



July 2025

STREAM MITIGATION DESIGN REPORT

MILL SWAMP MITIGATION BANK

Charles County, MD



Submitted to: Charles Soil Conservation District

**APPENDIX G
MITIGATION WORK PLAN**

MODIFICATION DATE: June 27, 2025



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01. INTRODUCTION

This **Appendix G** contains the elements of the mitigation work plan as specified in the MD MBI Template dated February 11, 2025, which is the basis for this document. The included mitigation plan discusses the template elements as required. In this section, the Sponsor has included supplemental information to the Mitigation Work Plan (MWP) for the IRT which details additional elements required for review. The Sponsor shall obtain MWP approval of the IRT prior to commencement of construction activities, which may include revisions later to meet specific permit conditions as required by the IRT.

The subsequent MWP elements are covered in the following sections, which include detailed specifications and work descriptions, including but not limited to:

- *The geographic boundaries of the Bank construction methods, timing, and sequence.*
- *Source(s) of water, including connections to existing waters and uplands.*
- *Methods for establishing the desired plant community.*
- *Plans to control invasive plant species.*
- *Soil management*
- *The proposed grading plan, including elevations and slopes of the substrate.*
 - *Erosion control measures,*
 - *Planform geometry, channel form (e.g., typical channel cross-sections), watershed size, design discharge, and riparian area plantings*

02. DESIGN APPROACH

The proposed restoration design, for improvements within the project area, is based upon a multitude of assessments and data evaluation, which included specific habitat assessments and analysis to determine departure from IRT-established creditable habitat parameters. This includes a watershed assessment, a historical perspective and understanding of the causes of current site instability, geomorphic and wetland data evaluation, soils assessment and validation, invasive species inventory, and a sediment transport analysis. All of these studies, located in the Baseline Information Report (**Appendix E**) have been utilized to provide guidance to the proper channel and floodplain dimensions which will serve to maintain sediment equilibrium and long-term stability without the need to import large quantities of stone or synthetic materials. The proposed design will focus on providing restoration approaches to address the principal impairments within the project area via the Stream Evolution Triangle (Castro et al., 2019) and the specific detailed Maryland IRT-accredited assessments previously outlined.

The objectives and basis for the design are as follows:

- Develop a stable design, dimension, pattern, and profile that will promote stable geomorphic function to both the proposed channel and the proposed floodplain.
- Develop a complex and biodiverse wetland system through hydrologic variation, microtopography, and vegetation heterogeneity to improve ecosystem functions, enhance landscape connectivity, and increase resilience to disturbances.



- Reduce floodplain velocities to accrete organic debris and suspended sediments through riparian vegetation, course woody debris, and floodplain reconnection.
- Develop a design approach which retains forest stands and limits the removal of trees to those that are absolutely necessary to achieve ecosystem wide goals.

The design approach to this system is a modified Rosgen/Floodplain Restoration approach as suitable for the Maryland coastal plain. The methodology utilizes both present day as well as historical references, and historic site soils to meet top level physiochemical and biological goals for the project. These goals are outlined in **Appendix E**. Additional details of the approach include:

- A proposed streambed profile utilizing native materials and furnished substrates of geologically appropriate composition and size in the event of a lack of native material or where needed for transitional reaches.
- A proposed low-gradient channel. Historic analyses indicate stable site conditions consist of a low-gradient system of moderate sinuosity which frequently connects to the floodplain during minor precipitation events promoting hydrologic complexity.
- A hydrologic and hydraulic regime where the stream floods frequently in a non-erosive manner to maintain geomorphic and biological functions in a depositional floodplain environment.
- Developing a low-energy floodplain environment with maximum shear stresses typically do not exceed 2.0 lbs./sq. ft., and a much lower average channel shear stress. A variety of woody debris structures have been proposed for minor grade control and specific habitats, which are sustainable with a surface treatment of native herbaceous and woody plant species through the full range of the ultimate conditions hydrograph.
- Planting with diverse and suitable woody and herbaceous species to stabilize site soils as well as promote woody substrates in the channel and wetlands.

The proposed design is intended to restore conditions which once existed prior to colonial settlement disturbances.

02.01. INTEGRATED WETLAND DESIGN ELEMENTS

Wetland design is largely dictated by the stream design methodology, as the two are intrinsically linked and not separable. A fundamental tenant of this design approach is that for multiple hydrologic conditions through the year, portions of the stream may be virtually indistinguishable from the wetland; similarly, close connectivity through shallow emerged habitats should distribute channel baseflow through the wetland as well as add groundwater from the wetland to the channel through hyporheic exchange. Stream channel pool and point bar locations are blended and connected to the floodplain. Additional floodplain connection is provided through small wetland stream channels (zero-order channels) which provide habitat for small fish and amphibians and shelter from predators.

Part of the proposed plan derives from reference studies multiple high-quality wetlands in the region. The specifics of these reference parameters are proprietary and not available to the IRT. This includes the use of log boulder step structures to allow floodwaters to access adjacent floodplains, create habitat and biodiversity, trap sediment and nutrients, and provide minor grade control. These structures have been utilized successfully at multiple coastal plain locations in Maryland, including grant funded projects on the Eastern shore as well as the Glenstone Museum. Areas with these proposed structures are located in forested portions of the site which due to their minimal installation footprint will limit any negative tree impacts. These structures provide a more permanent solution then post-assisted log structures and do not require the ongoing maintenance of beaver to maintain their stability. They serve to create a permeable element



which perches surface water and saturates adjacent floodplain soils, as well as provides shallow emergent areas suitable for a variety of purposes. These devices are not intended to be water-sealing dams, but porous devices made of logs, uncompacted mud, sticks, woody debris, and stones or boulders. Their composition will vary as salvaged materials vary through the site, and as woody vegetation grows in them over time. Woody vegetation will be installed via live stakes, seeding and planting, as well as management to foster native volunteers from the adjoining woodland and those seeds washing in through flow events. Accumulation of leaf pack from flow events will aid in long-term sequestration of organic matter, further developing organic floodplain soils.

The resulting habitats should therefore be one where vegetation controls the stream and wetland morphology. Temporary minor impoundment will alter vegetation towards the emergent regime, and during drier periods encourage tree and shrub growth integrated into those emergent areas. Long-term evolution of those areas will trend towards forested wetlands barring beaver herbivory. Other areas with longer inundation periods will vary as shallow emergent or small patches of mud flat habitats. Greater periods of inundation may result at the beginning and end of the growing season.

Using these approaches, wetlands are constructed to be immediately 2-parameter positive with hydric soils and surface/groundwater integrated hydrology. Obligate plant communities then immediately follow. Wetlands may be seasonally inundated due to higher stream flows.

Course woody debris are an essential element of the wetland design. JMT's preference is to utilize all materials which would be impacted through the grading process, and leave scattered branches, trees, and brush piles throughout the floodplain. Providing this type of carbon source not only provides cover and substrate for reptiles, amphibians, and birds, but provides additional carbon sources to the soil, overwintering habitats, and perching opportunities for birds. Floodplain roughness with the use of microtopography is also provided, slowing water flow through the floodplain, and further enhancing opportunity for hyporheic exchange and sediment deposition.

02.02. STREAM ELEMENTS

Specific design elements of this project are proposed to restore top level biological and physiochemical functions as defined in the Maryland IRT-defined crediting calculator(s). The performance standards in **Appendix I** specify what physical habitat and other elements are to be installed and their performance. Descriptions of these elements are included here:

Geologic Substrates

Where possible, materials native to the site will be re-used for the benefit of the restoration project. This includes the use of site soils and gravels in the foundation of the stream and floodplain.

- Furnished and native materials larger than gravel, such as cobble and boulder, will be utilized in the design for channel flow diversity and the pinning of woody debris structures.
- Floodplain surfaces shall be composed of native hydric soils uncovered through excavation, or suitable salvaged site topsoil. Uncovered hydric soil and site topsoil are at least 6-inches deep and have an average organic content of 2.00% across the project site.

No bank armoring of any type is proposed for credit, including imbricated riprap, rock toe, or other stone bank practices. Stone usage is limited to substrates and flow alteration structures as described in the design plans. Channel Form, Facet, and In-Channel Habitat Formation



The channel form will be modified to be in accordance with known reference parameters and to sustain a self-forming and diverse geomorphic system, capable of maintaining top-level biological and physiochemical functions and values. The channel will be altered to correct principal impairments previously identified in this document.

- Increase channel sinuosity to facilitate the stable formation and maintenance of diverse pools for in-channel cover and refugia. Add meander bends within acceptable stable known reference parameters for Coastal Plain streams. Construct a new channel offline, where able, to limit impact to existing resources and facilitate work curing in-channel time of year closures.
- Re-align confluences of tributaries to reflect reference habitat parameters and less reflect land drainage features.
- Re-size and re-shape channel for improved baseflow habitat and within reference parameters for floodplain restoration, Rosgen C4 and B4/B4c restored streams.
- Increase frequency of channel flooding to leave the base flow channel.
- Provide flow diversity through facets, obstructions, and graded features.
- Provide in-channel overhead cover for meander bends.
- Provide micro pools and other flow diversity features in each riffle, through the addition of random boulders and other substrates.
- Provide compound and diverse pools.
- Provide greater pool variability, including the addition of thermal refugia / overwintering pools greater than two feet static depth.
- Preserve existing habitats identified in preservation locations.

Woody Substrates:

Extensive alternatives analysis and design iteration has been used to limit disturbance to large and otherwise significant trees. The best evidence of this is the use of uplift and limited grading footprints which directly save specific stands and trees. However, some clearing of smaller trees is necessary in some locations to achieve the proposed project performance standards mandated by the IRT. Necessary tree removal consists primarily of low-quality trees smaller than 6-inches, trees in fair to poor condition, and Tulip Poplars which have weak wood, are prone to storm damage, and a shallow and competitive root system. Forest stand and individual tree retention is of utmost importance for the design of the project site. Tree protection measures are proposed for trees within the limit of disturbance that are to remain throughout the entirety of construction, as seen on the design plans. Trees 18-inches and above, that are slated for removal, can be seen on the Tree Inventory Table in **Appendix G.1**. Salvaged woody material will be utilized in the project design. Additional material may be imported from other offsite locations and approved for use prior to coming onto the project site. Approval will include screening for size, type, or any noted invasive species.

Trees and other woody materials salvaged during excavation of the proposed floodplain will be fully repurposed to provide minor grade control and habitat features throughout the proposed channel and floodplain. Trees are sustainable, renewable resources. These materials provide critical organic value to the ecosystem for both fish and wildlife. The extensive use of wood sequesters an available carbon source vital to both floodplain and in-channel nutrient processing.

Wood structures/habitat features to be implemented include:

- In channel log placements will be installed throughout the project reach to provide grade control and to generate low magnitude flow shear stress to aid in the formation and maintenance of pools. Logs from trees removed during



construction within the project site limits of disturbance will be salvaged and repurposed for use. The use of these in riffles will be used for substrate variability and minor grade control, and to generate flow diversity. Log vanes will utilize logs for similar flow manipulation.

- Toe wood will be utilized as cover and substrate in meander bends. This material is not an armoring process, but rather a means of creating a varied channel edge with cover opportunities. Its use in outer meander bends is to ensure shear stress adequately maintains voids between twigs and branches of debris to sustain cover. Because of its placement, it is commonly confused with an armoring practice.
- Course woody debris to be utilized in the proposed design includes the repurposing of smaller branches, saplings, treetops, and stumps removed during grading operations. The woody debris will be placed randomly throughout the project site as directed by an on-site designated stream specialist. Course woody debris in the channel and floodplain provide organic food content, critical cover for fish and wildlife and a trapping mechanism of finer organic materials. Broken and exposed wood also provides habitat for insects. Standing dead wood provides habitat for cavity nesting birds and roosting sites for bats. The woody debris will also aid in constructing a floodplain with varied microtopography and habitat diversity. The inclusion of woody stream bed materials and log grade controls will likely increase the capture and deposition of leaf litter and course organic material for macroinvertebrate processing. These habitat enhancements will positively benefit fish communities by increasing habitat refugia and food sources for fish and are expected to have significant benefits for small fish.

Vegetation:

In the proposed conditions, the entire floodplain area will be seeded with a robust native seed mix, which contains numerous native herbaceous plant species. Tree plantings are proposed throughout the floodplain area and adjacent upland areas. In the proposed conditions, the channel and floodplain vegetation will be highly connected to groundwater, providing year-round thermal stability. In addition, due to the small size of the proposed channel, the proposed herbaceous and grass community along the channel will accomplish or surpass the shading processes of trees during initial stability. The combination of a restored hyporheic connection and improved shade will enhance year-round temperature regulation. The use of trees on restored floodplains is not necessary to achieve long-term stability. Research from respected academia suggests that many stream valleys remained stable for thousands of years as sedge dominated, emergent wetland systems, largely devoid of trees. However, since the existing forest will be temporarily and minorly disturbed and existing trees repurposed, it is very appropriate to restore the proposed valley bottom to a forested condition.

Small or Zero Order Streams:

The purpose of smaller order streams on the project site is to restore the braided and small order stream habitats lost in the watershed as well as on the project site from agricultural impacts. These restored streams are habitat for young fish, smaller species of fish, amphibians, and macroinvertebrates. They serve as refugia in high flow conditions and as direct conduits for groundwater input into the mainstem and tributaries. They are a specific / specialist habitat represented in the overall restoration plan and credited at a lesser ratio through the mitigation credit calculator than other resources to take this into account.

Multiple new tributaries are proposed to increase the quantity of stream refugia on the site. The proposed design for these includes riffles at two feet wide and approximately 0.25-feet deep. Pools are varied and amorphous and intended to blend into mixed channel and wetland features as they accumulate detritus, vegetation and fine sediments. Braiding of channels



is anticipated in pool facets in the long term. Because of the small width, quick herbaceous overhead cover is anticipated for these channels, shading them within the first full growing season.

Channels such as these historically have been straightened, channelized, drained, and tiled, making them relatively rare within the watershed. They are an essential habitat for small and juvenile fish, herpetofauna, and other wildlife, and represent an interface between upland and wetland areas and the main stem channel.

Soils:

The project site has been historically altered for agricultural operations, disconnecting the channel from its floodplain as well as incising toward earlier geologic materials. A noted absence of carbon is visible in the more recent soil horizons, where landscape alterations are evident, indicating drier conditions with less carbon sequestration. Given this, JMT estimates that the present-day project conditions do not sequester carbon as effectively as historic conditions. The proposed shallow floodplain will improve wetland functions and aid in the creation of a wetland soil which rapidly sequesters carbon.

Excess site soils are inevitable in a restoration project such as this. In general, excess soils will be disposed of on-site or at an approved off-site location owned by the landowners in concert with the Charles Soil Conservation District (SCD). The soils are typically suitable for fill or agricultural purposes. This soil will be stabilized as appropriate via the farm's approved conservation plan.

Other soils may be exported from the site to approved disposal areas and stabilized per their individual site plans. All soil transport will be within the requirements of an approved erosion and sediment control plan.

- Vegetation Selection to Foster Sequestration of Soil Carbon: Tree and wetland species which create large amounts of biomass are proposed. This includes sycamores, maples, and other species which rapidly grow, producing leaves, bark, seeds, and other organic detritus. Increasing the organic carbon content of soils has multiple benefits, including enhancing infiltration rates, promoting plant growth, and reducing atmospheric carbon. Submerging woody debris in wetlands not only sequesters carbon but creates subsurface structure and texture characteristics found in high quality wetlands.

03. WETLAND PRESERVATION, RESTORATION AND ENHANCEMENT DESIGN

As discussed in previous sections, this design integrates stream and wetland design together into a system, where stream and wetland elements may blend depending on the level of inundation. In this respect, riverine wetlands are the dominant proposed type.

This mitigation work plan additionally preserves, enhances, and restores wetlands on the site. Preservation, though a passive design practice, has a direct response on the success of enhancement and restoration activities on the site. Preservation areas were selected based on their perceived high quality and high functional ability; such examples of this include forested wetlands with mature trees and stable hydrology. Preservation wetlands overall are forested with varying degrees of hydrologic connectivity. Most are seasonally inundated, perching surface flows predominantly through the winter, spring and early summer depending on precipitation. The wetlands highlighted for preservation have functions and values which could not be easily replicated in a restored wetland within a ten-year monitoring framework.

Preservation wetlands serve important purposes and are required for the success of the restored and enhanced wetland areas. They are refugia during construction for species which may be displaced in the construction and impact of other



existing wetlands and buffer areas. They additionally serve to provide a source adjacent to restored and enhanced areas to facilitate the repopulation native of species in the restored and enhanced areas. While these areas are proposed to be planted, natural recruitment of trees and wetland plants is important to the success of these areas.

Wetland rehabilitation/enhancement includes multiple practices combined:

- Increased floodplain connectivity through grading or hydraulic changes to the stream which enhance frequent connection of the wetland and the stream.
- Increased connectivity to adjacent existing, preserved, or enhanced wetlands. Alteration of surface and other runoff hydrology to enhance wetlands.
- Removal of invasive species and replanting with robust native trees, shrubs and herbaceous material to increase diversity and function of wetlands.
- Placement of coarse woody debris and other woody substrates within the wetlands.
- Maintaining, creating, and enhancing microtopography to support wetland function through textural / substrate changes.

Wetland enhancement approaches include not only changes in overall connectivity but substrate of wetlands, hydrology, and connectivity to effect functions and values on a systems-wide basis. They include invasive species management but also practices which impact the viability of invasive species found in the seed bank and those likely to volunteer on the site. They are proposed to be monitored similarly to restoration practices to facilitate comparison to preserved and restored systems to determine if functional uplift has occurred.

The fundamentals of the wetland restoration design of the site focuses on the assumption, which has been verified through Groundwater Well data (**Appendix E**), that sources of groundwater hydrology underlie much of the grading footprint and will be connected through the grading activities of the proposed design.

These fundamentals of floodplain restoration dictate the soils and hydrologic regime of the restored wetlands and indicate that these restored areas were historically wetland prior to agricultural impacts. As soils and hydrology are so readily apparent at these elevations, hydrology should be apparent in these systems year-round, as expressed through groundwater being at or near the floodplain surface and these areas being frequently inundated from the stream.

Because wetland restoration approaches require extensive earthwork, and that earthwork must be coordinated with stream channel work, this work must be supervised by a designated specialist or design engineer, particularly at points of intersection with the limit of disturbance and existing resources to be preserved. Grading efforts must ensure that secondary impacts to wetlands do not occur outside of the limit of disturbance, and similarly, that drainage patterns and connectivity of these resources to the stream channel are preserved. These drainage patterns and connectivity are often governed by very small topographic features, which may have escaped the topographic survey efforts, therefore field supervisory staff will have the following methodology at their disposal:

- The ability to coordinate the limit of disturbance with the resources observed in the field following stakeout. The contractor and Engineer shall walk and approve the limit of disturbance and adjust as necessary and coordinate with the soil conservation district to ensure preservation wetlands, specific trees, and other nature features are adequately accommodated.



- Adjustment of the grading plan to adjust drainage patterns, including installing micro berms, logs, and other flow controls, as directed to prevent impact to resources outside the limit of disturbance.
- Flexibility and understanding of the grading and design parameters to inform and direct the contractor to maximize success of the restored and preserved resources.

Existing wetlands near or adjacent to proposed grading areas will be monitored to ensure that there will not be adverse impacts to their hydrology. The primary source of hydrology for all of these identified wetlands is upgradient surface driven which will not be impacted through the restoration activities. These wetlands are defined below in the following Table as well as the Site Credit Map located in **Appendix F**:

Table 1: Existing Wetlands Requiring Hydrologic Monitoring

Wetland	Classification	Activity
WET W 02	PFO	Preservation
WET W 03	PEM	Preservation
WET W 05	PEM	Preservation
WET W 05	PFO	Preservation
WET W 06	PSS	Preservation
WET W 06	PEM	Preservation
WET W 06	PFO	Preservation
WET W 09	PEM	Preservation
WET W 10	PEM	Preservation

03.01 COMPLIANCE WITH MDE’S WETLAND MITIGATION STANDARDS

MDE’s guidance document, “Phase II Wetland Mitigation Plan – Required Information – Revised March 27, 2025” must be complied with to meet wetland mitigation guidance for this banking project. While much of the document is complied with through the MBI and its various appendices, key design elements are discussed in this section.

Existing and proposed wells and boring locations: Four (4) groundwater wells were installed on the Tippet agricultural properties to determine hydrology for the design of this section of the project, other areas have been observed to have groundwater and stream hydrology. The soil and hydrologic design elements of the project were based on floodplain restoration methodology. A proposed well plan will be included with the as-built plans submitted to the IRT; iris tubes or



films are proposed to indicate saturation and reduction. All hydrology is groundwater and surface water based per floodplain hydrology.

Best management practices: MDE's best management practices will be used to build the project, with the exception of chisel plowing to reduce compaction, as this would disturb the geologic valley substrates in the project. Other practices to reduce compaction including creating roughness and rough grading with the teeth on an excavator bucket have been shown on these projects to achieve a similar reduction in compaction within the top 6-12 inches of floodplain soils, suitable for vegetation growth. Chisel plowing typically disturbs 12-18 inches of soil depth and ruins the underlying geologic base layer.

Soil and substrates: Existing in-situ hydric soil and salvaged topsoil, as field verified, will be used for wetlands. Extensive use of coarse woody debris will augment the wetlands. Coarse woody debris will be in various configurations for habitat, perching, and herpetofauna habitat purposes. Microtopography will be incorporated across the site at 3-6 inches less than or greater than the planned elevation through placement of debris and through normal grading operations. The site grading tolerance is ± 0.02 -feet to facilitate this. Imported or salvaged topsoil will not be placed as the existing hydric soil layer and seed bank are necessary, unless areas are encountered which lack the appropriate soils. Additional topsoil on this surface would entrench the stream and limit floodplain connectivity.

Planting: A detailed planting plan is provided in **Appendix G.3**. It includes a variety of herbaceous seedlings, as well as tree and shrub plantings. The plan, through strategic tree saves and proximity to forest resources, has provisions for allowing natural volunteers of native species to be part of the overall vegetation composition, and tries not to plan species anticipated to volunteer on the site.

Reference Systems: Multiple reference wetlands were utilized for an understanding of the site restoration potential. Key parameters were taken from local references which scored an 80 or above in MDWAM assessment, including vegetation composition, topography / microtopography in relation to water surfaces, depths, proportions, and specific habitat elements including side slopes, differing slopes in transition areas, and species in relation to design water surface. Groundwater wells will be installed to monitor these reference wetlands concurrent with long-term monitoring of restored wetlands. Systems include public and private systems that are not accessible, including forested, scrub shrub, and emergent systems. JMT is modeling the proposed wetlands principally on the reference data collected on the Calvert Cliff / Excel Nuclear Generation site as well as completed floodplain restoration projects through Maryland and Pennsylvania. Collected reference data is proprietary; however, the basic parameters are approximate to Maryland's performance standards.

Hydrology at the reference sites is complex is evident in hydric soils with redox characteristics; soils are low chroma with iron and / or manganese nodules evident within the first foot of soils as seen not through test pits, but through beaver activity including small excavations and slides. The performance of this wetland through multiple years of observation indicates it matches well with MDE's wetland performance standards, as detailed in the performance standards of the MBI. This includes density of vegetation exceeding MDE's standard for small trees and shrubs, multiple inundation periods through the year including a seasonal inundation longer than 60 days from March-May, and period storm inundations exceeding two weeks following storm events during the July-September period. Native cover is over 85% with small pockets of herbaceous invasive cover observed in disturbed areas from park maintenance. Invasive cover includes is a relatively minor component of site, however the threat of adjacent phragmites is associated with all reference wetlands. Scrub shrub portions of the site include winterberry, which is dense in some areas, but also found through the site along



with dogwoods, willows, and redbud. Stream performance is similar with fish observed below and above dam and log/root step structures, and connectivity existing during storm events and periods of elevated seasonal flow.

04. VEGETATION AND PLANT COMMUNITY

As mentioned in the section above, a detailed planting plan with plant list is included in **Appendix G.3**. The goal is to create and restore native plant communities that provide ecosystem services and provide habitat for various wildlife. The planting plan is divided into various planting zones based on wetland indicator status. Tree and shrub species are chosen by understanding the existing community, supplementing with species that are native to the area and coastal plain province. Vegetation is established through seeding and direct planting by hand or aided by machines. Seeding is conducted via hand seeders, and installed plants are protected from herbivory through tree shelters and wire cages. Management of the vegetation includes pruning, replacement, and management of invasive species via the Maintenance plan in **Exhibit H**.

All plants should be healthy and free from any signs of insect, disease, injury, or show signs of any other stress. Plant species will be inspected by the on-site designated specialist or design engineer prior to installation. Plants will be installed during suitable times of the year for those species and nursery stock type.

Vegetation and Non-Native Invasive Species will be monitored post-installation per the Performance Standards in **Exhibit I**.

05. CONSTRUCTION METHODS

The project involves earthwork, structure placement, and planting / vegetation management to establish stream and wetland restoration, using the best available industry practices. Construction will take place using equipment and labor and a qualified and experienced stream and wetland restoration contractor with direct design consultant oversight. The contractor will conduct work using best industry practices and in cooperation with stakeholders, the project owner, and all applicable permits.

Timing of the construction work will be dependent on permit-related time of year closure periods intended to protect natural resources and specific species. These will be set by the IRT as part of permit issuance. Seeding and planting will be installed only during suitable times of the year for those species and nursery stock type.

The sequence of construction will be set by the Charles Soil Conservation District (SCD) in consultation with MDE's appropriate best management practices and guidelines for erosion and sediment control. In general, however, construction will commence with appropriate agency notifications, installation of first phase erosion and sediment perimeter controls, and generally work in a progressive manner with incremental stabilization to limit the potential for sediment to leave the project site. Streams will be worked offline or pumped around to reduce potential for sediment pollution. Completed work will be final stabilized. Planting of completed work will occur at the recommended time of year based on the species. Completed work will have flow returned to it and be surveyed as part of as-built survey compliance. Final walk-throughs and agency coordination will be conducted as appropriate prior to credit release. Following final walk through, JMT relies upon bonding, and contract-specific warranties to handle any issues with workmanship, and should the site be destabilized prior to vegetation establishing, has adequate contracting mechanisms to ensure the site is returned to the as-built condition. A one-year warranty is required for all installed



plants. Vegetative cover is required as per the erosion and sediment control permit, as inspected and verified by the County.

Vegetation is established through seeding and direct planting by hand. Seeding is conducted via hand seeders, and installed plants are protected from herbivory through tree shelters and wire cages. Management of the vegetation includes pruning, replacement, and management of invasive species via the Maintenance plan in **Appendix H**.

06. BEDLOAD SEDIMENT TRANSPORT ANALYSIS

A major determining factor in the sizing of the bankfull channel for the restoration of Mill Swamp and the UNT to Mill Swamp is to analyze the existing hydraulic characteristics of the channel (cross sectional area, width, and depth) and developing channel morphology that will minimize streambed substrate mobility yet maintain the competency to mobilize finer sediments being contributed to the design reach from the upper watershed. Based on geomorphic assessment of watershed condition, we anticipate the average size of these sediments to be no more than 10 mm to 20 mm in size. To accomplish this objective the proposed channel dimensions must be sized to provide a frequent hydraulic connection to the surrounding floodplain and maintain a low transport condition during bankfull flow events.

The dimensions of the proposed channels are based upon providing stability of the proposed channel bed by focusing on creating lower energy conditions than existing conditions with frequent hydraulic connection of flows to the floodplain at levels which eliminate bank erosion. Secondly, the proposed design must have the competency to mobilize finer sediments delivered to the project reach while maintaining sediment equilibrium of the streambed substrate.

The following analysis will utilize the Andrews (1995) marginal bed load transport function to analyze critical shear stresses necessary to initiate partial movement of the finer sediments. The data presented herein will be used as a guide to help establish a range of proposed channel parameters which considers the sustainable size fraction and load of sediments through which the project reach must transport and the stability of the streambed substrates or other materials which will form the bed of the proposed channels.

Due to a variety of past and present influences, the project site conditions, and the sediment regime of the project reach and upper watershed has been greatly altered. Therefore, the baseline information provided in **Appendix E** will serve as a general guide to help establish channel parameters that promote long-term stability of the active channel and floodway in the restoration design.

05.01 PRINCIPLES

A major premise of the sediment mobility analysis is that threshold conditions defined by any critical shear stress method represent a condition of very low transport rate (Wilcock 1988). Secondly, smaller grains within a mixture of sizes tend to be harder to move than they would in a bed consisting of uniform size sediments, and larger grains tend to become easier to move in a mixture of sizes. Based upon the data presented from the gravel samples, sufficient fine material exists in these samples to demonstrate a coarsening of the riffles through its transport from the site. Riffle materials in a less entrenched system would correspondingly constitute a more well-graded mixture of gravel substrates.

Methods considered in this report for the computation of the critical dimensionless shear stress condition for marginal transport of a specific size fraction in mixed-grain sediments (Andrews et al 1995) have the form:

$$\tau_{ci}^* = a (D1/D2)^b$$



where τ_{ci}^* is the critical dimensionless shear stress for a very low transport rate for the specific size fraction in the matrix armor layer. This equation is used to estimate the conditions under which marginal transport will exist in the channel. An assumption is made that the minimum shear stress under bankfull conditions in the assessment riffle should be that which mobilizes the largest particles in the bed load. The variables D_1 and D_2 are representative sizes of the sediment samples. Using Andrews' 1995 equation, D_1 is equal to D_i identified below, and D_2 is the mean diameter particle size of the riffle surface using the Wolman Pebble Count method. Coefficient 'a' and exponent 'b' are 0.0376 and -0.994 , respectively, for the 1995 equation.

The critical shear stress for marginal transport rate of the largest size fraction in the bed load corresponding to τ_{ci}^* , which relates shear stress to bed load material, is given as:

$$\tau_{ci} = \tau_{ci}^* (s-1) \gamma D_i$$

where τ_{ci} is the critical shear stress required to mobilize D_i , which represents the largest size fraction that is considered to be mobile; s is the specific gravity of the sediment (typically 2.65); and γ is the specific weight of water (62.4 psf).

The average boundary shear stress produced by a discharge over each riffle is expressed as:

$$\tau_b = \gamma R S_f$$

where τ_b is the cross section average boundary shear stress (psf), R is the hydraulic radius, and S_f is the energy slope. Because the channel depth on riffle features is relatively shallow (bank resistance considered minor at bankfull conditions) and backwater effects from downstream bends or other blockages will be minor in the proposed conditions, the average boundary stress, using the proposed average riffle depth was considered to be a good approximation for the average stress on the wetted perimeter of the cross-sectional area. To assess the maximum boundary shear stress which may be asserted on the streambed at any single point within the cross section, R or hydraulic radius has been approximated using D (max) or the maximum channel depth. The energy slope (friction slope), S_f , for each reach is the proposed bankfull slope of the proposed channels.

The use of critical shear stress (τ_{ci}) and boundary shear stress (τ_b) methodologies provides a sound approach for calibrating the threshold and recommended bankfull parameters at the riffles studied and for establishing the proper and/or threshold values for the depth and width-to-depth ratio in the natural channel design process. The proper dimensions of the proposed channel must be sized to both maintain stability on the basal gravel layer and have the competency to mobilize finer sediments transported to the project reach from upstream erosion. This design strategy may be appropriate to encourage the deposition and treatment of very fine sediment on the proposed floodplain surface. Although the supply of fine sediment from upstream sources is not significant enough to affect future channel stability, the fine sediment supplied from upstream reaches may actually create biodiversity in the proposed floodplain and create critical habitats. This is based on the design team's geomorphic assessment of watershed conditions. The proposed bankfull channel will need to be sized to maintain a near-equilibrium condition with the finer size fractions of the sampled basal gravels. The methodology used for this analysis were derived by Andrews from specific bed-load data sets for similar stream types located in the western United States and therefore may not be directly applicable to the project site; however, they provide a conservative estimate of the expected shear stress required for sediment mobility.



05.02 ENTRAINMENT ANALYSIS

For the entrainment study, JMT will perform a sediment mobility analysis, for the Final MBI submission, utilizing the proposed bankfull channel dimensions for all reaches to be restored. The basic premise, to maintain stability of the channel bed materials, is to create hydraulic conditions in which the boundary shear stress exerted on the channel bed does not exceed the critical shear stress necessary to begin mobilization of the proposed bed materials. Each reach of the proposed design was evaluated to determine the maximum boundary shear stress experienced at bankfull.

The results of this analysis will be performed using Andrews's 1995 methodology to determine critical shear stress. The proposed channel will be plotted using RIVERMorph and will be included in **Appendix G.1**. RIVERMorph will be used to determine the maximum proposed channel boundary shear stresses found in each reach. Cross sections within riffles at bankfull conditions will be used to determine the maximum shear stress in each analyzed reach. The maximum shear stresses will be used to determine the required material sizes for each reach and if any imported material is needed. The shear conditions will be evaluated for the proposed channel substrate within the bankfull channel, which is below the 10-year storm discharge. The bankfull channel dimensions developed provide a very conservative estimate of proposed channel hydraulics and sediment mobility competency.

Table 2 will be provided at the Final MBI stage and will show the sediment mobility computations included in **Appendix G.1**. **Appendix G.1** will also include the Andrews Methodology computations which detail the sizing and critical shear stress of the proposed substrate.

Table 2: Summary of Entrainment Data (Andrews 1995 Methodology)

Reach Cross Section	D50 = Proposed Mean Riffle Bed Material Size (mm)	D _i = Mobilized Particle Size (mm)	s = Bankfull Slope (ft/ft)	T _{ci} * = Critical Dimensionless Shear Stress for Proposed Riffle Bed Material	T _{ci} = Critical Shear Stress for Proposed Riffle Bed Material (psf)	d _r = Required Critical Depth (ft)	d = Bankfull Depth (ft)*	T _b = Boundary Shear Stress (psf)
SR-2								
SR-3								
SR-3A								
SR-4								
SR-4A								
SR-4B								
SR-5								

As previously discussed, the streams on site remain highly entrenched with significant stream power, despite their seemingly small size. Under these conditions, the channel will continue to erode both laterally and vertically and mobilize sediment much larger than is sustainable in the long-term. Even utilizing USFWS bankfull discharge relationships, boundary conditions remain too high to be sustainable without the need to import large volumes of non-native materials. Sizing a larger channel through bank grading which has the competency to mobilize the native streambed and larger materials will require armoring of the channel bed and does not address the stable sediment regime of the system. Adding



“hard” structures and imported bed materials, pins or forces the channel into a defined geometry and does not account for a higher risk of maintenance or failures because water will always find a way to erode around and through the fine alluvial sediments they are founded on. In addition, these methods may increase boundary roughness within the channel and increase existing flood elevations.

Being that the primary volume of sediment, which is transported to downstream receiving waters, consists of fine gravel, sand and silt generated from bank erosion, the design discharge of the proposed channel must remain at levels which can both transport and treat fine sediment from upstream sources and remain stable on native streambed materials. Based on our assessment of watershed and project site conditions, the sustainable supply of sediment from upstream sources are anticipated to be less than approximately 10 mm in size. Identifying what should be considered the long-term sustainable supply of sediment in highly impacted eastern stream systems should be considered the primary objective of a design discharge.

07. HYDRAULIC ANALYSIS

08.01 HYDRAULIC ANALYSIS

The hydraulic model in this report was created using the U.S. Army Corps of Engineers Hydrologic Engineering Center’s River Analysis System (HEC-RAS), version 6.3.1, dated September 2022. There is no current Federal Emergency Management Agency (FEMA) model for the project site to be utilized. Therefore, cross sections were created to best represent the existing 100-year flood event within the project area. An existing model for approximately 5,039 feet of reach length was developed to evaluate the existing flood conditions. A proposed model will be developed for the Final MBI to evaluate proposed flood conditions and to compare those to existing conditions. The HEC-RAS model includes sections throughout, upstream and downstream of the proposed restoration area and was run using a subcritical flow regime.

Table 3 depicts the reach names used in the HEC-RAS model as compared to the site assessment reach naming that has previously been discussed in this document. The Unnamed Tributary to Mill Swamp joins the main stem at a junction downstream of the project site.

The HEC-RAS model is split up into two reaches. Main Stem is the main stem of Mill Swamp from upstream of the culvert under Marshall Hall Road to just before the confluence with the UNT to Mill Swamp. UNT is the Unnamed Tributary to Mill Swamp and includes the culvert Under Marshall Hall Road.

Table 3: HEC-RAS Reach Naming Convention Compared to Site Assessment Reach

HEC-RAS Reach Name	Site Assessment Reaches
Main Stem	Main channel section: SR-1, SR-2, SR-3
UNT	Unnamed tributary to Mill Swamp channel section: SR-4, SR-5

The HEC-RAS maps showing the reaches and cross sections locations can be found in **Appendix G.2**.

08.02 HEC-RAS MODEL

08.02.01 Reach Boundary Conditions



There are two boundary conditions, one for each reach. Main Stem derives a normal depth from the slope of 0.005863 ft/ft on the downstream end. The Unnamed Tributary derives a normal depth from the slope of .0093405 ft/ft on the downstream end.

08.02.02 Cross Sections

A full topographic survey within the proposed easement is combined with Charles County LiDAR outside of the easement to make a surface. Cross sections are then cut from the combined terrain data in OpenRoads Designer (ORD 10.12). For the existing conditions model the Main Stem has 28 cross sections and the Unnamed Tributary has 12 cross sections.

Table 4: Cross Sections for HEC-RAS

Reach	Existing Conditions Model	Reach	Existing Conditions Model
UNT	1871.76	Main Stem	3167.55
UNT	1816.26	Main Stem	3054.33
UNT	1751.42	Main Stem	2973.38
UNT	1594.73	Main Stem	2839.60
UNT	1407.58	Main Stem	2660.24
UNT	1160.10	Main Stem	2519.45
UNT	1024.27	Main Stem	2308.05
UNT	842.87	Main Stem	2054.86
UNT	619.62	Main Stem	1818.29
UNT	377.47	Main Stem	1659.70
UNT	213.05	Main Stem	1568.01
UNT	0.00	Main Stem	1485.47
		Main Stem	1425.23
		Main Stem	1342.71
		Main Stem	1233.44
		Main Stem	1152.32
		Main Stem	1103.11
		Main Stem	1065.85
		Main Stem	1035.74
		Main Stem	964.76
		Main Stem	862.63
		Main Stem	661.45
		Main Stem	565.90
		Main Stem	443.98
		Main Stem	280.64
		Main Stem	194.03
		Main Stem	133.53
		Main Stem	24.38



08.02.03 Manning's N-values

Roughness values for the existing model were determined based on the USGS guide for selecting Manning's n -values for natural channels and floodplains, Table 3-1 of the HEC-RAS User Manual, and verified from field observations. Each cross-section's floodplain is broken into many divisions through aerial imagery and topographic information. Manning's n values for the floodplain range from 0.02-0.10.

Table 5: Manning's n -values for HEC-RAS

Reach	Channel Manning's n -value	Floodplain Manning's n -value range	Associated land use for Floodplain Manning's n -values
Main Stem	0.049 - 0.057	0.02 - 0.10	Woods and Low Density Residential
UNT	0.057	0.02 - 0.10	Old Agriculture Field and Woods

08.02.04 Structures

There are three culvert systems in the model. There is a 6'x10.5' dual box culvert where Marshall Hall Rd crosses the Unnamed Tributary, just upstream of the proposed easement. There is also a 6'x12' dual box culvert where Marshall Hall Rd crosses the Main Stem, upstream of the proposed easement. Additionally, there is a 72" RCP facilitating Main Stem flows underneath the private driveway that runs through the project site.

08.02.05 Contraction and Expansion Coefficients

Contraction and expansion coefficients of 0.1 and 0.3 for gradual transitions between cross sections were used. Coefficients of 0.3 and 0.5 are used for cross sections adjacent to all roadway crossings and private landowner's driveway crossing.

08.02.06 Ineffective Flow Areas

Ineffective flow areas are modeled at both of the Marshall Hall Road dual box culverts on the Main Stem and Unnamed Tributary. Ineffective flow areas are also modeled at the private landowner's driveway crossing (along Main Stem). The ineffective flow areas are projected at a 1:1 angle upstream of the crossing. Downstream of the crossing, the ineffective flow areas are projected at a 2:1 angle.

08.02.07 Steady Flow Data

The 2, 5, 10, 25, 50 and 100-year design storms were evaluated in the HEC-RAS models. The design storm flows are delineated for each reach separately based on the Watershed Hydrology Study in **Appendix G**. Per MDE guidelines, the 100-year design storm is used to evaluate the water surface elevation and the 2 and 10-year design storms are used to evaluate shear and velocity. The 2, 10, and 100-years are reported in **Tables 6, 7, and 8**, respectively. Proposed data will be provided at the Final MBI stage.



Table 6: 2-Year Storm Event, HEC-RAS Summary

Reach	Station	Discharge (cfs)	Shear Stress (lb/sq ft)			Velocity (ft/s)		
			Existing	Proposed	Difference	Existing	Proposed	Difference
UNT	1871.76	320.4	0.82			3.98		
UNT	1816.26	320.4	0.33			2.36		
UNT	1785.50	Culvert	-			-		
UNT	1751.42	320.4	0.80			3.77		
UNT	1594.73	320.4	0.41			3.22		
UNT	1407.58	320.4	0.38			3.27		
UNT	1160.10	320.4	0.11			1.87		
UNT	1024.27	320.4	0.92			5.15		
UNT	842.87	320.4	0.09			0.94		
UNT	619.62	320.4	0.03			0.49		
UNT	377.47	320.4	0.06			0.95		
UNT	213.05	320.4	3.08			6.32		
UNT	0.00	320.4	0.33			1.68		
Main Stem	3167.55	298.3	0.17			1.87		
Main Stem	3054.33	298.3	0.14			1.70		
Main Stem	3004.16	Culvert	-			-		
Main Stem	2973.38	298.3	0.32			2.56		
Main Stem	2839.60	298.3	0.39			2.57		
Main Stem	2660.24	298.3	0.13			1.27		
Main Stem	2519.45	298.3	0.13			1.33		
Main Stem	2308.05	298.3	0.14			1.06		
Main Stem	2054.86	298.3	0.13			1.08		
Main Stem	1818.29	298.3	0.07			0.80		
Main Stem	1659.70	298.3	0.05			0.60		
Main Stem	1568.01	298.3	0.06			0.69		
Main Stem	1485.47	298.3	0.04			0.54		
Main Stem	1425.23	298.3	0.04			0.53		
Main Stem	1342.71	298.3	0.04			0.53		
Main Stem	1233.44	298.3	0.04			0.57		
Main Stem	1152.32	298.3	0.04			0.58		
Main Stem	1103.11	298.3	0.04			0.58		
Main Stem	1065.85	298.3	0.16			1.58		
Main Stem	1052.49	Culvert	-			-		
Main Stem	1035.74	298.3	0.86			3.82		
Main Stem	964.76	298.3	0.20			2.32		
Main Stem	862.63	298.3	0.11			1.84		



Main Stem	661.45	298.3	0.12			1.16		
Main Stem	565.90	298.3	0.15			1.35		
Main Stem	443.98	298.3	0.17			1.35		
Main Stem	280.64	298.3	0.24			1.90		
Main Stem	194.03	298.3	0.21			1.59		
Main Stem	133.53	298.3	0.16			1.71		
Main Stem	24.38	298.3	0.33			2.77		

Table 7: 10-Year Storm Event, HEC-RAS Summary

Reach	Station	Discharge (cfs)	Shear Stress (lb/sq ft)			Velocity (ft/s)		
			Existing	Proposed	Difference	Existing	Proposed	Difference
UNT	1871.76	1256.5	0.12			1.12		
UNT	1816.26	1256.5	0.02			0.49		
UNT	1785.50	Culvert	-			-		
UNT	1751.42	1256.5	3.93			9.00		
UNT	1594.73	1256.5	1.01			5.05		
UNT	1407.58	1256.5	0.42			2.91		
UNT	1160.10	1256.5	0.24			2.04		
UNT	1024.27	1256.5	0.43			2.30		
UNT	842.87	1256.5	0.18			1.42		
UNT	619.62	1256.5	0.11			0.97		
UNT	377.47	1256.5	0.32			1.91		
UNT	213.05	1256.5	0.64			2.42		
UNT	0.00	1256.5	0.73			2.42		
Main Stem	3167.55	735.4	0.06			0.92		
Main Stem	3054.33	735.4	0.03			0.61		
Main Stem	3004.16	Culvert	-			-		
Main Stem	2973.38	735.4	1.01			4.61		
Main Stem	2839.60	735.4	0.75			3.21		
Main Stem	2660.24	735.4	0.22			1.49		
Main Stem	2519.45	735.4	0.22			1.53		
Main Stem	2308.05	735.4	0.22			1.34		
Main Stem	2054.86	735.4	0.27			1.50		
Main Stem	1818.29	735.4	0.16			1.15		
Main Stem	1659.70	735.4	0.11			0.94		
Main Stem	1568.01	735.4	0.17			1.15		
Main Stem	1485.47	735.4	0.12			0.94		
Main Stem	1425.23	735.4	0.12			0.94		
Main Stem	1342.71	735.4	0.11			0.96		



Main Stem	1233.44	735.4	0.13			1.06		
Main Stem	1152.32	735.4	0.14			1.09		
Main Stem	1103.11	735.4	0.13			1.07		
Main Stem	1065.85	735.4	0.38			1.97		
Main Stem	1052.49	Culvert	-			-		
Main Stem	1035.74	735.4	3.49			7.93		
Main Stem	964.76	735.4	0.41			3.56		
Main Stem	862.63	735.4	0.18			2.50		
Main Stem	661.45	735.4	0.22			1.60		
Main Stem	565.90	735.4	0.22			1.52		
Main Stem	443.98	735.4	0.32			1.79		
Main Stem	280.64	735.4	0.3			1.81		
Main Stem	194.03	735.4	0.25			1.61		
Main Stem	133.53	735.4	0.24			1.68		
Main Stem	24.38	735.4	0.53			2.73		

Table 8: 100-Year Water Surface Elevations

Reach	Station	Discharge (cfs)	Existing WSEL (ft)	Proposed WSEL (ft)	Difference
UNT	1871.76	2682.3	23.68		
UNT	1816.26	2682.3	23.70		
UNT	1785.50	Culvert	-		
UNT	1751.42	2682.3	22.37		
UNT	1594.73	2682.3	20.50		
UNT	1407.58	2682.3	19.31		
UNT	1160.10	2682.3	18.35		
UNT	1024.27	2682.3	17.90		
UNT	842.87	2682.3	17.48		
UNT	619.62	2682.3	17.26		
UNT	377.47	2682.3	16.71		
UNT	213.05	2682.3	15.76		
UNT	0.00	2682.3	13.95		
Main Stem	3167.55	2230.7	17.15		
Main Stem	3054.33	2230.7	17.07		
Main Stem	3004.16	Culvert	-		
Main Stem	2973.38	2230.7	16.72		
Main Stem	2839.60	2230.7	16.30		
Main Stem	2660.24	2230.7	16.00		
Main Stem	2519.45	2230.7	15.76		



Main Stem	2308.05	2230.7	15.40		
Main Stem	2054.86	2230.7	14.95		
Main Stem	1818.29	2230.7	14.53		
Main Stem	1659.70	2230.7	14.35		
Main Stem	1568.01	2230.7	14.19		
Main Stem	1485.47	2230.7	14.14		
Main Stem	1425.23	2230.7	14.02		
Main Stem	1342.71	2230.7	13.89		
Main Stem	1233.44	2230.7	13.74		
Main Stem	1152.32	2230.7	13.59		
Main Stem	1103.11	2230.7	13.48		
Main Stem	1065.85	2230.7	13.07		
Main Stem	1052.49	Culvert	-		
Main Stem	1035.74	2230.7	11.68		
Main Stem	964.76	2230.7	11.41		
Main Stem	862.63	2230.7	11.21		
Main Stem	661.45	2230.7	10.75		
Main Stem	565.90	2230.7	10.39		
Main Stem	443.98	2230.7	9.80		
Main Stem	280.64	2230.7	9.57		
Main Stem	194.03	2230.7	9.37		
Main Stem	133.53	2230.7	9.22		
Main Stem	24.38	2230.7	8.66		

08.03 HYDRAULIC MODEL ANALYSIS

The proposed model, along with an analysis of the existing and proposed HEC-RAS output, will be provided in the Final MBI stage.

08. PROJECT STRENGTHS

For the purposes of this discussion, the resilience of an ecosystem restoration project will be its ability to adapt to the changing boundary conditions of climate change without losing ecosystem complexity. Complexity may have many definitions, but it includes the diversity of biology, and ability of the system to continue to maintain and develop its functions and values. Those functions, values, and diversity may change with time, but not devolve into monocultures of vegetation, loss of flow diversity, or loss of overall habitat.

Similarly, the restored project provides ecosystem services on a watershed or regional basis. Resilient projects should continue to provide an array of ecosystem services through time, despite climate change. Those services may include habitats of regional value or concern for local or migratory species, flood flow attenuation, flood storage, nutrient processing, carbon sequestration, or similar services which are valued not only inside the physical bounds of the project, but also in a greater regional context. The regional context can be explored in several documents, including MDE's Climate Change Program, which promotes nature-based solutions to climate problems.



Carbon Sequestration

Prior to anthropogenic impact in the post-colonial era, it is well understood that floodplains, such as the one at the project site, were net depositional and sequestered carbon – hydric soil at these sites has typically higher levels of carbon than the younger soils transported through incised streams through them. Much of the prior-sequestered carbon at these coastal plain sites has been lost through wetting and drying, ditching, channelization, and poor land practices which destroyed the original floodplain wetlands and lowered the groundwater table. We operate under the assumption of restoring the system to a state similar to the unimpacted condition will yield similar results in terms of building rich carbon soils, understanding that present day climactic conditions are not unlike the extremes found within that geologic period.

Nutrient and Sediment Sequestration

Similarly, hydraulic modeling indicates that the restoration practices used will be net-depositional of sediment and nutrients across the floodplain. Nutrients will have direct contact with historic carbon-bearing soils in the presence of hydrology and hyporheic exchange. This increases the opportunity for sequestration and processing, making the watershed more resilient to nutrient pollution.

Flood Flow Attenuation and Flood Storage

These are functions which can only occur within the floodplain itself. While not a substitute for upland stormwater volume controls, flood flow attenuation and storage are necessary because the contributing catchments of the site are no longer in a pristine land use condition. Similarly, upland controls are unable to collect all upland runoff, and typical stormwater controls bypass and release untreated runoff after a design threshold. The floodplain restoration design of the project is designed to provide significant attenuation of velocity and peak discharges, and to have function beyond the 100-year storm design event. Floodplain soils are better suited for saturated chemistry such as denitrification, and at lower slopes to promote increased detention time and contact area for water quality treatment than an upland BMP can provide. The added benefits of floodplain attenuation and storage are useful ecosystem services that benefit the region on a watershed scale, aiding in the resilience of both infrastructure and ecosystems downstream.

Biodiversity

Agriculture and invasive species are site factors which promote monocultures in landscapes. Monocultures are more difficult to perpetuate in the face of climate change; a single species may not be adapted to handle increased rainfall, drought, or similar other changes of climactic boundary conditions. Take a cultivated conventional agriculture field for example, through winter it may have a winter rye cover crop but is often left bare. In spring it may be dominated by a few early emergent weed species but is quickly sprayed and becomes a monoculture of a cereal crop, maintained with discriminating herbicides. These single crops are highly susceptible to pests, fungus, drought or too much rain, any of which can reap consequences upon the entire landscape with no other species present which may resist it. Similar to the management of a field, invasive species often suppress other native species by out-competing them, or allelopathic properties to prevent their growth. This leaves a natural landscape less equipped to handle changes in climate, potentially lessening diversity on the site and promoting the invasive species.

Wetlands are some of the most diverse ecosystems on the planet, and by planting a robust and diverse native planting scheme and having a diversity of wetland environments, a wetland system will be better suited to persist in the event of significant climactic shifts or drastic weather events, as will the organisms which rely on the wetland system. Forested wetlands in particular will be better suited due to the amount of carbon they sequester and the resilient hydrology of the



floodplain environment, which includes a mix of surface and ground water. These practices will additionally regulate stream temperature better than a floodplain dominated by upland conditions and species.

09. ALTERNATIVE ANALYSIS

For the purposes of agency review, the alternatives analysis is utilized to determine the Least Environmentally Damaging Practicable Alternative (LEDPA) which achieves the goals of the Mitigation Bank and the functional uplift as mandated by the IRT. The goals of the project are stated previously in this document as well as articulated in multiple other attachments, including the performance standards in **Appendix I**. These goals represent what JMT believes to be the greatest possible ecological uplift of the site, and the preferred restoration alternative for this project is that which JMT feels best meets this goal.

Tree canopy and the associated forested wetlands below the canopy are the resources of most value on this site. As a result, these portions of the site require preservation to preserve their canopy and hydrology. Preservation alternatives are discussed in the next section.

A no-action alternative is also included in this analysis, which details the projected fate of the biological and physiochemical functions and values on the project site in relation to the identified principal impairments of the site and watershed. All analysis relates to the proposed alternative, which is the preferred alternative accomplishing the most goals in the long term when compared to other alternatives.

For the purposes of this alternative, goals must be considered in the long-term, in-perpetuity context which is set forth in the 2008 Final Mitigation Rule. To determine only short-term goals and attainments does not meet the mitigation standard, although it is industry standard when considering projects set forth with the intent to meet MS4 / TMDL program sediment and nutrient reduction goals.

No action alternative assumes that watershed and site pressures and impairments continue to act on the site as they do currently, or with the same relative rates of change as historically seen. The following effects are anticipated at the project site:

- **Moderate channel enlargement and change of profile within the next 5-10 years.**

Multiple locations exhibit excessive bank erosion and the potential for channel re-alignment, through activation of remnant channel threads. Debris jams may also increase this potential. While the hazard of bank erosion has detrimental watershed impacts, the greater risk is the loss of sensitive forested wetland habitats through erosion and channel change. Many of these habitats are partially connected to stream channels as they are potentially former stream locations. While the potential to form new habitats through stream channel change is anticipated, temporal impacts to these species, which require a more specialized hydroperiod than others, has the potential for detriment to them.

- **Loss of aquatic habitats**

Watershed pressures of development, water quality, and poorly managed runoff from urbanized and rural sectors will yield a continued degradation of habitat and lack of resiliency. While restoration activities cannot cure all watershed issues, greater resiliency through the addition of added floodplain wetlands and decreases in shear stress will aid in having a system resilient with watershed pressures.

A no action alternative does not significantly meet any goals of this project in the short or long term.



Uplift, Patch Work, Stabilize in Place Techniques

Stabilizing the channel in place and adding habitat structures within the existing channel would not meet the goals of the 2008 Final Mitigation Rule; channel deficiencies in hydraulics, excess shear stress, and impaired substrates would continue to operate and degrade channel habitats. Habitat and substrate placement would be jeopardized by frequent high shear stress discharges within the channel, as floodplain relief would not lessen these stresses for frequent discharges. Additionally, and most importantly, stone armoring practices and patchwork repair of the channel does not provide any significant sustainable habitat uplift. Repair and maintenance of the reach would be frequent and releasing credit from the project would be difficult to justify for the given performance criteria. Armoring of instabilities in the reach would be required, which is entirely inappropriate for a fishery of this potential quality. Simply stated, uplift cannot be provided to meet the mitigation standard using the stabilization practices which have been locally implemented to meet TMDL goals alone. These practices in the long term do not even meet sediment and nutrient source reduction goals particularly well, nor economically.

An alternative which lifts the channel using riffle grade controls, debris jams, or similar perching techniques would create a new floodplain at a higher elevation. This alternative would definitively meet many hydraulic goals. However, if not utilized in the correct location, would have the distinct disadvantage of perching water on private property, negatively impacting flooding on public roads, additionally requiring measures to ensure aquatic organism passage at transitions to existing grade. Benthos is anticipated to suffer in such an instance, as artificial substrates replace native ones and channel facets are altered drastically. Administrative hurdles, such as increases in the 100-year water surface and potential floodplain impacts to upstream property owners would also complicate the project. Ecosystem functions and values would none the less be lifted, however the entire ecosystem type would change to favor a warm water fishery more closely versus a cold-water fishery, as disconnection to the sands and gravels and groundwater table would occur, favoring a perched groundwater system. Hyporheic exchange would likely not increase definitively as dense in-situ sediments would remain in the floodplain. Inundation of existing canopy tree roots may result in additional temporary canopy impacts. Expansive open water systems, as we see in similar restorations in Howard or Anne Arundel County would promote increased water temperatures. This type of approach does not meet the full extent of project goals as the preferred alternative. Examples of this include:

- Does not utilize the appropriate stream substrate and topsoil / hydric soil layers within the design approach.
- Requires a significant amount of imported unnatural materials to stabilize the channel.
- Only creates limited flood flow relief for smaller flooding events contained within the inset bankfull bench/floodway feature.
- Regional curves for which method is highly dependent on, does not account for stable sediment regimes and usually creates a large channel with competency to mobilize more sediment than is sustainable.
- Does not fully meet Levels 3-5 of the Stream Functions Pyramid.
- Level 3 of the Stream Functions Pyramid cannot be achieved through importing large, unnatural materials into the system.
- Structures and imported bed materials may be highly susceptible to failure due to erosion occurring around and under them.
- High risk of failure and/or routine maintenance of rock structures.
- Serves to “pin” the channel in one position.
- Large channel dimensions will create a transport reach condition which may create future downstream instability.



- Very limited organic carbon inputs, which are vital to nutrient processing and food sources, can be incorporated into the system due to the fact that in-channel energy will remain at or above existing levels and cannot rely on vegetative stability.
- Increased boundary roughness within the channel may increase flood stage.
- Additional disturbance outside the limits of the inset floodplain will be required for construction access.
- Increased cost due to importing large quantities of rock, construction of structures and erosion and sediment controls.
- The requirement for importing large rock quantities for grade and structure control



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APPENDIX G.1 DESIGN COMPUTATIONS



PLUNGE POOL CALCULATIONS
TYPE I - PLUNGE POOL DEPRESSED 1/2 CULVERT RISE

Project:	Mill Swamp Mitigation Bank
Site Condition:	Existing
Reach:	SR-3
Outfall Type:	72" RCP

d	=	6.0	ft
Tw	=	5.54	ft
Q	=	735.4	cfs
d ₅₀	=	1.37	ft
B	=	30.0	ft
C	=	36.0	ft
D	=	2.75	ft
E	=	6.0	ft
3E	=	18.0	ft
2E	=	12.0	ft
F	=	3	ft
d ₅₀ (design)	=	1.63	ft
D (design)	=	3.25	ft

Class II/III Mix

Type I: $d_{50} = (0.0125d^2/TW)(Q_{10}/d^{2.5})^{1.333}$

where:

- d₅₀ = median stone size (ft)
- d = culvert diameter or span (ft)
- Tw = tailwater depth (ft)
- Q = design flow for the culvert, min 10-yr, 24-hr storm (cfs)
- B = plunge pool width (ft)
- C = plunge pool length (ft)
- D = 2 x d₅₀ = riprap thickness (ft)
- E = culvert diameter or span equal to d (ft)
- 3E = plunge pool bottom length (ft)
- 2E = plunge pool bottom width (ft)
- F = plunge pool depth (ft) = 0.5d

*Calculations are based off Section D-4-2 in the the 2011 Maryland Standards and Specifications for Soil Erosion and Sediment Control



TREE INVENTORY TABLE

Tree Inventory Table							
Tree No.	Tree Class	Common Name	Scientific Name	DBH (in.)	Multistem DBH (in.)	Condition	Comments
T-001	Normal	Red Maple	<i>Acer rubrum</i>	18.6		Good	
T-002	Specimen	Tulip poplar	<i>Liriodendron tulipifera</i>	32.5		Fair	Bark decay
T-003	Normal	Southern red oak	<i>Quercus falcata</i>	19.7		Good	
T-004	Normal	Southern red oak	<i>Quercus falcata</i>	23.5		Good	
T-005	Significant	White oak	<i>Quercus alba</i>	25.8		Good	
T-006	Significant	White oak	<i>Quercus alba</i>	28.2		Poor	Possibly dead.
T-007	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	28.2		Fair	
T-008	Normal	Mockernut hickory	<i>Carya tomentosa</i>	21.1		Poor	Dead branches, bark covered with fungus.
T-009	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.5		Good	
T-010	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.2		Good	
T-011	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.4		Good	
T-012	Normal	White oak	<i>Quercus alba</i>	21.1		Good	
T-013	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.1		Good	
T-014	Significant	American beech	<i>Fagus grandifolia</i>	24.6		Good	
T-015	Normal	White oak	<i>Quercus alba</i>	22		Good	
T-016	Normal	American beech	<i>Fagus grandifolia</i>	22.7		Good	
T-017	Normal	White oak	<i>Quercus alba</i>	19.6		Poor	Dead
T-018	Significant	American beech	<i>Fagus grandifolia</i>	25.5		Fair	Lots to dead branches.
T-019	Normal	White oak	<i>Quercus alba</i>	20		Good	
T-020	Normal	White oak	<i>Quercus alba</i>	20.7		Fair	Dead branches.
T-021	Normal	American beech	<i>Fagus grandifolia</i>	19.9		Fair	Dead branches.
T-022	Normal	White oak	<i>Quercus alba</i>	19		Good	
T-023	Normal	Red Maple	<i>Acer rubrum</i>	21.6		Good	
T-024	Normal	Southern red oak	<i>Quercus falcata</i>	23.7		Good	
T-025	Normal	Red Maple	<i>Acer rubrum</i>	20.1		Good	
T-026	Normal	Southern red oak	<i>Quercus falcata</i>	23.6		Good	
T-027	Normal	River birch	<i>Betula nigra</i>	19.4	16.0, 15.5	Good	Vines
T-028	Normal	River birch	<i>Betula nigra</i>	20		Poor	Covered in vines.
T-029	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18		Good	
T-030	Normal	Red Maple	<i>Acer rubrum</i>	18.7	15, 8.1	Good	
T-031	Significant	American beech	<i>Fagus grandifolia</i>	25.4		Good	
T-032	Significant	Red Maple	<i>Acer rubrum</i>	25		Good	
T-033	Normal	American beech	<i>Fagus grandifolia</i>	21.9		Good	
T-034	Significant	White oak	<i>Quercus alba</i>	26.5		Good	
T-035	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	22.5		Good	
T-036	Specimen	Tulip poplar	<i>Liriodendron tulipifera</i>	34.5		Fair	
T-037	Normal	Red Maple	<i>Acer rubrum</i>	23		Good	
T-094	Specimen	Tulip poplar	<i>Liriodendron tulipifera</i>	76		Fair	Bark decay
T-100	Normal	White oak	<i>Quercus alba</i>	19.7		Fair	Vines
T-101	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	20.4		Good	
T-102	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.7		Good	
T-103	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.4		Good	
T-104	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.5		Good	
T-105	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18		Good	
T-106	Normal	American sycamore	<i>Platanus occidentalis</i>	19.4		Good	
T-107	Normal	American sycamore	<i>Platanus occidentalis</i>	22		Good	Vines
T-108	Normal	Red Maple	<i>Acer rubrum</i>	19		Good	
T-109	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19		Good	
T-110	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.2		Good	
T-111	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	22.9		Good	
T-112	Normal	American sycamore	<i>Platanus occidentalis</i>	18.7		Good	
T-113	Normal	American sycamore	<i>Platanus occidentalis</i>	19.9		Good	
T-114	Normal	River birch	<i>Betula nigra</i>	31		Good	
T-115	Normal	River birch	<i>Betula nigra</i>	21.7		Good	
T-116	Normal	River birch	<i>Betula nigra</i>	18		Fair	Vines
T-117	Normal	American sycamore	<i>Platanus occidentalis</i>	19.9	19.8, 8	Good	
T-118	Normal	American elm	<i>Ulmus americana</i>	20		Good	
T-119	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	25.1		Good	
T-120	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	28.8		Good	
T-121	Normal	River birch	<i>Betula nigra</i>	20.2		Good	
T-122	Normal	River birch	<i>Betula nigra</i>	21.7		Good	
T-123	Normal	White oak	<i>Quercus alba</i>	21.4		Good	
T-124	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	25.4		Good	
T-125	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	26		Good	
T-126	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	25.1		Good	
T-127	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	24		Good	
T-128	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19.1		Good	
T-129	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	25		Poor	Covered in vines. Bark decay.
T-130	Specimen	American beech	<i>Fagus grandifolia</i>	38.8		Good	
T-131	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	22.3		Good	
T-132	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.5		Good	
T-133	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	20.8		Good	
T-134	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	23.1		Good	
T-135	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.6		Good	
T-136	Specimen	American sycamore	<i>Platanus occidentalis</i>	31		Poor	Covered in vines.
T-137	Normal	River birch	<i>Betula nigra</i>	19.5		Poor	Covered in vines.
T-138	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	22.3		Good	
T-139	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21		Good	
T-140	Significant	Red maple	<i>Acer rubrum</i>	24		Good	
T-141	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	20.3		Good	
T-142	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19.5		Good	
T-143	Normal	River birch	<i>Betula nigra</i>	18.4		Fair	Vines
T-144	Normal	American sycamore	<i>Platanus occidentalis</i>	18	16	Fair	Vines
T-145	Specimen	American sweetgum	<i>Liquidambar styraciflua</i>	44.7		Good	
T-146	Normal	Black cherry	<i>Prunus serotina</i>	18.7		Good	
T-147	Normal	Southern red oak	<i>Quercus falcata</i>	19.1		Good	
T-148	Significant	American sycamore	<i>Platanus occidentalis</i>	28		Good	
T-149	Normal	American sycamore	<i>Platanus occidentalis</i>	18		Fair	Partly rotted at the bottom.
T-150	Normal	American beech	<i>Fagus grandifolia</i>	19.5		Good	
T-151	Normal	Willow oak	<i>Quercus phellos</i>	19		Fair	Covered in vines.
T-152	Significant	American beech	<i>Fagus grandifolia</i>	24		Good	
T-153	Significant	American beech	<i>Fagus grandifolia</i>	25.8		Good	

Legend	
	outside of LOD
	to remain
	to be removed

Tree Inventory Table							
Tree No.	Tree Class	Common Name	Scientific Name	DBH (in.)	Multistem DBH (in.)	Condition	Comments
T-154	Normal	Red maple	<i>Acer rubrum</i>	18.7		Good	
T-155	Normal	Pin oak	<i>Quercus palustris</i>	18.2		Fair	Dead branches, beaver damage at base of trunk
T-156	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21.2		Good	
T-157	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	24.7		Good	
T-158	Normal	Pin oak	<i>Quercus palustris</i>	20.5		Fair	Covered in vines into canopy
T-159	Normal	Pin oak	<i>Quercus palustris</i>	21.1		Fair	Vines into canopy
T-160	Normal	River birch	<i>Betula nigra</i>	18		Fair	Vines
T-161	Normal	River birch	<i>Betula nigra</i>	21.6		Good	Trunk growing out of stream bank
T-162	Normal	River birch	<i>Betula nigra</i>	18	16, 10	Good	Trunk growing out of stream bank
T-163	Normal	River birch	<i>Betula nigra</i>	18		Poor	Covered in vines
T-164	Normal	Red maple	<i>Acer rubrum</i>	21.5		Good	
T-165	Normal	Red maple	<i>Acer rubrum</i>	22.3		Good	Trunk growing out of stream bank
T-166	Specimen	American sweetgum	<i>Liquidambar styraciflua</i>	32.5		Good	
T-167	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18		Fair	Vines on trunk, dead branches
T-168	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18		Fair	Vines, dead branches
T-169	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	23.9		Good	
T-170	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	20		Poor	Covered in vines
T-171	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18		Poor	Covered in vines into canopy
T-172	Significant	River birch	<i>Betula nigra</i>	25		Poor	Covered in vines into canopy, DBH estimated due to large vines
T-173	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	24		Poor	Vines, some branches with dead ends
T-174	Specimen	River birch	<i>Betula nigra</i>	30.2		Good	
T-175	Specimen	Willow oak	<i>Quercus phellos</i>	32		Good	
T-176	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	26.3		Good	
T-177	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.7		Good	
T-178	Significant	White oak	<i>Quercus alba</i>	24.9		Good	
T-179	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21.3		Fair	Sbranches with dead ends
T-180	Specimen	Red maple	<i>Acer rubrum</i>	31.7		Good	
T-181	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19		Good	
T-182	Normal	Red maple	<i>Acer rubrum</i>	22.5		Good	
T-183	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	26.3		Good	
T-184	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	24		Fair	Vines
T-185	Normal	Pin oak	<i>Quercus palustris</i>	19.1		Fair	Vines
T-186	Normal	River birch	<i>Betula nigra</i>	18		Poor	Covered in vines
T-187	Normal	River birch	<i>Betula nigra</i>	18		Fair	Trunk covered in vines
T-188	Significant	White mulberry	<i>Morus alba</i>	27		Poor	Dead branches, large hole in base of trunk
T-189	Normal	American beech	<i>Fagus grandifolia</i>	21.6		Good	
T-190	Specimen	Tulip poplar	<i>Liriodendron tulipifera</i>	37		Good	
T-191	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22.2		Good	
T-192	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.3		Good	
T-193	Significant	Willow oak	<i>Quercus phellos</i>	24.7		Fair	Bark decay.
T-194	Specimen	Red maple	<i>Acer rubrum</i>	30.8		Good	
T-195	Normal	American sycamore	<i>Platanus occidentalis</i>	18		Fair	Dead branches, small canopy
T-196	Specimen	Willow oak	<i>Quercus phellos</i>	34.4		Good	
T-197	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.7		Good	
T-198	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	24.5		Fair	Dead branches.
T-199	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	24.5		Good	
T-200	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22.1		Fair	Dead branches.
T-201	Specimen	American sweetgum	<i>Liquidambar styraciflua</i>	23.4	23.4, 23.3	Good	
T-202	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.3		Good	
T-203	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22		Fair	Vines into canopy.
T-204	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21.5		Good	
T-205	Normal	Red maple	<i>Acer rubrum</i>	20		Fair	Vines.
T-206	Normal	American sycamore	<i>Platanus occidentalis</i>	20.7		Fair	Dead branches, small canopy.
T-207	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	20		Good	
T-208	Normal	American sycamore	<i>Platanus occidentalis</i>	20.8		Good	
T-209	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22.4		Good	
T-210	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	23		Fair	Vines, dead branches.
T-211	Significant	Red maple	<i>Acer rubrum</i>	24		Fair	Covered in vines into canopy.
T-212	Normal	American sycamore	<i>Platanus occidentalis</i>	23.5		Fair	Vines into canopy.
T-213	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	20.5		Fair	Dead branches.
T-214	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	25.1		Good	
T-215	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22		Fair	Vines into canopy.
T-216	Normal	American elm	<i>Ulmus americana</i>	22.4			
T-217	Significant	Red maple	<i>Acer rubrum</i>	25.9		Fair	Dead branches and vines on trunk.
T-218	Normal	American sycamore	<i>Platanus occidentalis</i>	22.1		Good	
T-219	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	29.5		Good	
T-220	Specimen	Tulip poplar	<i>Liriodendron tulipifera</i>	31.2		Good	
T-221	Specimen	Willow oak	<i>Quercus phellos</i>	30.7		Good	
T-222	Normal	Red maple	<i>Acer rubrum</i>	23.8		Poor	Trunk splits and half is dead.
T-223	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	26		Good	
T-224	Normal	American sycamore	<i>Platanus occidentalis</i>	19.4		Fair	Twin trunk, other trunk dead.
T-225	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	28.8		Fair	Bark decay
T-226	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	26		Good	
T-227	Normal	Red maple	<i>Acer rubrum</i>	23.3	23.3, 26.6	Fair	
T-228	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21.2		Good	
T-229	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	25.6		Good	
T-230	Significant	American elm	<i>Ulmus americana</i>	29.1		Fair	Vines and dead branches
T-231	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	23		Fair	Dead branches, beaver damage to base of trunk.
T-232	Normal	Red maple	<i>Acer rubrum</i>	19.6	19.6, 18	Poor	Bark decay, dead branches.
T-233	Normal	River birch	<i>Betula nigra</i>	18		Fair	Dead branches
T-234	Normal	River birch	<i>Betula nigra</i>	20		Good	
T-235	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	26		Good	
T-236	Normal	Pignut hickory	<i>Carya glabra</i>	22.4		Good	
T-237	Normal	River birch	<i>Betula nigra</i>	22		Good	
T-238	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	21.4		Good	
T-239	Normal	Southern red oak	<i>Quercus falcata</i>	21		Good	
T-240	Normal	Southern red oak	<i>Quercus falcata</i>	18		Good	
T-241	Significant	American sycamore	<i>Platanus occidentalis</i>	24.8		Good	
T-242	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.7		Good	
T-243	Normal	Southern red oak	<i>Quercus falcata</i>	21.9		Good	
T-244	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	29.4		Good	
T-245	Specimen	Tulip poplar	<i>Liriodendron tulipifera</i>	32.6		Good	

Legend	
	outside of LOD
	to remain
	to be removed

Tree Inventory Table							
Tree No.	Tree Class	Common Name	Scientific Name	DBH (in.)	Multistem DBH (in.)	Condition	Comments
T-246	Normal	River birch	<i>Betula nigra</i>	19		Poor	Completely dead
T-247	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21.5		Good	
T-248	Normal	River birch	<i>Betula nigra</i>	22.5		Fair	Vines, bark decay
T-249	Normal	River birch	<i>Betula nigra</i>	19.8		Poor	Vines, canopy mostly dead
T-250	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.7		Good	
T-251	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19		Good	
T-252	Significant	River birch	<i>Betula nigra</i>	25		Good	
T-253	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19.5		Good	
T-254	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	28.8		Good	
T-255	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	22.9		Good	
T-256	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.1		Good	
T-257	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22.2		Good	
T-258	Significant	American sycamore	<i>Platanus occidentalis</i>	29.7		Good	
T-259	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	24.1		Good	
T-260	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	25.1		Good	
T-261	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	19.3		Good	
T-262	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	18.1		Good	
T-263	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	23.5		Good	
T-264	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	29		Good	Vines
T-265	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	23.7		Good	
T-266	Normal	American sycamore	<i>Platanus occidentalis</i>	22.2		Good	
T-267	Specimen	American sycamore	<i>Platanus occidentalis</i>	30.3		Good	
T-268	Normal	River birch	<i>Betula nigra</i>	19.5		Good	
T-269	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.8		Good	
T-270	Normal	River birch	<i>Betula nigra</i>	18		Good	
T-271	Normal	Red maple	<i>Acer rubrum</i>	20		Good	Vines
T-272	Significant	American sycamore	<i>Platanus occidentalis</i>	26.6		Good	
T-273	Normal	River birch	<i>Betula nigra</i>	19		Fair	Vines into canopy, dead branches
T-274	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.5		Good	
T-275	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	20.4		Good	
T-276	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19		Fair	Lots of vines.
T-277	Normal	River birch	<i>Betula nigra</i>	20	15", 20"	Fair	Vines into canopy.
T-278	Significant	Tulip poplar	<i>Liriodendron tulipifera</i>	24.7		Good	
T-279	Significant	Red maple	<i>Acer rubrum</i>	25.8		Good	Vines on trunk.
T-280	Normal	River birch	<i>Betula nigra</i>	19		Good	
T-281	Normal	Red maple	<i>Acer rubrum</i>	21		Good	
T-282	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22.5		Poor	Mostly dead.
T-283	Specimen	Northern red oak	<i>Quercus rubra</i>	30.2		Good	
T-284	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19		Good	Vines
T-285	Specimen	American sweetgum	<i>Liquidambar styraciflua</i>	33.2		Fair	Canopy half dead.
T-286	Specimen	Northern red oak	<i>Quercus rubra</i>	49		Good	
T-287	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19		Poor	Canopy mostly dead.
T-288	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	29.8		Good	Vines
T-289	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22		Good	
T-290	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.5		Fair	Dead canopy.
T-291	Normal	Northern red oak	<i>Quercus rubra</i>	23		Good	Vines into canopy.
T-292	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.3		Fair	Vines into canopy.
T-293	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	20.2		Fair	Vines into canopy.
T-294	Significant	Red maple	<i>Acer rubrum</i>	26		Good	Trunk covered in vines.
T-295	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18.3		Good	
T-296	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19.1		Good	
T-297	Significant	American sweetgum	<i>Liquidambar styraciflua</i>	26		Good	
T-298	Significant	Red maple	<i>Acer rubrum</i>	25		Good	
T-299	Normal	American sycamore	<i>Platanus occidentalis</i>	18		Good	Vines
T-300	Significant	Northern red oak	<i>Quercus rubra</i>	29		Good	
T-301	Specimen	Northern red oak	<i>Quercus rubra</i>	34.8		Good	
T-302	Normal	American sycamore	<i>Platanus occidentalis</i>	18.1		Good	
T-303	Significant	Northern red oak	<i>Quercus rubra</i>	27.8		Fair	Dead branches.
T-304	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	19		Good	
T-305	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18		Good	
T-306	Significant	Northern red oak	<i>Quercus rubra</i>	26.5		Good	
T-307	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	18		Poor	Almost dead.
T-308	Normal	Red maple	<i>Acer rubrum</i>	18		Good	
T-309	Normal	River birch	<i>Betula nigra</i>	21		Good	
T-310	Significant	Red maple	<i>Acer rubrum</i>	25.1		Good	
T-311	Normal	American elm	<i>Ulmus americana</i>	20.1		Good	
T-312	Normal	American sycamore	<i>Platanus occidentalis</i>	21.5		Good	
T-313	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	20		Fair	Vines into canopy.
T-314	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	21.1		Good	
T-315	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	23.7		Good	
T-316	Normal	Red maple	<i>Acer rubrum</i>	20		Poor	Bark decay, no canopy.
T-317	Normal	Red maple	<i>Acer rubrum</i>	22		Good	
T-318	Specimen	Northern red oak	<i>Quercus rubra</i>	33.2		Good	
T-319	Significant	River birch	<i>Betula nigra</i>	27.9		Good	
T-320	Normal	American sweetgum	<i>Liquidambar styraciflua</i>	22		Good	
T-321	Specimen	American sycamore	<i>Platanus occidentalis</i>	39.5		Good	
T-322	Normal	Tulip poplar	<i>Liriodendron tulipifera</i>	21.8	18.9	Good	
T-323	Specimen	Northern red oak	<i>Quercus rubra</i>	32		Good	
T-324	Normal	White oak	<i>Quercus alba</i>	20.4		Good	
T-325	Significant	White oak	<i>Quercus alba</i>	28.7		Fair	Missing bark along trunk; some dead branches
T-326	Significant	Northern red oak	<i>Quercus rubra</i>	25.1		Good	
T-327	Normal	Pignut hickory	<i>Carya glabra</i>	18		Good	
T-328	Specimen	Southern red oak	<i>Quercus falcata</i>	43.8		Good	
T-329	Normal	American beech	<i>Fagus grandifolia</i>	22.7		Good	
T-330	Significant	American beech	<i>Fagus grandifolia</i>	27.9		Good	
T-331	Normal	American beech	<i>Fagus grandifolia</i>	20.2		Good	
T-332	Significant	White oak	<i>Quercus alba</i>	25.4		Good	
T-333	Normal	American beech	<i>Fagus grandifolia</i>	22		Good	
T-334	Significant	American beech	<i>Fagus grandifolia</i>	24.2	8.1, 5.3, 5.0, 4.0, 4.0, 3.0	Good	
T-335	Normal	American beech	<i>Fagus grandifolia</i>	18.5		Good	
T-336	Normal	American beech	<i>Fagus grandifolia</i>	22.9		Good	
T-337	Normal	Willow oak	<i>Quercus phellos</i>	20.6		Good	

Legend	
	outside of LOD
	to remain
	to be removed

Tree Inventory Table							
Tree No.	Tree Class	Common Name	Scientific Name	DBH (in.)	Multistem DBH (in.)	Condition	Comments
T-338	Significant	White oak	<i>Quercus alba</i>	28.7		Good	
T-339	Normal	American beech	<i>Fagus grandifolia</i>	20		Good	
T-340	Normal	Post oak	<i>Other (see comments)</i>	22.8		Fair	Quercus stellata; missing bark and part of trunk
T-341	Normal	American beech	<i>Fagus grandifolia</i>	23.9		Good	
T-342	Normal	Southern red oak	<i>Quercus falcata</i>	22.7			
T-343	Significant	White oak	<i>Quercus alba</i>	25.7		Good	
T-344	Normal	Red maple	<i>Acer rubrum</i>	18		Good	

Legend	
	outside of LOD
	to remain
	to be removed



APPENDIX G.2 HYDROLOGY AND HYDRAULICS DATA

Manning's Roughness Coefficients for Natural Channels and Floodplains

Stream and Location: Mill Swamp Mitigation Bank

Reach: SR-1

Event for which n is assigned: Existing Bankfull flow condition

1. Is roughness uniform throughout the reach being considered? Yes

If not, should n be assigned for the average condition of the reach? _____

2. Is roughness uniformly distributed along the cross section? Yes

Is a division between channel and floodplain necessary? Yes

(Channel Roughness uses steps 3-13, Floodplain roughness uses steps 14-23.)

Is roughness uniformly distributed across the channel? Yes

If not, what basis should n for the individual segments be weighted? _____

3. Describe the channel. Are present conditions representative of those during the flood?

Clean stream channel, straightened, exhibiting riffle pool pattern. Bank erosion present, contributing to channel incision. Channel is entrenched 1.29

If not, describe the probable conditions during the flood. Flat floodplain present, forested. Channel is disconnected from floodplain.

4. How will the roughness-producing effects of the following on the channel be accounted for?

Bank roughness: Mostly exposed sand and silt. The majority of the banks are exposed, with some being vegetated.

Bedrock outcrops: No bedrock present.

Isolated boulders: No boulders present.

Vegetation: Mix of woody and herbaceous vegetation near the channel and in floodplain.

Obstructions: Mostly clear with a few large debris jams present.

Meander: Little to no sinuosity

5-10. Computation n for the Channel

Segment Number and Material	Approximate Dimensions		Wetted perimeter (ft)	Area (sf)	Median Grain Size (mm)	Base n for segment	Adjustments	Adjusted n	Weight Factors	Adjusted n times weight factors
	width (ft)	depth (ft)								
SR-1	21.4	1.86	17.03	20.17	13.65	0.029	None	N/A	N/A	0.029
Sum =										0.029
Weighted n =										0.029

11-13. Computation of n for the channel

Adjustment factors for the channel

Factor	Describe conditions briefly	Adjustment
Irregularity, n₁	Moderate - Compares to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded side slopes.	0.006
Alignment, n₂	Alternating occasionally - Size and shape of cross sections alternate occasionally.	0.001
Obstructions, n₃	Minor - Obstructions occupy less than 15 percent of the cross-sectional area	0.005
Vegetation, n₄	Small - Dense growth of grasses and other herbaceous vegetation and small woody vegetation.	0.008
Meander, m	Minor- Ratio of the channel length to valley length is 1.0 to 1.2	1.00
Weighted n plus n_x adjustments		0.049
Computed n times m factor =		0.049

14. Describe the floodplain. Moderately forested with medium amount of undergrowth.

Are present conditions representative of those during a flood? Yes

If not, describe probable conditions during the flood. _____

15. Is the roughness coefficient to be determined by roughness factors only or is it to include vegetation-density method? Roughness only

16. Is roughness uniformly distributed across the floodplain? Within proposed floodplain sections, mostly uniform

If not, how should the floodplain be subdivided? _____

**17-23. Computation n for floodplain
Adjustment factors not using vegetation-density method**

Subsection	Base n, nb	Irregularity, n1	Obstructions, n3	Vegetation, n4	Computed n
Left Bank	0.020	0.006	0.045	0.010	0.08
Right Bank	0.025	0.006	0.045	0.010	0.09

Manning's Roughness Coefficients for Natural Channels and Floodplains

Stream and Location: Mill Swamp Mitigation Bank

Reach: SR-2

Event for which n is assigned: Existing Bankfull flow condition

1. Is roughness uniform throughout the reach being considered? Yes

If not, should n be assigned for the average condition of the reach? _____

2. Is roughness uniformly distributed along the cross section? Yes

Is a division between channel and floodplain necessary? Yes

(Channel Roughness uses steps 3-13, Floodplain roughness uses steps 14-23.)

Is roughness uniformly distributed across the channel? Yes

If not, what basis should n for the individual segments be weighted? _____

3. Describe the channel. Are present conditions representative of those during the flood?

Clean stream channel, with moderate sinuosity, exposed soil present in stream banks. Bank erosion present, contributing to channel incision. Channel is entrenched 2.51

If not, describe the probable conditions during the flood. Flat floodplain present, forested, with multiple channels present on floodplain for overbank flow

4. How will the roughness-producing effects of the following on the channel be accounted for?

Bank roughness: Mostly exposed sand and silt. The majority of the banks are exposed, with some being vegetated.

Bedrock outcrops: No bedrock present.

Isolated boulders: No boulders present.

Vegetation: Mix of woody and herbaceous vegetation near the channel and in floodplain.

Obstructions: Clear of major debris

Meander: Moderate sinuosity, some torturous meanders

5-10. Computation n for the Channel

Segment Number and Material	Approximate Dimensions		Wetted perimeter (ft)	Area (sf)	Median Grain Size (mm)	Base n for segment	Adjustments	Adjusted n	Weight Factors	Adjusted n times weight factors
	width (ft)	depth (ft)								
SR-2	22.7	1.87	17.27	17.91	8.66	0.029	None	N/A	N/A	0.029
Sum =										0.029
Weighted n =										0.029

11-13. Computation of n for the channel

Adjustment factors for the channel

Factor	Describe conditions briefly	Adjustment
Irregularity, n ₁	Moderate - Compared to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded side slopes.	0.006
Alignment, n ₂	Alternating occasionally - Size and shape of cross sections alternate occasionally.	0.003
Obstructions, n ₃	Negligible- Obstructions occupy less than 5 percent of the cross-sectional area	0.004
Vegetation, n ₄	Small - Dense growth of grasses and other herbaceous vegetation and small woody vegetation.	0.008
Meander, m	Appreciable - Ratio of the channel length to valley length is 1.2 to 1.5	1.15
Weighted n plus n_x adjustments		0.050
Computed n times m factor =		0.057

14. Describe the floodplain. Forested with medium amount of undergrowth.

Are present conditions representative of those during a flood? Yes

If not, describe probable conditions during the flood. _____

15. Is the roughness coefficient to be determined by roughness factors only or is it to include vegetation-density method? Roughness only

16. Is roughness uniformly distributed across the floodplain? Within proposed floodplain sections, mostly uniform

If not, how should the floodplain be subdivided? _____

**17-23. Computation n for floodplain
Adjustment factors not using vegetation-density method**

Subsection	Base n, nb	Irregularity, n1	Obstructions, n3	Vegetation, n4	Computed n
Left Bank	0.025	0.006	0.045	0.010	0.09
Right Bank	0.025	0.006	0.045	0.010	0.09

Manning's Roughness Coefficients for Natural Channels and Floodplains

Stream and Location: Mill Swamp Mitigation Bank

Reach: SR-3

Event for which n is assigned: Existing Bankfull flow condition

1. Is roughness uniform throughout the reach being considered? Yes

If not, should n be assigned for the average condition of the reach? _____

2. Is roughness uniformly distributed along the cross section? Yes

Is a division between channel and floodplain necessary? Yes

(Channel Roughness uses steps 3-13, Floodplain roughness uses steps 14-23.)

Is roughness uniformly distributed across the channel? Yes

If not, what basis should n for the individual segments be weighted? _____

3. Describe the channel. Are present conditions representative of those during the flood?

Moderately clean stream channel, mostly straightened, exhibiting riffle pool pattern. Bank erosion present, contributing to channel incision. Channel is entrenched 1.81

If not, describe the probable conditions during the flood. Flat floodplain present, mix of forest and residential

4. How will the roughness-producing effects of the following on the channel be accounted for?

Bank roughness: Mostly exposed sand and silt. The majority of the banks are exposed, with some being vegetated.

Bedrock outcrops: No bedrock present.

Isolated boulders: No boulders present.

Vegetation: Mix of woody and herbaceous vegetation near the channel and in floodplain, with some areas of turfgrass.

Obstructions: Mostly clear with a few large debris jams present.

Meander: Little to no sinuosity

5-10. Computation n for the Channel

Segment Number and Material	Approximate Dimensions		Wetted perimeter (ft)	Area (sf)	Median Grain Size (mm)	Base n for segment	Adjustments	Adjusted n	Weight Factors	Adjusted n times weight factors
	width (ft)	depth (ft)								
SR-3	22.7	1.87	16.99	19.33	20.20	0.030	None	N/A	N/A	0.030
Sum =										0.030
Weighted n =										0.030

11-13. Computation of n for the channel

Adjustment factors for the channel

Factor	Describe conditions briefly	Adjustment
Irregularity, n ₁	Moderate - Compared to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded side slopes.	0.006
Alignment, n ₂	Alternating occasionally - Size and shape of cross sections alternate occasionally.	0.003
Obstructions, n ₃	Minor - Obstructions occupy less than 15 percent of the cross-sectional area	0.010
Vegetation, n ₄	Small - Dense growth of grasses and other herbaceous vegetation and small woody vegetation.	0.008
Meander, m	Minor- Ratio of the channel length to valley length is 1.0 to 1.2	1.00
Weighted n plus n_x adjustments		0.057
Computed n times m factor =		0.057

14. Describe the floodplain. Partly forested with medium undergrowth, partly residential area

Are present conditions representative of those during a flood? Yes

If not, describe probable conditions during the flood. _____

15. Is the roughness coefficient to be determined by roughness factors only or is it to include vegetation-density method? Roughness only

16. Is roughness uniformly distributed across the floodplain? No

If not, how should the floodplain be subdivided? Upstream section is residential, downstream section is forested

17-23. Computation n for floodplain

Adjustment factors not using vegetation-density method

Subsection	Base n, nb	Irregularity, n1	Obstructions, n3	Vegetation, n4	Computed n
Upstream Left Bank	0.020	0.006	0.004	0.001	0.03
Upstream Right Bank	0.025	0.006	0.004	0.001	0.04
Downstream Left Bank	0.015	0.006	0.040	0.005	0.07
Downstream Right Bank	0.015	0.006	0.045	0.010	0.08

Manning's Roughness Coefficients for Natural Channels and Floodplains

Stream and Location: Mill Swamp Mitigation Bank

Reach: SR-4

Event for which n is assigned: Existing Bankfull flow condition

1. Is roughness uniform throughout the reach being considered? Yes

If not, should n be assigned for the average condition of the reach? _____

2. Is roughness uniformly distributed along the cross section? Yes

Is a division between channel and floodplain necessary? Yes

(Channel Roughness uses steps 3-13, Floodplain roughness uses steps 14-23.)

Is roughness uniformly distributed across the channel? Yes

If not, what basis should n for the individual segments be weighted? _____

3. Describe the channel. Are present conditions representative of those during the flood?

Moderately clean stream channel, straightened, exhibiting riffle pool pattern. Bank erosion present, contributing to channel incision. Channel is entrenched 1.32

If not, describe the probable conditions during the flood. Flat floodplain present, comprised of forested and historically farmed areas

4. How will the roughness-producing effects of the following on the channel be accounted for?

Bank roughness: Mostly exposed sand and silt. The majority of the banks are exposed, with some being vegetated.

Bedrock outcrops: No bedrock present.

Isolated boulders: No boulders present.

Vegetation: Mix of woody and herbaceous vegetation near the channel and in floodplain.

Obstructions: Mostly clear with a few large debris jams present.

Meander: No sinuosity

5-10. Computation n for the Channel

Segment Number and Material	Approximate Dimensions		Wetted perimeter (ft)	Area (sf)	Median Grain Size (mm)	Base n for segment	Adjustments	Adjusted n	Weight Factors	Adjusted n times weight factors
	width (ft)	depth (ft)								
SR-4	22.8	1.95	17.49	25.23	12.38	0.029	None	N/A	N/A	0.029
Sum =										0.029
Weighted n =										0.029

11-13. Computation of n for the channel

Adjustment factors for the channel

Factor	Describe conditions briefly	Adjustment
Irregularity, n ₁	Moderate - Compared to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded side slopes.	0.006
Alignment, n ₂	Gradual - Size and shape of cross sections change gradually	0.000
Obstructions, n ₃	Minor - Obstructions occupy less than 15 percent of the cross-sectional area	0.008
Vegetation, n ₄	Medium - Moderately dense stem grasses, weeds, or tree seedlings growing	0.010
Meander, m	Minor- Ratio of the channel length to valley length is 1.0 to 1.2	1.00
Weighted n plus n_x adjustments		0.053
Computed n times m factor =		0.053

14. Describe the floodplain. Forested with medium undergrowth with historically farmed land

Are present conditions representative of those during a flood? Yes

If not, describe probable conditions during the flood. _____

15. Is the roughness coefficient to be determined by roughness factors only or is it to include vegetation-density method? Roughness only

16. Is roughness uniformly distributed across the floodplain? Within proposed floodplain sections, mostly uniform

If not, how should the floodplain be subdivided? _____

17-23. Computation n for floodplain

Adjustment factors not using vegetation-density method

Subsection	Base n, nb	Irregularity, n1	Obstructions, n3	Vegetation, n4	Computed n
Left Bank	0.020	0.006	0.040	0.010	0.08
Right Bank	0.02	0.006	0.04	0.010	0.08

Manning's Roughness Coefficients for Natural Channels and Floodplains

Stream and Location: Mill Swamp Mitigation Bank

Reach: SR-5

Event for which n is assigned: Existing Bankfull flow condition

1. Is roughness uniform throughout the reach being considered? Yes

If not, should n be assigned for the average condition of the reach? _____

2. Is roughness uniformly distributed along the cross section? Yes

Is a division between channel and floodplain necessary? Yes

(Channel Roughness uses steps 3-13, Floodplain roughness uses steps 14-23.)

