MITIGATION PLAN

Final

November 2019

SASSARIXA SWAMP MITIGATION PLAN

Johnston County, NC
NCDEQ Contract No. 7425
DMS ID No. 100040

Neuse River Basin
HUC 03020201

USACE Action ID No. 2018-00432
RFP #: 16-007279

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

PREPARED BY:

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DRAFT MITIGATION PLAN

SASSARIXA SWAMP MITIGATION SITE

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This mitigation Plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern DMS operations and procedures for the delivery of compensatory mitigation.

Contributing Staff:
Angela Allen, PE, *Project Manager and Lead Designer*
John Hutton, *Principal in Charge*
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Greg Turner, PE, *Designer*
Win Taylor, PWS, *Wetland Delineations*
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November 19, 2019

Ms. Kim Browning
Department of the Army
Wilmington District, Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403-1343

RE: Sassarixa Swamp Mitigation Site – NCIRT Comments during 30-day Mitigation Plan Review
Sassarixa Swamp Mitigation Site (USACE AID# SAW-2018-00432, NCDMS # 100040)
Neuse 03020201, Johnston County, NC

Dear Ms. Browning,

Thank you for compiling and providing comments on the Sassarixa Mitigation Site final draft Mitigation Plan. We have reviewed the comments dated September 13, 2019 and have revised the Mitigation Plan accordingly. This letter includes a response to each comment; comments have been reprinted with our response in *italics*. The revised Mitigation Plan is being submitted with this letter.

<u>DWR Comments, Mac Haupt and Katie Merritt</u>

1. DWR has concerns regarding the 3 tributaries added since the post-contract site visit. Reaches T1B and T1D appear to be associated with wetlands. In addition, they did not appear on the DWR stream call list. The drainage areas are extremely small so there are serious questions whether these features are wetlands, or some sort of ephemeral conveyance.

   During our IRT site walk, T1B was identified by IRT members as a potential reach we should assess for the jurisdictional determination (JD), which led to the evaluation of this reach. During the JD evaluation, T1A was shown with two draws, but both identified as T1A. For the purpose of plan sheets, and needing to hydrologically connect these pieces, we labeled a portion T1D. We do agree this is a short drainage feature originating from a wetland and have removed it from crediting. It will still remain part of the construction project to improve the hydrologic function and connectivity. T1C was in a portion of the floodplain not explored during the proposal phase. But found during our wetland and stream delineation site work.

2. DWR recommends a figure/concept map be included with the 401/404 mitigation plan where all State and Federal credits/offsets are being generated.

   Since this review, Wildlands has communicated further with DWR to reconcile differences between DWR calls and final JD calls on this project. This communication is located within Appendix 1: Buffer Mitigation Plan (regarding T1A-C and T4R3). A Figure has been attached to this letter as further visual explanation.

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3. There appears to be considerable wetland acreage on site (Figure 6). Table 6 states there are 13.034 acres of wetland on the site, which represents approximately 22% of the conservation easement/project area. We are a little surprised there wasn't more discussion of what the proposed site will do to enhance/restore these wetlands.

   The RFP this project was contracted under required wetland credits to be generated from 100% restoration activities. While this project has significant wetland acreage, none of the acreage would have met the standard for restoration. However, DWR is correct in that wetlands will be enhanced and preserved as part of project development though no wetland credits are requested. A discussion of this has been added in Section 8.6.1 of the Mitigation Plan.

4. Table 16-Project Stream Assets – How does reach T1A go from existing footage of 67 to restoration footage of 358? While proposed as E2, it appears some work on channel features is being performed, however; is it possible upper T1A was not a stream as seen in the DWR stream call?

   In its existing condition, T1 runs along the edge of the valley, through a small failed pond, and intersects T1A just below the old pond bed. The proposed restoration moves T1 to the center of the valley. T1A maintains its original channel configuration. In doing this, the overall length of T1 shortens and T1A lengthens. Wildlands believes this is the most appropriate channel configurations for the natural valleys.

   Prior to surveying the area, the channels surrounding the failed pond and wetland areas had not been properly analyzed. Upon further inspection, both Wildlands and USACE confirmed T1A as a jurisdictional stream.

5. Section 8.6.3 – Preservation Reaches – and footnote 1 in Table 16, how much of T4 R3 is considered for preservation credit? With 275 linear feet going subterranean for significant portions of the year, it may be a different (higher) credit ratio necessary for this reach.

   In the initial IRT walk, just after two major hurricanes, there were areas of sand deposition within T4-R3 causing subterranean flow. It was requested by the IRT to determine the portion of the reach where subterranean flow occurred. The 275 feet was measured during the initial design phase. Since then, Wildlands has been continually monitoring the pulsing of deposited sediment out of the reach. As of summer 2019, deposited sediment has flushed out of the reach. This is now noted in section 3.3.6 in the existing conditions description. The note has been removed from Table 16. Wildlands believes the 10:1 proposed preservation ratio is fair.

6. Figure 11 – Monitoring Component Map – The flow gauge for T2 will need to be moved down to at least mid-reach (out of the relic pond bed). DWR requires an additional flow gauge on reach

T3 at station 402+30 (design sheet 1.31). In addition, depending on the answer to #4, DWR may require another flow gauge on T4R3.

Flow gauges on T2 and T3 are added to Figure 11 as described above.

7. Design sheet 1.32 – please install a wetland gauge on stream right at station 404+75.

   A wetland gauge has been added to design sheet 1.32 as described above.

8. As stated at the post contract site visit by several IRT members, DWR believes reach T2 is at a high risk for losing flow and not maintaining channel like characteristics.

   This is noted. A flow gauge will be installed, and credit release will be dependent on success criteria for T2.

9. DWR believes there may be flow issues on reach T3.

   This is noted. A flow gauge will be installed, and credit release will be dependent on success criteria for T3.

10. DWR requests capping the proposed *percentage* of green ash (*Fraxinus pennsylvanica)* to be planted at 5% due to emerald ash borer (*agrilus planipennis*).

    Green ash has been removed from the planting plan.

11. DWR was under the impression most of the area around reaches T5A, T5B, and T5C would be protected within the conservation easement. As seen in design sheet 5.10, much of the wetland area outside reach T5A will not be in the easement. This was not the proposed easement shown in the initial proposal. If this is the case, DWR will revise recommendations for the enhancement ratios due to the fact that if cattle pressure continues adjacent to the wetlands not in the easement, the functional benefit of the enhancement is greatly reduced.

    The easement has been adjusted to include the hillside seeps draining to T5A-C. A figure is attached to this memo showing the old vs. new boundary in this area.

12. Fencing is only proposed on the left side of Sassarixa Creek as shown on plan sheets 5.0-5.3. No existing or proposed fencing is shown on the right side/bank. However, there is an internal crossing proposed on Sheet 1.2. If this crossing is to give cattle access to the other side of Sassarixa in the future, there needs to be fencing installed on the left side/bank of Sassarixa Creek as part of this Plan.

    There will be fencing on the right bank of Sassarixa Creek. The plans missed a call out for existing fencing tie-in. We have edited plan sheets to show proposed fencing, should any *portion of existing fencing not be located appropriately according to the recorded easement.*

13. DWR would also like to reiterate the IRT's position of fragmented reaches and reaches above and below ponds. Collectively, fragmented reaches, numerous crossings and/or breaks in the stream reaches and ponds breaking up aquatic passage and nutrient flows; all these characteristics undermine the functional uplift of the potential project. In the future, this type of site will likely not be approved.

    Noted.

<u>USACE Comments, Kim Browning:</u>

1. IRT field notes from February 23, 2018 indicate the wetland areas around reaches T5A, T5B, and T5C would be protected within the conservation easement. As presented now, the easement area has changed and a large portion of the wetland area around reach T5A will not be in the easement. The enhancement ratio on this reach would be more appropriate at 4:1 due to the anticipated future impacts to surrounding wetlands by livestock.

    The easement has been adjusted to include the hillside seeps draining to T5A-C. Livestock will be excluded from the area.

2. Section 5 – Functional Uplift: The functional pyramid is used to demonstrate current and projected conditions however there are no assessment data sheets to document how each reach was assessed. Please include these in the appendix.

    The functional pyramid was used to frame a qualitative assessment with data from topographical survey and other acquired existing conditions data. No official functional pyramid forms were used in this analysis.

    a. NCSAM sheets are included in the appendix, which is appreciated, but this information is not discussed in the narrative. Since this is the approved assessment method, it would be beneficial to include this.

       DMS prefers not to include discussion of NCSAM in the narrative.

    b. Table 4 indicates that Sassarixa Creek and T1C both have Functioning existing conditions (Similar to T3R2) but they are proposed as enhancement reaches. It is clear that there is livestock access and lack of riparian understory; however, given that only supplemental planting and fencing will occur (and only one-sided fencing on the main stem), the ratio for this main reach would be more appropriate at 4:1 unless there is justification for the proposed 2.5:1.

There will be fencing around the entirety of Sassarixa and T1C (See response #12 above). The ratio of 2.5:1 was agreed upon in the initial IRT site walk. Meeting minutes have been added to Appendix 5.

3. The proposed ford crossing on Sassarixa Creek has the potential for future maintenance issues, especially since it is located in a braided system. Please address any anticipated maintenance.

    The ford was field located by the landowner because the channel is a single thread through this section, and it is currently used as a ford crossing. We will be making improvements to the existing crossing. It is designed with fence line that can be retracted while not in use to allow for major storm flows to pass through the floodplain without causing fence failure. Fence catching debris across floodplains is often the major cause of failure in similar situations. This will also allow for better biological and hydrological connectivity of the site when not in use. All crossings, including the ford, will be inspected upon each visual inspection site visit. Any damage from high flows will be addressed with maintenance as needed.

4. T2, T1D, and T4 appear to have inconsistent information regarding jurisdiction. T1D is not on the PJD or Stream Call form. The jurisdictional limits of T2 appear to be much shorter than proposed, especially given the fact that the pond was constructed in an upland. T4 has areas that flow subsurface. Please verify.

    T2 is currently ponded and piped within the farm field. It becomes jurisdictional at a pipe outlet at the edge of the field. Based on historical aerials and surrounding hydrologic indicators, Wildlands is confident T2 will be jurisdictional as proposed post-restoration. T2 will be monitored with a gauge and credit release will be dependent on success criteria being met.

    Please see response #1 in the DWR questions regarding T1D. It has been removed from credits.

    Please see response to #5 in the DWR questions regarding T4. Additionally, T4 has since been re-evaluated by DWR for jurisdictionality and buffer viability. This update is included in the Buffer Mitigation Plan in Appendix 1.

5. Page 9 – The discussion states "There is no opportunity to improve hydrologic function on the rest of the site." On the contrary, the removal of the pond that separates T5A-B-C with T5 would allow for a natural flow regime. Additionally, aquatic passage is restricted here. Are cattle excluded from this pond?

    Although we agree that removal of ponds are ideal practice for hydrologic functional uplift, that was not possible on this project due to landowner constraints. There is not *currently livestock access to the pond. It is used as an event space for educational programs for students as well as a wedding venue.*

6. Planting Plan, Design Sheet 3.2 – does not depict reach T1D.

    T1D has been added to Sheet 3.2.

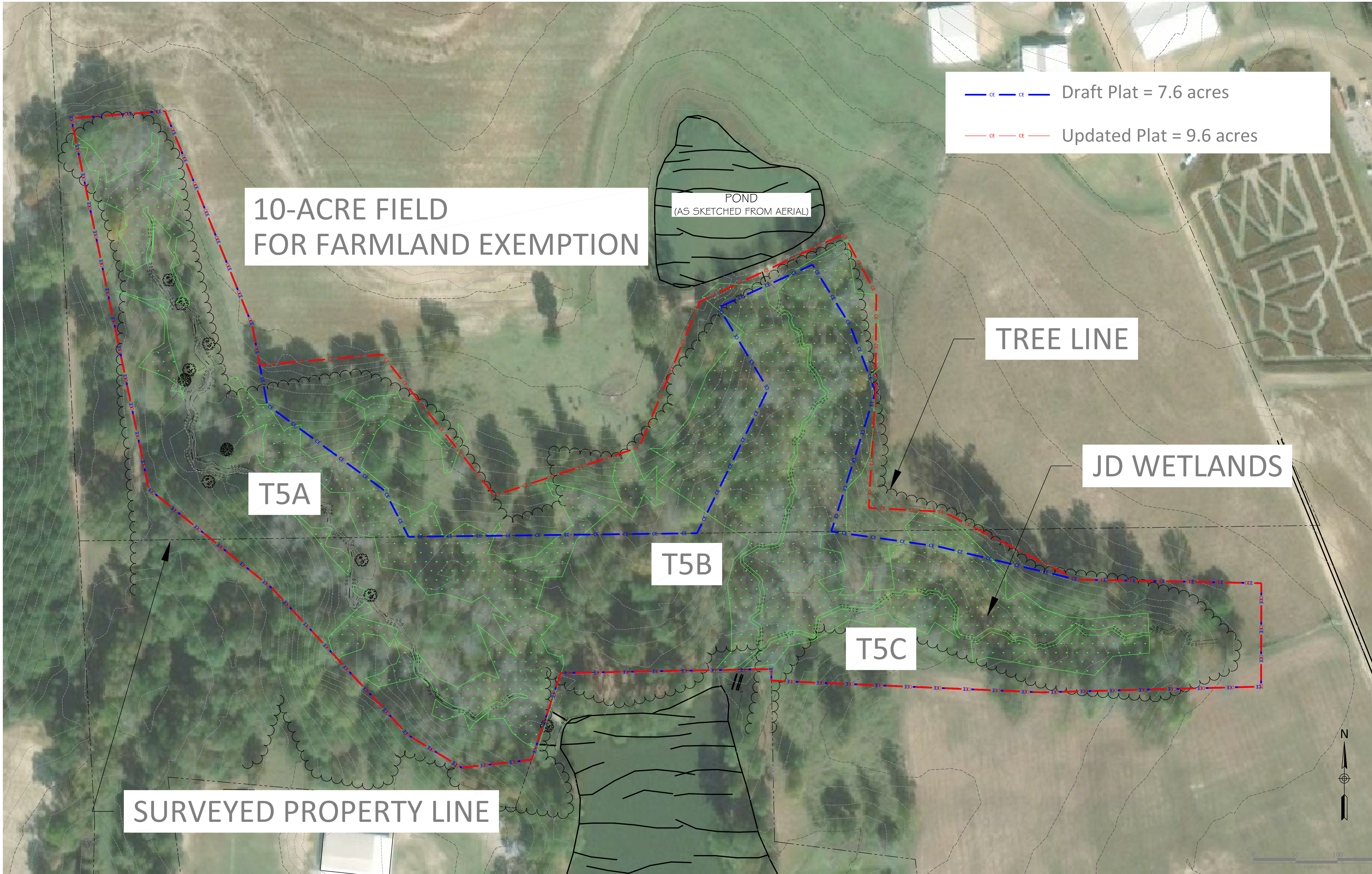
7. Section 9.2 – Please add a vigor standard of 7 feet for year 5.

    This has been added to the second sentence of Section 9.2.

If you have any questions please contact me at aallen@wildlandseng.com, (919)851-9986 x 106.

Sincerely,

Angela Allen, P.E., *Project Manager*


Draft Plat = 7.6 acres
Updated Plat = 9.6 acres
10-ACRE FIELD
FOR FARMLAND EXEMPTION
POND
(AS SKETCHED FROM AERIAL)
TREE LINE
JD WETLANDS
T5A
T5B
T5C
SURVEYED PROPERTY LINE
N

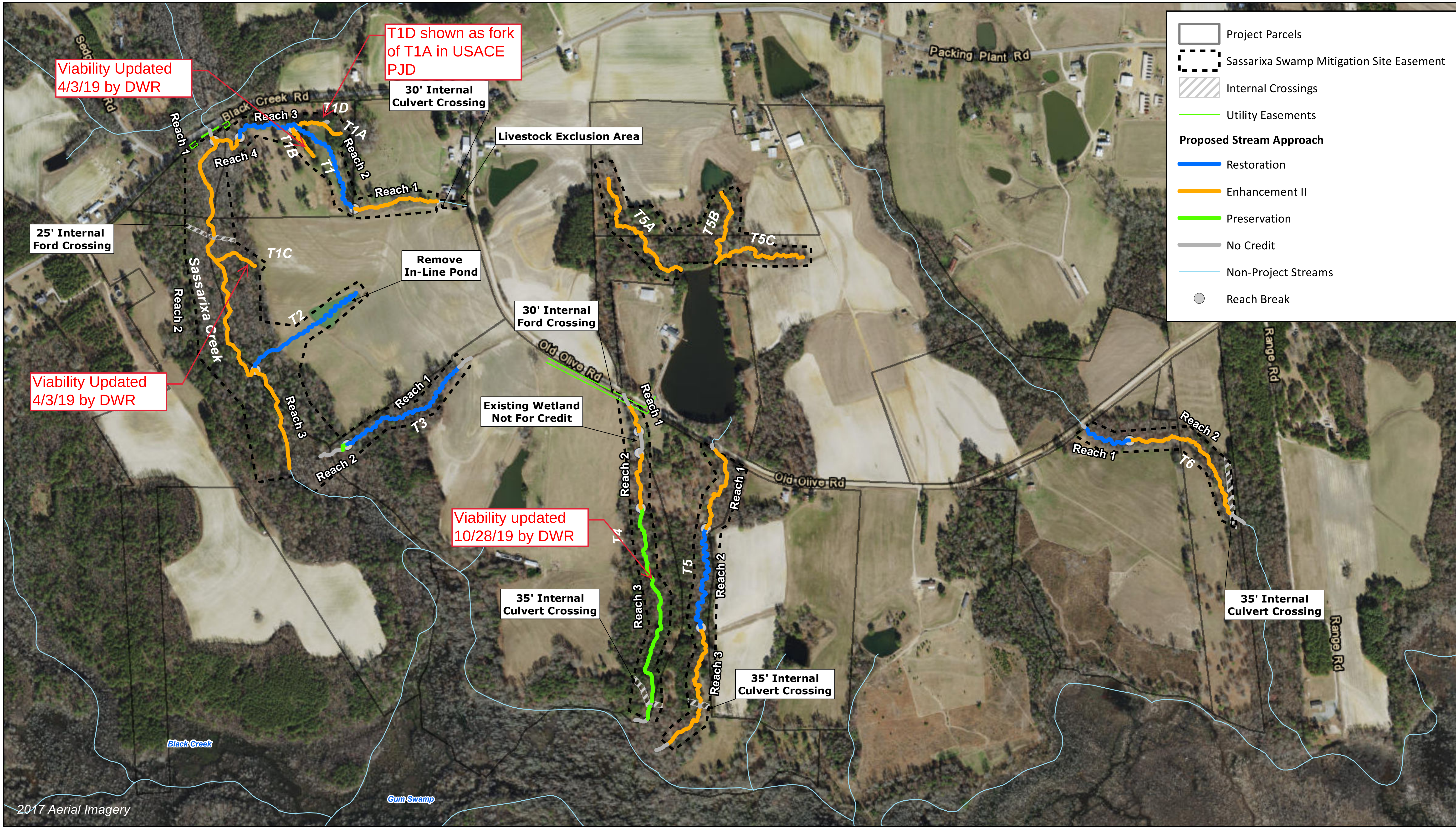


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Figure 7. Concept Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

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1.0 Introduction

The Sassarixa Swamp Mitigation Site (Site) is in Johnston County, NC approximately six miles southwest of Smithfield and five miles north of Four Oaks (Figure 1). The project is in the NC Division of Mitigation Services (DMS) targeted local watershed (TLW) for the Neuse River Basin Hydrologic Unit (HU) 03020201130030 and NC Division of Water Resources (DWR) Subbasin 03-04-04 (NC DWQ 2011). The Site was selected by DMS to provide stream mitigation credits and buffer credits in the Neuse River Basin 03020201 (Neuse 01). The project involves the restoration, enhancement, and preservation of Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek (Figure 2). The restoration of these streams will provide 8,618.650 stream credits. The project will also restore, enhance, and preserve 58 acres of riparian buffer on site, which will provide 1,098,146.503 buffer credits. Establishment of the riparian buffer including planting, construction, and livestock exclusion will be concurrent with the establishment of the stream project. The Site will be protected by a 65-acre conservation easement. The Site Protection Instrument detailing the easement is in Appendix 2.

Table 1: Project Attribute Table Part 1 – *Sassarixa Swamp Mitigation Site*

Project Information	
Project Name	Sassarixa Swamp Mitigation Site
County	Johnston
Project Area (acres)	65.06
Project Coordinates (latitude and longitude)	35°28'19.75"N 78°26'9.60"W
Planted Acreage (acres of woody stems planted)	13.03

2.0 Watershed Approach and Site Selection

The Sassarixa Swamp Mitigation Site is in a new Targeted Local Watershed (TLW) that is not described in the 2010 Neuse River Basin Restoration Priorities (RBRP) Plan (Breeding, 2010). The TLW was added in the 2015 Neuse 01 CU Update (NCDWR, 2015) because there were more water quality issues than assets. Stressors for this TLW include impervious surfaces, disturbed riparian buffers, agricultural land use, and animal operations. The site provides the opportunity to addresses the TLW stressors of agricultural land use and animal operations, as it is an active cattle farm that lacks protected riparian buffers. The project will also address key Cataloging Unit (CU) wide restoration goals for the Neuse River 03020201 described in the RBRP including reduction of sediment and nutrient loads from agricultural lands and increasing or improving riparian buffers (NC DWQ, 2009). The project streams drain directly into Holts lake, which is a recreational lake classified as a Nutrient Sensitive Water (NSW) that drains to the Neuse River, which is a water supply for the City of Goldsboro. The Sassarixa Swamp Mitigation Site was selected because of its location within the TLW and its potential to address the TLW goals through stream restoration and buffer restoration.

Restoration of streams on the Site will directly and indirectly address stressors identified in the RBRP by creating stable stream banks, restoring meandering pattern, and restoring a forested buffer. This project will slow surface runoff, provide shade to streams, remove farm ponds, and reconnect streams to their historic floodplains and riparian wetlands, which will reduce sediment and nutrient loading. In addition, restoration will provide and improve instream and terrestrial (riparian) habitats while improving stream stability and overall hydrology.

3.0 Baseline and Existing Conditions

The Site watershed (Table 2 and Figure 3) is situated in the rural countryside in Johnston County near Smithfield, NC, adjacent to Holts Lake and the Black Creek Swamp. The following sections describe the existing conditions of the watershed and watershed processes including disturbance and response.

Table 2: Project Attribute Table Part 2 – *Sassarixa Swamp Mitigation Site*

Project Watershed Summary Information	
Physiographic Province	Coastal Plain
Ecoregion	Rolling Coastal Plain
River Basin	Neuse River
USGS HUC (8-digit, 14 digit)	03020201, 03020201130030
NCDWR Sub-basin	03-04-04
Project Drainage Area (acres)	5,024
Project Drainage Area Percentage of Impervious Area	0.9%
CGIA Land Use Classification	66% agriculture, 27% forested, 7% developed

3.1 Landscape Characteristics

3.1.1 Physiography and Topography

The Site is in the Coastal Plain physiographic province and is characterized by sandy hills and shallow valleys. The Site topography and relief are typical of the Coastal Plain, with elevations in the watershed ranging from 215 feet above mean sea level (msl) at the upstream end of tributaries, to 115 feet msl along Sassarixa Creek, as illustrated in Figure 4. Sassarixa Creek is an anabranching stream in a gentle (0.3%) unconfined alluvial valley (>400 feet). Streams T1, T1A, T1B, T1C, and T1D are in unconfined alluvial valleys with steeper slopes, ranging from 2%-3%. T2, T3, T4, and T5 streams start off with steep and moderately confined alluvial valleys that eventually widen to unconfined valleys with gentler slopes as they approach the floodplains of Sassarixa Creek and Black Creek. Slopes on these reaches range from 1% to 4% and valleys fluctuate between 30 and 60 feet in width. The alluvial valleys of T5a, T5b, and T5c are unconfined, with widths ranging from 60 to 150 feet. T6 is an unconfined alluvial valley (2%) in the upstream project extents that gradually narrows (from 150 ft to 80 ft) and steepens towards the downstream end of the project.

3.1.2 Geology and Soils

The Site is in the Rolling Coastal Plain of the Coastal Plain physiographic province. The Coastal Plain is characterized by relatively flat terraces of primarily unconsolidated sediments and carbonate rocks ranging in age from Cretaceous to Quaternary. These layered materials accumulated as sediments deposited in what was once a shallow ocean or shelf interface along a shallow ocean. The deposits form roughly parallel belts that trend southwest to northeast. The site is in the belt called the Middendorf Formation (km), which formed during the Cretaceous period. Sohl and Owens (1991) describe the Middendorf formation as deeply weathered and consisting mainly of layered delta plain to fluvial deposits. Sediments are layered in think black clay and light-colored sand layers consisting of sand, sandstone, and mudstone. Sands are primarily quartz; however, outcrops of feldspar may be up to 15 percent. Due to the weathered condition of the soils and base geology, no exposed bedrock is located on site.

The sandy layers of black clay and light-colored sand were evident in soil cores taken on the site during wetland investigations. Deep layers of light color sand were noted along T5 and T6. Soils on site range between sandy loams and loamy sands. They are deep to very deep soils. The well drained soils on site like Gilead sandy loam, Cowarts sandy loam, Nason silt loam, and Uchee loamy sand, are located along the tributaries in their narrower steeper valleys (NRCS, 2011). The poorly drained soils on site like the Bibb sandy loam and Wehadkee loam, are in the broad valley of Sassarixa Creek and the downstream portion of T1 as it flows into Sassarixa Creek. This pattern closely mimics the areas of riparian wetland occurrence within the project area. Figure 5 provides a soil map of the Site.

3.2 Land Use/Land Cover

The project includes several adjacent properties that have been owned and operated as a livestock farm by a single family since 1850, where livestock are continually rotated through all fields with access to the project streams. A review of historic aerials from 1950 to 2012, located in the appendix, shows that onsite streams have existed in their approximate locations with very little change to riparian buffer extents since 1950. The watershed as a whole has not changed significantly in land use or riparian buffer extents aside from the site-specific alterations listed below. Two alterations to the Site visible from historical aerial photography are the addition of the pond on T2 between 1964 and 1973, and the addition of the large pond below T5A, T5B, and T5C between 1950 and 1961. According to the landowners, in the 1960's and early 1970's a hog yard was located at the upstream end of T4 and T5, where the streams were diverted to make a hog wallow area. The hogs were moved to a hog house in the early 1970's, however goats, horses, and cattle had continuous access to this portion of the site until Hurricane Matthew struck in September 2016. The floods from the storm destroyed much of the fencing around T4 and T5 and livestock have been rotated in other fields since that time while fencing is repaired. Other portions of the site have not seen significant changes in land use with livestock or crop rotations from existing activities.

This consistency in land use within the project watershed over the past 68 years indicates that watershed processes affecting hydrology, sediment supply, and nutrient and pollutant delivery have not varied widely over time. The addition of farm ponds has been the only significant change in hydrology. With a lack of developmental pressure, watershed processes and stressors from outside the project limits are likely to remain consistent throughout the implementation, monitoring, and closeout of this project. These stressors and processes are discussed further in Section 4, below.

3.3 Project Resources

On May 29 through June 2, 2018, Wildlands investigated on-site jurisdictional waters of the U.S. within the project area. Jurisdictional areas were delineated using the US Army Corps of Engineers (USACE) Routine On-Site Determination Method presented in the 1987 Corps of Engineers Delineation Manual, the subsequent Regional Supplement for the Atlantic and Gulf Coastal Plain, and the evaluator's best professional judgement. All jurisdictional waters of the U.S. were located by sub-meter GPS. Wetland determination forms representative of on-site jurisdictional areas as well as non-jurisdictional upland areas are included in Appendix 3.

USACE staff approved the extent of jurisdictional resources on March 21, 2019. There are thirty-three jurisdictional wetland features located on-site (Figure 6). These wetland features are classified as Headwater Forests, Bottomland Hardwood Forests, and Riverine Swamp Forests using the North Carolina Wetland Assessment Method. The wetlands occur on the slopes and the floodplains that drain to Sassarixa Creek and its tributaries. These features exhibit prolonged saturation within 12 inches of the soil surface, hydrophytic vegetation, and a low chroma matrix and/or darkened surface horizons. Common hydrophytic vegetation includes swamp tupelo (*Nyssa biflora*), bulbous buttercup (*Ranunculus bulbosus*), and pale smartweed (*Persicaria lapathifolia*). Many of these areas are impacted by cattle grazing.

The Site contains five perennial streams (Sassarixa Creek, T3, T4, T5, and T6) and nine intermittent streams (T1, T1A, T1B, T1C, T2, T5A, T5B, T5C). A tributary of T1A has been labeled T1D in this document and the construction plans for clarity, as it is draining a separate linear wetland (wetland DD). The confluence of T1A and T1D is a headcut located under a large tree that is threatening upstream migration and further incision of T1A and T1D. These features were confirmed by staff from NC DWR on April 4, 2018. NC DWR Stream Identification Forms (Version 4.11) are in Appendix 4 along with a confirmation letter from DWR regarding stream calls. US Army Corps of Engineers (USACE) forms and NCSAM forms are in Appendix 3. Stream features are described in more detail in Section 5. Table 3 provides a summary of water resources within the project limits. Existing conditions are also illustrated in Figure 6. Cross-section and pebble count data is in Appendix 5.

3.3.1 Sassarixa Creek

Sassarixa Creek is a perennial stream that enters the Site under a bridge on Black Creek Road and flows southeast. The first two reaches (R1 and R2) are an anabranching sand bed system of E5 channels in a wide alluvial valley consisting of one large main channel and several smaller interconnected channels. There are large deposits of alluvial gravel/cobble material in the floodplain, likely originating from flood flows during hurricane Matthew in 2016 and hurricane Florence in 2018. Near the confluence with T2, the creek forms a single thread channel (Reach 3) as the valley constricts slightly. The banks along this single-thread reach are relatively stable, with localized scour on outer meander bends and erosion due to livestock access and trampling of banks. Several livestock pathways wind through the riparian buffer and cross Sassarixa Creek. There is a large amount of woody debris in the system from felled trees that help maintain pools, form grade control, and provide habitat niches. Sassarixa Creek is connected to its floodplain (Bank Height Ratio (BHR) = 1.0) and there is evidence of recent bankfull events from sand and gravel deposits at the top of bank.

3.3.2 T1, T1A, T1B, and T1D

T1 enters the site at Old Olive Road in the northeast section of the project. The stream is a sand bed system with limited amounts of sediment input from the watershed due to the pond upstream of Old Olive Road. The alluvial valley is relatively narrow at the upstream limit and widens as the stream flows towards Sassarixa Creek. The first reach (R1) is most closely described as an incised and straightened B5. It has a baseflow channel with a vegetated inner berm and is incised (BHR = 3.0) but relatively stable. There is localized erosion from livestock trampling across the channel. Most of the buffer on this reach is fescue with a single row of large specimen trees along the bank. As the stream makes a 90-degree bend towards the north (start of R2), the incision increases, and it transitions to a G5 channel. This channel is impounded by a small pond along R2. Below the pond (R3), the channel remains incised (BHR = 3.1) but increases in sinuosity. The stream scores towards perennial upstream of the pond, however, the pond appears to have heavily impacted the hydrology, and the overall stream scores as intermittent. T1A is a small intermittent stream that joins T1 downstream of the existing pond. It is a relatively stable stream with an existing meander pattern and scour located along meander bends and evidence of livestock trampling the banks. The floodplain at the confluence of T1 and T1A has been heavily manipulated by livestock, where their trampling of the wetland seep has altered the surface hydrology of the wetland through continual compaction.T1D is a small and short intermittent stream reach that flows out of the linear Wetland DD into T1A from the right floodplain with the same characteristic impacts of livestock on the riparian area. T1B is a small intermittent stream that flows into T1 from the left floodplain. It is incised and is heavily manipulated by livestock access pathways trampling existing streambanks.

3.3.3 T1C

T1C is an E5 channel that originates from a spring seep in a headcut on the edge of the fields at the extent of the Sassarixa Swamp floodplain. The stream is stable and has low banks, varied bedform, and a stable meander pattern. Its stability is currently threatened by lack of vegetation on banks due to livestock access.

3.3.4 T2

The origin of T2 is a farm pond located in the natural valley of this drainage area that is dominated by fescue and hay production. The pond has a buried outlet pipe that daylights at the tree line with a five-foot vertical drop between the outlet and receiving stream. The stream within the forest is an intermittent, G5, sand bed system that is incised (BHR = 6.5) along the reach length and has significant scour along the streambanks from high energy produced by the system over the headcut. Livestock have access to this reach, which contributes to bank trampling, mass wasting of bank material, and inputs of fecal coliform.

3.3.5 T3

T3 is a perennial stream that originates in the farm field south of Old Olive Road. It is incised at the top of reach 1 (R1) (BHR = 2.3) and the incision increases (BHR 3.9) as it flows down the steep (3.5%) alluvial valley classifying the stream as a G5. The streambed is sand with a small amount of gravel in the pavement. While T3 has a forested buffer, livestock access has impacted most of the understory and contributed to bank trampling. Headcuts along R1, caused by woody debris dams, increase incision and overall bed scour. Lack of grade control other than tree roots could continue to be a destabilizing factor for this reach and incision may continue. As T3 enters the Sassarixa Creek floodplain it flattens out and stabilizes.

3.3.6 T4 and T5

T4 and T5 are perennial streams that enter the Site through culverts at Old Olive Road. They are in similar alluvial valleys that are restricted for most of the length, with the streams traversing between valley walls, but that open as the channels approach the Black Creek floodplain. The impact of the old hog wallow area discussed in Section 2.1 is evident in T4-R1 and T5-R1. Both channels include areas where the stream appears to go subterranean through wetlands due to manipulation of the channel and surrounding floodplain. T4 is most accurately described as an E5b channel, with a slightly steeper valley than T5. The T4 channel is incised (BHR= 2.0) along T4-R1 and becomes less incised as it flows downstream where livestock damage is lessened, and the riparian buffer is more mature.

At the onset of the project, T4-R3 had sediment deposits, likely from two hurricanes the previous fall, which caused 275 feet of channel to go subterranean during summer. Throughout the design process, T4-R3 has been monitored and as of the summer of 2019 those areas of sediment deposition have flushed from the system.

T5 is most accurately described as an E5 stream. Reach T5-R1 is relatively stable, with localized scour on the meander bends. The reach becomes moderately incised (BHR = 1.7) at the headcut located at the transition point between T5-R1 and T5-R2. The stream becomes narrow (width to depth ratio of 2.2), which is causing scour of the sand bed stream that is likely to continue without intervention. As the stream transitions to a wider valley along R3 the stream becomes more stable.

3.3.7 T5A, T5B, T5C

T5A, T5B, and T5C are the intermittent headwater streams to T5. They originate in the northernmost region of the project, upstream of a large pond. Their watersheds are primarily livestock grazing areas and row crops. These reaches are in steep alluvial valleys ranging from 2.5% -3.75%. There is minimal scour and incision along the reaches except for localized bank trampling from continued livestock access and they are moderately incised (BHR=1.3 – 1.7). A forested canopy covers the stream area, but livestock access has impacted the understory, which is now dominated by Japanese stiltgrass. These streams are best described as B5, sand bed channels.

3.3.8 T6

T6 has the widest alluvial valley of any of the tributaries on site. The perennial stream enters the project area through a culvert under Old Olive Road. Reach 1 (R1) incised G5 channel (BHR = 2.1). There is evidence of channel manipulation with dredged channel material located on the tops of banks. This incision reduces as the channel moves downstream (BHR = 1.2). Spoil piles are less present, the stream begins to increase its meander pattern, and the stream transitions to an E5 stream type.

Table 3: Project Attribute Table Part 3 – *Sassarixa Swamp Mitigation Site*

Reach Summary Information														
Parameter	**Sassarixa Creek**	**T1**	**T1A**	**T1B**	**T1C**	**T1D**	**T2**	**T3**	**T4**	**T5**	**T5a**	**T5b**	**T5c**	**T6**
Length of Reach(lf)	2,595	2,202	67	258	307	48	348	1,098	2,198	2,544	996	588	343	999
Valley Confinement (confined, moderately confined, unconfined)	unconfined	unconfined	unconfined	unconfined	moderately confined to unconfined	unconfined	moderately confined to unconfined	moderately confined to unconfined	moderately confined to unconfined	moderately confined to unconfined	unconfined	unconfined	unconfined	unconfined to moderately confined
Drainage Area (acres)	4,726	45	4	2	6	0.5	13	26	32	136	24	25	10	130
Perennial, Intermittent, Ephemeral	P	I	I	I	I	I	I	P	P	P	I	I	I	P
NCDWR Water Quality Classification	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	C, NSW	B, NSW	B, NSW	B, NSW	B, NSW	B, NSW	B, NSW
Stream Classification (Existing and Proposed)	E5: E5	G5: C5b	E5: E5	B5: B5	E5: E5	E5:E5	G5: C5b	B5/G5: C5b	E5b: E5b	E5	B5: B5	B5:C5b	B5: B5	G5/ E5: C5b
Evolutionary Trend (Simon)	Stage VI: Quasi Equilibrium	Stage III: Degradation	Stage III: Degradation	Stage III: Degradation	Stage III: Degradation	Stage III: Degradation	Stage IV: Degradation and widening	Stage IV: Degradation and widening	Stage III: Degradation	Stage III: Degradation	Stage III: Degradation	Stage III: Degradation	Stage III: Degradation	Stage IV: Degradation and widening
FEMA Classification	Partial Zone AE	X	X	X	X	X	X	X	X	X	X	X	X	X

1. Wetland areas are not proposed for restoration or enhancement credit. A Summary table of these features is in the Appendix.

3.4 Existing Vegetation

Three streams on site lack a riparian buffer: T1-R1, the upstream end of T2, and the upstream end of T3. The riparian zone in these areas consist primarily of fescue (*Festuca* sp.) and some areas of hay production to feed livestock. The canopy on T1-R2 is unique in that it is dominated by loblolly pine (*Pinus taeda*) with an understory of Japanese stiltgrass (*Microstegium vimeneum*). All other riparian areas include a mix of canopy species including red maple (*Acer rubrum*), sweetgum (*Liquidambar styraciflua*), willow oak (*Quercus phellos*), tulip poplar (*Liriodendron tulipifera*), ironwood (*Carpinus caroliniana*), sycamore (*Platanus occidentalis*), water oak (*Quercus nigra*), and black willow (*Salix nigra*). While the understory of all reaches is dominated by Japanese stiltgrass, there is still a mix of understory species present, predominantly along Sassarixa Creek and T4R3. Understory species include Christmas fern (*Polystichum acrostichoides*), dogfennel (*Eupatorium caplilifolium*), greenbrier (*Smilax sp.*), Virginia creeper (*Parthenocissus quinuefolia*), sawtooth blackberry (*Rubus argutus*), common ragweed (*Ambrosia artemisifolia*), poison ivy (*Toxicodendron radicans*), common rush (*Juncus effesus*), and common sedge (*Carex sp.*). Invasive species located in the riparian buffers include Chinese privet (*Ligustrum sinese*) and Japanese honeysuckle (*Lonicera japonica*).

4.0 Watershed and Channel Disturbance and Response

As discussed above in Section 3.2, there has been very little change in the on-site watersheds for several decades. The primary cause of degradation to the Site is the historic and continued access of livestock to streams and wetlands. Lack of adequate riparian buffers and a grazed understory has allowed significant runoff from the grass pastures to flow into streams during storm events. This has created incision in over 50% of the stream length on site. Direct access by livestock in the channel has contributed to mass wasting of bank material.

5.0 Functional Uplift Potential

The potential for functional uplift is described in this section according to the Stream Functions Pyramid (Harman, 2012). The Stream Functions Pyramid describes a hierarchy of five stream functions, each of which supports the functions above it on the pyramid (and sometimes reinforces those below it). The five functions in order from bottom to top are hydrology, hydraulics, geomorphology, physicochemical, and biology.

5.1 Hydrology

The major watershed disturbance, prior to 1950, has been deforestation and conversion of 66% of the watersheds to agricultural land uses. These alterations in land cover typically result in reductions in rainfall interception and evapotranspiration which lead to increases in runoff and water yield (Dunne and Leopold, 1978). A primary result of these changes is an increase in both peak flows and base flows, though the magnitude of this effect is likely small in watersheds of this size. Initial increases in water yield usually change over time as vegetation regrows and crops are planted. There are no stream gauges within this watershed and, thus, no way to know the degree to which clearing of 66% of the land affected this watershed other than to say that water yields have almost certainly increased. However, these changes primarily occurred several decades ago (prior to available aerial photography) and additional clearing in the watershed has been limited. Another watershed disturbance was the creation of the farm ponds on site, as described in Section 3.2. These ponds altered the storm flows in reaches T2 and T5 by impounding water. The historic aerials for T2 show the old channel starting near the existing forebay for the pond.

The watershed has adjusted to its hydrologic regime and is stable now. Population growth in this rural area is essentially non-existent. Therefore, future alteration to the land cover and associated effects on hydrology are not expected in the foreseeable future. No measurements of existing conditions in hydrology have been made to date for this project. However, due to the stability of the watershed the Site hydrology is assumed to be functioning (Table 4).

There is one opportunity to improve hydrologic function on site. The removal of the pond at the headwaters of T2 will allow for a natural flow regime for the tributary. Currently, in drought situations, the pond may cut off a continuous flow to the downstream reach and removal of the pond will prevent that from occurring. There is no opportunity to improve hydrologic function on the rest of the site. Even though trees will be planted within the conservation easement, this is unlikely to result in improvements to the rainfall-runoff relationship on a watershed scale.

5.2 Hydraulics

Hydraulic function varies across the site. The combination of entrenchment ratios (ERs) and bank height ratios (BHR) describe the streams that are currently not functioning. T1-R2, T2, T3-R1, T5-R2, and T6-R1, classified as Rosgen type G5 channels, have BHRs over 2.0 and ERs under 2.2 (both not functioning). This combination shows that they are hydraulically disconnected from their floodplains, have incised, and may be actively incising.

Several stream reaches are actively incising (BHR above 1.6 and not functioning), but still have access to their floodplains (ER above 1.4 and functioning). These streams (T1R1, T1B, T4-R1, T4-R2, T5-R1, T5A, and T5C) are considered to be functioning-at-risk overall. Without intervention they may continue to incise and degrade transitioning from Rosgen type B5 and E5 channels to Rosgen type G channels.

Sassarixa Creek, T1A, T1C, T3-R2, T5B, T5-R3, and T6-R2 do not appear to be actively incising and currently are hydraulically connected to their floodplains (BHRs less than 1.3 and ERs above 1.4). These reaches are considered functioning for hydraulics.

There is opportunity to uplift hydraulics on the Site from not functioning and functioning-at-risk to functioning. Those streams that are not functioning, as described above, can be reconstructed so that they are connected to their floodplains and so that stream flows above bankfull stage will flood the floodplain. The BHR for restored stream reaches will be 1.0 (functioning). Bankfull flow velocities and shear stress will be maintained at functioning levels through the dimension, plan, and profile design of the channel, as well as the introduction of roughness through woody and rocky material in constructed riffles and the planting of streambanks. The hydraulics of those channels that are functioning-at-risk will be improved using a lighter touch approach, which may include the grading of streambanks in areas of scour, adding floodplain benches to decrease effects of incision, the introduction of instream and streambank structures, and the planting of streambanks and riparian buffers. Livestock will be excluded from all channels.

5.3 Channel Geomorphology

Past channelization, incision, and ongoing sloughing and widening described in Section 4 and Section 5.2 place streams on Site in either Stage III: Degradation, or Stage IV: Degradation and Widening of the Simon Channel Evolution Model (both classified as not functioning). Overall, 53% of the site shows active incision (vertical instability) and 25% of the site shows active erosion (lateral instability). T1, T2, T3, and T6, classified as Rosgen type G5 channels, have incised and are starting to widen (Stage IV), while T1-R1, T1B, T4-R1, T4-R2, T5-R1, T5A, and T5C are actively incising and show only moderate signs of bank erosion (Stage III). The leading cause of degradation along Sassarixa Creek, T1A, T1C, T3-R2, T5-R3, and T6-R2 is a lack of riparian vegetation and/or livestock trampling banks which is contributing to the mass wasting of bank material and fining of bed material. They are considered to be early in Stage III: Degradation. Those reaches up or downstream of reaches already incised are at greatest risk for further degradation.

The bedform is inconsistent on all project streams, but varies the most on T1, T2, T3, T5-R2, and T6-R1, where pool to pool spacing ratios are all outside of the range considered functioning (> 7.0). Other project streams show spacing within functioning ranges, but that vary outside of functioning throughout the reach. Bank migration and lateral stability were not measured for this project. Overall, the existing geomorphology on site is poor and is classified as not functioning.

There is an opportunity to improve the geomorphology function on the site. The incision and bank erosion will be corrected through restoration and enhancement activities. Bedform will be diversified and spaced with appropriate design ratios. LWD will be added to the system through construction of instream structures and bank revetments and a riparian buffer will be planted. The geomorphology function will be restored to functioning (Table 4).

5.4 Physicochemical

No water quality sampling has been conducted on the Sassarixa Swamp Site and there are no water quality monitoring stations within the watershed. Stressors include impervious surface, disturbed riparian buffers, and agricultural land use/animal operations. The Sassarixa Swamp site has the latter two of these stressors. Incision and erosion caused by disturbed riparian buffers and livestock access likely increases TSS within the watershed, and livestock access to streams likely increases levels of fecal coliform on site. Since there is no water quality data available to evaluate the current level of physicochemical functioning, this function is not rated.

There is potential to improve the physicochemical functioning of the project streams. Water will flow over instream structures that will provide aeration, trees will be planted in the riparian zone to eventually shade and cool stream flow and help filter runoff, the streams will be reconnected to their floodplain and adjacent riparian wetlands to provide storage and treatment of overbank flows, and streambank erosion will be greatly reduced to reduce a source of sediment and nutrients. However, the potential improvements to physicochemical functioning will not happen immediately and some aspects will not occur until a mature canopy is established. Therefore, physicochemical improvements will not be included in the project success criteria for the seven-year monitoring period and the functional uplift potential is not rated (Table 4).

5.5 Biology

There are no available biological data for the Site, however the habitat conditions on the Site are poor on T1, T2, T3, and portions of T5 and T6. Riffles contain coarse sand and very little woody debris or organic material necessary to support diverse macroinvertebrate and fish communities. Livestock trampling has impacted the bed in these streams and caused a fining of riffle material. The lack of riparian corridors along T1, T2, and T3-R1 limit available terrestrial habitat other than pasture grass. Instream habitat is more defined along Sassarixa Creek where the anabranching channel has coarse riffles and some large trees have fallen to form woody debris jams. Sassarixa Creek also has deeper pools that provide refuge for fish species. T4-R3 has more defined riffle pool sequences, less incision in the stream, and a more mature riparian buffer due to the exclusion of livestock from this reach since 2016. Because no data on the existing communities are available to evaluate the current level of biologic functioning, this function is not rated (Table 4).

There is opportunity to improve the instream and riparian habitat in addition to the physicochemical function described in Section 5.4. Habitat will be improved by adding instream structures with a variety of rock and woody materials, adding woody bank revetments, reducing the abundance of nuisance macrophytes through chemical intervention, providing a riparian buffer to shade the stream and improve terrestrial habitat, creating pools of variable depths, and cutting of sources of fine sediments. The culvert outlets will be addressed to improve aquatic organism passage. In riparian areas, invasive species will be initially treated to encourage growth of a diverse native riparian buffer and understory, providing a variety of terrestrial habitat niches. The biological response of the stream system will be tied to the physiochemical response post-restoration. As the physiochemical response may be delayed, the ultimate level of improvement in biology may not occur until after the completion of the seven-year monitoring period and, therefore, the functional uplift potential will be not rated (Table 4).

Table 4: Functional Pyramid Resource Summary – *Sassarixa Swamp Mitigation Site*

Functional Pyramid Resource Summary												
Resource	**Sassarixa Creek**		**T1R1/T1R3**		**T1R2**		**T1A**		**T1B**		**T1C**	
Functional Category	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**
Hydrology	F	F	F	F	F	F	F	F	F	F	F	F
Hydraulics	F	F	FAR	F	NF	F	F	F	FAR	F	F	F
Geomorphology	F	F	NF	F	NF	F	NF	F	NF	F	F	F
Physiochemical	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Biology	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Overall	F	F	NF	F	NF	F	NF	F	NF	F	F	F
Functional Pyramid Resource Summary Continued												
Resource	**T1D**		**T2**		**T3R1**		**T3R2**		**T4R1/T4R2**		**T5R1/T5R3**	
Functional Category	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**
Hydrology	F	F	FAR	F	F	F	F	F	F	F	F	F
Hydraulics	F	F	NF	F	NF	F	F	F	FAR	F	FAR	F
Geomorphology	FAR	F	NF	F	NF	F	F	F	F	F	FAR	F
Physiochemical	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Biology	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Overall	FAR	F	NF	F	NF	F	F	F	FAR	F	FAR	F
Functional Pyramid Resource Summary Continued												
Resource	**T5R2**		**T5A**		**T5B**		**T5C**		**T6R1**		**T6R2**	
Functional Category	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**	**EX**	**PRO**
Hydrology	F	F	F	F	F	F	F	F	F	F	F	F
Hydraulics	NF	F	FAR	F	F	F	FAR	F	NF	F	F	F
Geomorphology	NF	F	NF	F	FAR	F	NF	F	NF	F	FAR	F
Physiochemical	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Biology	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Overall	NF	F	NF	F	FAR	F	NF	F	NF	F	FAR	F

5.6 Overall Functional Uplift Potential

Overall, the Sassarixa Swamp Mitigation Site can be considered as Functioning-at-Risk, but the functional uplift potential is a reclassification of Functioning (Table 4). This change in overall classification is related to improvements in hydraulic and geomorphology between the existing and proposed conditions. The hydrology function will not change on the site as a whole because watershed-scale reforestation would be required to drive this function. Physicochemical and Biological improvements are likely a result of the project. However, there is no existing basis for classifying the existing condition of these functions and the likely improvements will occur gradually after construction.

Therefore, these functions are not rated and not considered in the overall functional rating. Project goals are tied only to hydraulics and geomorphology.

5.7 Site Constraints to Functional Uplift

Four culverts and two ford crossings will be constructed on project streams to allow for continued use of the land outside of the project area for agriculture. Each crossing is internal to the easement. Wherever possible, culverts were located at the start or end of the project reach to limit impact on stream pattern, plan, and profile. All culverts will be designed to pass well over the bankfull storm, to provide resilience to the design for future stormflows.

The valley widths on the Site will allow for the development of pattern and channel dimensions to restore stable, functioning streams and there are no other known constraints to the functional uplift described above in this section. The degree to which the physicochemical and biology functions can improve on the Site is limited by the watershed conditions beyond the project limits, upstream water quality, and the presence of source communities upstream and downstream of the Site.

6.0 Regulatory Considerations

Table 5, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 6.1-6.3.

Table 5: Project Attribute Table Part 4 – *Sassarixa Swamp Mitigation Site*

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	PCN[1]
Water of the United States - Section 401	Yes	Yes	PCN
Endangered Species Act	Yes	Yes	Appendix 6
Historic Preservation Act	Yes	Yes	Appendix 6
Coastal Zone Management Act	No	No	N/A
FEMA Floodplain Compliance	No	N/A	N/A[2]
Essential Fisheries Habitat	No	N/A	N/A

1. PCN to be provided to DMS with Final Mitigation Plan
2. FEMA boundaries shown on Figure 7

6.1 Biological and Cultural Resources

A Categorical Exclusion for the Sassarixa Swamp Mitigation Site was submitted to DMS on April 12, 2018 and approved on April 19, 2018. This document included investigation into the presence of threatened and endangered species on Site protected under the Endangered Species Act of 1973, as well as any historical resources protected under the National Historic Preservation Act of 1966. Wildlands requested review and comment from the United States Fish and Wildlife Service on February 5, 2018 in respect to the Sassarixa Swamp Mitigation Site and its potential impacts on threatened or endangered species. USFWS responded on March 2, 2018 and stated the “proposed action is not likely to adversely affect any federally listed endangered or threatened species, their formally designated critical habitat or species currently proposed for listing under the Act.” A follow up email was sent to USFWS on April 6, 2018 regarding the new addition of the yellow lance on April 4, 2018 to Johnston County’s endangered species list. USFWS responded on April 9, 2018 with no additional objection. All correspondence with USFWS and a list of Threatened and Endangered Species in Johnston County, NC is included in Appendix

6. The conclusion for cultural resources according to the Categorical Exclusion research and response by the State Historic Preservation Office is that there are no historic resources that would be affected by this project. For additional information and regulatory communications please refer to the Categorical Exclusion document in Appendix 6.

6.2 FEMA Floodplain Compliance and Hydrologic Trespass

The Site is represented on the Johnston County Flood Insurance Rate Map Panel 1662. Sassarixa Creek and the downstream portions of T4, T5, and T6 are mapped in Zone AE from the modeled Black Creek, however no streams on Site are modeled. Areas within the mapping are slated for enhancement and preservation and will not require fill within the floodplain. Wildlands will coordinate with the Johnston County floodplain administrator to obtain the appropriate floodplain development permit for the project, if required.

6.3 401/404

Care has been taken to design the streams to remain hydrologically connected to existing wetlands on-site, while minimizing impacts to those wetlands. Short sections of T1, T3, and T6 are aligned through existing, highly impacted, poor quality wetlands. This alignment was chosen because it is the natural low point in the valley. Those re-alignments will account for the permanent impacts on site. The majority of floodplain grading will be considered a temporary impact to wetlands as hydrologic connectivity is anticipated to improve after channel restoration, and vegetation will be re-established. Any wetlands within the conservation easement and outside of the limits of disturbance will be flagged with safety fence during construction to prevent unintended impacts. This will be noted in the final construction plans on the Erosion and Sediment Control Plan and Detail plan sheets, as well as in the project specifications. Table 6 estimates the anticipated impacts to wetland areas on this project. The Pre-Construction Notification, including this data, will be provided to DMS in the Final Mitigation Plan.

Table 6: Estimated Impacts to Project Wetlands – *Sassarixa Swamp Mitigation Site*

Jurisdictional Feature	Classification	Acreage	Permanent (P) Impact		Temporary (T) Impact	
			Type of Activity	Impact Area (acres)	Type of Activity	Impact Area (acres)
Wetlands D, F, G, H, J, L, V, W, X, FF, GG	Riparian Riverine	13.034	Conversion to Stream Resource	0.123	Floodplain Grading	0.556

7.0 Mitigation Site Goals and Objectives

The project will improve stream functions as described in Section 5 through stream restoration and riparian buffer re-vegetation. Project goals are desired project outcomes and are verifiable through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 11 of this report. The project goals and related objectives are described in Table 7.

Table 7: Mitigation Goals and Objectives – *Sassarixa Swamp Mitigation Site*

Goal	Objective	Expected Outcomes	Function(s) Supported
Reconnect channels with floodplains and to allow a natural flooding regime.	Reconstruct stream channels with designed bankfull dimensions and depth based on reference reach data. Remove pond above T2.	Allow more frequent flood flows to disperse on the floodplain. Support geomorphology and higher-level functions.	Geomorphology
Improve the stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary. Support all stream functions above hydrology.	Geomorphology
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant native shrub and herbaceous species on streambanks.	Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplain. Provide riparian habitat. Add a source of LWD and organic material to stream. Support all stream functions.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Install habitat features such as constructed riffles, lunker logs, and brush toes into restored/enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians leading to colonization and increase in biodiversity over time. Add complexity including LWD to the streams.	Geomorphology (supporting Biology)
Permanently protect the Site from harmful uses.	Establish conservation easements on the Site.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Hydrology (local), Hydraulic, Geomorphic, Physicochemical, Biologic

8.0 Design Approach and Mitigation Work Plan

8.1 Design Approach Overview

The design approach (Figure 8) for this site was developed to meet the goals and objectives described in Section 7, which were formulated based on the potential for the uplift described in Section 5, though these are not tied to performance criteria. The design is also intended to provide the expected outcomes in Section 7.

The design approach for this site utilized a combination of analog and analytical approaches for stream restoration. Reference reaches were identified to serve as the basis for design parameters. Channels were sized based on design discharge hydrologic analysis. Designs were then verified and/or modified based on a sediment transport analysis. This approach has been used on successful coastal plain restoration projects (Falling Creek and Devil's Racetrack) and is appropriate for the simple goals and objectives for this site.

The project streams proposed for restoration on the site will be reconnected with an active floodplain and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. The project streams proposed for restoration vary in design approach. The design approach for each restoration reach was determined by the existing conditions and design goals. T1-R2, T3-R1, T5-R2, and T6-R1 are primarily Priority I designs, meaning project streams will be reconnected with historic floodplains and the channels will be reconstructed with stable dimension, pattern, and profile that will transport the water and sediment delivered to the system. T2 is a Priority I design in the old pond bed and transitions to a Priority II design as it exits the pond to reconnect to Sassarixa Creek. The Priority II section will have floodplains at lower elevations than existing ground, created through excavation. Care will be taken to stockpile existing topsoil in these areas during excavation to promote vegetation growth after construction. This is discussed more in Section 8.6.1. This approach was necessitated by the elevation of a spring and drain tiles within the old pond bed. Adjacent floodplains and will be planted with native tree species. Instream structures will be constructed in the channels to help maintain stable channel morphology and improve aquatic habitat. The entire project area will be protected in perpetuity by a conservation easement.

Most of the remaining project stream length will be treated as enhancement level II. Enhancement level II consists of cattle exclusion, planting of existing floodplain, and spot-treating areas of channel instability. Channels deemed suitable for this design approach are in overall good condition or are expected to mostly self-correct any problems caused by cattle after cattle are excluded and the floodplain and streambanks are planted with native vegetation. T3-R2, and T4-R3 are in good condition, with vegetated buffers and existing cattle exclusion and will be treated as preservation.

8.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. Six reference reaches were identified for this Site and used to support the design of T1, T2, T3, T5 and T6 (Figure 9). These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. Geomorphic parameters for these reference reaches are summarized in Appendix 5 (except for reference reaches only used for discharge analysis). A description of each reference reach is included below.

Table 8: Stream Reference Data Used in Development of Design Parameters – *Sassarixa Swamp Mitigation Site*

Reference Reach Name	Still Creek	Scout West 1	Scout West 2	Scout East 1	Scout East 2	Johanna Creek
Stream Type	E5	E/C5b	E5	E5b	E5	E5/C5
T1 R2	-	Q, Dimension, Pattern, Profile	-	Q, Dimension, Profile	-	-
T1 R3	-	Q, Dimension, Pattern, Profile	-	Q	-	-
T2	-	Q, Dimension, Pattern, Profile	-	Q, Dimension, Pattern, Profile	-	-
T3	-	Q, Dimension, Pattern, Profile	-	Q, Dimension, Pattern, Profile	-	-
T5R2	Q, Dimension, Pattern, Profile	-	Q	-	Q, Dimension, Pattern, Profile	Q
T6R1	Q	-	Q	-	Q, Dimension, Pattern, Profile	Q

8.2.1 Scout Camp Reference Site

The Scout Camp reference site (including four surveyed streams) is a wooded area located in southeastern Johnston County near Bentonville in the Mill Creek watershed. It is situated in a similar landscape to the project site and is similar in position relative to an especially broad, flat, and low-lying zone of the Neuse River floodplain and surrounding wetlands. The small headwaters streams on the site are similar in gradient to the upper portions of the tributaries on the project site with slopes up to 4.5%. The larger streams are less steep (Scout West 2 has a gradient of 0.4%).

Scout West 1 is a very small, sand bed stream that is very steep for most of its length with an overall gradient of 2.6%. It has a width to depth ratio ranging from 5.4 in the upper sections to 19.4 in the lower, less steep reaches. Its sinuosity is 1.1 and its entrenchment ratio is high – greater than 2.2 throughout. It is most closely represented by an E/C5b according the Rosgen classification system (Rosgen, 1994) although for most of its length it is not a meandering riffle-pool stream. Much of the energy dissipation, gradient, and pool formation are controlled by sudden drops over woody structure (logs and tree roots). Scout East 1 is steeper than Scout West 1 with a slope of 4.3%. It is a smaller, steep headwater stream with pattern more akin to a B channel, but with an entrenchment ratio and floodplain access of an E channel.

Scout East 2 is a similar but larger sand bed stream with an overall slope of 1.7%, a width to depth ratio of 3.6 to 5.4, an entrenchment ratio of greater than 2.2, and a sinuosity of 1.2. It meanders more than

Scout West 1 but also has a lot of energy loss and pool formation over woody structure. It is most similar to a Rosgen E5 stream.

Scout West 2 is a larger, flatter stream with a width to depth ratio range of 5.7 to 11.0, a very large entrenchment ratio much greater than 2.2, and a sinuosity of 1.1 to 1.2. It is most similar to a Rosgen E5 stream type and functions more like an E5 as described by Rosgen with pool formations in meander bends and less drop in gradient over woody structure.

8.2.2 Johanna Branch

The Johanna Branch site is also located near Bentonville as are both the Cox and Westbrook mitigation sites. Johanna Branch is a low slope (0.22%), meandering channel similar to but larger than Scout West 2.

Johanna Branch is the largest of the primary reference reaches and has the lowest slope. Its width to depth ratio is 10.1 to 19.7, its entrenchment ratio is as large as nearly 10, and its sinuosity is 1.2. Johanna Branch is most similar to an E5/C5 stream type and fits the Rosgen classification system as well or better than Scout West 2 in that it is a meandering stream with pool formation and energy dissipation in meander bends.

8.2.3 Still Creek

Still Creek is located in the Cliffs of Neuse State Park east of Mount Olive near Seven Springs. Still Creek flows into Mill Creek just upstream of its confluence with the Neuse River. It is a small system, moderately flat with an overall slope of 0.88%, a width to depth ratio of 7.4 to 11.3, an entrenchment ratio of 4.85 to 13.0, and a sinuosity of 1.33. It is a sand bed system where woody debris plays a large role in the development of flow diversity and habitat niches. It is hydraulically connected to its riparian wetland system. The watershed is located entirely within park boundaries.

8.3 Design Channel Morphological Parameters

Reference reaches were a primary source of information to develop the pattern and profile design parameters for the streams. Ranges of pattern parameters were developed within the reference reach parameter ranges with some exceptions based on best professional judgement and knowledge from previous projects.

Most streams on site were designed to be Rosgen Type C5/E5 channels, with width-to-depth ratios on the low end of a C channel or high end of an E channel. Narrow and deeper channels are common in the ecoregion and were observed in the reference channels. However, the reference channels have established vegetation that maintain stability on steeper streambanks. The design channels will begin with flatter side slopes that will be more stable without established vegetation and will allow for sediment deposition and channel narrowing as the streambank vegetation establishes.

Proposed channel sinuosity ranges between 1.2 and 1.3+, with 1.2 being the steeper tributaries and 1.3+ in the flatter valleys. Complete design morphological parameters for all streams proposed for restoration in are in Appendix 5.

Table 9: Summary of Morphological Parameters for C5/E5 Design Stream Types – *Sassarixa Swamp Mitigation Site*

Parameter	Existing Parameters				Reference Parameters		Proposed Parameters			
	T1 R2	T1 R3	T2	T3 R1	Scout West 1	Scout East 1	T1 R2	T1 R3	T2	T3 R1
Valley Width (ft)	50 - 120	50 - 70	40 - 70	20 - 90	-	-	50 - 80	50 - 70	40 - 70	20 - 90
Contributing Drainage Area (acres)	32	40	15	24	38	13	32	40	15	24
Channel/ Reach Classification	G5	G5	G5	B5 / G5	E/C5 b	E5b	E5/C5 b	C5	C5b	C5b
Design Discharge Width (ft)	3.4	3.4	3.0	3.2 / 4.2	2.6 - 6.3	3.1	3.6	4.2	3.2	3.6
Design Discharge Depth (ft)	0.7	0.7	0.50	0.50 / 4.2	0.3 - 0.5	0.3	0.3	0.4	0.3	0.3
Design Discharge Area (ft2)	2.5	2.5	1.5	1.7	1.2 - 2.0	0.9	1.2	1.5	0.9	1.0
Design Discharge Velocity (ft/s)	3.6	3.6	3.6	4.0 / 3.6	1.3 - 2.3	2.0	2.8	2.3	2.2	2.5
Design Discharge (cfs)	-	-	-	-	2.6	1.8	3.0	3.5	2.0	2.5
Water Surface Slope	0.030	0.019	0.029	0.034	-	0.043	0.034	0.016	0.027	0.032
Sinuosity	1.2	1.3	1.1	1.2	1.1	-	1.2	1.2	1.3	1.2
Width/ Depth Ratio	4.9	4.9	6.0	6.4 / 10	5.4 - 19.9	10.5	11	12	12	12
Bank Height Ratio	3.0	3.0	10 .0	2.1 / 7.0	1.1 - 1.3	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	2.2	2.2	1.2	7.5 / 11	>2.2	3.2	>2.2	>2.2	>2.2	>2.2
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	0.30 / 0.42 / 0.58 / 0.89 / 5.2 / 8.5	0.30 / 0.42 / 0.58 / 0.89 / 5.2 / 8.5	0.21 / 0.47 / 0.98 / 2.1 / 6.3 /12	0.28 / 0.44 / 1.1 / 6.3 / 8.8 / 14	-	-	-	-	-	-

Table 10: Summary of Morphological Parameters for C5b/E5b Design Stream Types – *Sassarixa Swamp Mitigation Site*

Parameter	Existing Parameters		Reference Parameters		Proposed Parameters	
	T5 R2	T6 R1	Still Creek	Scout East 2	T5 R2	T6 R1
Valley Width (ft)	20 - 60	70 - 140	-	-	20 - 60	70 - 140
Contributing Drainage Area (acres)	122	95	220	430	122	95
Channel/ Reach Classification	E5	G5	E5	E5	C5	C5
Design Discharge Width (ft)	3.1	4.1	6.8 - 8.0	4.7 - 6.1	5.6	6.4
Design Discharge Depth (ft)	1.1	1.1	0.71 - 1.0	1.1 - 1.3	0.5	0.5
Design Discharge Area (ft2)	3.5	4.4	5.7 - 6.7	6.0 - 6.9	2.7	3.3
Design Discharge Velocity (ft/s)	3.1	2.9	1.2	2.5 - 2.9	2.3	1.7
Design Discharge (cfs)	-	-	7.3	18	6.0	5.5
Water Surface Slope	0.012	0.0086	0.0066	0.017	0.011	0.006
Sinuosity	1.2	1.1	1.3	1.2	1.4	1.1
Width/ Depth Ratio	2.8	3.7	7.4 - 11	3.6 - 5.4	12	13
Bank Height Ratio	1.6	2.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	8.7	1.7	4.9 - 13	>2.2	>2.2	>2.2
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	0.26/0.46/1.2 /2.3/4.3/6.9	6.0/15/21/30 /43/64	-	-	-	-

8.4 Design Bankfull Discharge Analysis

Multiple methods including regional curves, hydraulic geometry relationships, and regional flood frequency analysis were used to develop design discharges for each of the restoration reaches. Design discharges are analyzed to determine the appropriate discharge to meet the project goals with a return interval similar to the bankfull discharge. The resulting values were compared and concurrence between the estimates were assessed. The purpose of using multiple methods to estimate bankfull discharge is to eliminate reliance on a single method as the basis of channel design. However, the methods commonly produce significantly different results, so professional judgement must be used to select a design discharge for each restoration reach.

8.4.1 Published Regional Curve Data

Discharge was estimated using the NC rural Coastal Plain regional Curves published by NCSU (Doll et al. 2003).

8.4.2 Wildlands Regional Flood Frequency Analysis

Twelve U.S. Geological Survey (USGS) stream gage sites were identified within the southeast (Virginia to Georgia) coastal plain for use in development of a project specific regional flood frequency analysis. The Hosking and Wallis (1993) homogeneity test was performed using the Homtest package in the statistical software program, R® to verify that the gages selected were appropriate. The gages used were:

- USGS 02227422 – Crooked Creek Tributary Near Bristol, GA (DA = 0.28 mi^2)
- USGS 0209173190 – Unnamed Tributary to Sandy Run Near Lizzie, NC (DA = 0.57 mi^2)
- USGS 02227990 – Satilla River Tributary 2 at Atkinson, GA (DA = 0.67 mi^2)
- USGS 02169960 – Lake Marion Tributary Near Vance, SC (DA = 2.12 mi^2)
- USGS 01668300 – Farmers Hall Creek Near Champlain, VA (DA = 2.18 mi^2)
- USGS 021355013 – Davis Branch Near Sumter, SC (DA = 2.50 mi^2)
- USGS 02136361 – Turkey Creek Near Maryville, SC (DA = 4.25 mi^2)
- USGS 021720725 – Canton Creek Near Moncks Corner, SC (DA = 4.82 mi^2)
- USGS 02148090 – Swift Creek Near Camden, SC (DA = 4.90 mi^2)
- USGS 02130800 – Backswamp Near Darlington, SC (DA = 6.22 mi^2)
- USGS 01661800 – Bush Mill Stream Near Heathsville, VA (DA = 6.77 mi^2)
- USGS 02102908 – Flat Creek Near Inverness, NC (DA = 7.63 mi^2)

Flood frequency curves were developed for the bankfull discharges using the above gage data. These drainage area–discharge relationships were used to estimate bankfull discharges for the ungaged streams on Site.

8.4.3 Site Specific Reference Reach Curve

Six reference reaches were identified for this project (Section 4.2). Each reference reach was surveyed to develop information for analyzing drainage area-discharge relationships as well as development of design parameters. Stable cross-sectional dimensions and channel slopes were used to compute a bankfull discharge with the Manning's equation for each reference reach. The resulting discharge values were plotted with drainage area and compared the other discharge estimation methods.

8.4.4 Existing Bankfull Indicators (Manning's Equation)

A riffle cross-section was surveyed on each design reach on the Site. Bankfull indicators were identified in the field during this survey. Manning's equation was used to calculate a corresponding discharge using the pebble count information for roughness and the survey data for channel slope. It can be difficult to identify clear bankfull indicators on incised and degraded channels, so the highest quality indicators were used to calibrate others.

8.4.5 Design Discharge Analysis Summary

The primary design goal for restoration reaches on site is to hydraulically connect the reaches to their existing floodplains to prevent continued incision along Site streams. The results of the discharge analysis provided a range of discharge values with the Manning's Equation results from surveyed cross-sections being the highest, followed by the Wildlands USGS Flood Frequency Analysis. The Reference Reach curve and NC rural Regional Curve produced lower discharge estimates compared to the other methods. Since on site streams are highly degraded and incised, there is less confidence in the discharge values derived from the Manning's Equation from surveyed Cross-sections. The final design values for the Site are generally in between the Reference Reach Curve, the NC rural Regional Curve, and the 1.2-year return interval discharge. Table 11 gives a summary of the discharge analysis. Figure 10 illustrates the design discharge data plotted on the NCSU coastal plain regional curve.

Table 11: Summary of Design Discharge Analysis – *Sassarixa Swamp Mitigation Site*

		T1R2	T1R3	T2	T3R1	T5R2	T5A	T6R1
DA (acres)		32	40	14.7	24.3	122	25.5	95.4
DA (sq. mi.)		0.05	0.06	0.02	0.04	0.19	0.04	0.15
NCRural Coastal Plain Regional Curve (cfs)		1.9	2.2	1.1	1.6	5	1.6	4.2
Wildlands Regional Flood Frequency Analysis (cfs)	**1.2-year event**	3.7	4.2	2.4	3.2	7.8	3.3	6.8
	1.5-year event	6.6	7.3	4.4	5.7	13.0	5.8	11.5
Site Specific Reference Reach Curve (cfs)		2.6	2.9	1.6	2.2	5.7	2.2	4.9
Manning's Equation from Surveyed XS (cfs)	**XS2**	4.2						
	XS3		8.8					
	XS6				6.2			
	XS9					10.9		
	XS11						3.4	
	XS14							12.8
Design Q		3	3.5	2	2.5	6	2.5	5.5

8.5 Sediment Transport Analysis

In order to gain an understanding of the quantity of sediment supplied to the design reaches, Wildlands performed a qualitative assessment of the historic, current, and potential future conditions of the watershed through aerial photography and field reconnaissance (as discussed in detail in Sections 3.2 and 5.1). One of the goals was to identify sources of sediment (primarily sand in texture) delivered to project reaches to determine if capacity was an important consideration in channel design or if the proposed channels would likely be supply-limited. The main sources of sediment on site were identified as existing bank erosion and runoff from adjacent agricultural fields. The ponds above T1 and T5 greatly reduce the potential for sediment input their watersheds, as they act as sediment traps. There is no anticipated change in land use in the watershed that would alter the current sediment sources and delivery.

On-site sediment delivery through bank erosion and runoff is being addressed through the stabilization of stream banks with restoration and enhancement activities and the planting of riparian buffers. With these sediment input controls in place, bedload supply is not high enough to cause the project streams to be capacity limited. Therefore, the focus of sediment transport analysis for this design was to verify that designed channels will be stable over time and can pass the sizes of sediment supplied from the watersheds. A competence analysis was performed on the streams to aid in the development of final channel designs.

Competence analyses were performed iteratively during design for each of the restoration reaches by comparing shear stress associated with the design bankfull discharge, proposed channel dimensions, and proposed channel slopes with the size distribution of the existing bed load. A HEC-RAS model of existing and proposed streams provided the shear stress and energy grade line slope data. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001) to determine movable particle sizes for a given shear stress. Proposed stream design conditions were evaluated to determine what the largest movable particle size was for the design shear stress and compare that to the existing channel material. The goal is to have the D50 of the design material be mobile, while the Dmax remains stable. This provides stable grade control while allowing for continued sediment transport processes. For T2 and T6, the existing bed material was sufficient for sediment transport needs. For T1, T3, and T5, slightly larger material will be used for D50 and Dmax in the constructed riffles.

Table 12: Results of Competence Analysis – *Sassarixa Swamp Mitigation Site*

	T1	T2	T3	T5	T6
Dbkf (ft)	0.4	0.4	0.3	0.5	0.5
Energy Grade line Slope (ft/ft)	0.030	0.028	0.034	0.012	0.013
Bankfull Shear Stress, t (lb/sq ft)	0.42	0.39	0.53	0.29	0.32
Largest movable particle size (mm)	32	30	40	22	24
Existing D50	0.6	1.0	1.1	1.2	21
Existing Dmax Bar/Subpavement (mm)	22	64	32	11	180
Proposed D50	8	1	4	2	21
Proposed Dmax	32	64	40	22	180

8.6 Project Implementation

8.6.1 Existing Wetlands

Wetland rehabilitation is not being performed for credit on this project, however enhancement activities for wetlands will take place. Care was taken in all cases to avoid existing wetlands as much as possible in designing restored stream channels, while also restoring hydrologic connection through the raising of stream channels. All wetland areas within the easement currently lacking vegetative cover will be planted with appropriate species as noted in the planting plan sheets. Livestock will be excluded from stream and wetland complexes, allowing for understory species to recolonize both new planting areas and those currently forested. The buffer mitigation bank proposed for areas along T1, T3, T5A-C, and T65 will protect additional wetland area extending past the easement area for this project.

8.6.2 Restoration Reaches

The streams slated for restoration will be raised using a Priority I restoration for the greatest length possible, with short sections of Priority II at upstream and downstream tie in points where necessary (Table 13). This will raise the water table, improve hydrologic connections to any riparian wetlands, allow for frequent inundation of the floodplain, and a reduce shear stress on the channel. In sections of Priority II restoration, a floodplain will be graded at bankfull elevation. The floodplain will not meander along with the stream pattern but will be relatively straight and will be greater than twice the bankfull width of the stream. In order to promote vegetative success, topsoil will be stockpiled and replaced during construction. Soil tests will be completed to determine rates of lime and fertilizer application. Organic matter will be added to the topsoil to further improve vegetative success. Valley walls will be graded back at slopes of 5:1 or less to prevent rill erosion onto the floodplain.

Table 13: Functional Impairments and Restoration Approach – *Sassarixa Swamp Mitigation Site*

Resource	Reach(es)	Primary Stressors/Impairments	Restoration Approach
Sassarixa Creek	1-3	Livestock access, lack of riparian understory	Enhancement II
T1	1	Livestock access, lack of riparian buffer, bank trampling	Enhancement II
	2-3	Incision, Scour, lack of riparian vegetation, lack of habitat, livestock access	Restoration - Priority I
	4	Livestock access, lack of riparian buffer, bank trampling	Enhancement II

Resource	Reach(es)	Primary Stressors/Impairments	Restoration Approach
T1A	-	Livestock access, lack of riparian understory, lack of habitat	Enhancement II
T1B	-	Incision, Scour, lack of riparian vegetation, lack of habitat, livestock access	Enhancement II
T1C	-	Livestock access, lack of riparian understory	Enhancement II
T1D	-	Livestock access, lack of riparian understory, lack of habitat	Enhancement II
T2	-	Ponded headwater, livestock access, lack of riparian buffer	Restoration - Priority II and Priority I
T3	1	Incision, livestock access, lack of riparian understory, lack of habitat	Restoration - Priority I
	2	Sediment inputs from unstable banks upstream	Preservation
T4	1-2	Livestock access, lack of habitat, bank trampling	Enhancement II
	3	Sediment inputs from unstable banks upstream	Preservation
T5	1	Lack of riparian understory, localized scour	Enhancement II
	2	Incision, Scour, lack of riparian understory, lack of habitat, invasive species	Restoration - Priority II
	3	Lack of riparian understory, localized scour, invasive species	Enhancement II
T5A	-	Livestock Access, lack of riparian understory, lack of habitat	Enhancement II
T5B	-	Livestock Access, lack of riparian understory, lack of habitat	Enhancement II
T5C	-	Livestock Access, lack of riparian understory, lack of habitat	Enhancement II
T6	1	Livestock Access, scour, incision, lack of habitat, lack of riparian understory	Restoration- Priority I
	2	Livestock Access, localized scour, lack of riparian understory	Enhancement II

Most of T1 (R2 and R3) will be moved from its channelized position at the edge of valley to meander through the center of the natural valley. In doing so, T1A will be lengthened to intercept the new channel, and T1B will remain in generally the same position but stabilized with bank treatments in place. The headcut at the confluence of T1A and T1D will be stabilized. The abandoned and breached pond on this reach will be filled or otherwise cut off hydraulically from the new channel to prevent preferential flow through the area.

The restoration of T2 will include the removal of the existing pond and daylighting of the drain pipe from the pond to expose a new channel. Historical aerials were referred to in determining the likely start of intermittent hydrology on T2. Historical aerials from the 50s and 60s show the stream starting just upstream of the existing forebay. Several field drains were installed near the area of the top of pond to direct stream water and field drainage into the pond. Those will be severed at the edge of the proposed buffer to provide diffuse flow into the easement at the headwaters of T2. Currently, the outlet pipe of the pond is causing subsidence of sediment around the pipe, and the pipe may be failing. The outlet pipe generally follows the low point of the valley and outlets under a large sycamore tree at the tree line. The new channel will be built within the old pond bed at an elevation set to intercept drainage from the field drains at the top of the pond. The valley will be reformed where the dam is located. The pond will be drained early on during construction. The path of the future channel will be over-excavated, and fill material from the old dam will be used to stabilize the pond bed for the construction of the bed and banks of the new channel. The headcut at the edge of the forest will be removed and that fall distance will be spread across the proposed channel with a series of log steps. The majority of T2 will be Priority II however, it will transition to Priority I as it intercepts the floodplain of Sassarixa Creek. Stream T1C will be used as a reference for planform for the design of T2 as it reaches the floodplain of Sassarixa Creek.

T3 involves some stabilization of the drainage channel entering T1R1, and then continuing with a Priority I restoration through the wooded reach. Care will be taken to maintain select tree groups to improve the natural look of the restoration through this area.

T5-R2 is bound by two enhancement reaches, requiring short sections of Priority II restoration at tie in sections, to match the mild incision found on T5-R1 and T5-R3. Most of the reach will be Priority I restoration. While the channel is being constructed, any privet and other invasive species will be removed mechanically.

T6-R1 will be restored using Priority I restoration, with a potential short section of Priority II at the culvert inlet on Old Olive Road. Care will be taken to maintain select tree groups to improve the natural look of the restoration through this area.

Reaches proposed for restoration vary between C5/E5 and C5b/E5b stream types depending on channel width to depth ratios and valley slope. The degree of meander will vary by stream depending on the steepness of the channel and the width of the valley. Stable up and/or downstream reaches were used to inform sinuosity. The beds will be comprised of riffle-pool sequences with log drop structures. In-stream bed structures will include various types of constructed riffles appropriate to the stream types and available materials, log sills and lunker logs. The structures will reinforce channel stability and serve as habitat features. The constructed riffles will be comprised of the rocky waste material from local sand mines, which contain an appropriate range of heterogenous material based on sediment transport calculations. The riffles will also incorporate woody brush material and logs. The diverse range of structures will provide grade control, diversity of habitat, and will create varied flow vectors. Log sills will be used to allow for grade drops in steeper channel reaches, mimicking natural grade control from large tree roots found in reference channels. At select outer bends, the channel banks will be constructed with brush toe revetments to reduce erosion potential, encourage pool maintenance, and provide varied pool habitat. Lunker logs will also be used to provide pool habitat variability. Livestock will be excluded from all restoration reaches. Riparian buffers will be re-established on all restoration reaches.

8.6.3 Enhancement Reaches

The design plan for Enhancement II reaches (Table 13) varies based on the current level of degradation. T1R1 will include significant bank work and the addition of habitat structures, due to the damage done by livestock wallowing in the area. Select bank work, short sections of realignment, and habitat structures will be completed on T-5R1 and T5-R3. This will include the mechanical removal of a significant amount of privet and other invasive species as well as the reestablishment of a riparian buffer along the left riparian zone. T5A interventions will address the high level of impact of livestock wallowing and an undersized culvert at the downstream end pond entrance. A larger culvert will be placed at the pond and a new channel will be cut through the lower livestock wallow area. Sections of bank will be repaired at the upstream reaches and habitat features will be installed. The upper headwater wetland seeps will be protected by the easement and livestock will be excluded. This is depicted in Figure 6 as wetland CC.

Several reaches are relatively stable and will only require planting and the exclusion of livestock to improve stream function. These reaches include T1A, T1B, T1C, Sassarixa Creek, T5B, T5C, and T6-R2. Livestock will be excluded from these reaches and all other enhancement reaches either through removal of livestock from the parcel or the installation of fencing. Riparian buffers will be re-established, and invasive species will be treated and maintained.

8.6.4 Preservation Reaches

Two reaches on site are slated for preservation due to their high-quality stream and riparian buffers. These areas currently exclude livestock and will continue to do so. T4R3 has several sections of seasonally subterranean flow. In the dryer summer months, subterranean sections vary in length from 30 – 130 linear feet. In fall, winter, and spring months, the channel flows on the surface and develops above surface channels. These sections account for 275 linear feet (approximately 17.5%) of T4R3.

8.6.5 Stream Crossings

Six stream crossings will be located on this project: four culverts (one each on T1, T4, T5, and T6) and two fords (on Sassarixa Creek and T4). Culverts will be designed for aquatic organism passage and not to hinder the hydraulic function of the channels during storm events. Crossings will be internal to the easement, allowing the easement holder more control of the crossing locations and functions, while the landowner maintains access to adjoining fields.

8.6.6 Connectivity

All streams on site are connected to forested parcels at their downstream limits that are unlikely to ever face developmental pressures. Once riparian buffers are established on-site, mammalian and avian species will likely migrate to the newly forested areas improving terrestrial diversity.

8.7 Vegetation, Planting Plan, and Land Management

8.7.1 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a thriving riparian buffer composed of native tree species. This restored buffer will improve riparian habitat, help the restored streams stay stable, shade the streams, and provide a source for LWD and organic material to the streams. The Site will generate Riparian Buffer Credits as well as SMUs for the Neuse 01 CU in accordance with 15A NCAC 02B .0295 (Effective November 1, 2015). The Site will also be in conjunction with the Sassarixa Swamp Nutrient Offset and Buffer Mitigation Parcel (DWR ID 2018-0198). The Site will be planted to the extents of the conservation easement, to include the additional buffer areas as shown in Figure 11. Riparian buffers will be planted with early and late successional native vegetation (a mixture of trees and shrubs). The specific species composition to be planted was selected based on the community type, occurrence of species in riparian buffers adjacent to the Site, best professional judgement on species establishment and anticipated Site conditions in the early years following project implementation, and the requirement of a minimum of four species according to Rule 0295. Species chosen for the planting plan are listed on Sheet 3.0 of the Draft Plans located in Appendix 7. The Draft Plans also contain additional guidance on planting zones, Site preparation, and Site stabilization during construction.

The riparian buffer areas will be planted with bare root seedlings. Species planted as bare roots will be planted at 12-foot by 6-foot spacing (targeted densities after monitoring year 3 are 320 stems per acre). In addition, streambanks will be planted with a combination of live stakes and herbaceous plugs according to the detail in the plans.

To help ensure tree growth and survival, soil amendments may be added to areas of the floodplain throughout the Site where overburden material is removed. Soil tests will be performed in areas of cut and fertilizer and lime will be applied based on the results. Additionally, topsoil will be stockpiled, and reapplied before permanent seeding and planting activities take place.

Invasive species on Site are present throughout the existing vegetation. The most prevalent species, Chinese privet (*Ligustrum sinense*) and Japanese stiltgrass (*Microstegium vimeneum*), are spread throughout the length of the project. Multiflora rose (*Rosa multiflora*), and trifoliate orange (*Poncirus trifoliata*) are also scattered along Sassarixa Creek, but in much lower quantities. A small number of mature princess tree (*Paulownia tomentosa*) and Bradford pear (*Pyrus calleryana*) were also observed on the west side of T5. The furthest downstream portion of Sassarixa Creek included in the project also contains a low-density population of invasive water primrose (*Ludwigia hexepetela*).

One goal of this project is to treat and remove as much existing invasive species as possible before and during construction. Post construction, the presence and extents of invasive species will be monitored. Treatment of invasive species will continue as necessary throughout the life of the project to ensure project stability and success of the riparian and streambank vegetation. Additional monitoring and maintenance issues regarding vegetation can be found in Sections 9 and 10 and Appendix 8.

8.7.2 Land Management

The primary goal of land management prior to construction is to effectively treat most invasive plant populations on the site. Initial work took place in August 2018 treating the water primrose population at the downstream portion of Sassarixa Creek R3. Significant work in October 2018 treated extensive populations of Chinese privet along with smaller populations of multiflora rose (*Rosa multiflora*), trifoliate orange, princess tree, and Bradford pear. All areas, other than the disjunct area along T5A, T5B, and T5C, on the site were treated at this time.

Invasive plant populations not treated or effectively controlled by the 2018 treatments will be monitored and treated post-construction. The primary invader, Chinese privet, produces seeds that typically lose viability in the seed bank within 12 months (USDA, 2012). Thus, by effectively controlling mature individuals early in the project, recruitment of Chinese privet will significantly diminish, and long-term treatment needs will be much lower. All known mature princess tree and Bradford pear individuals will also be treated prior to seed production in 2019 to limit recruitment in soils disturbed by construction. Continued treatment of the invasive water primrose will begin again in summer 2019. All other populations of invasive plants on the site will be monitored by Wildlands and treated as necessary during the monitoring period. Wildlands will also monitor the site for future land management issues, such as floodplain erosion, bare areas, and damaged fences, that arise during the monitoring period.

8.8 Project Risk and Uncertainties

This project is low risk. The land use surrounding the project is currently in livestock or hay production. There are no utilities crossing the project area that would require outside maintenance. Due to the rural nature of the area, there is little risk that changes in land use upstream in the project watershed would alter the hydrology or sediment supply.

9.0 Performance Standards

The stream performance standards for the project will follow approved performance standards presented in the DMS Mitigation Plan Template (version 2.3, 12/18/2014), the Annual Monitoring Template (April 2015), and the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. Annual monitoring and routine site visits will be conducted to assess the condition of the finished project by a qualified scientist. Specific performance standard components are proposed for stream morphology, hydrology, and vegetation. Performance standards will be evaluated throughout the seven-year post-construction monitoring.

9.1 Streams

9.1.1 Dimension

Riffle cross-sections on the restoration reaches should be stable and should show little change in bankfull area, maximum depth ratio, and width-to-depth ratio. Per DMS guidance, bank height ratios shall not exceed 1.2 and entrenchment ratios shall be at least 2.2 for restored C and E channels to be considered stable. All riffle cross-sections should fall within the parameters defined for channels of the designed stream type. If any changes do occur, these changes will be evaluated to assess whether the stream channel is showing signs of instability. Indicators of instability include a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. It is important to note that in sand bed channels pools and bed forms (ripples, dunes, etc.) may migrate over time as a natural function of the channel hydraulics. These sorts of bed changes do not constitute a problem of indicate a need for remedial actions. Remedial action would not be taken if channel changes indicate a movement toward stability.

9.1.2 Pattern and Profile

Visual assessments and photo documentation should indicate that streams are remaining stable and do not indicate a trend toward vertical or lateral instability.

9.1.3 Substrate

This is a sand bed system and the nature of the bed material is not expected to change over time. No pebble counts will be conducted for the project reaches and no performance standard is being set for substrate.

9.1.4 Photo Documentation

Photographs should illustrate the Site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent of mid-channel bars or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable, while scour pools on the channel side are expected.

9.1.5 Hydrology

The occurrence of bankfull events will be documented throughout the monitoring period. Four bankfull flow events must be documented on restoration streams during the seven-year monitoring period. The four bankfull events must occur in separate years. Stream monitoring will continue until performance standards in the form of four bankfull events in separate years have been documented. Intermittent channels proposed for restoration activities (T1 Reaches 2 and 3, and T2) will be monitored for hydrology and must demonstrate at least 30 consecutive days of stream flow.

9.2 Vegetation

Vegetative performance for riparian buffers associated with the stream restoration component of the project (buffer widths 0 – 50ft) will be in accordance with the Stream Mitigation Guidelines issued October 2016 by the USACE and NCIRT. The success criteria is an interim survival rate of 320 planted stems per acre at the end of monitoring year three (MY3), 260 stems per acre and an average planted vegetation height of seven feet at the end of monitoring year 5 (MY5) and a final vegetation survival rate of 210 stems per acre at the end of monitoring year 7 (MY7). Planted vegetation must average 10 feet in height in each plot at the end of the seventh year of monitoring. Vegetation monitoring will be conducted between July 1st and the end of the growing season with an emphasis on monitoring later in the growing season to capture any effects of climatic or other conditions that may adversely affect vegetation survival. Individual plot data will be provided and will include height, density, vigor, damage (if any), and survival. In fixed vegetation plots, planted woody stems will be marked annually as needed and given a coordinate, based off a known origin, so they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living planted stems and the current year's living planted stems.

The extent of invasive species coverage will be monitored and controlled as necessary throughout the required monitoring period (MY7).

9.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above.

10.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met, and project goals and objectives are achieved. A separate buffer monitoring report will be submitted to NCDWR each year as described in the Buffer Mitigation Plan in Appendix 1.

Table 14, below, describes how the monitoring plan is set up in order to verify project goals and objectives have been achieved.

Table 14: Monitoring Plan – *Sassarixa Swamp Mitigation Site*

Goal	Objective	Performance Standards	Monitoring Metric
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with designed bankfull dimensions and depth based on reference reach data and past projects in the region.	Four bankfull events in separate years within monitoring period.	Crest gauges and/or pressure transducers recording flow elevations.
Improve stability of stream channels.	Construct stream channels that will maintain stable cross-sections, patterns, and profiles over time.	Entrenchment ratio stays over 2.2 and bank height ratio below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring and visual inspections.
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant native shrub and herbaceous species on streambanks.	210 planted stems per acre at MY7. Interim survival rate of 320 planted stems per acre at MY3 and 260 at MY5.	One hundred square meter vegetation plots will be placed on 2% of the planted area of the project and monitored annually.
Improve instream habitat.	Install habitat features such as constructed riffles, lunker logs, and brush toes into restored/ enhanced streams. Add woody materials to channel beds. Construct pools of varying depth.	There is no required performance standard for this metric.	N/A
Permanently protect the Site from harmful uses.	Establish conservation easements on the Site.	Prevent easement encroachment.	Visually inspect the perimeter of the Site to ensure no easement encroachment is occurring.

10.1 Monitoring Components

Project monitoring components are listed in more detail in Table 15. Approximate locations of the proposed monitoring components are illustrated in Figure 11.

Table 15: Monitoring Components – *Sassarixa Swamp Mitigation Site*

Parameter	Monitoring Feature	Quantity/ Length by Reach					Frequency	Notes
		T1	T2	T3	T5	T6		
Dimension	Riffle Cross-sections	2	1	1	1	1	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	1	1	1	1	0		
Pattern	Pattern	N/A					N/A	2
Profile	Longitudinal Profile	N/A					N/A	
Substrate	Reach wide (RW), Riffle (RF) 100 pebble count	N/A					N/A	3
Hydrology	Crest Gage and/or Transducer	1 CG	1 CG & 1 FG	1 CG & 1 FG	1 CG	N/A	Semi- Annual	4
Vegetation	CVS Level 2	10 Fixed; 1 Random					Year 1, 2, 3, 5, and 7	5
Visual Assessment		Y					Semi-Annual	
Exotic and nuisance vegetation							Semi-Annual	6
Project Boundary							Semi-Annual	7
Reference Photos	Photographs	53					Annual	

1. Cross-sections will be permanently marked with rebar to establish location. Surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate lack of stability and profile survey is warranted in additional years.
3. Pebble counts will not be performed due to the sand bed nature of the streams.
4. Crest gages and/or transducers will be inspected quarterly or semi-annually, evidence of bankfull events will be documented with a photo when possible. Transducers will be set to record stage once every 3 hours. The transducer will be inspected and downloaded semi-annually.
5. Vegetation monitoring will follow CVS protocols, separate monitoring reports will be submitted to NCDMS and NCDWR.
6. Locations of exotic and nuisance vegetation will be mapped.
7. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

11.0 Long-Term Management Plan

The site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

The Site Protection Instrument can be found in Appendix 2.

12.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 9 and 10. Project maintenance will be performed during the monitoring years to address minor issues as necessary (Appendix 8). If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the DMS of the need to develop a Plan of Corrective Action. Once the Plan of Corrective Action is prepared and finalized Wildlands will:

- Notify the USACE as required by the Nationwide 27 permit general conditions;
- Revise performance standards, maintenance requirements, and monitoring requirements as necessary and/or required by the USACE;
- Obtain other permits as necessary;
- Implement the Corrective Action Plan; and
- Provide the USACE a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

13.0 Determination of Credits

The final stream credits associated with the Site are listed in Table 16. Stream Restoration is at a ratio of 1:1. All Preservation reaches are credited at a 10:1 ratio. Enhancement II reaches are credited at a 2.5:1 ratio. T5C is credited using the headwater stream guidance (USACE 2005), so credit is based on valley length. T4R3 is credited at a 10:1 ratio for preservation. T5R3 is an enhancement reach credited at a 4:1 ratio. Enhancement activities include short sections of channel relocation and bank stabilization, the removal of a significant amount of privet and other invasive species, and the re-establishment of a riparian buffer on the left bank. The lack of existing livestock in the reach is the reason for the increased credit ratio from the other enhancement reaches.

Buffers are the required minimum of 50 feet in all but the last 140 feet of the left bank of T6, which has a minimum of 15 feet due to the property line location and stream alignment. This accounts for 0.6 percent of the project and does not affect overall stream credits. The first 100 feet of the buffer is credited at a 1:1 ratio. The next 100 feet is credited at a ratio of 3:1, according to DWR guidelines. The riparian buffer credit asset table is in the Riparian Buffer Mitigation Plan in Appendix 1.

Table 16: Project Stream Asset Table – *Sassarixa Swamp Mitigation Site*

Mitigation Credits						
	Stream		Riparian Wetland		Non-Riparian Wetland	
Type	R	RE	R	RE	R	RE
Totals	8,461.650	157.000	N/A	N/A	N/A	N/A

Project Components

Project Component or Reach ID		Existing Footage/ Acreage	Proposed Stationing Location	Approach (P1, P2, etc.)	Restoration (R) or Restoration Equivalent (RE)	Restoration Footage or Acreage	Mitigation Ratio (:1)	Proposed Credit
Sassarixa Creek R1-R3		2,595	100+35.2 - 107+96.1; 108+21.0 - 126+90.8	EII	R	2,631	2.5	1,052.400
T1	R1	570	200+00.0 - 205+69.5	EII	R	570	2.5	228.000
T1	R2	923	205+69.5 - 213+93.8	R, P1	R	824	1.0	824.000
T1	R3	457	213+93.8 - 219+03.1	R, P1	R	509	1.0	509.000
T1	R4	252	219+03.1 - 221+55.2	EII	R	252	2.5	100.800
T1A		67	220+00.0 - 223+58.5	EII	R	358	2.5	143.200
T1B		258	240+00.0 - 242+74.6	EII	R	275	2.5	110.000
T1C		307	260+00.0 – 263+06.9	EII	R	307	2.5	122.800
T2		348	300+00.0 - 310+10.2	R, P2	R	1,010	1.0	1,010.000
T3	R1	1,037	401+01.1 - 411+54.3	R, P1	R	1,053	1.0	1,053.000
T3	R2	61	411+54.3 - 412+15.0	P	RE	61	10.0	6.100
T4	R1	199	500+71.6 - 502+77.8	EII	R	206	2.5	82.400
T4	R2	400	504+26.0 - 508+23.9	EII	R	398	2.5	159.200
T4	R3[1]	1,599	508+23.9 - 522+48.0; 522+85.0 – 523+70.0	P	RE	1,509	10.0	150.900
T5	R1	670	600+25.6 - 606+95.3	EII	R	670	2.5	268.000
T5	R2	799	606+95.3 - 615+80.6	R, P1	R	885	1.0	885.000
T5	R3	1,075	615+80.6 - 621+74.7; 622+10.0 – 625+81.0	EII	R	965	4.0	241.250
T5A		996	620+00.0 - 630+25.6	EII	R	1,026	2.5	410.400
T5B		584	640+04.6 - 645+84.5	EII	R	580	2.5	232.000
T5C[1]		588	-	EII	R	588	2.5	235.200
T6	R1	343	700+15.2 - 703+96.5	R, P1	R	381	1.0	381.000
T6	R2	999	703+96.5 - 714+31.7	EII	R	1,035	2.5	414.000

1. T5C Credited using the Headwater Stream guidance method of the valley length.

Component Summation			
Restoration Level	**Stream (LF)**	**Riparian Wetland (Acres)**	**Non-Riparian Wetland (AC)**
Restoration	4,662	N/A	N/A
Enhancement II	9,861	N/A	N/A
Preservation	1,570	N/A	N/A

14.0 References

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Appendix 1

Buffer Mitigation Plan

RIPARIAN AREA MITIGATION PLAN

Final

November 2019

SASSARIXA SWAMP MITIGATION PLAN

Johnston County, NC
NCDEQ Contract No. 7425
DMS ID No. 100040

Neuse River Basin
HUC 03020201

USACE Action ID No. SAW 2018-00432
DWR Project No. 2018-0198
RFP #: 16-007279

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

FINAL RIPARIAN AREA MITIGATION PLAN

SASSARIXA SWAMP MITIGATION SITE

Johnston County, NC
NCDEQ Contract No. 7425
DMS ID No. 100040

Neuse River Basin
HUC 03020201

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
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PREPARED BY:

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Phone: (919) 851-9986

This Mitigation Plan has been written in conformance with the requirements of the following:

- 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers.
- 15A NCAC 02B. 0240, Nutrient Offset Payments Rule, amended effective September 1, 2010
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern DMS operations and procedures for the delivery of compensatory mitigation.

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WILDLANDS ENGINEERING

November 19, 2019

Mr. Jeremiah Dow
NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

RE: DMS Review comments for Mitigation Plan
Sassarixa Swamp Mitigation Site (DMS ID # 100040)
Neuse 03020201, Johnston County, NC
Contract No. 7425

Dear Mr. Dow,

Thank you for compiling and providing comments on the Sassarixa Mitigation Site draft Mitigation Plan.

1. The use of the term "buffer" or "riparian buffer" is used too loosely throughout the plan. These terms should only be used to describe an area that is within the Neuse Riparian Buffer. For this site, only the first 50' adjacent to streams subject to the rule are Neuse Riparian Buffers. Therefore, please correct applicable references to "buffer" or "riparian buffer" and replace incorrect references with "riparian areas" or "riparian restoration".

    References to "buffer" or "riparian buffer" were corrected to "riparian areas" and "riparian restoration".

2. The plan describes this site as a "Buffer Restoration Project" throughout the text. However, most of the site is actually buffer enhancement w/some preservation. I recommend "buffer mitigation project" or something other than "buffer restoration project" to avoid confusion.

    References to "Buffer Restoration Project" has been replaced to "Buffer Mitigation Project".

3. Section 2.2 page 6
    a. This section is titled "Project Location", but it includes references to the Alternative mitigation options being proposed onsite. I recommend separating this information out into its own section.

        "Project Location" has been separated out into "Project Location" and "Buffer Project Attributes".

    b. Some streams onsite are "not subject". Correct where applicable.
        Corrected to include non-subject streams too.

c. Enhancement via Cattle Exclusion is also an alternative option that should be added to this section.

Enhancement via Cattle Exclusion has been added as an alternative option.

d. For Ephemeral channels, last bullet, correct the rule reference to just be 15A NCAC 02B .0295 (n). Currently, the reference to 0295 (o) is too inclusive. For example, "enhancement" on Ephemerals can only be achieved by actually planting an area deemed "Enhancement Site" under 0295 (n). Areas deemed as "Enhancement" via cattle Exclusion are approved under 0295 (o) and cannot be achieved adjacent to Ephemeral channels. T3 Ephemeral is currently proposed as "Enhancement via Cattle Exclusion" and instead, should be Preservation according to viability letter.

The rule reference has been updated. T3 Ephemeral reach has been changed to Preservation to match the viability letter.

e. For coastal HW Streams, add additional information.
    i. The rule requires that the site meet success criteria for the stream mitigation. Therefore, this area requires 7 years of monitoring instead of 5.

    7 years of monitoring has been added

    ii. The rule requires the creditable areas to be planted to get buffer credit adjacent to HW streams. Therefore, areas currently forested on T5C must be excluded from credit, and only the restoration areas in the fields are viable.

    Forested areas along the HW streams have been excluded from credit.

    iii. Text says the buffer will be measured based on valley length, but where is that measurement provided or represented?

    The valley length is shown in Figure 6 and Figure 7.

4. Section 2.5
    a. The statement provided about the purpose of the internal crossings suggests that there may should be fencing on both sides of Sassarixa creek. No fencing is shown on the plan sheets or the figures for the right side of Sassarixa Creek. If "agriculture" in this section implies cattle, then sassaixa creek will require fencing on both sides of the easement in order to comply with 0295 (o)(6). Please explain.

    Fencing has been added to the right side of Sassarixa Creek.

5. Section 5.2 & Plan Sheet 3.0 lists Green Ash to be planted. Based on concerns of the Emerald Ash Borer and its ability to spread and attack saplings (>1-inch diameter), DWR highly recommends this tree not be included in the planting plan.

Green Ash has been removed from the planting plan.

6. Provide a reasonable justification to plant Cypress trees, a softwood, which are not considered an appropriate species to meet performance standards per 0295 (n)(2)(B). Provide specifics as to where Cypress will be planted in the Plan Sheets.

    Cypress has been removed from the planting plan.

7. Section 5.3 –
    a. The viability letter notes that there are two types of enhancement on this project. Enhancement under 0295 (n) indicates that the area requires plantings vs Enhancement under 0295 (o)(6) requires just the removal of cattle. The upper reach of T4 was determined to be Enhancement under 0295 (n). Other Enhancement areas met .0295(o)(6). Correct figures where cattle exclusion is shown on the upper reach of T4 and show as "Enhancement". Confirm that the planting sheets show plantings in this area as well.

        The upper reach of T4 will also be planted.

    b. How will cattle be "excluded" in the buffer enhancement areas?

        It has been noted in Section 5.3 that cattle will be "excluded" through fencing.

    c. Correct rule reference to be 15A NCAC 02B .0295(o). It currently reads .0296

        Rule reference has been corrected.

8. Section 6.2 Please revise plan to add that planted stems in the monitoring plats will all be flagged.

    Flagging planted stems has now been noted in Section 6.2.

9. Table 9 – add another parameter to account for T5C needing 7 years of monitoring.

    Table 9 is updated to reflect the 7 years of monitoring along T5C.

10. Section 7.1 – Add that "height" will be measured to assess the vigor of stems.

    Height has been added to assess the vigor of stems.

11. Section 7.4 – Add a note about T5C and its additional monitoring to meet performance standards. The rule also requires that the stream mitigation meets the performance criteria by the USACE as well. Therefore, DWR cannot accept the restoration area adjacent to T5C without knowing it meets the final performance criteria at closeout by the IRT. Please indicate that

closeout of credits adjacent to T5C will be done at Closeout with IRT. If T5C is removed from the buffer plan all together, then none of this applies.

The additional monitoring performance for T5C has been added.

12. Tables 7a & 7b
    a. Use newer version to the table (request from DMS) and attempt to keep the table all on one page. If needing to split 7a and 7b on separate pages that is fine. This may require a larger paper size to accommodate this request. Please do not reduce the font size in the table too much such that it makes the table difficult to read as hard copy.

       Newer version of the table is now being used.

    b. Correct table based on comments provided with this letter.

       Corrections have been incorporated.

    c. T4 should be "Enhancement" and not "Enhancement via Cattle Excl". See comment #7.

       T4 is now "Enhancement".

    d. Breakout T5C credits separate from others and as "not convertible to Nutrient".

       T5C credits are now separated from the others and listed as "NOC".

    e. T5C is not viable for Enhancement, remove from table.

       Enhancement for T5C has now been removed.

    f. T3 Ephemeral reach is not viable for Enhancement via Cattle Excl. Change this to preservation.

       T3 Ephemeral has been changed to preservation.

    g. T4 & T5 Restoration 0-1000' are both shown with"**". Explain why these two are different than other Restoration areas 0-100' shown in the table. If the explanation is due to widths, then why can't the Min-Max width be shown as different?

       The asterisks have been removed with the new table.

    h. Formulas may be off on table, so once newer version of the table is completed for this site, I will be able to decipher whether the subtotals and totals are compliant.

       Noted.

i. T2 restoration area may need to be edited based on comment #15 below.

Noted.

13. Paragraph below Table 7b will need to be edited based on comments made in this letter. Specifically, the viability of certain streams/reaches that are stated incorrectly in the first sentence.

    The paragraph below Table 7b has been removed due to the clarification from correspondence with Ms. Katie Merritt sent on August 16. 2019.

14. Table 7a-b shows nutrient offset conversions. However, there is no reference to this in the introduction of the Plan. If this site is to be reviewed by DWR to generate nutrient and/or buffer, please include language to the effect in the introduction.

    Nutrient offset credits are not being request at this time, but areas may be converted to nutrient offset credits by DMS later. Since nutrients are not being requested at this time, language is not needed in the introduction. A note below Table 7a has been added indicating potential nutrient request in the future.

15. Figure 6 –
    a. Identify the location of the Ephemeral channel along T3.

       The location of the Ephemeral channel along T3 has been noted.

    b. Show Preservation instead of Cattle Excl. along T3 ephemeral reach.

       T3 has been changed to Preservation.

    c. Add Enhancement (non-cattle excl) along T4 (R1 & R2) (see plan sheet 3.3)

       T4 (R1 &2) has been changed to Enhancement (non-cattle exclusion)

    d. Remove Enhancement adjacent to T5C.

       T5C Enhancement has been removed.

    e. T2 restoration area should only be measured from Top of Bank of the Stream Determination point by DWR or the "radius/bubble" above the point. When comparing this area to Figure 7, the top of bank appears to be measured from the proposed stream alignment beyond the wood line.

       Figure 7 has been corrected to the Top of Bank of the Stream Determination point by DWR.

f. T4 Preservation area needs to be excluded from credit unless the DWR has confirmed this feature is a stream.

T4 Reach 3 has now been confirmed a stream based on the On-Site Determination for Applicability to the Neuse Riparian Area Protection Rules (15A NCAC 02B .0233) dated October 28. 2019. Supporting documentation is located in the Appendix.

g. I prefer the legend also identify the Coastal HW credits (instead of blue, use a different color)

Coastal HW credits have been identified in another color.

16. Figure 8 –
    a. Show the non-cattle exclusion Enhancement Area & Coastal HW area.

    Figure 8 has been updated according to above changes.

    b. All plots along T1 are on the same side. Please move a plot to represent the other side of T1 as well.

    The vegetations plots along T1 have been moved to represent the other side.

    c. There is a plot located within Cattle Exclusion areas along T4. Why?

    The plot located within the Cattle Exclusion has been removed.

17. Figure 9-
    a. Remove T5C from being able to be converted to NOC. NOC is not viable adjacent to coastal HW stream sites as shown in the viability letter.

    T5C has been removed from being converted to NOC.

18. Service Area map – This map does not comply with Rule .0295. The service area for buffer mitigation projects in the Neuse 01 below Falls Lake is the Neuse 01below Falls Lake and does not include the Falls Lake WS. Edit this map to exclude the Falls Lake completely from the service area.

    The Service Area Map has been updated to exclude the Falls Lake WS.

19. There are not dates on the site photos, when were these photos taken.

    Dates have been added to the site photos.

20. Overall, if the riparian efforts are done according to the plan and addresses all comments and corrections provided by DWR, the site should provide a good buffer mitigation and/or nutrient offset project.

    Noted.

If you have any questions please contact me at aallen@wildlandseng.com, (919)851-9986 x 106.

Sincerely,

Angela Allen, P.E., *Project Manager*

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APPENDIX

1.0 Introduction

The Sassarixa Swamp Mitigation Site (Site) is a buffer and nutrient mitigation project in conjunction with a stream mitigation project. Construction of the stream restoration project will occur concurrently with planting and excluding livestock from the riparian buffers. The Site is located in Johnston County approximately six miles southwest of Smithfield and five miles north of Four Oaks (Figures 1). The Site is comprised of approximately 65.1 acres along Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek. Currently, the Site is characterized by a mix of active pastures, fields, and woodlands. The project will restore, enhance, and preserve riparian buffer area within the project area, which will provide 1,098,146.503 buffer credits or 55.9 acres worth of buffer mitigation.

The Site is located within the Hydrologic Unit Code (HUC) 03020201130030 and North Carolina Division of Water Resources (NCDWR) Sub-basin 03-04-04 Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek on the Site flow into Holts Lake, which drains to the Neuse River. Holts Lake is a recreational lake classified as a Nutrient Sensitive Water (NSW) and the Neuse River is a water supply for the City of Goldsboro.

The Sassarixa Swamp Mitigation Site is located in a new Targeted Local Watershed (TLW) that is not described in the 2010 Neuse River Basin Restoration Priorities (RBRP) Plan. The TLW was added in the 2015 Neuse 01 CU Update because there were more water quality issues than assets. Stressors for this TLW include impervious surfaces, disturbed riparian areas, and agricultural land use/animal operations. The Site addresses the TLW stressors of agricultural land use/animal operations and the lack of protected riparian areas. The project will also address key Cataloging Unit (CU) wide restoration goals for the Neuse River 03020201 described in the RBRP including reduction of sediment and nutrient loads from agricultural lands and increasing or improving riparian buffers (NC DWR 2009).

This buffer mitigation project will reduce sediment and nutrient loading, improve terrestrial and in stream habitats, and improve stream and bank stability. The area surrounding the streams proposed for restoration is a mixture of active pasture, fields, and woodlands. By removing cattle access to onsite tributaries to Holts Lake, restoring a forest to maintained riparian areas and protecting and preserving existing forested areas; the project will reduce nutrient and sediment inputs to project streams, and ultimately to Holts Lake. The restored floodplain areas will filter sediment during rainfall events. The establishment of riparian areas will create shading to minimize thermal pollution. Finally, invasive vegetation will be treated within the project area as needed and the proposed native vegetation will provide cover and food for wildlife.

T4

2.0 Mitigation Project Summary

The major goals of the proposed buffer mitigation project are to provide ecological and water quality enhancements to the Neuse River Basin by creating a functional riparian corridor and restoring the riparian area. Specific enhancements to water quality and ecological processes are outlined below in Table 1.

Table 1: Ecological and Water Quality Goals – *Sassarixa Swamp Mitigation Site*

Goal	Objective	CU-Wide and RBRP Objectives Supported
Decrease nutrient levels	Filtering runoff from the agricultural fields through restored native buffer zones. The off-site nutrient input will also be absorbed on-site by filtering flood flows through restored floodplain areas, where flood flows can disperse through native vegetation.	Reduce nutrient inputs to waters of the Neuse River Basin.
Exclude cattle from project streams.	Install fencing around project areas adjacent to cattle pastures.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Decrease water temperature and increase dissolved oxygen concentrations	Establishment and maintenance of riparian buffers will create additional long-term shading of the channel flow to reduce thermal pollution.	Improve habitat to wildlife by providing additional habitat.
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Provide a canopy to shade streams and reduce thermal loadings; Contribute to protection of or improvement to a Water Supply Waterbody.
Permanently protect the project Site from harmful uses.	Establish a conservation easement on the Site.	Protect aquatic habitat; protect water supply waters.

2.1 Existing Site Conditions

The buffer mitigation project will place put 65.1 acres of agricultural fields and woodlands along Sassarixa Creek and several unnamed tributaries that drain into the Holts Lake watershed, part of the Neuse River Basin under a conservation easement. Out of the 65.1 acres, 55.9 acres will be proposed for a combination of riparian buffer restoration, enhancement, and preservation.

The project includes several adjacent properties that have been owned and operated as a livestock farm by a single family since 1850, where livestock are continually rotated through all fields (with access to their associated streams). The western portion of the project includes Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek (T1, T1A, T1B, T1C, T1D, T2, and T3) (Figure 2). The eastern portion of the site contains six unnamed tributaries to Black Creek (T4, T5, T5A, T5B, T5C, and T6). A review of historic aerials from 1950 to 2012, located in the appendix, show that onsite streams have existed in their approximate locations with very little change to riparian zones since 1950. Two alterations to the Site visible from aerial photography are the addition of the pond on T2 between 1964 and 1973, and the addition of the large pond below T5A, T5B, and T5C, between 1950 and 1961.

Sassarixa Creek is a perennial stream that enters the Site from Black Creek Road and flows southeast. A mature hardwood forest surrounds the stream on both sides.

T1 enters the site at Old Olive Road in the northeast section of the project. T1A and T1D enter the right bank of T1, while T1B enters from the left bank downstream of T1A and T1D. The canopy is dominated by loblolly pine (*Pinus taeda*) with an understory of Japanese stilt grass (*Microstegium vimeneum*).

T1C is a short reach that starts at the tree line and flows into Sassarixa Creek.

The origin of T2 is a farm pond located in the natural valley of this drainage area that is dominated by fescue and hay production. There is a grass swale at the outlet of the pond, and once the swale reaches the edge of the forest, there is a large (>5') headcut as it enters the valley of Sassarixa Creek.

A ditch originates south of Old Olive Road, flowing into T3 which starts as an ephemeral channel. T3 continues along a forested buffer transitioning into an intermittent stream. While the channel along T3 is forested, livestock access has impacted most of the understory.

T4 starts as an intermittent stream that enters the Site through a culvert at Old Olive Road. Roughly 200 feet down the stream breaks and becomes a degraded wetland picking back up another 300 feet to continue being an intermittent channel. The upper portion of T4 has sporadic conifer trees, while the understory has been trampled by cattle.

T5A, T5B, and T5C are the intermittent headwater streams to T5. They originate in the northernmost region of the project, upstream of a large pond. Their watersheds are primarily livestock grazing areas and row crops.

T5 and T6 are intermittent streams that enter the project area at Old Olive Road. A mature hardwood canopy extends the length of both streams.

2.2 Parcel Location

The Site is approximately six miles southwest of Smithfield and five miles north of Four Oaks (Figure 1). The site is within the DMS targeted Neuse River Basin HUC 03020201130030 and NCDWR Subbasin 03-04-04.

From Raleigh take I-40 E. Take exit 319 for NC-210 toward Smithfield/Angier. Turn left onto NC-210 E (signs for Smithfield). Continue on NC-210 E for 2.4 miles and turn right onto Lassiter Roads. After 4.6 miles, turn left onto Black Creek Road. Continue on Black Creek Road for 0.7 miles and then turn right onto Old Olive Road. The first parcel is 0.1 mile on the right of Old Olive Road. The other parcels are at various locations further down Old Olive Road.

2.3 Buffer Project Attributes

Table 2: Buffer Project Attributes – *Sassarixa Swamp Mitigation Site*

Project Name	Sassarixa Swamp Mitigation Site
Hydrologic Unit Code	03020201130030
River Basin	Neuse River
Geographic Location (Lat, Long)	35°28'19.75"N 78°26'9.60"W
Site Protection Instrument (DB, PG)	To be recorded
Total Credits (BMU)	1,080,086
Types of Credits	Riparian Buffer
Mitigation Plan Date	May 2019
Initial Planting Date	March 2020
Baseline Report Date	May 2020
MY1 Report Date	November 2020
MY2 Report Date	November 2021
MY3 Report Date	November 2022
MY4 Report Date	November 2023
MY5 Report Date	November 2024

2.4 Alternative Mitigation

In addition to buffer restoration on subject streams, per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o)), alternative mitigation is proposed on the Site in the form of buffer restoration on ephemeral channels and coastal headwater streams, and preservation of forested buffer on subject and non-subject streams. The proposed project is in compliance with these rules in the following ways:

Buffer Restoration on Ephemeral Channels 15A NCAC 02B .0295 (n):

- The ephemeral channel is directly connected to intermittent or perennial stream channels and will be protected under the same contiguous easement boundary (Figure 2).
- The area of the mitigation site on ephemeral channels does not compromise more than 25 percent of the total area of buffer mitigation.
- The mitigation area on the Site's ephemeral channels is located completely within its drainage area.
- The proposed area meets all applicable requirements of Paragraph (n) of (15A NCAC 02B .0295), for restoration or enhancement.

T2

Buffer Restoration on Coastal Headwater Streams 15A NCAC 02B .0295 (o)(2):

- Wooded buffers planted along Outer Coastal Plain headwater stream mitigation sites may also be approved as riparian buffer mitigation credit if the Site meets all applicable requirements of 15A NCAC 02B .0295 (n).
- All success criteria specified in the approval of the stream mitigation site by the Division shall be met. Seven years of monitoring is required.

- Area of the buffer shall be measured perpendicular to the length of the valley being restored.
- The area within the proposed buffer mitigation site shall not also be used as wetland mitigation.

Enhancement via Cattle Exclusion 15A NCAC 02B .0295 (o)(6)

- Livestock is permanently excluded from riparian area.
- An enhancement plan must be provided in accordance by Paragraph (n) of 15A NCAC 02B .0295
- Grazing must be the predominant land use since the effective date of the applicable buffer rule.

Preservation on Subject Streams 15A NCAC 02B .0295 (o)(5):

- The buffer width is at least 30 feet from the stream (Figure 7).
- The area meets the requirements of 15A NCAC 02R 0.0403(c)(7), (8), and (11) with no known structures, infrastructure, hazardous substances, solid waste, or encumbrances within the mitigation boundary (see Section 4.4 for more detail).
- Preservation mitigation is being requested on no more than 25% of the total area of buffer mitigation (Table 8).

Preservation on Non-Subject Streams 15A NCAC 02B .0295 (o)(4):

- The streams were confirmed as intermittent or perennial by DWR per the On-Site Determination for Applicability to the Neuse River Riparian Buffer Rules and Water Quality Standards dated April 4, 2018
- The buffer width is at least 30 feet from the stream (Figure 7).
- Preservation mitigation is being requested on no more than 25% of the total area of buffer mitigation (Table 8).

2.5 Watershed Characterization

The Site topography, as indicated on the Four Oaks, NC USGS 7.5-minute topographic quadrangle shows a series of moderately sloped valleys (1-3%) that increase in width as they approach the floodplains of Sassarixa Creek and Black Creek (Figure 3).

Drainage areas for the streams and riparian areas were determined by delineating watersheds on the Four Oaks USGS 7.5-minute topographic quadrangles. Figure 4 shows the watershed boundaries for each area. Each of the riparian watersheds are mix of active pastures, fields, and woodlands. The watershed and current land use are summarized in Table 3 below.

Table 3: Drainage Areas and Associated Land Use – *Sassarixa Swamp Mitigation Site*

Reach Name	DWR Stream Designation	Buffer Area (Acres)	Watershed Area (acres)	Land Use
Sassarixa Creek	Perennial	14.3	4,726	47% agricultural, 7% developed, 46% forested
T1	Intermittent	6.44	45	63% agricultural, 20% developed, 17% forested
T1A	Intermittent	0.39	6	80% agricultural, 0% developed, 20% forested
T1B	Intermittent	0.56	2	80% agricultural, 0% developed, 20% forested
T1C	Intermittent	1.20	6	80% agricultural, 0% developed, 20% forested
T1D	Intermittent	.09	0.5	80% agricultural, 0% developed, 20% forested
T2	Intermittent	1.05	13	80% agriculture, 7% developed, 13% forested
T3 R1	Ephemeral	0.80	17	80% agricultural, 7% developed, 13% forested
T3 R2	Intermittent	3.52	26	80% agricultural, 7% developed, 13% forested
T4	Intermittent	7.00	40	52% agricultural, 4% developed, 44% forested

Reach Name	DWR Stream Designation	Buffer Area (Acres)	Watershed Area (acres)	Land Use
T5	Intermittent	7.28	136	60% agricultural, 4% developed, 36% forested
T5A*	Wetland (Impacts from cattle in T5 stream resulted in a wetland)	4.33	24	80% agricultural, 0% developed, 20% forested
T5B	Intermittent	4.54	25	80% agricultural, 0% developed, 20% forested
T5C	Headwater Wetlands	0.29	10	90% agriculture, 10% forested
T6	Intermittent	4.11	130	60% agricultural, 4% developed, 36% forested

**Proposing stream restoration to reconnect T5A stream throughout. If stream restoration is approved by the IRT and a stream channel is constructed, then the new riparian areas will be viable as an Enhancement Site per 15A NCAC 02B .0295 (o) (6).*

2.6 Vegetation

Three reaches on site lack a riparian buffer: T1-R1, the upstream end of T2, and the upstream end of T3. The riparian buffer in these areas consist primarily of fescue (*Festuca* sp.) and some areas of hay production to feed livestock. The canopy on T1-R2 is unique in that it is dominated by loblolly pine (*Pinus taeda*) with an understory of Japanese stiltgrass (*Microstegium vimeneum*). All other riparian areas include a mix of canopy species including red maple (*Acer rubrum*), sweetgum (*Liquidambar straciflua*), willow oak (*Quercus phellos*), tulip poplar (*Liriodendron tulipifera*), ironwood (*Carpinus caroliniana*), sycamore (*Platanus occidentalis*), water oak (*Quercus nigra*), and black willow (*Salix nigra*). While the understory of all reaches is dominated by Japanese stiltgrass, there is still a diverse mix of understory species present, especially along Sassarixa Creek and T4-R3. Understory species include Christmas fern (*Polystichum acrostichoides*), dogfennel (*Eupatorium caplilifolium*), greenbrier (*Smilax sp.*), Virginia creeper (*Parthenocissus quinuefolia*), sawtooth blackberry (*Rubus argutus*), common ragweed (*Ambrosia artemisifolia*), poison ivy (*Toxicodendron radicans*), common rush (*Juncus effesus*), and common sedge (*Carex sp.*). Invasive species located in the riparian buffers include Chinese privet (*Ligustrum sinese*) and Japanese honeysuckle (*Lonicera japonica*).

2.7 Site Constraints and Access

The Site is accessible in multiple locations off Old Olive Road. Several culverts and two ford crossing will be constructed on project streams to allow for continued use of the land outside of the project area for agriculture. Each crossing is a 35-foot crossing internal to the easement. Wherever possible, culverts will be located at the start or end of the project reach to limit impact on stream pattern, plan, and profile. There are no known airport facilities within five miles of the project area (Figure 1). There is one utility easement at the start of T4 and will be used as a ford crossing. There are no other known constraints on the proposed Site.

2.8 Current Site Resources

On February 9, 2018 (dated May 21, 2018) Ms. Katie Merritt, with DWR, conducted on-site determinations to review features and land use within the project boundary. In March 2019 Ms. Sam Dailey, with USACE, determined two additional features, T1B and T1C, within the project boundary as intermittent channels, resulting in an additional site-viability letter from Ms. Katie Merritt. The resulting DWR site viability letters and maps confirming the Site as suitable for riparian buffer mitigation is enclosed in the Appendix. The on-site determination approval letter from NCDWR is also included in the Appendix.

2.9 Historic Site Resources

A review of historic aerials from 1950 to 2012, located in the appendix, show that onsite streams have existed in their approximate locations with very little change to riparian area extents since 1950. Two alterations to the Site visible from historical aerial photography are the addition of the pond on T2 between 1964 and 1973, and the addition of the large pond below T5A, T5B, and T5C between 1950 and 1961.

3.0 Site Protection Instrument

3.1 Site Protection Instruments Summary Information

The land required for riparian planting, management, and stewardship of the mitigation project includes portions of the parcels listed in Table 4. Option agreements for the project area have been signed by the property owners and a Memorandum of Option have been recorded at the Johnston County Register of Deeds. The proposed conservation easements on these properties has not yet been recorded.

Table 4: Site Protection Instrument – *Sassarixa Swamp Mitigation Site*

Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage to be Protected
Hunter E. Oliver Janie E. Oliver	166200-58-6572 166200-59-2333	Johnston	Conservation Easement	DB: 3624 PG: 581	25.94
Junes Jones Olive Revocable Trust	166200-88-5084 166200-85-0452	Johnston	Conservation Easement	DB: 3719 PG: 717	15.73
Junes Jones Olive Revocable Trust Hunter E. Oliver	166200-57-0481 167200-17-2303	Johnston	Conservation Easement	DB: 3719 PG: 717	9.66
Mary Hunter Olive-Waller Todd Franklin Waller Amanda J. Olive	166200-49-5125	Johnston	Conservation Easement	DB: 4358 PG: 908	1.52
Tami Olive Thompson David Thompson Junes Jones Olive Revocable Trust	166200-66-6896	Johnston	Conservation Easement	DB: 3719 PG: 717	5.46
Matthew T. Keen	167200-06-5717	Johnston	Conservation Easement	DB: 4606 PG: 183	2.04
Tami Olive Thompson	166200-79-8148	Johnston	Conservation Easement	DB: 3719 PG: 717	4.71

All site protection instruments require 60-day advance notification to the Corps and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

4.0 Regulatory Considerations

Table 5, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 4.1-4.3. A copy of the signed Categorical Exclusion Form for the project can be found in the Sassarixa Swamp Mitigation Plan for the stream project.

Table 5: Project Attribute Table – *Sassarixa Swamp Mitigation Site*

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	(Appendix) Site Viability Letter
Water of the United States - Section 401	Yes	Yes	(Appendix) Site Viability Letter
Endangered Species Act	Yes	Yes	Sassarixa Swamp Mitigation Plan Appendix (Categorical Exclusion)
Historic Preservation Act	Yes	Yes	Sassarixa Swamp Mitigation Plan Appendix (Categorical Exclusion)
Coastal Zone Management Act	No	No	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

4.1 Threatened and Endangered Species

The NC Natural Heritage Program (NHP) database and the US Fish and Wildlife Service (USFWS) database were searched for federally listed threatened and endangered plant and animal species in Johnston County, NC. Five federally listed species, the red-cockaded woodpecker (*Picoides borealis*), dwarf wedgemussel (*Alasmidonta heterodon*), Tar River spinymussel (*Parvaspina steinstansana*), yellow lance (*Elliptio lanceolata*), and Michaux's sumac *(Rhus michauxii*) are currently listed in Johnston County. Table 6. list their federal status and habitat.

Table 6: Listed Threatened and Endangered Species in Johnston County, NC – *Sassarixa Swamp Mitigation Site*

Species	**Federal Status**	**Habitat**
Vertebrate		
Red-cockaded woodpecker (*Picoides borealis*)	E	Found in mature pine forests, these birds bore cavities inside of living pine trees
Invertebrate		
Dwarf wedge mussel *(Alasmidonta heterodon)*	E	Inhabit a wide range of stream sizes and types from small streams to large rivers. Known to live in substrates including clay, sand, gravel, pebble, and some silt depositional areas
Tar River spinymussel *(Parvaspina steinstansana)*	E	Live mostly in silt-free unconsolidated beds of coarse sand and gravel. Prefer faster flowing, well oxygenated streams.
Yellow lance *(Elliptio lanceolate)*	T	Lives in coarse to medium clean sand, and sometimes gravel. Usually found in the downstream portion of sand and gravel bars. Requires clean, well oxygenated water with moderate flows. Found in small to medium streams.
Vascular Plant		
Michaux's sumac *(Rhus michauxii*)	E	Woodland edges, woodland, sandhills and sandy forest.

E = Endangered;
T= Threatened

Wildlands requested review and comment from the United States Fish and Wildlife Service on February 5, 2018 in respect to the Sassarixa Swamp Mitigation Site and its potential impacts on threatened or endangered species. USFWS responded on March 2, 2018 and stated the "proposed action is not likely to adversely affect any federally listed endangered or threatened species, their formally designated critical habitat or species currently proposed for listing under the Act". A follow up email was sent to USFWS on April 6, 2018 regarding the new addition of the yellow lance on April 4, 2018 to Johnston

County's endangered species list. USFWS responded on April 9, 2018 with no additional objection. All correspondence with USFWS is include in the approved Categorical Exclusion found in the Sassarixa Swamp Mitigation Plan.

