition, the wetland mitigation takes into consideration the function of the wetlands.

9: The potential cumulative impacts associated with the loss of 1.62 acres of wetlands is described in Section 5.12.3.2 of the Draft EA and Final EA. In addition, Section 5.11.3.2 of the Draft EA and Final EA describes why the impact to 1.62 acres of wetlands cannot be avoided, and that the wetland mitigation would take into consideration the function of the wetland being affected. Language further explaining this loss of wetland function has been added to Section 5.11.3.2 of the Final EA.

10: Section 5.6.3.2 of the Draft and Final EA describes how demolition material would be handled.

11: The City acknowledges the USEPA's recommendation to provide yearly air quality emissions in future analyses.

12: Appendix G of the Draft EA and Final EA provides the MOVES model analysis files for the analysis related to the Proposed Action.

Letter 3 (Page 1/3)

Heath, Natalie

From: Howard, Janine (DEQ) <Janine.Howard@deq.virginia.gov>
Sent: Monday, March 05, 2018 8:22 AM
To: Heath, Natalie
Cc: Ewing, Amy (DGIF)
Subject: FW: ESSLog# 38126_18-022F_Manassas_DGIF_AME20180302

Good Morning Natalie,

I am passing on the below comments from DGIF on the Manassas airport project. They were received after we submitted our comments on the draft EA and therefore were not included. Please take them into consideration and forward them on to your client.

Thank you,

Janine Howard
Environmental Impact Review Coordinator
Office of Environmental Impact Review
Virginia Department of Environmental Quality

Bank of America Building
1111 East Main Street, Suite 1400
Richmond, Virginia 23219

t: (804) 698-4299
f: (804) 698-4178

For program updates and public notices please subscribe to the OEIR News Feed

DEQ Mailing Address:
Post Office Box 1105
Richmond, Virginia 23218

From: Ewing, Amy (DGIF)
Sent: Friday, March 02, 2018 4:51 PM
To: Howard, Janine (DEQ)
Cc: nhreview (DCR)
Subject: ESSLog# 38126_18-022F_Manassas_DGIF_AME20180302

1 Broad Run, which borders the airport on the southern side, is designated a Threatened and Endangered Species Water due to the presence of state Endangered brook floaters. It does not appear any instream work is proposed in which case we do not anticipate this project to result in significant adverse impacts upon this species. If instream work becomes necessary, we recommend additional coordination with us.

2 This project is located within 2 miles of a documented occurrence of a state or federal threatened or endangered plant or insect species and/or other Natural Heritage coordination species. Therefore, we recommend coordination with VDCR-DNH regarding the protection of these resources.

3 We recommend coordination with the USFWS regarding potential impacts upon federally Threatened northern long-eared bats associated with tree removal.

1

4 To minimize the adverse impacts of linear utility/road project development on wildlife resources, we offer the following general recommendations: avoid and minimize impacts to undisturbed forest, wetlands, and streams to the fullest extent practicable; maintain naturally vegetated buffers of at least 100 feet in width around wetlands and on both sides of perennial and intermittent streams, where practicable; conduct significant tree removal and ground clearing activities outside of the primary songbird nesting season of March 15 through August 15; and, implement and maintain appropriate erosion and sediment controls throughout project construction and site restoration. We understand that adherence to these general recommendations may be infeasible in some situations. We are happy to work with the applicant to develop project-specific measures as necessary to minimize project impacts upon the Commonwealth's wildlife resources.

5 Assuming adherence to erosion and sediment controls, we find this project consistent with the Fisheries Management Section of the CZMA.

Thanks, Amy

Amy M. Ewing
Environmental Services Biologist
Manager, Fish & Wildlife Information Services
VA Dept. of Game and Inland Fisheries
7870 Villa Park Dr., Henrico, VA 23228
804-367-2211 www.dgif.virginia.gov

"That land is a community is the basic concept of ecology, but that land is to be loved and respected is an extension of ethics." Aldo Leopold, 1948

DEPARTMENT OF GAME & INLAND FISHERIES
CONSERVE. CONNECT. PROTECT

Responses to Letter 3: Virginia Department of Game and Inland Fisheries (March 2, 2018)

1: Section 4.2 of the Draft EA and Final EA describes the designation of Broad Run. No instream work is required as part of the Proposed Action.

2: The City has coordinated with VDCR regarding the Proposed Action (see Appendices B and F of the Draft EA and Final EA, and Appendix I of the Final EA).

3: The City has coordinated with USFWS regarding the Proposed Action (see Appendix B of the Draft EA and Final EA).

4: The recommendations provided are included in Section 5.2.3.3 of the Draft EA and Final EA.

5: The determination regarding the Proposed Action's consistency with the Virginia Coastal Zone Management Program is described in Section 5.4.3.2 of the Draft EA and Final EA, as well Appendix F of the Draft and Final EA.