Is roughness uniformly distributed across the channel? Yes

If not, what basis should n for the individual segments be weighted? _____

3. Describe the channel. Are present conditions representative of those during the flood?

Moderately clean stream channel, straightened, exhibiting riffle pool pattern. Bank erosion present, contributing to channel incision. Channel is entrenched 1.07

If not, describe the probable conditions during the flood. Flat floodplain present, forested

4. How will the roughness-producing effects of the following on the channel be accounted for?

Bank roughness: Mostly exposed sand and silt. The majority of the banks are exposed, with some being vegetated.

Bedrock outcrops: No bedrock present.

Isolated boulders: No boulders present.

Vegetation: Mix of woody and herbaceous vegetation near the channel and in floodplain.

Obstructions: Mostly clear with a few large debris jams present.

Meander: No sinuosity

5-10. Computation n for the Channel

Segment Number and Material	Approximate Dimensions		Wetted perimeter (ft)	Area (sf)	Median Grain Size (mm)	Base n for segment	Adjustments	Adjusted n	Weight Factors	Adjusted n times weight factors
	width (ft)	depth (ft)								
SR-5	22.8	1.95	21.61	20.08	20.86	0.030	None	N/A	N/A	0.030
Sum =										0.030
Weighted n =										0.030

11-13. Computation of n for the channel

Adjustment factors for the channel

Factor	Describe conditions briefly	Adjustment
Irregularity, n₁	Moderate - Compared to dredged channels having moderate to considerable bed roughness and moderately sloughed or eroded side slopes.	0.006
Alignment, n₂	Gradual - Size and shape of cross sections change gradually	0.000
Obstructions, n₃	Minor - Obstructions occupy less than 15 percent of the cross-sectional area	0.008
Vegetation, n₄	Medium - Moderately dense stem grasses, weeds, or tree seedlings growing	0.010
Meander, m	Minor- Ratio of the channel length to valley length is 1.0 to 1.2	1.00
Weighted n plus n_x adjustments		0.054
Computed n times m factor =		0.054

14. Describe the floodplain. Forrested with medium to large amount of undergrowth.

Are present conditions representative of those during a flood? Yes

If not, describe probable conditions during the flood. _____

15. Is the roughness coefficient to be determined by roughness factors only or is it to include vegetation-density method? Roughness only

16. Is roughness uniformly distributed across the floodplain? Within proposed floodplain sections, mostly uniform

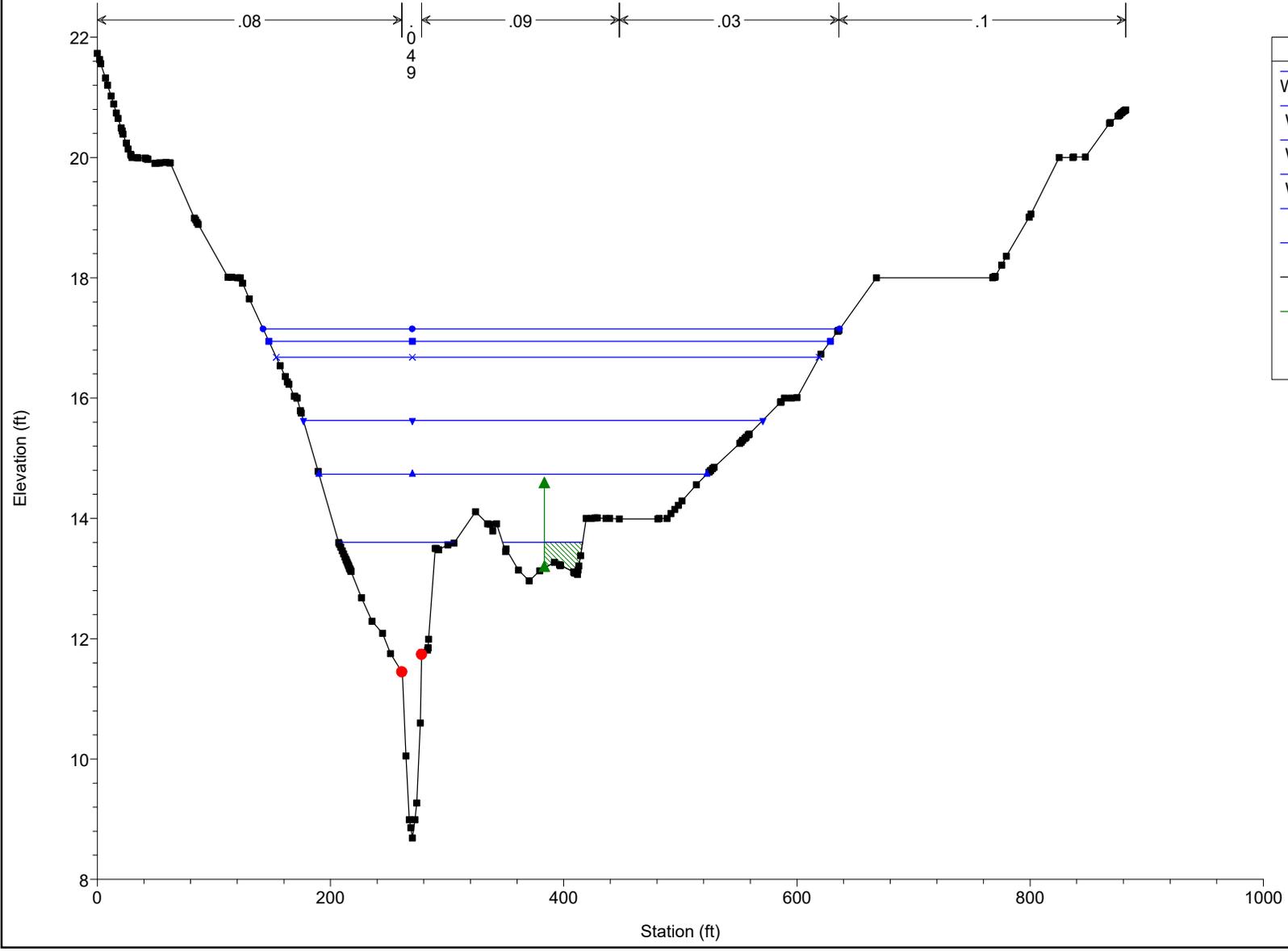
If not, how should the floodplain be subdivided? _____

17-23. Computation n for floodplain
Adjustment factors not using vegetation-density method

Subsection	Base n, nb	Irregularity, n1	Obstructions, n3	Vegetation, n4	Computed n
Left Bank	0.025	0.006	0.040	0.010	0.08
Right Bank	0.025	0.006	0.04	0.010	0.08

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

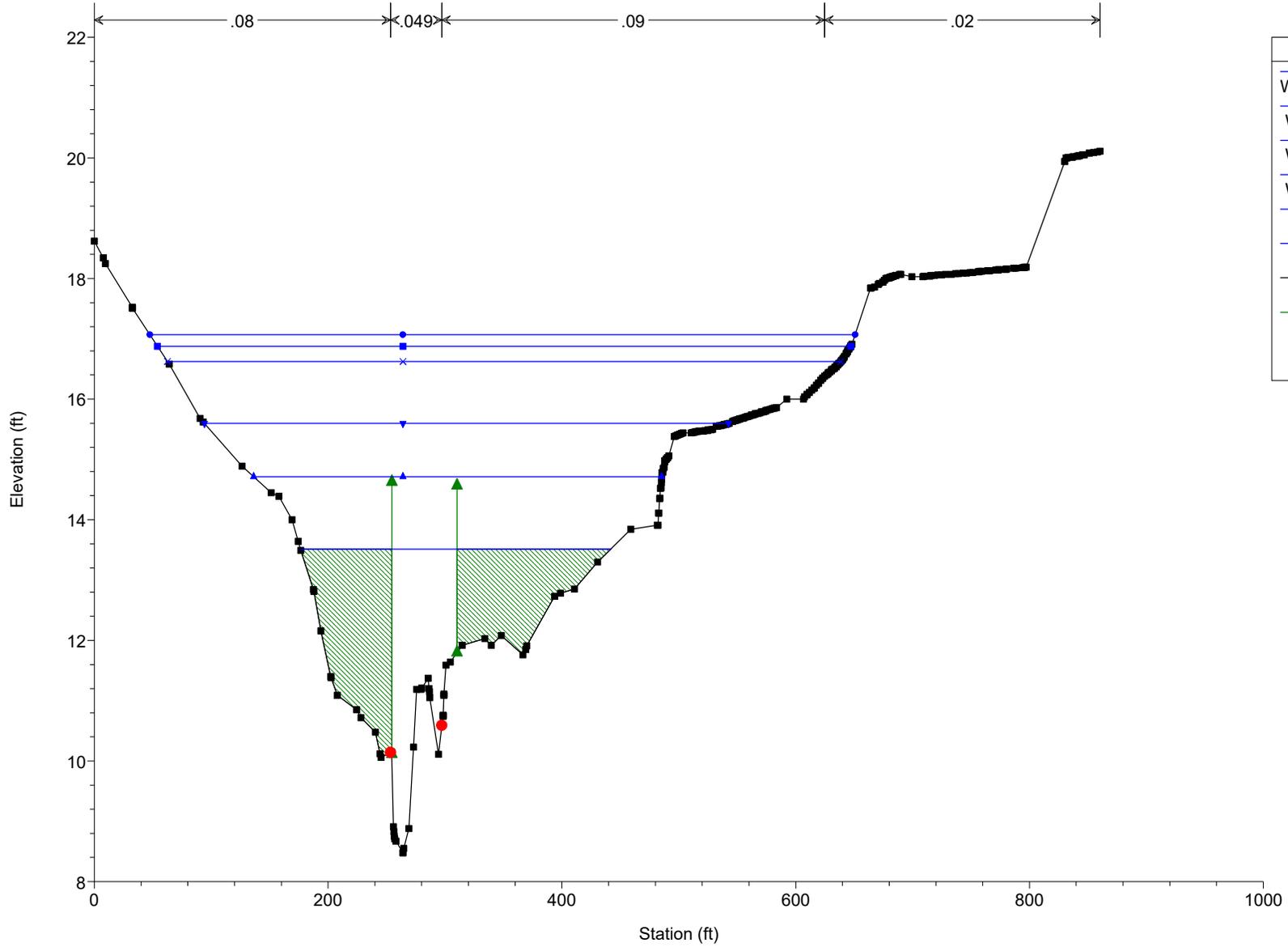
RS = 3167.546 XS-28



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

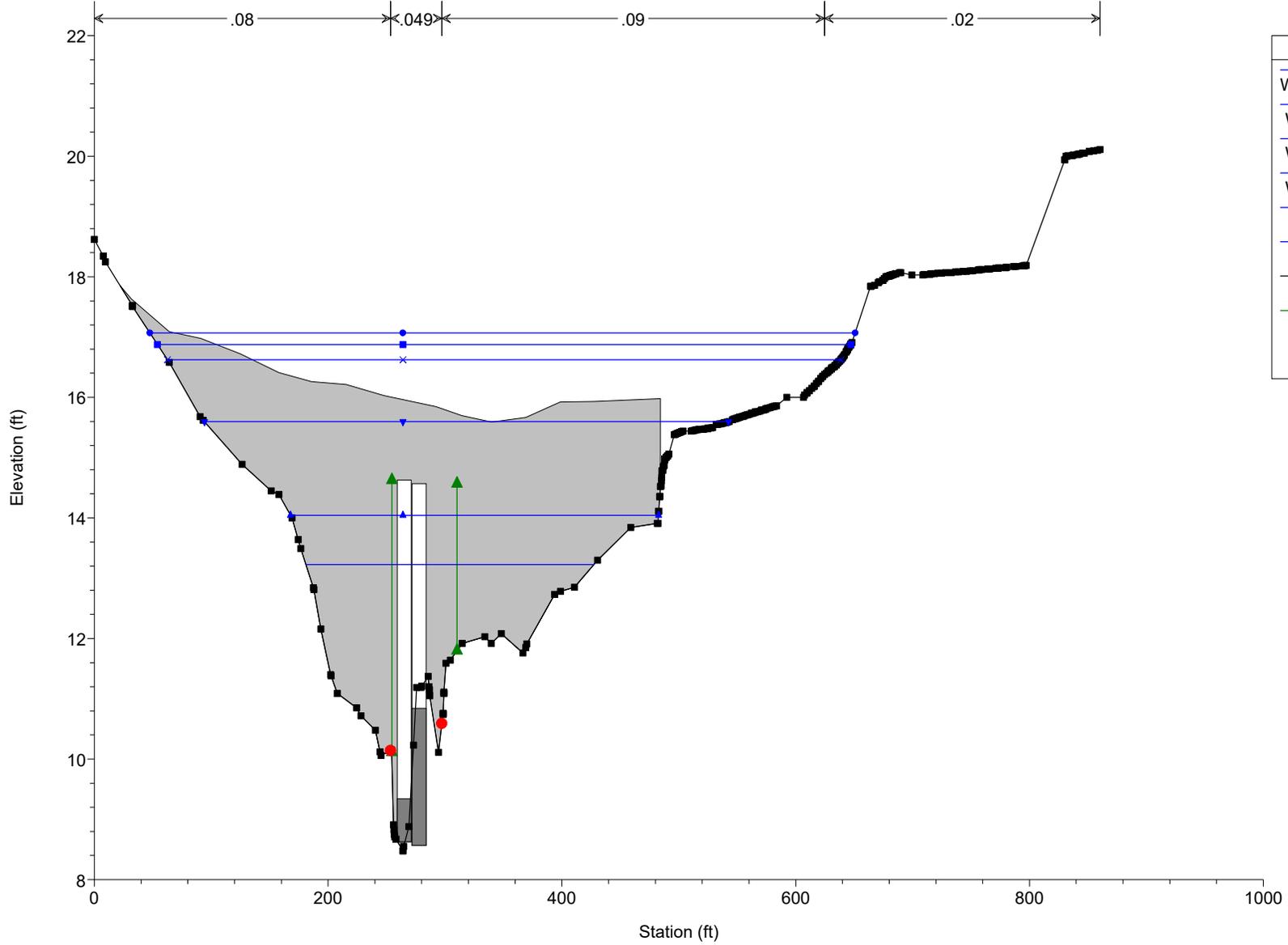
RS = 3054.333 XS-27



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	◆
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 3004.159 Culv

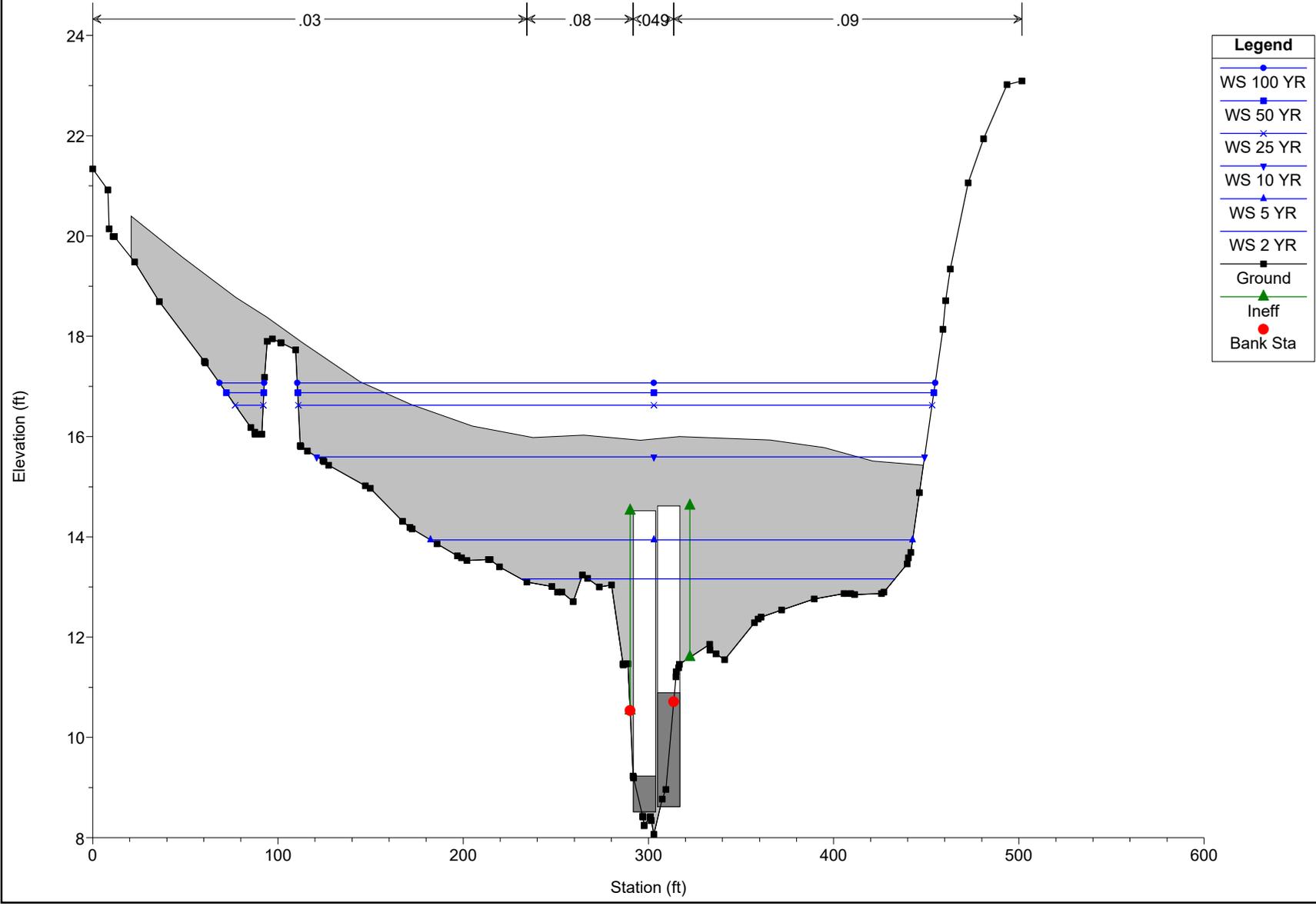


Legend

- WS 100 YR (Blue circle)
- WS 50 YR (Blue square)
- WS 25 YR (Blue x)
- WS 10 YR (Blue inverted triangle)
- WS 5 YR (Blue triangle)
- WS 2 YR (Blue square)
- Ground (Black line)
- Ineff (Green triangle)
- Bank Sta (Red circle)

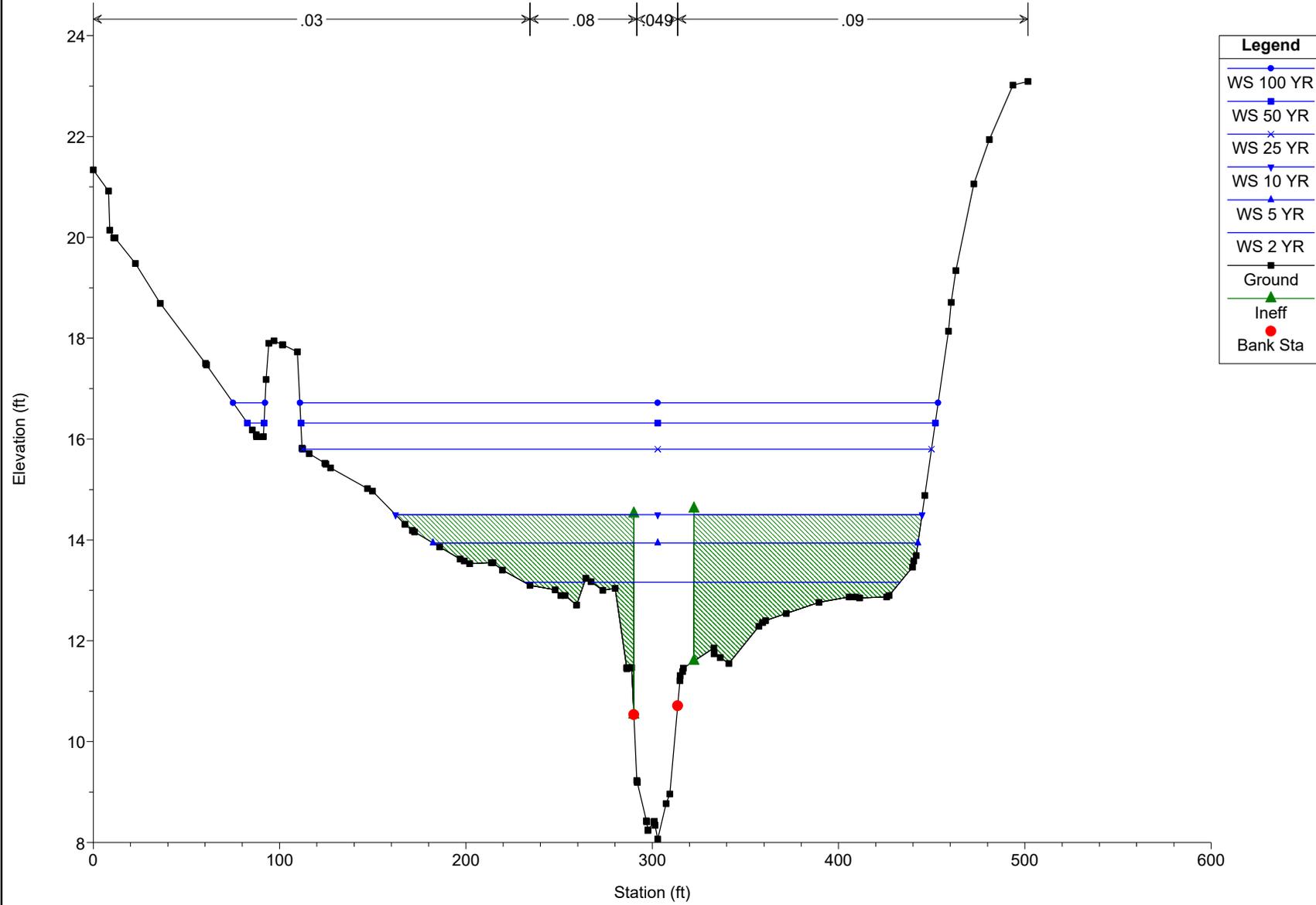
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 3004.159 Culv



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

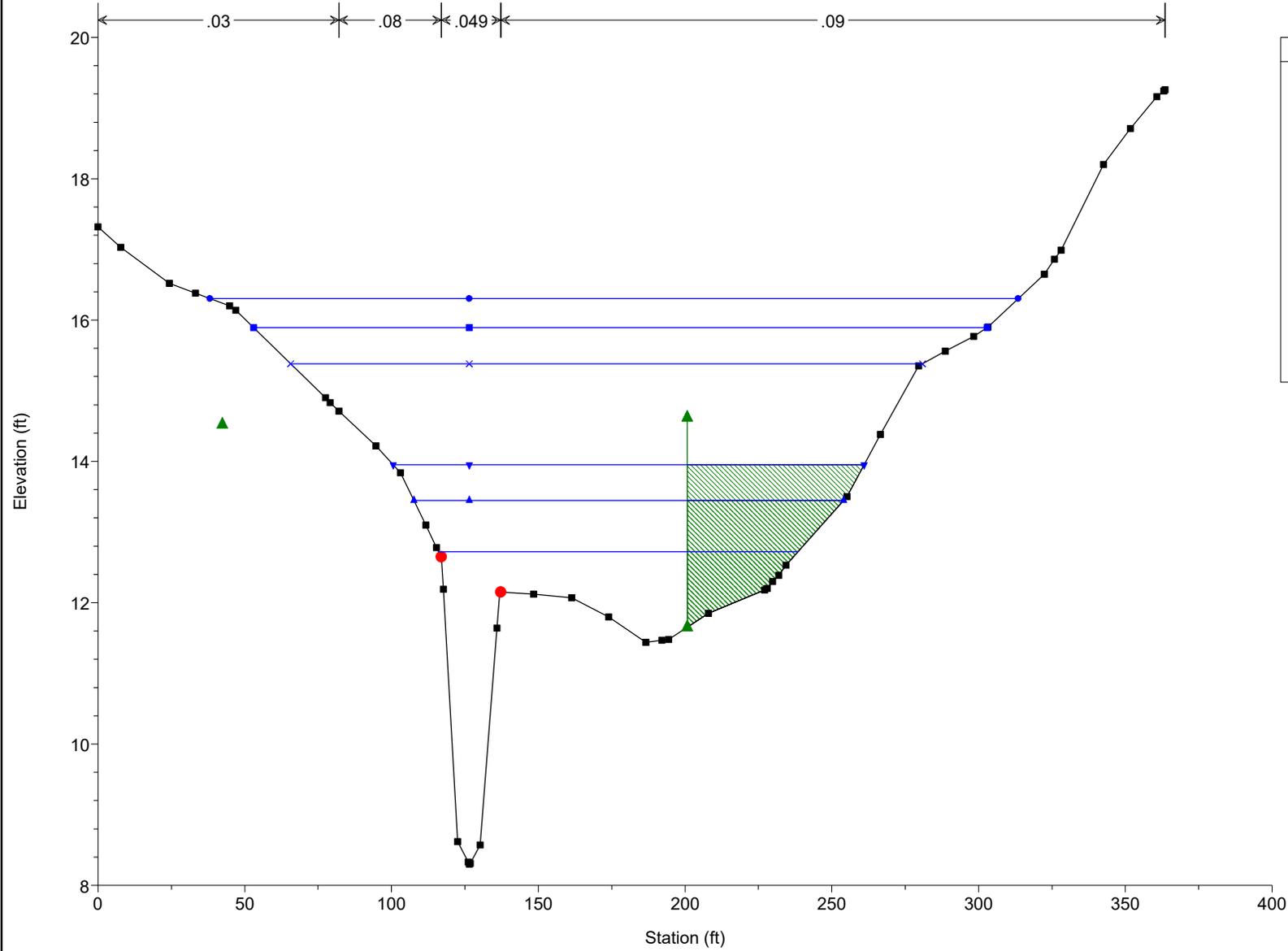
RS = 2973.376 XS-26



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	—
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 2839.603 XS-25

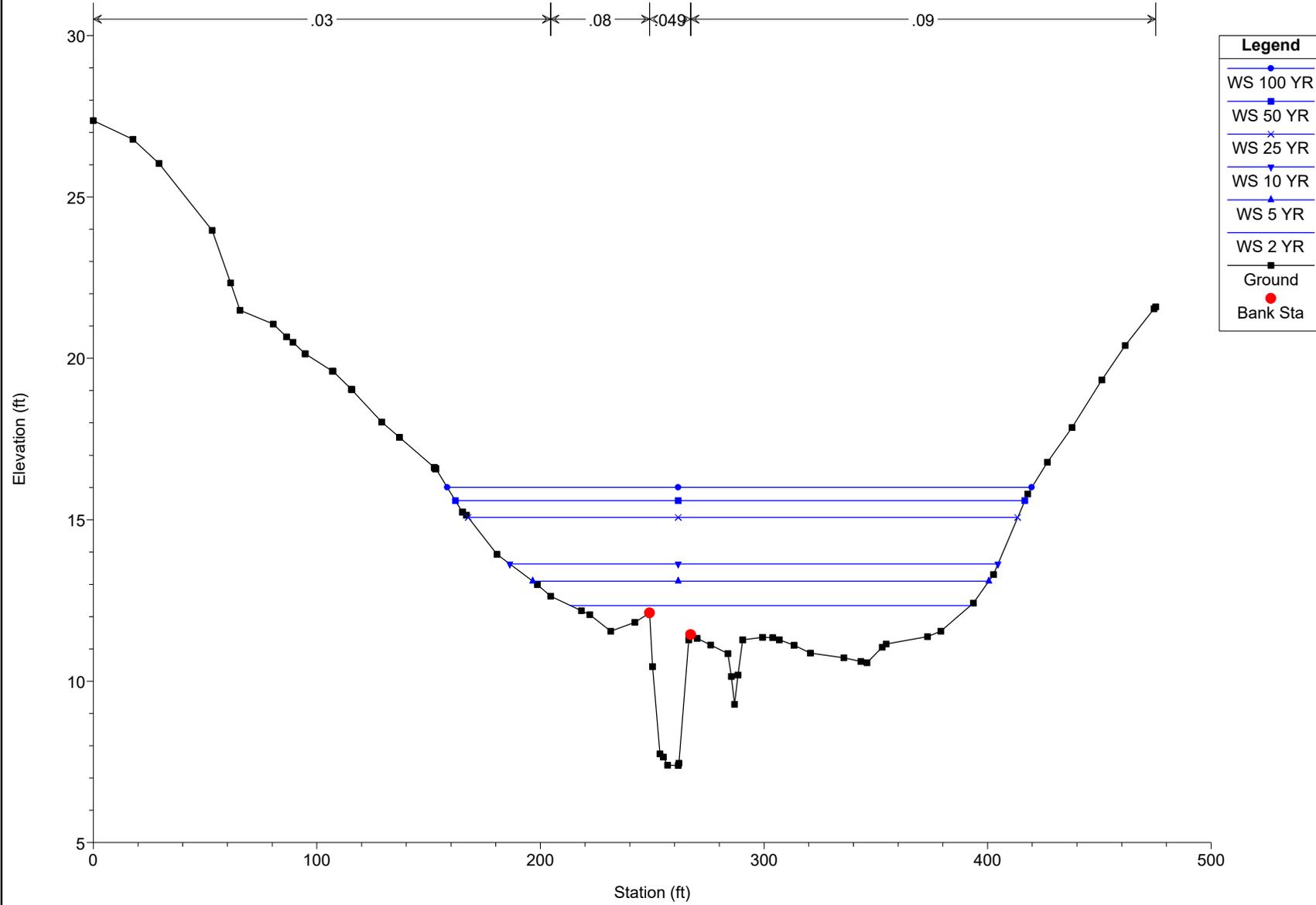


Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Ineff
- Bank Sta

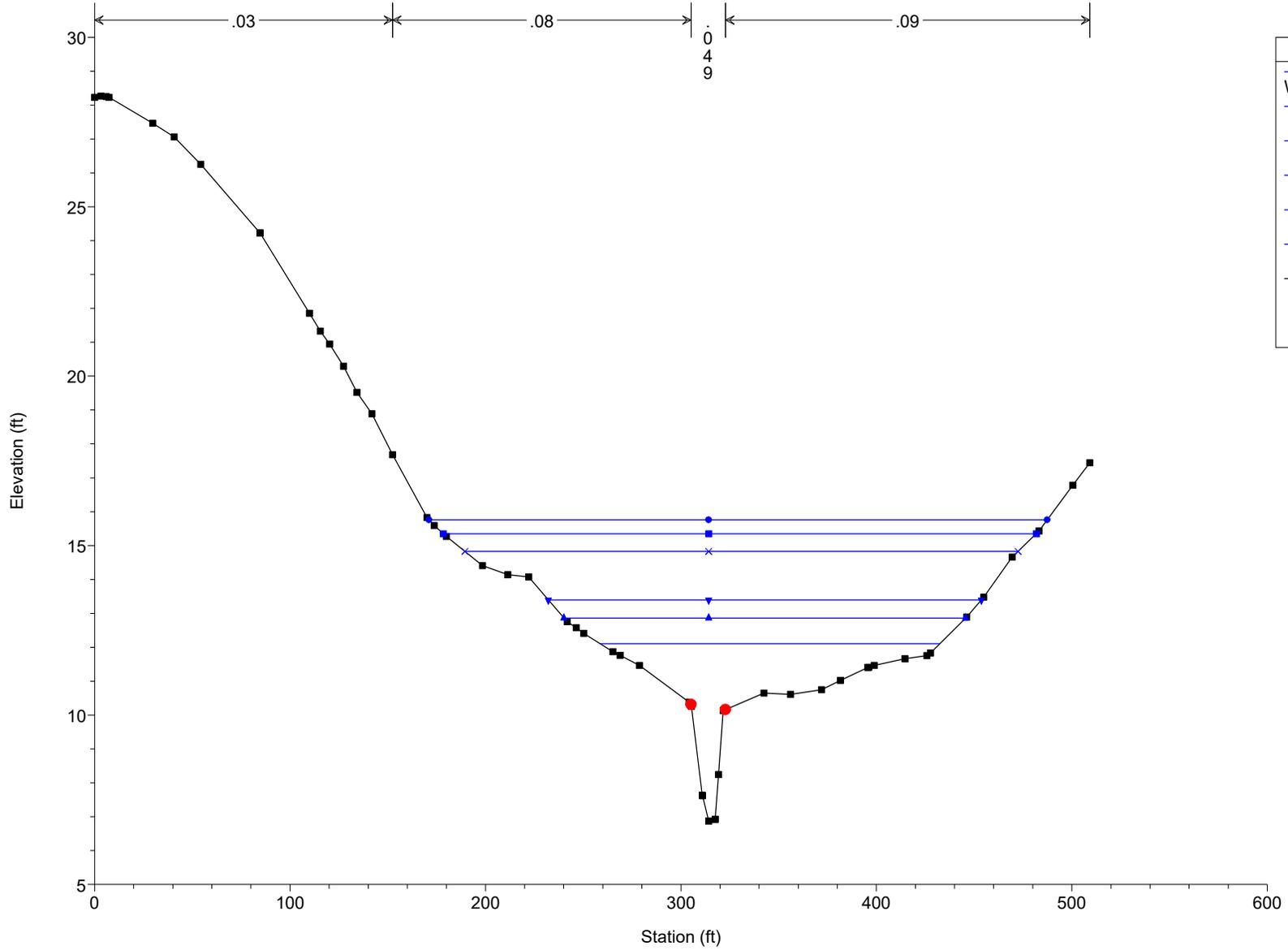
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 2660.237 XS-24



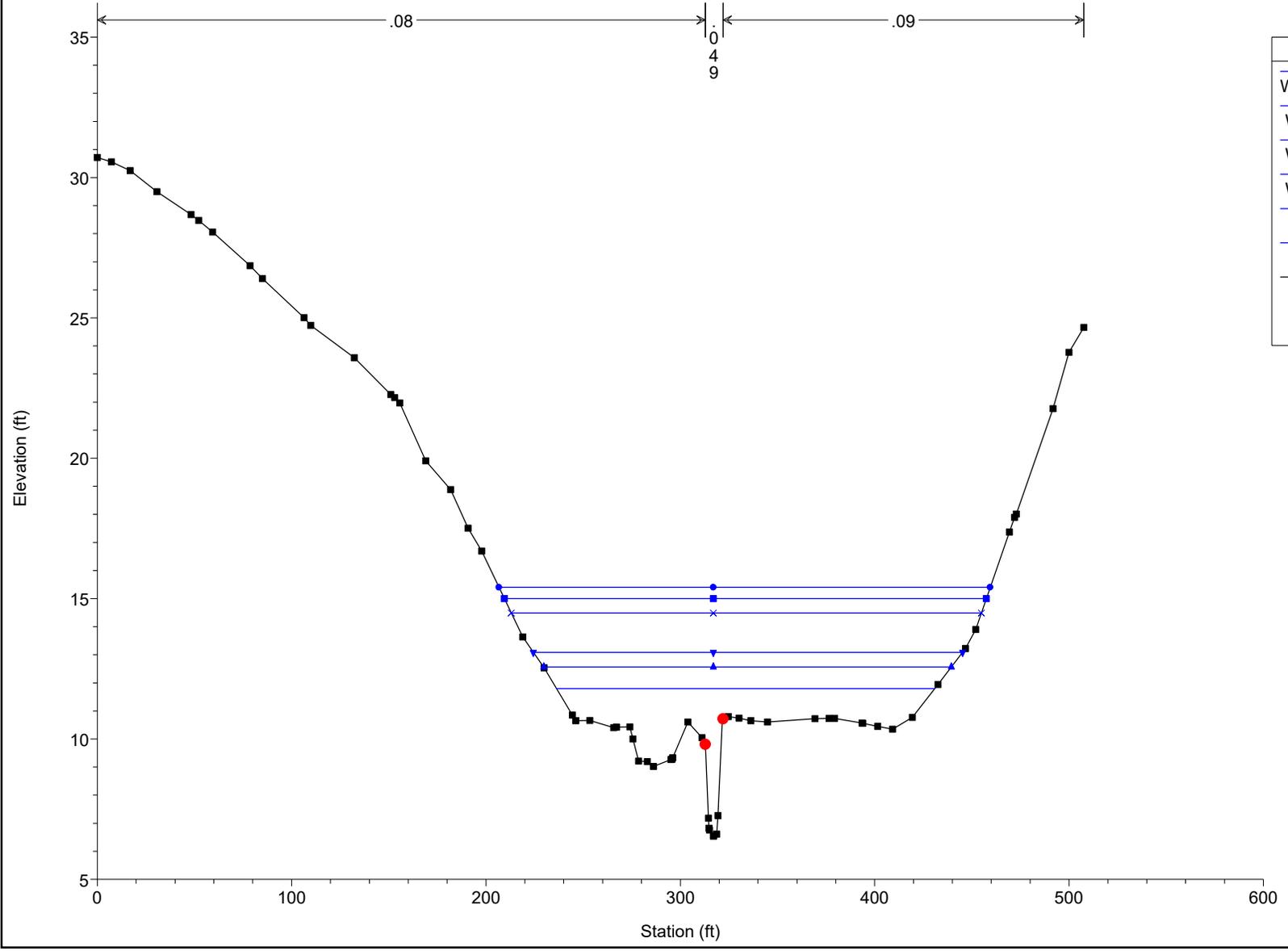
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 2519.448 XS-23



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 2308.054 XS-22

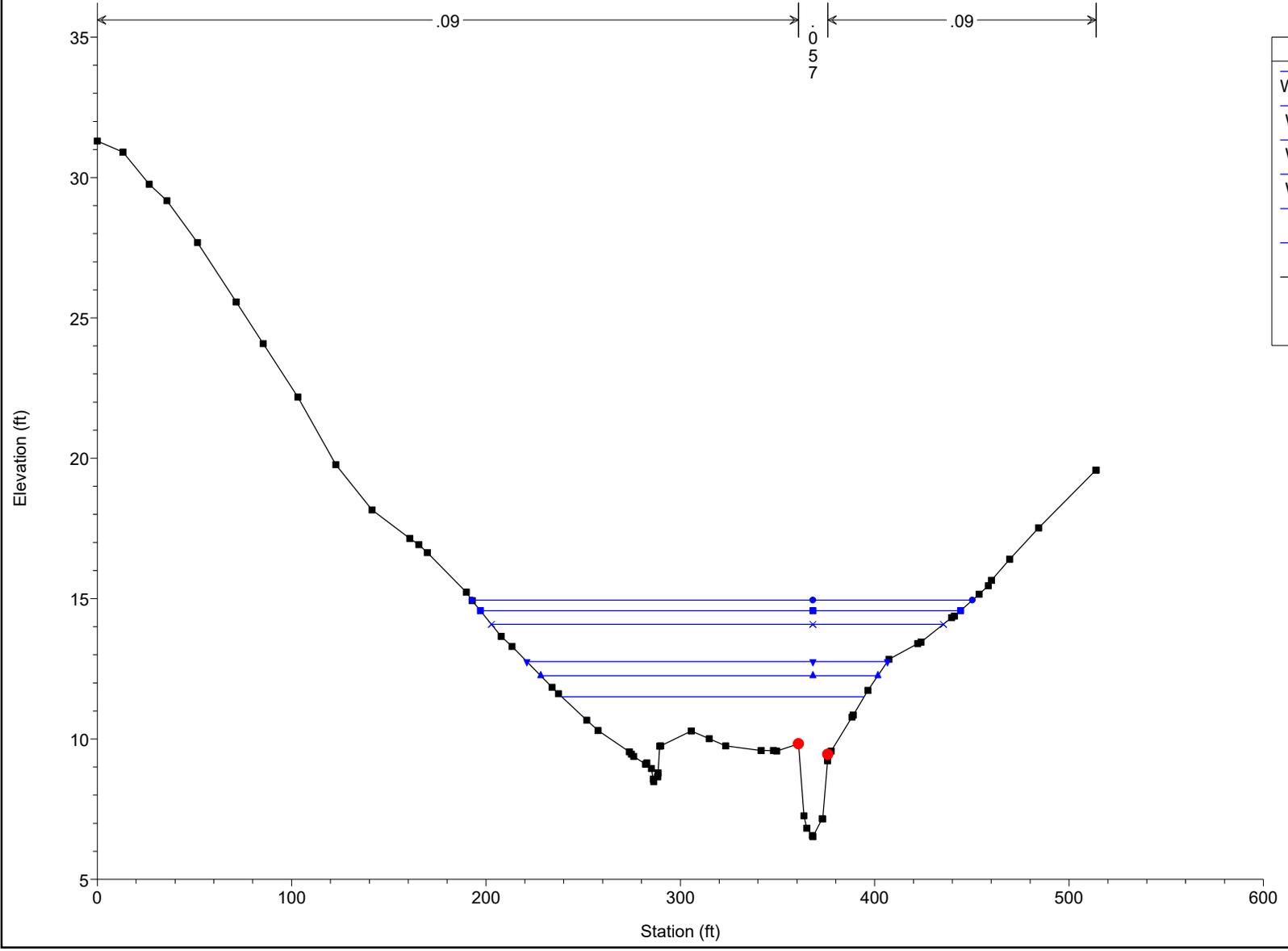


Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Bank Sta

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

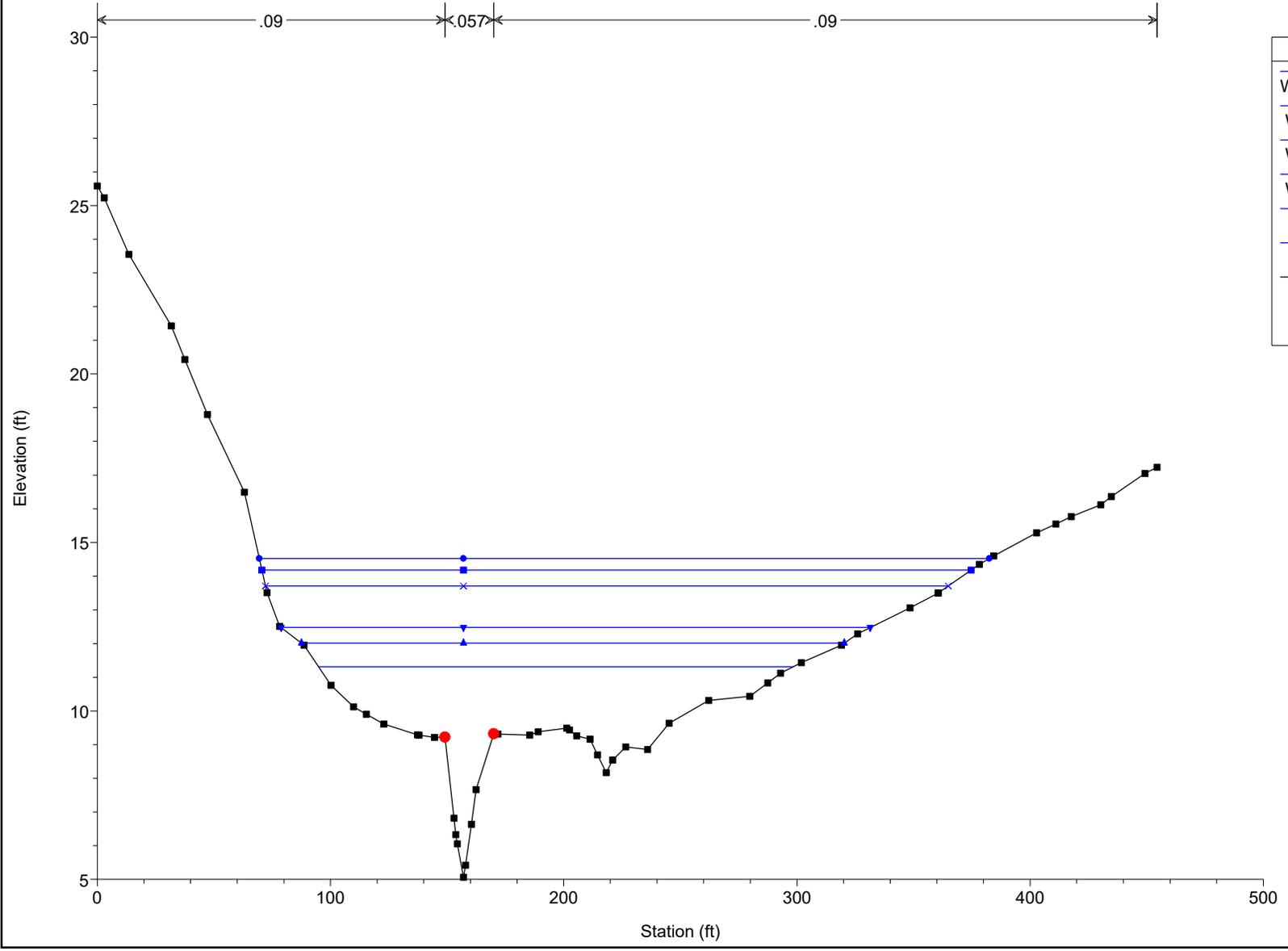
RS = 2054.860 XS-21



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

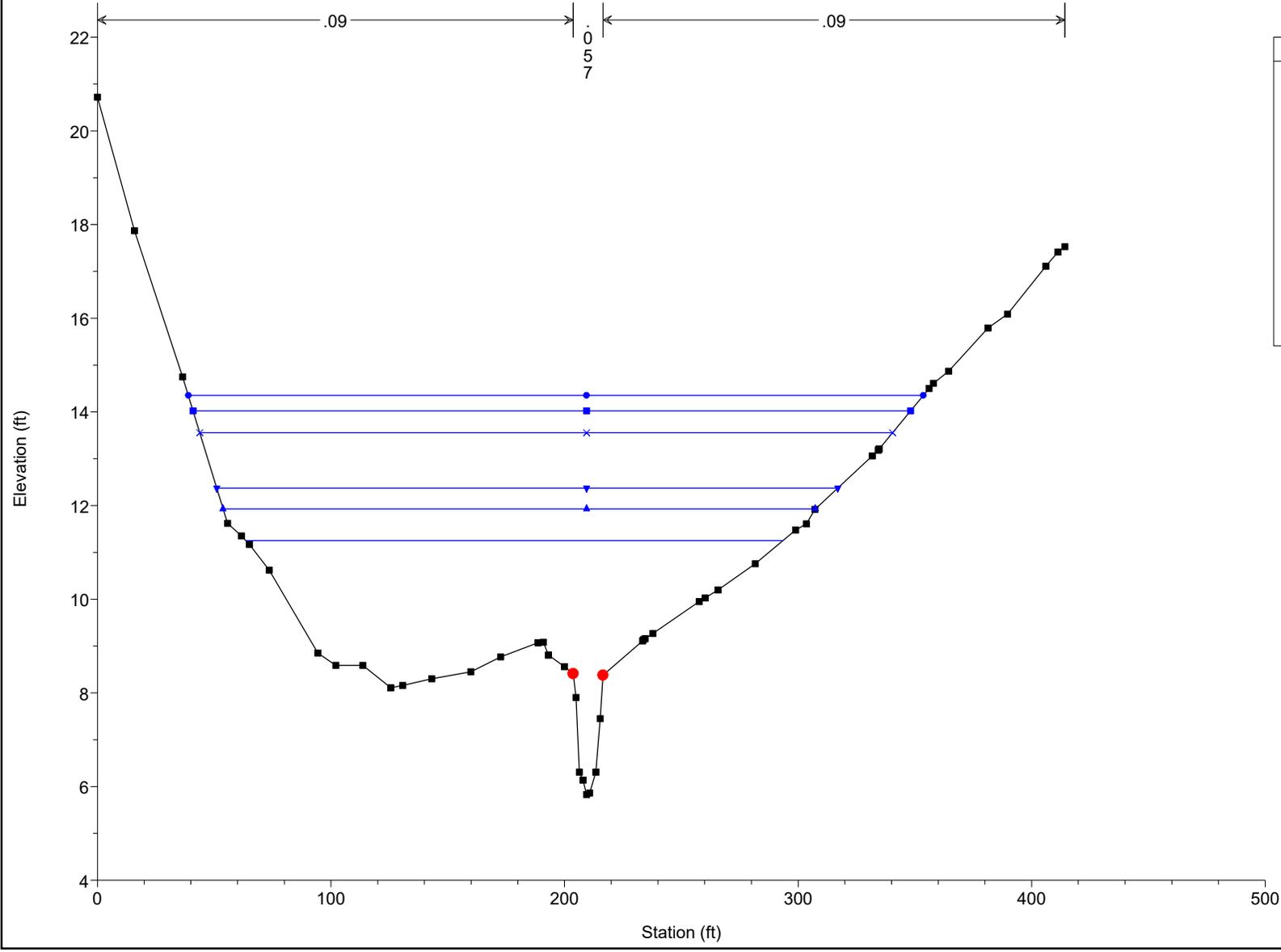
RS = 1818.292 XS-20



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1659.696 XS-19

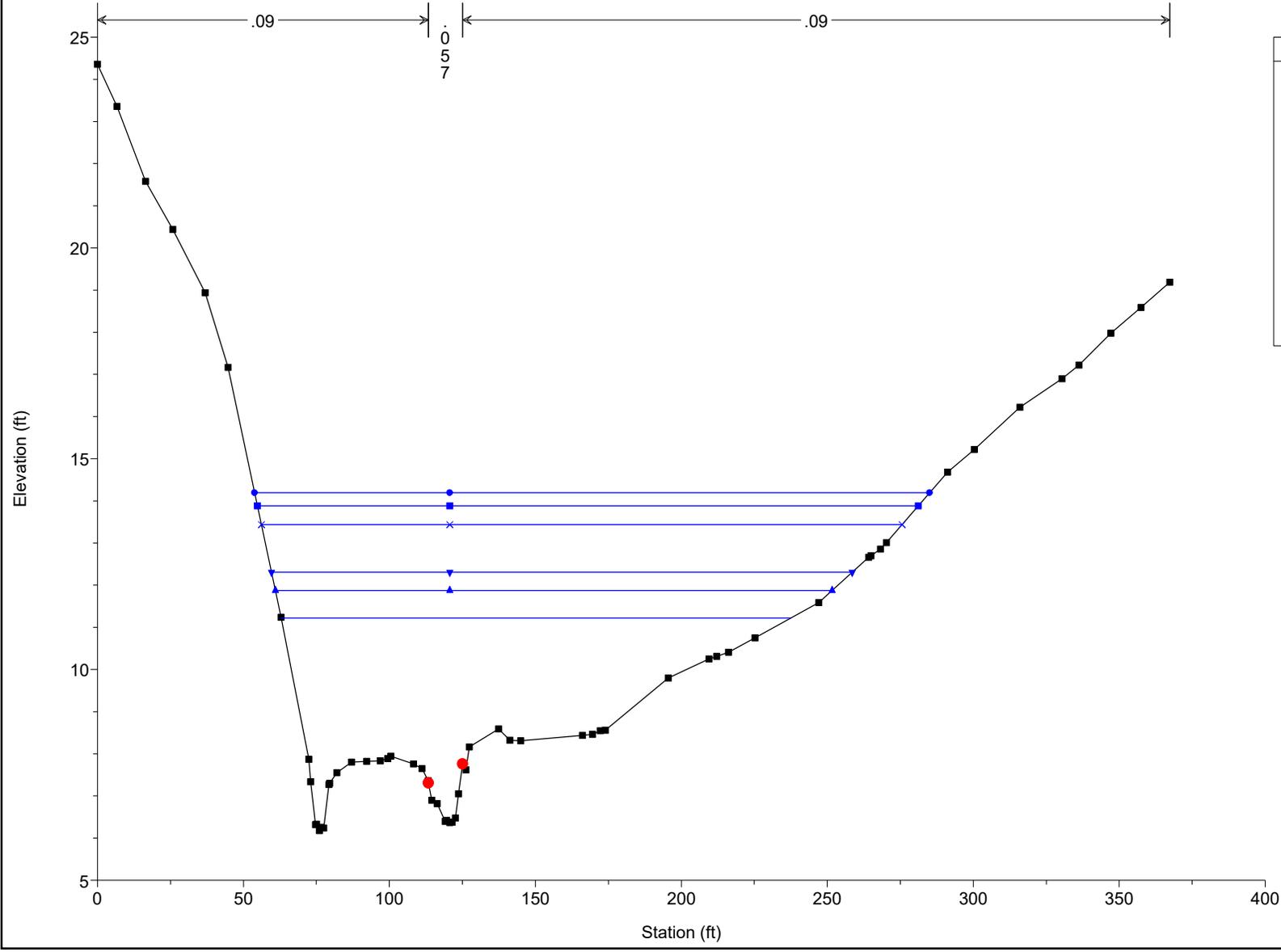


Legend

- WS 100 YR (Blue circle)
- WS 50 YR (Blue square)
- WS 25 YR (Blue cross)
- WS 10 YR (Blue inverted triangle)
- WS 5 YR (Blue triangle)
- WS 2 YR (Blue horizontal line)
- Ground (Black square)
- Bank Sta (Red circle)

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1568.009 XS-18

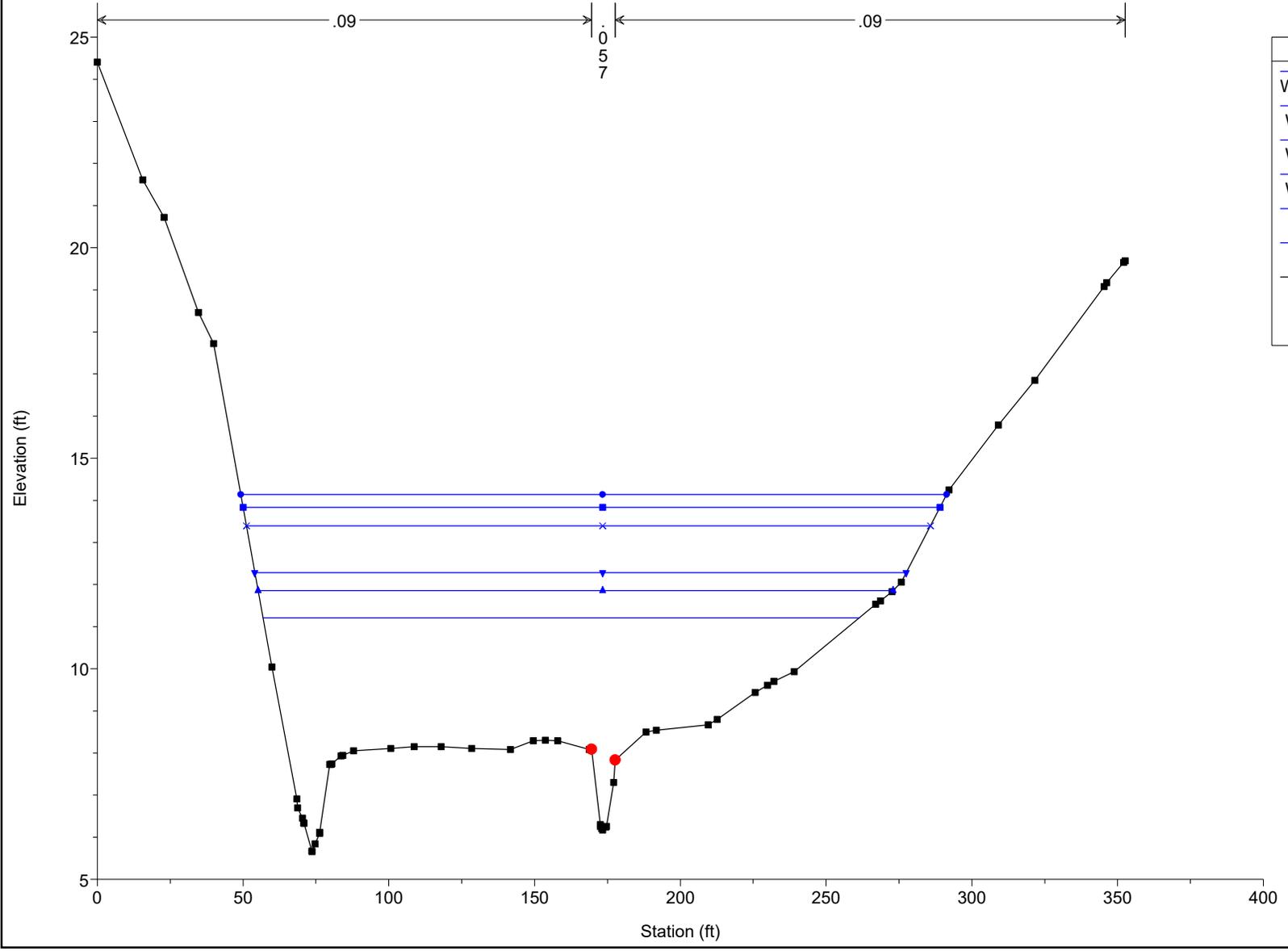


Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Bank Sta

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1485.470 XS-17

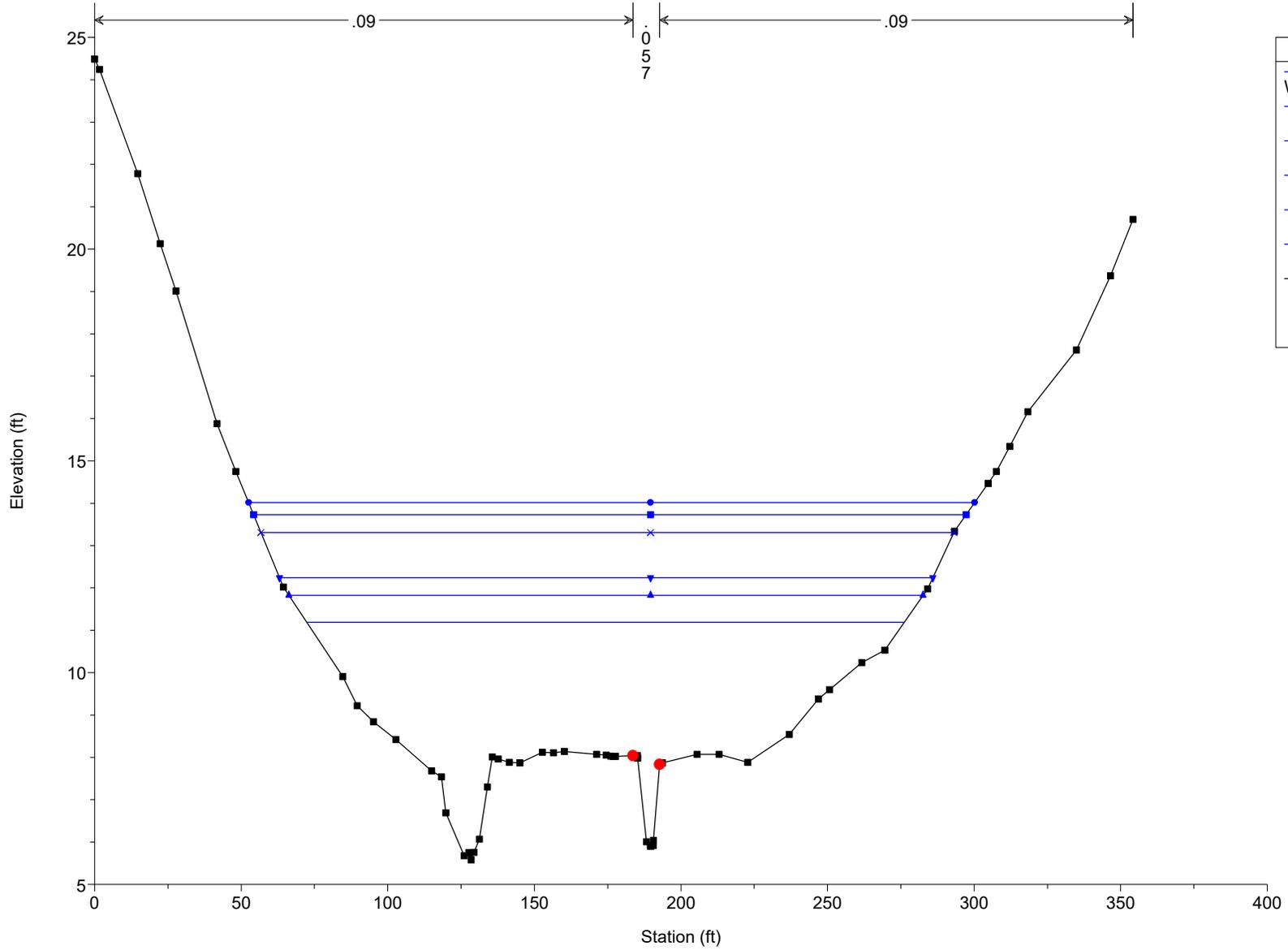


Legend

- WS 100 YR (Blue circle)
- WS 50 YR (Blue square)
- WS 25 YR (Blue cross)
- WS 10 YR (Blue inverted triangle)
- WS 5 YR (Blue triangle)
- WS 2 YR (Black square)
- Ground (Black square)
- Bank Sta (Red circle)

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1425.227 XS-16

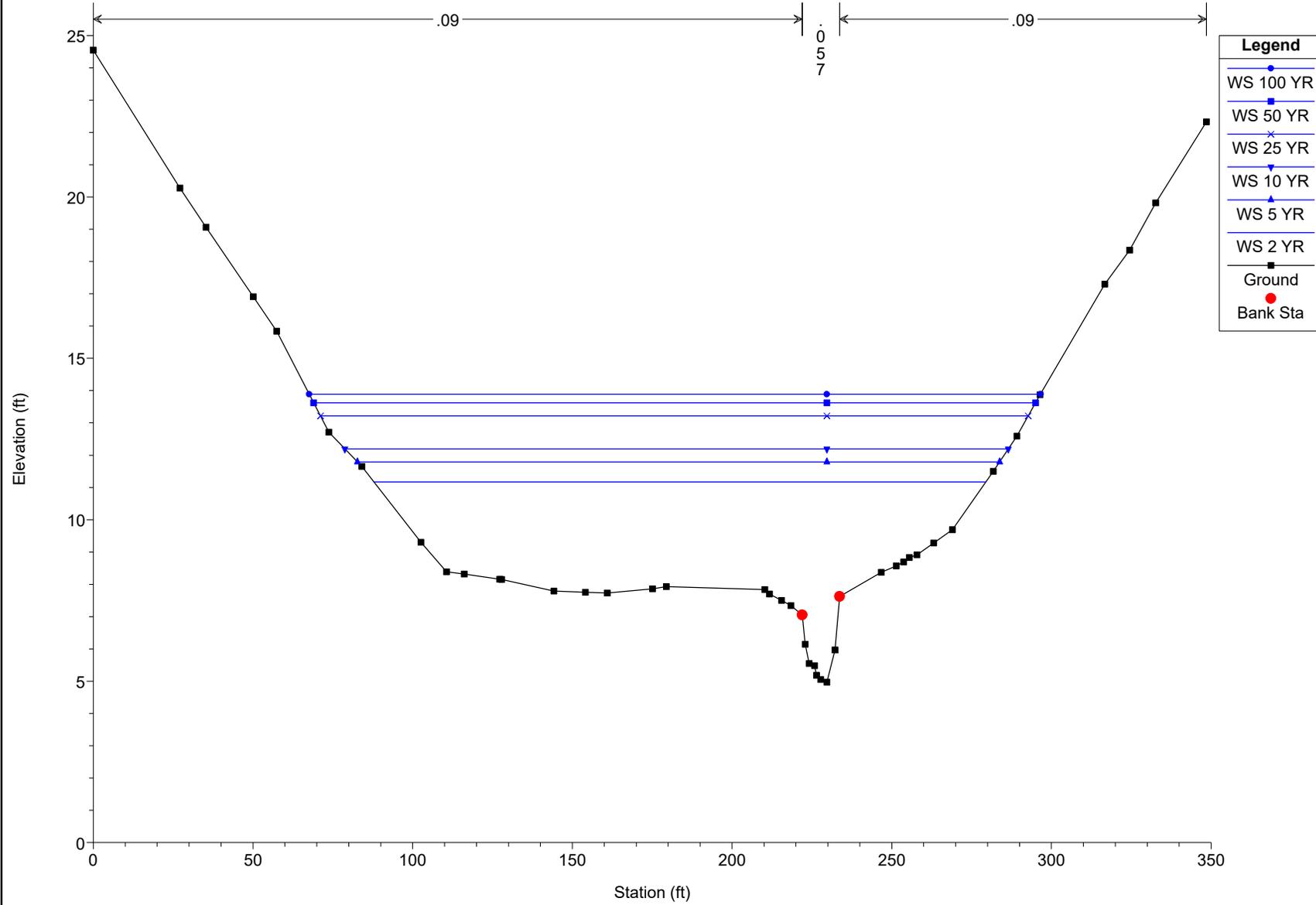


Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Bank Sta

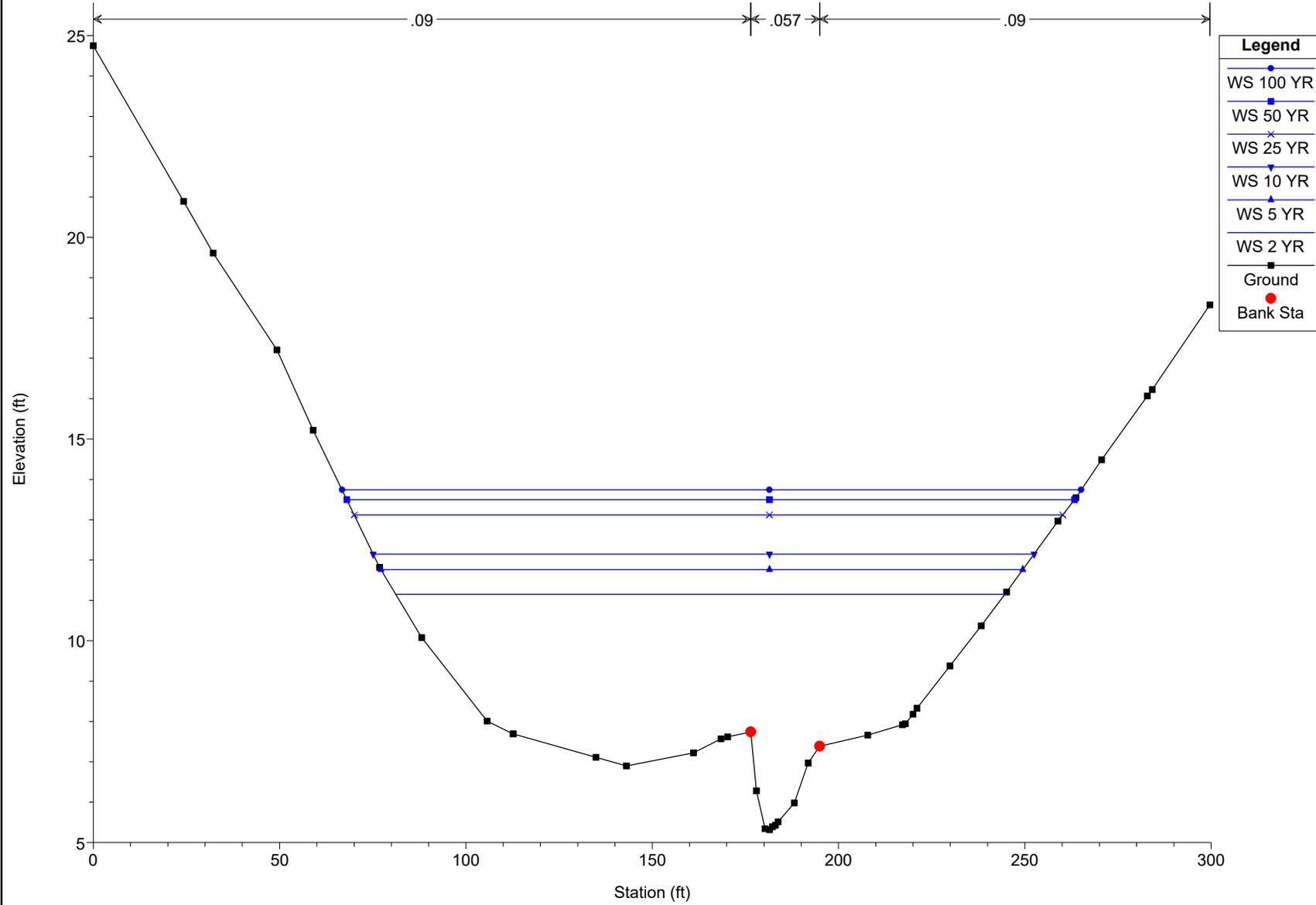
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1342.706 XS-15



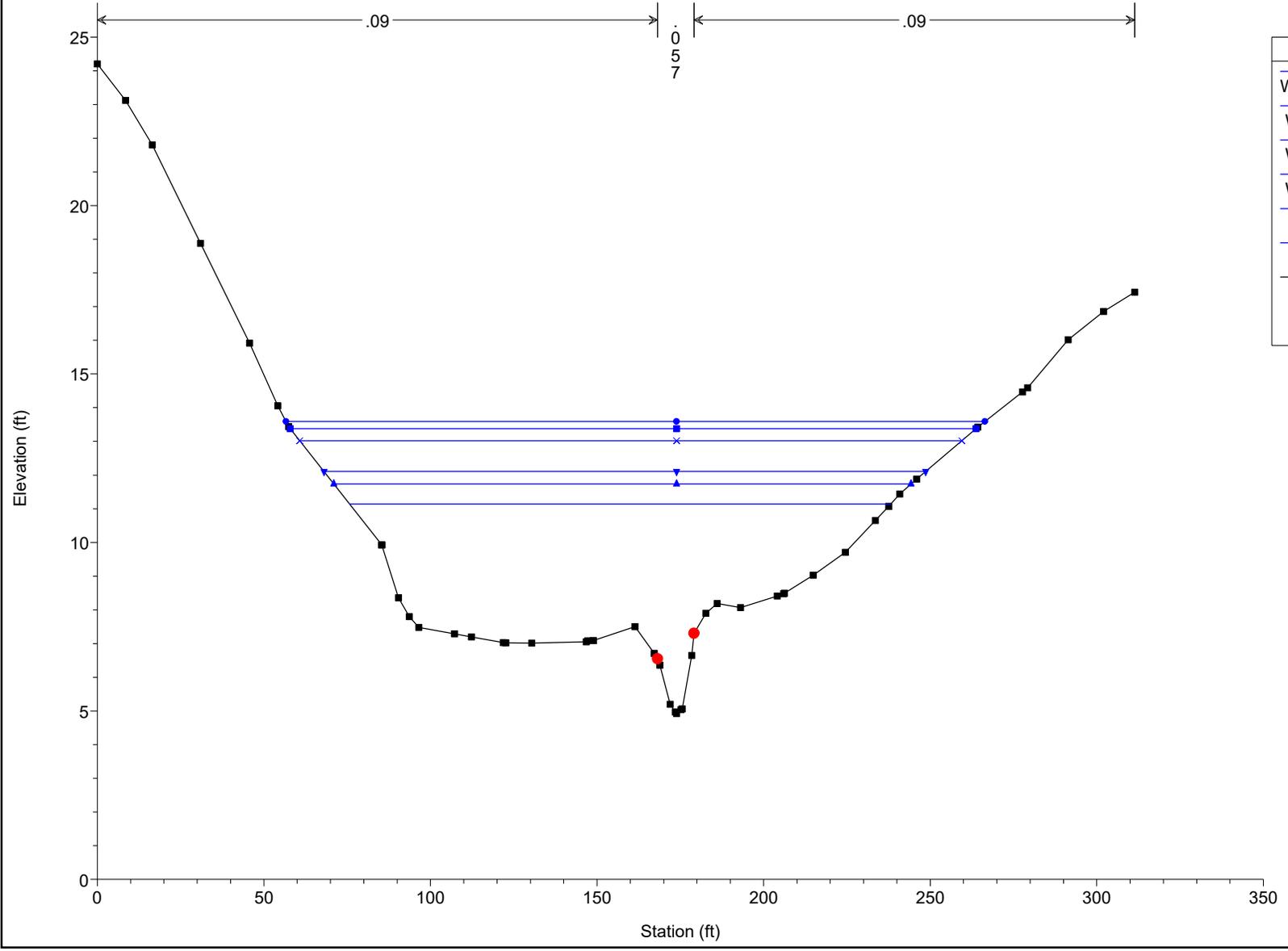
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1233.442 XS-14



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1152.323 XS-13

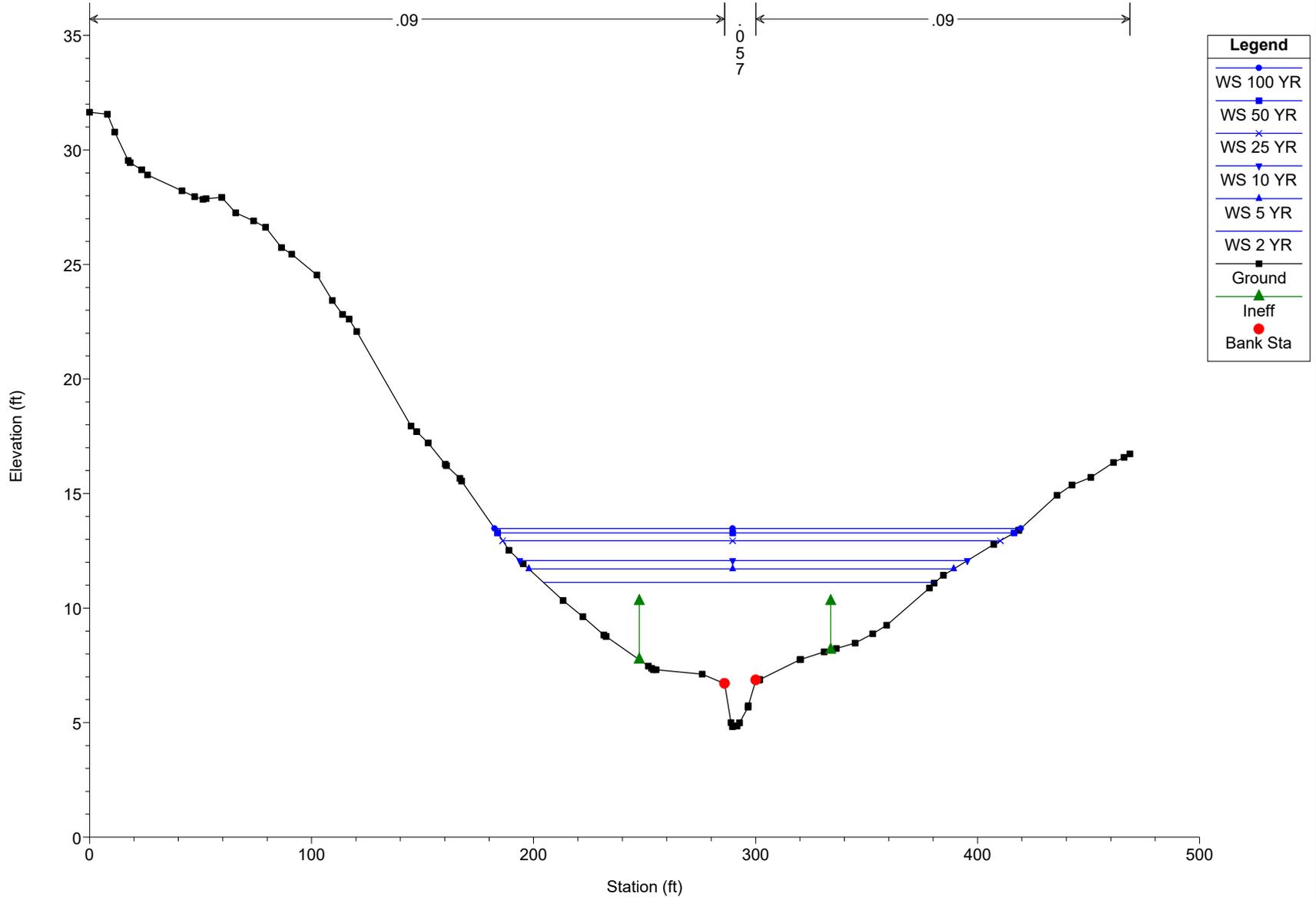


Legend

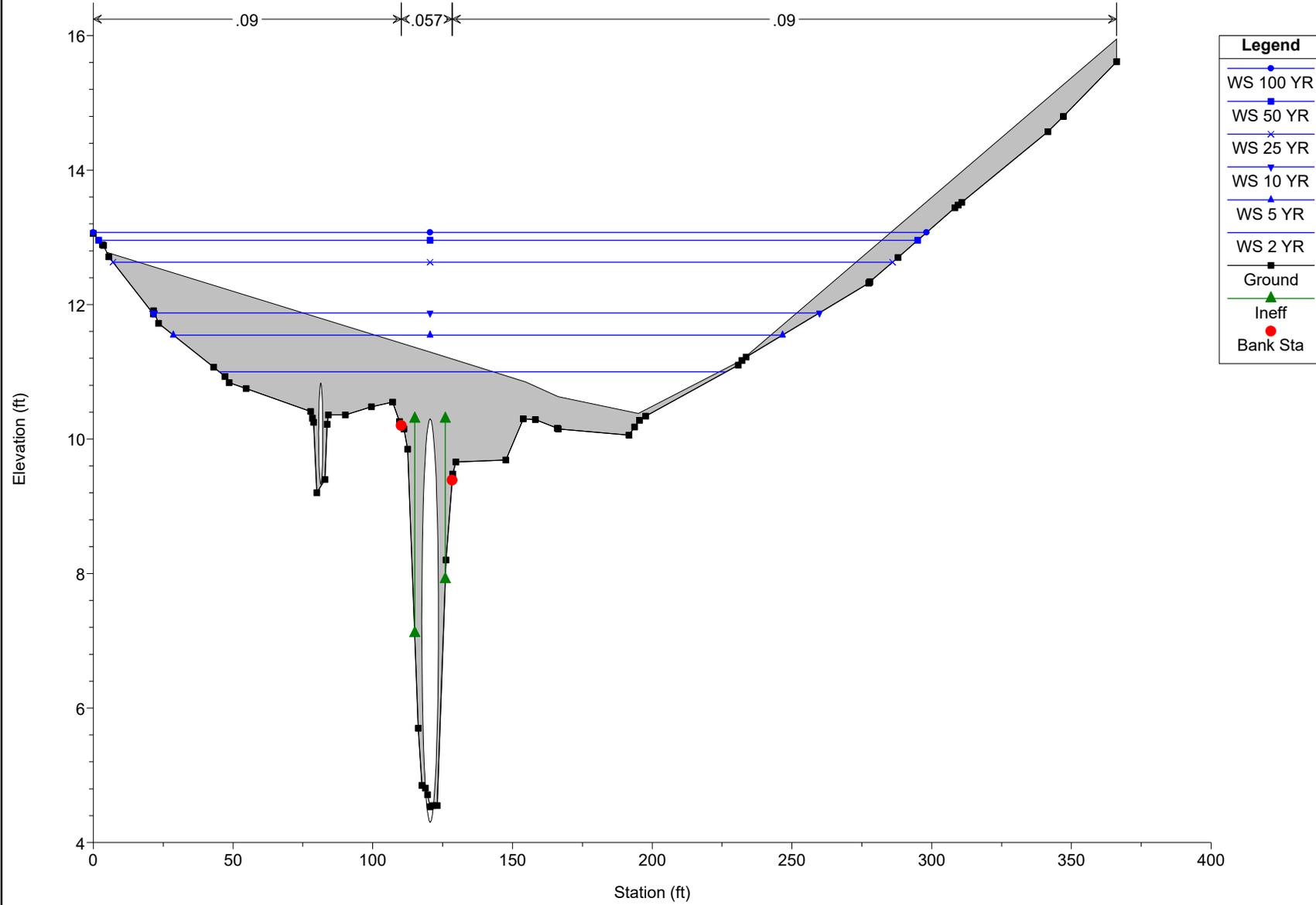
- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Bank Sta

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1103.114 XS-12



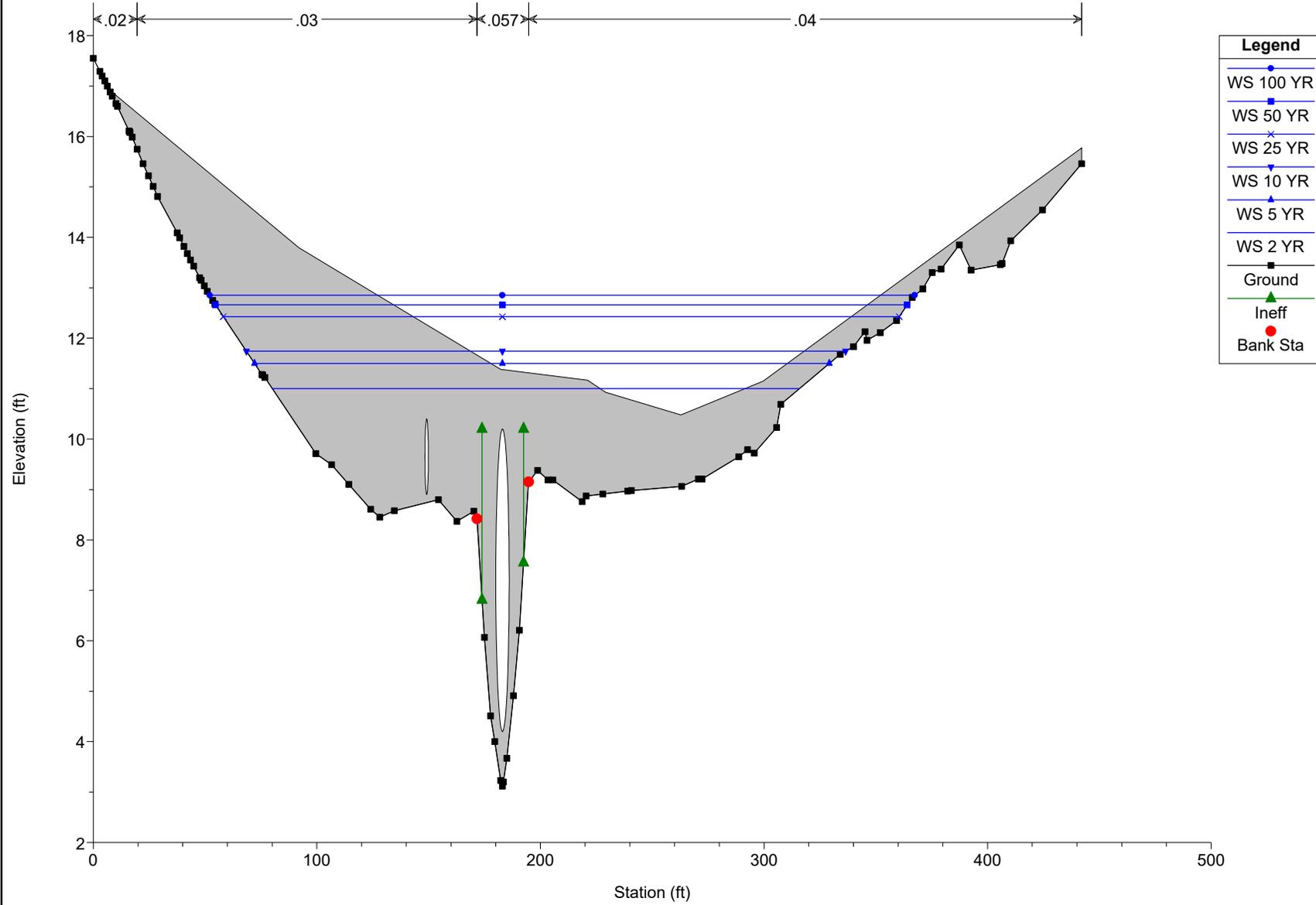
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025
 RS = 1052.49 Culv



Legend

- WS 100 YR (Blue circle)
- WS 50 YR (Blue square)
- WS 25 YR (Blue x)
- WS 10 YR (Blue inverted triangle)
- WS 5 YR (Blue triangle)
- WS 2 YR (Black square)
- Ground (Black line)
- Ineff (Green line with triangle)
- Bank Sta (Red circle)

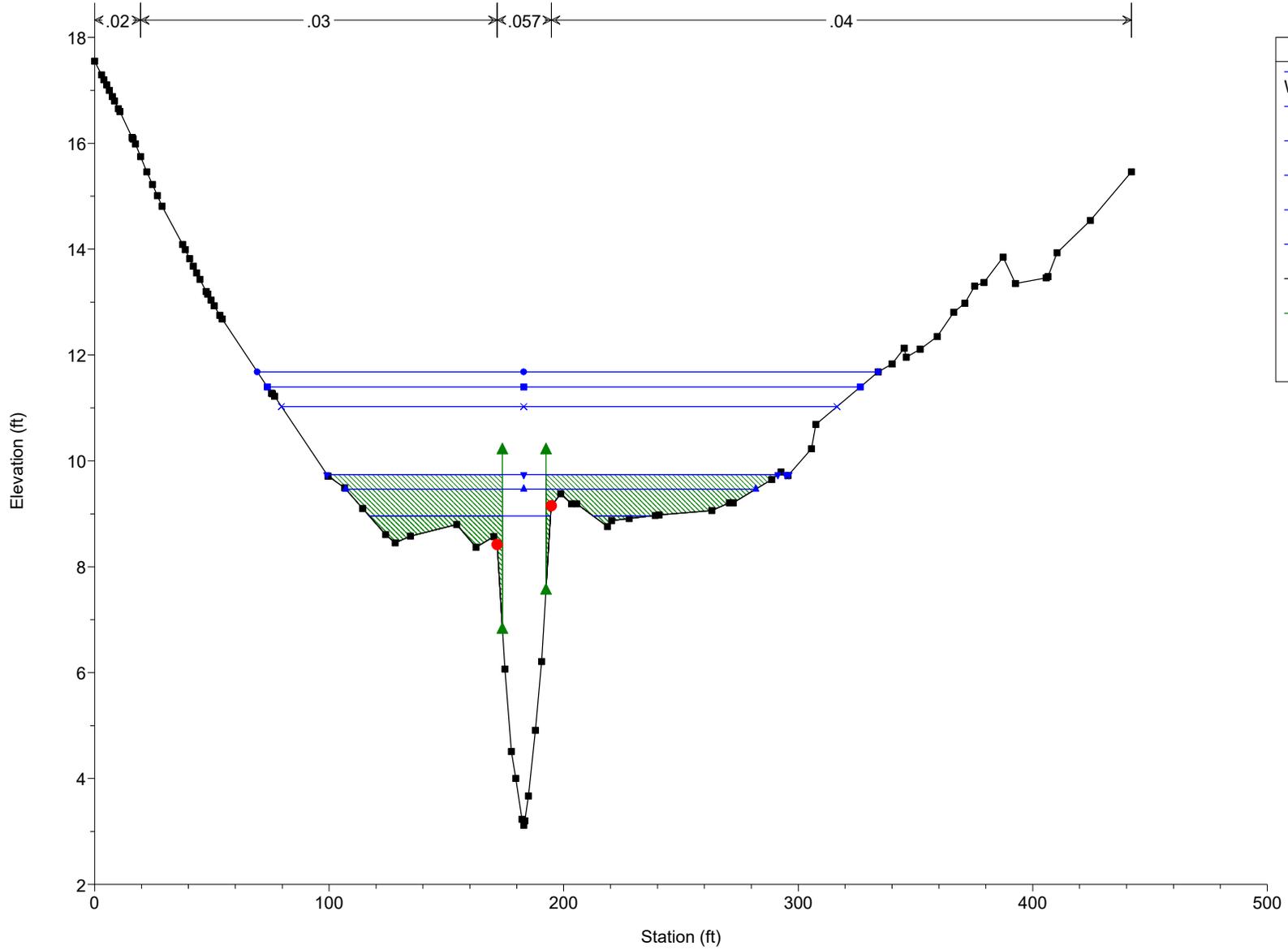
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025
 RS = 1052.49 Culv



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	▲
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1035.739 XS-10

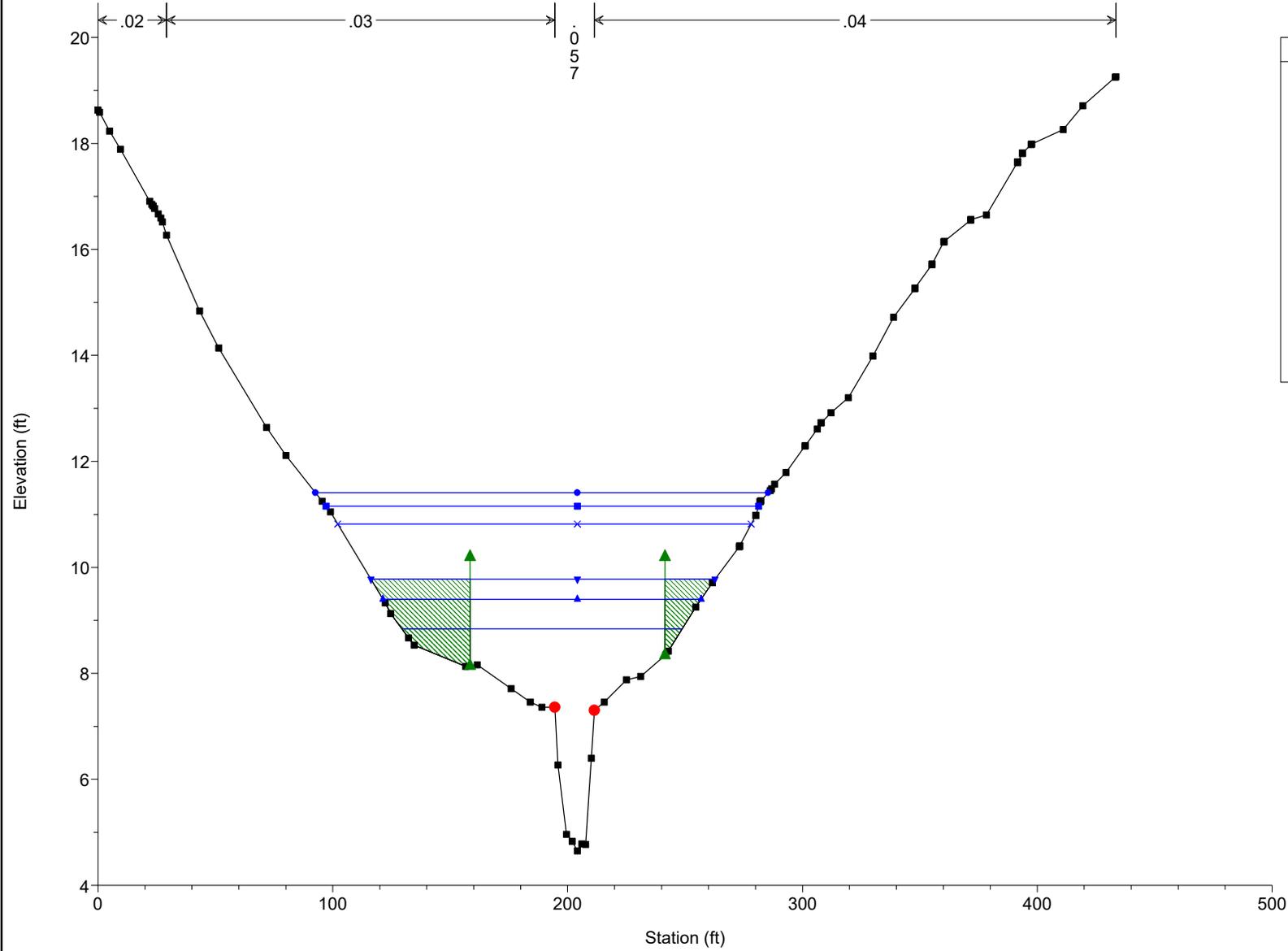
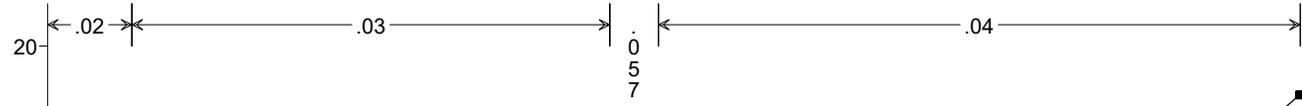


Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Ineff
- Bank Sta

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

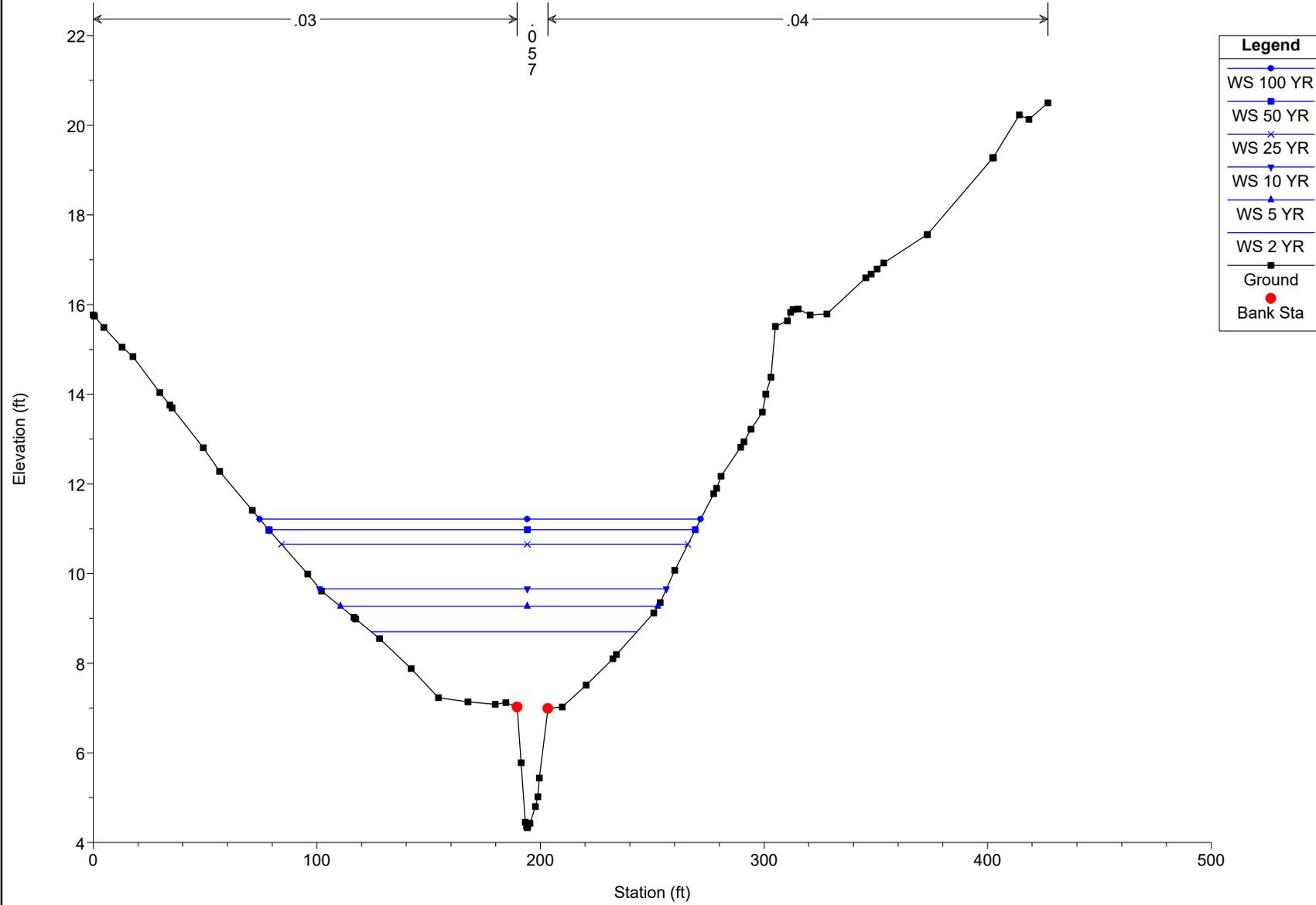
RS = 964.7622 XS-9



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	—■—
Ineff	—▲—
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 862.6342 XS-8

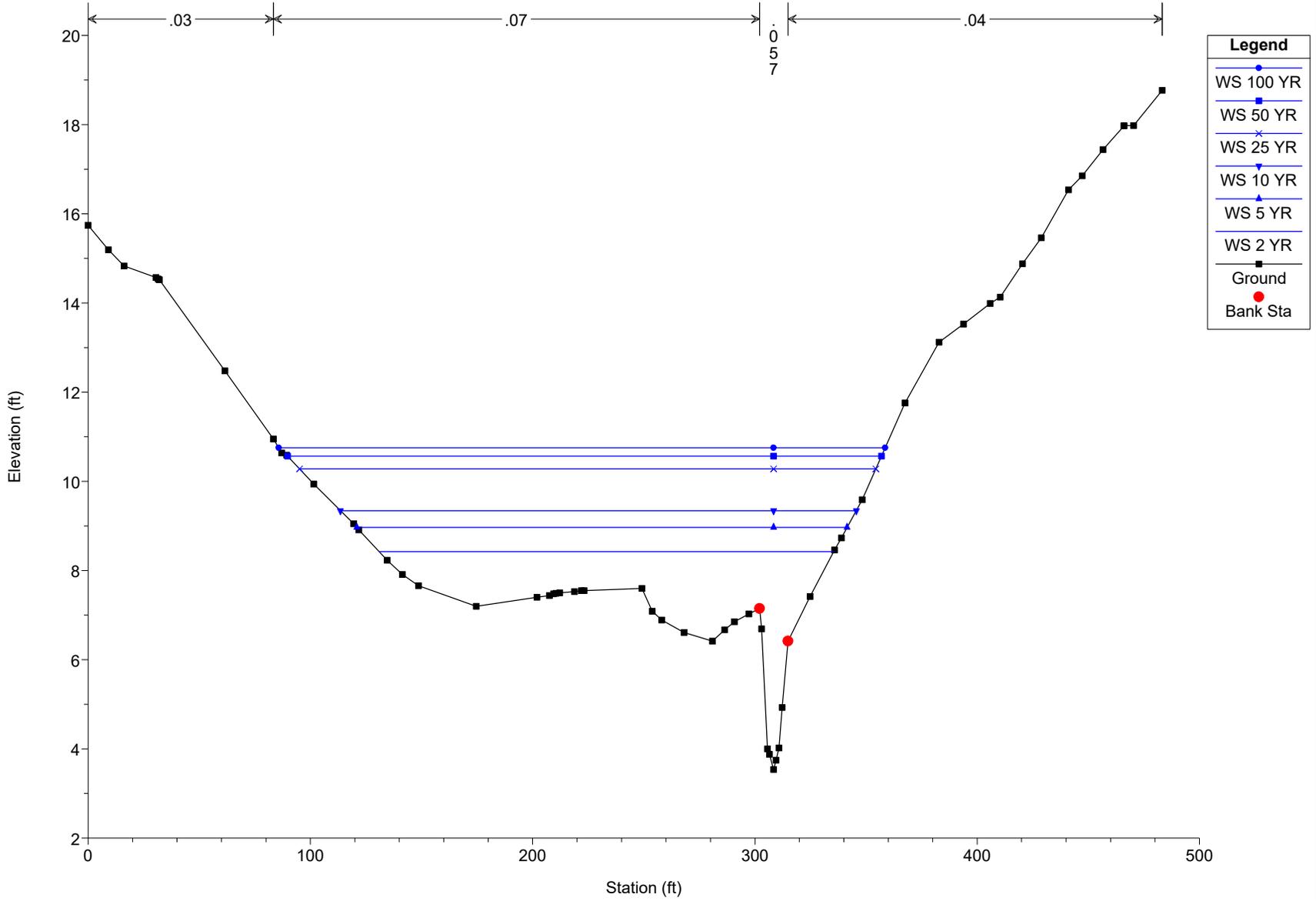


Legend

- WS 100 YR (blue circle)
- WS 50 YR (blue square)
- WS 25 YR (blue cross)
- WS 10 YR (blue inverted triangle)
- WS 5 YR (blue triangle)
- WS 2 YR (blue square)
- Ground (black square)
- Bank Sta (red circle)

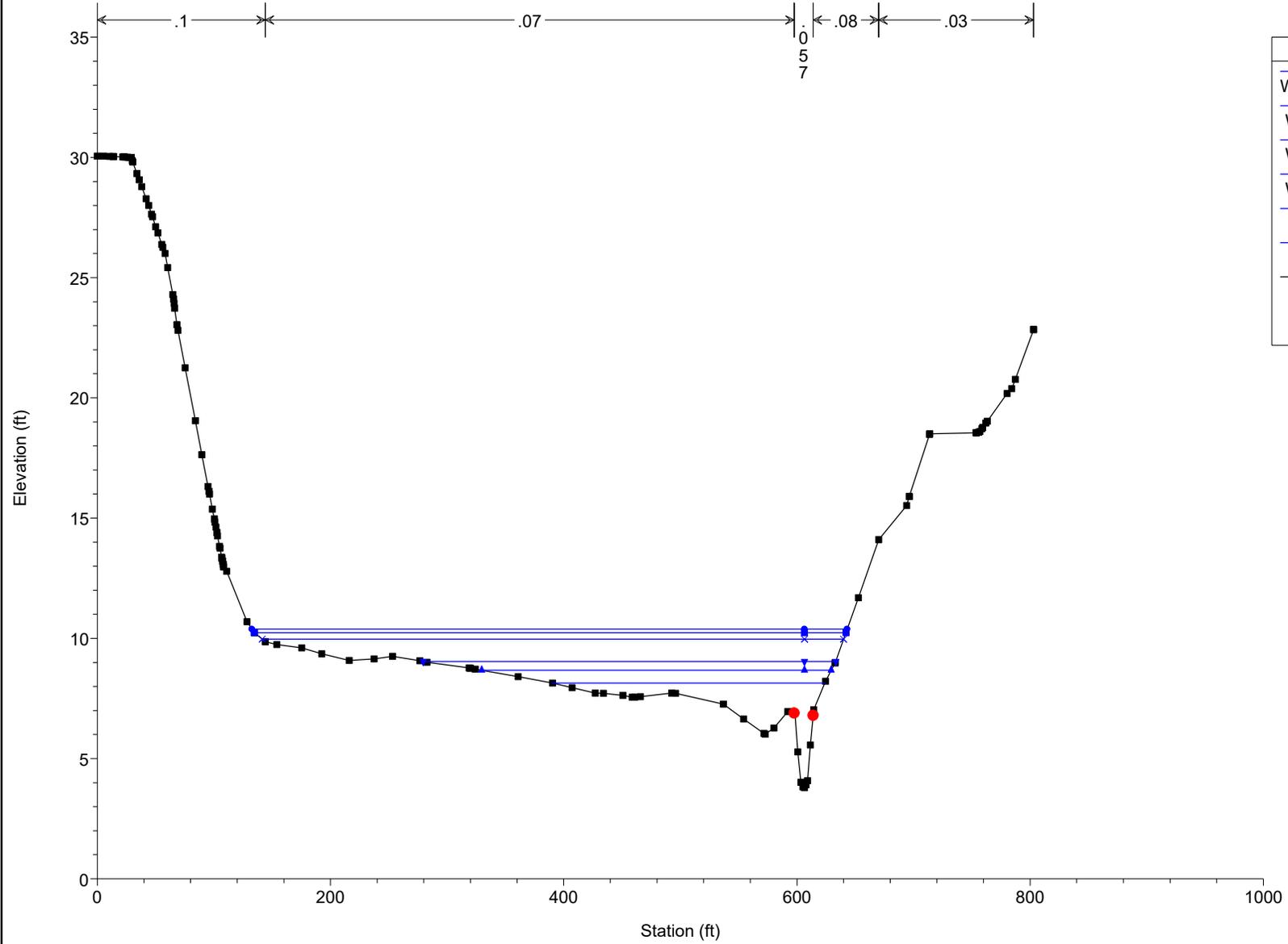
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 661.4513 XS-7



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

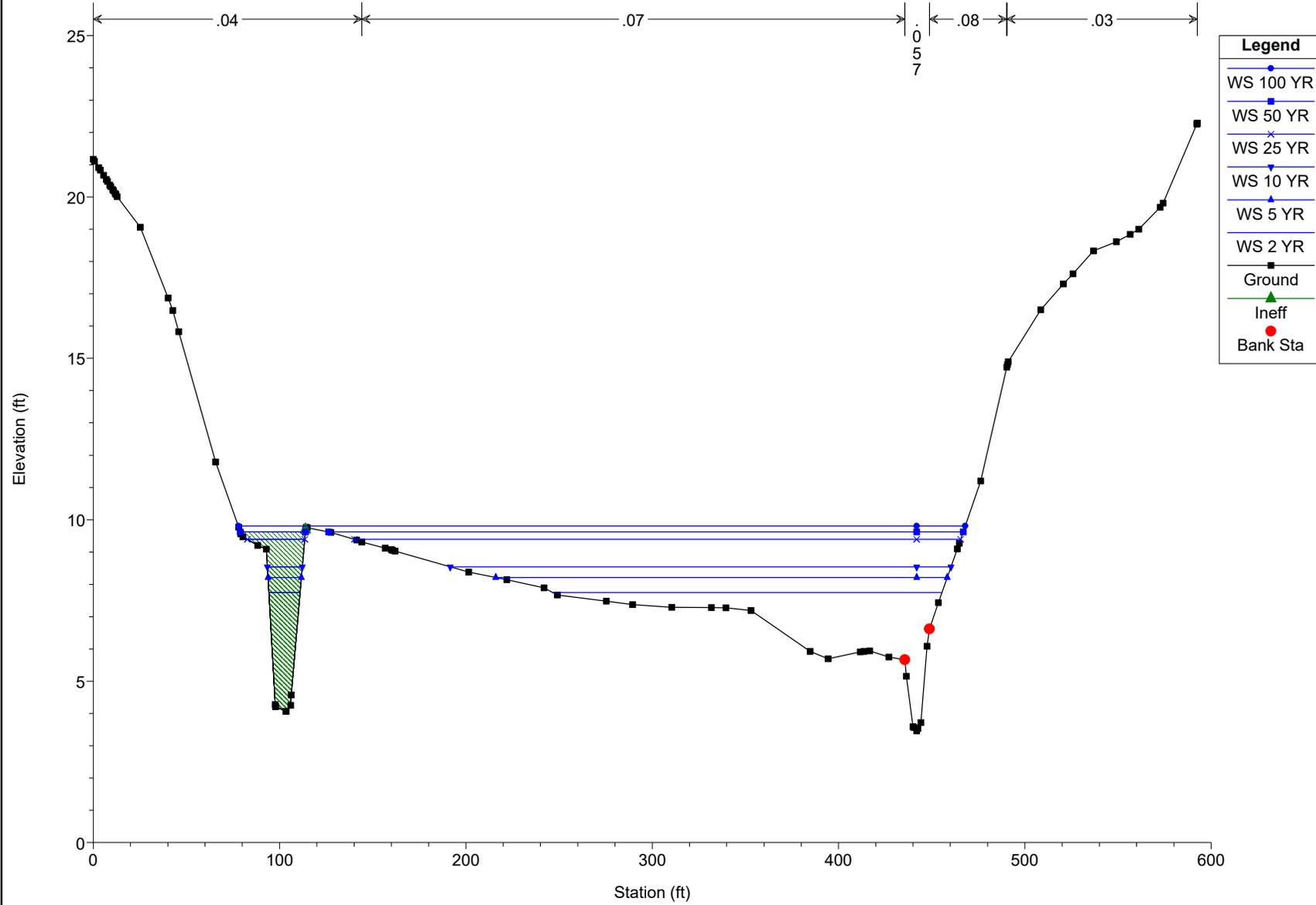
RS = 565.9014 XS-6



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Bank Sta	●

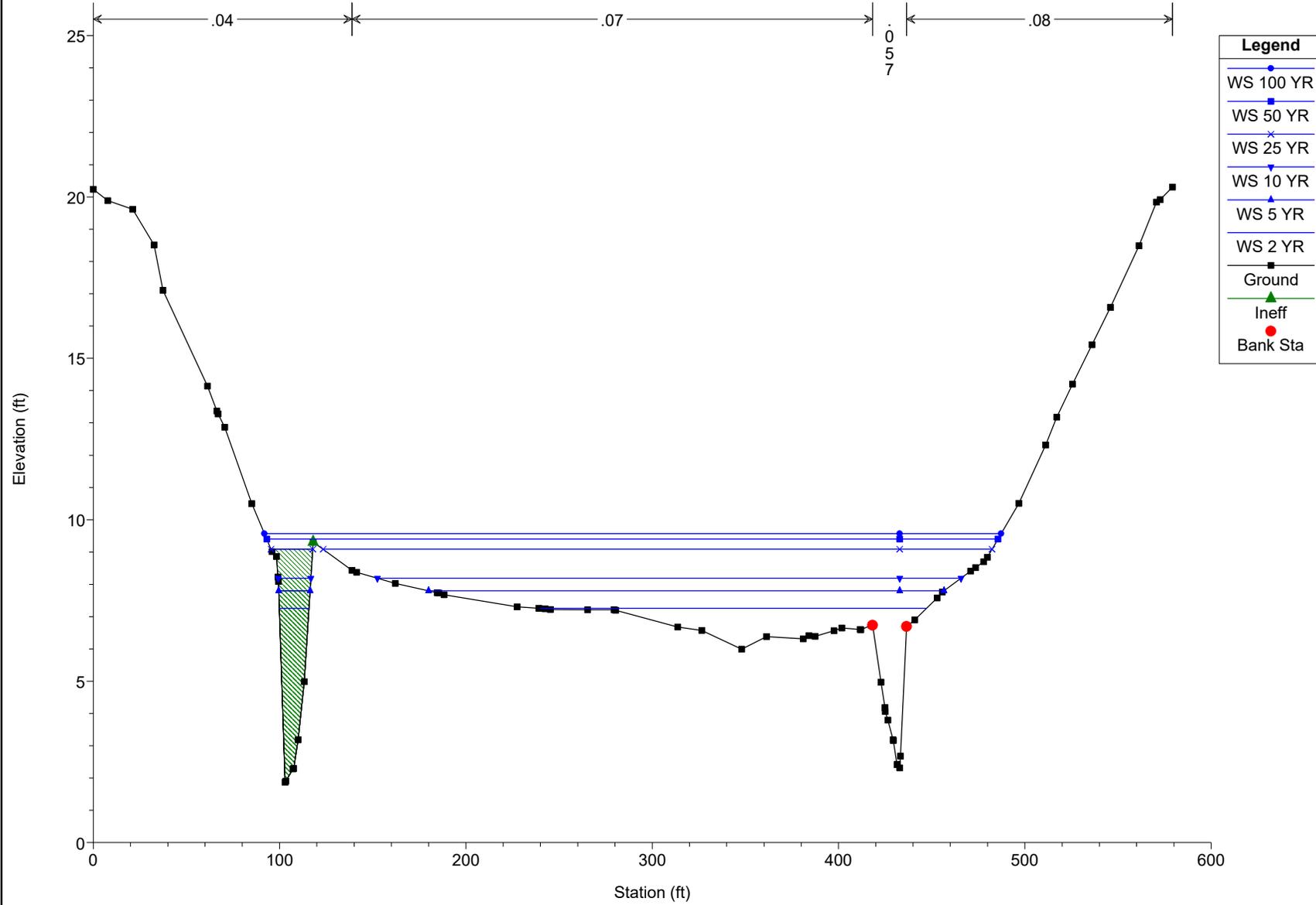
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 443.9817 XS-5



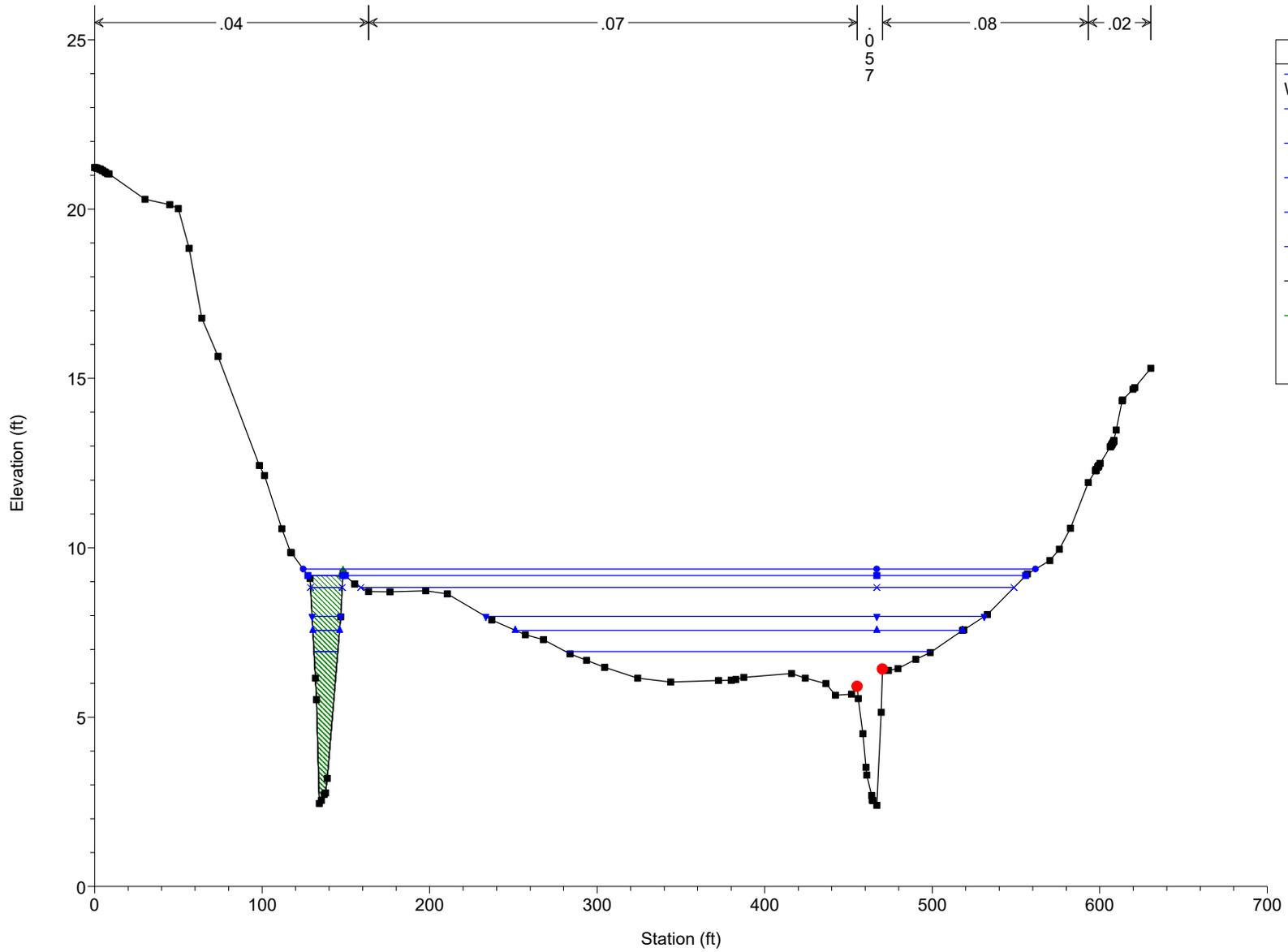
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 280.6386 XS-4



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

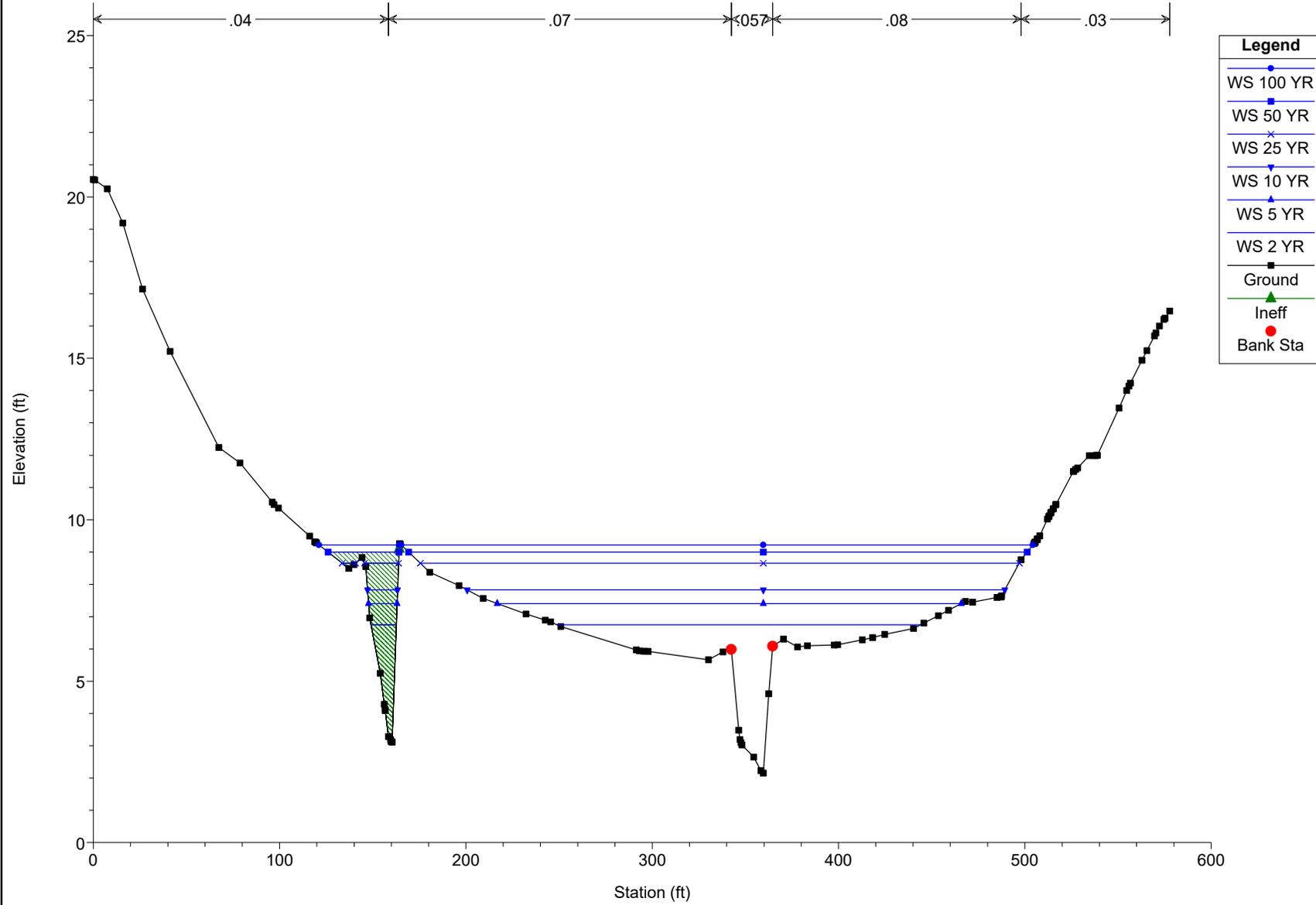
RS = 194.0256 XS-3



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	—
Ineff	▲
Bank Sta	●

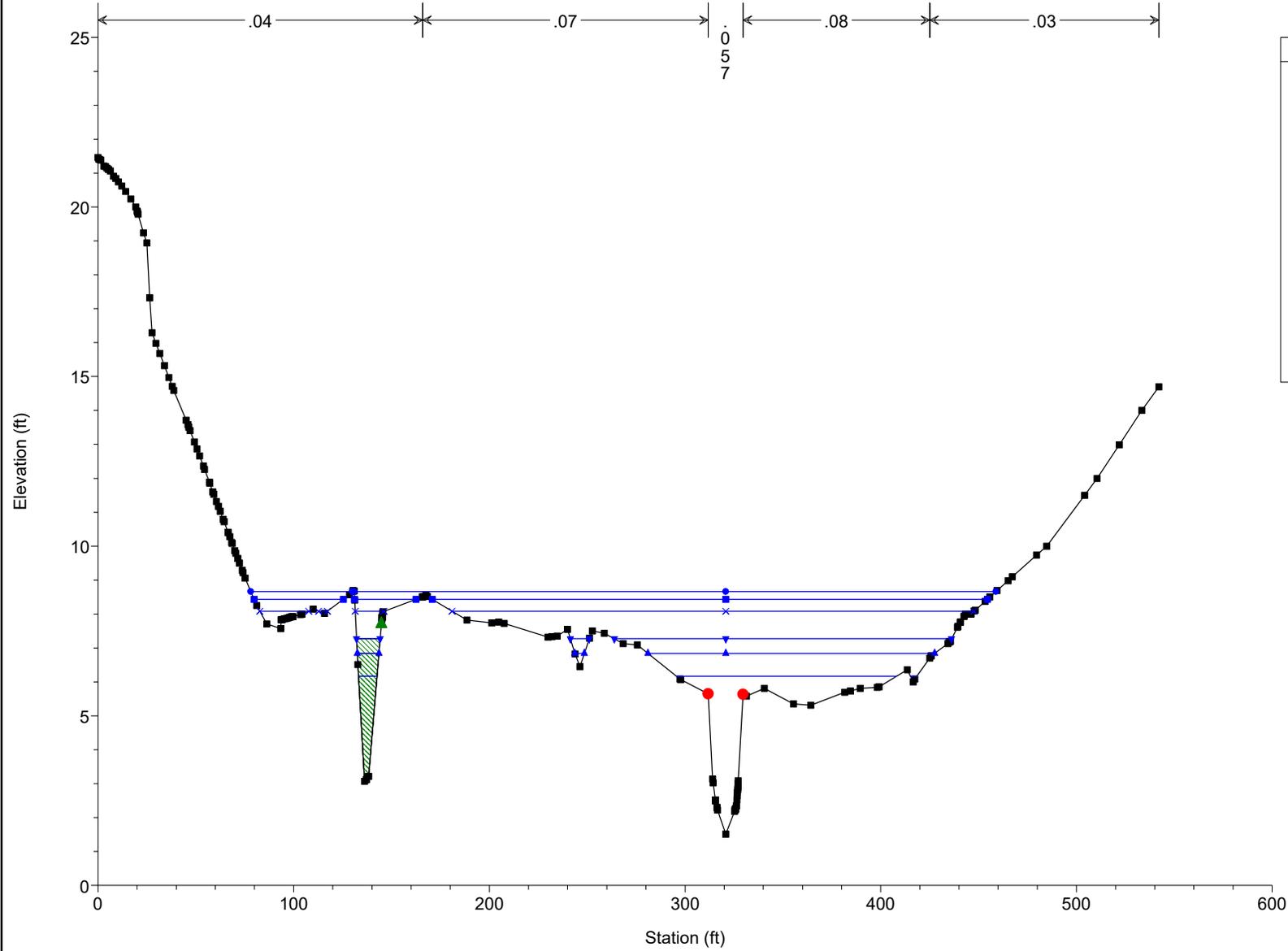
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 133.5329 XS-2



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

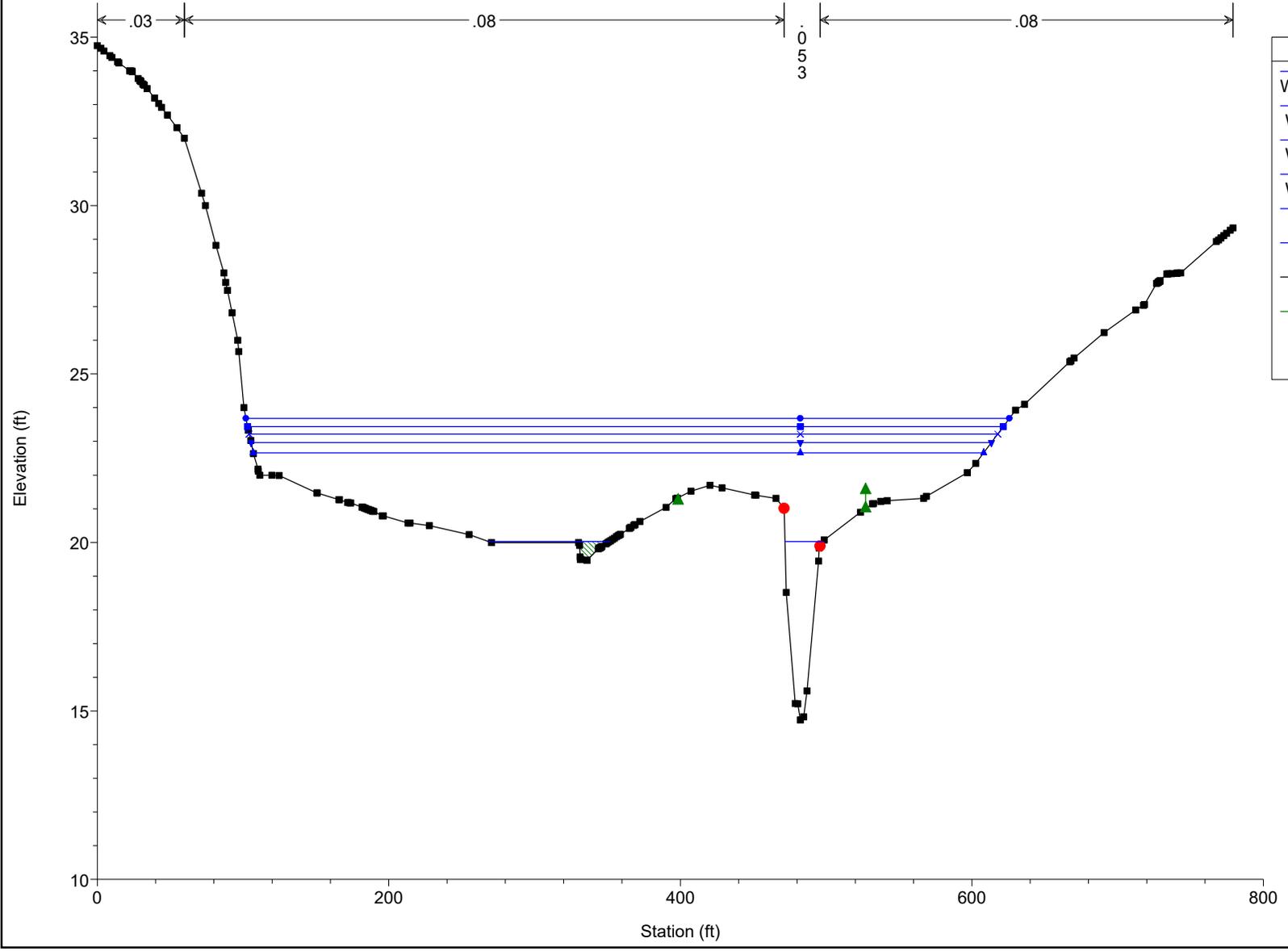
RS = 24.38062 XS-1



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

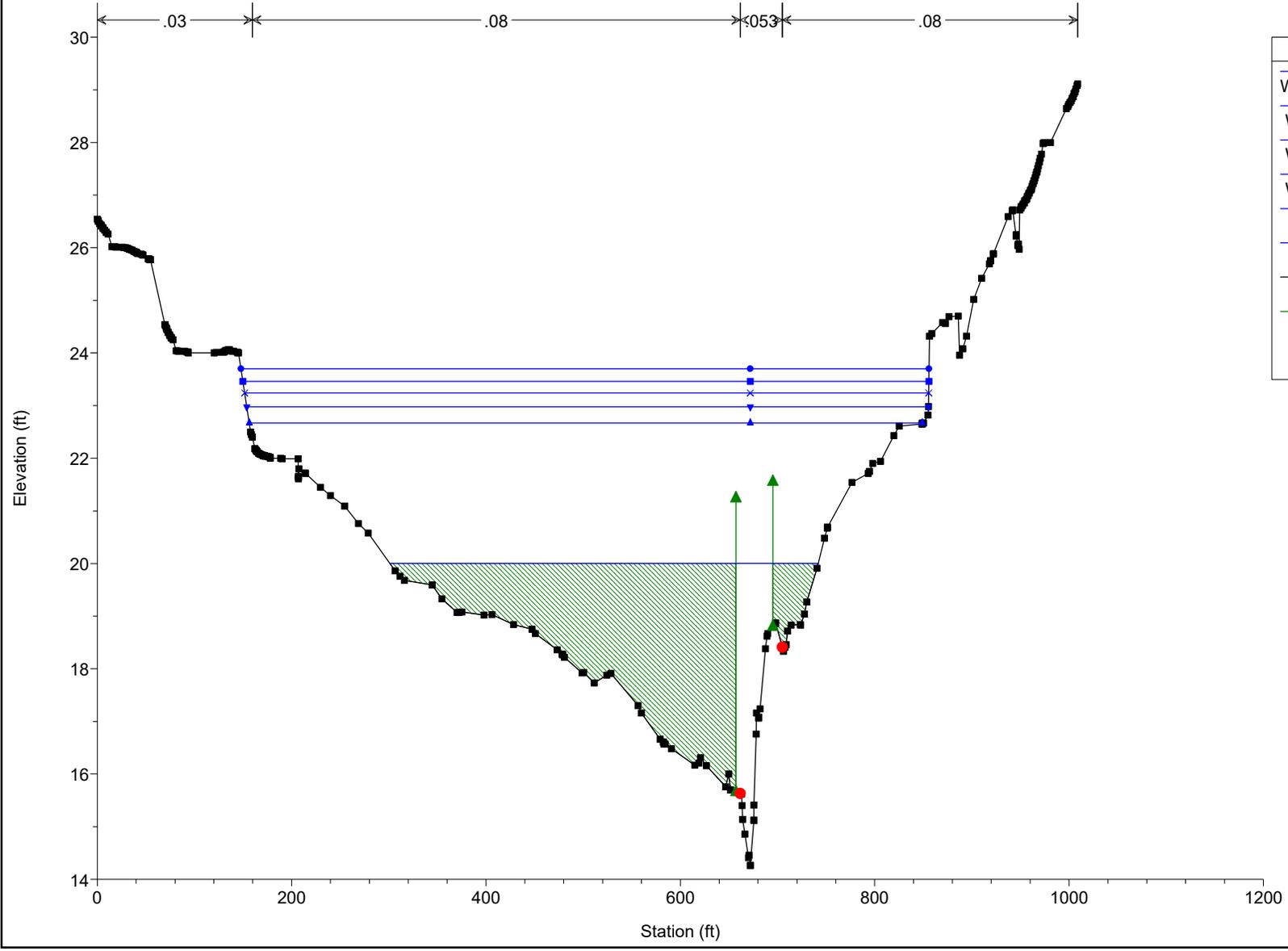
RS = 1871.760 XS-12A



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

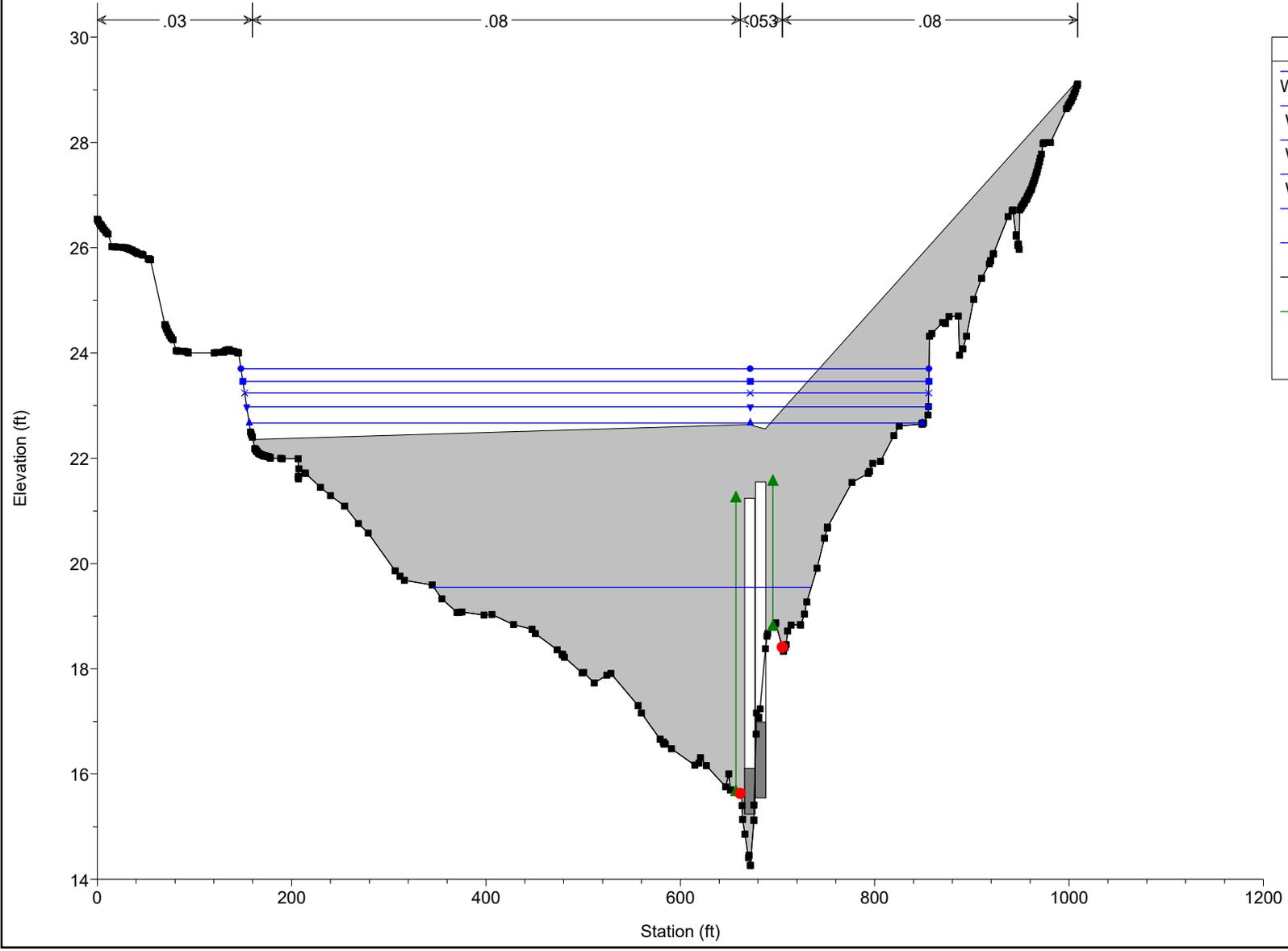
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1816.260 XS-11A



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

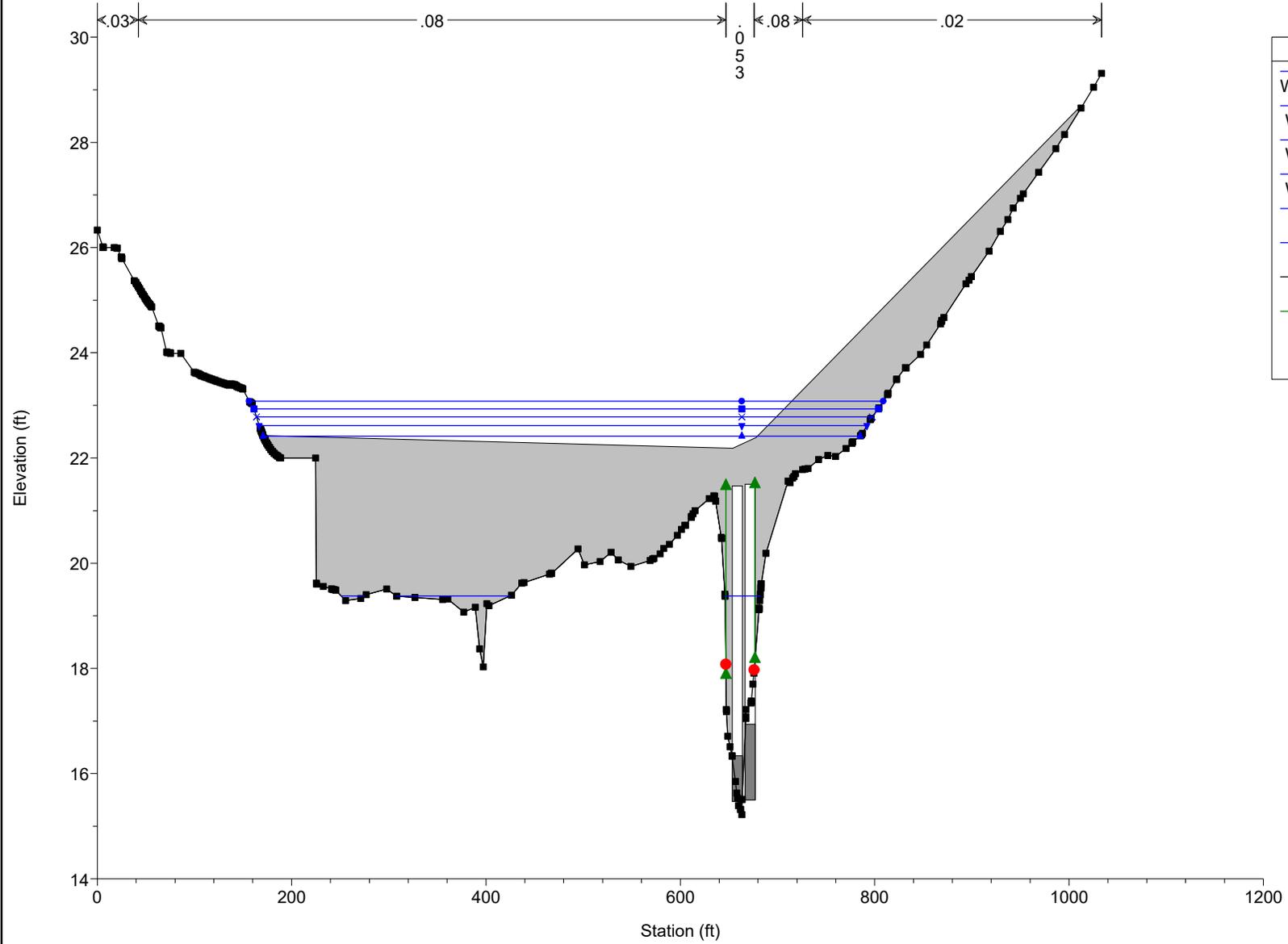
RS = 1785.496 Culv



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

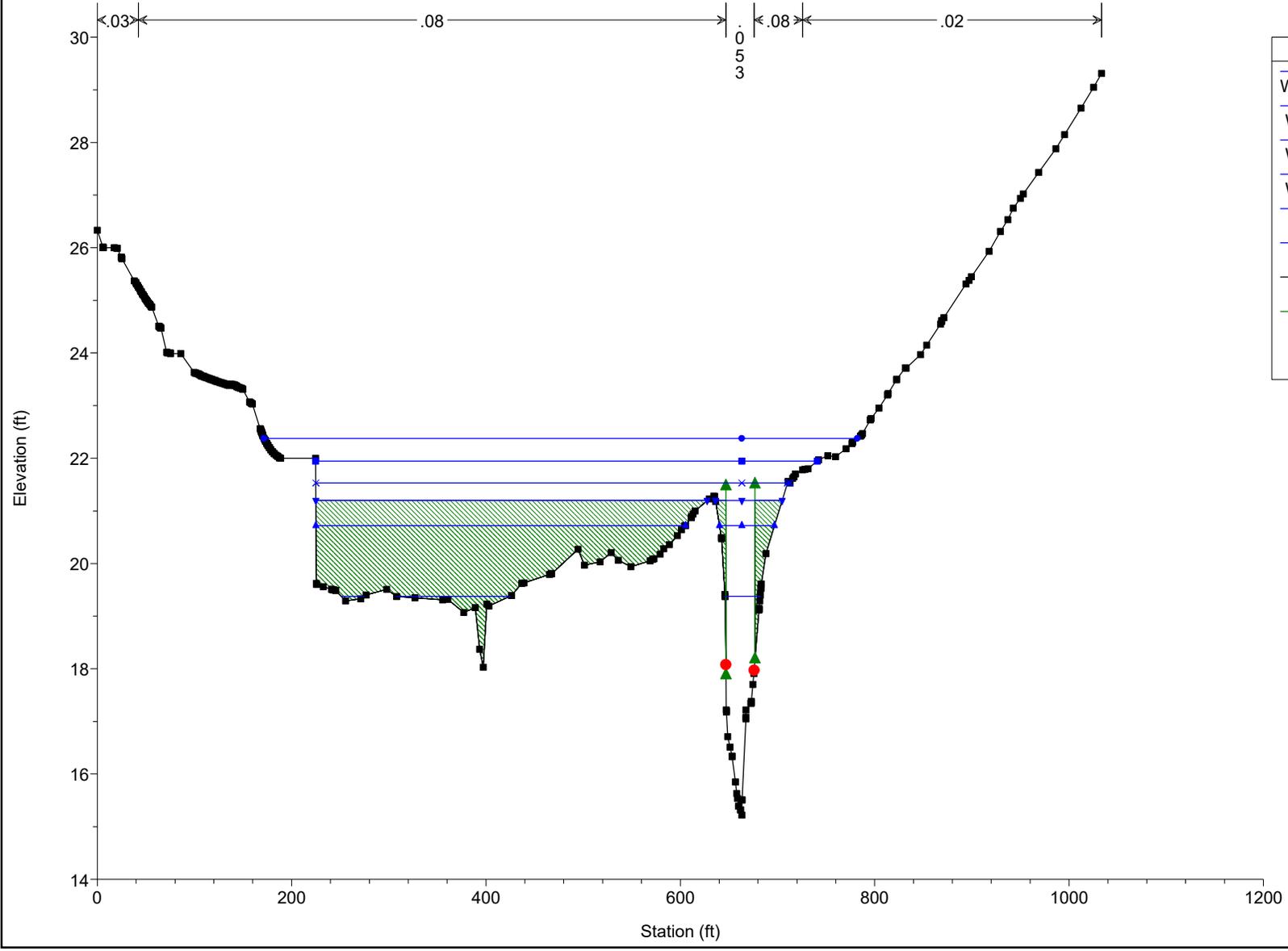
RS = 1785.496 Culv



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

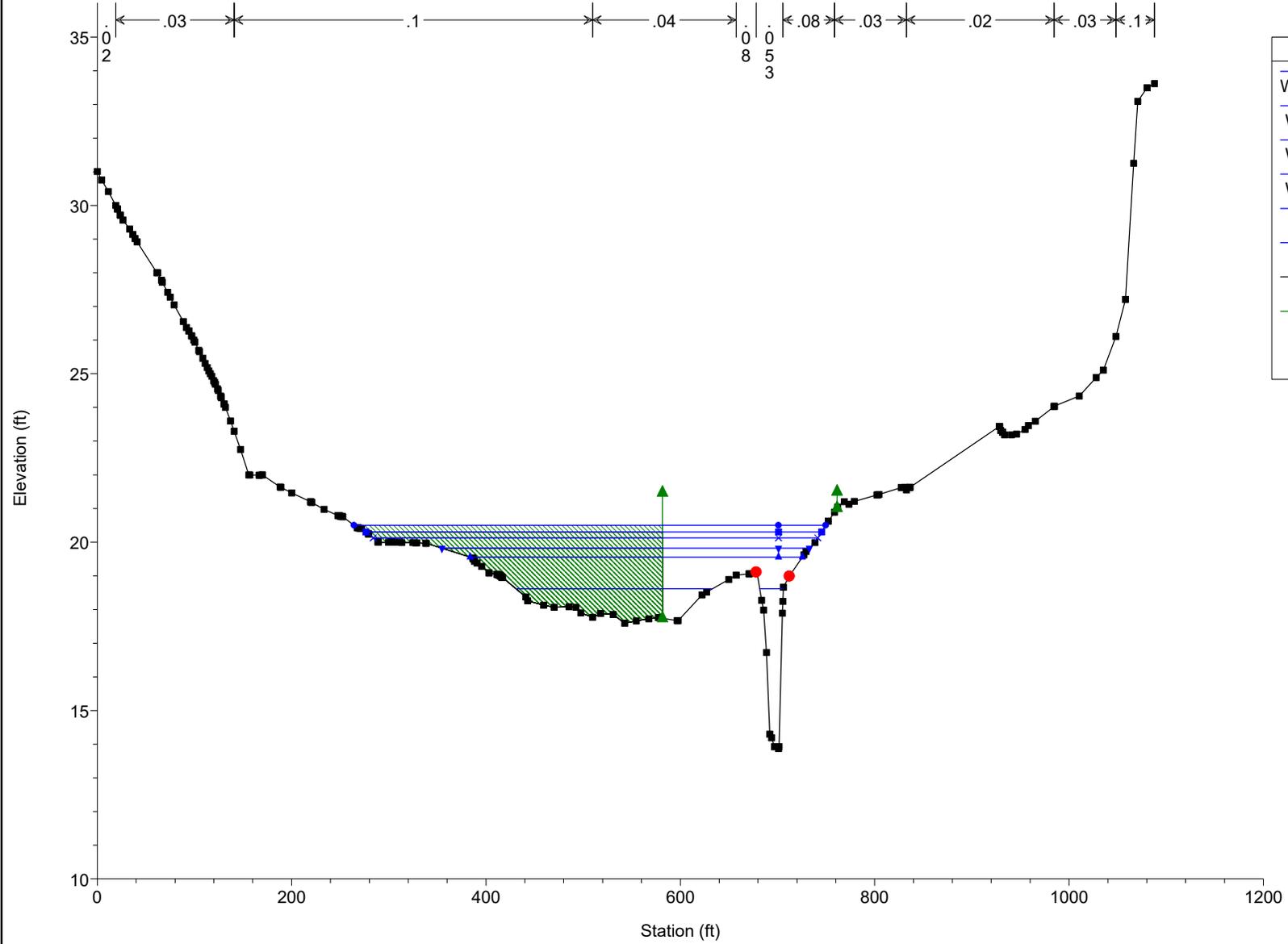
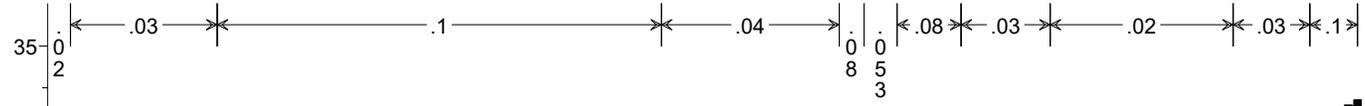
RS = 1751.420 XS-10A



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

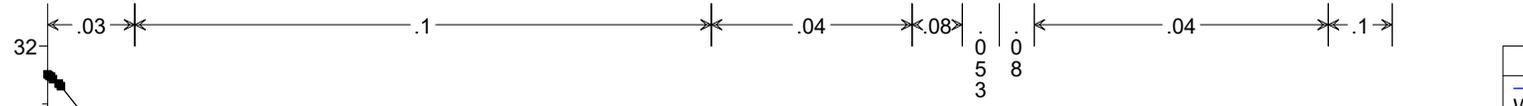
RS = 1594.725 XS-9A



Legend	
WS 100 YR	Blue circle
WS 50 YR	Blue square
WS 25 YR	Blue cross
WS 10 YR	Blue inverted triangle
WS 5 YR	Blue triangle
WS 2 YR	Blue diamond
Ground	Black square
Ineff	Green triangle
Bank Sta	Red circle

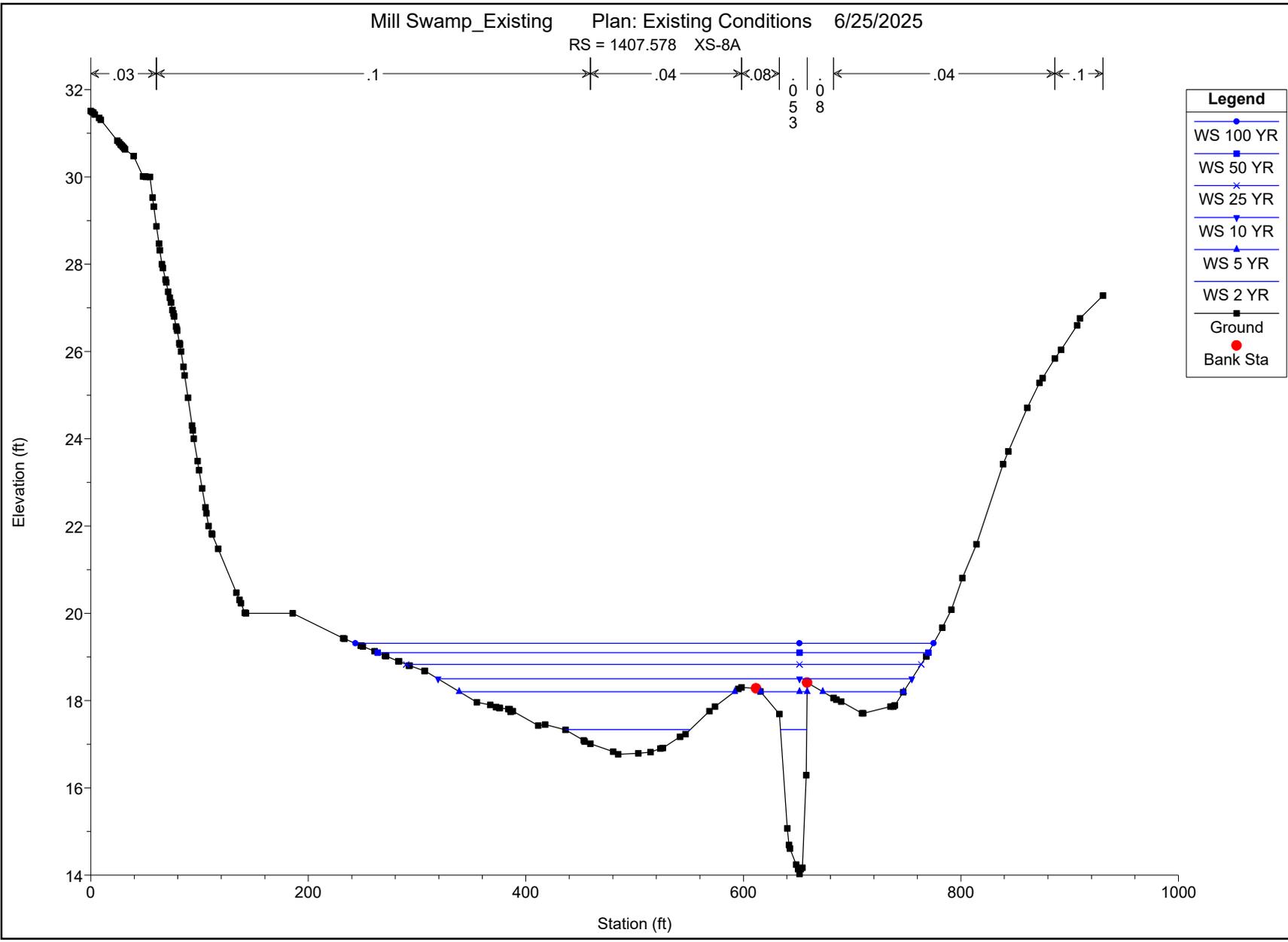
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1407.578 XS-8A



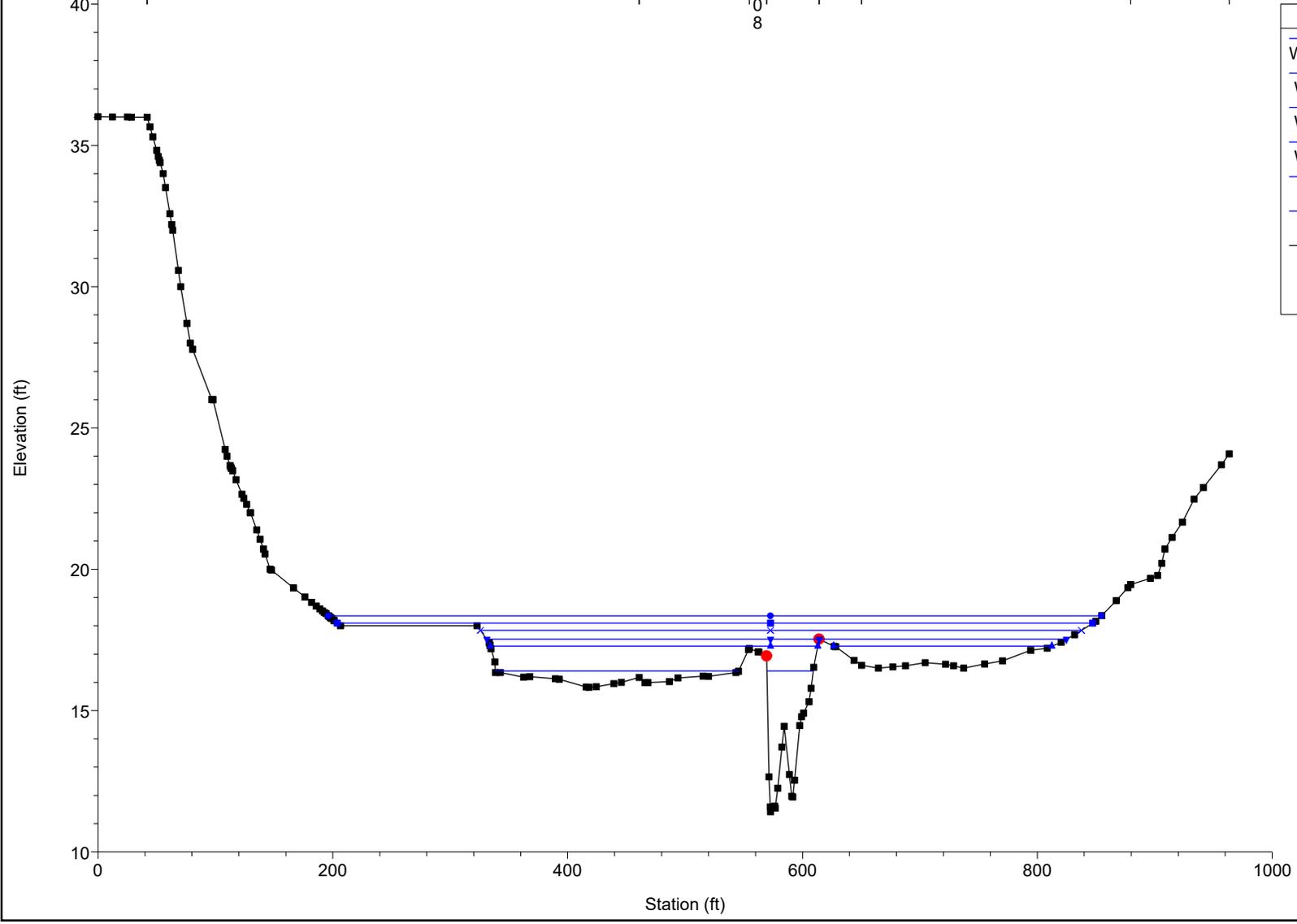
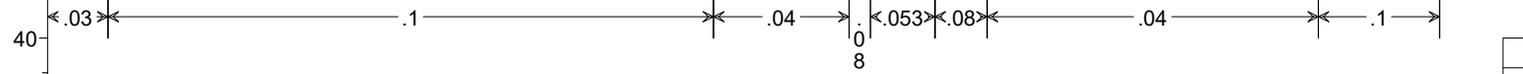
Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground
- Bank Sta



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

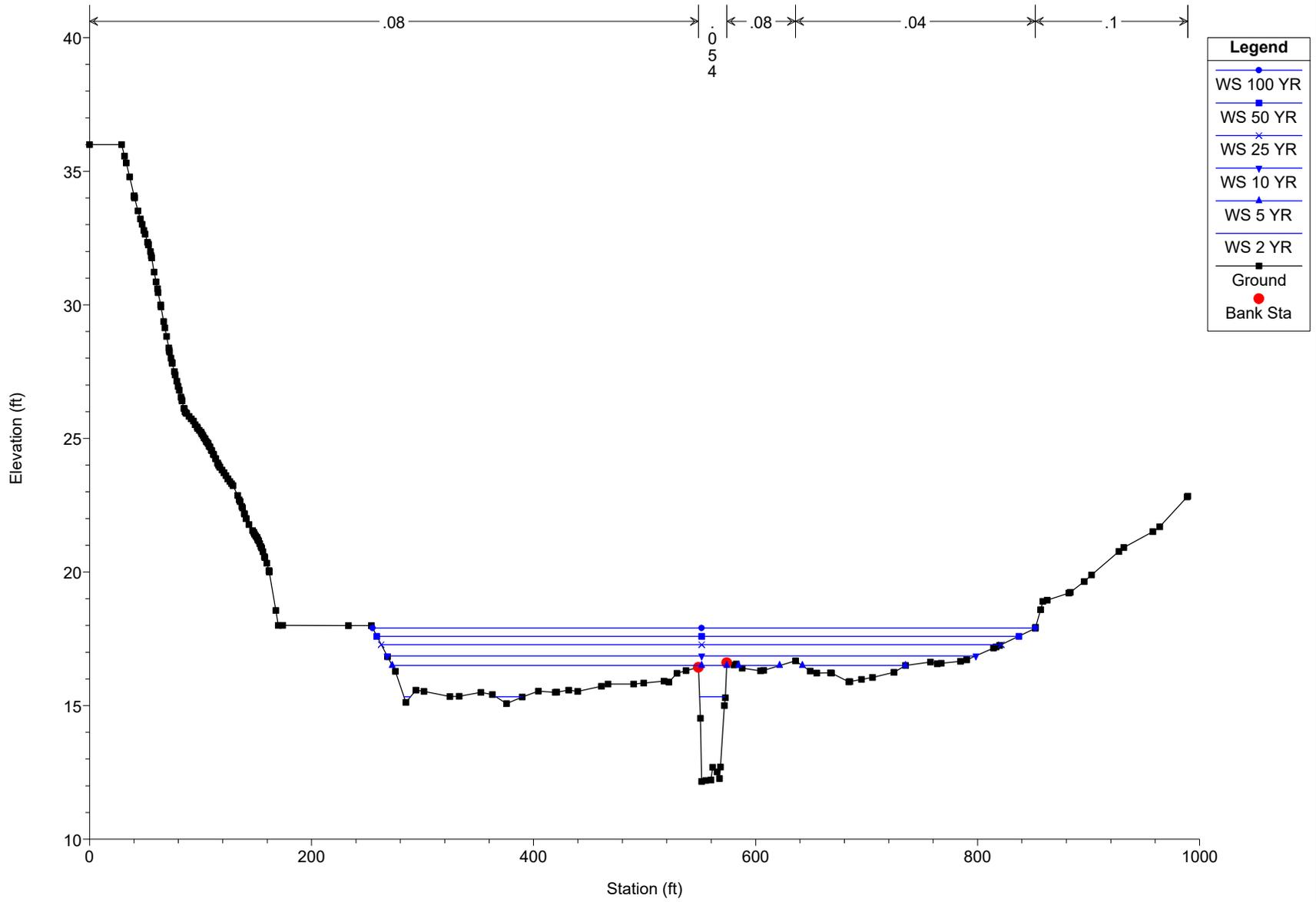
RS = 1160.098 XS-7A



Legend	
●	WS 100 YR
■	WS 50 YR
×	WS 25 YR
▼	WS 10 YR
▲	WS 5 YR
■	WS 2 YR
■	Ground
●	Bank Sta

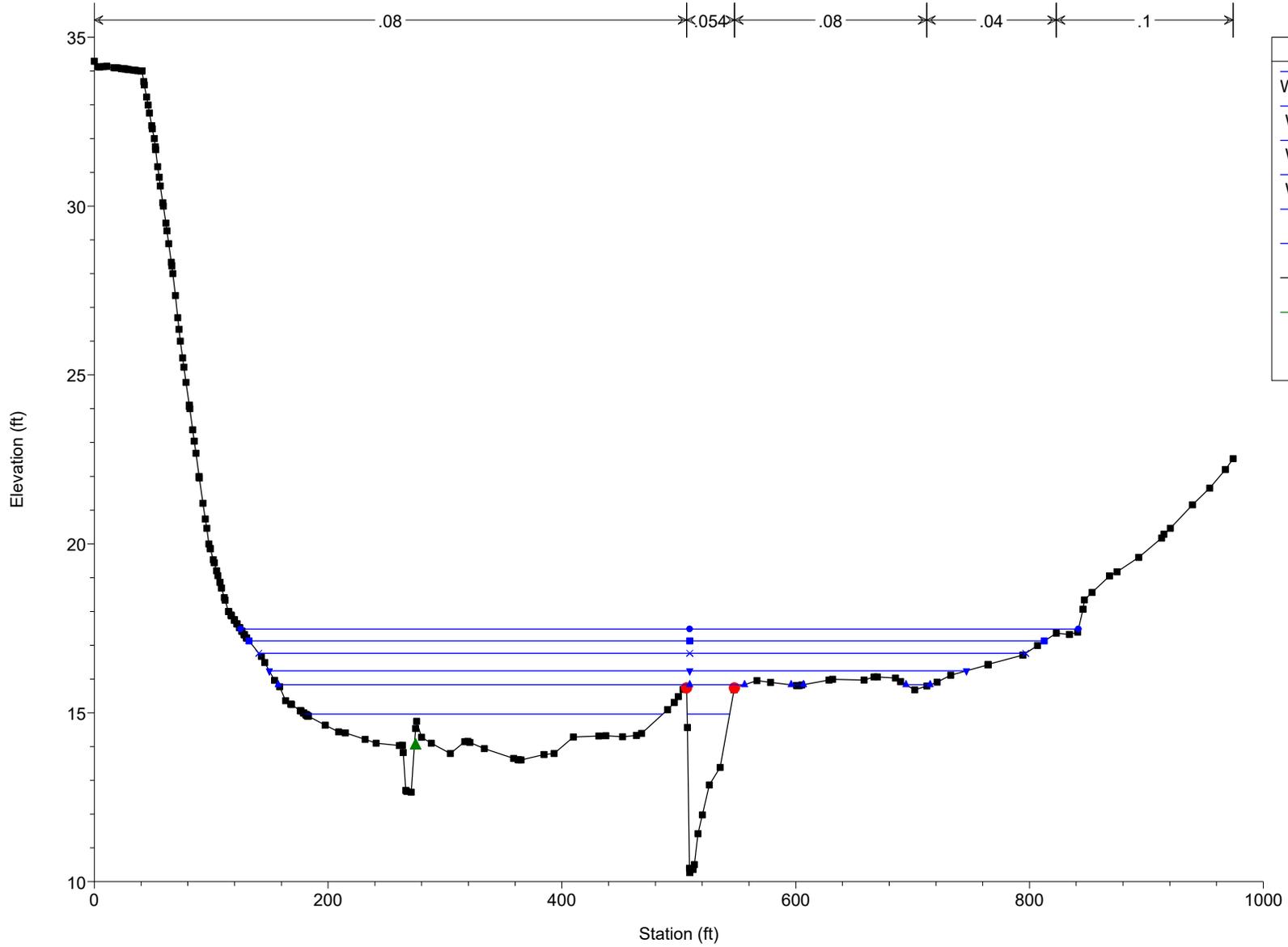
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 1024.274 XS-6A



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

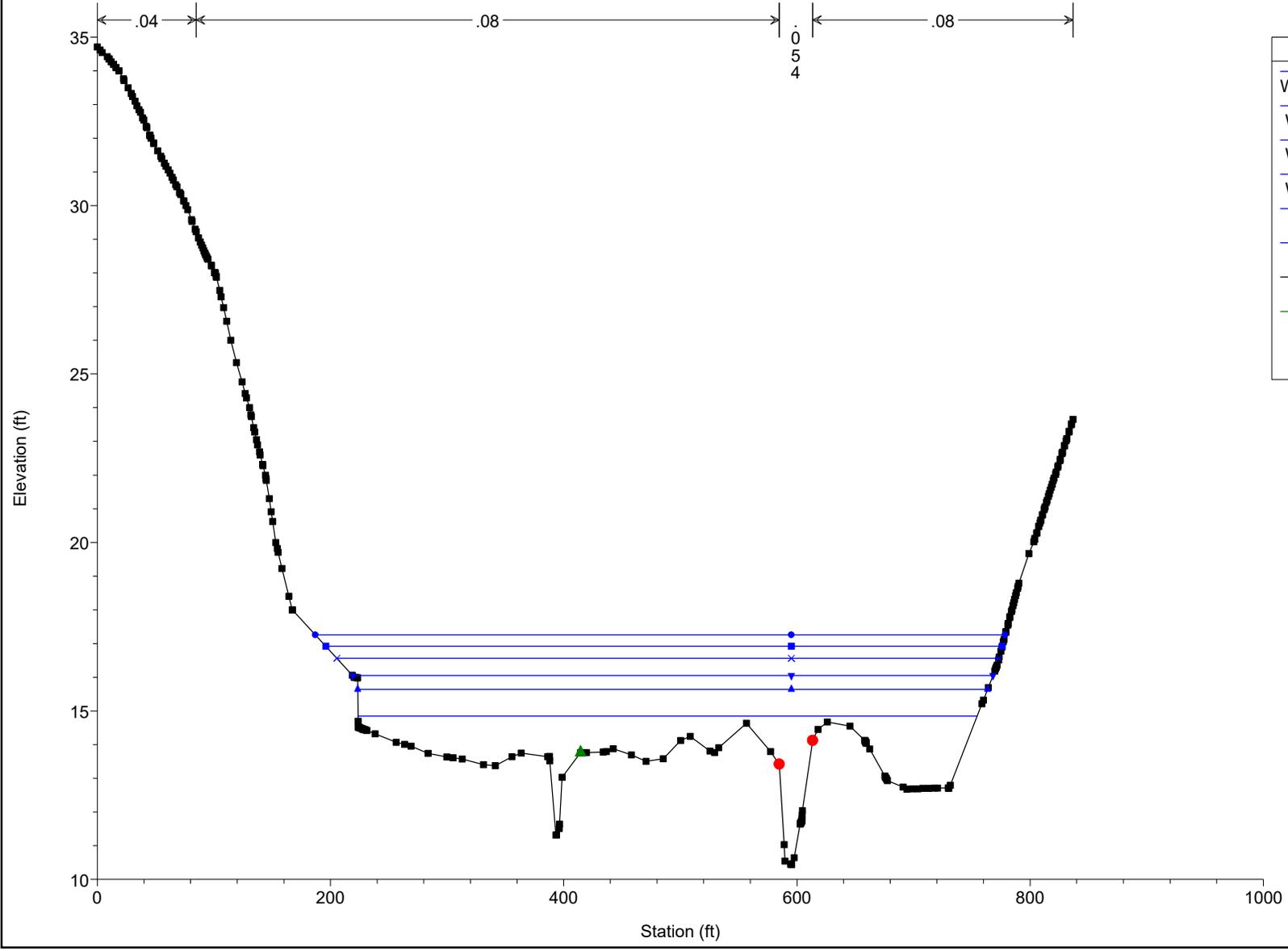
RS = 842.8703 XS-5A



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

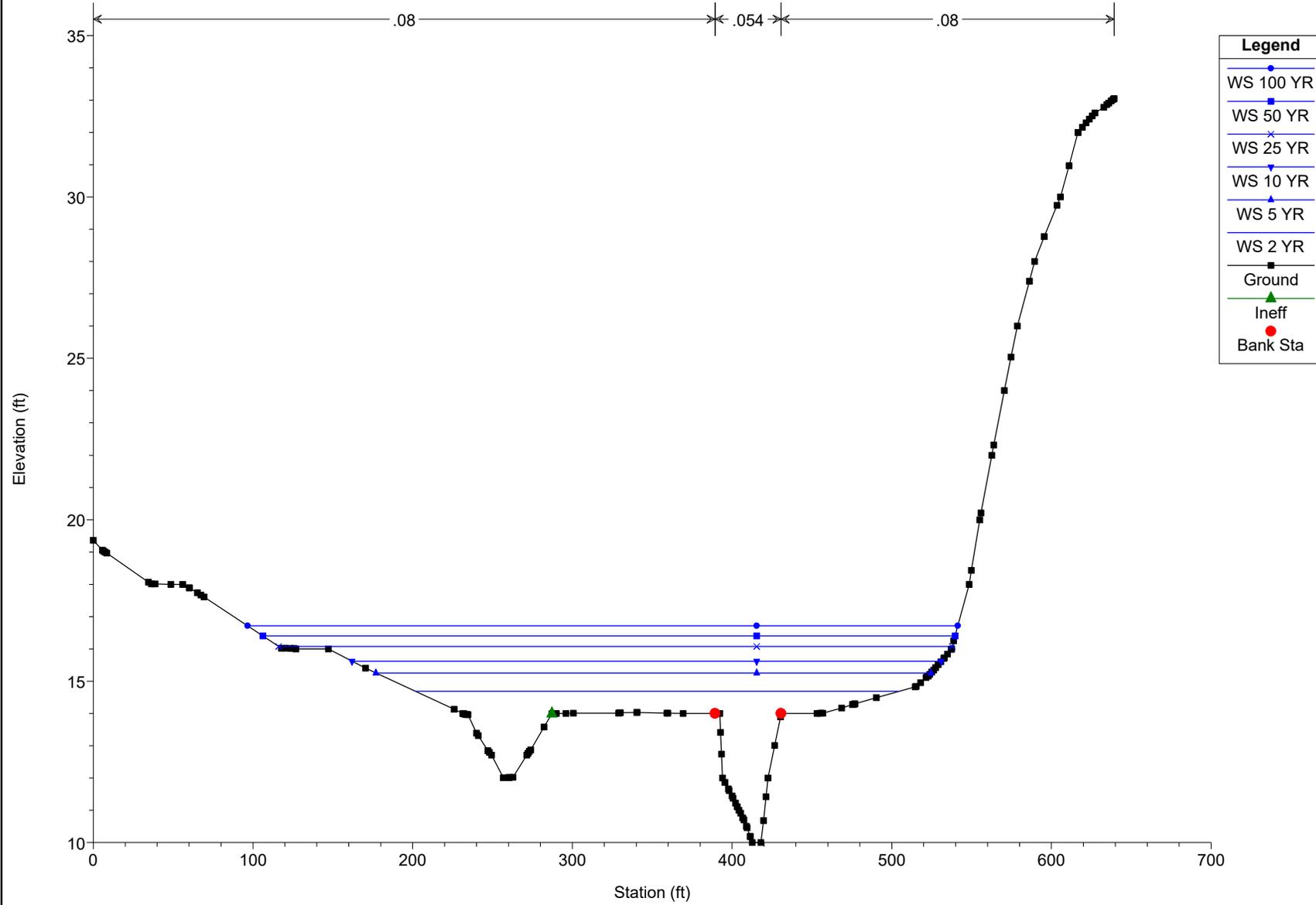
RS = 619.6199 XS-4A



Legend	
●	WS 100 YR
■	WS 50 YR
×	WS 25 YR
▼	WS 10 YR
▲	WS 5 YR
■	WS 2 YR
■	Ground
▲	Ineff
●	Bank Sta

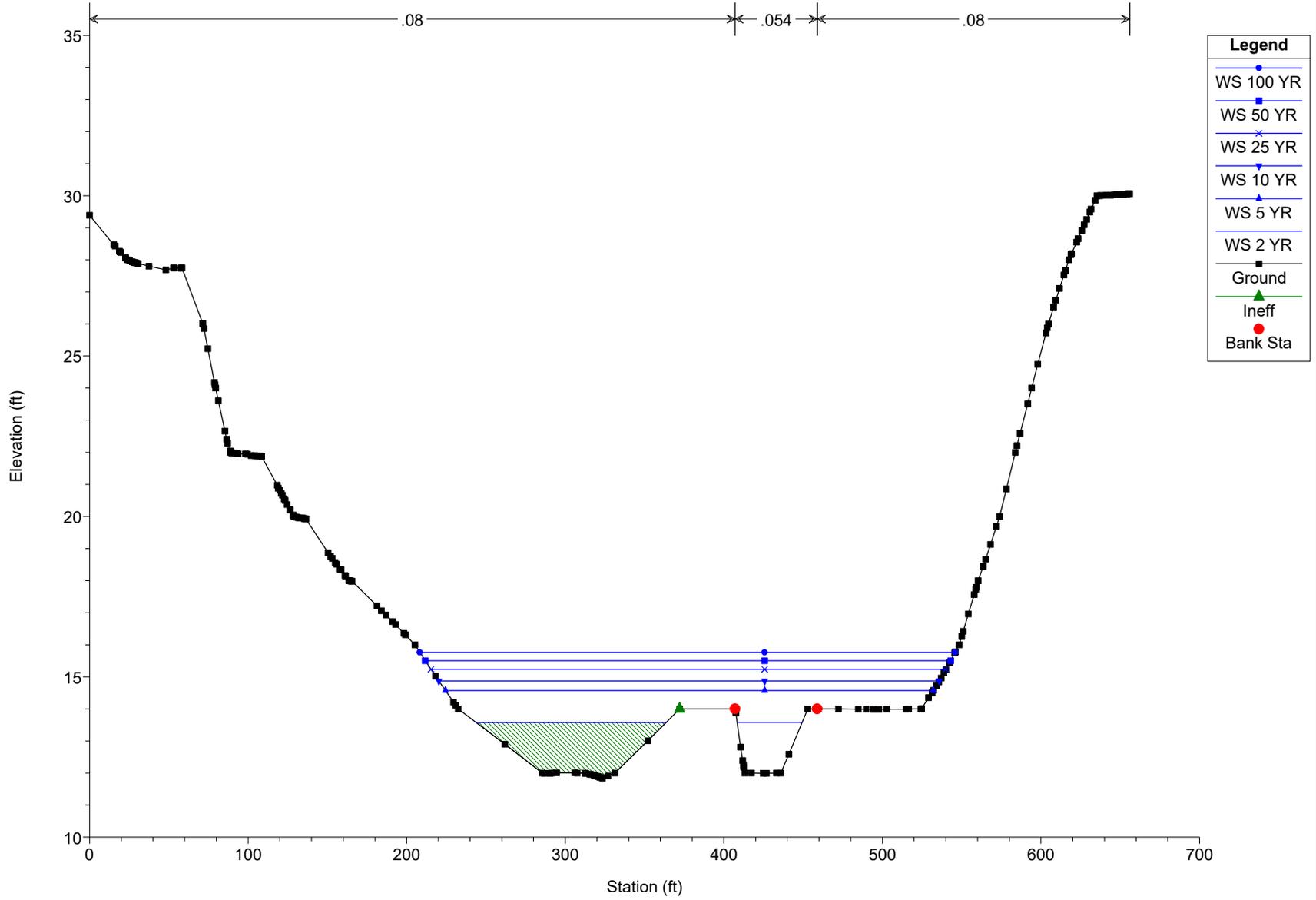
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 377.4746 XS-3A



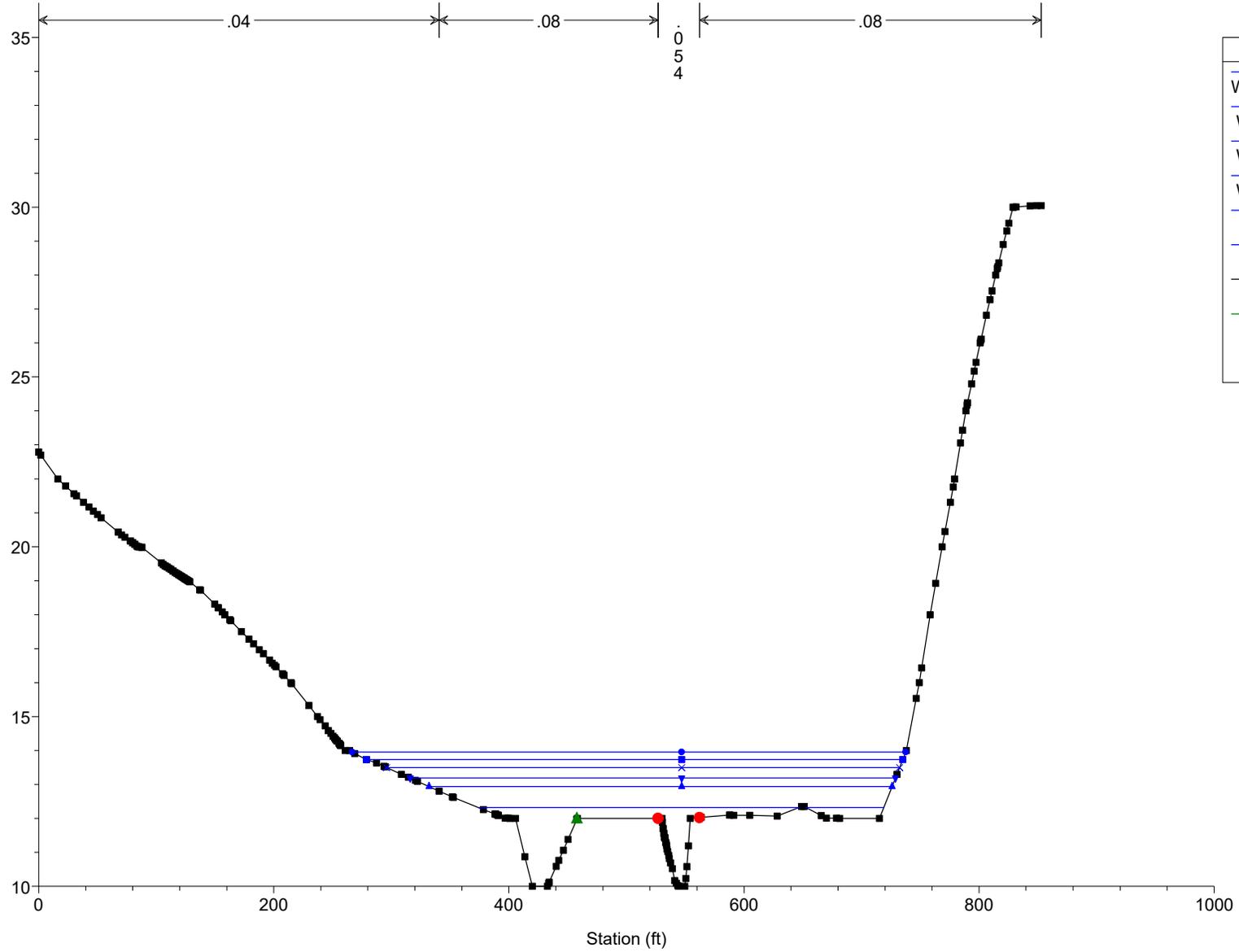
Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

RS = 213.0526 XS-2A



Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

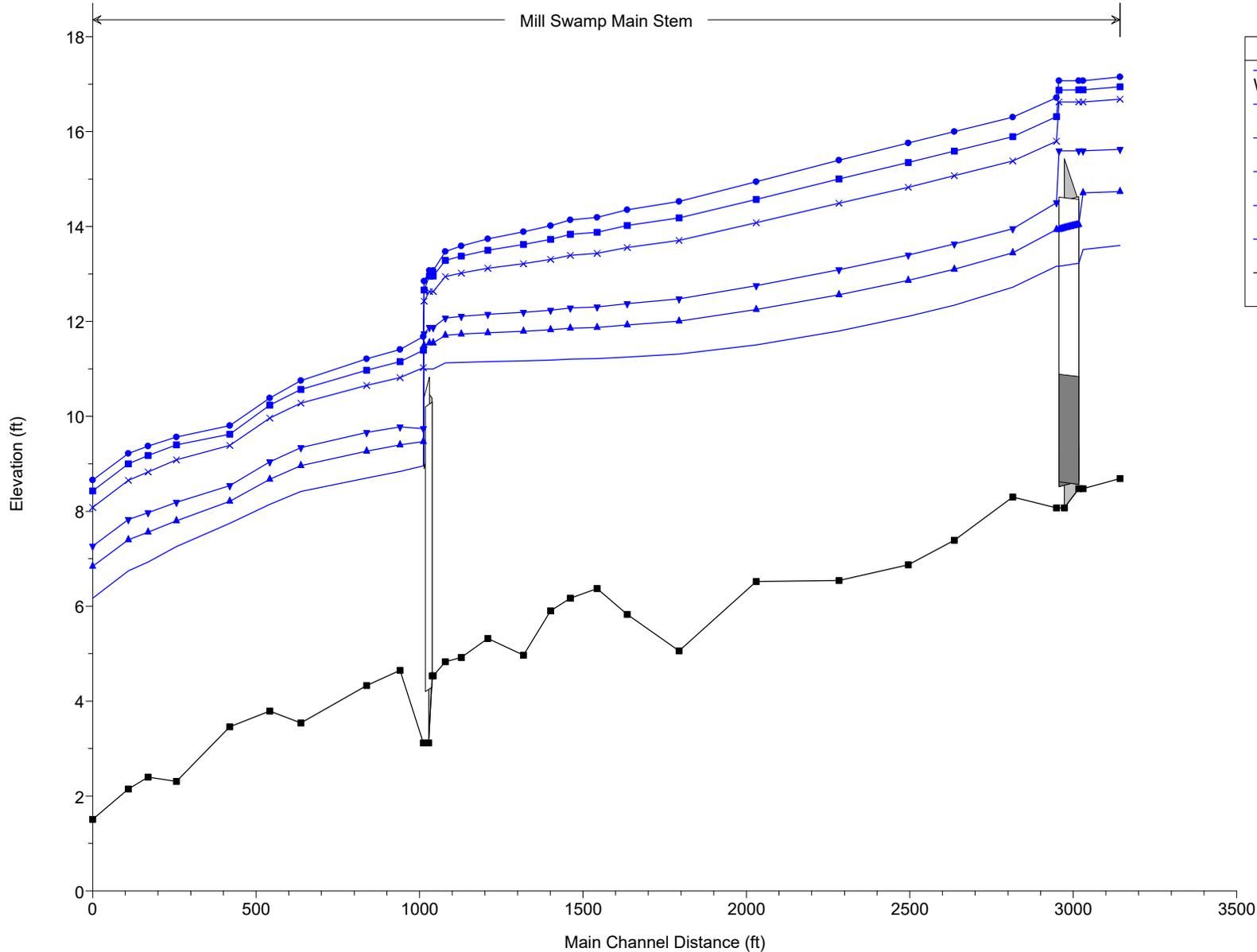
RS = 0.000000 XS-1A



Legend	
WS 100 YR	●
WS 50 YR	■
WS 25 YR	×
WS 10 YR	▼
WS 5 YR	▲
WS 2 YR	■
Ground	■
Ineff	▲
Bank Sta	●