A pedestrian survey conducted on April 10, 2018, indicated that the Site did not provide suitable habitat for the red-cockaded woodpecker and yellow lance. The pedestrian survey did indicate that the site provides suitable habitat for the dwarf wedgemussel, Tar River spinymussel, and Michaux's sumac but no species were identified on the site. Therefore, due to the absence of the listed species on the site, the project has been determined by Wildlands to "may affect, but not likely to adversely affect" the dwarf wedgemussel and Tar River spinymussel, and to have "no effect" on the Michaux's sumac. The project will have "no effect" on the red-cockaded woodpecker and yellow lance due to the absence of suitable habitat.

4.2 Cultural Resources and Significant Natural Heritage Areas

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

There are no existing structures in the project area. The Site is not located near any sites listed on the National Register with the State Historic Preservation Office (SHPO). SHPO was contacted February 2, 2018 and had no concerns or comments on the project site. The approved Categorical Exclusion for the project is in the Sassarixa Swamp Mitigation Plan.

4.3 FEMA Floodplain Compliance

The Site is represented on the Johnston County Flood Insurance Rate Map Panel 1662. Sassarixa Creek and the downstream portions of T4, T5, and T6 are mapped in Zone AE from the modeled Black Creek, however no streams on Site are modeled. Areas within the mapping are slated for stream enhancement and preservation as part of them stream mitigation project and will not require net fill within the floodplain. Wildlands will coordinate with the Johnston County floodplain administrator to obtain the appropriate floodplain development permit for the project, if required.

4.4 Other Environmental Issues

An EDR Radius Map Report with Geocheck was ordered for the Site through Environmental Data Resources, Inc. on January 29, 2018. The target property and the adjacent properties are not listed in any of the Federal, State, or Tribal environmental databases searched by EDR. There were no known or potentially hazardous waste sites identified within one mile of the Parcel.

4.5 Determination of Credits

Mitigation credits presented in Table 7a and 7b and Figures 6 and 9 are projections based upon site design and are intended to be used as either riparian buffer credits or nutrient offset credits, dependent on the need. Sassarixa Creek's anabranching streams have been remove for credit calculation purposes. Upon completion of site construction, the project components and credits data will be revised to be consistent with the as-built condition.

Table 7a: Riparian Buffer Credit Generation Summary for Restoration and Cattle Exclusion - *Sassarixa Swamp Mitigation Site*

Neuse 03020201 - Outside Falls Lake	**Service Area**
19.16394	**N Credit Ratio (sf/credit)**

Credit Type	Location	Subject? (enter NO if ephemeral or ditch [1])	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Total (Creditable) Area of Buffer Mitigation (sf)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Convertible to Riparian Buffer?	Riparian Buffer Credits	Convertible to Nutrient Offset?	Delivered Nutrient Offset: N (lbs)
Buffer	Rural	No	Ephemeral	Restoration	0-100	T3	18,165	18,165	1	100%	1.00000	Yes	18,165.000	Yes	947.874
Buffer	Rural	Yes	I / P	Restoration	0-50	T4, T5B	3,930	3,930	1	100%	1.00000	Yes	3,930.000	No	—
Buffer	Rural	Yes	I / P	Restoration	0-100	T1, T1A, T1B, T1D, T3, T4, T5, T5A, T5B, T6	356,364	356,364	1	100%	1.00000	Yes	356,364.000	Yes	18,595.550
Buffer	Rural	Yes	I / P	Restoration	101-200	T2, T4, T5, T5B	43,678	43,678	1	33%	3.03030	Yes	14,413.754	Yes	2,279.176
Buffer	Rural	Yes	I / P	Enhancement	0-50	T4	210	210	2	100%	2.00000	Yes	105.000	Yes	10.958
Buffer	Rural	Yes	I / P	Enhancement	0-100	T4	59,388	59,388	2	100%	2.00000	Yes	29,694.000	Yes	3,098.945
Buffer	Rural	Yes	I / P	Enhancement	101-200	T4	3,106	3,106	2	33%	6.06061	Yes	512.490	Yes	162.075
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	20-29	Sassarixa Creek, T5, T6	1,209	1,209	2	75%	2.66667	Yes	453.374	No	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-50	Sassarixa Creek, T5, T6	6,420	6,420	2	100%	2.00000	Yes	3,210.000	No	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	Sassarixa Creek, T1A, T1B, T1C, T2, T3, T5, T5A, T5B, T6	1,080,633	1,080,633	2	100%	2.00000	Yes	540,316.500	No	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	101-200	Sassarixa Creek, T5 T5A, T5B	377,045	377,045	2	33%	6.06061	Yes	62,212.385	No	—
Buffer	Rural	Yes	Coastal Headwater	Restoration	0-100	T5C	12,481	12,481	1	100%	1.00000	Yes	12,481.000	No	—
						Totals:	1,962,629	1,962,629							

*Per the Site Viability for Buffer Mitigation and Nutrient Offset Letter dated May 21, 2018, certain project reaches were deemed viable by DWR for nutrient offset credit at 2,273 lbs. Nitrogen per acre. The nutrient offset viable areas are depicted in Figure 9 and their associated potential nutrient offset credits are listed in Table 7a. These select project areas have a minimum easement width of 50 feet from the top of bank and will be restored, per Section 5.2. While nutrient offset credits are not being requested at this time, these areas may be converted to nutrient offset credits by DMS later.

Table 7b: Riparian Buffer Credit Generation Summary for Preservation - *Sassarixa Swamp Mitigation Site*

Enter Preservation Credits Below							**Eligible for Preservation (sf):**	654,210				
Credit Type	**Location**	**Subject?**	**Feature Type**	**Mitigation Activity**	**Min-Max Buffer Width (ft)**	**Feature Name**	**Total Area (sf)**	**Total (Creditable) Area for Buffer Mitigation (sf)**	**Initial Credit Ratio (x:1)**	**% Full Credit**	**Final Credit Ratio (x:1)**	**Riparian Buffer Credits**
Buffer	Rural	No	Ephemeral	Preservation	0-100	T3	16,744	16,744	10	100%	10.00000	1,674.400
	Rural	Yes	I / P		20-29	T5	235	235	10	75%	13.33333	17.625
	Rural	Yes	I / P		0-100	T3, T4, T5	545,794	545,794	10	100%	10.00000	54,579.400
	Rural	Yes	I / P		101-200	T3	544	544	10	33%	30.30303	17.952
							Preservation Area Subtotal (sf):	563,317				
							Preservation as % Total Area of Buffer Mitigation:	21.5%				
							Ephemeral Reaches as % Total Area of Buffer Mitigation:	1.4%				

*Area eligible for preservation may be no more than 25% of total area, where total area is back calculated with the equation R+E/0.75.
*Ephemeral channels may be no more than 25% of mitigation area for buffer credits, no limit on nutrients

Table 7c: Total Riparian Buffer Credit Generation Summary – *Sassarixa Swamp Mitigation Site*

TOTAL AREA OF BUFFER MITIGATION (TABM)		
Mitigation Totals	**Square Feet**	**Credits**
Restoration:	434,618	405,353.754
Enhancement:	1,528,011	636,503.749
Preservation:	563,317	56,289.000
Total Riparian Buffer:	2,525,946	1,098,146.503

TOTAL NUTRIENT OFFSET MITIGATION			
Mitigation Totals		**Square Feet**	**Credits**
Nutrient Offset:	**Nitrogen:**	0	0.000
	Phosphorus:		0.000

5.0 Implementation Plan

The Wildlands Team proposes to restore high quality ecological function to Sassarixa Creek and 13 unnamed tributaries on the Site. The ecological uplift can be summarized as transforming agriculturally impacted areas to a protected forested riparian corridor. The project design will ensure that no adverse impacts to wetlands or existing riparian areas occur. All riparian restoration activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where riparian restoration is being performed may be altered slightly depending on the implementation of the Sassarixa Swamp Stream Mitigation Plan. Planting and fencing will happen in conjunction with the Sassarixa Swamp Nutrient Offset and Buffer Mitigation Bank Parcel. Figure 7 illustrates the conceptual design for the Site.

5.1 Parcel Preparation

The current land uses adjacent to the streams proposed for riparian restoration are active agricultural lands. Areas slated for riparian restoration that are not impacted by the construction of the stream mitigation project will require little site preparation including select herbicide treatments or limited mechanical clearing to remove undesirable underbrush or invasive species. Other areas of the easement will be graded in accordance with the Interagency Review Team (IRT) approved stream mitigation plan. After the grading for the stream mitigation is complete, the floodplain will be prepared for seeding and planting by applying stockpiled topsoil to the floodplain between bankfull elevation of the stream and the grading limits. All haul roads and other areas of compacted soil within the easement boundary will be ripped prior to planting.

As part of the stream mitigation project, the farm pond and drainpipe that currently impounds water at the headwaters of T2 will be eliminated and the channel restored. Several field drains were installed near the area at the top of the pond to direct stream water and field drainage into the pond. Those will be severed at the edge of buffer to provide diffuse flow into the easement. The earthen dam is proposed to be removed and a portion of the dam will be used to fill the pond bottom to provide stable foundation for construction of the new channel. The path of the future channel will be over-excavated, and fill material from the old dam will be used to stabilize the pond bed for the construction of the bed and banks of the new channel. Once the dam is removed, the stream restoration will begin near the upstream extent of the existing impoundment. Below the existing dam the restored channel will follow the existing valley flowing southwest until it reaches the confluence with Sassarixa Creek. Sheets 1.25-1.29 from the Sassarixa Swamp Stream Mitigation Plan (SAW# 2018-00432) set depicts the pond footprint, conservation easement boundary, and new stream alignment, which is included in Appendix 7 of the Sassarixa Swamp Stream Mitigation Plan.

The specifics of the stream restoration project, including breaching the pond on T2 and grading plan, are included in the Sassarixa Swamp Stream Mitigation Plan. A 401 permit will be required for all stream restoration work, including work within the pond on T2 and will be obtained before any work in the waters begins.

5.2 Riparian Area Restoration Activities

The revegetation plan for the riparian mitigation area will include permanent seeding, planting bare root trees, live stakes, and herbaceous plugs. These revegetation efforts will be coupled with controlling invasive species population. The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian areas adjacent to the Parcel, and best professional judgement on species establishment and anticipated site conditions in the early years following project implementation. Table 8 list woody species that are native to the area and may become established in the Site during the duration of the project. Refer to Sheet 3.0 of the Draft Plans located in Appendix 7 of the Sassarixa Swamp Stream Mitigation Plan for the planting plan.

Table 8: Native Woody Species to be Established – *Sassarixa Swamp Mitigation Site*

Scientific Name	Common Name	Dominant Method of Establishment
Acer rubrum	Red Maple	Natural Colonization
Acer negundo	Box Elder	Hand Planting
Betula nigra	River Birch	Hand Planting
Carpinus caroliniana	Ironwood	Natural Colonization
Liriodendron tulipifera	Tulip Poplar	Natural Colonization
Liquidambar straciflua	Sweetgum	Natural Colonization
Magnolia virginiana	Sweetbay Magnolia	Hand Planting
*Platanus occidentalis**	American Sycamore	Hand Planting
Populus deltoides	Eastern Cottonwood	Hand Planting
Quercus michauxii	Swamp Chestnut Oak	Hand Planting
*Quercus nigra**	Water Oak	Hand Planting
Quercus pagoda	Cherry Bark Oak	Hand Planting
*Quercus phellos**	Willow Oak	Hand Planting
*Salix nigra**	Black Willow	Hand Planting
Ulmus alata	Winged Elm	Hand Planting

*These late successional species may naturally colonize but are not expected to reach high-density numbers, height, and/or vigor after disturbance.

Trees will be planted at a density sufficient to meet the performance standards outlined in the Rule 15A NCAC 02B .0295 of 260 trees per acre at the end of five years. No one tree species will be greater than 50% of the established stems. An appropriate seed mix will also be applied as necessary to provide temporary ground cover for soil stabilization and reduction of sediment loss during rain events in disturbed areas. This will be followed by an appropriate permanent seed mixture. Planting is scheduled to begin in March 2020.

Vegetation management and herbicide applications may be needed during tree establishment in the restoration areas to prevent establishment of invasive species that could compete with the planted native species.

5.3 Riparian Area Enhancement Activities

The revegetation plan for the enhancement areas under NCAC 02B .0295 (n) will include planting supplemental bare root trees and controlling invasive species growth. The tree species to be planted are listed in Table 8.

For enhancement areas under NCAC 02B .0295 (o), cattle exclusion, planting isn't anticipated to be needed except where required in the stream mitigation plan. A seed mix will be applied where cattle have caused bare soils and cattle will be excluded from the riparian enhancement areas by fencing.

5.4 Riparian Area Preservation Activities

There will be no parcel preparation work done in the riparian preservation areas, as allowed under 15A NCAC 02B .0295(o). The preservation area will be protected in perpetuity under a conservation easement.

6.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met, and project goals and objectives are achieved. The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes and assist in close-out decision making.

6.1 Monitoring Components

Project monitoring components are listed in more detail in Table 9 and Figure 8.

6.2 Vegetation

Vegetation monitoring quadrants will be installed across the Site to measure the survival of the planted trees (Figure 8). The first annual monitoring activities will commence at the end of the first growing season, at least six months after planting has been completed, and will be reassessed annually no earlier than the Fall of each year. Species composition, density, height, and survival rates will be evaluated on an annual basis by plot and for the entire site. The number of monitoring quadrants required, and frequency of monitoring will be based on the DMS monitoring guidance documents. Vegetation monitoring will follow the CVS-EEP Protocol for Recording Vegetation (2008) or another DMS approved protocol. Planted stems will be flagged each monitoring year. Reference photographs of the vegetation plots and Site will be taken during the annual vegetation assessments.

6.3 Overview Photographs

Overview photographs will be taken of the project area once a year to visually document stability for five years following construction.

6.4 Visual Assessment

Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species or encroachment).

Table 9: Monitoring Components – *Sassarixa Swamp Mitigation Site*

Parameter	Monitoring Feature	Quantity	Frequency
Vegetation	CVS Level 2	9	Year 1-5
	Visual	T5C	Year 1-7
Visual Assessment		Yes	Semi-Annual
Exotic and Nuisance Vegetation			Semi-Annual
Project Boundary			Semi-Annual

7.0 Project Success Criteria

The project success criteria for the Site follows approved performance criteria presented in the guidance documents outlined in RFP 16-007279 and the Consolidated Buffer Rule (15A NCAC 02B .0295). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The buffer mitigation project has been assigned specific performance criteria components for vegetation. Performance criteria will be evaluated throughout the five-year post-construction monitoring. An outline of the performance criteria components follows.

7.1 Vegetation

The final vegetative success criteria will be the health, survival, height, and density of at least 260 stems per acre at the end of the fifth year of monitoring, with a minimum of four native hardwood tree or shrub species composition and no one species comprises more than 50 percent of stems. Vigor, species composition, and density will all be assessed. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

7.2 Overview Photographs

Overview photographs will be taken of the project area once a year to visually document stability for five years following construction.

7.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above. Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species or encroachment). Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas with be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

To ensure compliance with 0295 (0) (6): A visual assessment of the cattle exclusion and preservation areas within the conservation easement will also be performed each year to confirm:

- No cattle access within the conservation easement area; no encroachment has occurred; diffuse flow is being maintained in the conservation easement area; and there has not been any cutting, clearing, filling, grading, or similar activities that would negatively affect the functioning of the buffer.
- Any issues identified during the visual assessment of the cattle exclusion and preservation areas will be photographed and mapped as part of the annual monitoring report with remedial efforts proposed or documented.

7.4 Reporting Performance Criteria

Using the DMS Riparian Buffer and Nutrient Offset Buffer Baseline and Annual Monitoring Report Template version 2.0 (May 2017), a baseline monitoring document and as-built record drawings of the project will be developed for the constructed Site. Complete monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS. Annual monitoring reports will be based on the above referenced DMS Template (May 2017). The monitoring period will extend five years beyond completion of construction or until performance criteria have been met. Additional visual monitoring period for Coastal Headwaters will extend seven years beyond completion of construction or until performance criteria have been met. Closeout of buffer mitigation credits adjacent to the Coastal Headwaters will be done at IRTcloseout of the stream and wetland mitigation project.

7.5 Maintenance and Contingency Plans

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

8.0 Stewardship

8.1 Long Term Stewardship

The Site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

8.2 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Section 7. Project maintenance will be performed during the monitoring years to address minor issues as necessary. If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of DMS/NCDWR and work with the DMS/NCDWR to develop contingency plans and remedial actions.

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions if the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

9.0 References

National Land Cover Database 2011 (NLCD 2011), Multi-Resolution Land Characteristics (MRLC) consortium, https://www.mrlc.gov/nlcd2011.php

Natural Resources Conservation Service (NRCS). Web Soil Survey of Johnston County. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

North Carolina Division of Mitigation Services (DMS), 2016. River Basin Restoration Priority Transition Approach.

North Carolina Division of Water Quality (NCDWQ), 2011. Surface Water Classifications. http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

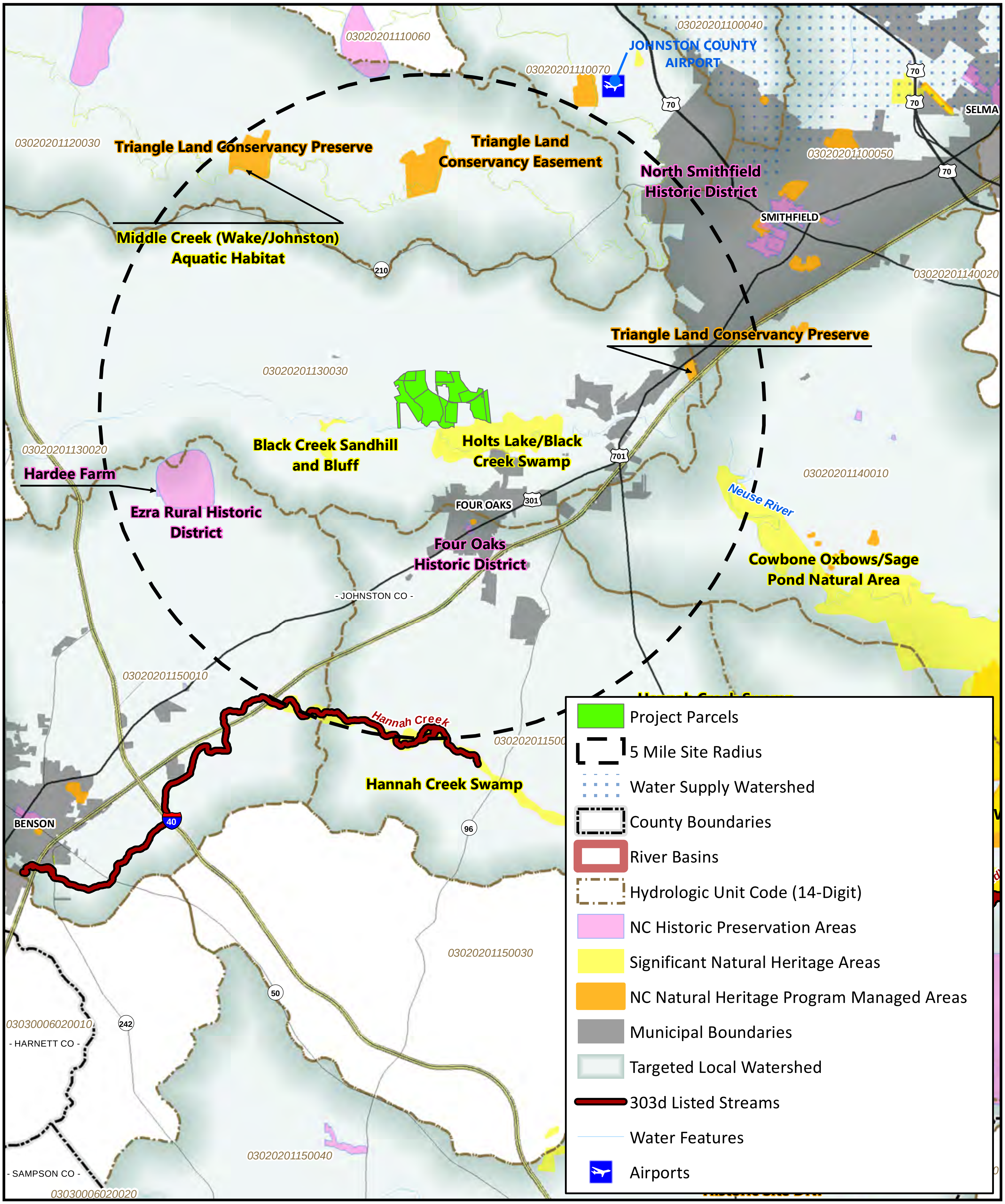
North Carolina Geological Survey (NCGS), 1985, Geologic Map of North Carolina: Raleigh, North Carolina Department of Natural Resources and Community Development, Geological Survey Section, scale 1:500,00, in color.

NCGS, 2013. Mineral Resources. http://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/mineral-resources

North Carolina Natural Heritage Program (NHP), 2018. Natural Heritage Element Occurrence Database, Johnston County, NC.

Rob Breeding, Eastern Watershed Planner, North Carolina Ecosystem Enhancement Program (NCEEP), 2010. Neuse River Basin Restoration Priorities.

United States Fish and Wildlife Service (USFWS), 2018. Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species, Johnston County, NC.



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0 1 2 Miles

N

Figure 1. Vicinity Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

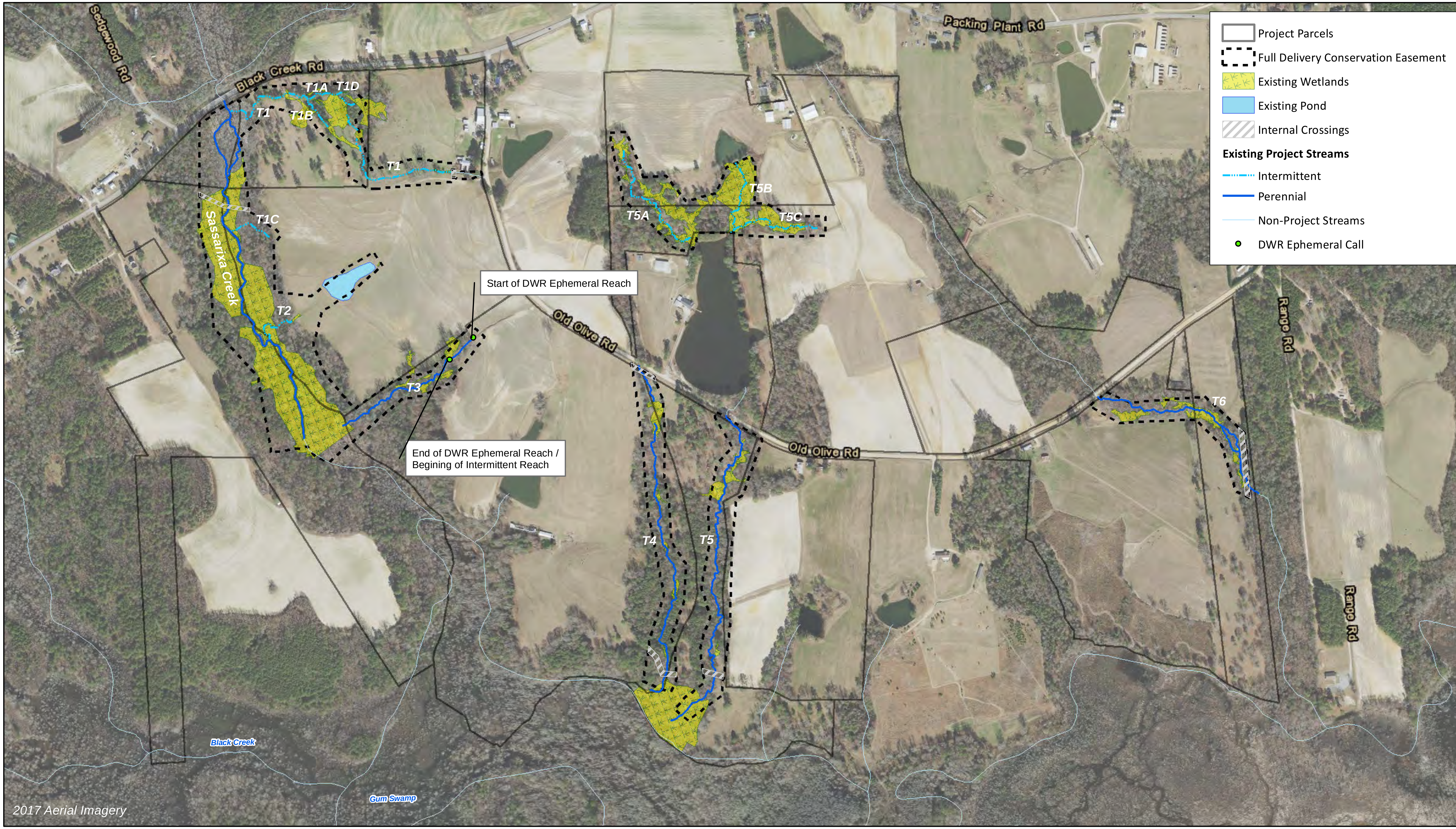

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Figure 2. Site Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

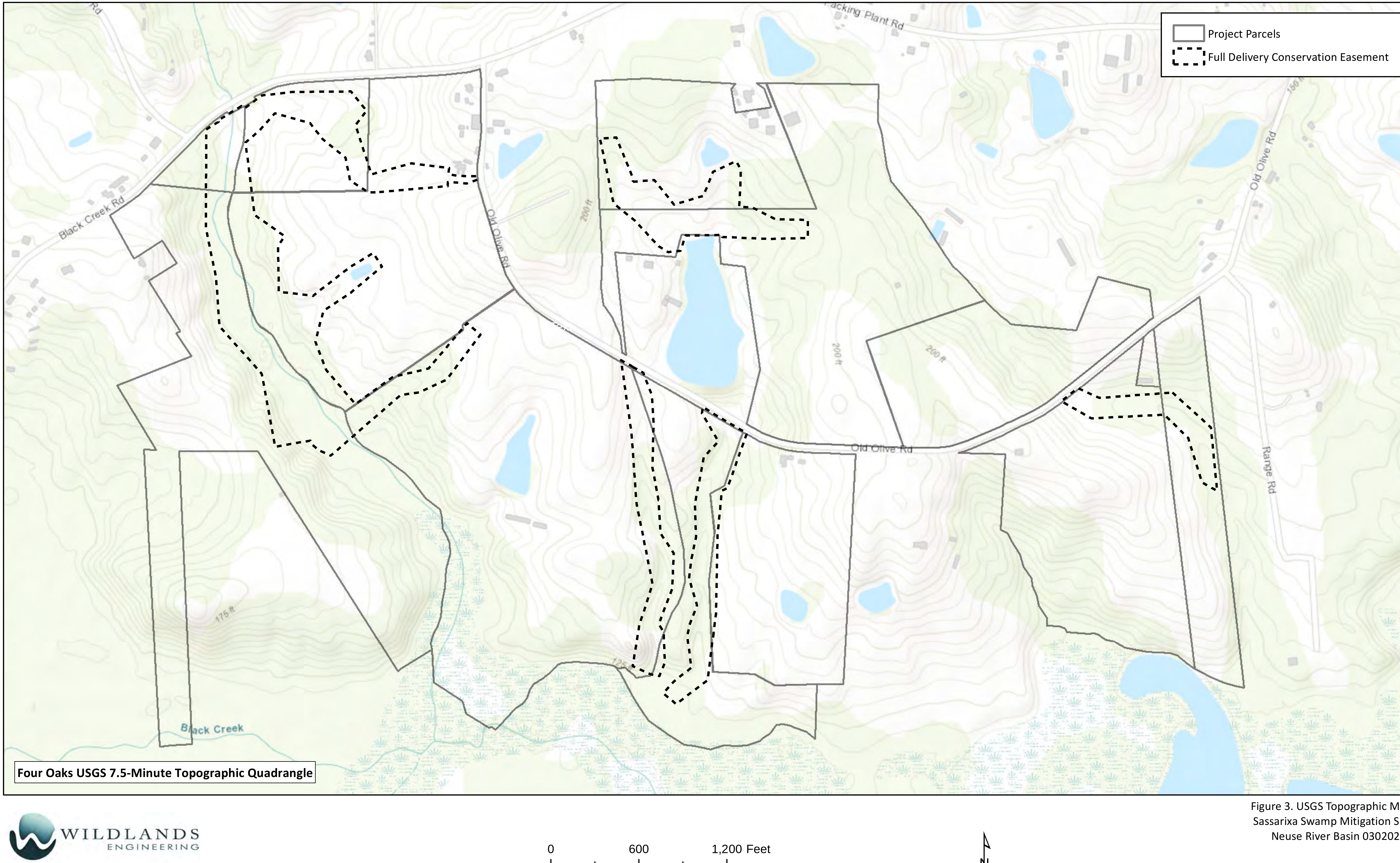


Figure 3. USGS Topographic Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

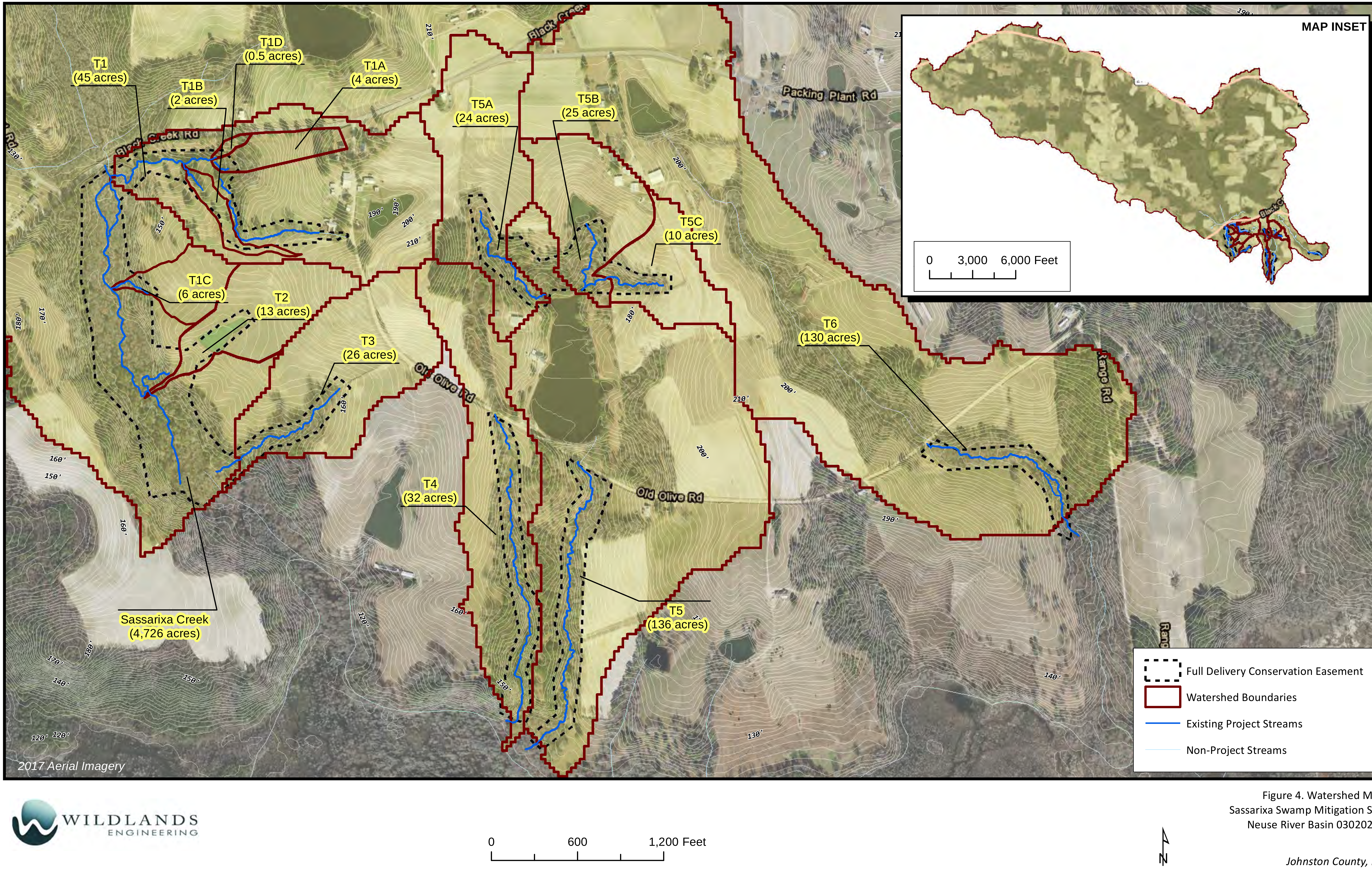
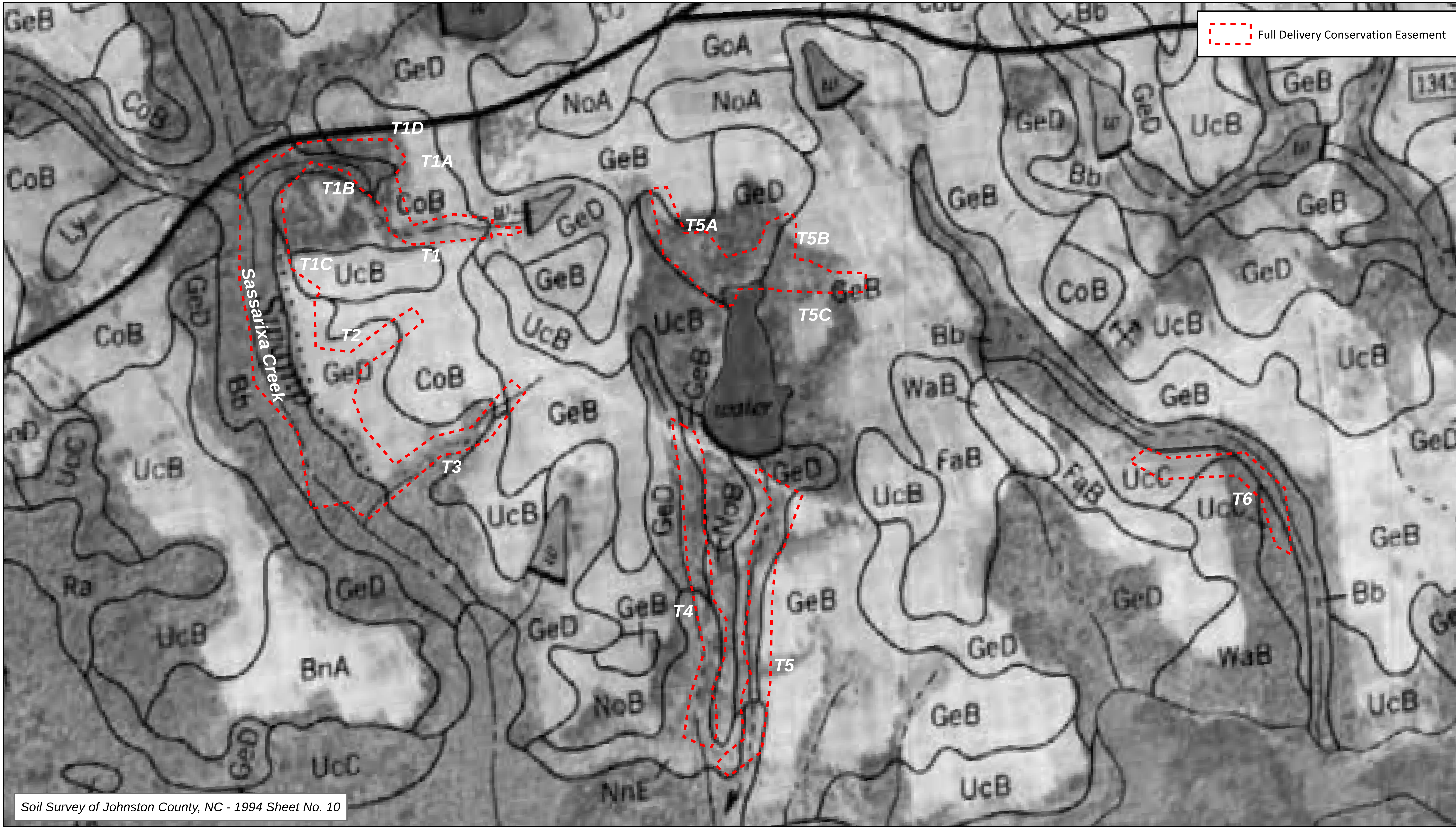


Figure 4. Watershed Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



0 600 1,200 Feet

N

Figure 5. Soils Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

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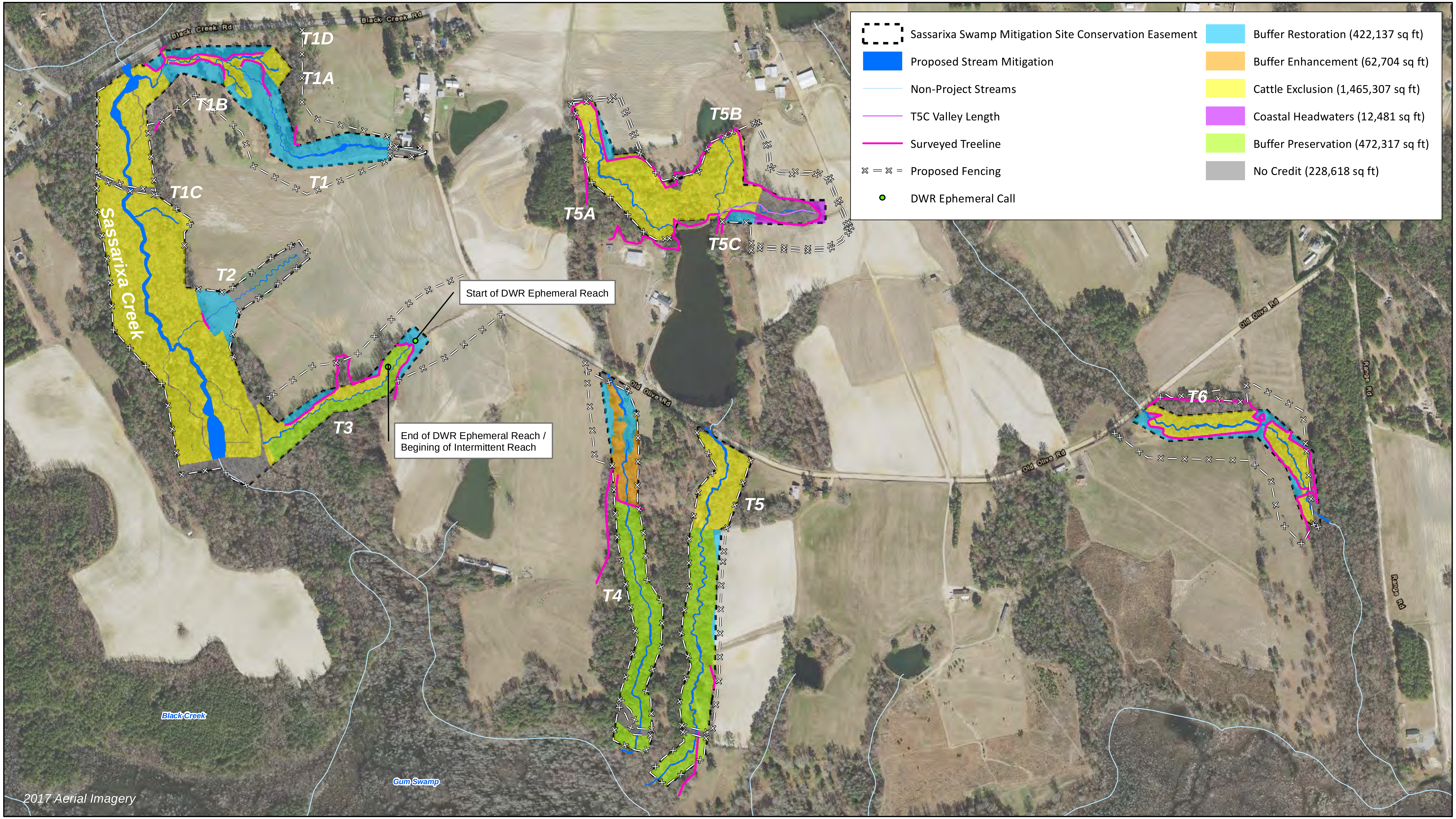

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Figure 6. Credit Calculations Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

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Figure 7. Riparian Buffer Zones Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

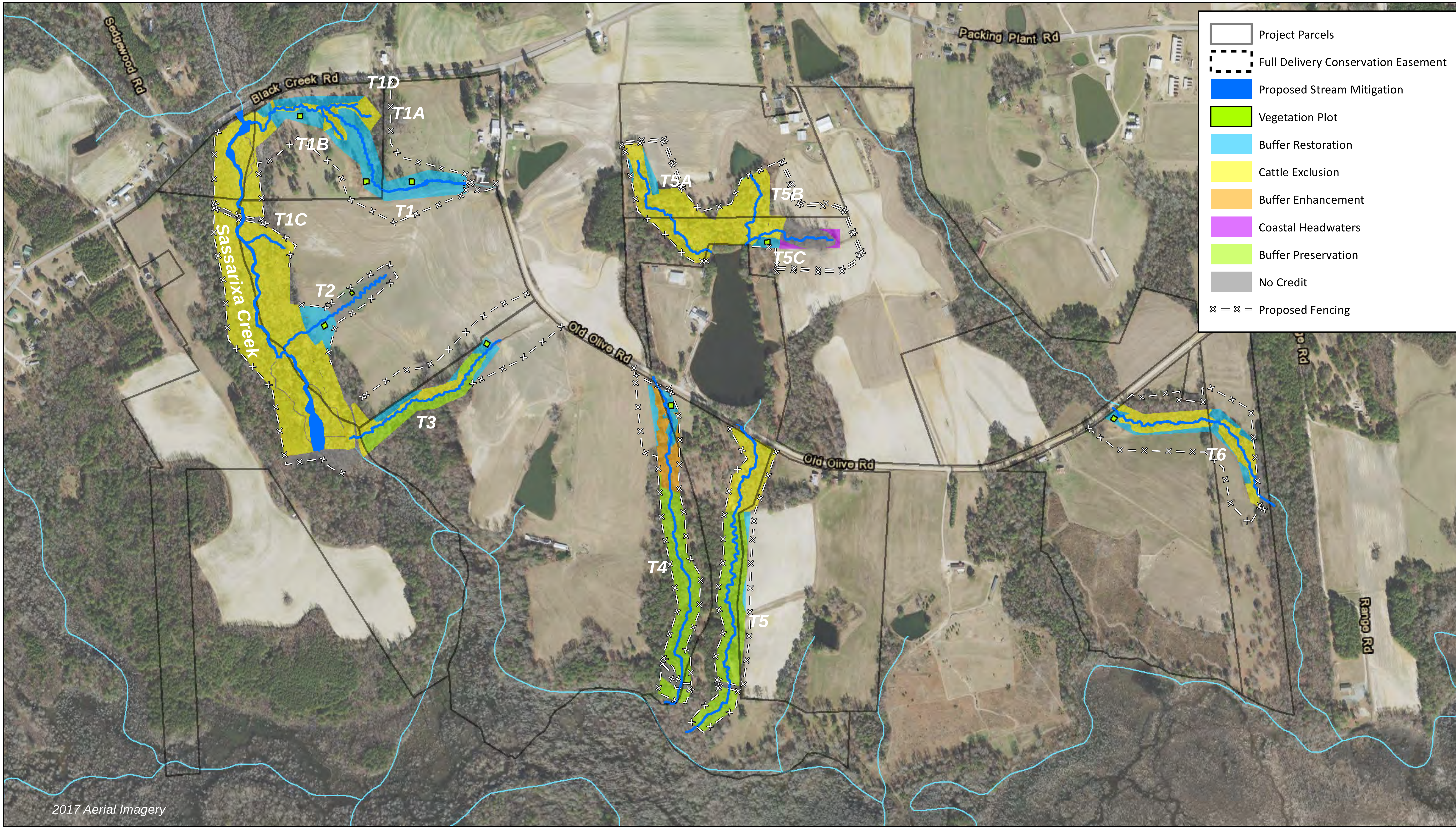

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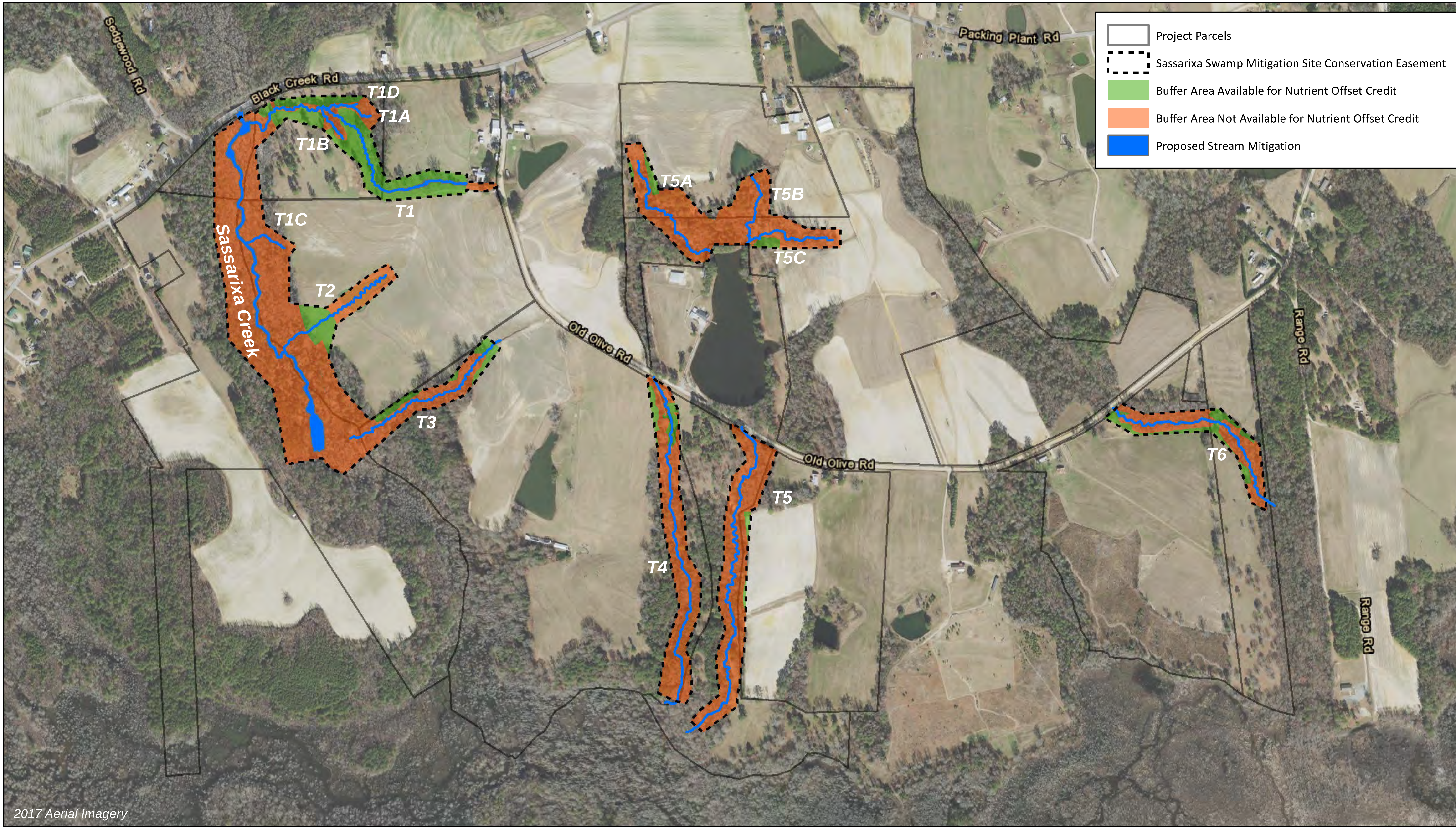
Figure 8. Proposed Monitoring Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



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0 600 1,200 Feet

N

Figure 9. Nutrient Offset Zones Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

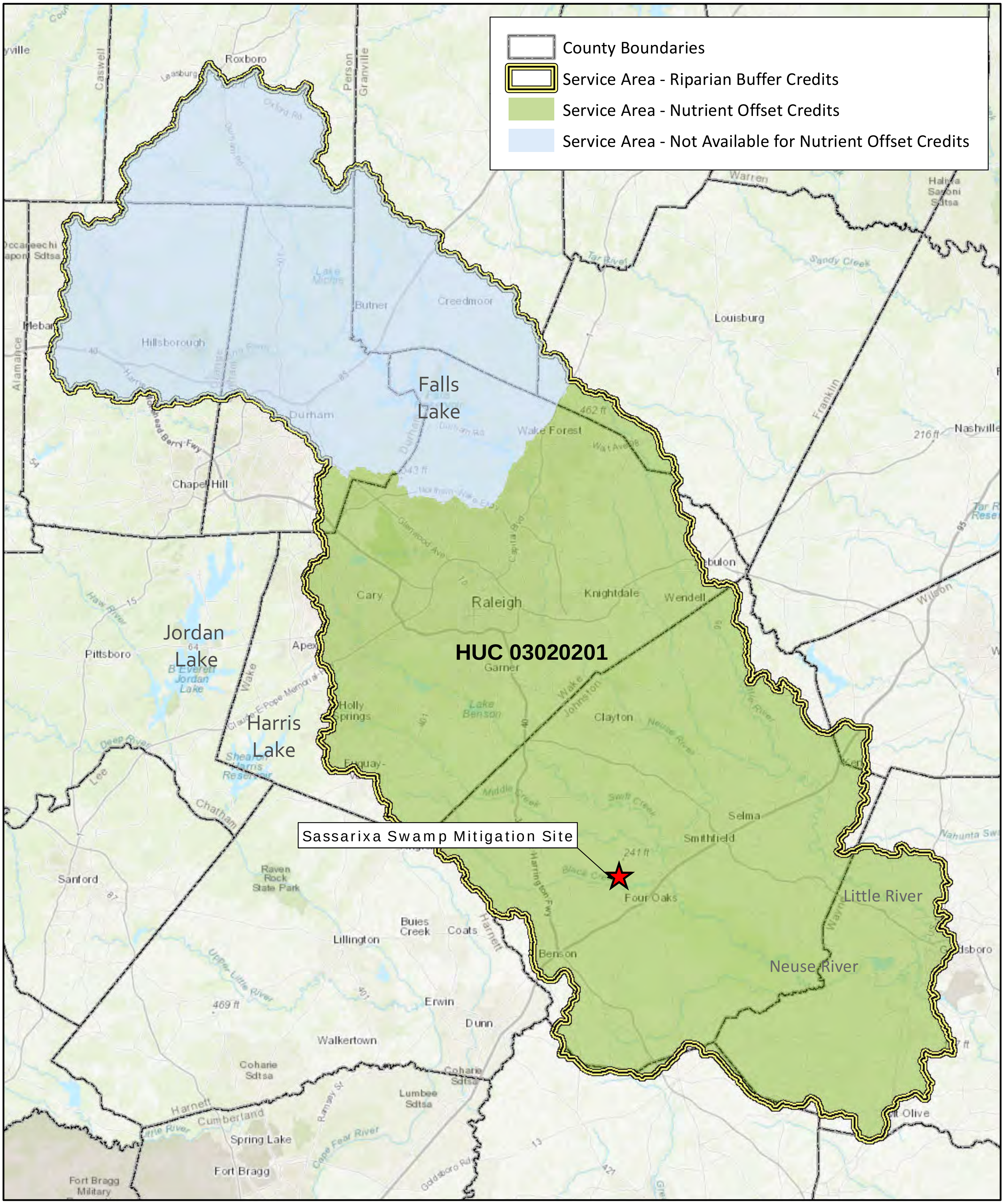


Figure 10. Service Area Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

APPENDIX

Water Resources
ENVIRONMENTAL QUALITY

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Interim Director

May 21, 2018

John Hutton
Wildlands Engineering, Inc.
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: jhutton@wildlandseng.com)

DWR ID# 2018-0198
Johnston County

Re: Site Viability for Buffer Mitigation and Nutrient Offset & Buffer- Sassarixa Swamp Site
2-162 Olive Rd, Smithfield, NC
Neuse 03020201 (not in Falls WS)

Dear Mr. Hutton,

On February 9, 2018, Katie Merritt, with the Division of Water Resources (DWR), received a request from Wildlands Engineering, Inc. (WEI) for an onsite mitigation determination near the above-referenced site (Site). The Site is located in the Neuse River Basin within the 8-digit Hydrologic Unit Code 03020201. The Site is being proposed as part of a full-delivery stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007279). Members of the Interagency Review Team (IRT) and Division of Mitigation Services were also present onsite. At your request, on February 23, 2018, Ms. Merritt performed an onsite assessment of riparian land uses adjacent to streams onsite, which are shown on the attached map labeled "Figure 6A".

Ms. Merritt's evaluation of the features and their associated mitigation determination for the riparian areas are provided in the table below. The evaluation was made from Top of Bank (TOB) out to 200' from each existing or *proposed* feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to proposed Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Credit Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
T1A	Stream @ DWR flag	No	Forested pasture actively grazed by cattle	Yes[4]	Yes *(non-forested areas only)*	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T1	Stream	Yes	Forested & Non-forested pasture actively grazed by cattle	Yes[4]	Yes *(non-forested areas only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
Sassarixa Creek (R2-R3)	Stream	Yes	Forested pasture grazed by cattle	Yes[4]	No	**Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6) No cattle observed in riparian areas below R-3 (see map)

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to proposed Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Credit Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
T2 Pond	Pond (not in line)	No	Agriculture	No	No	N/A
T2 (inside woodline)	Stream	Yes	*(starts in the woodline)* Forested pasture grazed by cattle	Yes[4]	No	**Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T3 (R1)	Ditch	No	Left Bank – Hay crop fields Right Bank – Non-forested pasture grazed by cattle	No	Yes	Restoration Site per 15A NCAC 02B .0295 (n)
T3 (R2)	Ephemeral	No	Left Bank- hay crop fields and forest Right Bank – a narrow fringe of forested areas; fields are actively grazed by cattle.	*Yes[3,5]	Yes *(non-forested areas only)*	**Forested Areas** - Preservation Site per 15A NCAC 02B .0295 (o)(7) **Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(7) **Must meet additional requirements under .0295 (o)(7) to be viable for buffer mitigation*
T3 (R3)	Stream	Yes	Forested, no cattle present	Yes[3]	No	Preservation Site per 15A NCAC 02B .0295 (o)(5)
T4 (R1)	Stream	Yes	Partial canopy forested pasture actively grazed by cattle	Yes[4]	Yes	**Buffer Mitigation** – Enhancement Site per 15A NCAC 02B .0295 (o) (6) **Nutrient Offset** – Enhancement Site per 15A NCAC 02B .0295 (n) *(planting required)*
T4 (R2)	Stream	Yes	Partial canopy forested pasture actively grazed by cattle	Yes[4]	Yes	**Buffer Mitigation** – Enhancement Site per 15A NCAC 02B .0295 (o) (6) **Nutrient Offset** – Enhancement Site per 15A NCAC 02B .0295 (n) *(planting required)*
T4 (R3)	Wetland/ Inconsistent channelization	No	Forested	No	No	N/A
T5 (R1)	Stream	Yes	Full-canopy forested pasture actively grazed by cattle	Yes[4]	No	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5 (R2-R3)	Stream	Yes	Right Bank- Forested Left Bank- mostly forested with a crop field	Yes[3]	Yes *(field only)*	**Forested Areas** - Preservation Site per 15A NCAC 02B (o)(5) **Fields** - Restoration Site per 15A NCAC 02B .0295 (n)

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to proposed Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Credit Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
T5A	Stream	No	Full-canopy forested pasture actively grazed by cattle with adjacent ag fields	Yes[4]	No	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5A Wetland (see map)	Wetland *(impacts from cattle in T5 stream resulted in a wetland)*	No	Full-canopy forested pasture actively grazed by cattle	(see note)	No	Mitigation Note: Proposing stream restoration to reconnect T5A stream throughout. If stream restoration is approved by the IRT and a stream channel is constructed, then the new riparian areas will be viable as an Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5B	Stream	Yes	Full-canopy forested pasture actively grazed by cattle	Yes[4]	No	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5C	Headwater Stream/ Wetland complex	No	Full canopy forested pasture surrounded by agriculture fields	*Yes *(fields only)*	No	**Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(2) **Must be approved by the IRT as a Coastal Headwater Stream Mitigation Site to be viable for credit.*
T6	Stream	Yes	Combination of forested pasture and agriculture fields	Yes[4]	Yes *(field only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated April 5, 2018 and April 6, 2018 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS.

[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*

[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation only site to comply with this rule.

[4]The area described as an Enhancement Site was assessed and determined to comply with all of 15A NCAC 02B .0295(o)(6).

[5]The area of the mitigation site on ephemeral channel shall comprise no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 02B .0295 (o)(7).

Maps that are attached to this letter were provided by WEI and were initialed by Ms. Merritt on May 21, 2018. This letter should be provided in all stream, wetland, buffer and/or nutrient offset mitigation plans for this Site.

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on May 21, 2020 or upon the submittal of an As-Built Report to the DWR, whichever comes first. Please contact Katie Merritt at (919)-807-6371 if you have any questions regarding this correspondence.

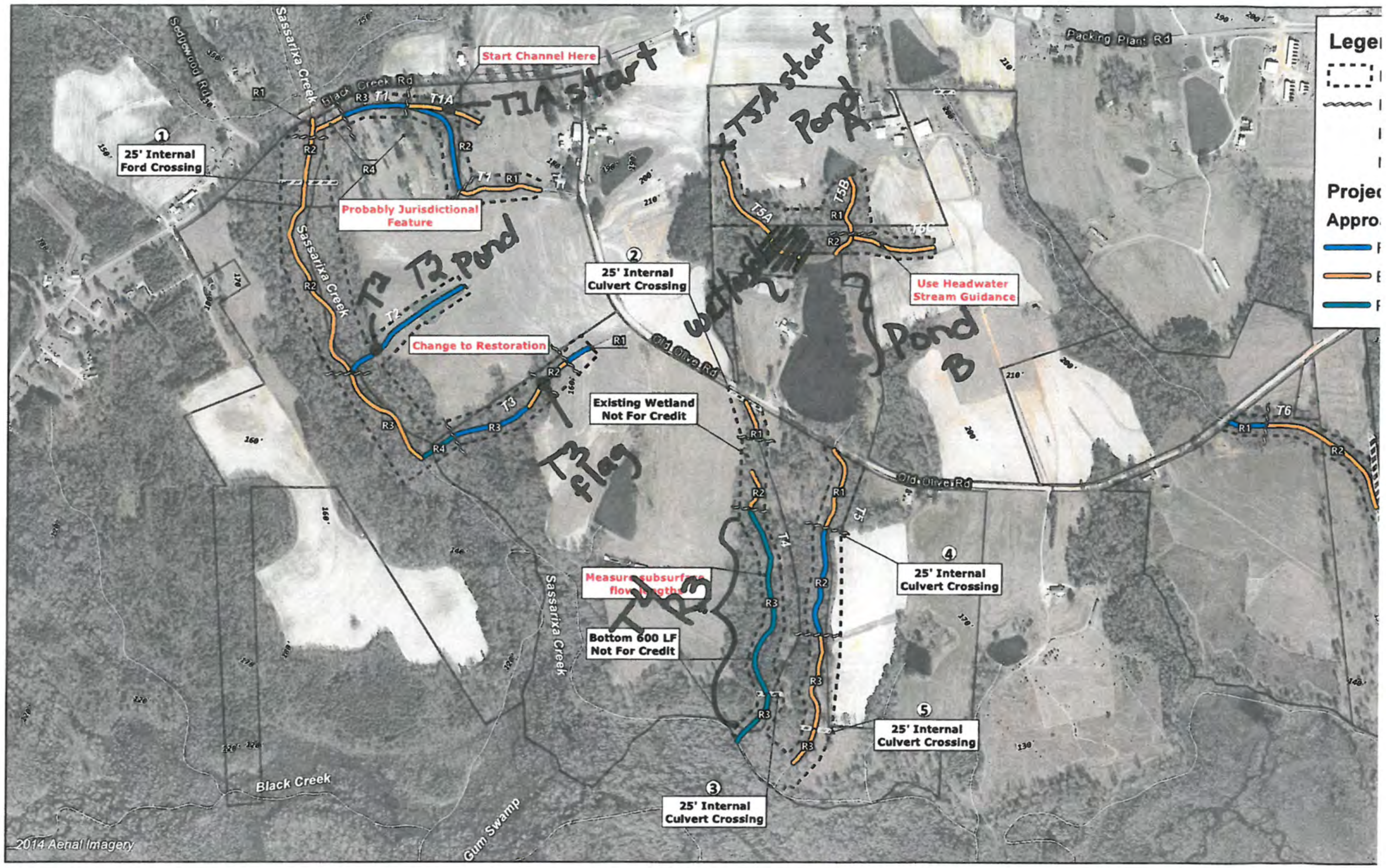
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Figure 6A

cc: File Copy (Katie Merritt)
DMS – Jeff Schaffer (via electronic mail)



WILDLANDS ENGINEERING

DWR#-2018-0198
KYM 4/4/18
(stream determination)

KYM
5/21/2018

0 300 600 Feet

Figure 6A

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

April 3, 2019

Angela Allen
Wildlands Engineering, Inc.
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: aallen@wildlandseng.com)

DWR ID# 2018-0198
Johnston County

Re: Site Viability for Buffer Mitigation and Nutrient Offset & Buffer- Sassarixa Swamp (T1)
2-162 Olive Rd, Smithfield, NC
Neuse 03020201 (not in Falls WS)

Dear Ms. Allen,

On February 20, 2019, Katie Merritt, with the Division of Water Resources (DWR), received a request from you on behalf of Wildlands Engineering, Inc (WEI) to evaluate the potential for riparian buffer mitigation and nutrient offset on two additional features on the subject site. Features labeled T1B and T1C on the attached map labeled "Figure 3a Site Map" were evaluated by Sam Dailey with the US Army Corps of Engineers in March 2019 and these features were determined to be at least intermittent channels. The Site is also being proposed as part of a full-delivery stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007279).

Ms. Merritt's evaluation of the features and their associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) and landward 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
T1B	Stream	No	Combination of forested and non-forested pasture actively grazed by cattle	[4]Yes	Yes *(non-forested areas only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(3) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T1C	Stream	No	Forested pasture actively grazed by cattle; ag fields at the upstream portion	[4]Yes	Yes *(ag fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(3) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated March 21, 2019 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS .
[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*
[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation Only site to comply with this rule.
[4]The area described as an Enhancement Site was assessed and determined to comply with all 15A NCAC 02B .0295(o)(6). Cattle exclusion fencing is required to be installed around the mitigation area to get buffer credit under this part of the rule.
[5]The area of the mitigation site on ephemeral channels shall comprise no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 02B .0295 (o)(7). Cattle exclusion fencing is required to be installed around the mitigation area to get buffer credit under this part of the rule.

Maps that are attached to this letter were prepared by WEI and initialed by Ms. Merritt on April 3, 2019. **This letter should be provided in all stream and wetland, buffer and/or nutrient offset mitigation plans for this Site.**

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on April 3, 2021 or upon the submittal of an As-Built Report to the DWR, whichever comes first. This letter should be provided in all stream, wetland or buffer mitigation plans for this Site.

Please contact Katie Merritt at (919) 707-3637 if you have any questions regarding this correspondence.

Sincerely,

Chonticha McDaniel

for Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Figure 3a

cc: File Copy (Katie Merritt)

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

October 28, 2019

Angela Allen
Wildlands Engineering, Inc.
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: aallen@wildlandseng.com)

DWR ID# 2018-0198
Johnston County

Re: Site Viability for Buffer Mitigation and Nutrient Offset & Buffer- Sassarixa Swamp
Re-evaluation of T4-Reach 3
2-162 Olive Rd, Smithfield, NC
Neuse 03020201 (not in Falls WS)

Dear Ms. Allen,

On April 4, 2018 and May 21, 2018, the Division of Water Resources (DWR) issued a stream/buffer determination letter and Site Viability letter respectively, for the subject site. On October 15, 2019, DWR received a stream determination appeal request from Wildlands Engineering, Inc (Wildlands) requesting that a feature labeled T4-R3 on the subject site be re-evaluated based on a preliminary Jurisdictional Determination (JD) by the USACE showing the feature to be a perennial stream and not a linear wetland. In support of this JD, DWR issued a revised stream /buffer determination letter on October 28, 2019. T4-R3 and its riparian areas are also being proposed as part of a full-delivery stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007279).

On October 15, 2019, DWR also received a request from Wildlands to re-evaluate the potential for riparian buffer mitigation and nutrient offset along T4-R3 based on the JD by USACE.

DWR's evaluation of T4-R3 and its associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) and landward 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240. ***This evaluation replaces the evaluation made on T4-R3 issued on May 21, 2018.***

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
T4 (R3)	Stream (see map)	Yes	Forested	[3]Yes	No	Preservation Site per 15A NCAC 02B .0295 (o)(5)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated October 28, 2019 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS .
[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*
[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation Only site to comply with this rule.

The map that is attached to this letter was prepared by Wildlands. **This letter should be provided in all stream and wetland, buffer and/or nutrient offset mitigation plans for this Site.**

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on April 3, 2021 or upon the submittal of an As-Built Report to the DWR, whichever comes first. This letter should be provided in all stream, wetland or buffer mitigation plans for this Site.

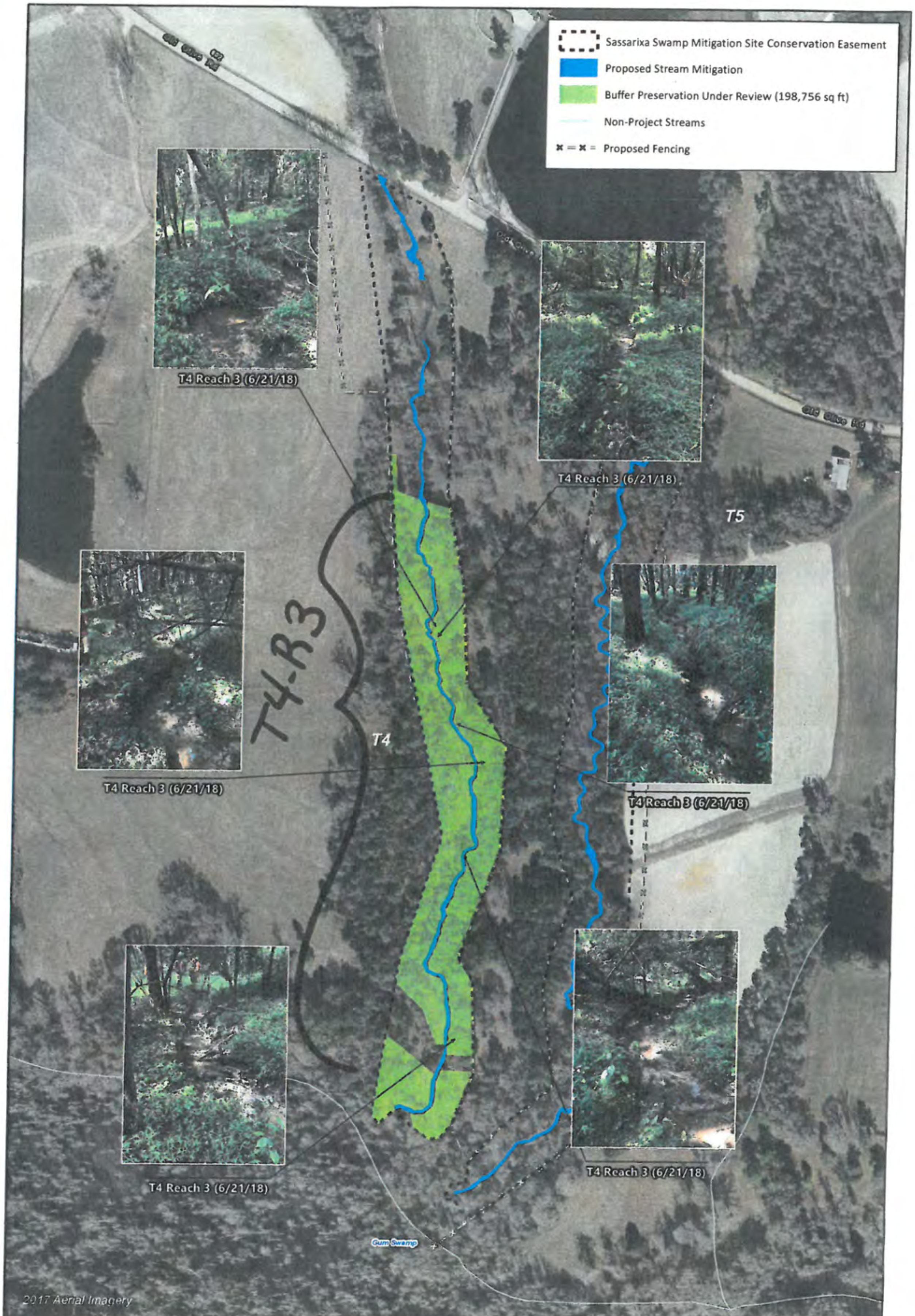
Please contact Katie Merritt at (919) 707-3637 if you have any questions regarding this correspondence.

Sincerely,

Mac Haupt, Acting Supervisor
401 and Buffer Permitting Branch

MH/*km*
Attachments: Figure 1. Reclassification of T4 Reach 3 map

cc: File Copy (Katie Merritt)



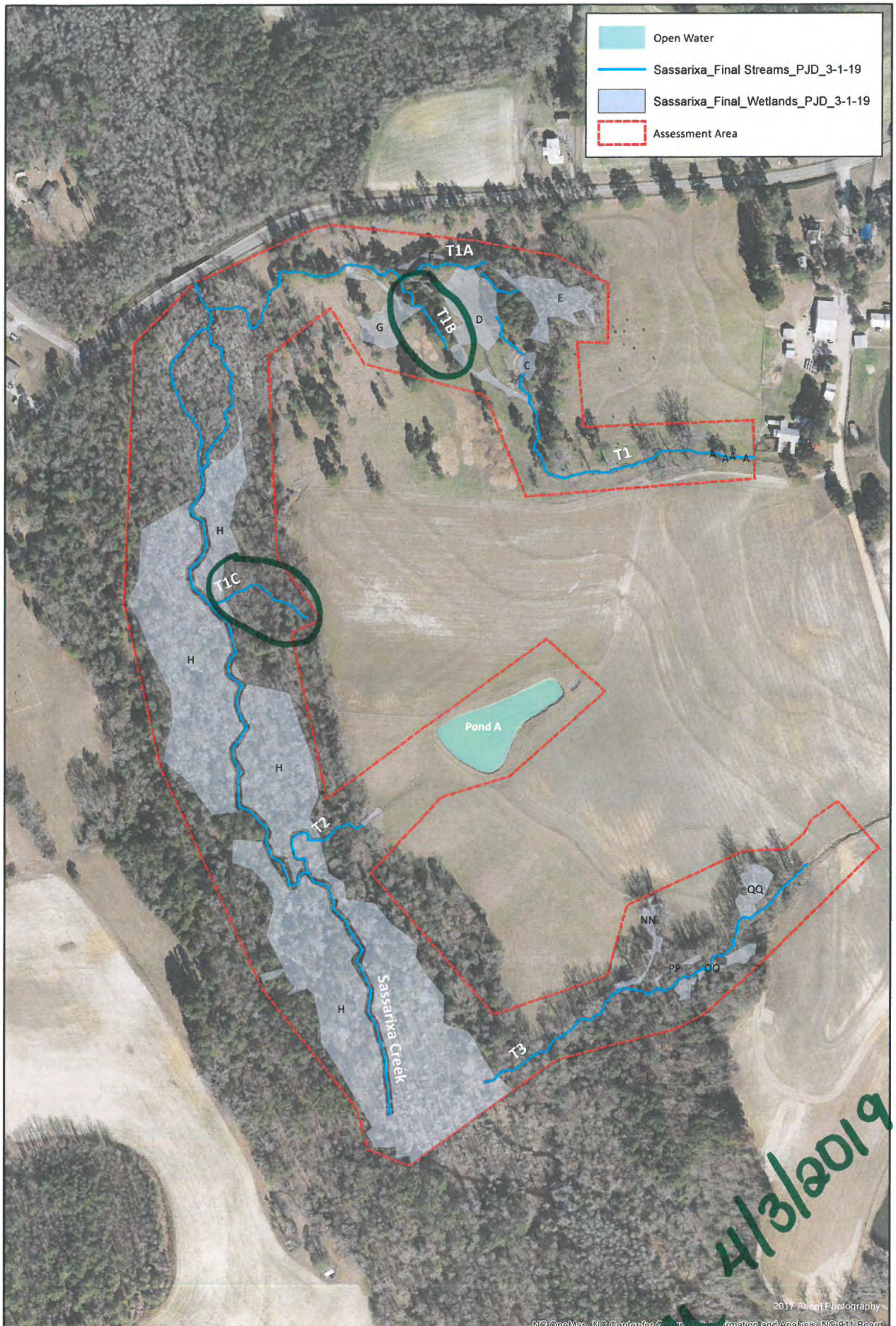
WILDLANDS ENGINEERING

KM 10/28/19

0 200 400 Feet

Figure 1. Reclassification of T4 Reach 3 Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

0 112.5 225 Feet

Figure 3a Site Map - Sheet 1
Sassarixa Swamp Mitigation Site
Neuse River Basin (03020201)

Johnston County, NC

Appendix 2

Site Protection Instrument

1.0 Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the parcels listed in Table 1. A conservation easement will be recorded on the parcels and includes streams being restored along with their corresponding riparian buffers. Easement Plats will be reported with the Final Mitigation Plan.

Table 1: Site Protection Instrument – *Sassarixa Swamp Mitigation Site*

Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage to be Protected
Hunter E. Olive Janie E. Olive	166200-58-6572 166200-59-2333	Johnston	Conservation Easement	DB: 3624 PG: 581	23.32
Junes Jones Olive Revocable Trust	166200-88-5084 166200-85-0452	Johnston	Conservation Easement	DB: 3719 PG: 717	14.56
Junes Jones Olive Revocable Trust Hunter E. Oliver	166200-57-0481 167200-17-2303	Johnston	Conservation Easement	DB: 3719 PG: 717	35.81
Mary Hunter Olive-Waller Todd Franklin Waller Amanda J. Olive	166200-49-5125	Johnston	Conservation Easement	DB: 4358 PG: 908	1.52
Tami Olive Thompson David Thompson Junes Jones Olive Revocable Trust	166200-66-6896	Johnston	Conservation Easement	DB: 3719 PG: 717	5.53
Matthew T. Keen	167200-06-5717	Johnston	Conservation Easement	DB: 4606 PG: 183	2.05
Tami Olive Thompson	166200-79-8148	Johnston	Conservation Easement	DB: 3719 PG: 717	2.95

All site protection instruments require 60-day advance notification to the USACE and or DMS prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

Appendix 3

Approved JD and Supporting USACE Assessment Forms

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2018-00432** County: **JOHNSTON** U.S.G.S. Quad: **FOUR OAKS**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Requestor: **Wildlands Engineering, Inc.**
Mr. Charlie Neaves
Address: **312 West Millbrook**
Raleigh, North Carolina 27609

Size (acres)	**~83**	Nearest Town	**Smithfield**
Nearest Waterway	**Black Creek**	River Basin	**Neuse River**
USGS HUC	**03020201**	Coordinates	Latitude: **35.473294** Longitude: **-78.437318**

Location description: **The project area is identified as an approximate 83 acre tract of land, located at 160 Old Olive Road, Smithfield, Johnston County, North Carolina. Waters on-site drain into Sassarixa Creek and Black Creek; both are within the Neuse River watershed (8-digit HUC: 03020201).**

Indicate Which of the Following Apply:

A. Preliminary Determination

X There are waters, including wetlands, on the above described project area, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The waters, including wetlands, have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

_ There are wetlands on the above described property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the waters, including wetlands, have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the waters, including wetlands, at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the waters of the U.S. on your property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

B. Approved Determination

_ There are Navigable Waters of the United States within the above described property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are waters of the U.S., including wetlands, on the above described project area subject to the permit requirements of Section 404 of the Clean Water Act (CWA) (33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ We recommend you have the waters of the U.S. on your property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

_ The waters of the U.S., including wetlands, on your project area have been delineated and the delineation has been verified by the Corps. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

_ The waters of the U.S., including wetlands, have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on ______________. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ There are no waters of the U.S., to include wetlands, present on the above described project area which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

_ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in Morehead City, NC, at (252) 808-2808 to determine their requirements.

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Ms. Samantha Dailey at 919-554-4884, ext. 22 or by email at Samantha.J.Dailey@usace.army.mil**.

C. Basis For Determination: **N/A. An Approved JD has not been completed.**

D. Remarks: Refer to the enclosed Preliminary JD Form and Figures 3, 3a, 3b, and 3c for a detailed evaluation of the aquatic resources on-site.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information for Approved Jurisdiction Determinations (as indicated in Section B. above)

If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Jason Steele, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by___________.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: DAILEY.SAMANTHA.J.1387567948 Digitally signed by DAILEY.SAMANTHA.J.1387567948 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=DAILEY.SAMANTHA.J.1387567948 Date: 2019.03.22 11:27:23 -04'00'

Date: **March 22, 2019** Expiration Date: **N/A**

The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete our Customer Satisfaction Survey, located online at http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0.

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Wildlands Engineering, Inc.**	File Number: **SAW-2018-00432**	Date: **March 22, 2019**
Attached is:		See Section below
☐ INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
☐ PROFFERED PERMIT (Standard Permit or Letter of permission)		B
☐ PERMIT DENIAL		C
☐ APPROVED JURISDICTIONAL DETERMINATION		D
☒ PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact: **District Engineer, Wilmington Regulatory Division** **Raleigh Regulatory Field Office** **Attn: Samantha Dailey** **3331 Heritage Trade Drive, Suite 105** **Wake Forest, North Carolina 27587**	If you only have questions regarding the appeal process you may also contact: Mr. Jason Steele, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

____________________________________ Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, Attn: #PM_FULLNAME#, 69 Darlington Avenue, Wilmington, North Carolina 28403

For Permit denials, Proffered Permits and approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Jason Steele, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

APPENDIX 2

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): March 22, 2019

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

Requestor: **Wildlands Engineering, Inc.**
Mr. Charlie Neaves
Address: **312 West Millbrook**
Raleigh, North Carolina 27609

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington, Sassarixa Swamp DMS Site, Wildlands Engineering, Inc., Johnston County, SAW-2018-00432

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)
State: **NC** County/parish/borough: **Johnston County** City: **Smithfield**
Center coordinates of site (lat/long in degree decimal format): Lat. **35.473294°N**, Long. **-78.437318° W**.
Universal Transverse Mercator:
Name of nearest water body: **Neuse River (8-digit HUC: 03020201)**

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLIES):
☒ Office (Desk) Determination. Date: **March 22, 2019**
☒ Field Determination. Date(s): **February 28, 2019**

1. The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7)whether the applicant elects to use either an AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply): Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor: **Wildlands Engineering, Inc. submitted a Jurisdictional Determination Request on December 3, 2018, with revisions received on March 21, 2019.**
☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.
  ☒ Office concurs with data sheets/delineation report.
  ☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
  ☐ USGS NHD data.
  ☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name: **1:24K, NC-Four Oaks**
☒ USDA Natural Resources Conservation Service Soil Survey. Citation: **Web Soil Survey: February 2018**.
☒ National wetlands inventory map(s). Cite name: **Corps of Engineers SimSuite – February 2018**.
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date): .
  or ☐ Other (Name & Date): .
☐ Previous determination(s). File no. and date of response letter: .
☐ Other information (please specify): .

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

DAILEY.SAMANTHA.J.1387567948

Digitally signed by DAILEY.SAMANTHA.J.1387567948
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=DAILEY.SAMANTHA.J.1387567948
Date: 2019.03.22 11:24:14 -04'00'

Signature and date of Regulatory Project Manager (REQUIRED)	Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is Impracticable)

[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.

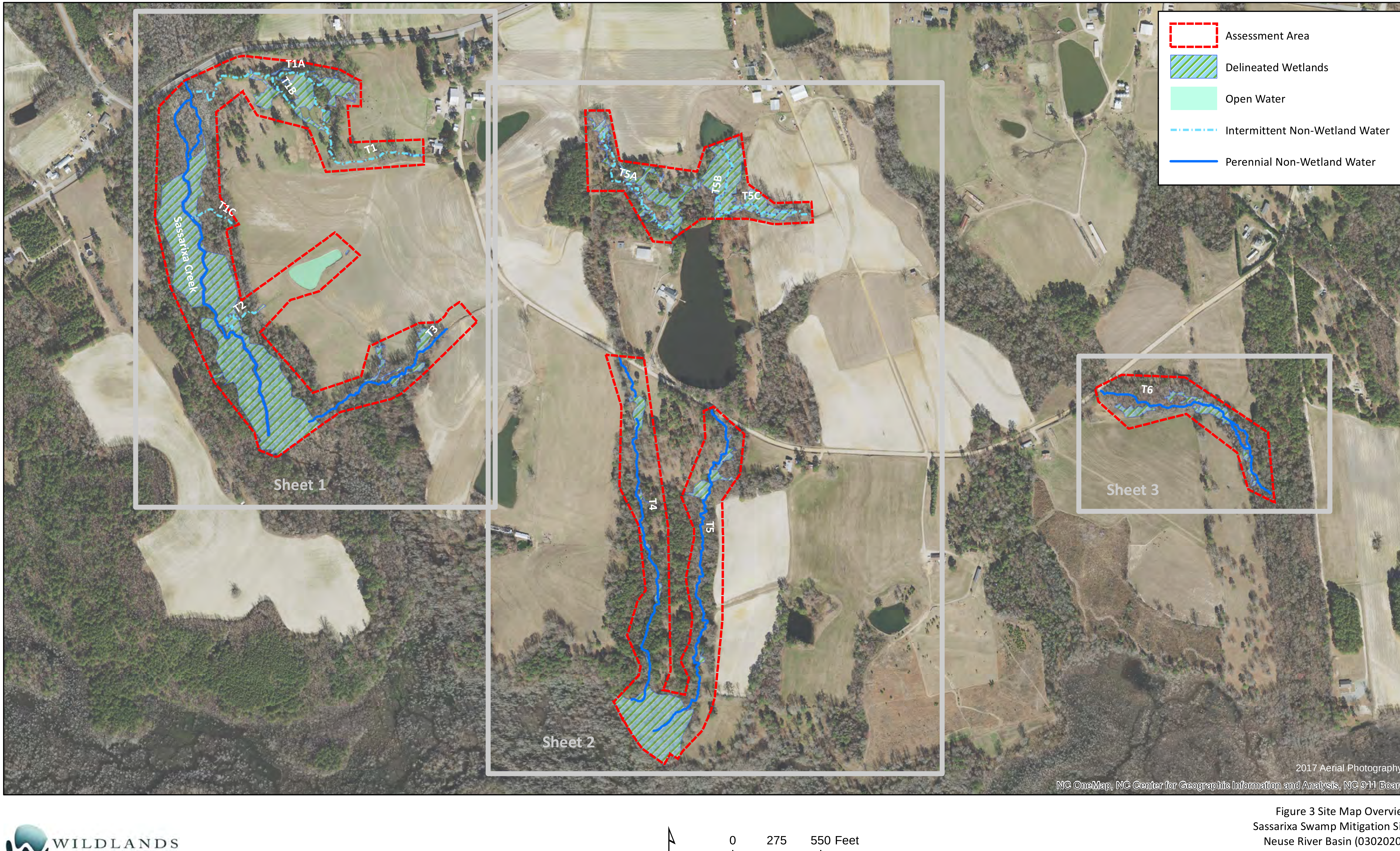
Table 1. Summary of On-Site Jurisdictional Waters

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Sassarixa Creek	35.475377	-78.446255	Riverine-Unconsolidated Bottom	3142	Perennial Non-Wetland Waters of the US
T1	35.477619	-78.443646	Riverine-Streambed	1731	Intermittent Non-Wetland Waters of the US
T1A	35.478594	-78.444288	Riverine-Streambed	384	Intermittent Non-Wetland Waters of the US
T1B	35.478424	-78.444761	Riverine-Streambed	259	Intermittent Non-Wetland Waters of the US
T1C	35.476262	-78.44093	Riverine-Streambed	307	Intermittent Non-Wetland Waters of the US
T2	35.474431	-78.445631	Riverine-Streambed	354	Intermittent Non-Wetland Waters of the US
T3	35.473283	-78.442523	Riverine-Unconsolidated Bottom	1190	Perennial Non-Wetland Waters of the US
T4	35.47037	-78.436943	Riverine-Unconsolidated Bottom	2319	Perennial Non-Wetland Waters of the US
T5	35.469702	-78.435939	Riverine-Unconsolidated Bottom	2606	Perennial Non-Wetland Waters of the US
T5A	35.476707	-78.437547	Riverine-Streambed	956	Intermittent Non-Wetland Waters of the US
T5B	35.47674	-78.435242	Riverine-Streambed	553	Intermittent Non-Wetland Waters of the US
T5C	35.476133	-78.43458	Riverine-Streambed	706	Intermittent Non-Wetland Waters of the US
T6	35.472774	-78.425131	Riverine-Unconsolidated Bottom	1750	Perennial Non-Wetland Waters of the US

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Wetland A	35.477202	-78.442021	Palustrine-Emergent	0.018	Non-Section 10 Wetland
Wetland C	35.477833	-78.443679	Palustrine-Emergent	0.066	Non-Section 10 Wetland
Wetland D	35.478356	-78.444258	Palustrine-Emergent	0.710	Non-Section 10 Wetland
Wetland E	35.478495	-78.443599	Palustrine-Forested	0.476	Non-Section 10 Wetland
Wetland F	35.478670	-78.444729	Palustrine-Emergent	0.030	Non-Section 10 Wetland
Wetland G	35.478095	-78.444905	Palustrine-Emergent	0.348	Non-Section 10 Wetland
Wetland H	35.445762	-79.445763	Palustrine-Forested	11.074	Non-Section 10 Wetland
Wetland I	35.471473	-78.424226	Palustrine-Forested	0.049	Non-Section 10 Wetland
Wetland J	35.472610	-78.424949	Palustrine-Forested	0.331	Non-Section 10 Wetland
Wetland K	35.472610	-78.424949	Palustrine-Forested	0.234	Non-Section 10 Wetland
Wetland L	35.472717	-78.426815	Palustrine-Forested	0.237	Non-Section 10 Wetland
Wetland M	35.472836	-78.437100	Palustrine-Emergent	0.285	Non-Section 10 Wetland
Wetland N	35.471325	-78.437110	Palustrine-Forested	0.031	Non-Section 10 Wetland
Wetland O	35.470409	-78.436950	Palustrine-Forested	0.023	Non-Section 10 Wetland

Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Wetland P	35.470409	-78.436950	Palustrine-Forested	0.057	Non-Section 10 Wetland
Wetland Q	35.468516	-78.436989	Palustrine-Forested	0.014	Non-Section 10 Wetland
Wetland R	35.468496	-78.435843	Palustrine-Forested	0.035	Non-Section 10 Wetland
Wetland S	35.468496	-78.435843	Palustrine-Forested	0.450	Non-Section 10 Wetland
Wetland T	35.468496	-78.435843	Palustrine-Forested	0.009	Non-Section 10 Wetland
Wetland U	35.468496	-78.435843	Palustrine-Forested	0.133	Non-Section 10 Wetland
Wetland V	35.473363	-78.442656	Palustrine-Forested	0.133	Non-Section 10 Wetland
Wetland W	35.473321	-78.442267	Palustrine-Forested	0.139	Non-Section 10 Wetland
Wetland X	35.473321	-78.442267	Palustrine-Forested	0.035	Non-Section 10 Wetland
Wetland Y	35.471325	-78.437110	Palustrine-Forested	0.200	Non-Section 10 Wetland
Wetland Z	35.476783	-78.437307	Palustrine-Forested	1.187	Non-Section 10 Wetland
Wetland AA	35.476783	-78.437307	Palustrine-Forested	0.031	Non-Section 10 Wetland
Wetland BB	35.476783	-78.437307	Palustrine-Forested	0.043	Non-Section 10 Wetland
Wetland CC	35.477589	-78.437893	Palustrine-Forested	0.191	Non-Section 10 Wetland

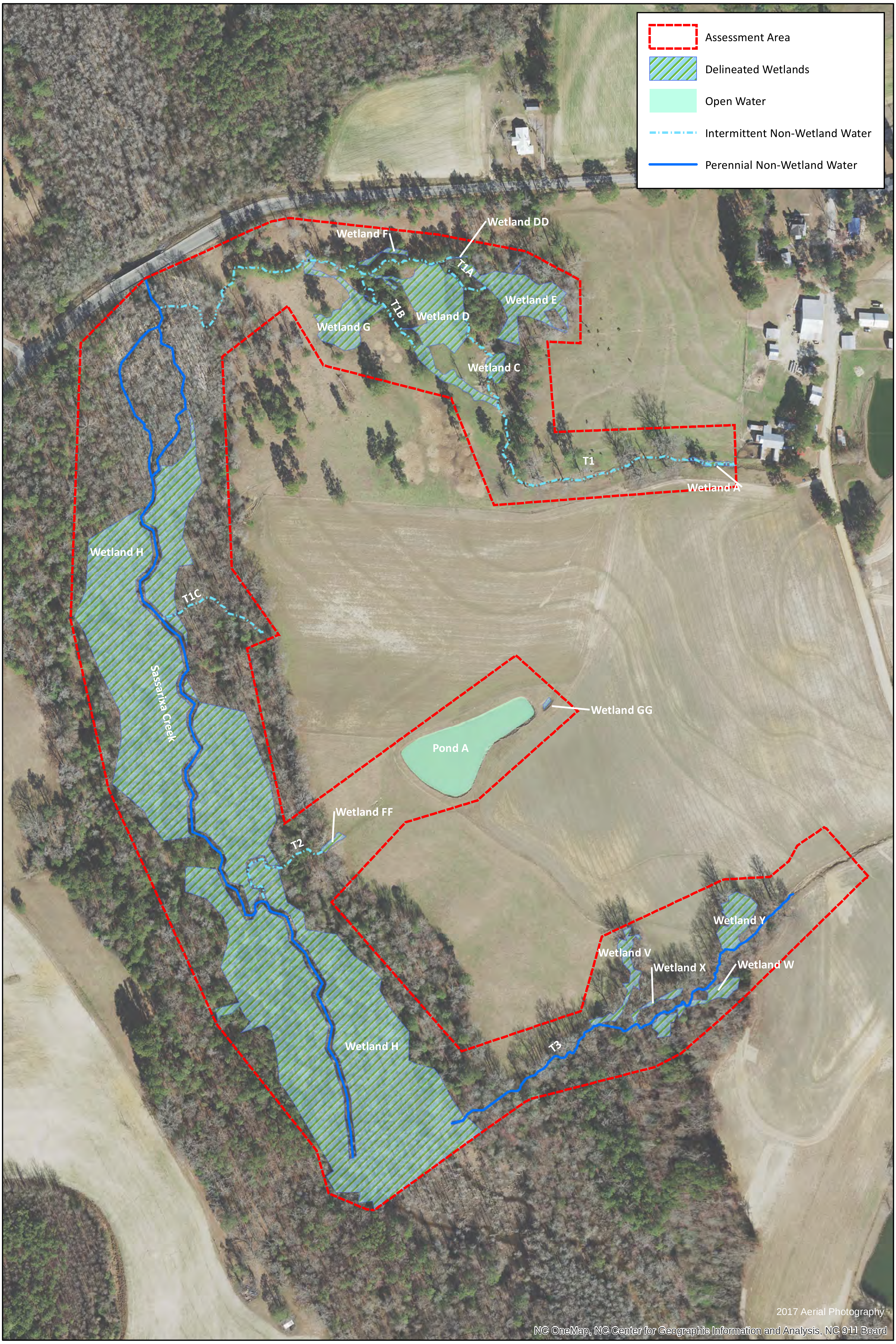
Feature	Latitude	Longitude	Cowardin Class	Estimated Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
Wetland DD	35.478616	-78.443947	Palustrine-Forested	0.003	Non-Section 10 Wetland
Wetland FF	35.474567	-78.445068	Palustrine-Emergent	0.022	Non-Section 10 Wetland
Wetland GG	35.475520	-78.443236	Palustrine-Emergent	0.005	Non-Section 10 Wetland
Wetland HH	35.476782	-78.435273	Palustrine-Forested	2.391	Non-Section 10 Wetland
Wetland II	35.467781	-78.436896	Palustrine-Forested	3.091	Non-Section 10 Wetland
Pond A	35.475248	-78.443940	Lacustrine-Limnetic	0.862	Non-Section 10 Wetland



WILDLANDS ENGINEERING

Figure 3 Site Map Overview
Sassarixa Swamp Mitigation Site
Neuse River Basin (03020201)

Johnston County, NC



WILDLANDS ENGINEERING

Figure 3a Site Map - Sheet 1
Sassarixa Swamp Mitigation Site
Neuse River Basin (03020201)

Johnston County, NC

WILDLANDS ENGINEERING

Figure 3b Site Map - Sheet 2
Sassarixa Swamp Mitigation Site
Neuse River Basin (03020201)

Johnston County, NC

WILDLANDS ENGINEERING

N

0 50 100 Feet

Figure 3c Site Map - Sheet 3
Sassarixa Swamp Mitigation Site
Neuse River Basin (03020201)

Johnston County, NC

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland A- DP 1

Investigator(s): C. Neaves Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.477162 Long: W 78.441764 Datum:

Soil Map Unit Name: Cowart sandy loam (Cob) NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ✓ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐	
Wetland Hydrology Present?	Yes ✓ No ☐	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓	No ☐	Depth (inches): 0
Water Table Present?	Yes ✓	No ☐	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Bench along stream channel.

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland A - DP 1

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Polygonum lapathifolium	70	Yes	FACW
2. Juncus effusus	10	No	OBL
3. Eupatorium capillifolium	5	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	85 = Total Cover		
50% of total cover:	42.5	20% of total cover:	17

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes [x] No [ ]

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland A - DP 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 6/2	90	10 YR 6/6	10	C	PL	S	
3-12+	2.5 YR 4/1	95	7.5 YR 5/6	5	C	PL	SL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☑ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland B - DP 2

Investigator(s): C. Neaves Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1%

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.477172 Long: W 78.442475 Datum:

Soil Map Unit Name: Cowart sandy loam (CoB) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ✓ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☐	Is the Sampled Area within a Wetland?	Yes ✓ No ☐
Hydric Soil Present?	Yes ✓	No ☐		
Wetland Hydrology Present?	Yes ✓	No ☐		

Remarks:

Man-made depression adjacent to stream channel.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓	No ☐	Depth (inches): 0
Water Table Present?	Yes ✓	No ☐	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland B - DP 2

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 5')			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? **Yes** ☐ **No** ☐

Remarks: (If observed, list morphological adaptations below).

No vegetation present

SOIL

Sampling Point: Wetland B - DP 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 5/1	70	10YR 7/6	30	C	M	SL	
4-12+	2.5YR 4/1	75	5YR 4/6	25	C	PL	L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland C - DP 3

Investigator(s): C. Neaves Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <1%

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.477835 Long: W 78.443692 Datum: ______

Soil Map Unit Name: Cowart Sandy Loam (CoB) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ✓ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐	
Wetland Hydrology Present?	Yes ✓ No ☐	

Remarks:

Man-made impoundment of stream. Dam has breached.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 0	
Water Table Present?	Yes ✓ No ☐	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): 0	**Wetland Hydrology Present? Yes ✓ No ☐**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland C - DP 3

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Persicaria Lapathifolium	50	Yes	FACW
2. Ranunculus bulbosus	10	No	FAC
3. Juncus effusus	5	No	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	65 = Total Cover		
50% of total cover:	32.5	20% of total cover:	13

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland C - DP 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/1	70	10 YR 6/3	30	C	M	LS	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☑ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland D/DD/EE - DP 4

Investigator(s): C. Neaves Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.478304 Long: W 78.444135 Datum: ______

Soil Map Unit Name: Bibb sandy loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ✓ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	**Is the Sampled Area within a Wetland?**	**Yes** ✓ **No** ☐
Hydric Soil Present?	Yes ✓ No ☐		
Wetland Hydrology Present?	Yes ✓ No ☐		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

✓ Surface Water (A1)	☐ Aquatic Fauna (B13)
✓ High Water Table (A2)	☐ Marl Deposits (B15) **(LRR U)**
✓ Saturation (A3)	☐ Hydrogen Sulfide Odor (C1)
☐ Water Marks (B1)	✓ Oxidized Rhizospheres along Living Roots (C3)
☐ Sediment Deposits (B2)	✓ Presence of Reduced Iron (C4)
☐ Drift Deposits (B3)	☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Algal Mat or Crust (B4)	☐ Thin Muck Surface (C7)
☐ Iron Deposits (B5)	☐ Other (Explain in Remarks)
☐ Inundation Visible on Aerial Imagery (B7)	
☐ Water-Stained Leaves (B9)	

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 0	
Water Table Present?	Yes ✓ No ☐	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): 0	**Wetland Hydrology Present? Yes** ☐ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland D/DD/EE - DP 4

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Persicaria lapathifolium	65	FACW	Yes
2. Ranunculus bulbosus	15	FAC	N
3. Juncus effusus	5	OBL	No
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	85		

50% of total cover: 42.5 20% of total cover: 17

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
= Total Cover			

50% of total cover: ____ 20% of total cover: ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Wetland D/DD/EE - DP 4

Sampling Point: ____________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth	Matrix		Redox Features				Texture	Remarks
(inches)	Color (moist)	%	Color (moist)	%	Type[1]	Loc[2]		
0-8	2.5Y 4/1	85	5YR 4/6	15	C	PL	SiL	
8-12+	2.5Y 4/1	60	7.5YR 6/6	40	C	M	SL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________________

Depth (inches): ____________________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland E - DP 5

Investigator(s): C. Neaves Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Hill Slope Local relief (concave, convex, none): none Slope (%): 3

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.478280 Long: W 78.443515 Datum: ______

Soil Map Unit Name: Cowarts Loamy Sand (CoB) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ✓ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐	
Wetland Hydrology Present?	Yes ✓ No ☐	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 0	
Water Table Present?	Yes ✓ No ☐	Depth (inches): 0	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): 0	**Wetland Hydrology Present? Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland E - DP 5

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	65	Yes	OBL
2. Liriodendron tulipifera	20	Yes	FACU
3.			
4.			
5.			
6.			
	85 = Total Cover		
50% of total cover: 42.5	20% of total cover: 17		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Persea borbonia	5	Yes	FACW
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60 = Total Cover		
50% of total cover: 30	20% of total cover: 12		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes [x] No [ ]

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland E - DP 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1	100					Mucky L	
4-12	10YR 6/1	100					S	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [x] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ✓ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland F- DP 6

Investigator(s): C. Neaves Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): <2

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.478607 Long: W 78.444722 Datum: ______

Soil Map Unit Name: Bibb sandy loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ✓ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland?	Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐		
Wetland Hydrology Present?	Yes ✓ No ☐		

Remarks:

Hydrology altered by cattle and stream incision.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ✓ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ✓ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☐	No ✓	Depth (inches):
Water Table Present?	Yes ✓	No ☐	Depth (inches): 4
Saturation Present? (includes capillary fringe)	Yes ✓	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland F - DP 6

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

50% of total cover: ________ 20% of total cover: ________

Sapling Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

50% of total cover: ________ 20% of total cover: ________

Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	

50% of total cover: ________ 20% of total cover: ________

Herb Stratum (Plot size: 5')			
1. Carex comcosa	70	Yes	OBL
2. Boehmeria cylindrica	10	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80	= Total Cover	

50% of total cover: 40 20% of total cover: 16

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
		= Total Cover	

50% of total cover: ________ 20% of total cover: ________

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ________

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland F - DP 6

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12+	2.5Y4/1	90	5YR 4/6	10	C	PL	L	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/30/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland G - DP 7

Investigator(s): C. Neaves Section, Township, Range:

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.478197 Long: W 78.444888 Datum:

Soil Map Unit Name: Cowart sandy loam (CoB) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ☐
Hydric Soil Present?	Yes ✓	No ☐
Wetland Hydrology Present?	Yes ✓	No ☐

Is the Sampled Area within a Wetland? **Yes** ✓ **No** ☐

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ✓ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓	No ☐	Depth (inches): 0
Water Table Present?	Yes ✓	No ☐	Depth (inches): 0
Saturation Present? (includes capillary fringe)	Yes ✓	No ☐	Depth (inches): 0

Wetland Hydrology Present? **Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland G - DP 7

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex comcosa	50	Yes	OBL
2. Persecaria lapathifolia	30	Yes	FACW
3. Ranunculus bulbosus	10	No	FAC
4. Juncus effusus	10	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100	= Total Cover	
50% of total cover:	20	20% of total cover:	20

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
		= Total Cover	
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland G - DP 7

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 3/2	100					SiL	
3-6	10 YR 6/1	90	7.5 YR 5/8	10	C	PL	SL	
6-12+	10 YR 7/2	70	7.5 YR 6/8	30	C	PL,M	SCL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: 5/29/18

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Upland - DP 8

Investigator(s): C. Neaves Section, Township, Range: ____

Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): convex Slope (%): 3

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.477481 Long: W 78.443742 Datum: ____

Soil Map Unit Name: Bibb sandy loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ✓ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	☐	✓
Hydric Soil Present?	☐	☐
Wetland Hydrology Present?	☐	✓

Is the Sampled Area within a Wetland? **Yes** ☐ **No** ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	☐	☐	
Water Table Present?	☐	☐	
Saturation Present? (includes capillary fringe)	☐	☐	

Wetland Hydrology Present? **Yes** ☐ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Upland - DP 8

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Cynodon dactylon	90	Yes	FACU
2. Amaranthus hybridus	5	No	UPL
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☐ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Upland - DP 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	10 YR 3/3						SL	
3-7	10 YR 5/4		7.5 YR 6/6	10			S	
7-12+	10 YR 6/6						S	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Four Oaks/Johnston Sampling Date: ______

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland H - DP 9

Investigator(s): C. Neaves Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): none Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.475029 Long: W 78.445762 Datum: ______

Soil Map Unit Name: Bibb sandy loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☑ Soil ☑ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland?	**Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☐ Surface Water (A1)	☐ Aquatic Fauna (B13)	
☑ High Water Table (A2)	☐ Marl Deposits (B15) **(LRR U)**	
☑ Saturation (A3)	☐ Hydrogen Sulfide Odor (C1)	
☐ Water Marks (B1)	☐ Oxidized Rhizospheres along Living Roots (C3)	
☐ Sediment Deposits (B2)	☐ Presence of Reduced Iron (C4)	
☐ Drift Deposits (B3)	☐ Recent Iron Reduction in Tilled Soils (C6)	
☐ Algal Mat or Crust (B4)	☐ Thin Muck Surface (C7)	
☐ Iron Deposits (B5)	☐ Other (Explain in Remarks)	
☐ Inundation Visible on Aerial Imagery (B7)		
☑ Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):
Water Table Present?	Yes ☑	No ☐	Depth (inches): 6
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): 4

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland H - DP 9

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	40	Yes	OBL
2. Acer rubrum	40	Yes	FAC
3.			
4.			
5.			
6.			
	80 = Total Cover		

50% of total cover: 40 20% of total cover: 16

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: 20% of total cover:

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	40	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	40 = Total Cover		

50% of total cover: 20 20% of total cover: 8

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	80	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		

50% of total cover: 40 20% of total cover: 16

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: 20% of total cover:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland H - DP 9

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-3	10YR 4/1	95	10YR 4/6	5	C	PL	SiL	
3-12+	10YR 5/1	90	10YR 5/8	10	C	PL	SL	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/29/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland I - DP10

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.471489 Long: W 78.424216 Datum:

Soil Map Unit Name: Bibb Sandy Loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☑ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ☑

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐
Hydric Soil Present?	Yes ☑	No ☐
Wetland Hydrology Present?	Yes ☑	No ☐

Is the Sampled Area within a Wetland? **Yes** ☑ **No** ☐

Remarks:

Vegetation significantly impacted due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches): 0.25
Water Table Present?	Yes ☑	No ☐	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland I - DP10

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	60	Yes	OBL
2. Acer rubrum	15	Yes	FAC
3.			
4.			
5.			
6.			
	75	= Total Cover	
50% of total cover: 37.5	20% of total cover: 15		

Sapling Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	0	= Total Cover	
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 15')			
1. Ligustrum sinense	30	Yes	FAC
2. Persea borbonia	5	No	FACW
3.			
4.			
5.			
6.			
	35	= Total Cover	
50% of total cover: 17.5	20% of total cover: 7		

Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	70	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70	= Total Cover	
50% of total cover: 35	20% of total cover: 14		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland I - DP10

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1	95	10YR 4/6	5	C	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes [x] No [ ]

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/29/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland J/K - DP11

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.472718 Long: W -78.425102 Datum:

Soil Map Unit Name: Bibb Sandy Loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	✓	
Hydric Soil Present?	✓	
Wetland Hydrology Present?	✓	

Is the Sampled Area within a Wetland? Yes ✓ No ☐

Remarks:

Vegetation significantly impacted due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ✓ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	✓		0.25
Water Table Present?	✓		0-12+
Saturation Present? (includes capillary fringe)	✓		0-12+

Wetland Hydrology Present? Yes ✓ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland J/K - DP11

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Salix nigra	25	Yes	OBL
2. Acer rubrum	15	Yes	FAC
3. Quercus phellos	5	No	FACW
4.			
5.			
6.			
	45 = Total Cover		
50% of total cover: 22.5	20% of total cover: 9		
Sapling Stratum (Plot size: 15')			
1. Acer rubrum	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size: 15')			
1. Ligustrum sinense	2	No	FAC
2.			
3.			
4.			
5.			
6.			
	2 = Total Cover		
50% of total cover:	20% of total cover:		
Herb Stratum (Plot size: 5')			
1. Persicaria longiseta	70	Yes	FAC
2. Carex bullata	5	No	OBL
3. Juncus effusus	2	No	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	77 = Total Cover		
50% of total cover: 38.5	20% of total cover: 15.4		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland J/K - DP11

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 3/1	95	10YR 5/6	5	C	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland L - DP12

Investigator(s): W. Taylor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.472717 Long: W -78.426815 Datum: ______

Soil Map Unit Name: Bibb Sandy Loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☑ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ☑

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland? Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Vegetation significantly impacted due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches): 0.25
Water Table Present?	Yes ☑	No ☐	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland L - DP12

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	70	Yes	FAC
2. Acer rubrum	15	No	FAC
3.			
4.			
5.			
6.			
	85	= Total Cover	

50% of total cover: 42.5 20% of total cover: 17

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	5	Yes	OBL
2. Liquidambar styraciflua	5	Yes	FAC
3.			
4.			
5.			
6.			
	10	= Total Cover	

50% of total cover: 5 20% of total cover: 2

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5	= Total Cover	

50% of total cover: 2.5 20% of total cover: 1

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	35	Yes	FAC
2. Persicaria longiseta	35	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	70	= Total Cover	

50% of total cover: 35 20% of total cover: 14

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Smilax rotundifolia	5	Yes	FAC
2.			
3.			
4.			
5.			
	5	= Total Cover	

50% of total cover: 2.5 20% of total cover: 1

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL Sampling Point: Wetland L - DP12

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1	90	10YR 4/6	10	C	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? **Yes** ☑ **No** ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Upland - DP13

Investigator(s): W. Taylor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.472841 Long: W 78.426061 Datum: ______

Soil Map Unit Name: Bibb Sandy Loam (Bb) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ☐
Hydric Soil Present?	Yes ☐	No ✓
Wetland Hydrology Present?	Yes ☐	No ✓

Is the Sampled Area within a Wetland? **Yes** ☐ **No** ✓

Remarks:

Vegetation significantly impacted due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☐	No ☐	Depth (inches): ______
Water Table Present?	Yes ☐	No ☐	Depth (inches): ______
Saturation Present? (includes capillary fringe)	Yes ☐	No ☐	Depth (inches): ______

Wetland Hydrology Present? **Yes** ☐ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Upland - DP13

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	90	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	90 = Total Cover		
50% of total cover: 45	20% of total cover: 18		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	3	No	FAC
2.			
3.			
4.			
5.			
6.			
	3 = Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	40	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Smilax rotundifolia	5	Yes	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Upland - DP13

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/3						sandy loam	
4-12	10YR 3/3						sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: __________

Depth (inches): __________

Hydric Soil Present? **Yes** ☐ **No** ☑

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland M - DP14

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.472836 Long: W -78.437100 Datum:

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☑ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ☑

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑	No ☐	**Is the Sampled Area within a Wetland?** **Yes** ☑ **No** ☐
Hydric Soil Present?	Yes ☑	No ☐	
Wetland Hydrology Present?	Yes ☑	No ☐	

Remarks:

Vegetation significantly impacted due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☑ Surface Water (A1)	☐ Aquatic Fauna (B13)	
☑ High Water Table (A2)	☐ Marl Deposits (B15) **(LRR U)**	
☑ Saturation (A3)	☐ Hydrogen Sulfide Odor (C1)	
☐ Water Marks (B1)	☐ Oxidized Rhizospheres along Living Roots (C3)	
☐ Sediment Deposits (B2)	☐ Presence of Reduced Iron (C4)	
☐ Drift Deposits (B3)	☐ Recent Iron Reduction in Tilled Soils (C6)	
☐ Algal Mat or Crust (B4)	☐ Thin Muck Surface (C7)	
☑ Iron Deposits (B5)	☐ Other (Explain in Remarks)	
☐ Inundation Visible on Aerial Imagery (B7)		
☐ Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches): 0.25
Water Table Present?	Yes ☑	No ☐	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland M - DP14

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	10	Yes	OBL
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		

50% of total cover: 5 20% of total cover: 2

Sapling Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: 20% of total cover:

Shrub Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

50% of total cover: 20% of total cover:

Herb Stratum (Plot size: 5')			
1. Ranunculus ambigens	40	Yes	OBL
2. Persicaria longiseta	10	Yes	FAC
3. Cicuta bulbifera	5	No	OBL
4. Juncus effusus	5	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60 = Total Cover		

50% of total cover: 30 20% of total cover: 12

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: 20% of total cover:

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland M - DP14

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 2/1						loamy sand	
4-12	10YR 3/1						loamy sand	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [x] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [ ] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes [x] No [ ]

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland N - DP15

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.471325 Long: W -78.437110 Datum:

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐	
Wetland Hydrology Present?	Yes ✓ No ☐	
Remarks:		

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 0.25	
Water Table Present?	Yes ✓ No ☐	Depth (inches): 0-12+	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): 0-12+	**Wetland Hydrology Present? Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland N - DP15

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	30	Yes	FAC
2. Nyssa biflora	10	No	OBL
3. Quercus phellos	10	No	FACW
4. Salix nigra	10	No	OBL
5.			
6.			
	60	= Total Cover	
50% of total cover: 30	20% of total cover: 12		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	5	Yes	FAC
2. Liquidambar styraciflua	5	Yes	FAC
3.			
4.			
5.			
6.			
	10	= Total Cover	
50% of total cover: 5	20% of total cover: 2		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Arundinaria tecta	15	Yes	FACW
2. Persea borbonia	5	Yes	FACW
3.			
4.			
5.			
6.			
	20	= Total Cover	
50% of total cover: 10	20% of total cover: 4		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	60	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60	= Total Cover	
50% of total cover: 30	20% of total cover: 12		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Vitis rotundifolia	15	Yes	FAC
2. Parthenocissus quinquefolia	5	Yes	FACU
3.			
4.			
5.			
	20	= Total Cover	
50% of total cover: 10	20% of total cover: 4		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88 (A/B)

Prevalence Index worksheet:

Total % Cover of:	Multiply by:
OBL species ____	x 1 = ____
FACW species ____	x 2 = ____
FAC species ____	x 3 = ____
FACU species ____	x 4 = ____
UPL species ____	x 5 = ____
Column Totals: ____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland N - DP15

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/2	95	10YR 4/6	5	C	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland O/P - DP16

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.470409 Long: W -78.436950 Datum:

Soil Map Unit Name: Nason Silt Loam (NnE) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐	
Wetland Hydrology Present?	Yes ✓ No ☐	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☐	No ✓	Depth (inches):
Water Table Present?	Yes ☐	No ✓	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes ✓	No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? Yes ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland O/P - DP16

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	5	Yes	FAC
2. Ligustrum sinense	5	Yes	FAC
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	50	Yes	FAC
2. Mecardonia acuminata	40	Yes	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		
50% of total cover: 45	20% of total cover: 18		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Ampelopsis arborea	10	Yes	FAC
2.			
3.			
4.			
5.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland O/P - DP16

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/2	90	10YR 4/6	10	C	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland Q - DP17

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.468516 Long: W -78.436989 Datum:

Soil Map Unit Name: Nason Silt Loam (NnE) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No		
Hydrophytic Vegetation Present?	✓		**Is the Sampled Area within a Wetland?**	**Yes** ✓ **No** ☐
Hydric Soil Present?	✓			
Wetland Hydrology Present?	✓			

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ✓ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

	Yes	No	Depth (inches)
Surface Water Present?	✓		0.5
Water Table Present?	✓		0-12+
Saturation Present? (includes capillary fringe)	✓		0-12+

Wetland Hydrology Present? Yes ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland Q - DP17

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	15	Yes	OBL
2.			
3.			
4.			
5.			
6.			
	15 = Total Cover		
50% of total cover: 7.5	20% of total cover: 3		
Sapling Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size: 15')			
1. Ligustrum sinense	10	Yes	FAC
2. Persea borbonia	10	Yes	FACW
3.			
4.			
5.			
6.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		
Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	2	No	FAC
2. Boehmeria cylindrica	2	No	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	4 = Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland Q - DP17

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 3/1	95	10YR 4/6	5	C	PL	loam	
6-12	10YR 3/2	98	10YR 4/6	2	C	PL	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland R - DP18

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.468496 Long: W -78.435843 Datum:

Soil Map Unit Name: Wehadkee Loam (Wt) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland?	Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐		
Wetland Hydrology Present?	Yes ✓ No ☐		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 0.25	
Water Table Present?	Yes ✓ No ☐	Depth (inches): 0-12+	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): 0-12+	**Wetland Hydrology Present?** Yes ✓ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland R - DP18

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
= Total Cover	10		

50% of total cover: 5 20% of total cover: 2

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
= Total Cover	0		

50% of total cover: ____ 20% of total cover: ____

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
= Total Cover	10		

50% of total cover: 5 20% of total cover: 2

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	80	Yes	FAC
2. Carex bullata	10	No	OBL
3. Persicaria longiseta	5	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
= Total Cover	95		

50% of total cover: 47.5 20% of total cover: 19

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Vitis rotundifolia	10	Yes	FAC
2. Smilax rotundifolia	2	No	FAC
3.			
4.			
5.			
= Total Cover	12		

50% of total cover: 6 20% of total cover: 2.4

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	____	x 1 = ____
FACW species	____	x 2 = ____
FAC species	____	x 3 = ____
FACU species	____	x 4 = ____
UPL species	____	x 5 = ____
Column Totals:	____ (A)	____ (B)

Prevalence Index = B/A = ____

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland R - DP18

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-6	10YR 2/2	95	10YR 4/6	5	C	PL	sandy loam	
6-12	2.5Y 2/1						sandy	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland S/T/U 19

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.468496 Long: W -78.435843 Datum:

Soil Map Unit Name: Wehadkee Loam (Wt) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes [x] No [ ] (If no, explain in Remarks.)

Are Vegetation [x] Soil [ ] or Hydrology [ ] significantly disturbed? [ ] Are "Normal Circumstances" present? Yes [ ] No [x]

Are Vegetation [ ] Soil [ ] or Hydrology [ ] naturally problematic? [ ] (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes [x]	No [ ]	Is the Sampled Area within a Wetland? **Yes** [x] **No** [ ]
Hydric Soil Present?	Yes [x]	No [ ]	
Wetland Hydrology Present?	Yes [x]	No [ ]	

Remarks:

Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- [ ] Surface Water (A1)
- [ ] High Water Table (A2)
- [x] Saturation (A3)
- [ ] Water Marks (B1)
- [x] Sediment Deposits (B2)
- [ ] Drift Deposits (B3)
- [ ] Algal Mat or Crust (B4)
- [x] Iron Deposits (B5)
- [ ] Inundation Visible on Aerial Imagery (B7)
- [ ] Water-Stained Leaves (B9)
- [ ] Aquatic Fauna (B13)
- [ ] Marl Deposits (B15) **(LRR U)**
- [ ] Hydrogen Sulfide Odor (C1)
- [ ] Oxidized Rhizospheres along Living Roots (C3)
- [ ] Presence of Reduced Iron (C4)
- [ ] Recent Iron Reduction in Tilled Soils (C6)
- [ ] Thin Muck Surface (C7)
- [ ] Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- [ ] Surface Soil Cracks (B6)
- [ ] Sparsely Vegetated Concave Surface (B8)
- [ ] Drainage Patterns (B10)
- [ ] Moss Trim Lines (B16)
- [ ] Dry-Season Water Table (C2)
- [ ] Crayfish Burrows (C8)
- [ ] Saturation Visible on Aerial Imagery (C9)
- [ ] Geomorphic Position (D2)
- [ ] Shallow Aquitard (D3)
- [ ] FAC-Neutral Test (D5)
- [ ] Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes [ ]	No [x]	Depth (inches):
Water Table Present?	Yes [ ]	No [x]	Depth (inches):
Saturation Present? (includes capillary fringe)	Yes [x]	No [ ]	Depth (inches): 0-12+

Wetland Hydrology Present? Yes [x] **No** [ ]

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland S/T/U 19

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Liquidambar styraciflua	15	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	15 = Total Cover		

50% of total cover: 7.5 20% of total cover: 3

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Murdannia keisak	30	Yes	FACW
2. Ranunculus bulbosus	20	Yes	FAC
3. Juncus effusus	5	No	OBL
4. Carex bullata	2	No	OBL
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	57 = Total Cover		

50% of total cover: 28.5 20% of total cover: 11.4

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland S/T/U 19

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/1						loam	
2-12	10YR 4/1	80	10YR 4/6	20	C	PL	loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- [ ] Histosol (A1)
- [ ] Histic Epipedon (A2)
- [ ] Black Histic (A3)
- [ ] Hydrogen Sulfide (A4)
- [ ] Stratified Layers (A5)
- [ ] Organic Bodies (A6) **(LRR P, T, U)**
- [ ] 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- [ ] Muck Presence (A8) **(LRR U)**
- [ ] 1 cm Muck (A9) **(LRR P, T)**
- [ ] Depleted Below Dark Surface (A11)
- [ ] Thick Dark Surface (A12)
- [ ] Coast Prairie Redox (A16) **(MLRA 150A)**
- [ ] Sandy Mucky Mineral (S1) **(LRR O, S)**
- [ ] Sandy Gleyed Matrix (S4)
- [ ] Sandy Redox (S5)
- [ ] Stripped Matrix (S6)
- [ ] Dark Surface (S7) **(LRR P, S, T, U)**
- [ ] Polyvalue Below Surface (S8) **(LRR S, T, U)**
- [ ] Thin Dark Surface (S9) **(LRR S, T, U)**
- [ ] Loamy Mucky Mineral (F1) **(LRR O)**
- [ ] Loamy Gleyed Matrix (F2)
- [x] Depleted Matrix (F3)
- [ ] Redox Dark Surface (F6)
- [ ] Depleted Dark Surface (F7)
- [ ] Redox Depressions (F8)
- [ ] Marl (F10) **(LRR U)**
- [ ] Depleted Ochric (F11) **(MLRA 151)**
- [ ] Iron-Manganese Masses (F12) **(LRR O, P, T)**
- [ ] Umbric Surface (F13) **(LRR P, T, U)**
- [ ] Delta Ochric (F17) **(MLRA 151)**
- [ ] Reduced Vertic (F18) **(MLRA 150A, 150B)**
- [ ] Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- [ ] 1 cm Muck (A9) **(LRR O)**
- [ ] 2 cm Muck (A10) **(LRR S)**
- [ ] Reduced Vertic (F18) **(outside MLRA 150A,B)**
- [ ] Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- [ ] Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- [ ] Red Parent Material (TF2)
- [ ] Very Shallow Dark Surface (TF12)
- [ ] Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes [x] No [ ]

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Upland - DP20

Investigator(s): W. Taylor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.471624 Long: W -78.437102 Datum: ______

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	✓	
Hydric Soil Present?		✓
Wetland Hydrology Present?		✓

Is the Sampled Area within a Wetland? Yes ☐ No ✓

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ☐ No ☐ Depth (inches): ______

Water Table Present? Yes ☐ No ☐ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ☐ No ☐ Depth (inches): ______

Wetland Hydrology Present? Yes ☐ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Upland - DP20

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Ilex opaca	30	Yes	FAC
2. Quercus phellos	20	Yes	FACW
3. Liriodendron tulipifera	40	Yes	FACU
4.			
5.			
6.			
	90 = Total Cover		
50% of total cover: 45	20% of total cover: 18		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Ilex opaca	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Ligustrum sinense	5	Yes	FAC
2. Juniperus virginiana	1	No	FACU
3.			
4.			
5.			
6.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	50	Yes	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

Total Number of Dominant Species Across All Strata: 6 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 83 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Upland - DP20

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 3/3						loam	
2-10	7.5YR 4/3						sandy loam	
10-12	2.5Y 3/3						sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☐ No ☑

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland V - DP21

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.473363 Long: W -78.442656 Datum:

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☑ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ☑

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland? Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐	
Wetland Hydrology Present?	Yes ☑ No ☐	

Remarks:

Vegetation significantly impacted by livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

☑ Surface Water (A1)	☐ Aquatic Fauna (B13)
☑ High Water Table (A2)	☐ Marl Deposits (B15) **(LRR U)**
☑ Saturation (A3)	☐ Hydrogen Sulfide Odor (C1)
☐ Water Marks (B1)	☐ Oxidized Rhizospheres along Living Roots (C3)
☐ Sediment Deposits (B2)	☐ Presence of Reduced Iron (C4)
☑ Drift Deposits (B3)	☐ Recent Iron Reduction in Tilled Soils (C6)
☐ Algal Mat or Crust (B4)	☐ Thin Muck Surface (C7)
☐ Iron Deposits (B5)	☐ Other (Explain in Remarks)
☐ Inundation Visible on Aerial Imagery (B7)	
☐ Water-Stained Leaves (B9)	

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☑ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☑	No ☐	Depth (inches): 0.25
Water Table Present?	Yes ☑	No ☐	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ☑	No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? Yes ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland V - DP21

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	80	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10	Yes	FAC
2. Persea borbonia	5	Yes	FACW
3.			
4.			
5.			
6.			
	15 = Total Cover		
50% of total cover: 7.5	20% of total cover: 3		

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Persicaria longiseta	10	Yes	FAC
2. Microstegium vimineum	2	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	12 = Total Cover		
50% of total cover: 6	20% of total cover: 2.4		

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland V - DP21

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1						sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☑ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ________

Depth (inches): ________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wet W/XFF/GG - DP22

Investigator(s): W. Taylor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain / hillside seep Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.473321 Long: W -78.442267 Datum: ______

Soil Map Unit Name: Gilead Sandy Loam (GeD) & Uchee Loamy Sand (UcB) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland?	Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☑ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ☐ No ☑ Depth (inches): ______

Water Table Present? Yes ☐ No ☑ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ☑ No ☐ Depth (inches): 0-12+

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wet W/X/FF/GG - DP22

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	40	Yes	OBL
2. Liriodendron tulipifera	20	Yes	FACU
3. Betula nigra	10	No	FACW
4.			
5.			
6.			
	70 = Total Cover		
50% of total cover: 35		20% of total cover: 14	

Sapling Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		
50% of total cover:		20% of total cover:	

Shrub Stratum (Plot size: 15')	Absolute % Cover	Dominant Species?	Indicator Status
1. Persea borbonia	80	Yes	FACW
2. Ligustrum sinense	5	No	FAC
3.			
4.			
5.			
6.			
	85 = Total Cover		
50% of total cover: 42.5		20% of total cover: 17	

Herb Stratum (Plot size: 5')	Absolute % Cover	Dominant Species?	Indicator Status
1. Boehmeria cylindrica	5	Yes	FACW
2. Parathelypteris noveboracensis	5	Yes	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10 = Total Cover		
50% of total cover: 5		20% of total cover: 2	

Woody Vine Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:		20% of total cover:	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 7 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 88 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No

Remarks: (If observed, list morphological adaptations below).

SOIL

Wet W/X/FF/GG - DP22

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1						sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☑ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________

Depth (inches): ______________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Upland - DP23

Investigator(s): W. Taylor Section, Township, Range: ____

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.473383 Long: W -78.442430 Datum: ____

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ✓ No ☐

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ☐	Is the Sampled Area within a Wetland? Yes ☐ No ✓
Hydric Soil Present?	Yes ☐	No ✓	
Wetland Hydrology Present?	Yes ☐	No ✓	

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☐ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present? Yes ☐ No ☐ Depth (inches): ____

Water Table Present? Yes ☐ No ☐ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ☐ No ☐ Depth (inches): ____

Wetland Hydrology Present? Yes ☐ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Upland - DP23

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	40	Yes	FACU
2. Acer rubrum	15	Yes	FAC
3. Liquidambar styraciflua	10	No	FAC
4.			
5.			
6.			
	65	= Total Cover	

50% of total cover: 32.5 20% of total cover: 13

Sapling Stratum (Plot size: 15')			
1. Acer rubrum	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	10	= Total Cover	

50% of total cover: 5 20% of total cover: 2

Shrub Stratum (Plot size: 15')			
1. Ilex opaca	2	No	FAC
2.			
3.			
4.			
5.			
6.			
	2	= Total Cover	

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: 5')			
1. Microstegium vimineum	40	Yes	FAC
2. Phytolacca americana	5	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	45	= Total Cover	

50% of total cover: 22.5 20% of total cover: 9

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	0	= Total Cover	

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- [ ] 1 - Rapid Test for Hydrophytic Vegetation
- [x] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ✓ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Upland - DP23

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-1	10YR 3/3						sandy loam	
1-12	10YR 5/3						sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____

Depth (inches): ____

Hydric Soil Present? Yes ☐ No ☑

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 5/30/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland Y - DP24

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.471325 Long: W -78.437110 Datum:

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓	No ☐	Is the Sampled Area within a Wetland? Yes ✓ No ☐
Hydric Soil Present?	Yes ✓	No ☐	
Wetland Hydrology Present?	Yes ✓	No ☐	

Remarks:

Vegetation affected by livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

✓ Surface Water (A1)	☐ Aquatic Fauna (B13)	
✓ High Water Table (A2)	☐ Marl Deposits (B15) **(LRR U)**	
✓ Saturation (A3)	☐ Hydrogen Sulfide Odor (C1)	
☐ Water Marks (B1)	☐ Oxidized Rhizospheres along Living Roots (C3)	
☐ Sediment Deposits (B2)	☐ Presence of Reduced Iron (C4)	
☐ Drift Deposits (B3)	☐ Recent Iron Reduction in Tilled Soils (C6)	
☐ Algal Mat or Crust (B4)	☐ Thin Muck Surface (C7)	
✓ Iron Deposits (B5)	☐ Other (Explain in Remarks)	
☐ Inundation Visible on Aerial Imagery (B7)		
✓ Water-Stained Leaves (B9)		

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓	No ☐	Depth (inches): 0.25
Water Table Present?	Yes ✓	No ☐	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ✓	No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? Yes ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants.

Sampling Point: Wetland Y - DP24

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Nyssa biflora	70	Yes	OBL
2.			
3.			
4.			
5.			
6.			
	70 = Total Cover		

50% of total cover: 35 20% of total cover: 14

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Persea borbonia	20	Yes	FACW
2. Nyssa biflora	10	Yes	OBL
3.			
4.			
5.			
6.			
	30 = Total Cover		

50% of total cover: 15 20% of total cover: 6

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
	0 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Murdannia keisak	40	Yes	OBL
2. Impatiens capensis	10	No	FACW
3. Microstegium vimineum	10	No	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	60 = Total Cover		

50% of total cover: 30 20% of total cover: 12

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- [x] 1 - Rapid Test for Hydrophytic Vegetation
- [ ] 2 - Dominance Test is >50%
- [ ] 3 - Prevalence Index is ≤3.0[1]
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes [x] No [ ]

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland Y - D24

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1						loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☑ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ____________

Depth (inches): ____________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 6/1/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wet Z/AA/BB/HH -DP25

Investigator(s): W. Taylor Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.476783 Long: W -78.437307 Datum: ______

Soil Map Unit Name: Gilead Sandy Loam (GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ☑ No ☐ (If no, explain in Remarks.)

Are Vegetation ☑ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ☑

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☑ No ☐	Is the Sampled Area within a Wetland?	Yes ☑ No ☐
Hydric Soil Present?	Yes ☑ No ☐		
Wetland Hydrology Present?	Yes ☑ No ☐		

Remarks:

Vegetation significantly disturbed due to livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ☑ Surface Water (A1)
- ☑ High Water Table (A2)
- ☑ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☑ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ☑ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ☑ No ☐	Depth (inches): 0.25
Water Table Present?	Yes ☑ No ☐	Depth (inches): 0-12+
Saturation Present? (includes capillary fringe)	Yes ☑ No ☐	Depth (inches): 0-12+

Wetland Hydrology Present? **Yes** ☑ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wet Z/AA/BB/HH DP25

Tree Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	20	Yes	FAC
2. Nyssa biflora	20	Yes	OBL
3. Liquidambar styraciflua	10	Yes	FAC
4.			
5.			
6.			
	50 = Total Cover		

50% of total cover: 25 20% of total cover: 10

Sapling Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		

50% of total cover: 5 20% of total cover: 2

Shrub Stratum (Plot size: 15')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Pinus taeda	5	Yes	FAC
2.			
3.			
4.			
5.			
6.			
	5 = Total Cover		

50% of total cover: 2.5 20% of total cover: 1

Herb Stratum (Plot size: 5')

	Absolute % Cover	Dominant Species?	Indicator Status
1. Microstegium vimineum	80	Yes	FAC
2. Persicaria longiseta	10	No	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	90 = Total Cover		

50% of total cover: 45 20% of total cover: 18

Woody Vine Stratum (Plot size: 30')

	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		

50% of total cover: ______ 20% of total cover: ______

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

Wet Z/AA/BB/HH DP25

SOIL

Sampling Point: ___________

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 2/1						loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☑ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______________________

Depth (inches): ______________________

Hydric Soil Present? Yes ☑ No ☐

Remarks:

WETLAND DETERMINATION DATA FORM – Atlantic and Gulf Coastal Plain Region

Project/Site: Sassarixa Swamp Mitigation Site City/County: Smithfield / Johnston Sampling Date: 6/1/2018

Applicant/Owner: Wildlands Engineering Inc. State: NC Sampling Point: Wetland CC - DP26

Investigator(s): W. Taylor Section, Township, Range:

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): <1

Subregion (LRR or MLRA): MLRA 133A Lat: N 35.477589 Long: W -78.437893 Datum:

Soil Map Unit Name: Gilead Sandy Loam (GeB & GeD) NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No ☐ (If no, explain in Remarks.)

Are Vegetation ✓ Soil ☐ or Hydrology ☐ significantly disturbed? ☐ Are "Normal Circumstances" present? Yes ☐ No ✓

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? ☐ (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ✓ No ☐	Is the Sampled Area within a Wetland?	Yes ✓ No ☐
Hydric Soil Present?	Yes ✓ No ☐		
Wetland Hydrology Present?	Yes ✓ No ☐		

Remarks:

Vegetation significantly impacted by livestock grazing.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is required; check all that apply)

- ✓ Surface Water (A1)
- ✓ High Water Table (A2)
- ✓ Saturation (A3)
- ☐ Water Marks (B1)
- ☐ Sediment Deposits (B2)
- ☐ Drift Deposits (B3)
- ☐ Algal Mat or Crust (B4)
- ☐ Iron Deposits (B5)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Aquatic Fauna (B13)
- ☐ Marl Deposits (B15) **(LRR U)**
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Tilled Soils (C6)
- ☐ Thin Muck Surface (C7)
- ☐ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ☐ Surface Soil Cracks (B6)
- ☐ Sparsely Vegetated Concave Surface (B8)
- ✓ Drainage Patterns (B10)
- ☐ Moss Trim Lines (B16)
- ☐ Dry-Season Water Table (C2)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Geomorphic Position (D2)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)
- ☐ Sphagnum moss (D8) **(LRR T, U)**

Field Observations:

Surface Water Present?	Yes ✓ No ☐	Depth (inches): 0.25	
Water Table Present?	Yes ✓ No ☐	Depth (inches): 0-12+	
Saturation Present? (includes capillary fringe)	Yes ✓ No ☐	Depth (inches): 0-12+	**Wetland Hydrology Present? Yes** ✓ **No** ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: Wetland CC DP26

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10	Yes	FAC
2. Salix nigra	10	Yes	OBL
3. Liquidambar styraciflua	10	Yes	FAC
4. Nyssa biflora	5	No	OBL
5.			
6.			
	35 = Total Cover		
50% of total cover: 17.5	20% of total cover: 7		

Sapling Stratum (Plot size: 15')			
1.			
2.			
3.			
4.			
5.			
6.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Shrub Stratum (Plot size: 15')			
1. Salix nigra	1	No	OBL
2.			
3.			
4.			
5.			
6.			
	1 = Total Cover		
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size: 5')			
1. Persicaria longiseta	80	Yes	FAC
2. Juncus effusus	3	No	OBL
3. Eupatorium capillifolium	2	No	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	85 = Total Cover		
50% of total cover: 42.5	20% of total cover: 17		

Woody Vine Stratum (Plot size: 30')			
1.			
2.			
3.			
4.			
5.			
	0 = Total Cover		
50% of total cover:	20% of total cover:		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ☐ 1 - Rapid Test for Hydrophytic Vegetation
- ☑ 2 - Dominance Test is >50%
- ☐ 3 - Prevalence Index is ≤3.0[1]
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Five Vegetation Strata:

Tree – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and 3 in. (7.6 cm) or larger in diameter at breast height (DBH).

Sapling – Woody plants, excluding woody vines, approximately 20 ft (6 m) or more in height and less than 3 in. (7.6 cm) DBH.

Shrub – Woody plants, excluding woody vines, approximately 3 to 20 ft (1 to 6 m) in height.

Herb – All herbaceous (non-woody) plants, including herbaceous vines, regardless of size, and woody plants, except woody vines, less than approximately 3 ft (1 m) in height.

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ☑ No ☐

Remarks: (If observed, list morphological adaptations below).

SOIL

Sampling Point: Wetland CC DP26

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-4	10YR 3/2						loam	
4-12	10YR 3/2	95	10YR 5/4	5	C	PL	sandy loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5)
- ☐ Organic Bodies (A6) **(LRR P, T, U)**
- ☐ 5 cm Mucky Mineral (A7) **(LRR P, T, U)**
- ☐ Muck Presence (A8) **(LRR U)**
- ☐ 1 cm Muck (A9) **(LRR P, T)**
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Coast Prairie Redox (A16) **(MLRA 150A)**
- ☐ Sandy Mucky Mineral (S1) **(LRR O, S)**
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Dark Surface (S7) **(LRR P, S, T, U)**
- ☐ Polyvalue Below Surface (S8) **(LRR S, T, U)**
- ☐ Thin Dark Surface (S9) **(LRR S, T, U)**
- ☐ Loamy Mucky Mineral (F1) **(LRR O)**
- ☐ Loamy Gleyed Matrix (F2)
- ☑ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Marl (F10) **(LRR U)**
- ☐ Depleted Ochric (F11) **(MLRA 151)**
- ☐ Iron-Manganese Masses (F12) **(LRR O, P, T)**
- ☐ Umbric Surface (F13) **(LRR P, T, U)**
- ☐ Delta Ochric (F17) **(MLRA 151)**
- ☐ Reduced Vertic (F18) **(MLRA 150A, 150B)**
- ☐ Piedmont Floodplain Soils (F19) **(MLRA 149A)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 149A, 153C, 153D)**

Indicators for Problematic Hydric Soils[3]:

- ☐ 1 cm Muck (A9) **(LRR O)**
- ☐ 2 cm Muck (A10) **(LRR S)**
- ☐ Reduced Vertic (F18) **(outside MLRA 150A,B)**
- ☐ Piedmont Floodplain Soils (F19) **(LRR P, S, T)**
- ☐ Anomalous Bright Loamy Soils (F20) **(MLRA 153B)**
- ☐ Red Parent Material (TF2)
- ☐ Very Shallow Dark Surface (TF12)
- ☐ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type: ______

Depth (inches): ______

Hydric Soil Present? Yes ☑ No ☐

Remarks:

NC DWQ Stream Identification Form Version 4.11 Sassarixa Creek

Date: 8/30/17	Project/Site: Sassarixa	Latitude:
Evaluator: AA	County: Johnston	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 50.5	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 28.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control large trees & woody debris	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 13)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians Snakes, frogs	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Anabranching System

NC DWQ Stream Identification Form Version 4.11 1

Date: 8/30/17	Project/Site: Sassarixa	Latitude:
Evaluator: AA	County: Johnston	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 24	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name*:

A. Geomorphology (Subtotal = 18.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate varies, sand, gravel mainly	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits increase in D/S direction	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control large trees	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

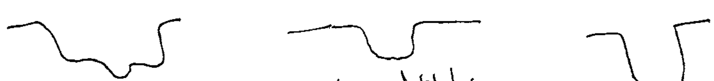
B. Hydrology (Subtotal = 2.5)				
12. Presence of Baseflow Present first 150'	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table? varies	No = 0		Yes = 3	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: channel interrupted by pond + dam, may braid just below dam for for few hundred feet

Sketch:



upstream pond

Immediately D/S Pond

further D/S

photos

NC DWQ Stream Identification Form Version 4.11 1A

Date: 8/30/17	Project/Site: Sassarixa	Latitude:
Evaluator: AA	County: Johnston	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 14)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate Sand/silt	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed some stilt grass	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

photo

T1B

NC DWQ Stream Identification Form Version 4.11

Date: 7/31	Project/Site: Sassarixa	Latitude: 35.478291
Evaluator: DD/CN	County: Johnston	Longitude: -78.444614
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28.75	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = ______)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

14

B. Hydrology (Subtotal = ______)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

8

C. Biology (Subtotal = ______)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

28.75

Notes: trib to T1 from South

Sketch:

NC DWQ Stream Identification Form Version 4.11

T1C

Date: 7/31	Project/Site: Sassarixa	Latitude: 35.476266
Evaluator: DD/CW	County:	Longitude: -78.446087
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28.75	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Trib to *e.g. Quad Name:* Sassarixa Creek

A. Geomorphology (Subtotal = ________)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

16.5

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = ________)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

8.5

C. Biology (Subtotal = ________)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

3

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 4/8/17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other T2 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: BELOW HEADCUT, INSIDE OF WOOD LINE

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIKA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31	**Stream Determination (circle one)** **Ephemeral Intermittent Perennial**	**Other** T3 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, *step-pool*, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: — MUCH MORE OF A PERENNIAL STREAM THAN IT SCORES

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30.25	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:* T4

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: *ex. riffle-pool, step-pool, ripple-pool sequence*	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5.75)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 41.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other TS *e.g. Quad Name:*

A. Geomorphology (Subtotal = 25)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5.75)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29.75	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name:* T5A

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	~~1~~	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: — APPEARS TO BE MUCH MORE OF A PERENNIAL STREAM IN AREAS NOT TRAMPLED BY LIVESTOCK.

—

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other T5B *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIKA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25.25	**Stream Determination (circle one)** Ephemeral ~~Intermittent~~ Perennial	**Other** TSC *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 38.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other T6 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8.25)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands Eng
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassarixa Creek
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Sassarixa Creek
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 5ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 13ft
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒A 
(more sinuous stream, flatter valley slope)

☐B 
(less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☒Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
    - ☐Section 10 water
    - ☐Classified Trout Waters
    - ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
    - ☐Essential Fish Habitat
    - ☐Primary Nursery Area
    - ☐ High Quality Waters/Outstanding Resource Waters
    - ☐Publicly owned property
    - ☐NCDWR Riparian buffer rule in effect
    - ☐Nutrient Sensitive Waters
    - ☐Anadromous fish
    - ☐303(d) List
    - ☐CAMA Area of Environmental Concern (AEC)
    - ☐Documented presence of a federal and/or state listed protected species within the assessment area.
      List species:
    - ☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☐B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☐A < 10% of channel unstable
   - ☐B 10 to 25% of channel unstable
   - ☒C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☐Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☐	☒	Sand (.062 – 2 mm)
☐	☐	☐	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ____________

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☒	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☒	Dipterans Blackfly(?)
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☒	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae ✓?
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes) But mature forest

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☒B	☒B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☐Y	Are wetlands present in the streamside area?
☐N	☒N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of and draining to the assessment reach.

- ☒A Streams and/or springs (jurisdictional discharges)
- ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☒C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☒D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☒B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☒A	☒A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ____________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:
Water rusty Brown; Main road starts the reach

NC SAM FIELD ASSESSMENT RESULTS

Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Carolyn
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassarixa
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T1 R1
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1 ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 2 ft
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒A  (more sinuous stream, flatter valley slope)

☐B  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
    - ☐Section 10 water
    - ☐Classified Trout Waters
    - ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
    - ☐Essential Fish Habitat
    - ☐Primary Nursery Area
    - ☐ High Quality Waters/Outstanding Resource Waters
    - ☐Publicly owned property
    - ☐NCDWR Riparian buffer rule in effect
    - ☐Nutrient Sensitive Waters
    - ☐Anadromous fish
    - ☐303(d) List
    - ☐CAMA Area of Environmental Concern (AEC)
    - ☐Documented presence of a federal and/or state listed protected species within the assessment area.
    - List species:
    - ☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☒B Not A

5. **Signs of Active Instability – assessment reach metric**

   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☒A < 10% of channel unstable
   - ☐B 10 to 25% of channel unstable
   - ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☒C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

***********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☐	☒	Sand (.062 – 2 mm)
☐	☒	☐	☐	☐	Silt/clay (< 0.062 mm)
☐	☒	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ______

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☒B	☒B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of and draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- Above ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☒B Degraded (example: scattered trees) few large trees
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☒D	☒D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☒B	☒B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

Sweetgum

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ____________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch: Connected to flood plain w/ active cattle

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:
1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassarixa Creek
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): T1R3
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 4ft
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:
15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒A  (more sinuous stream, flatter valley slope)

☐B  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:
18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
- ☐Section 10 water
- ☐Classified Trout Waters
- ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
- ☐Essential Fish Habitat
- ☐Primary Nursery Area
- ☐ High Quality Waters/Outstanding Resource Waters
- ☐Publicly owned property
- ☐NCDWR Riparian buffer rule in effect
- ☐Nutrient Sensitive Waters
- ☐Anadromous fish
- ☐303(d) List
- ☐CAMA Area of Environmental Concern (AEC)
- ☐Documented presence of a federal and/or state listed protected species within the assessment area.
  List species:
- ☐Designated Critical Habitat (list species)

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☐B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☐A < 10% of channel unstable
   - ☐B 10 to 25% of channel unstable
   - ☒C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS******************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☐Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☒	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ____________

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☒	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☒B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☐Y	Are wetlands present in the streamside area?
☐N	☒N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of and draining to the assessment reach.
- ☒A Streams and/or springs (jurisdictional discharges)
- ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.
- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

Maintain pasture, main road

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.
- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
[x] A	[x] A	☐ A	☐ A	≥ 100 feet wide or extends to the edge of the watershed
☐ B	☐ B	☐ B	☐ B	From 50 to < 100 feet wide
☐ C	☐ C	☐ C	☐ C	From 30 to < 50 feet wide
☐ D	☐ D	[x] D	☐ D	From 10 to < 30 feet wide
☐ E	☐ E	☐ E	[x] E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐ A	☐ A	Mature forest
[x] B	[x] B	Non-mature woody vegetation or modified vegetation structure
☐ C	☐ C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐ D	☐ D	Maintained shrubs
☐ E	☐ E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐ A	☐ A	☐ A	☐ A	☐ A	☐ A	Row crops
☐ B	☐ B	☐ B	☐ B	☐ B	☐ B	Maintained turf
☐ C	☐ C	☐ C	☐ C	☐ C	☐ C	Pasture (no livestock)/commercial horticulture
[x] D	[x] D	[x] D	[x] D	[x] D	[x] D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
[x] A	[x] A	Medium to high stem density
☐ B	☐ B	Low stem density
☐ C	☐ C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
[x] A	[x] A	The total length of buffer breaks is < 25 percent.
☐ B	☐ B	The total length of buffer breaks is between 25 and 50 percent.
☐ C	☐ C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐ A	☐ A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐ B	☐ B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
[x] C	[x] C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐ Yes [x] No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐ No Water ☐ Other: ____________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐ A < 46 ☐ B 46 to < 67 ☐ C 67 to < 79 ☐ D 79 to < 230 ☐ E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp 2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands 4. Assessor name/organization: Wildlands Eng
5. County: Johnston 6. Nearest named water body
7. River basin: Neuse on USGS 7.5-minute quad: Sassarixa Creek
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T1A 10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 5ft 13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒A  ☐B 

(more sinuous stream, flatter valley slope) (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.

☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☒B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☒A < 10% of channel unstable
   - ☐B 10 to 25% of channel unstable
   - ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☒	☐	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☒	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☐	☐	☒	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

lots of organic matter

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**
   12a. ☐Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
   If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ____________

   12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae (5)
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
   Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
   Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☒A	☒A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
   Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
   Check all contributors within the assessment reach or within view of and draining to the assessment reach.
   - ☐A Streams and/or springs (jurisdictional discharges)
   - ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
   - ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
   - ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
   - ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
   - ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
   Check all that apply.
   - ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
   - ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
   - ☐C Urban stream (≥ 24% impervious surface for watershed)
   - ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
   - ☐E Assessment reach relocated to valley edge
   - ☒F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
   Consider aspect. Consider "leaf-on" condition.
   - ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
   - ☐B Degraded (example: scattered trees)
   - ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

Pine community

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ______________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 9/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Carolyn Lanza
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassarixa Creek
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

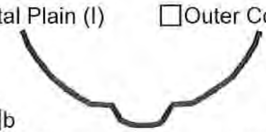
9. Site number (show on attached map): T2 (Start of tree line)
10. Length of assessment reach evaluated (feet): 300
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 7ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 3ft
13. Is assessment reach a swamp stream? ☐Yes ☒No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐Mountains (M) ☐Piedmont (P) ☒Inner Coastal Plain (I) ☐Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒a  (more sinuous stream, flatter valley slope)

☐b  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
   - ☐Section 10 water
   - ☐Classified Trout Waters
   - ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
   - ☐Essential Fish Habitat
   - ☐Primary Nursery Area
   - ☐High Quality Waters/Outstanding Resource Waters
   - ☐Publicly owned property
   - ☐NCDWR riparian buffer rule in effect
   - ☐Nutrient Sensitive Waters
   - ☐Anadromous fish
   - ☐303(d) List
   - ☐CAMA Area of Environmental Concern (AEC)
   - ☐Documented presence of a federal and/or state listed protected species within the assessment area.
     List species:
   - ☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☐B Not A

5. **Signs of Active Instability – assessment reach metric**

   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☐A < 10% of channel unstable
   - ☐B 10 to 25% of channel unstable
   - ☒C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
☐B Excessive sedimentation (burying of stream features or intertidal zone)
☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
☐D Odor (not including natural sulfide odors)
☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes" section.
☒F Livestock with access to stream or intertidal zone
☐G Excessive algae in stream or intertidal zone
☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc.)
☐I Other: ____________________ (explain in "Notes/Sketch" section)
☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream too large or dangerous to assess? **If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).**

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
☐A Multiple aquatic macrophytes and aquatic mosses (including liverworts, lichens, and algal mats)
☒B Multiple sticks and/or leaf packs and/or emergent vegetation
☐C Multiple snags and logs (including lap trees)
☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
☐E Little or no habitat

Check for Tidal Marsh Streams Only
☐F 5% oysters or other natural hard bottoms
☐G Submerged aquatic vegetation
☐H Low-tide refugia (pools)
☐I Sand bottom
☐J 5% vertical bank along the marsh
☐K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
☐A Riffle-run section **(evaluate 11c)**
☐B Pool-glide section **(evaluate 11d)**
☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☒	☐	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment?

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. [X] Yes [ ] No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. [ ] No Water [ ] Other: ______________________

12b. [X] Yes [ ] No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
[ ]	[ ]	Adult frogs
[ ]	[ ]	Aquatic reptiles
[ ]	[ ]	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
[ ]	[ ]	Beetles (including water pennies)
[ ]	[ ]	Caddisfly larvae (Trichoptera [T])
[ ]	[ ]	Asian clam (*Corbicula*)
[ ]	[ ]	Crustacean (isopod/amphipod/crayfish/shrimp)
[ ]	[ ]	Damselfly and dragonfly larvae
[ ]	[ ]	Dipterans (true flies)
[ ]	[ ]	Mayfly larvae (Ephemeroptera [E])
[ ]	[ ]	Megaloptera (alderfly, fishfly, dobsonfly larvae)
[X]	[ ]	Midges/mosquito larvae
[ ]	[ ]	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
[ ]	[ ]	Mussels/Clams (not *Corbicula*)
[ ]	[ ]	Other fish
[ ]	[ ]	Salamanders/tadpoles
[ ]	[ ]	Snails
[ ]	[ ]	Stonefly larvae (Plecoptera [P])
[ ]	[ ]	Tipulid larvae
[ ]	[ ]	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
[ ] A	[ ] A	Little or no alteration to water storage capacity over a majority of the streamside area
[ ] B	[ ] B	Moderate alteration to water storage capacity over a majority of the streamside area
[X] C	[X] C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
[ ] A	[ ] A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
[ ] B	[ ] B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
[X] C	[X] C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
[ ] Y	[X] Y	Are wetlands present in the streamside area?
[X] N	[ ] N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.
- [ ] A Streams and/or springs (jurisdictional discharges)
- [X] B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- [ ] C Obstruction that passes some flow during low-flow periods affecting assessment reach (ex: beaver dam, bottom-release dam)
- [X] D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
- [ ] E Stream bed or bank soil reduced (dig through deposited sediment if present)
- [ ] F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.
- [ ] A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- [ ] B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- [ ] C Urban stream (≥ 24% impervious surface for watershed)
- [ ] D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- [ ] E Assessment reach relocated to valley edge
- [X] F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.
- [X] A Stream shading is appropriate for the stream category (may include gaps associated with natural processes)
- [ ] B Degraded (example: scattered trees)
- [ ] C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees. Privet . Honeysuckle
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:
Abundant oxidizing minerals on leafs in water

NC SAM FIELD ASSESSMENT FORM
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INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Carolyn Lanza
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassarixa Creek
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T3 R4
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): .25 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 1 ft
13. Is assessment reach a swamp stream? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐Mountains (M) ☐Piedmont (P) ☒Inner Coastal Plain (I) ☐Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**): ☒a (more sinuous stream, flatter valley slope) ☐b (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☐Yes ☐No If Yes, check all that apply to the assessment area.
    - ☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
    - ☐Essential Fish Habitat ☐Primary Nursery Area ☐High Quality Waters/Outstanding Resource Waters
    - ☐Publicly owned property ☐NCDWR riparian buffer rule in effect ☐Nutrient Sensitive Waters
    - ☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
    - ☐Documented presence of a federal and/or state listed protected species within the assessment area.
      List species:
    - ☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
- ☒A Water throughout assessment reach.
- ☐B No flow, water in pools only.
- ☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
- ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
- ☒B Not A

3. Feature Pattern – assessment reach metric
- ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
- ☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☒B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☒A < 10% of channel unstable
- ☐B 10 to 25% of channel unstable
- ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
[X] A	[X] A	Little or no evidence of conditions that adversely affect reference interaction
[ ] B	[ ] B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
[ ] C	[ ] C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- [ ] A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- [ ] B <u>Excessive</u> sedimentation (burying of stream features or intertidal zone)
- [ ] C Noticeable evidence of pollutant discharges entering the assessment reach <u>and</u> causing a water quality problem
- [ ] D Odor (not including natural sulfide odors)
- [ ] E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes" section.
- [ ] F Livestock with access to stream or intertidal zone
- [ ] G Excessive algae in stream or intertidal zone
- [ ] H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc.)
- [ ] I Other: ____________________ (explain in "Notes/Sketch" section)
- [X] J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- [ ] A Drought conditions <u>and</u> no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- [ ] B Drought conditions <u>and</u> rainfall exceeding 1 inch within the last 48 hours
- [X] C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
[ ] Yes [X] No Is stream too large or dangerous to assess? **If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).**

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. [ ] Yes [X] No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- [ ] A Multiple aquatic macrophytes and aquatic mosses (including liverworts, lichens, and algal mats)
- [X] B Multiple sticks and/or leaf packs and/or emergent vegetation
- [X] C Multiple snags and logs (including lap trees)
- [ ] D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- [ ] E Little or no habitat

Check for Tidal Marsh Streams Only
- [ ] F 5% oysters or other natural hard bottoms
- [ ] G Submerged aquatic vegetation
- [ ] H Low-tide refugia (pools)
- [ ] I Sand bottom
- [ ] J 5% vertical bank along the marsh
- [ ] K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. [X] Yes [ ] No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- [X] A Riffle-run section **(evaluate 11c)**
- [X] B Pool-glide section **(evaluate 11d)**
- [ ] C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
[X]	[ ]	[ ]	[ ]	[ ]	Bedrock/saprolite
[X]	[ ]	[ ]	[ ]	[ ]	Boulder (256 – 4096 mm)
[X]	[ ]	[ ]	[ ]	[ ]	Cobble (64 – 256 mm)
[X]	[ ]	[ ]	[ ]	[ ]	Gravel (2 – 64 mm)
[ ]	[ ]	[ ]	[X]	[ ]	Sand (.062 – 2 mm)
[ ]	[ ]	[X]	[ ]	[ ]	Silt/clay (< 0.062 mm)
[ ]	[ ]	[X]	[ ]	[ ]	Detritus
[X]	[ ]	[ ]	[ ]	[ ]	Artificial (rip-rap, concrete, etc.)

11d. [ ] Yes [X] No Are pools filled with sediment?

12 **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ______

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles (including water pennies)
☐	☐	Caddisfly larvae (Trichoptera [T])
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans (true flies)
☐	☐	Mayfly larvae (Ephemeroptera [E])
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☒	☐	Midges/mosquito larvae — White
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles Water miter
☐	☐	Snails
☒	☐	Stonefly larvae (Plecoptera [P])
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☒Y	Are wetlands present in the streamside area?
☒N	☐N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction that passes some flow during low-flow periods affecting assessment reach (ex: beaver dam, bottom-release dam)
- ☐D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for the stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees. Privet, river cane, Holly
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:
Check about live stock

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassarixa
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T4 R1-R3
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 5
13. Is assessment reach a swamp steam? ☐ Yes ☒ No
14. Feature type: ☒ Perennial flow ☐ Intermittent flow ☐ Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒ A 
(more sinuous stream, flatter valley slope)

☐ B 
(less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒ Size 1 (< 0.1 mi²) ☐ Size 2 (0.1 to < 0.5 mi²) ☐ Size 3 (0.5 to < 5 mi²) ☐ Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒ Yes ☐ No If Yes, check all that apply to the assessment area.
    - ☐ Section 10 water
    - ☐ Classified Trout Waters
    - ☐ Water Supply Watershed (☐ I ☐ II ☐ III ☐ IV ☐ V)
    - ☐ Essential Fish Habitat
    - ☐ Primary Nursery Area
    - ☐ High Quality Waters/Outstanding Resource Waters
    - ☐ Publicly owned property
    - ☐ NCDWR Riparian buffer rule in effect
    - ☐ Nutrient Sensitive Waters
    - ☐ Anadromous fish
    - ☐ 303(d) List
    - ☐ CAMA Area of Environmental Concern (AEC)
    - ☐ Documented presence of a federal and/or state listed protected species within the assessment area.
      List species:
    - ☐ Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐ Yes ☐ No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
- ☒ A Water throughout assessment reach.
- ☐ B No flow, water in pools only.
- ☐ C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
- ☐ A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
- ☒ B Not A

3. Feature Pattern – assessment reach metric
- ☐ A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☒ B Not A

4. Feature Longitudinal Profile – assessment reach metric
- ☒ A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐ B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☐ A < 10% of channel unstable
- ☐ B 10 to 25% of channel unstable
- ☒ C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
[ ] A	[ ] A	Little or no evidence of conditions that adversely affect reference interaction
[X] B	[X] B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
[ ] C	[ ] C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- [ ] A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- [ ] B Excessive sedimentation (burying of stream features or intertidal zone)
- [X] C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- [ ] D Odor (not including natural sulfide odors) pasture, next to stream
- [ ] E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- [ ] F Livestock with access to stream or intertidal zone
- [ ] G Excessive algae in stream or intertidal zone
- [ ] H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- [ ] I Other: ____________________ (explain in "Notes/Sketch" section)
- [ ] J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- [ ] A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- [ ] B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- [X] C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
[ ] Yes [X] No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**

10a. [ ] Yes [X] No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- [ ] A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- [X] B Multiple sticks and/or leaf packs and/or emergent vegetation
- [X] C Multiple snags and logs (including lap trees)
- [X] D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- [ ] E Little or no habitat

Check for Tidal Marsh Streams Only
- [ ] F 5% oysters or other natural hard bottoms
- [ ] G Submerged aquatic vegetation
- [ ] H Low-tide refugia (pools)
- [ ] I Sand bottom
- [ ] J 5% vertical bank along the marsh
- [ ] K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS******************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. [X] Yes [ ] No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- [X] A Riffle-run section **(evaluate 11c)**
- [X] B Pool-glide section **(evaluate 11d)**
- [ ] C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
[X]	[ ]	[ ]	[ ]	[ ]	Bedrock/saprolite
[X]	[ ]	[ ]	[ ]	[ ]	Boulder (256 – 4096 mm)
[ ]	[X]	[ ]	[ ]	[ ]	Cobble (64 – 256 mm)
[ ]	[ ]	[X]	[ ]	[ ]	Gravel (2 – 64 mm)
[ ]	[ ]	[ ]	[X]	[ ]	Sand (.062 – 2 mm)
[ ]	[ ]	[X]	[ ]	[ ]	Silt/clay (< 0.062 mm)
[ ]	[ ]	[X]	[ ]	[ ]	Detritus
[X]	[ ]	[ ]	[ ]	[ ]	Artificial (rip-rap, concrete, etc.)

11d. [ ] Yes [X] No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ____________

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☒	☐	Dipterans Blackfly?
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☐Y	Are wetlands present in the streamside area?
☒N	☒N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☐A	≥ 100 feet wide <u>or</u> extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☒D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide <u>or</u> no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation <u>or</u> modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☒D	☐D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer <u>or</u> predominantly herbaceous species <u>or</u> bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> no vegetation.

Privet, MR

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ____________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp
2. Date of evaluation: 9/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassanxa
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T4 R3
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1 ft ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 2.5
13. Is assessment reach a swamp steam? ☐ Yes ☒ No
14. Feature type: ☒ Perennial flow ☐ Intermittent flow ☐ Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒ A  (more sinuous stream, flatter valley slope)
☐ B  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒ Size 1 (< 0.1 mi^2) ☐ Size 2 (0.1 to < 0.5 mi^2) ☐ Size 3 (0.5 to < 5 mi^2) ☐ Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒ Yes ☐ No If Yes, check all that apply to the assessment area.
    - ☐ Section 10 water
    - ☐ Classified Trout Waters
    - ☐ Water Supply Watershed (☐ I ☐ II ☐ III ☐ IV ☐ V)
    - ☐ Essential Fish Habitat
    - ☐ Primary Nursery Area
    - ☐ High Quality Waters/Outstanding Resource Waters
    - ☐ Publicly owned property
    - ☐ NCDWR Riparian buffer rule in effect
    - ☐ Nutrient Sensitive Waters
    - ☐ Anadromous fish
    - ☐ 303(d) List
    - ☐ CAMA Area of Environmental Concern (AEC)
    - ☐ Documented presence of a federal and/or state listed protected species within the assessment area.
      List species:
    - ☐ Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐ Yes ☐ No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
- ☒ A Water throughout assessment reach.
- ☐ B No flow, water in pools only.
- ☐ C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
- ☐ A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
- ☒ B Not A

3. Feature Pattern – assessment reach metric
- ☐ A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☒ B Not A

4. Feature Longitudinal Profile – assessment reach metric
- ☐ A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☒ B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☒ A < 10% of channel unstable
- ☐ B 10 to 25% of channel unstable
- ☐ C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ______

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☒	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☒	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☒F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat. Japanese Stiltgrass, Privet (sparse)

LB	RB	
☒A	☒A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ____________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassanxa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassanxa
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T5B
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): .25 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 1.5
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape **(skip for Tidal Marsh Stream)**:
☒A (more sinuous stream, flatter valley slope)
☐B (less sinuous stream, steeper valley slope)

17. Watershed size: **(skip for Tidal Marsh Stream)**
☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☐Yes ☐No If Yes, check all that apply to the assessment area.
- ☐Section 10 water
- ☐Classified Trout Waters
- ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
- ☐Essential Fish Habitat
- ☐Primary Nursery Area
- ☐ High Quality Waters/Outstanding Resource Waters
- ☐Publicly owned property
- ☐NCDWR Riparian buffer rule in effect
- ☐Nutrient Sensitive Waters
- ☐Anadromous fish
- ☐303(d) List
- ☐CAMA Area of Environmental Concern (AEC)
- ☐Documented presence of a federal and/or state listed protected species within the assessment area.
  List species:
- ☐Designated Critical Habitat (list species)

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☒B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☒A < 10% of channel unstable
   - ☐B 10 to 25% of channel unstable
   - ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
[X]A	[X]A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- [X]F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- [X]C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes [X]No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes [X]No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- [X]B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. [X]Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- [X]A Riffle-run section **(evaluate 11c)**
- [X]B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
[X]	☐	☐	☐	☐	Bedrock/saprolite
[X]	☐	☐	☐	☐	Boulder (256 – 4096 mm)
[X]	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	[X]	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	[X]	☐	Sand (.062 – 2 mm)
☐	☐	[X]	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	[X]	☐	☐	Detritus
[X]	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes [X]No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ______

12b. ☐Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☒	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☒	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.
- ☐A Streams and/or springs (jurisdictional discharges)
- ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☒D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☐E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.
- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.
- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ____________________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassarixa Swamp 2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands 4. Assessor name/organization: Wildlands Eng
5. County: Johnston 6. Nearest named water body
7. River basin: Neuse 4 on USGS 7.5-minute quad: Sassarixa Swamp
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T5C 10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): .25 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 1.5 13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒A  (more sinuous stream, flatter valley slope)

☐B  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☐Yes ☐No If Yes, check all that apply to the assessment area.
    - ☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
    - ☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
    - ☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
    - ☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
    - ☐Documented presence of a federal and/or state listed protected species within the assessment area.
      List species:
    - ☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☒B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☐A < 10% of channel unstable
   - ☒B 10 to 25% of channel unstable
   - ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☐Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. [x] Yes [ ] No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. [ ] No Water [ ] Other: ____________

12b. [ ] Yes [ ] No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
[ ]	[ ]	Adult frogs
[ ]	[ ]	Aquatic reptiles
[ ]	[ ]	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
[ ]	[ ]	Beetles
[ ]	[ ]	Caddisfly larvae (T)
[ ]	[ ]	Asian clam (*Corbicula*)
[ ]	[ ]	Crustacean (isopod/amphipod/crayfish/shrimp)
[ ]	[ ]	Damselfly and dragonfly larvae
[ ]	[ ]	Dipterans
[ ]	[ ]	Mayfly larvae (E)
[ ]	[ ]	Megaloptera (alderfly, fishfly, dobsonfly larvae)
[ ]	[x]	Midges/mosquito larvae
[ ]	[ ]	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
[ ]	[ ]	Mussels/Clams (not *Corbicula*)
[ ]	[ ]	Other fish
[ ]	[ ]	Salamanders/tadpoles
[ ]	[ ]	Snails
[ ]	[ ]	Stonefly larvae (P)
[ ]	[ ]	Tipulid larvae
[ ]	[ ]	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
[ ] A	[ ] A	Little or no alteration to water storage capacity over a majority of the streamside area
[ ] B	[ ] B	Moderate alteration to water storage capacity over a majority of the streamside area
[x] C	[x] C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
[ ] A	[ ] A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
[ ] B	[ ] B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
[x] C	[x] C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
[ ] Y	[x] Y	Are wetlands present in the streamside area?
[x] N	[ ] N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- [ ] A Streams and/or springs (jurisdictional discharges)
- [ ] B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- [ ] C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- [x] D Evidence of bank seepage or sweating (iron in water indicates seepage)
- [ ] E Stream bed or bank soil reduced (dig through deposited sediment if present)
- [ ] F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

- [ ] A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- [ ] B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- [ ] C Urban stream (≥ 24% impervious surface for watershed)
- [x] D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- [ ] E Assessment reach relocated to valley edge
- [ ] F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- [x] A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- [ ] B Degraded (example: scattered trees)
- [ ] C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
[x] A	[x] A	[x] A	[x] A	≥ 100 feet wide or extends to the edge of the watershed
[ ] B	[ ] B	[ ] B	[ ] B	From 50 to < 100 feet wide
[ ] C	[ ] C	[ ] C	[ ] C	From 30 to < 50 feet wide
[ ] D	[ ] D	[ ] D	[ ] D	From 10 to < 30 feet wide
[ ] E	[ ] E	[ ] E	[ ] E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
[ ] A	[ ] A	Mature forest
[x] B	[x] B	Non-mature woody vegetation or modified vegetation structure
[ ] C	[ ] C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
[ ] D	[ ] D	Maintained shrubs
[ ] E	[ ] E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: [ ]

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
[ ] A	[ ] A	[ ] A	[ ] A	[ ] A	[ ] A	Row crops
[ ] B	[ ] B	[ ] B	[ ] B	[ ] B	[ ] B	Maintained turf
[ ] C	[ ] C	[ ] C	[ ] C	[ ] C	[ ] C	Pasture (no livestock)/commercial horticulture
[x] D	[x] D	[x] D	[x] D	[x] D	[x] D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
[x] A	[x] A	Medium to high stem density
[ ] B	[ ] B	Low stem density
[ ] C	[ ] C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
[x] A	[x] A	The total length of buffer breaks is < 25 percent.
[ ] B	[ ] B	The total length of buffer breaks is between 25 and 50 percent.
[ ] C	[ ] C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
[ ] A	[ ] A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
[x] B	[x] B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
[ ] C	[ ] C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. [ ] Yes [ ] No Was conductivity measurement recorded?
If No, select one of the following reasons. [ ] No Water [ ] Other: ____________________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
[ ] A < 46 [ ] B 46 to < 67 [ ] C 67 to < 79 [ ] D 79 to < 230 [ ] E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:
1. Project name (if any): Sassarixa Swamp 2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands 4. Assessor name/organization: Wildlands Eng
5. County: Johnston 6. Nearest named water body
7. River basin: Neuse 4 on USGS 7.5-minute quad: Sassarixa Swamp
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): TS R1 10. Length of assessment reach evaluated (feet):
→ 11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1.5 [ ] Unable to assess channel depth.
→ 12. Channel width at top of bank (feet): 2.5 13. Is assessment reach a swamp steam? [ ] Yes [x] No
14. Feature type: [x] Perennial flow [ ] Intermittent flow [ ] Tidal Marsh Stream

STREAM CATEGORY INFORMATION:
15. NC SAM Zone: [ ] Mountains (M) [ ] Piedmont (P) [x] Inner Coastal Plain (I) [ ] Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
[x] A  (more sinuous stream, flatter valley slope)
[ ] B  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) [ ] Size 1 (< 0.1 mi²) [x] Size 2 (0.1 to < 0.5 mi²) [ ] Size 3 (0.5 to < 5 mi²) [ ] Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:
18. Were regulatory considerations evaluated? [ ] Yes [ ] No If Yes, check all that apply to the assessment area.
- [ ] Section 10 water
- [ ] Classified Trout Waters
- [ ] Water Supply Watershed ([ ] I [ ] II [ ] III [ ] IV [ ] V)
- [ ] Essential Fish Habitat
- [ ] Primary Nursery Area
- [ ] High Quality Waters/Outstanding Resource Waters
- [ ] Publicly owned property
- [ ] NCDWR Riparian buffer rule in effect
- [ ] Nutrient Sensitive Waters
- [ ] Anadromous fish
- [ ] 303(d) List
- [ ] CAMA Area of Environmental Concern (AEC)
- [ ] Documented presence of a federal and/or state listed protected species within the assessment area.
  List species:
- [ ] Designated Critical Habitat (list species)

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? [ ] Yes [ ] No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - [x] A Water throughout assessment reach.
   - [ ] B No flow, water in pools only.
   - [ ] C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - [ ] A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - [x] B Not A

3. **Feature Pattern – assessment reach metric**
   - [ ] A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - [x] B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - [x] A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - [ ] B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - [ ] A < 10% of channel unstable
   - [ ] B 10 to 25% of channel unstable
   - [x] C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☐Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams).** Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ______

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans black fly (15)
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea)*
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☒B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☐Y	Are wetlands present in the streamside area?
☐N	☒N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A Streams and/or springs (jurisdictional discharges)
☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C Urban stream (≥ 24% impervious surface for watershed)
☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E Assessment reach relocated to valley edge
☐F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B Degraded (example: scattered trees)
☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☒A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☒B	☒B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☐No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ______________________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassanxa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassanxa Swamp
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): TS R3
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.6 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 5.5
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape **(skip for Tidal Marsh Stream)**:

☒A  (more sinuous stream, flatter valley slope)

☐B  (less sinuous stream, steeper valley slope)

17. Watershed size: **(skip for Tidal Marsh Stream)** ☐Size 1 (< 0.1 mi²) ☒Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☐Yes ☐No If Yes, check all that apply to the assessment area.
    - ☐Section 10 water
    - ☐Classified Trout Waters
    - ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
    - ☐Essential Fish Habitat
    - ☐Primary Nursery Area
    - ☐ High Quality Waters/Outstanding Resource Waters
    - ☐Publicly owned property
    - ☐NCDWR Riparian buffer rule in effect
    - ☐Nutrient Sensitive Waters
    - ☐Anadromous fish
    - ☐303(d) List
    - ☐CAMA Area of Environmental Concern (AEC)
    - ☐Documented presence of a federal and/or state listed protected species within the assessment area.
      List species:
    - ☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☐No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☒A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☐B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances). Mid channel bars
   - ☐B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☐A < 10% of channel unstable
   - ☒B 10 to 25% of channel unstable
   - ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☒D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☐Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. [X] Yes [ ] No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. [ ] No Water [ ] Other: ____________________

12b. [ ] Yes [ ] No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
[ ]	[X]	Adult frogs
[ ]	[ ]	Aquatic reptiles
[ ]	[ ]	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
[ ]	[ ]	Beetles
[ ]	[ ]	Caddisfly larvae (T)
[ ]	[ ]	Asian clam (*Corbicula*)
[ ]	[ ]	Crustacean (isopod/amphipod/crayfish/shrimp)
[ ]	[ ]	Damselfly and dragonfly larvae
[ ]	[ ]	Dipterans Black fly
[ ]	[ ]	Mayfly larvae (E)
[ ]	[ ]	Megaloptera (alderfly, fishfly, dobsonfly larvae)
[ ]	[X]	Midges/mosquito larvae
[ ]	[ ]	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
[ ]	[ ]	Mussels/Clams (not *Corbicula*)
[ ]	[ ]	Other fish
[ ]	[ ]	Salamanders/tadpoles
[ ]	[ ]	Snails
[ ]	[ ]	Stonefly larvae (P)
[ ]	[ ]	Tipulid larvae
[ ]	[ ]	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
[ ] A	[X] A	Little or no alteration to water storage capacity over a majority of the streamside area
[ ] B	[ ] B	Moderate alteration to water storage capacity over a majority of the streamside area
[X] C	[ ] C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
[ ] A	[ ] A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
[ ] B	[ ] B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
[X] C	[X] C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
[ ] Y	[ ] Y	Are wetlands present in the streamside area?
[X] N	[X] N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of and draining to the assessment reach.

- [ ] A Streams and/or springs (jurisdictional discharges)
- [X] B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- [ ] C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- [X] D Evidence of bank seepage or sweating (iron in water indicates seepage)
- [ ] E Stream bed or bank soil reduced (dig through deposited sediment if present)
- [ ] F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.

- [ ] A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- [ ] B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- [ ] C Urban stream (≥ 24% impervious surface for watershed)
- [X] D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- [ ] E Assessment reach relocated to valley edge
- [ ] F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.

- [X] A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- [ ] B Degraded (example: scattered trees)
- [ ] C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☒A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☒B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☒A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☐D	☒D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

Dense privet

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☐No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ______________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Sassanxa Swamp
2. Date of evaluation: 4/10/18
3. Applicant/owner name: Wildlands
4. Assessor name/organization: Wildlands Eng
5. County: Johnston
6. Nearest named water body on USGS 7.5-minute quad: Sassanxa
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T6 R2
10. Length of assessment reach evaluated (feet):
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.5 Ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 9Ft
13. Is assessment reach a swamp steam? ☐Yes ☑No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)

16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):

☒A  (more sinuous stream, flatter valley slope)

☐B  (less sinuous stream, steeper valley slope)

17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi²) ☒Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☑Yes ☐No If Yes, check all that apply to the assessment area.

☐Section 10 water	☐Classified Trout Waters	☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat	☐Primary Nursery Area	☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property	☐NCDWR Riparian buffer rule in effect	☐Nutrient Sensitive Waters
☐Anadromous fish	☐303(d) List	☐CAMA Area of Environmental Concern (AEC)

☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☑No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.

2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A

3. **Feature Pattern – assessment reach metric**
   - ☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☒B Not A

4. **Feature Longitudinal Profile – assessment reach metric**
   - ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
   - ☐B Not A

5. **Signs of Active Instability – assessment reach metric**
   Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
   - ☐A < 10% of channel unstable
   - ☒B 10 to 25% of channel unstable
   - ☐C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.
- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: ____________________ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**
10a. ☐Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☒B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☒C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☐E Little or no habitat

Check for Tidal Marsh Streams Only
- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☐	☒	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? **(skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

12. **Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)**

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: ______

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☒	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☒	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish Black Fly
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☒	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. **Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. **Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)**
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. **Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)**
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. **Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)**
Check all contributors within the assessment reach or within view of and draining to the assessment reach.
- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☒D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☐E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. **Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)**
Check all that apply.
- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge pasture
- ☐F None of the above

18. **Shading – assessment reach metric (skip for Tidal Marsh Streams)**
Consider aspect. Consider "leaf-on" condition.
- ☒A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☐C Stream shading is gone or largely absent

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☒C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☒D	From 10 to < 30 feet wide
☐E	☐E	☐E	☐E	< 10 feet wide or no trees

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☒A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☐C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☒A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☐D	Pasture (active livestock use)

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☒A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☐C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. **Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

Some privet rose

LB	RB	
☒A	☒A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☐No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: ______________

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Appendix 4

DWR Stream Identification Forms

1.0 DWR Stream Classification

The results of the DWR Stream Classification Forms are listed in the table below. DWR forms can be found in this appendix and in the digital submission to DMS. DWR forms were completed by Wildlands for all on-site streams.

Table 1: DWR Form Summary – *Sassarixa Swamp Mitigation Site*

Stream	Geomorphology Score	Hydrology Score	Biology Score	Total Score
Sassarixa Creek	28.5	13	9	50.5
T1	18.5	2.5	5	26
T1A	14	4.5	5	23.5
T1B	15	8	4.75	27.75
T1C	16.5	8.5	3.75	28.75
T2	13	5.5	6.5	25
T3	18	6.5	6.5	31
T4	18	6.5	5.75	30.25
T5	25	10.5	5.75	41.25
T5A	15.5	8	6.25	29.75
T5B	11.5	5.5	6.25	23.25
T5C	13	6	6.25	25.25
T6	21	9	8.25	38.25

NC DWQ Stream Identification Form Version 4.11 Sassarixa Creek

Date: 8/30/17	Project/Site: Sassarixa	Latitude:
Evaluator: AA	County: Johnston	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 50.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = 28.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control large trees & woody debris	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 13)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians Snakes, frogs	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: Anabranching System

NC DWQ Stream Identification Form Version 4.11 1

Date: 8/30/17	Project/Site: Sassarixa	Latitude:
Evaluator: AA	County: Johnston	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 24	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name*:

A. Geomorphology (Subtotal = 18.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate Varies, sand, gravel mainly	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits increase in D/S direction	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control large trees	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

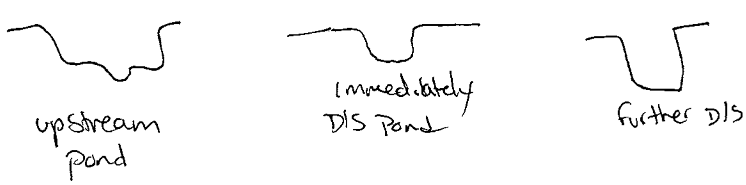
B. Hydrology (Subtotal = 2.5)				
12. Presence of Baseflow Present first 150'	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table? varies	No = 0		Yes = 3	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: channel interrupted by pond + dam, may braid just below dam for for few hundred feet

Sketch:



photos

NC DWQ Stream Identification Form Version 4.11 1A

Date: 8/30/17	Project/Site: Sassarixa	Latitude:
Evaluator: AA	County: Johnston	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other. *e.g. Quad Name:*

A. Geomorphology (Subtotal = 14)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate Sand/silt	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 4.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed some stilt grass	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

photo

TIB

NC DWQ Stream Identification Form Version 4.11

Date: 7/31	Project/Site: Sassarixa	Latitude: 35.478291
Evaluator: DD/CN	County: Johnston	Longitude: -78.444614
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28.75	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other *e.g. Quad Name:*

A. Geomorphology (Subtotal = ________)	Absent	Weak	Moderate	Strong
1[a.] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

14

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = ________)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

8

C. Biology (Subtotal = ________)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

28.75

Notes: trib to T1 from South

Sketch:

T1C

NC DWQ Stream Identification Form Version 4.11

Date: 7/31	Project/Site: Sassarixa	Latitude: 35.476266
Evaluator: DD/CH	County:	Longitude: -78.446087
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 28.75	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other Trib to *e.g. Quad Name:* Sassarixa Creek

A. Geomorphology (Subtotal = ________)	Absent	Weak	Moderate	Strong	
1[a] Continuity of channel bed and bank	0	1	2	3	
2. Sinuosity of channel along thalweg	0	1	2	3	
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3	
4. Particle size of stream substrate	0	1	2	3	
5. Active/relict floodplain	0	1	2	3	
6. Depositional bars or benches	0	1	2	3	
7. Recent alluvial deposits	0	1	2	3	
8. Headcuts	0	1	2	3	
9. Grade control	0	0.5	1	1.5	16.5
10. Natural valley	0	0.5	1	1.5	
11. Second or greater order channel	No = 0		Yes = 3		

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = ________)					
12. Presence of Baseflow	0	1	2	3	
13. Iron oxidizing bacteria	0	1	2	3	9.5
14. Leaf litter	1.5	1	0.5	0	
15. Sediment on plants or debris	0	0.5	1	1.5	
16. Organic debris lines or piles	0	0.5	1	1.5	
17. Soil-based evidence of high water table?	No = 0		Yes = 3		

C. Biology (Subtotal = ________)					
18. Fibrous roots in streambed	3	2	1	0	
19. Rooted upland plants in streambed	3	2	1	0	
20. Macrobenthos (note diversity and abundance)	0	1	2	3	
21. Aquatic Mollusks	0	1	2	3	3
22. Fish	0	0.5	1	1.5	
23. Crayfish	0	0.5	1	1.5	
24. Amphibians	0	0.5	1	1.5	
25. Algae	0	0.5	1	1.5	
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0				

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 4/8/17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other T2 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: BELOW HEADCUT, INSIDE OF WOOD LINE

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIKA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other T3 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.5)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: —MUCH MORE OF A PERENNIAL STREAM THAN IT SCORES

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLE	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* T4

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: *ex. riffle-pool, step-pool, ripple-pool sequence*	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5.75)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 41.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other TS *e.g. Quad Name:*

A. Geomorphology (Subtotal = 25)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5.75)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 29.75	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* T5A

A. Geomorphology (Subtotal = 15.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 8)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	~~1~~	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch: — APPEARS TO BE MUCH MORE OF A PERENNIAL STREAM ~~W~~ IN AREAS NOT TRAMPLED BY LIVESTOCK.

—

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other T5B *e.g. Quad Name*:

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIKA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25.25	**Stream Determination (circle one)** Ephemeral ~~Intermittent~~ Perennial	Other TSC *e.g. Quad Name:*

A. Geomorphology (Subtotal = 13)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 6.25)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 9-8-17	Project/Site: SASSARIXA	Latitude:
Evaluator: D. TAYLOR	County: JOHNSTON	Longitude:
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 38.25	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** T6 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8.25)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

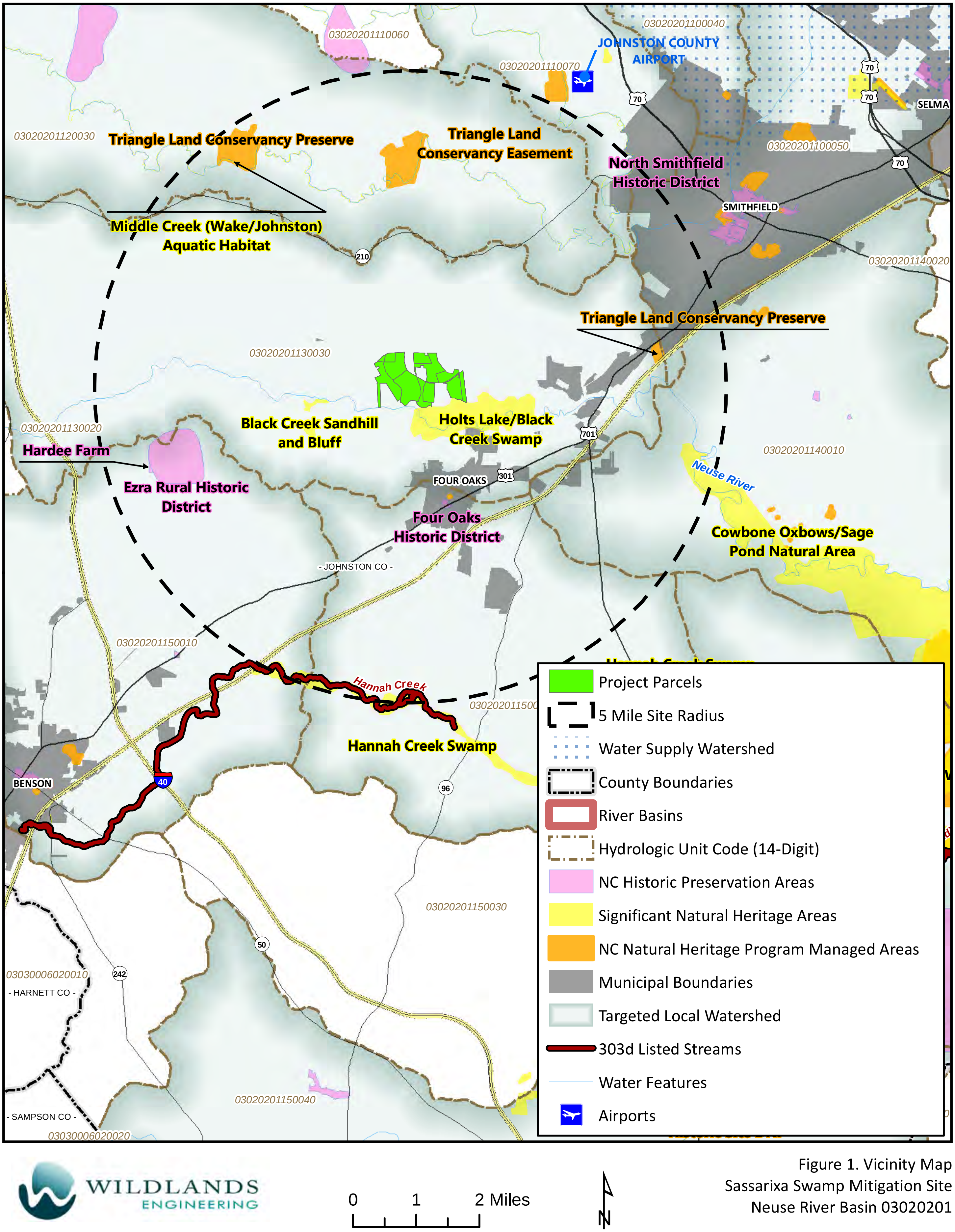
*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Appendix 5

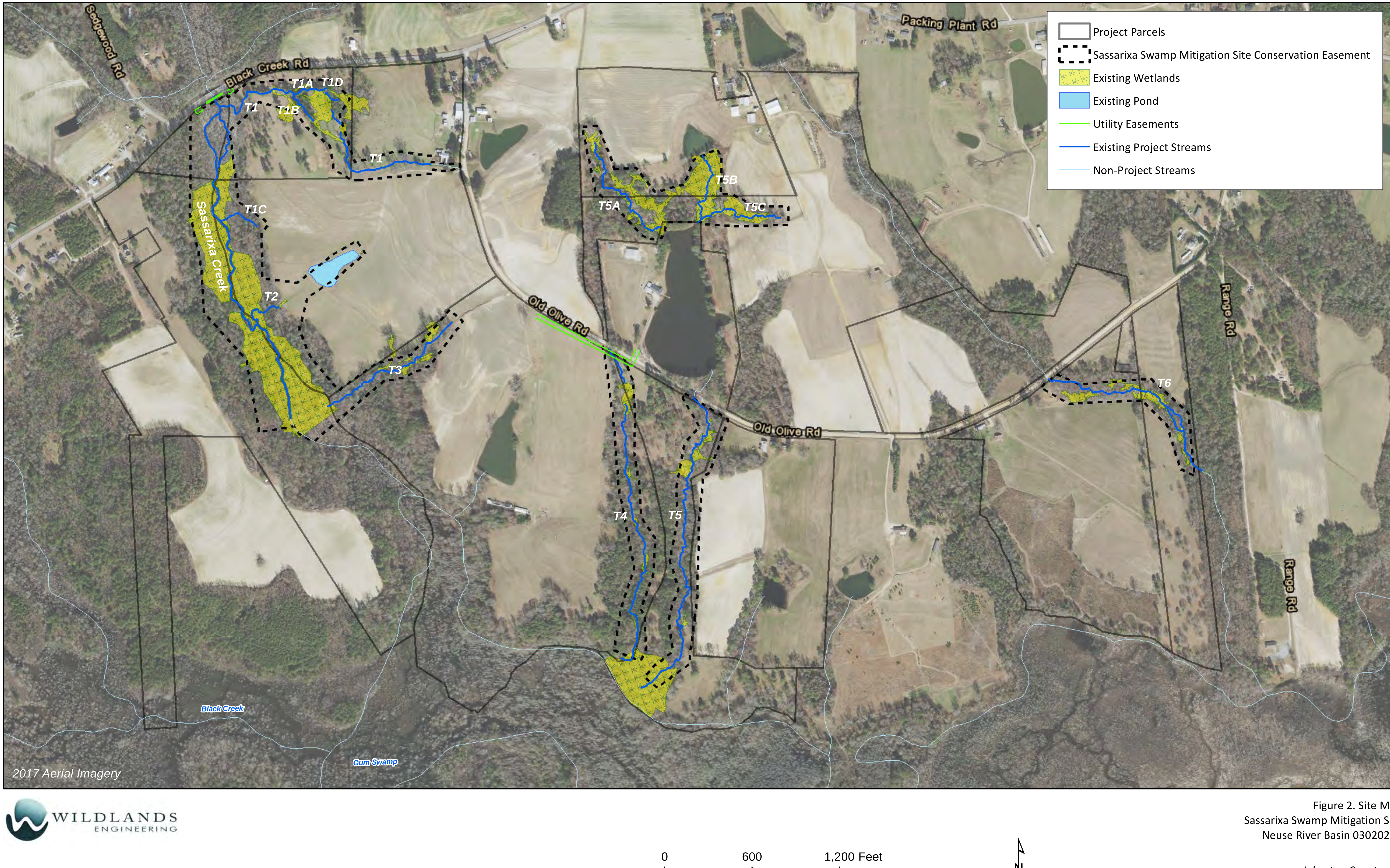
Data, Analysis, Supplementary Information, Figures, and Maps



WILDLANDS ENGINEERING

Figure 1. Vicinity Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

Figure 2. Site Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

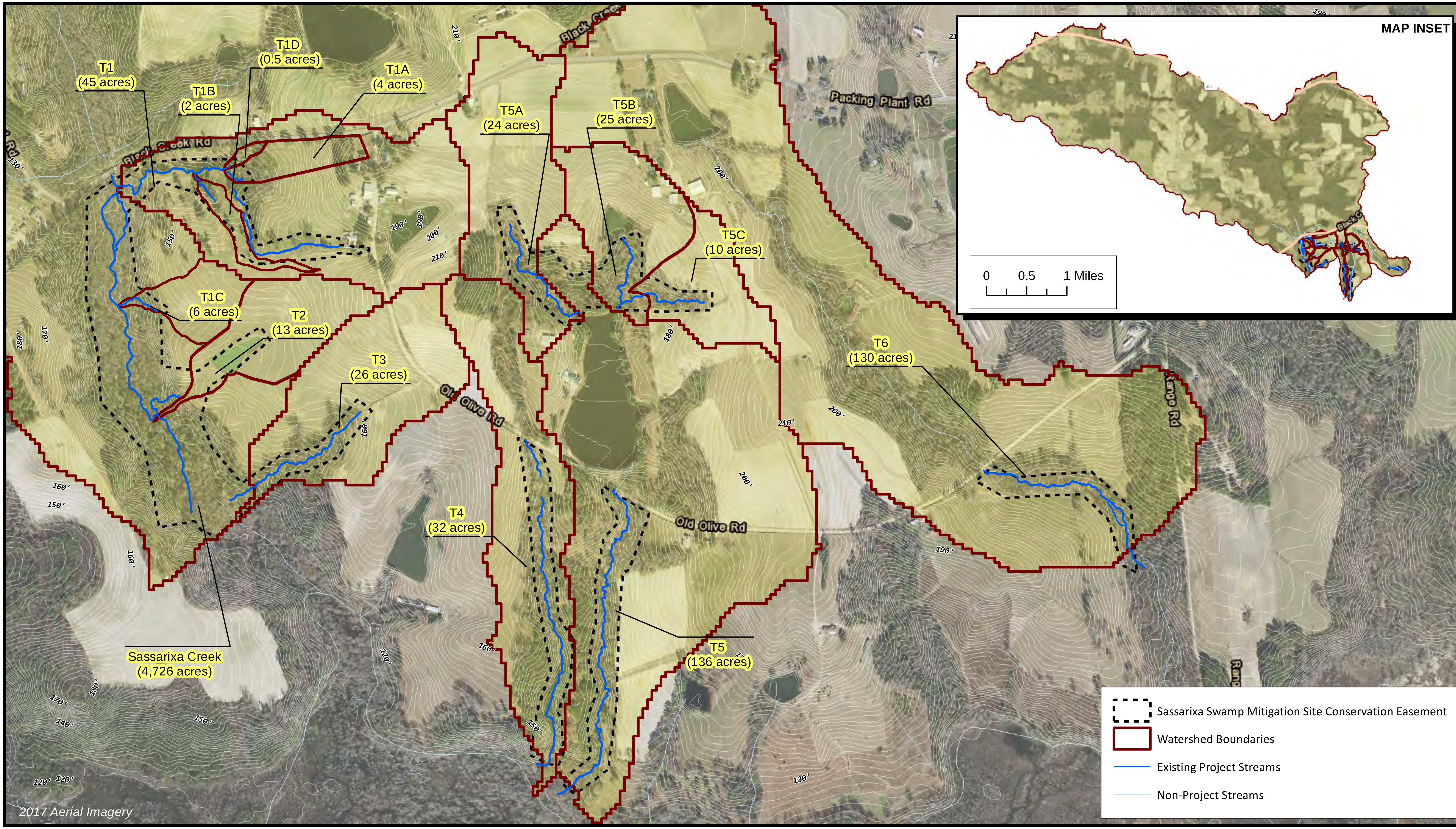
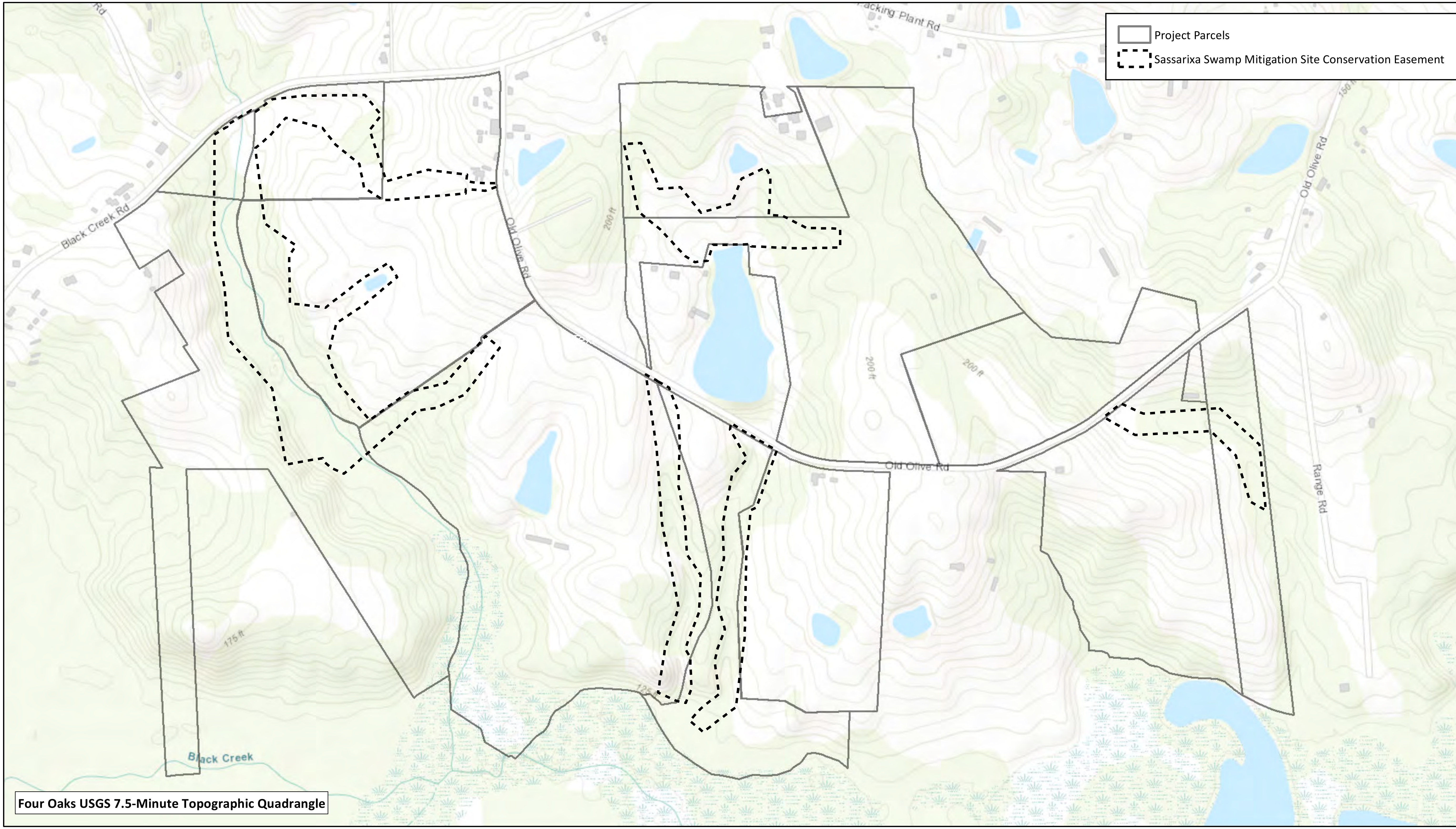


Figure 3. Watershed Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

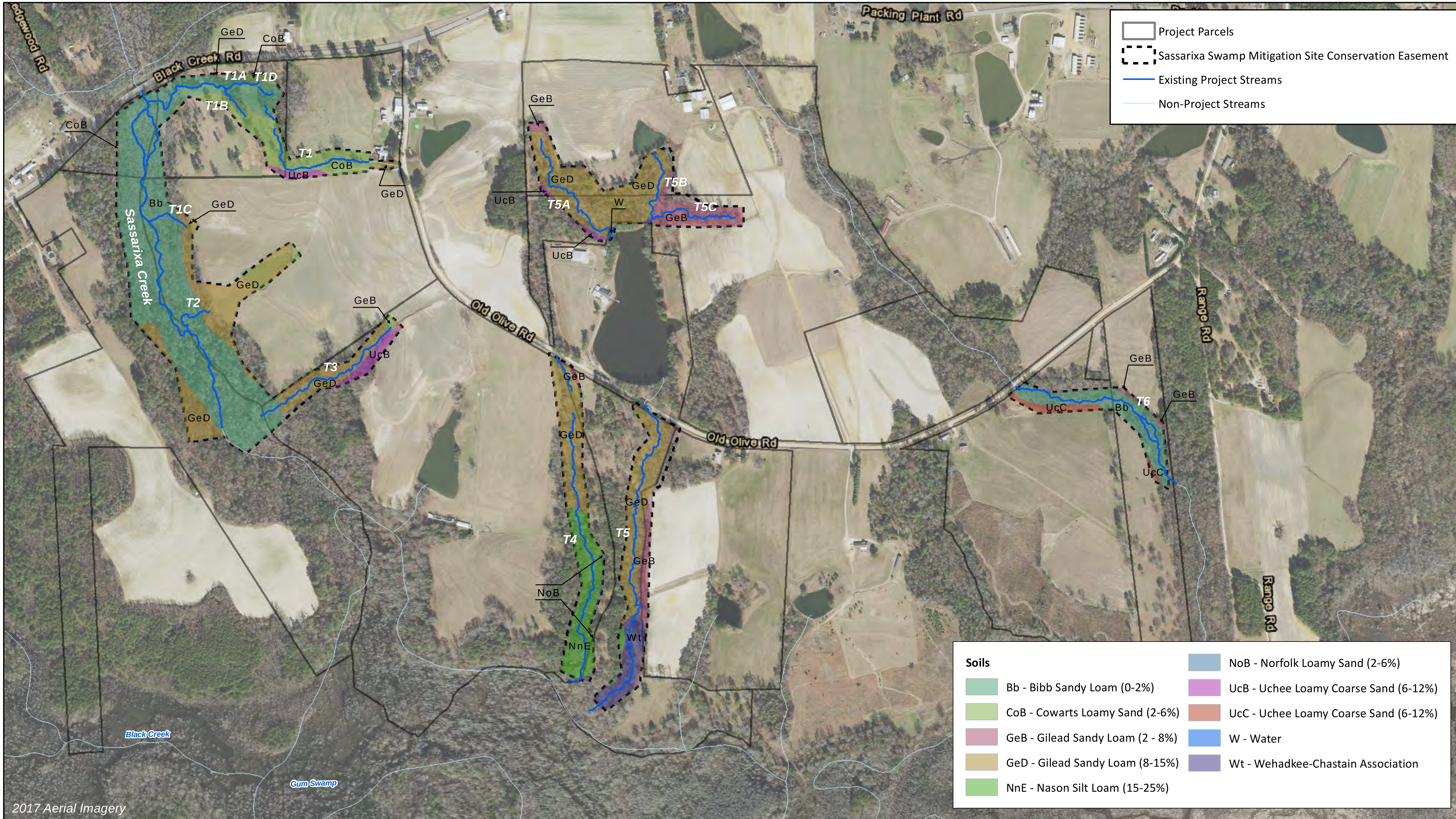
Johnston County, NC



WILDLANDS ENGINEERING

Figure 4. USGS Topographic Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

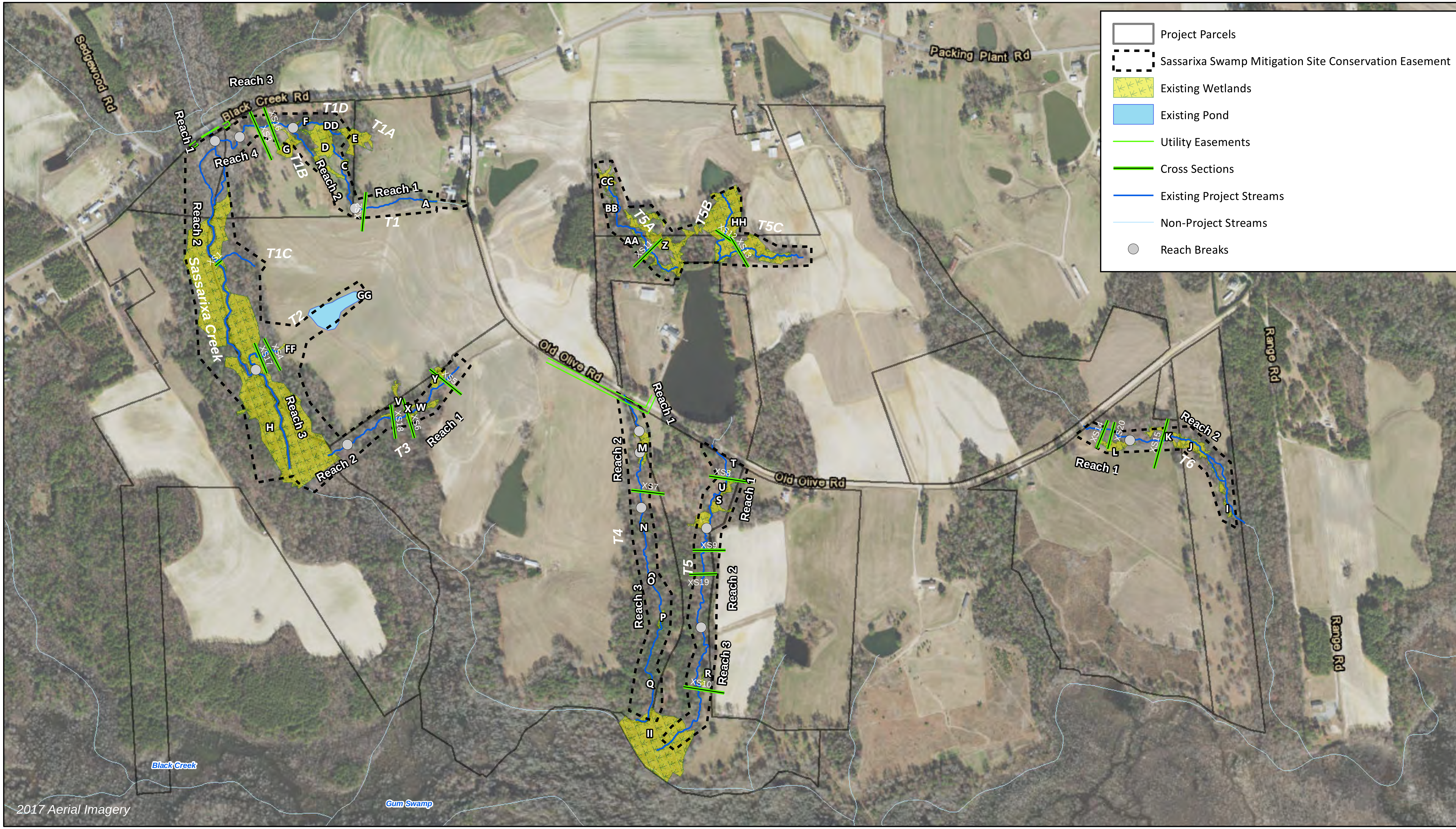
Johnston County, NC



WILDLANDS ENGINEERING

Figure 5. Soils Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

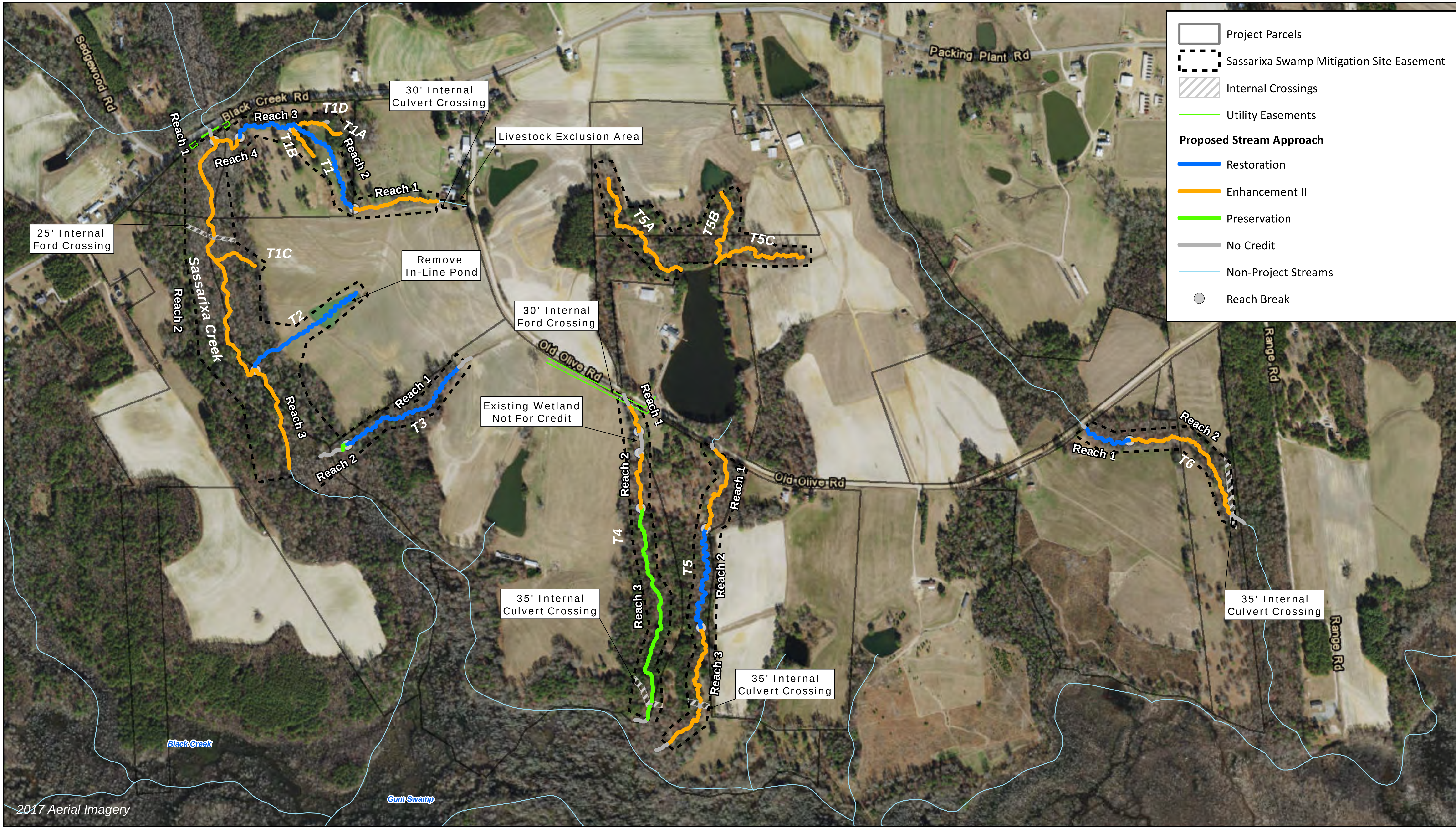
Johnston County, NC



WILDLANDS ENGINEERING

Figure 6. Existing Conditions Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

Figure 7. Concept Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

WILDLANDS ENGINEERING

Figure 8. FEMA Floodplain Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

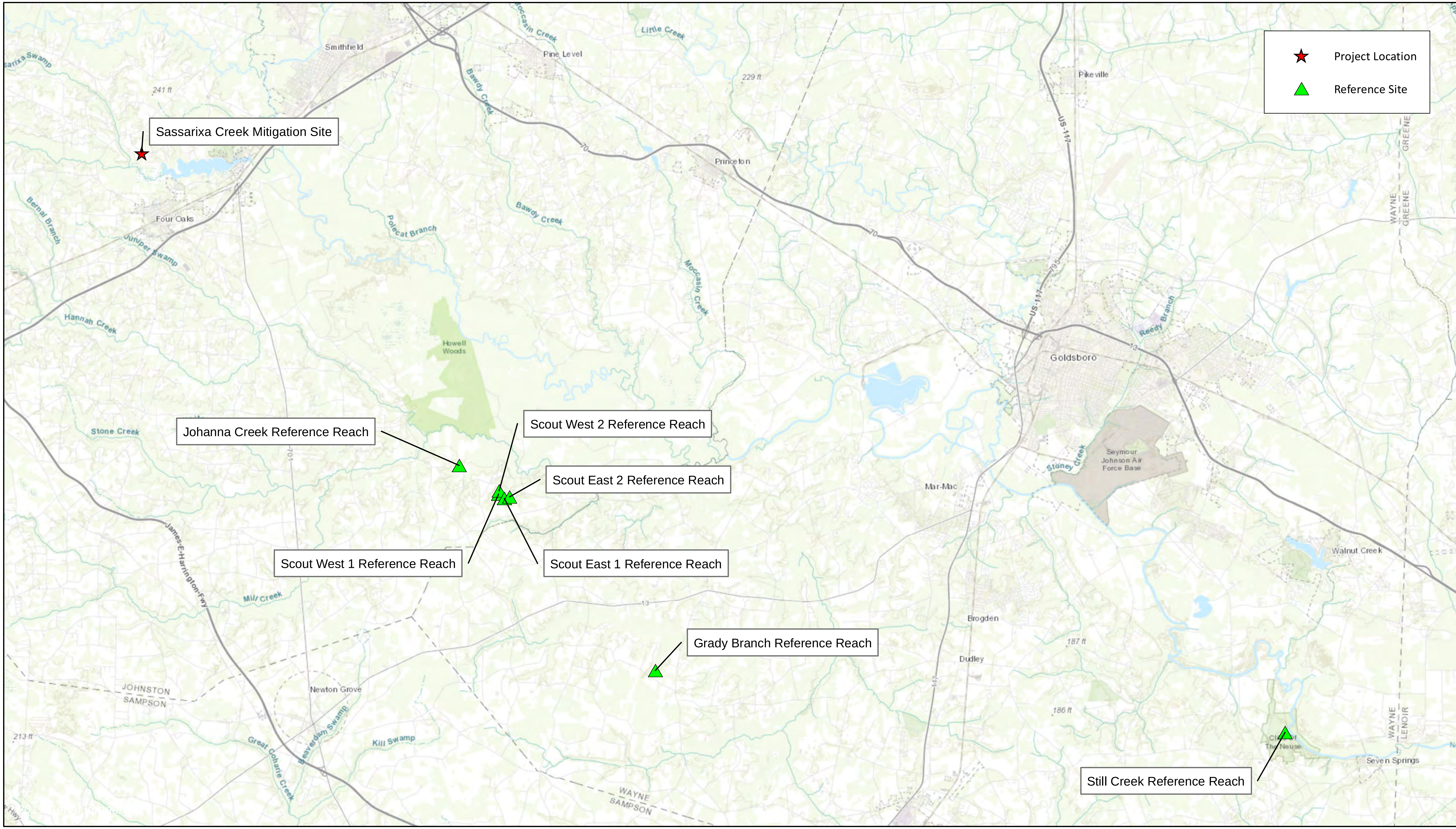
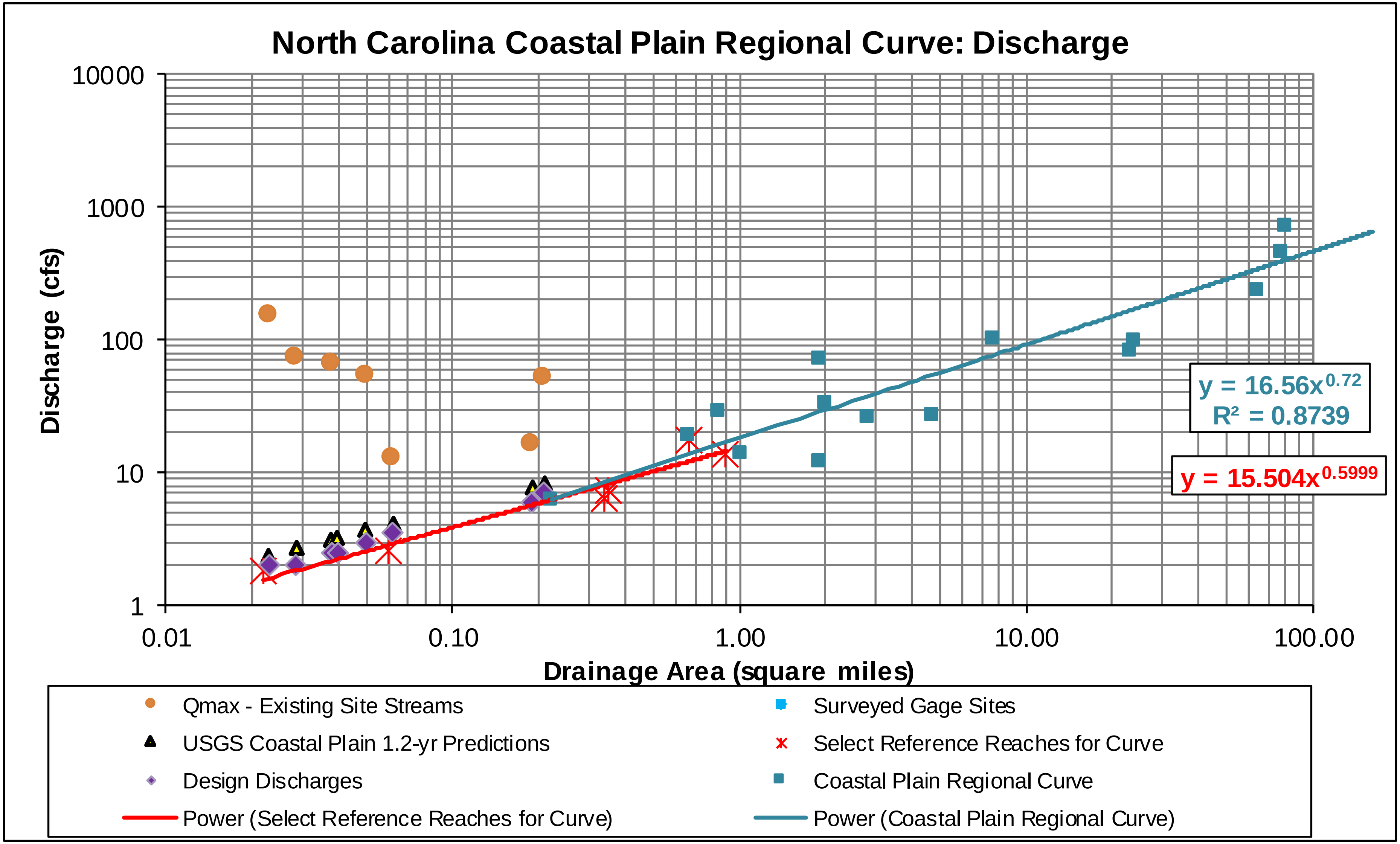


Figure 9. Reference Reach Vicinity Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

WILDLANDS ENGINEERING

Johnston County, NC



WILDLANDS ENGINEERING

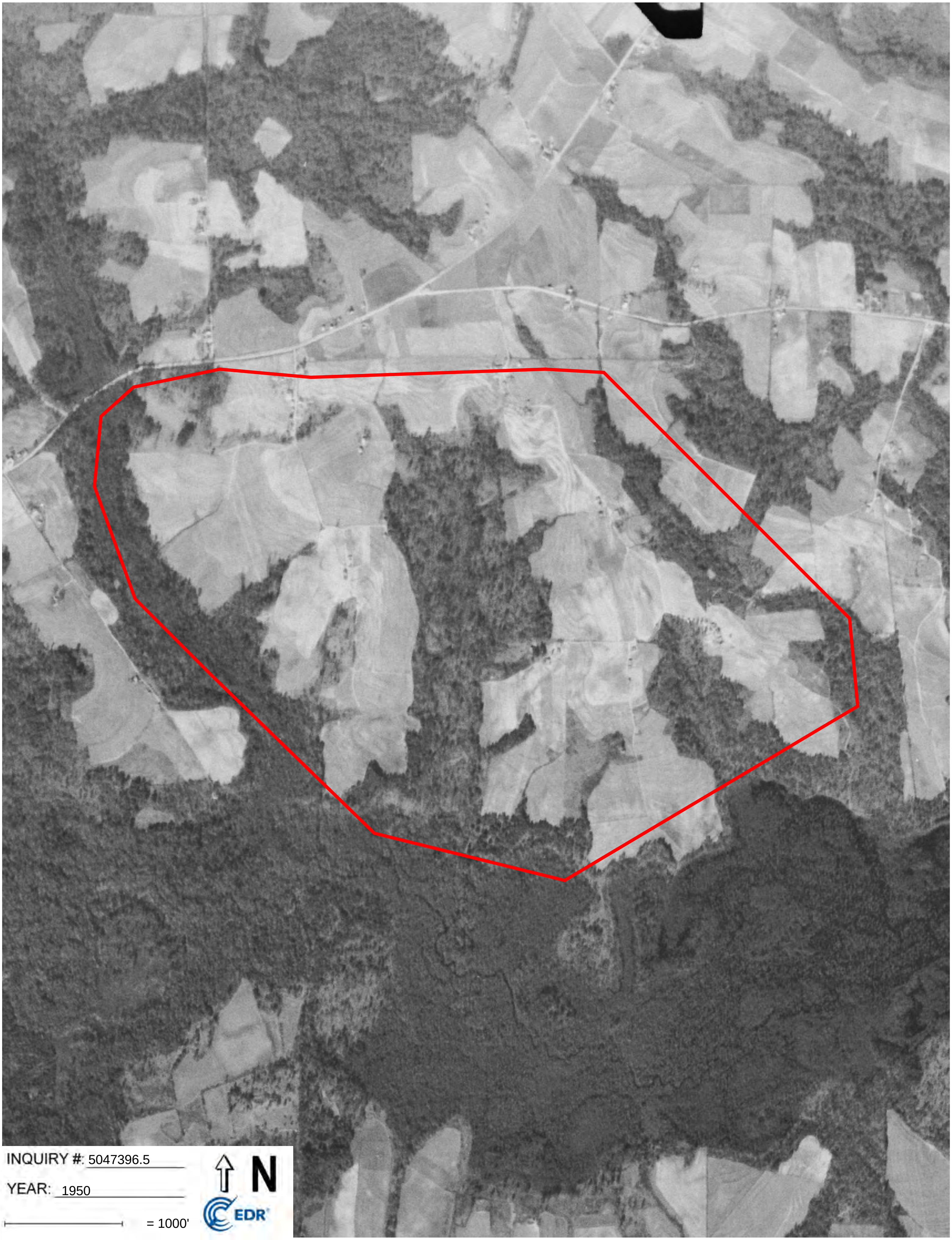
Figure 10. Discharge Analysis Graph
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

Figure 11. Monitoring Components Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

WILDLANDS ENGINEERING

Johnston County, NC



INQUIRY #: 5047396.5

YEAR: 1950

= 1000'

N

EDR

INQUIRY #: 5047396.5

YEAR: 1961

= 1000'

N

EDR

INQUIRY #: 5047396.5

YEAR: 1964

= 1000'

N

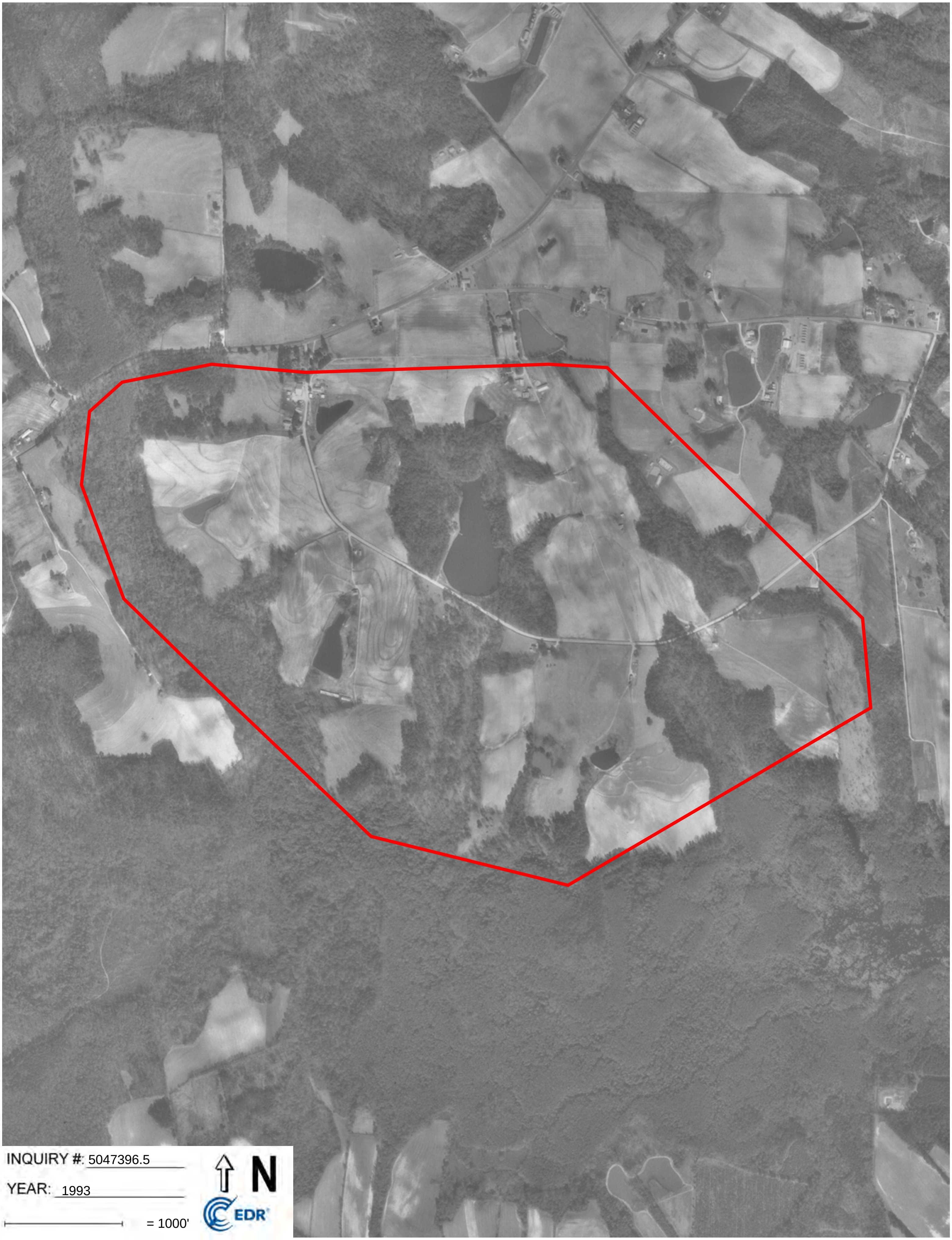
INQUIRY #: 5047396.5

YEAR: 1973

= 1000'

N

EDR



INQUIRY #: 5047396.5

YEAR: 1993

= 1000'

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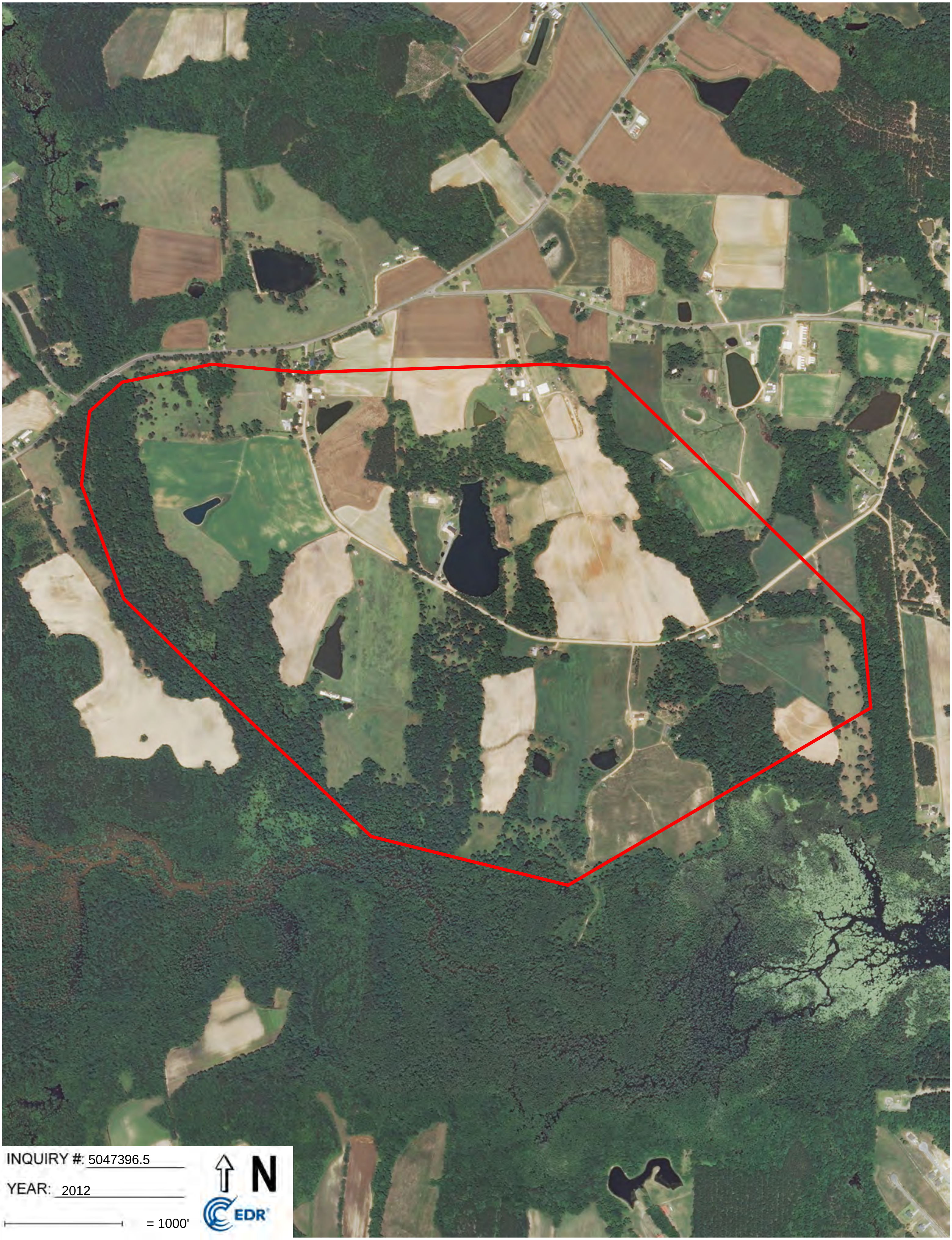

INQUIRY #: 5047396.5
YEAR: 2012
= 1000'
N
EDR

Sassarixa Creek Reach 2 - looking upstream

Sassarixa Creek Reach 2 - looking downstream

T1 Reach 1 - looking upstream

T1 Reach 1 - looking downstream

T1 Reach 3 - looking upstream

T1 Reach 3 - looking downstream

T2 - looking upstream

T2 - looking downstream

T3 Reach 1 - looking upstream

T3 Reach 1 - looking downstream

T3 Reach 2 - looking upstream

T3 Reach 2 - looking downstream

T4 Reach 1 - looking upstream

T4 Reach 1 - looking downstream

T5 Reach 1 - looking upstream

T5 Reach 1 - looking downstream

T5 Reach 2 - looking upstream

T5 Reach 2 - looking downstream

T5 Reach 3 - looking upstream

T5 Reach 3 - looking downstream

T5 Reach 4 - looking upstream

T5 Reach 4 - looking downstream

T5A - looking upstream

T5A - looking downstream

	
T5B Reach 1 - looking upstream	**T5B Reach 1 -** looking downstream
	
T5C - looking upstream	**T5C -** looking downstream
	
T6 Reach - looking upstream	**T6 Reach 1 -** looking downstream

	
T6 Reach 2 - looking upstream	**T6 Reach 2 -** looking downstream
	
T6 Reach 3 - looking upstream	**T6 Reach 3 -** looking downstream
	
T6 Reach 4 - looking upstream	**T6 Reach 4 -** looking downstream

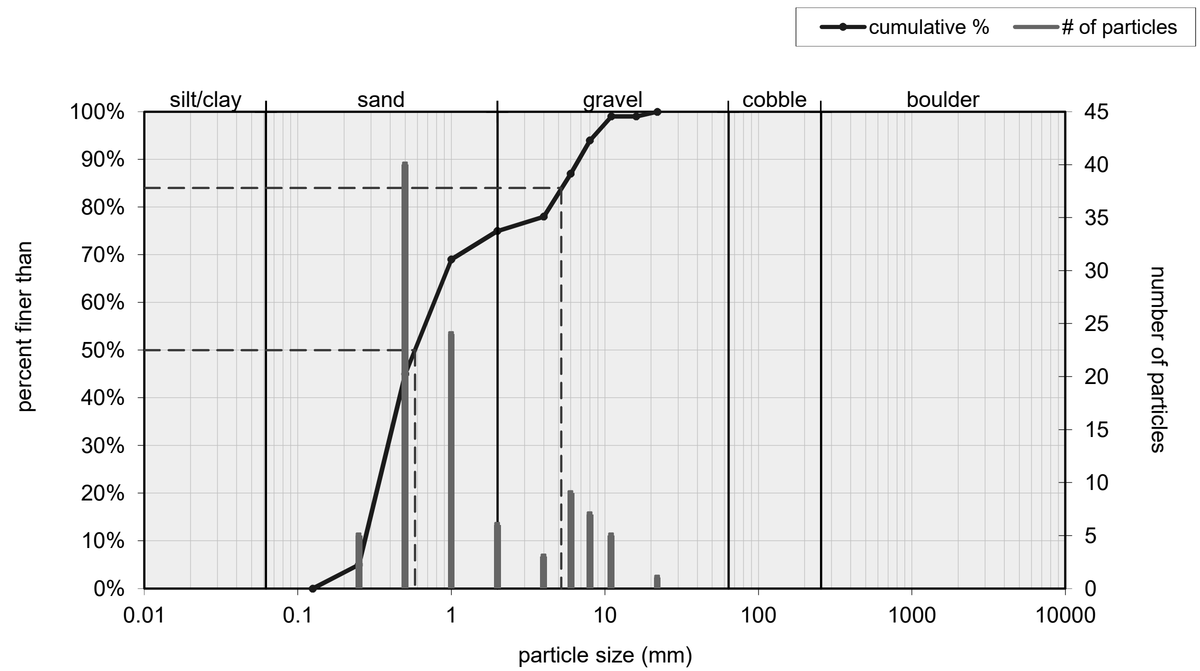
Existing Conditions Geomorphic Parameters												
Parameter			**T1-R2/R3**		**T2**		**T3 - R1**		**T5 R2**		**T6 R1**	
			min	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
stream type			G5		G5		B5 / G5		E5		G5	
drainage area	DA	sq mi	0.050	0.063	0.023		0.038		0.19		0.15	
bankfull cross-sectional area	A_{bkf}	SF	2.5		1.5		1.7	1.7	3.5		4.4	
avg velocity during bankfull event	v_{bkf}	fps	3.6		3.6		4.0	3.6	3.1		2.9	
width at bankfull	w_{bkf}	feet	3.4		3.0		3.2	4.2	3.1		4.1	
maximum depth at bankfull	d_{max}	feet	1.0		0.60		0.70	0.56	1.4		1.5	
mean depth at bankfull	d_{bkf}	feet	0.70		0.50		0.50	0.42	1.1		1.1	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		4.9		6.0		6.4	10	2.8		3.7	
low bank height		feet	3.0		3.9		1.5	3.9	2.2		3.0	
bank height ratio	BHR		3.0		6.5		2.1	7.0	1.6		2.0	
floodprone area width	w_{fpa}	feet	7.6		3.6		24	4.6	27		7.0	
entrenchment ratio	ER		2.2		1.2		7.5	1.1	8.7		1.7	
max pool depth at bankfull	d_{pool}	feet	1.3		1.9		1.7		1.7		2.3	
pool depth ratio	d_{pool}/d_{bkf}		1.9		3.8		3.4	4.0	1.5		2.1	
pool width at bankfull	w_{pool}	feet	3.8		3.6		5.3		9.3		7.0	
pool width ratio	w_{pool}/w_{bkf}		1.1		1.2		1.7	1.3	3.0		1.7	
Bkf pool cross-sectional area	A_{pool}	SF	3.4		4.6		5.9		9.8		11.3	
pool area ratio	A_{pool}/A_{bkf}		1.4		3.1		3.5	3.5	2.8		2.6	
pool-pool spacing	p-p	feet	19	103	34	87	17	148	31	174	33	83
pool-pool spacing ratio	p-p/W_{bkf}		5.6	30	11	29	5.3	46	10	56	8.0	20
valley slope	S_{valley}	feet/ foot	0.022	0.034	0.040		0.039		0.013		0.023	
channel slope	$S_{channel}$	feet/ foot	0.019	0.030	0.029		0.034		0.012		0.0086	
sinuosity	K		1.20		1.14		1.16		1.23		1.11	
belt width	w_{blt}	feet	13	37	21	33	15	48	14	34	46	39
meander width ratio	w_{blt}/w_{bkf}		3.8	11	7.0	11	4.7	15	4.5	11	11	10
meander length	L_m	feet	41	222	67	140	46	176	44	115	95	160
meander length ratio	L_m/w_{bkf}		12	65	22	47	14	55	14	37	23	39
Linear Wavelength	LW		33	164	60	106	39	141	33	89	87	147
Linear Wavelength Ratio	LW/w_{bkf}		9.7	48	20	35	12	44	11	29	21	36
radius of curvature	R_c	feet	20	50	9.2	52	14	68	9.0	43	38	82
radius of curvature ratio	R_c/ w_{bkf}		5.9	15	3.1	17	4.4	21	3.2	14	10	20

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	**5**
medium sand	0.25 - 0.5	**40**
coarse sand	0.5 - 1	**24**
very coarse sand	1 - 2	**6**
very fine gravel	2 - 4	**3**
fine gravel	4 - 6	**9**
fine gravel	6 - 8	**7**
medium gravel	8 - 11	**5**
medium gravel	11 - 16	
coarse gravel	16 - 22	**1**
coarse gravel	22 - 32	
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	-------------	
clay hardpan	-------------	
detritus/wood	-------------	
artificial	-------------	
total count:		100

Note: T1, XS3, AA, JP 4/18/18

Riffle Surface Pebble Count T1



Size (mm)	
D16	0.3
D35	0.42
D50	0.58
D65	0.89
D84	5.2
D95	8.5

Size Distribution	
mean	1.2
dispersion	5.4
skewness	0.30

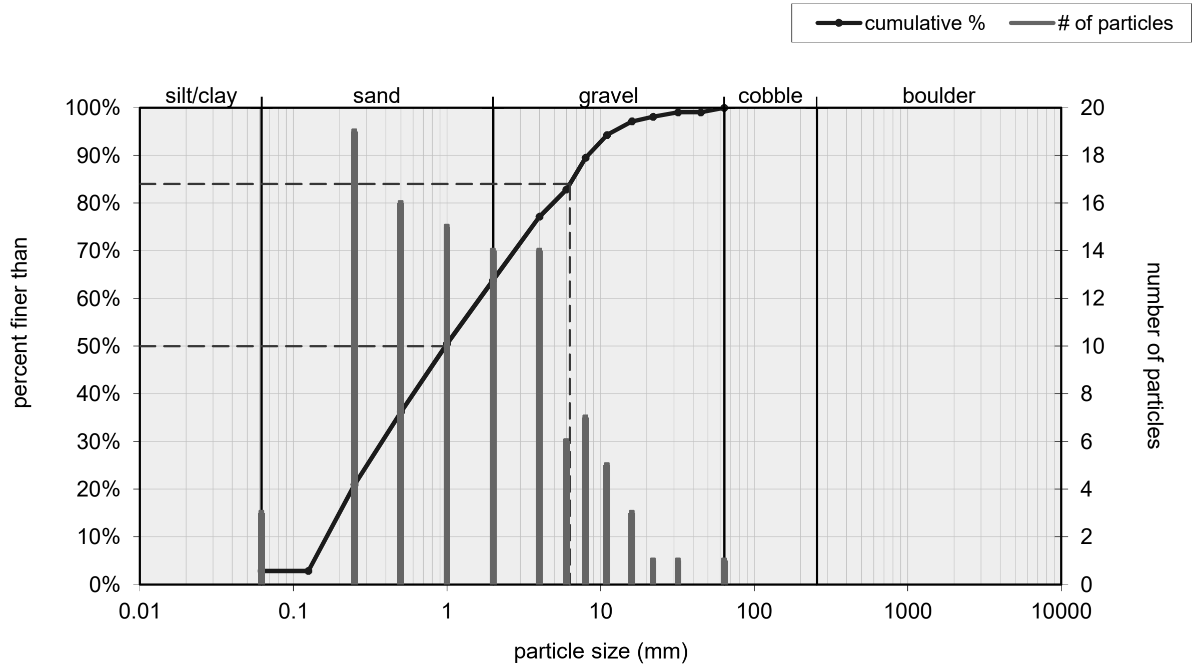
Type	
silt/clay	0%
sand	75%
gravel	25%
cobble	0%
boulder	0%

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	**3**
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	**19**
medium sand	0.25 - 0.5	**16**
coarse sand	0.5 - 1	**15**
very coarse sand	1 - 2	**14**
very fine gravel	2 - 4	**14**
fine gravel	4 - 6	**6**
fine gravel	6 - 8	**7**
medium gravel	8 - 11	**5**
medium gravel	11 - 16	**3**
coarse gravel	16 - 22	**1**
coarse gravel	22 - 32	**1**
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	**1**
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		105
bedrock	-------------	
clay hardpan	-------------	
detritus/wood	-------------	
artificial	-------------	
total count:		105

Note: T2, XS 4, AA, JP, 4/18/18

Riffle Surface Pebble Count T2



Size (mm)	
D16	0.21
D35	0.47
D50	0.98
D65	2.1
D84	6.3
D95	12

Size Distribution	
mean	1.2
dispersion	5.5
skewness	0.06

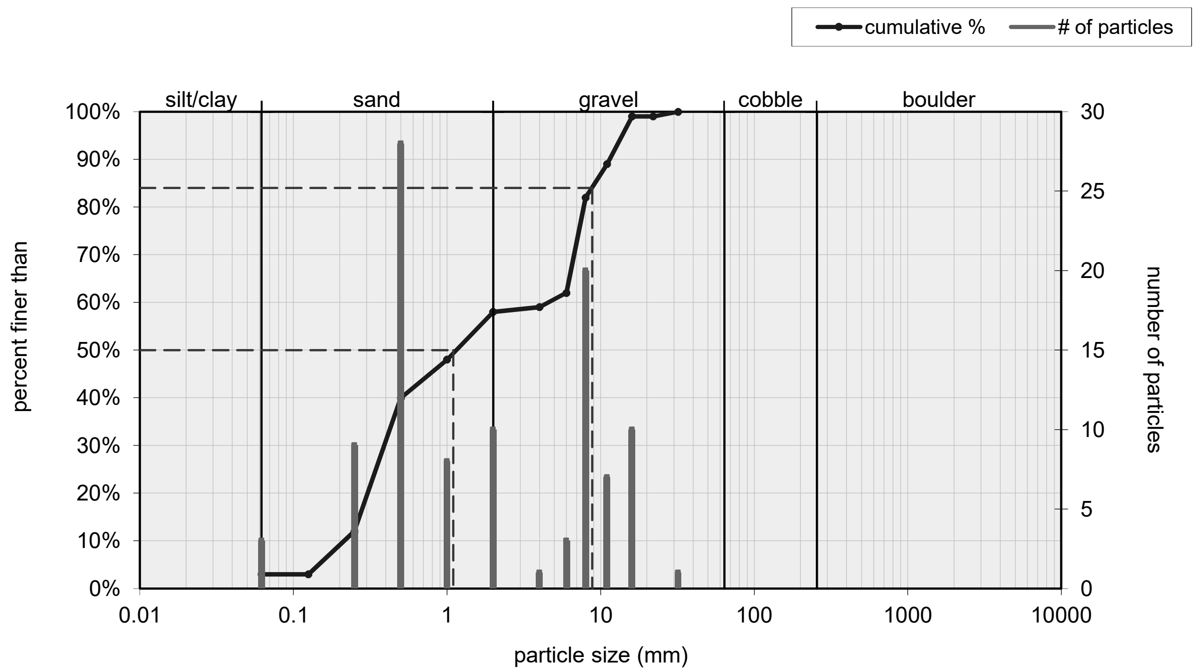
Type	
silt/clay	3%
sand	61%
gravel	36%
cobble	0%
boulder	0%

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	**3**
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	**9**
medium sand	0.25 - 0.5	**28**
coarse sand	0.5 - 1	**8**
very coarse sand	1 - 2	**10**
very fine gravel	2 - 4	**1**
fine gravel	4 - 6	**3**
fine gravel	6 - 8	**20**
medium gravel	8 - 11	**7**
medium gravel	11 - 16	**10**
coarse gravel	16 - 22	
coarse gravel	22 - 32	**1**
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock -------------		
clay hardpan -------------		
detritus/wood -------------		
artificial -------------		
total count:		100

Note: T3, XS 6, AA, JP, 4/18/18

Riffle Surface Pebble Count, T3



Size (mm)	
D16	0.28
D35	0.44
D50	1.1
D65	6.3
D84	8.8
D95	14

Size Distribution	
mean	1.6
dispersion	6.0
skewness	0.13

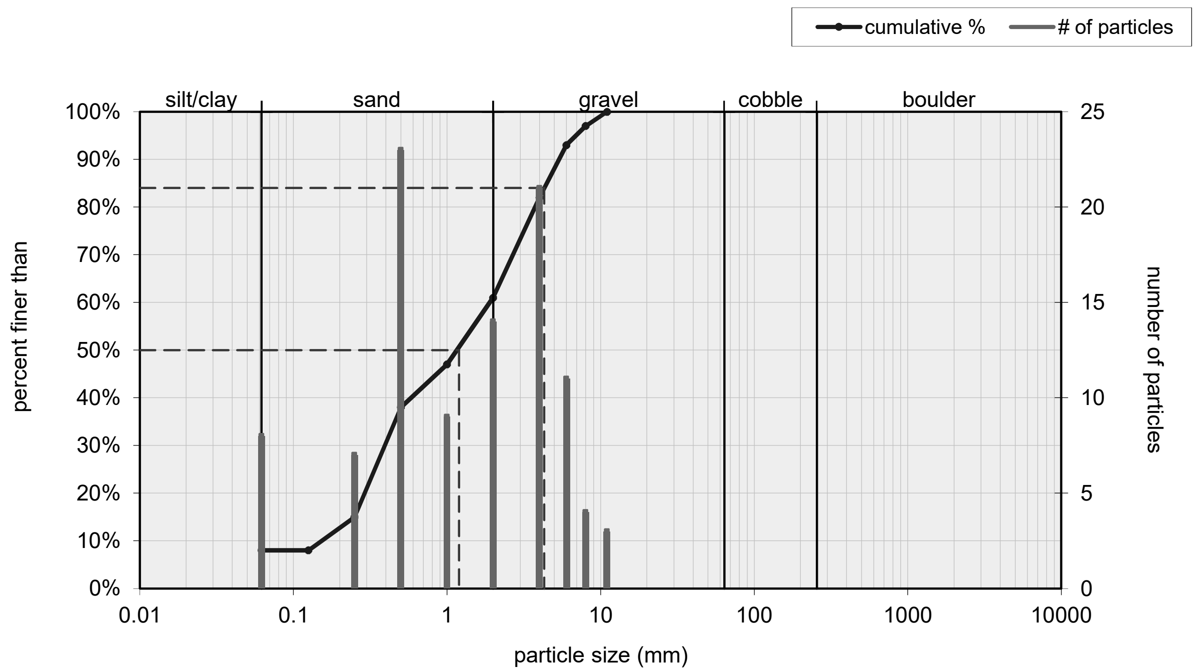
Type	
silt/clay	3%
sand	55%
gravel	42%
cobble	0%
boulder	0%

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	**8**
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	**7**
medium sand	0.25 - 0.5	**23**
coarse sand	0.5 - 1	**9**
very coarse sand	1 - 2	**14**
very fine gravel	2 - 4	**21**
fine gravel	4 - 6	**11**
fine gravel	6 - 8	**4**
medium gravel	8 - 11	**3**
medium gravel	11 - 16	
coarse gravel	16 - 22	
coarse gravel	22 - 32	
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		100
bedrock	-------------	
clay hardpan	-------------	
detritus/wood	-------------	
artificial	-------------	
total count:		100

Note: T5, XS9, AA, JP, 4/18/18

Riffle Surface Pebble Count, T5



Size (mm)	
D16	0.26
D35	0.46
D50	1.2
D65	2.3
D84	4.3
D95	6.9

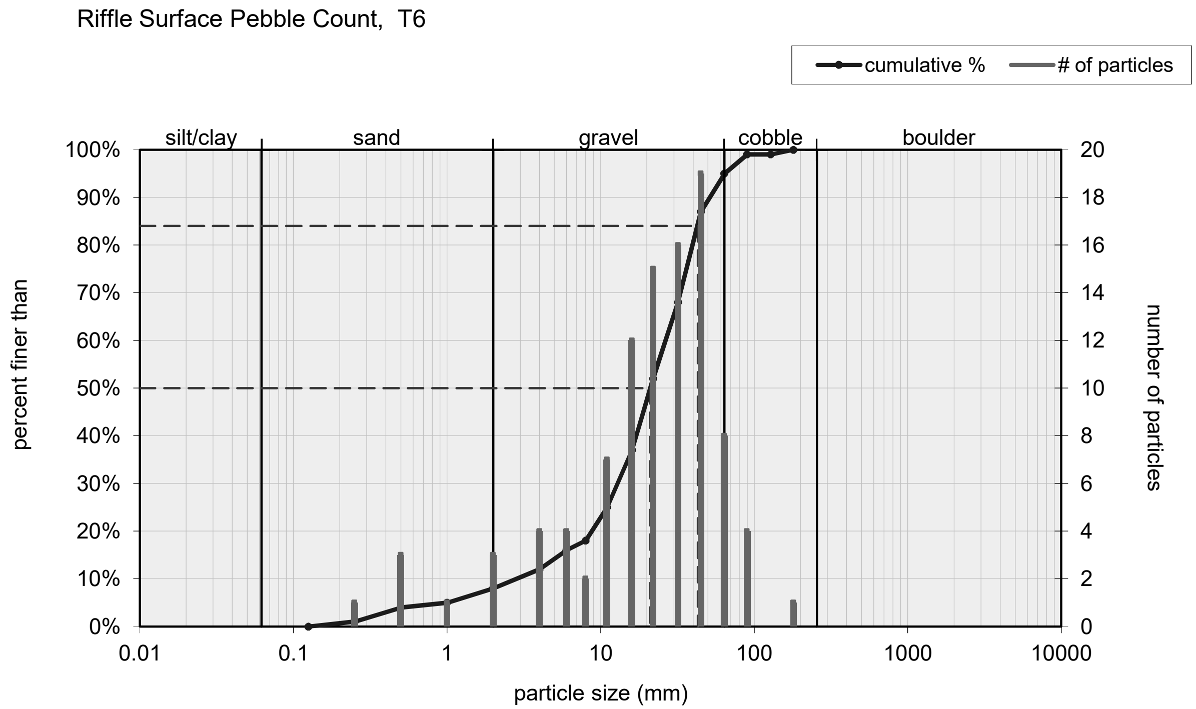
Size Distribution	
mean	1.1
dispersion	4.1
skewness	-0.05

Type	
silt/clay	8%
sand	53%
gravel	39%
cobble	0%
boulder	0%

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	**1**
medium sand	0.25 - 0.5	**3**
coarse sand	0.5 - 1	**1**
very coarse sand	1 - 2	**3**
very fine gravel	2 - 4	**4**
fine gravel	4 - 6	**4**
fine gravel	6 - 8	**2**
medium gravel	8 - 11	**7**
medium gravel	11 - 16	**12**
coarse gravel	16 - 22	**15**
coarse gravel	22 - 32	**16**
very coarse gravel	32 - 45	**19**
very coarse gravel	45 - 64	**8**
small cobble	64 - 90	**4**
medium cobble	90 - 128	
large cobble	128 - 180	**1**
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
	total particle count:	100
bedrock	-------------	
clay hardpan	-------------	
detritus/wood	-------------	
artificial	-------------	
	total count:	100

Note: T6, XS 14, AA, JP, 4/18/18



Size (mm)	
D16	6
D35	15
D50	21
D65	30
D84	43
D95	64

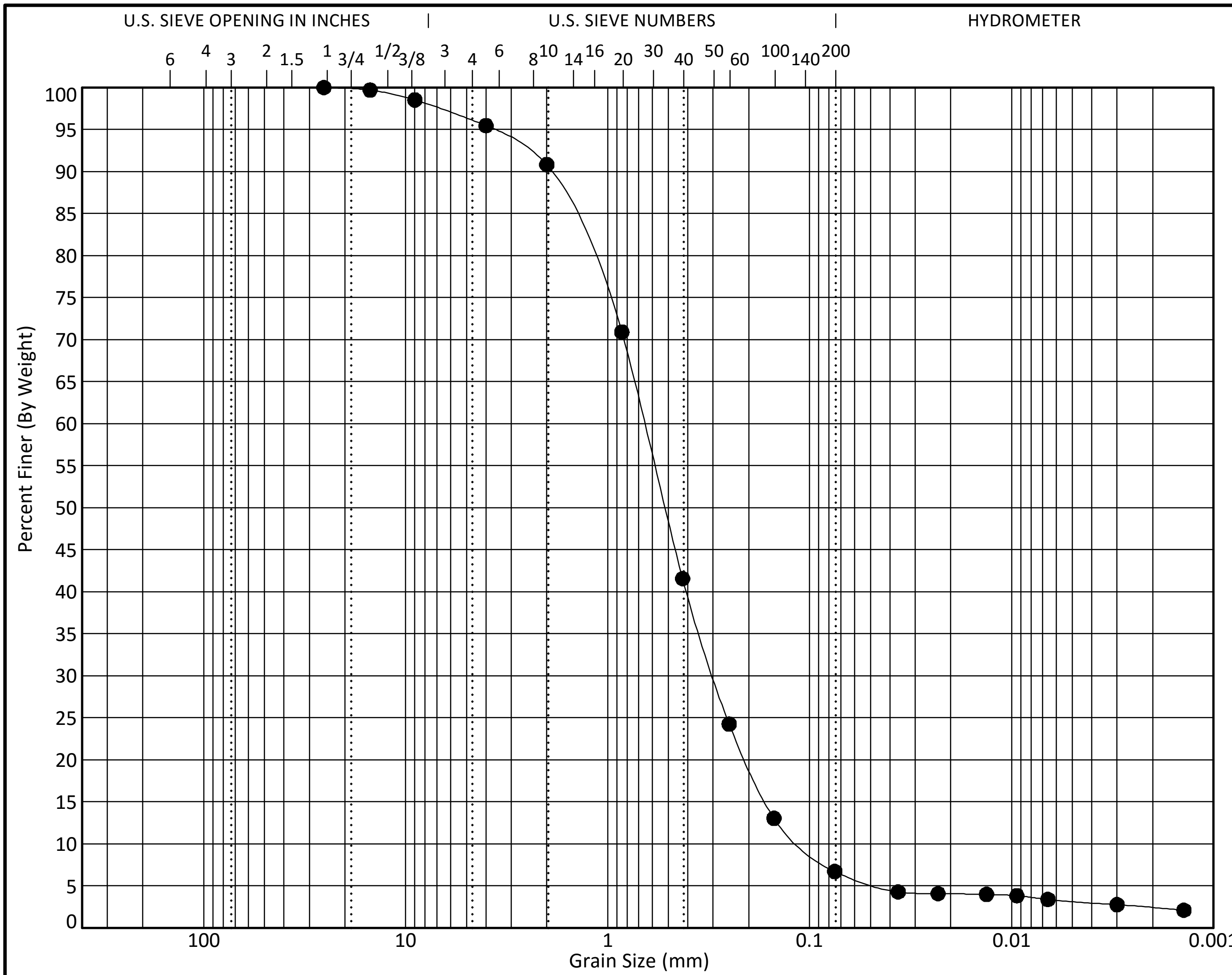
Size Distribution	
mean	16.1
dispersion	2.8
skewness	-0.13

Type	
silt/clay	0%
sand	8%
gravel	87%
cobble	5%
boulder	0%

Froehling & Robertson, Inc.