Mill Swamp_Existing Plan: Existing Conditions 6/25/2025

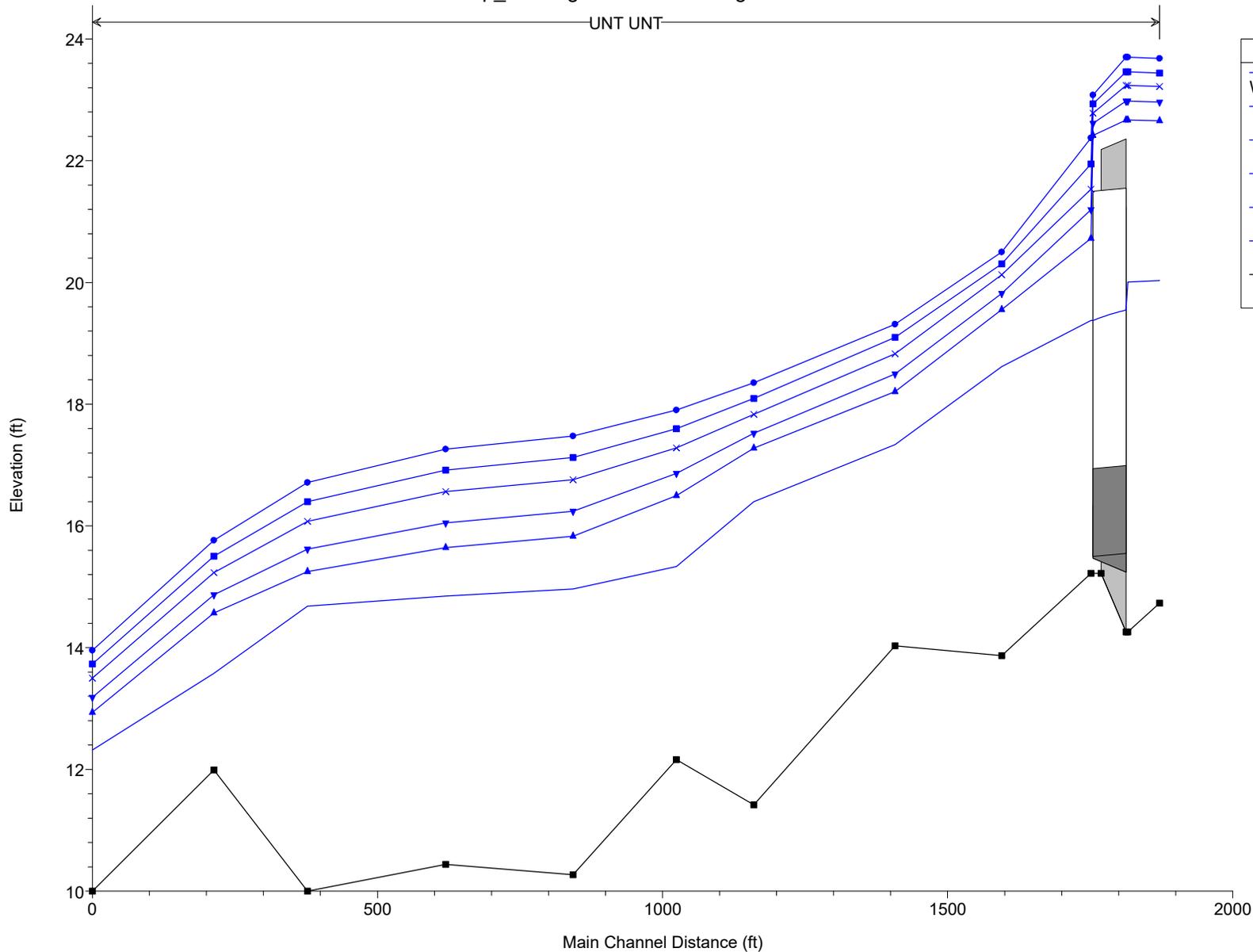
Mill Swamp Main Stem



Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground

UNT UNT



Legend

- WS 100 YR
- WS 50 YR
- WS 25 YR
- WS 10 YR
- WS 5 YR
- WS 2 YR
- Ground

HEC-RAS Plan: EC

River	Reach	River Sta	Profile	Q Total (cfs)	Invert Slope	W.S. Elev (ft)	Crit W.S. (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear Total (lb/sq ft)	Shear Chan (lb/sq ft)	Shear LOB (lb/sq ft)	Shear ROB (lb/sq ft)	Vel Total (ft/s)	Vel Chnl (ft/s)	Vel Left (ft/s)	Vel Right (ft/s)
UNT	UNT	1871.760	2 YR	320.40	0.0085	20.03	18.11	80.44	109.12	0.39	0.82	0.88		0.02	3.98	3.99		0.21
UNT	UNT	1871.760	5 YR	909.70	0.0085	22.66	20.32	969.81	501.06	0.16	0.08	0.23	0.08	0.06	0.94	2.21	0.74	0.61
UNT	UNT	1871.760	10 YR	1256.50	0.0085	22.96	21.27	1125.12	507.80	0.18	0.12	0.30	0.12	0.09	1.12	2.58	0.92	0.77
UNT	UNT	1871.760	25 YR	1768.60	0.0085	23.22	21.69	1255.97	513.64	0.22	0.20	0.45	0.19	0.15	1.41	3.19	1.19	1.00
UNT	UNT	1871.760	50 YR	2207.60	0.0085	23.44	21.95	1369.34	518.53	0.25	0.26	0.57	0.25	0.19	1.61	3.60	1.39	1.16
UNT	UNT	1871.760	100 YR	2682.30	0.0085	23.68	22.21	1493.69	523.66	0.26	0.32	0.68	0.32	0.24	1.80	3.94	1.57	1.32
UNT	UNT	1816.260	2 YR	320.40	-0.0148	20.00	17.24	135.55	440.92	0.23	0.33	0.32	0.41		2.36	2.44		1.94
UNT	UNT	1816.260	5 YR	909.70	-0.0148	22.67	19.06	2338.38	692.62	0.05	0.01	0.02	0.02	0.01	0.39	0.72	0.37	0.21
UNT	UNT	1816.260	10 YR	1256.50	-0.0148	22.98	19.69	2554.52	701.59	0.07	0.02	0.04	0.02	0.01	0.49	0.90	0.47	0.28
UNT	UNT	1816.260	25 YR	1768.60	-0.0148	23.24	20.52	2737.78	703.98	0.08	0.04	0.06	0.04	0.02	0.65	1.17	0.62	0.38
UNT	UNT	1816.260	50 YR	2207.60	-0.0148	23.46	21.24	2894.49	706.00	0.10	0.05	0.08	0.06	0.03	0.76	1.38	0.73	0.47
UNT	UNT	1816.260	100 YR	2682.30	-0.0148	23.70	21.24	3064.55	708.19	0.11	0.07	0.10	0.08	0.04	0.88	1.57	0.84	0.56
UNT	UNT	1785.496		Culvert														
UNT	UNT	1751.420	2 YR	320.40	0.0086	19.38	18.04	85.04	176.25	0.39	0.80	0.82		0.37	3.77	3.80		1.49
UNT	UNT	1751.420	5 YR	909.70	0.0086	20.72	19.61	125.33	437.21	0.63	2.64	2.67		1.69	7.26	7.33		3.58
UNT	UNT	1751.420	10 YR	1256.50	0.0086	21.20	20.35	139.56	471.53	0.74	3.97	3.97		2.67	9.00	9.10		4.62
UNT	UNT	1751.420	25 YR	1768.60	0.0086	21.53	21.33	937.54	485.77	0.34	0.34	0.87	0.32	0.22	1.89	4.30	1.45	1.15
UNT	UNT	1751.420	50 YR	2207.60	0.0086	21.95	21.48	1145.02	516.31	0.32	0.35	0.84	0.35	0.16	1.93	4.29	1.58	1.07
UNT	UNT	1751.420	100 YR	2682.30	0.0086	22.37	21.51	1393.91	610.67	0.32	0.34	0.84	0.35	0.14	1.92	4.35	1.61	1.36
UNT	UNT	1594.725	2 YR	320.40	-0.0009	18.62	16.95	99.36	226.80	0.40	0.41	0.82	0.19		3.22	3.81		1.86
UNT	UNT	1594.725	5 YR	909.70	-0.0009	19.56	19.22	209.43	342.07	0.54	0.73	1.38	0.57	0.15	4.34	5.20	3.67	0.73
UNT	UNT	1594.725	10 YR	1256.50	-0.0009	19.82	19.51	248.66	378.20	0.59	1.01	1.82	0.86	0.25	5.05	5.98	4.54	1.01
UNT	UNT	1594.725	25 YR	1768.60	-0.0009	20.12	19.86	295.97	457.35	0.66	1.42	2.49	1.31	0.43	5.98	7.00	5.67	1.39
UNT	UNT	1594.725	50 YR	2207.60	-0.0009	20.30	20.14	325.08	468.96	0.73	1.84	3.16	1.75	0.61	6.79	7.91	6.62	1.71
UNT	UNT	1594.725	100 YR	2682.30	-0.0009	20.50	20.41	357.81	485.54	0.78	2.25	3.79	2.20	0.82	7.50	8.68	7.50	2.03
UNT	UNT	1407.578	2 YR	320.40	0.0105	17.33	16.66	98.06	139.53	0.51	0.38	1.18	0.20		3.27	4.38		1.79
UNT	UNT	1407.578	5 YR	909.70	0.0105	18.21	17.94	311.30	370.67	0.58	0.39	0.84	0.38	0.14	2.92	4.56	2.42	1.52
UNT	UNT	1407.578	10 YR	1256.50	0.0105	18.50		432.04	435.70	0.54	0.42	0.82	0.42	0.21	2.91	4.41	2.57	1.93
UNT	UNT	1407.578	25 YR	1768.60	0.0105	18.83		580.80	473.44	0.51	0.49	0.90	0.48	0.31	3.05	4.42	2.79	2.35
UNT	UNT	1407.578	50 YR	2207.60	0.0105	19.10		714.21	506.34	0.47	0.51	0.92	0.50	0.36	3.09	4.37	2.87	2.60
UNT	UNT	1407.578	100 YR	2682.30	0.0105	19.31		824.74	531.55	0.47	0.57	1.01	0.56	0.43	3.25	4.51	3.04	2.88
UNT	UNT	1160.098	2 YR	320.40	-0.0054	16.40		171.03	246.67	0.27	0.11	0.40	0.05		1.87	2.62		0.47
UNT	UNT	1160.098	5 YR	909.70	-0.0054	17.28		497.39	464.54	0.30	0.18	0.52	0.09	0.09	1.83	3.09	1.31	1.25
UNT	UNT	1160.098	10 YR	1256.50	-0.0054	17.52		614.91	493.31	0.31	0.24	0.61	0.25	0.13	2.04	3.37	1.58	1.59
UNT	UNT	1160.098	25 YR	1768.60	-0.0054	17.83		771.19	511.71	0.33	0.30	0.71	0.32	0.20	2.29	3.67	1.85	1.97
UNT	UNT	1160.098	50 YR	2207.60	-0.0054	18.09		916.67	643.48	0.34	0.31	0.81	0.27	0.26	2.41	3.97	1.84	2.31
UNT	UNT	1160.098	100 YR	2682.30	-0.0054	18.35		1084.19	658.35	0.34	0.34	0.81	0.30	0.29	2.47	4.01	1.92	2.49
UNT	UNT	1024.274	2 YR	320.40	0.0104	15.33	14.52	62.17	54.07	0.61	0.92	1.88	0.11		5.15	5.46		0.54
UNT	UNT	1024.274	5 YR	909.70	0.0104	16.50		365.18	431.20	0.51	0.47	1.65	0.49	0.16	2.49	5.35		1.56
UNT	UNT	1024.274	10 YR	1256.50	0.0104	16.86		546.85	530.55	0.45	0.43	1.37	0.51	0.20	2.30	4.97		1.74
UNT	UNT	1024.274	25 YR	1768.60	0.0104	17.28		776.05	558.75	0.40	0.44	1.16	0.51	0.27	2.28	4.65		1.83
UNT	UNT	1024.274	50 YR	2207.60	0.0104	17.60		953.43	578.36	0.38	0.45	1.06	0.30	0.23	2.32	4.51		1.88
UNT	UNT	1024.274	100 YR	2682.30	0.0104	17.90		1134.04	597.08	0.36	0.45	1.00	0.52	0.32	2.37	4.42		1.93
UNT	UNT	842.8703	2 YR	320.40	-0.0008	14.96	13.94	342.52	342.50	0.21	0.09	0.21	0.08		0.94	1.80		0.64
UNT	UNT	842.8703	5 YR	909.70	-0.0008	15.83	14.79	665.61	430.40	0.25	0.20	0.35	0.20	0.01	1.37	2.43		1.14
UNT	UNT	842.8703	10 YR	1256.50	-0.0008	16.24	14.98	887.88	596.37	0.25	0.18	0.38	0.20	0.04	1.42	2.57		1.27
UNT	UNT	842.8703	25 YR	1768.60	-0.0008	16.76	15.22	1214.08	655.91	0.24	0.20	0.38	0.26	0.08	1.46	2.66		1.38
UNT	UNT	842.8703	50 YR	2207.60	-0.0008	17.12	15.40	1457.06	680.41	0.23	0.22	0.40	0.28	0.11	1.52	2.74		1.46
UNT	UNT	842.8703	100 YR	2682.30	-0.0008	17.48	15.56	1701.57	716.69	0.23	0.23	0.40	0.28	0.12	1.58	2.82		1.52
UNT	UNT	619.6199	2 YR	320.40	0.0018	14.85	13.28	653.77	531.01	0.11	0.03	0.07	0.03	0.03	0.49	1.11		0.38
UNT	UNT	619.6199	5 YR	909.70	0.0018	15.64	14.12	1080.09	540.20	0.15	0.08	0.16	0.08	0.08	0.84	1.73		0.76
UNT	UNT	619.6199	10 YR	1256.50	0.0018	16.05	14.34	1301.09	549.10	0.16	0.11	0.19	0.10	0.11	0.97	1.92		0.86
UNT	UNT	619.6199	25 YR	1768.60	0.0018	16.56	14.55	1588.67	567.81	0.17	0.14	0.23	0.13	0.14	1.11	2.16		1.03

HEC-RAS Plan: EC (Continued)

River	Reach	River Sta	Profile	Q Total (cfs)	Invert Slope	W.S. Elev (ft)	Crit W.S. (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear Total (lb/sq ft)	Shear Chan (lb/sq ft)	Shear LOB (lb/sq ft)	Shear ROB (lb/sq ft)	Vel Total (ft/s)	Vel Chnl (ft/s)	Vel Left (ft/s)	Vel Right (ft/s)
UNT	UNT	619.6199	50 YR	2207.60	0.0018	16.92	14.77	1791.99	579.90	0.18	0.17	0.27	0.16	0.16	1.23	2.36	1.12	1.15
UNT	UNT	619.6199	100 YR	2682.30	0.0018	17.26	14.90	1992.51	591.55	0.19	0.19	0.31	0.19	0.19	1.35	2.55	1.23	1.26
UNT	UNT	377.4746	2 YR	320.40	-0.0121	14.68	12.45	337.93	302.71	0.17	0.06	0.16	0.05	0.03	0.95	1.69	0.53	0.33
UNT	UNT	377.4746	5 YR	909.70	-0.0121	15.25	14.30	523.94	347.49	0.30	0.25	0.58	0.23	0.15	1.74	3.28	1.18	0.88
UNT	UNT	377.4746	10 YR	1256.50	-0.0121	15.62	14.60	656.23	369.06	0.32	0.32	0.70	0.30	0.21	1.91	3.66	1.39	1.12
UNT	UNT	377.4746	25 YR	1768.60	-0.0121	16.08	14.95	833.05	421.82	0.35	0.41	0.89	0.36	0.32	2.12	4.20	1.56	1.43
UNT	UNT	377.4746	50 YR	2207.60	-0.0121	16.40	15.15	971.93	433.49	0.36	0.48	0.99	0.43	0.39	2.27	4.47	1.73	1.63
UNT	UNT	377.4746	100 YR	2682.30	-0.0121	16.71	15.38	1109.58	444.76	0.37	0.54	1.08	0.49	0.47	2.42	4.72	1.89	1.82
UNT	UNT	213.0526	2 YR	320.40	0.0093	13.58	13.58	50.69	160.85	1.00	3.08	3.08			6.32	6.32		
UNT	UNT	213.0526	5 YR	909.70	0.0093	14.57	14.00	427.27	307.69	0.41	0.51	0.69	0.58	0.20	2.13	3.20	1.93	0.95
UNT	UNT	213.0526	10 YR	1256.50	0.0093	14.87	14.00	520.11	315.58	0.44	0.64	0.85	0.72	0.32	2.42	3.66	2.21	1.28
UNT	UNT	213.0526	25 YR	1768.60	0.0093	15.23	14.06	636.25	324.70	0.47	0.84	1.08	0.92	0.48	2.78	4.23	2.56	1.66
UNT	UNT	213.0526	50 YR	2207.60	0.0093	15.50	14.45	725.75	331.30	0.49	0.98	1.26	1.07	0.61	3.04	4.64	2.81	1.93
UNT	UNT	213.0526	100 YR	2682.30	0.0093	15.76	14.64	812.75	337.56	0.51	1.14	1.45	1.23	0.74	3.30	5.05	3.05	2.18
UNT	UNT	0.000000	2 YR	320.40		12.32	11.97	190.89	338.81	0.48	0.33	0.72	0.42	0.14	1.68	3.06	1.45	0.70
UNT	UNT	0.000000	5 YR	909.70		12.94	11.99	418.96	394.00	0.51	0.62	1.08	0.65	0.48	2.17	4.00	1.99	1.58
UNT	UNT	0.000000	10 YR	1256.50		13.19	12.69	519.83	412.90	0.53	0.73	1.22	0.74	0.62	2.42	4.34	2.25	1.86
UNT	UNT	0.000000	25 YR	1768.60		13.50	12.91	652.09	436.40	0.54	0.87	1.40	0.85	0.78	2.71	4.76	2.55	2.19
UNT	UNT	0.000000	50 YR	2207.60		13.73	13.06	755.63	456.27	0.55	0.96	1.53	0.92	0.91	2.92	5.06	2.76	2.41
UNT	UNT	0.000000	100 YR	2682.30		13.95	13.20	859.32	470.99	0.55	1.06	1.66	1.01	1.02	3.12	5.34	2.97	2.61
Mill Swamp	Main Stem	3167.546	2 YR	298.30	0.0019	13.60	12.04	159.68	167.61	0.30	0.17	0.51	0.16	0.07	1.87	3.38	0.97	0.50
Mill Swamp	Main Stem	3167.546	5 YR	525.70	0.0019	14.74	12.96	474.41	332.77	0.21	0.09	0.29	0.12	0.07	1.11	2.69	0.90	0.69
Mill Swamp	Main Stem	3167.546	10 YR	735.40	0.0019	15.63	13.50	798.66	393.95	0.15	0.06	0.17	0.07	0.05	0.92	2.10	0.74	0.76
Mill Swamp	Main Stem	3167.546	25 YR	1521.70	0.0019	16.68	14.66	1254.97	465.67	0.17	0.10	0.23	0.10	0.09	1.21	2.51	0.89	1.15
Mill Swamp	Main Stem	3167.546	50 YR	1890.60	0.0019	16.95	14.86	1380.34	481.54	0.18	0.12	0.28	0.12	0.11	1.37	2.78	0.98	1.32
Mill Swamp	Main Stem	3167.546	100 YR	2230.70	0.0019	17.15	15.01	1479.69	494.38	0.19	0.14	0.32	0.14	0.13	1.51	3.01	1.06	1.48
Mill Swamp	Main Stem	3054.333	2 YR	298.30	0.0051	13.51	10.97	175.87	265.65	0.18	0.14	0.16		0.09	1.70	1.87		0.71
Mill Swamp	Main Stem	3054.333	5 YR	525.70	0.0051	14.71	11.70	866.25	349.01	0.10	0.03	0.06	0.03	0.03	0.61	1.20	0.48	0.38
Mill Swamp	Main Stem	3054.333	10 YR	735.40	0.0051	15.60	12.14	1205.08	448.24	0.10	0.03	0.07	0.03	0.03	0.61	1.31	0.48	0.40
Mill Swamp	Main Stem	3054.333	25 YR	1521.70	0.0051	16.63	13.34	1744.28	576.15	0.14	0.07	0.14	0.07	0.06	0.87	1.98	0.74	0.60
Mill Swamp	Main Stem	3054.333	50 YR	1890.60	0.0051	16.88	13.81	1891.87	593.15	0.15	0.09	0.18	0.09	0.08	1.00	2.27	0.84	0.71
Mill Swamp	Main Stem	3054.333	100 YR	2230.70	0.0051	17.07	14.21	2006.77	603.37	0.17	0.11	0.23	0.11	0.10	1.11	2.51	0.93	0.81
Mill Swamp	Main Stem	3004.159		Culvert														
Mill Swamp	Main Stem	2973.376	2 YR	298.30	-0.0017	13.16	10.57	116.38	198.00	0.24	0.32	0.38		0.16	2.56	2.81		0.91
Mill Swamp	Main Stem	2973.376	5 YR	525.70	-0.0017	13.94	11.37	141.44	260.31	0.32	0.67	0.77		0.39	3.72	4.12		1.52
Mill Swamp	Main Stem	2973.376	10 YR	735.40	-0.0017	14.50	12.08	159.63	282.59	0.38	1.01	1.15		0.64	4.61	5.14		2.02
Mill Swamp	Main Stem	2973.376	25 YR	1521.70	-0.0017	15.80	13.85	949.83	337.64	0.20	0.16	0.38	0.11	0.18	1.60	3.06	1.57	1.09
Mill Swamp	Main Stem	2973.376	50 YR	1890.60	-0.0017	16.32	14.62	1126.67	349.44	0.20	0.16	0.37	0.12	0.19	1.68	3.04	1.78	1.13
Mill Swamp	Main Stem	2973.376	100 YR	2230.70	-0.0017	16.72	14.62	1269.14	359.67	0.19	0.17	0.37	0.13	0.20	1.76	3.06	1.94	1.17
Mill Swamp	Main Stem	2839.603	2 YR	298.30	0.0051	12.72	11.43	115.99	122.42	0.41	0.39	0.78	0.01	0.25	2.57	3.99	0.14	1.03
Mill Swamp	Main Stem	2839.603	5 YR	525.70	0.0051	13.45	12.66	180.57	146.42	0.44	0.59	1.05	0.50	2.91	4.80	0.72	1.60	
Mill Swamp	Main Stem	2839.603	10 YR	735.40	0.0051	13.95	13.05	229.08	160.41	0.46	0.75	1.27	0.20	0.70	3.21	5.40	0.98	1.99
Mill Swamp	Main Stem	2839.603	25 YR	1521.70	0.0051	15.38	14.10	581.94	215.24	0.40	0.61	1.15	0.26	0.65	2.61	5.40	1.47	2.00
Mill Swamp	Main Stem	2839.603	50 YR	1890.60	0.0051	15.89	14.51	701.06	249.89	0.41	0.64	1.28	0.32	0.68	2.70	5.77	1.86	2.06
Mill Swamp	Main Stem	2839.603	100 YR	2230.70	0.0051	16.30	14.52	808.51	275.43	0.41	0.65	1.33	0.33	0.71	2.76	5.95	2.11	2.14
Mill Swamp	Main Stem	2660.237	2 YR	298.30	0.0037	12.34		235.27	179.13	0.24	0.13	0.32	0.05	0.12	1.27	2.62	0.44	0.76
Mill Swamp	Main Stem	2660.237	5 YR	525.70	0.0037	13.10		381.16	204.09	0.25	0.18	0.37	0.10	0.19	1.38	2.92	0.78	1.00
Mill Swamp	Main Stem	2660.237	10 YR	735.40	0.0037	13.63		493.60	218.35	0.25	0.22	0.41	0.13	0.23	1.49	3.12	1.03	1.14
Mill Swamp	Main Stem	2660.237	25 YR	1521.70	0.0037	15.07		828.86	245.82	0.25	0.31	0.50	0.21	0.33	1.84	3.60	1.72	1.48
Mill Swamp	Main Stem	2660.237	50 YR	1890.60	0.0037	15.59		959.06	254.69	0.25	0.34	0.54	0.24	0.37	1.97	3.77	1.97	1.59
Mill Swamp	Main Stem	2660.237	100 YR	2230.70	0.0037	16.00		1065.01	261.43	0.26	0.37	0.57	0.27	0.40	2.09	3.94	2.18	1.69
Mill Swamp	Main Stem	2519.448	2 YR	298.30	0.0016	12.11		223.68	173.85	0.25	0.13	0.36	0.08	0.11	1.33	2.82	0.66	0.70

HEC-RAS Plan: EC (Continued)

River	Reach	River Sta	Profile	Q Total (cfs)	Invert Slope	W.S. Elev (ft)	Crit W.S. (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear Total (lb/sq ft)	Shear Chan (lb/sq ft)	Shear LOB (lb/sq ft)	Shear ROB (lb/sq ft)	Vel Total (ft/s)	Vel Chnl (ft/s)	Vel Left (ft/s)	Vel Right (ft/s)
Mill Swamp	Main Stem	2519.448	5 YR	525.70	0.0016	12.86		367.82	205.61	0.26	0.18	0.43	0.13	0.17	1.43	3.21	0.88	0.95
Mill Swamp	Main Stem	2519.448	10 YR	735.40	0.0016	13.40		481.94	221.61	0.27	0.22	0.48	0.22	0.22	1.53	3.45	1.04	1.10
Mill Swamp	Main Stem	2519.448	25 YR	1521.70	0.0016	14.83		839.79	283.03	0.29	0.33	0.66	0.24	0.35	1.81	4.20	1.31	1.50
Mill Swamp	Main Stem	2519.448	50 YR	1890.60	0.0016	15.35		992.65	303.43	0.29	0.36	0.72	0.28	0.39	1.90	4.44	1.43	1.60
Mill Swamp	Main Stem	2519.448	100 YR	2230.70	0.0016	15.76		1120.29	316.38	0.30	0.40	0.77	0.31	0.42	1.99	4.63	1.54	1.70
Mill Swamp	Main Stem	2308.054	2 YR	298.30	0.0001	11.80		280.99	194.70	0.21	0.14	0.28	0.16	0.11	1.06	2.42	1.01	0.69
Mill Swamp	Main Stem	2308.054	5 YR	525.70	0.0001	12.56		435.72	209.79	0.21	0.18	0.31	0.20	0.16	1.21	2.61	1.20	0.91
Mill Swamp	Main Stem	2308.054	10 YR	735.40	0.0001	13.09		549.46	220.92	0.21	0.22	0.35	0.24	0.20	1.34	2.82	1.34	1.07
Mill Swamp	Main Stem	2308.054	25 YR	1521.70	0.0001	14.49		875.17	241.91	0.23	0.36	0.48	0.36	0.34	1.74	3.44	1.76	1.49
Mill Swamp	Main Stem	2308.054	50 YR	1890.60	0.0001	15.00		1000.51	248.00	0.24	0.41	0.53	0.41	0.40	1.89	3.68	1.91	1.65
Mill Swamp	Main Stem	2308.054	100 YR	2230.70	0.0001	15.40		1100.20	252.74	0.25	0.47	0.59	0.47	0.45	2.03	3.90	2.05	1.78
Mill Swamp	Main Stem	2054.860	2 YR	298.30	0.0062	11.50		275.84	155.66	0.19	0.13	0.28	0.12	0.08	1.08	2.16	0.79	0.60
Mill Swamp	Main Stem	2054.860	5 YR	525.70	0.0062	12.25		398.68	173.48	0.21	0.21	0.39	0.20	0.13	1.32	2.62	1.05	0.79
Mill Swamp	Main Stem	2054.860	10 YR	735.40	0.0062	12.75		489.17	185.55	0.23	0.27	0.49	0.26	0.17	1.50	2.98	1.25	0.93
Mill Swamp	Main Stem	2054.860	25 YR	1521.70	0.0062	14.08		767.60	232.45	0.27	0.45	0.81	0.48	0.25	1.98	3.99	1.78	1.17
Mill Swamp	Main Stem	2054.860	50 YR	1890.60	0.0062	14.57		885.80	247.08	0.28	0.51	0.92	0.56	0.30	2.13	4.30	1.95	1.29
Mill Swamp	Main Stem	2054.860	100 YR	2230.70	0.0062	14.95		980.18	257.52	0.29	0.58	1.03	0.63	0.35	2.28	4.58	2.11	1.41
Mill Swamp	Main Stem	1818.292	2 YR	298.30	-0.0049	11.31		375.09	203.74	0.14	0.07	0.15	0.06	0.07	0.80	1.57	0.54	0.58
Mill Swamp	Main Stem	1818.292	5 YR	525.70	-0.0049	12.01		527.15	232.78	0.16	0.12	0.23	0.10	0.11	1.00	2.00	0.75	0.77
Mill Swamp	Main Stem	1818.292	10 YR	735.40	-0.0049	12.47		639.83	252.54	0.18	0.16	0.30	0.13	0.15	1.15	2.33	0.87	0.93
Mill Swamp	Main Stem	1818.292	25 YR	1521.70	-0.0049	13.71		976.85	292.74	0.22	0.29	0.51	0.27	0.27	1.56	3.15	1.32	1.30
Mill Swamp	Main Stem	1818.292	50 YR	1890.60	-0.0049	14.18		1118.51	304.12	0.23	0.33	0.58	0.32	0.31	1.69	3.40	1.47	1.43
Mill Swamp	Main Stem	1818.292	100 YR	2230.70	-0.0049	14.53		1225.52	313.09	0.24	0.38	0.65	0.38	0.36	1.82	3.65	1.61	1.54
Mill Swamp	Main Stem	1659.696	2 YR	298.30	-0.0059	11.25		497.52	229.88	0.10	0.05	0.09	0.05	0.03	0.60	1.26	0.55	0.39
Mill Swamp	Main Stem	1659.696	5 YR	525.70	-0.0059	11.93		662.28	253.57	0.13	0.08	0.15	0.09	0.06	0.79	1.65	0.75	0.56
Mill Swamp	Main Stem	1659.696	10 YR	735.40	-0.0059	12.37		778.63	265.97	0.14	0.11	0.20	0.13	0.08	0.94	1.94	0.91	0.68
Mill Swamp	Main Stem	1659.696	25 YR	1521.70	-0.0059	13.56		1112.15	296.72	0.19	0.23	0.38	0.26	0.17	1.37	2.75	1.36	1.02
Mill Swamp	Main Stem	1659.696	50 YR	1890.60	-0.0059	14.02		1251.88	307.19	0.20	0.28	0.45	0.21	0.21	1.51	3.02	1.52	1.15
Mill Swamp	Main Stem	1659.696	100 YR	2230.70	-0.0059	14.35		1354.92	314.69	0.21	0.32	0.52	0.37	0.25	1.65	3.28	1.66	1.26
Mill Swamp	Main Stem	1568.009	2 YR	298.30	0.0024	11.22		432.87	174.56	0.11	0.06	0.11	0.08	0.05	0.69	1.37	0.71	0.50
Mill Swamp	Main Stem	1568.009	5 YR	525.70	0.0024	11.88		553.28	190.76	0.15	0.11	0.20	0.15	0.09	0.95	1.90	0.99	0.73
Mill Swamp	Main Stem	1568.009	10 YR	735.40	0.0024	12.31		637.38	198.95	0.17	0.17	0.28	0.21	0.14	1.15	2.31	1.21	0.91
Mill Swamp	Main Stem	1568.009	25 YR	1521.70	0.0024	13.44		874.17	219.46	0.24	0.36	0.60	0.45	0.31	1.74	3.48	1.82	1.43
Mill Swamp	Main Stem	1568.009	50 YR	1890.60	0.0024	13.88		973.18	226.38	0.26	0.45	0.73	0.54	0.39	1.94	3.88	2.02	1.62
Mill Swamp	Main Stem	1568.009	100 YR	2230.70	0.0024	14.19		1044.16	231.22	0.28	0.54	0.86	0.64	0.47	2.14	4.26	2.22	1.80
Mill Swamp	Main Stem	1485.470	2 YR	298.30	0.0045	11.21		549.49	204.58	0.09	0.04	0.06	0.05	0.03	0.54	1.03	0.56	0.40
Mill Swamp	Main Stem	1485.470	5 YR	525.70	0.0045	11.86		686.73	217.87	0.11	0.08	0.11	0.09	0.06	0.77	1.43	0.80	0.57
Mill Swamp	Main Stem	1485.470	10 YR	735.40	0.0045	12.28		780.89	223.42	0.13	0.12	0.17	0.14	0.09	0.94	1.75	0.98	0.72
Mill Swamp	Main Stem	1485.470	25 YR	1521.70	0.0045	13.40		1035.42	234.65	0.18	0.27	0.36	0.31	0.21	1.47	2.68	1.54	1.19
Mill Swamp	Main Stem	1485.470	50 YR	1890.60	0.0045	13.83		1139.25	239.08	0.20	0.34	0.45	0.39	0.27	1.66	3.01	1.74	1.36
Mill Swamp	Main Stem	1485.470	100 YR	2230.70	0.0045	14.14		1212.25	242.15	0.22	0.41	0.54	0.47	0.33	1.84	3.33	1.92	1.52
Mill Swamp	Main Stem	1425.227	2 YR	298.30	0.0113	11.19		560.86	203.79	0.08	0.04	0.06	0.04	0.03	0.53	0.98	0.53	0.44
Mill Swamp	Main Stem	1425.227	5 YR	525.70	0.0113	11.82		694.47	216.33	0.11	0.08	0.11	0.09	0.07	0.76	1.39	0.75	0.65
Mill Swamp	Main Stem	1425.227	10 YR	735.40	0.0113	12.24		785.50	222.82	0.13	0.12	0.16	0.13	0.10	0.94	1.71	0.93	0.81
Mill Swamp	Main Stem	1425.227	25 YR	1521.70	0.0113	13.31		1031.01	236.38	0.18	0.28	0.36	0.30	0.25	1.48	2.65	1.47	1.31
Mill Swamp	Main Stem	1425.227	50 YR	1890.60	0.0113	13.73		1132.43	243.06	0.20	0.35	0.46	0.38	0.31	1.67	3.00	1.67	1.48
Mill Swamp	Main Stem	1425.227	100 YR	2230.70	0.0113	14.02		1202.62	247.65	0.22	0.43	0.56	0.46	0.38	1.85	3.34	1.86	1.64
Mill Swamp	Main Stem	1342.706	2 YR	298.30	-0.0032	11.17		561.45	191.62	0.08	0.04	0.06	0.04	0.03	0.53	1.06	0.48	0.39
Mill Swamp	Main Stem	1342.706	5 YR	525.70	-0.0032	11.79		683.72	201.11	0.11	0.07	0.12	0.08	0.06	0.77	1.51	0.71	0.58
Mill Swamp	Main Stem	1342.706	10 YR	735.40	-0.0032	12.19		765.78	207.73	0.13	0.11	0.18	0.12	0.09	0.96	1.88	0.89	0.73
Mill Swamp	Main Stem	1342.706	25 YR	1521.70	-0.0032	12.92		986.50	221.65	0.19	0.28	0.43	0.29	0.22	1.54	2.97	1.46	1.21
Mill Swamp	Main Stem	1342.706	50 YR	1890.60	-0.0032	13.63		1077.45	226.07	0.21	0.36	0.54	0.38	0.29	1.75	3.35	1.67	1.39
Mill Swamp	Main Stem	1342.706	100 YR	2230.70	-0.0032	13.89		1138.09	228.97	0.23	0.45	0.66	0.46	0.35	1.96	3.73	1.87	1.56

HEC-RAS Plan: EC (Continued)

River	Reach	River Sta	Profile	Q Total (cfs)	Invert Slope	W.S. Elev (ft)	Crit W.S. (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear Total (lb/sq ft)	Shear Chan (lb/sq ft)	Shear LOB (lb/sq ft)	Shear ROB (lb/sq ft)	Vel Total (ft/s)	Vel Chnl (ft/s)	Vel Left (ft/s)	Vel Right (ft/s)
Mill Swamp	Main Stem	1233.442	2 YR	298.30	0.0049	11.15		526.39	163.48	0.08	0.04	0.06	0.04	0.03	0.57	1.01	0.50	0.41
Mill Swamp	Main Stem	1233.442	5 YR	525.70	0.0049	11.76		628.63	172.24	0.11	0.08	0.12	0.08	0.06	0.84	1.49	0.74	0.62
Mill Swamp	Main Stem	1233.442	10 YR	735.40	0.0049	12.15		696.38	177.38	0.14	0.13	0.18	0.13	0.10	1.06	1.88	0.95	0.79
Mill Swamp	Main Stem	1233.442	25 YR	1521.70	0.0049	13.12		874.23	190.12	0.21	0.33	0.48	0.34	0.26	1.74	3.12	1.59	1.32
Mill Swamp	Main Stem	1233.442	50 YR	1890.60	0.0049	13.50		947.82	195.29	0.23	0.43	0.62	0.45	0.34	1.99	3.58	1.83	1.52
Mill Swamp	Main Stem	1233.442	100 YR	2230.70	0.0049	13.74		994.80	198.34	0.26	0.53	0.77	0.56	0.42	2.24	4.03	2.07	1.71
Mill Swamp	Main Stem	1152.323	2 YR	298.30	0.0018	11.14		510.35	162.41	0.08	0.04	0.07	0.05	0.03	0.58	1.13	0.55	0.41
Mill Swamp	Main Stem	1152.323	5 YR	525.70	0.0018	11.73		610.12	173.24	0.12	0.09	0.14	0.10	0.07	0.86	1.67	0.83	0.62
Mill Swamp	Main Stem	1152.323	10 YR	735.40	0.0018	12.11		676.17	180.60	0.15	0.14	0.23	0.16	0.10	1.09	2.11	1.05	0.80
Mill Swamp	Main Stem	1152.323	25 YR	1521.70	0.0018	13.02		849.07	198.74	0.23	0.37	0.60	0.42	0.28	1.79	3.51	1.75	1.35
Mill Swamp	Main Stem	1152.323	50 YR	1890.60	0.0018	13.38		921.61	205.88	0.26	0.48	0.78	0.54	0.37	2.05	4.03	2.00	1.56
Mill Swamp	Main Stem	1152.323	100 YR	2230.70	0.0018	13.59		965.47	209.82	0.28	0.61	0.98	0.68	0.47	2.31	4.54	2.26	1.77
Mill Swamp	Main Stem	1103.114	2 YR	298.30	0.0081	11.13	7.94	511.17	176.48	0.09	0.04	0.07	0.04	0.04	0.58	1.18	0.49	0.46
Mill Swamp	Main Stem	1103.114	5 YR	525.70	0.0081	11.71	8.46	618.49	191.46	0.12	0.08	0.15	0.08	0.07	0.85	1.74	0.73	0.68
Mill Swamp	Main Stem	1103.114	10 YR	735.40	0.0081	12.07	8.78	689.77	201.56	0.15	0.13	0.24	0.13	0.12	1.07	2.19	0.92	0.86
Mill Swamp	Main Stem	1103.114	25 YR	1521.70	0.0081	12.94	9.68	875.15	224.10	0.23	0.35	0.62	0.35	0.30	1.74	3.61	1.56	1.41
Mill Swamp	Main Stem	1103.114	50 YR	1890.60	0.0081	13.29	10.04	953.23	232.65	0.26	0.45	0.80	0.46	0.39	1.98	4.12	1.80	1.61
Mill Swamp	Main Stem	1103.114	100 YR	2230.70	0.0081	13.48	10.30	997.88	237.06	0.29	0.57	1.01	0.58	0.49	2.24	4.65	2.04	1.82
Mill Swamp	Main Stem	1065.854	2 YR	298.30	0.0468	11.00	8.20	188.72	181.34	0.25	0.16	0.53	0.08	0.12	1.58	2.95	0.54	0.71
Mill Swamp	Main Stem	1065.854	5 YR	525.70	0.0468	11.55	10.36	297.65	218.05	0.30	0.27	0.79	0.19	0.24	1.77	3.68	0.89	1.05
Mill Swamp	Main Stem	1065.854	10 YR	735.40	0.0468	11.88	11.03	373.05	238.24	0.33	0.38	1.03	0.34	0.19	1.97	4.24	1.15	1.28
Mill Swamp	Main Stem	1065.854	25 YR	1521.70	0.0468	12.63	11.87	568.99	278.93	0.43	0.80	1.90	0.68	0.73	2.67	5.90	1.87	1.98
Mill Swamp	Main Stem	1065.854	50 YR	1890.60	0.0468	12.96	12.12	662.18	293.01	0.45	0.94	2.12	0.82	0.87	2.86	6.29	2.10	2.19
Mill Swamp	Main Stem	1065.854	100 YR	2230.70	0.0468	13.07	12.35	696.83	298.19	0.50	1.19	2.65	1.04	1.10	3.20	7.05	2.39	2.49
Mill Swamp	Main Stem	1052.49		Culvert														
Mill Swamp	Main Stem	1035.739	2 YR	298.30	-0.0216	8.96	6.67	78.18	101.57	0.33	0.86	0.86			3.82	3.82		
Mill Swamp	Main Stem	1035.739	5 YR	525.70	-0.0216	9.47	7.67	87.65	174.81	0.49	2.04	2.04			6.00	6.00		
Mill Swamp	Main Stem	1035.739	10 YR	735.40	-0.0216	9.74	8.41	92.77	193.71	0.63	3.49	3.49			7.93	7.93		
Mill Swamp	Main Stem	1035.739	25 YR	1521.70	-0.0216	11.03	10.20	506.94	236.93	0.26	0.27	0.64	0.24	0.21	3.00	3.45	3.42	2.36
Mill Swamp	Main Stem	1035.739	50 YR	1890.60	-0.0216	11.39	10.20	596.84	252.74	0.26	0.29	0.66	0.26	0.24	3.17	3.56	3.66	2.54
Mill Swamp	Main Stem	1035.739	100 YR	2230.70	-0.0216	11.68	10.33	671.36	264.82	0.26	0.31	0.70	0.29	0.26	3.32	3.67	3.87	2.69
Mill Swamp	Main Stem	964.7622	2 YR	298.30	0.0031	8.84	7.88	128.43	119.24	0.24	0.20	0.41	0.15	0.13	2.32	2.57	2.44	1.69
Mill Swamp	Main Stem	964.7622	5 YR	525.70	0.0031	9.40	8.47	174.93	135.47	0.27	0.31	0.55	0.25	0.23	3.01	3.03	3.42	2.43
Mill Swamp	Main Stem	964.7622	10 YR	735.40	0.0031	9.78	8.72	206.29	146.52	0.29	0.41	0.68	0.35	0.32	3.56	3.42	4.16	2.99
Mill Swamp	Main Stem	964.7622	25 YR	1521.70	0.0031	10.82	9.50	437.18	176.05	0.27	0.33	0.66	0.30	0.27	3.48	3.51	3.94	2.74
Mill Swamp	Main Stem	964.7622	50 YR	1890.60	0.0031	11.16	9.84	497.89	184.26	0.28	0.38	0.75	0.35	0.32	3.80	3.76	4.31	3.04
Mill Swamp	Main Stem	964.7622	100 YR	2230.70	0.0031	11.41	10.14	545.64	192.82	0.29	0.43	0.84	0.40	0.36	4.09	4.03	4.65	3.27
Mill Swamp	Main Stem	862.6342	2 YR	298.30	0.0039	8.70		162.50	118.83	0.19	0.11	0.25	0.10	0.08	1.84	1.98	2.00	1.36
Mill Swamp	Main Stem	862.6342	5 YR	525.70	0.0039	9.27		236.18	142.01	0.21	0.15	0.32	0.14	0.12	2.23	2.32	2.46	1.72
Mill Swamp	Main Stem	862.6342	10 YR	735.40	0.0039	9.66		294.57	155.12	0.22	0.18	0.37	0.15	0.25	2.50	2.54	2.76	2.00
Mill Swamp	Main Stem	862.6342	25 YR	1521.70	0.0039	10.65		461.30	181.77	0.24	0.28	0.54	0.26	0.25	3.30	3.14	3.68	2.72
Mill Swamp	Main Stem	862.6342	50 YR	1890.60	0.0039	10.98		521.65	190.78	0.25	0.33	0.62	0.31	0.30	3.62	3.41	4.05	3.00
Mill Swamp	Main Stem	862.6342	100 YR	2230.70	0.0039	11.21		567.58	197.18	0.27	0.38	0.71	0.35	0.35	3.93	3.66	4.39	3.25
Mill Swamp	Main Stem	661.4513	2 YR	298.30	-0.0026	8.42		257.89	204.45	0.20	0.12	0.29	0.10	0.09	1.16	2.17	0.89	1.42
Mill Swamp	Main Stem	661.4513	5 YR	525.70	-0.0026	8.96		373.55	220.57	0.21	0.17	0.37	0.16	0.13	1.41	2.49	1.17	1.74
Mill Swamp	Main Stem	661.4513	10 YR	735.40	-0.0026	9.34		459.10	232.09	0.23	0.22	0.44	0.21	0.16	1.60	2.74	1.37	1.98
Mill Swamp	Main Stem	661.4513	25 YR	1521.70	-0.0026	10.28		689.24	259.26	0.27	0.38	0.69	0.38	0.28	2.21	3.56	1.95	2.79
Mill Swamp	Main Stem	661.4513	50 YR	1890.60	-0.0026	10.57		764.75	267.18	0.29	0.47	0.83	0.47	0.35	2.47	3.93	2.20	3.14
Mill Swamp	Main Stem	661.4513	100 YR	2230.70	-0.0026	10.75		815.48	272.86	0.31	0.57	0.99	0.57	0.42	2.74	4.32	2.43	3.49
Mill Swamp	Main Stem	565.9014	2 YR	298.30	0.0027	8.14		221.51	234.01	0.27	0.15	0.48	0.13	0.09	1.35	2.74	0.92	0.66
Mill Swamp	Main Stem	565.9014	5 YR	525.70	0.0027	8.67		362.21	299.81	0.28	0.20	0.56	0.18	0.13	1.45	3.04	1.14	0.82
Mill Swamp	Main Stem	565.9014	10 YR	735.40	0.0027	9.04		482.68	353.87	0.28	0.22	0.62	0.20	0.16	1.52	3.24	1.26	0.94
Mill Swamp	Main Stem	565.9014	25 YR	1521.70	0.0027	9.96		897.44	498.54	0.28	0.28	0.72	0.27	0.24	1.70	3.61	1.52	1.22

HEC-RAS Plan: EC (Continued)

River	Reach	River Sta	Profile	Q Total (cfs)	Invert Slope	W.S. Elev (ft)	Crit W.S. (ft)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl	Shear Total (lb/sq ft)	Shear Chan (lb/sq ft)	Shear LOB (lb/sq ft)	Shear ROB (lb/sq ft)	Vel Total (ft/s)	Vel Chnl (ft/s)	Vel Left (ft/s)	Vel Right (ft/s)
Mill Swamp	Main Stem	565.9014	50 YR	1890.60	0.0027	10.24		1035.99	507.44	0.29	0.32	0.76	0.30	0.26	1.82	3.73	1.67	1.30
Mill Swamp	Main Stem	565.9014	100 YR	2230.70	0.0027	10.39		1110.08	510.55	0.30	0.38	0.87	0.36	0.31	2.01	4.04	1.85	1.43
Mill Swamp	Main Stem	443.9817	2 YR	298.30	0.0070	7.75	6.62	221.76	225.73	0.27	0.17	0.47	0.15	0.09	1.35	2.72	1.03	0.64
Mill Swamp	Main Stem	443.9817	5 YR	525.70	0.0070	8.21	7.02	324.53	260.13	0.30	0.26	0.65	0.23	0.15	1.62	3.24	1.35	0.87
Mill Swamp	Main Stem	443.9817	10 YR	735.40	0.0070	8.54	7.19	409.76	287.42	0.31	0.32	0.76	0.29	0.20	1.79	3.58	1.55	1.03
Mill Swamp	Main Stem	443.9817	25 YR	1521.70	0.0070	9.39	8.20	662.31	356.17	0.35	0.50	1.09	0.48	0.33	2.30	4.42	2.10	1.43
Mill Swamp	Main Stem	443.9817	50 YR	1890.60	0.0070	9.62	8.44	739.38	375.52	0.37	0.59	1.26	0.57	0.40	2.56	4.79	2.36	1.59
Mill Swamp	Main Stem	443.9817	100 YR	2230.70	0.0070	9.80	8.59	893.01	390.05	0.34	0.52	1.10	0.50	0.36	2.50	4.50	2.36	1.52
Mill Swamp	Main Stem	280.6386	2 YR	298.30	-0.0010	7.26	6.79	157.17	223.30	0.36	0.24	0.84	0.18	0.10	1.90	3.55	1.04	0.59
Mill Swamp	Main Stem	280.6386	5 YR	525.70	-0.0010	7.80	7.18	291.76	293.64	0.34	0.28	0.83	0.25	0.15	1.80	3.62	1.31	0.84
Mill Swamp	Main Stem	280.6386	10 YR	735.40	-0.0010	8.19	7.53	406.38	330.84	0.32	0.30	0.80	0.28	0.17	1.81	3.62	1.46	0.92
Mill Swamp	Main Stem	280.6386	25 YR	1521.70	-0.0010	9.09	8.07	712.17	381.39	0.31	0.41	0.87	0.40	0.25	2.14	3.91	1.95	1.23
Mill Swamp	Main Stem	280.6386	50 YR	1890.60	-0.0010	9.40	8.24	923.28	392.45	0.27	0.34	0.65	0.33	0.21	2.05	3.41	1.96	1.15
Mill Swamp	Main Stem	280.6386	100 YR	2230.70	-0.0010	9.57	8.40	988.84	395.36	0.28	0.40	0.76	0.40	0.26	2.26	3.71	2.18	1.28
Mill Swamp	Main Stem	194.0256	2 YR	298.30	0.0041	6.93	6.53	188.00	232.50	0.31	0.21	0.65	0.18	0.08	1.59	3.15	1.10	0.56
Mill Swamp	Main Stem	194.0256	5 YR	525.70	0.0041	7.56	6.84	339.16	283.02	0.28	0.23	0.59	0.22	0.13	1.55	3.07	1.30	0.80
Mill Swamp	Main Stem	194.0256	10 YR	735.40	0.0041	7.97	7.05	455.62	314.70	0.27	0.25	0.59	0.25	0.15	1.61	3.14	1.44	0.91
Mill Swamp	Main Stem	194.0256	25 YR	1521.70	0.0041	8.83	7.57	737.38	408.84	0.32	0.41	0.95	0.41	0.33	2.06	4.10	1.91	1.44
Mill Swamp	Main Stem	194.0256	50 YR	1890.60	0.0041	9.18	7.76	875.27	426.82	0.31	0.44	0.94	0.35	0.35	2.16	4.13	2.06	1.51
Mill Swamp	Main Stem	194.0256	100 YR	2230.70	0.0041	9.37	7.92	1037.03	437.19	0.29	0.40	0.82	0.40	0.30	2.15	3.87	2.12	1.43
Mill Swamp	Main Stem	133.5329	2 YR	298.30	0.0059	6.74	5.03	174.36	208.58	0.29	0.16	0.56	0.13	0.08	1.71	2.96	0.89	0.60
Mill Swamp	Main Stem	133.5329	5 YR	525.70	0.0059	7.40	6.51	320.51	264.32	0.28	0.21	0.60	0.18	0.16	1.64	3.17	1.15	0.92
Mill Swamp	Main Stem	133.5329	10 YR	735.40	0.0059	7.83	6.84	436.65	304.71	0.28	0.24	0.65	0.22	0.19	1.68	3.35	1.32	1.05
Mill Swamp	Main Stem	133.5329	25 YR	1521.70	0.0059	8.65	7.53	689.77	346.87	0.33	0.44	0.99	0.40	0.40	2.21	4.27	1.90	1.65
Mill Swamp	Main Stem	133.5329	50 YR	1890.60	0.0059	9.00	7.81	803.20	370.13	0.33	0.50	1.06	0.46	0.46	2.35	4.46	2.07	1.83
Mill Swamp	Main Stem	133.5329	100 YR	2230.70	0.0059	9.22	7.97	954.29	382.15	0.32	0.46	1.00	0.42	0.45	2.34	4.36	2.13	1.86
Mill Swamp	Main Stem	24.38062	2 YR	298.30		6.17	4.63	107.72	125.37	0.39	0.33	1.10	0.10	0.19	2.77	4.16	0.68	0.92
Mill Swamp	Main Stem	24.38062	5 YR	525.70		6.84	6.28	198.42	162.53	0.41	0.47	1.31	0.22	0.39	2.65	4.68	1.20	1.50
Mill Swamp	Main Stem	24.38062	10 YR	735.40		7.27	6.68	269.54	194.03	0.41	0.53	1.45	0.26	0.51	2.73	5.00	1.31	1.87
Mill Swamp	Main Stem	24.38062	25 YR	1521.70		8.08	7.53	502.81	310.92	0.42	0.58	1.70	0.35	0.73	3.03	5.57	2.29	2.52
Mill Swamp	Main Stem	24.38062	50 YR	1890.60		8.43	7.71	620.65	360.55	0.43	0.62	1.82	0.39	0.82	3.05	5.81	2.16	2.79
Mill Swamp	Main Stem	24.38062	100 YR	2230.70		8.66	7.76	705.88	379.68	0.43	0.67	1.89	0.45	0.88	3.16	5.97	2.33	2.97

HEC-RAS HEC-RAS 6.3.1 September 2022
 U.S. Army Corps of Engineers
 Hydrologic Engineering Center
 609 Second Street
 Davis, California

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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
XXXXXXXX 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
  
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PROJECT DATA

Project Title: Mill Swamp_Existing
 Project File : MillSwamp_Existing.prj
 Run Date and Time: 6/25/2025 12:39:42 PM

Project in English units

PLAN DATA

Plan Title: Existing Conditions
 Plan File : C:\Users\khiggins\OneDrive - Johnson, Mirmiran
 Thompson\Desktop\HECRAS\MillSwamp_Existing.p01

Geometry Title: Mill Swamp Existing
 Geometry File : C:\Users\khiggins\OneDrive - Johnson, Mirmiran
 Thompson\Desktop\HECRAS\MillSwamp_Existing.g02

Flow Title : Mill Swamp Existing Flow
 Flow File : C:\Users\khiggins\OneDrive - Johnson, Mirmiran
 Thompson\Desktop\HECRAS\MillSwamp_Existing.f02

Plan Summary Information:

Number of: Cross Sections =	40	Multiple Openings =	0
Culverts =	3	Inline Structures =	0
Bridges =	0	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

FLOW DATA

Flow Title: Mill Swamp Existing Flow
 Flow File : C:\Users\khiggins\OneDrive - Johnson, Mirmiran
 Thompson\Desktop\HECRAS\MillSwamp_Existing.f02

Flow Data (cfs)

* River	Reach	RS	* 2 YR	5 YR
10 YR	25 YR	50 YR	100 YR *	
* Mill Swamp	Main Stem	3167.546*	298.3	525.7
735.4	1521.7	1890.6	2230.7 *	
* UNT	UNT	1871.760*	320.4	909.7
1256.5	1768.6	2207.6	2682.3 *	

Boundary Conditions

* River	Reach	Profile	* Upstream
Downstream	*		
* Mill Swamp	Main Stem	2 YR	*
Normal S = 0.005863	*		
* Mill Swamp	Main Stem	5 YR	*
Normal S = 0.005863	*		
* Mill Swamp	Main Stem	10 YR	*
Normal S = 0.005863	*		
* Mill Swamp	Main Stem	25 YR	*
Normal S = 0.005863	*		
* Mill Swamp	Main Stem	50 YR	*
Normal S = 0.005863	*		
* Mill Swamp	Main Stem	100 YR	*
Normal S = 0.005863	*		

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* UNT          UNT          2 YR          *
Normal S = 0.0093405 *
* UNT          UNT          5 YR          *
Normal S = 0.0093405 *
* UNT          UNT          10 YR         *
Normal S = 0.0093405 *
* UNT          UNT          25 YR         *
Normal S = 0.0093405 *
* UNT          UNT          50 YR         *
Normal S = 0.0093405 *
* UNT          UNT          100 YR        *
Normal S = 0.0093405 *
*****
*****

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GEOMETRY DATA

Geometry Title: Mill Swamp Existing
 Geometry File : C:\Users\khiggins\OneDrive - Johnson, Mirmiran
 Thompson\Desktop\HECRAS\MillSwamp_Existing.g02

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 3167.546

INPUT

Description: XS-28

Station Elevation Data num= 175

Sta	Elev								
0	21.73	1.9	21.63	2.87	21.56	7.07	21.32	8.82	21.2
11.88	21.02	14.04	20.89	16.38	20.74	17.82	20.65	20.57	20.49
21.44	20.44	22.07	20.39	24.88	20.24	26.42	20.14	28.56	20.05
28.83	20.04	29.62	20	33.99	20	35.07	19.99	41.08	19.99
41.6	19.98	42.71	19.98	43.37	19.97	49.27	19.9	50.34	19.9
53.24	19.91	53.62	19.91	58.85	19.92	61.98	19.91	62.5	19.91
83.23	18.99	84.28	18.96	85.37	18.92	86.48	18.89	112.03	18.01
115.25	18.01	120.32	18	122.63	18	124.71	17.91	130.31	17.65
156.84	16.54	161.09	16.36	163.06	16.27	164.18	16.23	168.81	16.03
169.26	16.03	171.17	16	171.23	16	174.26	15.79	174.93	15.75
189.35	14.78	207.07	13.6	207.69	13.57	208.66	13.52	210.04	13.46
211.21	13.41	212.21	13.36	213.08	13.32	213.51	13.3	214.21	13.27
214.83	13.24	215.39	13.22	215.9	13.2	216.35	13.17	216.63	13.16
217	13.15	217.33	13.13	217.53	13.12	226.55	12.68	235.63	12.29
244.67	12.09	251.59	11.75	261.14	11.45	261.54	11.44	264.67	10.05
267.58	8.99	268.97	8.86	270.24	8.69	272.45	8.99	273.92	9.27

276.95	10.6	278.23	11.74	278.26	11.77	283.25	11.81	283.56	11.85
284.03	11.99	289.81	13.5	290.58	13.5	292.75	13.48	300.52	13.56
305.79	13.59	324.35	14.11	334.78	13.91	336.61	13.9	339.18	13.79
342.4	13.91	350.14	13.45	350.54	13.49	361.2	13.14	370.4	12.96
379.36	13.13	392.08	13.27	396.4	13.23	396.79	13.22	397.31	13.22
408.54	13.11	409.01	13.1	409.67	13.09	410.56	13.09	411.7	13.07
412.33	13.14	412.86	13.21	414.36	13.38	419.25	14	423.73	14
426.84	14.01	428.86	14.01	436.27	14	439.35	14	447.75	13.99
480.72	13.99	481.74	14	488.55	14	491.95	14.08	495.31	14.15
498.45	14.22	501.39	14.29	513.66	14.56	524.52	14.77	525.71	14.79
526.07	14.8	527.54	14.83	528.95	14.85	551	15.25	552.3	15.27
553.5	15.3	555.31	15.33	556.39	15.35	558.21	15.39	559.15	15.4
586	15.93	586.12	15.93	586.23	15.94	586.36	15.94	589.3	16
595.34	16	600.06	16.01	620.51	16.73	634.86	17.11	635.38	17.12
635.91	17.13	668.22	18	767.84	18	768.24	18.01	769.69	18.01
769.82	18.02	769.87	18.02	775.5	18.21	779.58	18.36	799.17	19.01
800.61	19.06	824.89	20	836.69	20	837.21	20.01	847.32	20.01
868.16	20.57	868.78	20.58	875.44	20.69	876.42	20.7	877.12	20.72
878.12	20.74	879.11	20.75	880.11	20.77	881.08	20.78	881.86	20.79

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	261.14	.049	278.23	.09	447.75	.03	635.91	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

261.14	278.23	181.16	113.21	129.92	.1	.3
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Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
383.34	881.86	14.57	F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 3054.333

INPUT

Description: XS-27

Station Elevation Data num= 268

Sta	Elev								
0	18.62	7.71	18.34	9.57	18.25	32.51	17.52	32.6	17.52
32.62	17.51	32.67	17.51	64.01	16.58	90.49	15.68	93.24	15.62
126.35	14.89	151.33	14.45	157.99	14.39	169.02	14	174.39	13.64
176.59	13.49	187.31	12.84	187.79	12.81	193.82	12.16	202.07	11.4
202.63	11.38	207.84	11.09	224.45	10.85	228.09	10.72	240.38	10.48
244.43	10.12	245.39	10.06	253.54	10.14	254.44	10.15	255.96	8.91
256.25	8.83	256.45	8.75	256.97	8.71	258.14	8.67	264	8.48
264.01	8.48	264.68	8.55	269.16	8.88	273.11	10.23	275.79	11.19

279.45	11.19	280.06	11.21	285.61	11.37	286.23	11.2	286.64	11.15
286.88	11.05	294.36	10.11	297.37	10.59	298.33	10.74	298.38	10.75
298.39	10.76	299.04	11.09	299.06	11.09	299.12	11.11	300.92	11.59
304.57	11.64	314.7	11.92	334.14	12.03	339.51	11.92	348.23	12.08
366.69	11.76	369.04	11.85	370.07	11.91	393.8	12.73	398.82	12.78
410.65	12.85	430.63	13.3	458.94	13.84	481.72	13.91	482.37	13.91
482.76	14.11	482.89	14.11	483.5	14.35	483.82	14.36	484.35	14.52
484.82	14.53	485.2	14.62	485.31	14.67	485.61	14.78	486.38	14.79
486.61	14.85	487.51	14.87	487.97	14.96	488.07	14.98	489.15	15
489.23	15.01	490.38	15.03	490.4	15.03	491.43	15.06	496.1	15.38
497.27	15.39	498.49	15.4	499.73	15.41	500.99	15.42	502.26	15.43
503.56	15.44	510.68	15.44	511.94	15.45	513.21	15.45	514.48	15.46
515.91	15.46	517.18	15.47	520.98	15.47	522.25	15.48	524.8	15.48
525	15.49	527.59	15.49	528.89	15.5	532.08	15.55	533.4	15.55
534.74	15.56	536.09	15.56	537.44	15.57	538.81	15.58	540.2	15.58
541.6	15.59	543.02	15.6	545.92	15.63	547.33	15.64	548.75	15.65
549.01	15.65	550.45	15.66	551.92	15.67	552.17	15.67	553.65	15.68
555.17	15.69	555.41	15.69	556.94	15.7	558.51	15.71	558.72	15.71
560.31	15.72	561.92	15.73	562.11	15.74	563.74	15.74	565.4	15.75
565.57	15.76	567.24	15.76	568.94	15.77	570.65	15.78	570.81	15.79
572.53	15.79	574.28	15.8	574.42	15.81	576.18	15.82	577.96	15.83
579.76	15.84	581.57	15.85	581.68	15.85	583.52	15.86	592.3	16
606.67	16	607.54	16.04	609.65	16.07	609.7	16.08	611.77	16.11
613.78	16.15	615.72	16.18	615.84	16.19	617.71	16.23	619.49	16.26
619.67	16.27	621.37	16.31	622.98	16.34	623.22	16.35	624.74	16.38
626.19	16.4	627.57	16.42	627.86	16.44	629.17	16.45	630.43	16.47
630.76	16.49	631.97	16.5	633.12	16.51	633.5	16.53	634.6	16.54
635.03	16.56	636.08	16.57	636.55	16.59	637.55	16.6	638.49	16.62
639.01	16.64	639.87	16.65	640.43	16.67	641.19	16.69	641.79	16.71
643.09	16.75	643.59	16.77	644.3	16.79	644.65	16.81	645.4	16.83
646.2	16.85	647.04	16.87	647.26	16.89	648.16	16.91	663.95	17.84
664.65	17.84	667.41	17.86	670.56	17.9	671.33	17.92	674.44	17.94
674.57	17.94	675.9	17.97	677.21	18	677.25	18	678.69	18.01
679.97	18.01	680.44	18.02	681.28	18.02	681.95	18.03	682.53	18.03
683.37	18.04	683.75	18.04	685.47	18.05	685.71	18.05	688.83	18.07
689.88	18.07	699.36	18.03	708.81	18.03	709.73	18.04	714.53	18.04
715.64	18.05	718.77	18.05	721.69	18.06	724.63	18.06	727.96	18.07
733.01	18.07	736.78	18.08	739.16	18.08	743.12	18.09	746.06	18.09
749.25	18.1	751.36	18.1	756.11	18.11	756.75	18.11	757.37	18.12
759.14	18.12	764.18	18.13	765.86	18.13	771.26	18.14	773.14	18.14
773.58	18.15	779.59	18.15	780.03	18.16	780.45	18.16	786.4	18.17
788.12	18.17	794.05	18.18	795.31	18.18	795.6	18.19	797.2	18.19
830.15	19.94	830.22	19.94	831.26	20	832.3	20	832.8	20.01
836.6	20.01	837.53	20.02	840.99	20.03	841.77	20.03	842.44	20.04
843.01	20.04	845.38	20.05	846.99	20.05	851.2	20.08	851.36	20.08
854.91	20.09	858.18	20.1	860.43	20.11				

Manning's n Values num= 4
 Sta n Val Sta n Val Sta n Val Sta n Val

0 .08 253.54 .049 297.37 .09 624.74 .02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 253.54 297.37 76.13 80.96 221.24 .3 .5

Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 0 254.48 14.63 F
 310.28 860.43 14.57 F

CULVERT

RIVER: Mill Swamp
 REACH: Main Stem RS: 3004.159

INPUT

Description:
 Distance from Upstream XS = 12.717
 Deck/Roadway Width = 44.67
 Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates

num= 17

Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
0	18.575		12.16	18.0785	31.7	17.6339								
64.01	17.0913		91.03	16.9776	124.86	16.7221								
158	16.4098		185.93	16.2619	215.3	16.2134								
247.84	16.032		292.21	15.846	314.47	15.697								
340.11	15.5889		369.08	15.667	398.59	15.9248								
427.33	15.9327		484.35	15.9777										

Upstream Bridge Cross Section Data

Station Elevation Data num= 268

Sta	Elev								
0	18.62	7.71	18.34	9.57	18.25	32.51	17.52	32.6	17.52
32.62	17.51	32.67	17.51	64.01	16.58	90.49	15.68	93.24	15.62
126.35	14.89	151.33	14.45	157.99	14.39	169.02	14	174.39	13.64
176.59	13.49	187.31	12.84	187.79	12.81	193.82	12.16	202.07	11.4
202.63	11.38	207.84	11.09	224.45	10.85	228.09	10.72	240.38	10.48
244.43	10.12	245.39	10.06	253.54	10.14	254.44	10.15	255.96	8.91
256.25	8.83	256.45	8.75	256.97	8.71	258.14	8.67	264	8.48
264.01	8.48	264.68	8.55	269.16	8.88	273.11	10.23	275.79	11.19
279.45	11.19	280.06	11.21	285.61	11.37	286.23	11.2	286.64	11.15
286.88	11.05	294.36	10.11	297.37	10.59	298.33	10.74	298.38	10.75
298.39	10.76	299.04	11.09	299.06	11.09	299.12	11.11	300.92	11.59
304.57	11.64	314.7	11.92	334.14	12.03	339.51	11.92	348.23	12.08
366.69	11.76	369.04	11.85	370.07	11.91	393.8	12.73	398.82	12.78
410.65	12.85	430.63	13.3	458.94	13.84	481.72	13.91	482.37	13.91
482.76	14.11	482.89	14.11	483.5	14.35	483.82	14.36	484.35	14.52

484.82	14.53	485.2	14.62	485.31	14.67	485.61	14.78	486.38	14.79
486.61	14.85	487.51	14.87	487.97	14.96	488.07	14.98	489.15	15
489.23	15.01	490.38	15.03	490.4	15.03	491.43	15.06	496.1	15.38
497.27	15.39	498.49	15.4	499.73	15.41	500.99	15.42	502.26	15.43
503.56	15.44	510.68	15.44	511.94	15.45	513.21	15.45	514.48	15.46
515.91	15.46	517.18	15.47	520.98	15.47	522.25	15.48	524.8	15.48
525	15.49	527.59	15.49	528.89	15.5	532.08	15.55	533.4	15.55
534.74	15.56	536.09	15.56	537.44	15.57	538.81	15.58	540.2	15.58
541.6	15.59	543.02	15.6	545.92	15.63	547.33	15.64	548.75	15.65
549.01	15.65	550.45	15.66	551.92	15.67	552.17	15.67	553.65	15.68
555.17	15.69	555.41	15.69	556.94	15.7	558.51	15.71	558.72	15.71
560.31	15.72	561.92	15.73	562.11	15.74	563.74	15.74	565.4	15.75
565.57	15.76	567.24	15.76	568.94	15.77	570.65	15.78	570.81	15.79
572.53	15.79	574.28	15.8	574.42	15.81	576.18	15.82	577.96	15.83
579.76	15.84	581.57	15.85	581.68	15.85	583.52	15.86	592.3	16
606.67	16	607.54	16.04	609.65	16.07	609.7	16.08	611.77	16.11
613.78	16.15	615.72	16.18	615.84	16.19	617.71	16.23	619.49	16.26
619.67	16.27	621.37	16.31	622.98	16.34	623.22	16.35	624.74	16.38
626.19	16.4	627.57	16.42	627.86	16.44	629.17	16.45	630.43	16.47
630.76	16.49	631.97	16.5	633.12	16.51	633.5	16.53	634.6	16.54
635.03	16.56	636.08	16.57	636.55	16.59	637.55	16.6	638.49	16.62
639.01	16.64	639.87	16.65	640.43	16.67	641.19	16.69	641.79	16.71
643.09	16.75	643.59	16.77	644.3	16.79	644.65	16.81	645.4	16.83
646.2	16.85	647.04	16.87	647.26	16.89	648.16	16.91	663.95	17.84
664.65	17.84	667.41	17.86	670.56	17.9	671.33	17.92	674.44	17.94
674.57	17.94	675.9	17.97	677.21	18	677.25	18	678.69	18.01
679.97	18.01	680.44	18.02	681.28	18.02	681.95	18.03	682.53	18.03
683.37	18.04	683.75	18.04	685.47	18.05	685.71	18.05	688.83	18.07
689.88	18.07	699.36	18.03	708.81	18.03	709.73	18.04	714.53	18.04
715.64	18.05	718.77	18.05	721.69	18.06	724.63	18.06	727.96	18.07
733.01	18.07	736.78	18.08	739.16	18.08	743.12	18.09	746.06	18.09
749.25	18.1	751.36	18.1	756.11	18.11	756.75	18.11	757.37	18.12
759.14	18.12	764.18	18.13	765.86	18.13	771.26	18.14	773.14	18.14
773.58	18.15	779.59	18.15	780.03	18.16	780.45	18.16	786.4	18.17
788.12	18.17	794.05	18.18	795.31	18.18	795.6	18.19	797.2	18.19
830.15	19.94	830.22	19.94	831.26	20	832.3	20	832.8	20.01
836.6	20.01	837.53	20.02	840.99	20.03	841.77	20.03	842.44	20.04
843.01	20.04	845.38	20.05	846.99	20.05	851.2	20.08	851.36	20.08
854.91	20.09	858.18	20.1	860.43	20.11				

Manning's n Values num= 4
 Sta n Val Sta n Val Sta n Val Sta n Val

 0 .08 253.54 .049 297.37 .09 624.74 .02

Bank Sta: Left Right Coeff Contr. Expan.
 253.54 297.37 .3 .5

Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 0 254.48 14.63 F

310.28 860.43 14.57 F

Downstream Deck/Roadway Coordinates

num= 16

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
20.746	20.394		48.49	19.5755		77.31	18.775	
93.96	18.3846		113.51	17.866		144.31	17.0939	
171.84	16.6402		204.93	16.2078		237.76	15.979	
265.11	16.0282		295.7	15.9277		316.72	15.9976	
365.55	15.9327		394.97	15.782		421.24	15.5098	
452.62	15.4184							

Downstream Bridge Cross Section Data

Station Elevation Data num= 97

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	21.34	8.18	20.92	8.79	20.14	11.01	19.99	11.58	19.99
22.54	19.48	36	18.69	60.25	17.5	60.81	17.47	85.29	16.18
87.42	16.09	87.66	16.05	91.32	16.05	92.77	17.18	94.16	17.9
96.93	17.95	101.41	17.87	101.8	17.87	109.6	17.73	112.11	15.82
112.16	15.81	112.25	15.8	115.93	15.71	124.27	15.52	124.91	15.5
127.39	15.43	147.15	15.02	149.83	14.97	167.32	14.31	171.26	14.19
172.37	14.16	185.85	13.86	196.88	13.62	199.18	13.58	202.06	13.53
213.71	13.55	214.59	13.55	219.63	13.4	234.41	13.1	247.91	13.01
250.88	12.9	253.28	12.9	259.42	12.71	264.4	13.24	267.14	13.17
273.45	13	280.07	13.04	286.38	11.47	286.46	11.45	286.48	11.45
288.7	11.47	288.96	11.47	290.13	10.534	291.76	9.23	291.85	9.21
292.01	9.19	296.88	8.43	296.97	8.41	297.66	8.25	297.68	8.24
300.88	8.41	301.1	8.42	301.13	8.41	301.53	8.34	303.03	8.07
307.53	8.77	309.41	8.96	313.69	10.71	314.92	11.21	315.01	11.31
316.3	11.39	316.68	11.46	333.16	11.86	333.23	11.74	336.49	11.67
341.15	11.55	357.26	12.29	359.22	12.36	360.88	12.4	371.92	12.54
389.51	12.76	405.7	12.87	409.14	12.87	411.31	12.85	425.8	12.87
427.22	12.9	439.77	13.46	440.41	13.58	441.72	13.69	446.35	14.88
459.07	18.14	460.5	18.71	463.04	19.34	472.66	21.06	480.97	21.94
493.66	23.02	501.74	23.09						

Manning's n Values

num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	234.41	.08	291.76	.049	313.69	.09

Bank Sta: Left Right Coeff Contr. Expan.
290.13 313.69 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	290.13	14.52	F
322.46	501.74	14.62	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 =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name Shape Rise Span
 Culvert #1 Box 6 12
 FHWA Chart # 8 - flared wingwalls
 FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12.717 60.22 .01 .014 .71 .5
 1
 Upstream Elevation = 8.63
 Centerline Station = 265.15
 Downstream Elevation = 8.52
 Centerline Station = 297.87

Culvert Name Shape Rise Span
 Culvert #2 Box 6 12
 FHWA Chart # 8 - flared wingwalls
 FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12.717 60.22 .01 .014 2.27 .5
 1
 Upstream Elevation = 8.57
 Centerline Station = 277.85
 Downstream Elevation = 8.62
 Centerline Station = 310.94

CULVERT OUTPUT Profile #2 YR Culv Group: Culvert #1

 * Q Culv Group (cfs) * 186.37 * Culv Full Len (ft) * *
 * # Barrels * 1 * Culv Vel US (ft/s) * 4.05 *
 * Q Barrel (cfs) * 186.37 * Culv Vel DS (ft/s) * 3.95 *
 * E.G. US. (ft) * 13.57 * Culv Inv El Up (ft) * 8.63 *
 * W.S. US. (ft) * 13.51 * Culv Inv El Dn (ft) * 8.52 *
 * E.G. DS (ft) * 13.28 * Culv Frctn Ls (ft) * 0.02 *
 * W.S. DS (ft) * 13.16 * Culv Exit Loss (ft) * 0.12 *
 * Delta EG (ft) * 0.29 * Culv Entr Loss (ft) * 0.13 *
 * Delta WS (ft) * 0.35 * Q Weir (cfs) * *
 * E.G. IC (ft) * 12.45 * Weir Sta Lft (ft) * *

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* E.G. OC (ft) * 13.56 * Weir Sta Rgt (ft) * *
* Culvert Control * Outlet * Weir Submerg * *
* Culv WS Inlet (ft) * 13.17 * Weir Max Depth (ft) * *
* Culv WS Outlet (ft) * 13.16 * Weir Avg Depth (ft) * *
* Culv Nml Depth (ft) * 2.39 * Weir Flow Area (sq ft) * *
* Culv Crt Depth (ft) * 1.96 * Min El Weir Flow (ft) * 15.44 *
*****

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CULVERT OUTPUT Profile #5 YR Culv Group: Culvert #1

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*****
* Q Culv Group (cfs) * 315.09 * Culv Full Len (ft) * *
* # Barrels * 1 * Culv Vel US (ft/s) * 5.68 *
* Q Barrel (cfs) * 315.09 * Culv Vel DS (ft/s) * 5.58 *
* E.G. US. (ft) * 14.72 * Culv Inv El Up (ft) * 8.63 *
* W.S. US. (ft) * 14.71 * Culv Inv El Dn (ft) * 8.52 *
* E.G. DS (ft) * 14.19 * Culv Frctn Ls (ft) * 0.04 *
* W.S. DS (ft) * 13.94 * Culv Exit Loss (ft) * 0.23 *
* Delta EG (ft) * 0.54 * Culv Entr Loss (ft) * 0.25 *
* Delta WS (ft) * 0.78 * Q Weir (cfs) * *
* E.G. IC (ft) * 13.80 * Weir Sta Lft (ft) * *
* E.G. OC (ft) * 14.71 * Weir Sta Rgt (ft) * *
* Culvert Control * Outlet * Weir Submerg * *
* Culv WS Inlet (ft) * 13.96 * Weir Max Depth (ft) * *
* Culv WS Outlet (ft) * 13.94 * Weir Avg Depth (ft) * *
* Culv Nml Depth (ft) * 3.36 * Weir Flow Area (sq ft) * *
* Culv Crt Depth (ft) * 2.78 * Min El Weir Flow (ft) * 15.44 *
*****

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CULVERT OUTPUT Profile #10 YR Culv Group: Culvert #1

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*****
* Q Culv Group (cfs) * 425.65 * Culv Full Len (ft) * *
* # Barrels * 1 * Culv Vel US (ft/s) * 6.83 *
* Q Barrel (cfs) * 425.65 * Culv Vel DS (ft/s) * 6.73 *
* E.G. US. (ft) * 15.61 * Culv Inv El Up (ft) * 8.63 *
* W.S. US. (ft) * 15.60 * Culv Inv El Dn (ft) * 8.52 *
* E.G. DS (ft) * 14.88 * Culv Frctn Ls (ft) * 0.05 *
* W.S. DS (ft) * 14.50 * Culv Exit Loss (ft) * 0.32 *
* Delta EG (ft) * 0.73 * Culv Entr Loss (ft) * 0.36 *
* Delta WS (ft) * 1.10 * Q Weir (cfs) * 20.41 *
* E.G. IC (ft) * 14.83 * Weir Sta Lft (ft) * 335.33 *
* E.G. OC (ft) * 15.62 * Weir Sta Rgt (ft) * 543.89 *
* Culvert Control * Outlet * Weir Submerg * 0.00 *
* Culv WS Inlet (ft) * 14.53 * Weir Max Depth (ft) * 1.09 *
* Culv WS Outlet (ft) * 14.50 * Weir Avg Depth (ft) * 0.18 *
* Culv Nml Depth (ft) * 4.11 * Weir Flow Area (sq ft) * 12.96 *
* Culv Crt Depth (ft) * 3.39 * Min El Weir Flow (ft) * 15.44 *
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CULVERT OUTPUT Profile #25 YR Culv Group: Culvert #1

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* Q Culv Group (cfs)      * 372.89 * Culv Full Len (ft)    * 60.22 *
* # Barrels              *      1 * Culv Vel US (ft/s)    * 5.87  *
* Q Barrel (cfs)         * 372.89 * Culv Vel DS (ft/s)    * 5.87  *
* E.G. US. (ft)          * 16.65 * Culv Inv El Up (ft)   * 8.63  *
* W.S. US. (ft)          * 16.63 * Culv Inv El Dn (ft)   * 8.52  *
* E.G. DS (ft)           * 15.87 * Culv Frctn Ls (ft)    * 0.05  *
* W.S. DS (ft)           * 15.80 * Culv Exit Loss (ft)   * 0.47  *
* Delta EG (ft)          * 0.79  * Culv Entr Loss (ft)   * 0.27  *
* Delta WS (ft)          * 0.83  * Q Weir (cfs)          * 893.05 *
* E.G. IC (ft)           * 14.35 * Weir Sta Lft (ft)     * 131.86 *
* E.G. OC (ft)           * 16.66 * Weir Sta Rgt (ft)     * 640.04 *
* Culvert Control        * Outlet * Weir Submerg         * 0.12  *
* Culv WS Inlet (ft)     * 14.63 * Weir Max Depth (ft)   * 2.14  *
* Culv WS Outlet (ft)    * 14.52 * Weir Avg Depth (ft)   * 0.73  *
* Culv Nml Depth (ft)    *        * Weir Flow Area (sq ft) * 373.25 *
* Culv Crt Depth (ft)    * 3.11  * Min El Weir Flow (ft) * 15.44 *
*****

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CULVERT OUTPUT Profile #50 YR Culv Group: Culvert #1

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*****
* Q Culv Group (cfs)      * 312.66 * Culv Full Len (ft)    * 60.22 *
* # Barrels              *      1 * Culv Vel US (ft/s)    * 4.93  *
* Q Barrel (cfs)         * 312.66 * Culv Vel DS (ft/s)    * 4.93  *
* E.G. US. (ft)          * 16.91 * Culv Inv El Up (ft)   * 8.63  *
* W.S. US. (ft)          * 16.88 * Culv Inv El Dn (ft)   * 8.52  *
* E.G. DS (ft)           * 16.38 * Culv Frctn Ls (ft)    * 0.03  *
* W.S. DS (ft)           * 16.32 * Culv Exit Loss (ft)   * 0.31  *
* Delta EG (ft)          * 0.53  * Culv Entr Loss (ft)   * 0.19  *
* Delta WS (ft)          * 0.56  * Q Weir (cfs)          * 1364.70 *
* E.G. IC (ft)           * 13.77 * Weir Sta Lft (ft)     * 99.31  *
* E.G. OC (ft)           * 16.92 * Weir Sta Rgt (ft)     * 648.25 *
* Culvert Control        * Outlet * Weir Submerg         * 0.44  *
* Culv WS Inlet (ft)     * 14.63 * Weir Max Depth (ft)   * 2.40  *
* Culv WS Outlet (ft)    * 14.52 * Weir Avg Depth (ft)   * 0.93  *
* Culv Nml Depth (ft)    *        * Weir Flow Area (sq ft) * 509.91 *
* Culv Crt Depth (ft)    * 2.76  * Min El Weir Flow (ft) * 15.44 *
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CULVERT OUTPUT Profile #100 YR Culv Group: Culvert #1

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*****
* Q Culv Group (cfs)      * 255.13 * Culv Full Len (ft)    * 60.22 *
* # Barrels              *      1 * Culv Vel US (ft/s)    * 4.02  *
* Q Barrel (cfs)         * 255.13 * Culv Vel DS (ft/s)    * 4.02  *
* E.G. US. (ft)          * 17.11 * Culv Inv El Up (ft)   * 8.63  *
* W.S. US. (ft)          * 17.07 * Culv Inv El Dn (ft)   * 8.52  *
* E.G. DS (ft)           * 16.79 * Culv Frctn Ls (ft)    * 0.02  *
* W.S. DS (ft)           * 16.72 * Culv Exit Loss (ft)   * 0.18  *
* Delta EG (ft)          * 0.33  * Culv Entr Loss (ft)   * 0.13  *
* Delta WS (ft)          * 0.35  * Q Weir (cfs)          * 1802.53 *
* E.G. IC (ft)           * 13.19 * Weir Sta Lft (ft)     * 62.30  *

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* E.G. OC (ft)	* 17.12	* Weir Sta Rgt (ft)	* 651.72	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.67	*
* Culv WS Inlet (ft)	* 14.63	* Weir Max Depth (ft)	* 2.60	*
* Culv WS Outlet (ft)	* 14.52	* Weir Avg Depth (ft)	* 1.06	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	* 626.51	*
* Culv Crt Depth (ft)	* 2.41	* Min El Weir Flow (ft)	* 15.44	*

CULVERT OUTPUT Profile #2 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 111.93	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 3.91	*
* Q Barrel (cfs)	* 111.93	* Culv Vel DS (ft/s)	* 4.10	*
* E.G. US. (ft)	* 13.57	* Culv Inv El Up (ft)	* 8.57	*
* W.S. US. (ft)	* 13.51	* Culv Inv El Dn (ft)	* 8.62	*
* E.G. DS (ft)	* 13.28	* Culv Frctn Ls (ft)	* 0.04	*
* W.S. DS (ft)	* 13.16	* Culv Exit Loss (ft)	* 0.14	*
* Delta EG (ft)	* 0.29	* Culv Entr Loss (ft)	* 0.12	*
* Delta WS (ft)	* 0.35	* Q Weir (cfs)	*	*
* E.G. IC (ft)	* 13.06	* Weir Sta Lft (ft)	*	*
* E.G. OC (ft)	* 13.58	* Weir Sta Rgt (ft)	*	*
* Culvert Control	* Outlet	* Weir Submerg	*	*
* Culv WS Inlet (ft)	* 13.23	* Weir Max Depth (ft)	*	*
* Culv WS Outlet (ft)	* 13.16	* Weir Avg Depth (ft)	*	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	*	*
* Culv Crt Depth (ft)	* 1.39	* Min El Weir Flow (ft)	* 15.44	*

CULVERT OUTPUT Profile #5 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 210.61	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 5.48	*
* Q Barrel (cfs)	* 210.61	* Culv Vel DS (ft/s)	* 5.76	*
* E.G. US. (ft)	* 14.72	* Culv Inv El Up (ft)	* 8.57	*
* W.S. US. (ft)	* 14.71	* Culv Inv El Dn (ft)	* 8.62	*
* E.G. DS (ft)	* 14.19	* Culv Frctn Ls (ft)	* 0.06	*
* W.S. DS (ft)	* 13.94	* Culv Exit Loss (ft)	* 0.27	*
* Delta EG (ft)	* 0.54	* Culv Entr Loss (ft)	* 0.23	*
* Delta WS (ft)	* 0.78	* Q Weir (cfs)	*	*
* E.G. IC (ft)	* 14.26	* Weir Sta Lft (ft)	*	*
* E.G. OC (ft)	* 14.74	* Weir Sta Rgt (ft)	*	*
* Culvert Control	* Outlet	* Weir Submerg	*	*
* Culv WS Inlet (ft)	* 14.04	* Weir Max Depth (ft)	*	*
* Culv WS Outlet (ft)	* 13.94	* Weir Avg Depth (ft)	*	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	*	*
* Culv Crt Depth (ft)	* 2.12	* Min El Weir Flow (ft)	* 15.44	*

CULVERT OUTPUT Profile #10 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 289.33	* Culv Full Len (ft)	* 20.32	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 6.46	*
* Q Barrel (cfs)	* 289.33	* Culv Vel DS (ft/s)	* 6.68	*
* E.G. US. (ft)	* 15.61	* Culv Inv El Up (ft)	* 8.57	*
* W.S. US. (ft)	* 15.60	* Culv Inv El Dn (ft)	* 8.62	*
* E.G. DS (ft)	* 14.88	* Culv Frctn Ls (ft)	* 0.09	*
* W.S. DS (ft)	* 14.50	* Culv Exit Loss (ft)	* 0.31	*
* Delta EG (ft)	* 0.73	* Culv Entr Loss (ft)	* 0.32	*
* Delta WS (ft)	* 1.10	* Q Weir (cfs)	* 20.41	*
* E.G. IC (ft)	* 15.10	* Weir Sta Lft (ft)	* 335.33	*
* E.G. OC (ft)	* 15.59	* Weir Sta Rgt (ft)	* 543.89	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 14.57	* Weir Max Depth (ft)	* 1.09	*
* Culv WS Outlet (ft)	* 14.50	* Weir Avg Depth (ft)	* 0.18	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	* 12.96	*
* Culv Crt Depth (ft)	* 2.62	* Min El Weir Flow (ft)	* 15.44	*

CULVERT OUTPUT Profile #25 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 255.76	* Culv Full Len (ft)	* 60.22	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 5.71	*
* Q Barrel (cfs)	* 255.76	* Culv Vel DS (ft/s)	* 5.71	*
* E.G. US. (ft)	* 16.65	* Culv Inv El Up (ft)	* 8.57	*
* W.S. US. (ft)	* 16.63	* Culv Inv El Dn (ft)	* 8.62	*
* E.G. DS (ft)	* 15.87	* Culv Frctn Ls (ft)	* 0.09	*
* W.S. DS (ft)	* 15.80	* Culv Exit Loss (ft)	* 0.44	*
* Delta EG (ft)	* 0.79	* Culv Entr Loss (ft)	* 0.25	*
* Delta WS (ft)	* 0.83	* Q Weir (cfs)	* 893.05	*
* E.G. IC (ft)	* 14.75	* Weir Sta Lft (ft)	* 131.86	*
* E.G. OC (ft)	* 16.64	* Weir Sta Rgt (ft)	* 640.04	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.12	*
* Culv WS Inlet (ft)	* 14.57	* Weir Max Depth (ft)	* 2.14	*
* Culv WS Outlet (ft)	* 14.62	* Weir Avg Depth (ft)	* 0.73	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	* 373.25	*
* Culv Crt Depth (ft)	* 2.42	* Min El Weir Flow (ft)	* 15.44	*

CULVERT OUTPUT Profile #50 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 213.24	* Culv Full Len (ft)	* 60.22	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 4.76	*
* Q Barrel (cfs)	* 213.24	* Culv Vel DS (ft/s)	* 4.76	*
* E.G. US. (ft)	* 16.91	* Culv Inv El Up (ft)	* 8.57	*
* W.S. US. (ft)	* 16.88	* Culv Inv El Dn (ft)	* 8.62	*
* E.G. DS (ft)	* 16.38	* Culv Frctn Ls (ft)	* 0.07	*
* W.S. DS (ft)	* 16.32	* Culv Exit Loss (ft)	* 0.29	*
* Delta EG (ft)	* 0.53	* Culv Entr Loss (ft)	* 0.18	*
* Delta WS (ft)	* 0.56	* Q Weir (cfs)	* 1364.70	*
* E.G. IC (ft)	* 14.29	* Weir Sta Lft (ft)	* 99.31	*

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* E.G. OC (ft) * 16.90 * Weir Sta Rgt (ft) * 648.25 *
* Culvert Control * Outlet * Weir Submerg * 0.44 *
* Culv WS Inlet (ft) * 14.57 * Weir Max Depth (ft) * 2.40 *
* Culv WS Outlet (ft) * 14.62 * Weir Avg Depth (ft) * 0.93 *
* Culv Nml Depth (ft) * * Weir Flow Area (sq ft) * 509.91 *
* Culv Crt Depth (ft) * 2.14 * Min El Weir Flow (ft) * 15.44 *
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CULVERT OUTPUT Profile #100 YR Culv Group: Culvert #2

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*****
* Q Culv Group (cfs) * 173.04 * Culv Full Len (ft) * 60.22 *
* # Barrels * 1 * Culv Vel US (ft/s) * 3.87 *
* Q Barrel (cfs) * 173.04 * Culv Vel DS (ft/s) * 3.87 *
* E.G. US. (ft) * 17.11 * Culv Inv El Up (ft) * 8.57 *
* W.S. US. (ft) * 17.07 * Culv Inv El Dn (ft) * 8.62 *
* E.G. DS (ft) * 16.79 * Culv Frctn Ls (ft) * 0.05 *
* W.S. DS (ft) * 16.72 * Culv Exit Loss (ft) * 0.16 *
* Delta EG (ft) * 0.33 * Culv Entr Loss (ft) * 0.12 *
* Delta WS (ft) * 0.35 * Q Weir (cfs) * 1802.53 *
* E.G. IC (ft) * 13.83 * Weir Sta Lft (ft) * 62.30 *
* E.G. OC (ft) * 17.10 * Weir Sta Rgt (ft) * 651.72 *
* Culvert Control * Outlet * Weir Submerg * 0.67 *
* Culv WS Inlet (ft) * 14.57 * Weir Max Depth (ft) * 2.60 *
* Culv WS Outlet (ft) * 14.62 * Weir Avg Depth (ft) * 1.06 *
* Culv Nml Depth (ft) * * Weir Flow Area (sq ft) * 626.51 *
* Culv Crt Depth (ft) * 1.86 * Min El Weir Flow (ft) * 15.44 *
*****

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CROSS SECTION

RIVER: Mill Swamp
REACH: Main Stem RS: 2973.376

INPUT

Description: XS-26

Station Elevation Data		num=		97							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	21.34	8.18	20.92	8.79	20.14	11.01	19.99	11.58	19.99		
22.54	19.48	36	18.69	60.25	17.5	60.81	17.47	85.29	16.18		
87.42	16.09	87.66	16.05	91.32	16.05	92.77	17.18	94.16	17.9		
96.93	17.95	101.41	17.87	101.8	17.87	109.6	17.73	112.11	15.82		
112.16	15.81	112.25	15.8	115.93	15.71	124.27	15.52	124.91	15.5		
127.39	15.43	147.15	15.02	149.83	14.97	167.32	14.31	171.26	14.19		
172.37	14.16	185.85	13.86	196.88	13.62	199.18	13.58	202.06	13.53		
213.71	13.55	214.59	13.55	219.63	13.4	234.41	13.1	247.91	13.01		
250.88	12.9	253.28	12.9	259.42	12.71	264.4	13.24	267.14	13.17		
273.45	13	280.07	13.04	286.38	11.47	286.46	11.45	286.48	11.45		
288.7	11.47	288.96	11.47	290.13	10.534	291.76	9.23	291.85	9.21		

292.01	9.19	296.88	8.43	296.97	8.41	297.66	8.25	297.68	8.24
300.88	8.41	301.1	8.42	301.13	8.41	301.53	8.34	303.03	8.07
307.53	8.77	309.41	8.96	313.69	10.71	314.92	11.21	315.01	11.31
316.3	11.39	316.68	11.46	333.16	11.86	333.23	11.74	336.49	11.67
341.15	11.55	357.26	12.29	359.22	12.36	360.88	12.4	371.92	12.54
389.51	12.76	405.7	12.87	409.14	12.87	411.31	12.85	425.8	12.87
427.22	12.9	439.77	13.46	440.41	13.58	441.72	13.69	446.35	14.88
459.07	18.14	460.5	18.71	463.04	19.34	472.66	21.06	480.97	21.94
493.66	23.02	501.74	23.09						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	234.41	.08	291.76	.049	313.69	.09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

290.13	313.69	86.89	133.77	160.95	.3	.5
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Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	290.13	14.52	F
322.46	501.74	14.62	F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 2839.603

INPUT

Description: XS-25

Station Elevation Data num= 49

Sta	Elev								
0	17.32	7.71	17.03	24.33	16.52	33.18	16.38	44.86	16.2
46.92	16.14	77.51	14.9	79.08	14.83	82.11	14.71	94.73	14.22
103.08	13.84	111.66	13.1	115.34	12.78	116.99	12.65	117.65	12.19
122.53	8.62	126.15	8.33	126.46	8.3	126.88	8.31	130.2	8.57
135.94	11.64	136.91	12.15	137.23	12.15	148.41	12.12	161.41	12.07
173.96	11.8	186.63	11.44	192.16	11.47	194.43	11.48	207.98	11.85
227.06	12.18	227.94	12.2	229.81	12.3	231.97	12.39	234.41	12.53
255.18	13.5	266.58	14.38	279.55	15.35	288.62	15.56	298.34	15.77
303.19	15.9	322.38	16.65	325.85	16.86	328.08	16.99	342.53	18.2
351.77	18.71	360.73	19.16	363.11	19.24	363.52	19.26		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	82.11	.08	116.99	.049	137.23	.09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

116.99	137.23		160.25	179.37	192.71		.1	.3
Ineffective Flow		num=	2					
Sta L	Sta R	Elev	Permanent					
0	42.39	14.52	F					
200.76	363.52	14.62	F					

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 2660.237

INPUT

Description: XS-24

Station Elevation Data		num=	75						
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	27.37	17.72	26.79	29.42	26.04	53.2	23.96	61.42	22.34
65.65	21.49	80.45	21.06	86.39	20.67	89.35	20.5	94.82	20.14
94.83	20.14	106.94	19.61	107.07	19.61	107.14	19.6	107.22	19.6
115.5	19.04	115.54	19.04	115.58	19.03	129.06	18.03	137.01	17.55
152.49	16.62	152.77	16.6	153.04	16.59	153.13	16.58	153.24	16.58
165.09	15.24	165.18	15.23	165.19	15.23	166.89	15.14	180.59	13.93
198.62	12.99	204.57	12.63	218.29	12.18	222.1	12.06	231.48	11.55
242.24	11.82	248.86	12.11	250.16	10.45	253.52	7.75	255	7.65
256.88	7.4	261.57	7.39	262	7.46	266.34	11.28	266.57	11.44
267.08	11.45	267.21	11.44	270.06	11.33	276.14	11.12	283.89	10.85
285.39	10.14	286.87	9.28	288.39	10.19	290.48	11.28	299.33	11.36
303.92	11.35	306.87	11.28	313.53	11.11	320.74	10.87	335.68	10.72
343.28	10.61	346.09	10.57	352.9	11.05	354.62	11.15	373.13	11.38
379.06	11.55	393.68	12.42	402.61	13.3	417.97	15.8	426.79	16.78
437.83	17.86	451.06	19.33	461.52	20.4	474.43	21.54	475.24	21.6

Manning's n Values		num=	4					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	

0	.03	204.57	.08	248.86	.049	267.21	.09	

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	248.86	267.21		136.68	140.79		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 2519.448

INPUT

Description: XS-23

Station Elevation Data	num=	56
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Sta	Elev								
0	28.23	3.32	28.27	5.91	28.25	7.35	28.23	29.78	27.47
40.74	27.06	54.25	26.25	84.51	24.23	84.63	24.22	109.98	21.86
115.51	21.33	120.22	20.95	127.43	20.29	134.27	19.52	141.89	18.89
152.53	17.68	170.06	15.83	173.73	15.59	179.93	15.27	198.52	14.41
211.35	14.14	222.1	14.07	241.8	12.75	246.48	12.58	250.21	12.41
265.2	11.87	268.86	11.76	278.77	11.46	304.15	10.38	305.23	10.31
305.35	10.26	310.93	7.63	311.07	7.62	314.14	6.87	317.45	6.92
317.47	6.92	319.16	8.24	321.55	10.13	322.03	10.15	322.77	10.16
342.51	10.65	356.05	10.61	371.88	10.75	381.65	11.02	395.64	11.4
396.16	11.41	398.84	11.46	414.61	11.66	425.85	11.75	427.67	11.83
446.19	12.89	454.98	13.48	469.5	14.66	483.25	15.43	500.55	16.78
509.26	17.45								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	152.53	.08	305.23	.049	322.77	.09

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	305.23	322.77		173.72	211.39		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 2308.054