GRAIN SIZE DISTRIBUTION

Project No: 66V-0151
Client: Wildlands
Project: Sassarixa Swamp
City/State: Johnston County, NC



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample No.		Depth	Classification	LL	PL	PI	Cc	Cu
● 01	at	0.0					1.26	6.11

Sample No.		Depth	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● 01	at	0.0	25.4	0.657	0.298	0.107	3.9	89.4	3.5	3.2

FROEHLING & ROBERTSON

SIEVE ANALYSIS

Project: Sassarixa Swamp
Client: Wildlands

Project No: 66V-0151
Date: 8/31/2017

Sample 01 Sassarixa Swamp	Weight Retained	Percent Retained	Percent Passing
10" - 256 mm	0	0	100
5" - 128 mm	0	0	100
2.5" - 64 mm	0	0	100
1.0" - 25.4 mm	0	0	100
5/8" - 15 mm	31.01	0.3	99.7
3/8" - 9 mm	154.36	1.5	98.5
#5 - 4 mm	473.32	4.5	95.5
#10 - 2 mm	957.11	9.2	90.8
#20 - .85 mm	22.30	29.1	70.9
#40 - .425 mm	55.15	58.4	41.6
#60 - .25 mm	74.53	75.7	24.3
#100 - .150 mm	87.08	87.0	13.0
#200 - .075 mm	94.16	93.3	6.7

Sample 01 Sassarixa Swamp	
Pan #	J-7
Wet soil + tare (G)	15034.30
Dry soil + tare	13079.20
Wt. of Water	1955.10
Tare wt.	2639.70
Dry wt. of Soil	10439.50
Moisture %	**18.7**

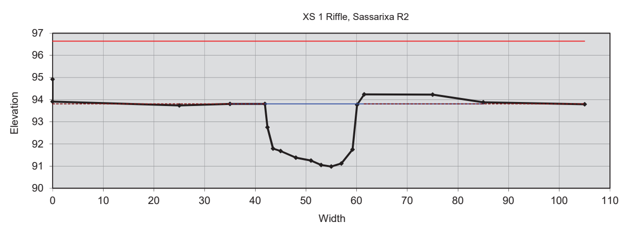
Largest Particle (1) mm	17.31
Largest Particle (2) mm	22.74
Largest Particle (1) Wt. Grams	16.25
Largest Particle (2) Wt. Grams	7.83

**Hydrometer Sample Split on the #10 Sieve*

Performed By: Dave Jenks

Date: 9/8/2017

XS1, Riffle, Sassarixa Creek R2 - Enhancement II



Bankfull Dimensions	
42	x-section area (ft.sq.)
18	width (ft)
2.3	mean depth (ft)
2.8	max depth (ft)
21	wetted perimeter (ft)
2.0	hydraulic radius (ft)
8.0	width-depth ratio

Flood Dimensions	
105	W flood prone area (ft)
5.7	entrenchment ratio
2.8	low bank height (ft)
1.0	low bank height ratio

Materials	
0.53	D50 Riffle (mm)
1.5	D84 Riffle (mm)
14	threshold grain size (mm):

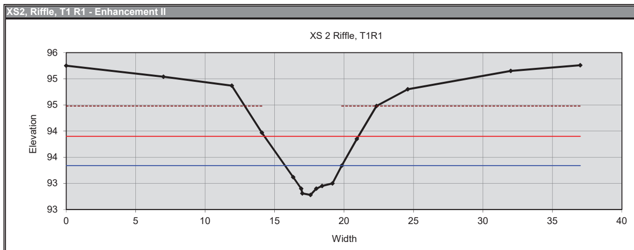
Rosgen Stream Type
E5

Bankfull Flow	
2.9	velocity (ft/s)
120	discharge rate (cfs)
0.35	Froude number

Flow Resistance	
0.040	Manning's roughness
0.15	Darcy-Weisbach fric.
18	resistance factor u/u*
466	relative roughness

Forces & Power	
0.23	channel slope (%)
0.29	shear stress (lb/sq.ft.)
0.39	shear velocity (ft/s)
0.94	unit strm power (lb/ft/s)

XS2, Riffle, T1 R1 - Enhancement II



Bankfull Dimensions	
1.4	x-section area (ft.sq.)
4.1	width (ft)
0.34	mean depth (ft)
0.56	max depth (ft)
4.3	wetted perimeter (ft)
0.32	hydraulic radius (ft)
12	width-depth ratio

Flood Dimensions	
6.8	W flood prone area (ft)
1.7	entrenchment ratio
1.7	low bank height (ft)
3.0	low bank height ratio

Materials	
0.53	D50 Riffle (mm)
1.5	D84 Riffle (mm)
29	threshold grain size (mm):

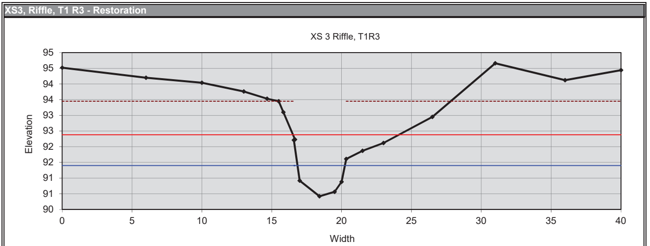
Rosgen Stream Type
B5

Bankfull Flow	
3.0	velocity (ft/s)
4.2	discharge rate (cfs)
0.93	Froude number

Flow Resistance	
0.040	Manning's roughness
0.27	Darcy-Weisbach fric.
14	resistance factor u/u*
69	relative roughness

Forces & Power	
2.95	channel slope (%)
0.59	shear stress (lb/sq.ft.)
0.55	shear velocity (ft/s)
1.9	unit strm power (lb/ft/s)

XS3, Riffle, T1 R3 - Restoration



Bankfull Dimensions	
2.5	x-section area (ft.sq.)
3.4	width (ft)
0.72	mean depth (ft)
1.0	max depth (ft)
4.3	wetted perimeter (ft)
0.58	hydraulic radius (ft)
4.7	width-depth ratio

Flood Dimensions	
7.6	W flood prone area (ft)
2.2	entrenchment ratio
3.0	low bank height (ft)
3.1	low bank height ratio

Materials	
0.53	D50 Riffle (mm)
1.5	D84 Riffle (mm)
34	threshold grain size (mm):

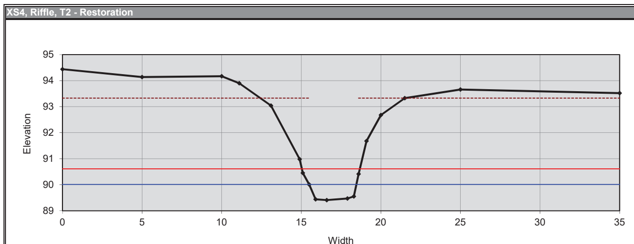
Rosgen Stream Type
G5

Bankfull Flow	
3.6	velocity (ft/s)
8.8	discharge rate (cfs)
0.83	Froude number

Flow Resistance	
0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
15	resistance factor u/u*
147	relative roughness

Forces & Power	
1.93	channel slope (%)
0.69	shear stress (lb/sq.ft.)
0.60	shear velocity (ft/s)
3.1	unit strm power (lb/ft/s)

XS4, Riffle, T2 - Restoration



Bankfull Dimensions	
1.5	x-section area (ft.sq.)
3.0	width (ft)
0.51	mean depth (ft)
0.60	max depth (ft)
3.6	wetted perimeter (ft)
0.42	hydraulic radius (ft)
5.8	width-depth ratio

Flood Dimensions	
3.6	W flood prone area (ft)
1.2	entrenchment ratio
3.9	low bank height (ft)
6.5	low bank height ratio

Materials	
0.53	D50 Riffle (mm)
1.5	D84 Riffle (mm)
38	threshold grain size (mm):

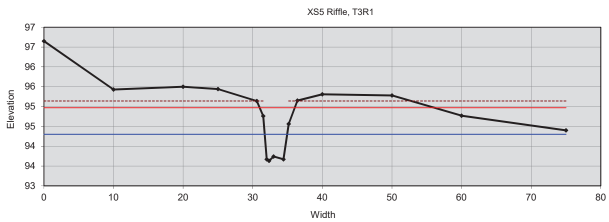
Rosgen Stream Type
G5

Bankfull Flow	
3.6	velocity (ft/s)
5.4	discharge rate (cfs)
1.0	Froude number

Flow Resistance	
0.040	Manning's roughness
0.25	Darcy-Weisbach fric.
14	resistance factor u/u*
103	relative roughness

Forces & Power	
2.93	channel slope (%)
0.76	shear stress (lb/sq.ft.)
0.63	shear velocity (ft/s)
3.3	unit strm power (lb/ft/s)

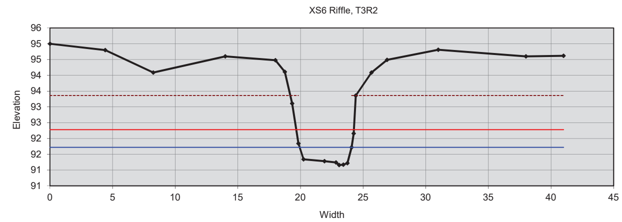
XS5, Riffle, T3 R1 - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
1.7	x-section area (ft.sq.)	24	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.2	width (ft)	7.4	entrenchment ratio	1.5	D84 Riffle (mm)
0.53	mean depth (ft)	1.5	low bank height (ft)	46	threshold grain size (mm):
0.67	max depth (ft)	2.3	low bank height ratio		
3.9	wetted perimeter (ft)			**Rosgen Stream Type**	
0.44	hydraulic radius (ft)			B5	
6.1	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
4.0	velocity (ft/s)	0.040	Manning's roughness	3.41	channel slope (%)
6.9	discharge rate (cfs)	0.24	Darcy-Weisbach fric.	0.93	shear stress (lb/sq.ft.)
1.1	Froude number	14	resistance factor u/u*	0.69	shear velocity (ft/s)
		108	relative roughness	4.5	unit strm power (lb/ft/s)

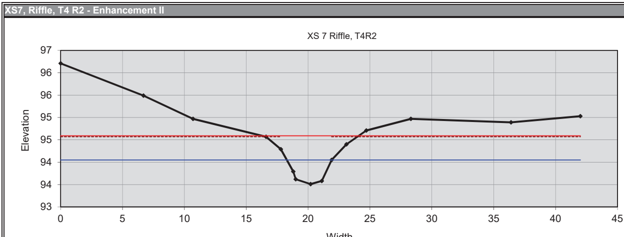
XS6, Riffle, T3 R2 - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
1.7	x-section area (ft.sq.)	4.6	W flood prone area (ft)	0.53	D50 Riffle (mm)
4.2	width (ft)	1.1	entrenchment ratio	1.5	D84 Riffle (mm)
0.42	mean depth (ft)	2.2	low bank height (ft)	39	threshold grain size (mm):
0.56	max depth (ft)	3.9	low bank height ratio		
4.6	wetted perimeter (ft)			**Rosgen Stream Type**	
0.38	hydraulic radius (ft)			G5	
9.9	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.6	velocity (ft/s)	0.040	Manning's roughness	3.41	channel slope (%)
6.2	discharge rate (cfs)	0.26	Darcy-Weisbach fric.	0.80	shear stress (lb/sq.ft.)
1.03	Froude number	14	resistance factor u/u*	0.64	shear velocity (ft/s)
		85	relative roughness	3.2	unit strm power (lb/ft/s)

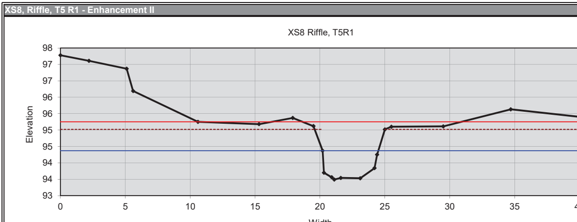
XS7, Riffle, T4 R2 - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
1.4	x-section area (ft.sq.)	7.8	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.6	width (ft)	2.1	entrenchment ratio	1.5	D84 Riffle (mm)
0.38	mean depth (ft)	1.1	low bank height (ft)	27	threshold grain size (mm):
0.54	max depth (ft)	2.0	low bank height ratio		
3.9	wetted perimeter (ft)			**Rosgen Stream Type**	
0.35	hydraulic radius (ft)			E5b	
9.6	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.9	velocity (ft/s)	0.040	Manning's roughness	2.5	channel slope (%)
4.0	discharge rate (cfs)	0.26	Darcy-Weisbach fric.	0.54	shear stress (lb/sq.ft.)
0.87	Froude number	14	resistance factor u/u*	0.53	shear velocity (ft/s)
		76	relative roughness	1.7	unit strm power (lb/ft/s)

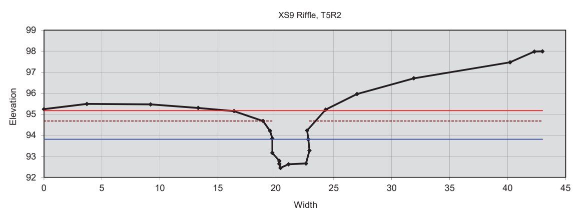
XS8, Riffle, T5 R1 - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
3.2	x-section area (ft.sq.)	18	W flood prone area (ft)	0.53	D50 Riffle (mm)
4.3	width (ft)	4.2	entrenchment ratio	1.5	D84 Riffle (mm)
0.73	mean depth (ft)	1.5	low bank height (ft)	21	threshold grain size (mm):
0.88	max depth (ft)	1.7	low bank height ratio		
5.3	wetted perimeter (ft)			**Rosgen Stream Type**	
0.60	hydraulic radius (ft)			E5	
5.9	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.9	velocity (ft/s)	0.040	Manning's roughness	1.16	channel slope (%)
9	discharge rate (cfs)	0.22	Darcy-Weisbach fric.	0.43	shear stress (lb/sq.ft.)
0.65	Froude number	15	resistance factor u/u*	0.47	shear velocity (ft/s)
		149	relative roughness	1.51	unit strm power (lb/ft/s)

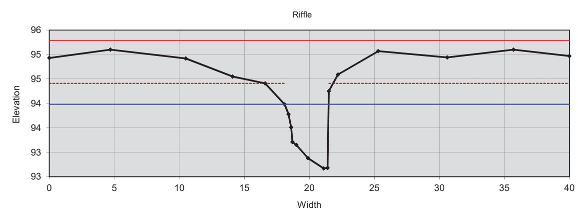
XS9, Riffle, T5 R2 - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
3.5	x-section area (ft.sq.)	27	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.1	width (ft)	8.8	entrenchment ratio	1.5	D84 Riffle (mm)
1.1	mean depth (ft)	2.2	low bank height (ft)	24	threshold grain size (mm):
1.4	max depth (ft)	1.6	low bank height ratio		
5.2	wetted perimeter (ft)			Rosgen Stream Type	
0.68	hydraulic radius (ft)			E5	
2.7	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.1	velocity (ft/s)	0.040	Manning's roughness	1.16	channel slope (%)
10.9	discharge rate (cfs)	0.21	Darcy-Weisbach fric.	0.49	shear stress (lb/sq.ft.)
0.66	Froude number	16	resistance factor u/u*	0.50	shear velocity (ft/s)
		230	relative roughness	2.5	unit strm power (lb/ft/s)

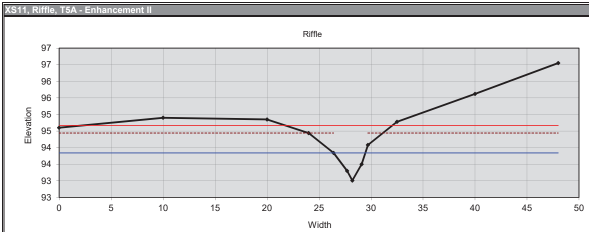
XS10, Riffle, T5 R3 - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
3.2	x-section area (ft.sq.)	40	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.4	width (ft)	11.8	entrenchment ratio	1.5	D84 Riffle (mm)
0.93	mean depth (ft)	1.7	low bank height (ft)	22	threshold grain size (mm):
1.3	max depth (ft)	1.3	low bank height ratio		
5.1	wetted perimeter (ft)			Rosgen Stream Type	
0.62	hydraulic radius (ft)			E5	
3.6	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.9	velocity (ft/s)	0.040	Manning's roughness	1.16	channel slope (%)
9	discharge rate (cfs)	0.22	Darcy-Weisbach fric.	0.45	shear stress (lb/sq.ft.)
0.65	Froude number	16	resistance factor u/u*	0.48	shear velocity (ft/s)
		190	relative roughness	2.0	unit strm power (lb/ft/s)

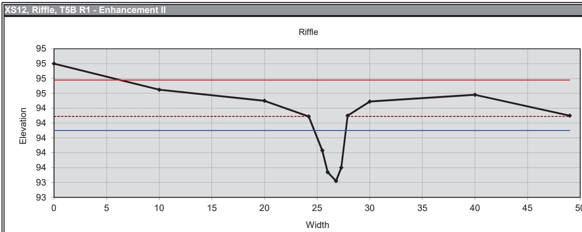
XS11, Riffle, T5A - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
1.3	x-section area (ft.sq.)	13	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.1	width (ft)	4.1	entrenchment ratio	1.5	D84 Riffle (mm)
0.42	mean depth (ft)	1.4	low bank height (ft)	21	threshold grain size (mm):
0.83	max depth (ft)	1.7	low bank height ratio		
3.5	wetted perimeter (ft)			Rosgen Stream Type	
0.37	hydraulic radius (ft)			B5	
7.3	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.6	velocity (ft/s)	0.040	Manning's roughness	1.91	channel slope (%)
3.4	discharge rate (cfs)	0.26	Darcy-Weisbach fric.	0.44	shear stress (lb/sq.ft.)
0.77	Froude number	14	resistance factor u/u*	0.47	shear velocity (ft/s)
		85	relative roughness	1.3	unit strm power (lb/ft/s)

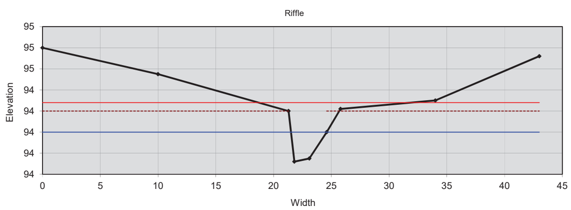
XS12, Riffle, T5B R1 - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
1.2	x-section area (ft.sq.)	43	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.0	width (ft)	14	entrenchment ratio	1.5	D84 Riffle (mm)
0.40	mean depth (ft)	0.9	low bank height (ft)	37	threshold grain size (mm):
0.68	max depth (ft)	1.3	low bank height ratio		
3.4	wetted perimeter (ft)			Rosgen Stream Type	
0.36	hydraulic radius (ft)			B5	
7.4	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.5	velocity (ft/s)	0.040	Manning's roughness	3.4	channel slope (%)
4.2	discharge rate (cfs)	0.26	Darcy-Weisbach fric.	0.76	shear stress (lb/sq.ft.)
1.0	Froude number	14	resistance factor u/u*	0.63	shear velocity (ft/s)
		82	relative roughness	3.0	unit strm power (lb/ft/s)

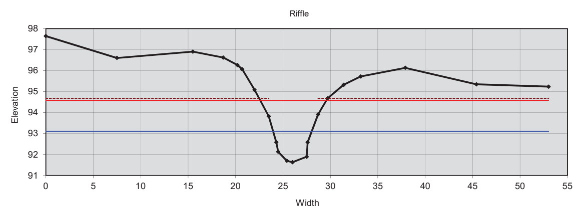
XS13, Riffle, T5C - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
0.57	x-section area (ft.sq.)	13	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.1	width (ft)	4.3	entrenchment ratio	1.5	D84 Riffle (mm)
0.19	mean depth (ft)	0.48	low bank height (ft)	15	threshold grain size (mm):
0.28	max depth (ft)	1.7	low bank height ratio		
3.2	wetted perimeter (ft)			Rosgen Stream Type	
0.18	hydraulic radius (ft)			B5	
16.7	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.0	velocity (ft/s)	0.040	Manning's roughness	2.8	channel slope (%)
1.1	discharge rate (cfs)	0.33	Darcy-Weisbach fric.	0.31	shear stress (lb/sq.ft.)
0.82	Froude number	12	resistance factor u/u*	0.40	shear velocity (ft/s)
		38	relative roughness	0.64	unit strm power (lb/ft/s)

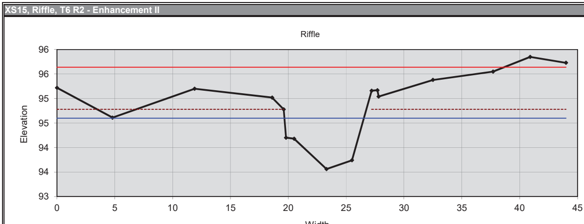
XS14, Riffle, T6 R1 - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
4.4	x-section area (ft.sq.)	7.0	W flood prone area (ft)	0.53	D50 Riffle (mm)
4.1	width (ft)	1.7	entrenchment ratio	1.5	D84 Riffle (mm)
1.1	mean depth (ft)	3.0	low bank height (ft)	20	threshold grain size (mm):
1.5	max depth (ft)	2.1	low bank height ratio		
5.6	wetted perimeter (ft)			Rosgen Stream Type	
0.78	hydraulic radius (ft)			G5	
3.8	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.9	velocity (ft/s)	0.040	Manning's roughness	0.856	channel slope (%)
12.8	discharge rate (cfs)	0.20	Darcy-Weisbach fric.	0.4	shear stress (lb/sq.ft.)
0.58	Froude number	16	resistance factor u/u*	0.46	shear velocity (ft/s)
		219	relative roughness	1.68	unit strm power (lb/ft/s)

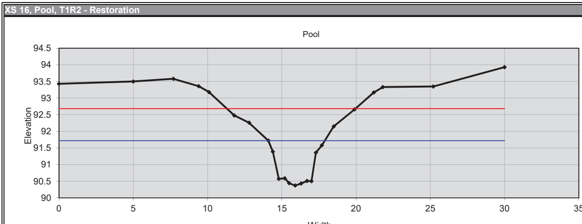
XS15, Riffle, T6 R2 - Enhancement II



Bankfull Dimensions		Flood Dimensions		Materials	
4.9	x-section area (ft.sq.)	39	W flood prone area (ft)	0.53	D50 Riffle (mm)
6.9	width (ft)	5.6	entrenchment ratio	1.5	D84 Riffle (mm)
0.71	mean depth (ft)	1.2	low bank height (ft)	15	threshold grain size (mm):
1.0	max depth (ft)	1.2	low bank height ratio		
7.5	wetted perimeter (ft)			Rosgen Stream Type	
0.65	hydraulic radius (ft)			E5	
9.6	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
2.4	velocity (ft/s)	0.040	Manning's roughness	0.768	channel slope (%)
12.0	discharge rate (cfs)	0.21	Darcy-Weisbach fric.	0.31	shear stress (lb/sq.ft.)
0.54	Froude number	15	resistance factor u/u*	0.40	shear velocity (ft/s)
		145	relative roughness	0.8	unit strm power (lb/ft/s)

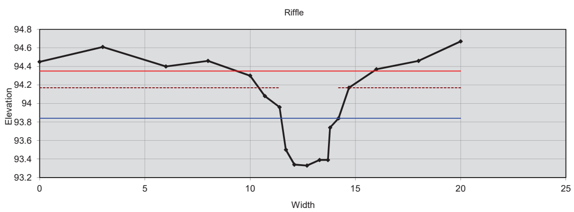
XS 16, Pool, T1R2 - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
3.4	x-section area (ft.sq.)	8.7	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.8	width (ft)	2.3	entrenchment ratio	1.5	D84 Riffle (mm)
0.9	mean depth (ft)	---	low bank height (ft)	---	threshold grain size (mm):
1.3	max depth (ft)	---	low bank height ratio		
5.2	wetted perimeter (ft)			Rosgen Stream Type	
0.7	hydraulic radius (ft)			---	
4.2	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
---	velocity (ft/s)	0.016	Manning's roughness	---	channel slope (%)
---	discharge rate (cfs)	0.03	Darcy-Weisbach fric.	---	shear stress (lb/sq.ft.)
---	Froude number	15.7	resistance factor u/u*	---	shear velocity (ft/s)
		183.7	relative roughness	---	unit strm power (lb/ft/s)

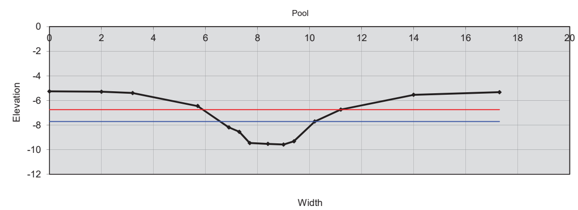
XS 16a, riffle, T1B



Bankfull Dimensions		Flood Dimensions		Materials	
1.0	x-section area (ft.sq.)	6.5	W flood prone area (ft)	0.53	D50 Riffle (mm)
2.7	width (ft)	2.4	entrenchment ratio	1.5	D84 Riffle (mm)
0.4	mean depth (ft)	0.8	low bank height (ft)	36	threshold grain size (mm):
0.5	max depth (ft)	1.6	low bank height ratio		
3.2	wetted perimeter (ft)			**Rosgen Stream Type**	
0.3	hydraulic radius (ft)			b	Missing: , , Sinuosity, ,
7.2	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
3.3	velocity (ft/s)	0.040	Manning's roughness	3.7	channel slope (%)
3.4	discharge rate (cfs)	0.27	Darcy-Weisbach fric.	0.74	shear stress (lb/sq.ft.)
1.04	Froude number	13.7	resistance factor u/u*	0.62	shear velocity (ft/s)
		76.5	relative roughness	2.9	unit strm power (lb/ft/s)

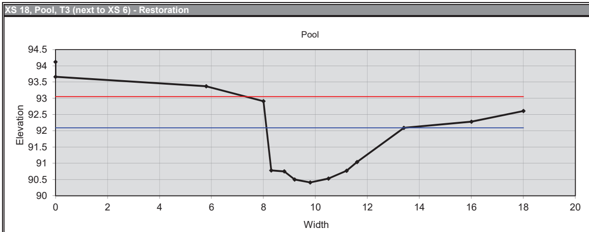
XS17, Pool, T2 - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
4.6	x-section area (ft.sq.)	5.3	W flood prone area (ft)	0.53	D50 Riffle (mm)
3.6	width (ft)	1.5	entrenchment ratio	1.5	D84 Riffle (mm)
1.3	mean depth (ft)	---	low bank height (ft)	---	threshold grain size (mm):
1.9	max depth (ft)	---	low bank height ratio		
5.7	wetted perimeter (ft)			**Rosgen Stream Type**	
0.8	hydraulic radius (ft)			---	
2.9	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
---	velocity (ft/s)	0.016	Manning's roughness	---	channel slope (%)
---	discharge rate (cfs)	0.03	Darcy-Weisbach fric.	---	shear stress (lb/sq.ft.)
---	Froude number	16.3	resistance factor u/u*	---	shear velocity (ft/s)
		255.1	relative roughness	---	unit strm power (lb/ft/s)

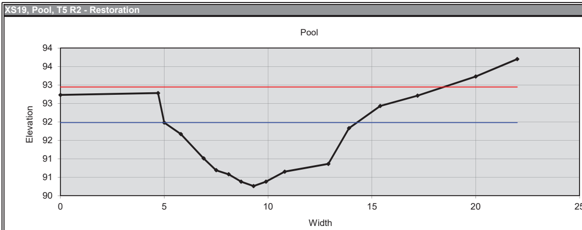
XS 18, Pool, T3 (next to XS 6) - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
5.9	x-section area (ft.sq.)	---	W flood prone area (ft)	0.53	D50 Riffle (mm)
5.3	width (ft)	---	entrenchment ratio	1.5	D84 Riffle (mm)
1.1	mean depth (ft)	---	low bank height (ft)	---	threshold grain size (mm):
1.7	max depth (ft)	---	low bank height ratio		
6.9	wetted perimeter (ft)			**Rosgen Stream Type**	
0.9	hydraulic radius (ft)			E5	
4.7	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
---	velocity (ft/s)	0.016	Manning's roughness	---	channel slope (%)
---	discharge rate (cfs)	0.03	Darcy-Weisbach fric.	---	shear stress (lb/sq.ft.)
---	Froude number	16.3	resistance factor u/u*	---	shear velocity (ft/s)
		227.3	relative roughness	---	unit strm power (lb/ft/s)

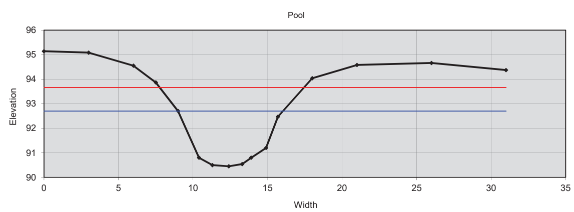
XS19, Pool, T5 R2 - Restoration



Bankfull Dimensions		Flood Dimensions		Materials	
9.8	x-section area (ft.sq.)	---	W flood prone area (ft)	0.53	D50 Riffle (mm)
9.3	width (ft)	---	entrenchment ratio	1.5	D84 Riffle (mm)
1.1	mean depth (ft)	---	low bank height (ft)	---	threshold grain size (mm):
1.7	max depth (ft)	---	low bank height ratio		
10.1	wetted perimeter (ft)			**Rosgen Stream Type**	
1.0	hydraulic radius (ft)			E5	
8.8	width-depth ratio				

Bankfull Flow		Flow Resistance		Forces & Power	
---	velocity (ft/s)	0.016	Manning's roughness	---	channel slope (%)
---	discharge rate (cfs)	0.03	Darcy-Weisbach fric.	---	shear stress (lb/sq.ft.)
---	Froude number	16.5	resistance factor u/u*	---	shear velocity (ft/s)
		213.8	relative roughness	---	unit strm power (lb/ft/s)

XS20, Pool, T6 R1 - Restoration



Bankfull Dimensions	
11.3	x-section area (ft.sq.)
7.0	width (ft)
1.6	mean depth (ft)
2.3	max depth (ft)
9.0	wetted perimeter (ft)
1.26	hydraulic radius (ft)
4.4	width-depth ratio

Flood Dimensions	
9.7	W flood prone area (ft)
1.4	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials	
0.53	D50 Riffle (mm)
1.5	D84 Riffle (mm)
---	threshold grain size (mm):

Rosgen Stream Type
G5

Bankfull Flow	
---	velocity (ft/s)
---	discharge rate (cfs)
---	Froude number

Flow Resistance	
0.016	Manning's roughness
0.03	Darcy-Weisbach fric.
17	resistance factor u/u*
325	relative roughness

Forces & Power	
---	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

	Notation	Units	T1R2			T1R3			T2 R1A		
			Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max
stream type			C5b/E5b			C5/E5			C5b/E5b		
drainage area	DA	*sq mi*	0.050			0.063			0.023		
design discharge	Q	*cfs*	3.0			3.5			2.0		
bankfull cross-sectional area	A_{bkf}	*SF*	1.2	-		1.5	-		1.5	-	
average velocity during bankfull event	v_{bkf}	*fps*	-	2.8		-	2.3		-	1.4	
Cross Section											
width at bankfull	w_{bkf}	*feet*	3.6	-		4.2	-		4.2	-	
maximum depth at bankfull	d_{max}	*feet*	0.50	0.40	0.53	0.50	0.42	0.56	0.50	0.42	0.56
mean depth at bankfull	d_{bkf}	*feet*	0.33	-		0.35	-		0.35	-	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		11	-		12	-		12	-	
max depth ratio	d_{max}/d_{bkf}	*feet*	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6
bank height ratio	BHR	-	-	1.0	1.2	-	1.0	1.2	-	1.0	1.2
floodprone area width	w_{fpa}	*feet*	-	>7.9		-	>9.2		-	>9.2	
entrenchment ratio	ER	-	-	>2.2		-	>2.2		-	>2.2	
Slope											
valley slope	S_{valley}	*feet/ foot*	0.032 - 0.045			0.012 - 0.032			0.0077		
channel slope	S_{chnl}	*feet/ foot*	0.027 - 0.038	0.025	0.041	0.010 - 0.026	0.0092	0.025	0.0055	0.0051	0.0064
Profile											
riffle slope	S_{riffle}	*feet/ foot*	-	0.025	0.062	-	0.010	0.073	-	0.0056	0.019
riffle slope ratio	S_{riffle}/S_{chnl}	-	-	1.0	1.5	-	1.1	2.9	-	1.1	2.9
pool slope	S_p	*feet/ foot*	-	0.0000	0.0000	-	0.0000	0.0000	-	0.0000	0.0000
pool slope ratio	S_p/S_{chnl}	-	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
pool-to-pool spacing	L_{p-p}	*feet*	-	18	44	-	21	50	-	21	50
pool spacing ratio	L_{p-p}/w_{bkf}	-	-	4.9	12	-	4.9	12	-	4.9	12
pool cross-sectional area	A_{pool}	*SF*	2.5 - 3.1	1.6	3.6	3.6 - 4.5	2.0	4.5	3.6 - 4.5	2.0	4.5
pool area ratio	A_{pool}/A_{bkf}	-	-	1.3	3.0	-	1.3	3.0	-	1.3	3.0
maximum pool depth	d_{pool}	*feet*	1.0 - 1.3	0.5	1.4	1.2 - 1.5	0.53	1.5	1.2 - 1.5	0.53	1.5
pool depth ratio	d_{pool}/d_{bkf}	-	-	1.5	4.2	-	1.5	4.2	-	1.5	4.2
pool width at bankfull	w_{pool}	*feet*	5.0	4.3	5.8	6.0	5.0	6.7	6.0	5.0	6.7
pool width ratio	w_{pool}/w_{bkf}	-	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6
Pattern											
sinuosity	K	-	-	1.2		-	1.2		-	1.4	
belt width	w_{blt}	*feet*	-	9.0	24	-	11	28	-	11	28
meander width ratio	w_{blt}/w_{bkf}	-	-	2.5	6.6	-	2.5	6.6	-	2.5	6.6
linear wavelength (formerly meander length)	LW	*feet*	-	22	43	-	25	50	-	25	50
linear wavelength ratio (formerly meander length ratio)	LW/w_{bkf}	-	-	6.0	12	-	6.0	12	-	6.0	12
meander length	L_m	*feet*	-	94	180	-	130	260	-	150	300
meander length ratio	L_m/W_{bkf}	-	-	26	51	-	31	62	-	35	71
radius of curvature	R_c	*feet*	-	7.2	14	-	8.4	17	-	8.4	17
radius of curvature ratio	R_c/ w_{bkf}	-	-	2.0	4.0	-	2.0	4.0	-	2.0	4.0

	T2 R1B			T3R1			T5R2			T6R1		
	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max	Typical Section Values	Min	Max
stream type	C5b/E5b			C5b/E5b			C5/E5			C5/E5		
drainage area	0.023			0.038			0.19			0.15		
design discharge	2.0			2.5			6.0			5.5		
bankfull cross-sectional area	0.88	-		1.0	-		2.7	-		3.3	-	
average velocity during bankfull event	-	2.2		-	2.5		-	2.3		-	1.7	
Cross Section												
width at bankfull	3.2	-		3.6	-		5.6	-		6.4	-	
maximum depth at bankfull	0.40	0.34	0.45	0.40	0.35	0.46	0.70	0.58	0.8	0.70	0.49	0.66
mean depth at bankfull	0.28	-		0.29	-		0.48	-		0.41	-	
bankfull width to depth ratio	12	-		12	-		12	-		12	-	
max depth ratio	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6
bank height ratio	-	1.0	1.2	-	1.0	1.2	-	1.0	1.2	-	1.0	1.2
floodprone area width	-	>7.0		-	>7.9		-	>11		-	>14	
entrenchment ratio	-	>2.2		-	>2.2		-	>2.2		-	>2.2	
Slope												
valley slope	0.012 - 0.033			0.016 - 0.045			0.012 - 0.019			0.0064 - 0.016		
channel slope	0.011 - 0.027	0.011	0.030	0.019 - 0.039	0.028	0.033	0.0090 - 0.014	0.0086	0.017	0.0055 - 0.014	0.0049	0.015
Profile												
riffle slope	-	0.012	0.087	-	0.028	0.050	-	0.0095	0.049	-	0.0054	0.044
riffle slope ratio	-	1.1	2.9	-	1.0	1.5	-	1.1	2.9	-	1.1	2.9
pool slope	-	0.0000	0.0000	-	0.0000	0.0000	-	0.0000	0.0000	-	0.0000	0.0000
pool slope ratio	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00
pool-to-pool spacing	-	16	38	-	18	43	-	27	67	-	31	77
pool spacing ratio	-	4.9	12	-	4.9	12	-	4.9	12	-	4.9	12
pool cross-sectional area	2.0 - 2.5	1.1	2.6	2.5 - 3.1	1.3	3.0	6.4 - 8.0	3.5	8.1	9.0 - 11	4.3	9.9
pool area ratio	-	1.3	3.0	-	1.3	3.0	-	1.3	3.0	-	1.3	3.0
maximum pool depth	0.90 - 1.1	0.42	1.2	1.0 - 1.3	0.44	1.2	1.6 - 2.0	1.0	2.0	1.9 - 2.4	0.82	1.7
pool depth ratio	-	1.5	4.2	-	1.5	4.2	-	2.0	4.2	-	2.0	4.2
pool width at bankfull	4.0 - 4.5	3.8	5.1	5.0	4.3	5.8	8.0	6.7	9.0	9.5	7.7	10
pool width ratio	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6	-	1.2	1.6
Pattern												
sinuosity	-	1.1		-	1.2		-	1.4		-	1.2	
belt width	-	8.0	21	-	9.0	24	-	14	37	-	16	42.2
meander width ratio	-	2.5	6.6	-	2.5	6.6	-	2.5	6.6	-	2.5	6.6
linear wavelength (formerly meander length)	-	19	38	-	22	43	-	34	67	-	38	77
linear wavelength ratio (formerly meander length ratio)	-	6.0	12	-	6.0	12	-	6.0	12	-	6.0	12
meander length	-	77	150	-	90	180	-	250	510	-	290	570
meander length ratio	-	24	48	-	25	50	-	45	91	-	45	89
radius of curvature	-	6.4	13		7.2	14		11	22		13	26
radius of curvature ratio	-	2.0	4.0		2.0	4.0		2.0	4.0		2.0	4.0

Reference Reach Geomorphic Parameters										
			T1R2, T1R3, T2, T3				**T5R2, T6R1**			
	Notation	***Units***	**Scout West 1**		**Scout East 1**		**Still Creek**		**Scout East 2**	
			min	**max**	**min**	**max**	**min**	**max**	**Min**	**Max**
stream type			E/C5b		E5b		E5		E5	
drainage area	DA	*sq mi*	0.06		0.02		0.35		0.67	
design discharge	Q	*cfs*	2.6		1.8		7.3		17.5	
bankfull cross-sectional area	A_{bkf}	*SF*	1.2	2	0.9		5.7	6.7	6	6.9
average velocity during bankfull event	v_{bkf}	*fps*	1.3	2.3	2		1.2		2.9	2.5
Cross-Section										
width at bankfull	w_{bkf}	*feet*	2.6	6.3	3.1		6.8	8.0	4.7	6.1
maximum depth at bankfull	d_{max}	*feet*	0.5	0.7	0.5		1.1	1.4	1.7	1.8
mean depth at bankfull	d_{bkf}	*feet*	0.3	0.5	0.3		0.7	1.0	1.1	1.3
bankfull width to depth ratio	w_{bkf}/d_{bkf}		5.4	19.9	105		7.4	11.3	3.6	5.4
depth ratio	d_{max}/d_{bkf}	*feet*	1.5	1.9	1.6		1.7		1.4	1.5
bank height ratio	BHR		1.1	1.3	1		1	1.01	1	
floodprone area width	w_{fpa}	*feet*	>20		10		69	88	>50	
entrenchment ratio	ER		>2.2		3.2		5	13	>2.2	
Slope										
valley slope	S_{valley}	*feet/ foot*	0.029		0.0452		0.0088		0.0197	
channel slope	S_{chnl}	*feet/ foot*	-		0.0433		0.0066		0.0168	
Profile										
riffle slope	S_{riffle}	*feet/ foot*	0.026	0.047	-	-	-	-	-	-
riffle slope ratio	S_{riffle}/S_{chnl}		1	1.8	-	-	-	-	-	-
pool slope	S_p	*feet/ foot*	0.0125	0.027	-	-	0.0001		-	-
pool slope ratio	S_p/S_{chnl}		0.5	1.1	-	-	0.2		-	-
pool-to-pool spacing	L_{p-p}	*feet*	27	67	-	-	45		-	-
pool spacing ratio	L_{p-p}/w_{bkf}		4.9	12.2	-	-	6.18		-	-
pool cross-sectional area	A_{pool}	*SF*	2.2		-	-			-	-
pool area ratio	A_{pool}/A_{bkf}		1.3		-	-	1.2		-	-
maximum pool depth	d_{pool}	*feet*	0.6		-	-	1.45		-	-
pool depth ratio	d_{pool}/d_{bkf}		1		-	-	1.73		-	-
pool width at bankfull	w_{pool}	*feet*	6.7		-	-	9.04		-	-
pool width ratio	w_{pool}/w_{bkf}		1.2		-	-	1.24		-	-
Pattern										
sinuosity	K		1.1		-		1.33		1.2	
belt width	w_{blt}	feet	8.7	14.3	-	-	15	48	7.2	16.2
meander width ratio	w_{blt}/w_{bkf}		1.6	2.6	-	-	2.06	6.59	1.3	3
linear wavelength (formerly meander length)	L_m	feet	39.8	84.8	-	-	43	84	36.5	63.2
linear wavelength ratio (formerly meander length ratio)	L_m/w_{bkf}		7.2	15.4	-	-	5.9	11.53	6.8	11.7
radius of curvature	R_c	feet	3.1	9	-	-	21	47	5.5	16
radius of curvature ratio	R_c/ w_{bkf}		0.6	1.6	-	-	2.88	6.45	1	3

IRT Field Meeting Notes – Sassarixa Swamp

February 23, 2018

Meeting Attendees
Andrea Hughes/USACE
Ross Sullivan/USACE
Mac Haupt/NCDWR
Travis Wilson/NCWRC
Jeff Schaffer/ NCDMS
Katie Merritt/NCDWR
John Hutton/Wildlands
Angela Allen/Wildlands
Daniel Taylor/Wildlands

Angela Allen of Wildlands Engineering, Inc. (Wildlands) led the group on a tour of the proposed mitigation site. The purpose of the tour was to present the site to a group of NCIRT members and to get input into the management/mitigation options implemented at the site. During the tour, the group openly discussed the condition of the stream channels on the site and the design options and crediting scenarios they felt would be most appropriate to restore, enhance, and preserve the channels. The accompanying map identifies the stream reach names.

T1

The group agreed with the approaches and ratios along T1 presented in the technical proposal. The group noted a small channel along the left bank of T1 entering into Reach 3 that may be jurisdictional. This channel would be filled with its flow routed into T1 as it is moved to the center of the valley. The feature will need to be delineated and accounted for with the permitting of this project. It was also noted that flow should be monitored along T1 during the course of the project with a transducer placed half way down the reach. Documenting hoof shear and livestock presence in T1-R3 was recommended.

T1A

It was recommended that the start of the jurisdictional feature T1A be moved about half way down the reach shown in the proposal to the point where several seeps joined together at a headcut. This will be surveyed and adjusted at the mitigation plan stage. The IRT agreed that 2.5:1 was an appropriate ratio for this enhancement 2 reach.

Sassarixa Swamp

The group agreed with the approach of E2 for Sassarixa Creek and the proposed credit ratio. They noted care should be taken in the design of the internal crossing to prevent livestock access into the easement area. As this is an anabranching system, it was agreed that the easement width should extend a minimum of 50 feet past the outermost channel. This would include most or all of the width of the valley floor. Early treatment to control privet was recommended on this reach, since once livestock are fenced out it will grow faster.

T2

The group agreed with the approach and credit ratio for T2, however, they noted that there may be significant challenges presented with the existing pond. It was agreed the pond is feed by a seep, but that the existing pond is quite deep and could present a construction issue. The group requested information on how water is routed through the pond at the mitigation plan stage.

T3

The group discussed and agreed that restoration and the proposed credit ratio was appropriate for R1, R2, and R3. The small E2 reach of R2 is not worth breaking out with another activity and more good could be done for the system by continuing a restoration approach.

T4

The group agreed with the approach on T4 and felt leaving out the linear wetland area between R1 and R2 was the appropriate call. Several sections of subsurface flow were noted along R3, including a long section at the top of the reach. The IRT requested a quantification of the percentage of the system where flow is subsurface (subsurface reaches greater than 30ft in length). This will be used to determine if crediting of the reach needs to be altered (according to stream length). It was noted that these subsurface areas may have been the result of excessive sediment deposition during hurricane Mathew and that the stream could cut through them over time. Continued documentation of stream conditions through the life of the project is recommended. The proposed credit ratio of 10:1 for preservation was agreed upon.

T5A-B-C

The group discussed crediting of the E2 reaches above the existing pond. It was agreed that since the entire floodplain width was being protected including numerous wetland seep areas where no wetland credit is being requested, and that since these are the headwaters to reach T5, that the ratio of 2.5:1 is acceptable for the reaches. The design of T5A will include a channel connection at the downstream end where the livestock trampling has caused sheet flow. The group agreed that T5C will be credited according to the headwater stream guidance with credit given for valley length.

T5

Reach 3 (slated as E2) was relatively stable, and the group agreed that the credit ratio may require adjusting to 3:1 or 4:1. They requested documentation of the proportion of the buffer area that will be planted, and continued documentation of existing conditions. The group commented that the length of R2 attributed to restoration will depend on a further examination of existing conditions to determine the level of incision and need for restoration as opposed to E2, specifically towards the downstream end of the reach. This will be evaluated at the mitigation plan phase of the project.

T6

No comments were given by the group. Credit ratios were agreed upon.

Summary

The NCIRT generally agreed upon approaches presented in the proposal, with the exception of changing T3-R2 from E2 to Restoration and potentially reducing the length of restoration in T5-R2 based on design level data. The starting point of stream T1A will be adjusted to the confluence of several seeps. The percentage of subsurface flow on T4-R3 will be evaluated and information provided to the NCIRT. This may or may not affect overall credits on this reach. Crediting for T5C will be according to the headwater stream guidance. Crediting ratios on the E2 reach of T5-R3 may be adjusted to 3:1 or 4:1 based on information provided in the mitigation plan (e.g. proportion of new buffer planted along reach).

All intermittent streams will include flow monitoring at the midpoint of the reach and impact of livestock on site will continue to be monitored.

Contacts

Jeff Schaffer will serve as the Project Manager for NCDMS and the main point of contact. Angela Allen will be the Wildlands Project Manager and coordinate/submit project deliverables directly to Jeff Schaffer for distribution to all NCIRT team members.

Action Items and Next Steps

- Project Schedule – Wildlands is ready to proceed immediately with the Task 1 deliverable (Categorical Exclusion) and does not anticipate project delays.
- After the jurisdictional determination has been conducted, any wetland areas that will be impacted by the proposed work (filled or drained) will need to be identified and functional replacement for those losses should be proposed and discussed in the draft mitigation plan.
- USACE requires Jurisdictional (JD) stream/wetland calls for the project. Wildlands will coordinate with USACE for on-site JD verification prior to mitigation plan submittal.
- Wildlands will provide NCIRT with requested data discussed in the Summary during the mitigation plan phase of the project.

This represents Wildlands' interpretation of the meeting discussions. If any meeting attendees should find any information contained in these meeting minutes to be in error and/or incomplete based on individual comments or conversations, please notify Angela Allen with corrections/additions as soon as possible.

Sincerely,

AJ Allen

Angela Allen

aallen@wildlandseng.com

919.851.9986 x 106

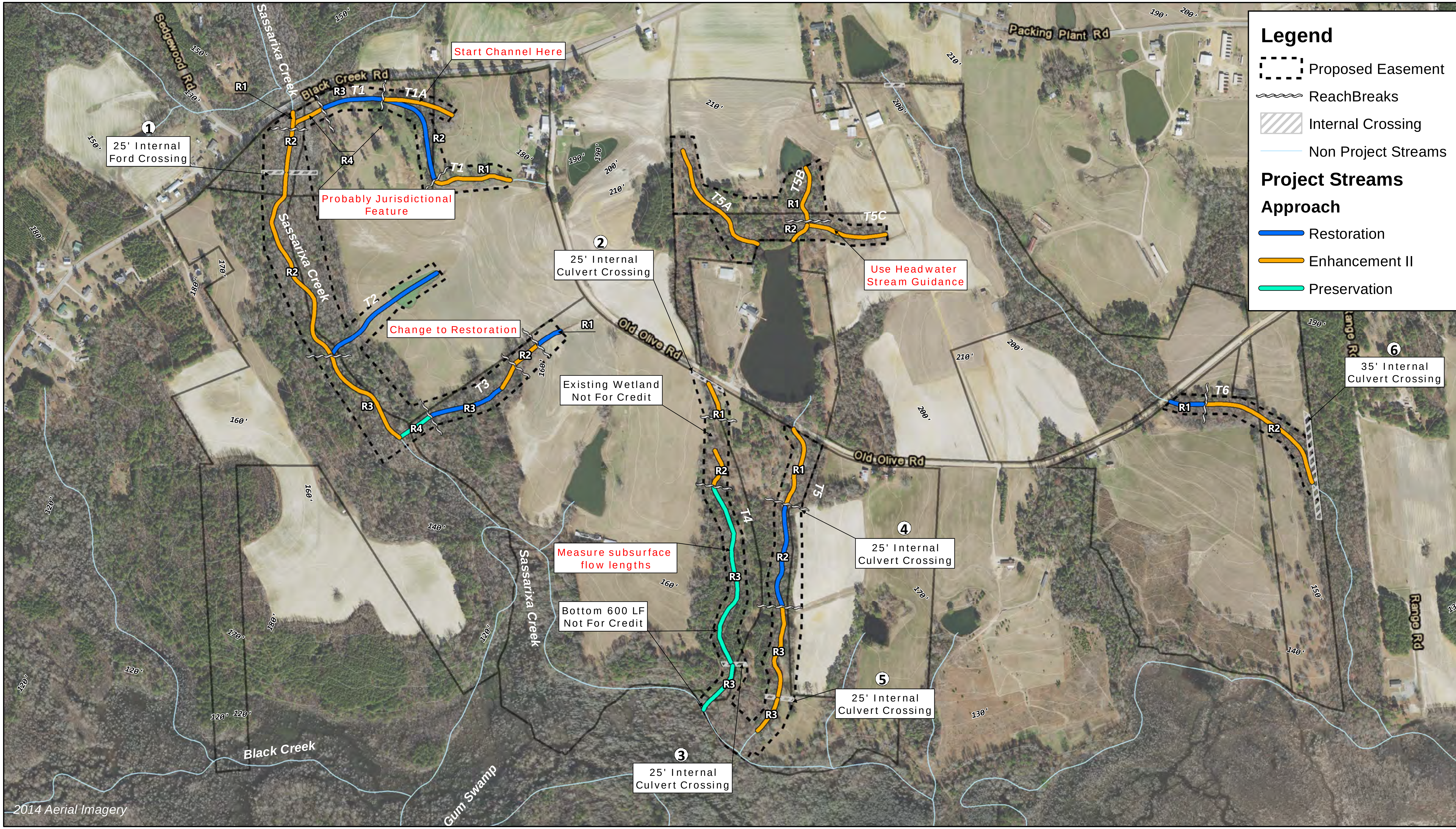


Figure 6A Concept Map (Option 1)
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

WILDLANDS ENGINEERING

Johnston County, NC

Appendix 6

Approved FHWA Categorical Exclusion Form

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Sassarixa Swamp Mitigation Site
County Name:	Johnston County
EEP Number:	100040
Project Sponsor:	Wildlands Engineering, Inc.
Project Contact Name:	Carolyn Lanza
Project Contact Address:	312 W. Millbrook, Suite 225, Raleigh NC 27609
Project Contact E-mail:	clanza@wildlandseng.com
EEP Project Manager:	Jeff Schaffer

Project Description

The Sassarixa Swamp Mitigation Site is a stream mitigation project located approximately 6 miles southwest of Smithfield and 5 miles north of Four Oaks in Johnston County. A single family has owned and operated the projected area for agriculture (specifically livestock production) since 1850. The project includes Sassarixa Creek and ten unnamed tributaries. Four flowing into Sassarixa Creek and six flowing into Black Creek for a total of 15,581 linear feet of stream. The project will provide stream mitigation units to the Division of Mitigation Services in the Neuse River Basin (03020201).

For Official Use Only

Reviewed By:

4/19/2018
Date

Jeff Schaffer
EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

4-19-18
Date

For Division Administrator FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☑ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☑ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☑ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☑ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☑ Yes ☐ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☑ Yes ☐ No ☐ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☑ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A

Sassarixa Swamp Mitigation Site
Categorical Exclusion

SUMMARY

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a Federal "Superfund" to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

As the Sassarixa Swamp Mitigation Site is a full-delivery project; an EDR Radius Map Report with Geocheck was ordered for the site through Environmental Data Resources, Inc on January 29, 2018. Neither the target property nor the adjacent properties were listed in any of the Federal, State, or Tribal environmental databases searched by the EDR. The assessment revealed no evidence of any "recognized environmental conditions" in connection with the target property. The Executive Summary of the EDR report is included in the Appendix. The full report is available if needed.

National Historic Preservation Act (Section 106)

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

Wildlands Engineering, Inc. (Wildlands) requested review and comment from the State Historic Preservation Office (SHPO) with respect to any archeological and architectural resources related to the Sassarixa Swamp Mitigation Site on February 2, 2018. SHPO responded on February 28, 2018 and stated they were aware of "no historic resources which would be affected by the project" and would have no further comment. All correspondence related to Section 106 is included in the Appendix.

Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)

These acts, collectively known as the Uniform Act, provide for uniform and equitable treatment of persons displaced from their homes, businesses, non-profit associations, or farms by federal and federally-assisted programs, and establish uniform and equitable land acquisition policies.

Sassarixa Swamp Mitigation Site is a full-delivery project that includes land acquisition. Notification of the fair market value of the project property and the lack of condemnation authority by Wildlands was included in the signed Option Agreements for the project property. Copies of the relevant section of the Option Agreements is included in the Appendix.

Endangered Species Act (ESA)

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.

The Johnston County listed endangered species includes the red-cockaded woodpecker (*Picoides borealis*), dwarf wedgemussel (*Alasmidonta heterodon*), Tar River spinymussel (*Parvaspina steinstansana*), yellow lance (*Elliptio lanceolata*) and Michaux's sumac (*Rhus michauxii*).

A pedestrian survey conducted on April 10, 2018, indicated that the Site did not provide suitable habitat for the red-cockaded woodpecker and yellow lance. The pedestrian did indicate that the site provides suitable habitat for the dwarf wedgemussel, Tar River spinymussel, and Michaux's sumac but no species were identified on the site. Therefore, due to the absence of the listed species on the site, the project has been determined by Wildlands to "may affect, but not likely to adversely affect" the dwarf wedgemussel and Tar River spinymussel, and to have "no effect" on the Michaux's sumac. The project will have "no effect" on the red-cockaded woodpecker and yellow lance due to the absence of suitable habitat.

Wildlands requested review and comment from the United States Fish and Wildlife Service (USFWS) on February 5, 2018 in respect to the Sassarixa Swamp Mitigation Site and its potential impacts on threatened or endangered species. USFWS responded on March 2, 2018 commenting "that the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites". A follow up email was sent to USFWs on April 6, 2018 regarding the new addition of the yellow lance on April 4, 2018 to Johnston County's endangered species list. USFWS responded on April 9, 2018 with no additional objection. All documents and correspondence submitted to the USFWS are included in the Appendix.

Farmland Protection Policy Act (FPPA)

The FPPA requires that, before taking or approving any federal action that would result in conversion of farmland, the agency must examine the effects of the action using the criteria set forth in the FPPA, and, if there are adverse effects, must consider alternatives to lessen them.

The Sassarixa Swamp Mitigation Site includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resources Conservation Service (NRCS). The completed form and correspondence documenting its submittal is included in the Appendix.

Fish and Wildlife Coordination Act (FWCA)

The FWCA requires consultation with the USFWS and the appropriate state wildlife agency on projects that alter or modify a water body. Reports and recommendations prepared by these agencies document project effects on wildlife and identify measures that may be adopted to prevent loss or damage to wildlife resources.

The Sassarixa Swamp Mitigation Site includes stream restoration. Wildlands requested comment on the project from both the USFWS and the North Carolina Wildlife Resources Commission (NCWRC) on February 5, 2018. NCWRC responded on March 21, 2018 and had no objections to the project. USFWS responded on March 2, 2018 and had no objections to the project. All correspondence with the two agencies is included in the Appendix.

Migratory Bird Treaty Act (MBTA)

The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute a taking.

Wildlands requested comment on the Sassarixa Swamp Mitigation Site from the USFWS regarding migratory birds on February 5, 2018. The USFWS responded on March 2, 2018 but had no comment regarding migratory birds. All correspondence with USFWS is included in the Appendix.

Sassarixa Swamp Mitigation Site
Categorical Exclusion

APPENDIX

Sassarixa Swamp
274-420 Old Olive Rd
Smithfield, NC 27577

Inquiry Number: 5170847.2s
January 29, 2018

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

274-420 OLD OLIVE RD
SMITHFIELD, NC 27577

COORDINATES

Latitude (North):	35.4734440 - 35˚ 28' 24.39''
Longitude (West):	78.4370220 - 78˚ 26' 13.27''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	732551.9
UTM Y (Meters):	3928369.0
Elevation:	167 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5948588 FOUR OAKS, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140611
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
274-420 OLD OLIVE RD
SMITHFIELD, NC 27577

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION

NO MAPPED SITES FOUND

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL.......................... National Priority List
Proposed NPL.............. Proposed National Priority List Sites
NPL LIENS.................. Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL............... National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY........ Federal Facility Site Information listing
SEMS......................... Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE............ Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS.................. Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF................. RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG.................. RCRA - Large Quantity Generators
RCRA-SQG.................. RCRA - Small Quantity Generators
RCRA-CESQG.............. RCRA - Conditionally Exempt Small Quantity Generator

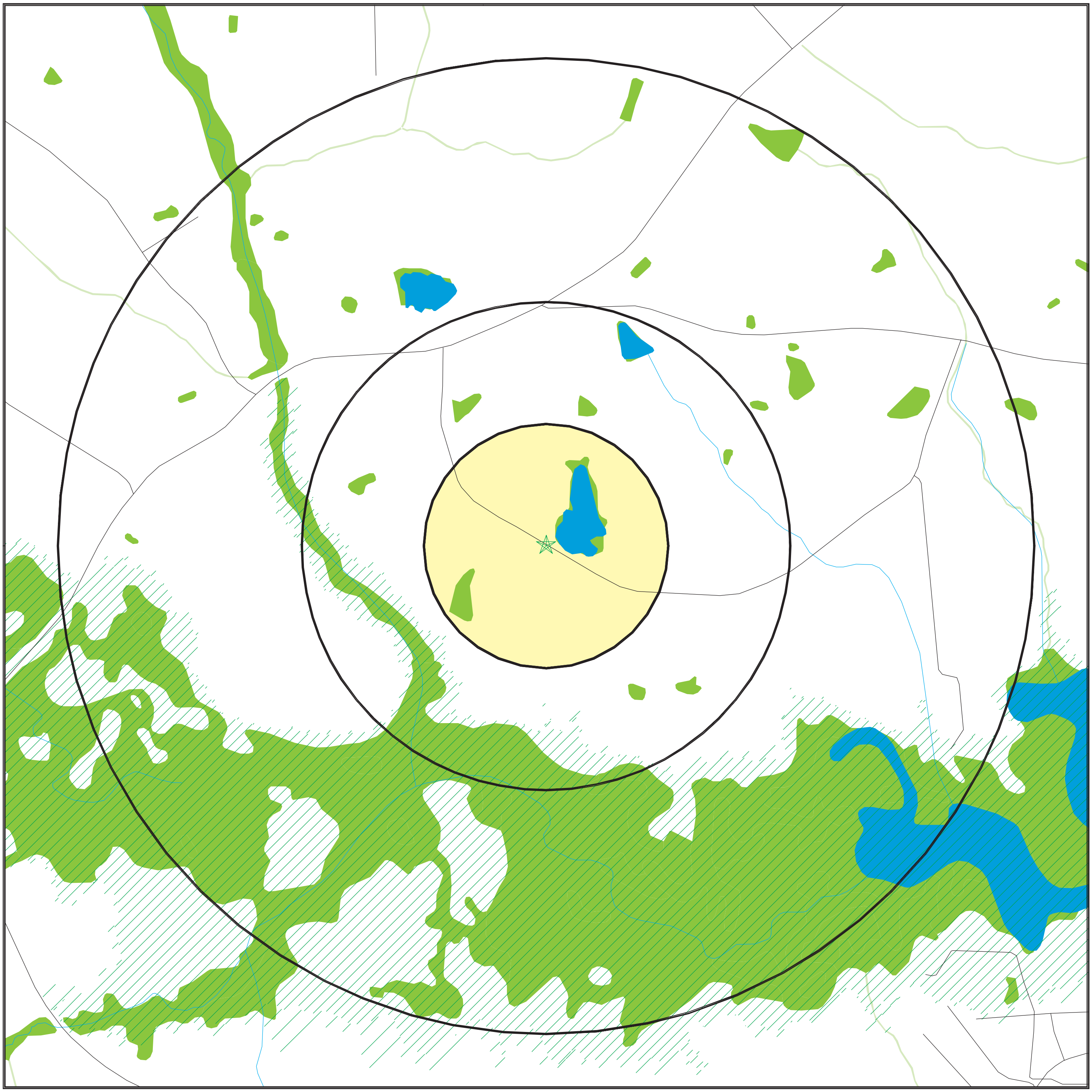
Federal institutional controls / engineering controls registries

LUCIS......................... Land Use Control Information System
US ENG CONTROLS....... Engineering Controls Sites List

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5170847.2S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

National Priority List Sites

Dept. Defense Sites

0 1/4 1/2 1 Miles

Indian Reservations BIA

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

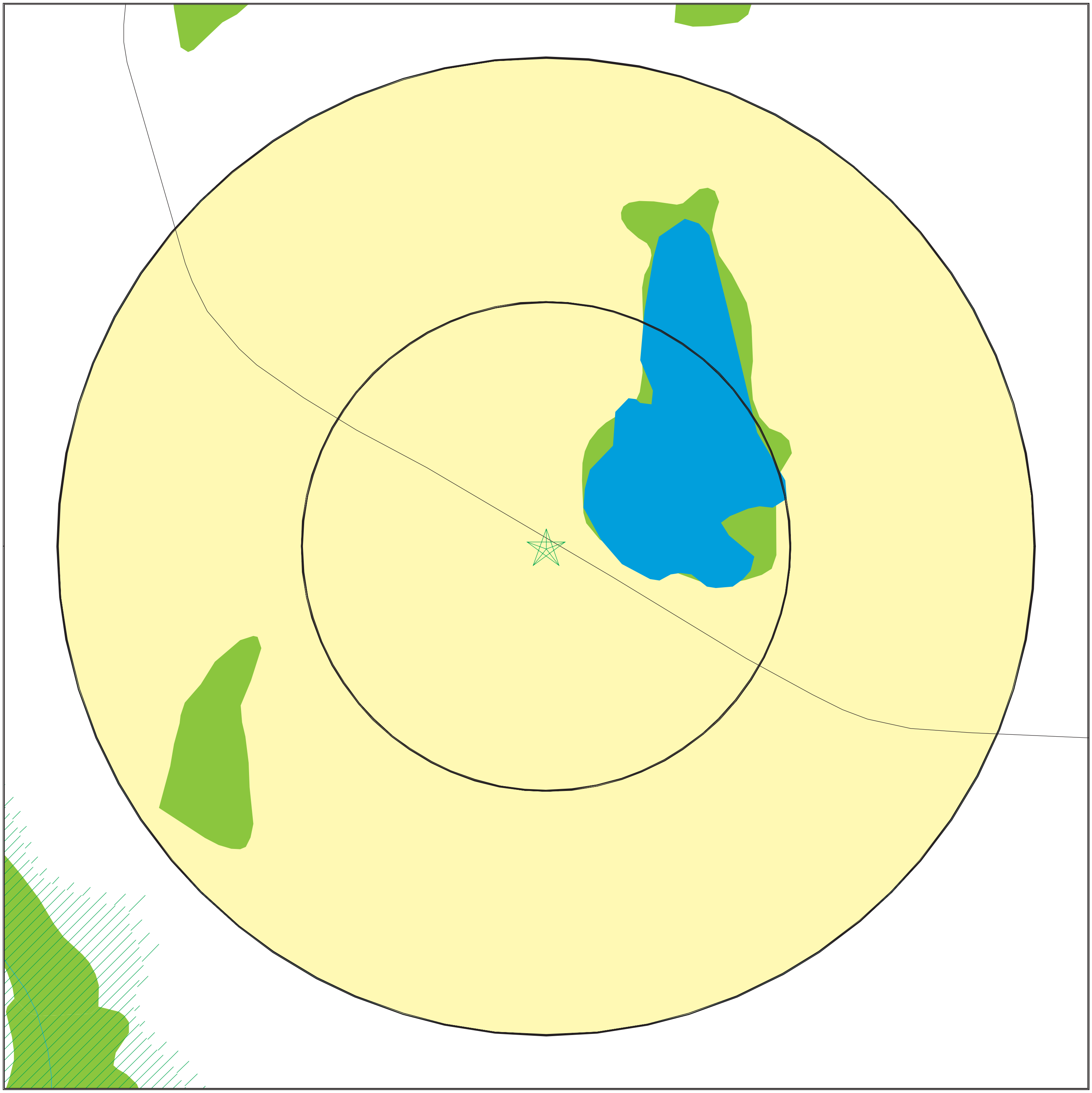
Upgradient Area

Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Sassarixa Swamp ADDRESS: 274-420 Old Olive Rd Smithfield NC 27577 LAT/LONG: 35.473444 / 78.437022	CLIENT: Wildlands Eng, Inc. CONTACT: Carolyn Lanza INQUIRY #: 5170847.2s DATE: January 29, 2018 1:19 pm

DETAIL MAP - 5170847.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Sassarixa Swamp	CLIENT: Wildlands Eng, Inc.
ADDRESS: 274-420 Old Olive Rd	CONTACT: Carolyn Lanza
Smithfield NC 27577	INQUIRY #: 5170847.2s
LAT/LONG: 35.473444 / 78.437022	DATE: January 29, 2018 1:20 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent NPL								
NC HSDS	1.000		0	0	0	0	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
OLI	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LAST	0.500		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
LUST	0.500		0	0	0	NR	NR	0
INDIAN LUST	0.500		0	0	0	NR	NR	0
LUST TRUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
UST	0.250		0	0	NR	NR	NR	0
AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
SWRCY	0.500		0	0	0	NR	NR	0
HIST LF	0.500		0	0	0	NR	NR	0
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
IMD	0.500		0	0	0	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
SPILLS 80	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
COAL ASH	0.500		0	0	0	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
NPDES	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
RGA HWS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	0	0	0	0	0

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

February 2, 2018

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: Sassarixa Swamp Mitigation Site
Johnston County, North Carolina

Dear Ms. Gledhill-Earley,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to archaeological or cultural resources associated with the Sassarixa Swamp Mitigation Site. A Site Map and USGS Topographic Map with approximate project areas are enclosed. The topographic figure was prepared from the Four Oaks, 7.5-Minute USGS Topographic Quadrangles.

The Sassarixa Swamp Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on Sassarixa Creek and four unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek all which flow into Holts Lake. The site has historically been disturbed due to livestock use. There are no existing structures within the project area. Furthermore, no archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes.

We ask that you review this site based on the attached information to determine the presence of any historic properties.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the project.

Sincerely,

Carolyn Lanza

Carolyn Lanza
Environmental Scientist

Attachment:
Figure 1 Site Map
Figure 2 USGS Topographic Map

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

February 28, 2017

Carolyn Lanza
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Re: Sassarixa Swamp Mitigation Site, Johnston County, ER 18-0279

Dear Ms. Lanza:

Thank you for your email of February 2, 2018, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

4.7 **Value of Mitigation Property; No Power of Eminent Domain**. In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer hereby notifies Seller that: (i) Buyer believes that the fair market value of the Mitigation Values of the Mitigation Property is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

4.8 **Entire Agreement**. Each party acknowledges they are not relying on any statements made by the other party, other than in this agreement, regarding the subject matter of this agreement. Neither party will have a basis for bringing any claim for fraud in connection with any such statements.

4.9 **Additional Documents**. Before and after Closing, each party shall sign and deliver documents as needed and as requested by the other party to carry out the purpose of this agreement. This section survives Closing.

4.10 **Dispute Resolution**. In the event of any dispute, claim, question or disagreement arising out of or relating to this agreement, either party may invoke the Dispute Resolution provision of this section by notifying the other party in writing of the matter in dispute and of the party's intention to resolve the dispute under this section. The parties shall then attempt to resolve the dispute informally for a period of 15 calendar days from the date of the notice. The period of informal negotiations may be extended 15 calendar days by written agreement of the parties to the dispute. If the parties are unable to resolve the dispute through informal negotiation, any party may invoke formal dispute resolution through mediation. The parties will agree to mediate all disputes in good faith and shall agree on a North Carolina Superior Court Certified Mediator to mediate the dispute. The mediation process must commence within 60 days of the selection of a mediator and the costs of mediation shall be borne equally by both parties. If mediation fails to resolve the dispute between the parties, either party may seek judicial resolution of the dispute in a North Carolina Court.

4.11 **Attorneys' Fees**. If either party commences an action against the other to interpret or enforce any of the terms of this agreement or because of the breach by the other party of any of the terms of this agreement, the losing party shall pay to the prevailing party reasonable attorneys' fees, expenses, court costs, litigation costs and any other expenses incurred in connection with the prosecution or defense of such action, whether or not the action is prosecuted to a final judgment.

4.12 **Memorandum**. Concurrently with the signing of this agreement, Buyer and Seller agree to sign a Memorandum of Option which will be recorded against the Property in the Register of Deeds of the County stated in paragraph A within five business days after the Effective Date.

4.13 **Landowner Authorization**. Concurrently with the signing of this agreement, Seller agrees to sign the Landowner Authorization Form.

4.14 **Tax Deferred Exchange**. If Seller desires to effect a tax-deferred exchange (the "Exchange") in connection with Buyer's purchase of the Conservation Easement, the parties agree to cooperate in effecting the Exchange. Seller is responsible for all additional costs associated with the

Seller HEO Seller JEO

Buyer

specific performance. Nothing stated in this section 4.3.2 precludes any action under any indemnification or defense provision in this agreement, nor for the award of attorney's fees and costs in conjunction with any action relating to this agreement.

3.3 **Brokers**. Buyer employs three North Carolina licensed real estate brokers, none of which have received a commission or finder's fee in connection with this agreement. Buyer has not employed a broker or finder or incurred any liability for any brokerage fee, commission or finder's fee in connection with this agreement.

3.4 **Notice**. All notices required by this agreement shall be in writing, shall be given only in accordance with the provisions of this Section, shall be addressed to the Parties in the manner stated below, and shall be conclusively deemed properly delivered: (a) upon receipt when hand delivered during normal business hours; (b) upon the day of delivery if the notice has been deposited in an authorized receptacle of the United States Postal Service as first-class, registered or certified mail, postage prepaid, with a return receipt requested; (c) one business day after the notice has been deposited with either FedEx or United Parcel Service to be delivered by overnight delivery; or (d) if sent by email, upon receipt of an acknowledgement email sent to the sender's email address in which the party receiving the email notice acknowledges having received that email. An automatic "read receipt" is not acknowledgement for purposes of this section 4.5. The addresses of the parties to receive notices are as follows:

Seller:	Hunter Olive Central Marketing Inc. P.O. Box 148 Smithfield, NC 27577 Email:	and	June Olive Lazy O Farm 3583 Packing Plant Rd. Smithfield, NC 27577
Buyer:	Wildlands Engineering, Inc. 1430 S. Mint Street, Suite 104 Charlotte, NC 28203 Attention: Shawn Wilkerson swikerson@wildlandseng.com		

3.5 **Assignment**. Buyer has the right to assign this agreement without the consent of Seller. No assignment shall be effective unless the assignee has delivered to Seller a written assumption of Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

3.6 **Value of Mitigation Property; No Power of Eminent Domain**. In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Buyer hereby notifies Seller that: (i) Buyer believes that the fair market value of the Mitigation Values of the Mitigation Property is an amount equal to the Purchase Price; and (ii) Buyer does not have the power of eminent domain.

Seller ______ Seller ______
Seller ______ Buyer ______

Attention: Shawn Wilkerson
swikerson@wildlandseng.com

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3.8 **Additional Documents**. Before and after Closing, each party shall sign and deliver documents as needed and as requested by the other party to carry out the purpose of this agreement. This section survives Closing.

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3.10 **Attorneys' Fees**. If either party commences an action against the other to interpret or enforce any of the terms of this agreement or because of the breach by the other party of any of the terms of this agreement, the losing party shall pay to the prevailing party reasonable attorneys' fees, expenses, court costs, litigation costs and any other expenses incurred in connection with the prosecution or defense of such action, whether or not the action is prosecuted to a final judgment.

3.11 **Memorandum**. Concurrently with the signing of this agreement, Buyer and Seller agree to sign a Memorandum of Option which will be recorded against the Property in the Register of Deeds of the County stated in paragraph A within five business days after the Effective Date.

Seller MK__ Seller _________

Buyer _________

swikerson@wildlandseng.com

3.5 **Assignment**. Buyer has the right to assign this agreement without the consent of Seller. No assignment shall be effective unless the assignee has delivered to Seller a written assumption of Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

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3.12 **Landowner Authorization**. Concurrently with the signing of this agreement, Seller agrees to sign the Landowner Authorization Form.

Seller ______ Seller ______

Seller ______ Buyer ______

4.5 **Notice**. All notices required by this agreement shall be in writing, shall be given only in accordance with the provisions of this Section, shall be addressed to the Parties in the manner stated below, and shall be conclusively deemed properly delivered: (a) upon receipt when hand delivered during normal business hours; (b) upon the day of delivery if the notice has been deposited in an authorized receptacle of the United States Postal Service as first-class, registered or certified mail, postage prepaid, with a return receipt requested; (c) one business day after the notice has been deposited with either FedEx or United Parcel Service to be delivered by overnight delivery; or (d) if sent by email, upon receipt of an acknowledgement email sent to the sender's email address in which the party receiving the email notice acknowledges having received that email. An automatic "read receipt" is not acknowledgement for purposes of this section 4.5. The addresses of the parties to receive notices are as follows:

Seller: Tami Olive Thompson
Lazy O Farm
3583 Packing Plant Road
Smithfield, NC 27577

Buyer: Wildlands Engineering, Inc.
1430 S. Mint Street, Suite 104
Charlotte, NC 28203
Attention: Shawn Wilkerson
swikerson@wildlandseng.com

4.6 **Assignment.** Buyer has the right to assign this agreement without the consent of Seller. No assignment shall be effective unless the assignee has delivered to Seller a written assumption of Buyer's obligations under this agreement. Seller hereby releases Buyer from any obligations under this agreement arising after the effective date of any assignment of this agreement by Buyer.

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Seller ______ Seller ______
Buyer ______ Seller ______

3.3 **Brokers**. Buyer employs three North Carolina licensed real estate brokers, none of which have received a commission or finder's fee in connection with this agreement. Buyer has not employed a broker or finder or incurred any liability for any brokerage fee, commission or finder's fee in connection with this agreement.

3.4 **Notice**. All notices required by this agreement shall be in writing, shall be given only in accordance with the provisions of this Section, shall be addressed to the Parties in the manner stated below, and shall be conclusively deemed properly delivered: (a) upon receipt when hand delivered during normal business hours; (b) upon the day of delivery if the notice has been deposited in an authorized receptacle of the United States Postal Service as first-class, registered or certified mail, postage prepaid, with a return receipt requested; (c) one business day after the notice has been deposited with either FedEx or United Parcel Service to be delivered by overnight delivery; or (d) if sent by email, upon receipt of an acknowledgement email sent to the sender's email address in which the party receiving the email notice acknowledges having received that email. An automatic "read receipt" is not acknowledgement for purposes of this section 4.4. The addresses of the parties to receive notices are as follows:

Seller:

Tami Olive Thompson
Lazy O Farm
3595 Packing Plant Road
Smithfield, NC 27577

Buyer:

Wildlands Engineering, Inc.
1430 S. Mint Street, Suite 104
Charlotte, NC 28203
Attention: Shawn Wilkerson
swikerson@wildlandseng.com

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Seller ______ Seller ______
Buyer ______ Seller ______

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4.8 **Entire Agreement**. Each party acknowledges they are not relying on any statements made by the other party, other than in this agreement, regarding the subject matter of this agreement. Neither party will have a basis for bringing any claim for fraud in connection with any such statements.

4.9 **Additional Documents**. Before and after Closing, each party shall sign and deliver documents as needed and as requested by the other party to carry out the purpose of this agreement. This section survives Closing.

4.10 **Dispute Resolution**. In the event of any dispute, claim, question or disagreement arising out of or relating to this agreement, either party may invoke the Dispute Resolution provision of this section by notifying the other party in writing of the matter in dispute and of the party's intention to resolve the dispute under this section. The parties shall then attempt to resolve the dispute informally for a period of 15 calendar days from the date of the notice. The period of informal negotiations may be extended 15 calendar days by written agreement of the parties to the dispute. If the parties are unable to resolve the dispute through informal negotiation, any party may invoke formal dispute resolution through mediation. The parties will agree to mediate all disputes in good faith and shall agree on a North Carolina Superior Court Certified Mediator to mediate the dispute. The mediation process must commence within 60 days of the selection of a mediator and the costs of mediation shall be borne equally by both parties. If mediation fails to resolve the dispute between the parties, either party may seek judicial resolution of the dispute in a North Carolina Court.

4.11 **Attorneys' Fees**. If either party commences an action against the other to interpret or enforce any of the terms of this agreement or because of the breach by the other party of any of the terms of this agreement, the losing party shall pay to the prevailing party reasonable attorneys' fees, expenses, court costs, litigation costs and any other expenses incurred in connection with the prosecution or defense of such action, whether or not the action is prosecuted to a final judgment.

4.12 **Memorandum**. Concurrently with the signing of this agreement, Buyer and Seller agree to sign a Memorandum of Option which will be recorded against the Property in the Register of Deeds of the County stated in paragraph A within five business days after the Effective Date.

4.13 **Landowner Authorization**. Concurrently with the signing of this agreement, Seller agrees to sign the Landowner Authorization Form.

4.14 **Tax Deferred Exchange**. If Seller desires to effect a tax-deferred exchange (the "Exchange") in connection with Buyer's purchase of the Conservation Easement, the parties agree to cooperate in effecting the Exchange. Seller is responsible for all additional costs associated with the Exchange and Buyer shall not have any additional liability with respect to the Exchange. The parties will execute any additional documents required for the Exchange at no cost to Buyer.

Seller ________ Seller ________

Buyer

February 5, 2018

Emily Wells
US Fish and Wildlife Service
P.O. Box 33726
Raleigh, North Carolina 27636-3726

Subject: Sassarixa Swamp Mitigation Site
Johnston County, North Carolina

Dear Ms. Wells,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to endangered species, migratory birds, or other trust resources associated with the proposed Sassarixa Swamp Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Four Oaks, 7.5-Minute USGS Topographic Quadrangles.

The Sassarixa Swamp Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on Sassarixa Creek and four unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek all which flow into Holts Lake. The site has historically been disturbed due to livestock use.

According to your website (https://www.fws.gov/raleigh/species/cntylist/johnston.html) the threatened or endangered species for Johnston County are: the red-cockaded woodpecker (*Picoides borealis*), dwarf wedgemussel (*Alasmidonta heterodon*), Tar River spinymussel (*Parvaspina steinstansana*) and Michaux's sumac (*Rhus michauxii*). If we have not heard from you in 30 days, we will assume that you do not have any comments regarding associated laws and that you do not have any information relevant to this project at the current time.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Carolyn Lanza

Carolyn Lanza
Environmental Scientist

Attachment:
Figure 1 USGS Topographic Map
Figure 2 Site Map

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

March 2, 2018

Ms. Carolyn Lanza
Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Re: Sassarixa Swamp Mitigation Site– Johnston County, NC

Dear Ms. Lanza:

This letter is to inform you that the Service has established an on-line project planning and consultation process which assists developers and consultants in determining whether a federally-listed species or designated critical habitat may be affected by a proposed project. For future projects, please visit the Raleigh Field Office's project planning website at https://www.fws.gov/raleigh/pp.html. If you are only searching for a list of species that may be present in the project's Action Area, then you may use the Service's Information, Planning, and Consultation System (IPaC) website to determine if any listed, proposed, or candidate species may be present in the Action Area and generate a species list. The IPaC website may be viewed at https://ecos.fws.gov/ipac/. The IPaC web site contains a complete and frequently updated list of all endangered and threatened species protected by the provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), a list of federal species of concern[1] that are known to occur in each county in North Carolina, and other resources.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or

[1] The term "federal species of concern" refers to those species which the Service believes might be in need of concentrated conservation actions. Federal species of concern receive no legal protection and their designation does not necessarily imply that the species will eventually be proposed for listing as a federally endangered or threatened species. However, we recommend that all practicable measures be taken to avoid or minimize adverse impacts to federal species of concern.

evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes.

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

With regard to the above-referenced project, we offer the following remarks. Our comments are submitted pursuant to, and in accordance with, provisions of the Endangered Species Act.

Based on the information provided and other information available, it appears that the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites. We believe that the requirements of section 7(a)(2) of the Act have been satisfied for your project. Please remember that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

However, the Service is concerned that restoring stream reaches that flow into a pond may not be appropriate. T5A-C appears to flow into a pond that isn't proposed to be drained and restored, so the benefit of restoring these features may be lost once the water enters the pond.

The Service may also have concerns about the potential impacts the proposed action might have on aquatic species in general. Aquatic resources are highly susceptible to sedimentation. Therefore, we recommend that all practicable measures be taken to avoid adverse impacts to aquatic species, including implementing directional boring methods and stringent sediment and erosion control measures. An erosion and sedimentation control plan should be submitted to and approved by the North Carolina Division of Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls should be installed and maintained between the construction site and any nearby down-gradient surface waters. In addition, we recommend maintaining natural, vegetated buffers on all streams and creeks adjacent to the project site.

The North Carolina Wildlife Resources Commission has developed a Guidance Memorandum (a copy can be found on our website at (http://www.fws.gov/raleigh) to address and mitigate secondary and cumulative impacts to aquatic and terrestrial wildlife resources and water quality. We recommend that you consider this document in the development of your projects and in completing an initiation package for consultation (if necessary).

We hope you find our web page useful and informative and that following the process described above will reduce the time required, and eliminate the need, for general correspondence for species' lists. If you have any questions or comments, please contact Emily Wells of this office at (919) 856-4520 ext. 25.

Sincerely,

for Pete Benjamin
Field Supervisor

From:	Carolyn Lanza
To:	"Wells, Emily"
Subject:	RE: [EXTERNAL] yellow lance (Elliptio lanceolata)
Date:	Monday, April 9, 2018 11:19:00 AM

Hi Emily,

Yes, Sassarixa Swamp is in Johnston County. I was mixing it up with the Catfish Pond Mitigation Site in Durham County, which does not have yellow lance.

Thank you,

Carolyn

Carolyn Lanza | *Environmental Scientist*
O: 919.851.9986 x113 **M**: 313.969.7318

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

From: Wells, Emily <emily_wells@fws.gov>
Sent: Monday, April 9, 2018 11:11 AM
To: Carolyn Lanza <clanza@wildlandseng.com>
Subject: Re: [EXTERNAL] yellow lance (Elliptio lanceolata)

Hi Carolyn,

Isn't Sassarixa Swamp in Johnston County? Yellow Lance is known to be in Neuse system in Johnston County, but not in the area that this project is located. In addition, the onsite work for this project would not be in potential suitable habitat for the species, so the comment letter would not need to be changed.

Thank you,
Emily

On Fri, Apr 6, 2018 at 1:20 PM, Carolyn Lanza <clanza@wildlandseng.com> wrote:

> Hi Emily,
>
> As of Tuesday (4/3/18) the yellow lance (*Elliptio lanceolata*) was put on Durham County's T & E list. I received USFWS Response Letter for Sassarixa Swamp on March 2, 2018. How should I go about making this amendment?
>
> Thank you,

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 2/13/18
Name Of Project Sassarixa Swamp Mitigation Site	Federal Agency Involved NC Division of Mitigation Services
Proposed Land Use Stream Restoration	County And State Johnston County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS 3/12/18

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☑	No ☐	Acres Irrigated None	Average Farm Size 156 acres
Major Crop*(s)* CORN	Farmable Land In Govt. Jurisdiction Acres: 390, 735 acres % 76		Amount Of Farmland As Defined in FPPA Acres: 379, 107 acres % 74	
Name Of Land Evaluation System Used Johnston county, NC LESA	Name Of Local Site Assessment System N/A		Date Land Evaluation Returned By NRCS March 26, 2018 by eMail	

PART III *(To be completed by Federal Agency)*		Alternative Site Rating			
		Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly		63.4			
B. Total Acres To Be Converted Indirectly					
C. Total Acres In Site		63.4	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information					
A. Total Acres Prime And Unique Farmland		6.1			
B. Total Acres Statewide And Local Important Farmland		22.0			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted		0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value		76.6			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*		11	0	0	0
PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	20			
4. Protection Provided By State And Local Government	20	20			
5. Distance From Urban Builtup Area	15	10			
6. Distance To Urban Support Services	15	4			
7. Size Of Present Farm Unit Compared To Average	10	5			
8. Creation Of Nonfarmable Farmland	10	10			
9. Availability Of Farm Support Services	5	0			
10. On-Farm Investments	20	0			
11. Effects Of Conversion On Farm Support Services	10				
12. Compatibility With Existing Agricultural Use	10				
TOTAL SITE ASSESSMENT POINTS	160	94	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100	11	0	0	0
Total Site Assessment *(From Part VI above or a local site assessment)*	160	94	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	105	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

From: Carolyn Lanza
To: "Cortes, Milton - NRCS, Raleigh, NC"
Subject: RE: Request for AD1006 Form - Sassarixa Swamp Mitigation Site - Johnston County, NC
Date: Tuesday, April 3, 2018 5:00:00 PM
Attachments: AD1006 Sassarixa Swamp (003).pdf
image001.png

Milton

Attached is the completed AD1006 form for the Sassarixa Swamp Mitigation Site for your files.

Thanks for your help.

Carolyn Lanza | *Environmental Scientist*
O: 919.851.9986 x113 **M**: 313.969.7318

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

From: Cortes, Milton - NRCS, Raleigh, NC <Milton.Cortes@nc.usda.gov>
Sent: Monday, March 26, 2018 3:28 PM
To: Carolyn Lanza <clanza@wildlandseng.com>
Cc: Charlie Neaves <cneaves@wildlandseng.com>
Subject: RE: Request for AD1006 Form - Sassarixa Swamp Mitigation Site - Johnston County, NC
Importance: High

Carolyn:

Please find attached the Farmland Conversion Impact Rating for the Sassarixa Swamp Mitigation Site - Johnston County, NC.

Let us know if we can be of further assistance

Cordially;

Milton Cortes
Assistant State Soil Scientist
USDA Natural Resources Conservation Service
4407 Bland Rd, Suite 117
Raleigh, NC 27609
Phone: 919-873-2171
milton.cortes@nc.usda.gov
USDA

From: Carolyn Lanza [mailto:clanza@wildlandseng.com]
Sent: Monday, March 12, 2018 7:32 AM
To: Cortes, Milton - NRCS, Raleigh, NC <Milton.Cortes@nc.usda.gov>
Cc: Charlie Neaves <cneaves@wildlandseng.com>
Subject: FW: Request for AD1006 Form - Sassarixa Swamp Mitigation Site - Johnston County, NC

Milton,
I am following up on my February submittal for Sassarixa Swamp AD1006. We have received comments from other agencies requesting coordinates, so I am including them for the other projects Wildlands has submitted as well.
Sassarixa Swamp: 35.476537, -78.446634
Catfish Pond: 36.162130, -78.907381
McClenny: 35.389648, -78.058428.
Thank you for your assistance and please let me know if you need any additional information.

Carolyn Lanza | *Environmental Scientist*
O: 919.851.9986 x113 **M**: 313.969.7318

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

From: Carolyn Lanza
Sent: Tuesday, February 13, 2018 4:36 PM
To: Milton.Cortes@nc.usda.gov
Subject: Request for AD1006 Form - Sassarixa Swamp Mitigation Site - Johnston County, NC

Milton,

I have a request for a completed AD-1006 form for a NCDENR Division of Mitigation Services (DMS) stream restoration project (Sassarixa Swamp Mitigation Site) located in Johnston County. Please find a Soils Map attached in addition to the AD-1006 form with Parts I and III filled out. The soil breakdown is included on the Soils Map.

Thank you for your assistance and please let me know if you need any additional information.

Carolyn Lanza | *Environmental Scientist*
O: 919.851.9986 x113 **M**: 313.969.7318

Wildlands Engineering, Inc.
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

February 5, 2018

Shannon Deaton
North Carolina Wildlife Resource Commission
Division of Inland Fisheries
1721 Mail Service Center
Raleigh, NC 27699

Subject: Sassarixa Swamp Mitigation Site
Johnston County, North Carolina

Dear Ms. Deaton,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with the proposed Sassarixa Swamp Mitigation Site. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Four Oaks, 7.5-Minute USGS Topographic Quadrangles.

The Sassarixa Swamp Mitigation Site is being developed to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channel have been identified as significantly degraded. The project will include stream restoration on Sassarixa Creek and four unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek all which flow into Holts Lake. The site has historically been disturbed due to livestock use.

We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning this project.

Sincerely,

Carolyn Lanza

Carolyn Lanza
Environmental Scientist

Attachment:
Figure 1 USGS Topographic Map
Figure 2 Site Map

North Carolina Wildlife Resources Commission
Gordon Myers, Executive Director

March 21, 2018

Ms. Carolyn Lanza
Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203

Subject: Request for Environmental Information for the Sassarixa Swamp Mitigation Project, Johnston County, North Carolina.

Dear Ms. Lanza,

Biologists with the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the proposed project description. Comments are provided in accordance with certain provisions of the Clean Water Act of 1977 (as amended), Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

Wildlands Engineering, Inc. has developed the Sassarixa Swamp Mitigation Project in order to provide in-kind mitigation for unavoidable stream channel impacts. Several sections of channels have been identified as significantly degraded. This project will include stream restoration to Sassarixa Creek, four unnamed tributaries to Sassarixa Creek and six unnamed tributaries to Black Creek. The Natural Heritage Natural Area – Holts Lake/Black Creek Swamp – is located directly downstream of the proposed mitigation sites. The project areas are located south of Black Creek Road, along portions of Old Olive Road, north of Four Oaks.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats and provide a travel corridor for wildlife species. The NCWRC recommends the use of biodegradable and wildlife-friendly sediment and erosion control devices. Silt fencing, fiber rolls and/or other products should have loose-weave netting that is made of natural fiber materials with movable joints between the vertical and horizontal twines. Silt fencing and similar products that have been reinforced with plastic or metal mesh should be avoided as they impede the movement of terrestrial wildlife species. Excessive silt and sediment loads can have detrimental effects on aquatic resources including destruction of spawning habitat, suffocation of eggs and clogging of gills. Any invasive plant species that are found onsite should be removed.

Mailing Address: Habitat Conservation • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

Thank you for the opportunity to review and comment on this project. If I can be of further assistance, please contact me at (910) 409-7350 or gabriela.garrison@ncwildlife.org.

Sincerely,

Gabriela Garrison

Gabriela Garrison
Eastern Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

Sassarixa Swamp Mitigation Site
Categorical Exclusion

FIGURES

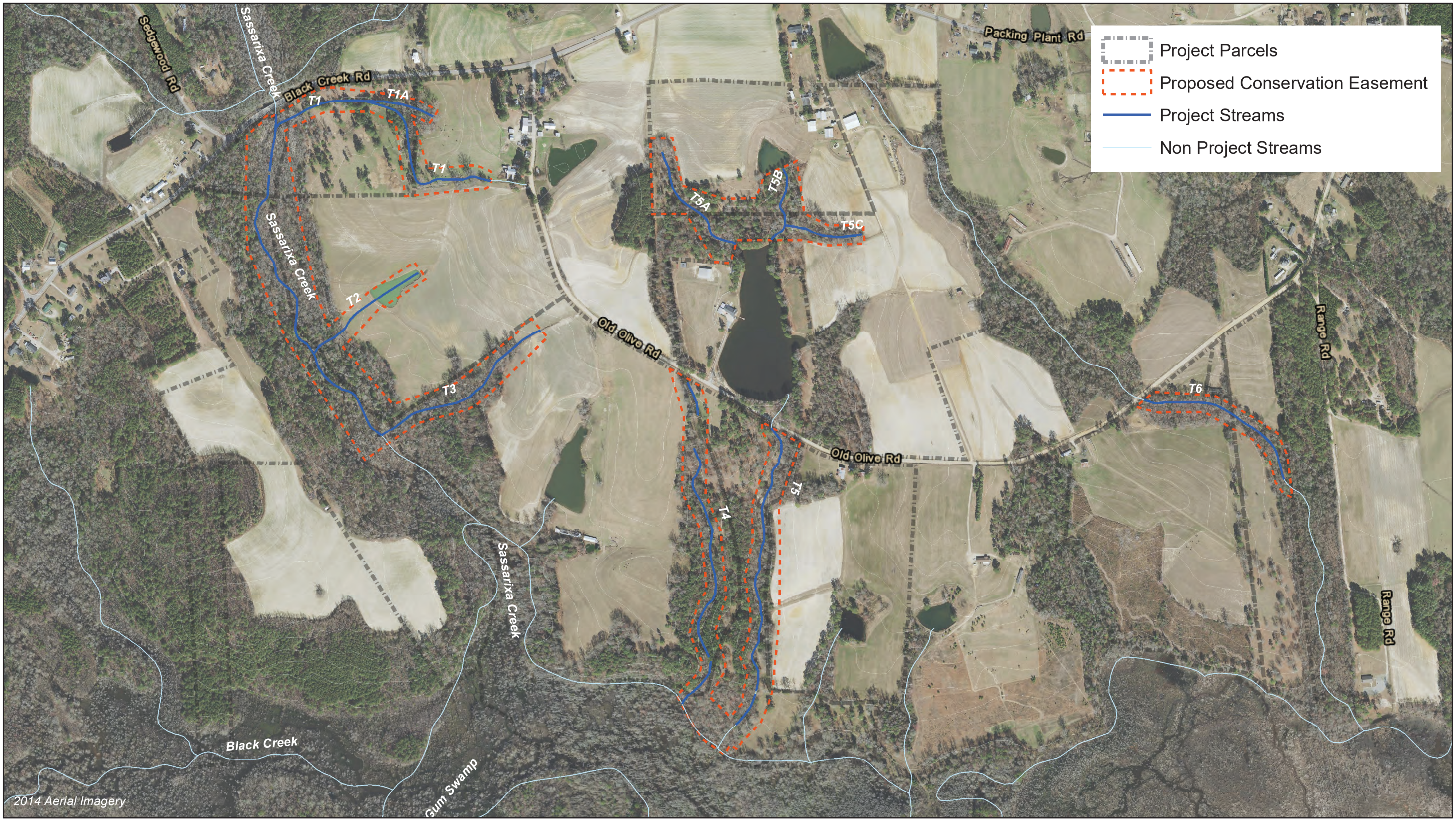


Figure 2 Site Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

WILDLANDS ENGINEERING

Johnston County, NC

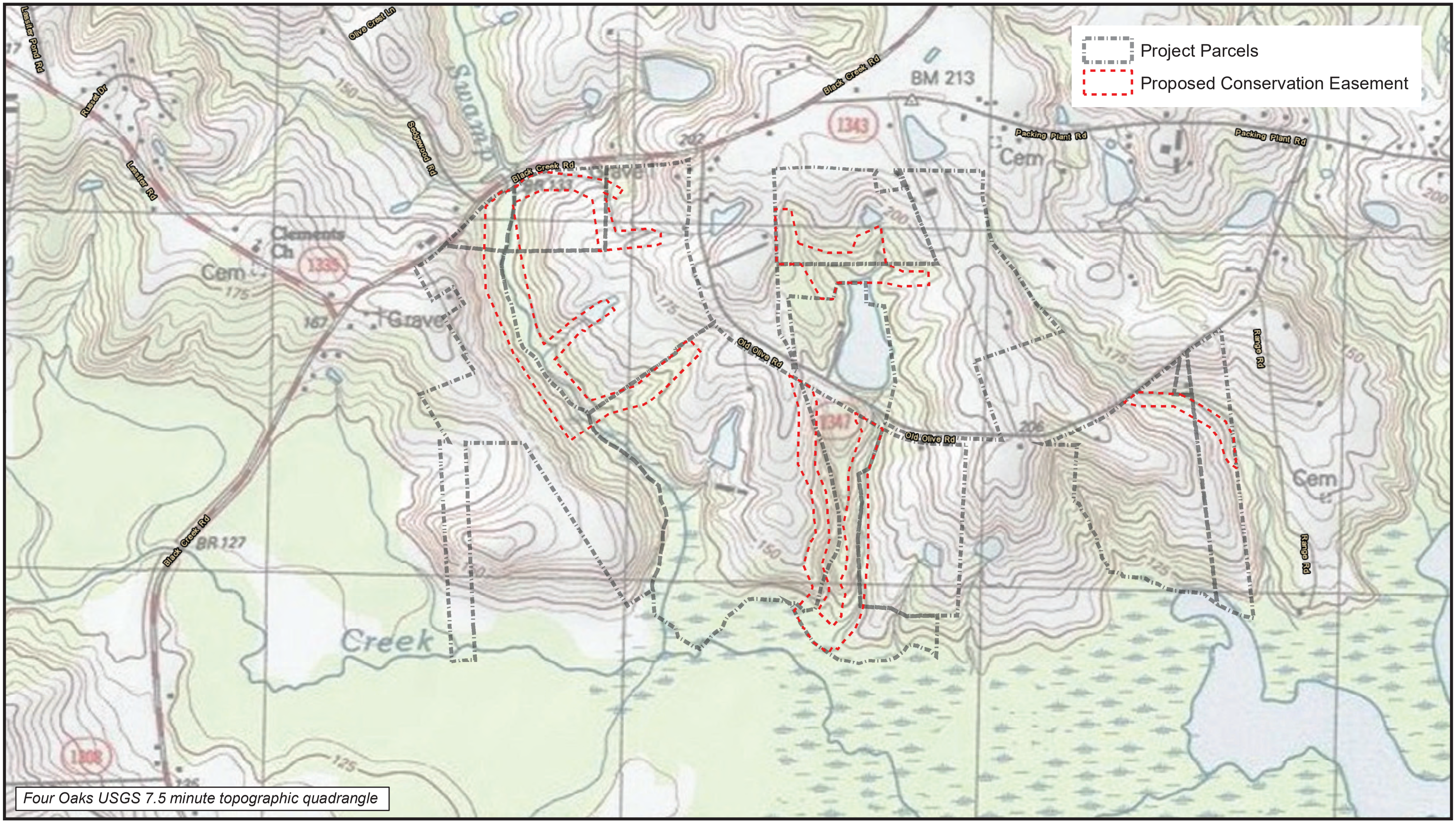


Figure 1 USGS Topographic Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

WILDLANDS ENGINEERING

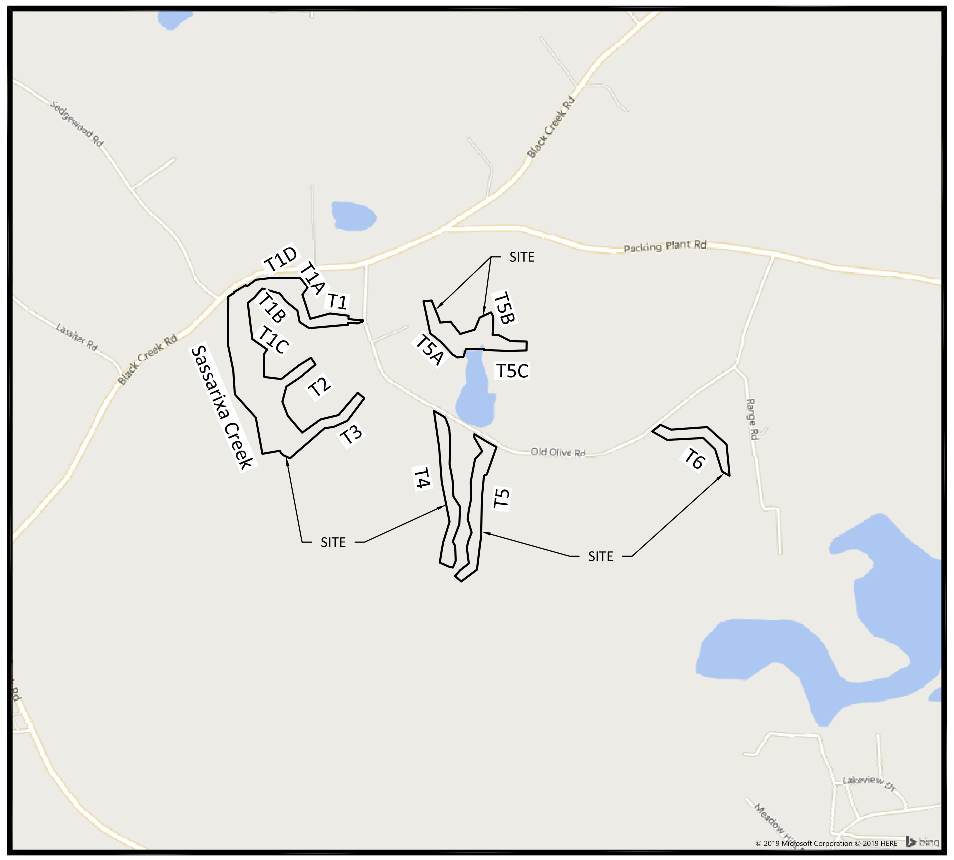
Appendix 7

Plan Sheets – See Report Attachment

Sassarixa Swamp Mitigation Site

Neuse River Basin 03020201

Johnston County, North Carolina



Vicinity Map
Not to Scale

BEFORE YOU DIG!
CALL 1-800-632-4949
N.C. ONE-CALL CENTER
IT'S THE LAW!

90% PLANS
MITIGATION PLAN
SUBMITTAL
ISSUED NOVEMBER 2019

Stream Origins

Stream	Latitude	Longitude
Sassarixa Creek	N35° 28' 42.20"	W78° 26' 47.71"
T1	N35° 28' 37.81"	W78° 26' 29.83"
T1A	N35° 28' 42.25"	W78° 26' 37.42"
T1B	N35° 28' 40.77"	W78° 26' 39.59"
T1C	N35° 28' 33.68"	W78° 26' 44.27"
T1D	N35° 28' 43.01"	W78° 26' 38.46"
T2	N35° 28' 31.91"	W78° 26' 36.28"
T3	W78° 26' 36.28"	W78° 26' 28.15"
T4	N35° 28' 25.04"	W78° 26' 15.03"
T5	N35° 28' 21.72"	W78° 26' 08.08"
T5A	N35° 28' 39.23"	W78° 26' 16.24"
T5B	N35° 28' 38.28"	W78° 26' 07.29"
T5C	N35° 28' 34.05"	W78° 26' 00.85"
T6	N35° 28' 22.94"	W78° 25' 38.59"

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Angela Allen, PE, Project Manager
Greg Turner, PE, Project Engineer
919-851-9986

Surveying:
Kee Mapping and Surveying, PA
88 Central Avenue
Asheville, NC 28801
Phillip B. Kee, PLS
828-645-8275

WILDLANDS ENGINEERING
312 W. Millbrook Road, Ste 225
Raleigh, NC 27609
Tel: 919.851.9986
Firm License No. F-0831

PRELIMINARY
DO NOT
USE FOR
CONSTRUCTION

Sassarixa Swamp
Johnston County, North Carolina

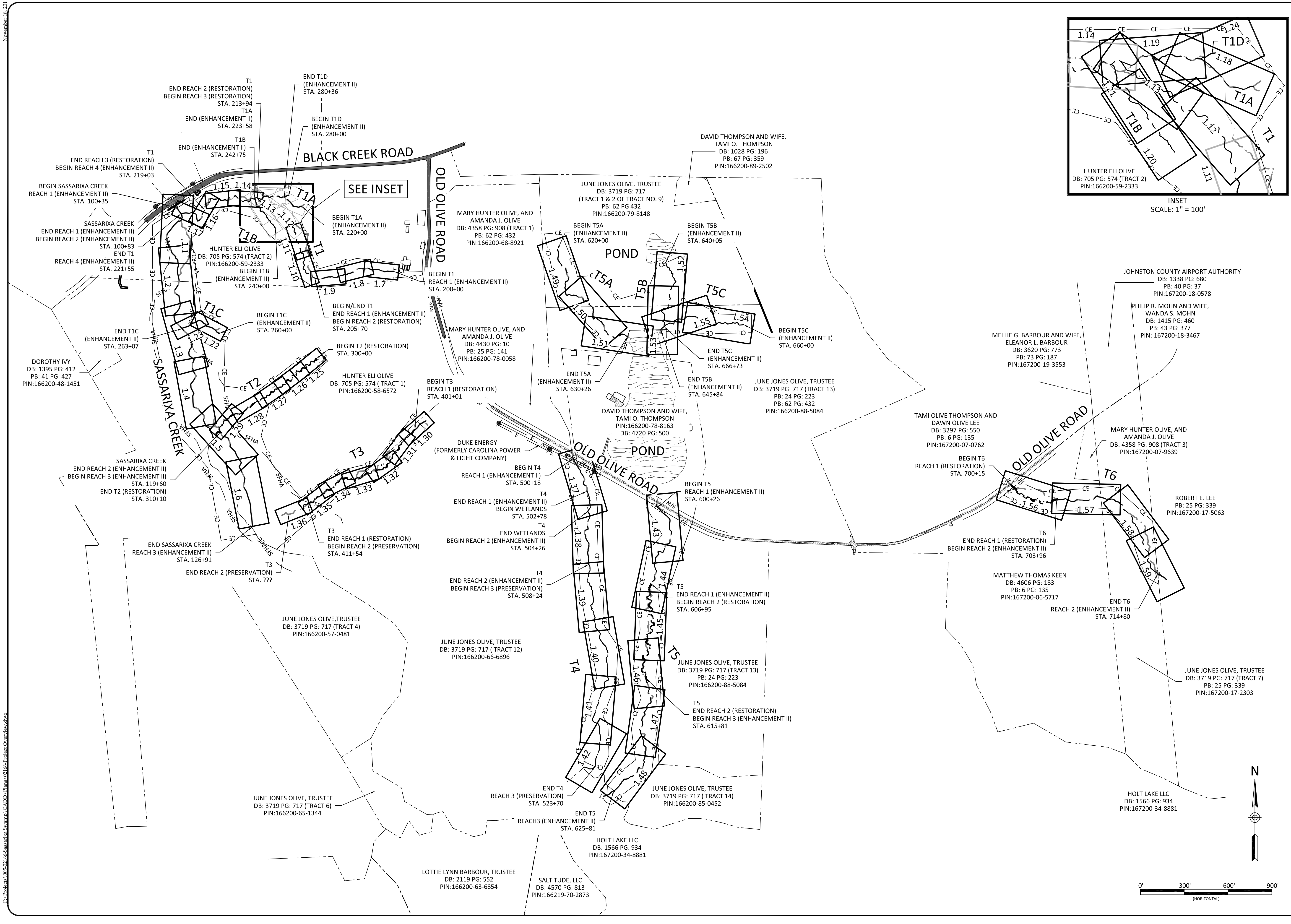
Appendix 7
Cover Sheet Mit Plan

Revisions:

Date: 11.15.2019
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

0.1
Sheet

F:\Projects\005-02166-Sassarixa Swamp\CADD\Plans\02166-Title Sheet.dwg
November 18, 201



WILDLANDS ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919.851.9986
License No. F-0831

PRELIMINARY DO NOT USE FOR CONSTRUCTION

Sassarixa Swamp
Johnston County, North Carolina

Project Overview

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

Sheet 0.2

General Notes for All Construction Reaches

1. All erosion and sediment control practices shall comply with the North Carolina Erosion and Sediment Control Planning and Design Manual.
2. Contractor will install pump-around systems to divert flow while working in live, flowing channels. The Contractor shall operate and maintain the pump-around system 24 hours a day until all disturbed areas are stabilized. The disturbed area within the pump around must be stabilized with temporary seeding, mulch and erosion control matting by the end of each workday. Contractor shall not remove pump-around systems and advance to the next work area until the current work area is completed and stabilized.
3. No material from the off-line proposed stream channel excavation may be backfilled into the adjacent existing stream channel until the newly constructed proposed stream section is completed, stabilized, and the stream flow has been diverted into it, not even if that section of old/ existing stream is being pumped.
4. In areas without a pump-around system, Contractor shall disturb only as much channel bank as can be stabilized with temporary seeding, mulch, and a sod mat or erosion control matting by the end of each workday.
5. Clearing and grubbing activities shall not extend more than 150 linear feet ahead of in-stream work.
6. When crossing an active section of new or old stream channel, a Timber Mat shall be installed according to the details and specifications.
7. All graded areas with slopes steeper than 3:1 will be stabilized within seven (7) working days. All other areas will be stabilized within 14 working days.
8. Locations for staging and stockpile areas and temporary stream crossings have been provided on the Plans. Additional or alternative staging and/or stockpile areas and stream crossings may be used by the Contractor provided that all practices comply with the North Carolina Erosion and Sediment Control Planning and Design Manual and that the areas are approved by the Engineer prior to implementation. Short-term stockpile areas are those that will remain in place for a short period of time so that the disturbed area can be stabilized within the timeframes in item #7 of the General Construction Notes. Additional stockpile areas and other short-term stockpiles, staging areas, and stream crossings not shown on the plans will require approval of the Division of Energy, Mineral, and Land Resources.
9. Vegetation on-site to be used as transplant material (juncus, small trees, and sod mats) shall not be disturbed until Contractor is prepared to install transplants.
10. Various types of constructed riffles are specified on the plans. Contractor shall build the specific types of constructed riffles at locations shown on the Plans. Changes in constructed riffle type must be approved by the Engineer.
11. Existing fence located inside the conservation easement shall be removed during construction.
12. Contractor is to make every effort to avoid damaging or removing existing trees.
13. Under no circumstances will the Contractor exceed the limits of disturbance and/or go outside of temporary construction access areas shown on the plans.

Initial Site Preparation

1. Call NC DEQ LQS at the Raleigh Regional Office at 919-791-4200 to schedule a pre-construction meeting at least 48 hours prior to project activation.
2. Contact North Carolina "One Call" Center (1.800.632.4949) before any excavation.
3. Contact Division of Energy, Mineral and Land Resources (919-791-4200) before any work begins on the project and notify them of the start date.
4. Mobilize equipment and materials to the Site.
5. Identify and establish construction entrance, staging and stockpile areas, haul roads, silt fence, tree protection fencing, safety fencing, and temporary stream crossings as indicated on the Plans for work areas.
6. All haul roads shall be monitored for sediment loss daily. In the event of sediment loss, silt fence or other acceptable sediment and erosion control practices shall be installed. Silt fence outlets shall be located at points of low elevation or a minimum spacing of 150 ft.
7. Set up temporary facilities, locate equipment within the staging area, and stockpile materials needed for the initial stages of construction within the stockpile area(s).
8. Install and maintain an onsite rain gauge and logbook to record the rainfall amounts and dates. Maintain an approved copy of the E&SC plan with placard and approval letter and a copy of the NPDES permit with a minimum of 30 days of self-inspection reports on site until project closure by NCDEQ. Complete the self-inspection as required by NCDEQ permit. Rainfall records, completed self-inspection forms, and permits should be maintained on site.
9. Monitor site for sediment loss and inspect all erosion control features after each rain event. Maintain erosion control features according to the North Carolina Erosion and Sediment Control Manual.

Construction Sequence

1. Erosion and Sediment Control (E&SC) permit and a Certificate of Coverage (COC) must be obtained before land disturbing activities occur. The COC can be obtained by filling out the Electronic Notice of Intent (e-NOI) form at deq.nc.gov/NCG01. Please note, the e-NOI form may only be filled out once the plans have been approved. A copy of the E&SC permit, the COC and a hard copy of the plans must be kept on site, preferably in a permit box, and accessible during inspection.
2. This project may be constructed in phases according to construction entrances and grouped streams (T1 and T2, T3, T4 and T5, T6, and TA-TC). The Contractor shall not start construction on one phase and move to another phase before stabilizing the first, unless a crew is continuing work on the initial phase.
3. All construction entrances are located off of Old Olive Road.
4. Install temporary livestock fencing as necessary to secure project area under construction. Conservation easement Fencing may be installed prior to construction to reduce or eliminate the need for temporary fencing.
5. Perform any necessary clearing and grubbing in phases as work progresses. Bank vegetation and vegetation immediately adjacent to live channels shall be left undisturbed as long as possible. Remove all non-native and invasive vegetation prior to beginning the channel construction. Take care with vegetation marked for transplant from the old channel to new channel. Do not disturb transplant vegetation until time of transplant.
6. Construction of all channels are to be done in the dry. Construction should generally progress from upstream to downstream to prevent sediment runoff from upstream construction affecting completed downstream reaches. Use a pump around as shown on the plans and discussed in the General Notes.
7. Where feasible, more than one offline section may be constructed concurrently. Offline sections shall be tied online sequentially from downstream to upstream.
8. As work progresses, remove and stockpile the top three inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for onsite replacement prior to floodplain seeding.
9. Construct the proposed stream channel to the grade specified in the cross-sections and profile. Transfer coarse material from abandoned channel riffles to new channel riffles utilizing a pump-around when doing so.
10. Grade the adjacent floodplain area according to grades shown on the plan.
11. Install in-stream structures (riffles, angled log sill, log J-hook, cover log, and boulder sill) and in-bank bioengineering such as brush toe and sod mats after channel grading is completed according to details and specifications.
12. Seed (with specified temporary seed and permanent seed mix) and straw mulch areas where the coir fiber matting is to be installed.
13. Install coir fiber matting according to plans and specifications.
14. Sod mats may be used in lieu of coir fiber matting, where available, to stabilize all stream banks as the preferential stabilization method. Coir fiber matting may be used where sod mats are not available or if coir fiber matting is the preferred at the discretion of the Designer.
15. Backfill abandoned channel sections with stockpiled soil according to the grades shown on the Plans. Non-native and invasive vegetation (e.g. Chinese privet and multiflora rose) shall be removed from the existing channel prior to backfilling.
16. Prepare floodplain for seeding by applying stockpiled topsoil to the floodplain between bankfull elevation and the grading limits, ripping, and raking/smoothing. Seed with specified temporary and permanent seed mix and mulch. Any areas within the conservation easement that have not been graded shall be treated according to the planting plan.
17. If at any time circumstances should arise where water has been turned into the new channel and additional work must be done on the floodplain, erosion control devices will be installed to protect the new channel from sedimentation.
18. Once all phases of channel and floodplain construction are complete, prepare the floodplain areas for planting per the specifications.
19. Install live stakes and herbaceous plugs along the stream banks according to the plans and specifications.
20. When the project is complete, the permittee shall contact DEMLR to close out the E&SC Plan. After DEMLR informs the permittee of the project close out, via inspection report, the permittee shall visit deq.nc.gov/NCg01 to submit an electronic notice of Termination (e-NOT). A $100 annual general permit fee will be charged until the e-NOT has been filled out.

Construction Demobilization

1. Remove temporary stream crossings.
2. The Contractor shall ensure that the site is free of trash and leftover materials prior to demobilization of equipment from the site.
3. Complete the removal of any additional stockpiled material from the site.
4. Demobilize grading equipment from the site.
5. All rock and other stockpiled materials must be removed from the limits of disturbance and conservation easement. All areas outside the conservation easement shall be returned to pre-project conditions or better.
6. Seed, mulch, and stabilize staging areas, stockpile areas, haul roads, and construction entrances. Pasture seed mix is to be applied to areas of disturbance outside of the conservation easement.

Existing Features

- Existing Property Boundary
- R/W — Existing NCDOT Right-of-way
- Existing Guardrail
- OHE — Existing Overhead Utility
- OUE — Existing Utility Easement
- Existing Storm Pipe
- 540 — Existing 5' Major Contour
- Existing 1' Minor Contour
- Existing Thalweg
- Existing Top of Bank
- Existing Edge of Pavement
- X — Existing Fence
- SFHA — Special Flood Hazard Area
- Existing Treeline
- Existing Tree
- Existning Spring
- Existing Fire Hydrant
- Existing Utility Pole
- Existing Guy Anchor
- Existing Asphalt
- Existing Gravel Road
- Existing Bedrock
- Existing Debris
- Existing Wetland Area
- Existing Rip Rap
- CPP — Corrugated Plastic Pipe
- PVC — Polyvinyl Chloride Pipe
- CMP — Corrugated Metal Pipe

Proposed Features

- CE — Proposed Conservation Easement
- CE-IX — Proposed Conservation Easement Crossing
- CE-B — Proposed Bank Conservation Easement
- 10+00 — Proposed Stream Alignment
- Proposed Bankfull
- 540 — Proposed 5' Major Contour
- Proposed 1' Minor Contour
- Proposed Five-Strand Barbed Wire Fence
- Proposed High Tensile Wire Fence
- CR-ALR — Proposed Angled Log Riffle, See Detail 1, Sheet 6.0
- CR-NM — Proposed Native Material Riffle, See Detail 2, Sheet 6.0
- CR-WD — Proposed Woody Riffle, See Detail 3, Sheet 6.0
- Proposed Lunker Log, See Detail 2, Sheet 6.1
- Proposed Angled Log Sill, See Detail 1, Sheet 6.1
- Proposed Brush Toe, See Details 1, Sheet 6.2
- Proposed Culvert, See Detail Sheets 6.3-6.7
- Proposed Stream Bank Grading

Erosion Control Features

- Proposed Construction Entrance, See Detail 2, Sheet 6.10
- Proposed Pump Around, See Detail 1, Sheet 6.10
- Proposed Silt Fence, See Detail 2, Sheet 6.9
- Proposed Silt Fence Gravel Outlet, See Detail 3, Sheet 6.9
- Proposed Temporary Stream Crossing with Silt Fence - Timber Mat, See Detail 4, Sheet 6.9
- SAF — Proposed Tree Protection Fencing, See Detail 3, Sheet 6.8
- Proposed Haul Road
- Proposed Stockpile/Staging Area
- LOD — Proposed Limits Of Disturbance

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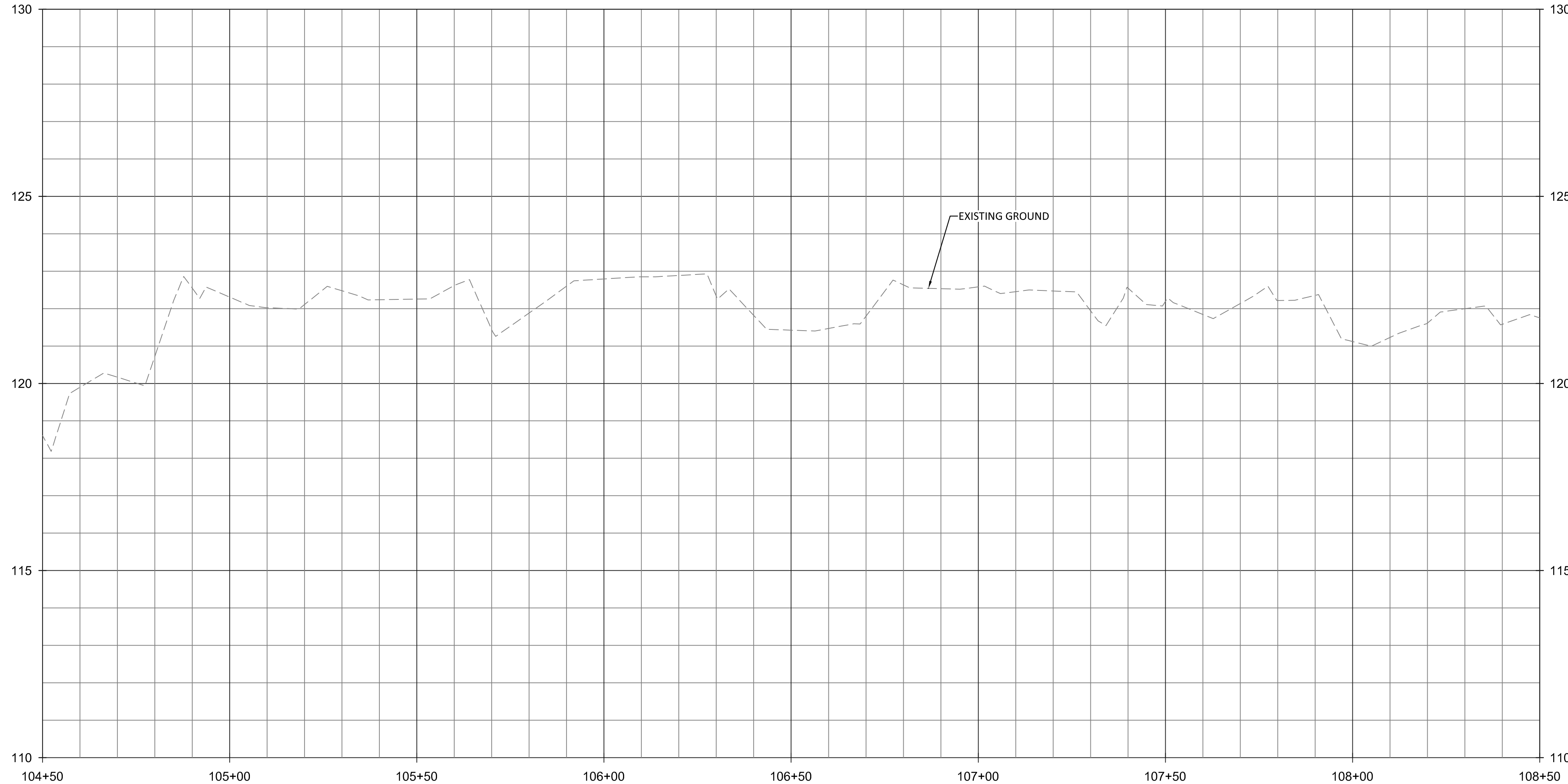
Sassarixa Swamp
Johnston County, North Carolina

General Notes and Symbols

Revisions:

Date: 11.15.2019
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 0.3



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0' 20' 40' 60'
(HORIZONTAL)

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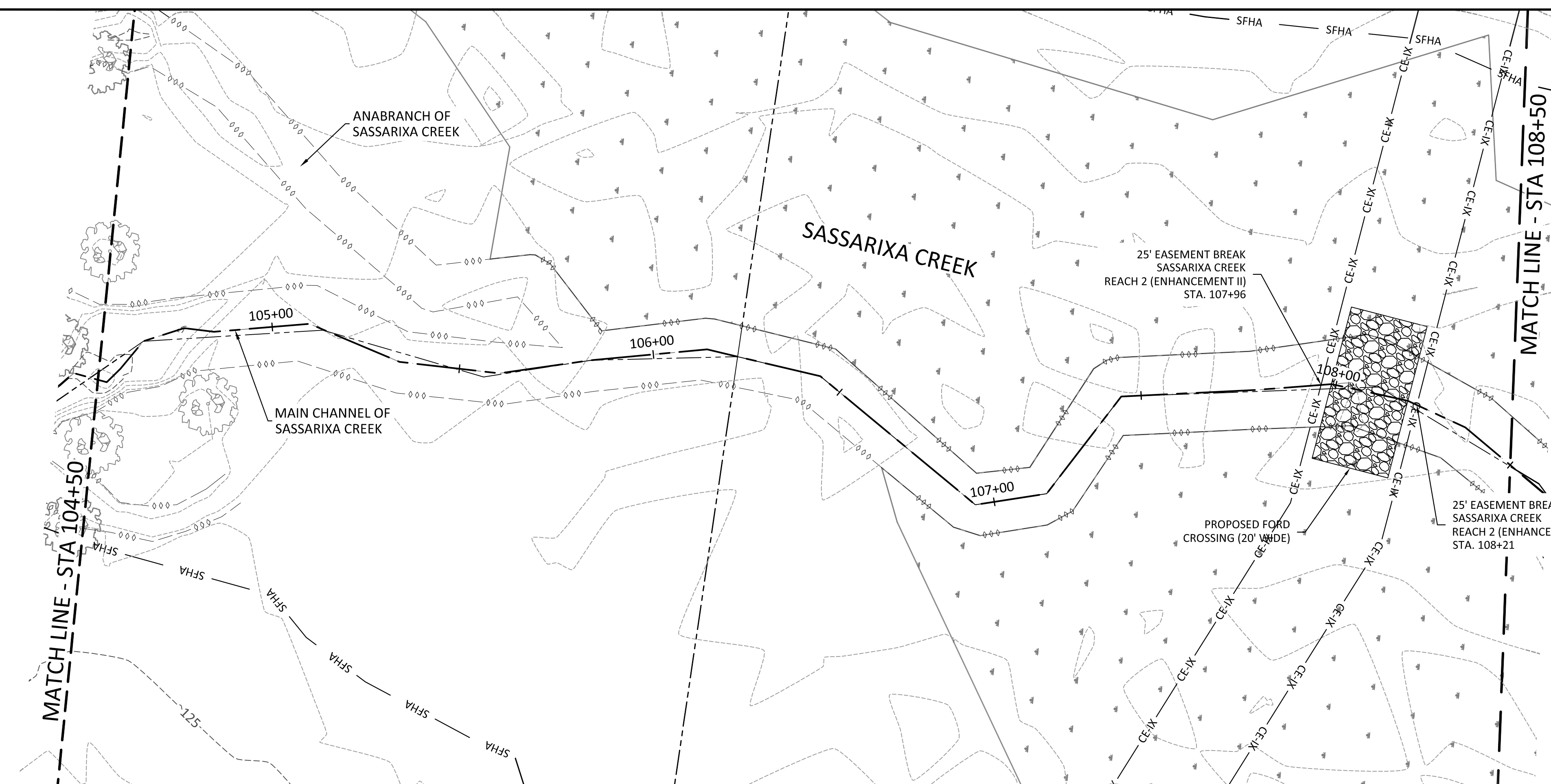

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Sassarixa Creek
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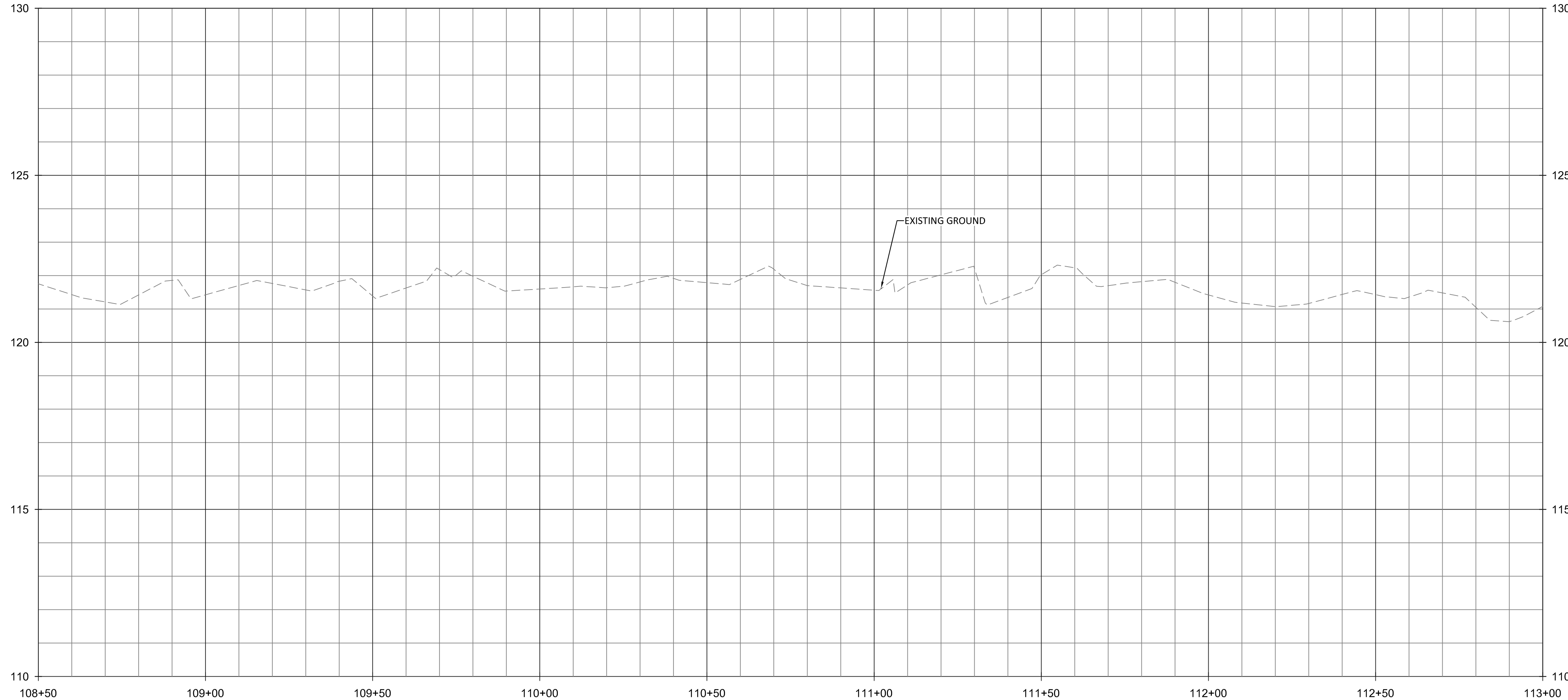

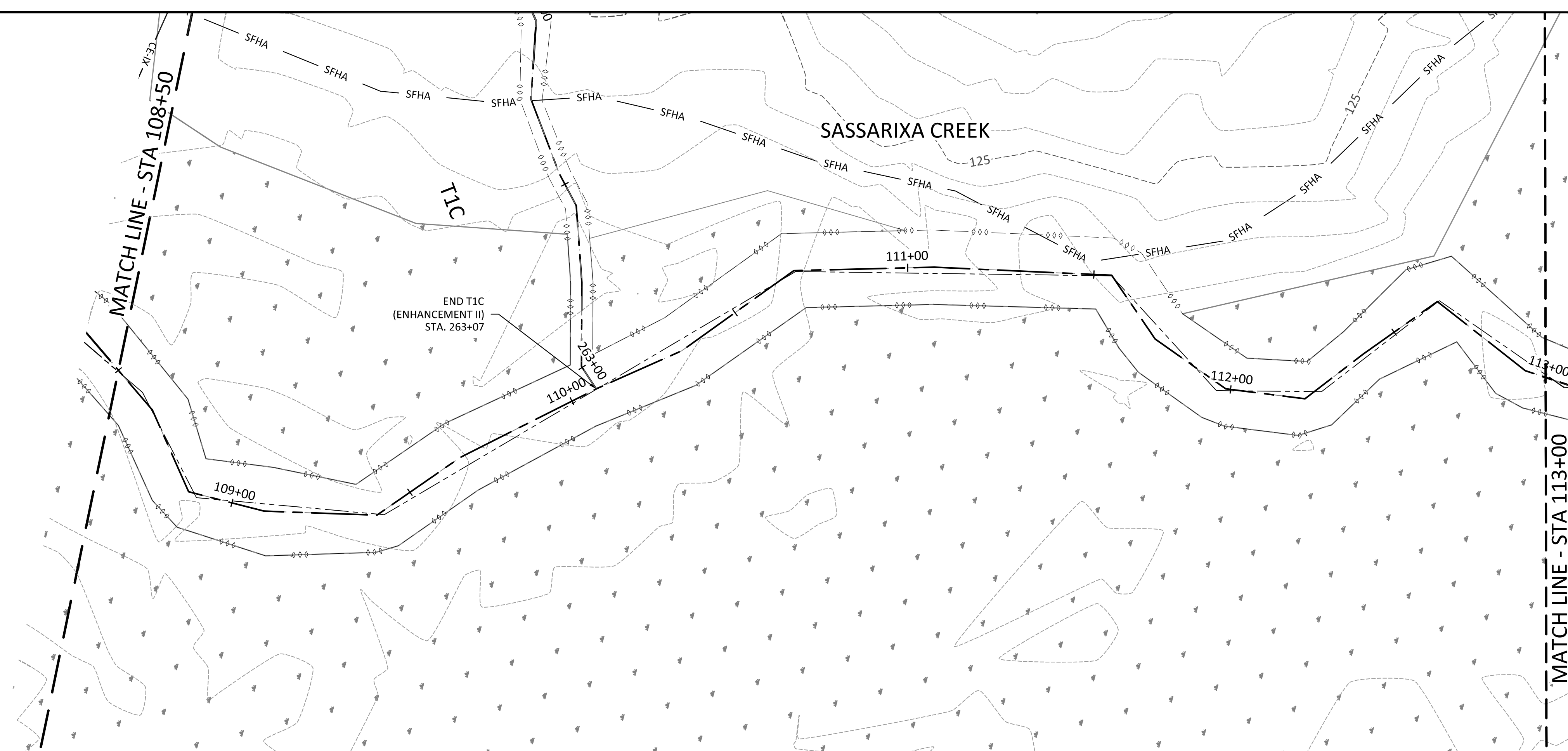

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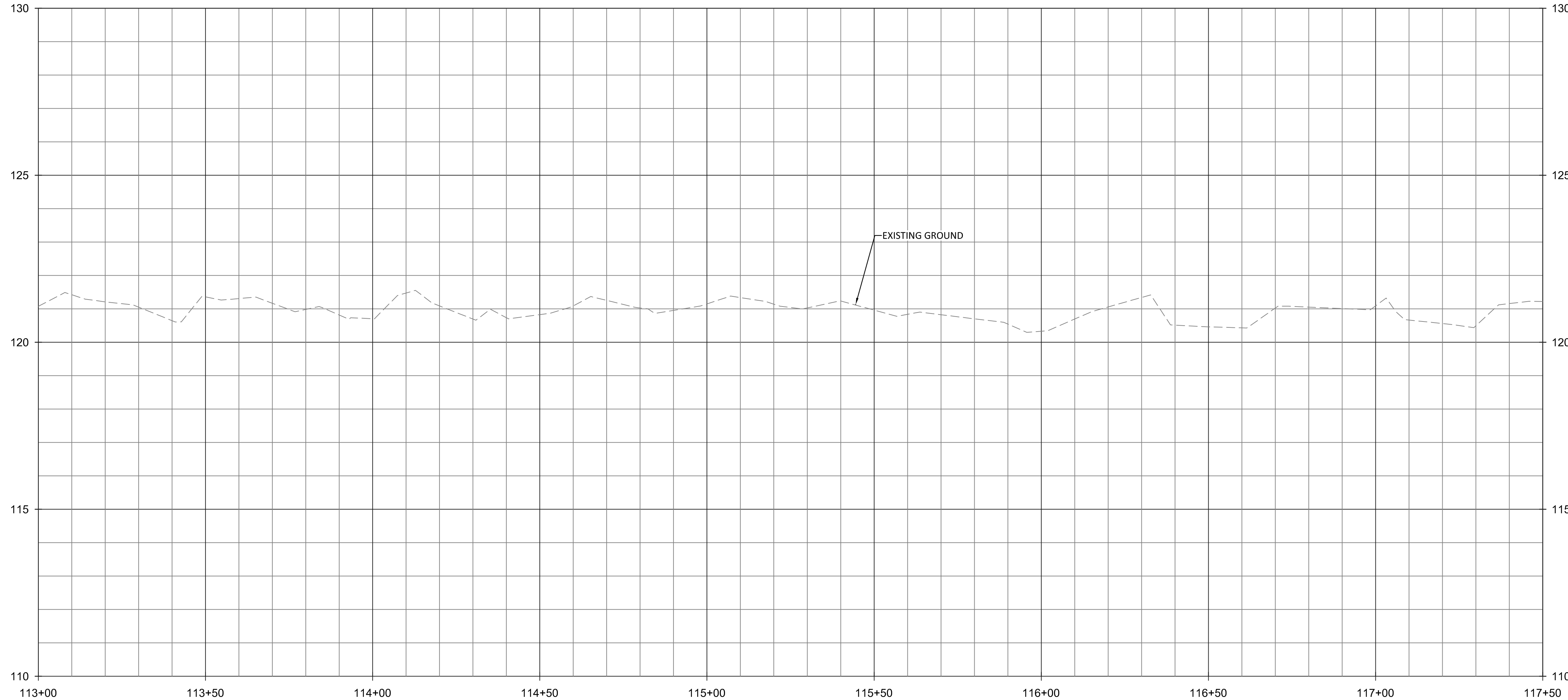

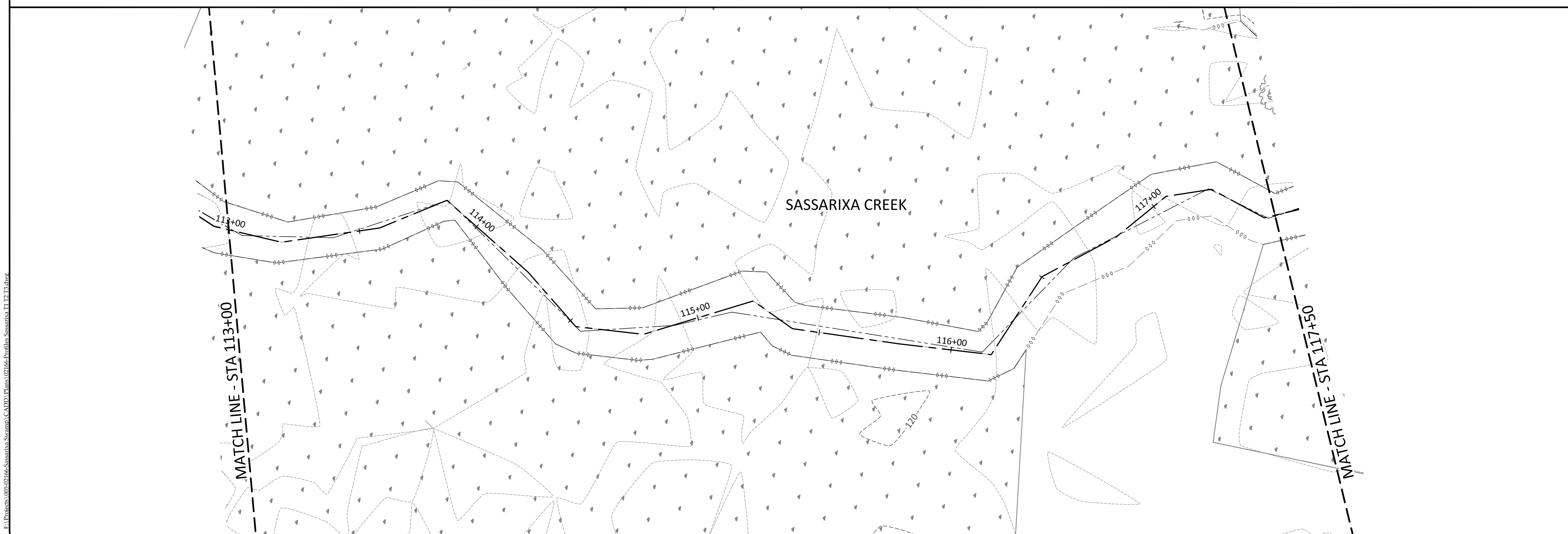

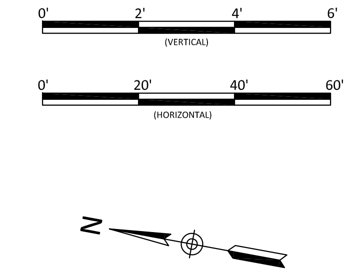

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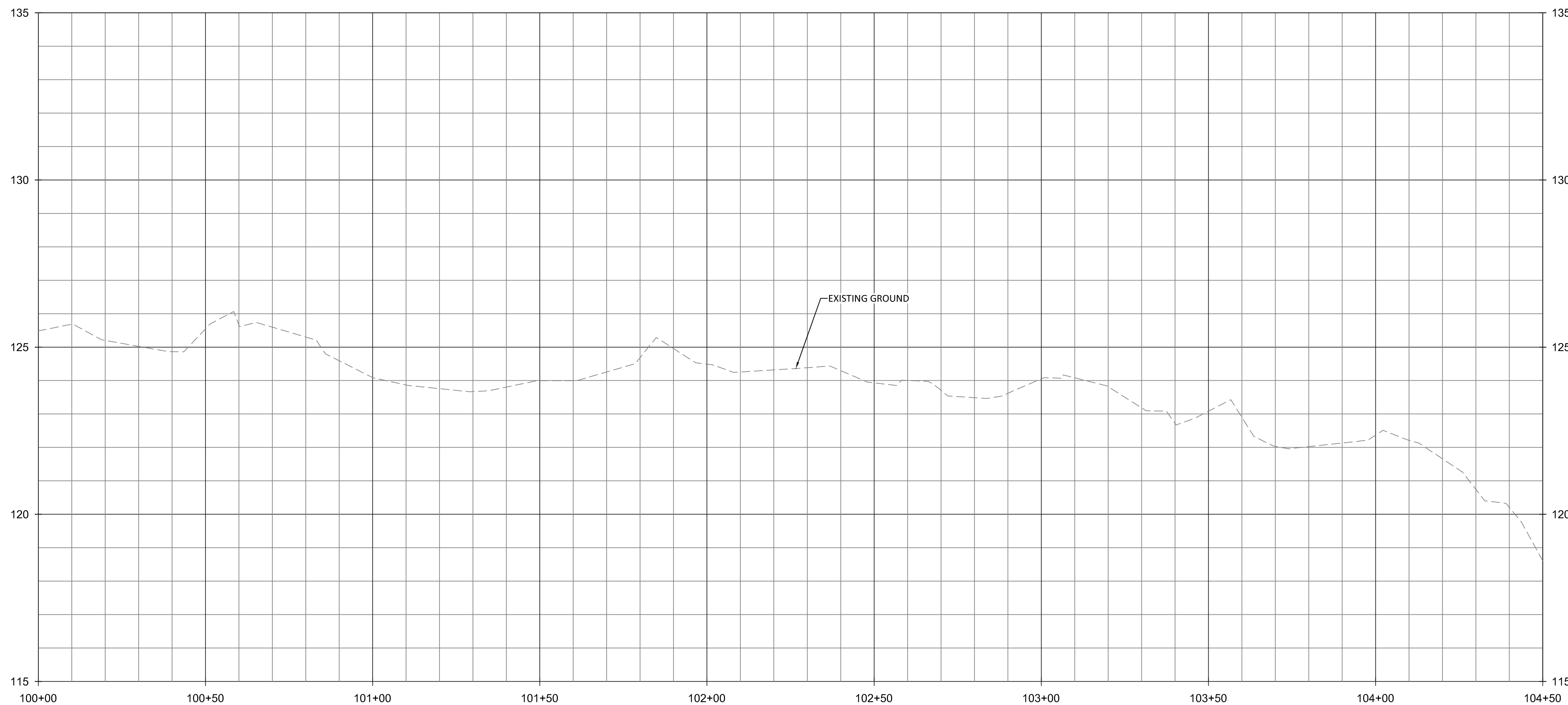

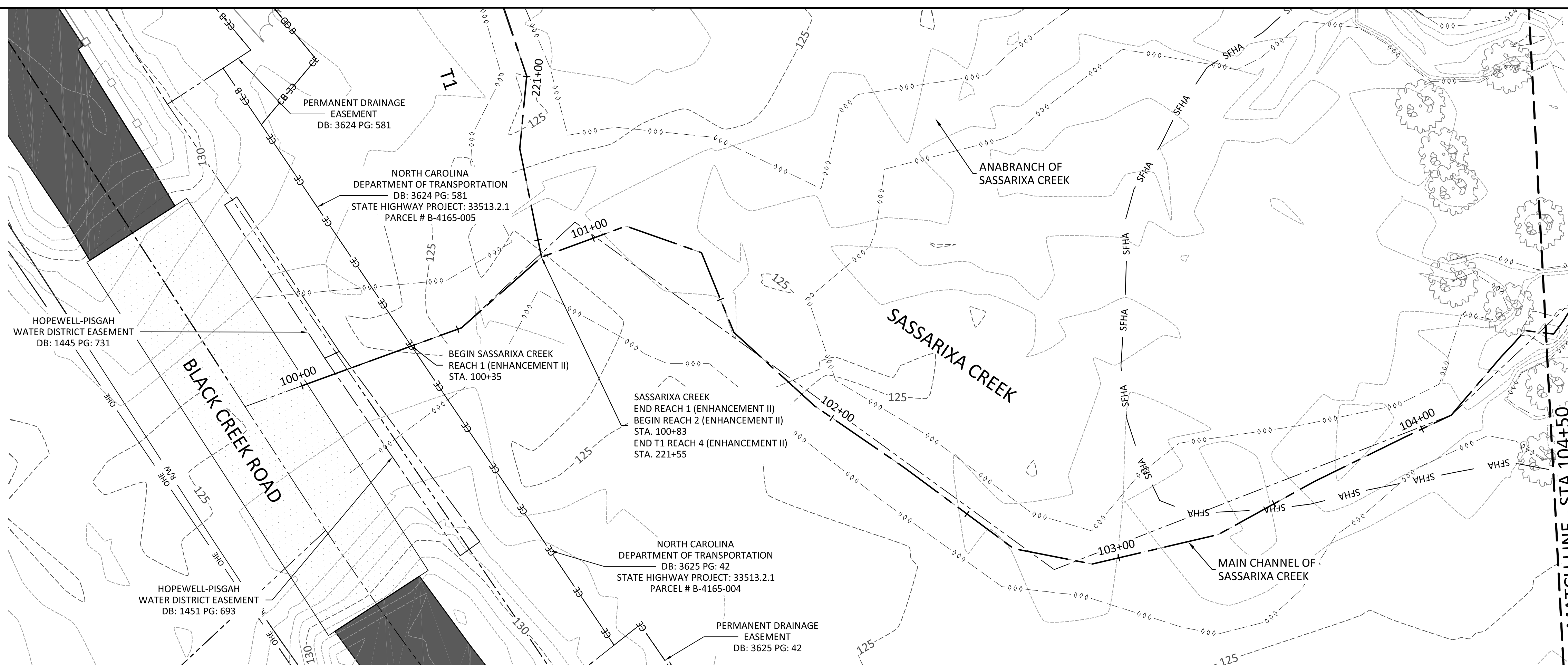

0' 2' 4' 6' (VERTICAL)

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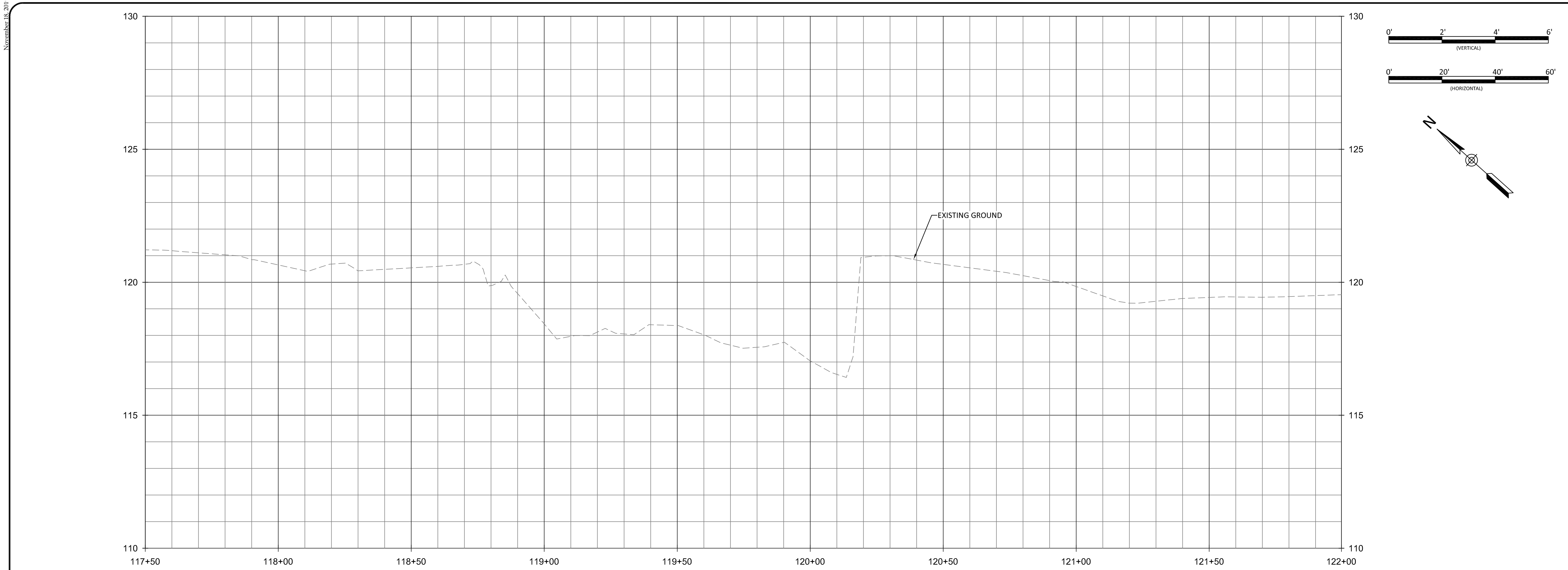

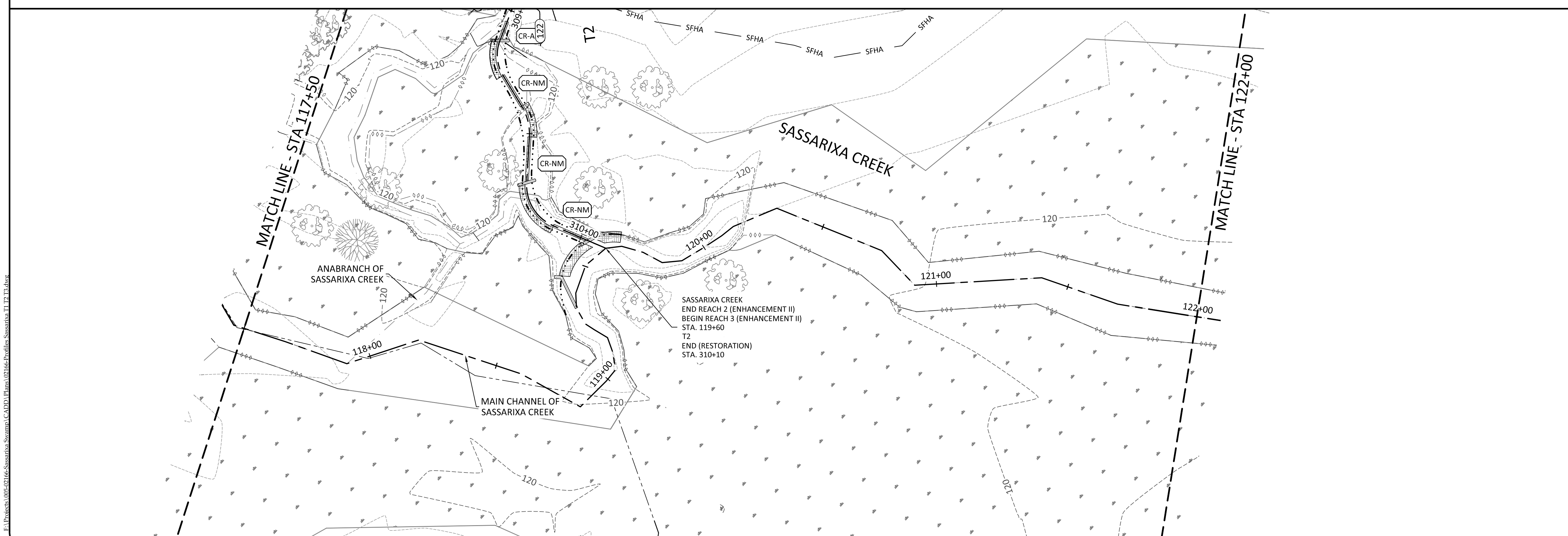

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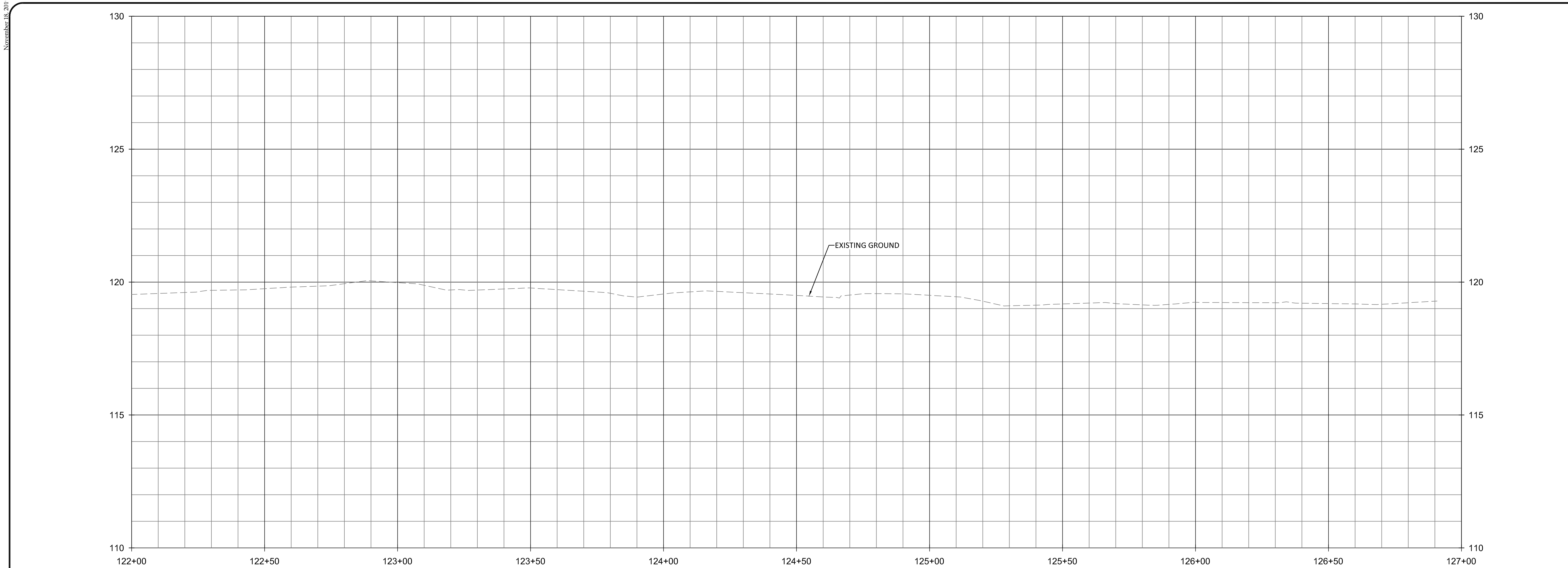

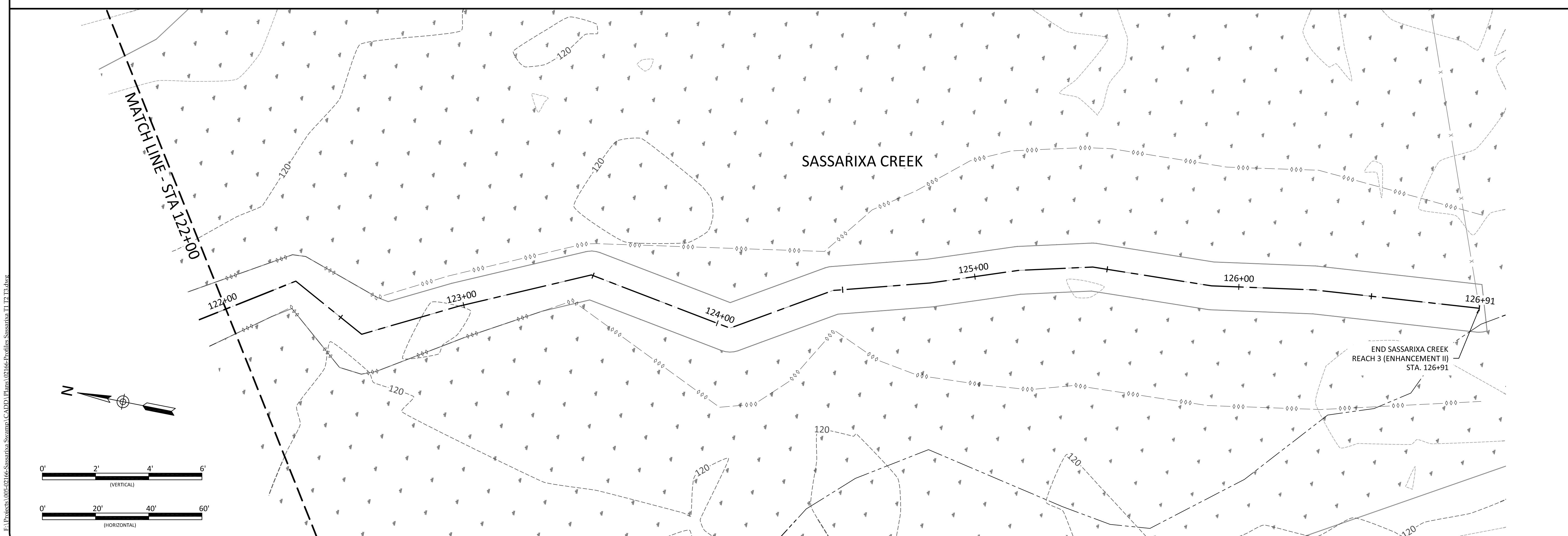

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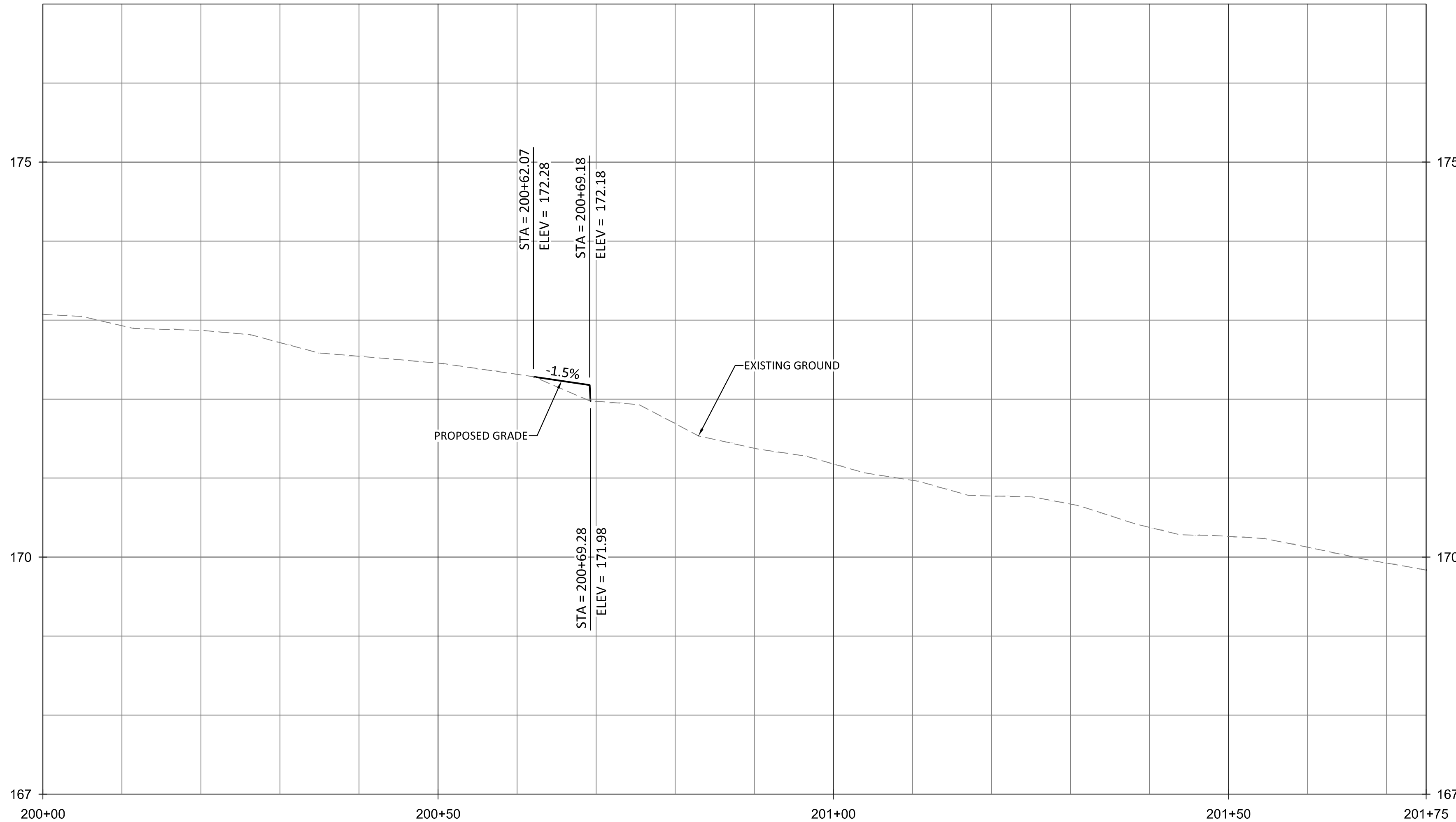

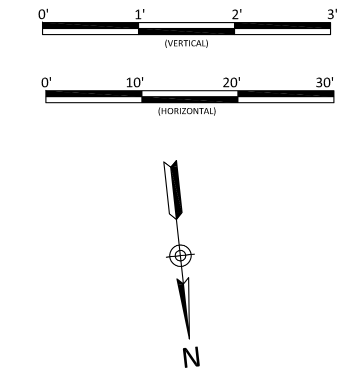

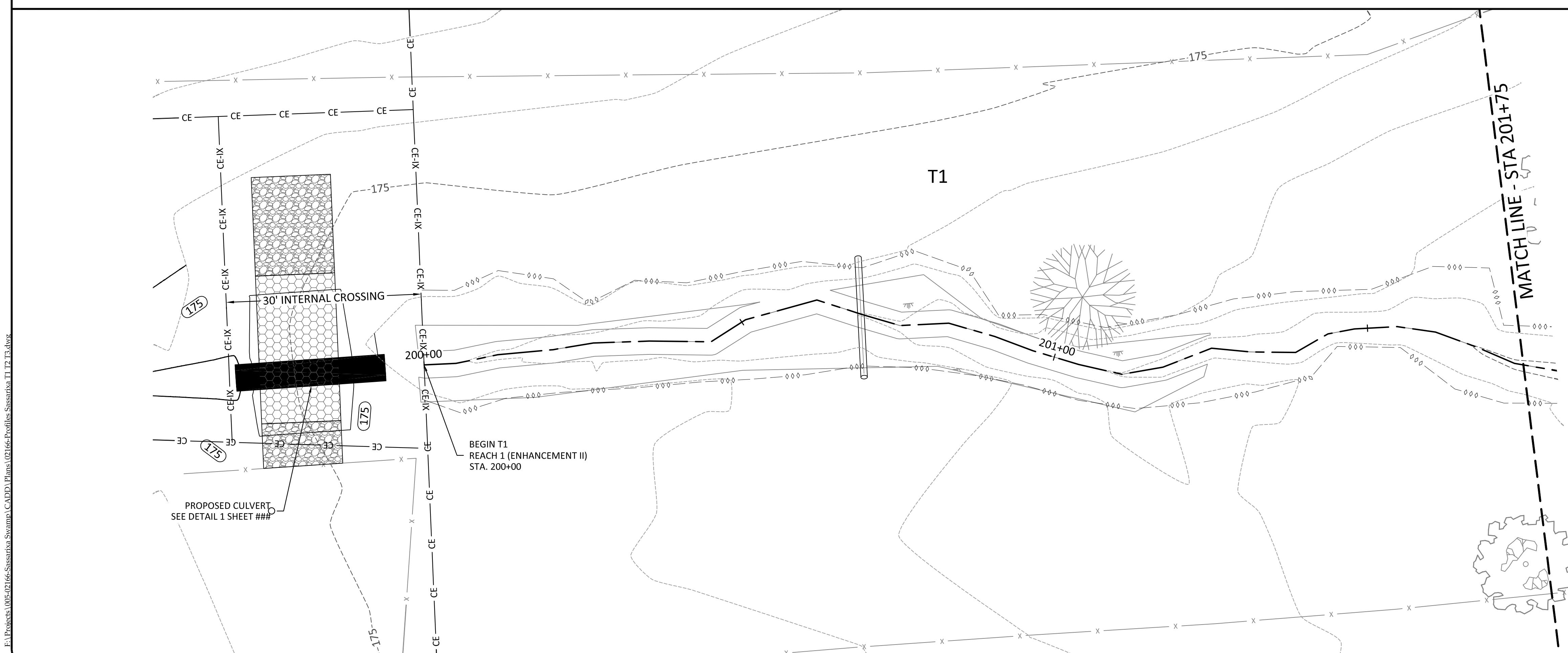

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T1
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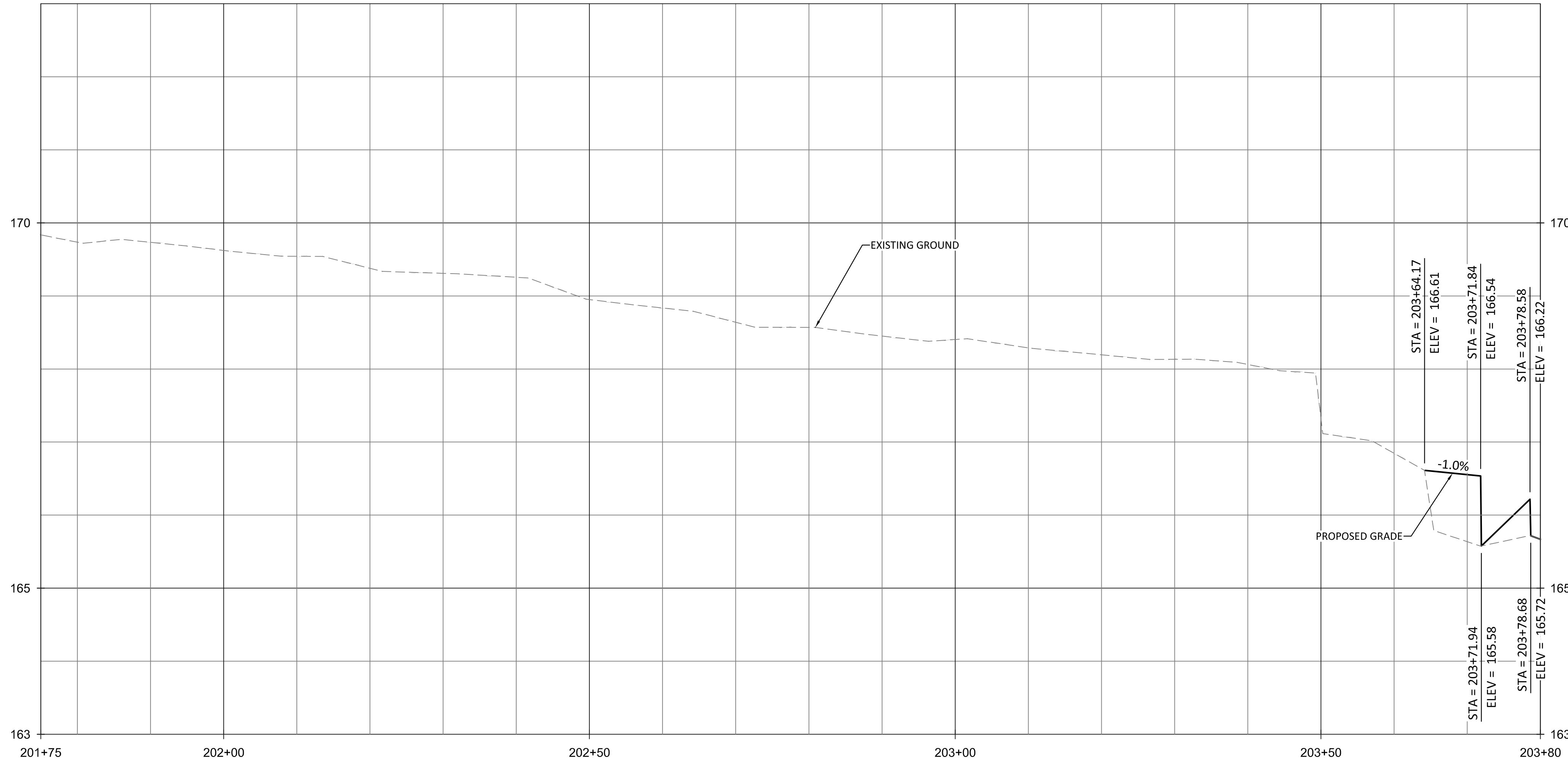

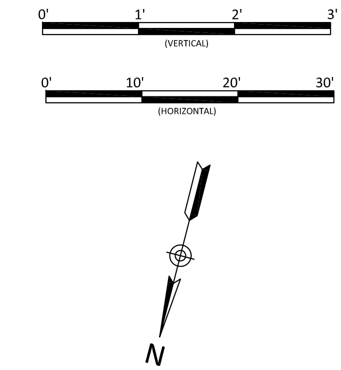

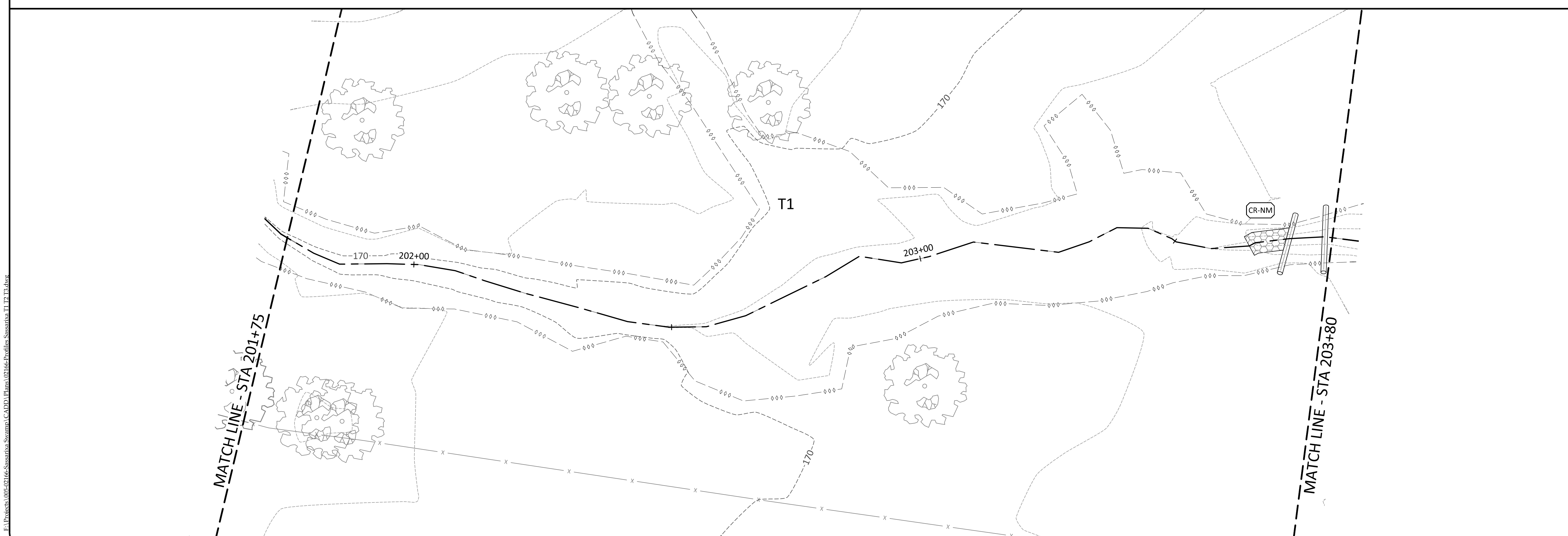

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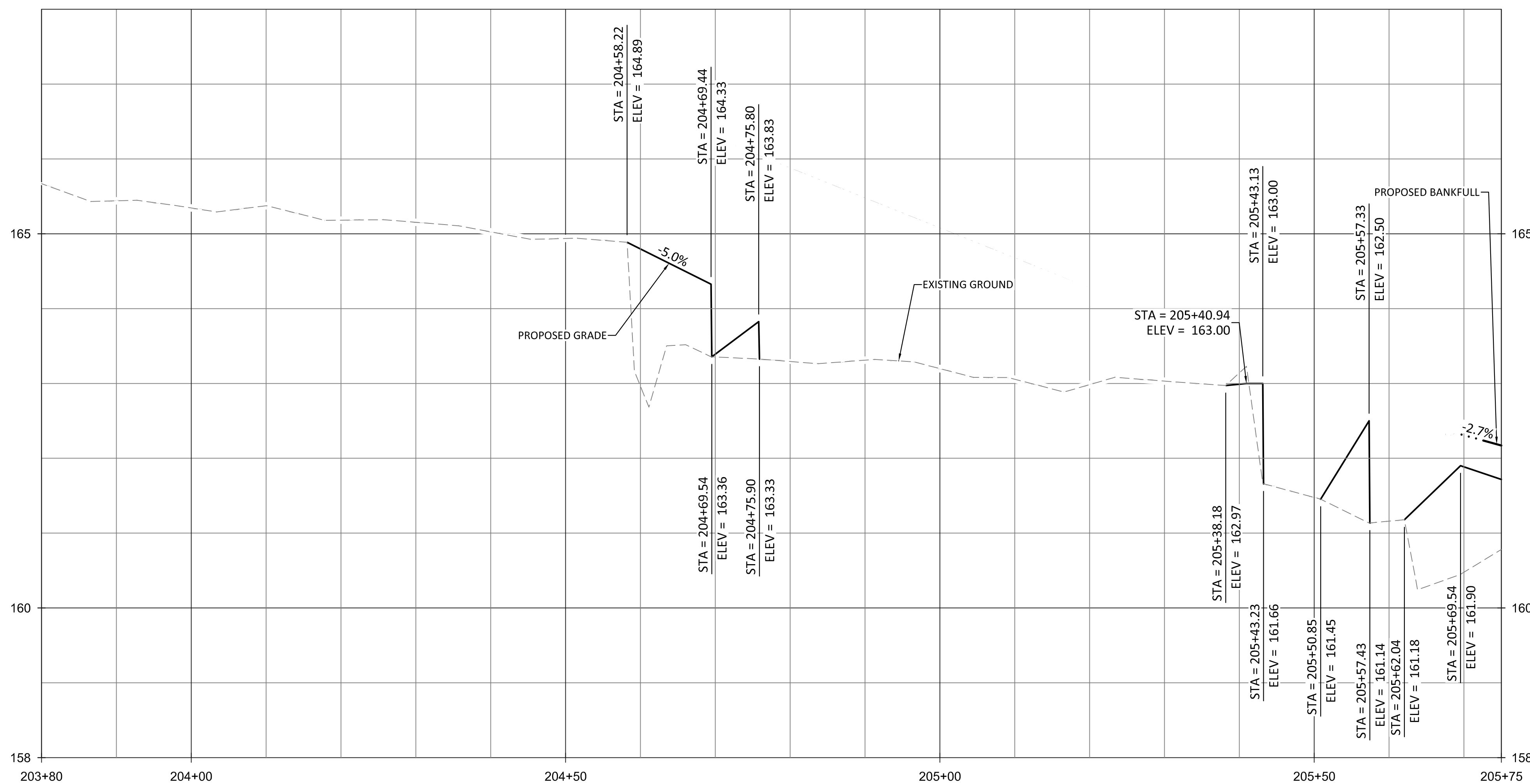

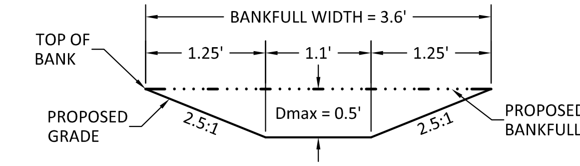

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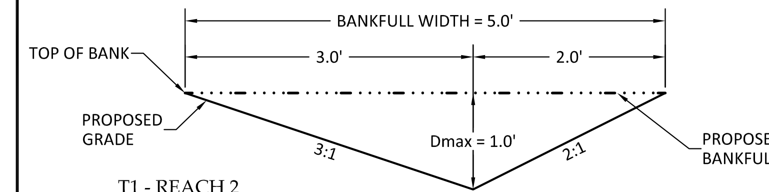

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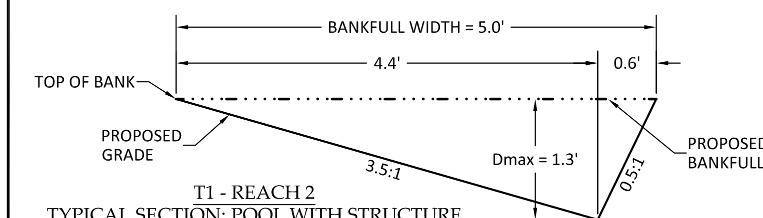

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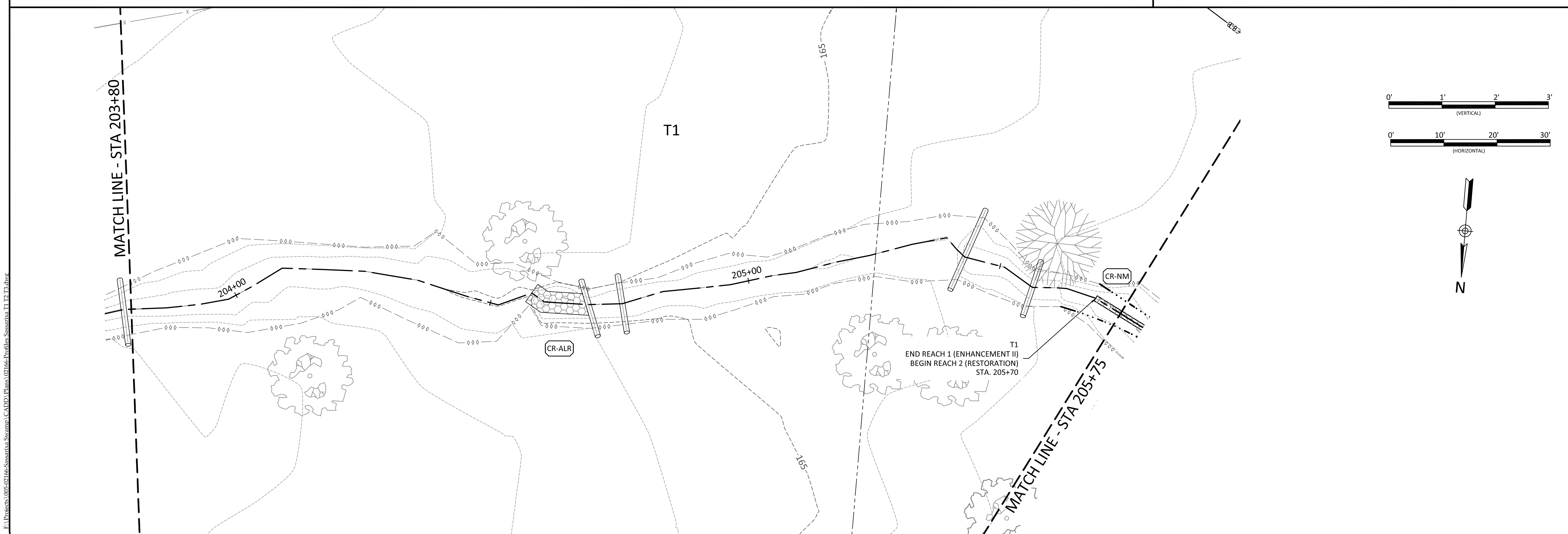

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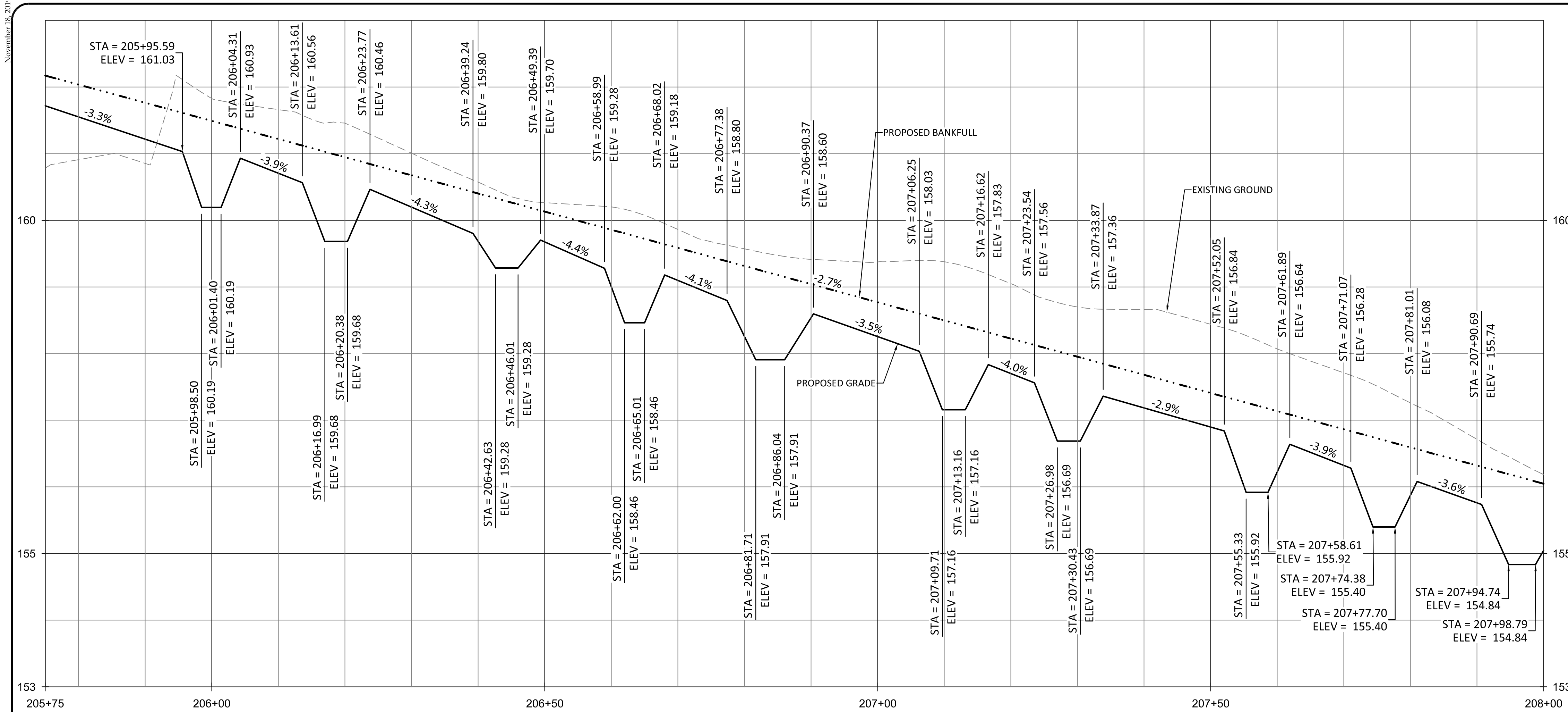

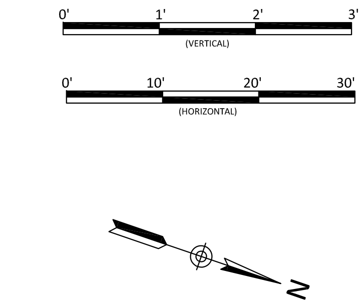

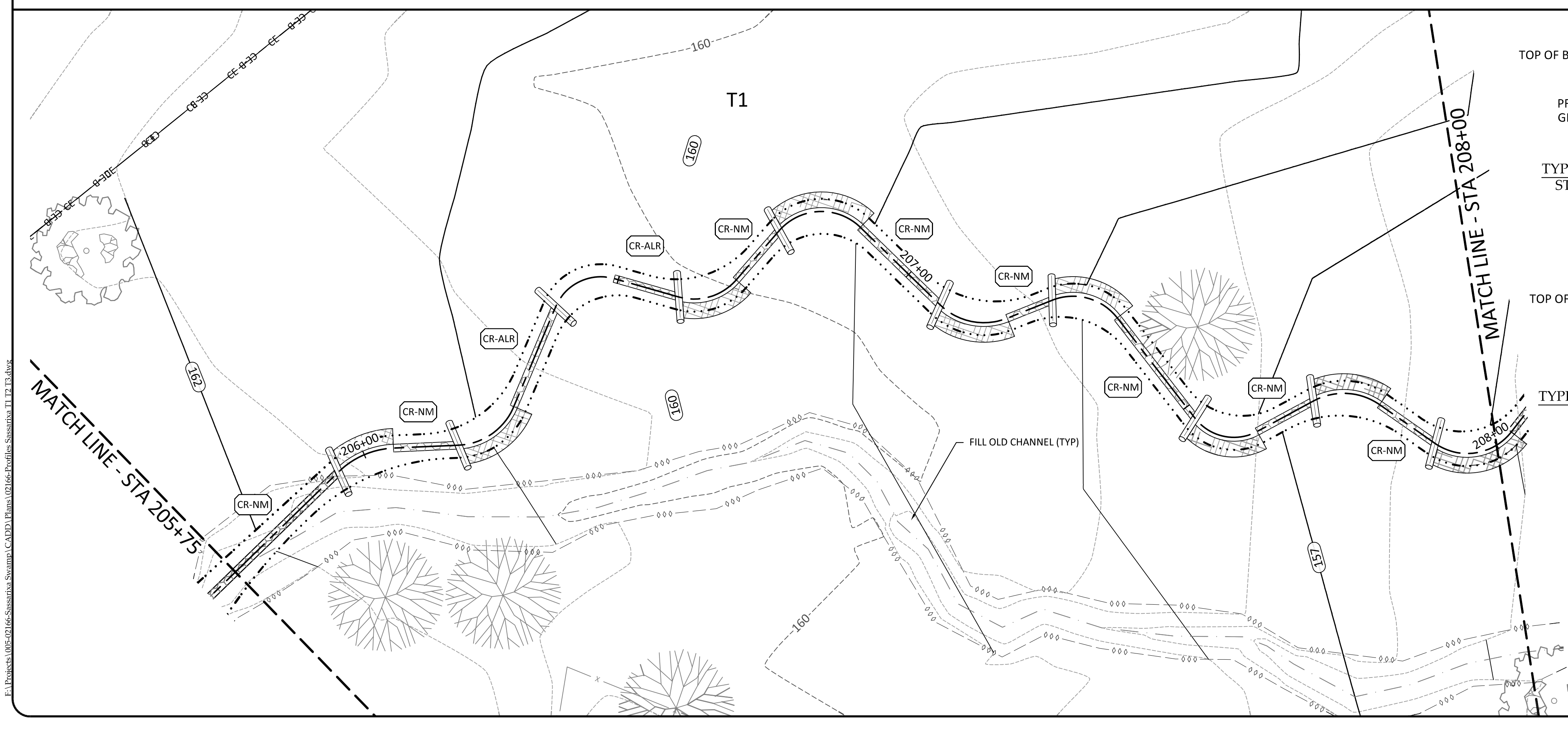

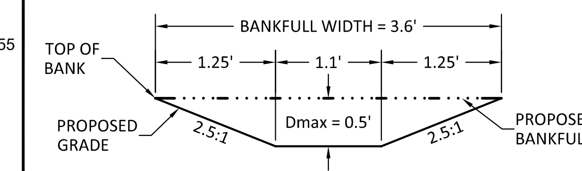

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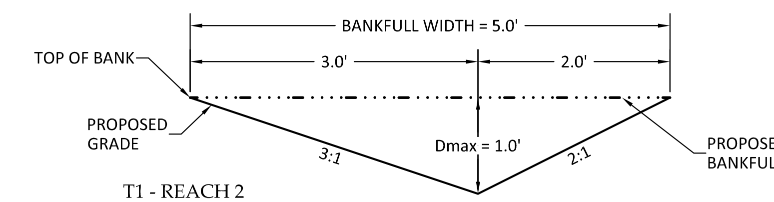

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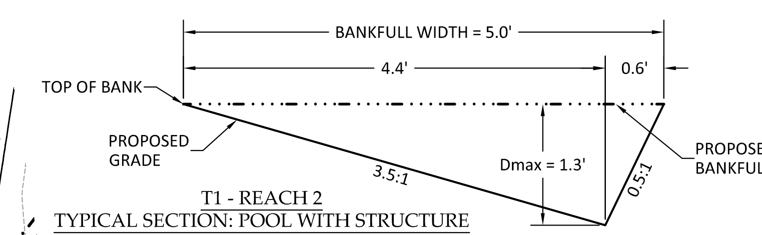

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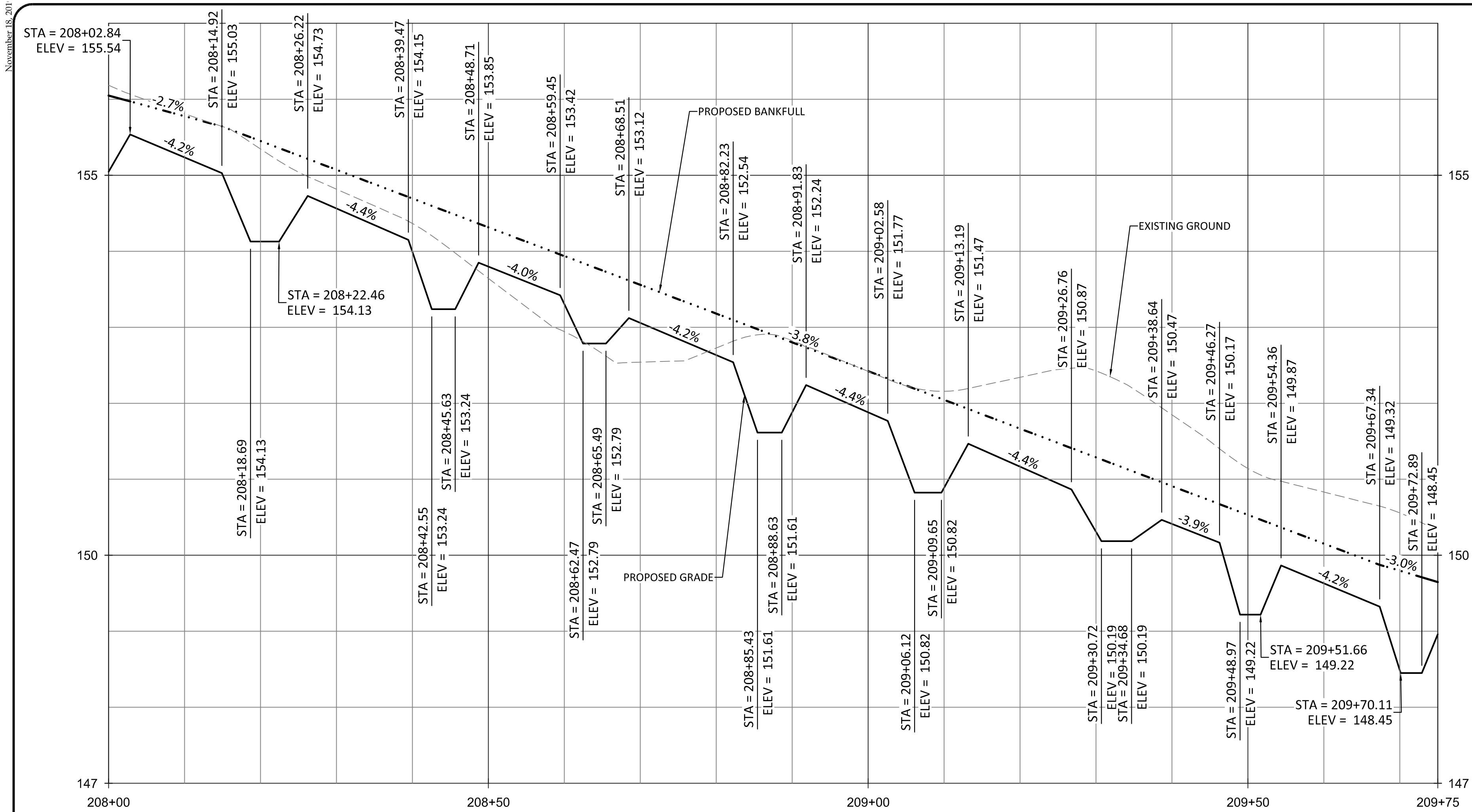

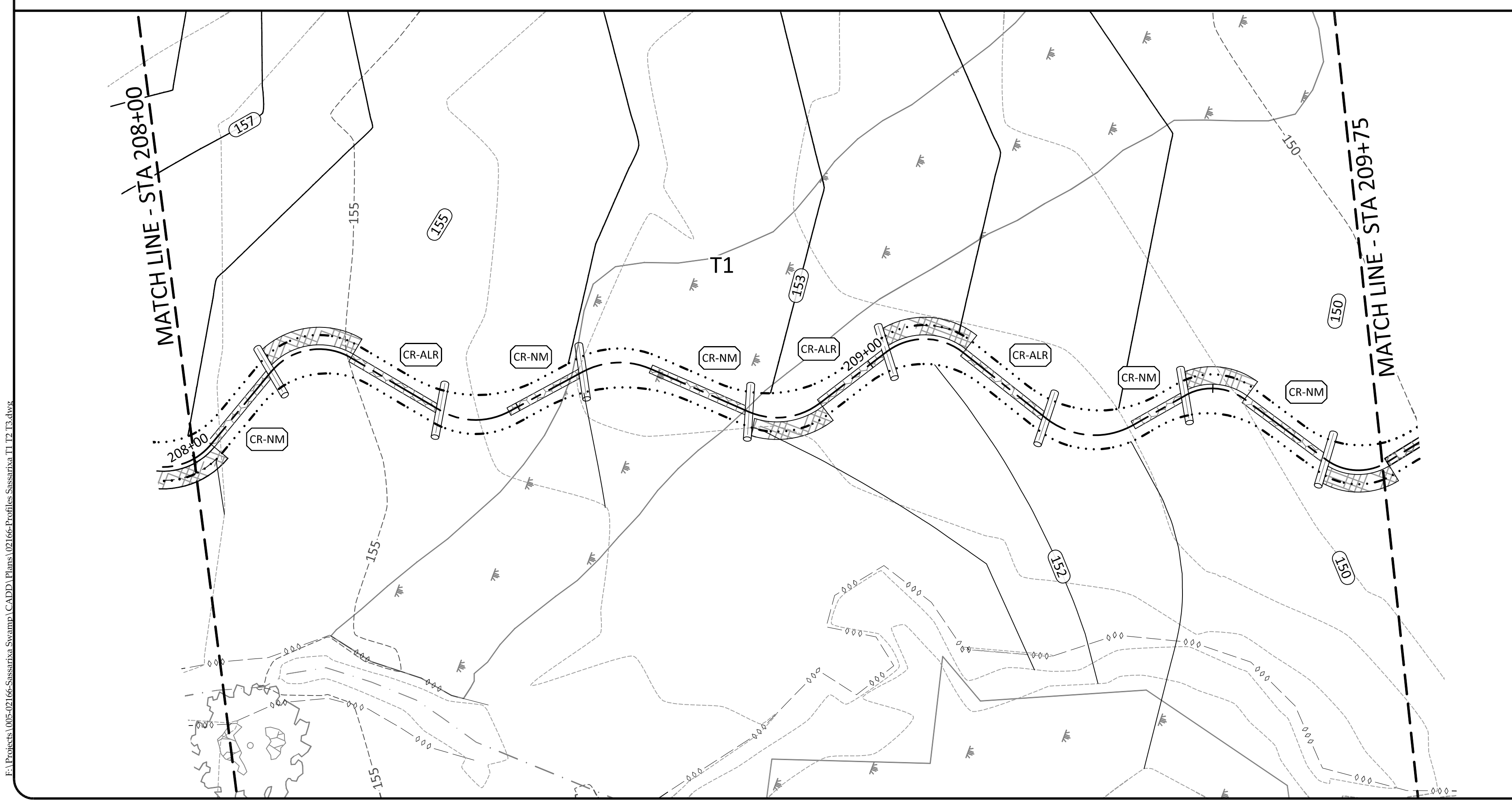

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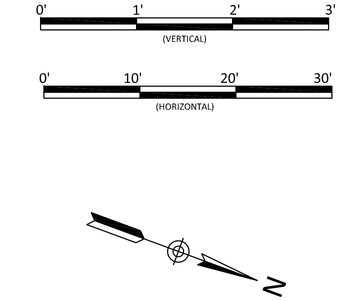

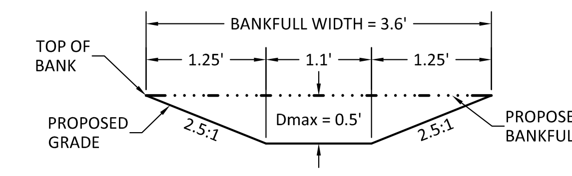

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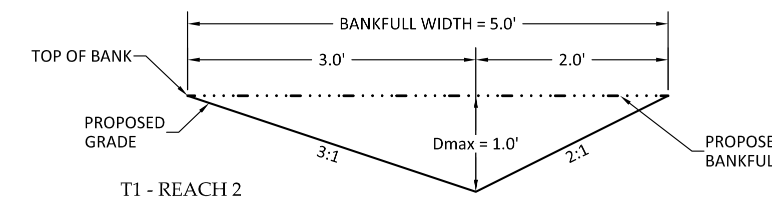

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STA: 205+70 TO 213+94
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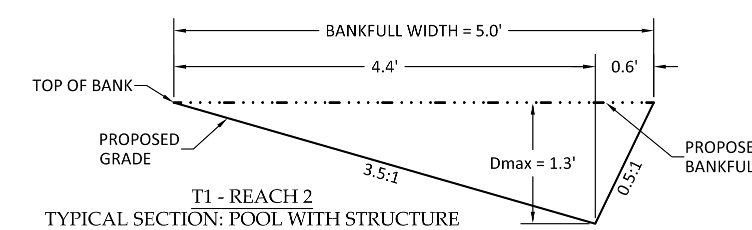

T1 - REACH 2
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 205+70 TO 213+94
SCALE: 1" = 1'

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Johnston County, North Carolina

T1
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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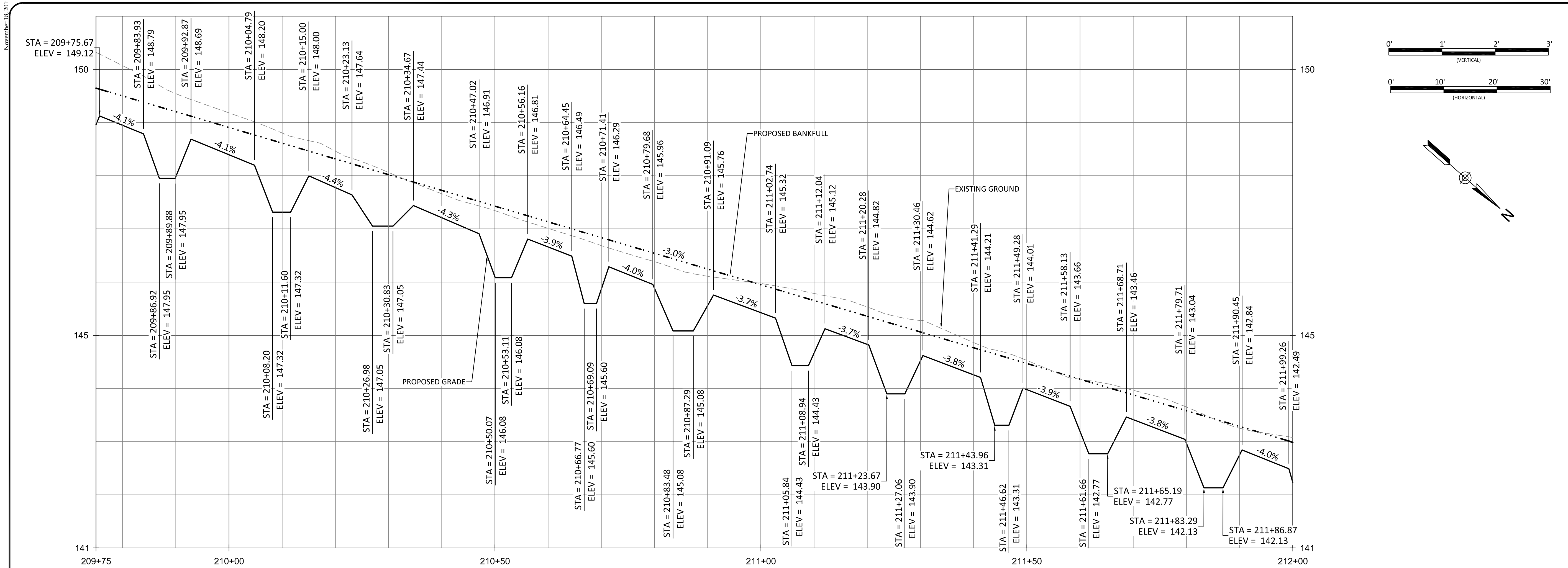
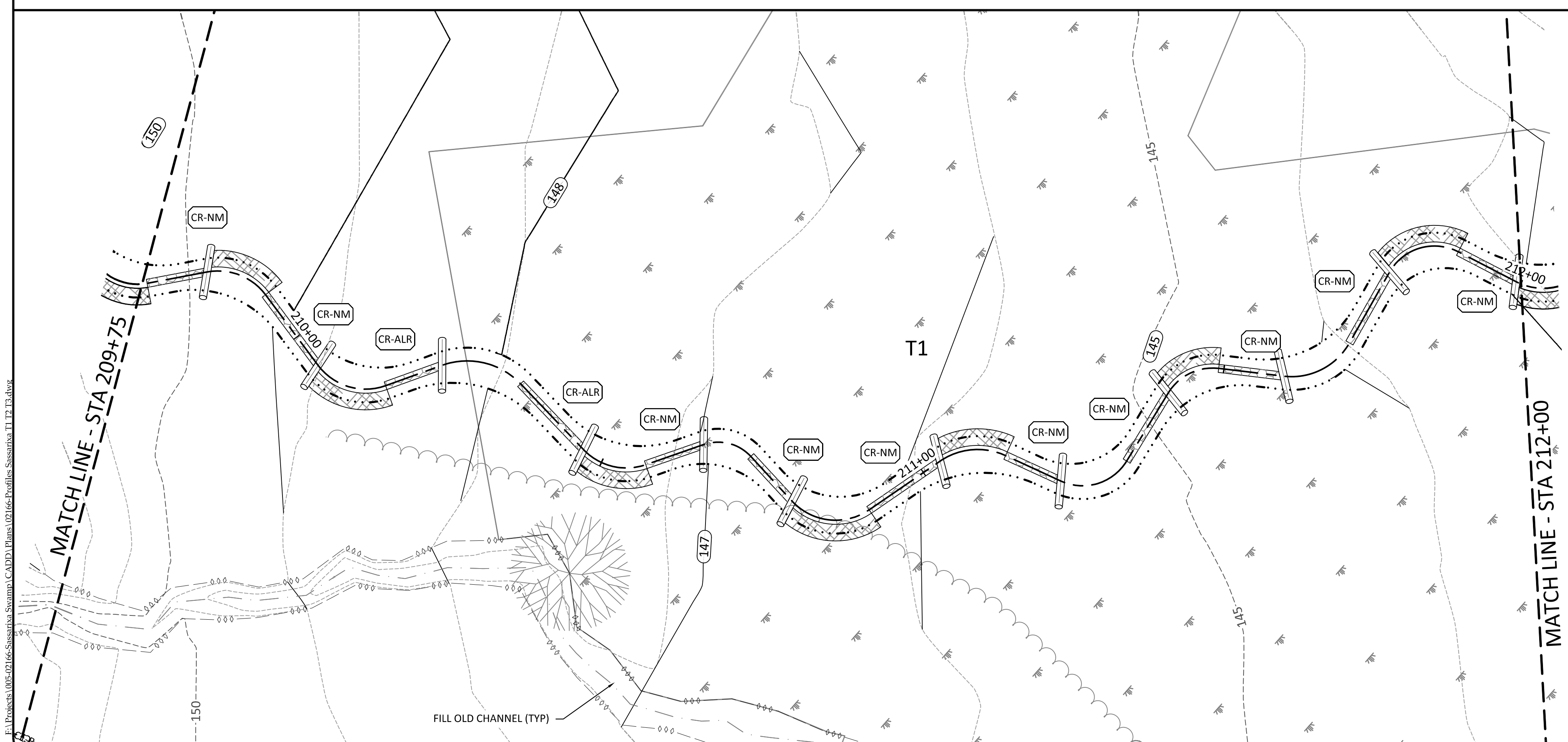
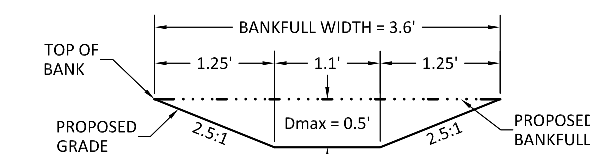
1.11



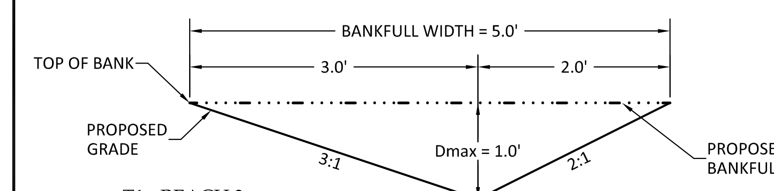
0' 1' 2' 3'
(VERTICAL)
0' 10' 20' 30'
(HORIZONTAL)

N

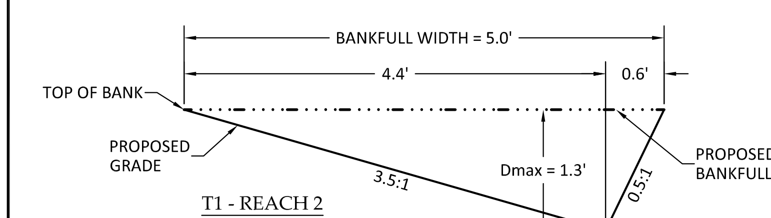




T1 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 205+70 TO 213+94
SCALE: 1" = 1'



T1 - REACH 2
TYPICAL SECTION: POOL
STA: 205+70 TO 213+94
SCALE: 1" = 1'



T1 - REACH 2
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 205+70 TO 213+94
SCALE: 1" = 1'

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Johnston County, North Carolina

T1
Stream Plan and Profile

Revisions:

Date:	11.15.2019
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Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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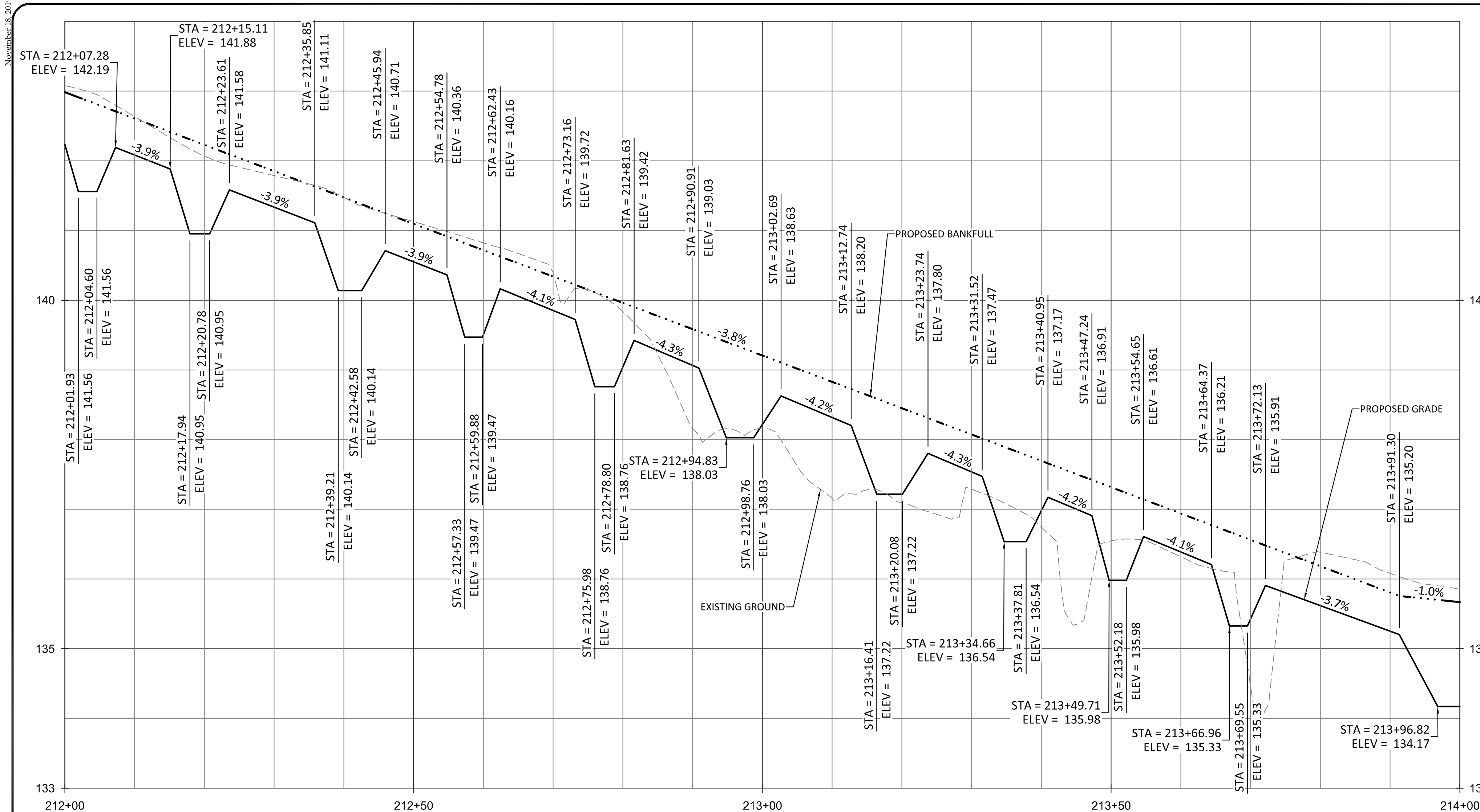
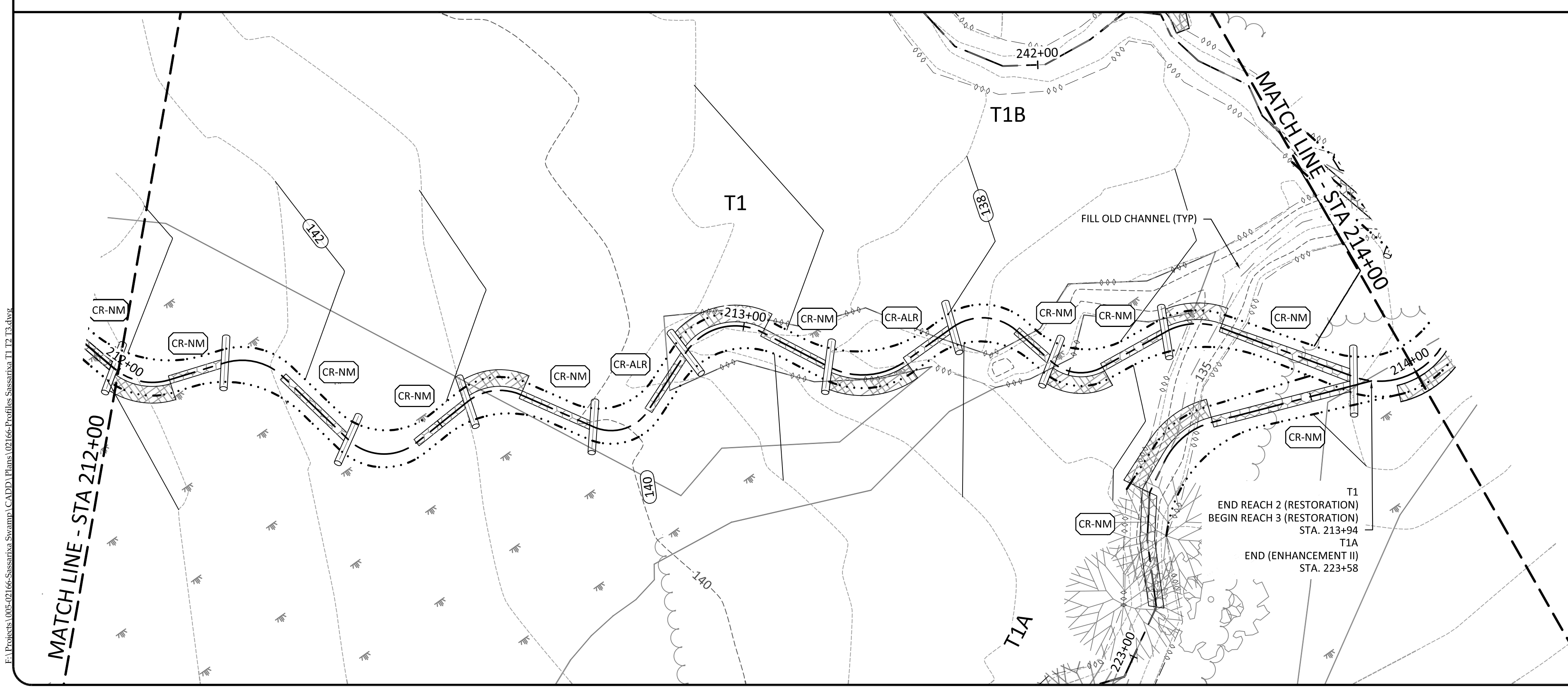
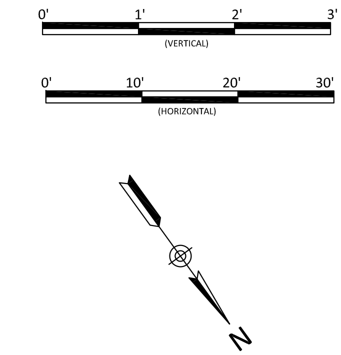
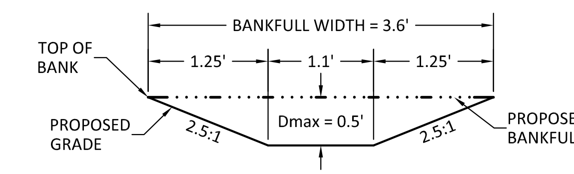
Sheet









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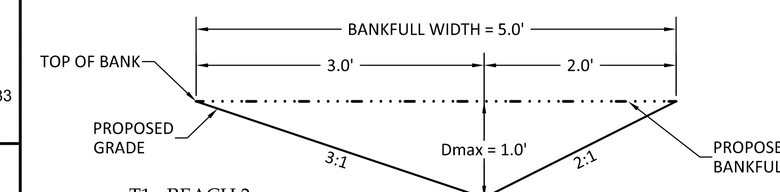
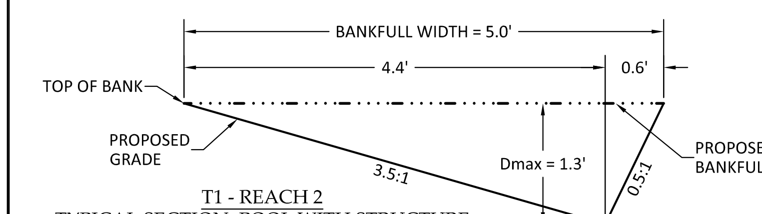
TYPICAL SECTION: RIFFLE
STA: 205+70 TO 213+94
SCALE: 1" = 1'



T1 - REACH 2
TYPICAL SECTION: POOL
STA: 205+70 TO 213+94
SCALE: 1" = 1'



T1 - REACH 2
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 205+70 TO 213+94
SCALE: 1" = 1'

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Sassarixa Swamp
Johnston County, North Carolina

T1
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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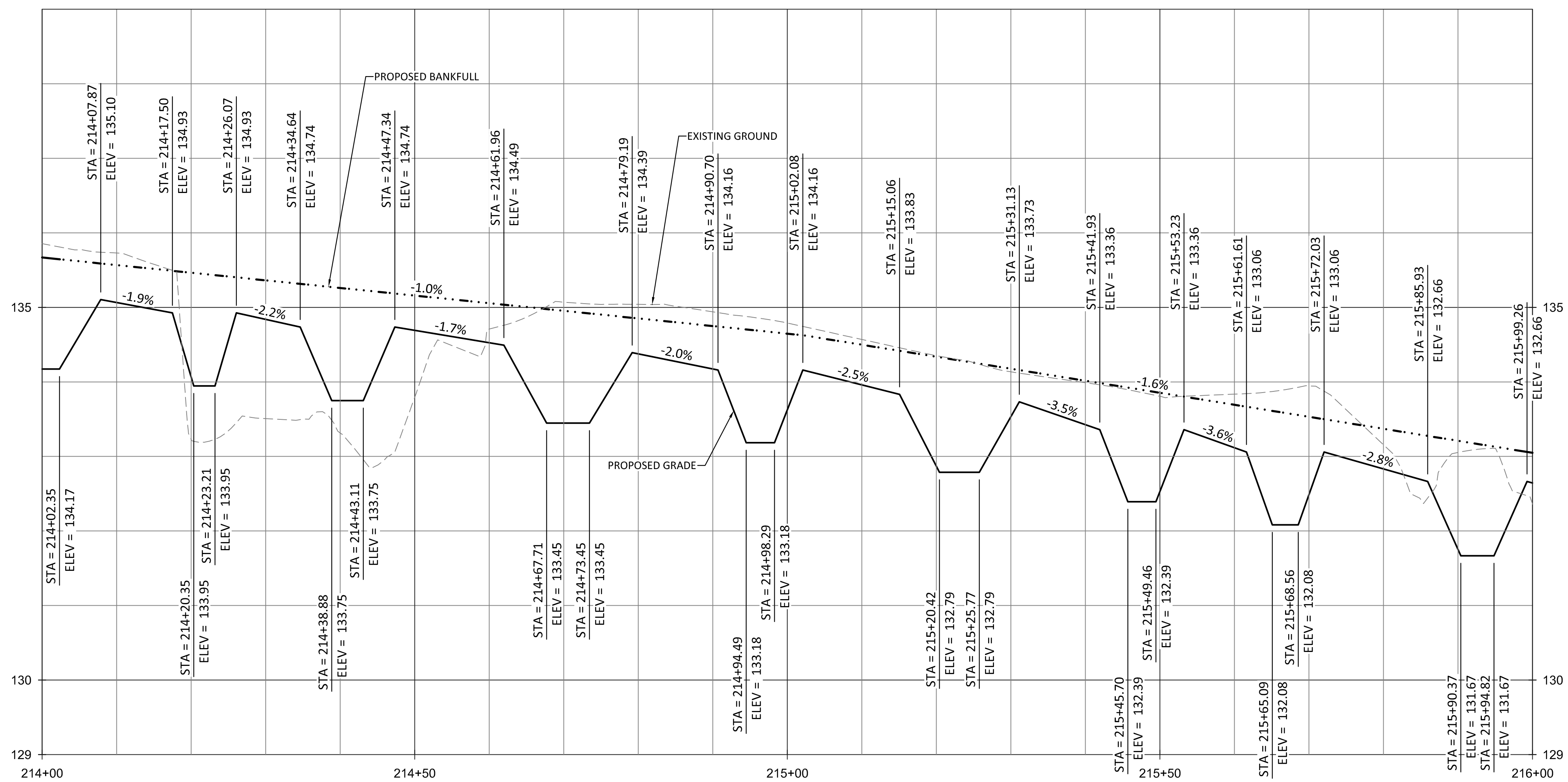
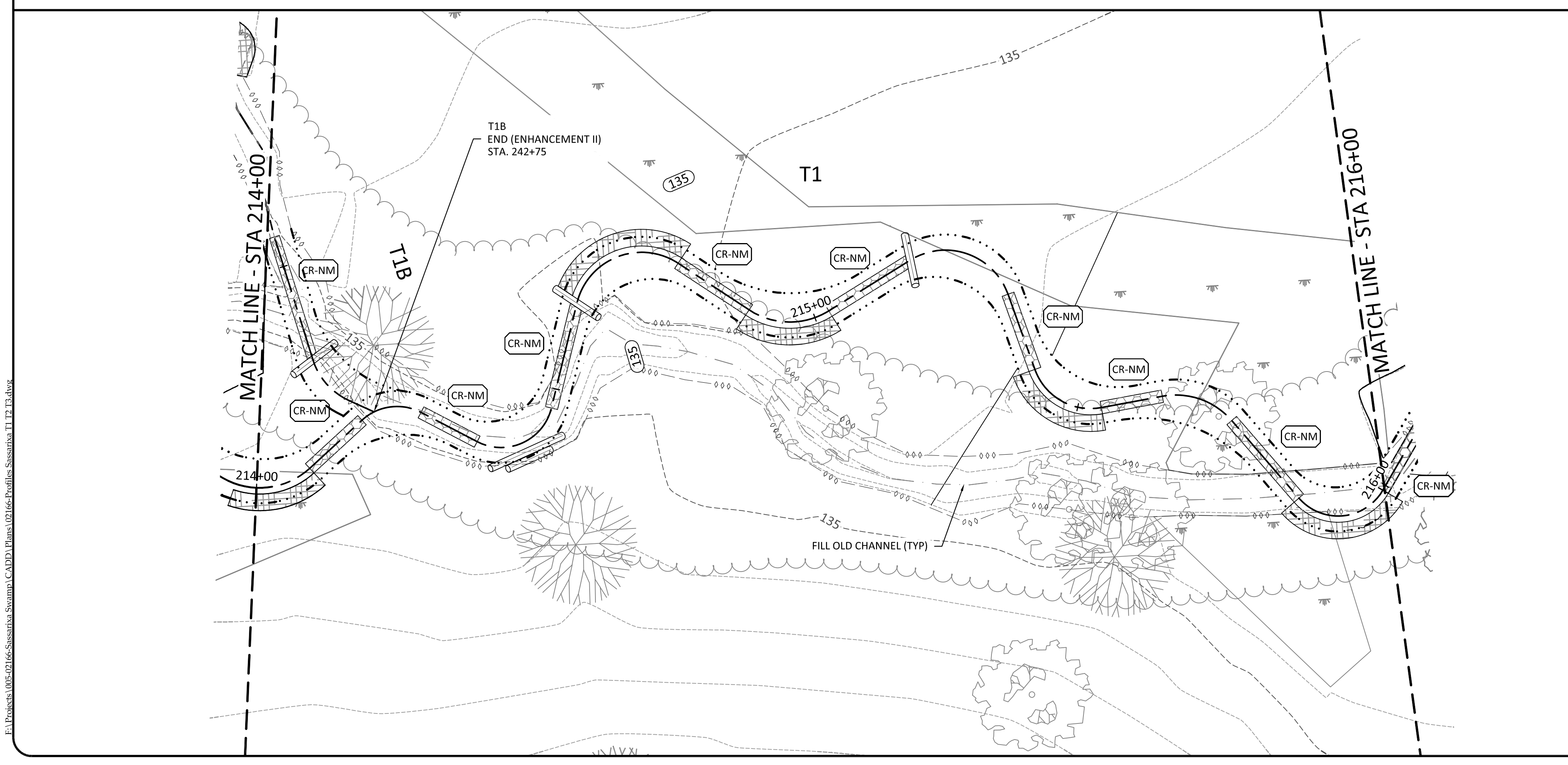
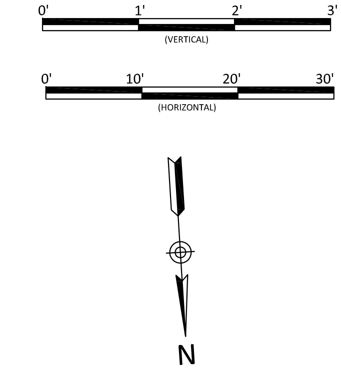
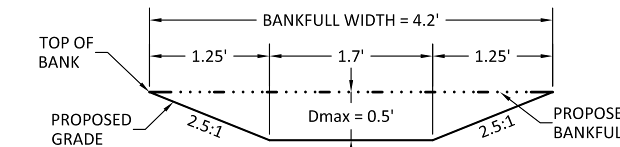
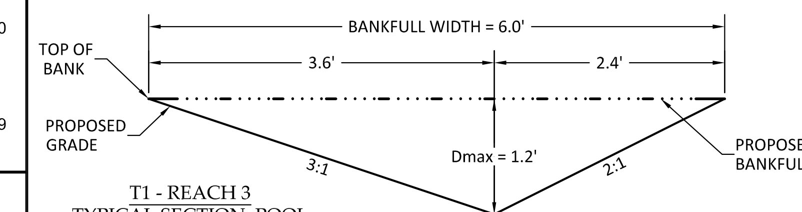




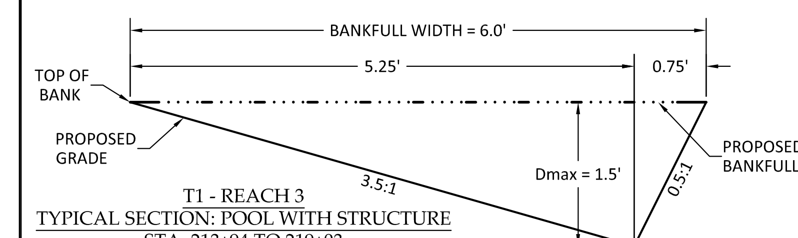




T1 - REACH 3
TYPICAL SECTION: RIFFLE
STA: 213+94 TO 219+03
SCALE: 1" = 1'



T1 - REACH 3
TYPICAL SECTION: POOL
STA: 213+94 TO 219+03
SCALE: 1" = 1'



T1 - REACH 3
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 213+94 TO 219+03
SCALE: 1" = 1'

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Johnston County, North Carolina

T1
Stream Plan and Profile

Revisions:

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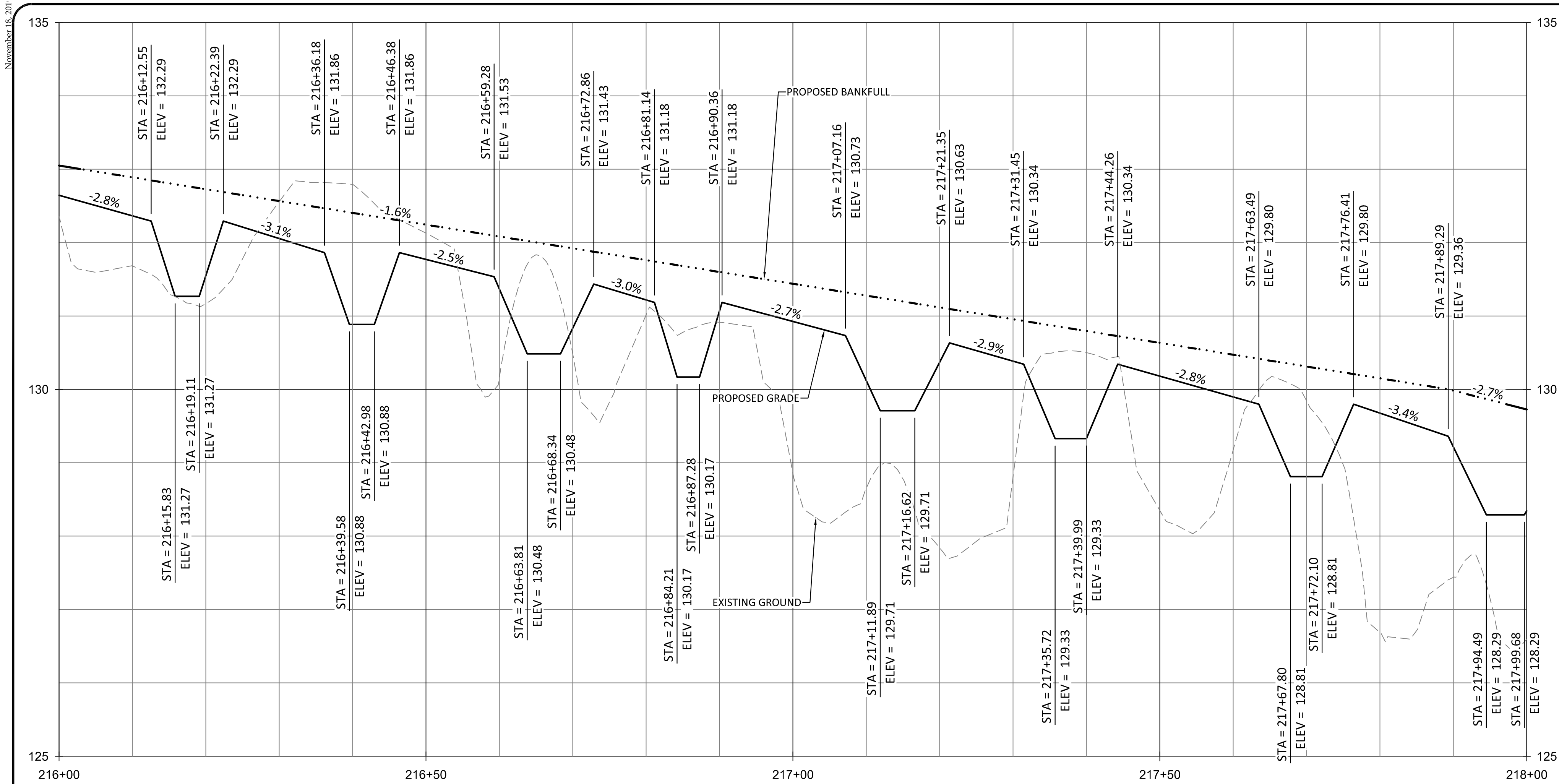

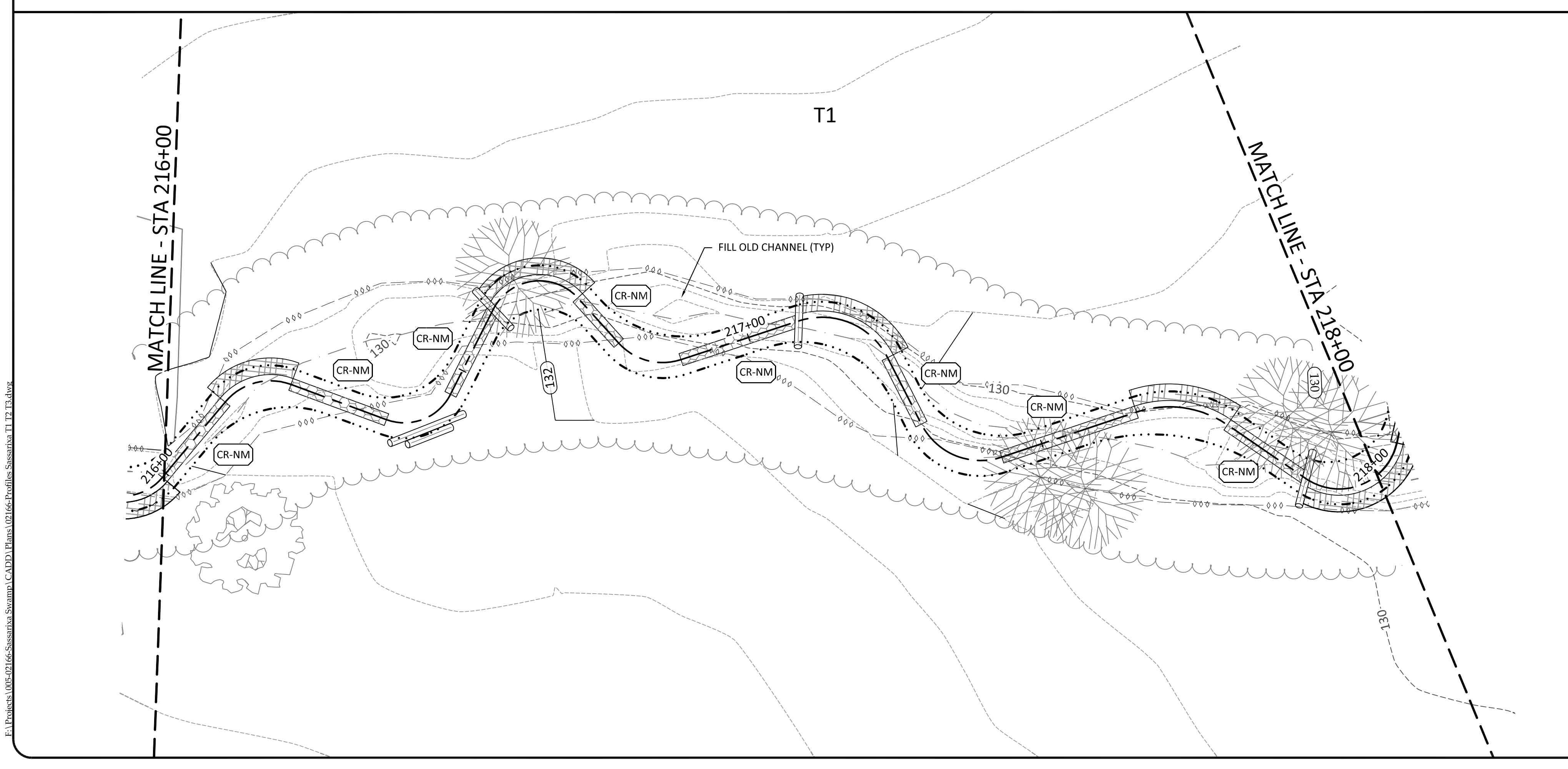

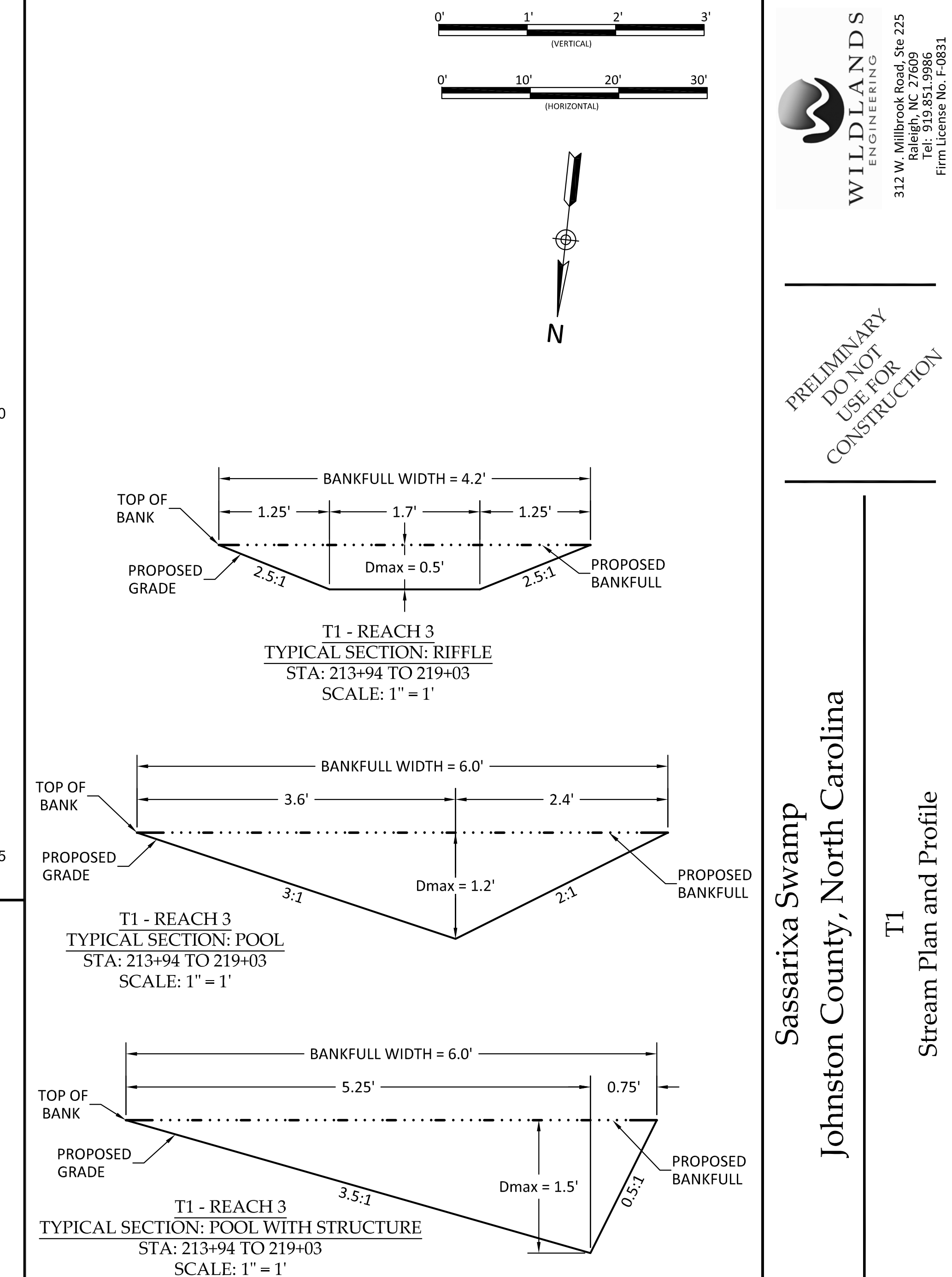

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T1
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
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Sheet

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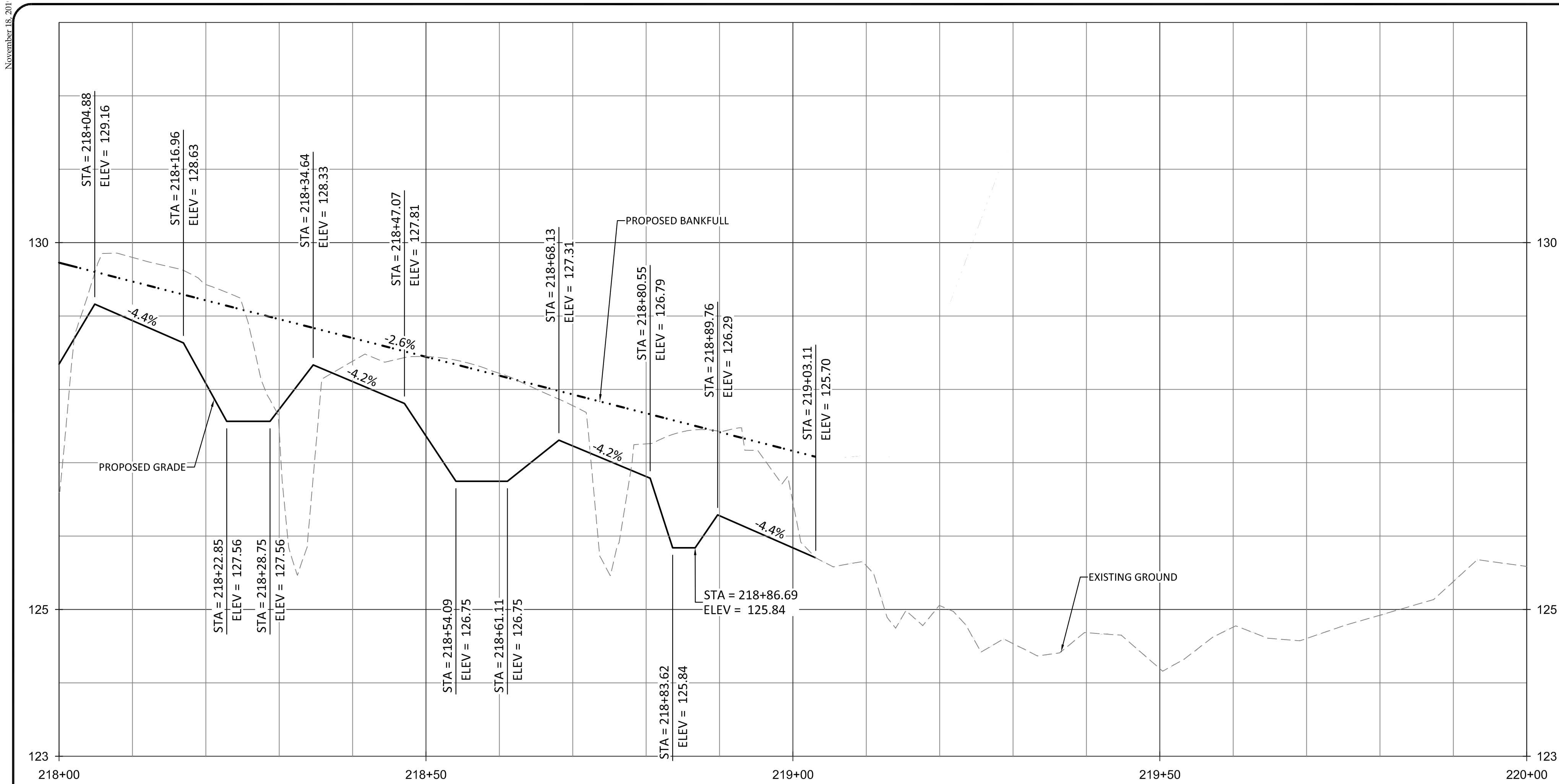
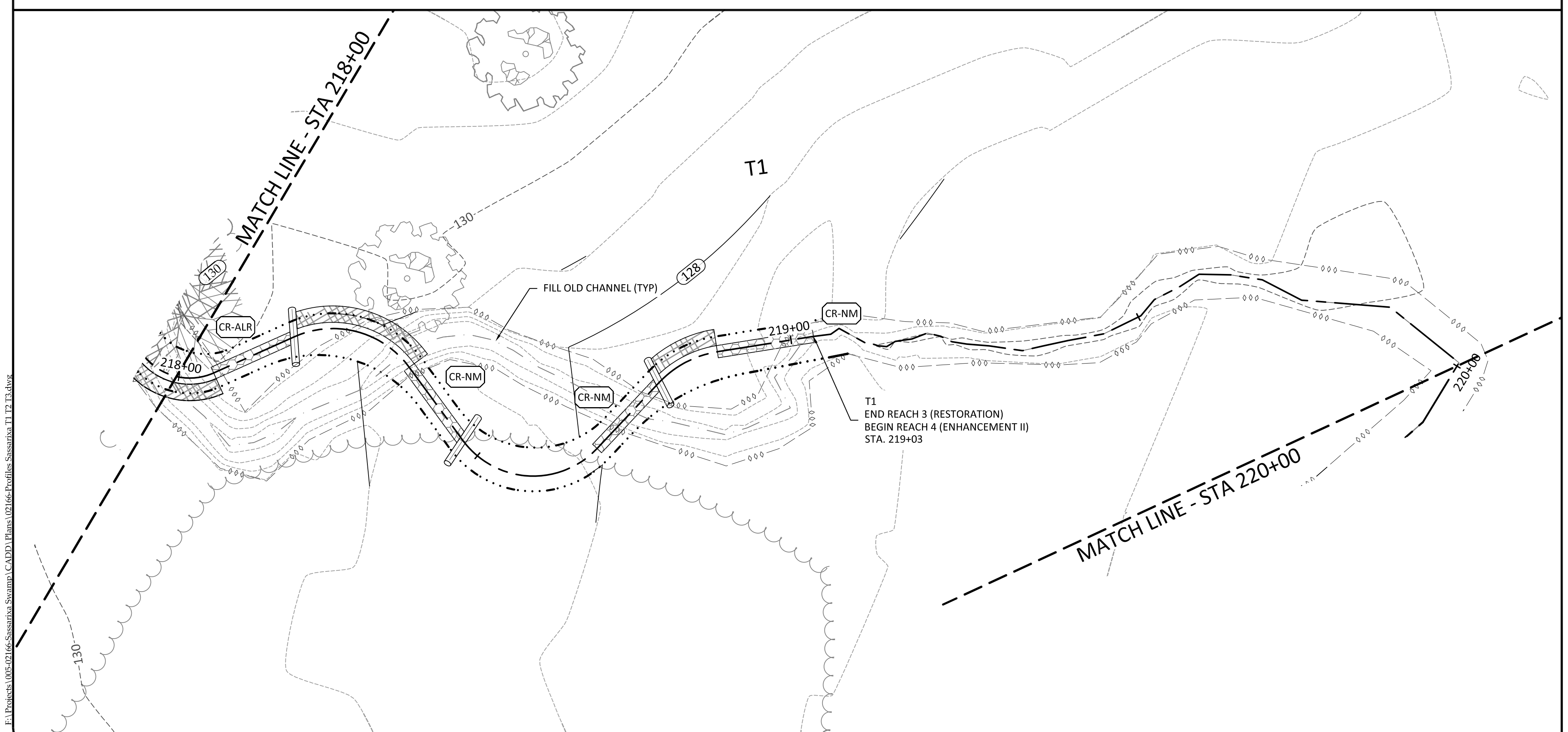
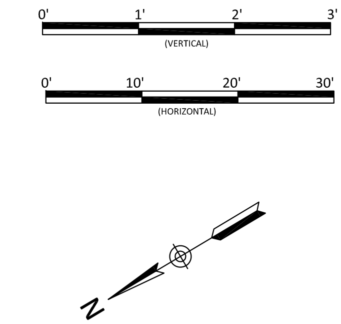
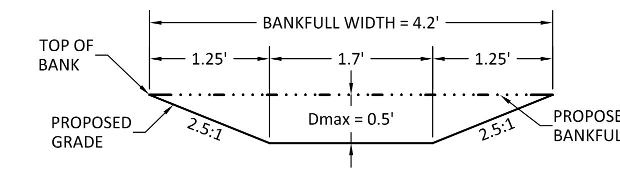
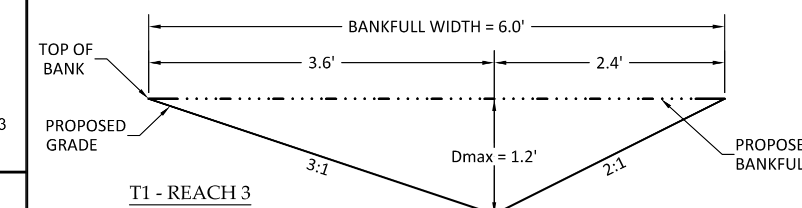




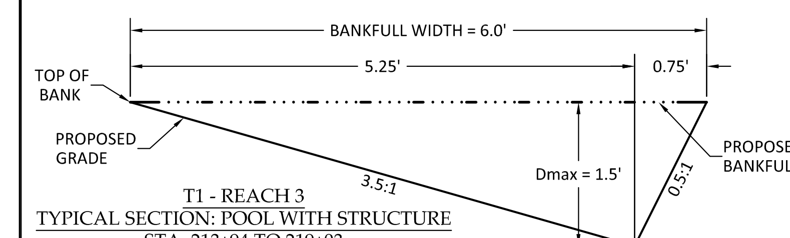




T1 - REACH 3
TYPICAL SECTION: RIFFLE
STA: 213+94 TO 219+03
SCALE: 1" = 1'



T1 - REACH 3
TYPICAL SECTION: POOL
STA: 213+94 TO 219+03
SCALE: 1" = 1'



T1 - REACH 3
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 213+94 TO 219+03
SCALE: 1" = 1'

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T1
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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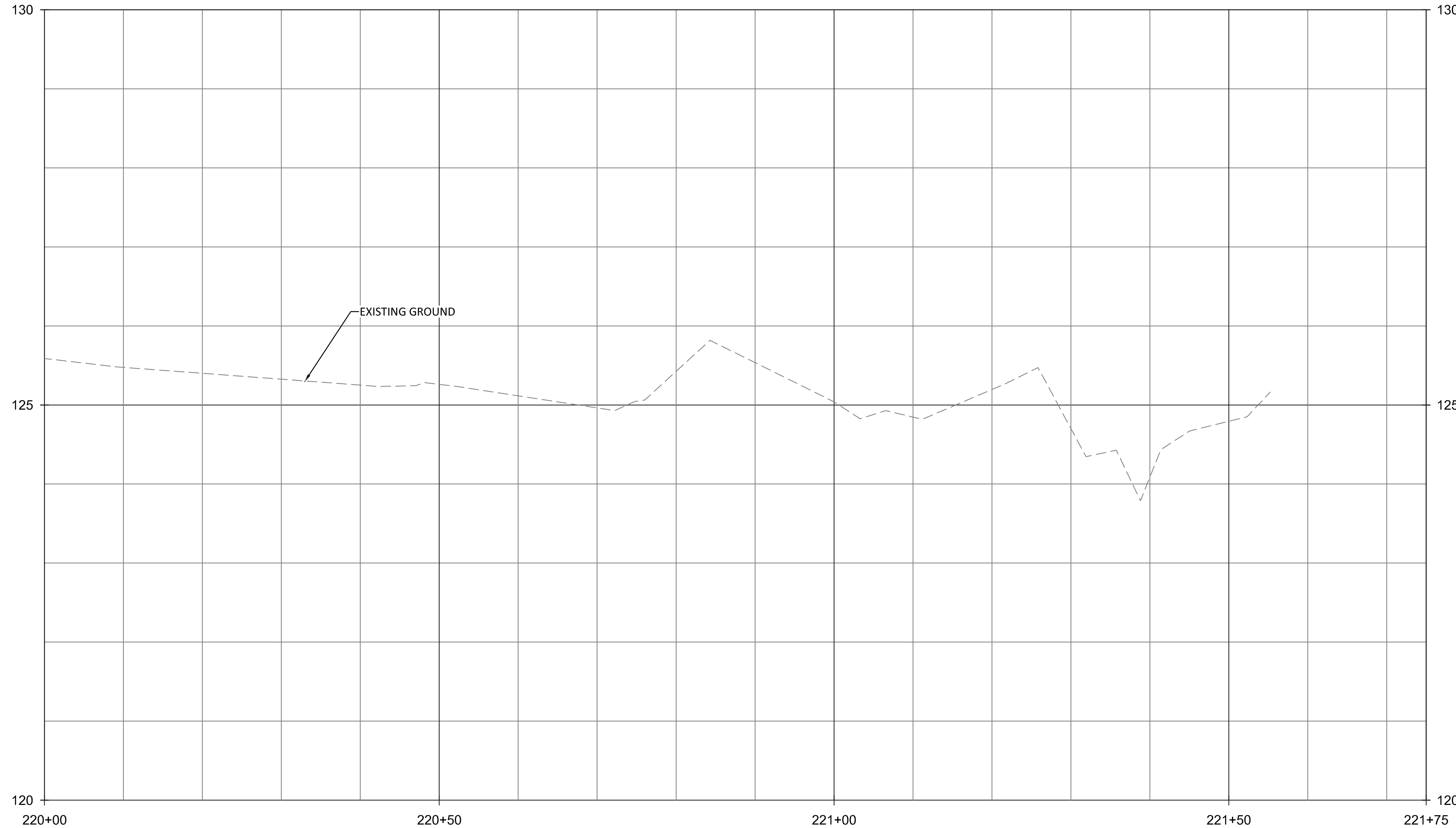
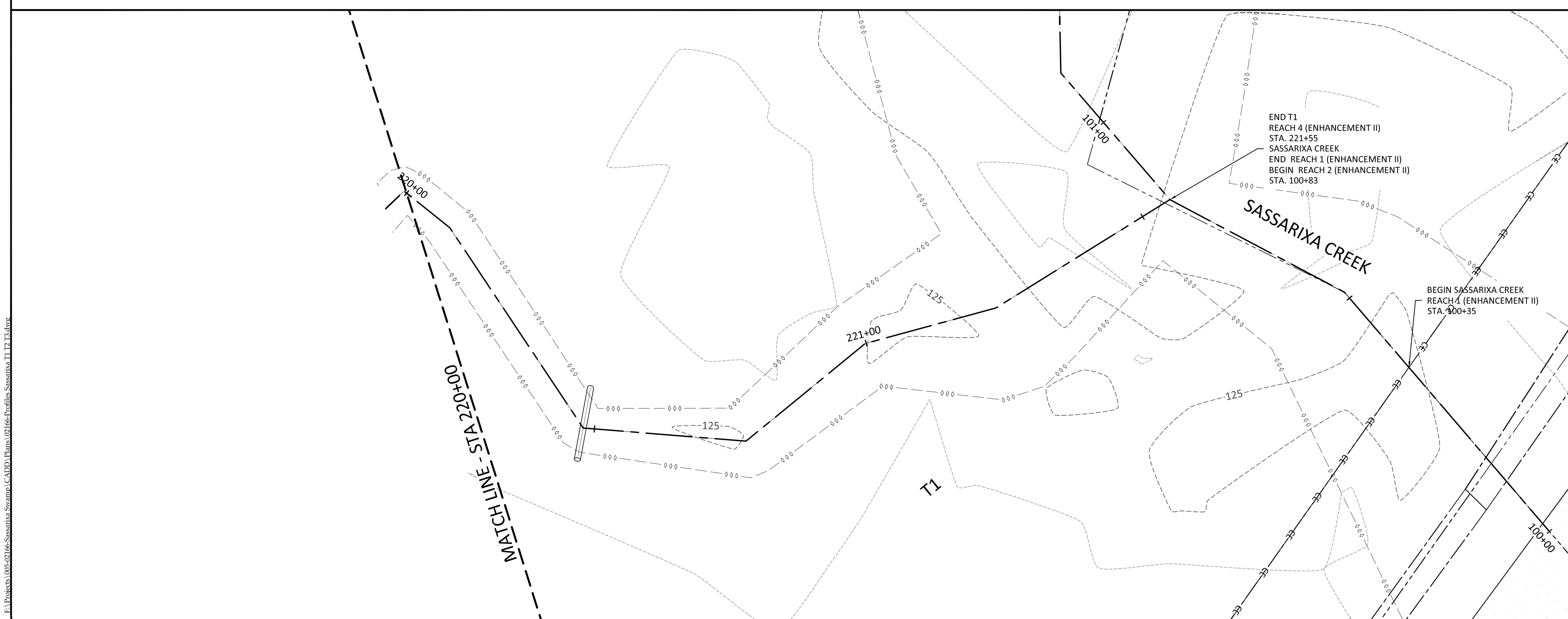
November 18, 201



0' 1' 2' 3'
(VERTICAL)
0' 10' 20' 30'
(HORIZONTAL)
N



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Sassarixa Swamp
Johnston County, North Carolina

T1
Stream Plan and Profile

Revisions:

Date: 11.15.2019
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

1.17
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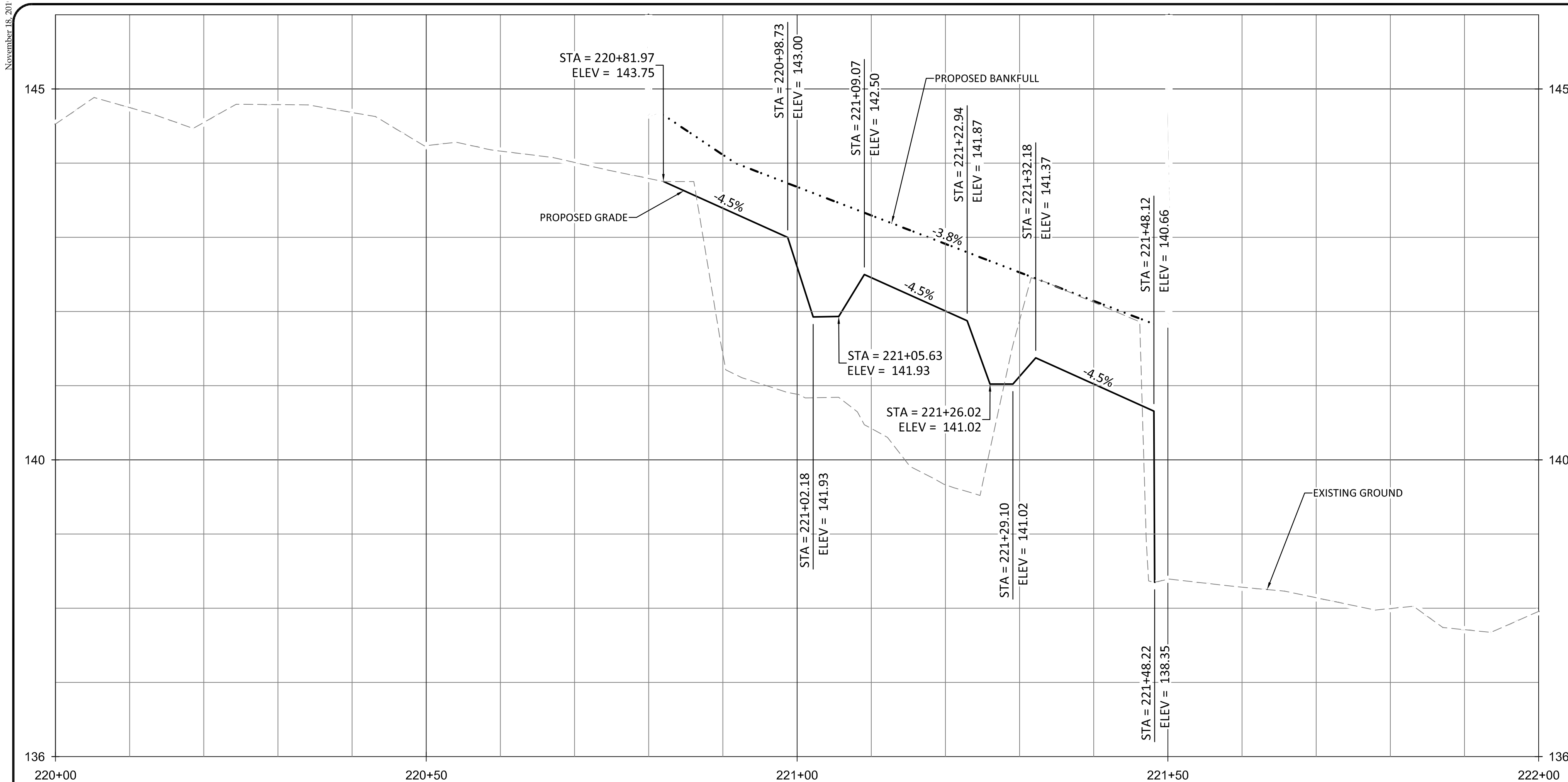
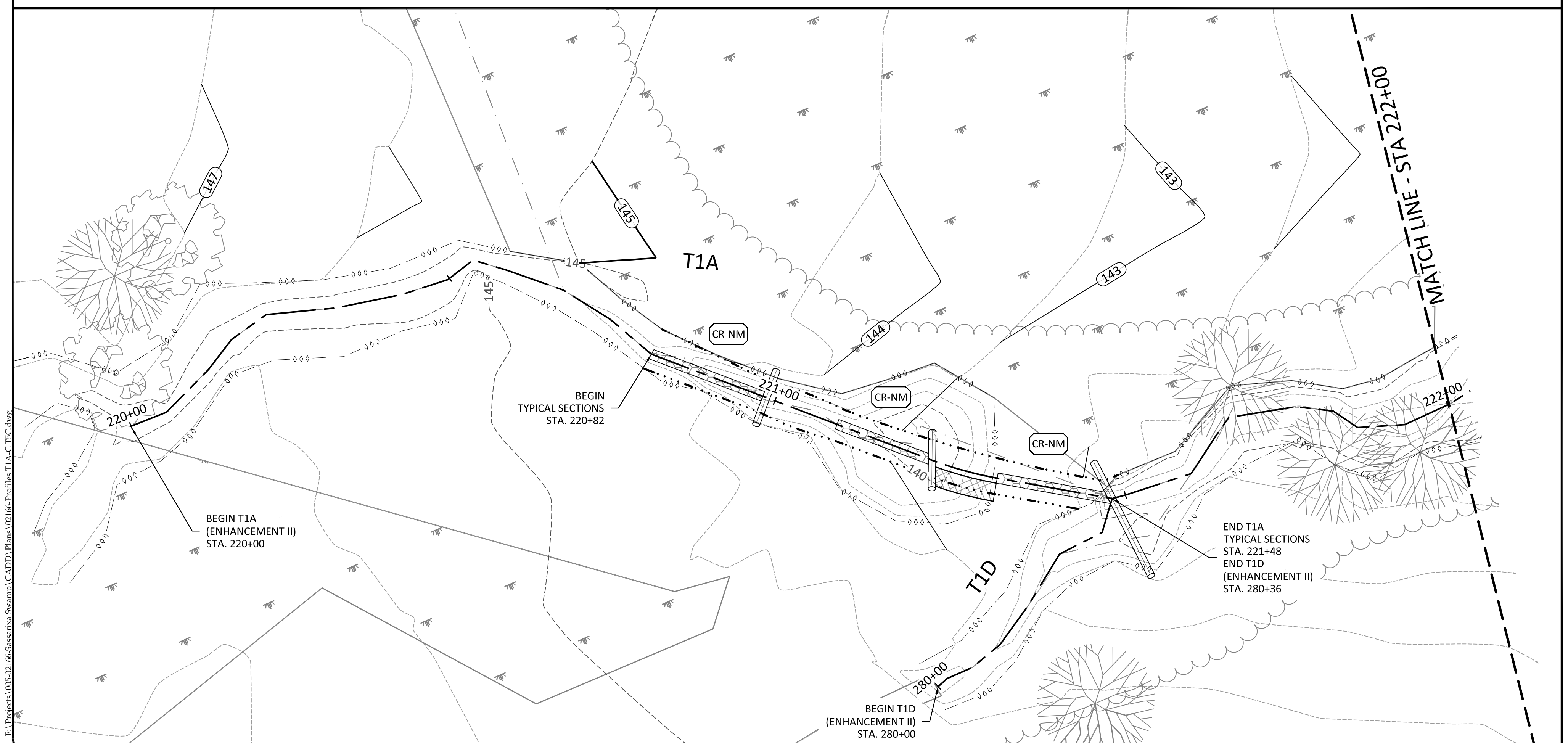
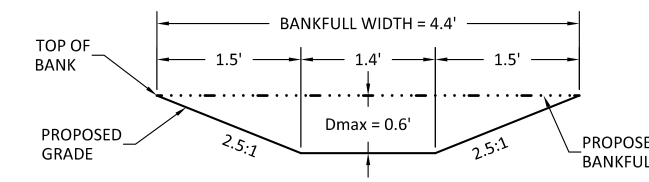
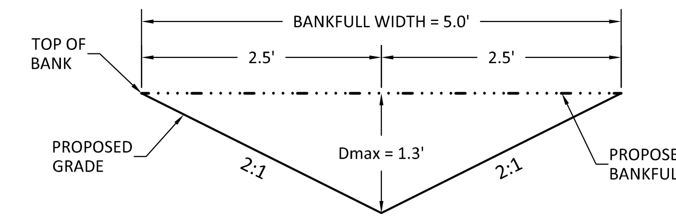


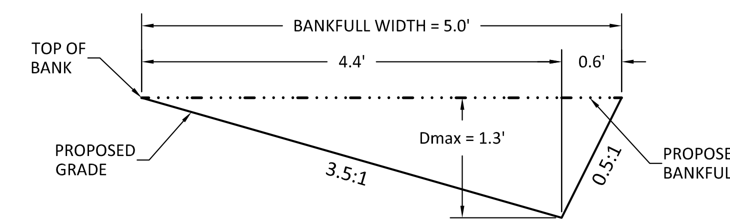




T1A
TYPICAL SECTION: RIFFLE
STA: 220+82 TO 221+48
SCALE: 1" = 1'



T1A
TYPICAL SECTION: INLINE POOL
STA: 220+82 TO 221+48
SCALE: 1" = 1'



T1A
TYP. SECTION: POOL WITH STRUCTURE
STA: 220+82 TO 221+48
SCALE: 1" = 1'