INPUT

Description: XS-22

Station Elevation Data num= 67

Sta	Elev								
0	30.71	7.21	30.56	16.88	30.25	30.65	29.5	48.21	28.68
52.18	28.47	59.38	28.06	78.62	26.86	84.96	26.4	106.31	25.01
109.74	24.73	132.28	23.58	151	22.27	153.07	22.16	155.65	21.97
168.99	19.91	181.86	18.88	190.84	17.51	197.77	16.69	218.89	13.64
229.94	12.54	244.45	10.85	246.1	10.65	253.4	10.66	265.68	10.4
267.19	10.42	274.09	10.43	275.57	10	278.5	9.21	282.97	9.19
286.15	9.02	295.19	9.27	295.67	9.28	296.05	9.33	303.91	10.6
311.14	10.05	312.85	9.81	314.52	7.18	314.73	6.82	315.05	6.76
316.96	6.54	317.11	6.55	318.67	6.61	319.38	7.27	321.61	10.7
322.02	10.71	324.64	10.8	330.15	10.74	336.26	10.65	344.9	10.6
369.27	10.72	376.6	10.73	379.32	10.73	393.48	10.57	393.88	10.56
401.49	10.45	409.15	10.35	419.4	10.77	432.64	11.94	446.77	13.22
451.96	13.9	469.27	17.37	471.99	17.89	472.9	18.01	491.79	21.77
499.98	23.77	507.6	24.66						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
*****	*****	*****	*****	*****	*****
0	.08	312.85	.049	322.02	.09

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	312.85	322.02		188.9	253.19		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 2054.860

INPUT

Description: XS-21

Station Elevation Data	num=	65							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
0	31.3	13.2	30.91	26.68	29.76	35.75	29.18	51.47	27.68
71.46	25.57	85.37	24.08	103.23	22.18	122.75	19.77	141.44	18.16
160.79	17.14	165.4	16.92	169.79	16.64	189.82	15.23	192.92	14.93
207.89	13.65	213.34	13.3	233.94	11.84	237.26	11.61	251.81	10.67
257.66	10.3	273.78	9.54	274.89	9.46	276.02	9.38	282.14	9.1
282.78	9.15	285.09	8.95	286.02	8.57	286.32	8.48	288.35	8.65
288.41	8.66	288.55	8.79	289.31	9.74	289.86	9.75	305.62	10.28
314.93	10.01	323.37	9.75	341.57	9.59	347.93	9.59	349.62	9.57
360.85	9.83	363.61	7.26	365.13	6.82	368.04	6.56	368.23	6.52
373.02	7.16	373.21	7.15	375.79	9.22	375.97	9.45	377.59	9.57
388.31	10.78	388.93	10.85	396.5	11.73	407.42	12.84	422.11	13.4
423.93	13.45	439.63	14.32	441.03	14.38	453.72	15.16	458.54	15.46
460.13	15.65	469.47	16.4	484.36	17.52	513.86	19.58	513.94	19.58

Manning's n Values	num=	3			
Sta	n Val	Sta	n Val	Sta	n Val
*****	*****	*****	*****	*****	*****
0	.09	360.85	.057	375.97	.09

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	360.85	375.97		300.33	236.57		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1818.292

INPUT

Description: XS-20

Station Elevation Data	num=	58							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	25.58	2.96	25.23	13.56	23.55	31.76	21.43	37.54	20.43
47.28	18.8	63.05	16.49	72.8	13.51	78.2	12.51	88.59	11.95
100.16	10.76	109.84	10.12	115.35	9.9	122.93	9.61	137.3	9.29
137.98	9.28	144.54	9.21	149.07	9.22	152.96	6.82	153.66	6.33
154.41	6.05	157.04	5.06	157.85	5.42	160.46	6.63	162.45	7.66
170.04	9.32	171.73	9.31	185.38	9.28	189.06	9.38	201.3	9.49
202.52	9.43	205.52	9.26	211.25	9.16	214.51	8.69	218.23	8.17
221.03	8.54	226.57	8.93	235.99	8.85	245.22	9.63	262.13	10.31
279.75	10.43	287.47	10.83	293.03	11.12	301.88	11.43	319.05	11.95
325.98	12.29	348.5	13.06	360.54	13.49	360.65	13.5	378.24	14.35
384.34	14.6	402.76	15.29	410.99	15.55	417.62	15.77	430.34	16.12
434.82	16.36	449.2	17.05	454.37	17.23				

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 149.07 .057 170.04 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 149.07 170.04 164.68 158.6 102.54 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1659.696

INPUT

Description: XS-19

Station Elevation Data num= 52

Sta	Elev								
0	20.72	15.83	17.87	36.49	14.75	55.66	11.62	61.68	11.35
65.1	11.17	73.52	10.62	94.38	8.85	102.06	8.59	113.67	8.59
125.59	8.11	130.72	8.16	143.11	8.3	159.86	8.45	172.68	8.77
188.66	9.07	190.96	9.08	193.13	8.81	193.18	8.81	200	8.56
203.7	8.41	204.92	7.9	206.37	6.31	207.92	6.14	209.47	5.83
210.71	5.86	213.38	6.31	215.23	7.45	216.48	8.38	233.4	9.11
233.77	9.14	234.55	9.16	237.87	9.27	257.66	9.95	260.18	10.03
265.68	10.2	281.61	10.76	298.9	11.48	303.52	11.61	307.2	11.92
331.76	13.06	334.25	13.18	334.5	13.2	334.77	13.21	356.06	14.5
357.99	14.61	364.51	14.87	381.28	15.79	389.72	16.09	406.05	17.11
411.22	17.41	414.25	17.53						

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 203.7 .057 216.48 .09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
203.7	216.48	73.13	91.69	74.44		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1568.009

INPUT

Description: XS-18

Station Elevation Data		num=		62					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	24.36	6.69	23.36	16.49	21.58	25.82	20.44	36.89	18.94
44.76	17.17	62.87	11.24	72.42	7.87	73.05	7.34	74.74	6.32
75.06	6.33	76.04	6.18	76.61	6.26	77.53	6.24	79.27	7.27
79.51	7.3	81.99	7.55	87.04	7.8	92.25	7.82	96.87	7.83
99.42	7.89	100.5	7.94	108.27	7.76	111.17	7.65	113.26	7.36
113.41	7.31	114.52	6.9	116.4	6.82	119.05	6.4	119.53	6.42
120.69	6.37	121.45	6.38	122.61	6.48	123.71	7.05	125.11	7.76
126.25	7.62	127.35	8.16	137.45	8.59	141.29	8.32	145	8.31
166.17	8.44	169.53	8.46	172.23	8.55	174	8.56	195.59	9.8
209.49	10.25	212.07	10.31	216.2	10.41	225.25	10.75	247.12	11.59
264.17	12.66	264.96	12.7	268.22	12.86	270.27	13.01	291.2	14.68
300.38	15.22	315.98	16.22	330.4	16.9	336.2	17.22	347.12	17.98
357.46	18.59	367.3	19.19						

Manning's n Values		num=		3	
Sta	n Val	Sta	n Val	Sta	n Val

0	.09	113.41	.057	125.11	.09

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
113.41	125.11	37.5	82.54	53.84		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1485.470

INPUT

Description: XS-17

Station Elevation Data		num=		59					
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	24.41	15.58	21.61	22.87	20.72	34.72	18.46	39.92	17.72
59.87	10.04	68.48	6.91	68.72	6.7	70.4	6.45	70.86	6.34
70.9	6.33	73.61	5.66	73.62	5.67	74.74	5.84	76.25	6.09

76.29	6.12	79.71	7.73	80.12	7.73	80.4	7.74	83.6	7.93
84.22	7.94	87.92	8.05	100.65	8.11	108.74	8.15	117.97	8.15
128.47	8.11	141.76	8.08	149.57	8.29	153.68	8.3	157.97	8.29
168.76	8.08	169.55	8.09	172.52	6.3	172.57	6.26	173.04	6.21
173.39	6.17	174.45	6.24	174.67	6.26	177.16	7.3	177.66	7.83
188.28	8.5	191.74	8.54	209.57	8.67	212.61	8.8	225.71	9.44
229.88	9.61	232.12	9.7	239.08	9.93	267.03	11.53	268.65	11.61
272.63	11.83	275.77	12.06	292.22	14.25	309.08	15.79	321.6	16.85
345.43	19.08	346.3	19.17	352.09	19.65	352.63	19.69		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 169.55 .057 177.66 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 169.55 177.66 83.15 60.24 103.32 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1425.227

INPUT

Description: XS-16

Station Elevation Data num= 61

Sta	Elev								
0	24.49	1.64	24.24	14.74	21.78	22.4	20.13	27.73	19.01
41.75	15.88	48.22	14.75	64.37	12.02	84.66	9.91	89.59	9.22
95.15	8.84	102.79	8.42	114.98	7.68	118.33	7.54	119.76	6.69
126.08	5.68	127.63	5.75	128.39	5.58	129.42	5.76	131.25	6.07
134	7.3	135.62	8.01	137.7	7.96	141.45	7.88	145.07	7.87
152.71	8.12	156.53	8.11	160.21	8.14	171.28	8.07	174.51	8.05
176.05	8.03	176.95	8.02	177.64	8.02	183.7	8.04	185.2	8.04
185.28	7.98	188.28	6.01	189.59	5.91	189.65	5.9	189.75	5.91
190.51	5.92	190.65	6.04	192.73	7.83	193.74	7.87	205.52	8.07
213	8.07	222.81	7.88	236.98	8.54	246.87	9.38	250.71	9.6
261.74	10.24	269.53	10.53	284.16	11.98	293.36	13.34	304.8	14.47
307.63	14.75	312.17	15.34	318.32	16.16	334.89	17.62	346.57	19.37
354.23	20.7								

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 183.7 .057 192.73 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 183.7 192.73 82.01 82.52 50.49 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1342.706

INPUT

Description: XS-15

Station Elevation Data num= 44

Sta	Elev								
0	24.55	27.14	20.28	35.27	19.06	50.09	16.91	57.42	15.84
73.78	12.71	84.08	11.65	102.58	9.3	110.58	8.39	116.15	8.32
127.24	8.16	127.83	8.15	144.17	7.79	154.07	7.75	160.94	7.73
175.09	7.86	179.47	7.93	210.3	7.84	211.7	7.7	215.52	7.5
218.41	7.34	221.99	7.05	222.94	6.14	224.12	5.55	225.85	5.48
226.45	5.18	227.78	5.05	229.71	4.97	232.26	5.97	233.66	7.62
246.72	8.37	251.45	8.57	253.72	8.69	255.47	8.83	257.93	8.91
263.16	9.28	268.97	9.69	281.82	11.5	289.21	12.59	296.45	13.87
316.74	17.3	324.5	18.35	332.66	19.82	348.53	22.33		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.09	221.99	.057	233.66	.09

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	221.99	233.66		50.17	109.26	113.65	.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1233.442

INPUT

Description: XS-14

Station Elevation Data num= 39

Sta	Elev								
0	24.75	24.22	20.89	32.15	19.61	49.29	17.21	59.01	15.22
76.83	11.82	88.14	10.08	105.68	8.01	112.67	7.69	112.69	7.69
134.88	7.11	143.09	6.9	161.07	7.22	168.49	7.57	170.25	7.62
176.49	7.74	177.99	6.28	180.27	5.34	181.49	5.32	182.26	5.39
183.05	5.43	183.76	5.51	188.18	5.98	191.84	6.97	194.99	7.39
207.84	7.66	217.14	7.92	217.92	7.94	219.99	8.18	221.08	8.33
229.92	9.38	238.29	10.37	245.09	11.21	258.91	12.97	263.72	13.55
270.61	14.49	282.88	16.07	284.23	16.23	299.68	18.33		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 176.49 .057 194.99 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 176.49 194.99 72.81 81.12 77 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1152.323

INPUT

Description: XS-13

Station Elevation Data num= 50
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 0 24.21 8.49 23.12 16.53 21.8 30.97 18.88 45.68 15.92
 54.17 14.06 57.41 13.44 85.37 9.93 85.4 9.93 85.42 9.92
 90.41 8.36 93.62 7.8 96.47 7.48 107.21 7.29 112.3 7.2
 121.87 7.03 122.66 7.02 130.41 7.01 146.72 7.05 147.22 7.08
 148.92 7.09 161.38 7.5 167.16 6.71 168.21 6.55 168.85 6.36
 171.96 5.2 173.48 4.97 173.87 4.92 175.19 5.04 175.54 5.06
 178.44 6.65 179.15 7.3 182.69 7.9 186.09 8.19 193.09 8.07
 204.13 8.41 206.03 8.48 206.25 8.49 214.86 9.03 224.53 9.71
 233.53 10.65 237.53 11.07 240.89 11.44 245.91 11.88 264.3 13.42
 277.72 14.47 279.23 14.59 291.42 16.02 302.09 16.86 311.38 17.43

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 168.21 .057 179.15 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 168.21 179.15 54.41 49.21 37.53 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1103.114

INPUT

Description: XS-12

Station Elevation Data num= 74
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 0 31.65 8.06 31.56 11.32 30.78 17.41 29.54 18.29 29.44

23.45	29.13	26.11	28.91	41.67	28.22	47.33	27.96	51.1	27.84
52.47	27.87	59.54	27.93	65.83	27.25	73.9	26.9	79.3	26.62
86.42	25.74	91.09	25.45	102.39	24.54	109.34	23.43	113.92	22.82
116.88	22.62	120.3	22.07	144.77	17.95	147.34	17.7	152.46	17.21
160.18	16.28	160.78	16.22	166.77	15.66	167.58	15.54	183.76	13.29
189	12.52	195.37	11.93	213.24	10.33	222.21	9.63	231.69	8.83
232.71	8.76	251.74	7.47	253.16	7.37	254	7.31	255.21	7.31
275.93	7.12	285.87	6.71	286.1	6.71	288.95	5	289.61	4.83
289.68	4.83	291.54	4.85	291.65	4.85	292.74	4.99	296.67	5.67
296.75	5.74	300.19	6.86	301.55	6.86	301.63	6.87	301.96	6.88
319.99	7.75	320.32	7.76	330.82	8.09	336.39	8.24	344.91	8.47
352.82	8.88	359.08	9.25	378.38	10.88	380.38	11.09	384.56	11.43
407.25	12.78	418.36	13.39	418.65	13.4	435.81	14.93	442.51	15.37
451.05	15.71	461.27	16.36	466	16.58	468.58	16.73		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 286.1 .057 300.19 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 286.1 300.19 57.24 37.26 37.39 .1 .3
 Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 0 247.6 10.3 F
 333.84 468.58 10.3 F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 1065.854

INPUT

Description: XS-11

Station Elevation Data num= 59

Sta	Elev								
0	13.06	3.22	12.89	3.7	12.88	5.57	12.71	21.5	11.86
21.59	11.91	23.38	11.72	43.07	11.07	47.16	10.93	48.58	10.84
54.68	10.75	77.76	10.41	78.41	10.31	78.83	10.25	80	9.2
82.91	9.4	83.72	10.22	84.11	10.36	90.2	10.36	99.55	10.48
107.13	10.55	109.59	10.26	109.98	10.21	110.19	10.2	111.2	10.15
112.48	9.85	116.3	5.7	117.59	4.85	118.81	4.81	119.6	4.71
120.54	4.53	121.5	4.55	123.05	4.55	126.25	8.2	128.4	9.39
128.57	9.48	129.71	9.66	147.62	9.69	153.92	10.3	158.24	10.29
166.07	10.16	166.43	10.15	191.7	10.06	193.68	10.18	195.46	10.28
197.64	10.34	230.77	11.1	232.11	11.17	233.64	11.22	277.5	12.32
277.7	12.33	277.93	12.34	287.93	12.7	308.27	13.44	309.43	13.48
310.79	13.52	341.57	14.57	347.16	14.8	366.19	15.61		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .09 110.19 .057 128.4 .09

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 110.19 128.4 23.66 30.11 20.63 .3 .5
 Ineffective Flow num= 2
 Sta L Sta R Elev Permanent
 0 115 10.3 F
 126 366.19 10.3 F

CULVERT

RIVER: Mill Swamp
 REACH: Main Stem RS: 1052.49

INPUT

Description:
 Distance from Upstream XS = 3.12
 Deck/Roadway Width = 10.5
 Weir Coefficient = 2.6
 Upstream Deck/Roadway Coordinates

num= 7
 Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord Sta Hi Cord Lo Cord

 0 12.84 120.559 11.294 154.72 10.85
 166.406 10.63 195.048 10.38 231.801 11.17
 366.19 15.95

Upstream Bridge Cross Section Data

Station Elevation Data num= 59
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 0 13.06 3.22 12.89 3.7 12.88 5.57 12.71 21.5 11.86
 21.59 11.91 23.38 11.72 43.07 11.07 47.16 10.93 48.58 10.84
 54.68 10.75 77.76 10.41 78.41 10.31 78.83 10.25 80 9.2
 82.91 9.4 83.72 10.22 84.11 10.36 90.2 10.36 99.55 10.48
 107.13 10.55 109.59 10.26 109.98 10.21 110.19 10.2 111.2 10.15
 112.48 9.85 116.3 5.7 117.59 4.85 118.81 4.81 119.6 4.71
 120.54 4.53 121.5 4.55 123.05 4.55 126.25 8.2 128.4 9.39
 128.57 9.48 129.71 9.66 147.62 9.69 153.92 10.3 158.24 10.29
 166.07 10.16 166.43 10.15 191.7 10.06 193.68 10.18 195.46 10.28
 197.64 10.34 230.77 11.1 232.11 11.17 233.64 11.22 277.5 12.32
 277.7 12.33 277.93 12.34 287.93 12.7 308.27 13.44 309.43 13.48
 310.79 13.52 341.57 14.57 347.16 14.8 366.19 15.61

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
*****	*****	*****	*****	*****	*****
0	.09	110.19	.057	128.4	.09

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	110.19	128.4		.3	.5

Ineffective Flow	num=	2	
Sta L	Sta R	Elev	Permanent
0	115	10.3	F
126	366.19	10.3	F

Downstream Deck/Roadway Coordinates

num=	8													
Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
0	17.19				91.98	13.794				182.28	11.382			
221.06	11.168				229.08	10.93				262.81	10.48			
299.63	11.15				442.1	15.772								

Downstream Bridge Cross Section Data

Station Elevation Data	num=	87							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
0	17.55	3.01	17.29	3.98	17.2	5.14	17.1	6.23	17
7.62	16.88	8.49	16.8	10.16	16.65	10.83	16.6	16.02	16.11
16.27	16.09	16.39	16.08	17.36	15.99	19.57	15.75	22.28	15.46
24.61	15.22	26.72	15.01	28.72	14.81	37.53	14.09	38.6	13.99
40.47	13.82	42.07	13.68	43.51	13.55	44.87	13.43	47.57	13.2
48.22	13.15	49.62	13.04	51.03	12.93	53.38	12.75	54.37	12.68
75.4	11.28	75.79	11.27	76.73	11.22	99.52	9.71	106.62	9.49
114.32	9.1	124.14	8.61	128.17	8.45	134.69	8.58	154.32	8.8
162.58	8.37	170.19	8.57	171.68	8.42	174.92	6.07	177.73	4.51
179.55	4	182.28	3.23	183.03	3.12	183.49	3.2	184.98	3.67
187.99	4.91	190.64	6.21	194.72	9.15	194.78	9.15	198.69	9.38
203.4	9.19	205.56	9.19	218.71	8.76	220.48	8.87	227.95	8.91
239.05	8.97	240.67	8.98	263.19	9.06	270.66	9.21	272.26	9.21
288.71	9.65	292.71	9.79	295.61	9.72	305.65	10.23	307.53	10.69
334.08	11.68	340.05	11.83	345.18	12.13	346.04	11.96	352.02	12.11
359.27	12.35	366.33	12.81	371.04	12.98	375.23	13.3	379.25	13.37
387.33	13.85	392.62	13.35	405.72	13.46	406.52	13.48	410.42	13.93
424.61	14.54	442.1	15.46						

Manning's n Values	num=	4					
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
*****	*****	*****	*****	*****	*****	*****	*****
0	.02	19.57	.03	171.68	.057	194.78	.04

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	171.68	194.78		.3	.5

Ineffective Flow	num=	2
------------------	------	---

Sta L	Sta R	Elev	Permanent
0	173.9	10.2	F
192.5	442.1	10.2	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 =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name	Shape	Rise	Span
Culvert #2	Circular	1.5	1.5

FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	11.01	16.65	.011	.011	0	.2	

Upstream Elevation = 9.33
 Centerline Station = 81.39
 Downstream Elevation = 8.9
 Centerline Station = 149.12

Culvert Name	Shape	Rise	Span
Culvert #1	Circular	6	6

FHWA Chart # 1 - Concrete Pipe Culvert
 FHWA Scale # 1 - Square edge entrance with headwall
 Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1	3.12	20.5	.011	.011	0	.5	

Upstream Elevation = 4.3
 Centerline Station = 120.54
 Downstream Elevation = 4.2
 Centerline Station = 183.03

CULVERT OUTPUT Profile #2 YR Culv Group: Culvert #2

 * Q Culv Group (cfs) * 7.81 * Culv Full Len (ft) * *
 * # Barrels * 1 * Culv Vel US (ft/s) * 5.72 *
 * Q Barrel (cfs) * 7.81 * Culv Vel DS (ft/s) * 8.25 *
 * E.G. US. (ft) * 11.11 * Culv Inv El Up (ft) * 9.33 *
 * W.S. US. (ft) * 11.00 * Culv Inv El Dn (ft) * 8.90 *
 * E.G. DS (ft) * 9.18 * Culv Frctn Ls (ft) * 0.17 *

* W.S. DS (ft)	* 8.96	* Culv Exit Loss (ft)	* 1.57	*
* Delta EG (ft)	* 1.93	* Culv Entr Loss (ft)	* 0.17	*
* Delta WS (ft)	* 2.04	* Q Weir (cfs)	* 63.97	*
* E.G. IC (ft)	* 11.09	* Weir Sta Lft (ft)	* 134.65	*
* E.G. OC (ft)	* 11.02	* Weir Sta Rgt (ft)	* 229.05	*
* Culvert Control	* Inlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 10.41	* Weir Max Depth (ft)	* 0.73	*
* Culv WS Outlet (ft)	* 9.69	* Weir Avg Depth (ft)	* 0.39	*
* Culv Nml Depth (ft)	* 0.65	* Weir Flow Area (sq ft)	* 36.73	*
* Culv Crt Depth (ft)	* 1.08	* Min El Weir Flow (ft)	* 10.49	*

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #5 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 10.38	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 5.87	*
* Q Barrel (cfs)	* 10.38	* Culv Vel DS (ft/s)	* 10.00	*
* E.G. US. (ft)	* 11.68	* Culv Inv El Up (ft)	* 9.33	*
* W.S. US. (ft)	* 11.55	* Culv Inv El Dn (ft)	* 8.90	*
* E.G. DS (ft)	* 10.03	* Culv Frctn Ls (ft)	* 0.27	*
* W.S. DS (ft)	* 9.47	* Culv Exit Loss (ft)	* 1.28	*
* Delta EG (ft)	* 1.65	* Culv Entr Loss (ft)	* 0.11	*
* Delta WS (ft)	* 2.08	* Q Weir (cfs)	* 263.12	*
* E.G. IC (ft)	* 11.69	* Weir Sta Lft (ft)	* 89.68	*
* E.G. OC (ft)	* 11.39	* Weir Sta Rgt (ft)	* 246.42	*
* Culvert Control	* Inlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 10.83	* Weir Max Depth (ft)	* 1.31	*
* Culv WS Outlet (ft)	* 9.75	* Weir Avg Depth (ft)	* 0.70	*
* Culv Nml Depth (ft)	* 0.77	* Weir Flow Area (sq ft)	* 109.71	*
* Culv Crt Depth (ft)	* 1.24	* Min El Weir Flow (ft)	* 10.49	*

Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #10 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 11.55	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 6.54	*
* Q Barrel (cfs)	* 11.55	* Culv Vel DS (ft/s)	* 10.73	*
* E.G. US. (ft)	* 12.04	* Culv Inv El Up (ft)	* 9.33	*
* W.S. US. (ft)	* 11.88	* Culv Inv El Dn (ft)	* 8.90	*
* E.G. DS (ft)	* 10.72	* Culv Frctn Ls (ft)	* 0.33	*
* W.S. DS (ft)	* 9.74	* Culv Exit Loss (ft)	* 0.85	*
* Delta EG (ft)	* 1.32	* Culv Entr Loss (ft)	* 0.13	*
* Delta WS (ft)	* 2.13	* Q Weir (cfs)	* 457.03	*
* E.G. IC (ft)	* 12.02	* Weir Sta Lft (ft)	* 62.73	*
* E.G. OC (ft)	* 11.57	* Weir Sta Rgt (ft)	* 256.14	*
* Culvert Control	* Inlet	* Weir Submerg	* 0.00	*

```

* Culv WS Inlet (ft)      * 10.83 * Weir Max Depth (ft)    * 1.66 *
* Culv WS Outlet (ft)    * 9.78 * Weir Avg Depth (ft)    * 0.88 *
* Culv Nml Depth (ft)    * 0.82 * Weir Flow Area (sq ft) * 170.20 *
* Culv Crt Depth (ft)    * 1.30 * Min El Weir Flow (ft)  * 10.49 *
*****

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Note: The flow in the culvert is entirely supercritical.

CULVERT OUTPUT Profile #25 YR Culv Group: Culvert #2

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*****
* Q Culv Group (cfs)      * 16.21 * Culv Full Len (ft)     * 16.65 *
* # Barrels               * 1     * Culv Vel US (ft/s)     * 9.17 *
* Q Barrel (cfs)         * 16.21 * Culv Vel DS (ft/s)     * 9.17 *
* E.G. US. (ft)          * 12.89 * Culv Inv El Up (ft)    * 9.33 *
* W.S. US. (ft)          * 12.63 * Culv Inv El Dn (ft)    * 8.90 *
* E.G. DS (ft)           * 11.18 * Culv Frctn Ls (ft)     * 0.29 *
* W.S. DS (ft)           * 11.03 * Culv Exit Loss (ft)    * 1.16 *
* Delta EG (ft)          * 1.71 * Culv Entr Loss (ft)    * 0.26 *
* Delta WS (ft)          * 1.60 * Q Weir (cfs)           * 1256.40 *
* E.G. IC (ft)           * 13.67 * Weir Sta Lft (ft)      * 2.64 *
* E.G. OC (ft)           * 12.88 * Weir Sta Rgt (ft)      * 281.02 *
* Culvert Control        * Outlet * Weir Submerg           * 0.09 *
* Culv WS Inlet (ft)     * 10.83 * Weir Max Depth (ft)    * 2.54 *
* Culv WS Outlet (ft)    * 10.40 * Weir Avg Depth (ft)    * 1.37 *
* Culv Nml Depth (ft)    * 1.03 * Weir Flow Area (sq ft) * 382.31 *
* Culv Crt Depth (ft)    * 1.50 * Min El Weir Flow (ft)  * 10.49 *
*****

```

Note: Culvert critical depth exceeds the height of the culvert.

Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.

Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded. The outlet answer will be used.

CULVERT OUTPUT Profile #50 YR Culv Group: Culvert #2

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*****
* Q Culv Group (cfs)      * 16.12 * Culv Full Len (ft)     * 16.65 *
* # Barrels               * 1     * Culv Vel US (ft/s)     * 9.12 *
* Q Barrel (cfs)         * 16.12 * Culv Vel DS (ft/s)     * 9.12 *
* E.G. US. (ft)          * 13.23 * Culv Inv El Up (ft)    * 9.33 *
* W.S. US. (ft)          * 12.96 * Culv Inv El Dn (ft)    * 8.90 *
* E.G. DS (ft)           * 11.56 * Culv Frctn Ls (ft)     * 0.28 *
* W.S. DS (ft)           * 11.39 * Culv Exit Loss (ft)    * 1.12 *
* Delta EG (ft)          * 1.67 * Culv Entr Loss (ft)    * 0.26 *
* Delta WS (ft)          * 1.56 * Q Weir (cfs)           * 1626.98 *
* E.G. IC (ft)           * 13.63 * Weir Sta Lft (ft)      * 0.00 *
* E.G. OC (ft)           * 13.23 * Weir Sta Rgt (ft)      * 289.13 *
* Culvert Control        * Outlet * Weir Submerg           * 0.17 *

```

* Culv WS Inlet (ft)	* 10.83	* Weir Max Depth (ft)	* 2.83	*
* Culv WS Outlet (ft)	* 10.40	* Weir Avg Depth (ft)	* 1.61	*
* Culv Nml Depth (ft)	* 1.02	* Weir Flow Area (sq ft)	* 464.31	*
* Culv Crt Depth (ft)	* 1.50	* Min El Weir Flow (ft)	* 10.49	*

Note: Culvert critical depth exceeds the height of the culvert.
 Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
 Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded.
 The outlet answer will be used.

CULVERT OUTPUT Profile #100 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 15.58	* Culv Full Len (ft)	* 16.65	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 8.81	*
* Q Barrel (cfs)	* 15.58	* Culv Vel DS (ft/s)	* 8.81	*
* E.G. US. (ft)	* 13.41	* Culv Inv El Up (ft)	* 9.33	*
* W.S. US. (ft)	* 13.07	* Culv Inv El Dn (ft)	* 8.90	*
* E.G. DS (ft)	* 11.87	* Culv Frctn Ls (ft)	* 0.28	*
* W.S. DS (ft)	* 11.68	* Culv Exit Loss (ft)	* 1.02	*
* Delta EG (ft)	* 1.54	* Culv Entr Loss (ft)	* 0.24	*
* Delta WS (ft)	* 1.39	* Q Weir (cfs)	* 1974.90	*
* E.G. IC (ft)	* 13.41	* Weir Sta Lft (ft)	* 0.00	*
* E.G. OC (ft)	* 13.39	* Weir Sta Rgt (ft)	* 296.01	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.21	*
* Culv WS Inlet (ft)	* 10.83	* Weir Max Depth (ft)	* 3.07	*
* Culv WS Outlet (ft)	* 10.40	* Weir Avg Depth (ft)	* 1.81	*
* Culv Nml Depth (ft)	* 1.00	* Weir Flow Area (sq ft)	* 535.93	*
* Culv Crt Depth (ft)	* 1.50	* Min El Weir Flow (ft)	* 10.49	*

Note: Culvert critical depth exceeds the height of the culvert.
 Note: During the supercritical calculations a hydraulic jump occurred inside of the culvert.
 Note: The culvert inlet is submerged and the culvert flows full over part or all of its length. Therefore, the culvert inlet equations are not valid and the supercritical result has been discarded.
 The outlet answer will be used.

CULVERT OUTPUT Profile #2 YR Culv Group: Culvert #1

* Q Culv Group (cfs)	* 226.53	* Culv Full Len (ft)	* 9.68	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 9.42	*
* Q Barrel (cfs)	* 226.53	* Culv Vel DS (ft/s)	* 9.42	*
* E.G. US. (ft)	* 11.11	* Culv Inv El Up (ft)	* 4.30	*
* W.S. US. (ft)	* 11.00	* Culv Inv El Dn (ft)	* 4.20	*
* E.G. DS (ft)	* 9.18	* Culv Frctn Ls (ft)	* 0.05	*

* W.S. DS (ft)	* 8.96	* Culv Exit Loss (ft)	* 1.15	*
* Delta EG (ft)	* 1.93	* Culv Entr Loss (ft)	* 0.73	*
* Delta WS (ft)	* 2.04	* Q Weir (cfs)	* 63.97	*
* E.G. IC (ft)	* 10.90	* Weir Sta Lft (ft)	* 134.65	*
* E.G. OC (ft)	* 11.11	* Weir Sta Rgt (ft)	* 229.05	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 8.93	* Weir Max Depth (ft)	* 0.73	*
* Culv WS Outlet (ft)	* 8.96	* Weir Avg Depth (ft)	* 0.39	*
* Culv Nml Depth (ft)	* 3.51	* Weir Flow Area (sq ft)	* 36.73	*
* Culv Crt Depth (ft)	* 4.12	* Min El Weir Flow (ft)	* 10.49	*

CULVERT OUTPUT Profile #5 YR Culv Group: Culvert #1

* Q Culv Group (cfs)	* 252.21	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 9.73	*
* Q Barrel (cfs)	* 252.21	* Culv Vel DS (ft/s)	* 9.59	*
* E.G. US. (ft)	* 11.68	* Culv Inv El Up (ft)	* 4.30	*
* W.S. US. (ft)	* 11.55	* Culv Inv El Dn (ft)	* 4.20	*
* E.G. DS (ft)	* 10.03	* Culv Frctn Ls (ft)	* 0.05	*
* W.S. DS (ft)	* 9.47	* Culv Exit Loss (ft)	* 0.87	*
* Delta EG (ft)	* 1.65	* Culv Entr Loss (ft)	* 0.74	*
* Delta WS (ft)	* 2.08	* Q Weir (cfs)	* 263.12	*
* E.G. IC (ft)	* 11.47	* Weir Sta Lft (ft)	* 89.68	*
* E.G. OC (ft)	* 11.68	* Weir Sta Rgt (ft)	* 246.42	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 9.47	* Weir Max Depth (ft)	* 1.31	*
* Culv WS Outlet (ft)	* 9.47	* Weir Avg Depth (ft)	* 0.70	*
* Culv Nml Depth (ft)	* 3.77	* Weir Flow Area (sq ft)	* 109.71	*
* Culv Crt Depth (ft)	* 4.35	* Min El Weir Flow (ft)	* 10.49	*

CULVERT OUTPUT Profile #10 YR Culv Group: Culvert #1

* Q Culv Group (cfs)	* 266.82	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 9.87	*
* Q Barrel (cfs)	* 266.82	* Culv Vel DS (ft/s)	* 9.78	*
* E.G. US. (ft)	* 12.04	* Culv Inv El Up (ft)	* 4.30	*
* W.S. US. (ft)	* 11.88	* Culv Inv El Dn (ft)	* 4.20	*
* E.G. DS (ft)	* 10.72	* Culv Frctn Ls (ft)	* 0.05	*
* W.S. DS (ft)	* 9.74	* Culv Exit Loss (ft)	* 0.51	*
* Delta EG (ft)	* 1.32	* Culv Entr Loss (ft)	* 0.76	*
* Delta WS (ft)	* 2.13	* Q Weir (cfs)	* 457.03	*
* E.G. IC (ft)	* 11.83	* Weir Sta Lft (ft)	* 62.73	*
* E.G. OC (ft)	* 12.04	* Weir Sta Rgt (ft)	* 256.14	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 9.76	* Weir Max Depth (ft)	* 1.66	*
* Culv WS Outlet (ft)	* 9.74	* Weir Avg Depth (ft)	* 0.88	*
* Culv Nml Depth (ft)	* 3.93	* Weir Flow Area (sq ft)	* 170.20	*
* Culv Crt Depth (ft)	* 4.47	* Min El Weir Flow (ft)	* 10.49	*

CULVERT OUTPUT Profile #25 YR Culv Group: Culvert #1

* Q Culv Group (cfs)	* 249.09	* Culv Full Len (ft)	* 20.50	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 8.81	*
* Q Barrel (cfs)	* 249.09	* Culv Vel DS (ft/s)	* 8.81	*
* E.G. US. (ft)	* 12.89	* Culv Inv El Up (ft)	* 4.30	*
* W.S. US. (ft)	* 12.63	* Culv Inv El Dn (ft)	* 4.20	*
* E.G. DS (ft)	* 11.18	* Culv Frctn Ls (ft)	* 0.05	*
* W.S. DS (ft)	* 11.03	* Culv Exit Loss (ft)	* 1.05	*
* Delta EG (ft)	* 1.71	* Culv Entr Loss (ft)	* 0.60	*
* Delta WS (ft)	* 1.60	* Q Weir (cfs)	* 1256.40	*
* E.G. IC (ft)	* 11.40	* Weir Sta Lft (ft)	* 2.64	*
* E.G. OC (ft)	* 12.89	* Weir Sta Rgt (ft)	* 281.02	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.09	*
* Culv WS Inlet (ft)	* 10.30	* Weir Max Depth (ft)	* 2.54	*
* Culv WS Outlet (ft)	* 10.20	* Weir Avg Depth (ft)	* 1.37	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	* 382.31	*
* Culv Crt Depth (ft)	* 4.32	* Min El Weir Flow (ft)	* 10.49	*

CULVERT OUTPUT Profile #50 YR Culv Group: Culvert #1

* Q Culv Group (cfs)	* 247.50	* Culv Full Len (ft)	* 20.50	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 8.75	*
* Q Barrel (cfs)	* 247.50	* Culv Vel DS (ft/s)	* 8.75	*
* E.G. US. (ft)	* 13.23	* Culv Inv El Up (ft)	* 4.30	*
* W.S. US. (ft)	* 12.96	* Culv Inv El Dn (ft)	* 4.20	*
* E.G. DS (ft)	* 11.56	* Culv Frctn Ls (ft)	* 0.05	*
* W.S. DS (ft)	* 11.39	* Culv Exit Loss (ft)	* 1.02	*
* Delta EG (ft)	* 1.67	* Culv Entr Loss (ft)	* 0.60	*
* Delta WS (ft)	* 1.56	* Q Weir (cfs)	* 1626.98	*
* E.G. IC (ft)	* 11.36	* Weir Sta Lft (ft)	* 0.00	*
* E.G. OC (ft)	* 13.23	* Weir Sta Rgt (ft)	* 289.13	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.17	*
* Culv WS Inlet (ft)	* 10.30	* Weir Max Depth (ft)	* 2.83	*
* Culv WS Outlet (ft)	* 10.20	* Weir Avg Depth (ft)	* 1.61	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	* 464.31	*
* Culv Crt Depth (ft)	* 4.31	* Min El Weir Flow (ft)	* 10.49	*

CULVERT OUTPUT Profile #100 YR Culv Group: Culvert #1

* Q Culv Group (cfs)	* 240.23	* Culv Full Len (ft)	* 20.50	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 8.50	*
* Q Barrel (cfs)	* 240.23	* Culv Vel DS (ft/s)	* 8.50	*
* E.G. US. (ft)	* 13.41	* Culv Inv El Up (ft)	* 4.30	*
* W.S. US. (ft)	* 13.07	* Culv Inv El Dn (ft)	* 4.20	*
* E.G. DS (ft)	* 11.87	* Culv Frctn Ls (ft)	* 0.05	*

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* W.S. DS (ft) * 11.68 * Culv Exit Loss (ft) * 0.94 *
* Delta EG (ft) * 1.54 * Culv Entr Loss (ft) * 0.56 *
* Delta WS (ft) * 1.39 * Q Weir (cfs) * 1974.90 *
* E.G. IC (ft) * 11.20 * Weir Sta Lft (ft) * 0.00 *
* E.G. OC (ft) * 13.41 * Weir Sta Rgt (ft) * 296.01 *
* Culvert Control * Outlet * Weir Submerg * 0.21 *
* Culv WS Inlet (ft) * 10.30 * Weir Max Depth (ft) * 3.07 *
* Culv WS Outlet (ft) * 10.20 * Weir Avg Depth (ft) * 1.81 *
* Culv Nml Depth (ft) * * Weir Flow Area (sq ft) * 535.93 *
* Culv Crt Depth (ft) * 4.25 * Min El Weir Flow (ft) * 10.49 *
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CROSS SECTION

RIVER: Mill Swamp
REACH: Main Stem RS: 1035.739

INPUT

Description: XS-10

Station Elevation Data num= 87

Sta	Elev								
0	17.55	3.01	17.29	3.98	17.2	5.14	17.1	6.23	17
7.62	16.88	8.49	16.8	10.16	16.65	10.83	16.6	16.02	16.11
16.27	16.09	16.39	16.08	17.36	15.99	19.57	15.75	22.28	15.46
24.61	15.22	26.72	15.01	28.72	14.81	37.53	14.09	38.6	13.99
40.47	13.82	42.07	13.68	43.51	13.55	44.87	13.43	47.57	13.2
48.22	13.15	49.62	13.04	51.03	12.93	53.38	12.75	54.37	12.68
75.4	11.28	75.79	11.27	76.73	11.22	99.52	9.71	106.62	9.49
114.32	9.1	124.14	8.61	128.17	8.45	134.69	8.58	154.32	8.8
162.58	8.37	170.19	8.57	171.68	8.42	174.92	6.07	177.73	4.51
179.55	4	182.28	3.23	183.03	3.12	183.49	3.2	184.98	3.67
187.99	4.91	190.64	6.21	194.72	9.15	194.78	9.15	198.69	9.38
203.4	9.19	205.56	9.19	218.71	8.76	220.48	8.87	227.95	8.91
239.05	8.97	240.67	8.98	263.19	9.06	270.66	9.21	272.26	9.21
288.71	9.65	292.71	9.79	295.61	9.72	305.65	10.23	307.53	10.69
334.08	11.68	340.05	11.83	345.18	12.13	346.04	11.96	352.02	12.11
359.27	12.35	366.33	12.81	371.04	12.98	375.23	13.3	379.25	13.37
387.33	13.85	392.62	13.35	405.72	13.46	406.52	13.48	410.42	13.93
424.61	14.54	442.1	15.46						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	19.57	.03	171.68	.057	194.78	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
171.68 194.78 57.69 70.98 88.27 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	173.9	10.2	F
192.5	442.1	10.2	F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 964.7622

INPUT

Description: XS-9

Station Elevation Data num= 92

Sta	Elev								
0	18.63	.67	18.59	4.92	18.23	9.59	17.89	21.97	16.91
22.89	16.85	23.42	16.82	24.1	16.77	25.64	16.67	26.77	16.59
27.45	16.52	29.16	16.27	43.29	14.84	51.43	14.14	71.83	12.64
80.06	12.11	95.49	11.25	98.99	11.05	122.28	9.33	124.68	9.13
132.29	8.67	134.67	8.53	156.61	8.13	161.54	8.16	175.92	7.71
184.12	7.46	189.03	7.36	194.57	7.36	195.92	6.27	199.54	4.96
201.94	4.83	204.16	4.65	205.97	4.78	207.64	4.77	210.11	6.4
211.39	7.3	215.56	7.46	225.03	7.88	231.12	7.94	241.75	8.35
242.87	8.42	254.53	9.25	261.65	9.71	273.03	10.39	273.21	10.4
273.25	10.4	273.31	10.41	280.06	10.98	280.11	10.98	281.98	11.24
281.99	11.24	282.04	11.25	282.31	11.26	286.25	11.45	286.83	11.48
288.2	11.57	293.01	11.79	301.05	12.29	301.26	12.3	306.32	12.61
307.91	12.73	307.92	12.73	312.15	12.92	319.54	13.2	330.01	13.99
338.76	14.72	347.88	15.26	347.98	15.27	355.15	15.71	355.19	15.72
355.21	15.72	360.21	16.14	360.26	16.14	360.35	16.15	371.63	16.55
371.7	16.56	371.77	16.56	378.34	16.65	391.57	17.64	391.61	17.64
391.62	17.65	391.65	17.65	393.64	17.81	393.7	17.81	393.79	17.82
397.41	17.98	397.58	17.99	397.62	17.99	411.02	18.26	419.37	18.71
433.21	19.25	433.45	19.26						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	29.16	.03	194.57	.057	211.39	.04

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff	Contr.	Expan.
194.57	211.39	92.1	102.13	96.42		.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	158.47	10.2	F
241.51	433.45	10.2	F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 862.6342

INPUT

Description: XS-8

Station Elevation Data num= 68

Sta	Elev								
0	15.77	.5	15.74	4.72	15.49	12.91	15.05	17.76	14.84
29.72	14.04	34.29	13.76	35.27	13.69	49.17	12.81	56.52	12.28
71.13	11.41	78.73	10.96	95.87	9.99	102.04	9.61	116.64	9.02
117.43	8.99	128.1	8.55	142.12	7.88	154.36	7.23	167.61	7.14
179.84	7.08	184.57	7.12	189.63	7.02	191.38	5.78	193.28	4.45
193.8	4.36	194.11	4.33	194.32	4.36	195.36	4.43	197.75	4.8
198.82	5.02	199.5	5.44	203.33	6.99	209.77	7.02	220.39	7.51
232.45	8.1	233.99	8.19	250.67	9.12	253.57	9.35	260.04	10.07
277.43	11.78	278.84	11.9	280.83	12.17	289.63	12.82	291.02	12.94
294.24	13.22	299.26	13.6	300.76	14	303.15	14.38	305.07	15.51
310.48	15.64	311.9	15.83	313.07	15.89	315.29	15.9	320.68	15.77
328.09	15.79	345.51	16.6	347.89	16.68	350.58	16.79	353.52	16.93
372.95	17.56	373.08	17.56	402.37	19.27	402.44	19.28	402.5	19.28
414.25	20.23	418.48	20.13	427.02	20.5				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	189.63	.057	203.33	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 189.63 203.33 222.22 201.18 192.95 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 661.4513

INPUT

Description: XS-7

Station Elevation Data num= 60

Sta	Elev								
0	15.74	9.11	15.19	16.19	14.83	30.51	14.57	31.54	14.54
32.05	14.52	61.53	12.48	83.34	10.95	87.12	10.64	89.3	10.59
101.51	9.94	119.42	9.05	121.82	8.91	134.58	8.23	141.33	7.91
148.64	7.66	174.65	7.2	201.96	7.4	207.57	7.44	209.44	7.48
210.58	7.49	212.23	7.5	218.8	7.53	221.97	7.55	223.19	7.55
249.17	7.6	253.85	7.09	258.13	6.89	268.1	6.61	280.92	6.42
286.38	6.67	290.76	6.85	297.24	7.03	302.13	7.15	303.02	6.69
305.67	4	306.55	3.88	308.46	3.54	309.53	3.75	310.82	4.02

312.29	4.93	314.86	6.42	324.81	7.42	335.87	8.46	338.87	8.73
348.32	9.59	367.51	11.76	382.88	13.12	393.81	13.53	405.86	13.99
410.37	14.13	420.36	14.88	428.88	15.46	441.06	16.54	447.27	16.85
456.57	17.44	466.08	17.97	466.12	17.98	470.43	17.98	483.24	18.77

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	83.34	.07	302.13	.057	314.86	.04

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	302.13	314.86		152.71	95.55		.1	.3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 565.9014

INPUT

Description: XS-6

Station Elevation Data num= 123

Sta	Elev								
0	30.05	5.31	30.05	10.26	30.04	13.55	30.04	14.19	30.03
21.77	30.02	22.93	30.02	23.66	30.01	25.73	30.01	27.35	30
28.98	30	30.04	29.86	30.45	29.81	33.93	29.33	35.93	29.07
38.04	28.78	41.86	28.28	43.98	28	46.45	27.64	47.29	27.53
50.09	27.12	52.01	26.86	55.38	26.38	56.26	26.26	58.04	26
60.32	25.42	64.67	24.29	65.33	24.11	65.76	23.93	66.37	23.73
68.17	23.05	69.12	22.81	75.34	21.25	84.07	19.05	89.7	17.64
94.98	16.31	95.79	16.11	96.22	16	98.76	15.37	100.34	14.97
100.89	14.83	101.7	14.63	102.62	14.4	103.17	14.26	104.92	13.82
105.22	13.75	106.68	13.38	106.82	13.34	106.93	13.31	107.4	13.2
107.85	13.08	107.86	13.08	108.27	12.98	108.28	12.97	111.06	12.79
128.29	10.69	134.74	10.23	144.13	9.86	153.86	9.74	175.31	9.61
192.47	9.36	215.93	9.08	237.35	9.14	253.33	9.25	276.55	9.07
282.71	9.01	318.92	8.77	319.58	8.76	320.16	8.75	324.08	8.72
360.9	8.41	390.35	8.14	407.09	7.95	426.91	7.72	434.13	7.71
450.74	7.63	458.81	7.55	460.88	7.55	465.8	7.58	492.71	7.72
496.02	7.71	536.88	7.26	554.2	6.65	571.72	6.05	572.83	6.01
580.19	6.27	592.11	6.96	597.77	6.89	598.23	6.89	600.78	5.28
603.33	4.02	605.14	3.83	606.52	3.79	607.72	3.91	609.16	4.08
611.62	5.57	614.04	6.79	614.51	7.03	624.49	8.22	632.71	8.97
632.95	9	652.69	11.69	670.2	14.1	694.04	15.52	696.37	15.9
696.4	15.9	713.71	18.48	713.79	18.49	713.83	18.5	753.8	18.55
753.82	18.55	753.9	18.56	755.7	18.57	756.85	18.6	758.6	18.72
759.34	18.77	762.01	18.95	763.26	19.03	780.19	20.18	784.22	20.38
787.33	20.77	802.87	22.83	802.97	22.85				

Manning's n Values num= 5
 Sta n Val

 0 .1 144.13 .07 597.77 .057 614.04 .08 670.2 .03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 597.77 614.04 182.24 121.92 109.82 .1 .3

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 443.9817

INPUT

Description: XS-5

Station Elevation Data num= 86
 Sta Elev Sta Elev Sta Elev Sta Elev Sta Elev

 0 21.17 .63 21.11 2.85 20.91 3.78 20.83 5.51 20.67
 7 20.54 7.65 20.48 8.87 20.37 9.41 20.32 10.43 20.23
 10.87 20.19 11.75 20.11 12.12 20.08 12.85 20.01 25.21 19.06
 40.18 16.87 42.65 16.48 45.87 15.83 65.68 11.79 78.11 9.77
 79.2 9.56 80.36 9.47 88.25 9.2 92.93 9.09 97.68 4.27
 97.84 4.21 97.86 4.21 103.4 4.06 103.47 4.06 106.03 4.25
 106.2 4.57 113.94 9.69 114.27 9.77 114.86 9.75 127.48 9.61
 141.37 9.37 144.12 9.31 156.75 9.12 160.07 9.07 160.73 9.05
 161.98 9.03 201.44 8.38 222 8.14 241.94 7.89 249.08 7.67
 275.39 7.48 289.46 7.37 310.51 7.29 331.76 7.28 339.57 7.27
 353.01 7.19 384.77 5.92 394.46 5.69 411.75 5.91 413.76 5.92
 416.8 5.94 427.01 5.75 435.68 5.66 436.42 5.15 439.98 3.59
 440.55 3.56 442.02 3.46 442.58 3.53 444.23 3.72 447.5 6.08
 448.81 6.62 453.58 7.43 463.74 9.1 464.77 9.27 476.33 11.2
 490.29 14.73 490.7 14.81 491.06 14.9 508.61 16.51 520.74 17.31
 525.86 17.62 536.8 18.33 549.07 18.61 556.47 18.84 561.13 19
 572.71 19.68 574.22 19.81 592.38 22.26 592.48 22.27 592.49 22.28
 592.61 22.29

Manning's n Values num= 5
 Sta n Val

 0 .04 144.12 .07 435.68 .057 448.81 .08 490.29 .03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 435.68 448.81 62.43 163.34 166.14 .1 .3

Ineffective Flow num= 1
 Sta L Sta R Elev Permanent
 0 113.94 9.69 F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 280.6386

INPUT

Description: XS-4

Station Elevation Data num= 75

Sta	Elev								
0	20.24	7.78	19.89	21.08	19.62	32.57	18.51	37.33	17.11
61.32	14.14	66.37	13.37	67.05	13.28	70.55	12.87	85.06	10.5
95.98	9.01	98.37	8.86	99.12	8.23	99.3	8.09	102.94	1.87
103.27	1.9	107.21	2.28	107.49	2.3	109.94	3.18	113.2	4.98
118.05	9.31	138.88	8.43	141.43	8.37	162.14	8.03	184.62	7.74
185.48	7.73	188.34	7.68	227.51	7.3	239.1	7.26	242.46	7.24
245.36	7.22	265.27	7.21	279.59	7.21	280.37	7.2	313.72	6.68
326.67	6.57	348.06	5.99	361.38	6.38	381.02	6.31	384.07	6.41
387.37	6.39	397.64	6.56	401.79	6.65	411.64	6.6	411.96	6.59
417.56	6.73	418.36	6.73	422.87	4.97	424.89	4.18	425.05	4.06
426.57	3.79	429.33	3.18	429.47	3.16	431.46	2.41	431.61	2.43
432.83	2.31	433.21	2.68	436.56	6.69	440.86	6.9	452.91	7.58
455.74	7.76	470.93	8.41	473.49	8.52	477.86	8.7	479.87	8.84
496.83	10.51	511.23	12.32	517.15	13.18	525.66	14.2	536.08	15.42
545.96	16.58	561.25	18.49	570.68	19.84	572.67	19.92	579.31	20.31

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	138.88	.07	418.36	.057	436.56	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 418.36 436.56 67.17 86.61 107.09 .1 .3

Ineffective Flow num= 1
 Sta L Sta R Elev Permanent
 0 118.05 9.31 F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 194.0256

INPUT

Description: XS-3

Station Elevation Data num= 110

Sta	Elev								
0	21.23	.85	21.22	1.43	21.21	1.47	21.21	2.67	21.19
3.26	21.18	3.56	21.18	4.43	21.15	4.96	21.13	6.1	21.1

6.61	21.08	7.7	21.05	8.57	21.04	30.06	20.29	44.8	20.13
49.99	20.02	56.47	18.84	64.04	16.78	73.72	15.65	98.42	12.43
101.45	12.13	111.7	10.56	117.01	9.87	117.43	9.85	128.53	9.1
131.73	6.15	132.48	5.52	134.12	2.45	135.27	2.54	137.04	2.72
137.81	2.76	138.92	3.19	146.96	7.96	148.27	9.24	155.21	8.93
163.6	8.71	176.42	8.7	197.66	8.73	210.58	8.64	237.09	7.87
257.09	7.43	267.98	7.29	283.75	6.87	293.61	6.68	304.4	6.47
324.11	6.15	343.84	6.04	372.45	6.08	380.02	6.09	380.18	6.09
382.76	6.11	387.48	6.17	416.11	6.29	424.27	6.15	436.59	5.99
442.3	5.65	451.83	5.68	455.17	5.91	455.76	5.55	458.61	4.51
460.45	3.52	460.94	3.29	463.88	2.69	464.22	2.55	464.57	2.53
466.95	2.4	469.59	5.14	470.24	6.42	473.92	6.38	479.61	6.43
490.16	6.71	498.85	6.91	518.11	7.56	518.94	7.58	532.86	8.03
556.74	9.23	570.14	9.62	575.84	9.96	582.51	10.58	593.24	11.93
597.56	12.28	597.58	12.28	597.7	12.29	597.73	12.29	597.85	12.3
597.95	12.31	597.99	12.31	598.82	12.38	598.96	12.39	599.07	12.4
599.17	12.4	599.25	12.41	599.53	12.43	600.21	12.49	606.35	12.98
606.39	12.98	606.87	13.02	607.19	13.04	607.38	13.06	607.7	13.09
608.02	13.11	608.29	13.13	608.36	13.14	608.48	13.17	609.88	13.48
613.31	14.34	613.65	14.36	619.83	14.68	620.9	14.73	630.54	15.3

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	163.6	.07	455.17	.057	470.24	.08	593.24	.02

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	455.17	470.24		33.45	60.49		.1	.3
Ineffective Flow	num=		1					
Sta L	Sta R	Elev	Permanent					
0	148.27	9.24	F					

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 133.5329

INPUT

Description: XS-2

Station Elevation Data num= 114

Sta	Elev								
0	20.54	.84	20.53	7.49	20.25	15.87	19.19	26.44	17.15
41.29	15.22	67.45	12.24	78.7	11.76	96.02	10.55	96.97	10.47
99.36	10.36	116.12	9.49	118.82	9.32	119.32	9.31	119.9	9.28
137.15	8.49	139.86	8.61	144.23	8.83	146.3	8.55	148.36	6.96
154.06	5.24	156.17	4.28	156.7	4.12	156.77	4.08	158.36	3.28
159.67	3.18	159.71	3.14	160.37	3.11	160.4	3.11	164.18	9.1
164.32	9.26	164.73	9.25	180.67	8.37	196.33	7.96	209.3	7.56

232.31	7.08	242.64	6.89	245.54	6.84	250.92	6.69	291.49	5.97
293.15	5.94	295.33	5.93	296.28	5.93	297.82	5.92	330.2	5.66
337.96	5.91	342.52	5.98	346.41	3.48	347.15	3.19	347.63	3.09
348.11	3.02	354.47	2.65	358.27	2.23	359.64	2.15	362.55	4.61
364.68	6.08	370.5	6.3	378.01	6.06	383.32	6.1	397.68	6.12
399.51	6.13	412.74	6.28	418.28	6.35	424.75	6.45	440.29	6.63
445.74	6.8	453.64	7.03	459.06	7.2	468.07	7.47	472	7.45
485.03	7.59	487.05	7.61	487.31	7.61	487.59	7.65	498.03	8.76
504.91	9.26	505.21	9.28	505.28	9.29	505.57	9.31	505.6	9.31
506.57	9.39	506.69	9.39	506.77	9.4	506.85	9.41	508.05	9.5
512.18	10.02	512.83	10.09	513.1	10.12	513.91	10.2	514.17	10.23
515.16	10.33	515.4	10.35	516.56	10.46	516.78	10.48	526	11.49
526.3	11.5	527.36	11.56	528.43	11.61	534.61	11.99	537.57	11.99
538.41	12	538.96	12	550.53	13.46	554.68	14	555.89	14.14
556.67	14.23	562.89	14.94	565.55	15.24	569.63	15.7	570.36	15.79
572.25	16	574.69	16.21	575.23	16.25	577.84	16.47		

Manning's n Values num= 5

Sta	n	Val	Sta	n	Val	Sta	n	Val	Sta	n	Val
0	.04	158.36	.07	342.52	.057	364.68	.08	498.03	.03		

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	342.52	364.68		102.93	109.15	103.73		.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	164.18	9.1	F

CROSS SECTION

RIVER: Mill Swamp
 REACH: Main Stem RS: 24.38062

INPUT

Description: XS-1

Station Elevation Data num= 192

Sta	Elev								
0	21.46	.46	21.41	.95	21.4	1.47	21.38	3.1	21.21
3.79	21.19	4.56	21.15	5.42	21.11	6.4	21.06	7.9	20.91
9.09	20.84	10.47	20.74	12.1	20.62	14.12	20.46	16.76	20.24
19.35	20	19.97	19.88	20.15	19.85	20.48	19.79	23.3	19.24
24.97	18.94	26.45	17.32	27.61	16.29	29.66	15.98	31.6	15.68
33.97	15.32	36.26	14.97	37.97	14.71	38.71	14.59	45.1	13.71
45.95	13.58	46.38	13.51	47.03	13.41	49.22	13.07	50.57	12.87
51.93	12.66	53.86	12.36	54.5	12.26	56.91	11.89	57.08	11.86
58.73	11.6	59.22	11.53	60.56	11.32	61.56	11.17	62.47	11.03
63.96	10.79	64.47	10.72	66.45	10.41	66.58	10.39	67.32	10.28
68.37	10.11	68.59	10.08	69.91	9.87	70.48	9.79	71.42	9.64

72.32	9.5	73.68	9.29	74.12	9.22	75.16	9.06	81.12	8.25
86.22	7.71	93.39	7.57	93.53	7.83	93.96	7.84	94.21	7.84
95.3	7.86	96.25	7.87	97.09	7.88	97.83	7.9	98.51	7.91
99.12	7.92	99.68	7.92	103.49	7.98	104.31	8	109.93	8.14
115.71	8.02	128.57	8.57	130.23	8.68	130.38	8.69	130.97	8.68
131.15	8.41	132.84	6.51	136.21	3.07	137.2	3.12	137.27	3.12
138.29	3.21	144.92	7.77	145.11	7.86	145.15	7.88	145.18	7.89
145.21	7.91	145.23	7.91	145.45	8.02	145.55	8.07	165.68	8.5
165.98	8.51	166.13	8.51	167.52	8.55	167.6	8.55	168.27	8.52
188.57	7.82	201.29	7.74	204.82	7.76	207.55	7.72	230.05	7.32
232.05	7.33	234.68	7.35	239.93	7.55	243.74	6.82	246.3	6.45
251.21	7.29	252.58	7.5	258.76	7.43	268.39	7.13	275.6	7.09
297.44	6.08	297.76	6.07	311.89	5.65	314.13	3.14	314.4	3.02
315.46	2.52	315.48	2.52	315.55	2.49	316.26	2.3	316.27	2.29
316.53	2.22	320.8	1.51	325.33	2.18	325.59	2.22	325.62	2.23
325.65	2.23	325.74	2.25	325.84	2.26	325.88	2.27	326.29	2.34
326.32	2.35	326.52	2.52	326.67	2.64	326.78	2.73	326.86	2.8
326.92	2.85	326.97	2.89	327.01	2.93	327.04	2.95	327.06	2.98
327.08	2.99	327.1	3	327.18	3.08	329.69	5.63	331.38	5.58
340.45	5.81	355.39	5.35	364.31	5.31	381.62	5.69	384.52	5.73
389.57	5.81	398.18	5.84	399.18	5.85	413.53	6.36	416.66	6
417.45	6.08	425.05	6.7	425.75	6.77	425.86	6.77	434.35	7.13
434.95	7.17	435.09	7.18	435.24	7.18	435.38	7.19	435.62	7.2
439.16	7.61	439.4	7.64	440.59	7.75	440.76	7.77	442.55	7.93
442.6	7.94	443.31	8	446.14	8	447.8	8.09	448.29	8.11
453.3	8.37	455.78	8.5	459.38	8.69	465.03	8.98	467.2	9.1
479.65	9.74	484.81	10	504.16	11.5	510.51	12	521.89	12.99
533.46	14	542.07	14.7						

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	165.98	.07	311.89	.057	329.69	.08	425.05	.03

Bank Sta:	Left	Right	Coeff	Contr.	Expan.
	311.89	329.69		.1	.3
Ineffective Flow			num=	1	
Sta L	Sta R	Elev	Permanent		
0	144.83	7.71	F		

CROSS SECTION

RIVER: UNT
 REACH: UNT RS: 1871.760

INPUT

Description: XS-12A

Station Elevation Data	num=	164			
Sta	Elev	Sta	Elev	Sta	Elev

0	34.75	2.39	34.67	4.52	34.59	8.56	34.45	9.98	34.4
13.97	34.27	14.79	34.24	22.13	34	22.72	34	23.09	33.99
23.72	33.99	23.88	33.98	28.06	33.77	29.21	33.71	29.55	33.7
29.94	33.68	31.15	33.61	31.66	33.59	32.25	33.57	34.19	33.47
39.37	33.19	42.19	33.03	44.09	32.92	48.18	32.69	54.58	32.31
59.76	32	71.59	30.37	74.21	30	81.37	28.82	86.8	28
88.14	27.72	89.3	27.48	92.54	26.82	96.37	26	97.14	25.67
100.68	24	103.52	23.33	105.27	23.03	107.08	22.64	110.23	22.18
110.53	22.12	111.5	22	119.74	22	124.79	21.99	150.54	21.47
150.82	21.47	165.82	21.27	166.16	21.27	171.85	21.19	172.81	21.18
173.81	21.17	181.62	21.05	182.34	21.04	183.42	21.02	184.17	21.01
185.24	20.99	186.02	20.98	187.06	20.96	187.86	20.95	188.86	20.93
189.65	20.92	195.5	20.79	196.3	20.79	213.16	20.58	214.61	20.58
227.73	20.5	255.1	20.23	270.51	20	330.15	20	330.82	19.91
331.29	19.57	331.4	19.49	332.17	19.49	335.89	19.47	336.02	19.47
343.63	19.81	344.3	19.83	344.46	19.83	344.64	19.84	344.84	19.84
345.05	19.85	345.28	19.85	345.55	19.86	345.86	19.87	346.23	19.88
349.01	19.96	349.93	19.99	350.96	20.02	352.13	20.05	353.43	20.09
354.81	20.13	356.17	20.17	357.36	20.2	357.91	20.22	358.79	20.24
365.06	20.42	365.61	20.44	366.08	20.45	368.09	20.51	368.8	20.53
368.89	20.53	372.23	20.62	390.2	21.04	396.93	21.3	397.92	21.32
407.26	21.52	420.4	21.7	428.7	21.62	451.03	21.41	451.94	21.4
465.66	21.31	471.31	21.01	472.74	18.52	478.82	15.22	480.59	15.21
482.39	14.73	484.65	14.82	486.88	15.59	494.79	19.45	495.27	19.84
495.96	19.89	496.57	19.94	498.69	20.07	523.57	20.9	531.85	21.15
532.52	21.16	537.53	21.22	541.92	21.24	567	21.31	568.89	21.37
596.9	22.07	602.77	22.35	630.03	23.93	636.11	24.1	667.12	25.36
668.09	25.39	670.16	25.48	690.74	26.23	712.53	26.9	717.71	27.04
718.4	27.06	726.75	27.69	727.53	27.71	727.77	27.72	728.02	27.73
728.5	27.75	728.74	27.75	728.97	27.76	729.14	27.77	733.78	27.97
734.46	27.97	734.8	27.98	737.05	27.98	740.28	27.99	740.73	27.99
741.01	28	743.32	28	767.79	28.93	769.28	28.98	770.95	29.04
772.8	29.11	774.89	29.18	777.25	29.27	779.28	29.34		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	59.76	.08	471.31	.053	495.96	.08

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	471.31	495.96		53.92	55.5		.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	398.55	21.24	F
527.18	779.28	21.55	F

CROSS SECTION

RIVER: UNT
REACH: UNT

RS: 1816.260

INPUT

Description: XS-11A

Station Elevation Data

num= 276

Sta	Elev								
0	26.54	.8	26.52	1.13	26.5	2.5	26.46	3.94	26.43
4.22	26.41	5.72	26.38	5.96	26.36	7.54	26.33	9.18	26.3
9.38	26.29	11.08	26.26	15.18	26.02	17.97	26.02	19.45	26.01
25.79	26.01	27.46	26	29.15	26	30.66	25.99	31.26	25.99
33	25.97	34.51	25.96	35.82	25.95	37.44	25.93	38.73	25.92
39.81	25.91	40.73	25.9	41.52	25.89	45.21	25.88	46.16	25.87
46.99	25.86	52.24	25.79	52.74	25.79	53.16	25.78	53.81	25.78
54.06	25.77	54.69	25.77	69.57	24.54	69.98	24.52	70.95	24.48
71.29	24.46	71.59	24.44	72.73	24.4	72.98	24.39	74.3	24.35
74.5	24.33	75.97	24.3	76.14	24.29	76.28	24.28	77.85	24.25
81.04	24.04	82.36	24.04	83.77	24.03	89.98	24.03	91.63	24.02
93.3	24.02	93.66	24	120.34	24	122.55	24.01	129.17	24.01
130.09	24.02	130.55	24.02	131.25	24.03	132.42	24.05	133	24.05
134.53	24.06	136.05	24.06	138.91	24.03	140.36	24.03	144.08	24.01
144.49	24.01	144.82	24	145.4	24	157.78	22.5	158.56	22.45
159.53	22.4	162.22	22.18	162.37	22.18	163.26	22.15	163.38	22.15
163.5	22.14	164.56	22.12	164.65	22.12	165.89	22.1	165.96	22.1
167.35	22.08	167.41	22.08	168.93	22.07	170.57	22.06	170.61	22.05
172.33	22.05	172.36	22.04	174.13	22.04	175.95	22.03	175.96	22.03
177.79	22.02	178.12	22	188.57	22	190.16	21.99	206.7	21.99
206.81	21.61	206.91	21.64	206.96	21.66	207.37	21.8	213.66	21.72
214.31	21.71	229.71	21.45	239.9	21.29	254.51	21.09	268.8	20.76
278.9	20.58	306.58	19.86	311.52	19.76	316.07	19.68	344.53	19.59
354.58	19.33	370.29	19.07	372.05	19.07	375.22	19.08	397.94	19.02
406.21	19.03	428.26	18.84	447.47	18.75	450.85	18.67	473.33	18.36
478.18	18.28	478.73	18.27	478.95	18.27	480.57	18.22	498.89	17.92
500.47	17.93	511.32	17.73	524.35	17.88	528.42	17.91	556.54	17.3
560.06	17.16	579.13	16.66	582.62	16.61	582.82	16.6	583.26	16.57
584.51	16.57	590.87	16.48	614.8	16.17	619.09	16.21	620.68	16.31
626.85	16.16	646.57	15.76	649.89	16	651.74	15.7	657.73	15.65
661.62	15.63	663.08	15.62	663.67	15.4	664.08	15.14	666.48	14.86
670.22	14.41	670.62	14.46	672.02	14.26	672.07	14.27	675.64	15.12
675.69	15.13	675.77	15.41	678.03	16.76	678.36	17.16	680.59	17.06
680.65	17.07	680.73	17.08	682.04	17.24	687.47	18.38	689.09	18.62
689.86	18.67	698.02	18.86	698.22	18.87	698.28	18.87	704.97	18.41
706.04	18.34	706.19	18.33	707.51	18.41	707.62	18.41	708.88	18.46
710.41	18.72	713.94	18.83	723.42	18.84	723.9	18.83	727.89	19.04
730.25	19.27	740.63	19.91	748.51	20.48	751.19	20.67	751.46	20.69
776.77	21.54	793.31	21.71	794.59	21.75	798.06	21.9	806.08	21.94
819.86	22.43	825.18	22.61	848.54	22.65	848.95	22.65	849.01	22.67
850.28	22.67	854.82	22.82	855.44	22.98	856.59	24.32	858.91	24.37
870.03	24.58	872.96	24.56	876.67	24.69	886.19	24.7	887.3	23.96

890.93	24.08	894.41	24.32	901.83	25.02	910.16	25.42	917.98	25.69
919.17	25.75	919.26	25.75	921.97	25.88	922.27	25.89	937.22	26.59
941.5	26.7	941.69	26.71	942.06	26.72	945.52	26.22	945.76	26.25
945.89	26.23	947.37	26.04	947.71	26.07	947.77	26.07	948.64	25.97
949.18	26.72	950.54	26.75	950.93	26.78	952.22	26.8	952.64	26.83
953.85	26.85	954.31	26.89	955.44	26.91	956.51	26.93	956.99	26.97
957.98	26.99	958.51	27.03	959.39	27.04	959.98	27.09	960.75	27.1
961.41	27.12	962.02	27.16	962.7	27.21	963.2	27.22	963.91	27.27
964.27	27.28	965.03	27.33	965.82	27.38	966.65	27.43	966.85	27.44
967.68	27.5	968.55	27.56	969.47	27.63	970.47	27.7	971.58	27.78
973.32	27.98	973.85	27.99	974.47	28	981.03	28	997.33	28.64
998.89	28.68	999.62	28.72	1001.06	28.76	1002.38	28.79	1003.17	28.84
1004.34	28.87	1005.22	28.93	1006.22	28.96	1007.22	29.02	1008.37	29.08
1008.99	29.11								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	159.53	.08	661.62	.053	704.97	.08

Bank Sta:	Left	Right	Lengths:	Left	Channel	Right	Coeff	Contr.	Expan.
	661.62	704.97		73.64	64.84	70.41		.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	657.09	21.24	F
695.25	1008.99	21.55	F

CULVERT

RIVER: UNT
 REACH: UNT RS: 1785.496

INPUT

Description:
 Distance from Upstream XS = 3.151
 Deck/Roadway Width = 44.03
 Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates

num=	4	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
		159.6		22.356			670.62		22.6387			687.37		22.5582		
		1007.22		29.139												

Upstream Bridge Cross Section Data

Station	Elevation	Data	num=	276	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	26.54		.8	26.52	1.13	26.5	2.5	26.46	3.94	26.43		

4.22	26.41	5.72	26.38	5.96	26.36	7.54	26.33	9.18	26.3
9.38	26.29	11.08	26.26	15.18	26.02	17.97	26.02	19.45	26.01
25.79	26.01	27.46	26	29.15	26	30.66	25.99	31.26	25.99
33	25.97	34.51	25.96	35.82	25.95	37.44	25.93	38.73	25.92
39.81	25.91	40.73	25.9	41.52	25.89	45.21	25.88	46.16	25.87
46.99	25.86	52.24	25.79	52.74	25.79	53.16	25.78	53.81	25.78
54.06	25.77	54.69	25.77	69.57	24.54	69.98	24.52	70.95	24.48
71.29	24.46	71.59	24.44	72.73	24.4	72.98	24.39	74.3	24.35
74.5	24.33	75.97	24.3	76.14	24.29	76.28	24.28	77.85	24.25
81.04	24.04	82.36	24.04	83.77	24.03	89.98	24.03	91.63	24.02
93.3	24.02	93.66	24	120.34	24	122.55	24.01	129.17	24.01
130.09	24.02	130.55	24.02	131.25	24.03	132.42	24.05	133	24.05
134.53	24.06	136.05	24.06	138.91	24.03	140.36	24.03	144.08	24.01
144.49	24.01	144.82	24	145.4	24	157.78	22.5	158.56	22.45
159.53	22.4	162.22	22.18	162.37	22.18	163.26	22.15	163.38	22.15
163.5	22.14	164.56	22.12	164.65	22.12	165.89	22.1	165.96	22.1
167.35	22.08	167.41	22.08	168.93	22.07	170.57	22.06	170.61	22.05
172.33	22.05	172.36	22.04	174.13	22.04	175.95	22.03	175.96	22.03
177.79	22.02	178.12	22	188.57	22	190.16	21.99	206.7	21.99
206.81	21.61	206.91	21.64	206.96	21.66	207.37	21.8	213.66	21.72
214.31	21.71	229.71	21.45	239.9	21.29	254.51	21.09	268.8	20.76
278.9	20.58	306.58	19.86	311.52	19.76	316.07	19.68	344.53	19.59
354.58	19.33	370.29	19.07	372.05	19.07	375.22	19.08	397.94	19.02
406.21	19.03	428.26	18.84	447.47	18.75	450.85	18.67	473.33	18.36
478.18	18.28	478.73	18.27	478.95	18.27	480.57	18.22	498.89	17.92
500.47	17.93	511.32	17.73	524.35	17.88	528.42	17.91	556.54	17.3
560.06	17.16	579.13	16.66	582.62	16.61	582.82	16.6	583.26	16.57
584.51	16.57	590.87	16.48	614.8	16.17	619.09	16.21	620.68	16.31
626.85	16.16	646.57	15.76	649.89	16	651.74	15.7	657.73	15.65
661.62	15.63	663.08	15.62	663.67	15.4	664.08	15.14	666.48	14.86
670.22	14.41	670.62	14.46	672.02	14.26	672.07	14.27	675.64	15.12
675.69	15.13	675.77	15.41	678.03	16.76	678.36	17.16	680.59	17.06
680.65	17.07	680.73	17.08	682.04	17.24	687.47	18.38	689.09	18.62
689.86	18.67	698.02	18.86	698.22	18.87	698.28	18.87	704.97	18.41
706.04	18.34	706.19	18.33	707.51	18.41	707.62	18.41	708.88	18.46
710.41	18.72	713.94	18.83	723.42	18.84	723.9	18.83	727.89	19.04
730.25	19.27	740.63	19.91	748.51	20.48	751.19	20.67	751.46	20.69
776.77	21.54	793.31	21.71	794.59	21.75	798.06	21.9	806.08	21.94
819.86	22.43	825.18	22.61	848.54	22.65	848.95	22.65	849.01	22.67
850.28	22.67	854.82	22.82	855.44	22.98	856.59	24.32	858.91	24.37
870.03	24.58	872.96	24.56	876.67	24.69	886.19	24.7	887.3	23.96
890.93	24.08	894.41	24.32	901.83	25.02	910.16	25.42	917.98	25.69
919.17	25.75	919.26	25.75	921.97	25.88	922.27	25.89	937.22	26.59
941.5	26.7	941.69	26.71	942.06	26.72	945.52	26.22	945.76	26.25
945.89	26.23	947.37	26.04	947.71	26.07	947.77	26.07	948.64	25.97
949.18	26.72	950.54	26.75	950.93	26.78	952.22	26.8	952.64	26.83
953.85	26.85	954.31	26.89	955.44	26.91	956.51	26.93	956.99	26.97
957.98	26.99	958.51	27.03	959.39	27.04	959.98	27.09	960.75	27.1
961.41	27.12	962.02	27.16	962.7	27.21	963.2	27.22	963.91	27.27
964.27	27.28	965.03	27.33	965.82	27.38	966.65	27.43	966.85	27.44

967.68	27.5	968.55	27.56	969.47	27.63	970.47	27.7	971.58	27.78
973.32	27.98	973.85	27.99	974.47	28	981.03	28	997.33	28.64
998.89	28.68	999.62	28.72	1001.06	28.76	1002.38	28.79	1003.17	28.84
1004.34	28.87	1005.22	28.93	1006.22	28.96	1007.22	29.02	1008.37	29.08
1008.99	29.11								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	159.53	.08	661.62	.053	704.97	.08

Bank Sta: Left Right Coeff Contr. Expan.

661.62	704.97		.3	.5
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Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	657.09	21.24	F
695.25	1008.99	21.55	F

Downstream Deck/Roadway Coordinates num= 4

Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord	Sta	Hi	Cord	Lo	Cord
173	22.424				654.1	22.1853				678.15	22.3921			
1012.35	28.695													

Downstream Bridge Cross Section Data Station Elevation Data num= 290

Sta	Elev								
0	26.33	5.71	26.01	5.85	26	5.98	26.01	6.32	26
17.49	26	19.71	25.99	20.6	25.99	24.65	25.82	24.87	25.82
25.1	25.8	25.37	25.79	38.11	25.37	39.54	25.34	40.19	25.31
41.54	25.28	42.25	25.25	43.51	25.22	44.27	25.18	45.44	25.16
46.24	25.12	47.31	25.1	48.29	25.07	49.13	25.04	50.02	25.02
50.84	25	51.6	24.98	52.45	24.95	53.16	24.94	53.83	24.92
54.49	24.91	55.36	24.88	55.99	24.87	63.2	24.51	63.59	24.5
63.97	24.5	64.36	24.49	64.74	24.48	65.12	24.48	65.5	24.47
71.47	24.01	71.88	24.01	72.36	24	75.06	24	75.23	23.99
85.79	23.99	99.52	23.63	101.05	23.62	101.34	23.61	102.85	23.61
104.34	23.6	104.65	23.59	106.12	23.58	106.45	23.57	107.91	23.56
109.35	23.56	109.7	23.55	111.12	23.54	111.48	23.54	112.9	23.53
114.31	23.52	114.67	23.52	116.07	23.51	116.45	23.5	117.83	23.5
118.21	23.49	119.58	23.48	120.93	23.48	121.32	23.47	122.66	23.46
123.04	23.46	124.37	23.45	124.75	23.45	126.06	23.44	126.43	23.44
127.73	23.43	128.09	23.43	129.37	23.42	129.71	23.42	130.97	23.41
131.3	23.41	132.54	23.4	132.84	23.41	134.05	23.39	134.33	23.4
135.51	23.38	135.77	23.39	137.13	23.41	138.33	23.4	140.15	23.4
141.35	23.39	141.77	23.38	142.22	23.38	143.37	23.37	143.84	23.36
144.94	23.35	145.42	23.35	146.47	23.34	146.96	23.34	147.96	23.33
148.47	23.33	149.41	23.32	149.93	23.31	156.66	23.07	157.44	23.06

158.17	23.05	158.86	23.04	159.5	23.03	167.57	22.56	167.96	22.55
168.34	22.53	168.7	22.51	169.04	22.5	169.37	22.48	169.99	22.45
170.29	22.44	170.57	22.42	171.38	22.38	172.2	22.35	172.7	22.34
173.2	22.32	174.17	22.29	174.39	22.28	175.54	22.25	175.73	22.24
177.04	22.2	177.2	22.2	178.64	22.16	178.76	22.16	180.31	22.12
180.4	22.12	182.03	22.09	182.09	22.09	183.8	22.06	185.58	22.04
185.61	22.04	187.44	22.01	187.45	22.01	188.75	22	224.62	22
225.31	19.62	225.72	19.6	232.52	19.56	241.05	19.51	241.37	19.51
242.61	19.5	243.3	19.5	245.21	19.49	245.31	19.49	255.5	19.29
271.17	19.33	276.59	19.4	297.84	19.51	308.19	19.37	326.86	19.35
355.33	19.31	360.64	19.32	376.97	19.07	388.89	19.16	393.37	18.37
397.26	18.03	401	19.23	402.87	19.19	426.27	19.39	436.69	19.62
439.32	19.63	465.42	19.79	467.19	19.81	467.39	19.8	494.69	20.27
501.22	19.97	517.4	20.03	528.77	20.21	536.13	20.06	549.1	19.94
568.82	20.05	571.56	20.08	572.81	20.09	579.2	20.18	582.9	20.28
588.86	20.36	596.93	20.53	601.14	20.64	604.52	20.72	605.39	20.72
611.31	20.87	611.46	20.89	613	20.94	615.17	21	629.7	21.23
634.43	21.28	635.23	21.27	636.32	21.18	642.13	20.49	642.41	20.47
642.43	20.47	645.98	19.41	646.09	19.37	646.1	19.37	646.82	18.08
647.29	17.22	647.34	17.2	647.42	17.18	648.88	16.71	651.07	16.51
653.14	16.34	653.29	16.33	656.6	15.85	658.01	15.63	658.67	15.54
659.73	15.39	662.01	15.32	662.02	15.32	663.29	15.22	663.49	15.51
663.5	15.51	667.52	17.05	667.54	17.08	667.6	17.22	672.74	17.36
672.85	17.34	672.87	17.35	672.98	17.38	674.67	17.7	675.64	17.91
675.9	17.97	680.96	19.12	681.02	19.13	681.05	19.14	681.11	19.15
681.66	19.29	682.22	19.4	682.27	19.41	682.81	19.53	682.83	19.53
682.85	19.54	682.86	19.54	683.18	19.6	683.28	19.61	688.05	20.19
710.77	21.56	712.91	21.53	715.51	21.62	716.96	21.65	718.63	21.7
726	21.78	728.4	21.79	731.45	21.8	742.43	21.97	751.77	22.05
759.64	22.03	770.56	22.18	776.55	22.28	777.03	22.3	777.54	22.31
785.44	22.42	786.55	22.44	787.6	22.47	795.46	22.73	796.29	22.75
804.4	22.95	813.07	23.2	813.47	23.21	813.85	23.23	822.45	23.49
822.68	23.5	831.7	23.72	832.17	23.71	832.25	23.71	847.32	23.97
853.58	24.15	867.82	24.55	868.82	24.6	869.12	24.62	871.26	24.67
893.94	25.31	897.08	25.38	899.57	25.45	917.79	25.93	929.48	26.31
937.05	26.53	942.69	26.75	949.98	26.94	952.95	27.02	968.78	27.43
986.42	27.88	995.5	28.15	1012.33	28.65	1025.42	29.05	1033.63	29.31

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	42.25	.08	646.82	.053	675.9	.08	726	.02

Bank Sta: Left	Right	Coeff	Contr.	Expan.
646.82	675.9		.3	.5
Ineffective Flow	num=	2		
Sta L	Sta R	Elev	Permanent	
0	646.93	21.47	F	
676.83	1033.63	21.5	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 =
 Energy head used in spillway design =
 Spillway height used in design =
 Weir crest shape = Broad Crested

Number of Culverts = 2

Culvert Name Shape Rise Span
 Culvert #1 Box 6 10.5
 FHWA Chart # 8 - flared wingwalls
 FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 1
 3.151 58.05 .011 .014 .87 .4
 1
 Upstream Elevation = 15.24
 Centerline Station = 671.52
 Downstream Elevation = 15.47
 Centerline Station = 658.67

Culvert Name Shape Rise Span
 Culvert #2 Box 6 10.5
 FHWA Chart # 8 - flared wingwalls
 FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 1
 3.151 58.05 .011 .014 1.44 .4
 1
 Upstream Elevation = 15.55
 Centerline Station = 682.54
 Downstream Elevation = 15.5
 Centerline Station = 671.88

CULVERT OUTPUT Profile #2 YR Culv Group: Culvert #1

 * Q Culv Group (cfs) * 182.32 * Culv Full Len (ft) * *
 * # Barrels * 1 * Culv Vel US (ft/s) * 5.05 *
 * Q Barrel (cfs) * 182.32 * Culv Vel DS (ft/s) * 5.72 *
 * E.G. US. (ft) * 20.09 * Culv Inv El Up (ft) * 15.24 *
 * W.S. US. (ft) * 20.00 * Culv Inv El Dn (ft) * 15.47 *
 * E.G. DS (ft) * 19.60 * Culv Frctn Ls (ft) * 0.06 *
 * W.S. DS (ft) * 19.38 * Culv Exit Loss (ft) * 0.29 *
 * Delta EG (ft) * 0.50 * Culv Entr Loss (ft) * 0.16 *
 * Delta WS (ft) * 0.63 * Q Weir (cfs) * *
 * E.G. IC (ft) * 19.48 * Weir Sta Lft (ft) * *

```

* E.G. OC (ft) * 20.10 * Weir Sta Rgt (ft) * *
* Culvert Control * Outlet * Weir Submerg * *
* Culv WS Inlet (ft) * 19.55 * Weir Max Depth (ft) * *
* Culv WS Outlet (ft) * 19.38 * Weir Avg Depth (ft) * *
* Culv Nml Depth (ft) * * * Weir Flow Area (sq ft) * *
* Culv Crt Depth (ft) * 2.11 * Min El Weir Flow (ft) * 22.37 *
*****

```

```

CULVERT OUTPUT Profile #5 YR Culv Group: Culvert #1
*****
* Q Culv Group (cfs) * 440.36 * Culv Full Len (ft) * *
* # Barrels * 1 * Culv Vel US (ft/s) * 8.22 *
* Q Barrel (cfs) * 440.36 * Culv Vel DS (ft/s) * 9.57 *
* E.G. US. (ft) * 22.67 * Culv Inv El Up (ft) * 15.24 *
* W.S. US. (ft) * 22.67 * Culv Inv El Dn (ft) * 15.47 *
* E.G. DS (ft) * 21.55 * Culv Frctn Ls (ft) * 0.12 *
* W.S. DS (ft) * 20.72 * Culv Exit Loss (ft) * 0.59 *
* Delta EG (ft) * 1.12 * Culv Entr Loss (ft) * 0.42 *
* Delta WS (ft) * 1.95 * Q Weir (cfs) * 101.87 *
* E.G. IC (ft) * 22.36 * Weir Sta Lft (ft) * 156.33 *
* E.G. OC (ft) * 22.68 * Weir Sta Rgt (ft) * 693.08 *
* Culvert Control * Outlet * Weir Submerg * 0.00 *
* Culv WS Inlet (ft) * 21.21 * Weir Max Depth (ft) * 0.32 *
* Culv WS Outlet (ft) * 20.72 * Weir Avg Depth (ft) * 0.17 *
* Culv Nml Depth (ft) * * * Weir Flow Area (sq ft) * 93.33 *
* Culv Crt Depth (ft) * 3.80 * Min El Weir Flow (ft) * 22.37 *
*****

```

```

CULVERT OUTPUT Profile #10 YR Culv Group: Culvert #1
*****
* Q Culv Group (cfs) * 420.74 * Culv Full Len (ft) * 58.05 *
* # Barrels * 1 * Culv Vel US (ft/s) * 7.81 *
* Q Barrel (cfs) * 420.74 * Culv Vel DS (ft/s) * 7.81 *
* E.G. US. (ft) * 22.98 * Culv Inv El Up (ft) * 15.24 *
* W.S. US. (ft) * 22.98 * Culv Inv El Dn (ft) * 15.47 *
* E.G. DS (ft) * 22.47 * Culv Frctn Ls (ft) * 0.13 *
* W.S. DS (ft) * 21.20 * Culv Exit Loss (ft) * 0.00 *
* Delta EG (ft) * 0.51 * Culv Entr Loss (ft) * 0.38 *
* Delta WS (ft) * 1.78 * Q Weir (cfs) * 465.74 *
* E.G. IC (ft) * 22.10 * Weir Sta Lft (ft) * 153.81 *
* E.G. OC (ft) * 22.98 * Weir Sta Rgt (ft) * 707.93 *
* Culvert Control * Outlet * Weir Submerg * 0.00 *
* Culv WS Inlet (ft) * 21.24 * Weir Max Depth (ft) * 0.62 *
* Culv WS Outlet (ft) * 21.53 * Weir Avg Depth (ft) * 0.47 *
* Culv Nml Depth (ft) * * * Weir Flow Area (sq ft) * 259.94 *
* Culv Crt Depth (ft) * 3.68 * Min El Weir Flow (ft) * 22.37 *
*****

```

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the

downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the culvert at the downstream end.

CULVERT OUTPUT Profile #25 YR Culv Group: Culvert #1

```
*****
* Q Culv Group (cfs)      * 458.14 * Culv Full Len (ft)    * 58.05 *
* # Barrels              *      1 * Culv Vel US (ft/s)   * 8.51 *
* Q Barrel (cfs)        * 458.14 * Culv Vel DS (ft/s)   * 8.51 *
* E.G. US. (ft)         * 23.25 * Culv Inv El Up (ft)  * 15.24 *
* W.S. US. (ft)         * 23.24 * Culv Inv El Dn (ft)  * 15.47 *
* E.G. DS (ft)          * 21.66 * Culv Frctn Ls (ft)   * 0.14 *
* W.S. DS (ft)          * 21.53 * Culv Exit Loss (ft)  * 1.00 *
* Delta EG (ft)         * 1.59 * Culv Entr Loss (ft)  * 0.45 *
* Delta WS (ft)         * 1.71 * Q Weir (cfs)         * 907.85 *
* E.G. IC (ft)          * 22.63 * Weir Sta Lft (ft)   * 151.62 *
* E.G. OC (ft)          * 23.26 * Weir Sta Rgt (ft)   * 720.80 *
* Culvert Control       * Outlet * Weir Submerg        * 0.00 *
* Culv WS Inlet (ft)    * 21.24 * Weir Max Depth (ft) * 0.89 *
* Culv WS Outlet (ft)   * 21.47 * Weir Avg Depth (ft) * 0.72 *
* Culv Nml Depth (ft)   *      * Weir Flow Area (sq ft) * 408.65 *
* Culv Crt Depth (ft)   * 3.90 * Min El Weir Flow (ft) * 22.37 *
*****
```

CULVERT OUTPUT Profile #50 YR Culv Group: Culvert #1

```
*****
* Q Culv Group (cfs)      * 432.42 * Culv Full Len (ft)    * 58.05 *
* # Barrels              *      1 * Culv Vel US (ft/s)   * 8.03 *
* Q Barrel (cfs)        * 432.42 * Culv Vel DS (ft/s)   * 8.03 *
* E.G. US. (ft)         * 23.47 * Culv Inv El Up (ft)  * 15.24 *
* W.S. US. (ft)         * 23.46 * Culv Inv El Dn (ft)  * 15.47 *
* E.G. DS (ft)          * 22.06 * Culv Frctn Ls (ft)   * 0.12 *
* W.S. DS (ft)          * 21.95 * Culv Exit Loss (ft)  * 0.89 *
* Delta EG (ft)         * 1.41 * Culv Entr Loss (ft)  * 0.40 *
* Delta WS (ft)         * 1.51 * Q Weir (cfs)         * 1396.30 *
* E.G. IC (ft)          * 22.24 * Weir Sta Lft (ft)   * 149.63 *
* E.G. OC (ft)          * 23.48 * Weir Sta Rgt (ft)   * 732.56 *
* Culvert Control       * Outlet * Weir Submerg        * 0.00 *
* Culv WS Inlet (ft)    * 21.24 * Weir Max Depth (ft) * 1.13 *
* Culv WS Outlet (ft)   * 21.47 * Weir Avg Depth (ft) * 0.94 *
* Culv Nml Depth (ft)   *      * Weir Flow Area (sq ft) * 548.09 *
* Culv Crt Depth (ft)   * 3.75 * Min El Weir Flow (ft) * 22.37 *
*****
```

CULVERT OUTPUT Profile #100 YR Culv Group: Culvert #1

```
*****
* Q Culv Group (cfs)      * 403.83 * Culv Full Len (ft)    * 58.05 *
* # Barrels              *      1 * Culv Vel US (ft/s)   * 7.50 *
```

* Q Barrel (cfs)	* 403.83	* Culv Vel DS (ft/s)	* 7.50	*
* E.G. US. (ft)	* 23.72	* Culv Inv El Up (ft)	* 15.24	*
* W.S. US. (ft)	* 23.70	* Culv Inv El Dn (ft)	* 15.47	*
* E.G. DS (ft)	* 22.48	* Culv Frctn Ls (ft)	* 0.12	*
* W.S. DS (ft)	* 22.37	* Culv Exit Loss (ft)	* 0.76	*
* Delta EG (ft)	* 1.23	* Culv Entr Loss (ft)	* 0.35	*
* Delta WS (ft)	* 1.33	* Q Weir (cfs)	* 1920.92	*
* E.G. IC (ft)	* 21.94	* Weir Sta Lft (ft)	* 147.75	*
* E.G. OC (ft)	* 23.72	* Weir Sta Rgt (ft)	* 743.61	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.00	*
* Culv WS Inlet (ft)	* 21.24	* Weir Max Depth (ft)	* 1.36	*
* Culv WS Outlet (ft)	* 21.47	* Weir Avg Depth (ft)	* 1.14	*
* Culv Nml Depth (ft)	*	* Weir Flow Area (sq ft)	* 682.08	*
* Culv Crt Depth (ft)	* 3.58	* Min El Weir Flow (ft)	* 22.37	*

CULVERT OUTPUT Profile #2 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 138.08	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 5.30	*
* Q Barrel (cfs)	* 138.08	* Culv Vel DS (ft/s)	* 5.40	*
* E.G. US. (ft)	* 20.09	* Culv Inv El Up (ft)	* 15.55	*
* W.S. US. (ft)	* 20.00	* Culv Inv El Dn (ft)	* 15.50	*
* E.G. DS (ft)	* 19.60	* Culv Frctn Ls (ft)	* 0.08	*
* W.S. DS (ft)	* 19.38	* Culv Exit Loss (ft)	* 0.23	*
* Delta EG (ft)	* 0.50	* Culv Entr Loss (ft)	* 0.17	*
* Delta WS (ft)	* 0.63	* Q Weir (cfs)	*	*
* E.G. IC (ft)	* 19.78	* Weir Sta Lft (ft)	*	*
* E.G. OC (ft)	* 20.08	* Weir Sta Rgt (ft)	*	*
* Culvert Control	* Outlet	* Weir Submerg	*	*
* Culv WS Inlet (ft)	* 19.47	* Weir Max Depth (ft)	*	*
* Culv WS Outlet (ft)	* 19.38	* Weir Avg Depth (ft)	*	*
* Culv Nml Depth (ft)	* 2.85	* Weir Flow Area (sq ft)	*	*
* Culv Crt Depth (ft)	* 1.75	* Min El Weir Flow (ft)	* 22.37	*

CULVERT OUTPUT Profile #5 YR Culv Group: Culvert #2

* Q Culv Group (cfs)	* 367.47	* Culv Full Len (ft)	*	*
* # Barrels	* 1	* Culv Vel US (ft/s)	* 8.69	*
* Q Barrel (cfs)	* 367.47	* Culv Vel DS (ft/s)	* 9.25	*
* E.G. US. (ft)	* 22.67	* Culv Inv El Up (ft)	* 15.55	*
* W.S. US. (ft)	* 22.67	* Culv Inv El Dn (ft)	* 15.50	*
* E.G. DS (ft)	* 21.55	* Culv Frctn Ls (ft)	* 0.14	*
* W.S. DS (ft)	* 20.72	* Culv Exit Loss (ft)	* 0.50	*
* Delta EG (ft)	* 1.12	* Culv Entr Loss (ft)	* 0.47	*
* Delta WS (ft)	* 1.95	* Q Weir (cfs)	* 101.87	*
* E.G. IC (ft)	* 22.51	* Weir Sta Lft (ft)	* 156.33	*
* E.G. OC (ft)	* 22.66	* Weir Sta Rgt (ft)	* 693.08	*
* Culvert Control	* Outlet	* Weir Submerg	* 0.00	*