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T1A
Stream Plan and Profile

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Project Engineer: GAT
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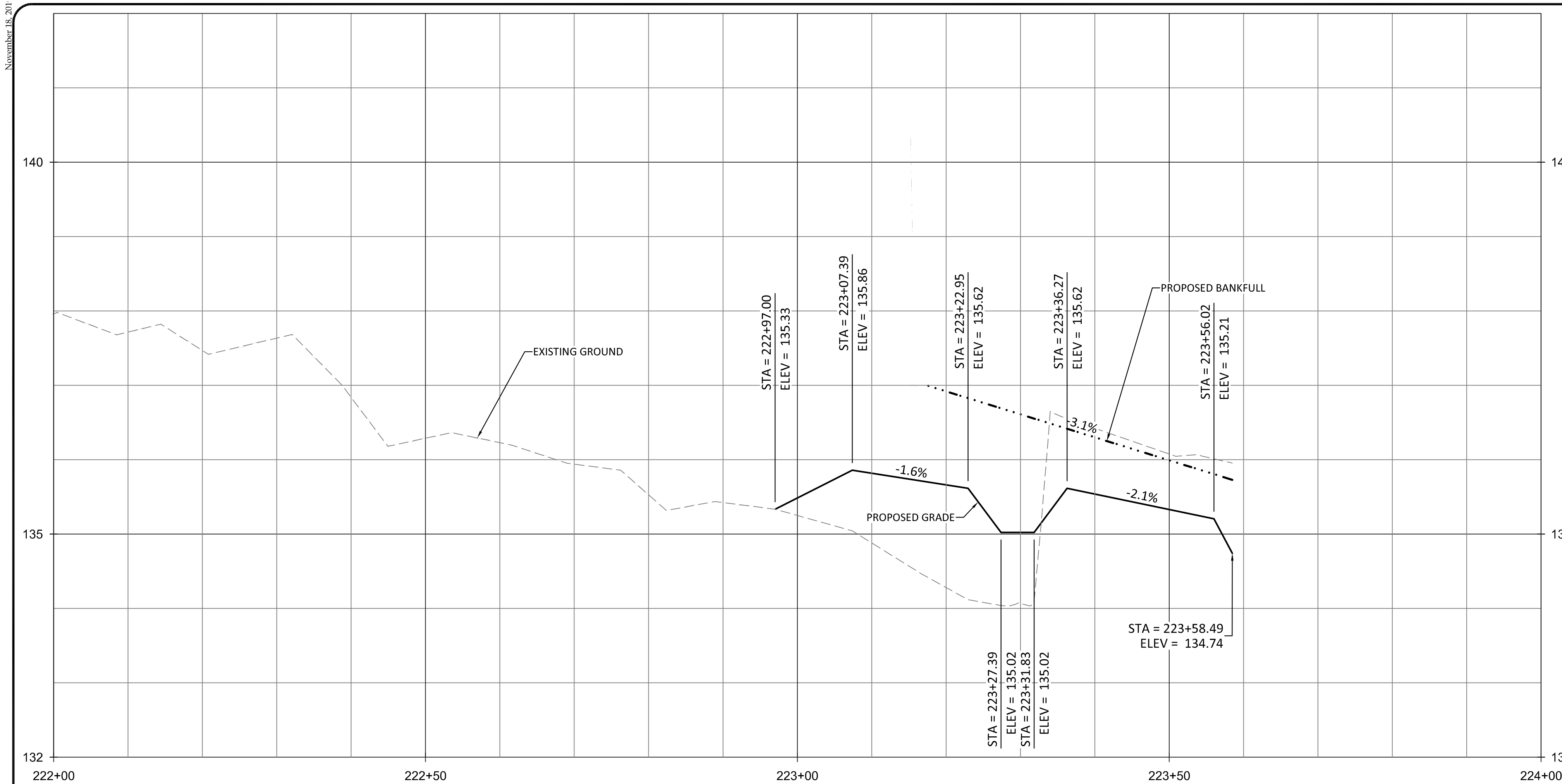
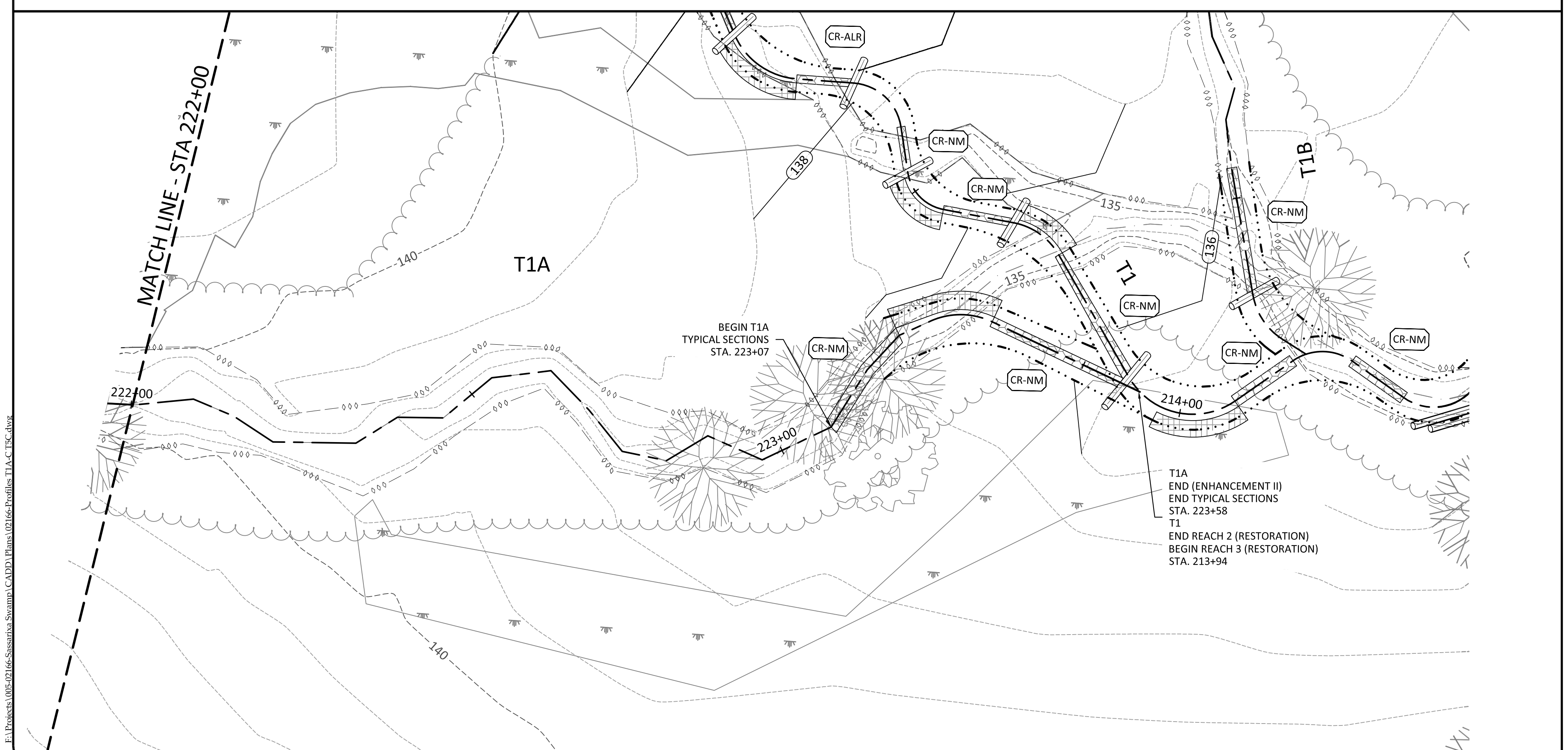
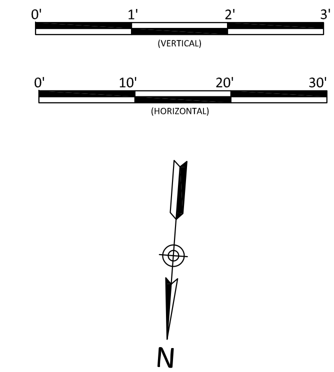
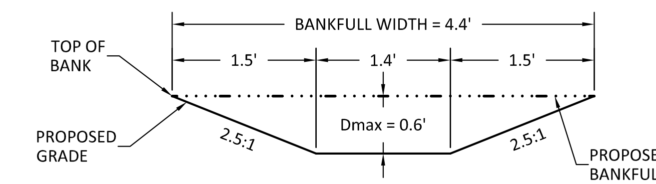
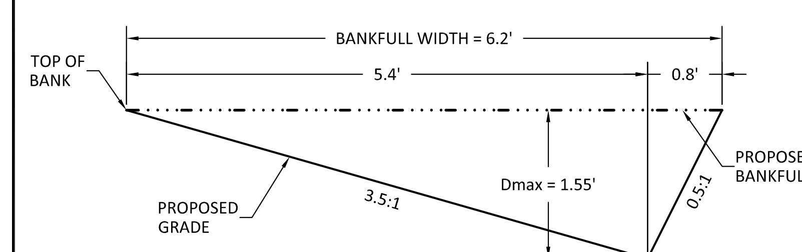








T1A
TYPICAL SECTION: RIFFLE
STA: 223+07 TO 223+58
SCALE: 1" = 1'



T1A
TYP. SECTION: POOL WITH STRUCTURE
STA: 223+07 TO 223+58
SCALE: 1" = 1'

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Johnston County, North Carolina

T1A
Stream Plan and Profile

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	GAW
Checked By:	ANA

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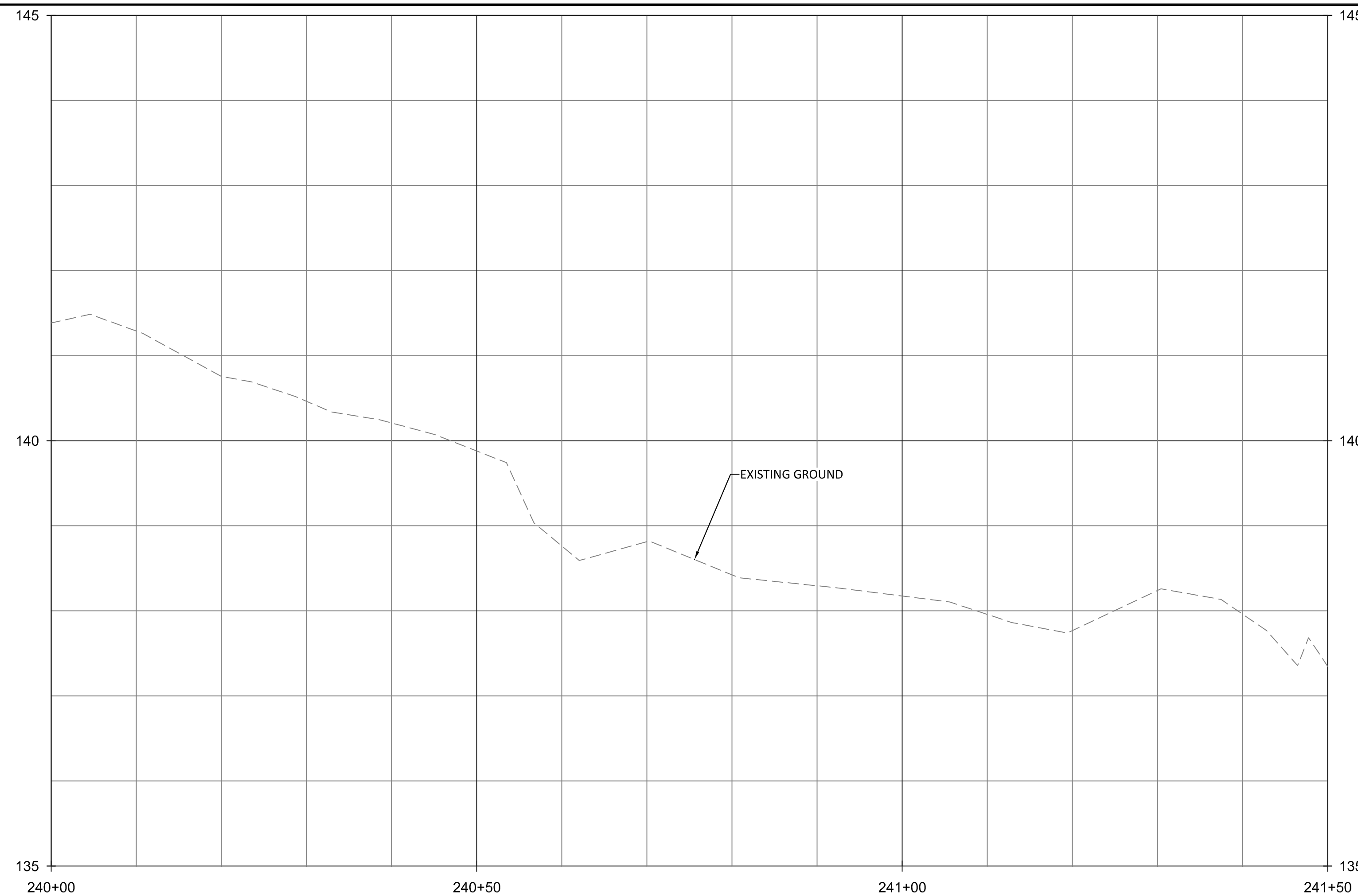

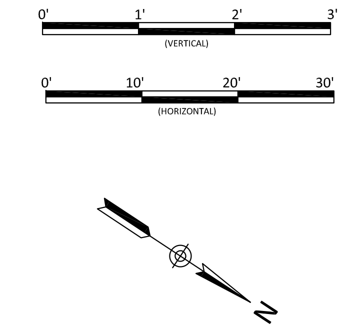

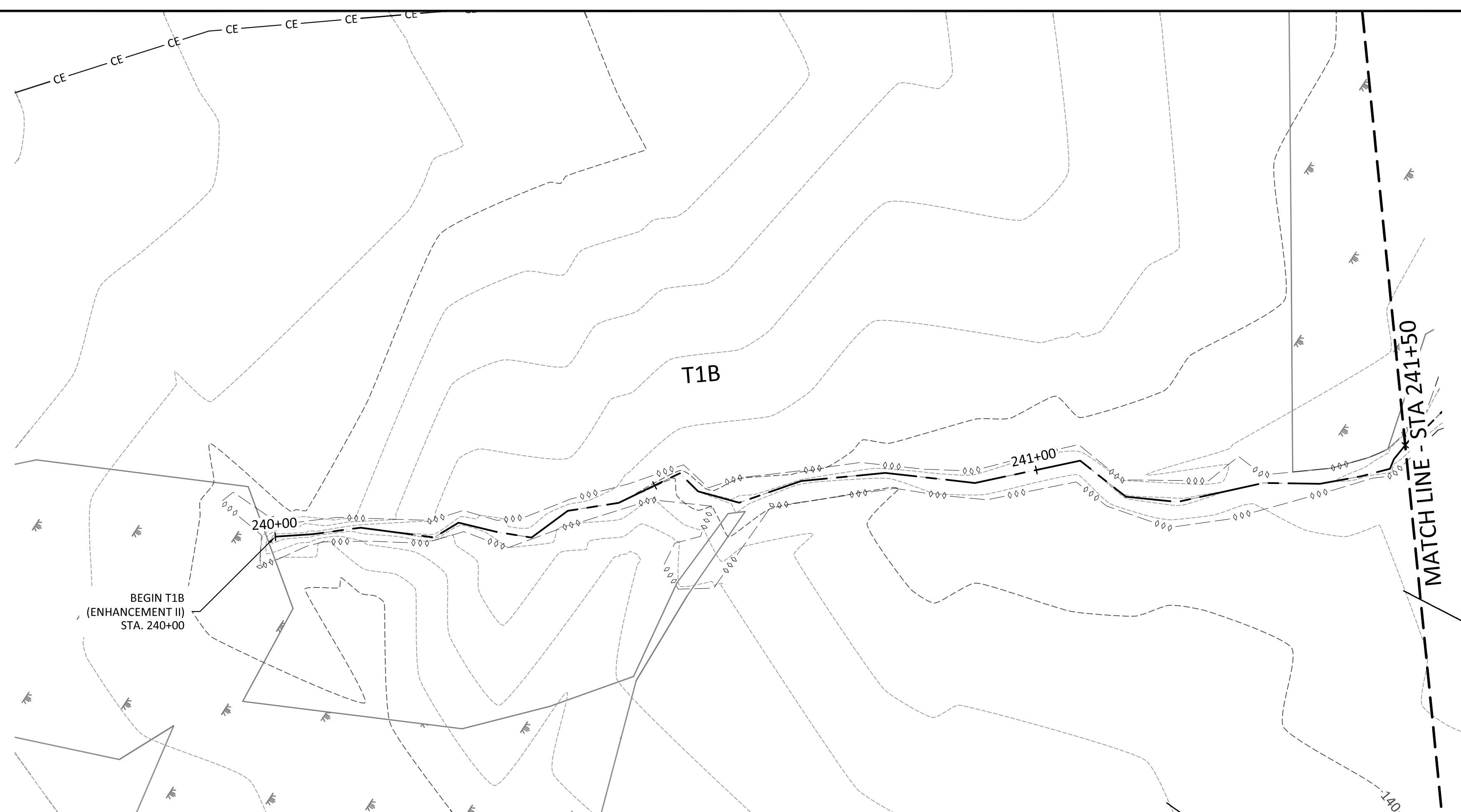

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Johnston County, North Carolina

T1B
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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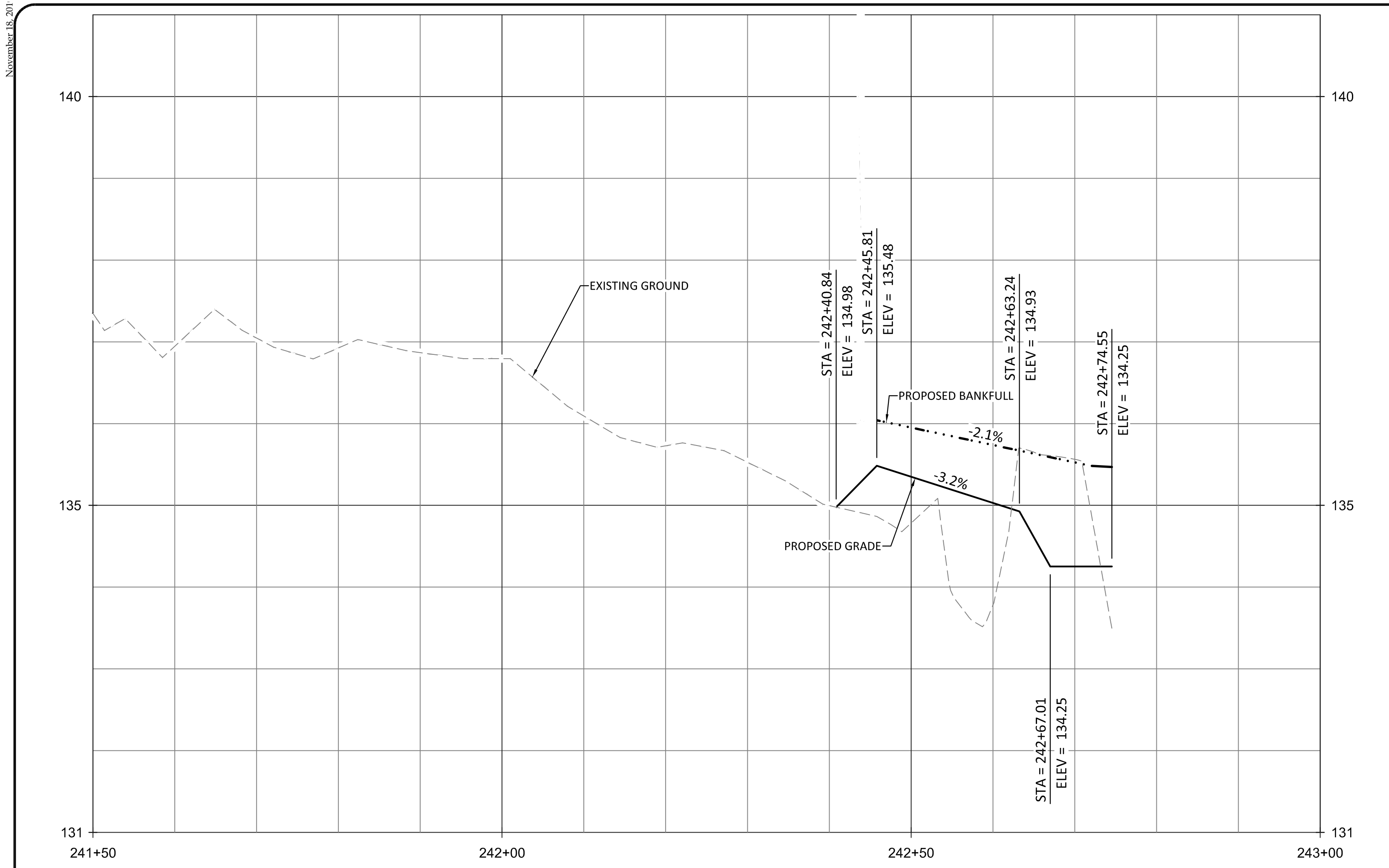
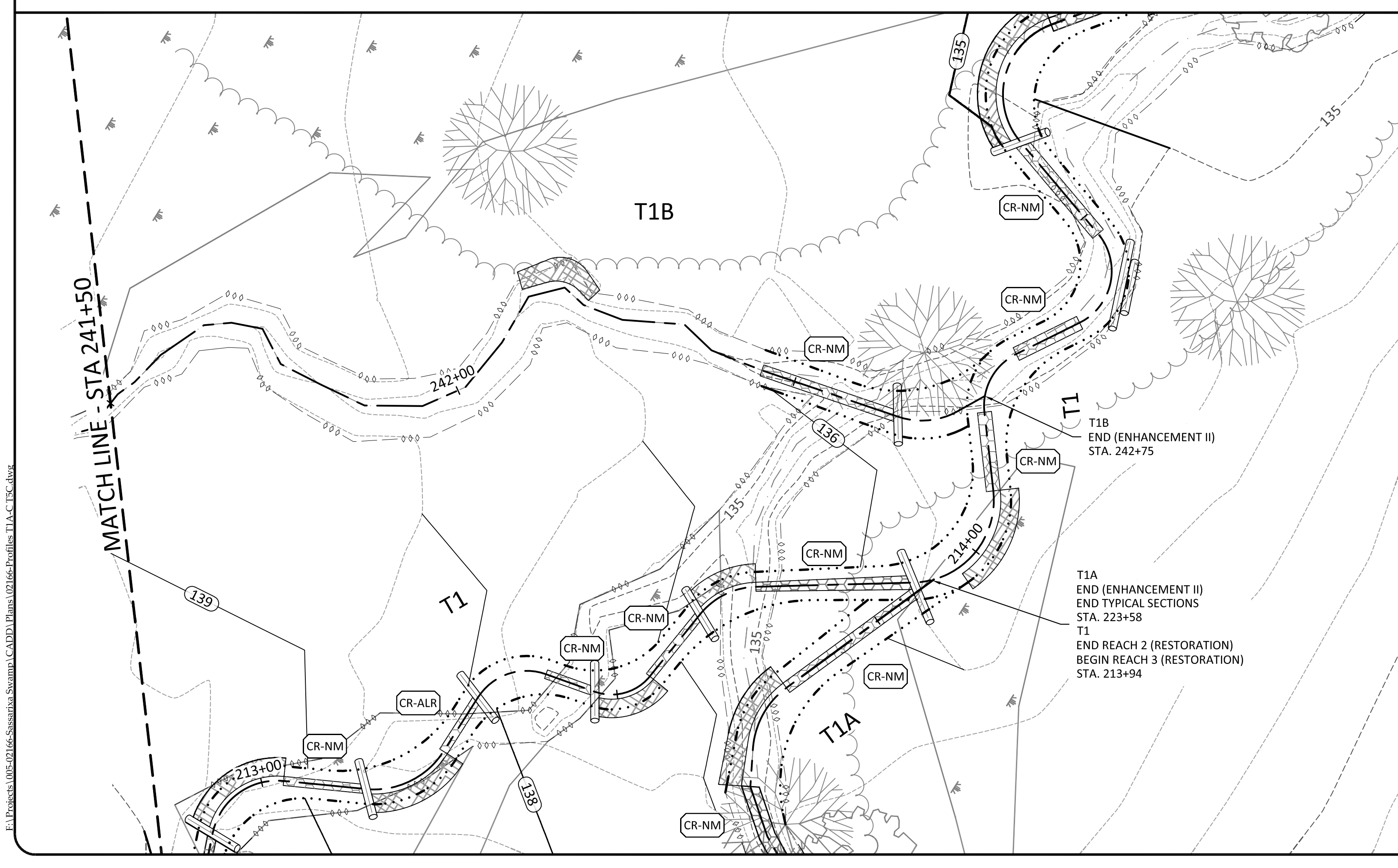
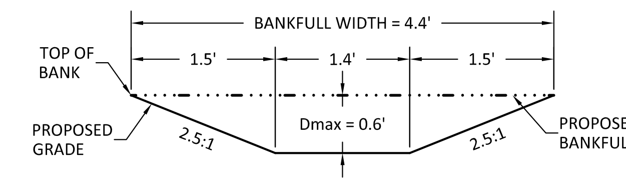
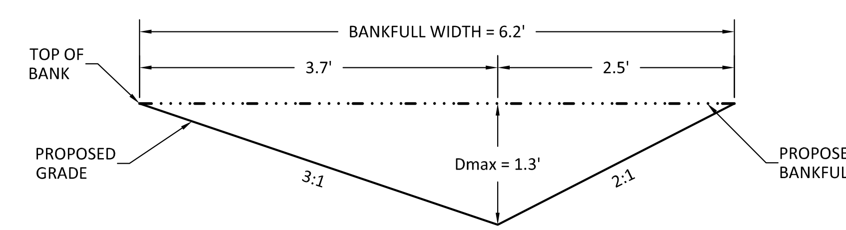
Sheet







T1B
TYPICAL SECTION: RIFFLE
STA: 242+46 TO 242+75
SCALE: 1" = 1'



T1B
TYPICAL SECTION: POOL
STA: 242+46 TO 242+75
SCALE: 1" = 1'

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Sassarixa Swamp
Johnston County, North Carolina

T1B
Stream Plan and Profile

Revisions:

Date: 11.15.2019
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

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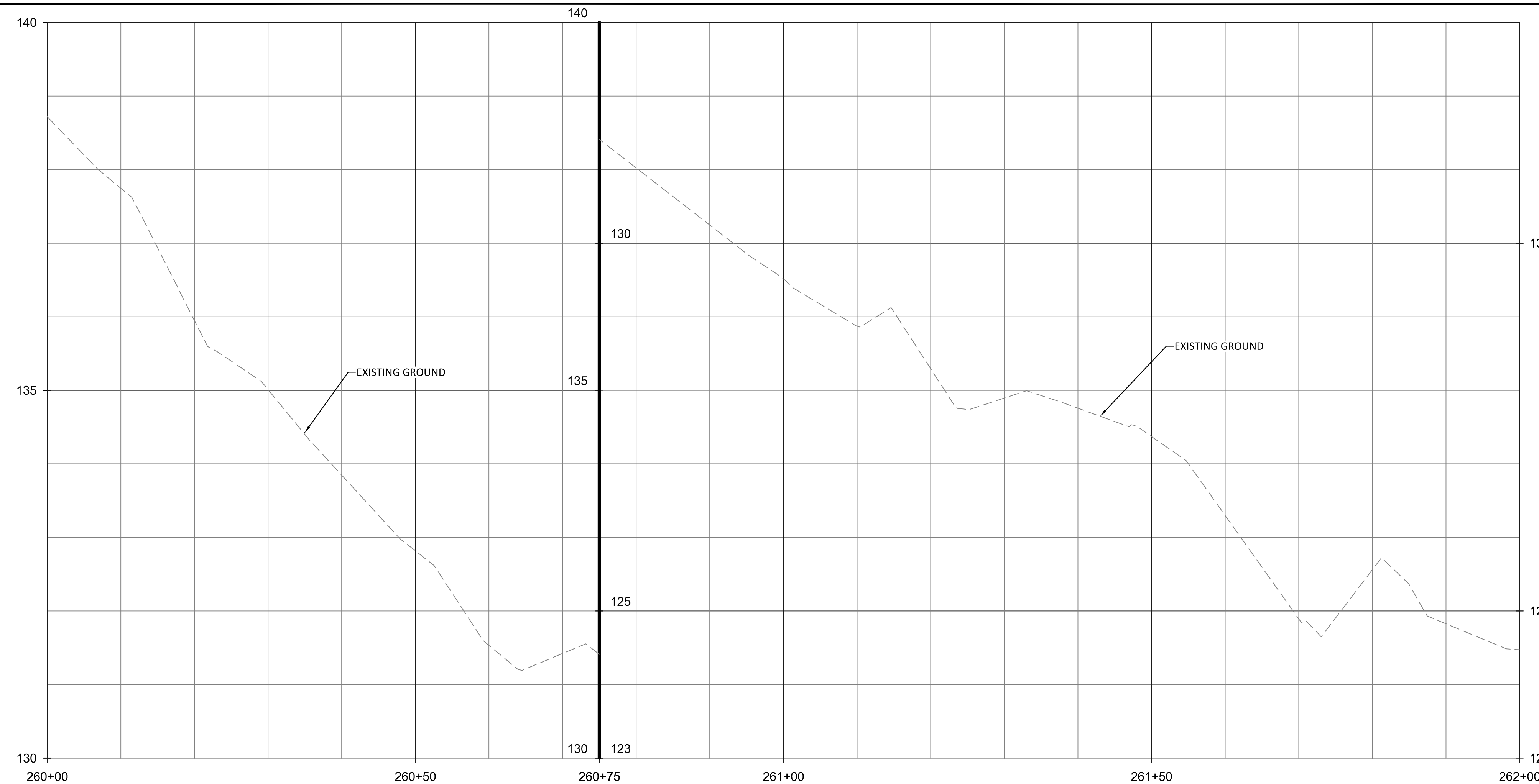

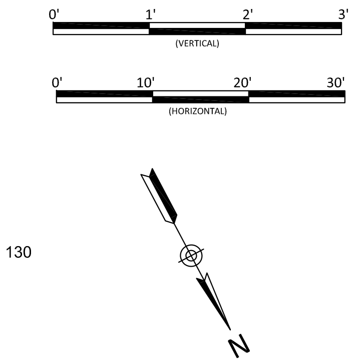

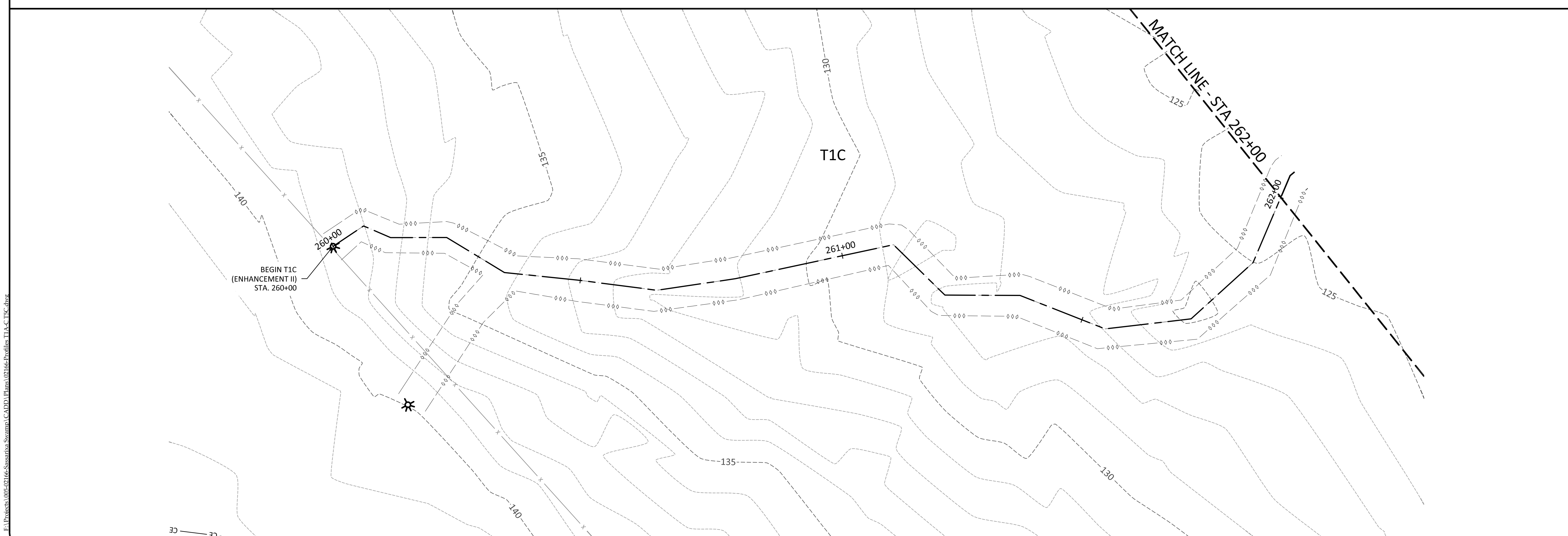

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Sassarixa Swamp
Johnston County, North Carolina

T1C
Stream Plan and Profile

Revisions:

Date:	11.15.2019
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Project Engineer:	GAT
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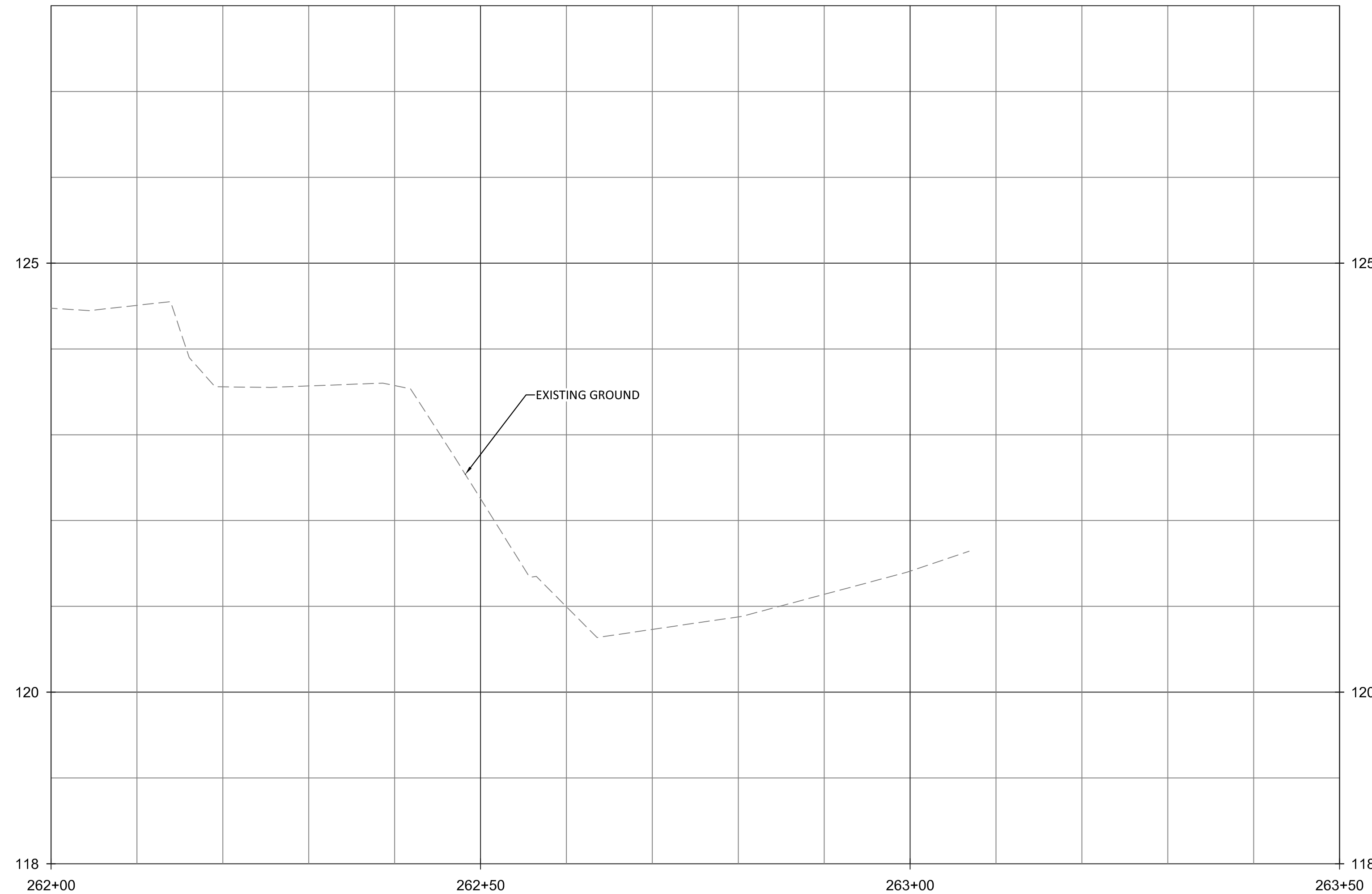

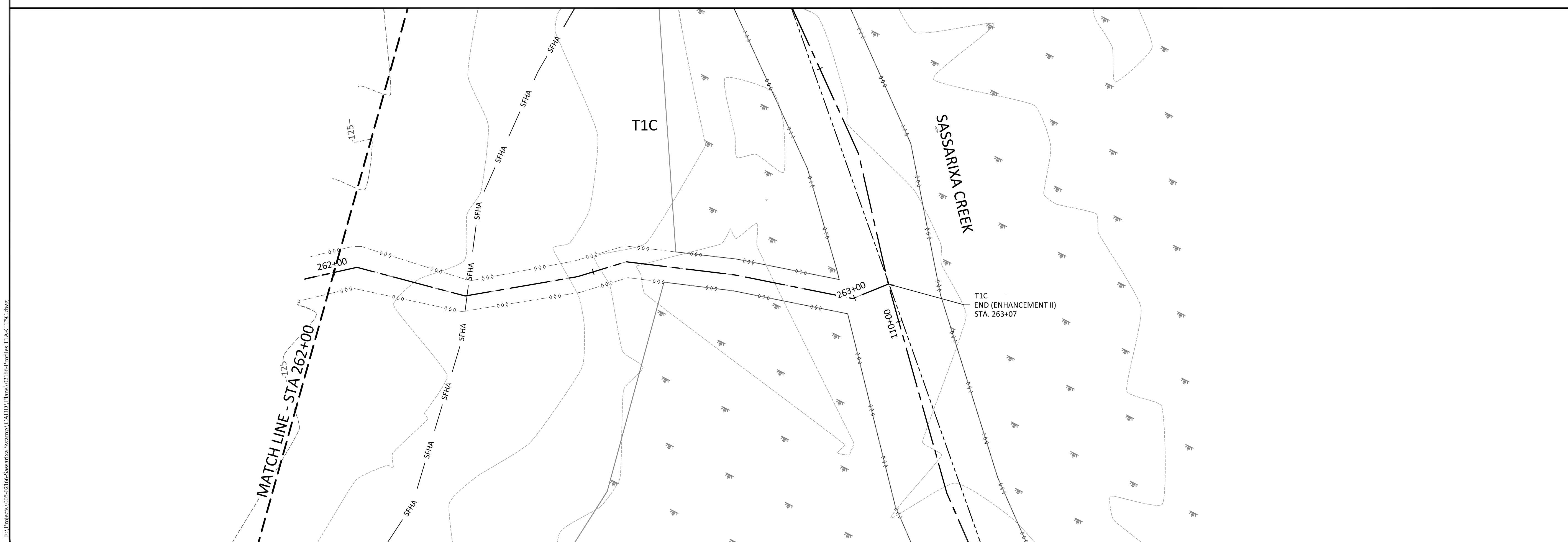

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Johnston County, North Carolina

T1C
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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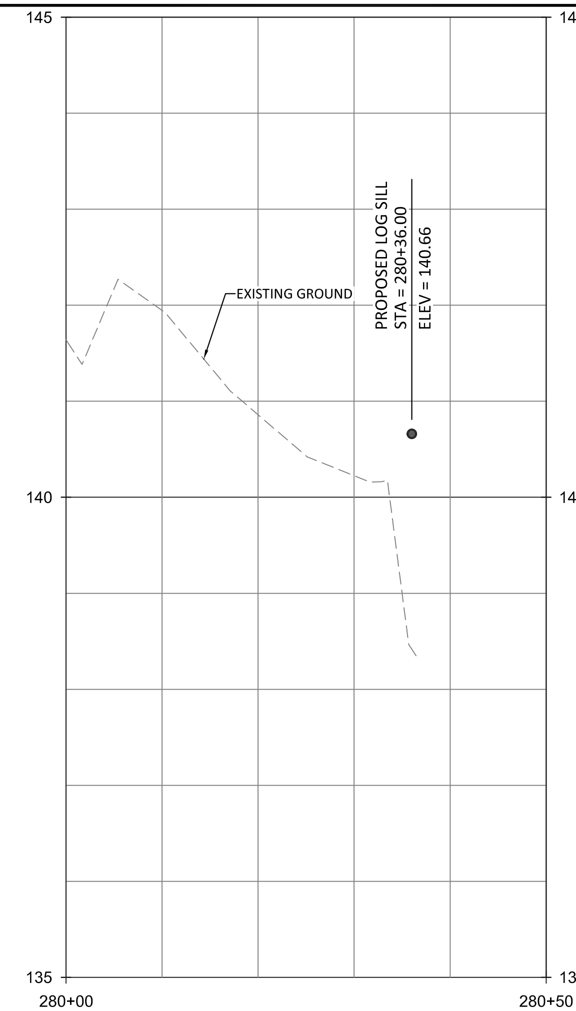
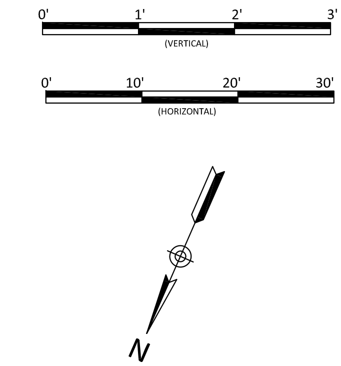
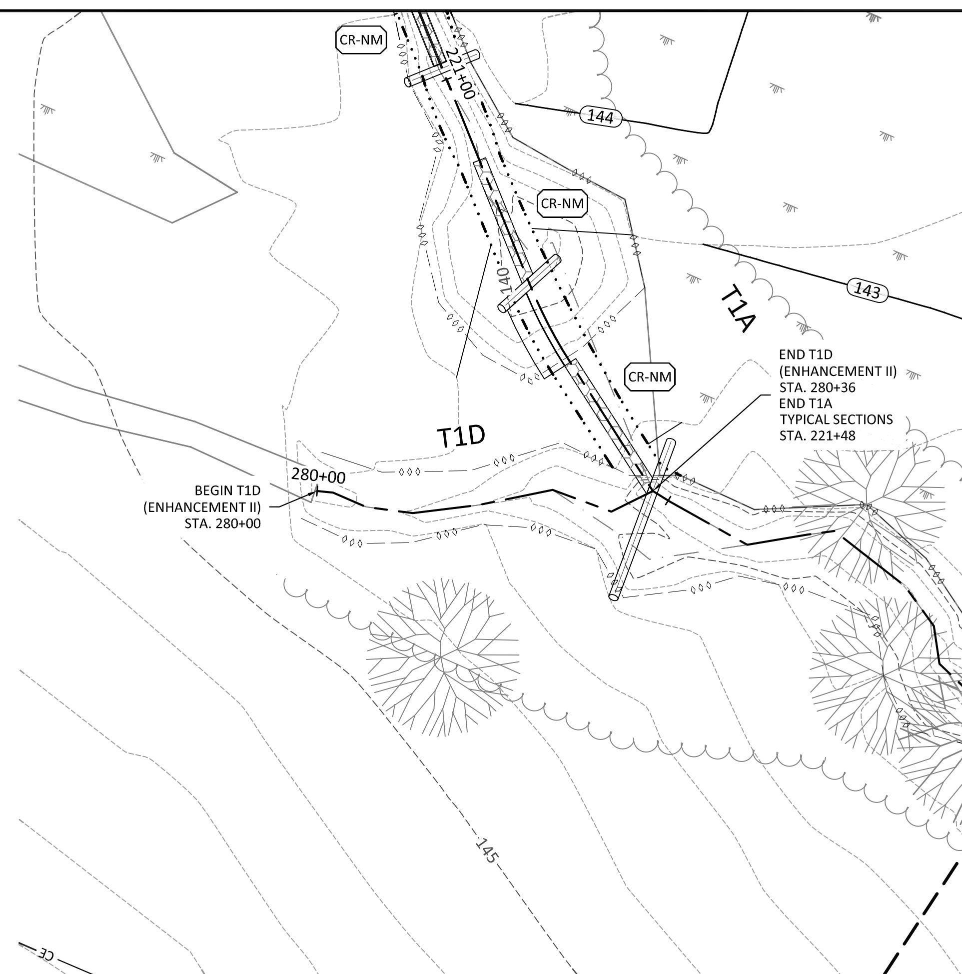
Sheet







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T1D
Stream Plan and Profile

Revisions:

Date: 11.15.2019
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

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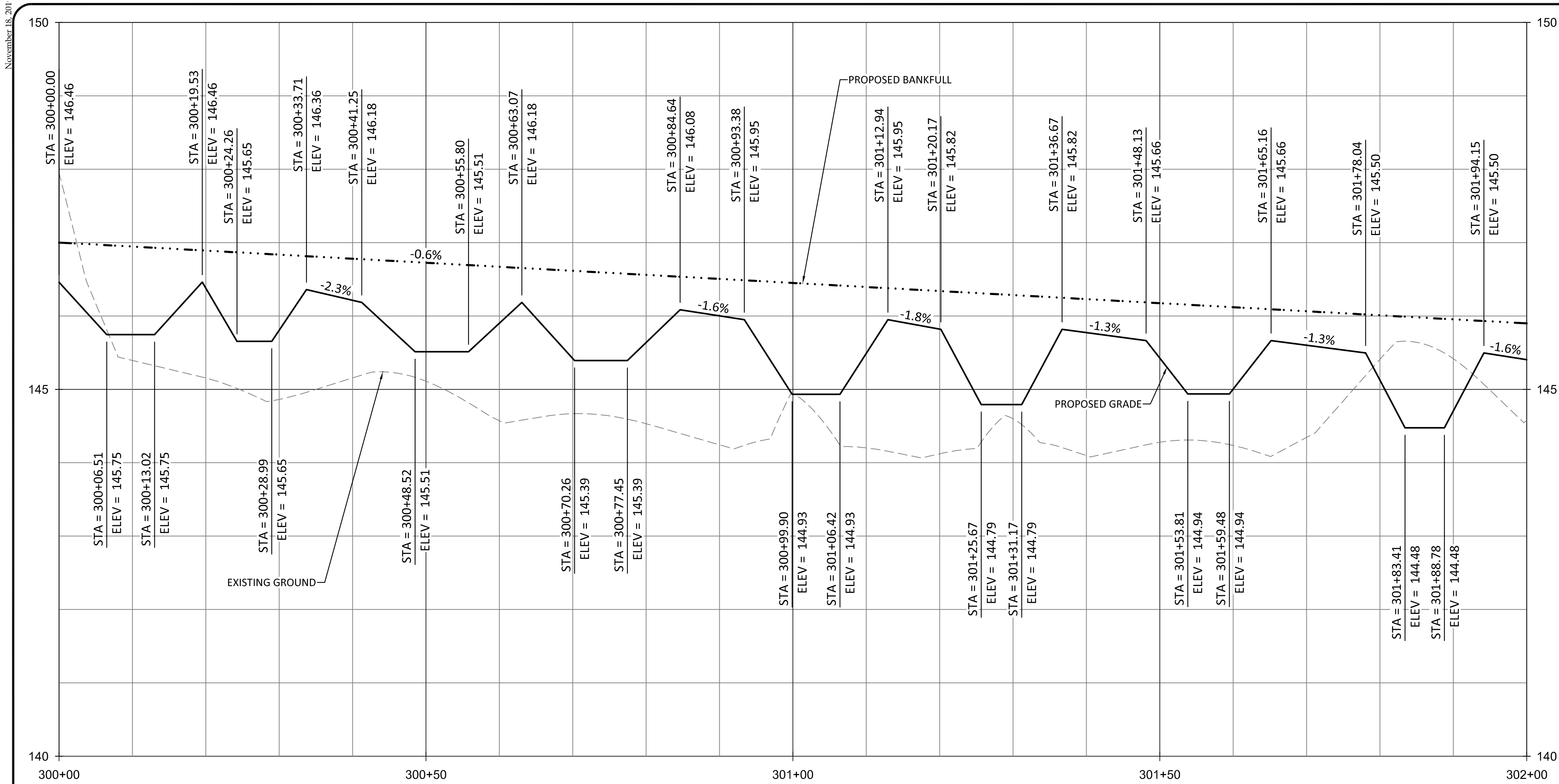

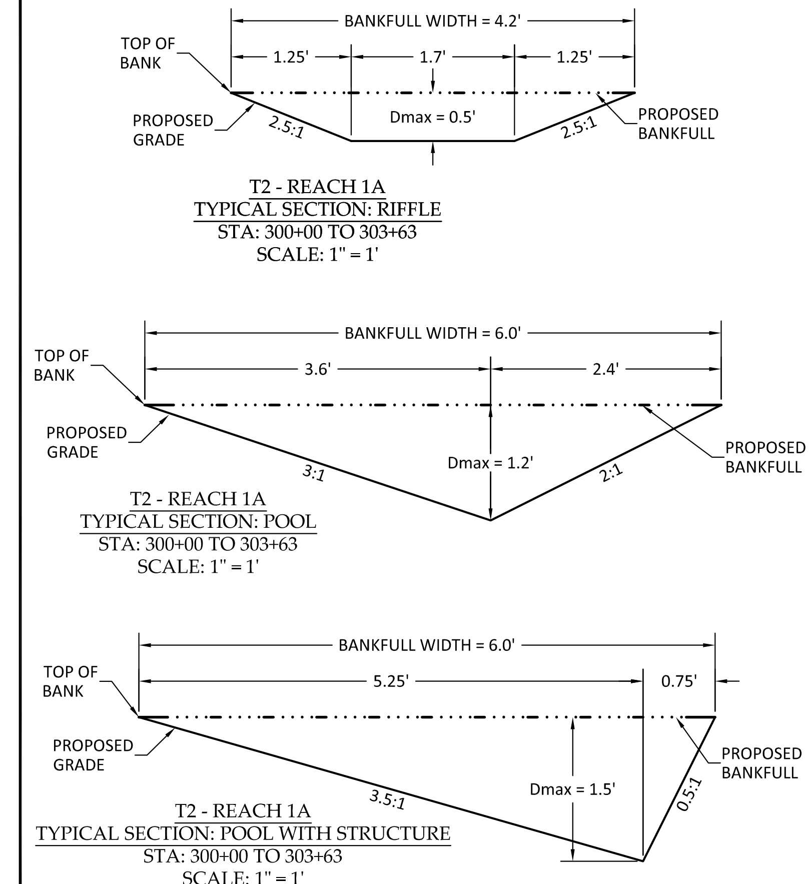

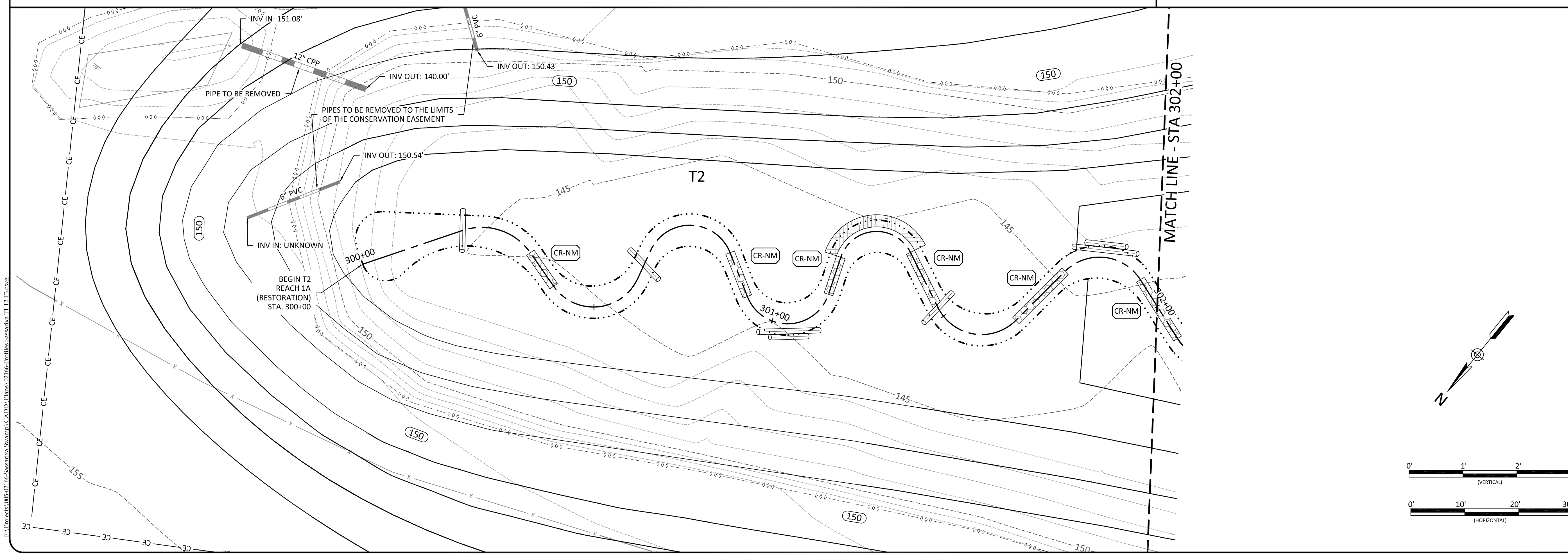

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T2
Stream Plan and Profile

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Date:	11.15.2019
Job Number:	005-02166
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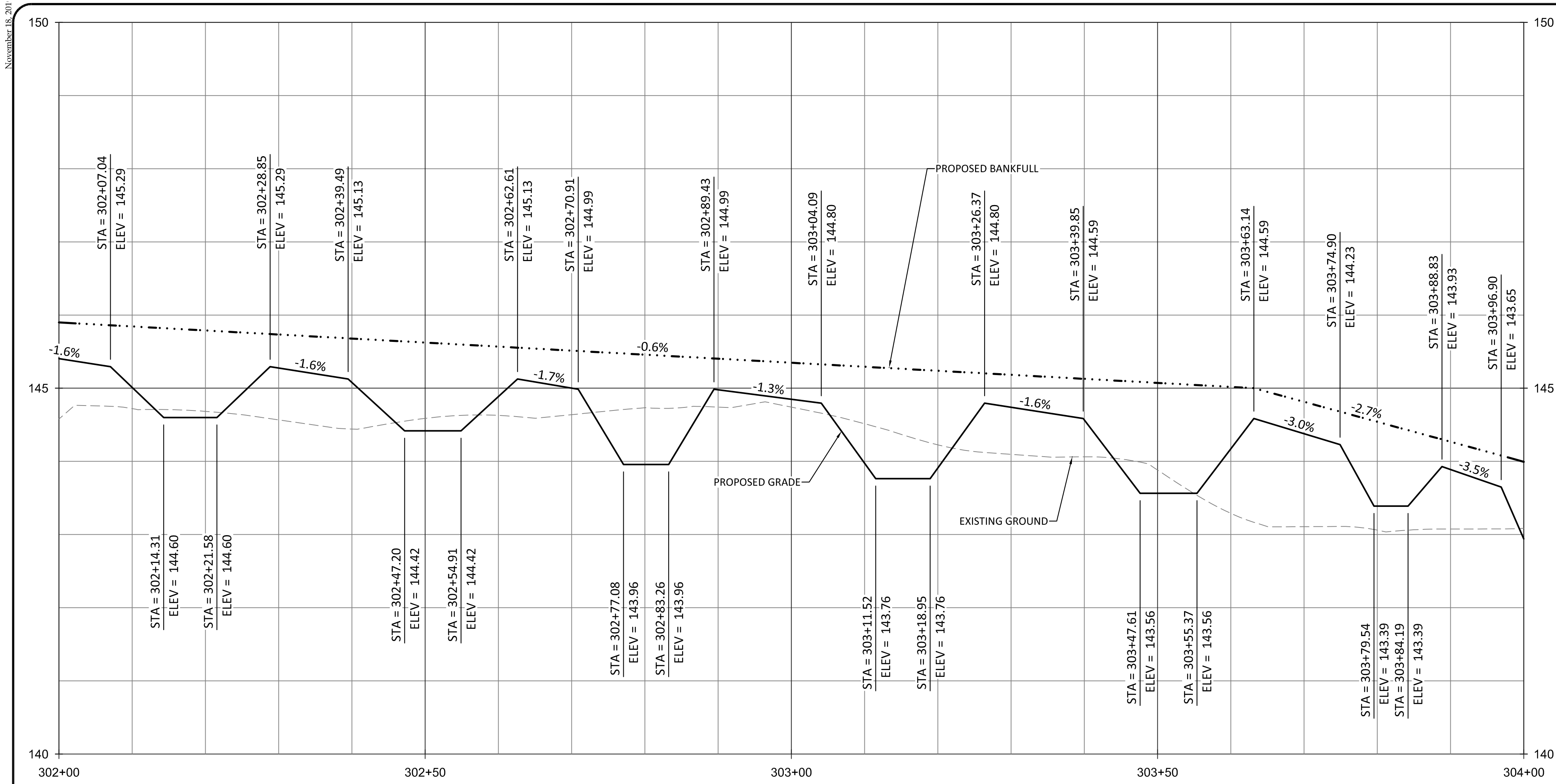
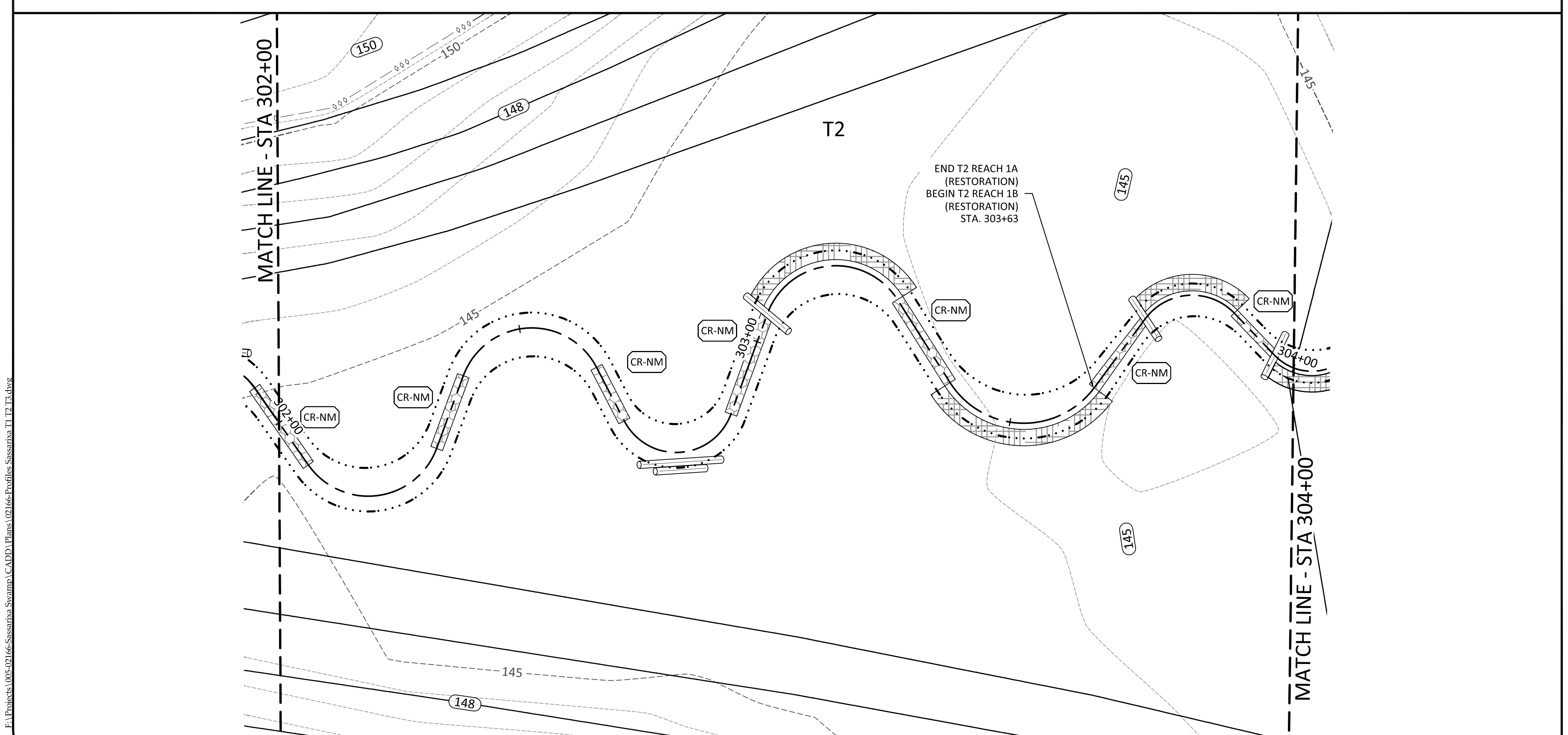
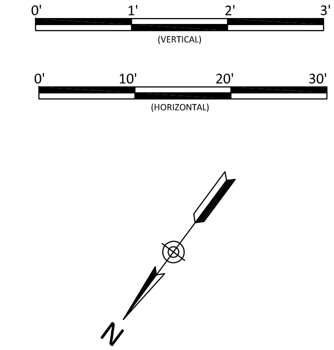
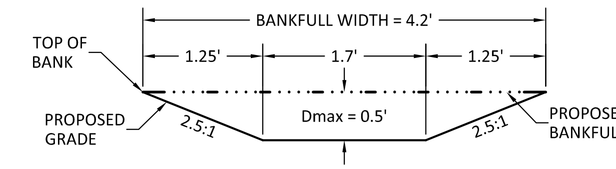
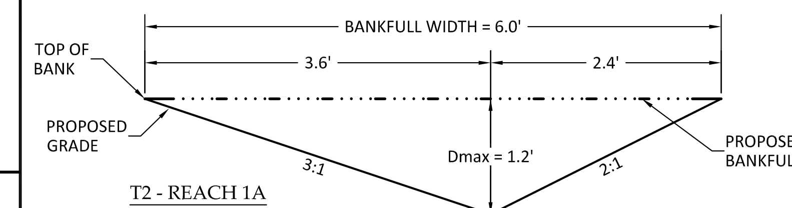








T2 - REACH 1A
TYPICAL SECTION: RIFFLE
STA: 300+00 TO 303+63
SCALE: 1" = 1'



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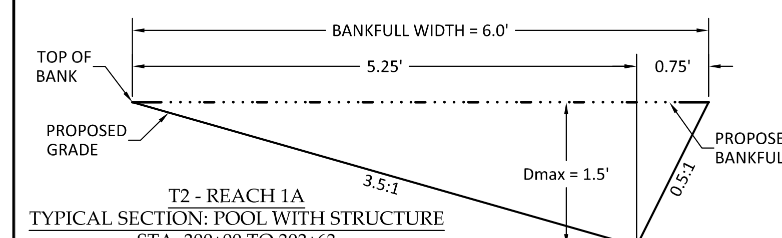
STA: 300+00 TO 303+63
SCALE: 1" = 1'



T2 - REACH 1A
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 300+00 TO 303+63
SCALE: 1" = 1'

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Date: 11.15.2019
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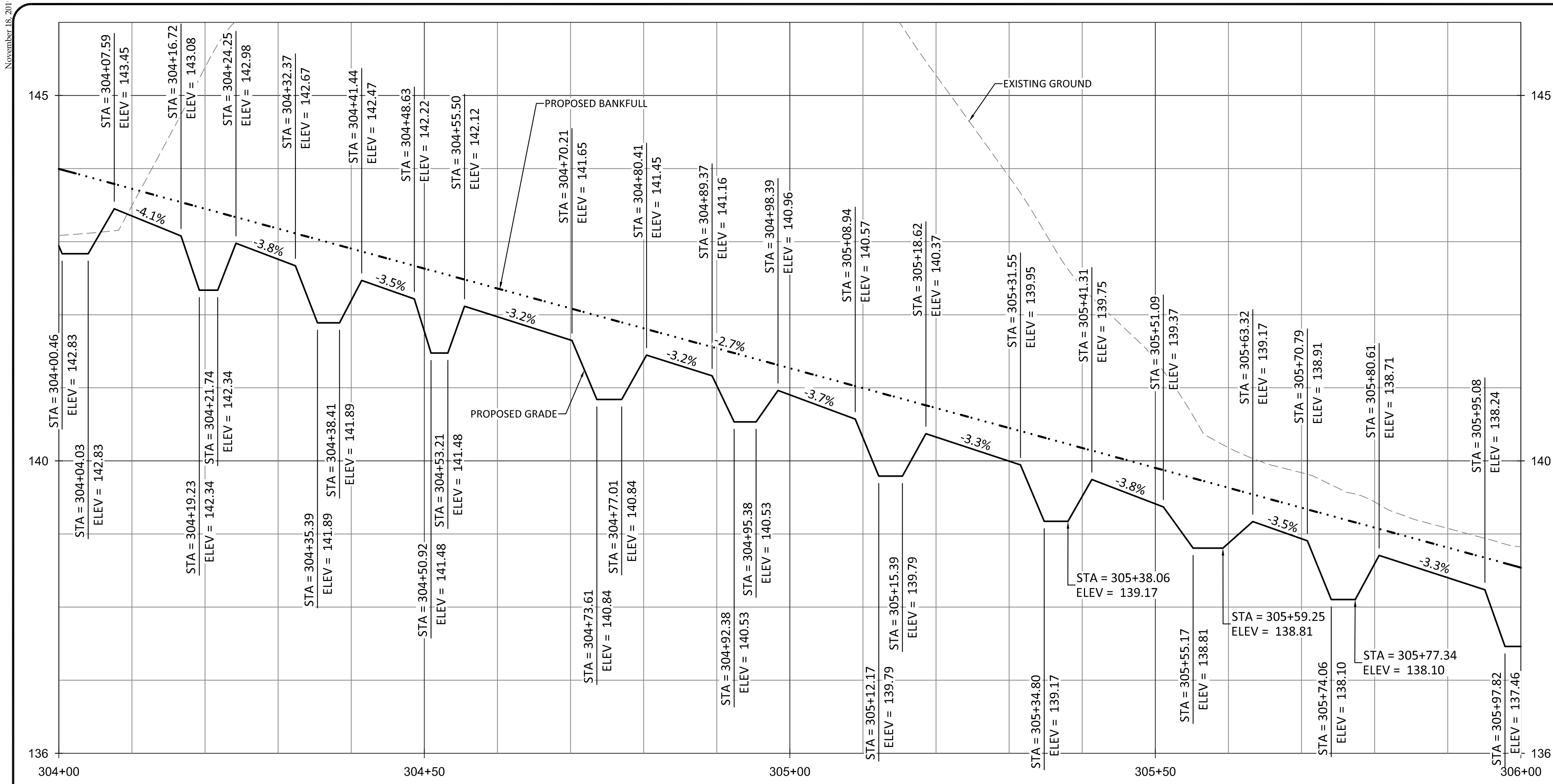

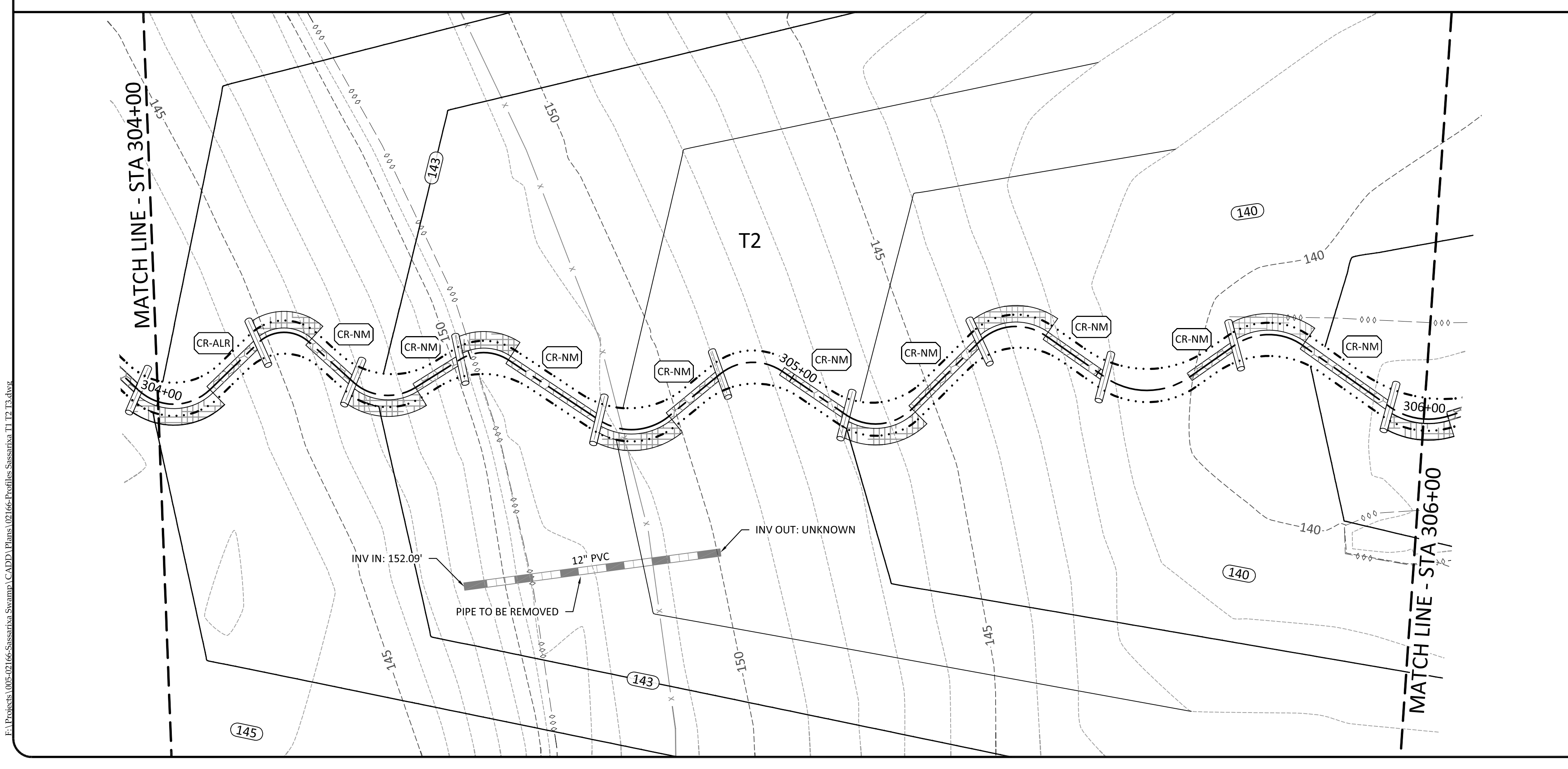

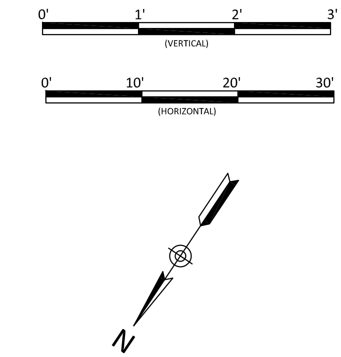

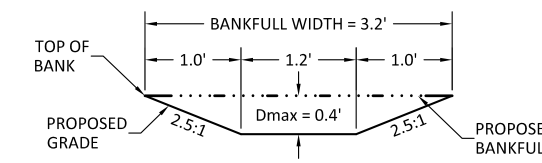

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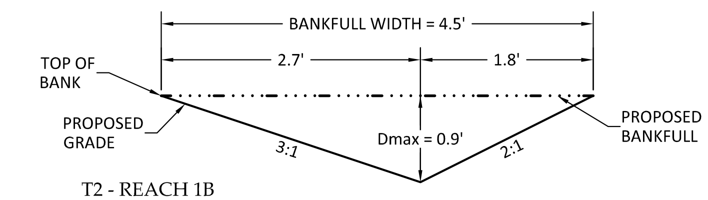
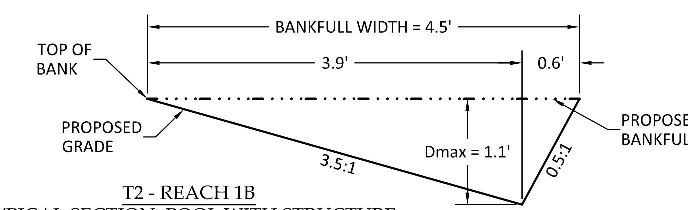
STA: 303+63 TO 310+10
SCALE: 1" = 1'



T2 - REACH 1B
TYPICAL SECTION: POOL
STA: 303+63 TO 310+10
SCALE: 1" = 1'



T2 - REACH 1B
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 303+63 TO 310+10
SCALE: 1" = 1'

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November 18, 201

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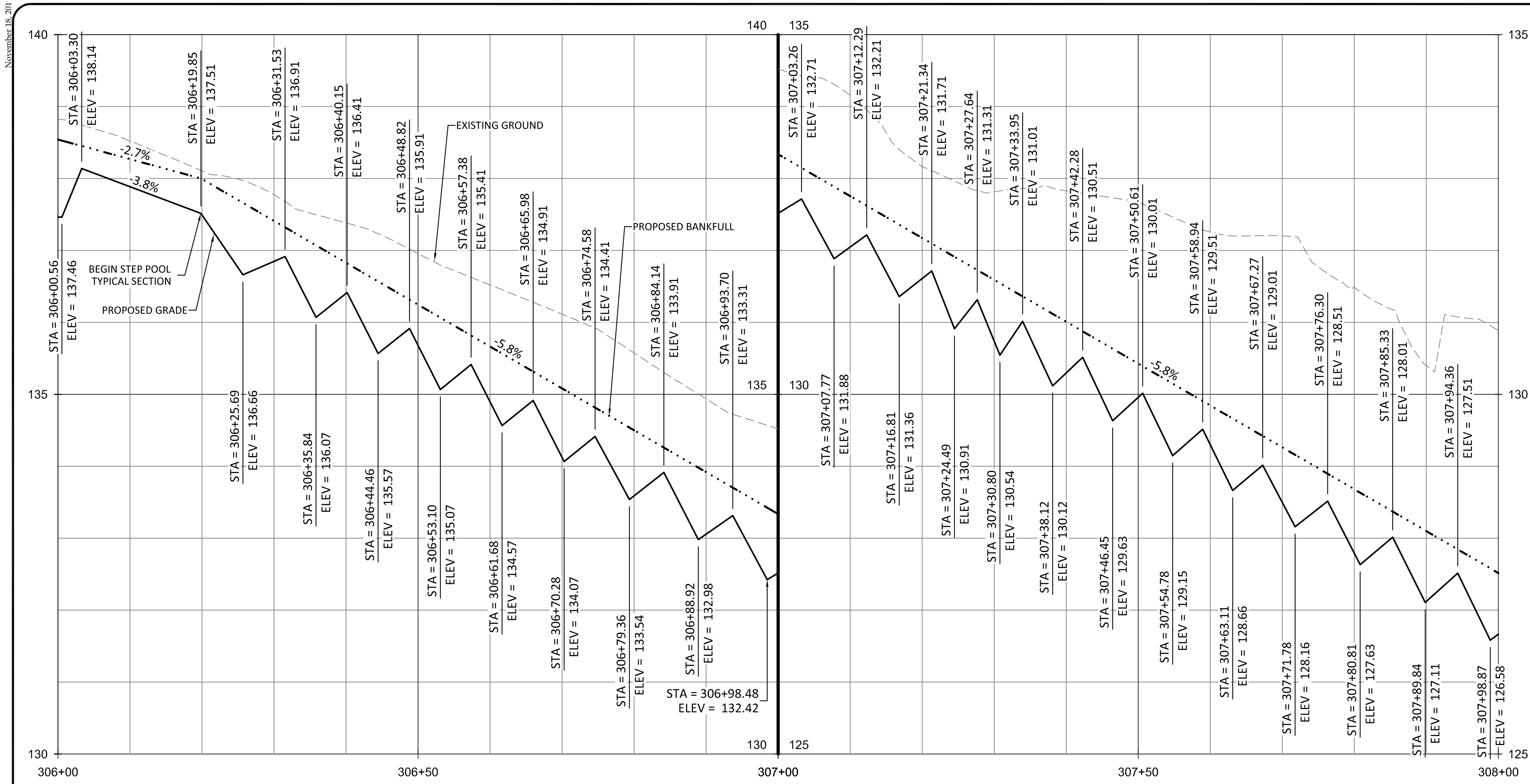

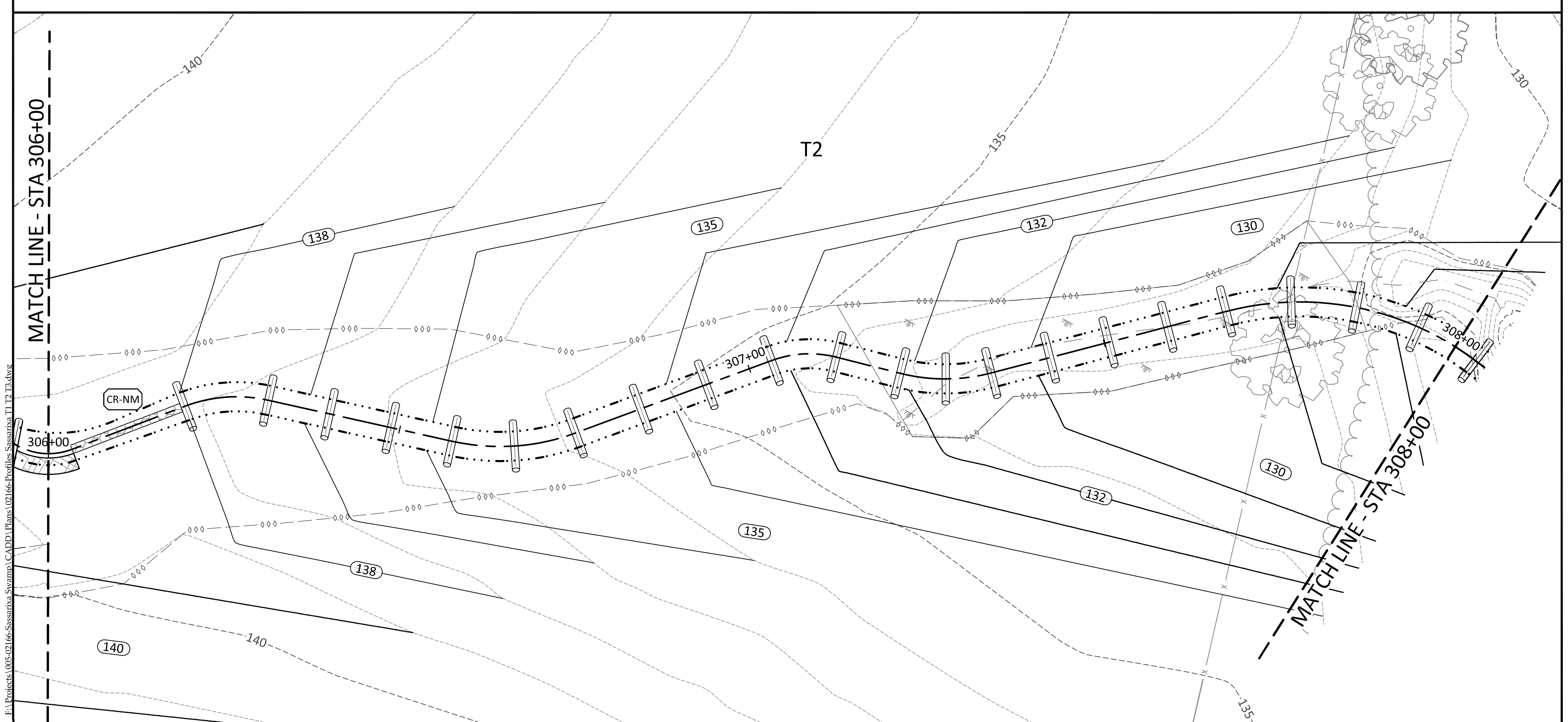

0' 1' 2' 3' (VERTICAL)

0' 10' 20' 30' (HORIZONTAL)

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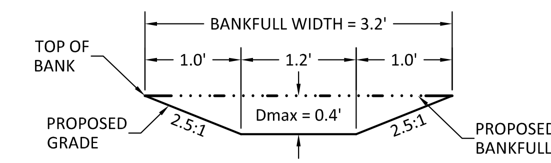

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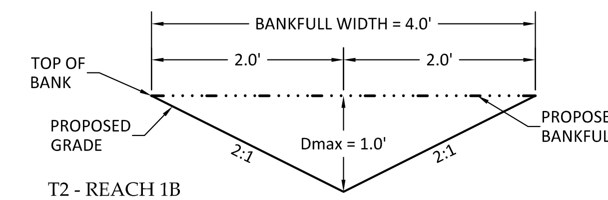
TYPICAL SECTION: RIFFLE
STA: 303+63 TO 310+10
SCALE: 1" = 1'



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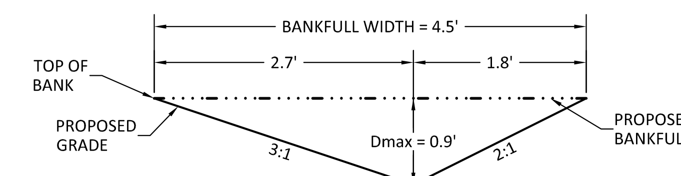
STA: 306+20 TO 309+12
SCALE: 1" = 1'



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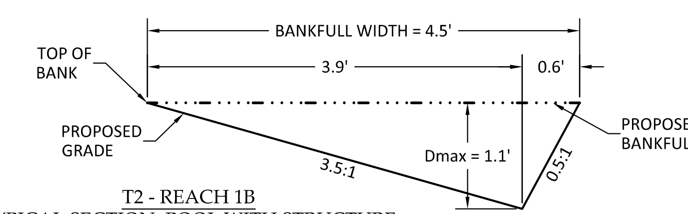
SCALE: 1" = 1'



T2 - REACH 1B
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 303+63 TO 310+10
SCALE: 1" = 1'

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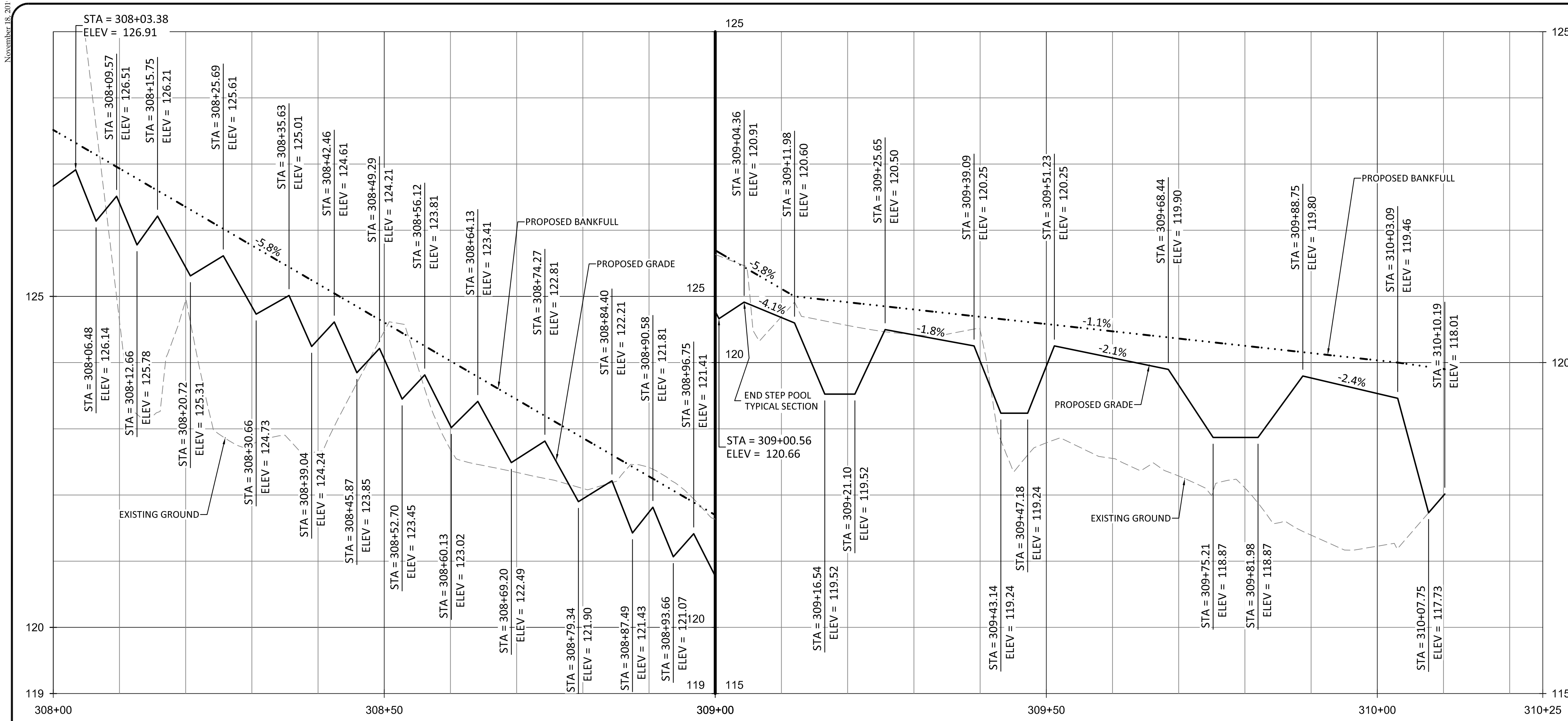

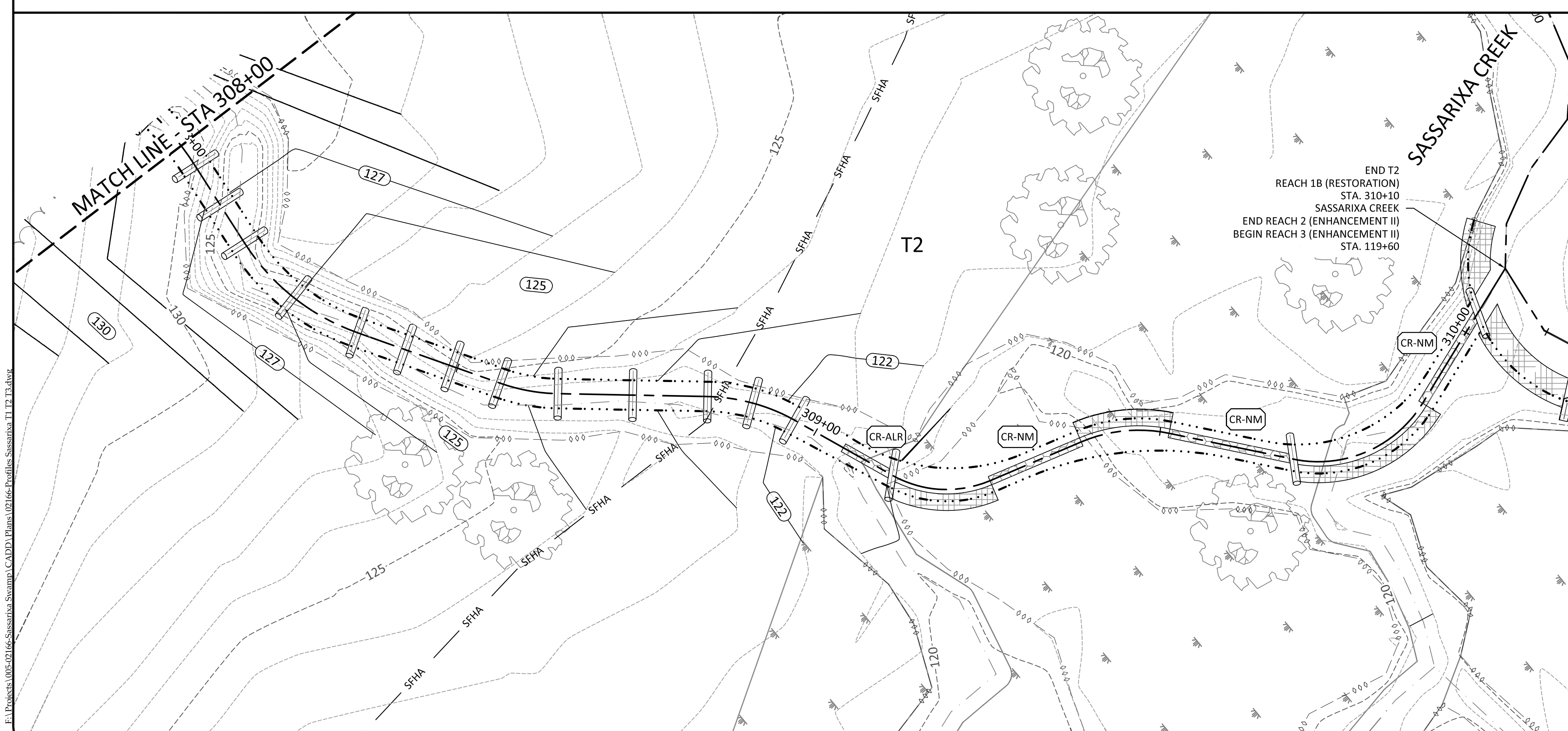

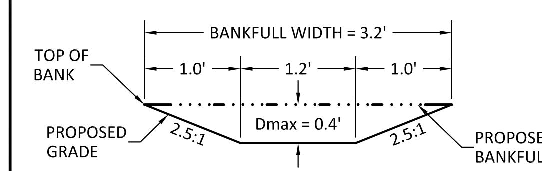

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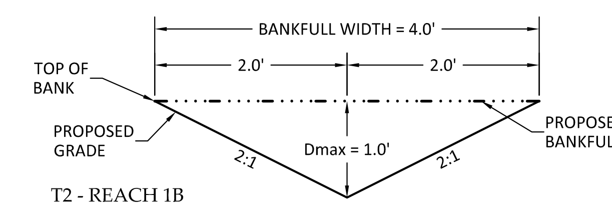
SCALE: 1" = 1'



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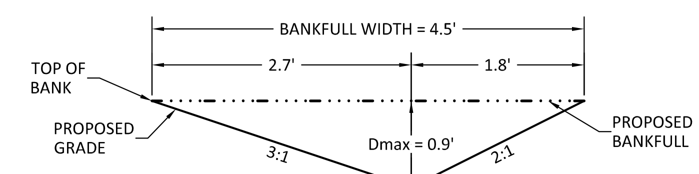
TYPICAL SECTION: STEP POOL
STA: 306+20 TO 309+12
SCALE: 1" = 1'



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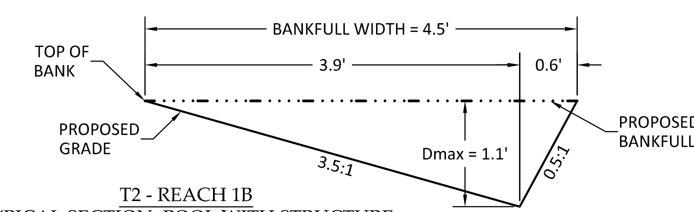
TYPICAL SECTION: POOL
STA: 303+63 TO 310+10
SCALE: 1" = 1'



T2 - REACH 1B
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 303+63 TO 310+10
SCALE: 1" = 1'

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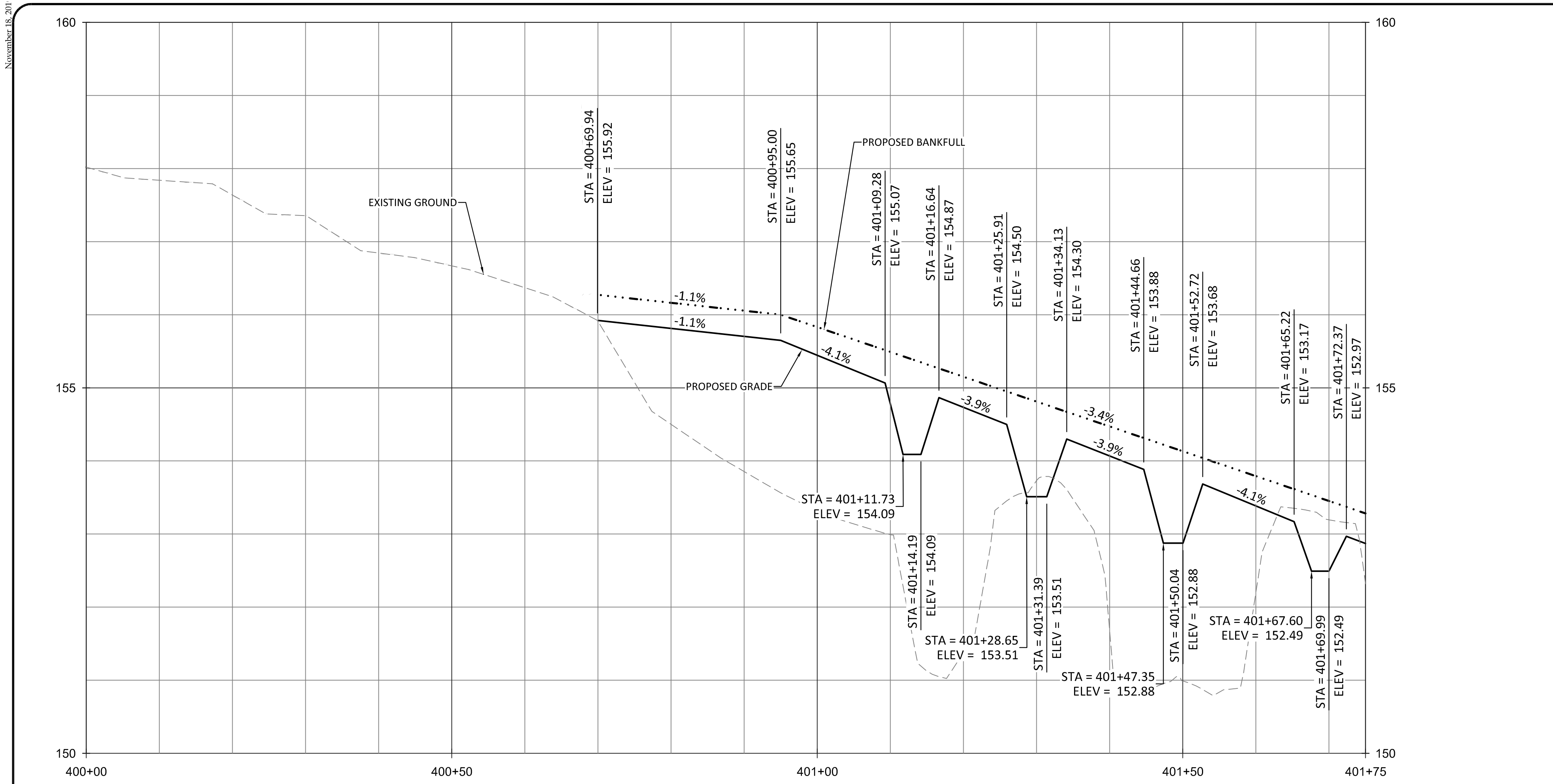

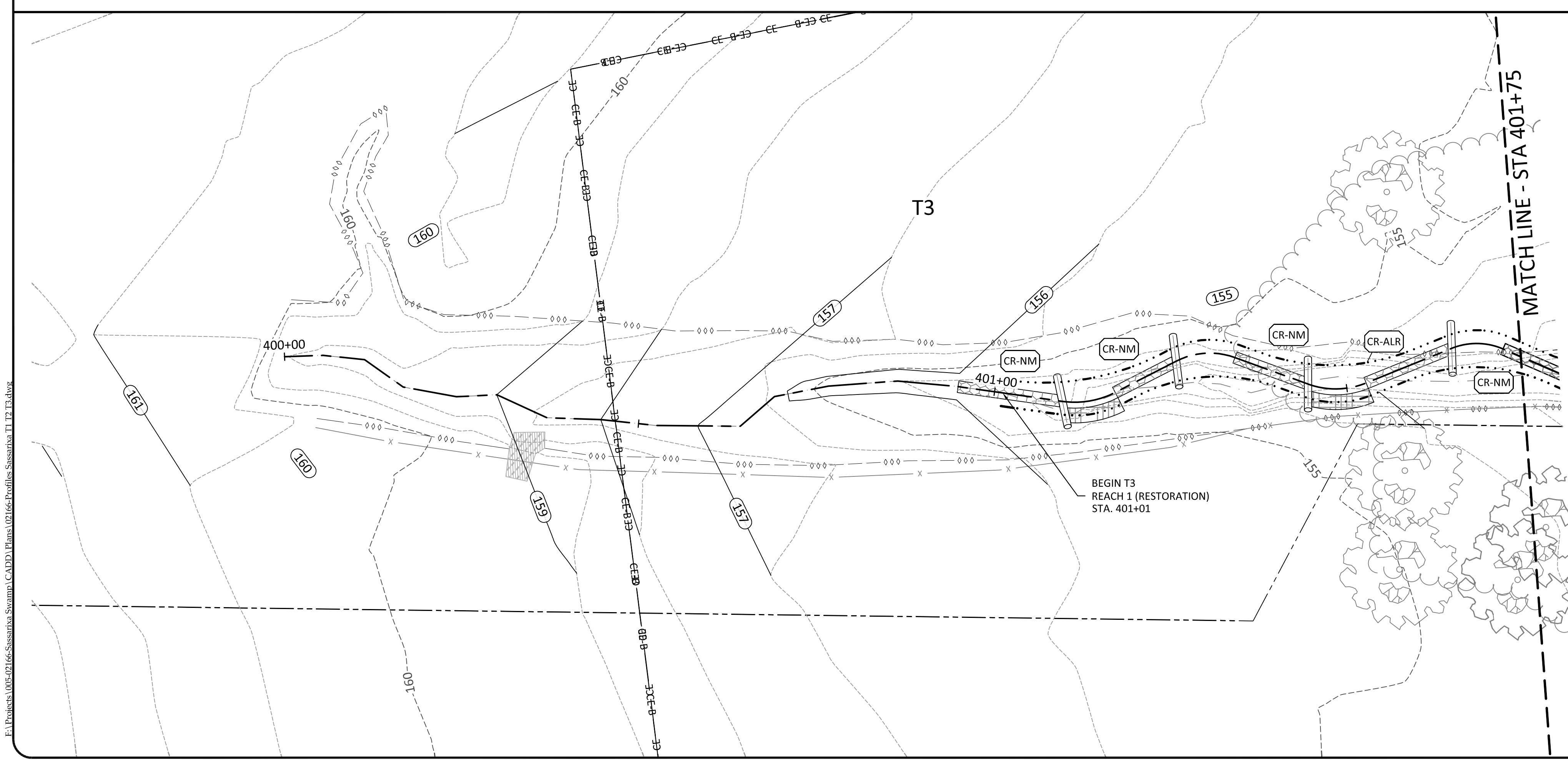

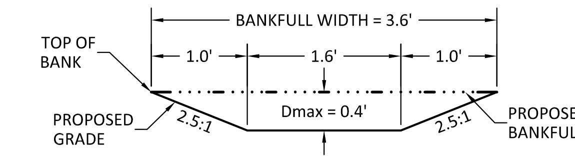

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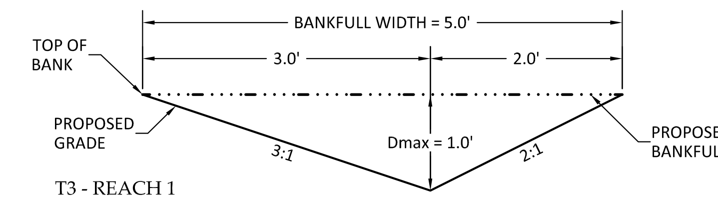
SCALE: 1" = 1'



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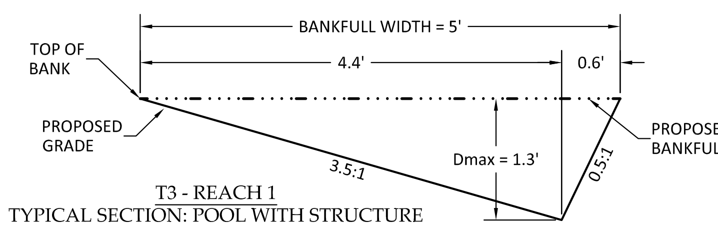

T3 - REACH 1
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 401+01 TO 411+54
SCALE: 1" = 1'

0' 1' 2' 3' (VERTICAL)
0' 10' 20' 30' (HORIZONTAL)

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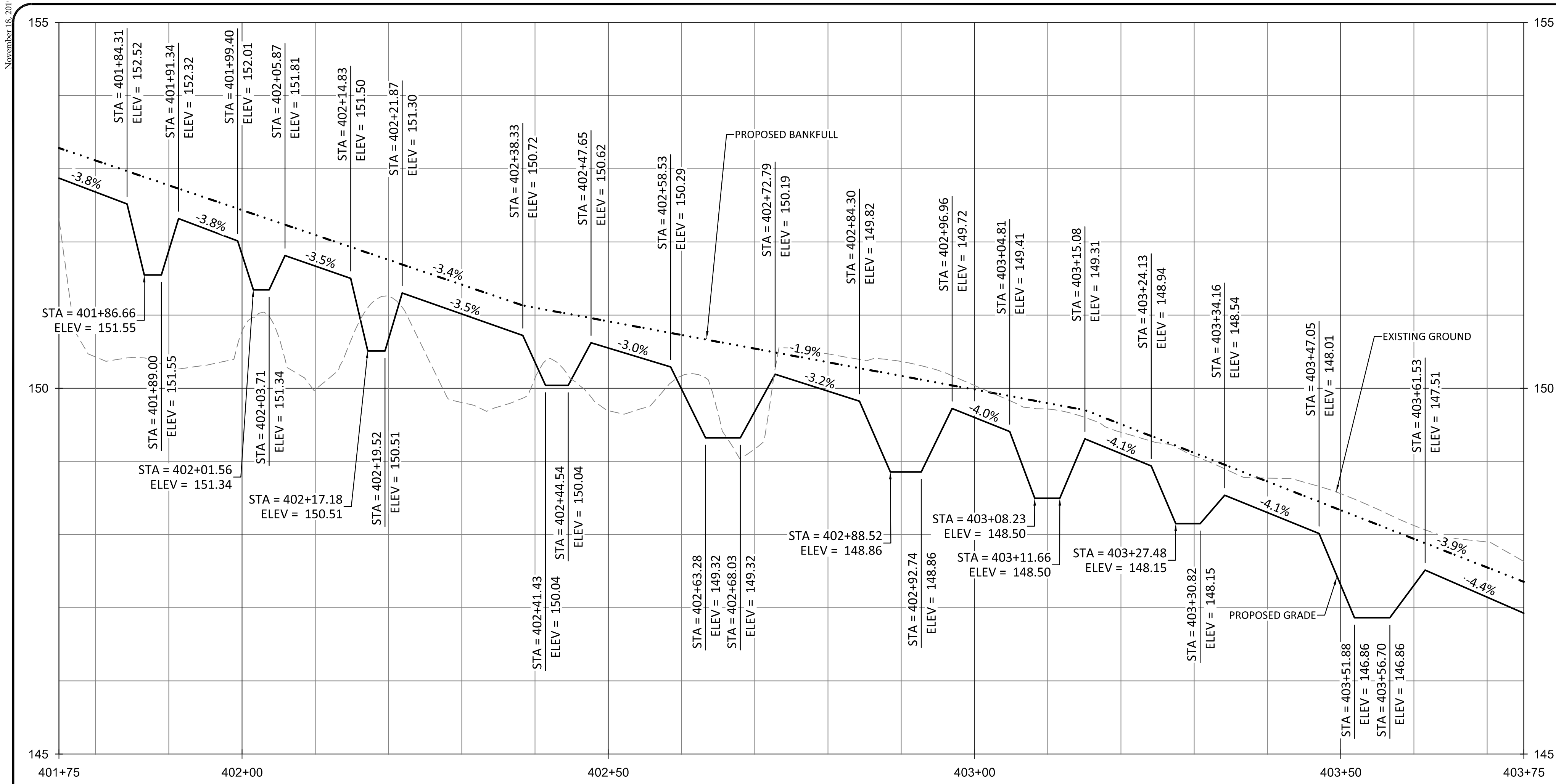

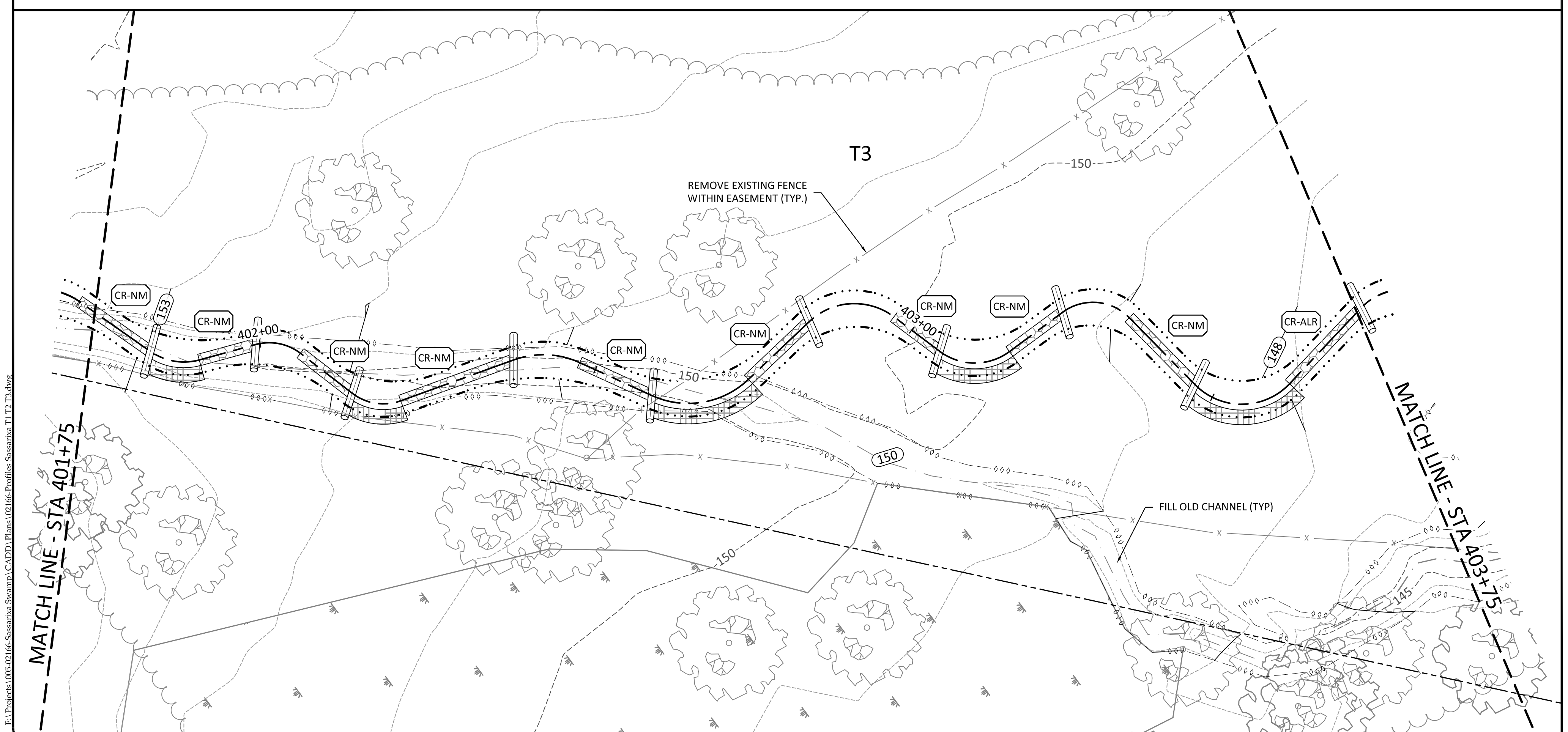

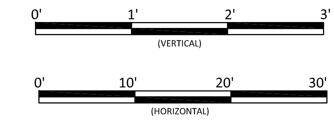

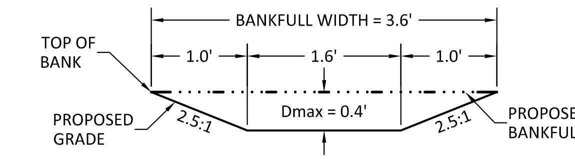

T3 - REACH 1
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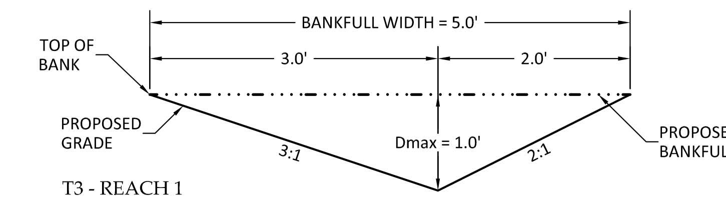
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
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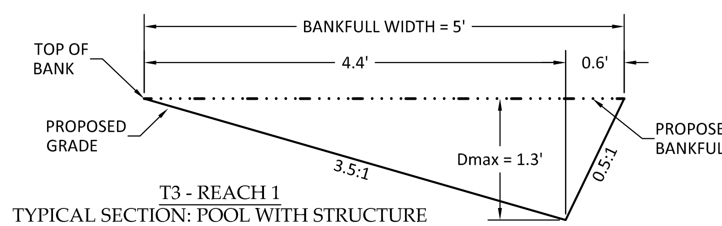
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 401+01 TO 411+54
SCALE: 1" = 1'

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Drawn By:	CAW
Checked By:	ANA

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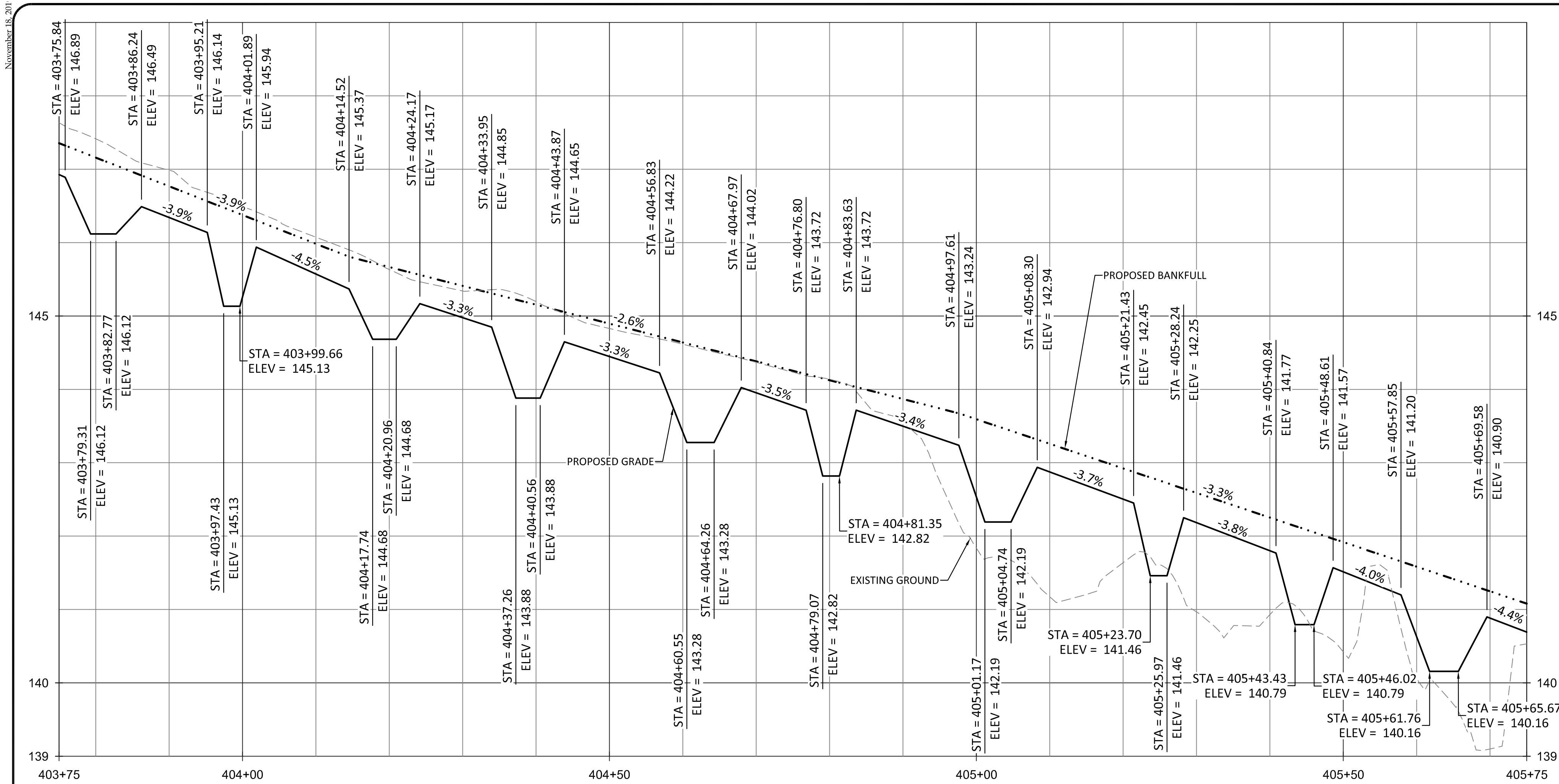

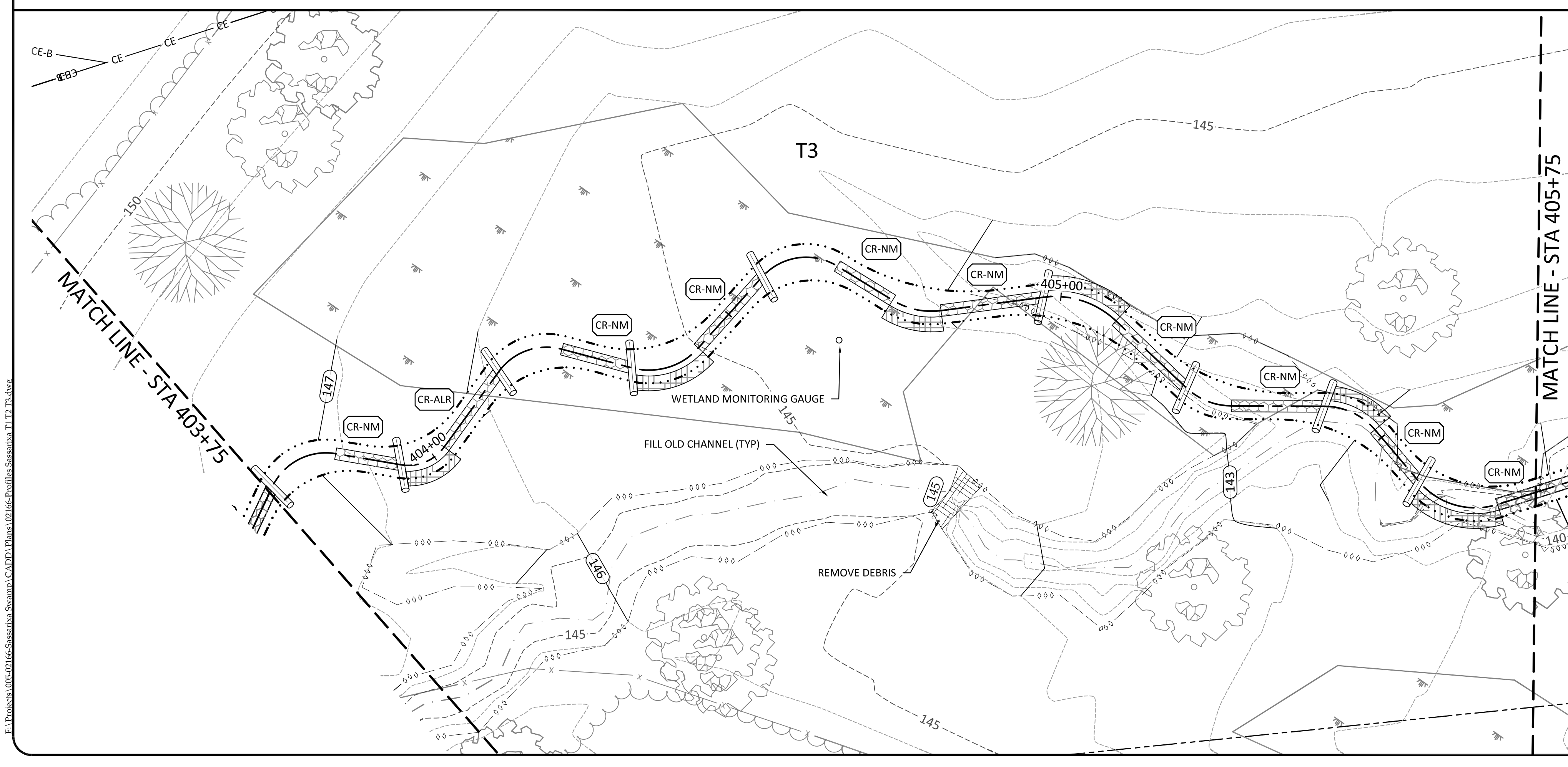

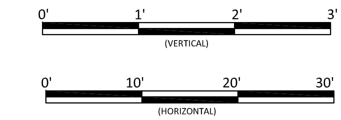

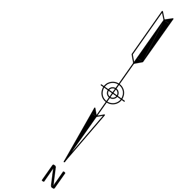

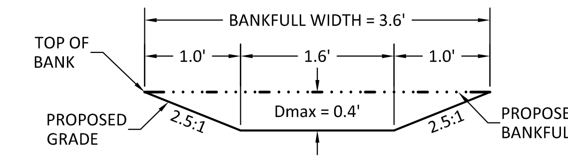

T3 - REACH 1
TYPICAL SECTION: RIFFLE
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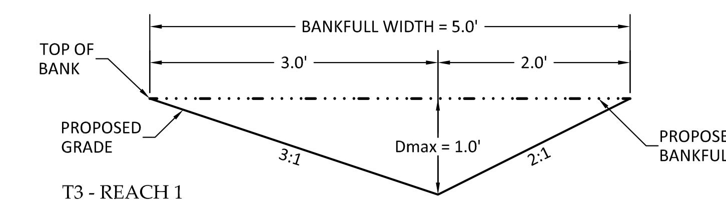

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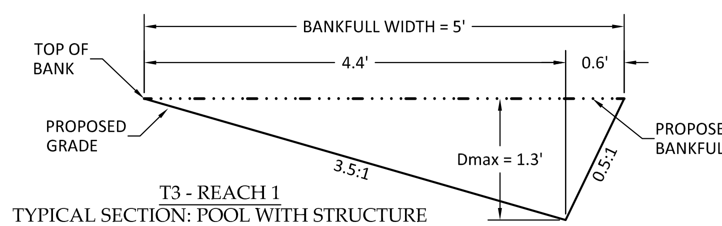

T3 - REACH 1
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 401+01 TO 411+54
SCALE: 1" = 1'

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Stream Plan and Profile

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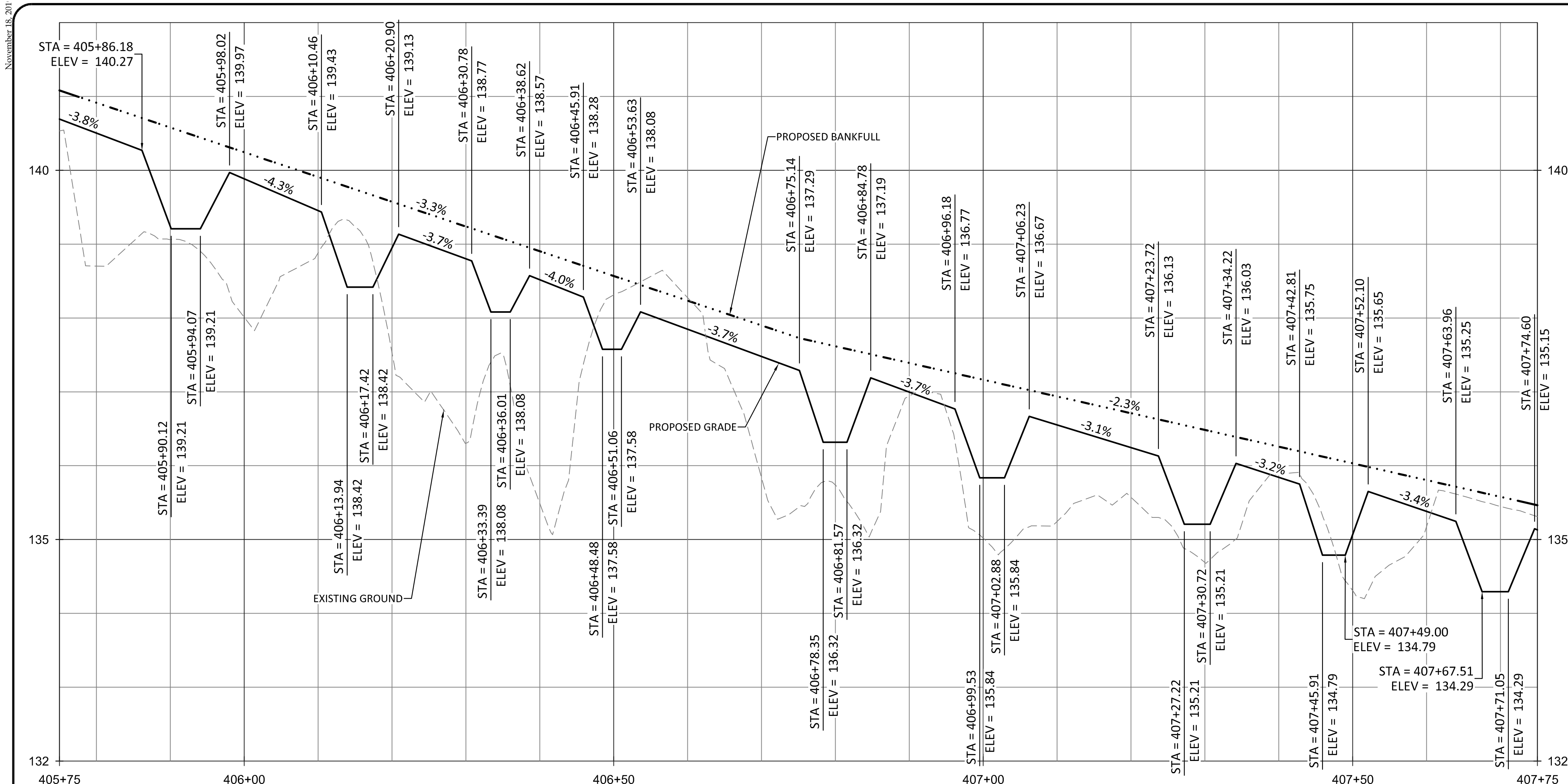
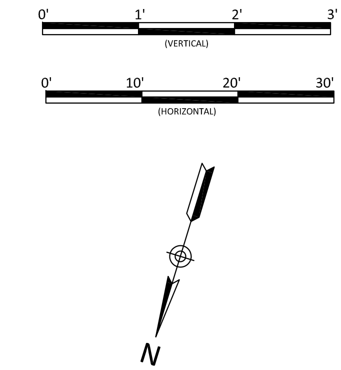
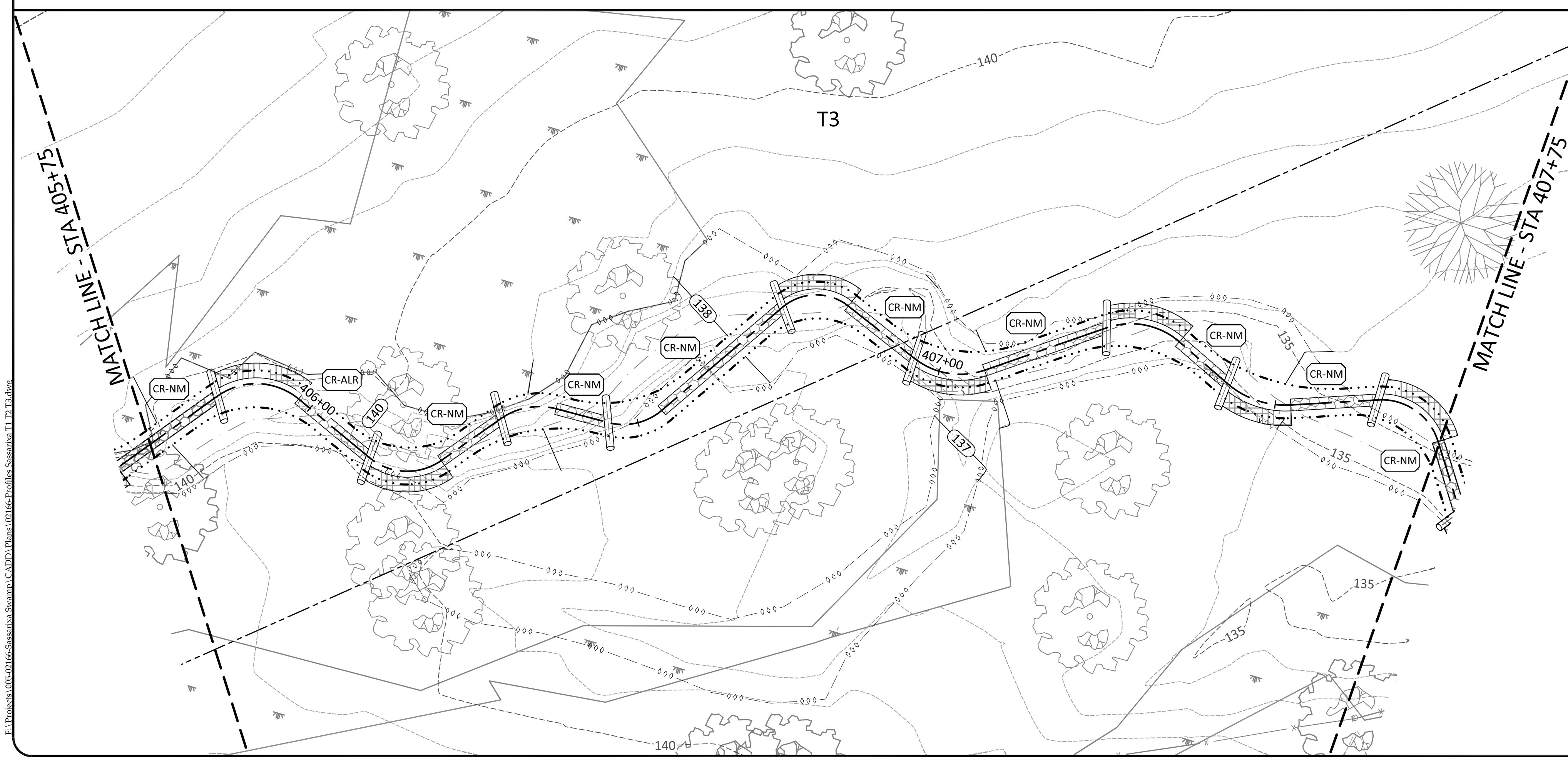
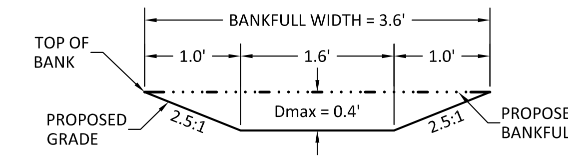
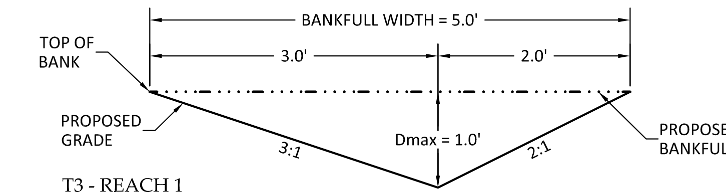




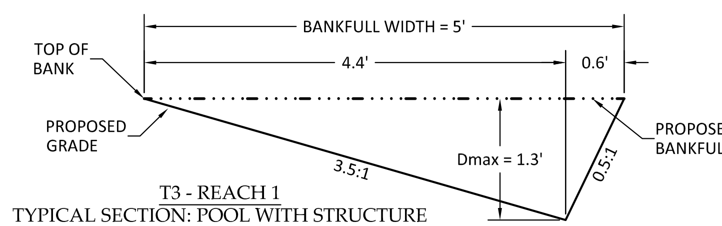




T3 - REACH 1
TYPICAL SECTION: RIFFLE
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 401+01 TO 411+54
SCALE: 1" = 1'

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Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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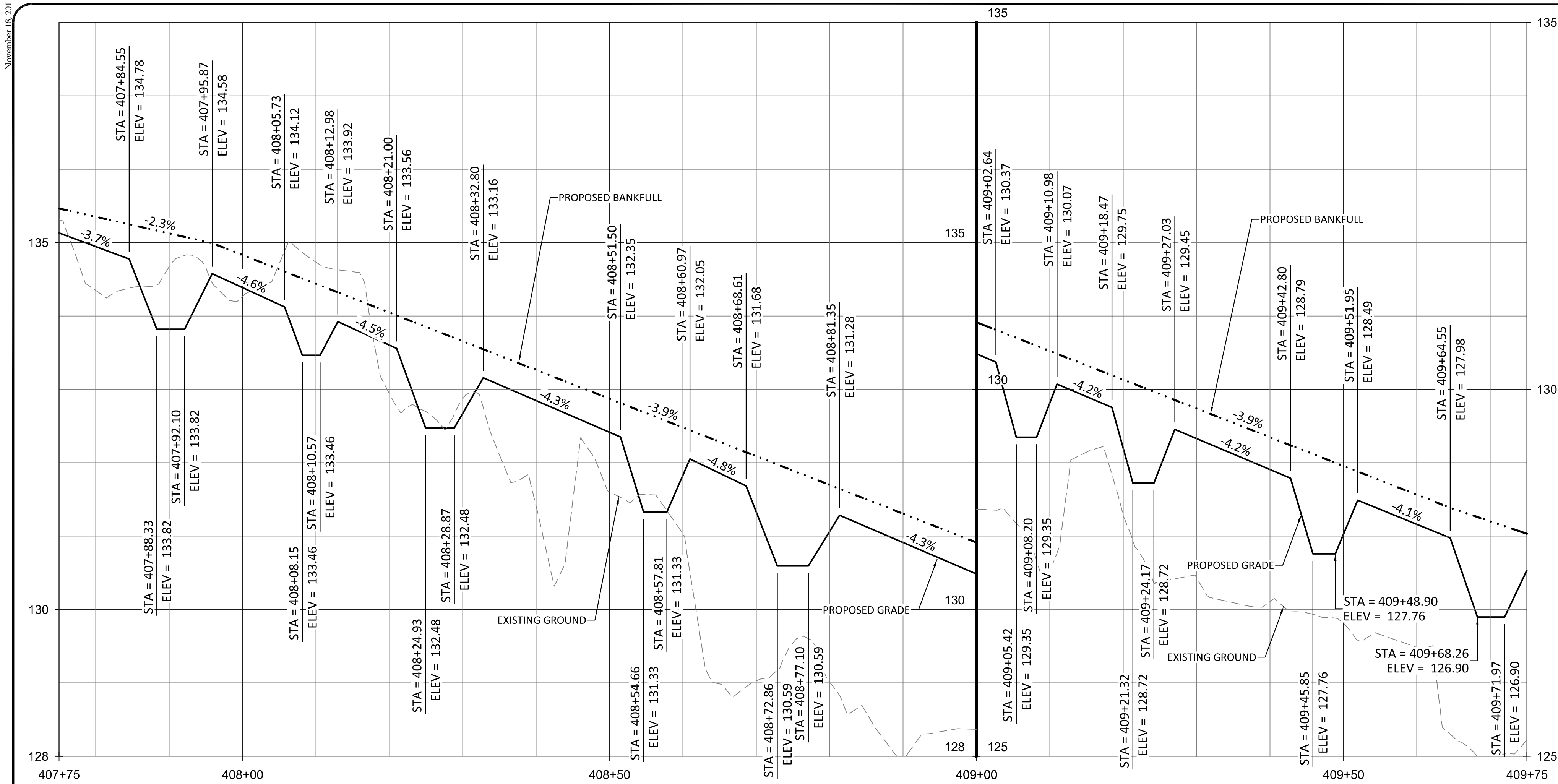
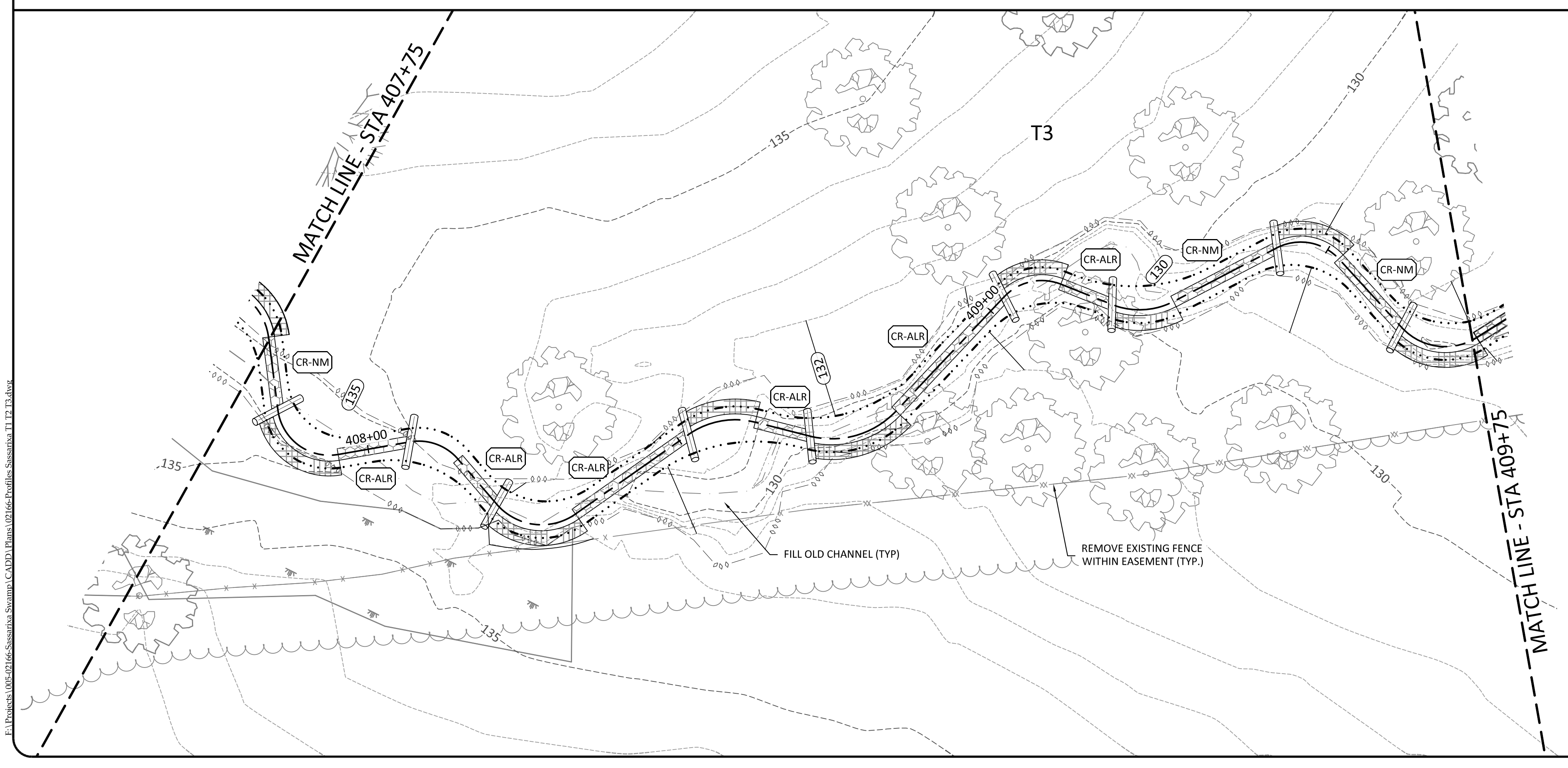
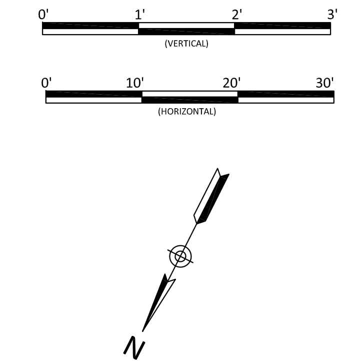
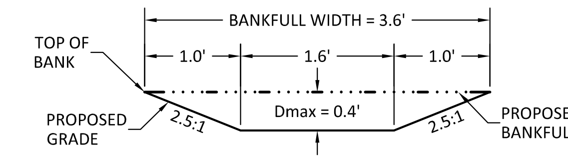
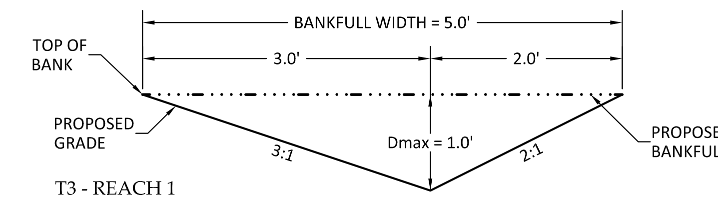




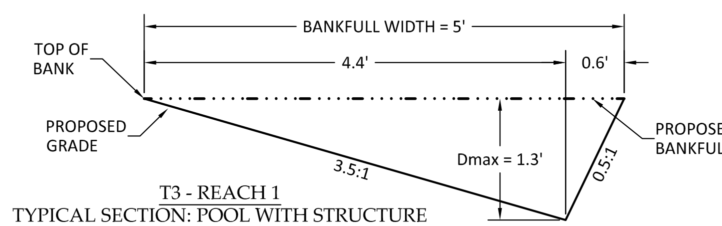




T3 - REACH 1
TYPICAL SECTION: RIFFLE
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 401+01 TO 411+54
SCALE: 1" = 1'

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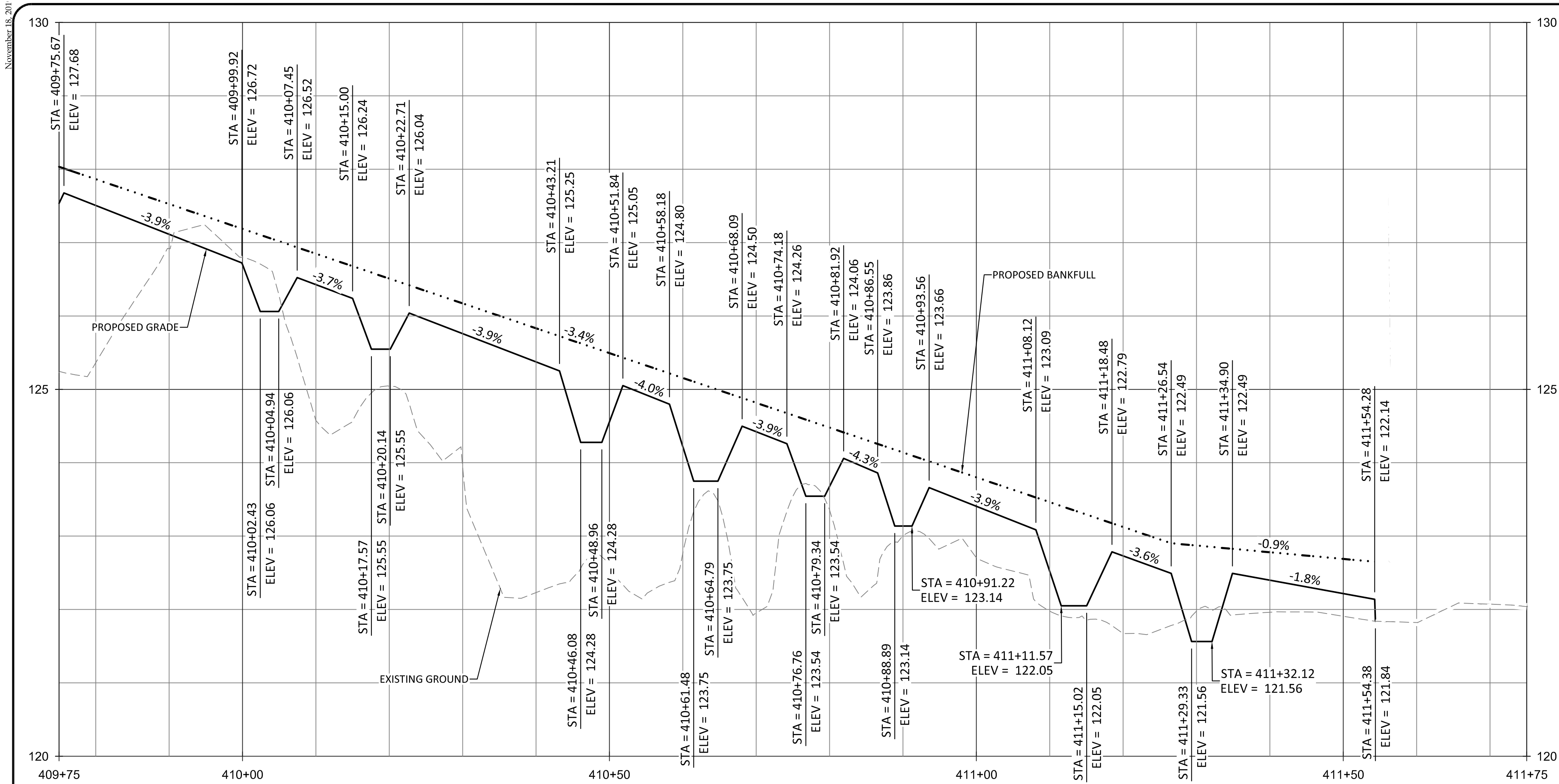
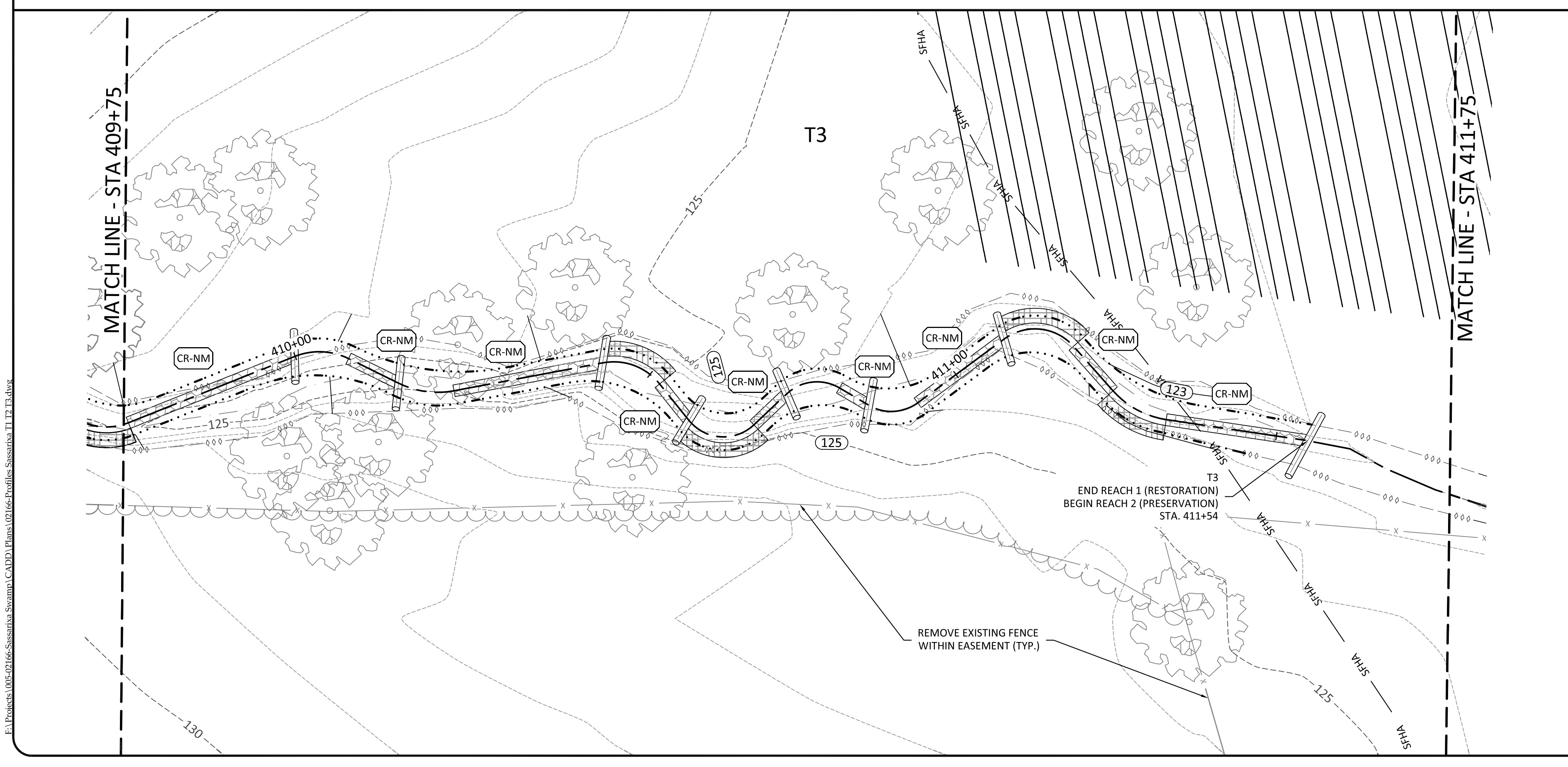
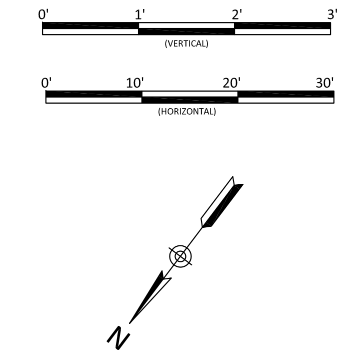
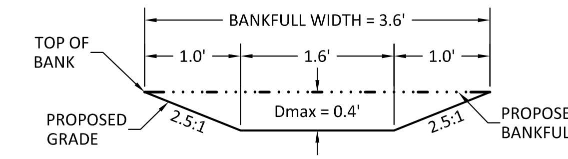
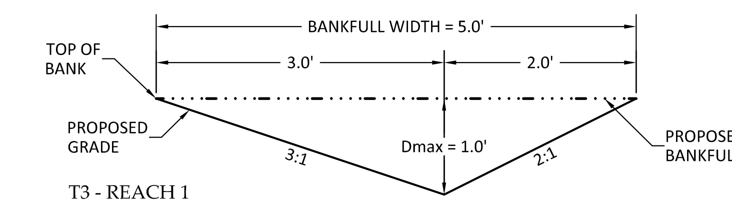




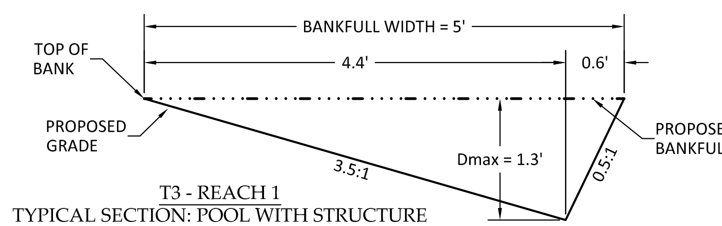




T3 - REACH 1
TYPICAL SECTION: RIFFLE
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL
STA: 401+01 TO 411+54
SCALE: 1" = 1'



T3 - REACH 1
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 401+01 TO 411+54
SCALE: 1" = 1'

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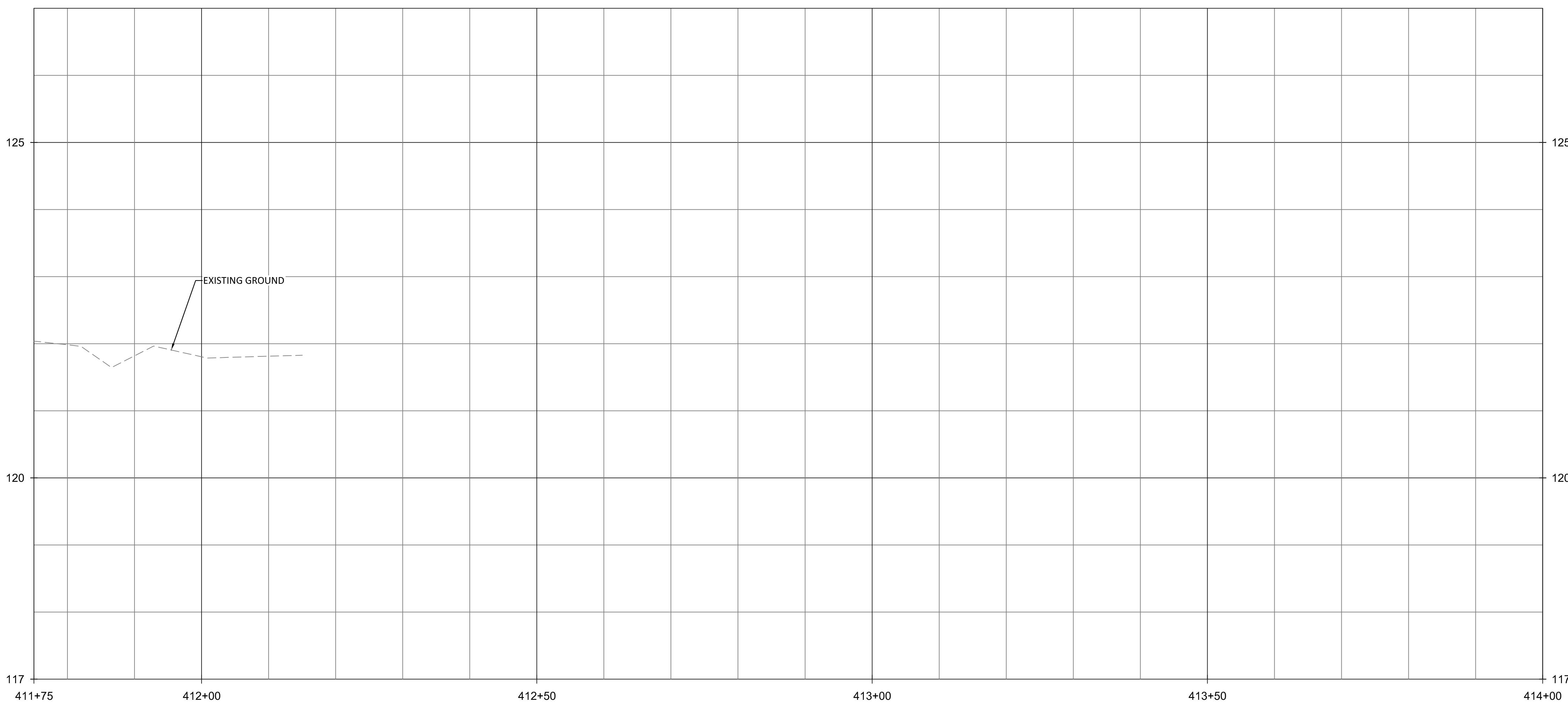

0' 1' 2' 3'
(VERTICAL)
0' 10' 20' 30'
(HORIZONTAL)
N

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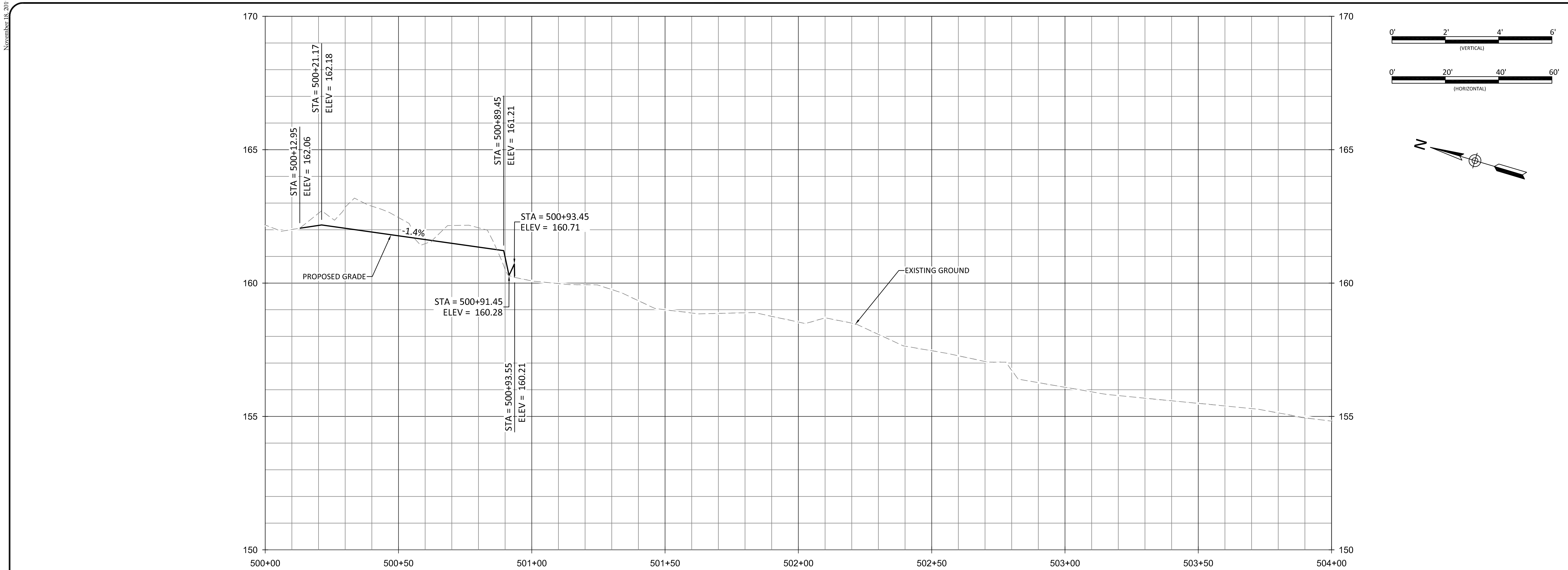

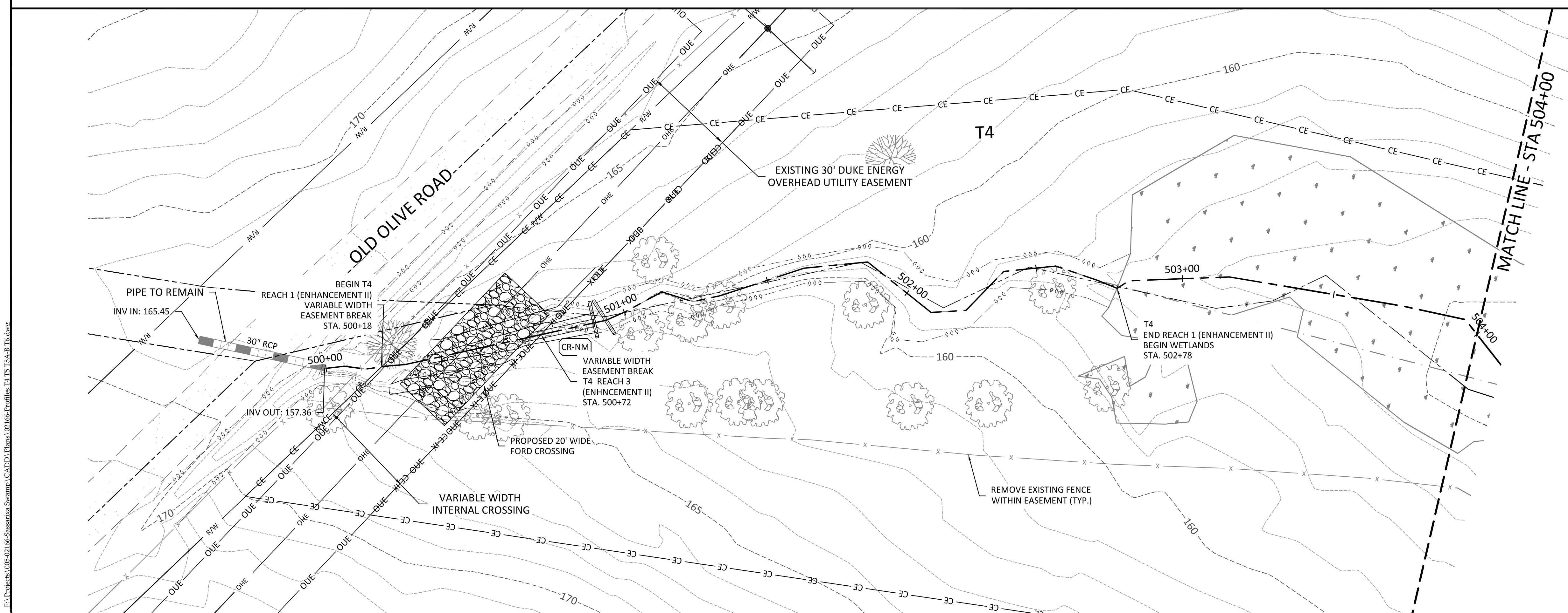

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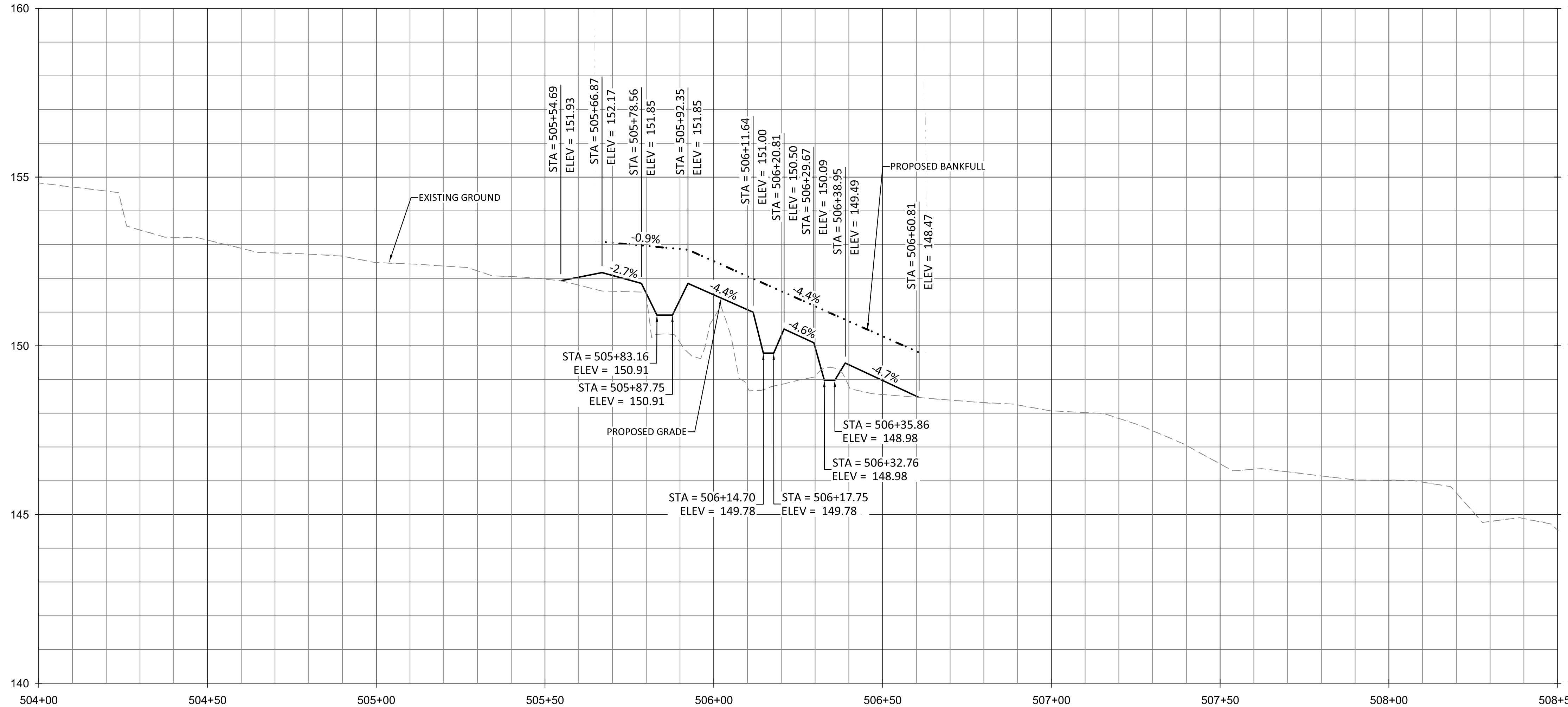

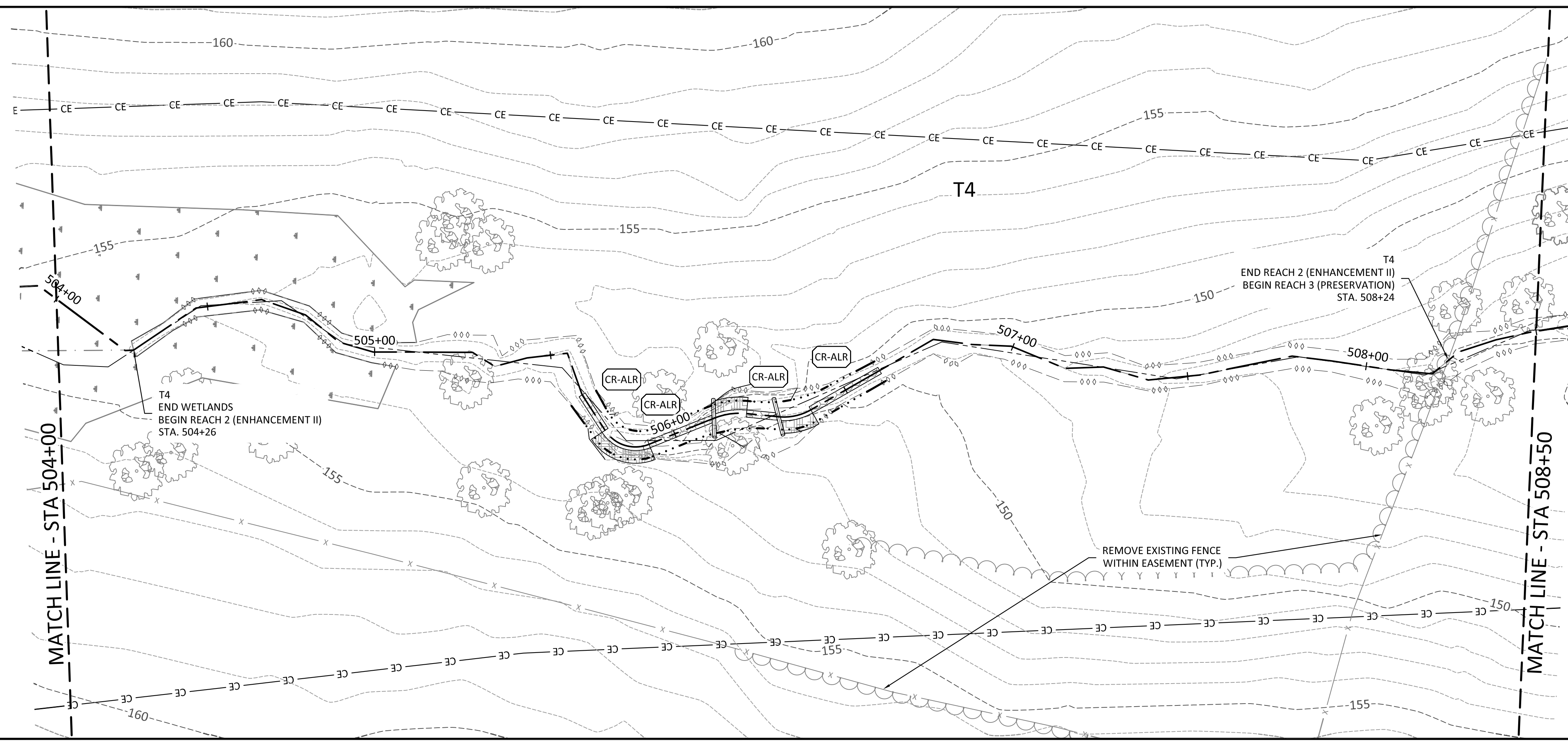

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

N

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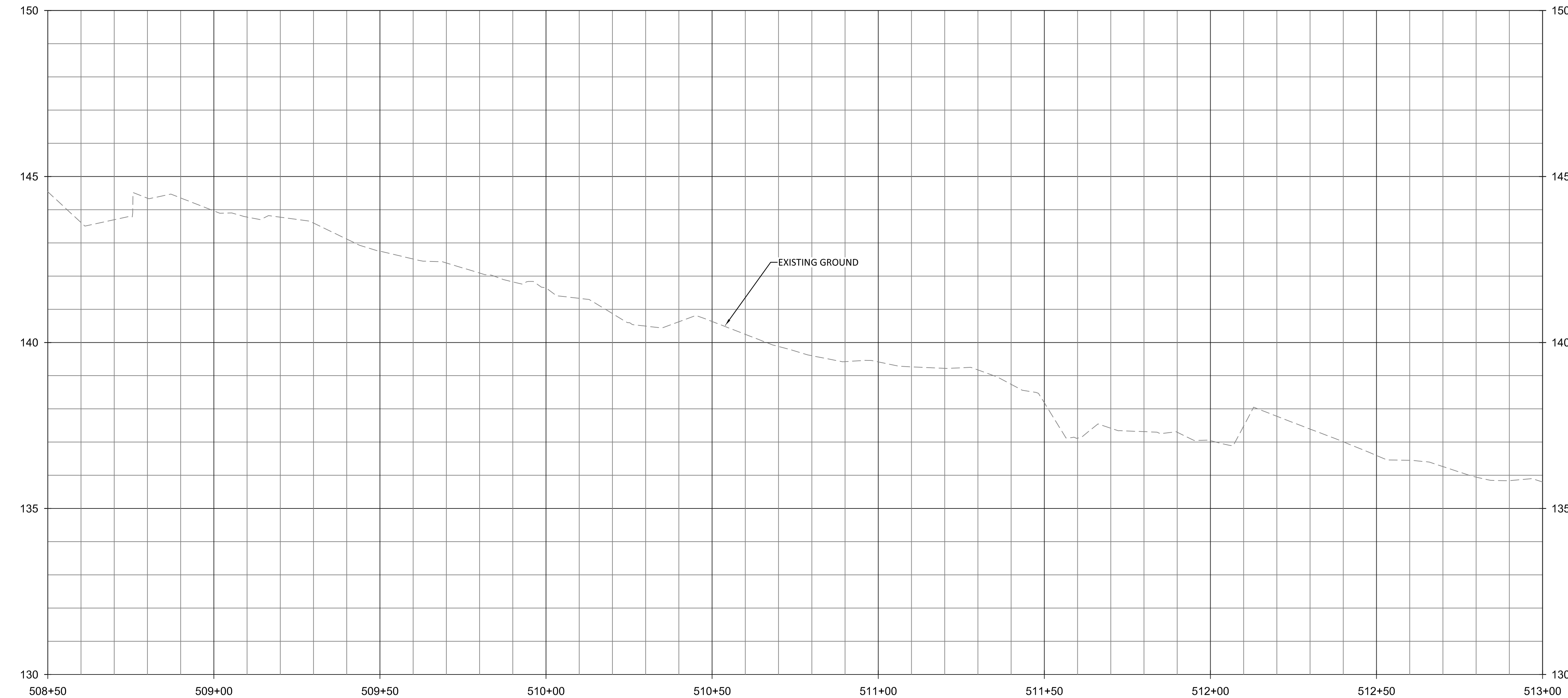

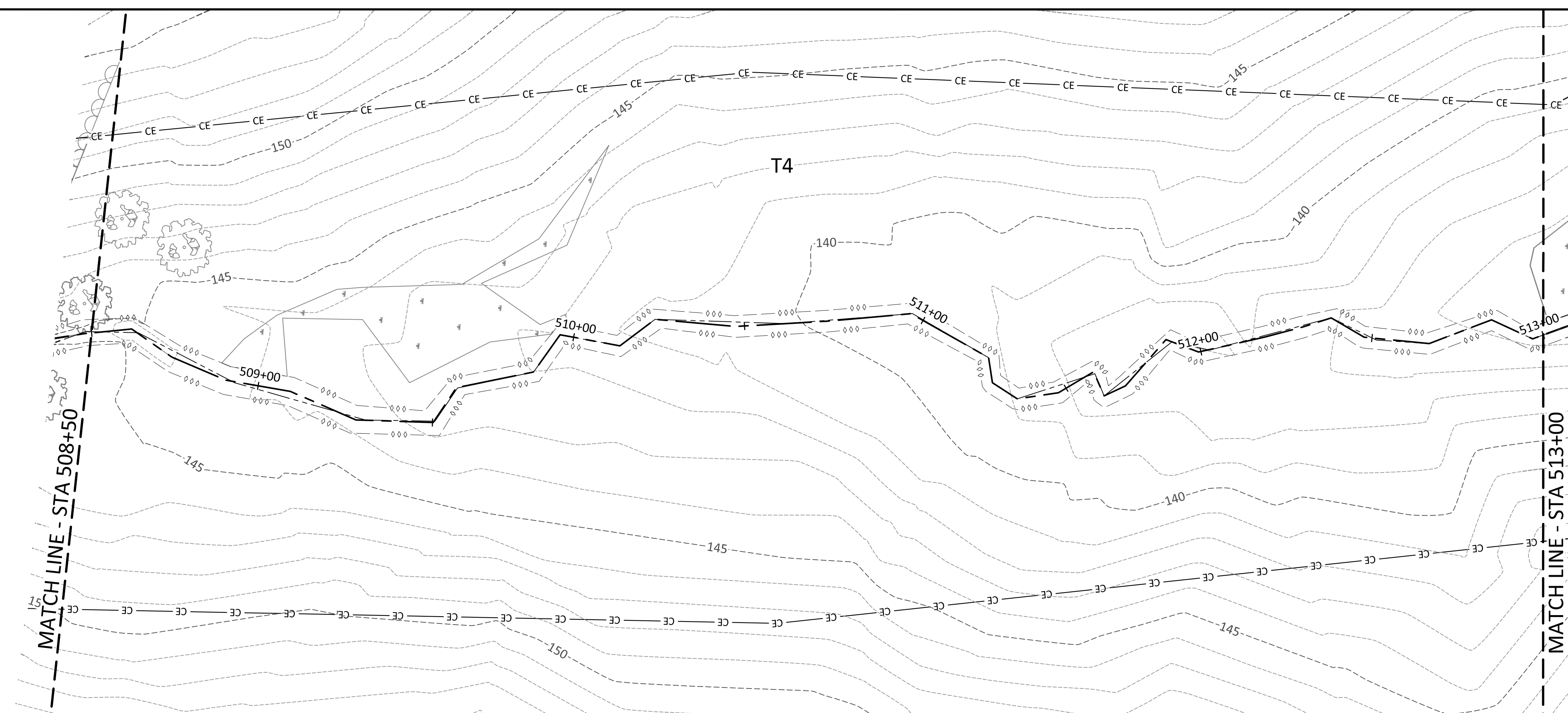

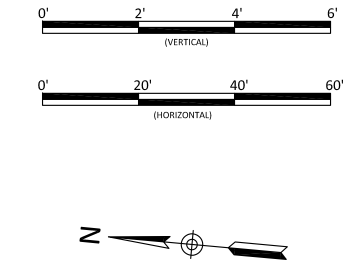

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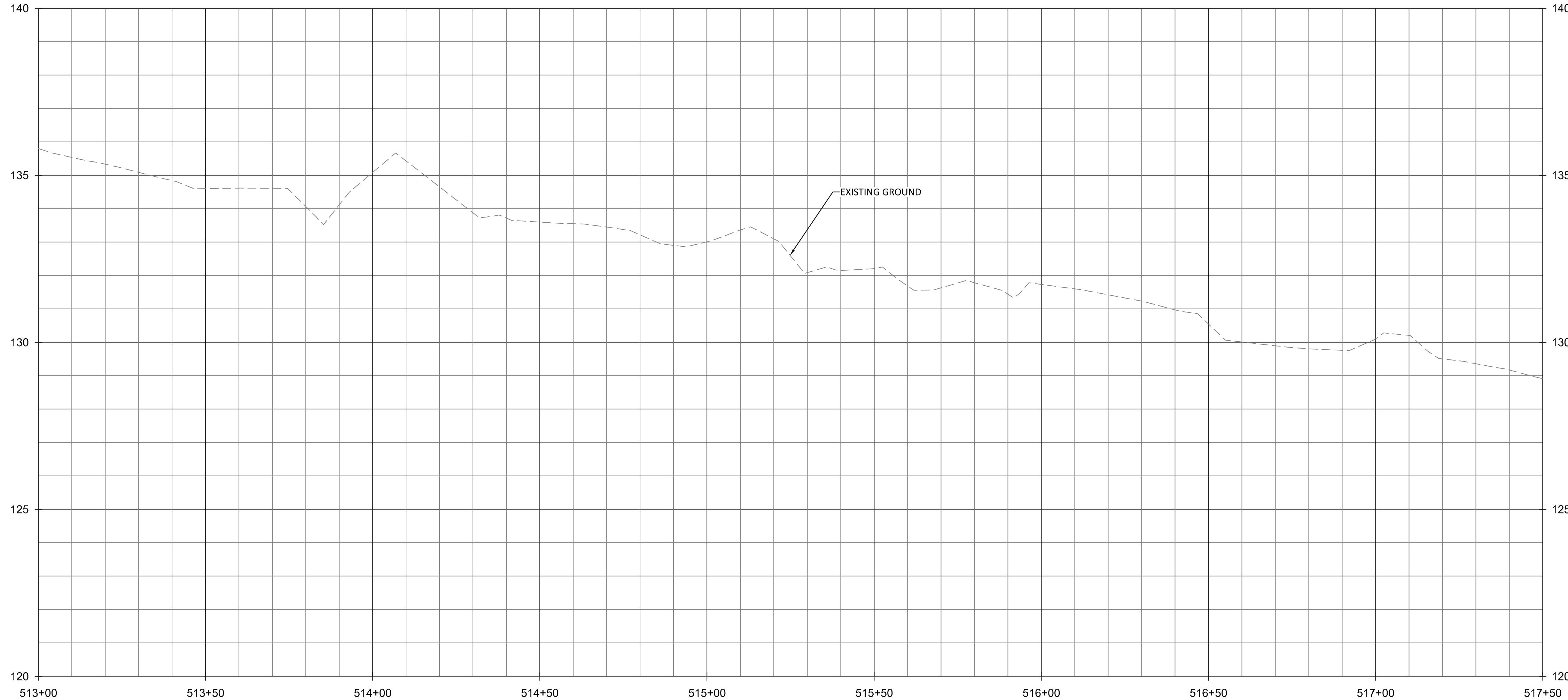

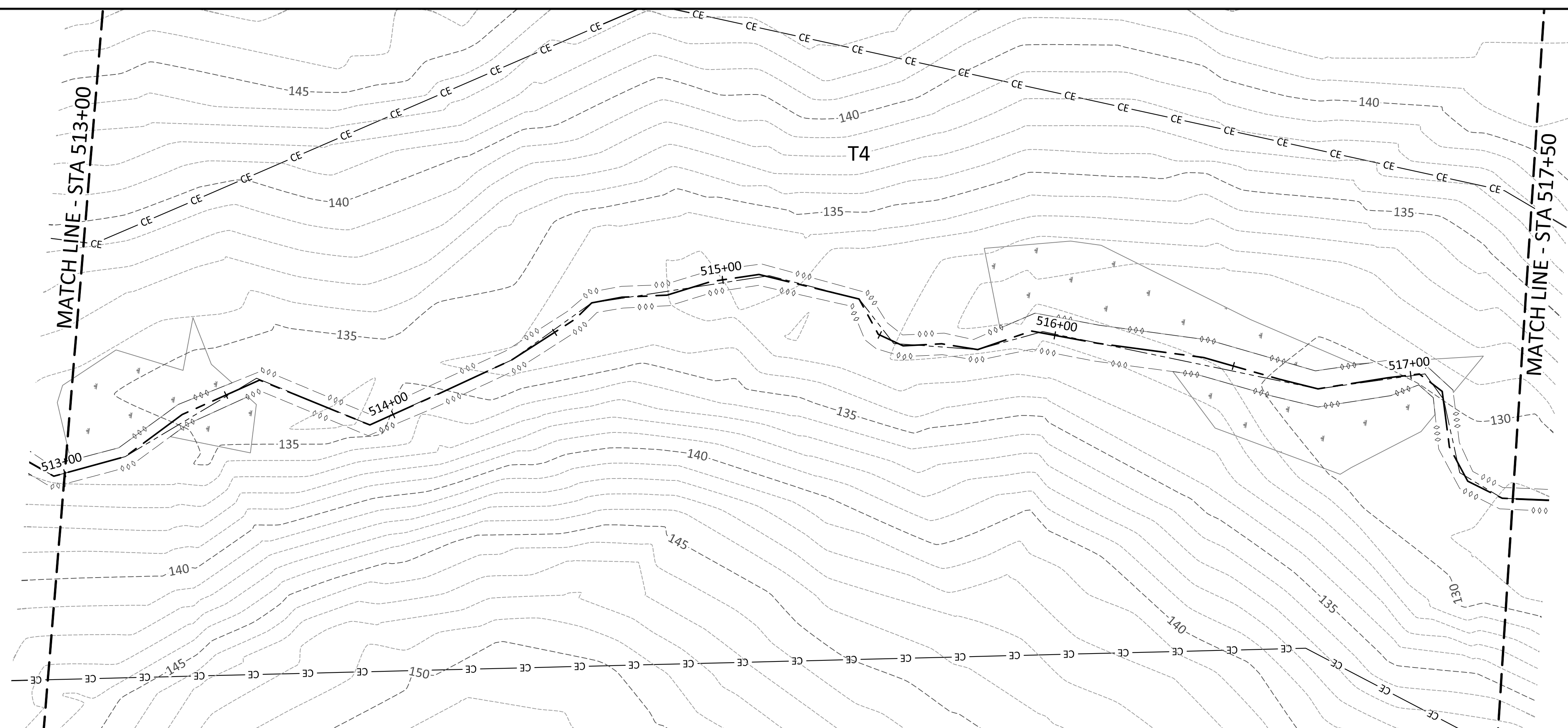

0' 2' 4' 6'
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

N

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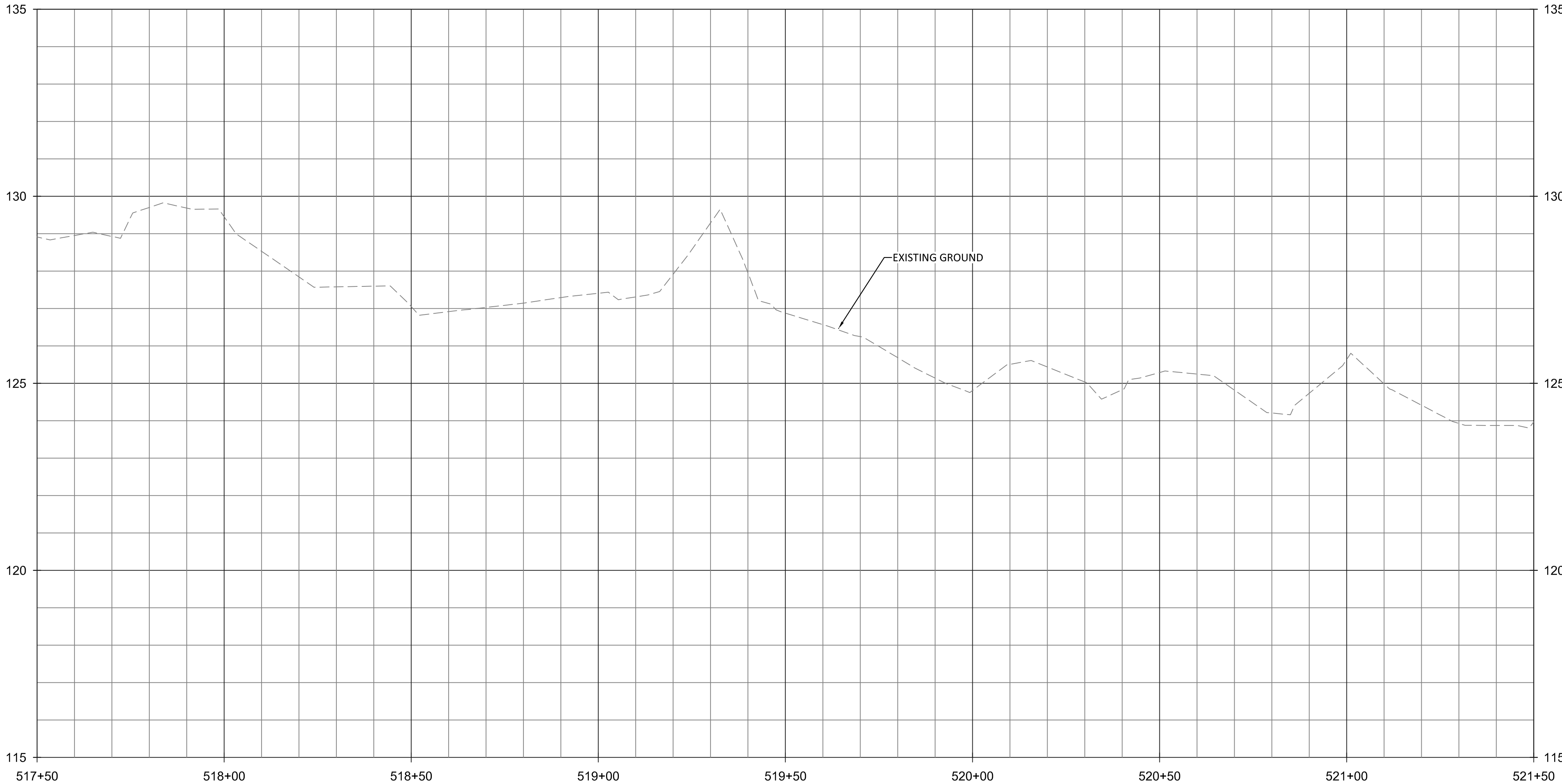

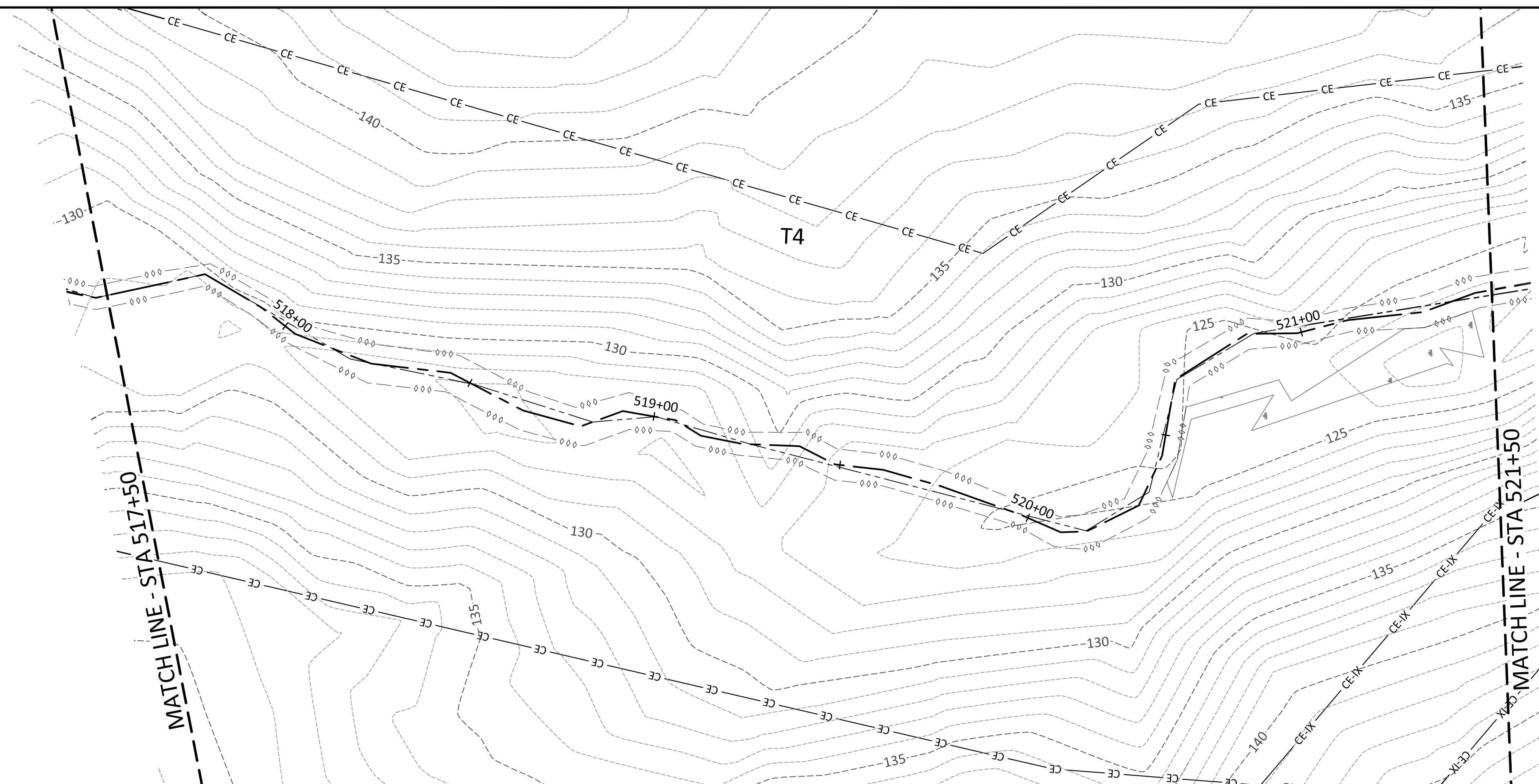

0' 2' 4' 6'
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

N

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Drawn By: CAW
Checked By: ANA

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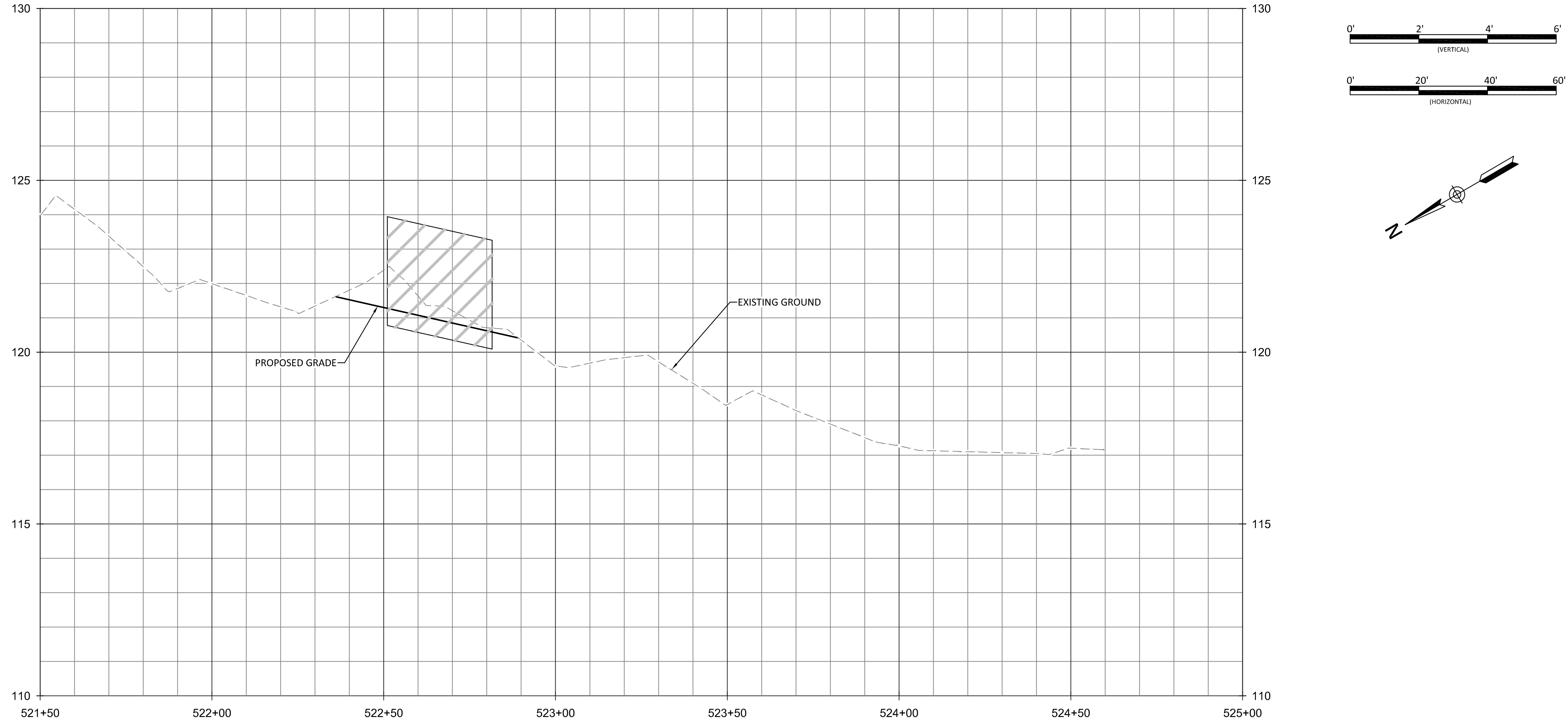

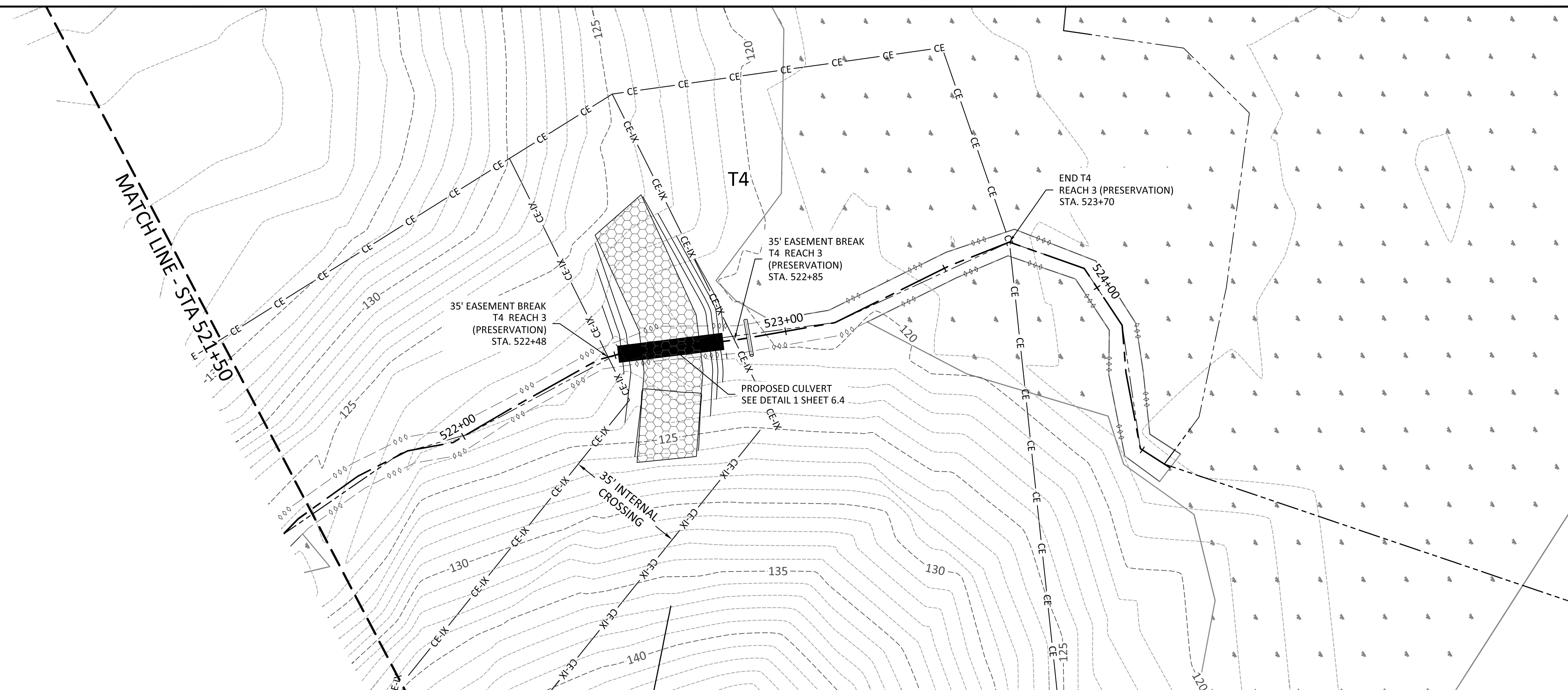

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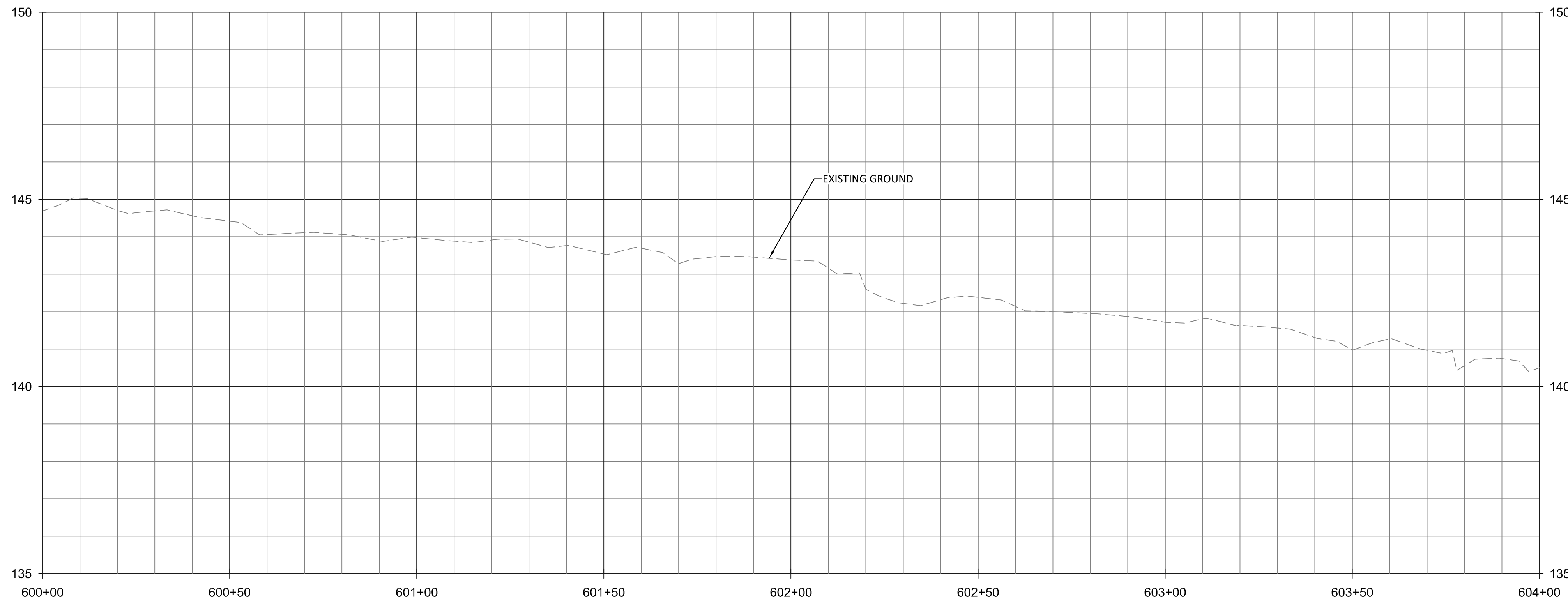
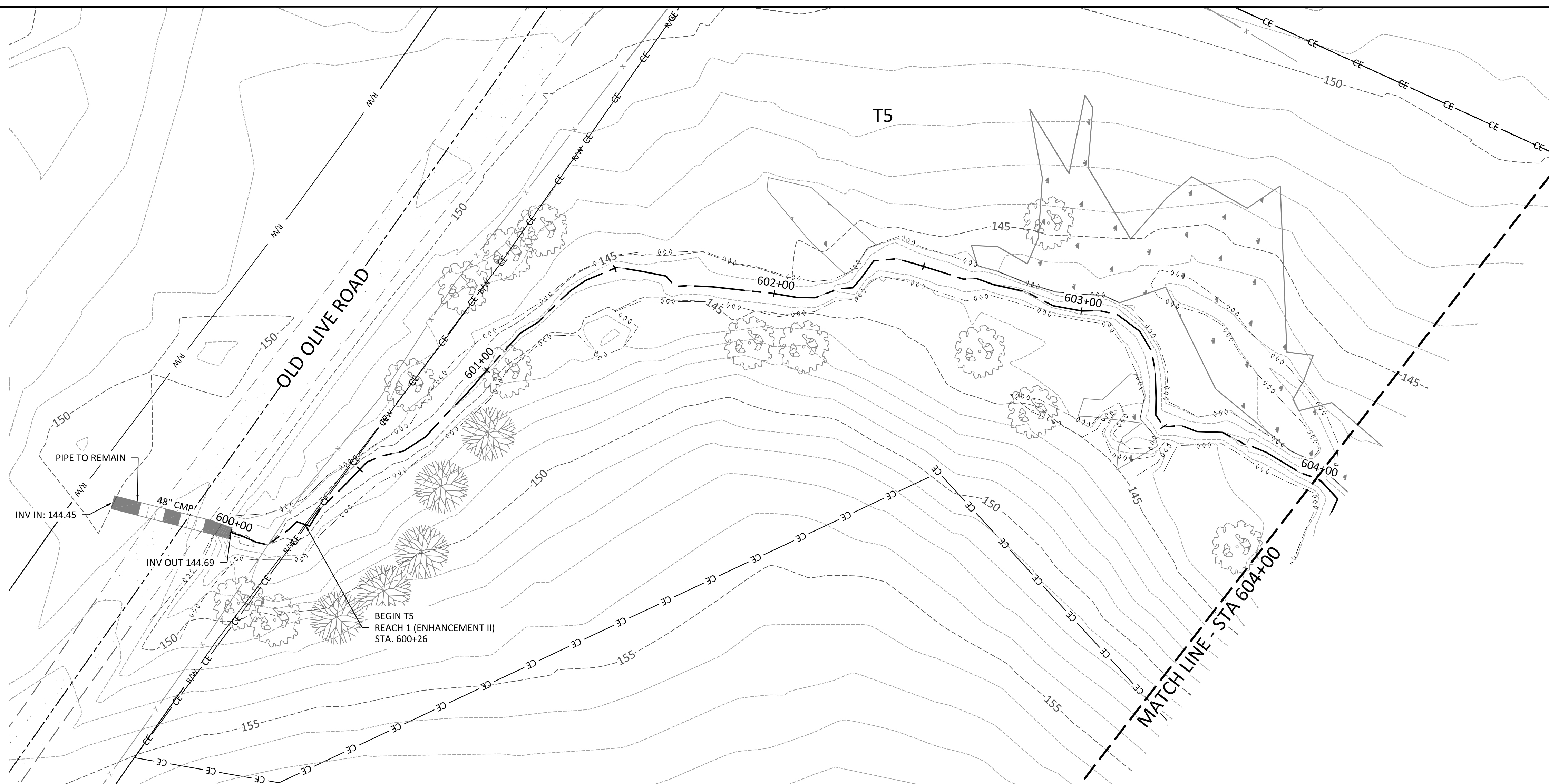


0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

N



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Checked By:	ANA

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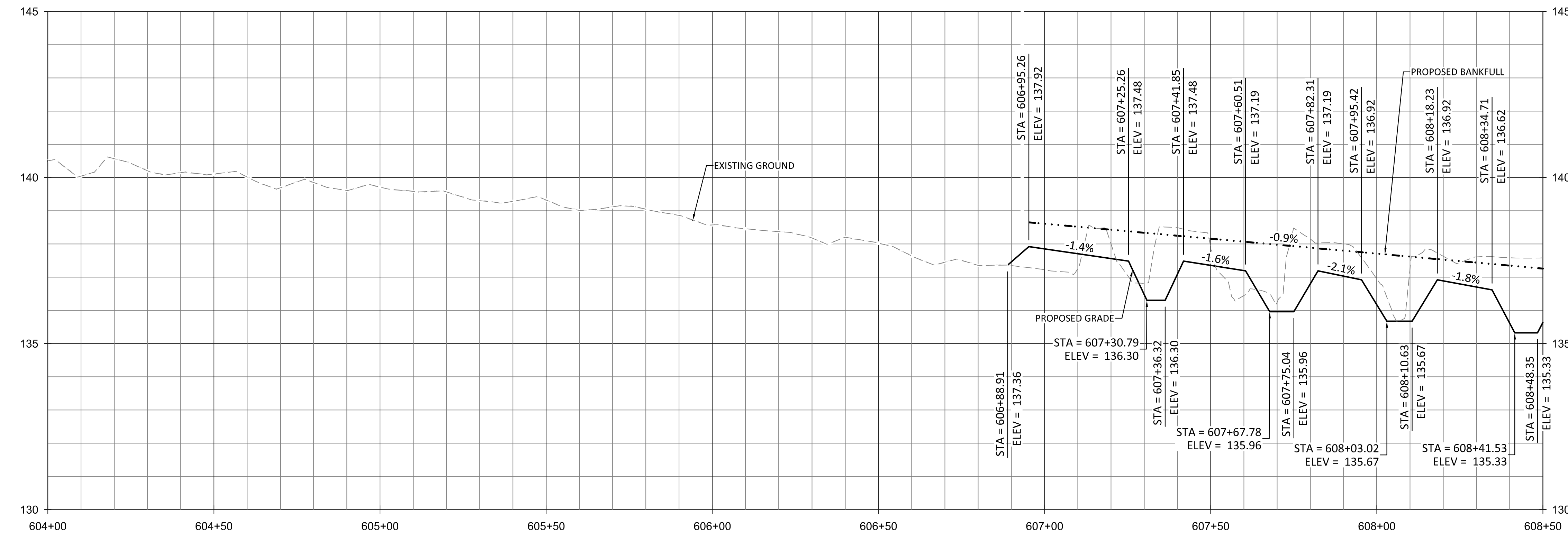
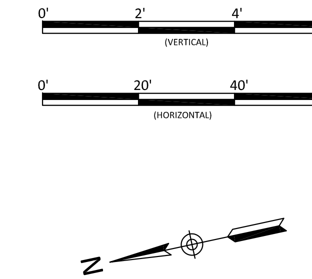
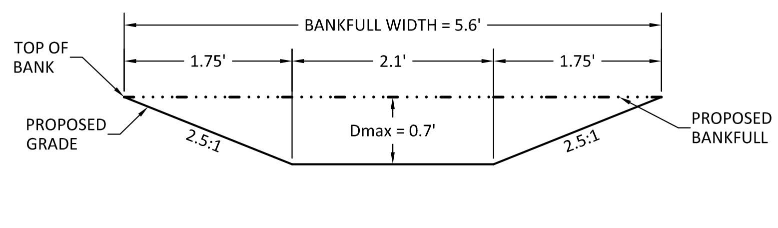
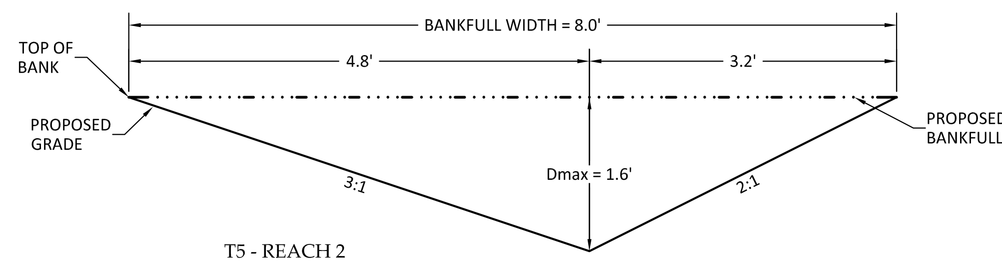


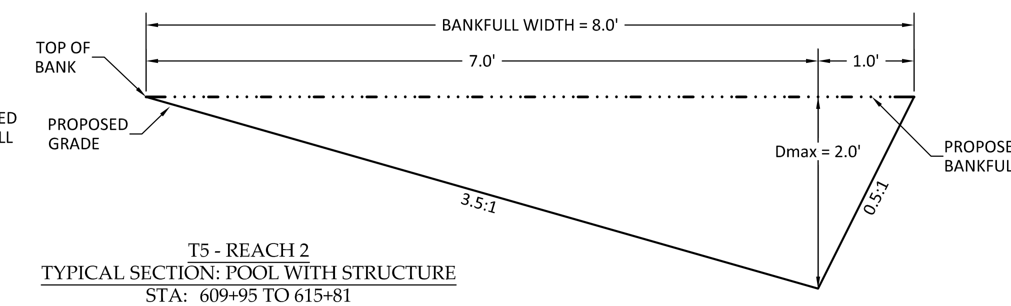




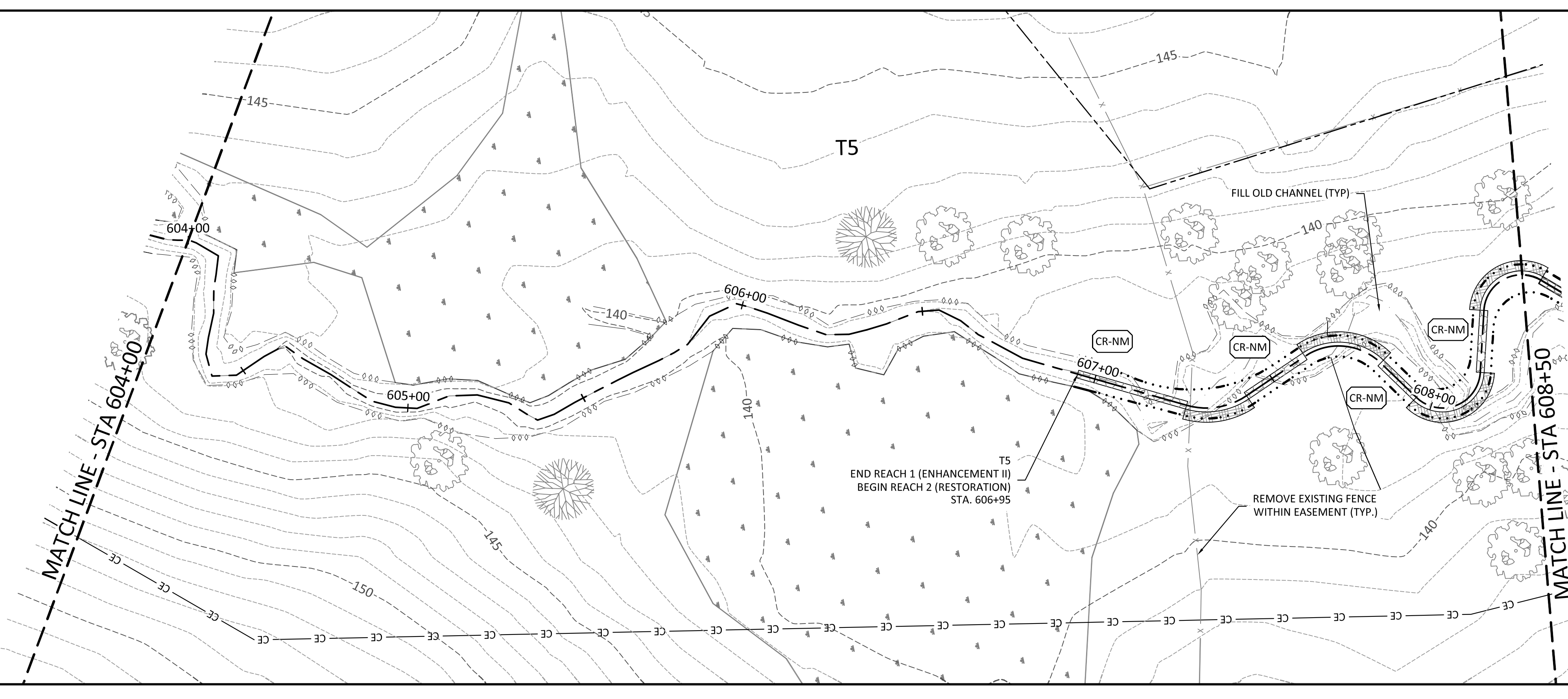
T5 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 609+95 TO 615+81
SCALE: 1" = 1'



T5 - REACH 2
TYPICAL SECTION: POOL
STA: 609+95 TO 615+81
SCALE: 1" = 1'



T5 - REACH 2
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 609+95 TO 615+81
SCALE: 1" = 1'



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Drawn By:	CAW
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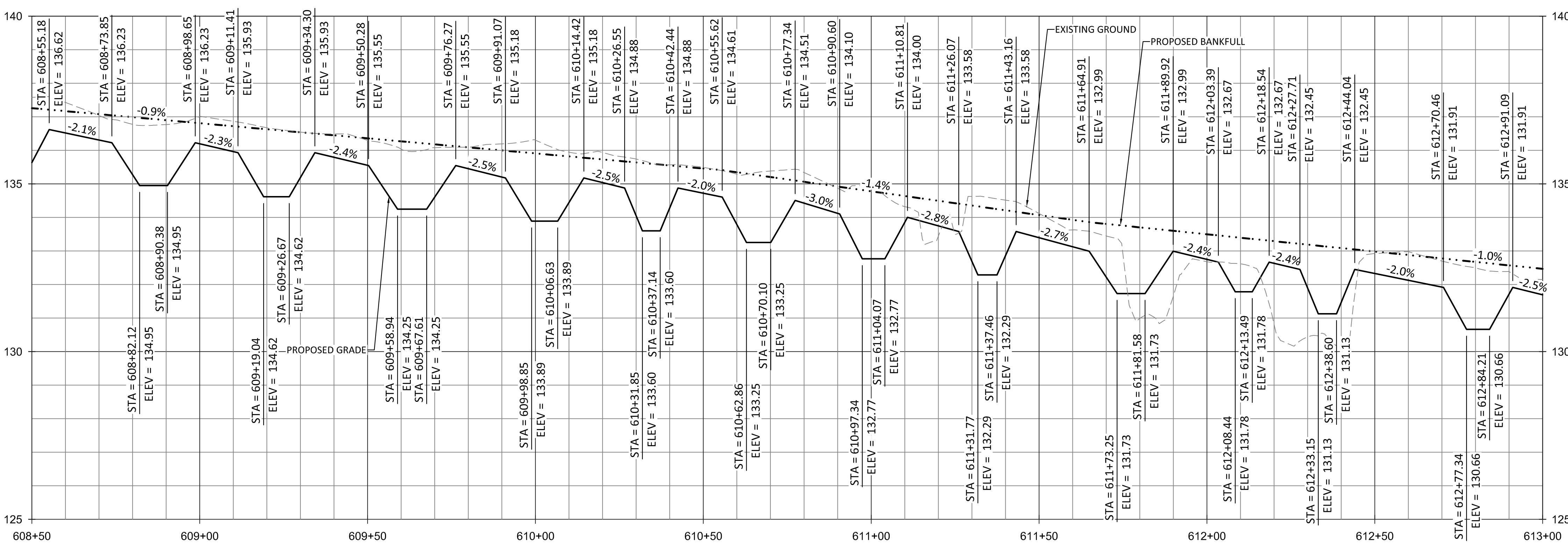
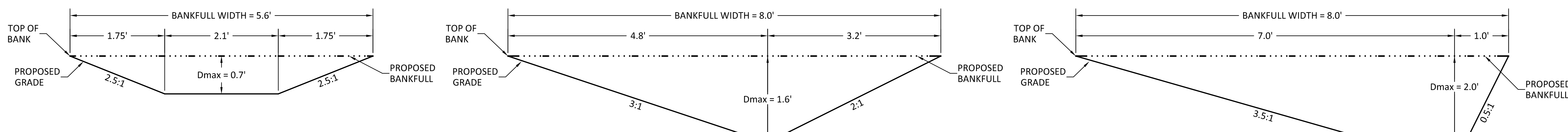
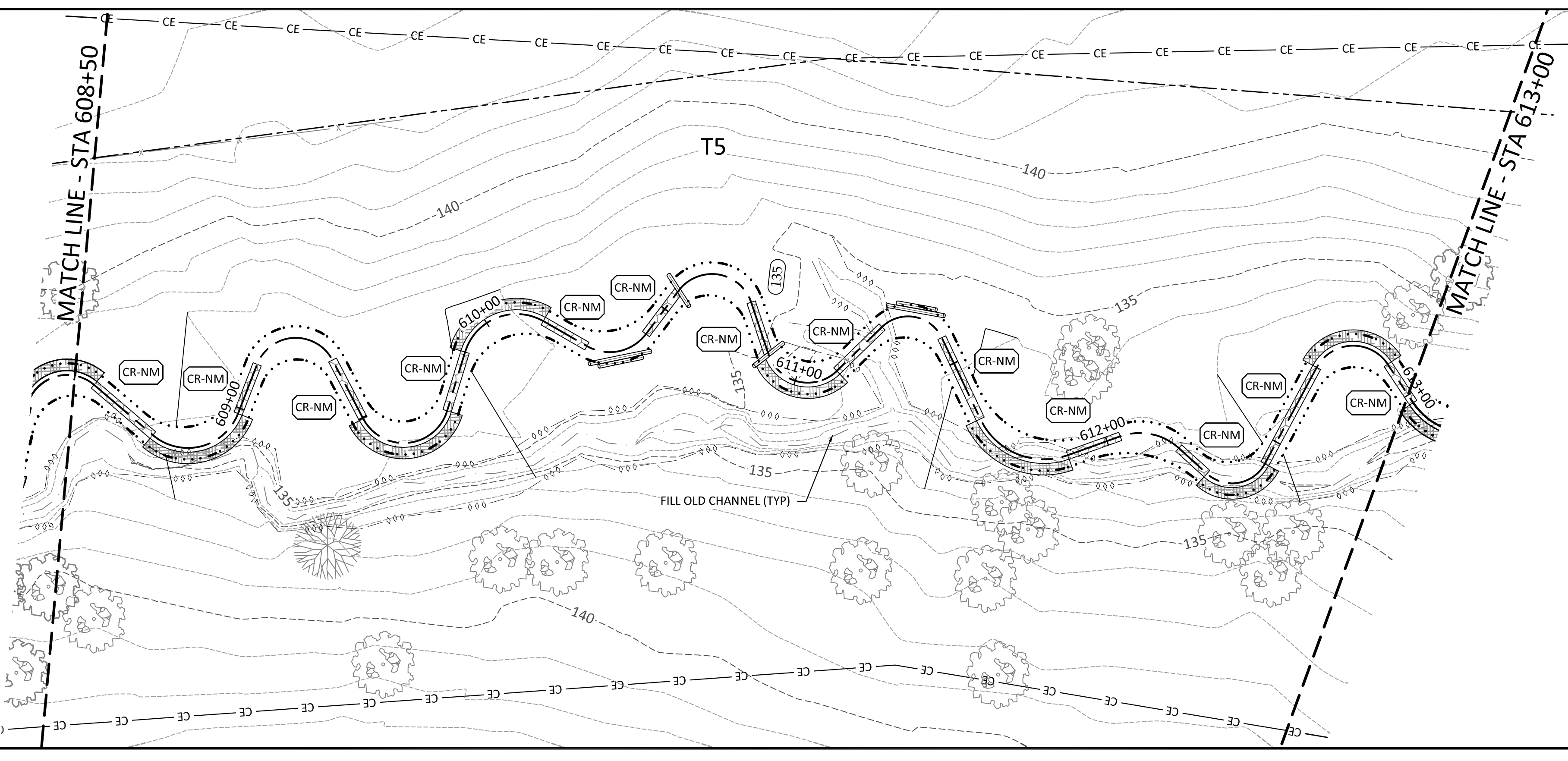




T5 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 609+95 TO 615+81
SCALE: 1" = 1'

T5 - REACH 2
TYPICAL SECTION: POOL
STA: 609+95 TO 615+81
SCALE: 1" = 1'

T5 - REACH 2
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 609+95 TO 615+81
SCALE: 1" = 1'



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Drawn By:	GAW
Checked By:	ANA

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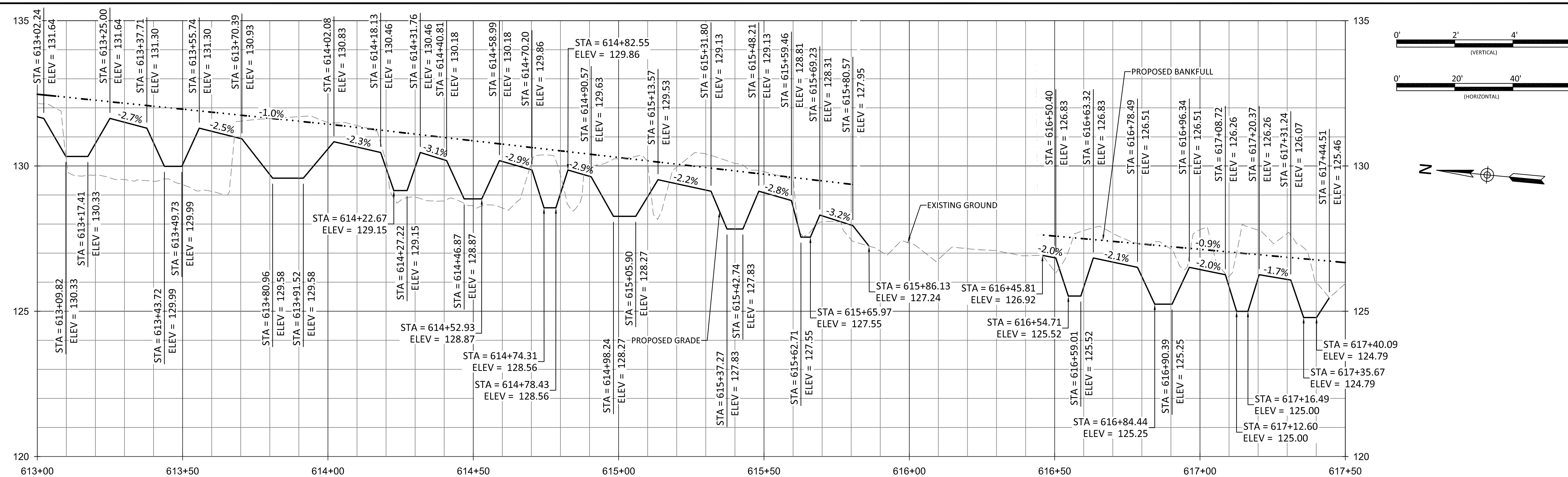
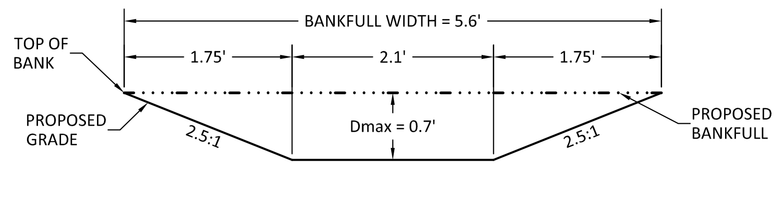
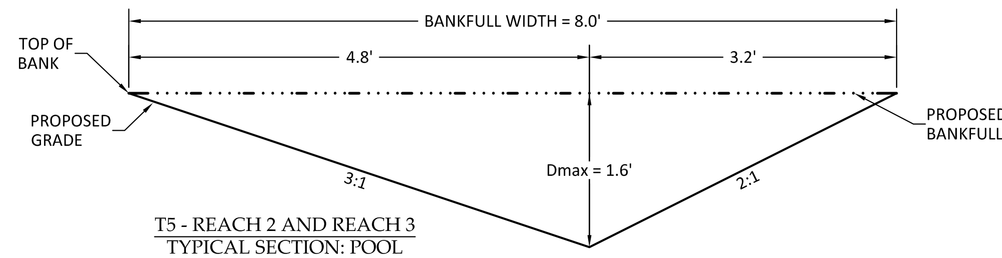
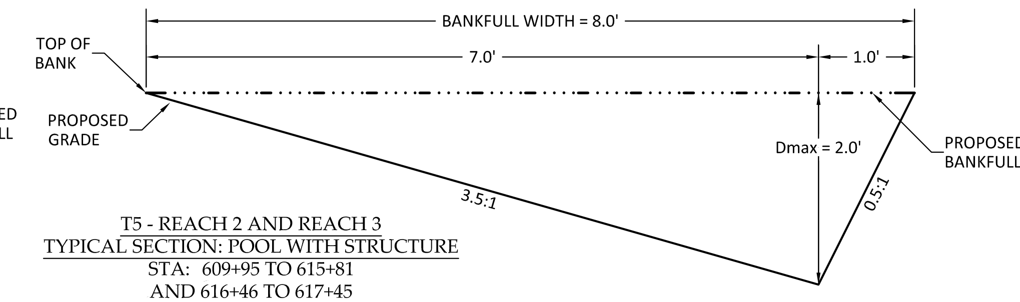




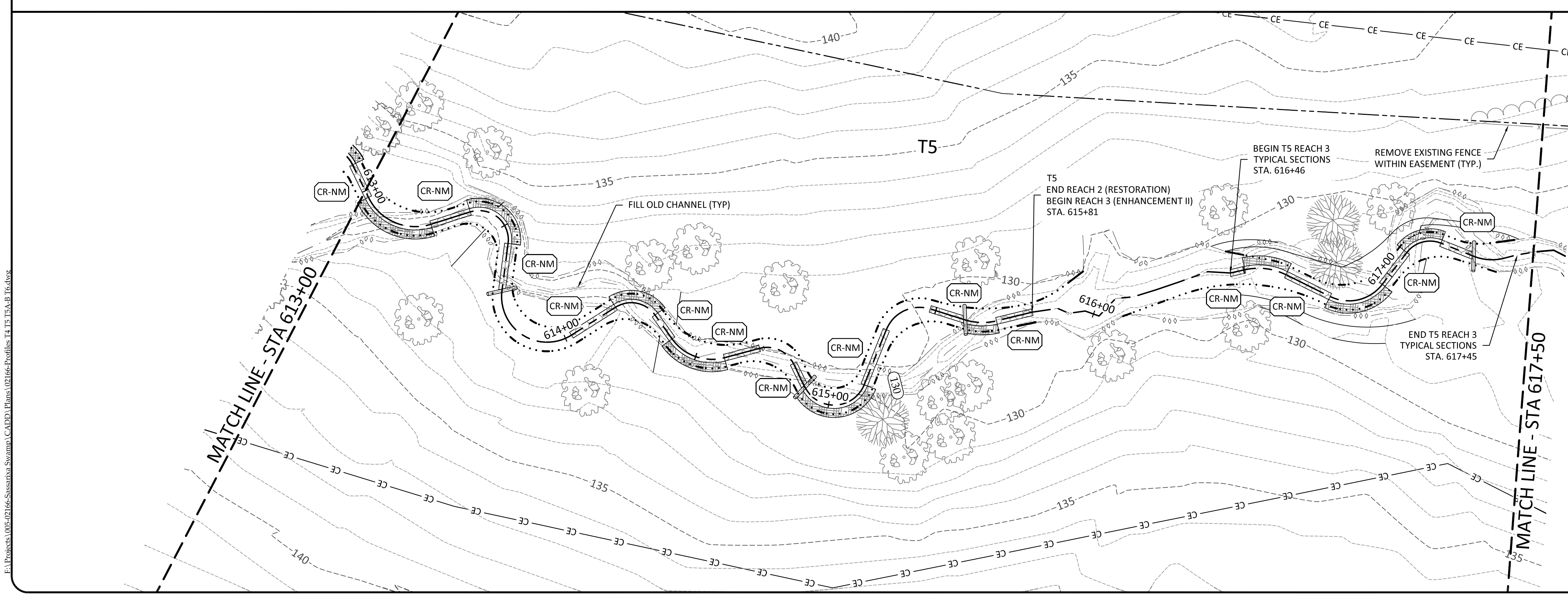
T5 - REACH 2 AND REACH 3
TYPICAL SECTION: RIFFLE
STA: 609+95 TO 615+81
AND 616+46 TO 617+45
SCALE: 1" = 1'



T5 - REACH 2 AND REACH 3
TYPICAL SECTION: POOL
STA: 609+95 TO 615+81
AND 616+46 TO 617+45
SCALE: 1" = 1'



T5 - REACH 2 AND REACH 3
TYPICAL SECTION: POOL WITH STRUCTURE
STA: 609+95 TO 615+81
AND 616+46 TO 617+45
SCALE: 1" = 1'



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Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

1.46

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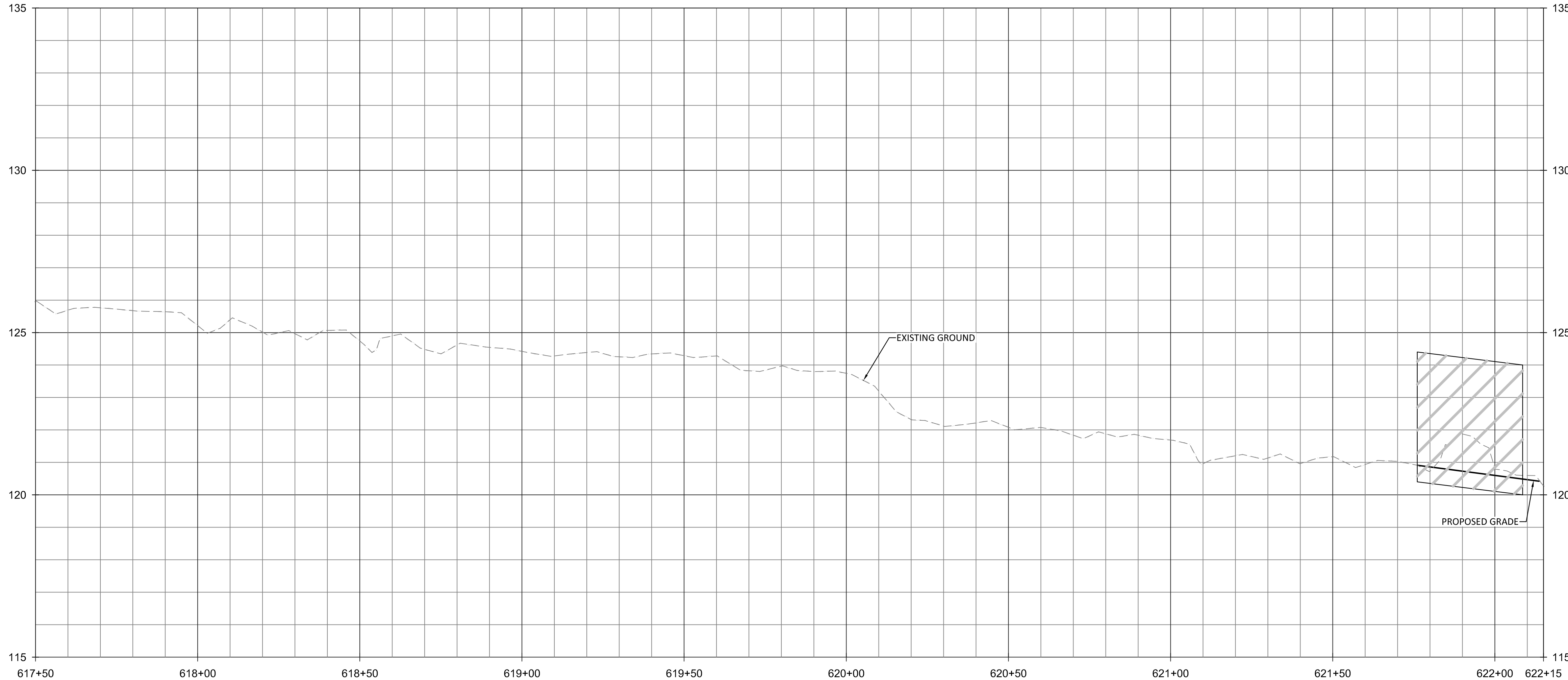

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0' 20' 40' 60'
(HORIZONTAL)

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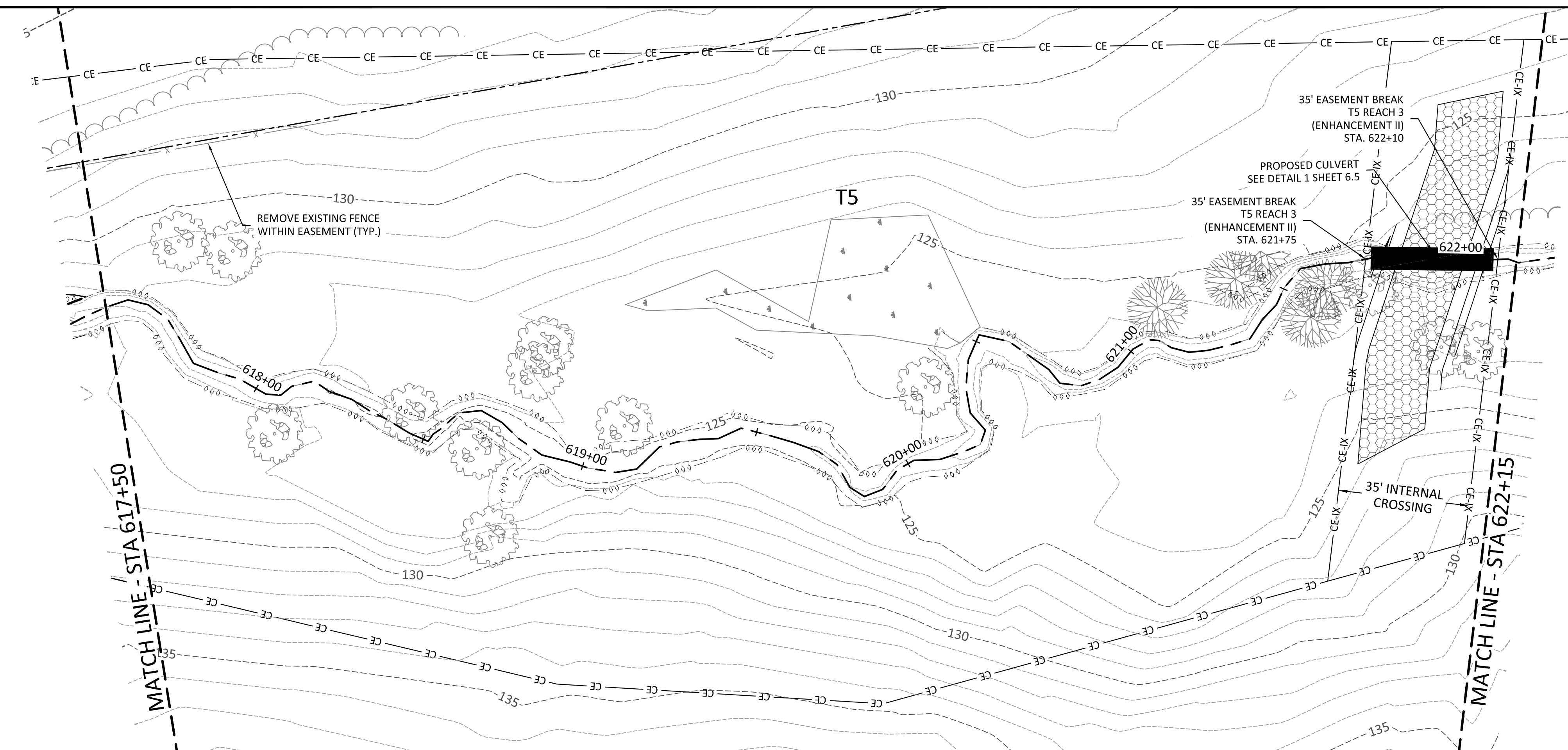

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Johnston County, North Carolina

T5
Stream Plan and Profile

Revisions:

Date:	11.15.2019
Job Number:	005-02166
Project Engineer:	GAT
Drawn By:	CAW
Checked By:	ANA

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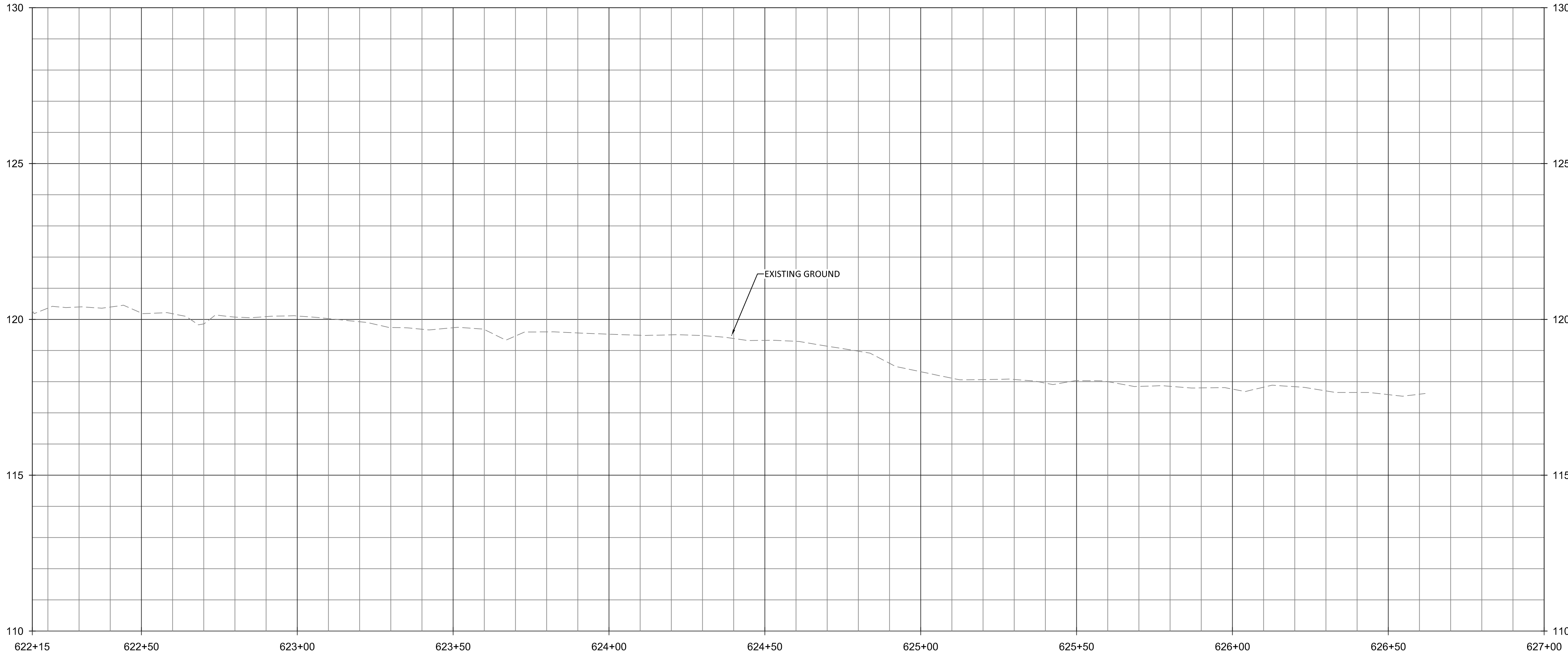

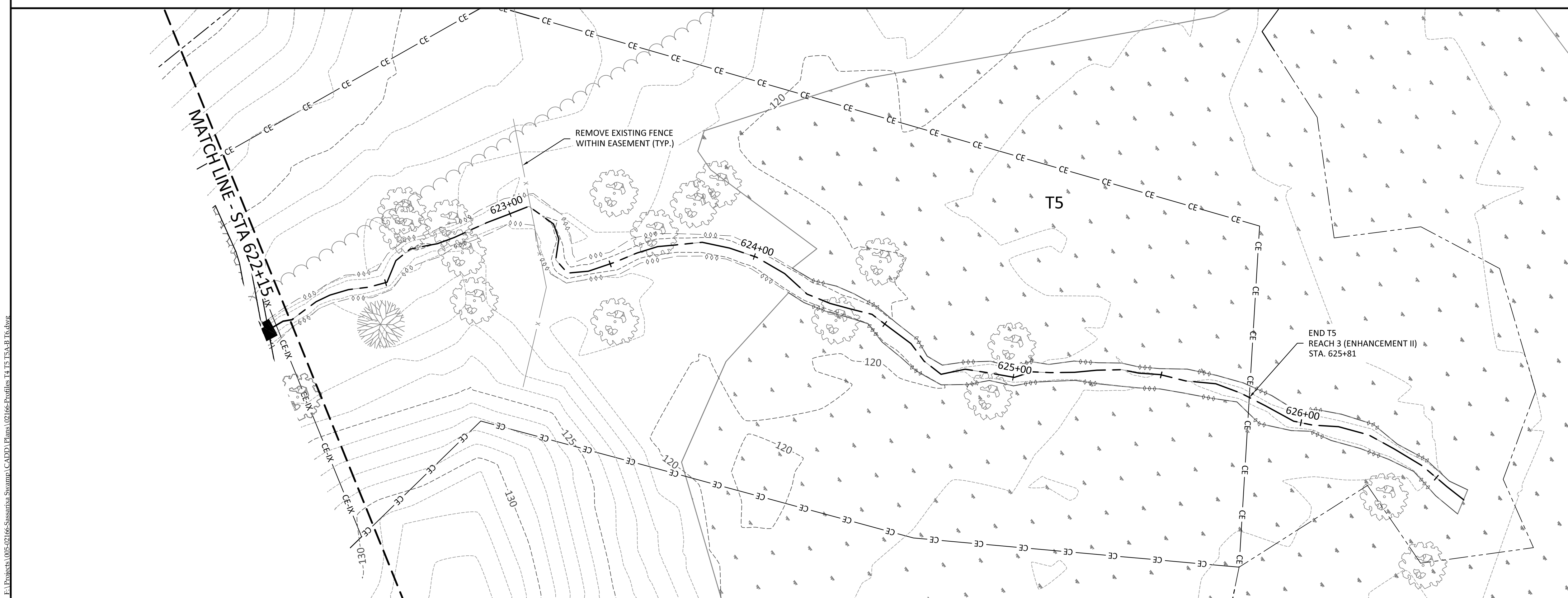

0' 2' 4' 6' (VERTICAL)
0' 20' 40' 60' (HORIZONTAL)

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T5
Stream Plan and Profile

Revisions:

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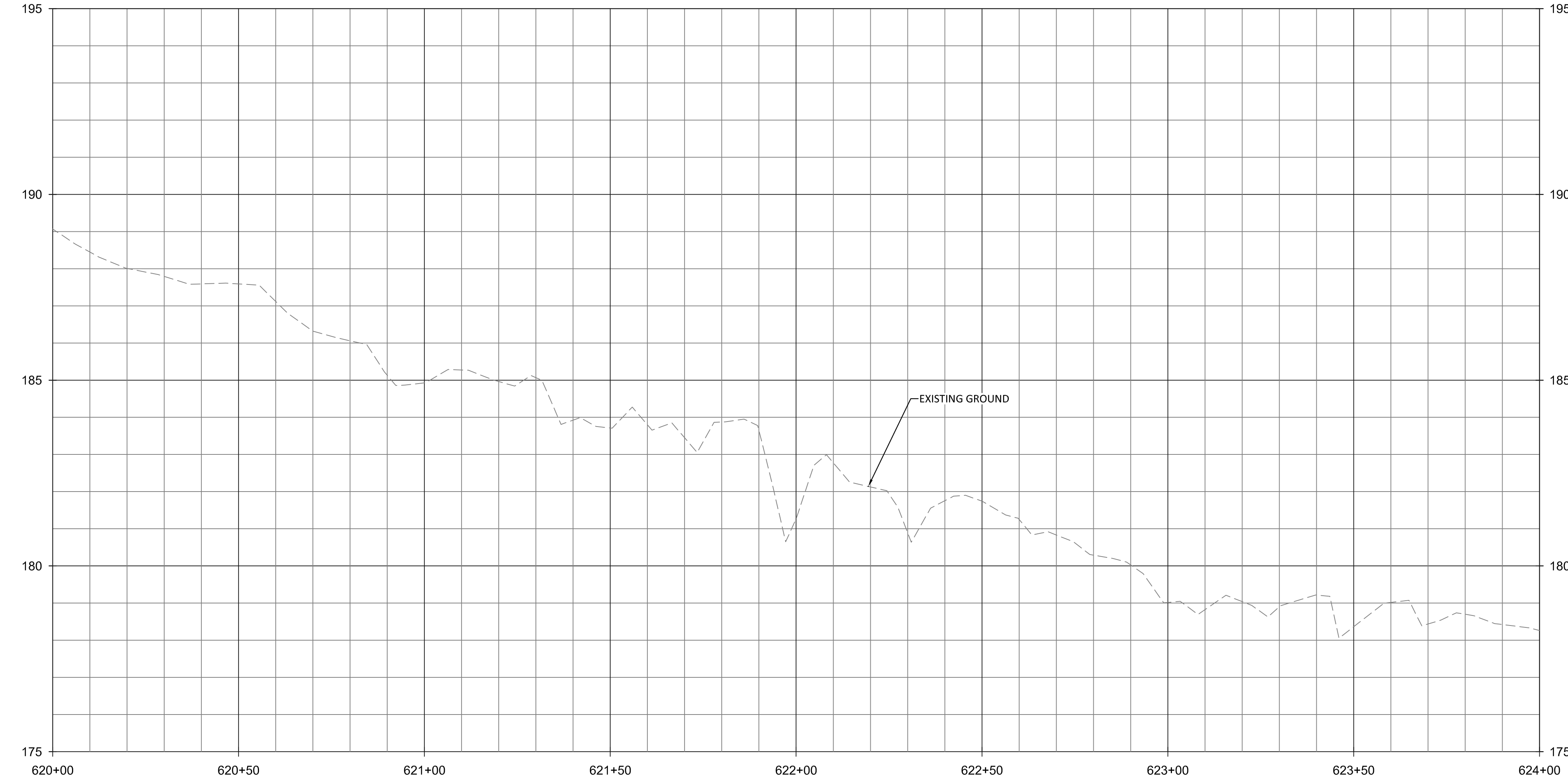

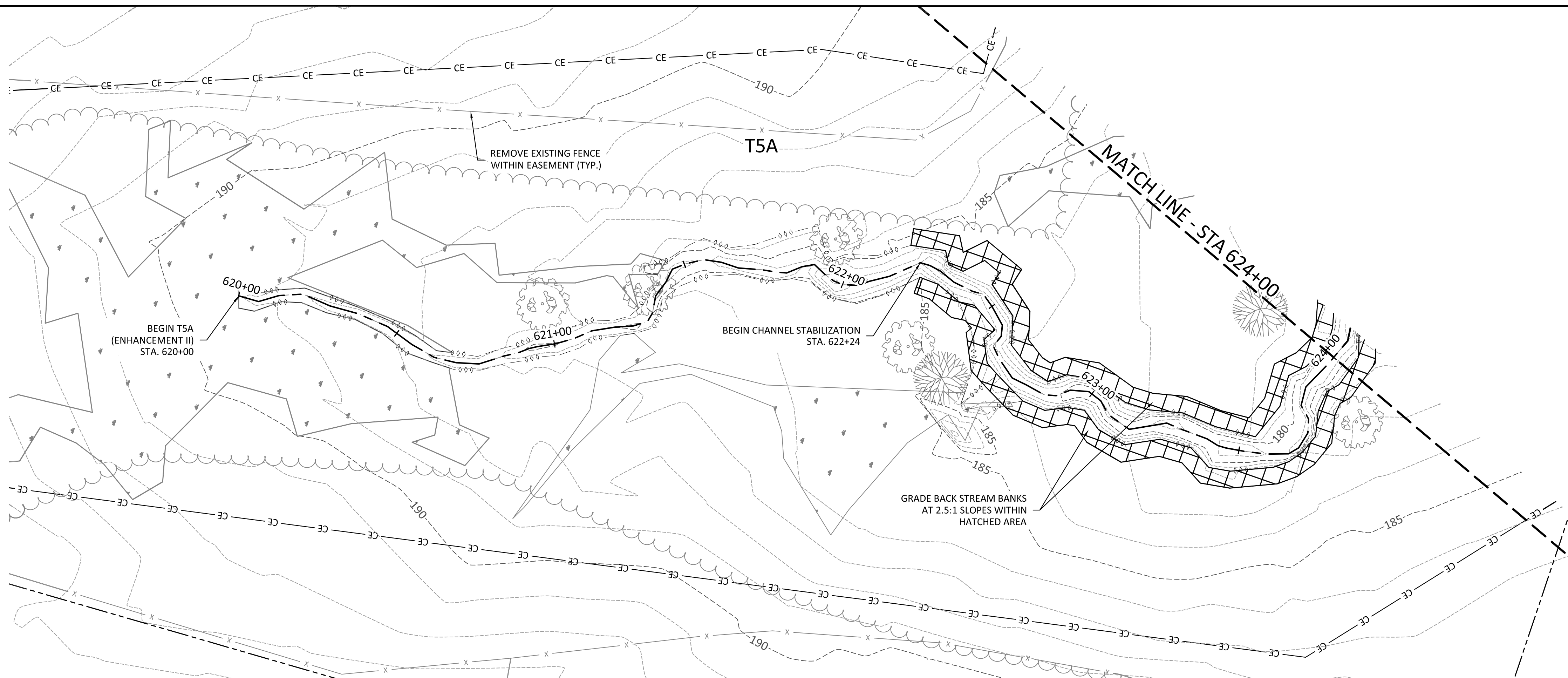

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0' 20' 40' 60' (HORIZONTAL)

N

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Stream Plan and Profile

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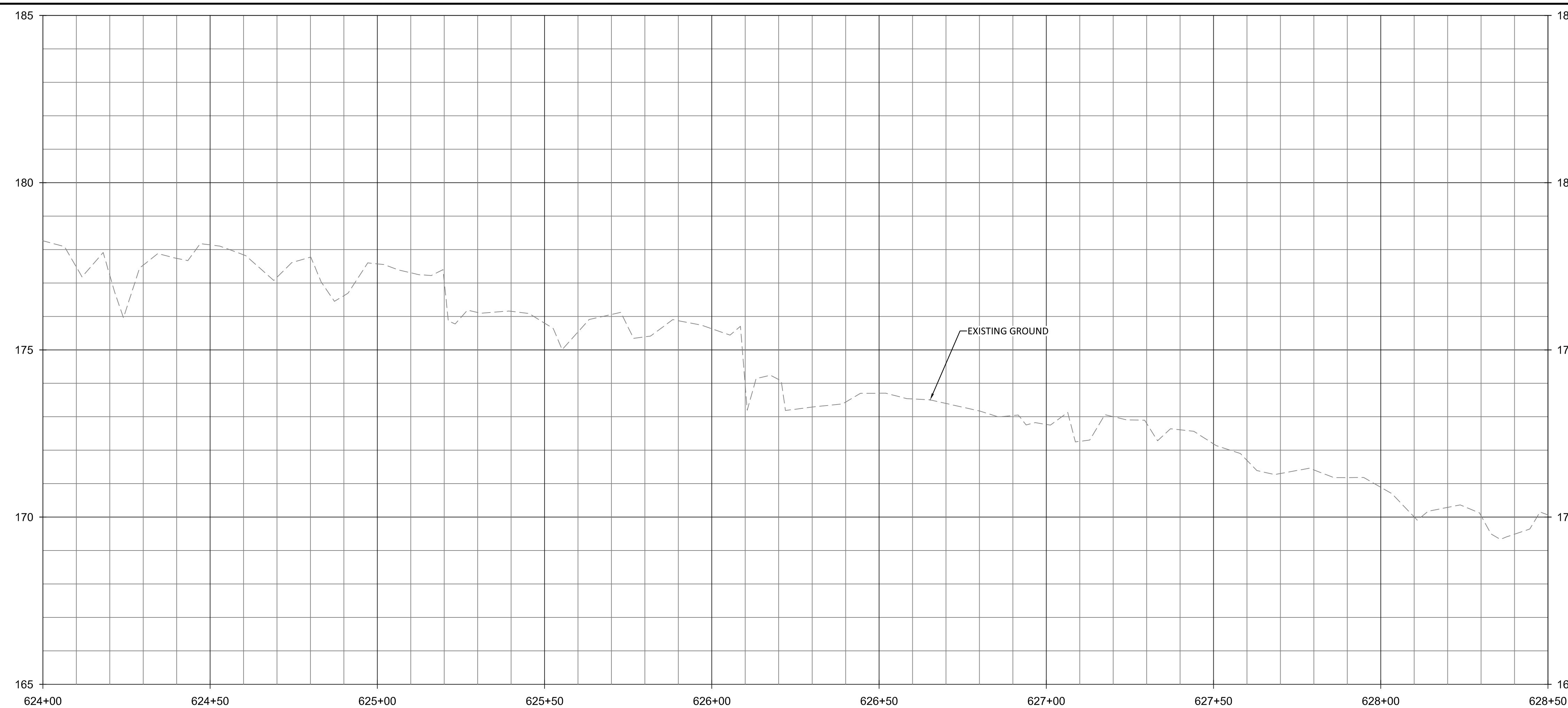

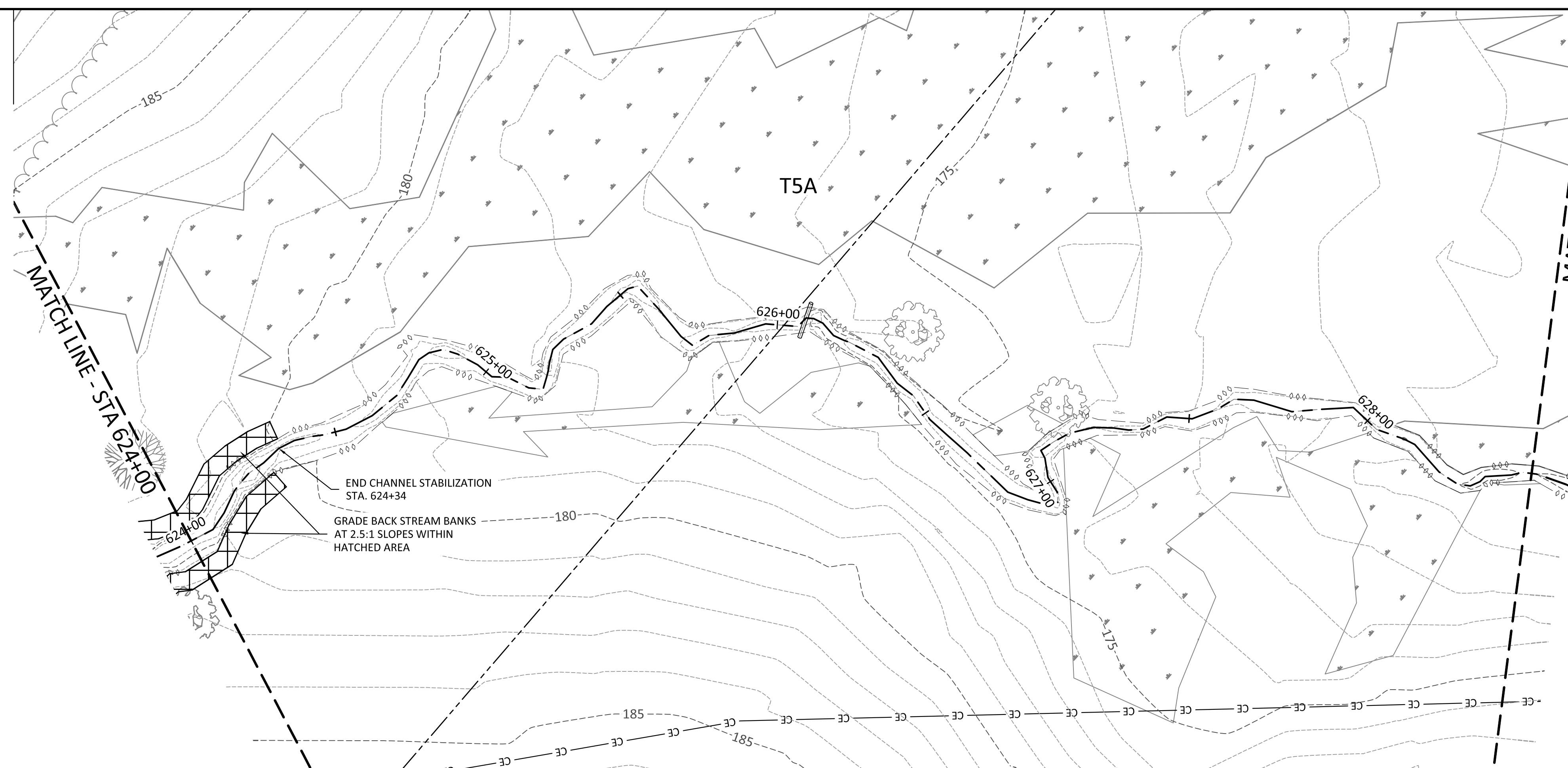

0' 2' 4' 6'
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

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T5A
Stream Plan and Profile

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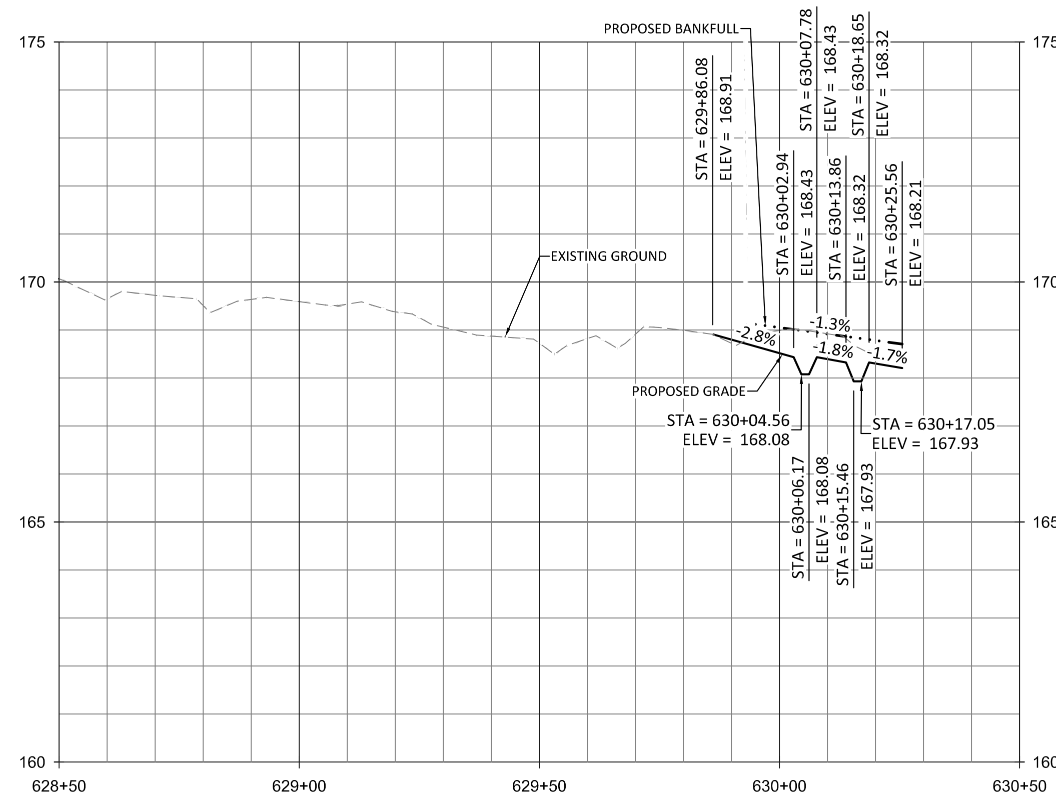

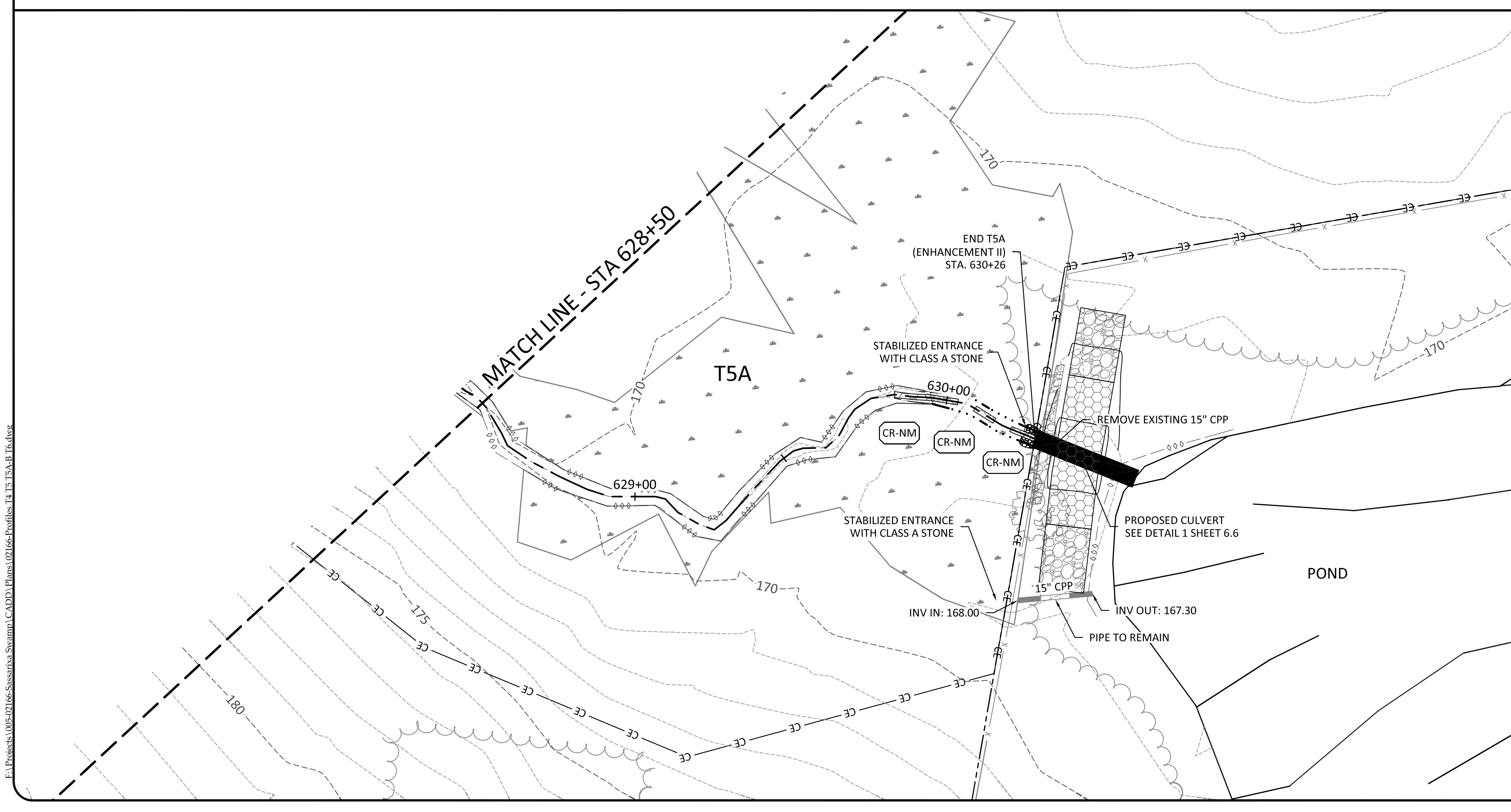

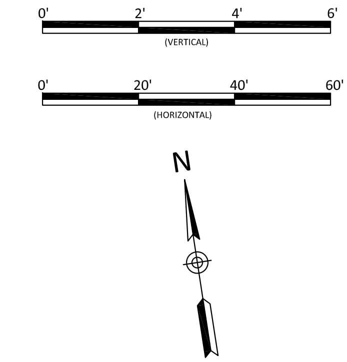

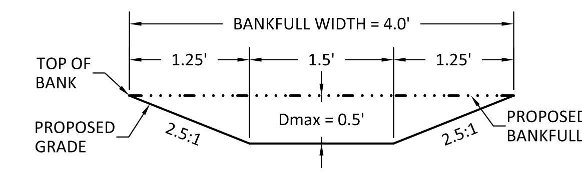

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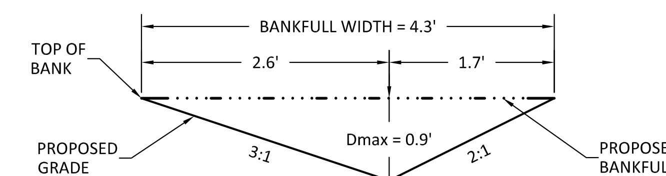
STA: 629+86 TO 630+26
SCALE: 1" = 1'



T5A
TYPICAL SECTION: POOL
STA: 629+86 TO 630+26
SCALE: 1" = 1'