```

* Culv WS Inlet (ft)      * 21.02 * Weir Max Depth (ft)    * 0.32 *
* Culv WS Outlet (ft)   * 20.72 * Weir Avg Depth (ft)   * 0.17 *
* Culv Nml Depth (ft)   * 4.56 * Weir Flow Area (sq ft) * 93.33 *
* Culv Crt Depth (ft)   * 3.36 * Min El Weir Flow (ft) * 22.37 *
*****

```

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height of the culvert.

CULVERT OUTPUT Profile #10 YR Culv Group: Culvert #2

```

*****
* Q Culv Group (cfs)     * 370.02 * Culv Full Len (ft)    * 58.05 *
* # Barrels              * 1      * Culv Vel US (ft/s)   * 7.73 *
* Q Barrel (cfs)        * 370.02 * Culv Vel DS (ft/s)   * 7.73 *
* E.G. US. (ft)         * 22.98 * Culv Inv El Up (ft)  * 15.55 *
* W.S. US. (ft)         * 22.98 * Culv Inv El Dn (ft)  * 15.50 *
* E.G. DS (ft)          * 22.47 * Culv Frctn Ls (ft)   * 0.14 *
* W.S. DS (ft)          * 21.20 * Culv Exit Loss (ft)  * 0.00 *
* Delta EG (ft)         * 0.51 * Culv Entr Loss (ft)  * 0.37 *
* Delta WS (ft)         * 1.78 * Q Weir (cfs)         * 465.74 *
* E.G. IC (ft)          * 22.55 * Weir Sta Lft (ft)    * 153.81 *
* E.G. OC (ft)          * 22.98 * Weir Sta Rgt (ft)    * 707.93 *
* Culvert Control       * Outlet * Weir Submerg         * 0.00 *
* Culv WS Inlet (ft)    * 21.55 * Weir Max Depth (ft)  * 0.62 *
* Culv WS Outlet (ft)   * 21.55 * Weir Avg Depth (ft)  * 0.47 *
* Culv Nml Depth (ft)   *      * Weir Flow Area (sq ft) * 259.94 *
* Culv Crt Depth (ft)   * 3.38 * Min El Weir Flow (ft) * 22.37 *
*****

```

Warning: During subcritical analysis, with the exit loss set =1.0, the projected WSEL in culvert has a lower energy than the downstream energy. Most likely, the downstream cross section blocks part of the culvert or the ineffective area is set too far in. Instead of projecting the WSEL, the program did an energy balance to get the WSEL inside the culvert at the downstream end.

CULVERT OUTPUT Profile #25 YR Culv Group: Culvert #2

```

*****
* Q Culv Group (cfs)     * 402.61 * Culv Full Len (ft)    * 58.05 *
* # Barrels              * 1      * Culv Vel US (ft/s)   * 8.41 *
* Q Barrel (cfs)        * 402.61 * Culv Vel DS (ft/s)   * 8.41 *
* E.G. US. (ft)         * 23.25 * Culv Inv El Up (ft)  * 15.55 *
* W.S. US. (ft)         * 23.24 * Culv Inv El Dn (ft)  * 15.50 *
* E.G. DS (ft)          * 21.66 * Culv Frctn Ls (ft)   * 0.18 *
* W.S. DS (ft)          * 21.53 * Culv Exit Loss (ft)  * 0.98 *
* Delta EG (ft)         * 1.59 * Culv Entr Loss (ft)  * 0.44 *
* Delta WS (ft)         * 1.71 * Q Weir (cfs)         * 907.85 *
* E.G. IC (ft)          * 23.10 * Weir Sta Lft (ft)    * 151.62 *

```

```

* E.G. OC (ft) * 23.23 * Weir Sta Rgt (ft) * 720.80 *
* Culvert Control * Outlet * Weir Submerg * 0.00 *
* Culv WS Inlet (ft) * 21.55 * Weir Max Depth (ft) * 0.89 *
* Culv WS Outlet (ft) * 21.50 * Weir Avg Depth (ft) * 0.72 *
* Culv Nml Depth (ft) * * Weir Flow Area (sq ft) * 408.65 *
* Culv Crt Depth (ft) * 3.58 * Min El Weir Flow (ft) * 22.37 *
*****

```

CULVERT OUTPUT Profile #50 YR Culv Group: Culvert #2

```

*****
* Q Culv Group (cfs) * 378.88 * Culv Full Len (ft) * 58.05 *
* # Barrels * 1 * Culv Vel US (ft/s) * 7.91 *
* Q Barrel (cfs) * 378.88 * Culv Vel DS (ft/s) * 7.91 *
* E.G. US. (ft) * 23.47 * Culv Inv El Up (ft) * 15.55 *
* W.S. US. (ft) * 23.46 * Culv Inv El Dn (ft) * 15.50 *
* E.G. DS (ft) * 22.06 * Culv Frctn Ls (ft) * 0.16 *
* W.S. DS (ft) * 21.95 * Culv Exit Loss (ft) * 0.86 *
* Delta EG (ft) * 1.41 * Culv Entr Loss (ft) * 0.39 *
* Delta WS (ft) * 1.51 * Q Weir (cfs) * 1396.30 *
* E.G. IC (ft) * 22.69 * Weir Sta Lft (ft) * 149.63 *
* E.G. OC (ft) * 23.45 * Weir Sta Rgt (ft) * 732.56 *
* Culvert Control * Outlet * Weir Submerg * 0.00 *
* Culv WS Inlet (ft) * 21.55 * Weir Max Depth (ft) * 1.13 *
* Culv WS Outlet (ft) * 21.50 * Weir Avg Depth (ft) * 0.94 *
* Culv Nml Depth (ft) * * Weir Flow Area (sq ft) * 548.09 *
* Culv Crt Depth (ft) * 3.43 * Min El Weir Flow (ft) * 22.37 *
*****

```

CULVERT OUTPUT Profile #100 YR Culv Group: Culvert #2

```

*****
* Q Culv Group (cfs) * 357.55 * Culv Full Len (ft) * 58.05 *
* # Barrels * 1 * Culv Vel US (ft/s) * 7.47 *
* Q Barrel (cfs) * 357.55 * Culv Vel DS (ft/s) * 7.47 *
* E.G. US. (ft) * 23.72 * Culv Inv El Up (ft) * 15.55 *
* W.S. US. (ft) * 23.70 * Culv Inv El Dn (ft) * 15.50 *
* E.G. DS (ft) * 22.48 * Culv Frctn Ls (ft) * 0.13 *
* W.S. DS (ft) * 22.37 * Culv Exit Loss (ft) * 0.76 *
* Delta EG (ft) * 1.23 * Culv Entr Loss (ft) * 0.35 *
* Delta WS (ft) * 1.33 * Q Weir (cfs) * 1920.92 *
* E.G. IC (ft) * 22.36 * Weir Sta Lft (ft) * 147.75 *
* E.G. OC (ft) * 23.72 * Weir Sta Rgt (ft) * 743.61 *
* Culvert Control * Outlet * Weir Submerg * 0.00 *
* Culv WS Inlet (ft) * 21.55 * Weir Max Depth (ft) * 1.36 *
* Culv WS Outlet (ft) * 21.50 * Weir Avg Depth (ft) * 1.14 *
* Culv Nml Depth (ft) * * Weir Flow Area (sq ft) * 682.08 *
* Culv Crt Depth (ft) * 3.30 * Min El Weir Flow (ft) * 22.37 *
*****

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CROSS SECTION

RIVER: UNT
REACH: UNT

RS: 1751.420

INPUT

Description: XS-10A

Station Elevation Data num= 290

Sta	Elev								
0	26.33	5.71	26.01	5.85	26	5.98	26.01	6.32	26
17.49	26	19.71	25.99	20.6	25.99	24.65	25.82	24.87	25.82
25.1	25.8	25.37	25.79	38.11	25.37	39.54	25.34	40.19	25.31
41.54	25.28	42.25	25.25	43.51	25.22	44.27	25.18	45.44	25.16
46.24	25.12	47.31	25.1	48.29	25.07	49.13	25.04	50.02	25.02
50.84	25	51.6	24.98	52.45	24.95	53.16	24.94	53.83	24.92
54.49	24.91	55.36	24.88	55.99	24.87	63.2	24.51	63.59	24.5
63.97	24.5	64.36	24.49	64.74	24.48	65.12	24.48	65.5	24.47
71.47	24.01	71.88	24.01	72.36	24	75.06	24	75.23	23.99
85.79	23.99	99.52	23.63	101.05	23.62	101.34	23.61	102.85	23.61
104.34	23.6	104.65	23.59	106.12	23.58	106.45	23.57	107.91	23.56
109.35	23.56	109.7	23.55	111.12	23.54	111.48	23.54	112.9	23.53
114.31	23.52	114.67	23.52	116.07	23.51	116.45	23.5	117.83	23.5
118.21	23.49	119.58	23.48	120.93	23.48	121.32	23.47	122.66	23.46
123.04	23.46	124.37	23.45	124.75	23.45	126.06	23.44	126.43	23.44
127.73	23.43	128.09	23.43	129.37	23.42	129.71	23.42	130.97	23.41
131.3	23.41	132.54	23.4	132.84	23.41	134.05	23.39	134.33	23.4
135.51	23.38	135.77	23.39	137.13	23.41	138.33	23.4	140.15	23.4
141.35	23.39	141.77	23.38	142.22	23.38	143.37	23.37	143.84	23.36
144.94	23.35	145.42	23.35	146.47	23.34	146.96	23.34	147.96	23.33
148.47	23.33	149.41	23.32	149.93	23.31	156.66	23.07	157.44	23.06
158.17	23.05	158.86	23.04	159.5	23.03	167.57	22.56	167.96	22.55
168.34	22.53	168.7	22.51	169.04	22.5	169.37	22.48	169.99	22.45
170.29	22.44	170.57	22.42	171.38	22.38	172.2	22.35	172.7	22.34
173.2	22.32	174.17	22.29	174.39	22.28	175.54	22.25	175.73	22.24
177.04	22.2	177.2	22.2	178.64	22.16	178.76	22.16	180.31	22.12
180.4	22.12	182.03	22.09	182.09	22.09	183.8	22.06	185.58	22.04
185.61	22.04	187.44	22.01	187.45	22.01	188.75	22	224.62	22
225.31	19.62	225.72	19.6	232.52	19.56	241.05	19.51	241.37	19.51
242.61	19.5	243.3	19.5	245.21	19.49	245.31	19.49	255.5	19.29
271.17	19.33	276.59	19.4	297.84	19.51	308.19	19.37	326.86	19.35
355.33	19.31	360.64	19.32	376.97	19.07	388.89	19.16	393.37	18.37
397.26	18.03	401	19.23	402.87	19.19	426.27	19.39	436.69	19.62
439.32	19.63	465.42	19.79	467.19	19.81	467.39	19.8	494.69	20.27
501.22	19.97	517.4	20.03	528.77	20.21	536.13	20.06	549.1	19.94
568.82	20.05	571.56	20.08	572.81	20.09	579.2	20.18	582.9	20.28
588.86	20.36	596.93	20.53	601.14	20.64	604.52	20.72	605.39	20.72
611.31	20.87	611.46	20.89	613	20.94	615.17	21	629.7	21.23
634.43	21.28	635.23	21.27	636.32	21.18	642.13	20.49	642.41	20.47
642.43	20.47	645.98	19.41	646.09	19.37	646.1	19.37	646.82	18.08
647.29	17.22	647.34	17.2	647.42	17.18	648.88	16.71	651.07	16.51

653.14	16.34	653.29	16.33	656.6	15.85	658.01	15.63	658.67	15.54
659.73	15.39	662.01	15.32	662.02	15.32	663.29	15.22	663.49	15.51
663.5	15.51	667.52	17.05	667.54	17.08	667.6	17.22	672.74	17.36
672.85	17.34	672.87	17.35	672.98	17.38	674.67	17.7	675.64	17.91
675.9	17.97	680.96	19.12	681.02	19.13	681.05	19.14	681.11	19.15
681.66	19.29	682.22	19.4	682.27	19.41	682.81	19.53	682.83	19.53
682.85	19.54	682.86	19.54	683.18	19.6	683.28	19.61	688.05	20.19
710.77	21.56	712.91	21.53	715.51	21.62	716.96	21.65	718.63	21.7
726	21.78	728.4	21.79	731.45	21.8	742.43	21.97	751.77	22.05
759.64	22.03	770.56	22.18	776.55	22.28	777.03	22.3	777.54	22.31
785.44	22.42	786.55	22.44	787.6	22.47	795.46	22.73	796.29	22.75
804.4	22.95	813.07	23.2	813.47	23.21	813.85	23.23	822.45	23.49
822.68	23.5	831.7	23.72	832.17	23.71	832.25	23.71	847.32	23.97
853.58	24.15	867.82	24.55	868.82	24.6	869.12	24.62	871.26	24.67
893.94	25.31	897.08	25.38	899.57	25.45	917.79	25.93	929.48	26.31
937.05	26.53	942.69	26.75	949.98	26.94	952.95	27.02	968.78	27.43
986.42	27.88	995.5	28.15	1012.33	28.65	1025.42	29.05	1033.63	29.31

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.03	42.25	.08	646.82	.053	675.9	.08	726	.02

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	646.82	675.9		137.28	156.67		.3	.5
Ineffective Flow	num=		2					
Sta L	Sta R	Elev	Permanent					
0	646.93	21.47	F					
676.83	1033.63	21.5	F					

CROSS SECTION

RIVER: UNT
 REACH: UNT RS: 1594.725

INPUT
 Description: XS-9A

Station Elevation Data num= 194

Sta	Elev								
0	31.01	4.61	30.76	11.25	30.41	18.97	30	20.63	29.9
20.76	29.89	23.52	29.72	23.85	29.71	26.33	29.57	33.22	29.3
36.39	29.14	38.88	29.02	40.88	28.92	61.33	28	62.01	28
65.98	27.78	66.95	27.72	72.43	27.42	75.02	27.28	79.1	27.05
88.61	26.55	91.72	26.38	94.06	26.28	94.4	26.27	96.98	26.13
97.14	26.12	99.35	26	100.33	25.94	104.38	25.7	105.09	25.66
108.48	25.46	111.08	25.31	113.15	25.19	114.67	25.09	116.35	25
117.74	24.93	119.6	24.8	120.7	24.74	121.64	24.69	123.75	24.55
124.44	24.51	126.9	24.34	127.33	24.32	127.71	24.29	130.32	24.11

130.45	24.1	131.84	24	137.17	23.6	140.83	23.29	147.55	22.75
155.99	22	156.99	22	166.37	21.99	166.81	21.99	169.67	22
169.93	22	188.11	21.64	188.84	21.63	199.94	21.46	219.22	21.2
219.51	21.2	219.84	21.19	220.2	21.19	220.58	21.18	233.37	20.97
247.74	20.79	248.33	20.79	248.95	20.78	249.58	20.78	250.22	20.77
250.86	20.77	251.49	20.76	252.12	20.76	252.75	20.75	267.43	20.43
268.22	20.43	268.6	20.42	270.43	20.42	270.79	20.41	271.82	20.41
278.84	20.25	279.24	20.25	279.44	20.24	288.83	20.01	288.87	20.01
289.06	20	299.78	20	303.01	20.01	304.94	20	310.7	20
313.28	19.99	324.67	19.99	327.79	19.98	328.85	19.98	337.91	19.97
338.56	19.97	386.36	19.53	386.89	19.5	388.1	19.43	390.79	19.38
395.71	19.28	402.97	19.09	403.3	19.08	411.22	19.04	411.63	19.04
412.05	19.03	413.57	19.03	413.81	19.02	414.26	19.01	414.71	19
415.14	18.99	415.56	18.98	415.96	18.97	416.34	18.96	416.69	18.95
416.99	18.95	441.13	18.37	443	18.26	459.34	18.13	470.01	18.07
485.37	18.08	492.66	18.07	497.59	17.9	509.87	17.77	517.92	17.88
530.95	17.85	542.75	17.59	554.78	17.66	567.62	17.72	577.46	17.76
596.66	17.67	597.84	17.67	622.34	18.43	627.21	18.52	649.72	18.89
657.55	19.02	670.75	19.06	671.07	19.06	678.16	19.11	678.76	19.12
683.77	18.27	685.87	17.98	688.53	16.72	692.2	14.3	693.96	14.19
696.91	13.92	700.99	13.87	701.73	13.92	705.08	17.89	705.58	18.24
706.21	18.66	712.23	18.99	727.19	19.62	729.44	19.72	738.57	19.99
752.24	20.62	758.58	20.89	761.89	21.04	768.78	21.2	773.44	21.13
779.16	21.21	802.18	21.4	802.8	21.4	804.44	21.42	827.48	21.62
831.15	21.63	832.74	21.55	836.14	21.62	836.19	21.63	836.25	21.63
928.44	23.44	928.48	23.44	928.54	23.43	929.78	23.32	931.79	23.26
931.84	23.26	933.58	23.19	940.78	23.19	946.13	23.21	954.88	23.35
958.2	23.46	965.4	23.59	984.76	24.03	984.89	24.03	985	24.04
1010.49	24.34	1028	24.89	1035.4	25.11	1048.24	26.11	1058.04	27.21
1066.56	31.25	1070.89	33.09	1080.39	33.5	1087.95	33.62		

Manning's n Values num= 11

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	18.97	.03	140.83	.1	509.87	.04	657.55	.08
678.16	.053	705.58	.08	758.58	.03	832.74	.02	984.76	.03
1048.24	.1								

Bank Sta:	Left	Right	Lengths:	Left Channel	Right	Coeff	Contr.	Expan.
	678.16	712.23		182.32	187.15		.1	.3
Ineffective Flow			num=	2				
Sta L	Sta R	Elev	Permanent					
0	581.58	21.47	F					
761.32	1087.95	21.5	F					

CROSS SECTION

RIVER: UNT

REACH: UNT

RS: 1407.578

INPUT

Description: XS-8A

Station Elevation Data

num= 141

Sta	Elev								
0	31.51	1.12	31.49	2.45	31.47	3.81	31.43	7.71	31.35
9.19	31.31	24.54	30.83	25.96	30.79	27.28	30.75	28.49	30.72
29.58	30.69	30.55	30.66	31.4	30.63	39.33	30.48	48.06	30.01
50.01	30.01	50.9	30	54.35	30	56.82	29.53	57.96	29.32
60.37	28.87	62.7	28.47	63.51	28.32	65.49	28	66.3	27.91
68.64	27.65	69.28	27.58	71.17	27.37	72.58	27.23	73.69	27.12
75.03	26.95	75.92	26.87	76.67	26.8	78.44	26.57	78.97	26.52
79.43	26.48	81.55	26.19	81.73	26.18	81.89	26.16	82.97	26
85.18	25.65	86.34	25.45	89.5	24.94	93.07	24.3	93.72	24.19
94.76	24	98.13	23.49	99.6	23.28	102.38	22.86	105.41	22.43
106.3	22.29	108.32	22	111.23	21.83	111.68	21.81	117.25	21.48
133.98	20.47	136.68	20.31	137.99	20.23	141.59	20.01	142.31	20.01
142.8	20	185.6	20	232.02	19.43	233.21	19.42	248.28	19.26
248.98	19.26	250.21	19.24	260.94	19.13	270.43	19.03	271.11	19.03
271.63	19.02	282.85	18.9	283.49	18.9	292.48	18.8	293.08	18.8
306.68	18.68	307.24	18.68	355.08	17.96	367.22	17.9	372.5	17.85
375.78	17.83	376.17	17.83	383.87	17.81	385.12	17.8	385.97	17.74
387.94	17.76	411.39	17.43	417.67	17.45	436.48	17.33	453.22	17.09
454.04	17.06	459.44	17.01	480.33	16.83	484.81	16.77	503.34	16.79
514.54	16.82	523.73	16.9	525.84	16.91	541.83	17.17	546.84	17.23
568.92	17.76	573.89	17.86	595.54	18.27	598.39	18.3	611.73	18.28
615.7	18.21	633.2	17.69	640.35	15.07	641.87	14.69	642.73	14.61
648.56	14.24	650.21	14.14	651.69	14.03	652.79	14.14	654.2	14.17
657.88	16.29	658.75	18.41	682.86	18.06	685.47	18.02	689.93	17.98
709.12	17.71	710.25	17.71	735.39	17.86	737.91	17.86	739.28	17.89
747.04	18.19	768.22	19.01	782.82	19.67	791.22	20.08	801.47	20.81
814.27	21.58	838.75	23.42	843.62	23.71	860.94	24.71	872.24	25.28
875.15	25.39	886.4	25.84	892.12	26.04	906.77	26.6	909.57	26.76
930.63	27.28								

Manning's n Values

num= 8

Sta	n Val	Sta	n Val						
0	.03	60.37	.1	459.44	.04	598.39	.08	633.2	.053
658.75	.08	682.86	.04	886.4	.1				

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 611.73 658.75 221.8 247.48 236.86 .1 .3

CROSS SECTION

RIVER: UNT

REACH: UNT

RS: 1160.098

INPUT

Description: XS-7A

Station Elevation Data

num= 141

Sta	Elev								
0	36.02	12.29	36.01	25.2	36.01	28.5	36	41.93	36
44.2	35.66	46.7	35.3	49.89	34.83	51.39	34.61	52.28	34.48
52.88	34.4	55.49	34	57.51	33.51	61.29	32.58	62.82	32.2
63.64	32	68.51	30.58	70.52	30	75.76	28.7	78.53	28
80.63	27.78	96.95	26.01	97.38	26.01	97.94	26	98.05	26
108.45	24.24	109.86	24	112.52	23.67	113.02	23.63	113.69	23.57
114.67	23.49	117.53	23.17	122.56	22.66	124.3	22.51	126.59	22.3
129.74	22.01	129.89	22	135.17	21.39	138.06	21.06	140.89	20.71
142.36	20.54	146.69	20	147.71	19.97	166.45	19.34	176.07	19.02
181.96	18.83	185.95	18.7	188.84	18.6	191.04	18.53	192.78	18.47
194.18	18.43	195.93	18.36	196.94	18.33	197.79	18.3	198.5	18.28
199.1	18.26	200.91	18.2	201.31	18.18	206.49	18	322.94	18
333.29	17.4	333.8	17.32	333.92	17.31	334.78	17.19	338.12	16.72
338.43	16.35	342.72	16.35	362.56	16.18	367.76	16.2	389.66	16.13
392.88	16.11	415.66	15.83	418.23	15.82	424.25	15.84	439.38	15.95
445.76	16	460.81	16.17	465.88	15.99	468.36	15.99	486.77	16.03
494.01	16.15	515.34	16.22	520.01	16.21	543.2	16.35	545.56	16.39
554.01	17.16	554.77	17.2	562.31	17.08	562.79	17.07	569.49	16.93
571.56	12.66	572.52	11.59	572.85	11.42	576.27	11.62	576.83	11.55
578.9	12.25	582.53	13.71	584.44	14.44	588.77	12.74	590.88	11.97
591.65	11.94	593.16	12.54	597.62	14.47	599.31	14.78	601	14.91
605.55	15.31	607.3	15.79	609.58	16.53	614.12	17.53	627.02	17.27
628.31	17.26	643.88	16.78	650.35	16.6	664.59	16.5	676.92	16.55
687.63	16.58	704.57	16.69	721.83	16.64	728.65	16.58	737.22	16.5
755.1	16.65	770.42	16.76	794.39	17.13	808.46	17.21	820.2	17.42
831.67	17.68	849.76	18.16	854.8	18.36	867.1	18.89	877.02	19.35
879.61	19.46	896.22	19.68	902.42	19.78	906.03	20.21	908.71	20.71
914.83	21.13	923.48	21.67	933.41	22.48	941.43	22.89	956.79	23.7
963.41	24.08								

Manning's n Values

num= 8

Sta	n Val								
0	.03	41.93	.1	460.81	.04	554.77	.08	569.49	.053
614.12	.08	650.35	.04	879.61	.1				

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 569.49 614.12 136.16 135.82 110.58 .1 .3

CROSS SECTION

RIVER: UNT

REACH: UNT

RS: 1024.274

INPUT

Description: XS-6A

Station Elevation Data

num= 191

Sta	Elev								
0	36	28.77	36	31.54	35.57	33.01	35.31	36.22	34.79
40.12	34.08	40.29	34.05	40.37	34.03	40.54	34	43.69	33.52
45.83	33.21	47.32	33.01	48.98	32.78	50	32.65	52.3	32.34
52.77	32.28	53.1	32.24	54.81	32	55.49	31.84	55.84	31.76
58.2	31.23	59.93	30.86	61.13	30.6	61.77	30.46	64.04	30
64.32	29.93	66.77	29.38	67.86	29.14	69.3	28.82	71.32	28.39
71.82	28.29	72.1	28.23	73.25	28	74.23	27.85	74.43	27.81
76.47	27.5	77.12	27.38	78.66	27.14	79.76	26.95	80.81	26.8
82.32	26.55	82.92	26.46	83.35	26.4	85	26.13	85.12	26.12
85.87	26	86.96	25.95	87	25.95	87.36	25.93	89.66	25.82
91.71	25.73	93.57	25.65	95.03	25.51	96.83	25.43	97.33	25.38
98.94	25.3	100.38	25.24	100.98	25.17	102.26	25.11	103	25.03
104.1	24.98	105	24.89	105.94	24.85	106.79	24.81	107.78	24.71
108.49	24.68	109.64	24.56	110.19	24.54	111.51	24.41	111.91	24.39
113.41	24.25	113.65	24.24	115.34	24.08	115.42	24.07	116.17	24
117.39	23.93	117.42	23.93	119.4	23.82	121.19	23.72	122.79	23.61
124.73	23.49	126.43	23.39	127.91	23.31	129.22	23.23	133.4	22.87
134.73	22.7	135.66	22.64	137.18	22.45	137.76	22.4	139.45	22.19
139.68	22.17	141.01	22	141.11	22	143.68	21.78	146.85	21.55
148.08	21.48	148.72	21.41	149.82	21.35	150.79	21.29	151.57	21.21
152.42	21.16	153.31	21.06	154.35	20.95	155.03	20.9	156.19	20.76
157.55	20.58	158	20.54	159.55	20.33	161.55	20.05	161.59	20.05
161.92	20	167.73	18.56	169.9	18	173.95	18	233.1	17.99
253.94	17.99	268.38	16.83	275.54	16.28	284.99	15.12	293.94	15.58
301.35	15.53	324.5	15.34	332.88	15.35	352.46	15.49	362.87	15.41
375.75	15.07	389.75	15.32	404.26	15.54	419.49	15.49	420.84	15.5
431.6	15.58	439.85	15.53	461.18	15.72	467.07	15.81	490.12	15.81
499.33	15.84	517.46	15.92	521.92	15.88	529.21	16.21	537.39	16.31
548.47	16.43	550.3	14.52	551.43	12.16	555.07	12.2	559.86	12.22
561.39	12.69	565.26	12.52	567.39	12.27	568.28	12.7	571.89	15
572.84	15.29	574.11	16.6	580.38	16.52	582.79	16.56	587.91	16.4
604.39	16.3	607.31	16.32	635.94	16.68	649.23	16.29	655.09	16.22
667.52	16.23	668.26	16.22	683.97	15.89	684.81	15.9	695.4	15.98
705.3	16.05	724.68	16.25	735.08	16.5	757.54	16.63	763.76	16.57
767.19	16.58	784.71	16.66	790.08	16.71	814.34	17.15	816.87	17.2
819.78	17.25	852.03	17.89	852.26	17.93	856.76	18.59	858.81	18.9
862.82	18.95	882.17	19.21	883.59	19.24	896.12	19.64	902.71	19.89
927.26	20.77	931.69	20.92	957.97	21.51	964.14	21.69	988.76	22.81
989.47	22.84								

Manning's n Values

num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	548.47	.054	574.11	.08	635.94	.04	852.03	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 548.47 574.11 244.6 181.4 134.55 .1 .3

CROSS SECTION

RIVER: UNT
 REACH: UNT RS: 842.8703

INPUT

Description: XS-5A

Station Elevation Data num= 201

Sta	Elev								
0	34.29	3.58	34.12	4.55	34.12	4.86	34.13	7.91	34.13
10.6	34.14	10.71	34.14	16.67	34.1	17.88	34.1	18.77	34.09
19.93	34.09	23.02	34.07	24.83	34.07	25.55	34.06	26.71	34.06
28.1	34.05	29.83	34.04	33.29	34.03	35.04	34.02	37.16	34.01
39.77	34	40.72	34	42.31	33.69	42.81	33.59	44.68	33.23
45.95	32.99	47.12	32.76	49.2	32.38	49.64	32.29	51.25	32
52.09	31.76	52.45	31.67	54.26	31.17	55.52	30.86	56.45	30.6
58.54	30.1	58.92	30	61.11	29.5	62.06	29.27	63.66	28.89
65.87	28.34	66.3	28.23	67.23	28	69.34	27.35	71.42	26.7
72.53	26.35	73.62	26	75.53	25.51	76.65	25.23	78.44	24.78
81.19	24.11	81.35	24.07	81.65	24	84.14	23.38	85.46	23.04
86.9	22.68	89.56	22	89.69	21.97	89.77	21.95	92.96	21.2
94.95	20.74	96.14	20.46	98.1	20	99.12	19.87	99.32	19.85
101.84	19.53	102.56	19.44	104.51	19.2	105.72	19.06	107.47	18.86
108.83	18.69	111.26	18.41	111.91	18.33	114.81	18	114.91	18
116.94	17.89	116.96	17.89	117.45	17.87	119.76	17.75	119.83	17.75
119.89	17.74	122.07	17.63	122.17	17.63	124.2	17.52	124.33	17.52
126.22	17.42	126.37	17.41	128.14	17.32	128.31	17.31	128.45	17.31
130.11	17.22	130.31	17.21	142.92	16.67	145.8	16.49	154.19	15.96
158.61	15.77	163.62	15.36	167.95	15.26	168.72	15.24	176.25	15.06
176.38	15.06	176.78	15.05	178.86	15	179.19	14.99	180.79	14.95
181.08	14.94	181.38	14.94	181.69	14.93	182	14.92	182.32	14.91
182.65	14.91	182.99	14.9	183	14.9	197.43	14.63	208.94	14.43
214.69	14.4	231.6	14.21	241.22	14.1	260.91	14.03	263.68	14.04
264.15	13.82	266.45	12.7	267.29	12.67	271.05	12.65	274.84	14.53
275.73	14.75	279.82	14.27	288.29	14.1	304.62	13.79	316.81	14.14
319.59	14.15	321.33	14.12	333.54	13.94	358.71	13.65	362.47	13.61
363.28	13.6	365.02	13.6	384.7	13.76	393.4	13.79	409.89	14.28
431.65	14.31	437.53	14.32	451.92	14.29	463.76	14.33	468.14	14.39
490.34	15.09	496.14	15.3	499.7	15.48	503.7	15.69	506.72	15.73
507.42	14.56	509.03	10.4	509.36	10.27	512.21	10.36	513.35	10.5
516.43	11.42	520.13	11.98	526.02	12.86	535.42	13.38	547.31	15.68
547.39	15.72	547.73	15.73	547.74	15.73	566.74	15.95	578.61	15.9
600.8	15.81	601.64	15.8	603.08	15.81	605.18	15.82	628.42	15.97
631.57	15.99	658.55	15.97	667.05	16.06	669.98	16.06	685.23	16.03

689.82	15.92	701.92	15.68	712.27	15.79	721.07	15.91	732.74	16.11
764.4	16.42	764.59	16.42	764.68	16.43	794.42	16.71	806.87	16.99
822.87	17.36	834.09	17.32	841.3	17.39	845.83	18.07	847	18.34
853.52	18.56	868.63	19.05	874.9	19.17	893.39	19.6	912.95	20.17
915.02	20.29	920.47	20.46	939.45	21.16	954.1	21.65	967.65	22.2
974.22	22.52								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.08	506.72	.054	547.73	.08	712.27	.04	822.87	.1

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

506.72	547.73	151.65	223.25	277.9	.1	.3
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Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	274.84	14.03	F

CROSS SECTION

RIVER: UNT
 REACH: UNT

RS: 619.6199

INPUT

Description: XS-4A

Station Elevation Data num= 292

Sta	Elev								
0	34.71	2.33	34.62	4.17	34.54	8.56	34.42	10.09	34.35
10.24	34.35	11.94	34.27	13.85	34.19	16.01	34.1	16.05	34.1
18.44	34	18.46	34	22.43	33.76	22.94	33.71	26.36	33.5
29.05	33.33	30.21	33.24	32.4	33.1	33.97	32.96	35.66	32.85
37.01	32.77	38.83	32.6	39.77	32.54	41.93	32.35	42.46	32.31
44.96	32.09	45.1	32.08	45.22	32.08	46.07	32	48.27	31.86
48.55	31.84	51.77	31.63	54.38	31.47	55.31	31.4	57.57	31.26
58.87	31.17	60.78	31.06	62.35	30.96	64.01	30.84	65.27	30.76
67.26	30.62	68.19	30.56	70.52	30.39	71.12	30.36	71.61	30.33
74.06	30.15	74.26	30.13	76.03	30	77.42	29.88	80.75	29.58
81.35	29.53	83.95	29.3	84.84	29.22	86.82	29.04	88.32	28.92
89.32	28.83	90.46	28.74	91.37	28.66	92.28	28.59	92.98	28.54
93.81	28.48	94.36	28.44	94.82	28.41	97.8	28.23	98.03	28.21
100.43	28.01	100.65	28.01	101.02	28	101.15	28	101.92	27.9
102.13	27.87	105.01	27.48	106.22	27.29	108.44	26.97	110.99	26.57
114.54	26	119.37	25.34	124.11	24.77	126.86	24.42	127.84	24.29
130.51	24	131.77	23.79	132.11	23.74	134.12	23.41	135.09	23.28
136.55	23.05	137.5	22.9	139.08	22.69	139.71	22.6	141.81	22.32
142.1	22.28	144.21	22	144.73	21.9	144.96	21.84	147.52	21.3
149.17	20.91	150.46	20.62	152.94	20	154.29	19.82	155.08	19.71
158.43	19.23	164.37	18.4	167.05	18	167.46	18	218.72	16.06

220.31	16	221.3	15.99	222.81	15.98	223.21	15.98	223.67	14.69
223.91	14.52	223.92	14.52	223.99	14.51	224.51	14.51	224.78	14.5
225.35	14.5	225.6	14.49	226.79	14.48	227.12	14.47	227.64	14.46
228.03	14.46	228.81	14.45	228.87	14.45	229.18	14.44	230.03	14.43
231.17	14.42	238.25	14.32	256.29	14.07	263.54	14.01	269.15	13.95
283.63	13.74	299.67	13.63	305.06	13.61	313.02	13.57	331.21	13.4
341.23	13.37	355.64	13.64	363.54	13.75	386.28	13.64	387.81	13.65
388.06	13.52	393.39	11.31	393.67	11.32	396.08	11.51	396.43	11.64
398.58	13.03	414.52	13.76	419.45	13.76	433.91	13.78	436.42	13.79
442.37	13.88	457.97	13.69	470.55	13.5	485.36	13.58	500.27	14.12
508.51	14.24	525.51	13.81	529.37	13.76	532.91	13.91	556.69	14.63
577.5	13.79	584.78	13.42	584.8	13.42	588.98	11.03	589.69	10.54
594.6	10.45	595.25	10.44	595.37	10.44	595.46	10.45	595.51	10.45
597.65	10.64	602.83	11.64	603.05	11.65	603.16	11.66	603.19	11.66
603.25	11.67	603.29	11.67	603.91	11.72	603.96	11.72	604.15	11.74
604.24	11.74	604.31	11.75	604.37	11.79	604.4	11.81	604.56	11.9
604.79	12.04	613.46	14.12	613.51	14.14	618.15	14.45	626.12	14.67
645.39	14.55	658.16	14.12	658.22	14.12	658.6	14.1	658.63	14.09
658.66	14.09	658.95	14.07	659.07	14.07	659.36	14.05	659.41	14.05
659.58	14.04	662.3	13.87	675.39	13.07	675.93	13.03	676.46	13
676.96	12.97	677.68	12.93	691.05	12.74	694.29	12.68	698.9	12.69
703.82	12.69	707.89	12.7	713.17	12.7	718.03	12.71	720.48	12.71
729.8	12.72	730.28	12.7	731.46	12.79	758.72	15.21	759.91	15.32
764.06	15.69	769.57	16.18	770.33	16.25	770.9	16.3	771.59	16.36
772.87	16.52	773.48	16.6	774.85	16.78	775.73	16.89	776.91	17.05
777.48	17.12	779.07	17.33	779.32	17.36	780.78	17.55	781.11	17.59
781.15	17.59	782.48	17.77	782.72	17.8	783.86	17.95	784.3	18
785.27	18.13	785.91	18.21	786.72	18.31	787.55	18.42	788.2	18.51
789.24	18.64	789.72	18.7	790.36	18.79	798.94	19.67	803.18	20.02
803.76	20.09	804.08	20.12	805.48	20.27	805.68	20.29	807.28	20.47
807.36	20.48	808.38	20.58	808.99	20.65	809.05	20.66	810.47	20.81
810.68	20.83	811.96	20.97	812.32	21.01	812.74	21.06	813.97	21.19
814.54	21.25	815.62	21.37	816.35	21.45	817.27	21.55	818.15	21.64
818.94	21.73	819.96	21.84	820.61	21.91	821.78	22.03	822.31	22.09
823.62	22.23	824.03	22.28	825.5	22.43	825.8	22.47	827.43	22.64
827.62	22.66	827.78	22.68	829.51	22.87	829.58	22.88	830.91	23.02
831.43	23.08	831.47	23.08	833.31	23.28	833.48	23.3	835.25	23.49
835.56	23.52	836.76	23.65						

Manning's n Values num= 4
 Sta n Val Sta n Val Sta n Val Sta n Val

 0 .04 84.84 .08 584.8 .054 613.46 .08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 584.8 613.46 280.97 242.15 180.93 .1 .3
 Ineffective Flow num= 1
 Sta L Sta R Elev Permanent
 0 414.52 13.76 F

CROSS SECTION

RIVER: UNT
 REACH: UNT

RS: 377.4746

INPUT

Description: XS-3A

Station Elevation Data num= 142

Sta	Elev								
0	19.36	5.71	19.06	6.53	19.03	7.44	19	8.42	18.97
34.55	18.07	36.4	18.01	38.68	18.01	48.59	18	55.95	18
60.05	17.89	60.11	17.89	65.16	17.74	67.37	17.67	69.39	17.61
117.75	16.02	120.16	16.02	123.61	16.01	125.86	16.01	126.81	16
147.22	16	170.42	15.4	225.93	14.13	231.42	14	231.69	13.99
232.14	13.98	232.3	13.98	233.25	13.97	233.74	13.97	234.11	13.96
234.61	13.96	239.94	13.39	241.13	13.31	247.18	12.85	248.07	12.79
249.44	12.71	256.89	12.01	260.4	12.01	260.58	12.02	262.79	12.02
271.39	12.71	272.23	12.76	273.06	12.82	273.87	12.87	282.27	13.58
287.16	13.99	288.7	13.99	289.9	14	295.91	14	300.63	14.01
328.89	14.01	329.5	14.02	330.04	14.02	340.3	14.03	340.47	14.03
359.23	14.01	359.82	14.01	369.29	14	389.44	14	392.25	14
392.75	13.41	393.32	12.74	394.01	12	395.52	11.86	397.72	11.66
398.13	11.61	399.98	11.44	400.67	11.37	402.2	11.22	403.19	11.11
404.41	11	405.39	10.91	406.64	10.76	407.38	10.7	408.93	10.5
409.41	10.46	411.31	10.19	411.5	10.18	412.66	10	418.08	10
419.72	10.68	421.32	11.42	422.57	12	426.72	13.01	430.35	13.89
430.74	14	453.22	14	455.37	14.01	456.73	14.01	468.65	14.17
475.43	14.27	475.77	14.27	476.15	14.28	476.56	14.29	477	14.3
490.37	14.49	514.69	14.82	515.32	14.84	518.08	14.95	521.42	15.11
522.39	15.16	522.87	15.16	523.88	15.21	524.99	15.28	526.21	15.34
527.56	15.42	529.06	15.51	530.74	15.6	532.62	15.71	532.83	15.72
534.86	15.84	537.17	15.98	537.45	16	538.83	16.25	548.51	18
549.91	18.43	555.04	20	555.86	20.21	562.66	22	563.9	22.32
570.45	24	574.74	25.04	578.69	26	586.16	27.39	589.4	28
595.42	28.77	603.45	29.74	605.63	30	611.11	30.97	616.68	32
616.7	32	619.33	32.16	621.65	32.3	623.72	32.41	625.56	32.51
627.2	32.6	632.84	32.78	634.71	32.86	635.8	32.91	637.44	32.98
638.68	33.02	639.32	33.05						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.08	389.44	.054	430.74	.08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 389.44 430.74 201.08 164.42 137.51 .1 .3

Ineffective Flow num= 1
 Sta L Sta R Elev Permanent

0 287.16 13.99 F

CROSS SECTION

RIVER: UNT

REACH: UNT

RS: 213.0526

INPUT

Description: XS-2A

Station Elevation Data num= 214

Sta	Elev								
0	29.39	15.33	28.47	16.15	28.43	18.86	28.27	19.33	28.25
19.73	28.23	22.6	28.06	22.7	28.06	23.66	28	25.3	27.97
26.95	27.94	28.09	27.92	28.9	27.91	29.51	27.9	30.65	27.89
37.4	27.8	48.12	27.69	52.8	27.74	53.21	27.75	57.51	27.74
57.89	27.74	58.23	27.75	71.33	26.02	71.56	26	72.1	25.86
74.6	25.23	78.79	24.18	79.11	24.1	79.52	24	81.17	23.61
85.33	22.66	86.47	22.41	87.02	22.29	88.6	22.04	88.66	22.03
88.69	22.02	88.71	22.02	88.88	22	89.39	21.99	89.55	21.99
90.15	21.98	91.09	21.98	91.67	21.97	93.01	21.96	93.77	21.95
98.42	21.95	99.57	21.94	101.92	21.9	104.2	21.9	105.25	21.89
106.23	21.89	107.11	21.88	107.88	21.88	108.52	21.87	118.32	20.97
119.08	20.88	119.99	20.82	120.92	20.72	121.66	20.66	122.76	20.55
123.31	20.5	124.62	20.37	126.27	20.22	126.5	20.2	128.39	20.04
128.43	20.03	128.85	20	130.05	19.98	131.19	19.97	132.03	19.96
132.66	19.95	134.03	19.95	134.85	19.94	135.51	19.93	136.03	19.92
136.45	19.92	150.45	18.87	151.99	18.76	153.09	18.69	154.97	18.56
155.8	18.51	158.03	18.36	158.56	18.33	161.16	18.16	161.39	18.14
163.57	18	163.79	18	164.55	17.99	165.1	17.98	165.5	17.98
181.26	17.21	184.1	17.06	187.03	16.93	190.99	16.72	193	16.63
198.22	16.36	199.22	16.31	205.11	16	218.18	15.02	229.5	14.21
230.94	14.11	232.46	14	261.91	12.9	285.53	12	286.86	11.99
290.47	11.99	291.53	12	294.57	12.01	306.05	12.01	307.47	12
312.43	12	312.72	11.99	312.91	11.99	315.52	11.96	316.36	11.95
318.11	11.92	319.19	11.91	320.69	11.89	321.65	11.87	322.1	11.86
323.38	11.84	326.91	11.91	331.27	12	352.03	13.01	372.15	14
407.05	14	407.3	14	407.49	13.93	407.63	13.88	410.51	12.81
411.91	12.39	412.37	12.24	412.55	12.18	413.33	12	417.5	12
424.78	11.99	426.77	11.99	433.1	12	436	12	441.05	12.59
452.86	14	458.97	14	472.28	14	484.85	13.99	489.71	13.99
494.26	13.98	497.72	13.98	502.69	13.99	514.92	13.99	516.51	14
524.32	14	524.75	14.01	529.09	14.35	531.36	14.5	532.23	14.58
534.2	14.72	535.48	14.84	537.08	14.96	538.83	15.13	540.03	15.23
542.33	15.44	545.6	15.75	546.01	15.78	548.34	16	549.96	16.26
550.89	16.42	554.22	16.96	557.8	17.56	558.76	17.72	559.21	17.79
560.4	18	563.6	18.45	565.11	18.67	568.26	19.13	571.9	19.69
573.91	20	578.17	20.86	583.75	22	584.8	22.21	586.8	22.59
591.56	23.51	594.15	24	597.96	24.74	603.19	25.72	604.04	25.88

604.68	26	607.98	26.53	609.34	26.74	611.66	27.11	614.45	27.53
615.32	27.66	617.54	28	618.94	28.16	619.24	28.19	622.41	28.55
623.4	28.66	625.68	28.92	627.25	29.09	628.75	29.26	630.81	29.49
631.63	29.58	634.12	29.86	635.33	30	637.02	30	637.82	30.01
641.14	30.02	643.81	30.02	645.99	30.03	647.81	30.04	650.77	30.04
652.11	30.05	654.19	30.05	655	30.06	655.96	30.06		

Manning's n Values num= 3
 Sta n Val Sta n Val Sta n Val

 0 .08 407.05 .054 458.97 .08

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
 407.05 458.97 244.51 213.05 153.04 .1 .3
 Ineffective Flow num= 1
 Sta L Sta R Elev Permanent
 0 372.15 14 F

CROSS SECTION

RIVER: UNT
 REACH: UNT RS: 0.000000

INPUT

Description: XS-1A

Station Elevation Data num= 211

Sta	Elev								
0	22.79	1.77	22.7	16.25	22	22.9	21.79	29.98	21.56
32.06	21.5	38.07	21.31	42.75	21.17	46.5	21.05	49.98	20.95
53.04	20.85	67.64	20.43	70.4	20.35	73.34	20.28	77.92	20.17
78.17	20.17	79.94	20.12	80.01	20.12	81.75	20.07	81.79	20.07
83.47	20.02	84.25	20	85.02	20	85.45	19.99	87.7	19.99
87.96	19.98	104.49	19.52	106.03	19.48	107.56	19.44	107.96	19.43
109.51	19.4	111.05	19.36	112.6	19.33	114.12	19.29	114.6	19.28
116.07	19.24	117.49	19.21	118.82	19.18	119.35	19.17	120.59	19.14
121.74	19.12	122.78	19.09	123.72	19.08	124.28	19.06	125.13	19.04
125.93	19.03	126.51	19.01	127.26	19	127.88	18.98	128.54	18.97
136.91	18.73	137.54	18.72	149.72	18.31	152.69	18.2	152.91	18.2
156.19	18.08	158.34	18	162.47	17.85	163.4	17.82	172.51	17.5
178.87	17.28	182.71	17.14	187.53	16.97	191.07	16.85	196.37	16.66
198.74	16.57	200.55	16.51	201.96	16.46	207.52	16.26	208.22	16.23
208.78	16.21	214.53	16	214.78	15.99	215.16	15.97	229.8	15.33
237.17	15	239.35	14.91	243.67	14.72	246.47	14.59	248.6	14.5
250.36	14.42	251.64	14.37	252.62	14.33	253.4	14.29	254.03	14.27
255.48	14.21	255.9	14.19	256.26	14.18	256.56	14.16	256.82	14.15
257.05	14.14	260.63	14	264.49	14	268.78	13.91	278.85	13.73
287.34	13.63	293.87	13.53	294.64	13.52	308.6	13.3	314.39	13.21
320.43	13.12	322.17	13.09	340.74	12.8	351.88	12.63	352.79	12.62

378.44	12.26	388.29	12.13	388.52	12.13	388.74	12.12	388.95	12.12
390.39	12.1	390.98	12.09	391.21	12.09	396.78	12.01	399.38	12.01
400.69	12	405.72	12	413.66	10.87	419.85	10	432.71	10
433.86	10.09	434.21	10.12	440.24	10.59	442.49	10.76	446.37	11.06
450.36	11.38	457.78	11.97	457.91	11.98	458.17	12	527	12
530.18	12	530.5	11.89	531.13	11.7	531.18	11.7	531.72	11.56
531.8	11.56	532.25	11.44	532.51	11.44	532.69	11.43	532.93	11.41
533.38	11.3	533.73	11.26	534.19	11.2	534.57	11.1	535.22	11.02
536.07	10.91	536.39	10.82	537.54	10.69	539.04	10.52	541.18	10.17
542.42	10.09	543.79	10.02	544.19	10	549.72	10	550.59	10.23
551.32	10.58	552.78	11.19	554.27	12	562.14	12.02	563.58	12.03
587.7	12.1	587.96	12.1	591.32	12.09	604.84	12.09	628.36	12.07
649.01	12.35	651.11	12.35	665.79	12.08	670.03	12.01	678.7	12.01
681.3	12	715.28	12	730.13	13.3	738.2	14	746.61	15.53
749.17	16	751.12	16.43	758.41	18	762.99	18.92	768.56	20
770.92	20.45	775.5	21.31	777.94	21.76	779.23	22	784.2	23.06
785.94	23.43	788.71	24	789.72	24.17	790.18	24.24	793.64	24.8
795.88	25.17	797.51	25.43	800.95	26	801.42	26.07	801.7	26.12
806.17	26.82	809.26	27.28	810.99	27.54	814.06	28	815.42	28.19
815.85	28.25	816.69	28.36	820.61	28.9	823.63	29.3	825.27	29.53
828.88	30	829.39	30	831.53	30.01	843.43	30.04	849.13	30.05
852.99	30.05								

Manning's n Values num= 4
 Sta n Val Sta n Val Sta n Val Sta n Val

 0 .04 340.74 .08 527 .054 562.14 .08

Bank Sta: Left Right Coeff Contr. Expan.
 527 562.14 .1 .3
 Ineffective Flow num= 1
 Sta L Sta R Elev Permanent
 0 457.78 11.97 F

SUMMARY OF MANNING'S N VALUES

River: Mill Swamp

* Reach	* River Sta.	* n1	* n2	* n3	* n4	* n5
*Main Stem	* 3167.546	* .08*	* .049*	* .09*	* .03*	
.1*						
*Main Stem	* 3054.333	* .08*	* .049*	* .09*	* .02*	
*						
*Main Stem	* 3004.159	*Culvert	*	*	*	*

*Main Stem	*	2973.376	*	.03*	.08*	.049*	.09*	
*								
*Main Stem	*	2839.603	*	.03*	.08*	.049*	.09*	
*								
*Main Stem	*	2660.237	*	.03*	.08*	.049*	.09*	
*								
*Main Stem	*	2519.448	*	.03*	.08*	.049*	.09*	
*								
*Main Stem	*	2308.054	*	.08*	.049*	.09*	*	
*								
*Main Stem	*	2054.860	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1818.292	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1659.696	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1568.009	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1485.470	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1425.227	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1342.706	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1233.442	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1152.323	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1103.114	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1065.854	*	.09*	.057*	.09*	*	
*								
*Main Stem	*	1052.49	*Culvert	*	*	*	*	*
*Main Stem	*	1035.739	*	.02*	.03*	.057*	.04*	*
*								
*Main Stem	*	964.7622	*	.02*	.03*	.057*	.04*	
*								
*Main Stem	*	862.6342	*	.03*	.057*	.04*	*	
*								
*Main Stem	*	661.4513	*	.03*	.07*	.057*	.04*	
*								
*Main Stem	*	565.9014	*	.1*	.07*	.057*	.08*	
.03*								
*Main Stem	*	443.9817	*	.04*	.07*	.057*	.08*	
.03*								
*Main Stem	*	280.6386	*	.04*	.07*	.057*	.08*	
*								
*Main Stem	*	194.0256	*	.04*	.07*	.057*	.08*	
.02*								
*Main Stem	*	133.5329	*	.04*	.07*	.057*	.08*	

.03*
 *Main Stem * 24.38062 * .04* .07* .057* .08*

.03*

 *

River:UNT

* Reach * River Sta. * n1 * n2 * n3 * n4 * n5
 * n6 * n7 * n8 * n9 * n10 * n11 *

*UNT * 1871.760 * .03* .08* .053* .08*

* * * * * * *

*UNT * 1816.260 * .03* .08* .053* .08*

* * * * * * *

*UNT * 1785.496 *Culvert * * * *

* * * * * * *

*UNT * 1751.420 * .03* .08* .053* .08*

.02* * * * *

*UNT * 1594.725 * .02* .03* .1* .04*

.08* .053* .08* .03* .02* .03* .1*

*UNT * 1407.578 * .03* .1* .04* .08*

.053* .08* .04* .1* * *

*UNT * 1160.098 * .03* .1* .04* .08*

.053* .08* .04* .1* * *

*UNT * 1024.274 * .08* .054* .08* .04*

.1* * * * *

*UNT * 842.8703 * .08* .054* .08* .04*

.1* * * * *

*UNT * 619.6199 * .04* .08* .054* .08*

* * * * *

*UNT * 377.4746 * .08* .054* .08* *

* * * * *

*UNT * 213.0526 * .08* .054* .08* *

* * * * *

*UNT * 0.000000 * .04* .08* .054* .08*

* * * * *

SUMMARY OF REACH LENGTHS

River: Mill Swamp

* Reach * River Sta. * Left * Channel * Right *

*Main Stem	*	3167.546	*	181.16*	113.21*	129.92*
*Main Stem	*	3054.333	*	76.13*	80.96*	221.24*
*Main Stem	*	3004.159	*Culvert	*	*	*
*Main Stem	*	2973.376	*	86.89*	133.77*	160.95*
*Main Stem	*	2839.603	*	160.25*	179.37*	192.71*
*Main Stem	*	2660.237	*	136.68*	140.79*	125.27*
*Main Stem	*	2519.448	*	173.72*	211.39*	257.72*
*Main Stem	*	2308.054	*	188.9*	253.19*	173.1*
*Main Stem	*	2054.860	*	300.33*	236.57*	134.45*
*Main Stem	*	1818.292	*	164.68*	158.6*	102.54*
*Main Stem	*	1659.696	*	73.13*	91.69*	74.44*
*Main Stem	*	1568.009	*	37.5*	82.54*	53.84*
*Main Stem	*	1485.470	*	83.15*	60.24*	103.32*
*Main Stem	*	1425.227	*	82.01*	82.52*	50.49*
*Main Stem	*	1342.706	*	50.17*	109.26*	113.65*
*Main Stem	*	1233.442	*	72.81*	81.12*	77*
*Main Stem	*	1152.323	*	54.41*	49.21*	37.53*
*Main Stem	*	1103.114	*	57.24*	37.26*	37.39*
*Main Stem	*	1065.854	*	23.66*	30.11*	20.63*
*Main Stem	*	1052.49	*Culvert	*	*	*
*Main Stem	*	1035.739	*	57.69*	70.98*	88.27*
*Main Stem	*	964.7622	*	92.1*	102.13*	96.42*
*Main Stem	*	862.6342	*	222.22*	201.18*	192.95*
*Main Stem	*	661.4513	*	152.71*	95.55*	82.74*
*Main Stem	*	565.9014	*	182.24*	121.92*	109.82*
*Main Stem	*	443.9817	*	62.43*	163.34*	166.14*
*Main Stem	*	280.6386	*	67.17*	86.61*	107.09*
*Main Stem	*	194.0256	*	33.45*	60.49*	43.15*
*Main Stem	*	133.5329	*	102.93*	109.15*	103.73*
*Main Stem	*	24.38062	*	*	0*	*

River: UNT

* Reach	* River Sta.	* Left	* Channel	* Right
*UNT	* 1871.760	* 53.92*	55.5*	36.34*
*UNT	* 1816.260	* 73.64*	64.84*	70.41*
*UNT	* 1785.496	*Culvert	*	*
*UNT	* 1751.420	* 137.28*	156.67*	163.58*
*UNT	* 1594.725	* 182.32*	187.15*	199.97*
*UNT	* 1407.578	* 221.8*	247.48*	236.86*
*UNT	* 1160.098	* 136.16*	135.82*	110.58*
*UNT	* 1024.274	* 244.6*	181.4*	134.55*
*UNT	* 842.8703	* 151.65*	223.25*	277.9*
*UNT	* 619.6199	* 280.97*	242.15*	180.93*
*UNT	* 377.4746	* 201.08*	164.42*	137.51*
*UNT	* 213.0526	* 244.51*	213.05*	153.04*
*UNT	* 0.000000	*	*	*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

River: Mill Swamp

* Reach	* River Sta.	* Contr.	* Expan.	*
*Main Stem	* 3167.546*	.1*	.3*	
*Main Stem	* 3054.333*	.3*	.5*	
*Main Stem	* 3004.159*	Culvert	*	*
*Main Stem	* 2973.376*	.3*	.5*	
*Main Stem	* 2839.603*	.1*	.3*	
*Main Stem	* 2660.237*	.1*	.3*	
*Main Stem	* 2519.448*	.1*	.3*	
*Main Stem	* 2308.054*	.1*	.3*	
*Main Stem	* 2054.860*	.1*	.3*	
*Main Stem	* 1818.292*	.1*	.3*	
*Main Stem	* 1659.696*	.1*	.3*	
*Main Stem	* 1568.009*	.1*	.3*	
*Main Stem	* 1485.470*	.1*	.3*	
*Main Stem	* 1425.227*	.1*	.3*	
*Main Stem	* 1342.706*	.1*	.3*	
*Main Stem	* 1233.442*	.1*	.3*	
*Main Stem	* 1152.323*	.1*	.3*	
*Main Stem	* 1103.114*	.1*	.3*	
*Main Stem	* 1065.854*	.3*	.5*	
*Main Stem	* 1052.49	*Culvert	*	*
*Main Stem	* 1035.739*	.3*	.5*	
*Main Stem	* 964.7622*	.1*	.3*	
*Main Stem	* 862.6342*	.1*	.3*	
*Main Stem	* 661.4513*	.1*	.3*	
*Main Stem	* 565.9014*	.1*	.3*	
*Main Stem	* 443.9817*	.1*	.3*	
*Main Stem	* 280.6386*	.1*	.3*	
*Main Stem	* 194.0256*	.1*	.3*	
*Main Stem	* 133.5329*	.1*	.3*	
*Main Stem	* 24.38062*	.1*	.3*	

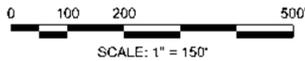
River: UNT

* Reach	* River Sta.	* Contr.	* Expan.	*
*UNT	* 1871.760*	.1*	.3*	
*UNT	* 1816.260*	.3*	.5*	
*UNT	* 1785.496*	Culvert	*	*
*UNT	* 1751.420*	.3*	.5*	
*UNT	* 1594.725*	.1*	.3*	

*UNT	*	1407.578*	.1*	.3*
*UNT	*	1160.098*	.1*	.3*
*UNT	*	1024.274*	.1*	.3*
*UNT	*	842.8703*	.1*	.3*
*UNT	*	619.6199*	.1*	.3*
*UNT	*	377.4746*	.1*	.3*
*UNT	*	213.0526*	.1*	.3*
*UNT	*	0.000000*	.1*	.3*



LEGEND	
	EXISTING 100-YEAR FLOODPLAIN
	HEC-RAS CROSS SECTION
	HEC-RAS REACH LENGTH
	HEC-RAS INEFFECTIVE FLOW



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31183, EXPIRATION DATE: 11/30/2027.

DESIGN PROFESSIONAL / CONTACT
 JEREMY KOSEK
 JOHNSON, MIRMAN & THOMPSON
 40 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-316-2360
 EMAIL: JKOSER@JMT.COM

MILL SWAMP MITIGATION BANK	
CHARLES COUNTY ELECTION DISTRICT 67 CONGRESSIONAL DISTRICT 03	
OWNER / DEVELOPER INFORMATION JOHNSON, MIRMAN & THOMPSON 40 WRIGHT AVENUE HUNT VALLEY, MD 21030	
CONTACT INFORMATION JEREMY KOSEK JOHNSON, MIRMAN & THOMPSON 40 WRIGHT AVENUE HUNT VALLEY, MD 21030	

REVISIONS	
CONCEPT DESIGN	
NOT FOR CONSTRUCTION	

EXISTING FLOODPLAIN			
SCALE: AS SHOWN	DATE: JULY 2024	PROJECT NO: 24-0015-01	
DESIGNED BY: RKH	CHECKED BY: JLM	DRAWN BY: JLM	DATE: 07/2024
PROJECT NO: 24-0015-01	DATE: 07/2024	PROJECT NO: 24-0015-01	
DRAWING NO: FP-EX-01		SHEET NO: 1 OF 1	

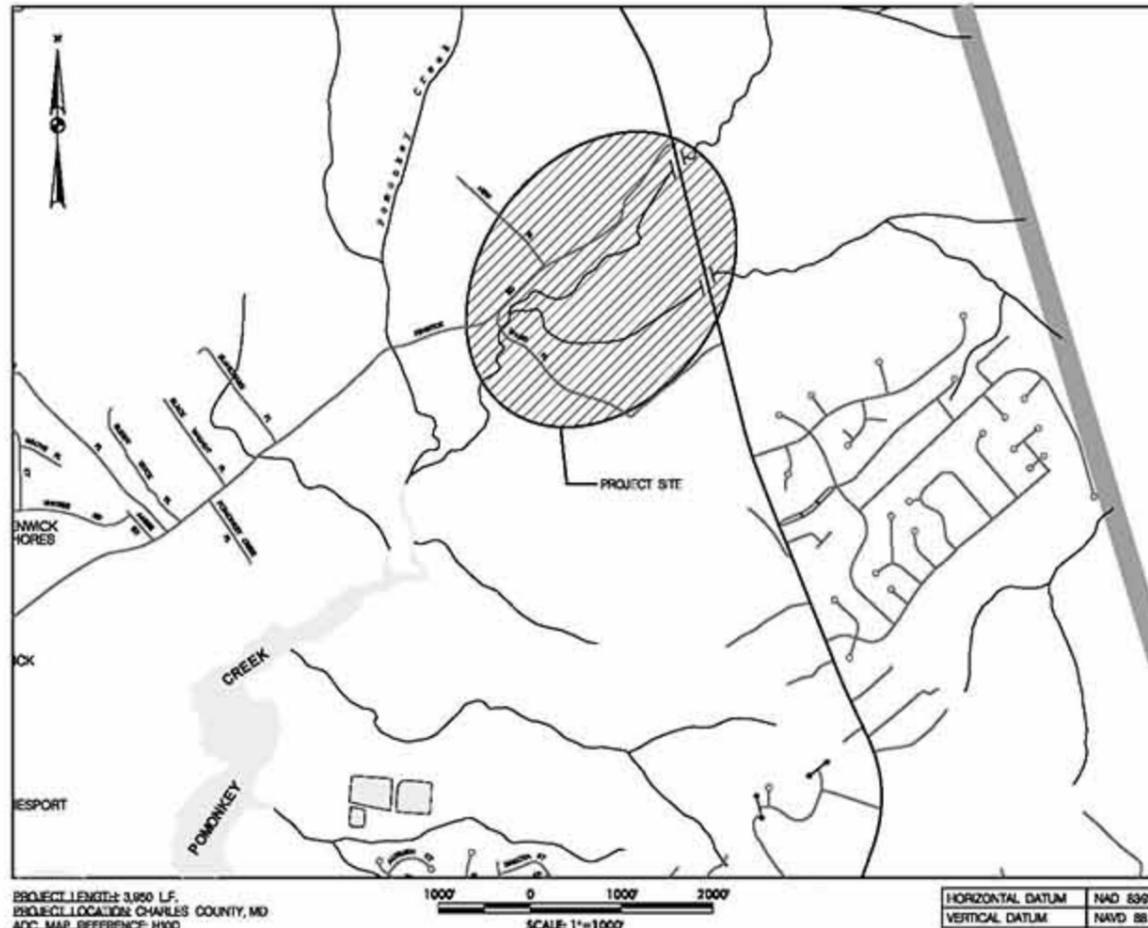
BY: GZeigler



APPENDIX G.3 DESIGN PLANS

SHEET INDEX		
SHEET NO.	DWG. NO.	DRAWING TITLE
1	—	TITLE SHEET
2	GN-01	LEGEND / GENERAL NOTES
3	EC-01	EXISTING CONDITIONS PLAN
4	RM-01	KEY MAP
5-7	SP-01 - SP-03	STREAM RESTORATION PROFILES
8-16	SA-01 - SA-09	STREAM RESTORATION PLANS
17-19	SD-01 - SD-03	STREAM RESTORATION DETAILS
20	TS-01	TYPICAL SECTIONS
21-29	PS-01 - PS-09	PLANTING PLANS
30	PD-01	PLANTING NOTES AND SCHEDULES
31-35	EH-01 - EH-05	EROSION AND SEDIMENT CONTROL NOTES AND DETAILS
36-44	ES-01 - ES-09	EROSION AND SEDIMENT CONTROL PLANS

MILL SWAMP MITIGATION BANK



- ### GENERAL INFORMATION
- THE SUBJECT PROPERTIES ARE ZONED RC (RURAL CONSERVATION) IN ACCORDANCE WITH THE OCTOBER 6, 2013 COMPREHENSIVE ZONING REGULATIONS.
 - NO STRUCTURES OR SUBDIVISIONS ARE PROPOSED.
 - THERE ARE NO BURIAL GROUNDS OR CEMETERY SITES LOCATED ON THE PROJECT SITE.
 - ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS OF MDSA.
 - THE CONTRACTOR SHALL NOTIFY "MISS UTILITY" AT 1-800-257-7777 AT LEAST 48 HOURS PRIOR TO ANY EXCAVATION WORK BEING DONE.
 - THE COORDINATES SHOWN HEREON ARE BASED ON GPS CONTROL.
 - NO WATER LINES EXIST WITHIN PROJECT LIMIT, PER UTILITY DESIGNATION.
 - NO SEWER LINES EXIST WITHIN PROJECT LIMIT, PER UTILITY DESIGNATION.
 - EXISTING UTILITIES ARE BASED ON FIELD SURVEYS AND AVAILABLE RECORD DRAWINGS.
 - FIELD INVESTIGATIONS TO IDENTIFY AND DELINEATE WETLANDS AND WATERWAYS FOR THE PROJECT WERE CONDUCTED IN APRIL, MAY, AND JUNE 2022; NOVEMBER 2024; AND APRIL 2025.
 - THIS SURVEY WAS BASED ON A FIELD-RUN TOPOGRAPHIC SURVEY PERFORMED BY JMT IN JANUARY 2025 AND REFLECTS SITE CONDITIONS AS OF THAT DATE. LIDAR AND GIS TOPOGRAPHIC DATA WERE USED FOR ALL AREAS OUTSIDE OF THE FIELD-RUN TOPOGRAPHIC SURVEY.
 - ALL WORK SHALL CONFORM TO THE MOST RECENT MANAGEMENT PRACTICES FOR WETLANDS AND WATERWAYS AS LISTED IN THE REQUIREMENTS OF THE NONTIDAL WETLANDS AND WATERWAYS PERMIT APPROVED ON 1.10.24 (MDE TRACKING #00-NF-00000000).
 - NO TRAFFIC STUDY IS REQUIRED FOR THIS PROJECT.
 - OBSTRUCTIONS SHOWN ON THIS DRAWING ARE FOR THE CONVENIENCE OF THE CONTRACTOR ONLY AND JMT DOES NOT WARRANT OR GUARANTEE THE CORRECTNESS OR COMPLETENESS OF THE INFORMATION GIVEN. SHOULD THE CONTRACTOR DISCOVER ANY DISCREPANCIES BETWEEN THE PLANS AND THE FIELD CONDITIONS, THE CONTRACTOR MUST VERIFY SUCH INFORMATION TO THEIR OWN SATISFACTION. THE ENGINEER SHALL BE NOTIFIED IMMEDIATELY TO RESOLVE THE SITUATION. SHOULD THE CONTRACTOR MAKE FIELD CORRECTIONS OR ADJUSTMENTS WITHOUT NOTIFYING THE ENGINEER, THE CONTRACTOR ASSUMES ALL RESPONSIBILITIES FOR THOSE CHANGES.
 - THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PROTECT ANY EXISTING UTILITIES AND MAINTAIN UNINTERRUPTED SERVICE. ANY DAMAGE INCURRED DUE TO THE CONTRACTOR'S OPERATION SHALL BE REPAIRED IMMEDIATELY AT THE CONTRACTOR'S EXPENSE.
 - THE APPLICANT SHALL OBTAIN ALL REQUIRED AUTHORIZATIONS AND PERMITS FROM THE MARYLAND DEPARTMENT OF THE ENVIRONMENT AND U.S. ARMY CORPS OF ENGINEERS FOR DISTURBANCES WITHIN THE FLOODPLAIN, WETLANDS, STREAMS, AND OTHER DEFERS. REFER TO THE APPLICABLE MDE OR USACE PERMITS OR TRACKING NUMBERS ON THE PLANS AND ANY BUILDING OR GRADING PERMITS.
 - ONCE THE PROJECT IS COMPLETE, THE LIMIT OF DISTURBANCE SHALL BE RESTORED TO ITS PREVIOUS CONDITION THROUGH STABILIZATION AND RE-PLANTING OF FOREST RESOURCES.
 - THIS PROJECT IS NOT LOCATED WITHIN A TCR # WATERSHED.

PROJECT NARRATIVE

THE MILL SWAMP MITIGATION BANK IS LOCATED IN CHARLES COUNTY, MD. THE PROJECT LIMITS INCLUDE MILL SWAMP AND THE UNNAMED TRIBUTARY (UNT) TO MILL SWAMP. THE PROJECT LIMITS START IMMEDIATELY DOWNSTREAM OF MARSHALL HALL ROAD AND INCLUDE APPROXIMATELY 3,573 LINEAR FEET OF EXISTING STREAM LENGTH.

MILL SWAMP AND THE UNT ARE LOCATED WITHIN THE ATLANTIC COASTAL PLAIN PHYSIOGRAPHIC PROVINCE. THE DRAINAGE AREA TO THE DOWNSTREAM PROJECT LIMITS OF MILL SWAMP AND THE UNT ARE APPROXIMATELY 2.54 AND 2.77 SQUARE MILES, RESPECTIVELY. MILL SWAMP AND THE UNT ARE LOCATED WITHIN THE MIDDLE POTOMAC-ANACOSTIA-OCCOCHAN WATERSHED (MDE #4-DIST BASIN CODE 080700) AND ARE CLASSIFIED AS USE CLASS I (WATER CONTACT RECREATION AND PROTECTION OF NONTIDAL WARMWATER AQUATIC LIFE) WATERWAYS. AS SUCH, IN-STREAM WORK IS PROHIBITED DURING A CLOSURE PERIOD FROM MARCH 1ST THROUGH JUNE 15TH.

THE PROPOSED IMPROVEMENTS WILL FOCUS ON FLOOD ATTENUATION TO PROTECT ADJACENT INFRASTRUCTURE AS WELL AS RESTORING IMPAIRED RESOURCES AND AQUATIC / TERRESTRIAL HABITATS TO PROVIDE WATER QUALITY IMPROVEMENTS AND BIOLOGICAL UPLIFT / DIVERSITY. IN ADDITION, ECOLOGICALLY VALUABLE RESOURCES WITHIN THE PROJECT LIMITS WILL BE PRESERVED AND/OR ENHANCED. THE IMPROVEMENTS WILL BE ACCOMPLISHED THROUGH STREAM CHANNEL GRADING AND MINOR GRADING IN AREAS ADJACENT TO HIGH QUALITY RESOURCES, AS WELL AS THE REMOVAL OF THE OVERBURDEN OF NUTRIENT RICH AND HIGHLY ERODIBLE WOODEN VALLEY SEDIMENTS. THE GENERAL RESTORATION STRATEGY WILL BE A COMBINATION OF HABITAT AND GEOMORPHIC IMPROVEMENTS AND, WHERE APPLICABLE, THE CONVERSION OF HIGHLY INCISED AND IMPAIRED EXISTING RESOURCES TO A FORMER LOW ENERGY, STABLE FLOW REGIME WHERE FEASIBLE. THE DESIGN STRATEGIES ARE INTENDED TO REESTABLISH AND/OR CREATE A DENSE RIPARIAN ROOT SYSTEM WHICH PROMOTES INCREASED SEDIMENT AND NUTRIENT PROCESSING AND THE PROTECTION OF BOTH CHANNEL BANKS AND THE FLOODPLAIN SURFACE FROM EROSION. FLOWS WITHIN THE PROPOSED CHANNELS ARE INTENDED TO REESTABLISH THE INTERACTION OF GROUNDWATER AND SURFACE WATER VITAL TO THE BIOCHEMICAL CYCLING OF NUTRIENTS AT THE GROUNDWATER/SURFACE WATER INTERFACE OR HYPOBIC ZONE. THIS INTERACTION WILL SERVE TO MAINTAIN CHANNEL BASE FLOWS DURING DRY PERIODS AND REGULATE WATER TEMPERATURE YEAR-ROUND, PROVIDING INCREASED BIOLOGICAL FUNCTION. PROPOSED CHANNEL GEOMETRY AND STABILITY AND HABITAT STRUCTURES ARE INTENDED TO INCREASE IN-STREAM BIO-DIVERSITY.

NO IMPERVIOUS SURFACES ARE PROPOSED AND THEREFORE NO SWM IS REQUIRED. EROSION AND SEDIMENT CONTROL WILL BE STRICTLY ENFORCED THROUGHOUT THE DURATION OF THE PROJECT, INCLUDING PUMP-AROUNDS TO ALLOW FOR DRY WORKING CONDITIONS.

- ### MDE BEST MANAGEMENT PRACTICES FOR WORKING IN NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, AND 100-YEAR FLOODPLAIN
- NO EXCESS FILL, CONSTRUCTION MATERIAL, OR DEBRIS TO BE STOCKPILED OR STORED IN NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
 - PLACE MATERIALS IN A LOCATION AND MANNER WHICH DOES NOT ADVERSELY IMPACT SURFACE OR SUBSURFACE WATER FLOW INTO OR OUT OF THE NONTIDAL WETLAND, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
 - DO NOT USE THE EXCAVATED MATERIAL AS BACKFILL IF IT CONTAINS WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE. IF ADDITIONAL BACKFILL IS REQUIRED, USE CLEAN MATERIAL FREE OF WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE.
 - PLACE HEAVY EQUIPMENT ON MATS OR SUITABLY OPERATE THE EQUIPMENT TO PREVENT DAMAGE TO THE NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
 - REPAIR AND MAINTAIN ANY SERVICABLE STRUCTURE OR FILL SO THERE IS NO PERMANENT LOSS OF NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, OR WATERWAYS OR PERMANENT MODIFICATION OF THE 100-YEAR FLOODPLAIN IN EXCESS OF THAT LOFT UNDER THE ORIGINALLY AUTHORIZED STRUCTURE OR FILL.
 - RECTIFY ANY NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, OR 100-YEAR FLOODPLAIN TEMPORARILY IMPACTED BY ANY CONSTRUCTION.
 - ALL STABILIZATION IN THE NONTIDAL WETLAND AND NONTIDAL WETLAND BUFFER TO CONSIST OF THE FOLLOWING SPECIES: ANNUAL RYEGRASS (*COLOM. MULTIFLORUM*), MILLET (*SETARIA ITALICA*), BARLEY (*HORDEUM SP.*), OATS (*Avena SP.*), AND/OR RYE (*SECALE CEREALE*). THESE SPECIES WILL ALLOW FOR THE STABILIZATION OF THE SITE WHILE ALSO ALLOWING FOR THE VOLUNTARY REVEGETATION OF NATURAL WETLAND SPECIES. OTHER NON-PERSISTENT VEGETATION MAY BE ACCEPTABLE, BUT MUST BE APPROVED BY THE NONTIDAL WETLANDS AND WATERWAYS DIVISION, KENTUCKY #1 FISCAL IS TO NOT BE UTILIZED IN WETLAND OR BUFFER AREAS. THE AREA IS TO BE SEEDED AND MULCHED TO REDUCE EROSION AFTER CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.
 - AFTER INSTALLATION HAS BEEN COMPLETED, MAKE POST-CONSTRUCTION GRADES AND ELEVATIONS THE SAME AS THE ORIGINAL GRADES AND ELEVATIONS IN TEMPORARILY IMPACTED AREAS.
 - TO PROTECT AQUATIC SPECIES, IN-STREAM WORK IS PROHIBITED AS DETERMINED BY THE CLASSIFICATION OF THE STREAM.
 - USE I WATERS (WATER CONTACT RECREATION, AND PROTECTION OF NONTIDAL WARMWATER AQUATIC LIFE). IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE, DURING ANY YEAR.
 - STORMWATER RUNOFF FROM IMPERVIOUS SURFACES TO BE CONTROLLED TO PREVENT THE WASHING OF DEBRIS INTO THE WATERWAY.
 - OUTLETS TO BE CONSTRUCTED AND ANY REPRAP PLACED SO AS NOT TO OBSTRUCT THE MOVEMENT OF AQUATIC SPECIES, UNLESS THE PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER.

PERMITS / APPROVALS

AGENCY	PERMIT #	DATE APPROVED
MDE JOINT PERMIT APPLICATION		
MDE DAM SAFETY	NA	NA
CHARLES SOIL CONSERVATION DISTRICT		
DEVELOPMENT SERVICES PERMIT FROM CHARLES COUNTY PLANNING AND GROWTH MANAGEMENT		



PROFESSIONAL CERTIFICATION:
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31183, EXPIRATION DATE 12/31/2027.

SEDIMENT AND EROSION CONTROL REGULATIONS WILL BE STRICTLY ENFORCED DURING CONSTRUCTION

CONSULTANT CERTIFICATION

I HEREBY CERTIFY THAT THIS PLAN HAS BEEN DESIGNED IN ACCORDANCE WITH THE 2011 STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL, OR CURRENT REVISIONS THEREOF, AND DEPARTMENT OF THE ENVIRONMENT STORMWATER MANAGEMENT REGULATIONS.

31183
 MD P.E. LICENSE # _____
 NA
 MD LAND SURVEYOR LICENSE # _____
 NA
 MD LANDSCAPE ARCHITECT # _____
 JEREMY KOSEK
 NAME
 JOHNSON, MIRMHAN & THOMPSON
 FIRM NAME
 40 WIGHT AVENUE, HUNT VALLEY, MD 21030
 STREET ADDRESS

SEAL
 SIGNATURE
 DATE

SITE ANALYSIS

47.83	TOTAL AREA (AC)
18.81	DISTURBED AREA (AC)
52.109	VOLUME OF SPOIL BORROW MATERIAL (C.Y.)
TO BE DETERMINED	OFF-SITE BORROW / WASTE AREA LOCATION
52.881	VOLUME OF EXCAVATION (C.Y.)

LANDOWNER INFORMATION

CAROL L WITTER & DEVIN G ARMSTRONG PARCEL: 0029 TAX MAP: 05 ELECTION DISTRICT: 07 ZONING: RC PRIMARY MAILING ADDRESS: 104 MATTAWOMAN WAY ACCOKEEK, MD 20607	KYLE J TIPPETT & CASEY A TIPPETT 6605 FENWICK RD BRYANS ROAD, MD 20616 PARCEL: 0458 TAX MAP: 05 ELECTION DISTRICT: 07 ZONING: RC PRIMARY MAILING ADDRESS: 6605 FENWICK RD BRYANS ROAD, MD 20616
AUDREY SUZANNE NORRIS PARCEL: 0407 TAX MAP: 05 ELECTION DISTRICT: 07 ZONING: RC PRIMARY MAILING ADDRESS: 6555 FENWICK RD BRYANS ROAD, MD 20616	KYLE J TIPPETT PARCEL: 0074 TAX MAP: 05 ELECTION DISTRICT: 07 ZONING: RC PRIMARY MAILING ADDRESS: 6605 FENWICK RD BRYANS ROAD, MD 20616
AUDREY SUZANNE NORRIS & JEREMY S NORRIS 6555 FENWICK RD BRYANS ROAD, MD 20616 PARCEL: 0060 TAX MAP: 05 ELECTION DISTRICT: 07 ZONING: RC	KYLE J TIPPETT PARCEL: 0031 TAX MAP: 05 ELECTION DISTRICT: 07 ZONING: RC PRIMARY MAILING ADDRESS: 6605 FENWICK RD BRYANS ROAD, MD 20616

OWNER / DEVELOPER CERTIFICATION

WE HEREBY CERTIFY THAT ALL CLEARING, GRADING, CONSTRUCTION, VEGETATIVE STABILIZATION AND/OR DEVELOPMENT WILL BE DONE PURSUANT TO THIS PLAN AND THAT ANY RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OF ATTENDANCE AT A MARYLAND DEPARTMENT OF THE ENVIRONMENT APPROVED TRAINING PROGRAM FOR THE CONTROL OF EROSION AND SEDIMENT BEFORE BEGINNING THE PROJECT. I HEREBY AUTHORIZE THE RIGHT TO ENTRY FOR PERIODIC ON-SITE EVALUATION BY STATE OF MARYLAND, DEPARTMENT OF THE ENVIRONMENT, COMPLIANCE INSPECTORS, CHARLES COUNTY INSPECTORS, AND THE REPRESENTATIVES OF THE CHARLES SOIL CONSERVATION DISTRICT.

OWNERS / DEVELOPER SIGNATURE & DATE
 JEREMY KOSEK, PROJECT MANAGER
 PRINTED NAME AND TITLE
 410-318-2360
 TELEPHONE NUMBER
 40 WIGHT AVENUE, HUNT VALLEY, MD 21030
 ADDRESS
 PRINTED NAME AND CARD NUMBER OF ON-SITE RESPONSIBLE PERSONNEL

CHARLES SOIL CONSERVATION DISTRICT APPROVAL

SEDIMENT AND EROSION CONTROL PLAN APPROVAL NUMBER _____
 SMALL POND APPROVAL FOR _____
 SEDIMENT AND EROSION CONTROL PLAN APPROVAL AND SMALL POND APPROVAL (IF APPLICABLE) IS HEREBY GRANTED BY THE CHARLES SOIL CONSERVATION DISTRICT.
 APPROVAL SIGNATURE / DATE _____
 APPROVAL EXPIRATION DATE _____
 (REQUESTS EXCLUSIVELY FOR EXTENSION OF THE APPROVAL EXPIRATION DATE NOTED ABOVE AND NOT INCLUDING ANY PLAN MODIFICATIONS TO THESE APPROVED PLAN SHEETS MUST BE SUBMITTED TO THE CHARLES SOIL CONSERVATION DISTRICT IN WRITING. THE CHARLES SOIL CONSERVATION DISTRICT, AT ITS DISCRETION, MAY APPROVE THE EXPIRATION DATE EXTENSION TO THE APPROVED PLAN VIA SEPARATE APPROVAL LETTER.)

BY: M MOELLER -



SCALE: 1" = 100'



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31818, EXPIRATION DATE: 12/31/2027.

DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-316-2960
 EMAIL: JKOSER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20818

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83/MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRIMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 TELEPHONE: 410-316-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

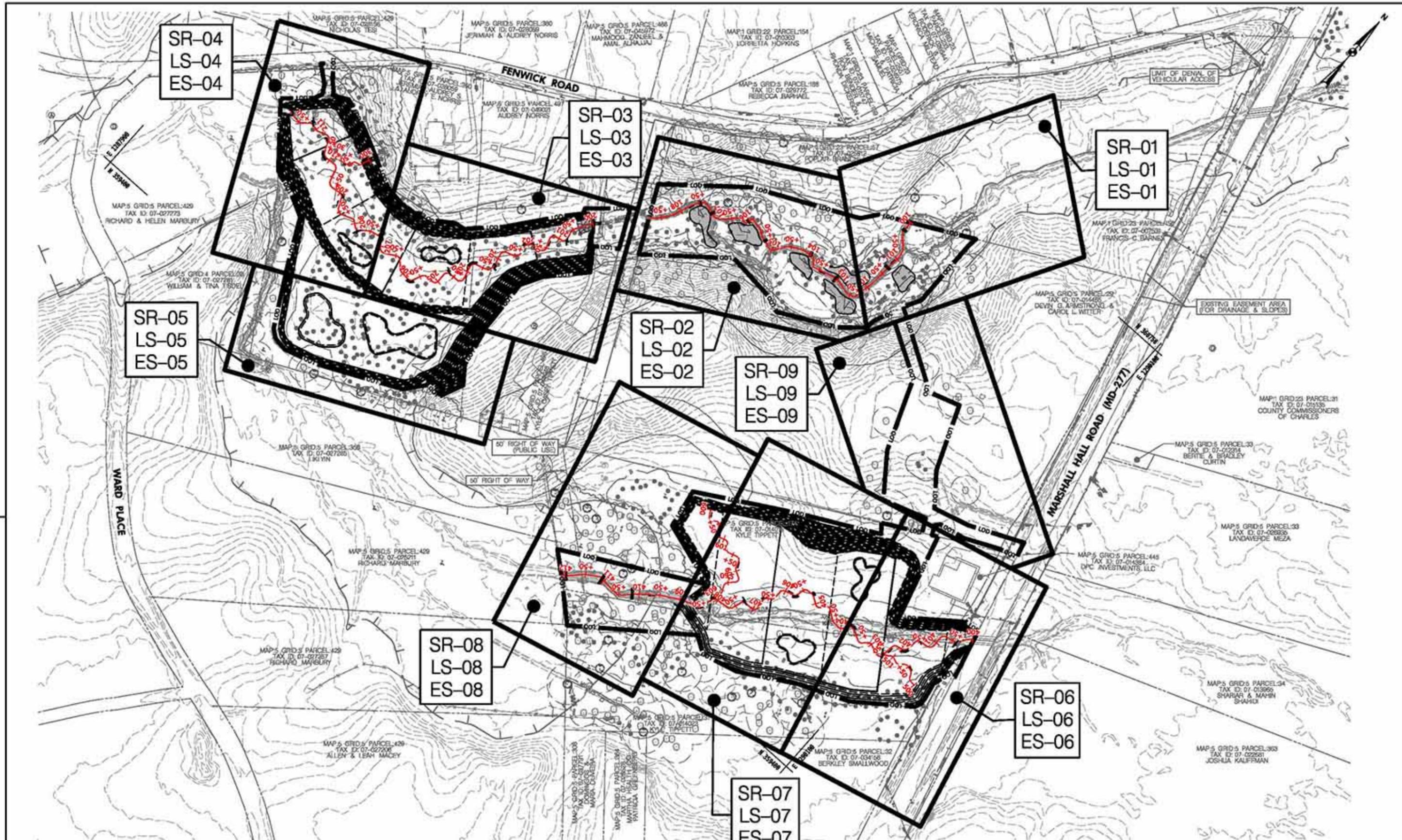
EXISTING CONDITIONS

SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-001

DESIGNED BY: KNI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. EC-01 OF 01 SHEET NO. 3 OF 44

BY: M/McCuller -



SR-04
LS-04
ES-04

SR-03
LS-03
ES-03

SR-01
LS-01
ES-01

SR-05
LS-05
ES-05

SR-02
LS-02
ES-02

SR-09
LS-09
ES-09

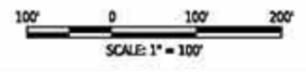
SR-08
LS-08
ES-08

SR-06
LS-06
ES-06

SR-07
LS-07
ES-07



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31913, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOSER
 JOHNSON MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2900
 EMAIL: JKOSER@JMT.COM



MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOSER
 JOHNSON MERRINAN & THOMPSON
 TELEPHONE: 410-216-2900
 EMAIL: JKOSER@JMT.COM

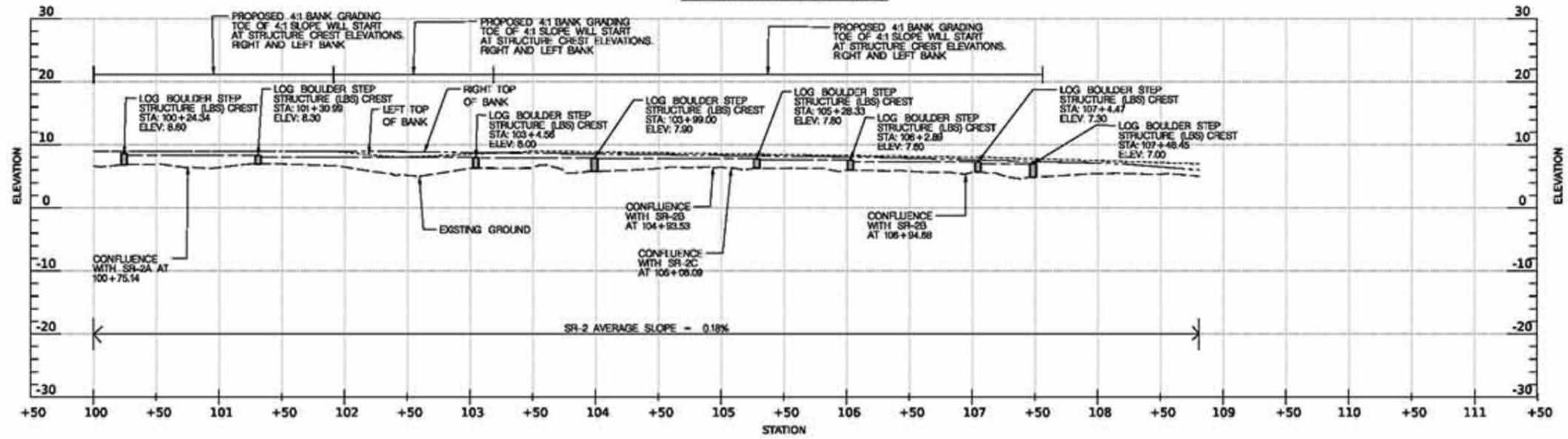
REVISIONS	
CONCEPT DESIGN	
NOT FOR CONSTRUCTION	

KEY MAP			
SCALE AS SHOWN	DATE JULY 2025	PROJECT NO.	25-0075-001
DESIGNED BY: JMT	COUNTY: CHARLES COUNTY		
DRAWN BY: JMT	LOGFILE: N/A		
CHECKED BY: JMT	HORIZONTAL SCALE: N/A		
F.A.P. NO.: N/A	VERTICAL SCALE: N/A		
DRAWING NO. KM-01 OF 01	SHEET NO. 1 OF 44		

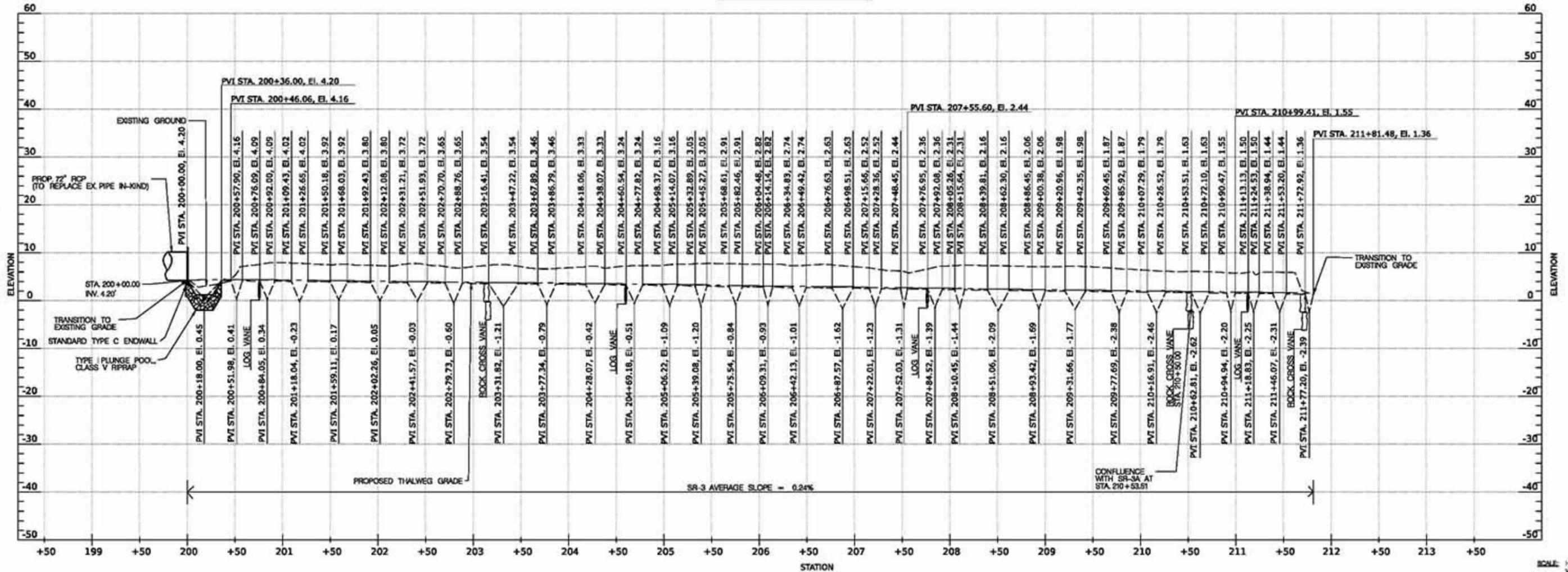
BY: M/McCuller

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PROFILE FOR REACH SR-2



PROFILE FOR REACH SR-3



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31818, EXPIRATION DATE: 12/31/2027.
 DESIGN PROFESSIONAL CONTACT
 JEREMY KOSSER
 JOHNSON MERRINAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

LEGEND
 EXISTING GROUND
 FLOODPLAIN/BANKFULL ELEV.
 PROPOSED THALWEG
 LEFT TOP OF BANK
 RIGHT TOP OF BANK

MILL SWAMP MITIGATION BANK
 WYANS ROAD, MD 20818
 CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
 MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT NAVD 83
 OWNER / DEVELOPER INFORMATION
 JOHNSON MERRINAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030
 CONTACT INFORMATION
 JEREMY KOSSER
 JOHNSON MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

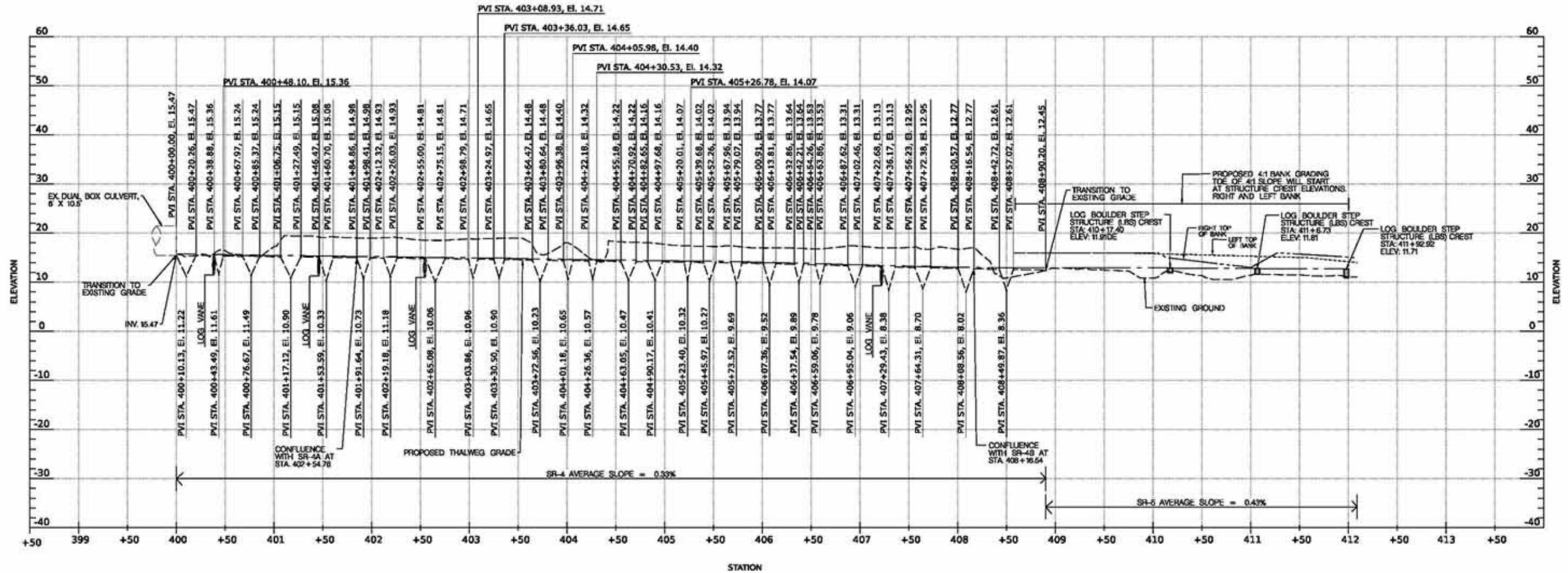
REVISIONS
 CONCEPT DESIGN
 NOT FOR CONSTRUCTION

STREAM RESTORATION PROFILES
 SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-001
 DESIGNED BY KNI COUNTY CHARLES COUNTY
 DRAWN BY MAM LOGFILE: N/A
 CHECKED BY JIM HORIZONTAL SCALE 1"=50'
 F.A.P. NO. N/A VERTICAL SCALE 1"=10'
 DRAWING NO. SP-01 OF 03 SHEET NO. 1 OF 44

BY: M/McCuller -

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PROFILE FOR REACHES SR-4 AND SR-5



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31813, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON MERRINAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

LEGEND
 EXISTING GROUND -----
 FLOODPLAIN/BANKFULL ELEV. - - - - -
 PROPOSED THALWEG -----
 LEFT TOP OF BANK -----
 RIGHT TOP OF BANK -----

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888
 CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
 MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 83
OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRINAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030
CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

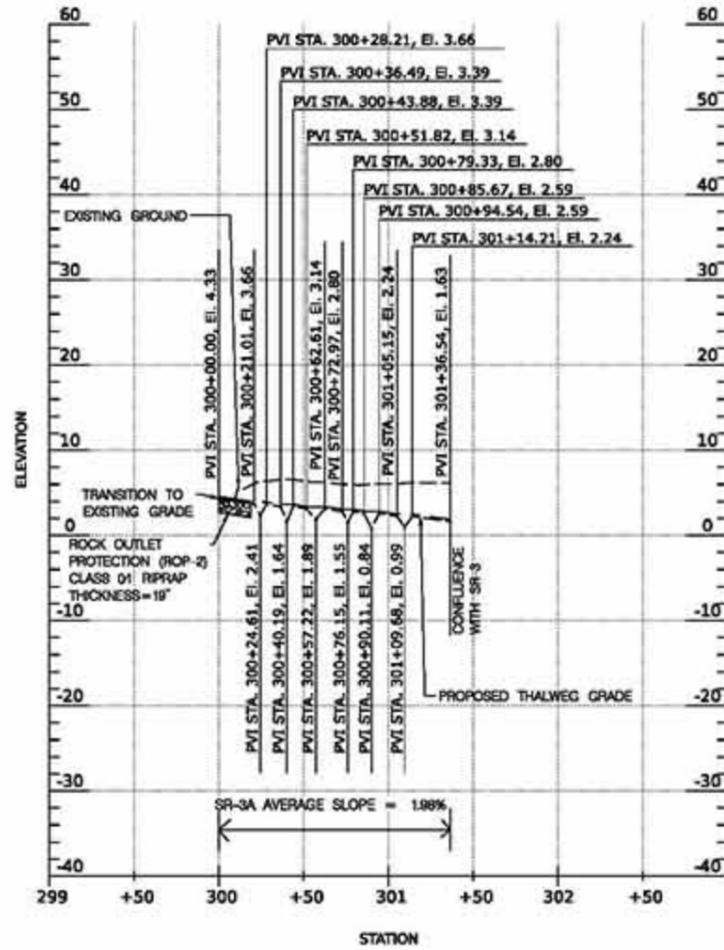
REVISIONS
 CONCEPT DESIGN
 NOT FOR CONSTRUCTION

STREAM RESTORATION PROFILES
 SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00
 DESIGNED BY KNI COUNTY CHARLES COUNTY
 DRAWN BY MAM LOGFILE: N/A
 CHECKED BY JIM HORIZONTAL SCALE 1" = 50'
 F.A.P. NO. N/A VERTICAL SCALE 1" = 10'
 DRAWING NO. **SP-02** OF **03** SHEET NO. 1 OF 44

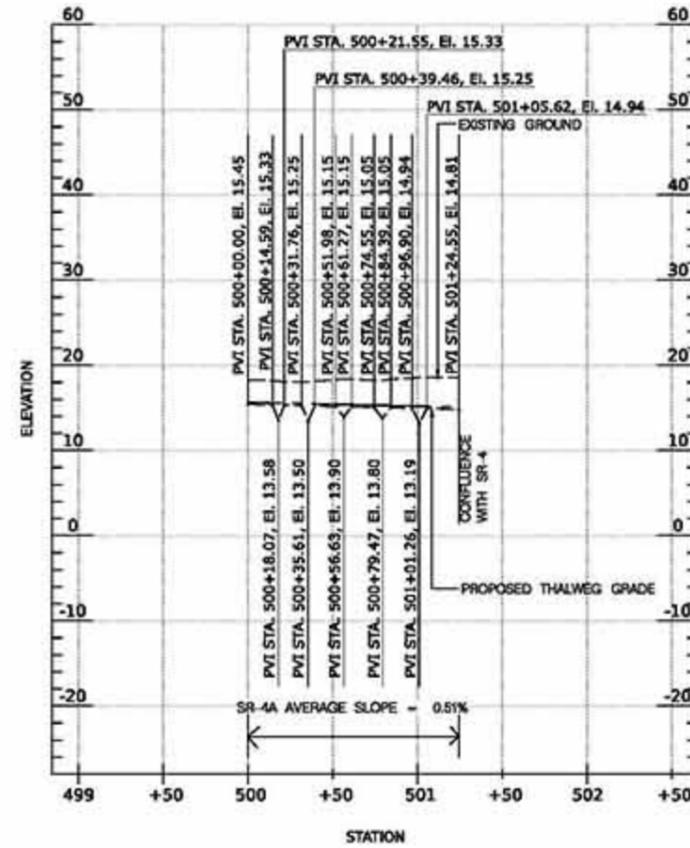
BY: M/McCuller -

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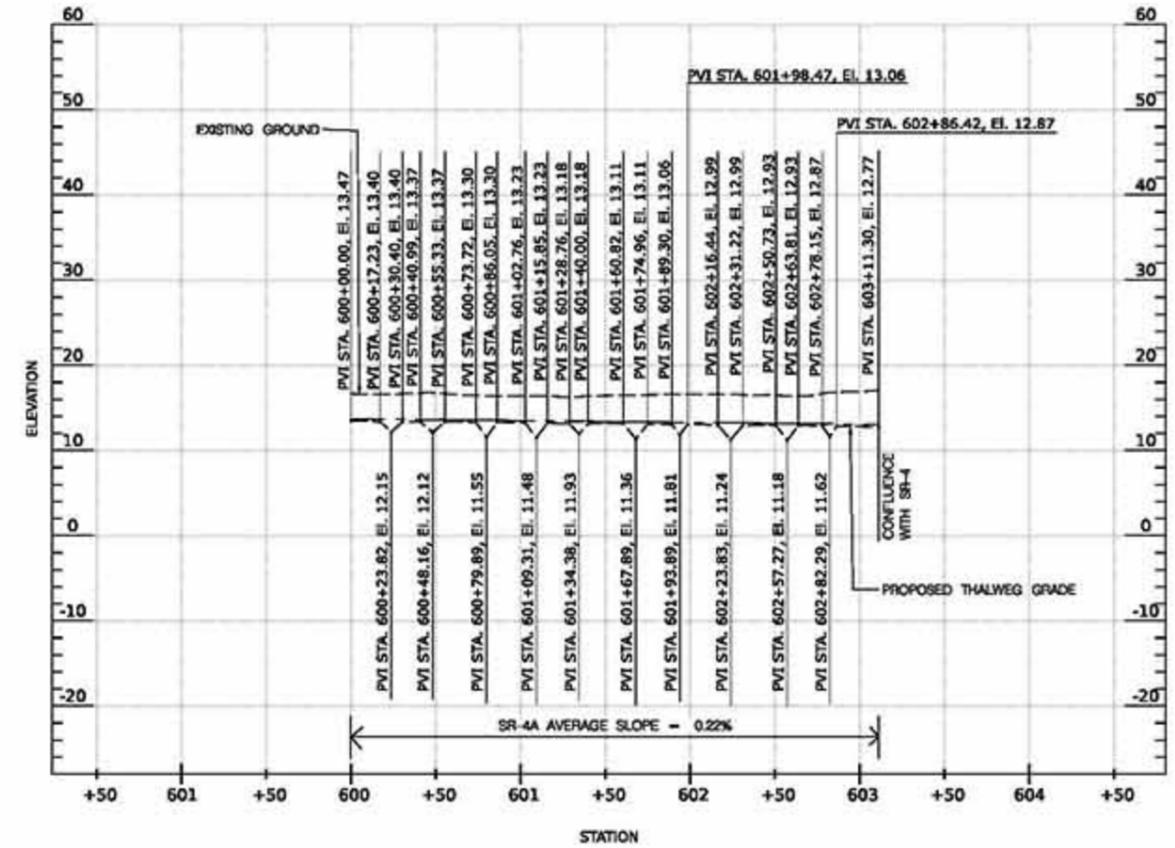
PROFILE FOR REACH SR-3A



PROFILE FOR REACH SR-4A



PROFILE FOR REACH SR-4B



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 13053, EXPIRATION DATE: 12/31/2027.
 DESIGN PROFESSIONAL CONTACT
 JEREMY KOEGER
 JOHNSON MERRINAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2900
 EMAIL: JKOEGER@JMT.COM

LEGEND

- EXISTING GROUND -----
- FLOODPLAIN BANK FULL ELEV. - - - - -
- PROPOSED THALWEG -----
- LEFT TOP OF BANK -----
- RIGHT TOP OF BANK -----

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION: JOHNSON MERRINAN & THOMPSON, 42 WEST AVENUE, HUNT VALLEY, MD 21030

CONTACT INFORMATION: JEREMY KOEGER, JOHNSON MERRINAN & THOMPSON, TELEPHONE: 410-216-2900, EMAIL: JKOEGER@JMT.COM

STREAM RESTORATION PROFILES

SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO: 25-0075-00

DESIGNED BY: JMT COUNTY: CHARLES COUNTY
 DRAWN BY: JMT LOGFILE: N/A
 CHECKED BY: JMT HORIZONTAL SCALE: 1" = 50'
 F.A.P. NO.: N/A VERTICAL SCALE: 1" = 10'

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

DRAWING NO: **SP-03** OF **03** SHEET NO. 1 OF 44

BY: M/McCuller

SCALE: HOR 1" = 50' VERT. 1" = 10'

MATCHLINE (SEE DWG. SR-09)

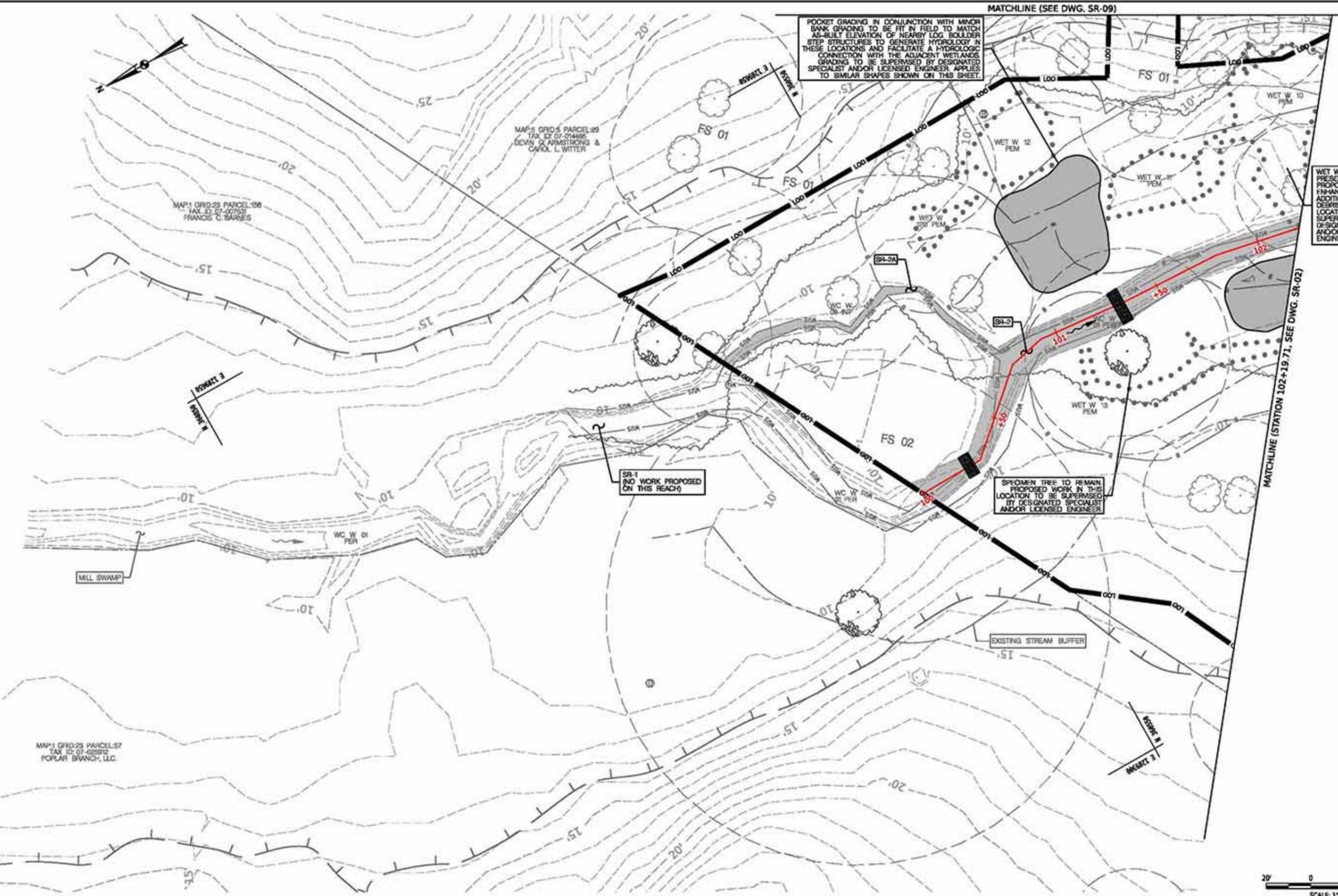
POCKET GRADING IN CONJUNCTION WITH MINOR BANK GRADING TO BE FIT IN FIELD TO MATCH AS-BUILT ELEVATION OF NEARBY LOG BOULDER STEP STRUCTURES TO GENERATE HYDROLOGIC CONNECTION WITH THE ADJACENT WETLANDS. GRADING TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER APPLIES TO SIMILAR SHAPES SHOWN ON THIS SHEET.

WET W 10 PEM TO BE PRESERVED. NO GRADING PROPOSED. ENHANCEMENTS INCLUDE ADDITION OF WOODY DEBRIS AND PLANTING. LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

SPECIMEN TREE TO REMAIN. PROPOSED WORK IN THIS LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

SR-1 (NO WORK PROPOSED ON THIS REACH)

MATCHLINE (STATION 102+19.71, SEE DWG. SR-02)



PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
JEREMY KOZER
JOHNSON MERRIMAN & THOMPSON
43 WRIGHT AVENUE
HUNT VALLEY, MD 21030
TELEPHONE: 410-216-2960
EMAIL: JKOZER@JMT.COM

MILL SWAMP MITIGATION BANK
BYRANS ROAD, MD 20885
CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
MARYLAND COORDINATE SYSTEM
NAD 83/MD STATE PLANE VERT. NAVD 88
OWNER / DEVELOPER INFORMATION
JOHNSON MERRIMAN & THOMPSON
43 WRIGHT AVENUE
HUNT VALLEY, MD 21030
CONTACT INFORMATION
JEREMY KOZER
JOHNSON MERRIMAN & THOMPSON
TELEPHONE: 410-216-2960
EMAIL: JKOZER@JMT.COM

REVISIONS	
CONCEPT DESIGN	
NOT FOR CONSTRUCTION	

STREAM RESTORATION PLAN			
SCALE AS SHOWN	DATE JULY 2025	PROJECT NO.	25-00175-001
DESIGNED BY KNI	COUNTY CHARLES COUNTY	LOGFILE	N/A
DRAWN BY GLZ	HORIZONTAL SCALE	N/A	
CHECKED BY JIM	VERTICAL SCALE	N/A	
F.A.P. NO. N/A			
DRAWING NO. SR-01	OF 09	SHEET NO.	1 OF 44

BY: MMcColler

\\jmt\projects\25-00175-001\Drawings\SR-01.dwg 25-07-2025 10:00 AM

WET W 10 PEM TO BE PRESERVED. NO GRADING PROPOSED. ENHANCEMENTS INCLUDE ADDITION OF WOODY DEBRIS AND PLANTING. LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

POCKET GRADING IN CONJUNCTION WITH MINOR BANK GRADING TO BE FIT IN FIELD TO MATCH AS-BUILT ELEVATION OF NEARBY 100' BOLDER STEP STRUCTURES TO GENERATE HYDROLOGIC CONNECTION WITH THE ADJACENT WETLANDS. GRADING TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER. APPLIES TO SIMILAR SHAPES SHOWN ON THIS SHEET.

WET W 06 PEM AND WET W 06 PRO TO BE PRESERVED. NO GRADING PROPOSED. ENHANCEMENTS INCLUDE ADDITION OF WOODY DEBRIS AND PLANTING. LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

WET W 06 PSS TO BE PRESERVED. NO GRADING PROPOSED. ENHANCEMENTS INCLUDE ADDITION OF WOODY DEBRIS AND PLANTING. LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

SPECIMEN TREE TO REMAIN. PROPOSED WORK IN THIS LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

SPECIMEN TREE TO REMAIN. PROPOSED WORK IN THIS LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

MATCHLINE (SEE DWG. SR-09)

MATCHLINE (SEE DWG. SR-03)

MATCHLINE (STATION 102+19.71, SEE DWG. SR-01)

MAP 5 GRID-5 PARCEL-29
TAX ID 07-014466
DEVAN G. ARMSTRONG &
CAROL L. WITTER

MAP 1 GRID-23 PARCEL-67
TAX ID 07-025917
POPULAR BRANCH, LLC.

SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31783, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
JEREMY KOZER
JOHNSON, MERRINAN & THOMPSON
43 WEST AVENUE
HUNT VALLEY, MD 21030
TELEPHONE: 410-216-2960
EMAIL: JKOZER@JMT.COM

MILL SWAMP MITIGATION BANK
BYANS ROAD, MD 2088
CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
MARYLAND COORDINATE SYSTEM
NAD 83 MD STATE PLANE VERT. NAVD 88
OWNER/DEVELOPER INFORMATION
JOHNSON, MERRINAN & THOMPSON
43 WEST AVENUE
HUNT VALLEY, MD 21030
CONTACT INFORMATION
JEREMY KOZER
JOHNSON, MERRINAN & THOMPSON
TELEPHONE: 410-216-2960
EMAIL: JKOZER@JMT.COM

REVISIONS
CONCEPT DESIGN
NOT FOR CONSTRUCTION

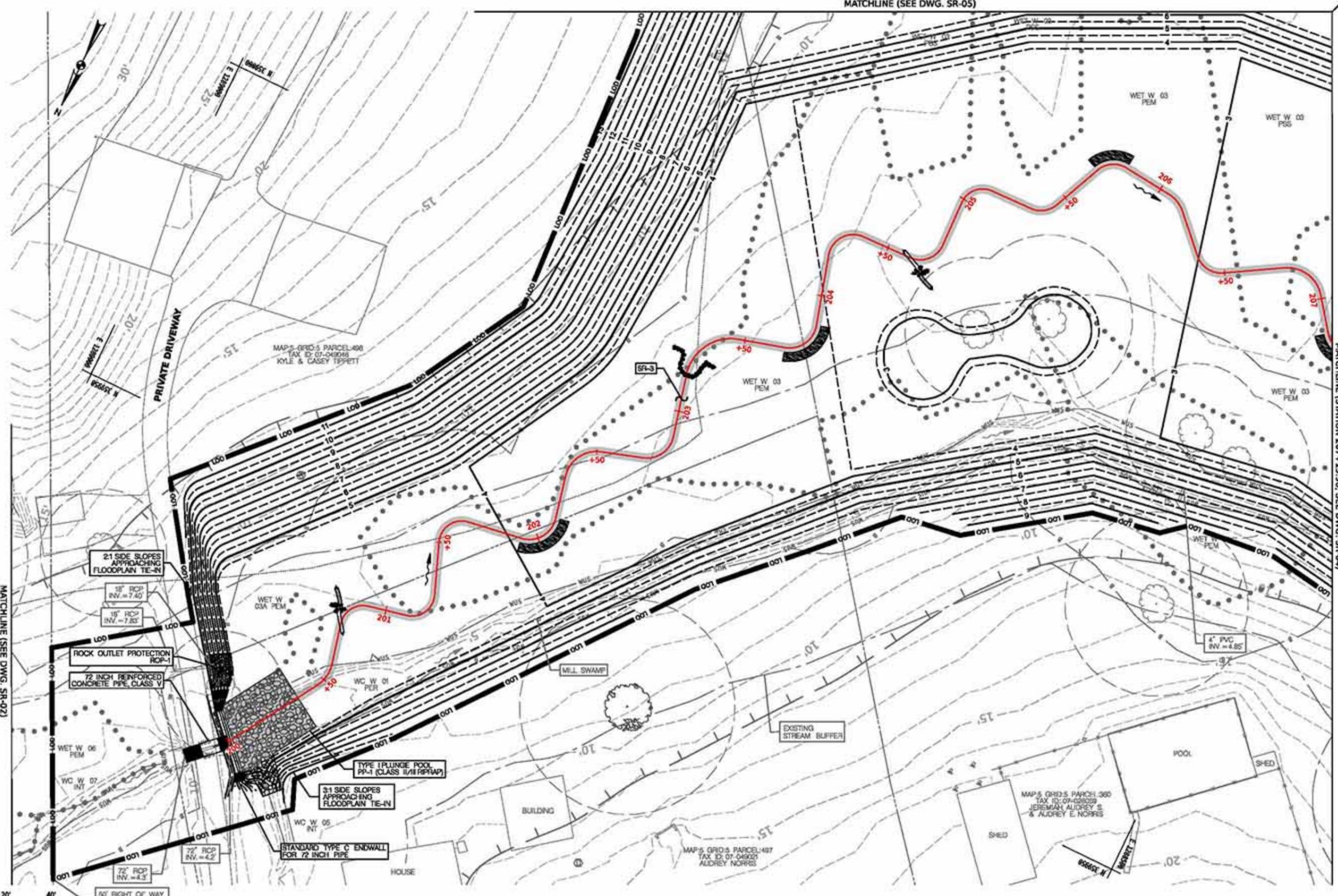
STREAM RESTORATION PLAN
SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00
DESIGNED BY: KNI COUNTY: CHARLES COUNTY
DRAWN BY: GLZ LOGFILE: N/A
CHECKED BY: JIM HORIZONTAL SCALE: N/A
F.A.P. NO.: N/A VERTICAL SCALE: N/A
DRAWING NO. SR-02 OF 09 SHEET NO. 1 OF 44

BY: M/McCuller -

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MATCHLINE (SEE DWG. SR-05)

MATCHLINE (STATION 207+19.98, SEE DWG. SR-04)



MATCHLINE (SEE DWG. SR-02)

SCALE: 1" = 20'



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 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.

DESIGN PROFESSIONAL CONTACT
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 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

NOTE:
 1. UNLESS OTHERWISE NOTED, ALL FLOODPLAIN SIDE SLOPES SHOWN PLANS ARE 6:1.

MILL SWAMP MITIGATION BANK
 WYANS ROAD, MD 2088

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83/11 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRINAN & THOMPSON
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 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
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 JOHNSON, MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS

CONCEPT DESIGN
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STREAM RESTORATION PLAN

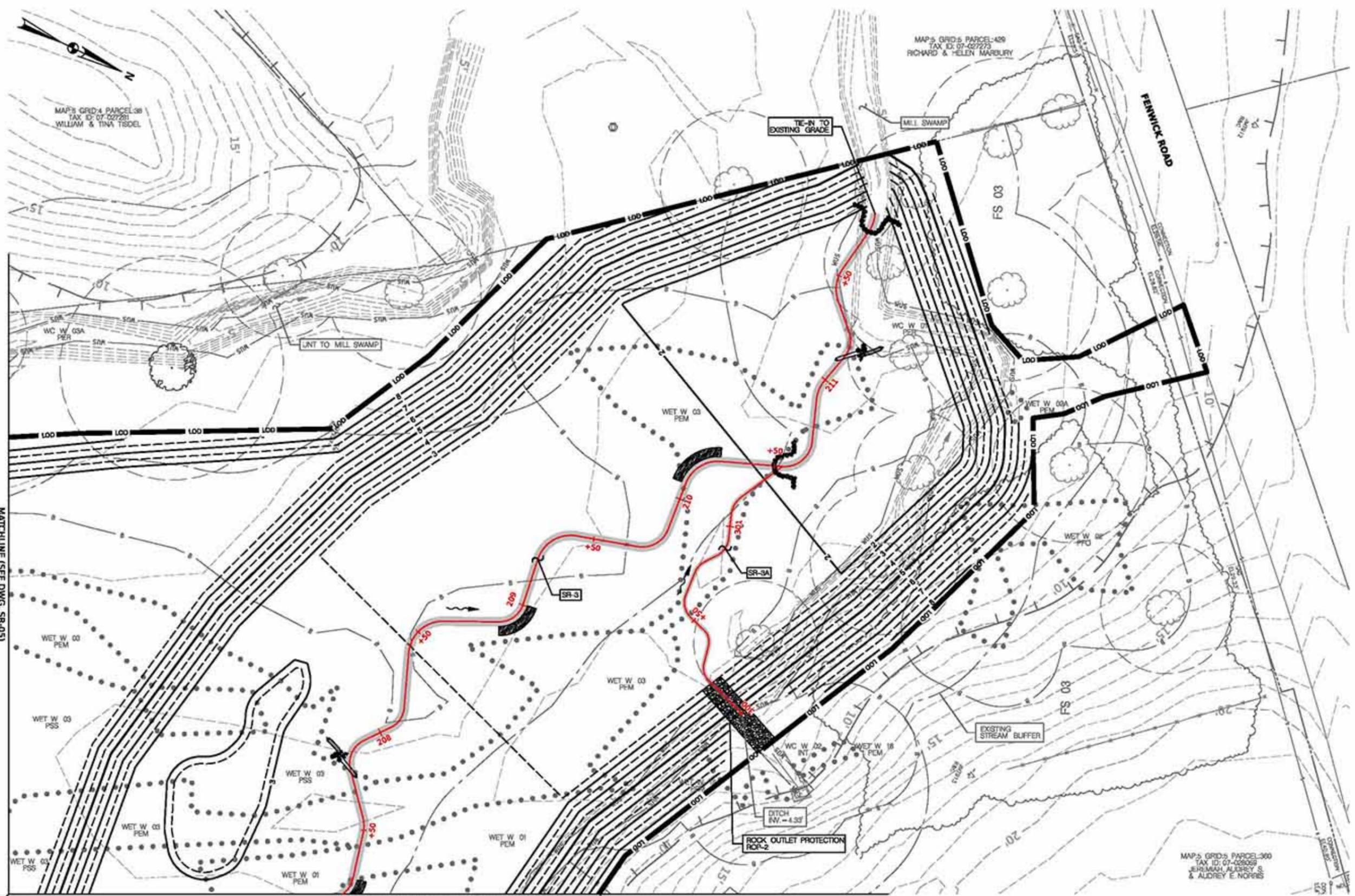
SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00

DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **SR-03** OF **09** SHEET NO. 11 OF 44

BY: M/McCuller

Vertical text on the right edge of the drawing.



SCALE: 1" = 20'

MATCHLINE (STATION 207+19.98, SEE DWG. SR-03)



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON, MERRINAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

NOTE:
 1. UNLESS OTHERWISE NOTED, ALL FLOODPLAIN SIDE SLOPES SHOWN PLANS ARE 6:1.

MILL SWAMP MITIGATION BANK
 WYANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRINAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON, MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

STREAM RESTORATION PLAN

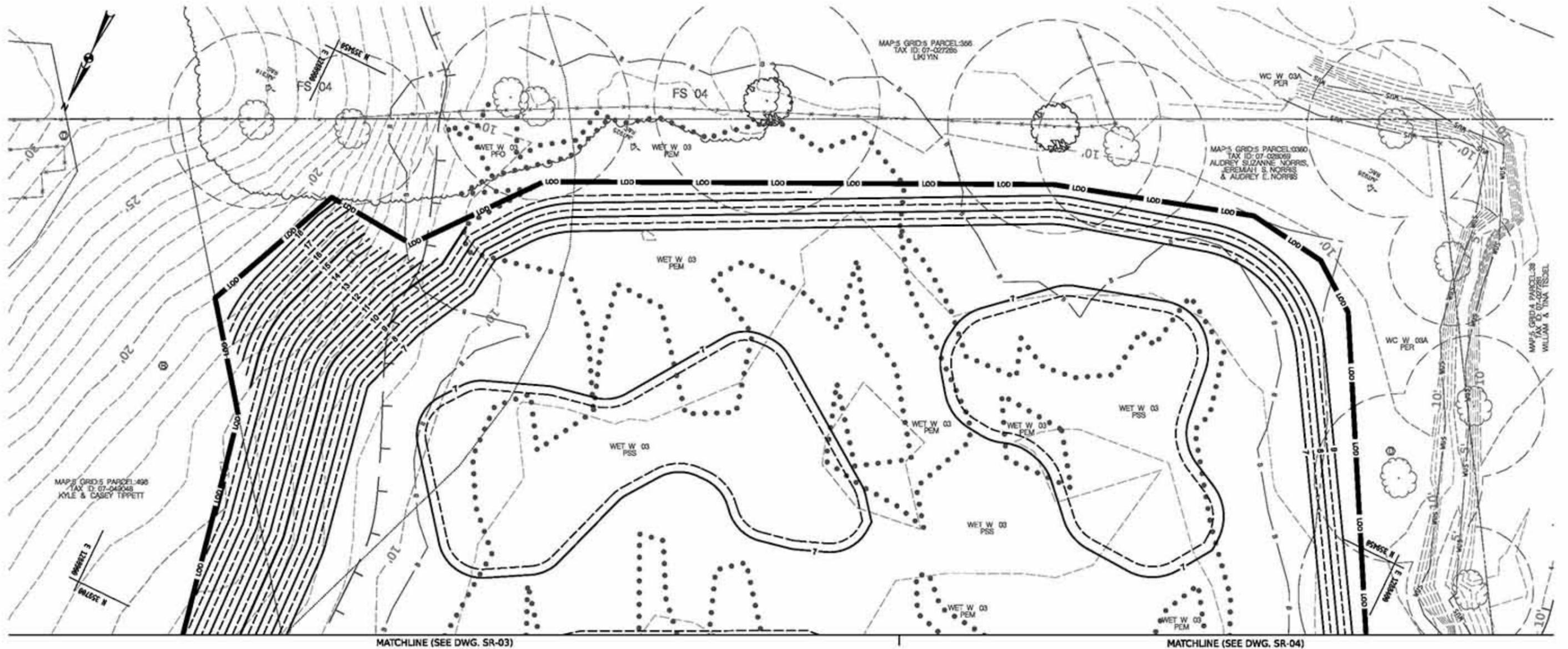
SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00

DESIGNED BY: KNI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **SR-04** OF **09** SHEET NO. 11 OF 44

BY: M/McCuller

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MATCHLINE (SEE DWG. SR-03)

MATCHLINE (SEE DWG. SR-04)



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31813, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
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 JOHNSON, MERMAN & THOMPSON
 42 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

NOTE:
 1. UNLESS OTHERWISE NOTED, ALL FLOODPLAIN SIDE SLOPES SHOWN PLANS ARE 6:1.

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERMAN & THOMPSON
 42 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
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 JOHNSON, MERMAN & THOMPSON
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 EMAIL: JKOSSE@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

STREAM RESTORATION PLAN

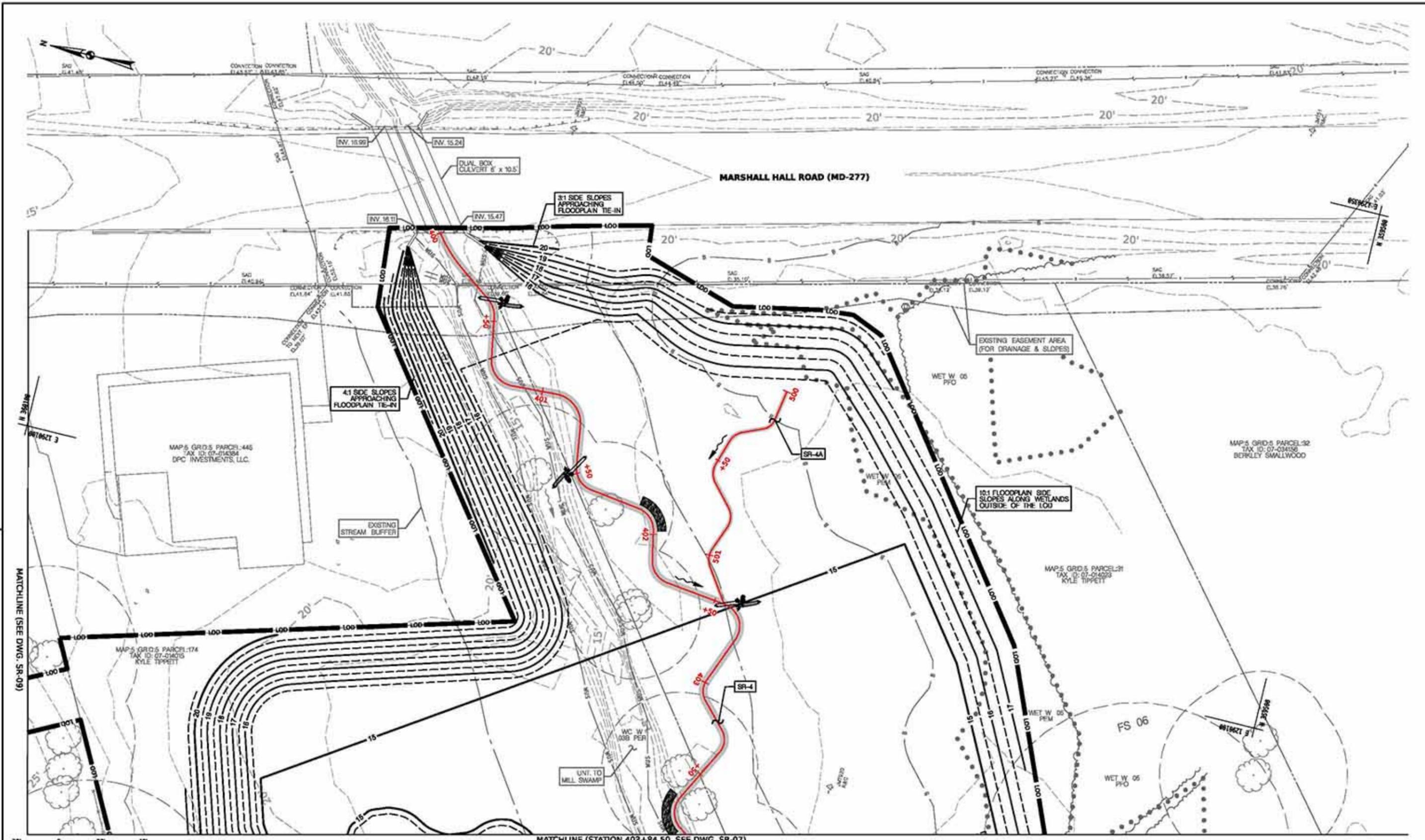
SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-00175-001

DESIGNED BY: KNEI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **SR-05** OF **09** SHEET NO. 12 OF 44

BY: MMCoeller

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MATCHLINE (SEE DWG. SR-09)

MATCHLINE (STATION 403+84.50, SEE DWG. SR-07)

SCALE 1" = 20'



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
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 43 WRIGHT AVENUE
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 TELEPHONE: 410-216-2960
 EMAIL: J.KOZER@JMT.COM

NOTE:
 1. UNLESS OTHERWISE NOTED, ALL FLOODPLAIN SIDE SLOPES SHOWN PLANS ARE 6:1.

MILL SWAMP MITIGATION BANK
 BRYANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83/MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRIMAN & THOMPSON
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CONCEPT DESIGN
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STREAM RESTORATION PLAN

SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00

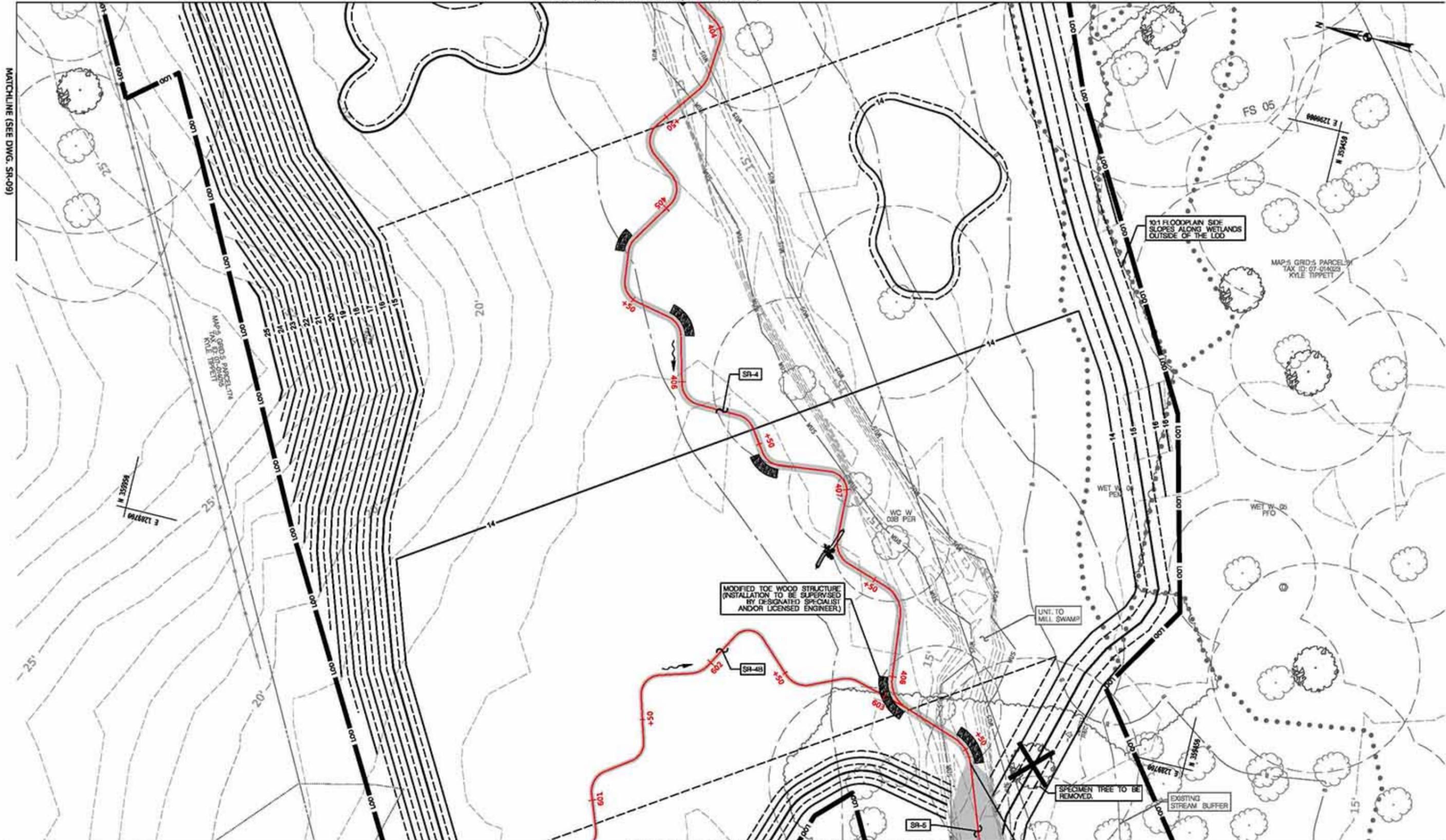
DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **SR-06** OF **09** SHEET NO. 11 OF 44

BY: M/McCuller

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MATCHLINE (STATION 403+84.50, SEE DWG. SR-06)



MATCHLINE (SEE DWG. SR-09)

SCALE: 1" = 20'

MATCHLINE (STATION 408+92.73 AND STATION 600+80.77, SEE DWG. SR-08)

BY: M/McCuller -



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.

DESIGN PROFESSIONAL CONTACT
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 JOHNSON MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

NOTE:
 1. UNLESS OTHERWISE NOTED, ALL FLOODPLAIN SIDE SLOPES SHOWN PLANS ARE: 6:1.

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRINAN & THOMPSON
 43 WRIGHT AVENUE
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CONTACT INFORMATION:
 JEREMY KOSER
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 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS

CONCEPT DESIGN
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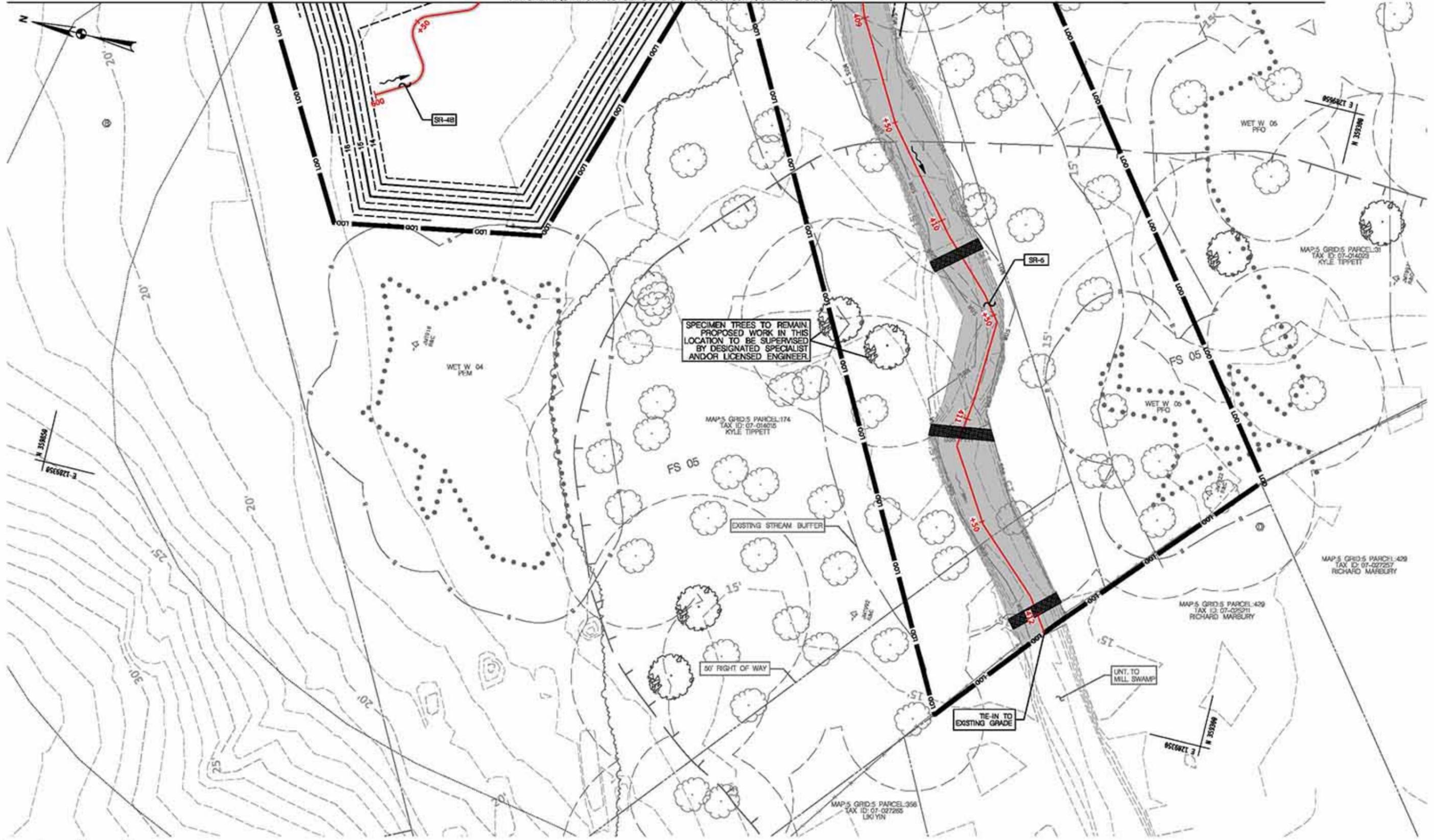
STREAM RESTORATION PLAN

SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-00

DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **SR-07** OF **09** SHEET NO. 11 OF 44

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SPECIMEN TREES TO REMAIN
PROPOSED WORK IN THIS
LOCATION TO BE SUPERVISED
BY DESIGNATED SPECIALIST
AND/OR LICENSED ENGINEER.

EXISTING STREAM BUFFER

50' RIGHT OF WAY

TIE-IN TO
EXISTING GRADE

UNT. TO
MILL SWAMP

SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS
WERE PREPARED OR APPROVED BY ME, AND
THAT I AM A DULY LICENSED PROFESSIONAL
ENGINEER UNDER THE LAWS OF THE STATE
OF MARYLAND, LICENSE NO. 31918,
EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
JEREMY KOEGER
JOHNSON, MERRIAM & THOMPSON
43 WRIGHT AVENUE
HUNT VALLEY, MD 21030
TELEPHONE: 410-216-2980
EMAIL: JKOEGER@JMT.COM

NOTE:
1. UNLESS OTHERWISE NOTED, ALL FLOODPLAIN
SIDE SLOPES SHOWN PLANS ARE 6:1.

MILL SWAMP MITIGATION BANK
BYRANS ROAD, MD 2088

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
JOHNSON, MERRIAM & THOMPSON
43 WRIGHT AVENUE
HUNT VALLEY, MD 21030

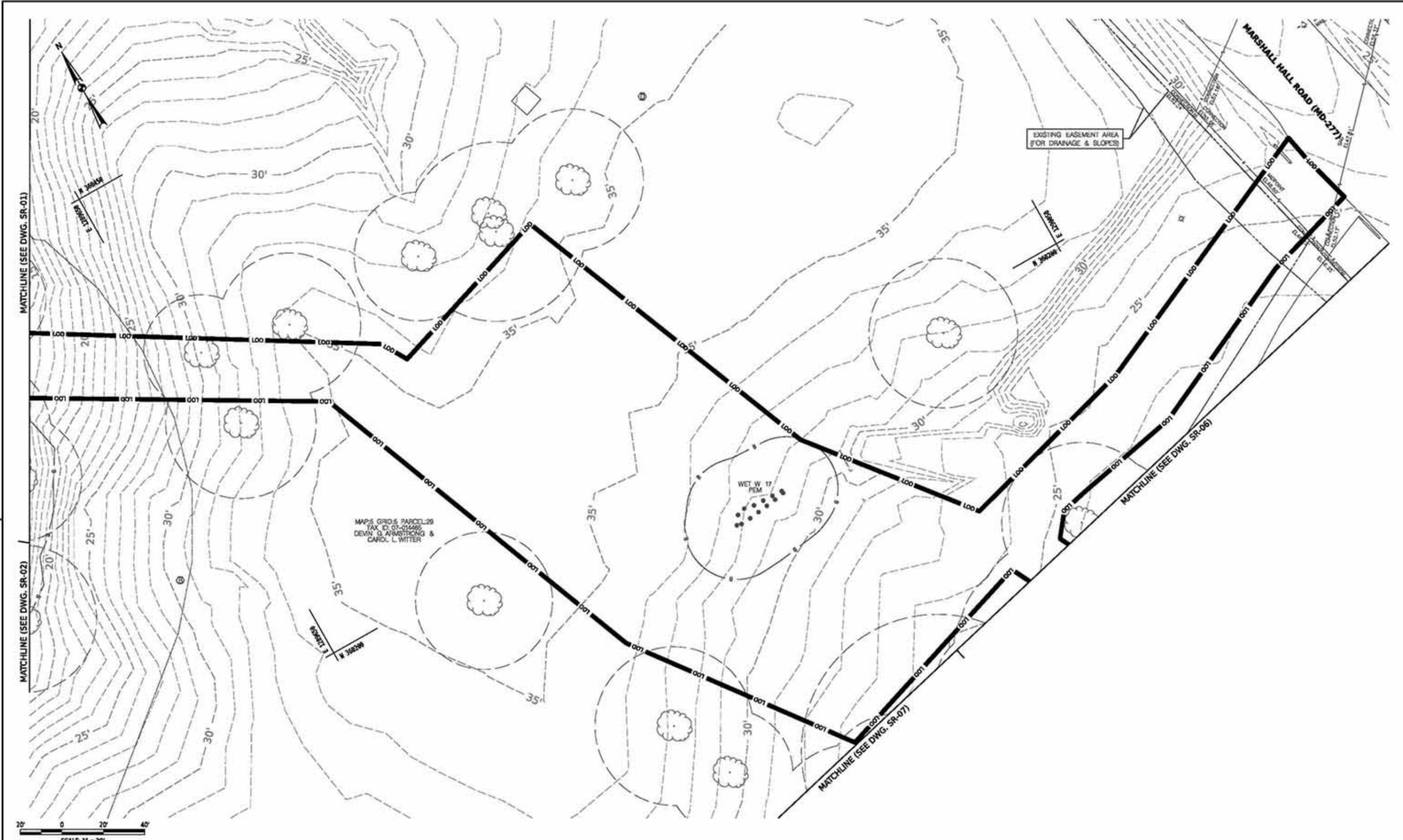
CONTACT INFORMATION:
JEREMY KOEGER
JOHNSON, MERRIAM & THOMPSON
TELEPHONE: 410-216-2980
EMAIL: JKOEGER@JMT.COM

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CONCEPT DESIGN	
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STREAM RESTORATION PLAN			
SCALE AS SHOWN	DATE JULY 2025	PROJECT NO.	25-0075-00
DESIGNED BY: KNI	COUNTY: CHARLES COUNTY		
DRAWN BY: GLZ	LOGFILE: N/A		
CHECKED BY: JIM	HORIZONTAL SCALE: N/A		
F.A.P. NO.: N/A	VERTICAL SCALE: N/A		
DRAWING NO. SR-08	OF 09	SHEET NO. 11	OF 44

BY: M/McCuller -

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PROFESSIONAL CERTIFICATION
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DESIGN PROFESSIONAL CONTACT
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 JOHNSON MERRIMAN & THOMPSON
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 EMAIL: JKOZER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20885

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
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 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 TELEPHONE: 410-316-2960
 EMAIL: JKOZER@JMT.COM

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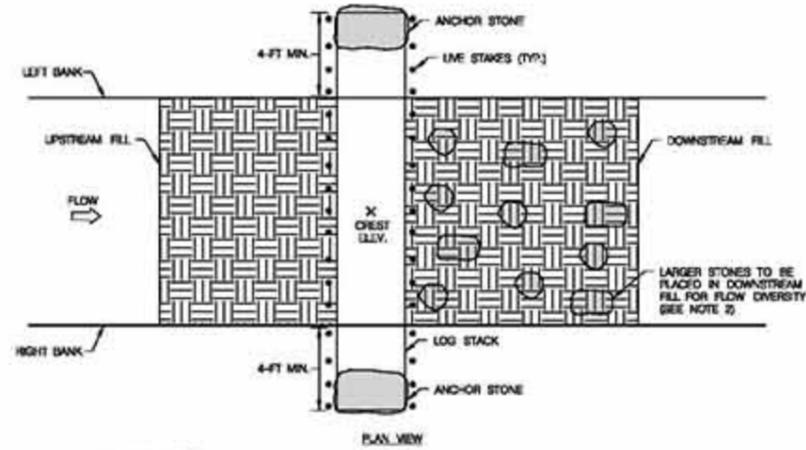
STREAM RESTORATION PLAN			
SCALE AS SHOWN	DATE JULY 2025	PROJECT NO. 25-0075-001	
DESIGNED BY KNI	COUNTY CHARLES COUNTY		
DRAWN BY GLZ	LOGFILE: N/A		
CHECKED BY JIM	HORIZONTAL SCALE N/A		
F.A.P. NO. N/A	VERTICAL SCALE N/A		
DRAWING NO. SR-09	OF 09	SHEET NO. 11	OF 44

BY: MMcColler -

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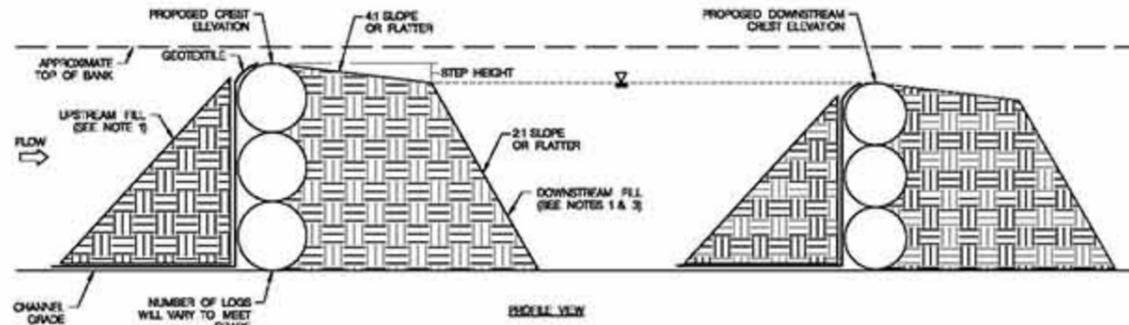
LOG BOULDER STEP DETAIL

NOT TO SCALE



PLAN VIEW NOTES

1. ANCHOR STONES SHALL BE MINIMUM 12x6 FEET AND ARRANGED TO HOLD CREST LOG IN PLACE SECURELY AS TESTED BY HAND AND THE EXCAVATOR.
2. DOWNSTREAM FILL SHALL ARRANGE LARGER CLASS AND OTHER PIECES OF STONE TO FORM FLOW DIVERSITY, SIMILAR TO RANDOM BOULDER APPLICATIONS.
3. GEOTEXTILE SHALL NOT BE VISIBLE IN FINAL INSTALLED STRUCTURE.
4. LENGTH OF LOGS MAY VARY TO MEET MINIMUM REQUIREMENT OF 4-FOOT KEY-IN ON LEFT AND RIGHT BANKS.
5. COMPACT FILL AROUND LOGS THOROUGHLY WITH BUCKET, AND PACK SURFACE 4-INCHES OF FILL AT BANKS WITH SOIL SUITABLE FOR PLANTING.
6. INSTALL LIVE STAKES INTO UPSTREAM AND DOWNSTREAM FILL AT 1-FOOT INTERVALS ON EACH SIDE OF CREST LOG, SPECIES AS APPROVED BY THE ENGINEER AND INSTALLED DURING THEIR DORMANT PERIOD.
7. STRUCTURE SHALL BE CONSIDERED COMPLETE WHEN IT IS OBSERVED HOLDING WATER ELEVATIONS AT THE APPROPRIATE CREST ELEVATIONS AS DEFINED ON THE PLANS AND/OR APPROVED IN THE FIELD. THIS MAY REQUIRE RE-WORKING SEVERAL STRUCTURES IN SEQUENCE.
8. PILING FLOWS WILL NOT BE PERMITTED.

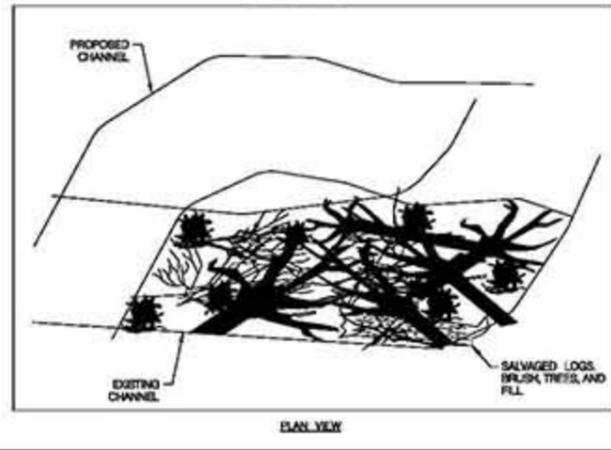


PROFILE VIEW NOTES

1. UPSTREAM AND DOWNSTREAM FILL SHALL BE SOIL AND SALVAGED CHANNEL BED MATERIAL MIXED INTO THE Voids OF A MIX OF CLASS OF STONE.
2. STEP ELEVATION SHALL BE DEFINED AS THE VERTICAL DISTANCE BETWEEN UPSTREAM AND DOWNSTREAM STRUCTURE CREST ELEVATIONS.
3. INSTALL DOWNSTREAM FILL AT A 4:1 SLOPE OR FLATTER THROUGH THE STEP ELEVATION, THEN 2:1 OR FLATTER TO MEET CHANNEL GRADE.
4. GEOTEXTILE SHALL BE WOVEN, MEETING SPECIFICATION OF MW41P1000 OR BETTER WHEN INSTALLING GEOTEXTILE. FASTEN TO LOG 1/2 DIAMETER BELOW CREST ELEVATION, FOLDED OVER AND SECURED EVERY 6 INCHES WITH STAINLESS 3-INCH CAP NAILS. GEOTEXTILE SHALL BE OF SUFFICIENT WIDTH TO BE ATTACHED ACROSS ENTIRE LENGTH OF LOGS. IF MULTIPLE PIECES ARE USED, OVERLAP MINIMUM OF 4 FEET. PNEUMATIC CAP NAILS MAY BE ATTACHED TO HOLD GEOTEXTILE ON LOGS BELOW CREST ELEVATION TO FACILITATE EFFECTIVE BACKFILL.
5. DO NOT STRESS, BULGE OR PUNCTURE GEOTEXTILE WHEN FILLING AND COMPACTING UPSTREAM FILL.
6. ENSURE GEOTEXTILE UNDERLAYS EXTENT OF UPSTREAM FILL TRIM EXCESS.
7. NUMBER OF LOGS SHALL VARY TO MEET CREST ELEVATION. LOGS SHALL BE MINIMUM 6-INCHES IN DIAMETER, AND HARDWOOD SPECIES (MAPLE, OAK, HICKORY, ASH, ETC), TULIP, POPLAR AND PINE SHALL NOT BE USED.
8. ELEVATIONS AND STATIONING MAY BE ADJUSTED TO MEET SITE CONDITIONS IN-FIELD BY THE ENGINEER.
9. IN LOCATIONS WHERE THIS STRUCTURE IS INSTALLED AND THERE IS NO EXISTING CHANNEL, THE CONTRACTOR SHOULD ASSUME AN APPROXIMATE DEPTH OF 3 FEET FOR EXCAVATION AND PLACEMENT OF FILL. EXCAVATION IS INCIDENTAL TO THE COST OF THE STRUCTURE.

STRATEGIC WOODY MATERIAL PLACEMENT

NOT TO SCALE



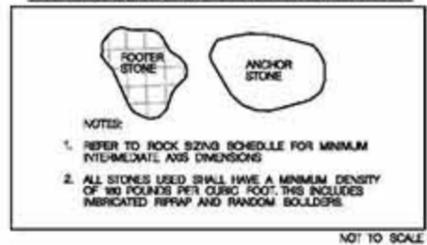
ROCK SIZING SCHEDULE					
TYPE	MINIMUM LENGTH (FT)	MINIMUM WIDTH (FT)	MINIMUM HEIGHT (FT)	TYPICAL SHAPE	TYPICAL USAGES
ANCHOR STONE	20	20	1.0	TABULAR	WANE STRUCTURES, DOGGER LOGS, LOG BOULDER STEP
FOOTER STONES	20	20	1.0	TABULAR	WANE STRUCTURES, RANDOM BOULDER STRUCTURE, DOGGER LOGS
RANDOM BOULDER	20	20	1.0	TABULAR	RANDOM BOULDER STRUCTURE
MURICATED ROCK WALL	20	1.5	1.0	TABULAR	MURICATED ROCK WALL STRUCTURE
SALVAGED CHANNEL BED MATERIAL	SEE SPECIFICATIONS FOR PARTICLE SIZE DISTRIBUTION			MIXED	CHOKING IN MATERIAL FOR CHANNEL BED, BACKFILL
RUNNED CHANNEL BED MATERIAL	SEE SPECIFICATIONS FOR PARTICLE SIZE DISTRIBUTION			MIXED	CHOKING IN MATERIAL FOR CHANNEL BED, BACKFILL
RIFPLE UNDERLAYMENT	SEE MDE 2011 EAS SPECIFICATIONS, TABLE H.2			ANGULAR	CHANNEL LOCATIONS AS SPECIFIED ON PLANS
CLASS 0, 1, 2 RIPRAP	SEE MDE 2011 EAS SPECIFICATIONS, TABLE H.1			ANGULAR	OUTFALL PROTECTION, SLOPE AND CHANNEL PROTECTION, MISC USES AS NOTED

*SEE SPECIFICATIONS FOR DETAILED DESCRIPTIONS AND TOLERANCES

LOG SIZING SCHEDULE			
TYPE	MINIMUM LENGTH (FT)	MINIMUM DIAMETER (IN)	TYPICAL USAGES
LOG WANE	10	6 - 8	LOG WANE STRUCTURES
DOGGER LOG	10	6 - 8	DOGGER LOG STRUCTURE
TOE WOOD FOUNDATION LOGS, CANTILEVERED LOGS	10	3 - 6	TOE WOOD STRUCTURES
LOG BOULDER STEP	W/VMS (SEE DETAIL)	6	LOG BOULDER STEP

*SEE SPECIFICATIONS FOR DETAILED DESCRIPTIONS AND TOLERANCES

ANCHOR AND FOOTER STONE DETAIL



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A FULLY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31183, EXPIRATION DATE: 10/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOEGER
 JOHNSON, MERRIMAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOEGER@JMT.COM

MILL SWAMP MITIGATION BANK
 BRYANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION: JOHNSON, MERRIMAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

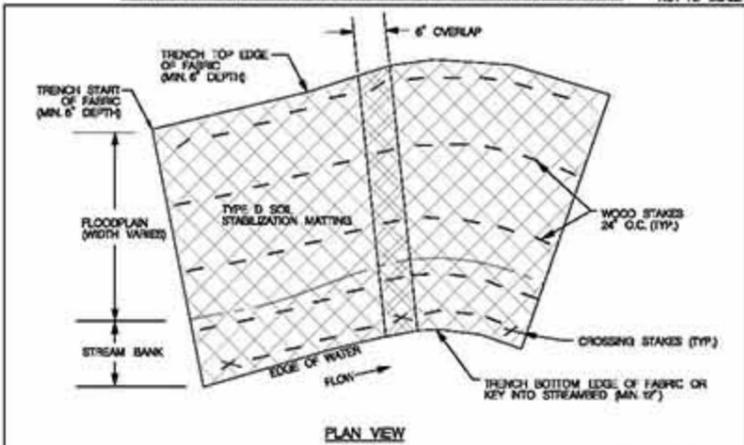
CONTACT INFORMATION: JEREMY KOEGER
 JOHNSON, MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOEGER@JMT.COM

REVISIONS	STREAM RESTORATION DETAILS		
CONCEPT DESIGN NOT FOR CONSTRUCTION	SCALE AS SHOWN	DATE JULY 2025	PROJECT NO. 25-0075-001
	DESIGNED BY: KNE	COUNTY: CHARLES COUNTY	
	DRAWN BY: JIM	LOGMILE: N/A	
	CHECKED BY: JIM	HORIZONTAL SCALE: N/A	
	F.A.P. NO.: N/A	VERTICAL SCALE: N/A	
	DRAWING NO. SRD-02	OF 03	SHEET NO. 11 OF 44

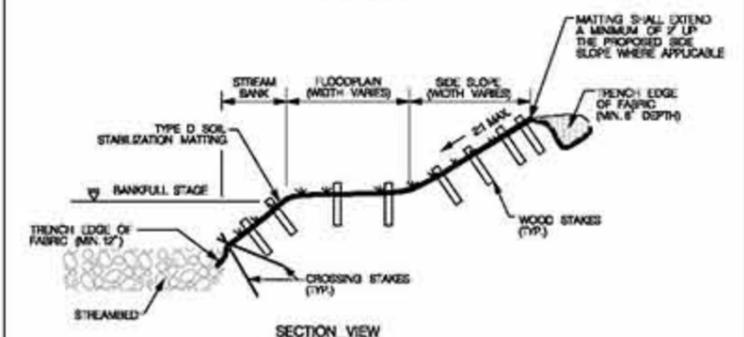
BY: M/McCuller

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STREAMBANK / FLOODPLAIN STABILIZATION DETAIL NOT TO SCALE



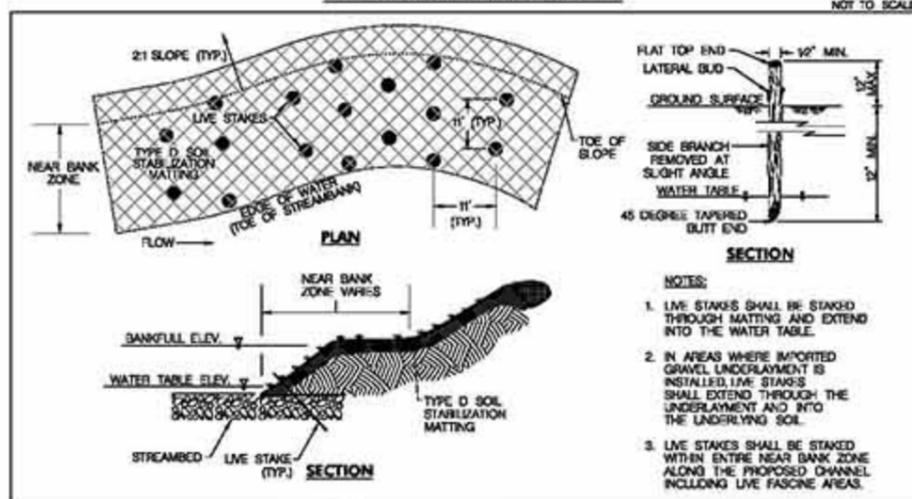
PLAN VIEW



SECTION VIEW

- NOTES:
1. TYPE D SOIL STABILIZATION MATTING (SSM) SHALL BE OVERLAPPED 'SHINGLE' STYLE OR PERPENDICULAR TO THE CHANNEL WITH THE UPSTREAM SECTION OF MATTING OVERLAPPING THE NEXT DOWNSTREAM SECTION OF MATTING.
 2. SPECIFIED SEED MIX SHALL BE APPLIED FIRST AND IMMEDIATELY COVERED WITH THE SSM.
 3. THE SSM SHALL BE 100 PERCENT BIODEGRADABLE COIR FIBER MATTING.
 4. THE SSM SHALL CONFORM TO THE SPECIFICATIONS.
 5. WOOD CROSSING STAKES SHALL BE UTILIZED TO SECURE ENDS OF THE SSM WHERE IT IS NOT FEASIBLE TO TRENCH OR KEY-IN THE END OF THE FABRIC.
 6. WOOD STAKES SHALL BE UNTRATED HARDWOOD OR SOUTHERN YELLOW PINE WITH A SAW FORMED POINT ON ONE END, 1" BY 2" IN SIZE AND 10-24 INCHES IN LENGTH.
 7. STAPLES ARE NOT AN ACCEPTABLE SUBSTITUTE FOR STAKES.
 8. IN THE EVENT OF LOSS OF FABRIC PRIOR TO GROWTH OF VEGETATION THE CONTRACTOR SHALL INSTALL NEW SEED AND TOPSOIL TO PROPOSED FINISHED GRADE AND RE-ANCHOR AREAS AT NO ADDITIONAL COST.

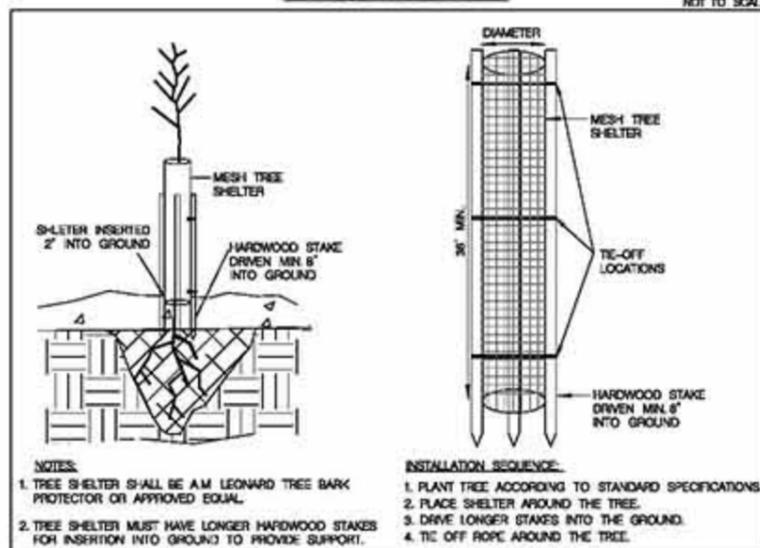
LIVE STAKE PLANTING DETAIL NOT TO SCALE



SECTION

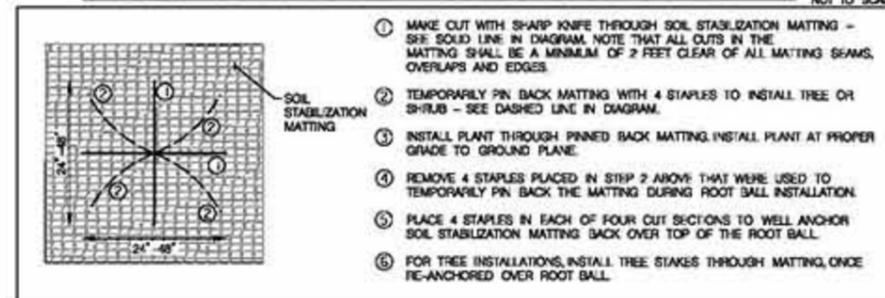
- NOTES:
1. LIVE STAKES SHALL BE STAKED THROUGH MATTING AND EXTEND INTO THE WATER TABLE.
 2. IN AREAS WHERE IMPORTED GRAVEL UNDERLAYMENT IS INSTALLED, LIVE STAKES SHALL EXTEND THROUGH THE UNDERLAYMENT AND INTO THE UNDERLYING SOIL.
 3. LIVE STAKES SHALL BE STAKED WITHIN ENTIRE NEAR BANK ZONE ALONG THE PROPOSED CHANNEL INCLUDING LIVE FASCINE AREAS.

TREE SHELTER DETAIL NOT TO SCALE



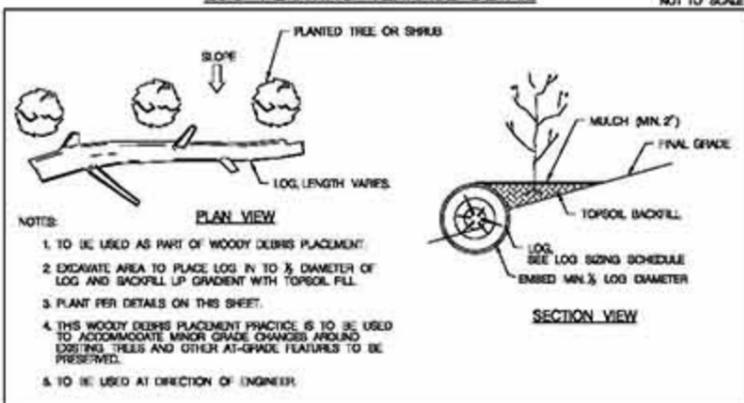
- NOTES:
1. TREE SHELTER SHALL BE A.M. LEONARD TREE BARK PROTECTOR OR APPROVED EQUAL.
 2. TREE SHELTER MUST HAVE LONGER HARDWOOD STAKES FOR INSERTION INTO GROUND TO PROVIDE SUPPORT.

TREE & SHRUB INSTALLATION THROUGH SOIL STABILIZATION MATTING NOT TO SCALE



1. MAKE CUT WITH SHARP KNIFE THROUGH SOIL STABILIZATION MATTING - SEE SOLID LINE IN DIAGRAM. NOTE THAT ALL CUTS IN THE MATTING SHALL BE A MINIMUM OF 2 FEET CLEAR OF ALL MATTING SEAMS, OVERLAPS AND EDGES.
2. TEMPORARILY PIN BACK MATTING WITH 4 STAPLES TO INSTALL TREE OR SHRUB - SEE DASHED LINE IN DIAGRAM.
3. INSTALL PLANT THROUGH PINNED BACK MATTING. INSTALL PLANT AT PROPER GRADE TO GROUND PLANE.
4. REMOVE 4 STAPLES PLACED IN STEP 2 ABOVE THAT WERE USED TO TEMPORARILY PIN BACK THE MATTING DURING ROOT BALL INSTALLATION.
5. PLACE 4 STAPLES IN EACH OF FOUR CUT SECTIONS TO WELL ANCHOR SOIL STABILIZATION MATTING BACK OVER TOP OF THE ROOT BALL.
6. FOR TREE INSTALLATIONS, INSTALL THREE STAKES THROUGH MATTING, ONCE RE-ANCHORED OVER ROOT BALL.

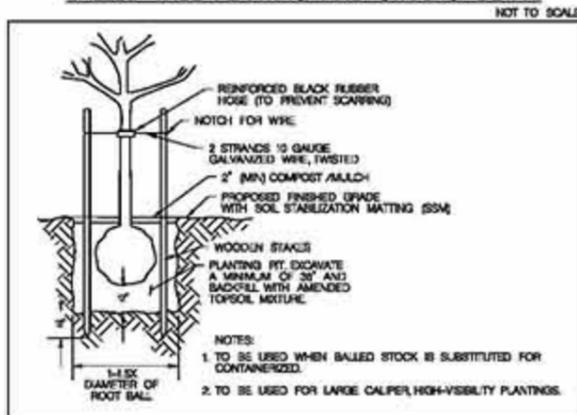
LOG PLANTING TERRACE DETAIL NOT TO SCALE



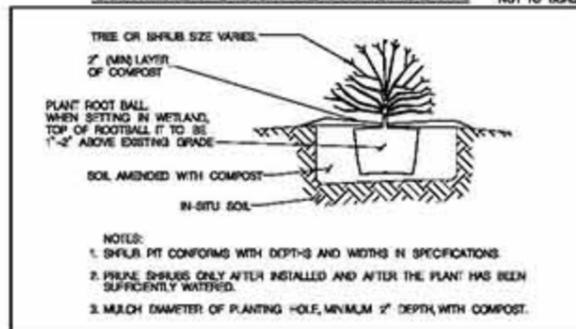
SECTION VIEW

- NOTES:
1. TO BE USED AS PART OF WOODY DEBRIS PLACEMENT.
 2. EXCAVATE AREA TO PLACE LOG IN TO 1/2 DIAMETER OF LOG AND BACKFILL UP GRADIENT WITH TOPSOIL FILL.
 3. PLANT PER DETAILS ON THIS SHEET.
 4. THIS WOODY DEBRIS PLACEMENT PRACTICE IS TO BE USED TO ACCOMMODATE MINOR GRADE CHANGES AROUND EXISTING TREES AND OTHER AT-GRADE FEATURES TO BE PRESERVED.
 5. TO BE USED AT DIRECTION OF ENGINEER.

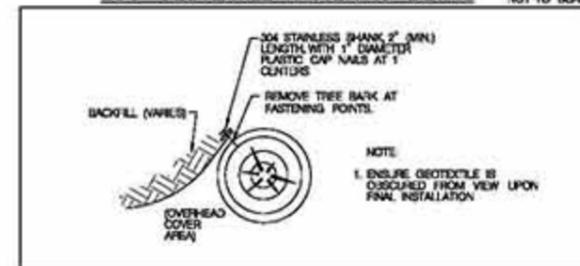
BALLED TREE PLANTING AND STAKING DETAIL NOT TO SCALE



CONTAINER STOCK PLANTING DETAIL NOT TO SCALE



LOG GEOTEXTILE FASTENING DETAIL NOT TO SCALE

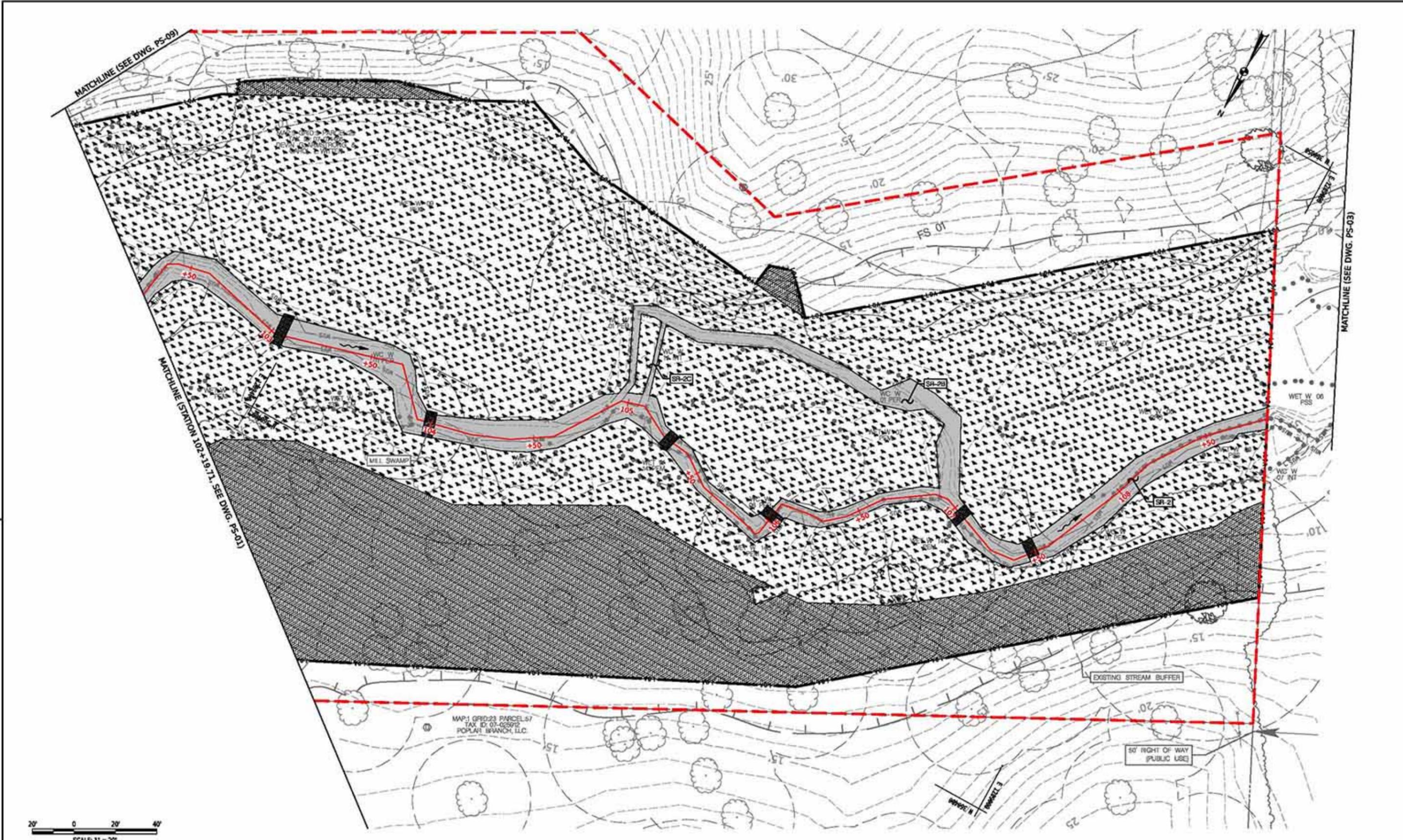


PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A FULLY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31983, EXPIRATION DATE: 10/2027
 DESIGN PROFESSIONAL CONTACT
 JEREMY KOSSER
 JOHNSON MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21080
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
 MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 83
 OWNER / DEVELOPER INFORMATION
 JOHNSON MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21080
 CONTACT INFORMATION
 JEREMY KOSSER
 JOHNSON MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

REVISIONS		STREAM RESTORATION DETAILS	
CONCEPT DESIGN	NOT FOR CONSTRUCTION	SCALE AS SHOWN	DATE JULY 2025 PROJECT NO. 25-0075-001
DESIGNED BY: JMT	COUNTY: CHARLES COUNTY	DRAWN BY: JMT	LOGICAL: N/A
CHECKED BY: JMT	HORIZONTAL SCALE: N/A	F.A.P. NO.: N/A	VERTICAL SCALE: N/A
DRAWING NO. SRD-03 OF 03	SHEET NO. 11 OF 44		



SCALE: 1" = 20'

MAP 1 GRID 23 PARCEL 57
TAX ID: 07-025912
POPLAR BRANCH, LLC



PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31783, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
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JOHNSON MERRIMAN & THOMPSON
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TELEPHONE: 410-216-2960
EMAIL: JKOSSE@JMT.COM

MILL SWAMP MITIGATION BANK
BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
NAD 83 / MD STATE PLANE VERT. NAVD 83

OWNER / DEVELOPER INFORMATION
JOHNSON MERRIMAN & THOMPSON
43 WEST AVENUE
HUNT VALLEY, MD 21030

CONTACT INFORMATION
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JOHNSON MERRIMAN & THOMPSON
TELEPHONE: 410-216-2960
EMAIL: JKOSSE@JMT.COM

REVISIONS

CONCEPT DESIGN
NOT FOR CONSTRUCTION

PLANTING PLAN

SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-00

DESIGNED BY: KNE	COUNTY: CHARLES COUNTY
DRAWN BY: GLZ	LOCALITY: N/A
CHECKED BY: JIM	HORIZONTAL SCALE: N/A
F.A.P. NO.: N/A	VERTICAL SCALE: N/A

DRAWING NO. **PS-02** OF **09** SHEET NO. 02 OF 44

BY: MMcColler -

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MATCHLINE (SEE DWG. PS-05)

MATCHLINE (STATION 207+19.98, SEE DWG. PS-04)



SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.

DESIGN PROFESSIONAL CONTACT
 JEREMY KOSSER
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MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 2088

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRINAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOSSER
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 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

PLANTING PLAN

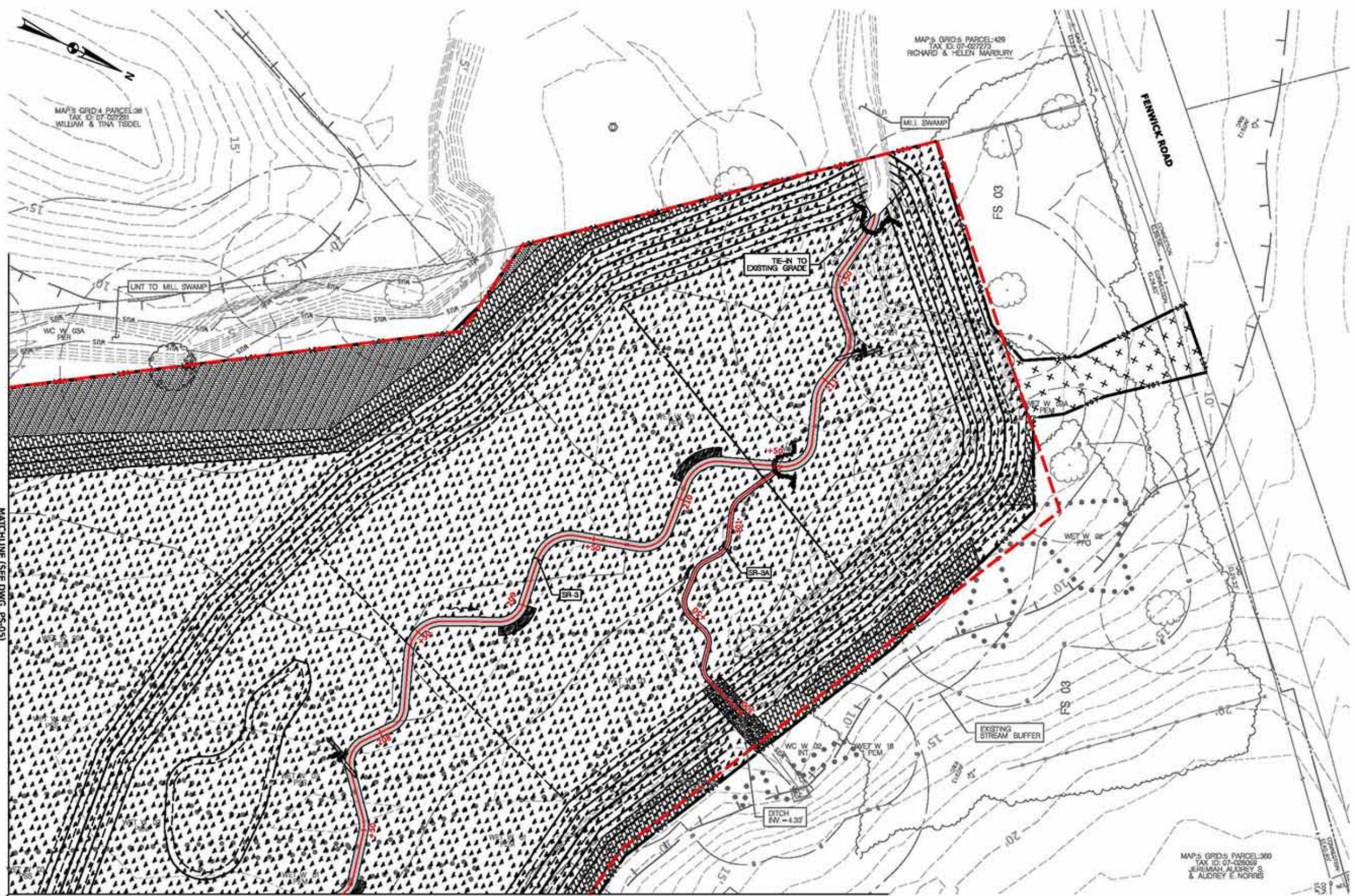
SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00

DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **PS-03** OF **09** SHEET NO. 03 OF 44

BY: MMcoller

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SCALE: 1" = 20'

MATCHLINE (STATION 207+19.98, SEE DWG. PS-03)



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 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31818, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOEGER
 JOHNSON, MERMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOEGER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 83

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOEGER
 JOHNSON, MERMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOEGER@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

PLANTING PLAN

SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00

DESIGNED BY: KNI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

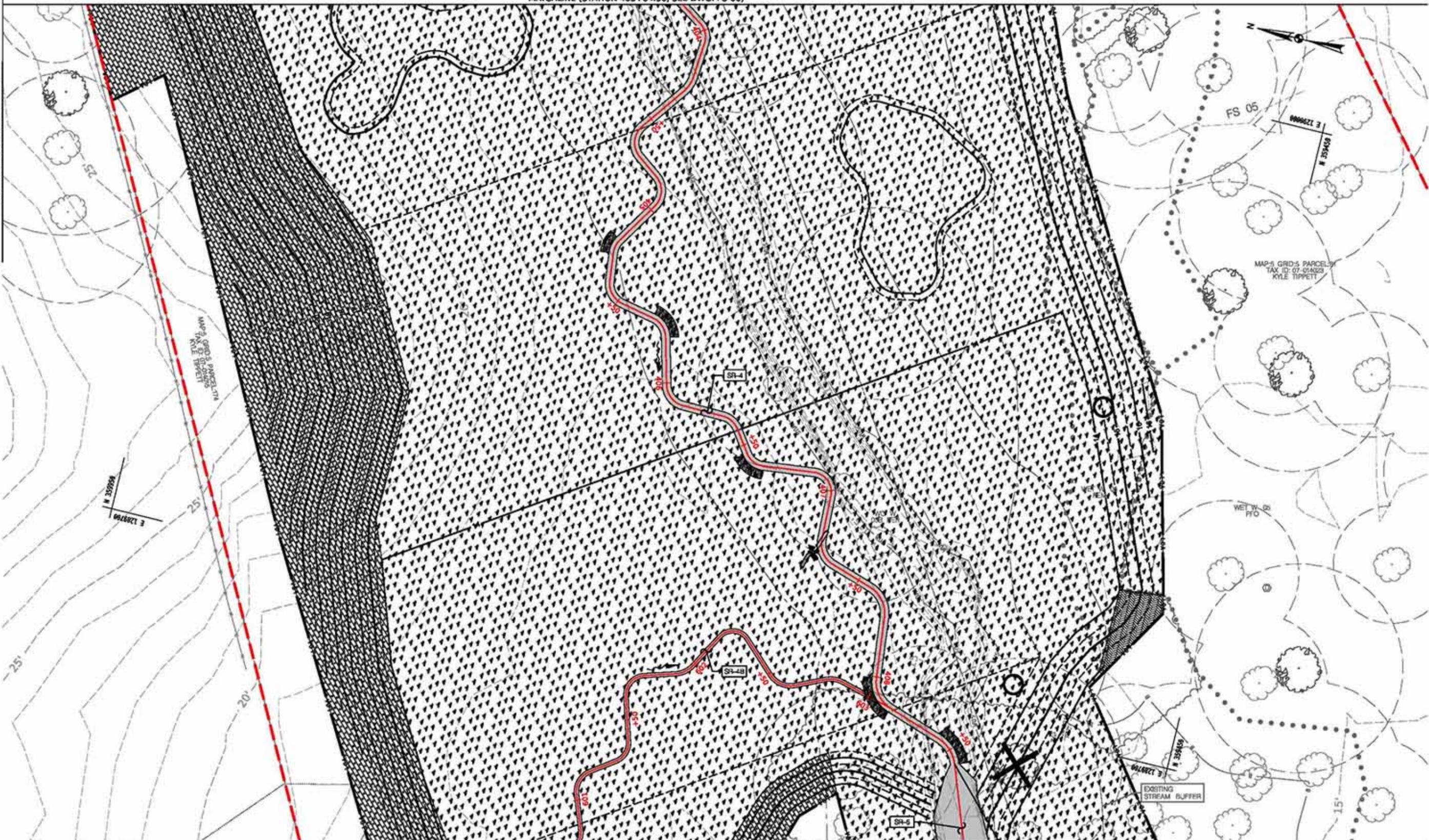
DRAWING NO. **PS-04** OF **09** SHEET NO. 14 OF 44

BY: M/McCuller

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MATCHLINE (STATION 403+84.50, SEE DWG. PS-06)

MATCHLINE (SEE DWG. PS-09)



MATCHLINE (STATION 408+92.73 AND STATION 600+80.77, SEE DWG. PS-08)

REACH BREAK

SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.

DESIGN PROFESSIONAL CONTACT
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 HUNT VALLEY, MD 21030
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 EMAIL: JKOZIER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 83

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRIMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZIER
 JOHNSON, MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOZIER@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

PLANTING PLAN

SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00

DESIGNED BY: KNI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **PS-07** OF **09** SHEET NO. 17 OF 44

BY: MMcColler

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SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
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DESIGN PROFESSIONAL CONTACT
 JEREMY KOEGER
 JOHNSON, MERRIMAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-316-2960
 EMAIL: JKOEGER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 83

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRIMAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOEGER
 JOHNSON, MERRIMAN & THOMPSON
 TELEPHONE: 410-316-2960
 EMAIL: JKOEGER@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

PLANTING PLAN

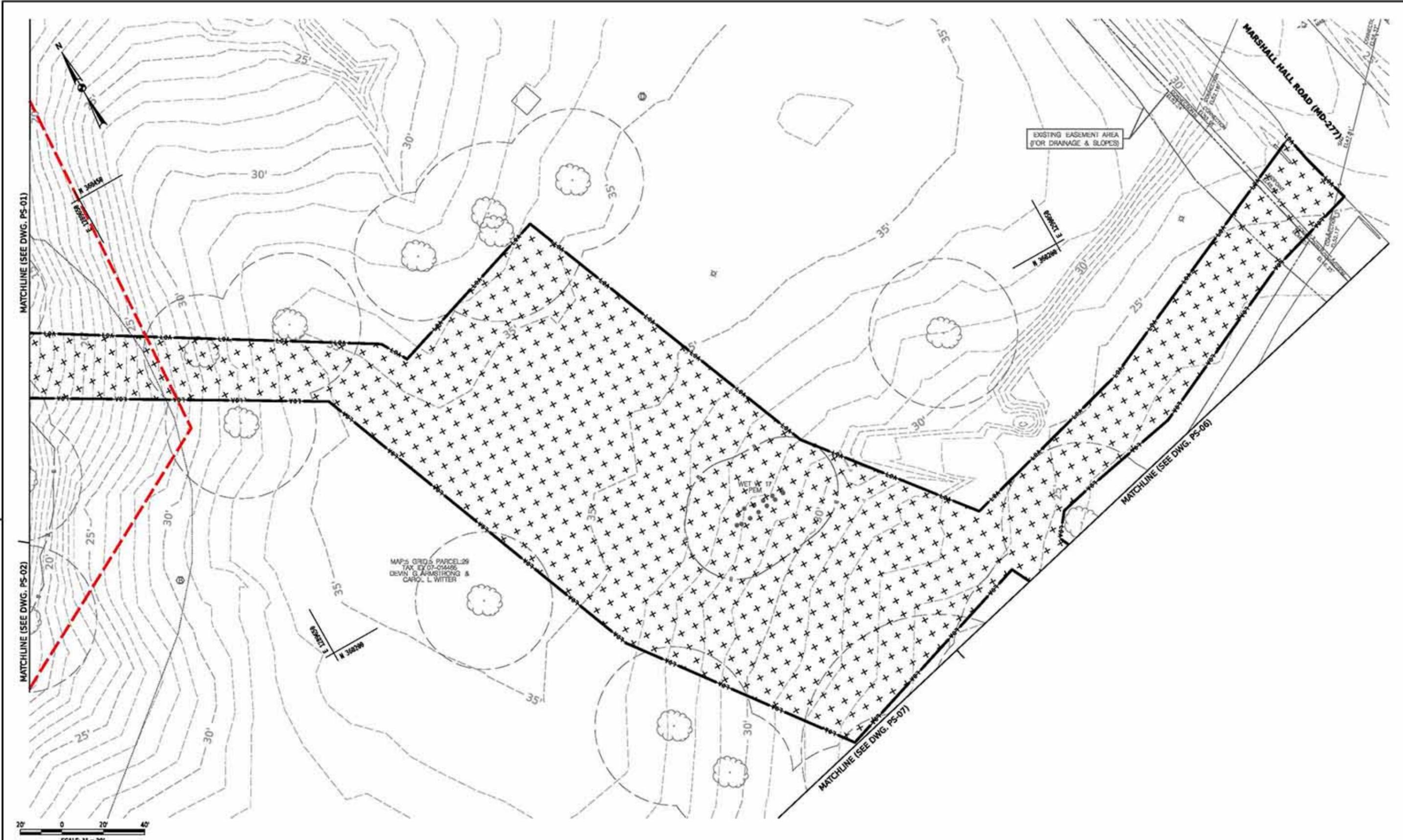
SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-00

DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **PS-08** OF **09** SHEET NO. 11 OF 44

BY: M/McCuller -

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PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOEGER
 JOHNSON MERRIMAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOEGER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83/11 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION
 JOHNSON MERRIMAN & THOMPSON
 42 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION
 JEREMY KOEGER
 JOHNSON MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOEGER@JMT.COM

REVISIONS	
CONCEPT DESIGN	
NOT FOR CONSTRUCTION	

PLANTING PLAN			
SCALE AS SHOWN	DATE JULY 2025	PROJECT NO.	25-0075-00
DESIGNED BY	KNI	COUNTY	CHARLES COUNTY
DRAWN BY	GLZ	LOGFILE	N/A
CHECKED BY	JIM	HORIZONTAL SCALE	N/A
F.A.P. NO.	N/A	VERTICAL SCALE	N/A
DRAWING NO.	PS-09	OF	09
SHEET NO.	09	OF	44

BY: M/Moeller

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PLANTING LEGEND	
	LIMIT OF PLANTING ACTIVITY
	CONSERVATION EASEMENT
	SPECIMEN TREE MITIGATION PLANTING
	ZONE 1 - WETLAND PLANTING (3.52 AC.) WETLAND TREE PLANTING, WETLAND SHRUB PLANTING & WETLAND SEED MIX
	ZONE 2 - UPLAND PLANTING (2.15 AC.) UPLAND TREE PLANTING, UPLAND SHRUB PLANTING & UPLAND SEED MIX
	ZONE 3 - UPLAND BUFFER PLANTING (1.42 AC.) UPLAND TREE PLANTING & UPLAND SHRUB PLANTING
	ZONE 4 - WARM SEASON GRASSES (1.00 AC.)

STABILIZATION SCHEDULE	
TYPE	QUANTITY (SY)
SOIL STABILIZATION MATTING - COIR MAT 700 (ZONE 1)	65,927
SOIL STABILIZATION MATTING - COIR MAT 400 (ZONE 2)	10,411
BLOWN STRAW (ZONE 4)	5,943

SEED MIX SCHEDULE	
SEED MIX	QUANTITY (SY)
WETLAND SEED MIX (ZONE 1)	65,927
UPLAND SEED MIX (ZONE 2)	10,411
WARM SEASON GRASSES (ZONE 4)	5,943

- NOTES:
- SEE SHEET SD-03 FOR PLANTING DETAILS.
 - ALL SPECIES PLANTED WITHIN THE WETLAND AND WETLAND BUFFER SHALL BE NATIVE TO THAT REGION OF THE STATE AND SHOULD BE LOCALLY SOURCED GENOTYPES. NO CULTIVARS SHOULD BE USED. ALL SPECIES USED FOR TEMPORARY OR PERMANENT SEEDING MUST BE NATIVE OR NON-PERSISTENT.
 - TREES/SHRUBS SHOULD BE PLANTED IN EARLY SPRING OR IN THE FALL.
 - TREE SHELTERS ARE TO BE USED FOR PLANT PROTECTION FROM HERBIVORY BY DEER, VOLES, BEAVER, ETC. SEE SHEET SD-03 FOR TREE SHELTER DETAIL.

WETLAND TREE PLANTING SCHEDULE (ZONE 1)							
QUANTITY	ABBR.	SCIENTIFIC NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING	INDICATOR STATUS
414	AR	<i>Acer rubrum</i>	Red Maple	1" cal.	#7	10' oc.	FAC
414	ASN	<i>Acer saccharinum</i>	Silver Maple	1" cal.	#7	10' oc.	FACW
415	CCR	<i>Carpinus caroliniana</i>	American Hornbeam	1" cal.	#7	10' oc.	FAC
417	BN	<i>Betula nigra</i>	River Birch	1" cal., 3" cal.**	#7, b&b**	10' oc.	FACW
415	POC	<i>Platanus occidentalis</i>	American Sycamore	1" cal.	#7	10' oc.	FACW
415	QB	<i>Quercus bicolor</i>	Swamp White Oak	1" cal.	#7	10' oc.	FACW
415	OPA	<i>Quercus palustris</i>	Pin Oak	1" cal.	#7	10' oc.	FACW
415	SAN?	<i>Salix nigra</i>	Black Willow	1" cal.	#7	10' oc.	OBL
415	TD	<i>Taxodium distichum</i>	Bald Cypress	1" cal.	#7	10' oc.	OBL
415	ANG	<i>Acer negundo</i>	Boxelder Maple	1" cal.	#7	10' oc.	FAC

*NO TREES ARE TO BE PLANTED ON SEWER LINES OR MANHOLES, 10' CENTER TO CENTER.
**SPECIMEN TREE MITIGATION PLANTINGS: 2 TREES OF THE SELECTED SPECIES MUST BE PLANTED WITH A DBH OF AT LEAST 3" CAL. AS A B&B, SEE PLANTING PLANS FOR APPROXIMATE LOCATIONS. THE CONTRACTOR SHALL COORDINATE ALL LOCATIONS WITH JMT PRIOR TO PLANTING.

WETLAND SHRUB PLANTING SCHEDULE (ZONE 1)							
QUANTITY	ABBR.	SCIENTIFIC NAME	COMMON NAME	HEIGHT (FT)	CONT. CLASS	SPACING	INDICATOR STATUS
592	CSE	<i>Viburnum corymbosum</i>	Highbush Blueberry	1.5	#1	10' oc.	FACW
592	SS	<i>Salix sericea</i>	Silky Willow	1.5	#1	10' oc.	FACW
593	VON	<i>Viburnum dentatum</i>	Arrowwood Viburnum	1.5	#1	10' oc.	FAC

UPLAND TREE PLANTING SCHEDULE (ZONES 2 & 3)							
QUANTITY	ABBR.	SCIENTIFIC NAME	COMMON NAME	SIZE	CONT. CLASS	SPACING	INDICATOR STATUS
25	ROPS	<i>Robinia pseudoacacia</i>	Black Locust	1" cal.	#7	15' oc.	FACU
25	LS	<i>Liquidambar styraciflua</i>	Sweet Gum	1" cal.	#7	15' oc.	FAC
25	COC	<i>Celtis occidentalis</i>	Common Hackberry	1" cal.	#7	15' oc.	FACU
25	QMO	<i>Quercus montana</i>	Chestnut Oak	1" cal.	#7	15' oc.	LPL
25	GT	<i>Gleditsia triacanthos</i>	Honey Locust	1" cal.	#7	15' oc.	FAC
25	CCA	<i>Cornus canadensis</i>	Eastern Redbud	1" cal.	#7	15' oc.	FACU
25	PDE	<i>Populus deltoides</i>	Eastern Cottonwood	1" cal.	#7	15' oc.	FAC
25	NS	<i>Nyssa sylvatica</i>	Black Gum	1" cal.	#7	15' oc.	FAC
25	QR	<i>Quercus rubra</i>	Northern Red Oak	1" cal.	#7	15' oc.	FACU
25	QA	<i>Quercus alba</i>	White Oak	1" cal.	#7	15' oc.	FACU

*NO TREES ARE TO BE PLANTED ON SEWER LINES OR MANHOLES, 10' CENTER TO CENTER.

UPLAND SHRUB PLANTING SCHEDULE (ZONES 2 & 3)							
QUANTITY	ABBR.	SCIENTIFIC NAME	COMMON NAME	HEIGHT (FT)	CONT. CLASS	SPACING	INDICATOR STATUS
27	PME	<i>Arcia molinocarpa</i>	Black Chokeberry	1.5	#1	15' oc.	FAC
27	SNI	<i>Sambucus nigra</i>	American Black Elderberry	1.5	#1	15' oc.	FAC
27	CR	<i>Cornus racemosa</i>	Gray Dogwood	1.5	#1	15' oc.	FAC
27	LBE	<i>Lindera benzoin</i>	Northern Spicebush	1.5	#1	15' oc.	FAC

WETLAND SEED MIX	
SEED MIX	PERCENT (%) BY WEIGHT
<i>Panicum clandestinum</i> /Deertongue	20.6
<i>Elymus riparius</i> /Riverbank Wildrye, PA Ecotype	20.0
<i>Andropogon gerardi</i> /Big Bluestem	10.0
<i>Carex lurida</i> /Lurid (Shallow) Sedge, PA Ecotype	10.0
<i>Carex vulpinoidea</i> /Fox Sedge	10.0
<i>Carex scoparia</i> /Blunt Broom Sedge, PA Ecotype	8.0
<i>Panicum virgatum</i> /Switchgrass	8.0
<i>Verbena hastata</i> /Blue Vervain, PA Ecotype	4.0
<i>Juncus effusus</i> /Soft Rush	3.0
<i>Asclepias incarnata</i> /Swamp Milkweed, PA Ecotype	1.0
<i>Aster novae-angliae</i> /New England Aster, PA Ecotype	1.0
<i>Desmodium paniculatum</i> /Partridgefoot Ticktrefoil, PA Ecotype	1.0
<i>Eupatorium fistulosum</i> /Joe Pye Weed, PA Ecotype	1.0
<i>Eupatorium perfoliatum</i> /Boneset, PA Ecotype	0.7
<i>Helenium autumnale</i> /Common Sneezeweed, PA Ecotype	0.5
<i>Monarda fistulosa</i> /Wild Bergamot, PA Ecotype	0.5
<i>Vernonia noveboracensis</i> /New York Ironweed, PA Ecotype	0.5
<i>Mimulus ringens</i> /Square Stemmed Monardella, PA Ecotype	0.2

*APPLIED AT 20 LBS/ACRE
**LESPEDEZA OF ANY KIND IS NOT TO BE PLANTED ON SITE.

UPLAND SEED MIX	
SEED MIX	PERCENT (%) BY WEIGHT
<i>Sorghastrum nutans</i> /Indiangrass, PA Ecotype	53.0
<i>Elymus virginicus</i> /Virginia Wildrye, PA Ecotype	15.0
<i>Tridens flavus</i> /Purpletop, VA Ecotype	8.0
<i>Andropogon gerardi</i> /Big Bluestem	5.0
<i>Chamaecrista fasciculata</i> /Partridge Pea, PA Ecotype	5.0
<i>Rudbeckia hirta</i> /Black-eyed Susan, NC Ecotype	3.0
<i>Asclepias syriaca</i> /Common Milkweed, PA Ecotype	2.0
<i>Aster novae-angliae</i> /New England Aster, PA Ecotype	2.0
<i>Aster sagittifolius</i> /Arrowleaf (Sagittate) Aster, PA Ecotype	1.0
<i>Helopsis helianthoides</i> /Oxeye Sunflower, PA Ecotype	1.0
<i>Penstemon digitalis</i> /Tall White Beardtongue, PA Ecotype	1.0
<i>Penstemon hirsutus</i> /Hairy Beardtongue	1.0
<i>Senna hebecarpa</i> /Wild Senna, VA & WV Ecotype	1.0
<i>Solidago juncea</i> /Early Goldenrod, VA Ecotype	1.0
<i>Monarda fistulosa</i> /Wild Bergamot, PA Ecotype	0.8
<i>Pycnanthemum tenuifolium</i> /Narrowleaf Mountainmint	0.3

*APPLIED AT 20 LBS/ACRE
**LESPEDEZA OF ANY KIND IS NOT TO BE PLANTED ON SITE.

PROFESSIONAL CERTIFICATION
I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A FULLY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31783, EXPIRATION DATE: 12/31/2027.

DESIGN PROFESSIONAL CONTACT
JEREMY KOSSER
JOHNSON MERRIFAN & THOMPSON
43 WEST AVENUE
HUNT VALLEY, MD 21030
TELEPHONE: 410-216-2960
EMAIL: JKOSSE@JMT.COM

MILL SWAMP MITIGATION BANK
BRYANS ROAD, MD 20615

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
NAD 83 / MD STATE PLANE / VERT. NAVD 88

OWNER / DEVELOPER INFORMATION JOHNSON MERRIFAN & THOMPSON 43 WEST AVENUE HUNT VALLEY, MD 21030	CONTACT INFORMATION JEREMY KOSSER JOHNSON MERRIFAN & THOMPSON TELEPHONE: 410-216-2960 EMAIL: JKOSSE@JMT.COM
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REVISIONS		PLANTING NOTES AND SCHEDULES	
CONCEPT DESIGN NOT FOR CONSTRUCTION	SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-0075-00		
DESIGNED BY: JMT	COUNTY: CHARLES COUNTY		
DRAWN BY: JMT	LOGFILE: N/A		
CHECKED BY: JMT	HORIZONTAL SCALE: N/A		
F.A.P. NO.: N/A	VERTICAL SCALE: N/A		
DRAWING NO. PD-01	SHEET NO. 01 OF 44		

2. TURFGRASS MIXTURES

- AREAS WHERE TURFGRASS MAY BE DESIRED INCLUDE LAWNS, PARKS, PLAYGROUNDS AND COMMERCIAL SITES WHICH WILL RECEIVE A MEDIUM TO HIGH LEVEL OF MAINTENANCE.
- SELECT ONE OR MORE OF THE SPECIES OR MIXTURES LISTED BELOW BASED ON THE SITE CONDITIONS OF PURPOSE, ENTER SELECTED MIXTURES, APPLICATION RATES AND SEEDING DATES IN THE PERMANENT SEEDING SUMMARY. THE SUMMARY IS TO BE PLACED ON THE PLAN.
- KENTUCKY BLUEGRASS: FULL SUN MIXTURE:** FOR USE IN AREAS THAT RECEIVE INTENSIVE MANAGEMENT IRRIGATION REQUIRED IN THE AREAS OF CENTRAL MARYLAND AND EASTERN SHORE. RECOMMENDED CERTIFIED KENTUCKY BLUEGRASS CULTIVARS SEEDING RATE: 15 TO 20 POUNDS PER 1000 SQUARE FEET. CHOOSE A MINIMUM OF THREE KENTUCKY BLUEGRASS CULTIVARS WITH EACH RANGING FROM 10 TO 35 PERCENT OF THE TOTAL MIXTURE BY WEIGHT.
- KENTUCKY BLUEGRASS/PERENNIAL RYE: FULL SUN MIXTURE:** FOR USE IN FULL SUN AREAS WHERE RAPID ESTABLISHMENT IS NECESSARY AND WHEN TURF WILL RECEIVE MEDIUM TO INTENSIVE MANAGEMENT. CERTIFIED PERENNIAL RYEGRASS CULTIVARS/CERTIFIED KENTUCKY BLUEGRASS SEEDING RATE: 2 POUNDS MIXTURE PER 1000 SQUARE FEET. CHOOSE A MINIMUM OF THREE KENTUCKY BLUEGRASS CULTIVARS WITH EACH RANGING FROM 10 TO 35 PERCENT OF THE TOTAL MIXTURE BY WEIGHT.
- TALL FESCUE/KENTUCKY BLUEGRASS: FULL SUN MIXTURE:** FOR USE IN DROUGHT PRONE AREAS AND/OR FOR AREAS RECEIVING LOW TO MEDIUM MANAGEMENT IN FULL SUN TO MEDIUM SHADE. RECOMMENDED MIXTURE INCLUDES CERTIFIED TALL FESCUE CULTIVARS 90 TO 100 PERCENT, CERTIFIED KENTUCKY BLUEGRASS CULTIVARS 0 TO 5 PERCENT. SEEDING RATE: 5 TO 8 POUNDS PER 1000 SQUARE FEET. ONE OR MORE CULTIVARS MAY BE BLENDED.
- KENTUCKY BLUEGRASS/PERENNIAL RYE: SHADE MIXTURE:** FOR USE IN AREAS WITH SHADE IN BLUEGRASS LAWNS. FOR ESTABLISHMENT IN HIGH QUALITY INTENSIVELY MAINTAINED TURF AREAS MIXTURE INCLUDES CERTIFIED KENTUCKY BLUEGRASS CULTIVARS 30 TO 40 PERCENT AND CERTIFIED FINE FESCUE AND 60 TO 70 PERCENT. SEEDING RATE: 10 TO 15 POUNDS PER 1000 SQUARE FEET.

NOTES:
 SELECT TURFGRASS VARIETIES FROM THOSE LISTED IN THE MOST CURRENT UNIVERSITY OF MARYLAND PUBLICATION, AGRONOMY MEMO #77 TURFGRASS CULTIVAR RECOMMENDATIONS FOR MARYLAND

CHOOSE CERTIFIED MATERIAL. CERTIFIED MATERIAL IS THE BEST GUARANTEE OF CULTIVAR PURITY. THE CERTIFICATION PROGRAM OF THE MARYLAND DEPARTMENT OF AGRICULTURE, TURF AND SEED SECTION, PROVIDES A RELIABLE MEANS OF CONSUMER PROTECTION AND ASSURES A PURE GENETIC LINE.

6. IDEAL TIMES OF SEEDING FOR TURF GRASS MIXTURES

CENTRAL MD: MARCH 1 TO MAY 15, AUGUST 15 TO OCTOBER 15 (HARDNESS ZONE 6B)

- TILL AREAS TO RECEIVE SEED BY DESIGN OR OTHER APPROVED METHODS TO A DEPTH OF 2 TO 4 INCHES LEVEL AND RAKE THE AREAS TO PREPARE A PROPER SEEDBED. REMOVE STONES AND DEBRIS OVER 1/2 INCHES IN DIAMETER. THE RESULTING SEEDBED MUST BE IN SUCH CONDITION THAT FUTURE MOWING OF GRASSES WILL POSE NO DIFFICULTY.
- IF SOIL MOISTURE IS DEFICIENT, SUPPLY NEW SEEDINGS WITH ADEQUATE WATER FOR PLANT GROWTH. DO TO 1 INCH EVERY 3 TO 4 DAYS DEPENDENT ON SOIL TEXTURE UNTIL THEY ARE FIRMLY ESTABLISHED. THIS IS ESPECIALLY TRUE WHEN SEEDINGS ARE MADE LATE IN THE PLANTING SEASON, IN ABNORMALLY DRY OR HOT SEASONS OR ON ADVERSE SITES.

B-4-B STANDARDS AND SPECIFICATIONS FOR STOCKPILE AREA

DEFINITION

A MOUND OR PILE OF SOIL PROTECTED BY APPROPRIATELY DESIGNED EROSION AND SEDIMENT CONTROL MEASURES.

PURPOSE

TO PROVIDE A DESIGNATED LOCATION FOR THE TEMPORARY STORAGE OF SOIL THAT CONTROLS THE POTENTIAL FOR EROSION, SEDIMENTATION, AND CHANGES TO DRAINAGE PATTERNS.

CONDITIONS WHERE PRACTICE APPLIES

STOCKPILE AREAS ARE UTILIZED WHEN IT IS NECESSARY TO SALVAGE AND STORE SOIL FOR LATER USE.

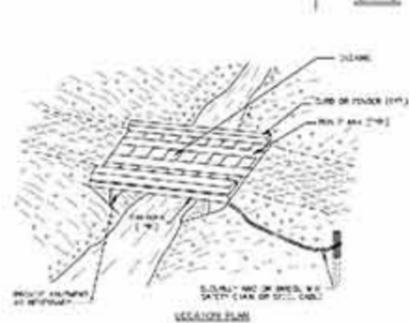
CRITERIA

- THE STOCKPILE LOCATION AND ALL RELATED SEDIMENT CONTROL PRACTICES MUST BE CLEARLY INDICATED ON THE EROSION AND SEDIMENT CONTROL PLAN.
- THE FOOTPRINT OF THE STOCKPILE MUST BE SIZED TO ACCOMMODATE THE ANTICIPATED VOLUME OF MATERIAL AND BASED ON A SIDE SLOPE RATIO NO STEEPER THAN 2:1. BENCHING MUST BE PROVIDED IN ACCORDANCE WITH SECTION B-3 LAND GRADING.
- RUNOFF FROM THE STOCKPILE AREA MUST DRAIN TO A SUITABLE SEDIMENT CONTROL PRACTICE.
- ACCESS THE STOCKPILE AREA FROM THE UPRIDGE SIDE.
- CLEAR WATER RUNOFF INTO THE STOCKPILE AREA MUST BE MINIMIZED BY USE OF A DIVERSION DEVICE SUCH AS AN EARTH DIKE, TEMPORARY SHALE OR DIVERSION FENCE. PROVISIONS MUST BE MADE FOR DISCHARGING CONCENTRATED FLOW IN A NON-EROSIVE MANNER.
- WHERE RUNOFF CONCENTRATES ALONG THE TOE OF THE STOCKPILE FILL, AN APPROPRIATE EROSION/SEDIMENT CONTROL PRACTICE MUST BE USED TO INTERCEPT THE DISCHARGE.
- STOCKPILES MUST BE STABILIZED IN ACCORDANCE WITH THE 37 DAY STABILIZATION REQUIREMENT AS WELL AS STANDARD B-4-1 INCREMENTAL STABILIZATION AND STANDARD B-4-4 TEMPORARY STABILIZATION.
- IF THE STOCKPILE IS LOCATED ON AN IMPERVIOUS SURFACE A LINER SHOULD BE PROVIDED BELOW THE STOCKPILE TO FACILITATE CLEANUP. STOCKPILES CONTAINING CONTAMINATED MATERIAL MUST BE COVERED WITH IMPERMEABLE SHEETING.

MAINTENANCE

THE STOCKPILE AREA MUST CONTINUOUSLY MEET THE REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B-4 VEGETATIVE STABILIZATION. SIDE SLOPES MUST BE MAINTAINED AT NO STEEPER THAN 2:1 RATIO. THE STOCKPILE AREA MUST BE KEPT FREE OF EROSION. IF THE VERTICAL HEIGHT OF A STOCKPILE EXCEEDS 20 FEET FOR 3:1 SLOPES, 30 FEET FOR 2:1 SLOPES, OR 40 FEET FOR 4:1 SLOPES, BENCHING MUST BE PROVIDED IN ACCORDANCE WITH SECTION B-3 LAND GRADING.

DETAIL B-4-1 TEMPORARY ACCESS BRIDGE

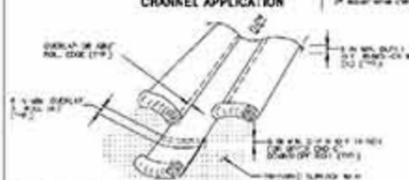


CONSTRUCTION SPECIFICATIONS:
 1. ACCESS ROUTES TO BE VERIFIED BY THE ENGINEER AT PRE CONSTRUCTION MEETING. REVISIONS TO THE ALIGNMENT THAT MINIMIZE TREE DISTURBANCE ARE ENCOURAGED AND REQUIRE REVIEW AND APPROVAL BY THE ENGINEER.
 2. SHA TYPE D SOIL STABILIZATION MATTING SHALL BE PLACED WITH SEAMS PARALLEL TO THE FLOW OF TRAFFIC. OVERLAP FABRIC BY 18" MIN AT SEAMS.
 3. CONTRACTOR SHALL MAINTAIN TEMPORARY ACCESS ROAD THROUGHOUT CONSTRUCTION PERIOD.

WITHIN STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.

TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.

DETAIL B-4-A TEMPORARY SOIL STABILIZATION MATTING CHANNEL APPLICATION

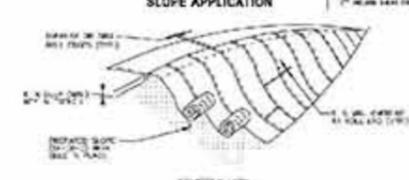


CONSTRUCTION SPECIFICATIONS:
 1. USE MATTING TO STABILIZE CHANNEL WALLS AND BOTTOMS OF CHANNELS TO PREVENT EROSION AND SEDIMENTATION.
 2. MATTING SHALL BE APPLIED TO CHANNEL WALLS AND BOTTOMS TO PREVENT EROSION AND SEDIMENTATION.
 3. MATTING SHALL BE APPLIED TO CHANNEL WALLS AND BOTTOMS TO PREVENT EROSION AND SEDIMENTATION.
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WITHIN STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.

TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.

DETAIL B-4-B TEMPORARY SOIL STABILIZATION MATTING SLOPE APPLICATION



CONSTRUCTION SPECIFICATIONS:
 1. USE MATTING TO STABILIZE SLOPES TO PREVENT EROSION AND SEDIMENTATION.
 2. MATTING SHALL BE APPLIED TO SLOPES TO PREVENT EROSION AND SEDIMENTATION.
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 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.

TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.

DETAIL B-4-1 TEMPORARY ACCESS BRIDGE

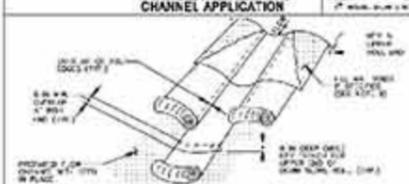


CONSTRUCTION SPECIFICATIONS:
 1. ACCESS ROUTES TO BE VERIFIED BY THE ENGINEER AT PRE CONSTRUCTION MEETING. REVISIONS TO THE ALIGNMENT THAT MINIMIZE TREE DISTURBANCE ARE ENCOURAGED AND REQUIRE REVIEW AND APPROVAL BY THE ENGINEER.
 2. SHA TYPE D SOIL STABILIZATION MATTING SHALL BE PLACED WITH SEAMS PARALLEL TO THE FLOW OF TRAFFIC. OVERLAP FABRIC BY 18" MIN AT SEAMS.
 3. CONTRACTOR SHALL MAINTAIN TEMPORARY ACCESS ROAD THROUGHOUT CONSTRUCTION PERIOD.

WITHIN STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
 SEE SECTION B-4 FOR STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
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TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.

DETAIL B-4-C PERMANENT SOIL STABILIZATION MATTING CHANNEL APPLICATION

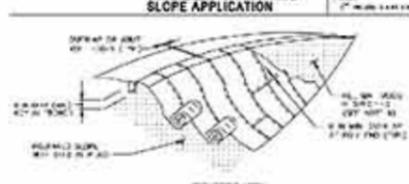


CONSTRUCTION SPECIFICATIONS:
 1. USE PERMANENT SOIL STABILIZATION MATTING TO STABILIZE CHANNEL WALLS AND BOTTOMS OF CHANNELS TO PREVENT EROSION AND SEDIMENTATION.
 2. PERMANENT SOIL STABILIZATION MATTING SHALL BE APPLIED TO CHANNEL WALLS AND BOTTOMS TO PREVENT EROSION AND SEDIMENTATION.
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TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.

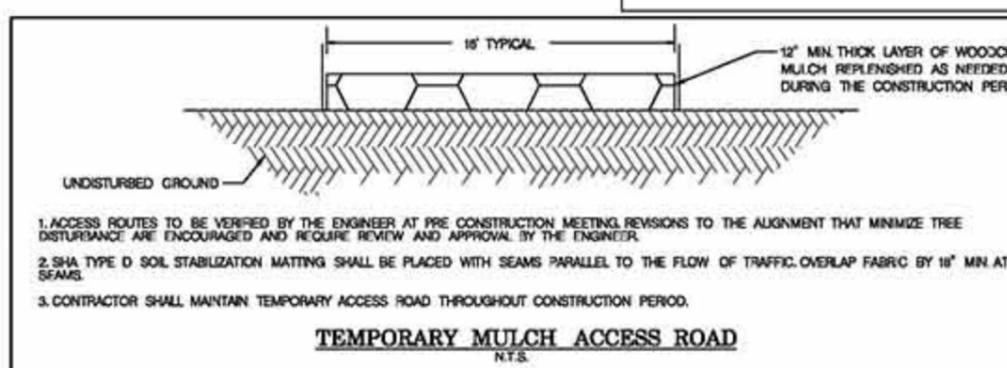
DETAIL B-4-D PERMANENT SOIL STABILIZATION MATTING SLOPE APPLICATION



CONSTRUCTION SPECIFICATIONS:
 1. USE PERMANENT SOIL STABILIZATION MATTING TO STABILIZE SLOPES TO PREVENT EROSION AND SEDIMENTATION.
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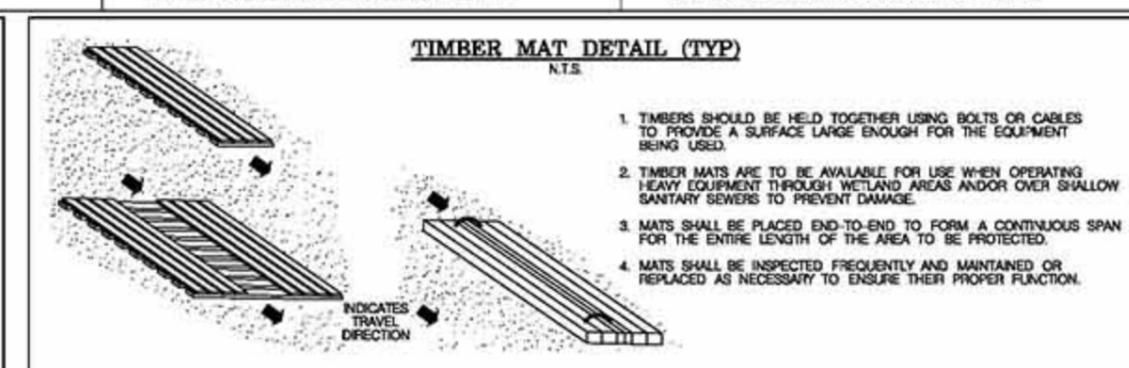
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CONSTRUCTION SPECIFICATIONS:
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TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.



CONSTRUCTION SPECIFICATIONS:
 1. TIMBERS SHOULD BE HELD TOGETHER USING BOLTS OR CABLES TO PROVIDE A SURFACE LARGE ENOUGH FOR THE EQUIPMENT BEING USED.
 2. TIMBER MATS ARE TO BE AVAILABLE FOR USE WHEN OPERATING HEAVY EQUIPMENT THROUGH WETLAND AREAS AND/OR OVER SHALLOW SANITARY SEWERS TO PREVENT DAMAGE.
 3. MATS SHALL BE PLACED END-TO-END TO FORM A CONTINUOUS SPAN FOR THE ENTIRE LENGTH OF THE AREA TO BE PROTECTED.
 4. MATS SHALL BE INSPECTED FREQUENTLY AND MAINTAINED OR REPLACED AS NECESSARY TO ENSURE THEIR PROPER FUNCTION.

WITHIN STANDARDS AND SPECIFICATIONS FOR SOIL STABILIZATION AND SEDIMENT CONTROL.
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TO BE TYPE D SOIL STABILIZATION MATTING AS DESCRIBED IN SHA STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS.



DESIGN PROFESSIONAL CONTACT
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 JOHNSON MERRIMAN & THOMPSON
 40 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31813, EXPIRATION DATE: 12/31/2027.

OWNER/DEVELOPER INFORMATION
 CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
 MARYLAND COORDINATE SYSTEM
 NAD 83 UTM 18Q UTM EASTING 681000 UTM NORTHING 5500000

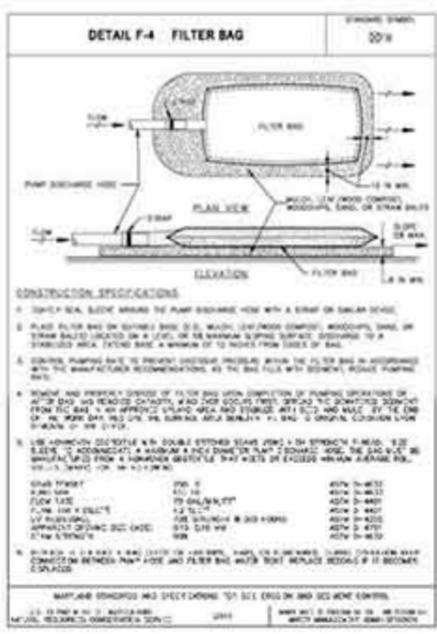
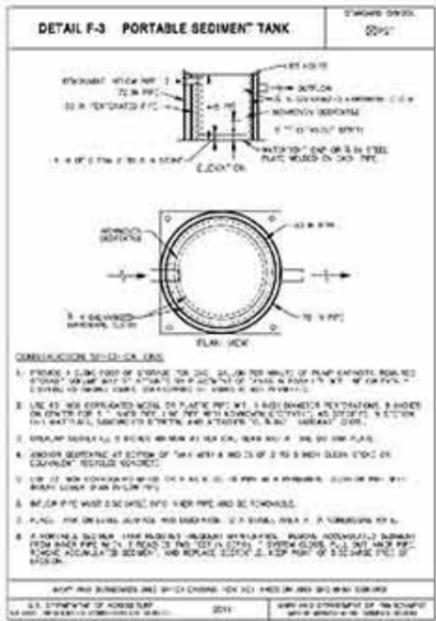
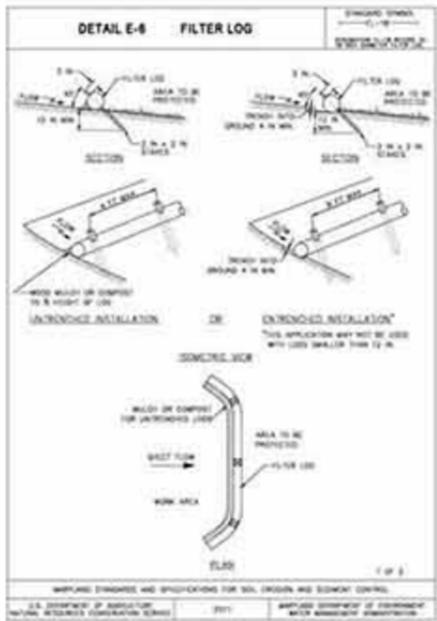
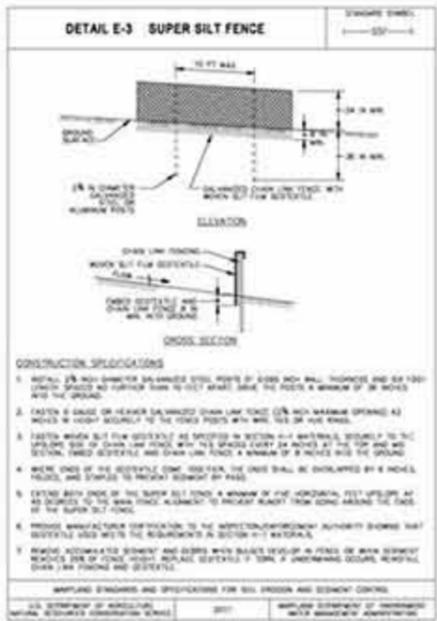
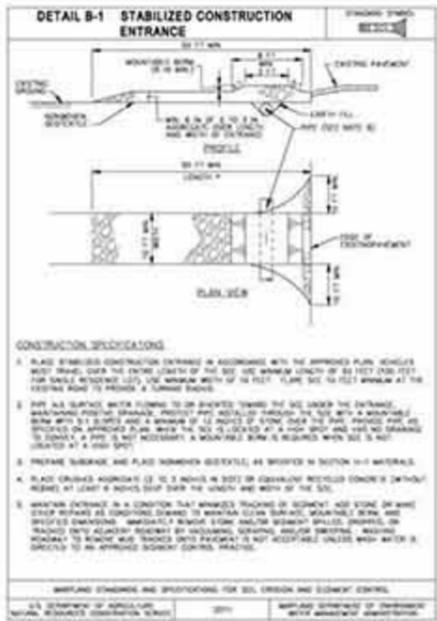
CONTACT INFORMATION
 JEREMY KOSSER
 JOHNSON MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

REVISIONS
 CONCEPT DESIGN
 NOT FOR CONSTRUCTION

EROSION AND SEDIMENT CONTROL NOTES AND DETAILS
 SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-001
 DESIGNED BY: KMI COUNTY: CHARLES COUNTY
 DRAWN BY: JIM LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A
 DRAWING NO.: EN-02 OF 05 SHEET NO.: 02 OF 44

BY: M/McCuller

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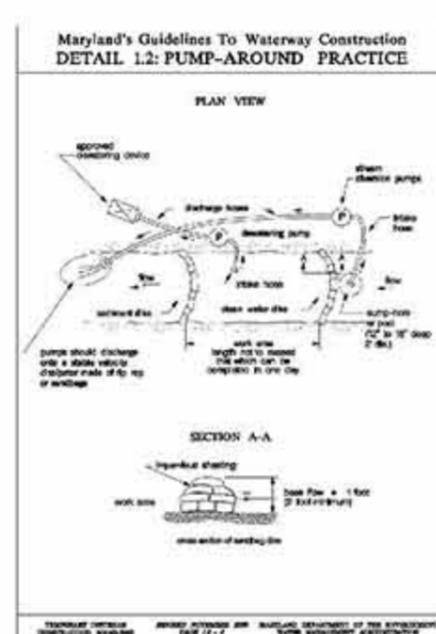
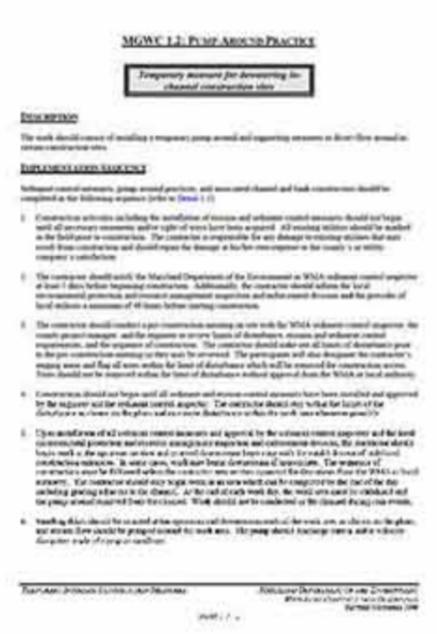


III. STANDARDS AND SPECIFICATIONS

III. MATERIALS

Table III.1: Concrete Values

PROPERTY	TEST METHOD	MINIMUM		TYPICAL		MAXIMUM	
		STRENGTH	MODULUS	STRENGTH	MODULUS	STRENGTH	MODULUS
Compressive Strength	ASTM C39	3000	3000	3000	3000	3000	3000
Modulus of Elasticity	ASTM C469	3,600,000	3,600,000	3,600,000	3,600,000	3,600,000	3,600,000
Water Absorption	ASTM C672	5%	5%	5%	5%	5%	5%
Chloride Ion Content	ASTM C1218	0.10	0.10	0.10	0.10	0.10	0.10
Air Content	ASTM C493	5%	5%	5%	5%	5%	5%



*MINIMUM PUMP AROUND CAPACITY = 1356 GPM (FOR INFORMATIONAL PURPOSES ONLY)
 **THE CONTRACTOR SHALL SET UP PUMP-AROUND PRACTICES FOR A DISTANCE OF NO MORE THAN 500-FEET OF EXISTING STREAM LENGTH AT ONE TIME, PER PUMP-AROUND PRACTICE.

STANDARD STABILIZATION NOTE:
 FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, SEEDING FOR PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DICES, SMALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING. ONCE VEGETATION IS ESTABLISHED, THE SITE SHALL HAVE 95% GROUND COVER TO BE CONSIDERED ADEQUATELY STABILIZED.



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31818, EXPIRATION DATE: 12/31/2027.
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 JOHNSON MERMAN & THOMPSON
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 TELEPHONE: 410-216-2960
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CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / NAD 83 / STATE PLANE / VERT. NAVD 88

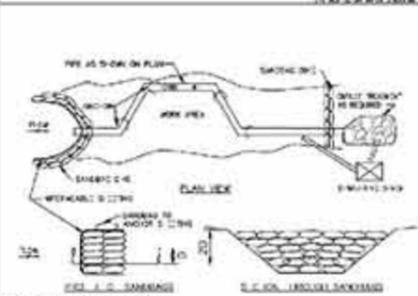
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	DRAWING NO.: EN-03 OF 05 SHEET NO.: 03 OF 44

BY: M/McCuller

DETAIL C-6 CLEAR WATER DIVERSION PIPE



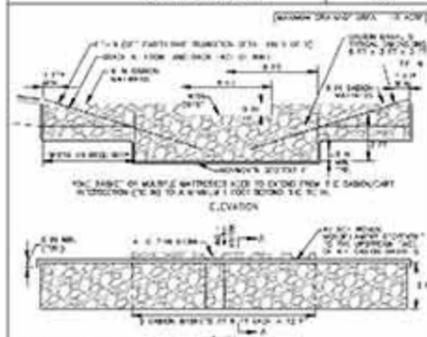
- CONSTRUCTION SPECIFICATIONS**
1. THE PIPE SHALL BE 12 INCHES DIAMETER, CONCRETE OR METAL, WITH A SLOPE OF 1/2 INCH PER FOOT. THE PIPE SHALL BE LINED WITH A JOINT MATERIAL.
 2. THE SANDING OR BEDDING SHALL BE 4 INCHES THICK, 1/2 INCH SAND, 1/2 INCH GRAVEL, 1/2 INCH SAND, AND 1/2 INCH GRAVEL. THE SANDING SHALL BE COMPACTED TO 95% RELATIVE DENSITY.
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DETAIL C-1 EARTH DIKE



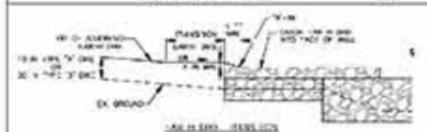
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DETAIL E-5 TEMPORARY GABION OUTLET STRUCTURE



- CONSTRUCTION SPECIFICATIONS**
1. THE PIPE SHALL BE 12 INCHES DIAMETER, CONCRETE OR METAL, WITH A SLOPE OF 1/2 INCH PER FOOT. THE PIPE SHALL BE LINED WITH A JOINT MATERIAL.
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DETAIL E-6 TEMPORARY GABION OUTLET STRUCTURE



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DESIGN PROFESSIONAL CONTACT
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 JOHNSON MERRIMAN & THOMPSON
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 HUNT VALLEY, MD 21080
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CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE / VERT. NAVD 83

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 HUNT VALLEY, MD 21080

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	CHECKED BY: JMT	HORIZONTAL SCALE: N/A
	F.A.P. NO.: N/A	VERTICAL SCALE: N/A
	DRAWING NO. EN-04	SHEET NO. 11 OF 44



BY: M/Moeller

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SEQUENCE OF CONSTRUCTION

1. CONTRACTOR /DEVELOPER MUST NOTIFY THE CHARLES COUNTY INSPECTIONS (301) 645-0700, 5 DAYS PRIOR TO COMMENCING WORK.
2. STANDARD STABILIZATION NOTE: FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, SEEDING FOR PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE. NOT UNDER ACTIVE GRADING. ONCE VEGETATION IS ESTABLISHED, THE SITE SHALL HAVE 95% GROUND COVER TO BE CONSIDERED ADEQUATELY STABILIZED.
3. ANY OTHER APPROVED SEDIMENT AND EROSION PLAN WITH A SEQUENCE AND/OR PRACTICES WHICH CONFLICT WITH THIS PLAN, WILL REQUIRE PLAN REVISIONS FOR ALL AFFECTED PLANS APPROVED BY THE CHARLES SOIL CONSERVATION DISTRICT.
4. EROSION AND SEDIMENT PRACTICES, AND SITE IN GENERAL, MUST BE INSPECTED WEEKLY AND AFTER EACH RAIN FALL EVENT, BY THE CONTRACTOR OR OTHER RESPONSIBLE PERSON, AND ANY NEEDED MAINTENANCE PERFORMED IMMEDIATELY.
5. SITE MUST BE GRADED IN SUCH A MANNER THAT THE APPROVED DRAINAGE DIVIDES ARE MAINTAINED THROUGHOUT SITE CONSTRUCTION.
6. THE APPROVAL OF THE SEDIMENT CONTROL INSPECTOR IS REQUIRED UPON INSTALLATION OF PERIMETER EROSION AND SEDIMENT CONTROLS, BUT BEFORE PROCEEDING WITH ANY OTHER EARTH DISTURBANCE OR GRADING.
7. MDE TRACKING PERMIT NUMBER IS XXXXXXXXXX-XX-XXXX. IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD OF MARCH 1 TO JUNE 15.
8. CONTRACTOR SHALL OBTAIN GRADING PERMIT FROM CHARLES COUNTY DEPARTMENT OF PLANNING AND GROWTH MANAGEMENT (PGM) PRIOR TO BEGINNING CONSTRUCTION. THE REFERENCE NUMBER TO THE GRADING PERMIT IS XXXXXXXXX.
9. CONTRACTOR SHALL CONTACT CHARLES COUNTY DEPARTMENT OF PLANNING AND GROWTH MANAGEMENT (PGM) AT (301) 645-0692 TO SCHEDULE A PRE-CONSTRUCTION MEETING AT LEAST 48 HOURS BEFORE CONSTRUCTION IS TO BEGIN.
10. WATERWAY CONSTRUCTION TO BE DONE IN ACCORDANCE WITH MDE STANDARDS AND DETAILS AS SHOWN ON THE PLANS.
11. CONTRACTOR SHALL DISTURB ONLY AS MUCH AREA THAT CAN BE BROUGHT TO FINAL GRADE AND STABILIZED AT THE END OF EACH DAY. AT THE END OF EACH WORK DAY THE CONTRACTOR SHALL STABILIZE ANY DISTURBED AREA WITHIN THE LOD NOT DIRECTED TO AN EROSION AND SEDIMENT CONTROL DEVICE AND AS NOTED. ALL DISTURBED AREAS ARE TO BE STABILIZED AS SHOWN ON THE PLANTING PLANS.
12. WHERE PUMP AROUND PRACTICES ARE UTILIZED, THE EXACT LOCATION OF THE HOSES AND FILTER BAG MAY BE MODIFIED IN THE FIELD BASED ON EXISTING CONDITIONS. ANY ADJUSTMENTS MUST BE APPROVED BY THE INSPECTOR. THE MINIMUM PUMP AROUND CAPACITY IS 1366 GPM. REFER TO DETAIL ON EN-03.
13. WORK WITHIN THE FLOODPLAIN SHALL BE CONDUCTED IN AN ORDER WHICH DOES NOT REQUIRE THE CONTRACTOR TO TRACK OVER FINISHED GRADING OR CROSS OVER THE STREAM IN ANY AREAS OTHER THAN THOSE SHOWN ON THE PLANS. THE ACCESS ROAD AND ANY STOCKPILE AREAS WILL BE REMOVED DURING THE FLOODPLAIN GRADING WORK IN EACH CONSTRUCTION PHASE AND SHALL NOT BE REMOVED UNTIL EACH WORK AREA IS PERMANENTLY STABILIZED.
14. THE STREAM WORK WILL BE DIVIDED INTO PHASES. FOR THE FINAL MDS SUBMISSION, THEY WILL BE SEEN ON THE EROSION AND SEDIMENT CONTROL PLANS. WORK IN THE STREAM AREAS MUST OCCUR IN ORDER FROM DOWNSTREAM TO UPSTREAM UNLESS OTHERWISE SPECIFIED.
15. SEDIMENT AND EROSION CONTROLS CANNOT BE REMOVED UNTIL THE SITE HAS ADEQUATE STABILIZATION. ONCE VEGETATION IS ESTABLISHED, THE SITE SHALL HAVE 95% GROUND COVER TO BE CONSIDERED ADEQUATELY STABILIZED AND THE SEDIMENT CONTROL INSPECTOR HAS APPROVED SUCH REMOVAL.

SITE ANALYSIS:	
47.83	TOTAL AREA (AC.)
18.81	DISTURBED AREA (AC.)
32.109	VOLUME OF SPOIL BORROW MATERIAL (CY)
TO BE DETERMINED	OFF-SITE BORROW /WASTE AREA LOCATION
12.891	VOLUME OF EXCAVATION (CY)

MAINTENANCE OF STREAM FLOW NOTES

1. SAND BAGS FOR PUMP-AROUND PRACTICE ARE TO BE ONE (1) FOOT ABOVE BASE FLOW ELEVATION (2-FOOT MINIMUM).
2. TWENTY-FOUR (24) HOUR PUMPING WILL BE CONDUCTED FOR ALL PUMP-AROUND PRACTICES THAT REQUIRE IT PER THE SEQUENCE OF CONSTRUCTION.

ADDITIONAL NOTES

1. LOD IS WITHIN ALL PERMANENT AND TEMPORARY EASEMENTS AS SHOWN ELSEWHERE IN THE PLAN SET.
2. CONTRACTOR IS NOT TO IMPACT WORK THAT HAS BEEN COMPLETED IN PREVIOUS PHASES.
3. TEMPORARY PULL OVER LANES WILL BE DETERMINED WITH THE CONTRACTOR AND INSPECTOR IN THE FIELD AS NEEDED.
4. ALL STAGE AND STOCKPILE AREAS ARE TO BE STABILIZED WITH DOUBLE STRAW MATTING.
5. AT NO POINT SHALL THE ACTIVE LOD BE LARGER THAN 20 ACRES.



PROFESSIONAL CERTIFICATION
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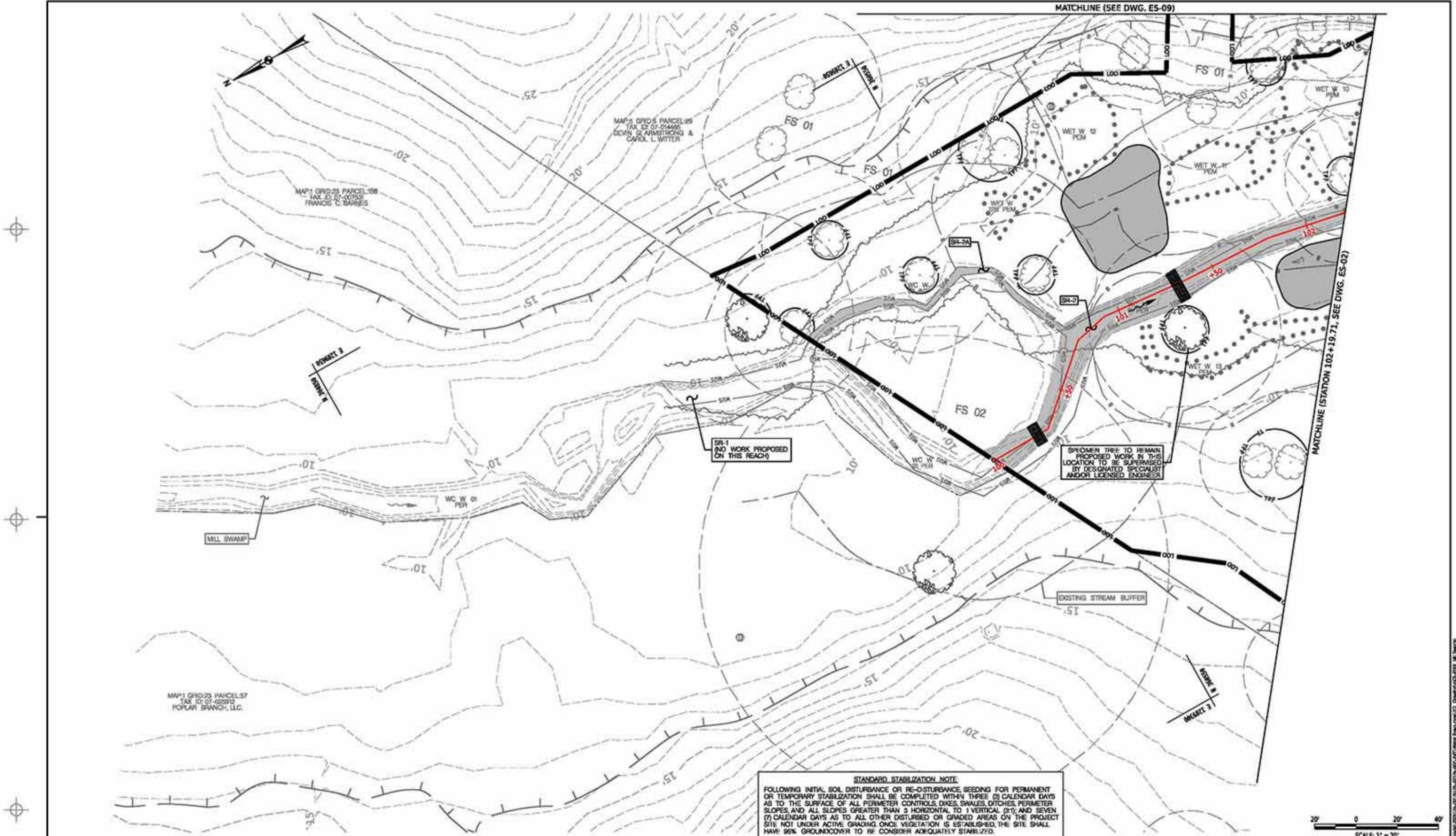
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	CHECKED BY JIM	HORIZONTAL SCALE N/A
	F.A.P. NO. N/A	VERTICAL SCALE N/A
	DRAWING NO. EN-05 OF 05	SHEET NO. 33 OF 44

MATCHLINE (SEE DWG. ES-09)



STANDARD STABILIZATION NOTE:
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PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOZER@JMT.COM

MILL SWAMP MITIGATION BANK
 BRYANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 83

OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRIMAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOZER@JMT.COM

REVISIONS

CONCEPT DESIGN
NOT FOR CONSTRUCTION

EROSION AND SEDIMENT CONTROL PLAN

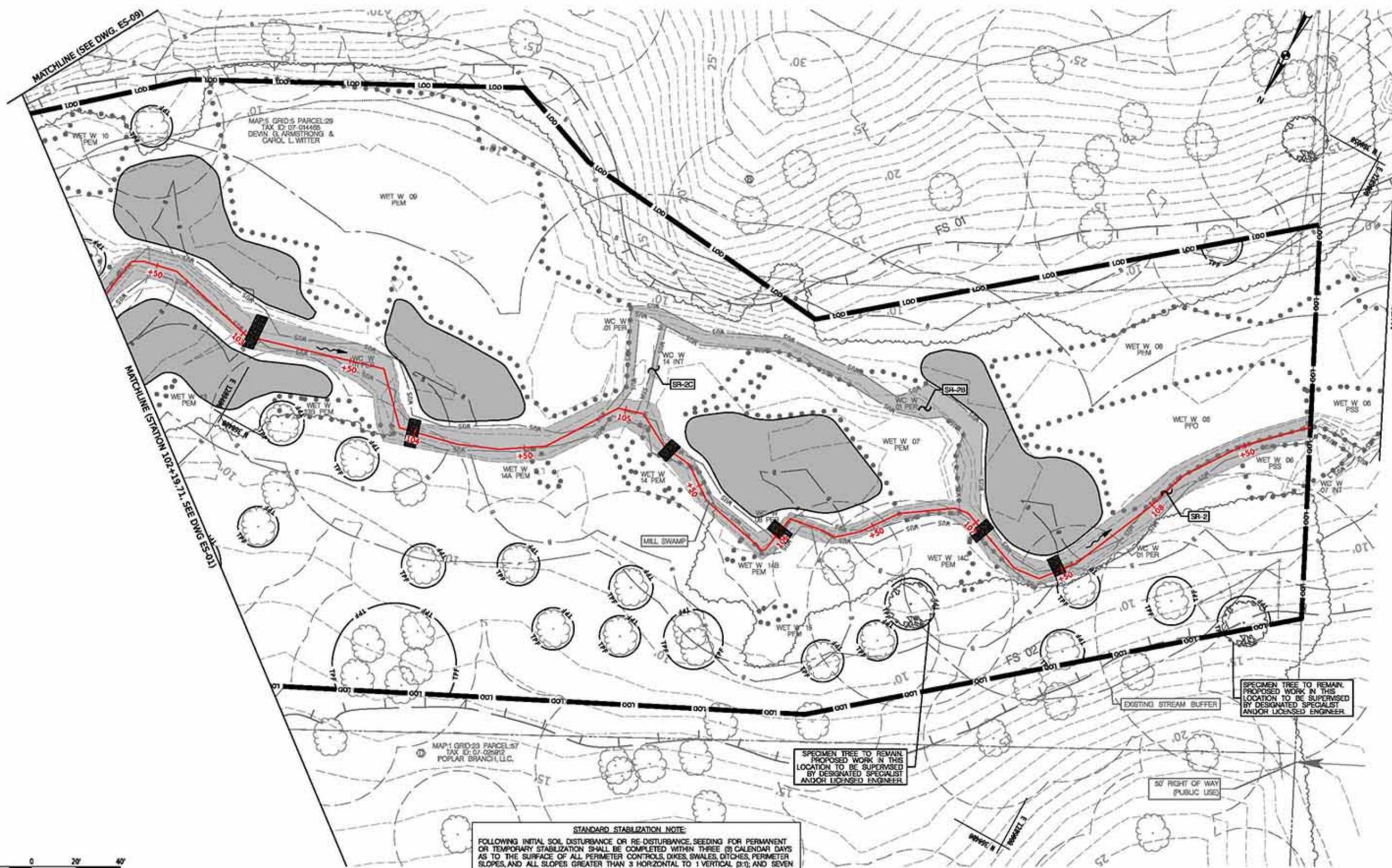
SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-001

DESIGNED BY: KNI	COUNTY: CHARLES COUNTY
DRAWN BY: GLZ	LOGFILE: N/A
CHECKED BY: JIM	HORIZONTAL SCALE: N/A
F.A.P. NO.: N/A	VERTICAL SCALE: N/A

DRAWING NO. **ES-01** OF **09** SHEET NO. **11** OF **44**

BY: M/McCuller

10/23/2025 10:58:00 AM C:\Users\jkozer\OneDrive\Documents\Projects\25-0075-001\Drawings\ES-01.dwg



SPECIMEN TREE TO REMAIN. PROPOSED WORK IN THIS LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

SPECIMEN TREE TO REMAIN. PROPOSED WORK IN THIS LOCATION TO BE SUPERVISED BY DESIGNATED SPECIALIST AND/OR LICENSED ENGINEER.

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PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31783, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON, MERRIAM & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOZER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYANS ROAD, MD 2088
 CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
 MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 88
OWNER/DEVELOPER INFORMATION:
 JOHNSON, MERRIAM & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON, MERRIAM & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOZER@JMT.COM

REVISIONS
 CONCEPT DESIGN
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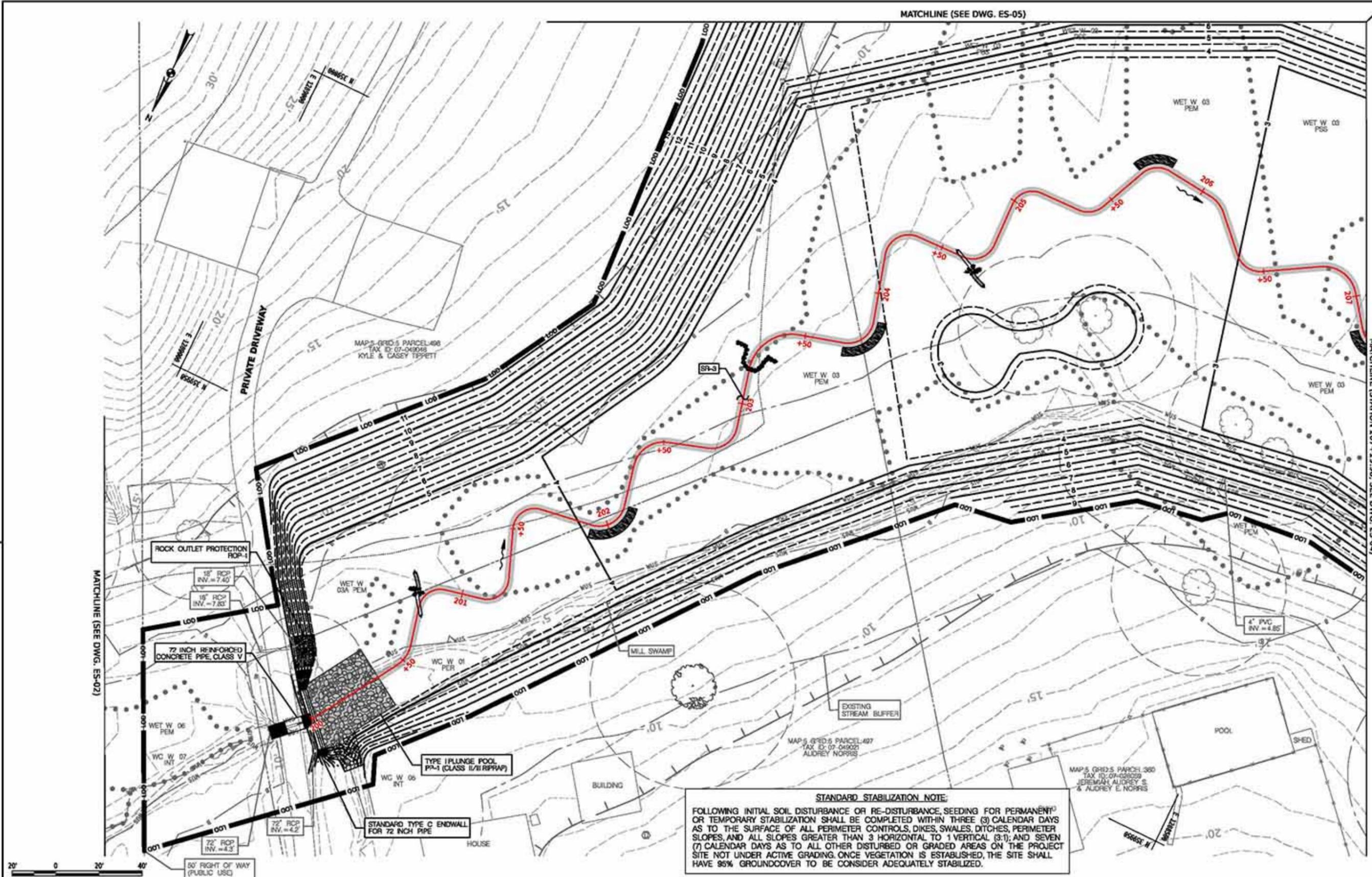
EROSION AND SEDIMENT CONTROL PLAN
 SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-001
 DESIGNED BY: KNI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A
 DRAWING NO.: ES-02 OF 09 SHEET NO.: 17 OF 44

BY: M/McCuller -

10/25/2025 10:00 AM C:\Users\jmerriam\OneDrive\Documents\Projects\2025\25-0075-001\25-0075-001-17.dwg User: jmerriam

MATCHLINE (SEE DWG. ES-05)

MATCHLINE (STATION 207+19.98, SEE DWG. ES-04)



STANDARD STABILIZATION NOTE:
 FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, SEEDING FOR PERMANENT¹ OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1); AND SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING. ONCE VEGETATION IS ESTABLISHED, THE SITE SHALL HAVE 95% GROUND COVER TO BE CONSIDERED ADEQUATELY STABILIZED.

SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31818, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZIER
 JOHNSON, MERRINAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: J.KOZIER@JMT.COM

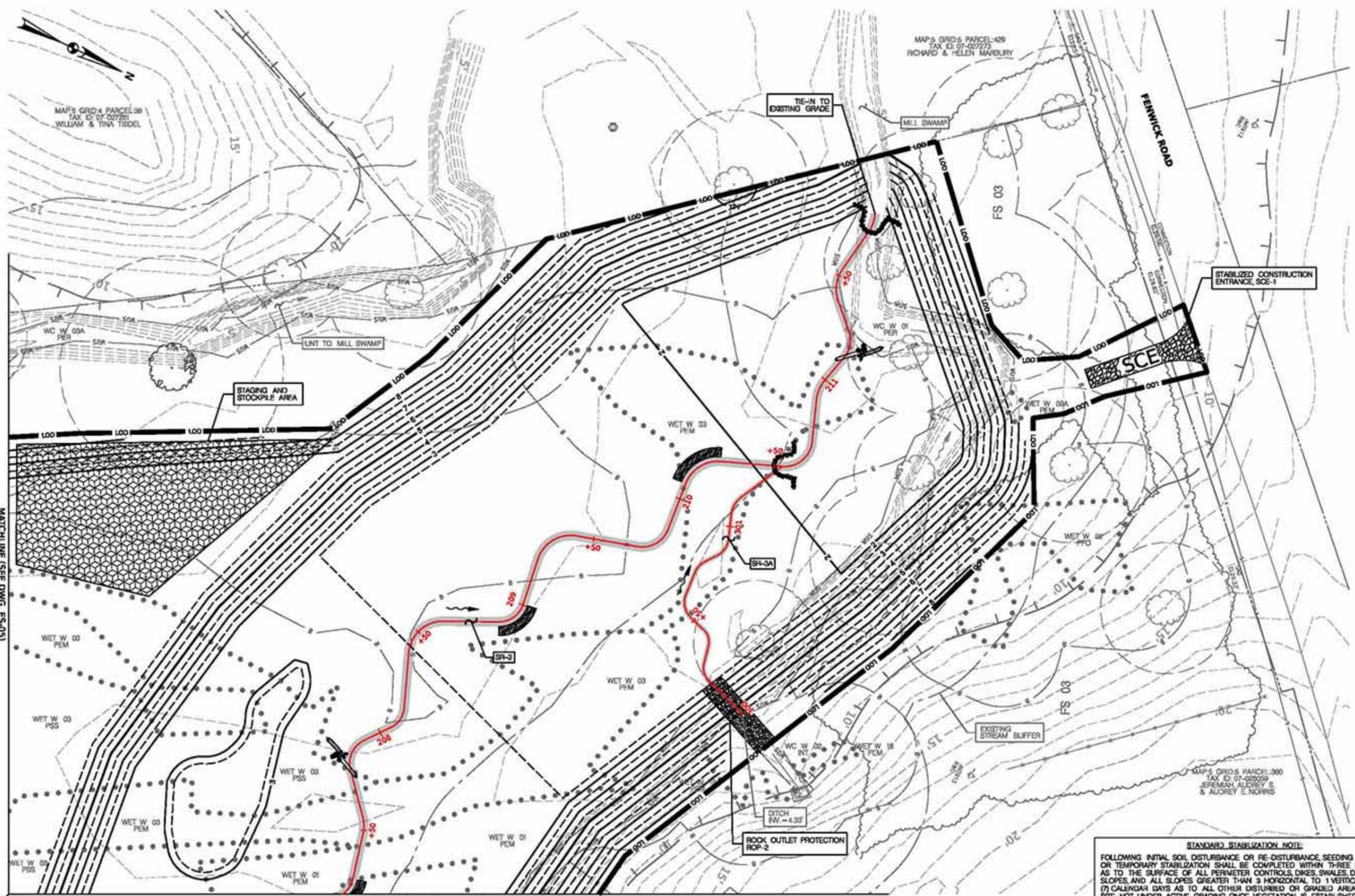
MILL SWAMP MITIGATION BANK
 WYANS ROAD, MD 20818
 CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06
 MARYLAND COORDINATE SYSTEM
 NAD 83/11 MD STATE PLANE VERT. NAVD 88
OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRINAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
CONTACT INFORMATION:
 JEREMY KOZIER
 JOHNSON, MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: J.KOZIER@JMT.COM

REVISIONS
 CONCEPT DESIGN
 NOT FOR CONSTRUCTION

EROSION AND SEDIMENT CONTROL PLAN
 SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-001
 DESIGNED BY: KNI COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A
 DRAWING NO. **ES-03** OF **09** SHEET NO. 33 OF 44

BY: MM/collier

10/15/25 10:00 AM C:\Users\jkozier\Documents\Projects\2025\25-0075-001\Drawings\ES-03.dwg (User: jkozier) Date: 10/15/25 10:00 AM



STANDARD STABILIZATION NOTE:
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SCALE: 1" = 20'

MATCHLINE (STATION 207+19.98, SEE DWG. ES-03)



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON, MERRIMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

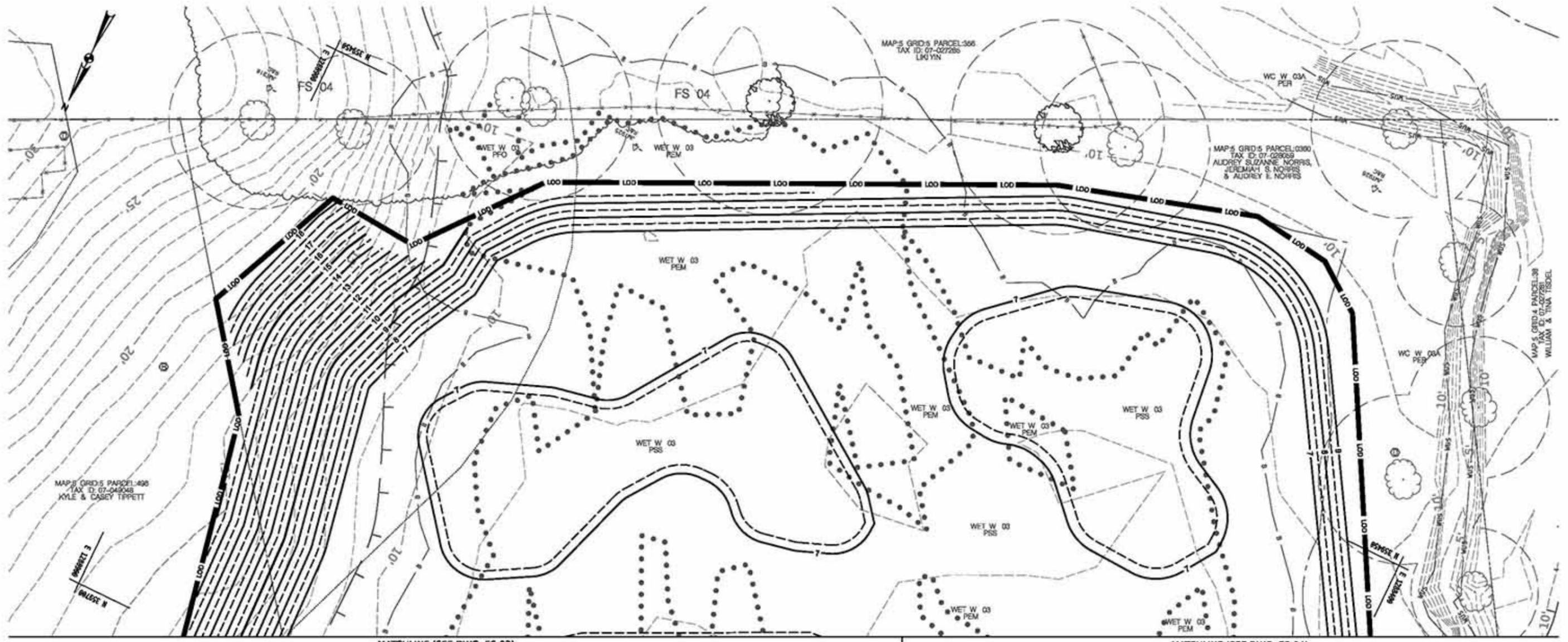
MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 83

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRIMAN & THOMPSON
 43 WEST AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON, MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS		EROSION AND SEDIMENT CONTROL PLAN	
CONCEPT DESIGN	NOT FOR CONSTRUCTION	SCALE: AS SHOWN	DATE: JULY 2025
		PROJECT NO. 25-0075-001	
DESIGNED BY: KNI	COUNTY: CHARLES COUNTY	DRAWN BY: GLZ	LOGFILE: N/A
CHECKED BY: JIM	HORIZONTAL SCALE: N/A	F.A.P. NO.: N/A	VERTICAL SCALE: N/A
DRAWING NO. ES-04 OF 09	SHEET NO. 09 OF 44		

BY: M/McCuller



MATCHLINE (SEE DWG. ES-03)

MATCHLINE (SEE DWG. ES-04)

STANDARD STABILIZATION NOTE
 FOLLOWING INITIAL SOIL DISTURBANCE OR RE-DISTURBANCE, SEEDING FOR PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN THREE (3) CALENDAR DAYS AS TO THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, DITCHES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1), AND SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING ONCE VEGETATION IS ESTABLISHED, THE SITE SHALL HAVE 95% GROUND COVER TO BE CONSIDERED ADEQUATELY STABILIZED.



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31813, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 42 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON MERRIMAN & THOMPSON
 42 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

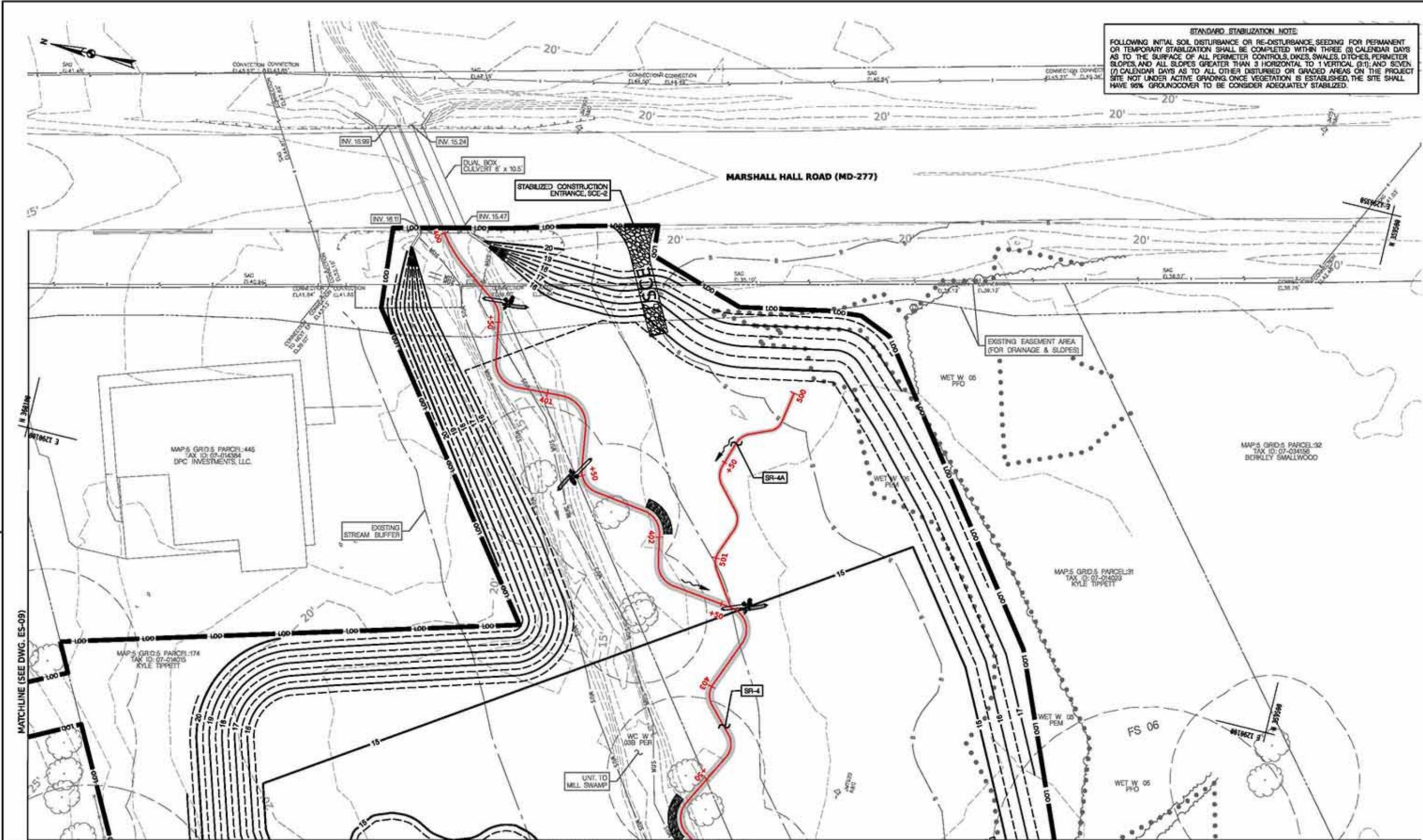
CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS		EROSION AND SEDIMENT CONTROL PLAN	
CONCEPT DESIGN	NOT FOR CONSTRUCTION	SCALE: AS SHOWN	DATE: JULY 2025
		PROJECT NO. 25-00775-001	
DESIGNED BY: KNI	COUNTY: CHARLES COUNTY	DRAWN BY: GLZ	LOGFILE: N/A
CHECKED BY: JIM	HORIZONTAL SCALE: N/A	F.A.P. NO.: N/A	VERTICAL SCALE: N/A
DRAWING NO. ES-05 OF 09	SHEET NO. 09 OF 44		

BY: M/McCuller

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STANDARD STABILIZATION NOTE:
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SCALE 1" = 20'

MATCHLINE (SEE DWG. ES-09)

MATCHLINE (STATION 403+84.50, SEE DWG. ES-07)



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOSSER
 JOHNSON, MERRIAM & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 21088

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83/11 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRIAM & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOSSER
 JOHNSON, MERRIAM & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSSE@JMT.COM

REVISIONS

CONCEPT DESIGN
 NOT FOR CONSTRUCTION

EROSION AND SEDIMENT CONTROL PLAN

SCALE AS SHOWN DATE JULY 2025 PROJECT NO. 25-00775-001

DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

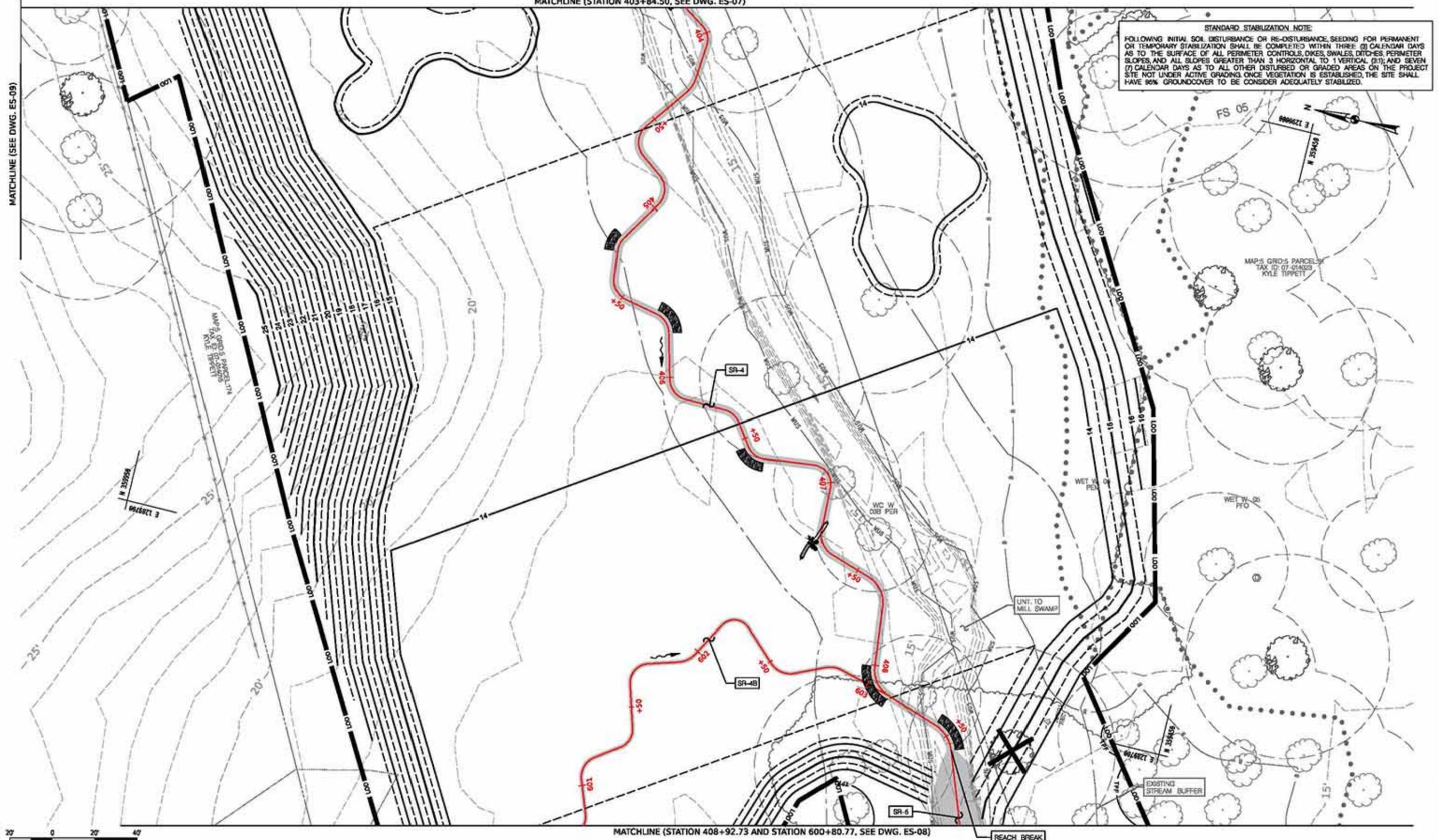
DRAWING NO. **ES-06** OF **09** SHEET NO. 11 OF 44

BY: M/McCuller

MATCHLINE (STATION 403+84.50, SEE DWG. ES-07)

STANDARD STABILIZATION NOTE:
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MATCHLINE (SEE DWG. ES-09)



MATCHLINE (STATION 408+92.73 AND STATION 600+80.77, SEE DWG. ES-08)

SCALE: 1" = 20'



PROFESSIONAL CERTIFICATION
 I HEREBY CERTIFY THAT THESE DOCUMENTS WERE PREPARED OR APPROVED BY ME, AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MARYLAND, LICENSE NO. 31918, EXPIRATION DATE: 12/31/2027.
DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
 JOHNSON, MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

MILL SWAMP MITIGATION BANK
 BRYANS ROAD, MD 20688

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
 JOHNSON, MERRINAN & THOMPSON
 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON, MERRINAN & THOMPSON
 TELEPHONE: 410-216-2960
 EMAIL: JKOSER@JMT.COM

REVISIONS

CONCEPT DESIGN
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EROSION AND SEDIMENT CONTROL PLAN

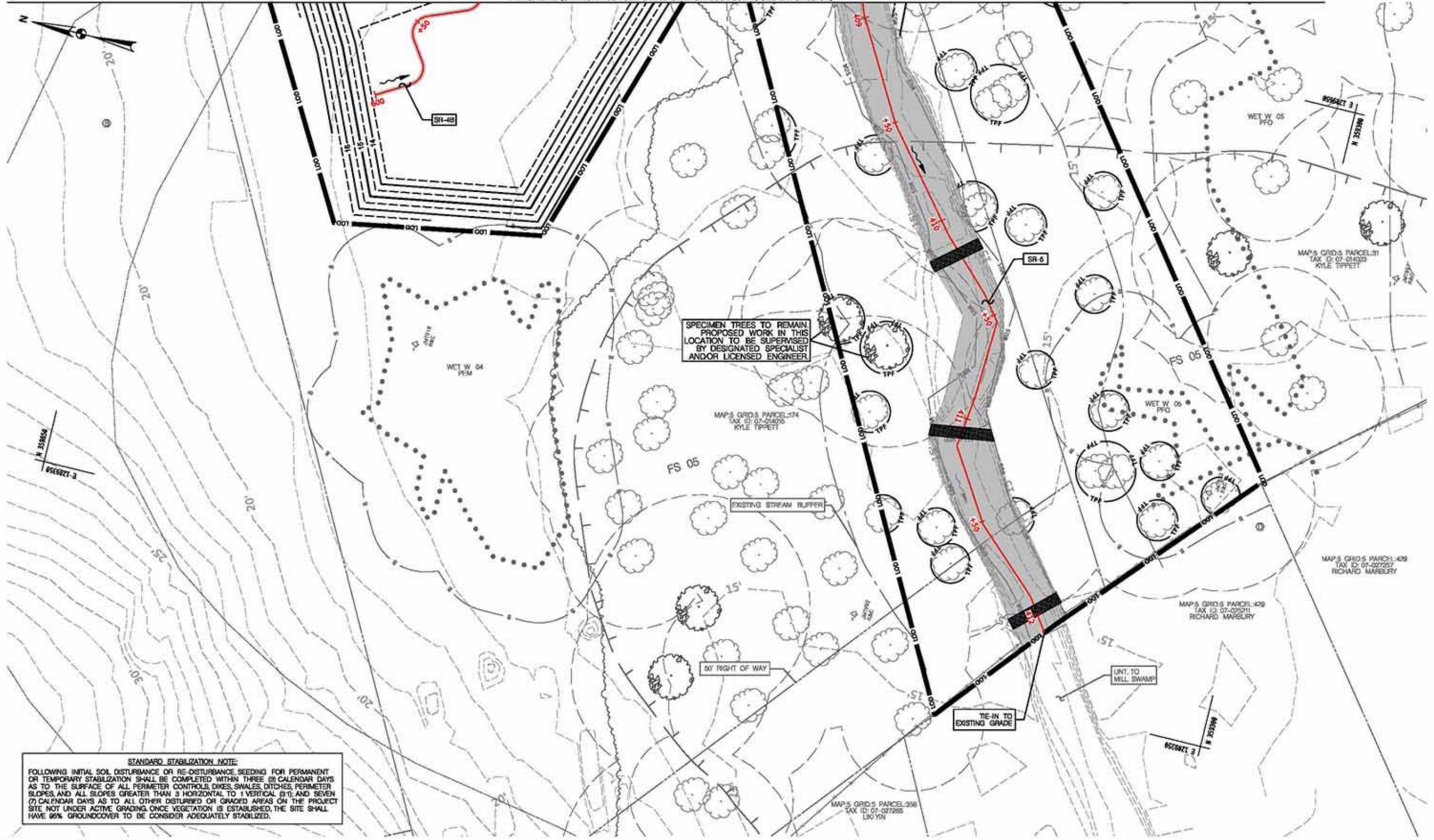
SCALE: AS SHOWN DATE: JULY 2025 PROJECT NO.: 25-0075-001

DESIGNED BY: KNE COUNTY: CHARLES COUNTY
 DRAWN BY: GLZ LOGFILE: N/A
 CHECKED BY: JIM HORIZONTAL SCALE: N/A
 F.A.P. NO.: N/A VERTICAL SCALE: N/A

DRAWING NO. **ES-07** OF **09** SHEET NO. 07 OF 44

BY: M/McCuller -

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DESIGN PROFESSIONAL CONTACT
 JEREMY KOZER
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MILL SWAMP MITIGATION BANK
 BYRANS ROAD, MD 20888

CHARLES COUNTY ELECTION DISTRICT 07 CONGRESSIONAL DISTRICT 06

MARYLAND COORDINATE SYSTEM
 NAD 83 / MD STATE PLANE VERT. NAVD 88

OWNER / DEVELOPER INFORMATION:
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 43 WRIGHT AVENUE
 HUNT VALLEY, MD 21030

CONTACT INFORMATION:
 JEREMY KOZER
 JOHNSON, MERRIMAN & THOMPSON
 TELEPHONE: 410-216-2960
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REVISIONS
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EROSION AND SEDIMENT CONTROL PLAN			
SCALE: AS SHOWN	DATE: JULY 2025	PROJECT NO.:	25-0075-001
DESIGNED BY: KNI	COUNTY: CHARLES COUNTY	DRAWN BY: GLZ	LOGFILE: N/A
CHECKED BY: JIM	HORIZONTAL SCALE: N/A	F.A.P. NO.:	N/A
DRAWING NO. ES-08	OF 09	SHEET NO.:	03 OF 44

BY: M/McCuller

100% (100% of the work) shall be completed by the date shown on the drawing. The contractor shall be responsible for obtaining all necessary permits and for complying with all applicable laws, regulations, and codes. The contractor shall be responsible for the safety of all workers and the public. The contractor shall be responsible for the protection of all existing utilities and structures. The contractor shall be responsible for the removal and disposal of all debris and waste. The contractor shall be responsible for the restoration of the site to its original condition or better. The contractor shall be responsible for the maintenance of all erosion and sediment control measures until the site is stabilized. The contractor shall be responsible for the monitoring and reporting of all erosion and sediment control measures. The contractor shall be responsible for the completion of all work within the specified time frame. The contractor shall be responsible for the payment of all taxes and fees. The contractor shall be responsible for the insurance of all workers and equipment. The contractor shall be responsible for the bonding of all work. The contractor shall be responsible for the coordination of all work with other contractors and agencies. The contractor shall be responsible for the communication of all work progress to the owner and the design professional. The contractor shall be responsible for the maintenance of all records and documents. The contractor shall be responsible for the protection of all confidential information. The contractor shall be responsible for the compliance with all applicable laws, regulations, and codes. The contractor shall be responsible for the safety of all workers and the public. The contractor shall be responsible for the protection of all existing utilities and structures. The contractor shall be responsible for the removal and disposal of all debris and waste. The contractor shall be responsible for the restoration of the site to its original condition or better. The contractor shall be responsible for the monitoring and reporting of all erosion and sediment control measures. The contractor shall be responsible for the completion of all work within the specified time frame. The contractor shall be responsible for the payment of all taxes and fees. The contractor shall be responsible for the insurance of all workers and equipment. The contractor shall be responsible for the bonding of all work. The contractor shall be responsible for the coordination of all work with other contractors and agencies. The contractor shall be responsible for the communication of all work progress to the owner and the design professional. The contractor shall be responsible for the maintenance of all records and documents. The contractor shall be responsible for the protection of all confidential information.