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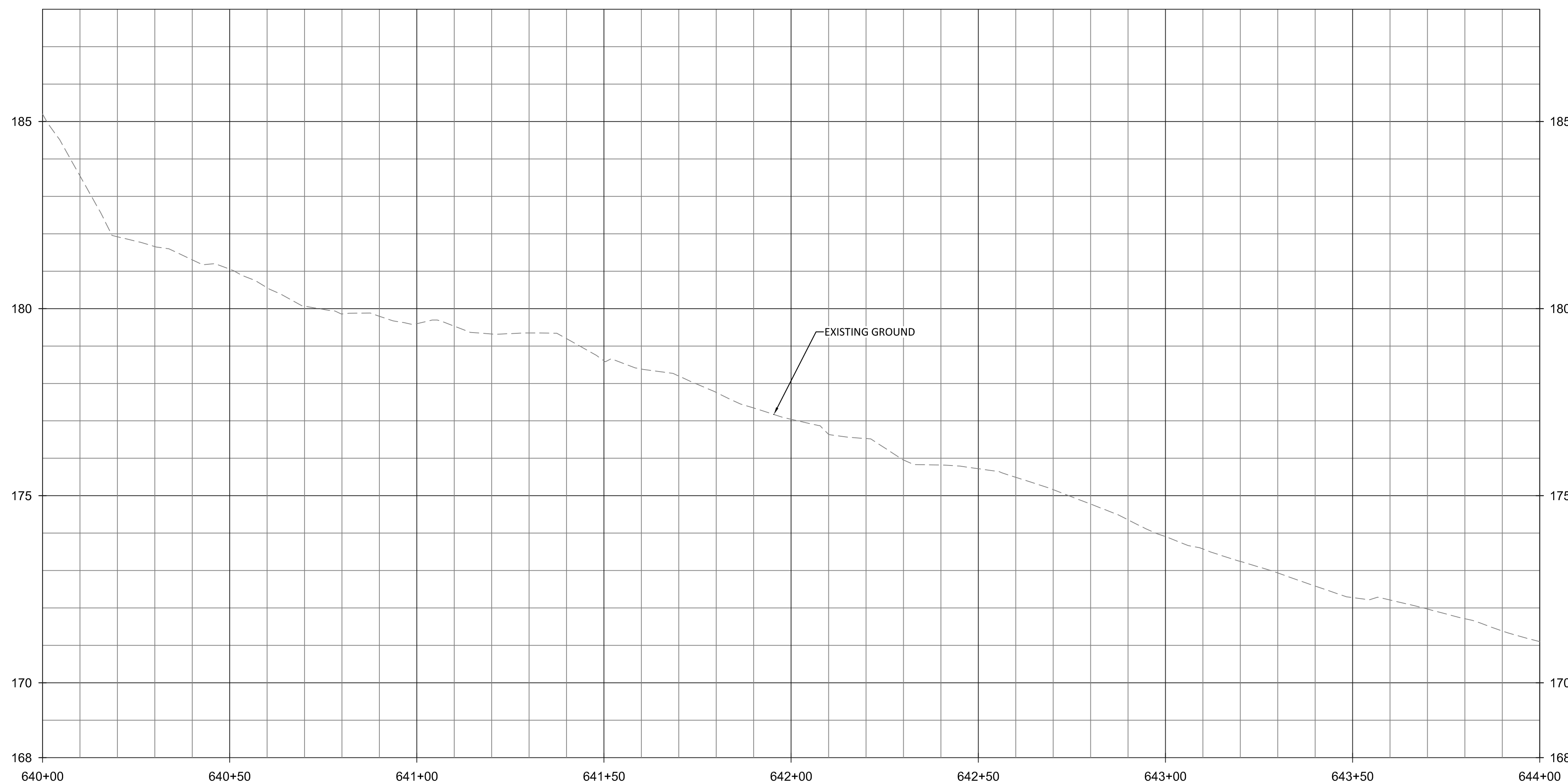

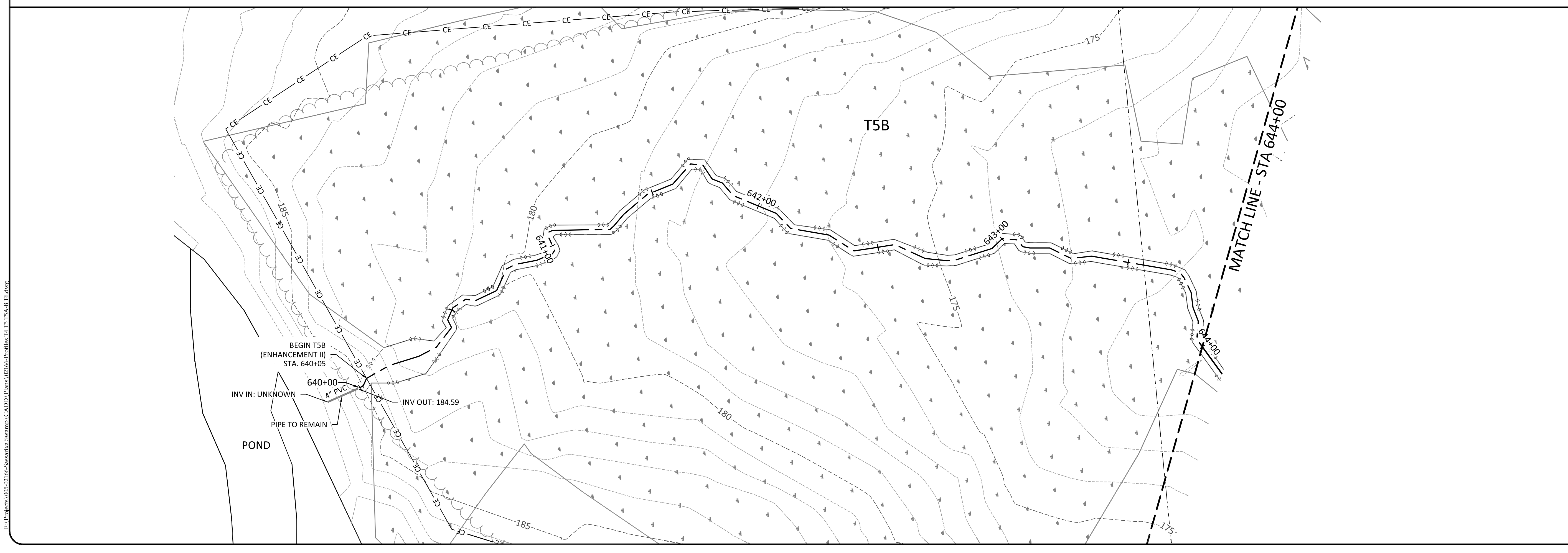

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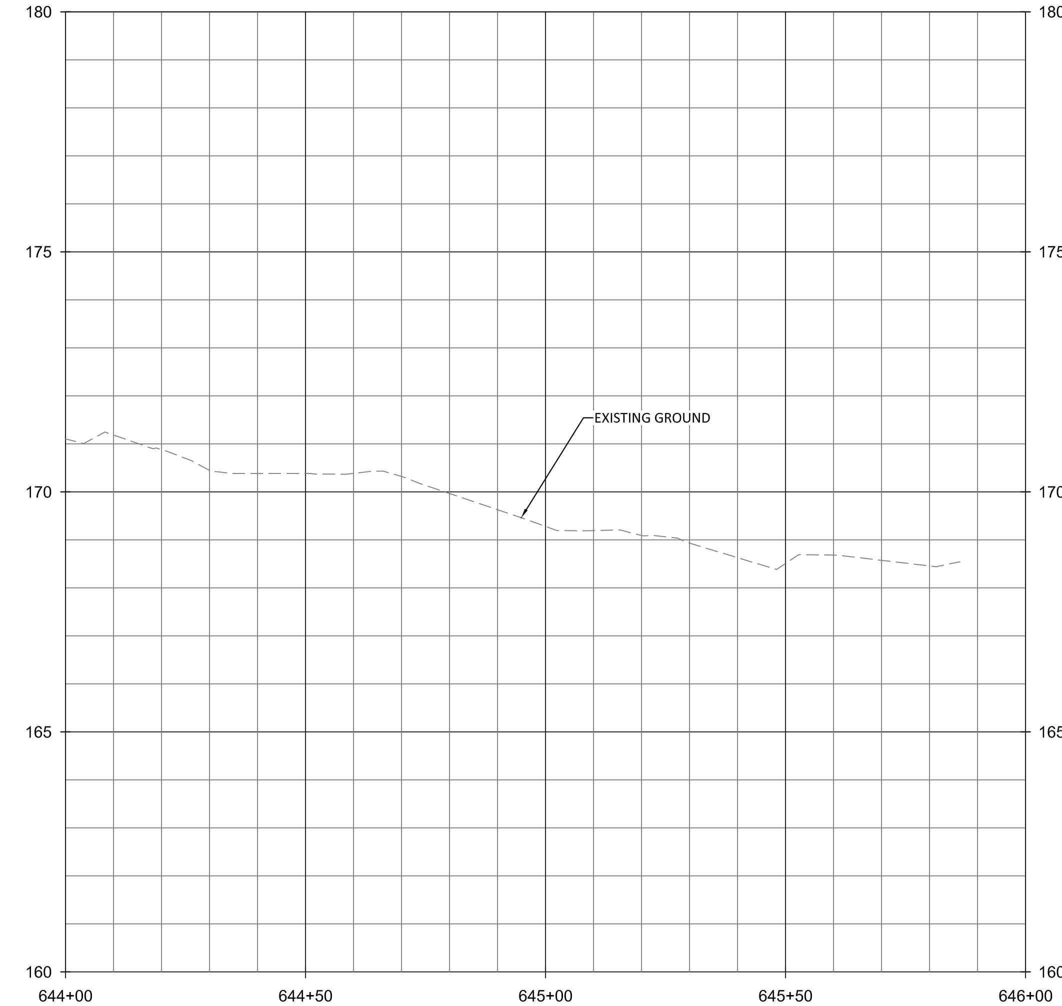

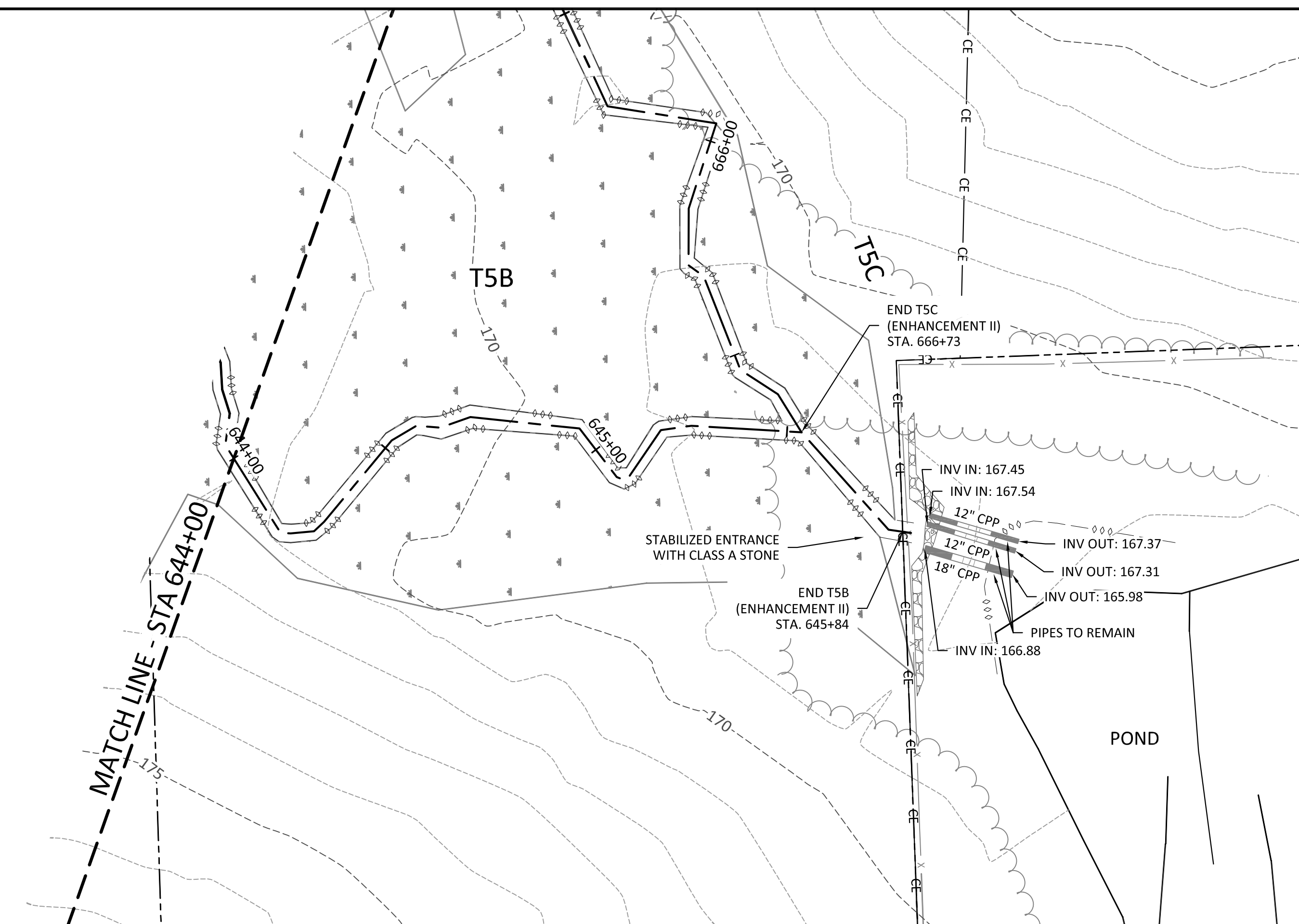

0' 2' 4' 6' (VERTICAL)

0' 20' 40' 60' (HORIZONTAL)

N

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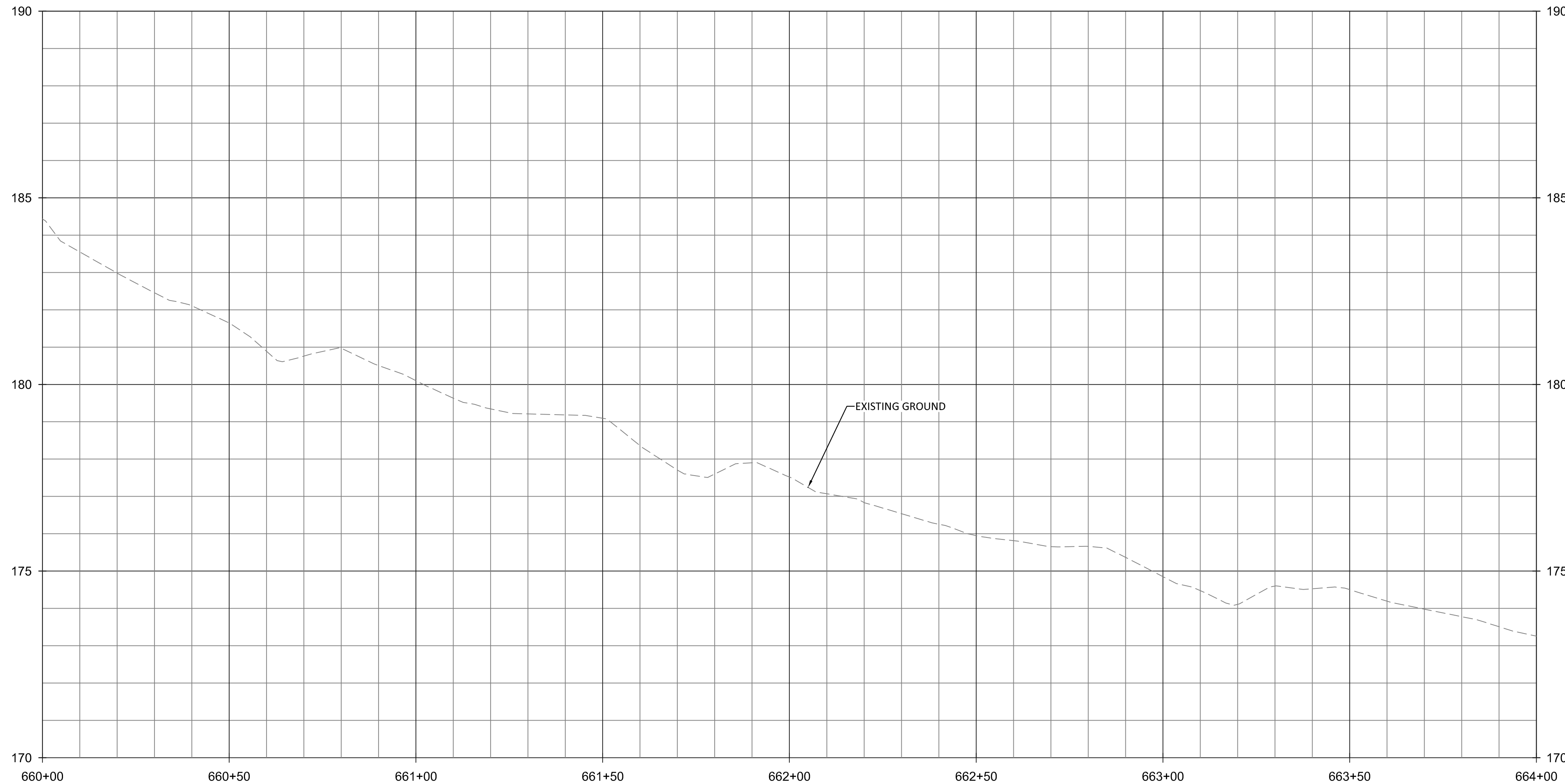

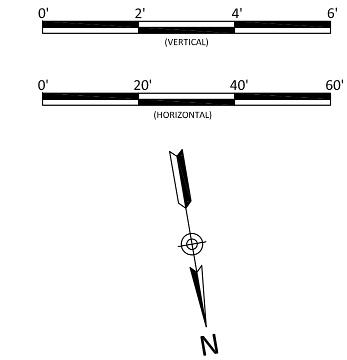

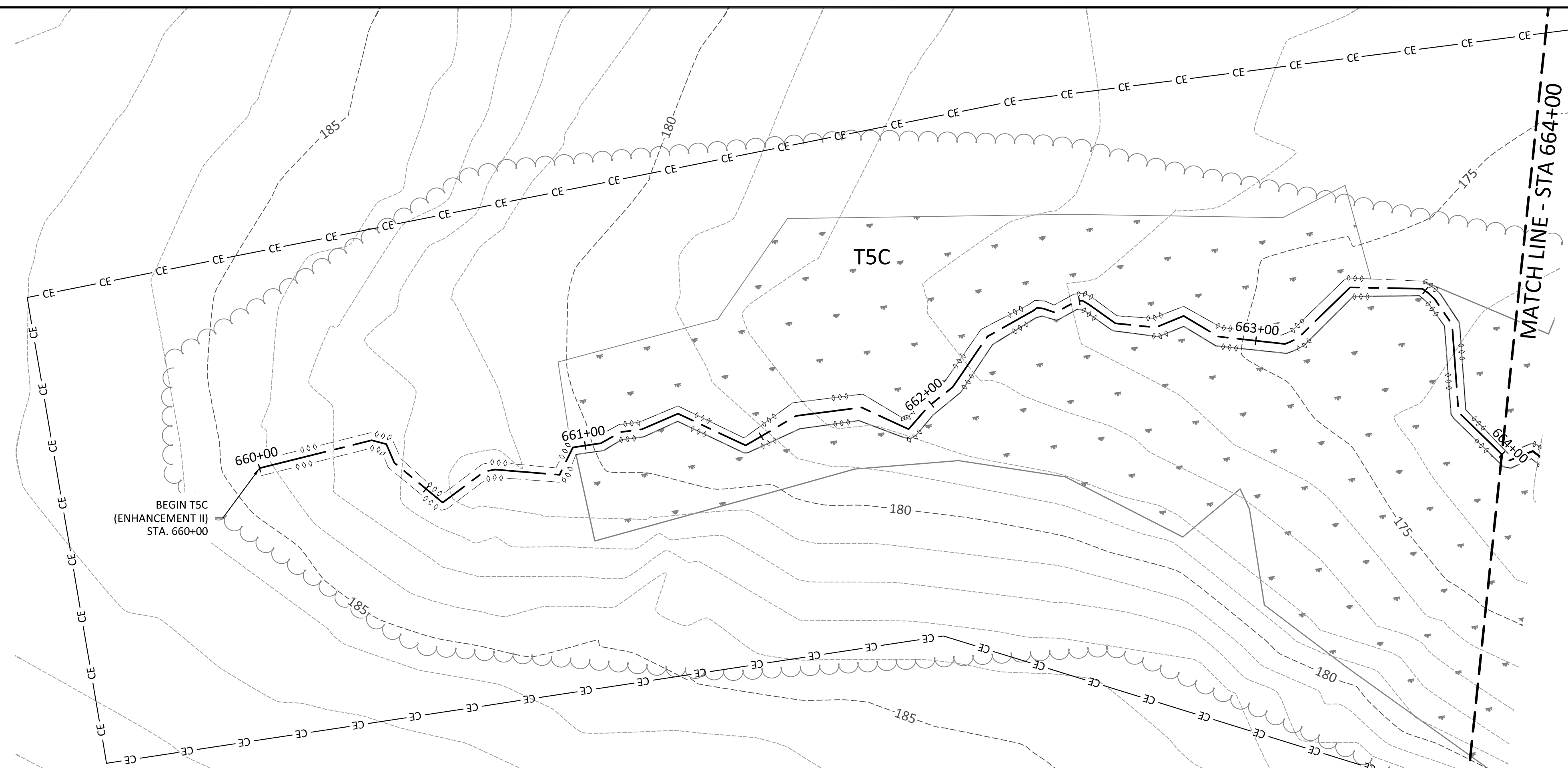

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Stream Plan and Profile

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1.54

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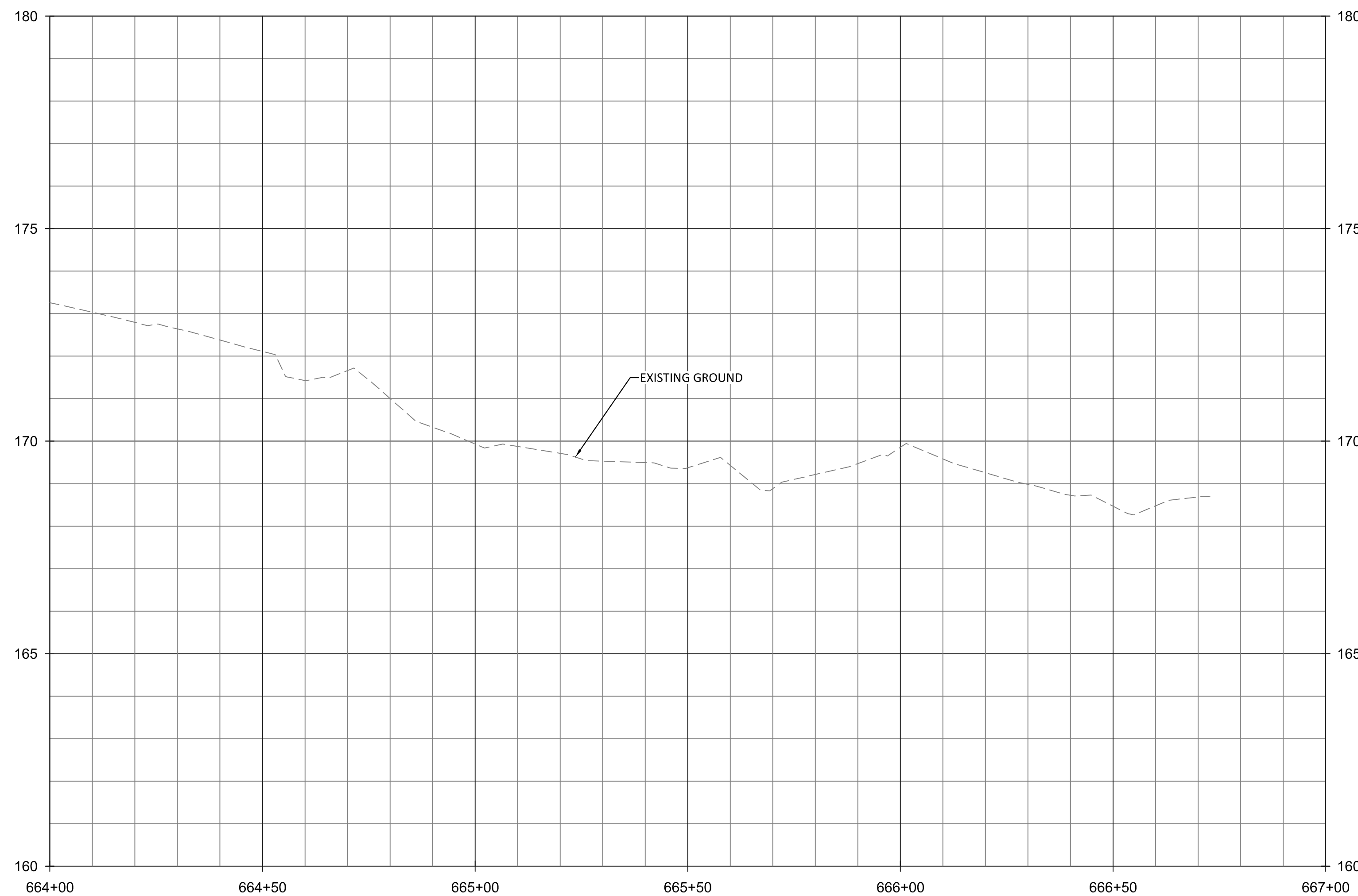

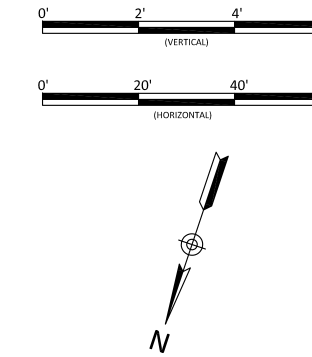

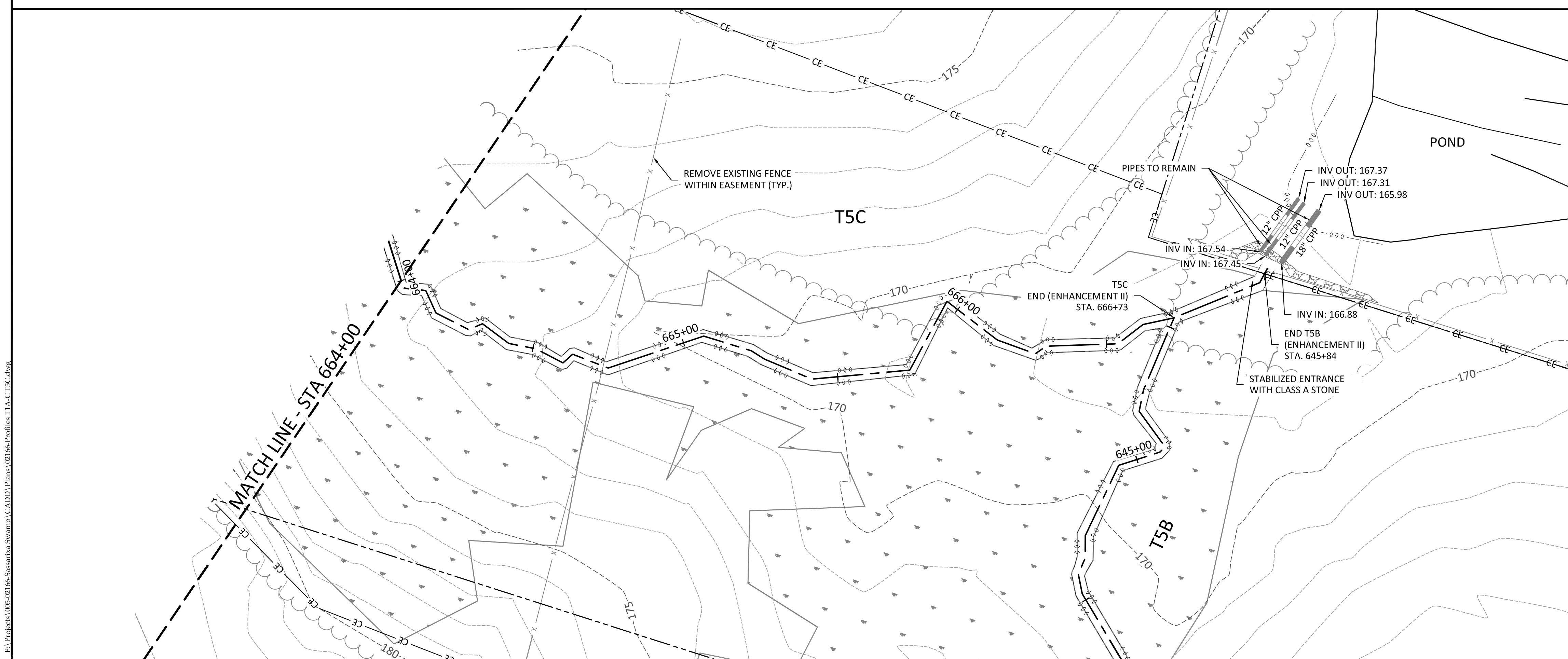

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T5C
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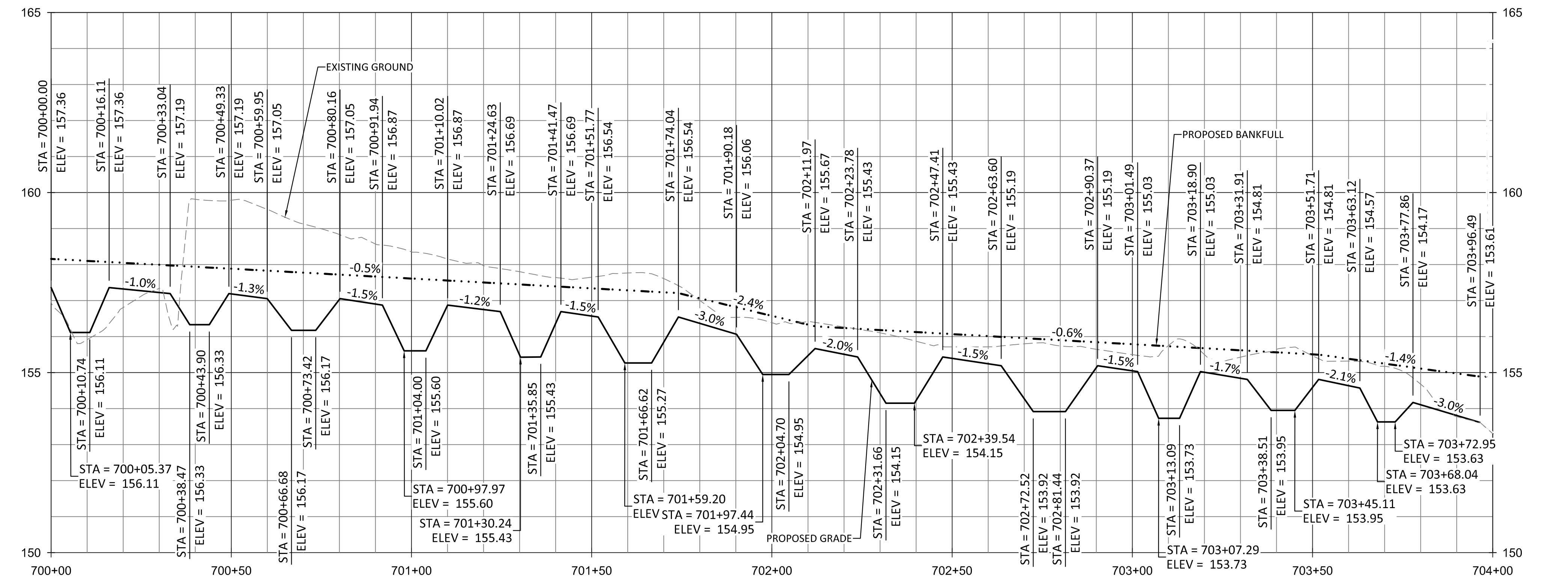

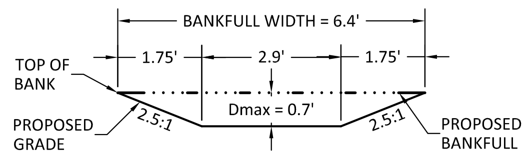

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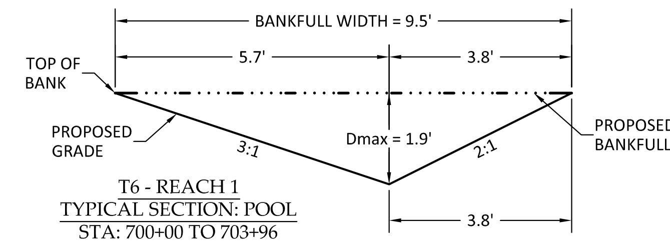
STA: 700+00 TO 703+96
SCALE: 1" = 2'



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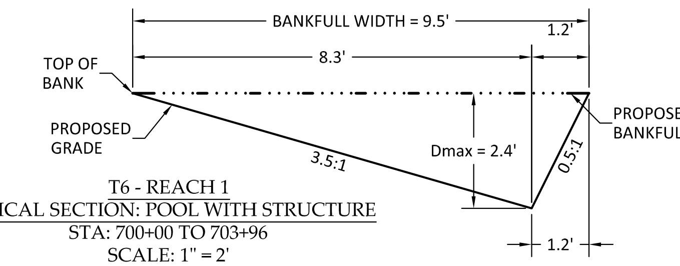

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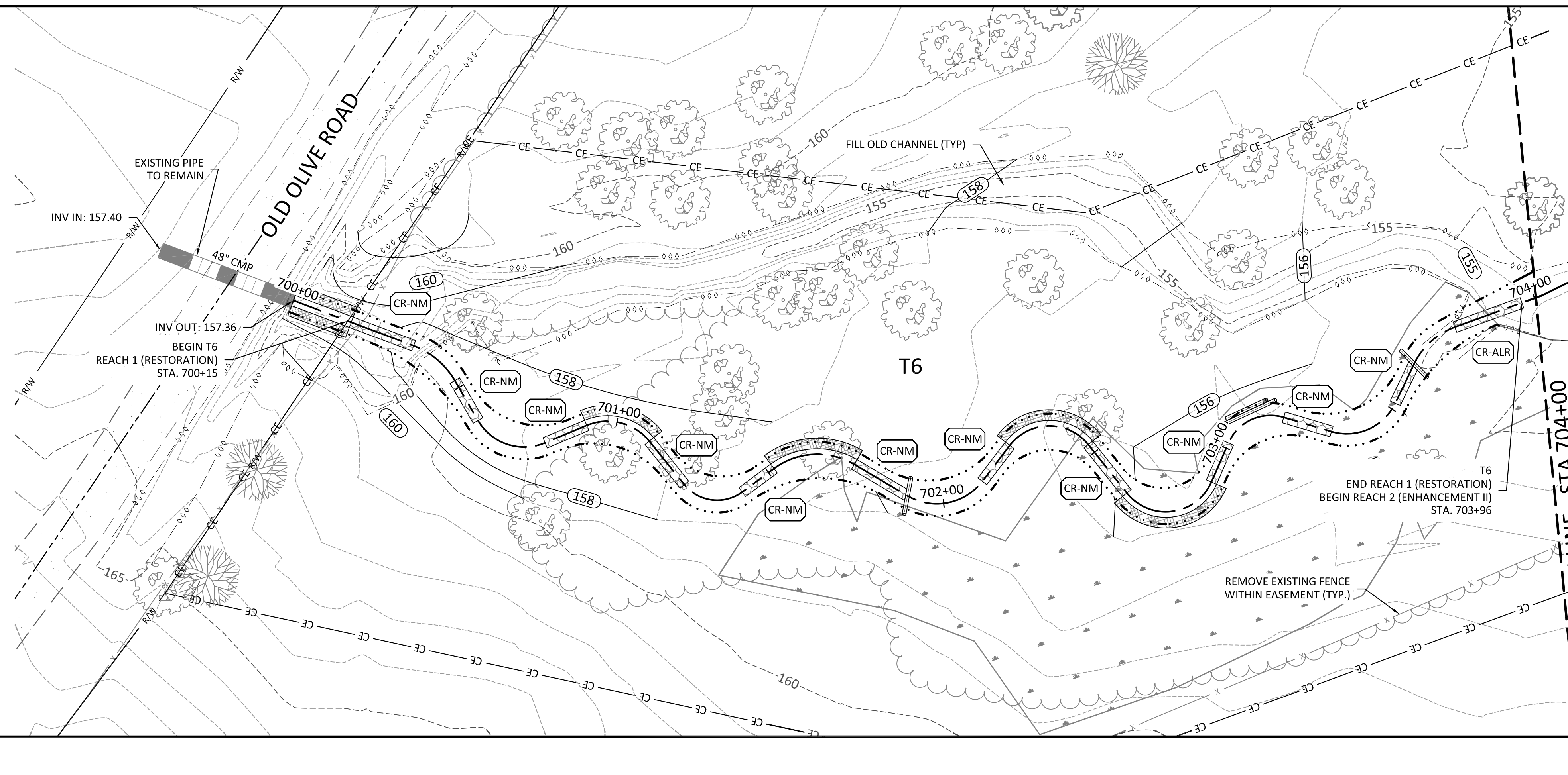

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Stream Plan and Profile

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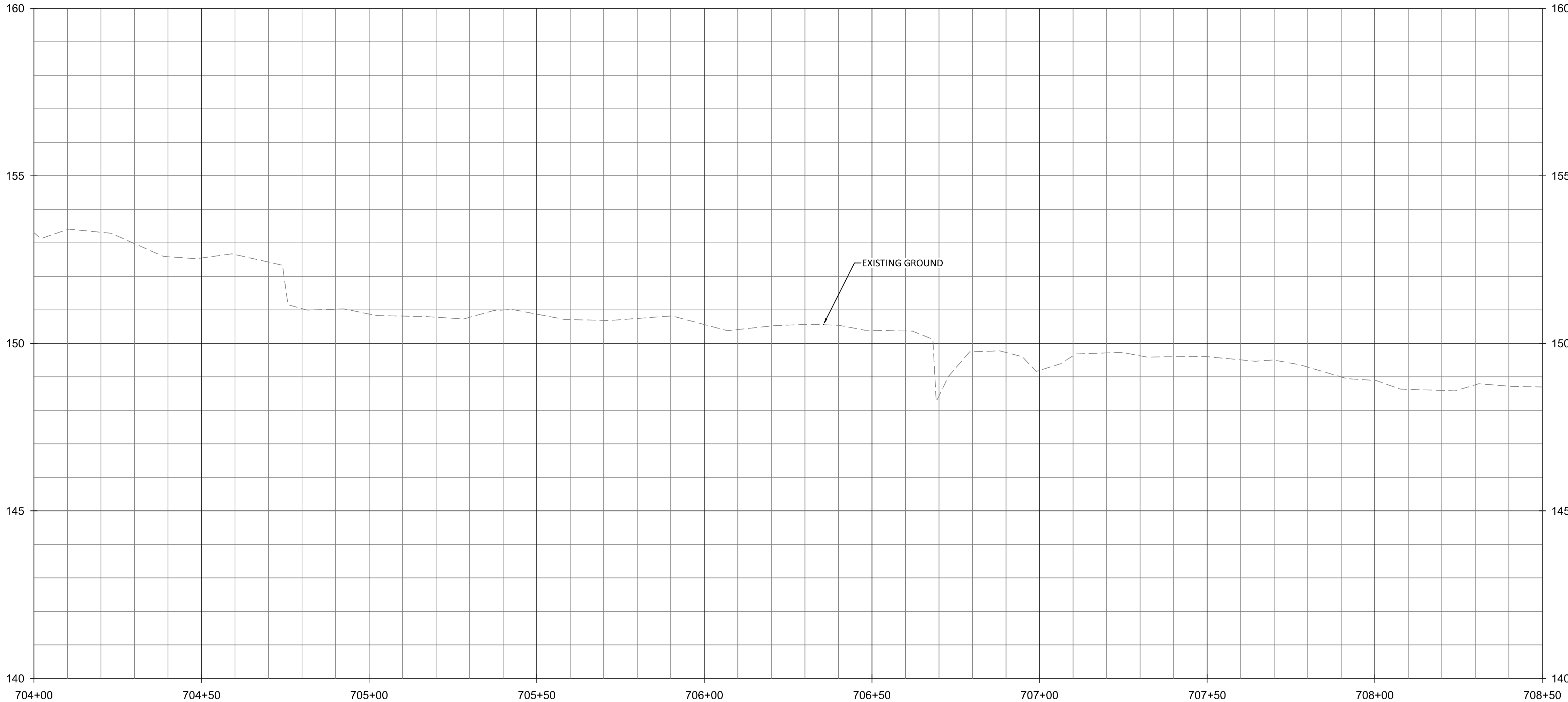

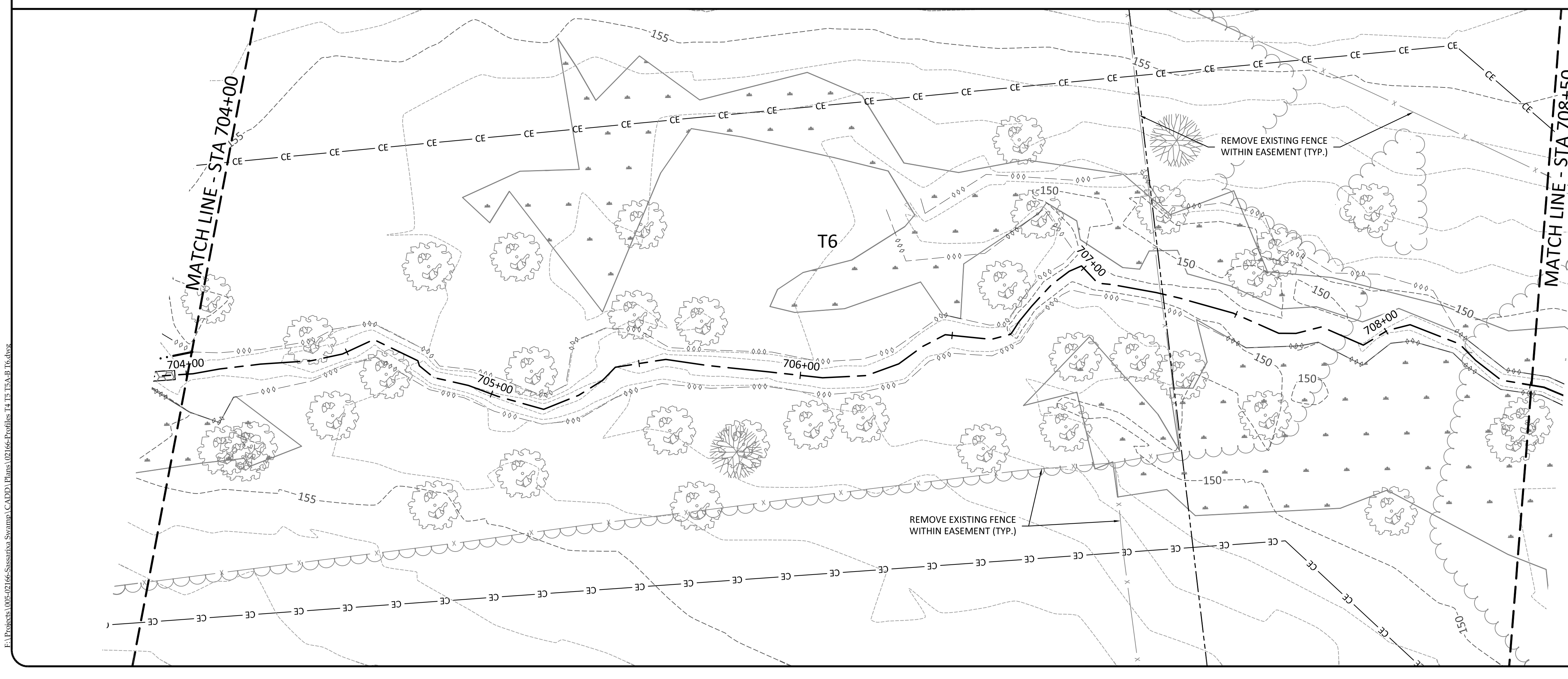

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T6
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1.57

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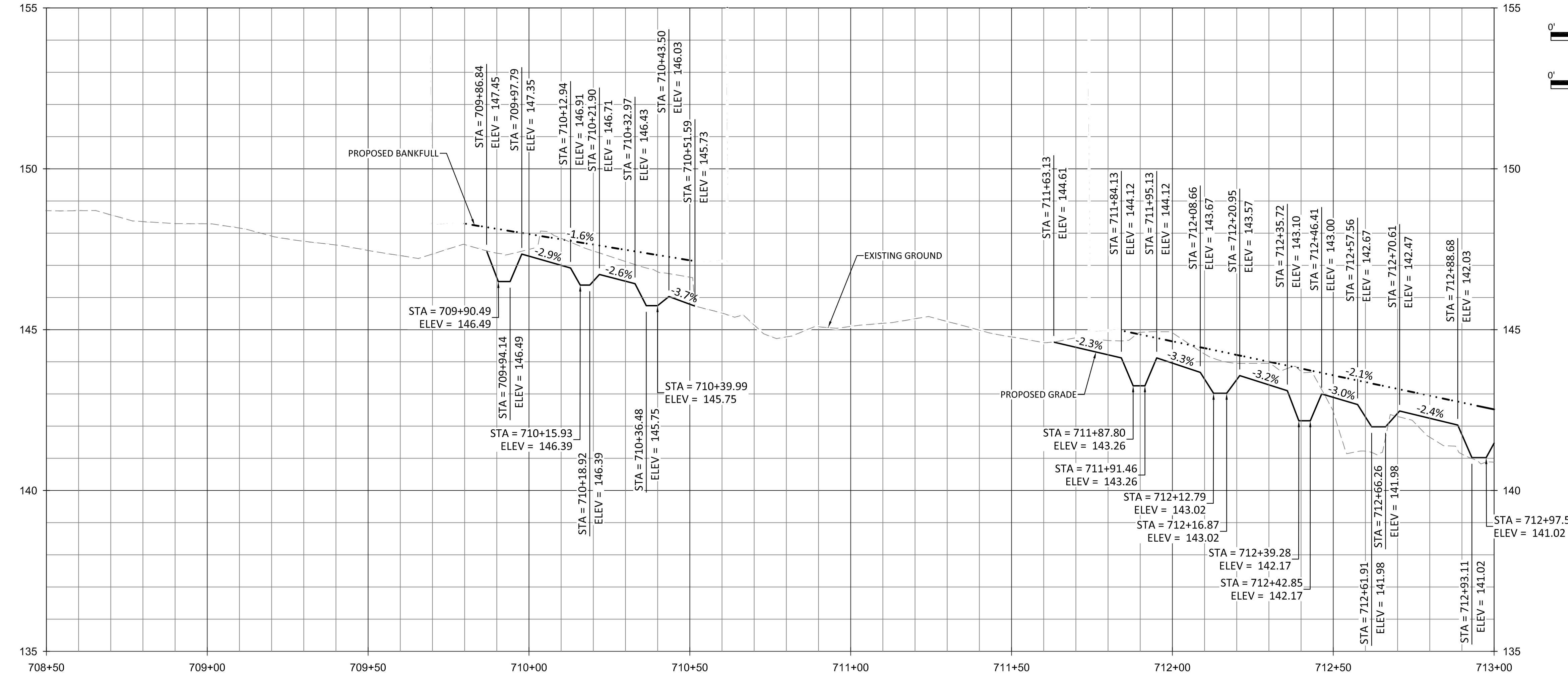

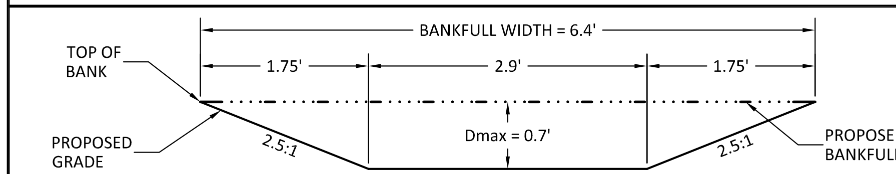

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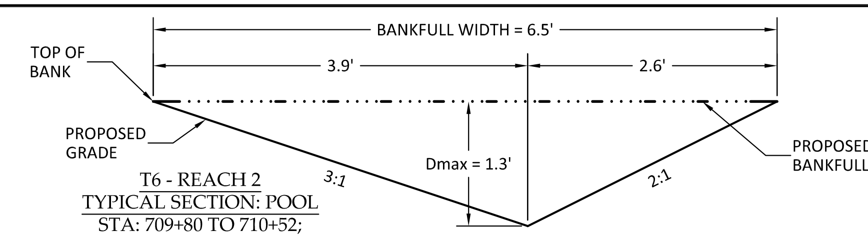
711+63 TO 714+41
SCALE: 1" = 1'



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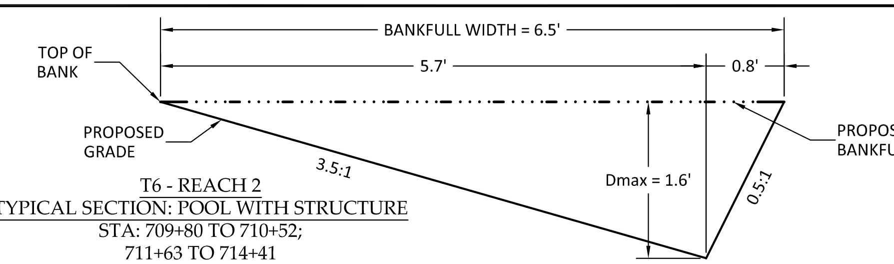

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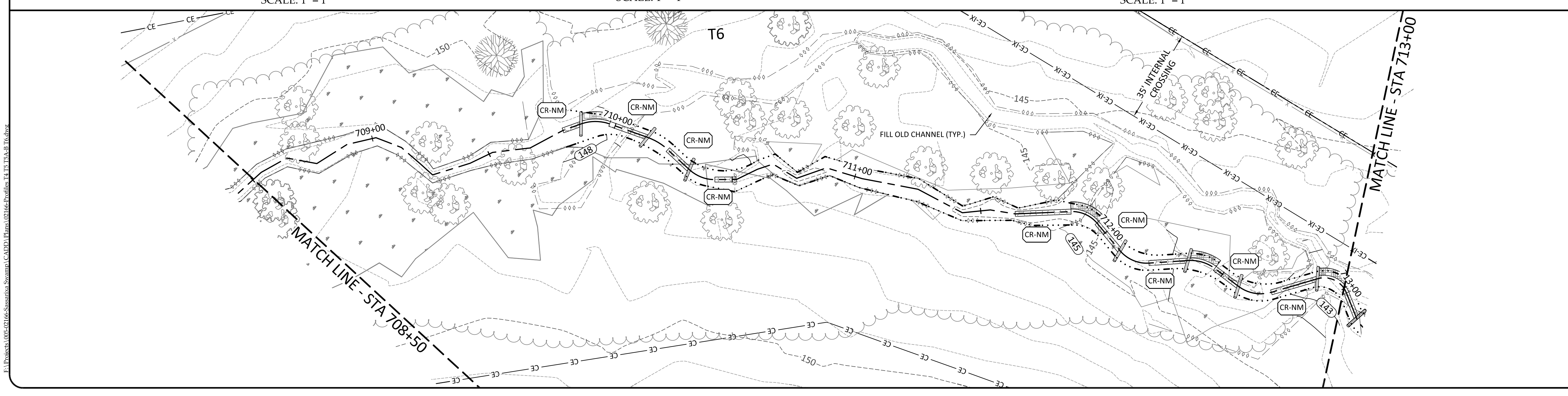

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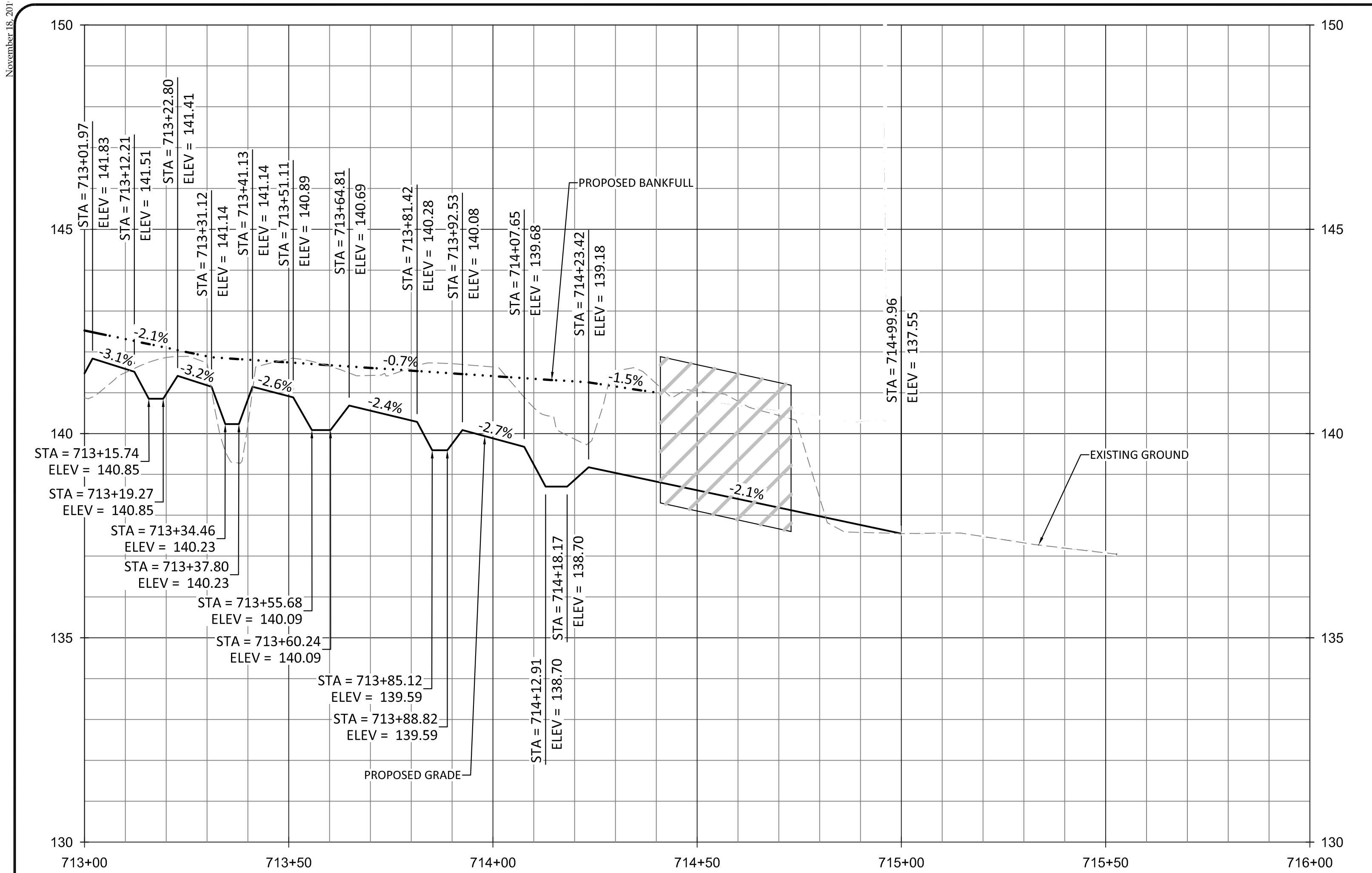

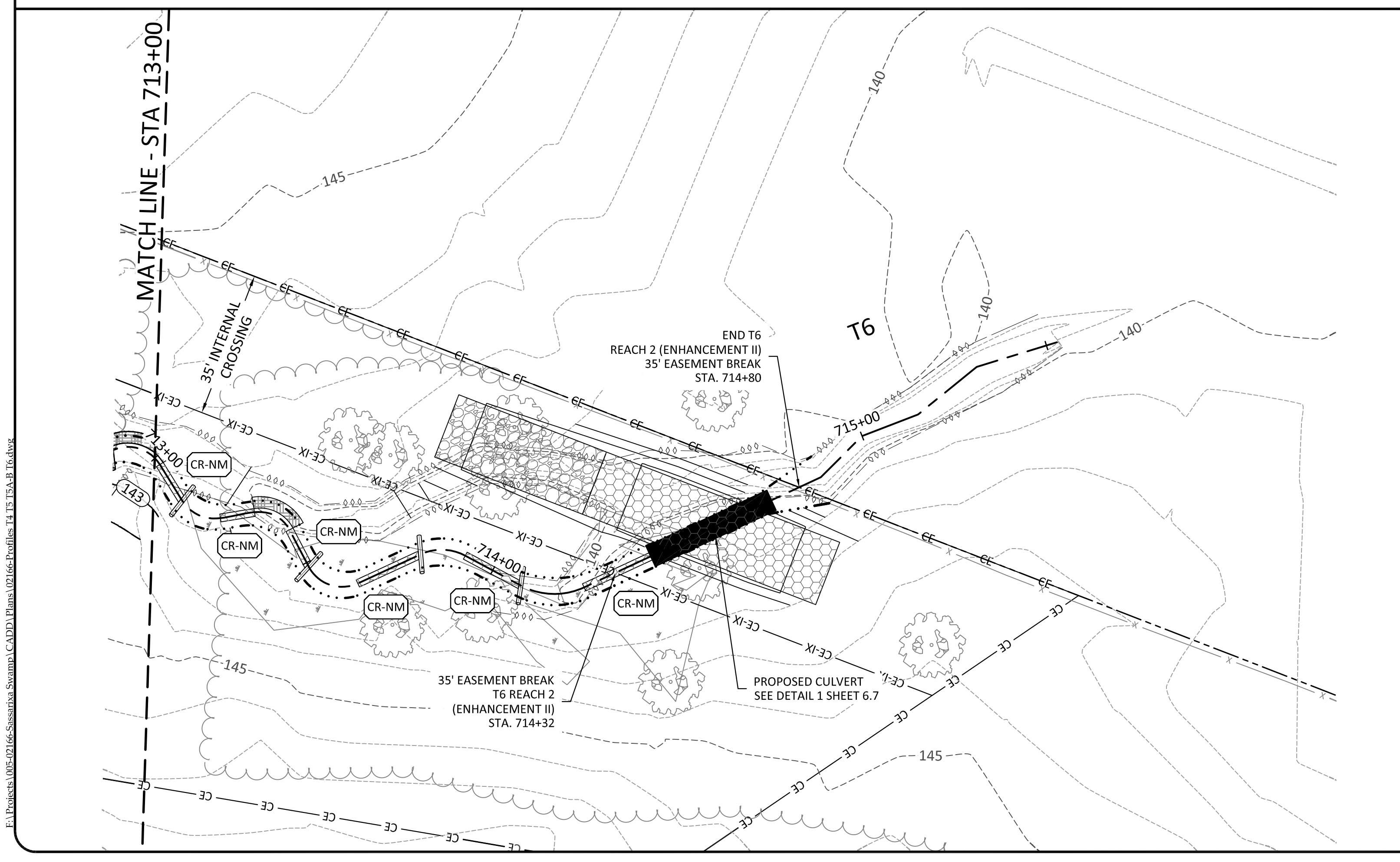

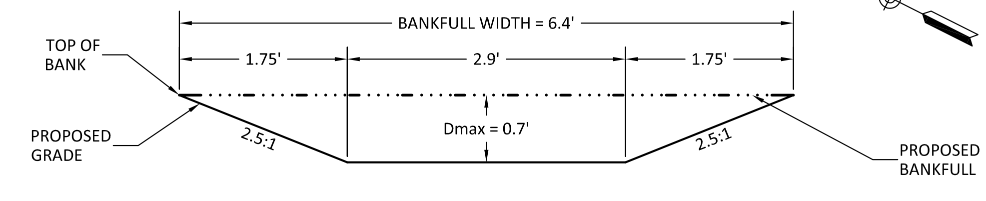

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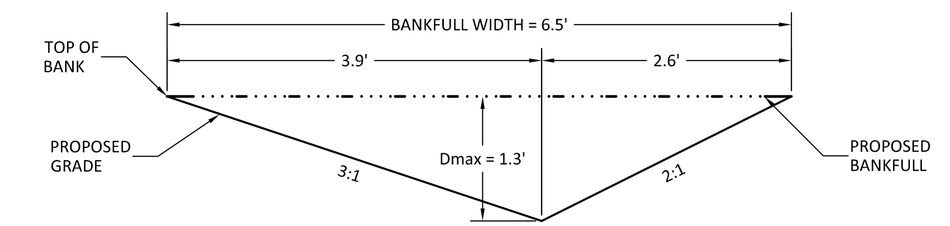
SCALE: 1" = 1'



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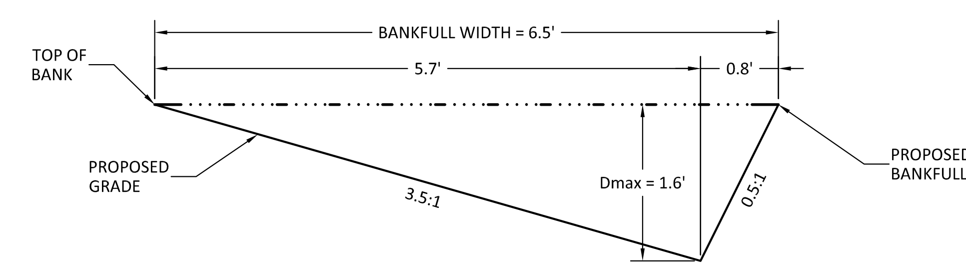

T6 - REACH 2
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STA: 709+80 TO 710+52;
711+63 TO 714+41
SCALE: 1" = 1'

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T6
Stream Plan and Profile

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Sassarixa Swamp
Johnston County, North Carolina

Additional Grading Overview
Grading Plans

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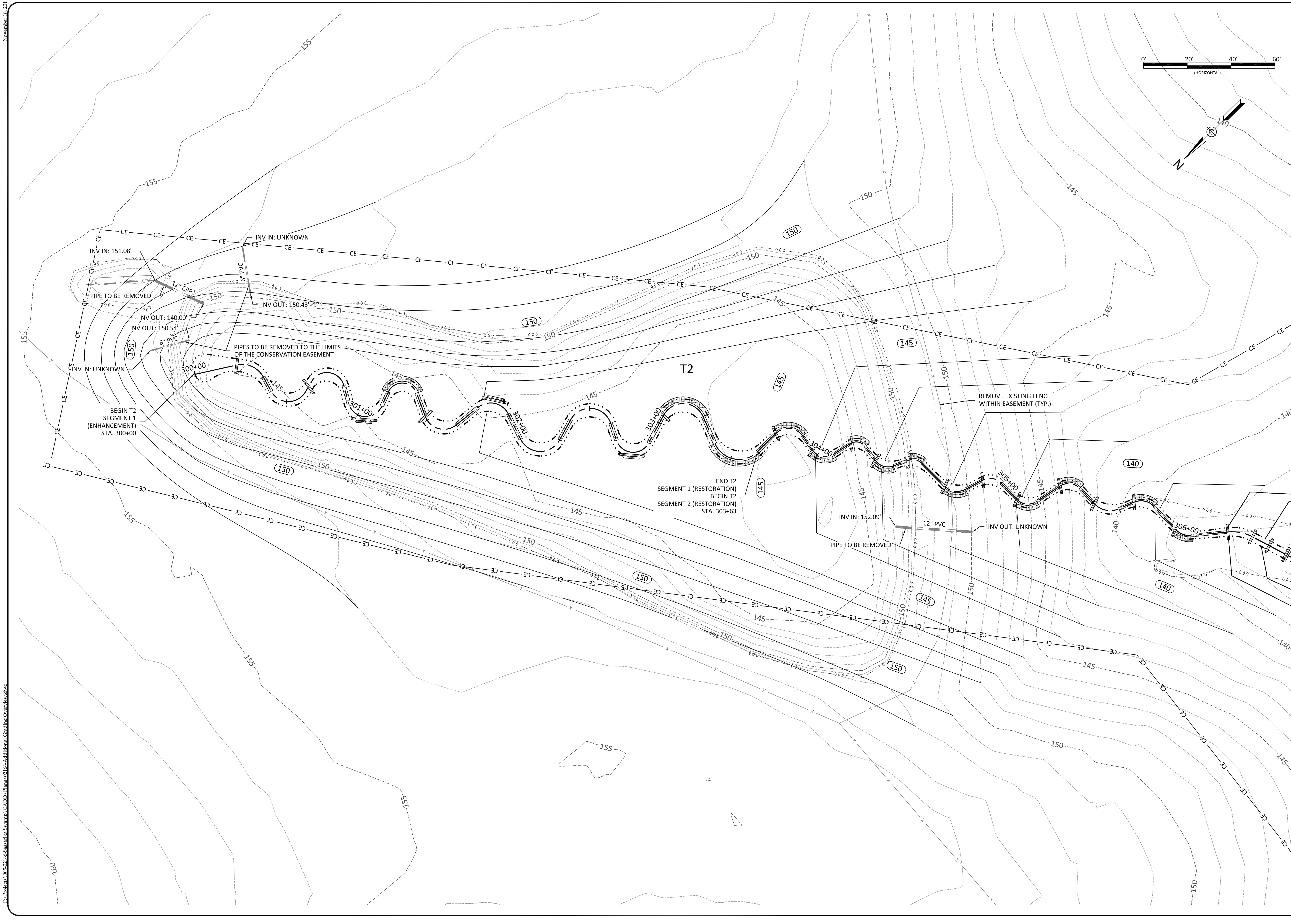

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Sassarixa Swamp
Johnston County, North Carolina

T2 Additional Grading
Grading Plans

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Sheet 2.1

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November 18, 2019

Zone 1 - Streambank Planting Zone
(See Detail 1, Sheet 6.8)

Zone 2 - Buffer Planting Zone
(See Detail 2, Sheet 6.8)

Zone 3 - Floodplain and Wetland Planting Zone
(See Detail Detail 2, Sheet 6.8)

Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting will occur within the Limits of Disturbance

Streambank Planting Zone

Species	Common Name	Indiv. Spacing	Min. Size	Stratum	% of Stems
Live Stakes					
Salix nigra	Black Willow	3-6 ft.	0.5"-1.5" cal.	Shrub	15%
Cornus ammomum	Silky Dogwood	3-6 ft.	0.5"-1.5" cal.	Shrub	45%
Salix sericea	Silky Willow	3-6 ft.	0.5"-1.5" cal.	Shrub	40%
					100%
Herbaceous Plugs					
Juncus effusus	Common Rush	4 ft.	1.0"- 2.0" plug	Herb	40%
Carex alata	Broadwing Sedge	4 ft.	1.0"- 2.0" plug	Herb	40%
Panicum virgatum	Switchgrass	4 ft.	1.0"- 2.0" plug	Herb	20%
					100%

Black Willow is only acceptable to be planted on any stream with a top of bank width of 10' or greater. Use elderberry on any stream who's top of bank width is less than 10'.

Buffer Planting Zone

Bare Root

Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	# of Stems
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Quercus nigra	Water Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	7%
Acer negundo	Box Elder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Populus deltoides	Eastern Cottonwood	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	7%
Magnolia virginiana	Sweetbay Mangolina	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	6%
						100%

Priority 1 Floodplain and Wetland Planting Zone

Bare Root

Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	# of Stems
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Acer negundo	Box Elder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Quercus pagoda	Cherry Bark Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Ulmus Alata	Winged Elm	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	5%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	20%
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	15%
Salix nigra	Black Willow	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	5%
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	10%
Quercus nigra	Water Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	5%
						100%

Permanent Riparian Seeding

Pure Live Seed (20 lbs / acre)

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)	pH	Percentage
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	1.6	5.0-7.5	8%
All Year	*Sorghastrum nutans*	Indiangrass	Herb	2.0	4.8-8.0	10%
All Year	*Elymus virginicus*	Virginia Wildrye	Herb	3.0	5.0-7.0	15%
All Year	*Bidens aristosa*	Bur Marigold	Herb	1.0	6.0-8.0	5%
All Year	*Helianthus angustifolius*	Narrowleaf Sunflower	Herb	1.0	4.0-7.0	5%
All Year	*Chasmanthium latifolium*	River Oats	Herb	1.0	5.0-7.0	5%
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	1.0	6.0-7.0	5%
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	1.0	6.0-7.0	5%
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	2.0	6.8-8.9	10%
All Year	*Panicum clandestinum*	Deertongue	Herb	3.4	4.0-7.5	17%
All Year	*Elymus riparius*	Riverbank Wildrye	Herb	1.0	4.5-7.2	5%
All Year	*Panicum virgatum*	Switchgrass	Herb	1.0	4.5-8.0	5%
All Year	*Chamaecrista fasciculata*	Partridge Pea	Herb	1.0	5.5-7.5	5%
						100%

*Wetland Status for Southeastern US

Most information provided by Ernst Conservation Seeds

Permanent Seeding Outside Easement

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)	Percentage
All Year	*Festuca arundinacea*	Tall Fescue	Herb	40	70%
All Year	*Festuca rubra*	Creeping Red Fescue	Herb	40	10%
All Year	*Dactylis glomerata*	Orchardgrass	Herb	40	20%
					100%

Temporary Seeding

Pure Live Seed

Approved Date	Species Name	Common Name	Stratum	Density (lbs/acre)
Aug 15 - May 1	*Secale cereale*	Rye Grain	Herb	140
May 1 - Aug 15	*Setaria italica*	German Millet	Herb	50

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Johnston County, North Carolina

Planting Tables

Revisions:

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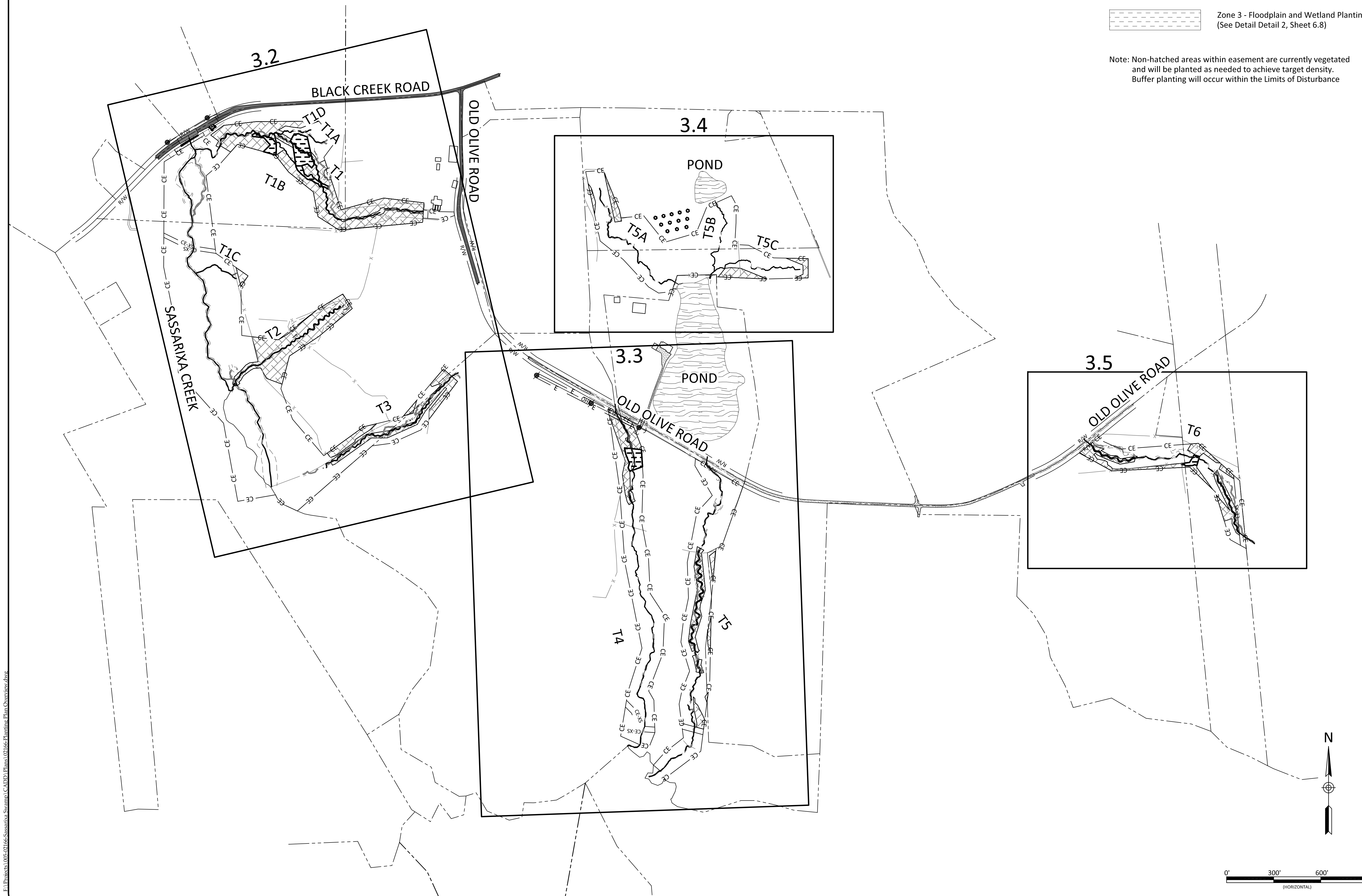
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

Sheet 3.0



Zone 1 - Streambank Planting Zone
(See Detail 1, Sheet 6.8)

Zone 2 - Buffer Planting Zone
(See Detail 2, Sheet 6.8)

Zone 3 - Floodplain and Wetland Planting Zone
(See Detail Detail 2, Sheet 6.8)

Note: Non-hatched areas within easement are currently vegetated and will be planted as needed to achieve target density. Buffer planting will occur within the Limits of Disturbance

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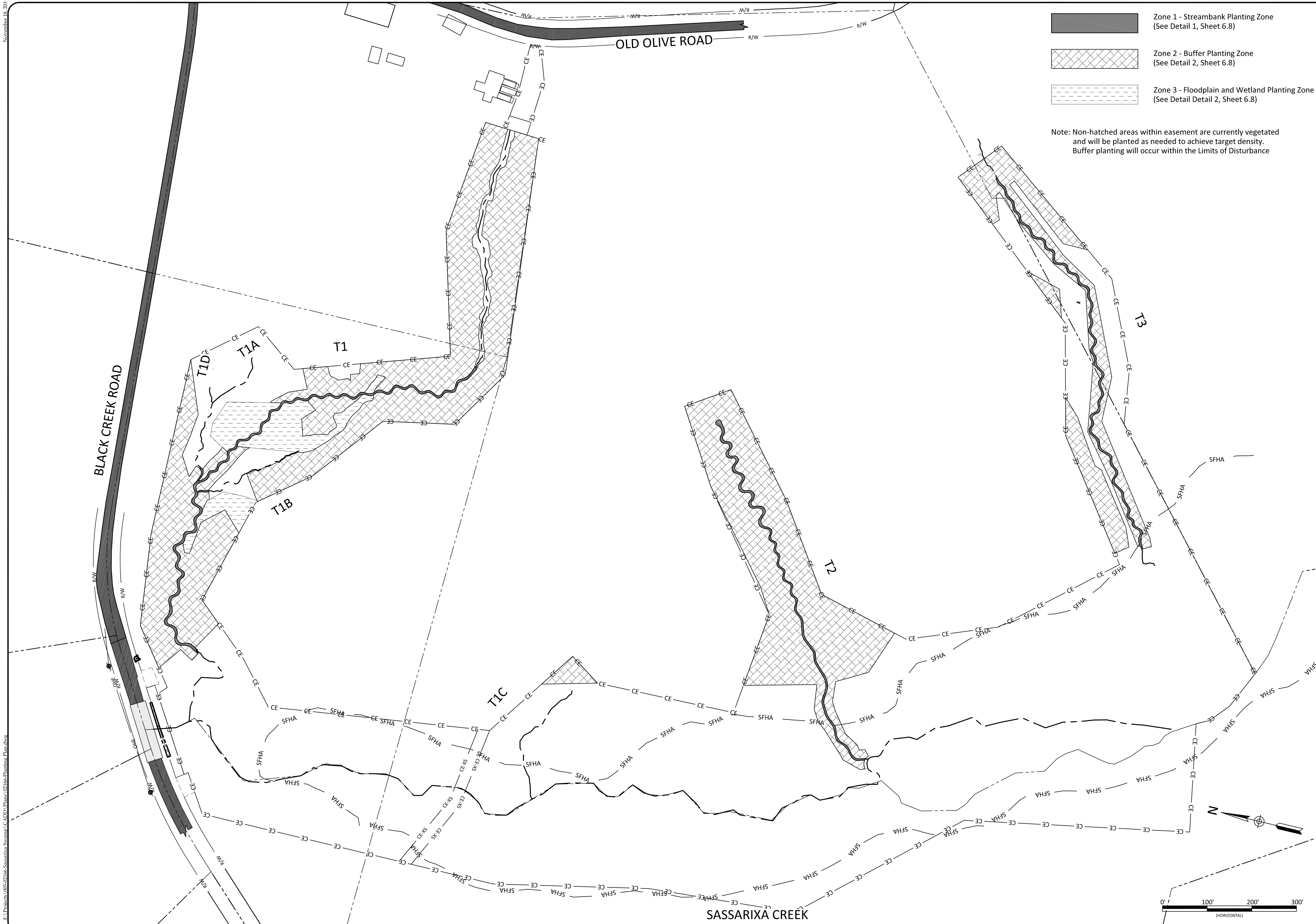

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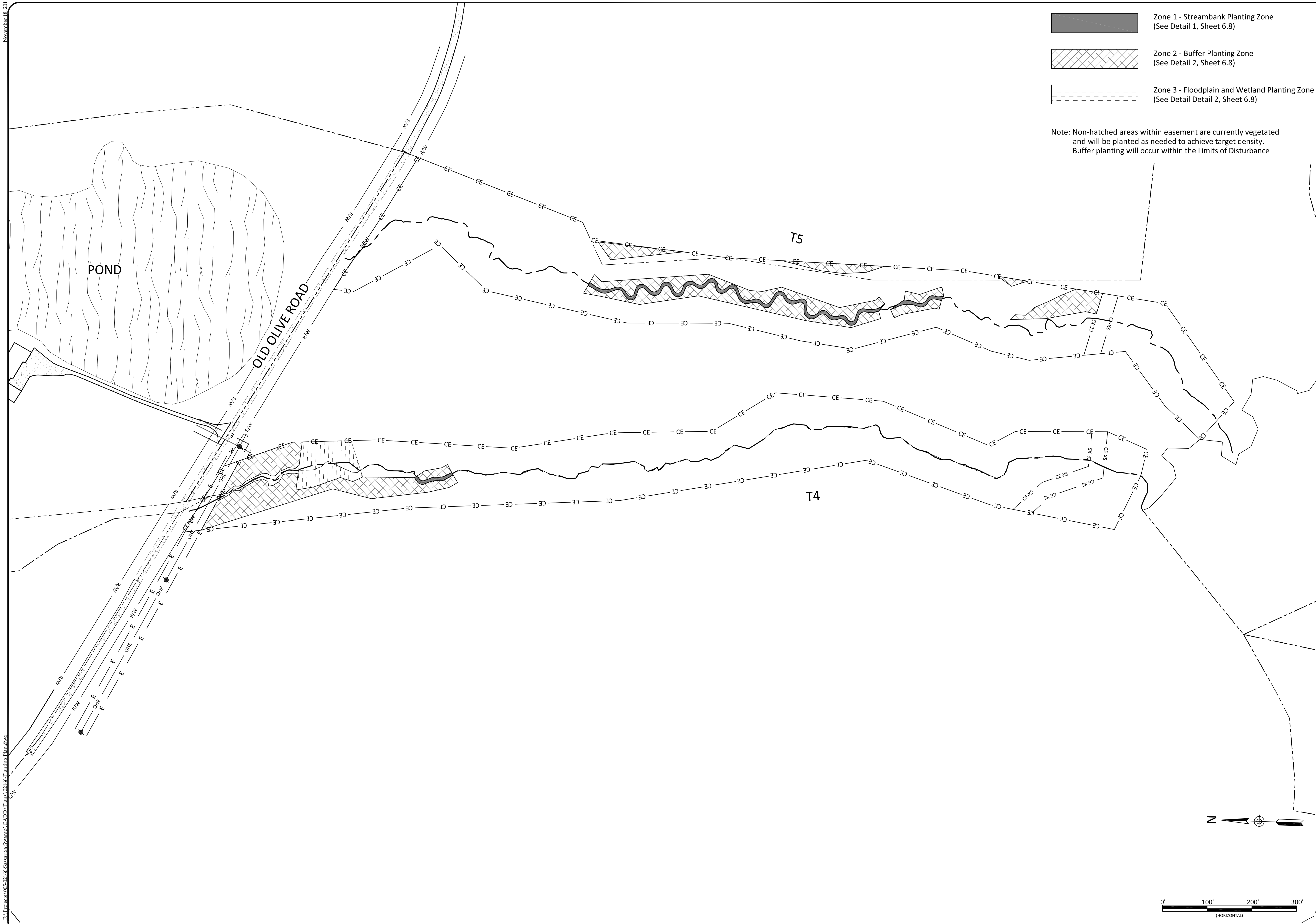

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Zone 1 - Streambank Planting Zone
(See Detail 1, Sheet 6.8)

Zone 2 - Buffer Planting Zone
(See Detail 2, Sheet 6.8)

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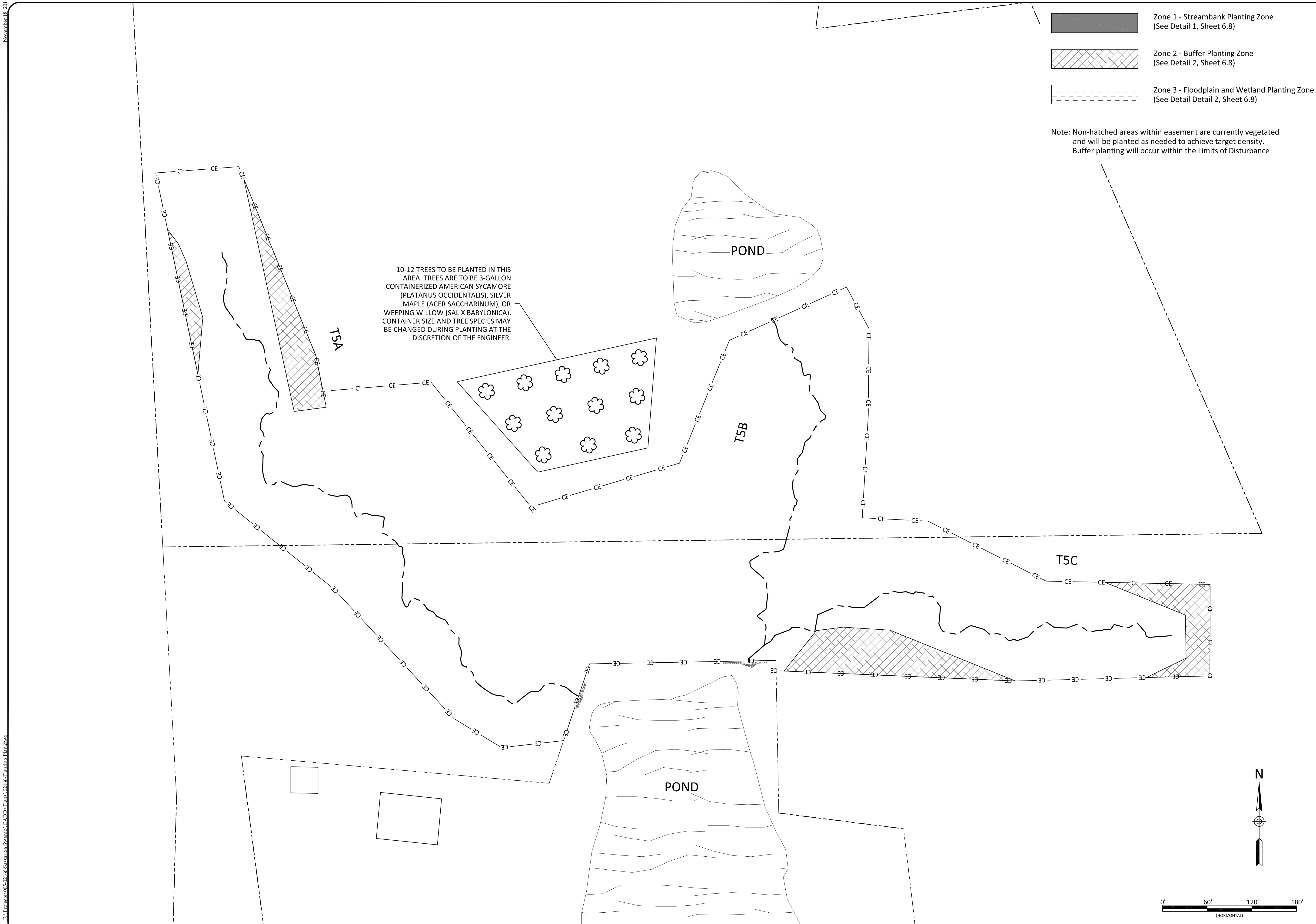

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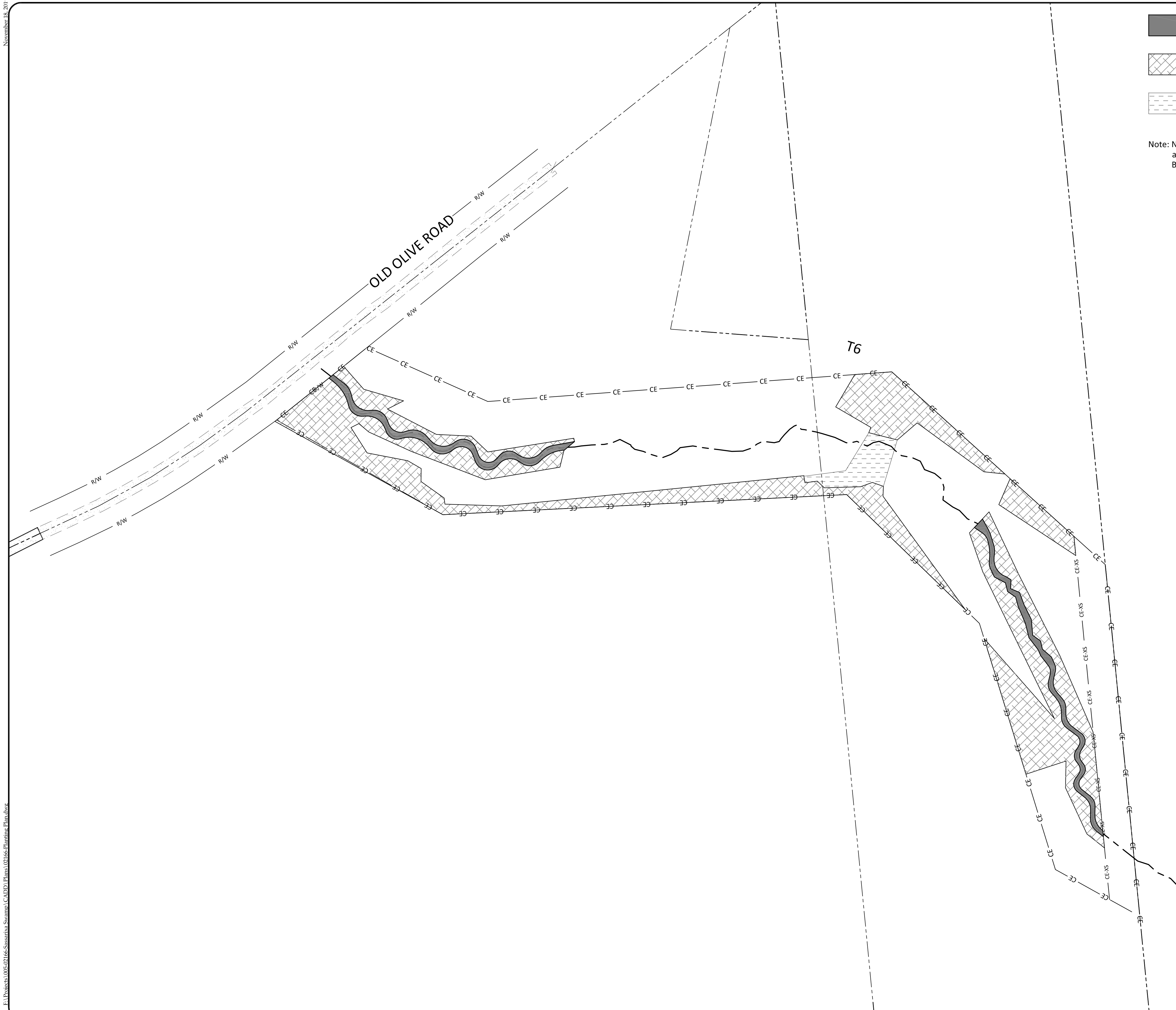

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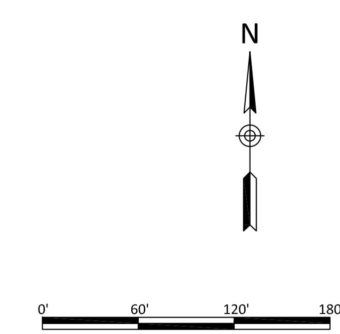

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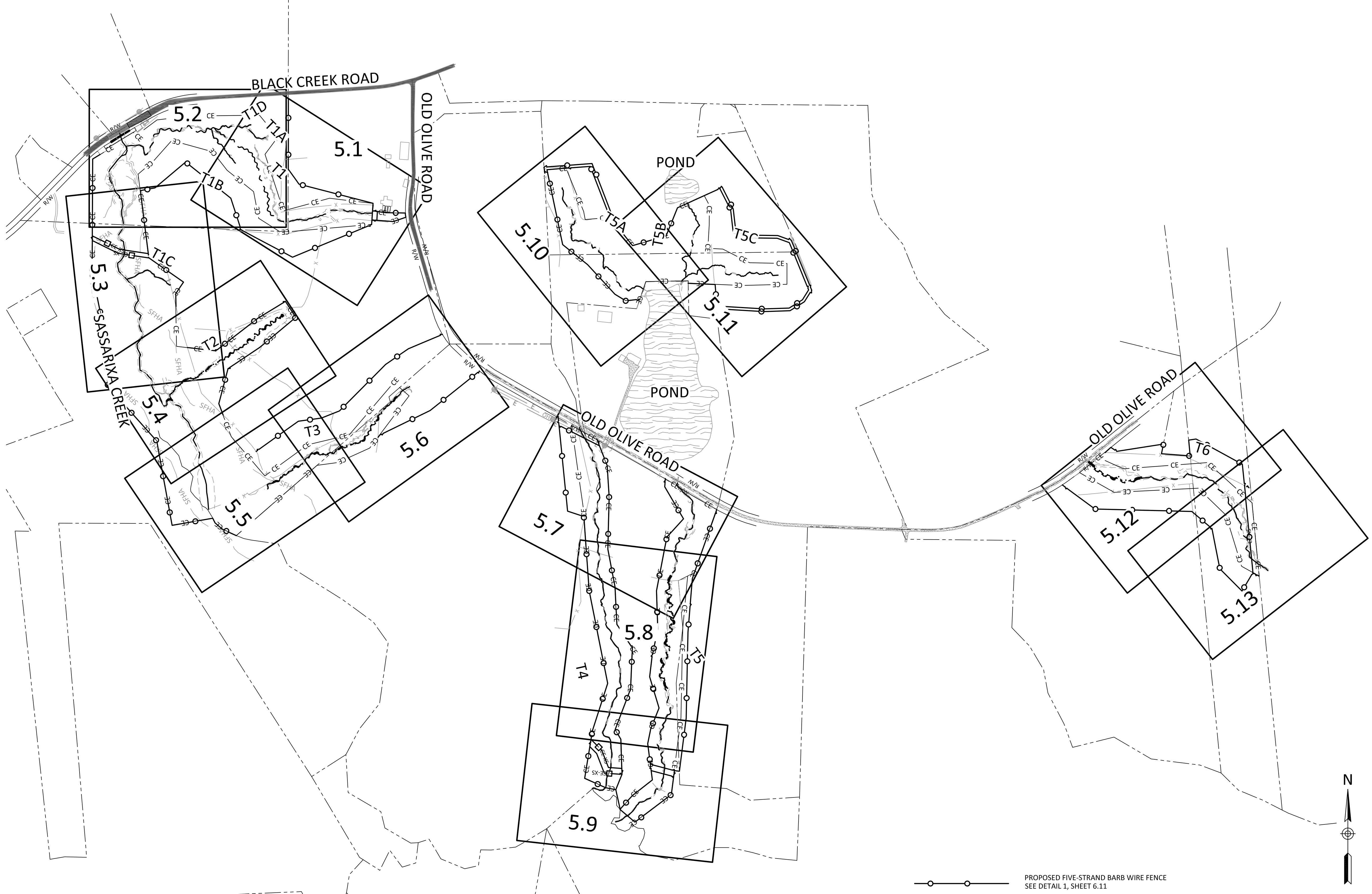

PROPOSED FIVE-STRAND BARB WIRE FENCE
SEE DETAIL 1, SHEET 6.11

PROPOSED HIGH TENSILE WIRE AT STREAM
CROSSINGS. SEE DETAIL 3, SHEET 6.11

PROPOSED 2" TUBE STEEL GATE
SEE DETAIL AS NOTED

0' 300' 600' 900'
(HORIZONTAL)

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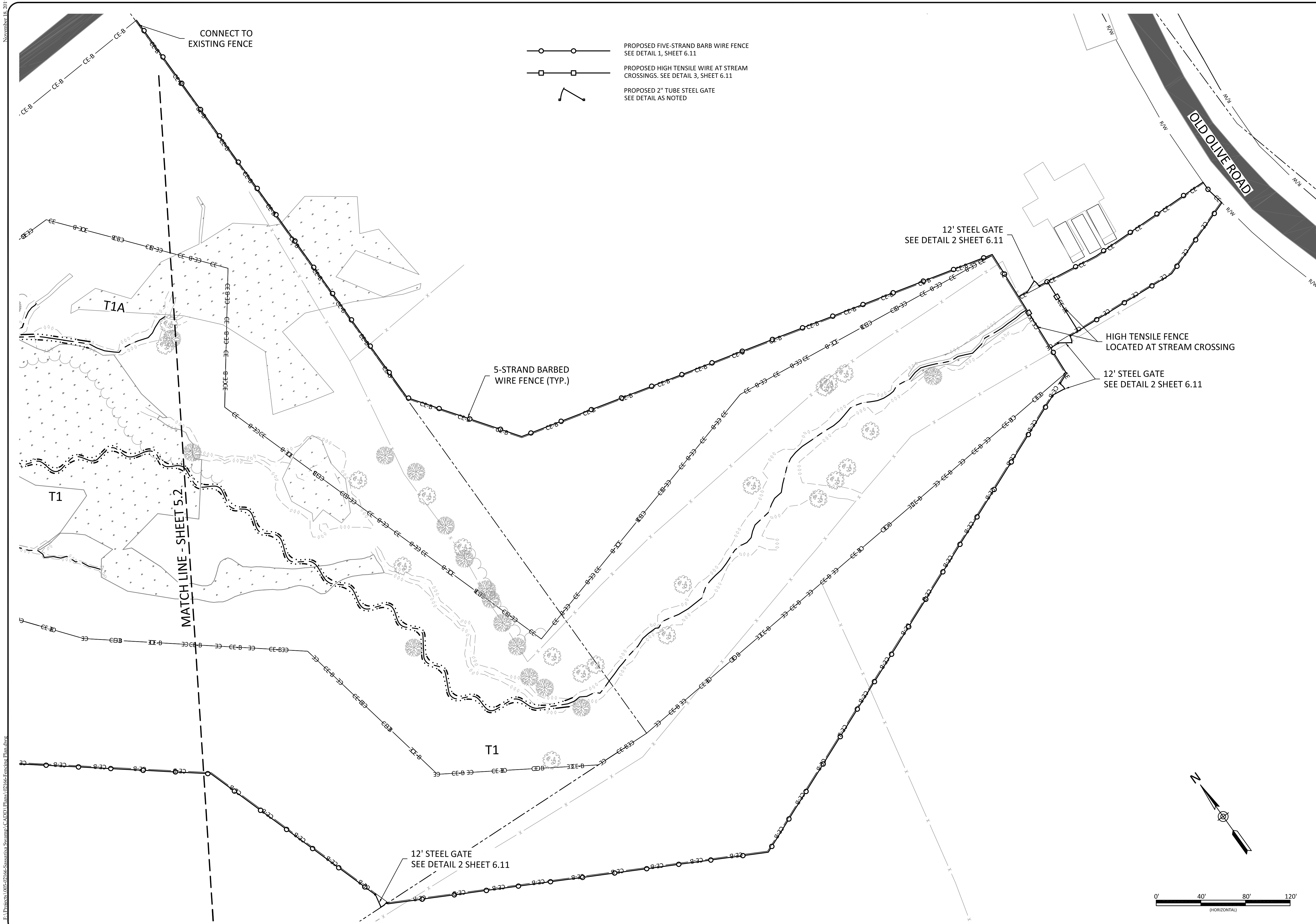

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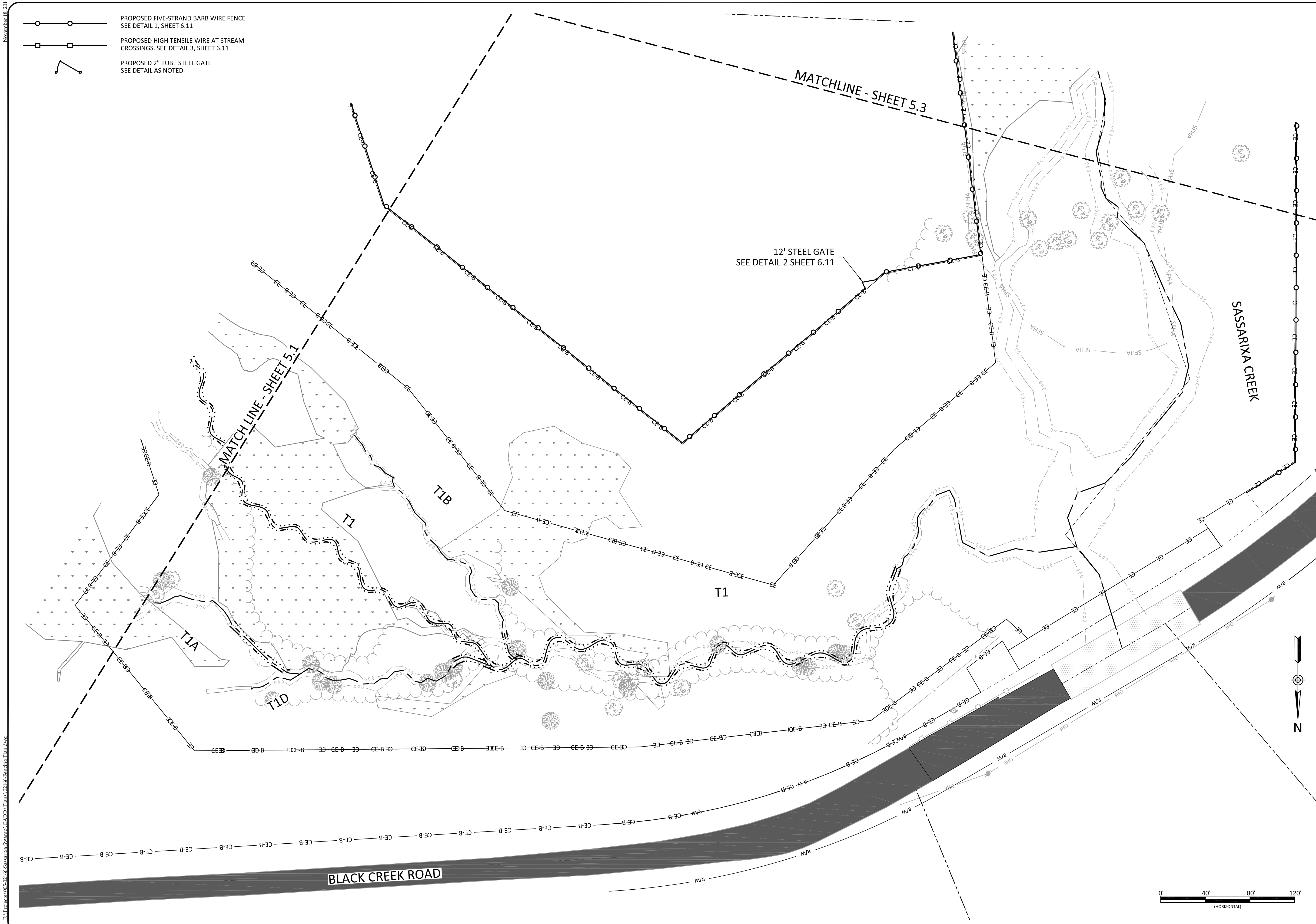

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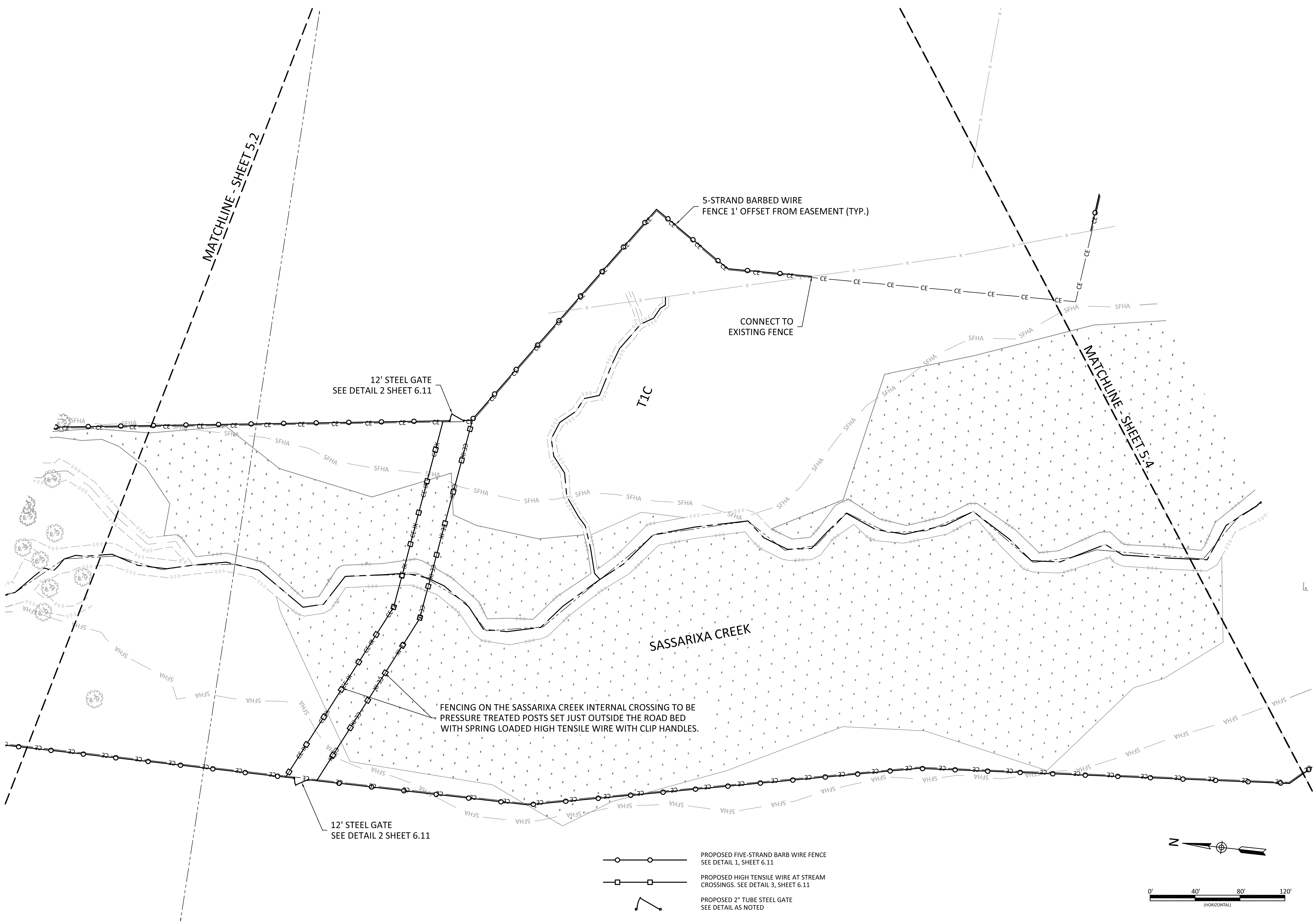

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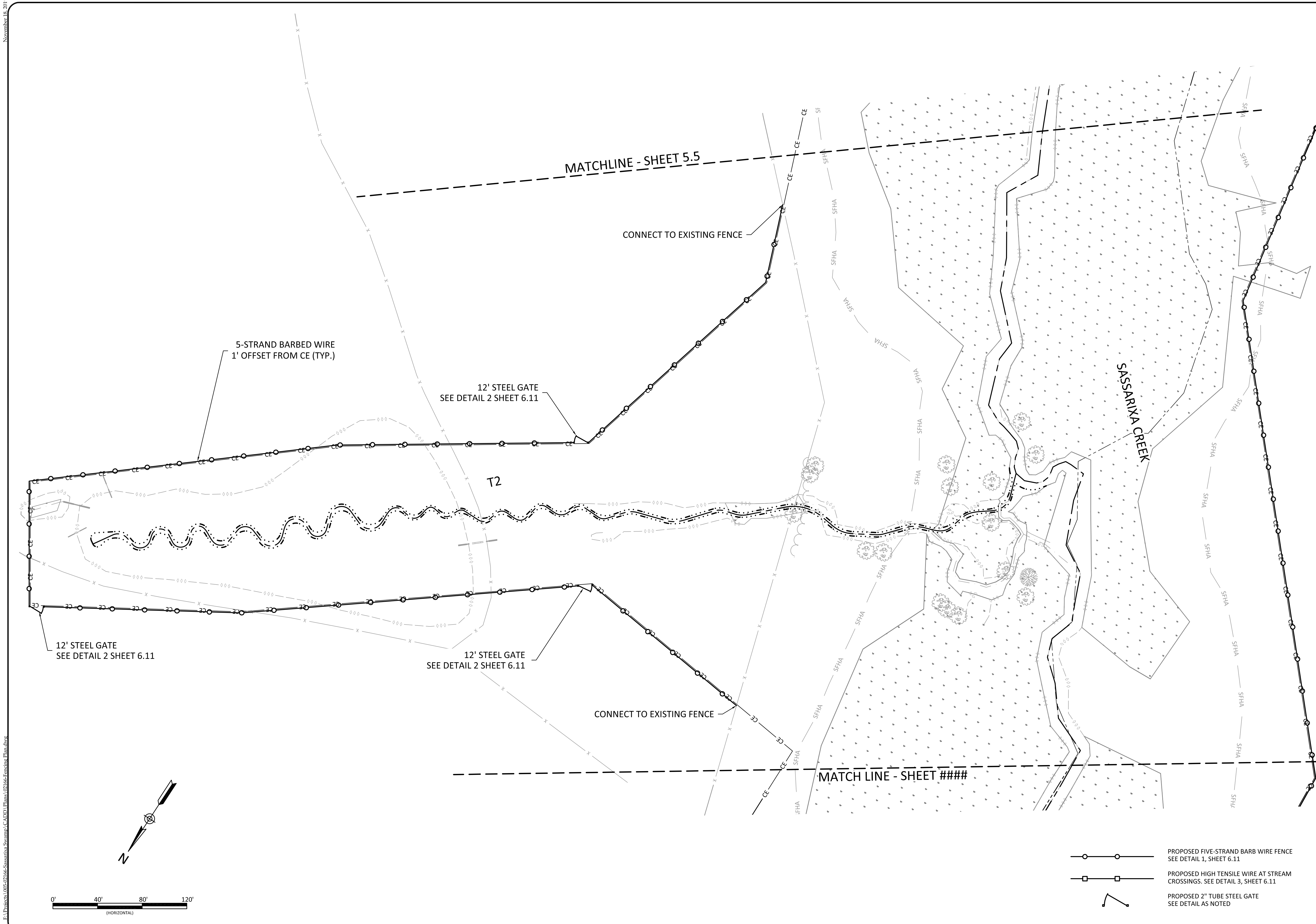

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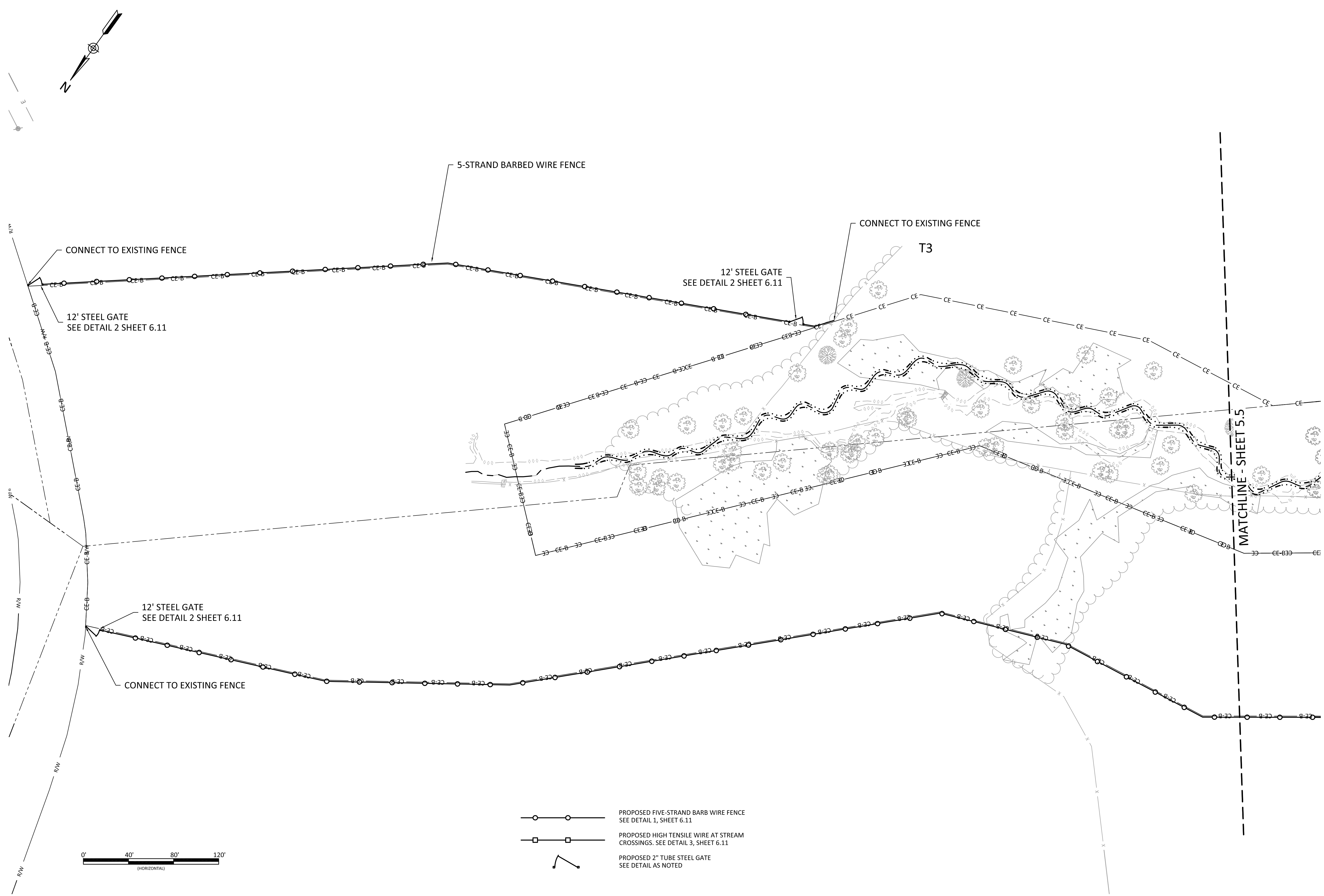

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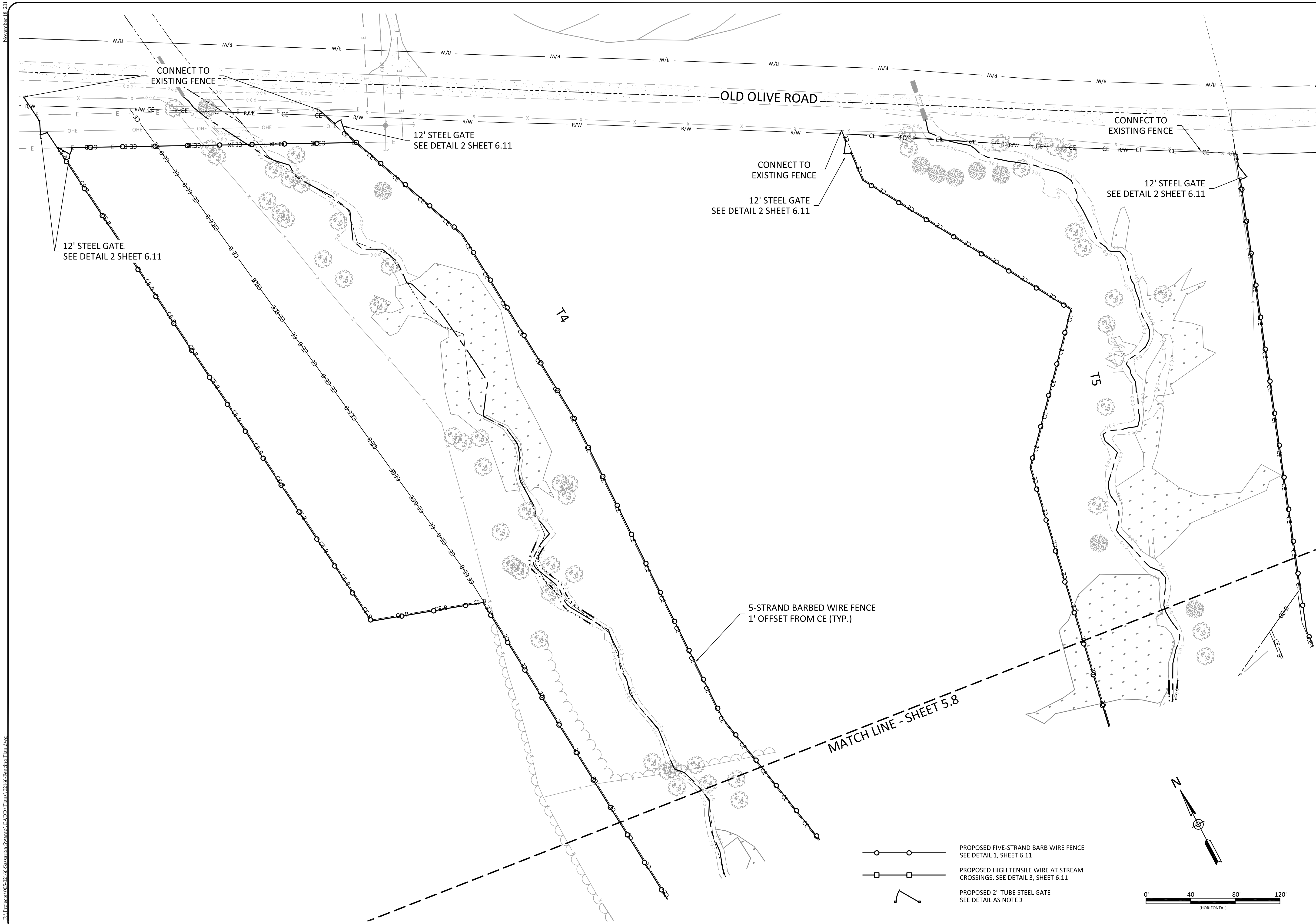

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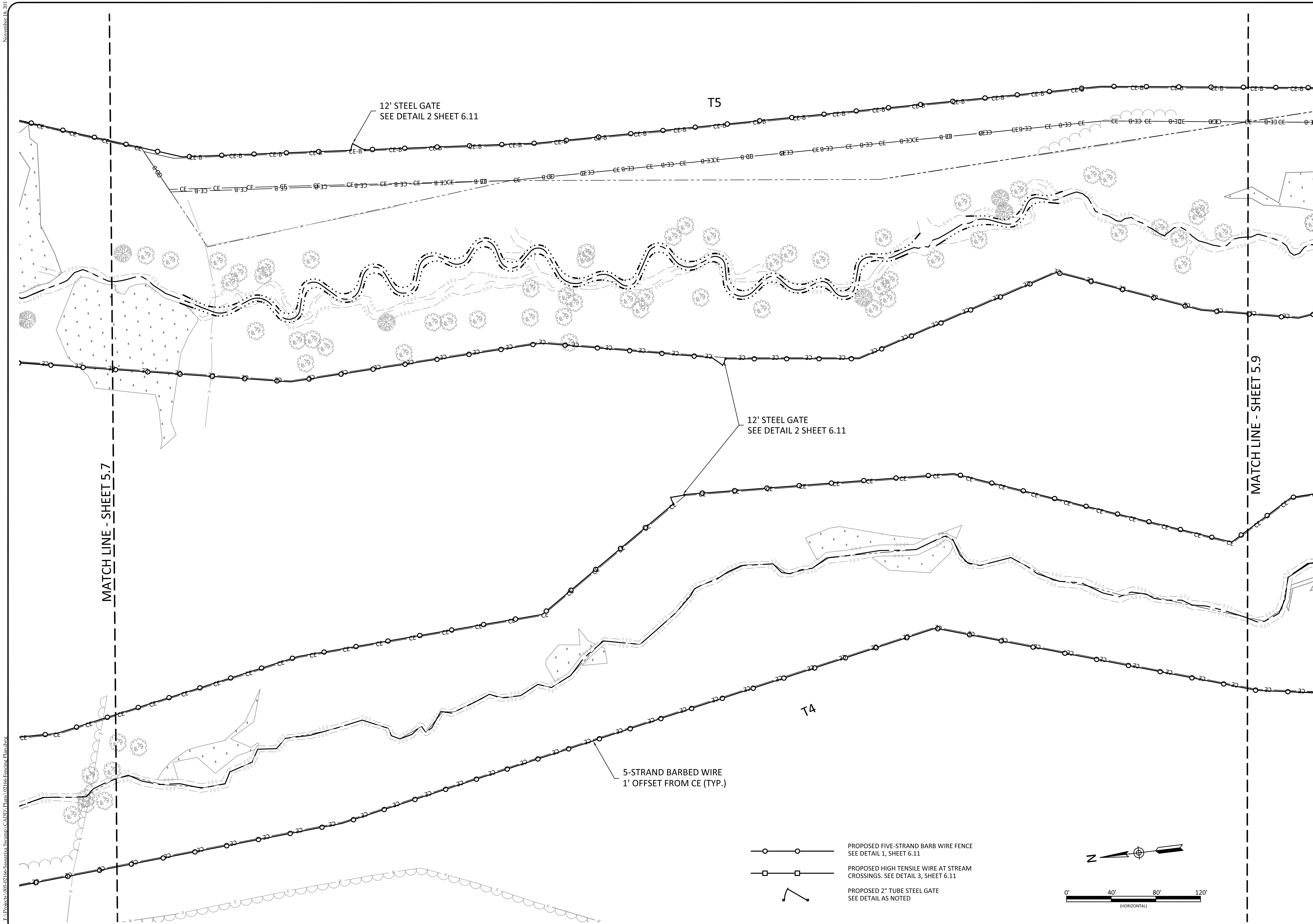

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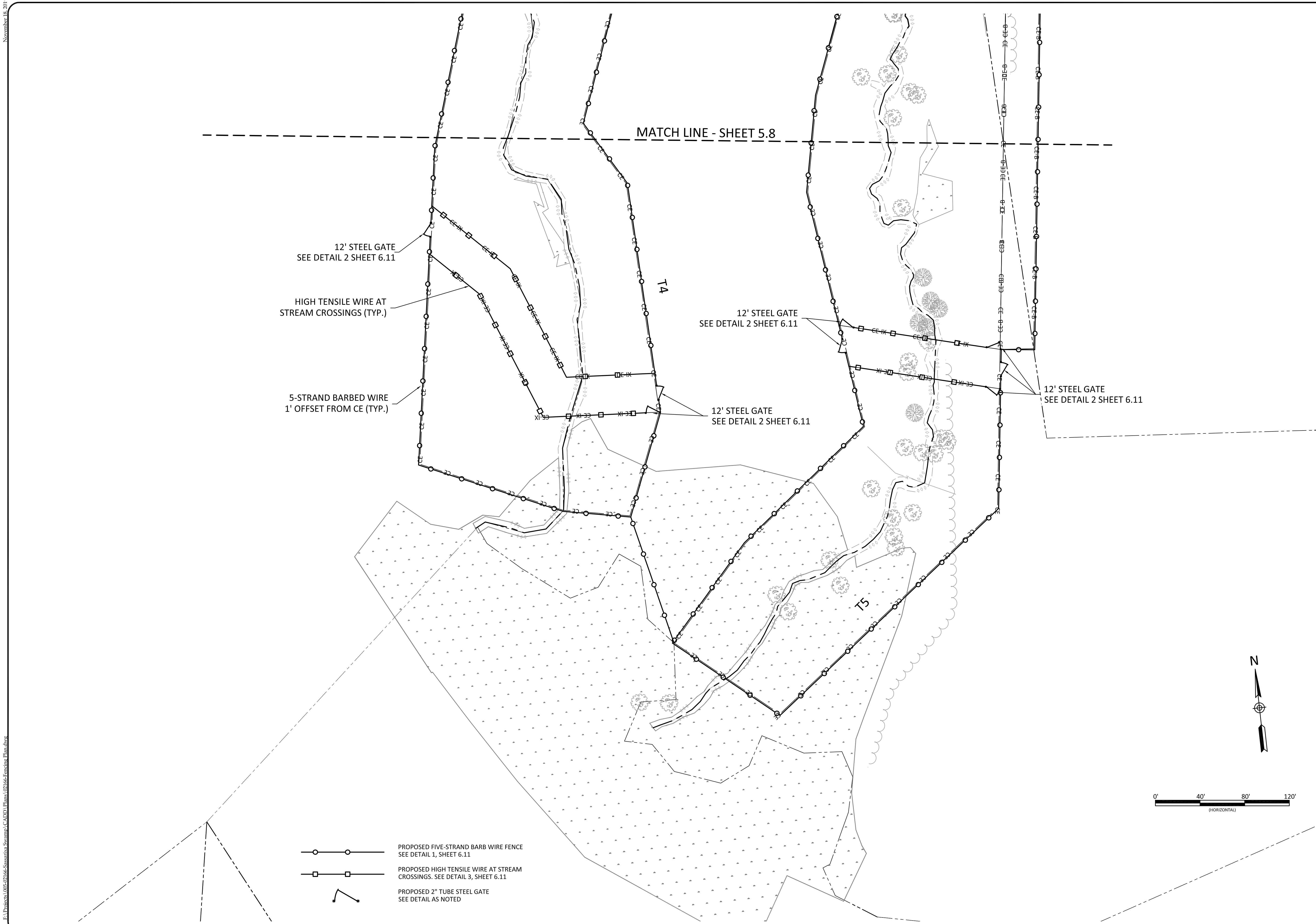

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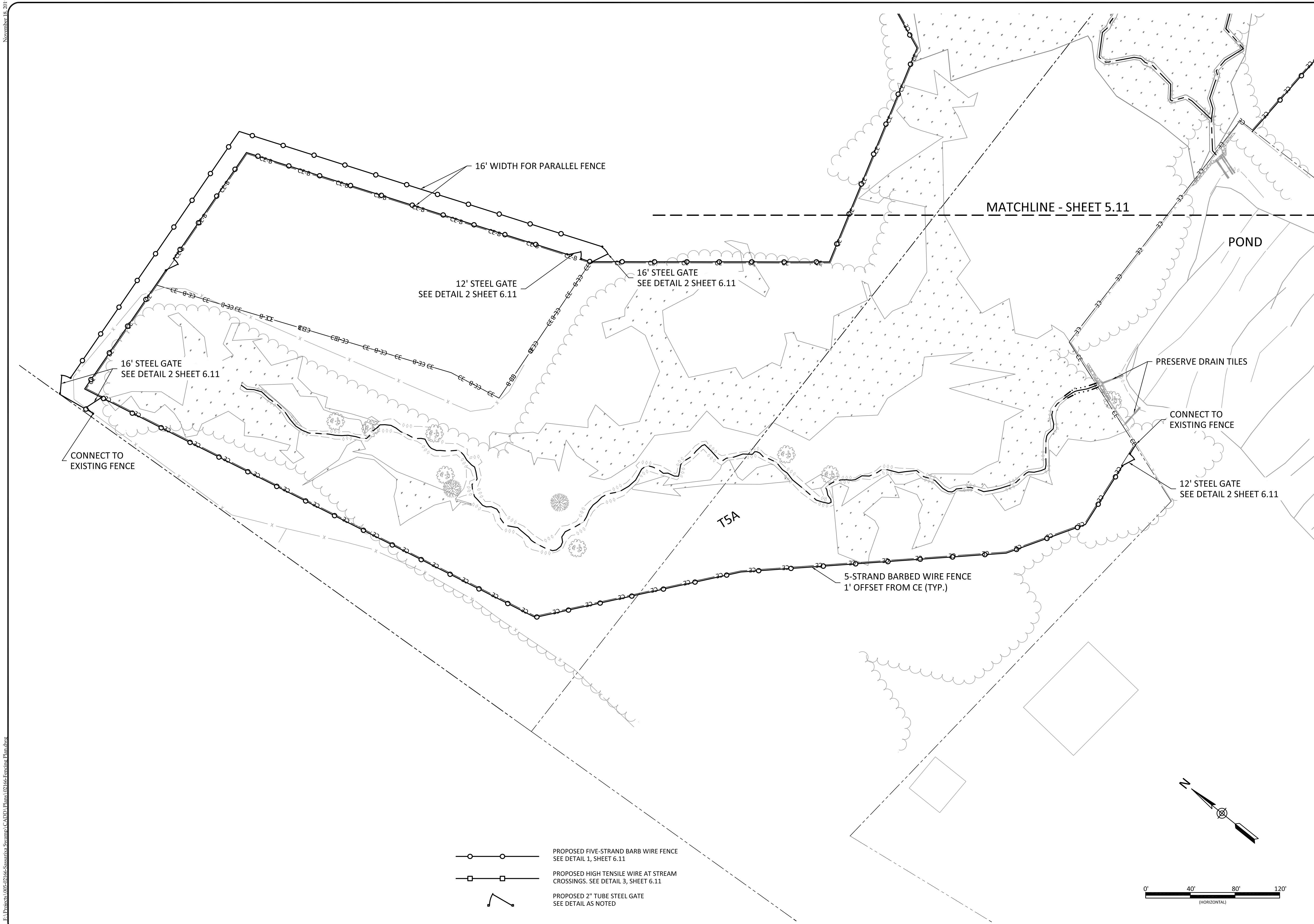

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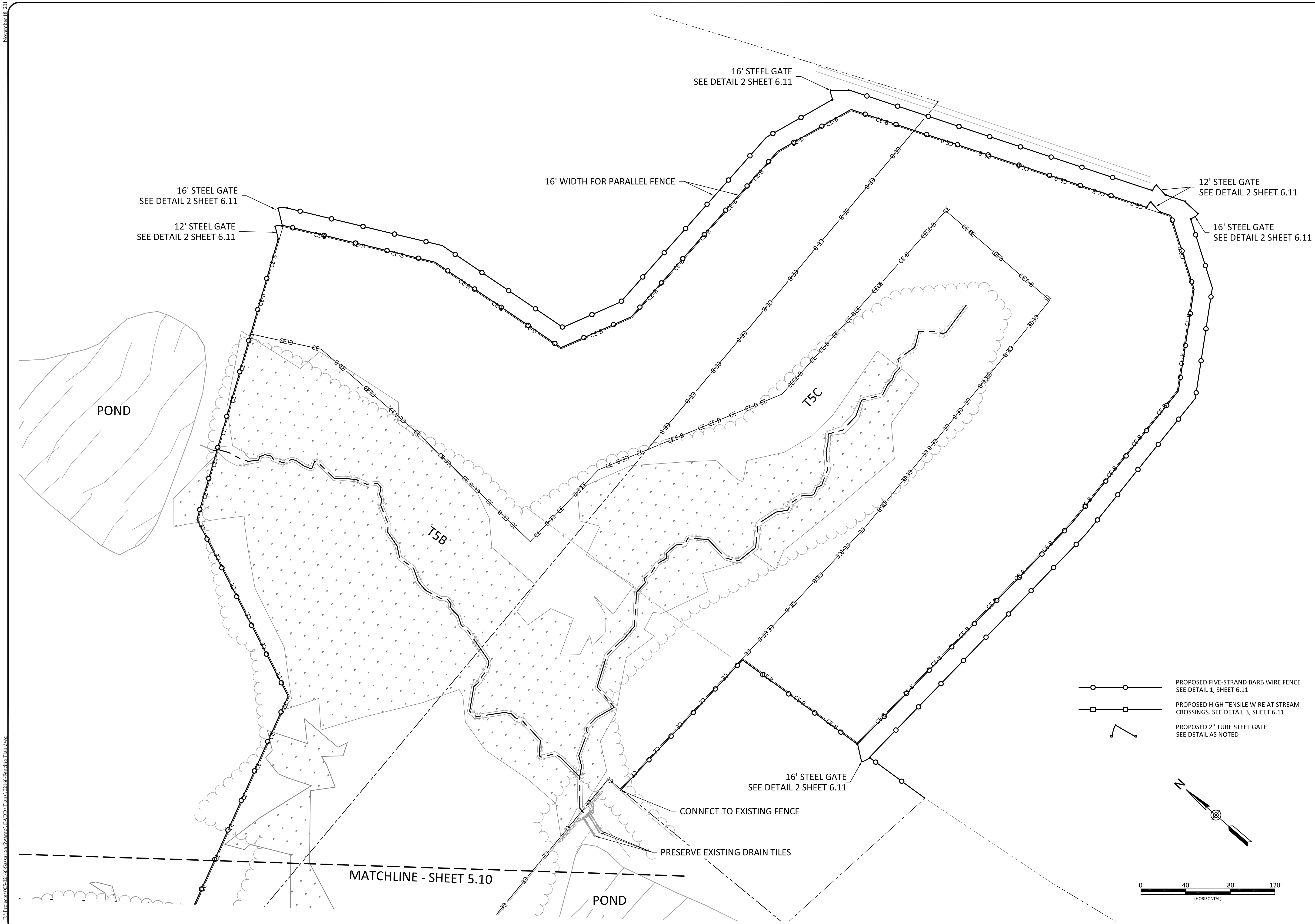

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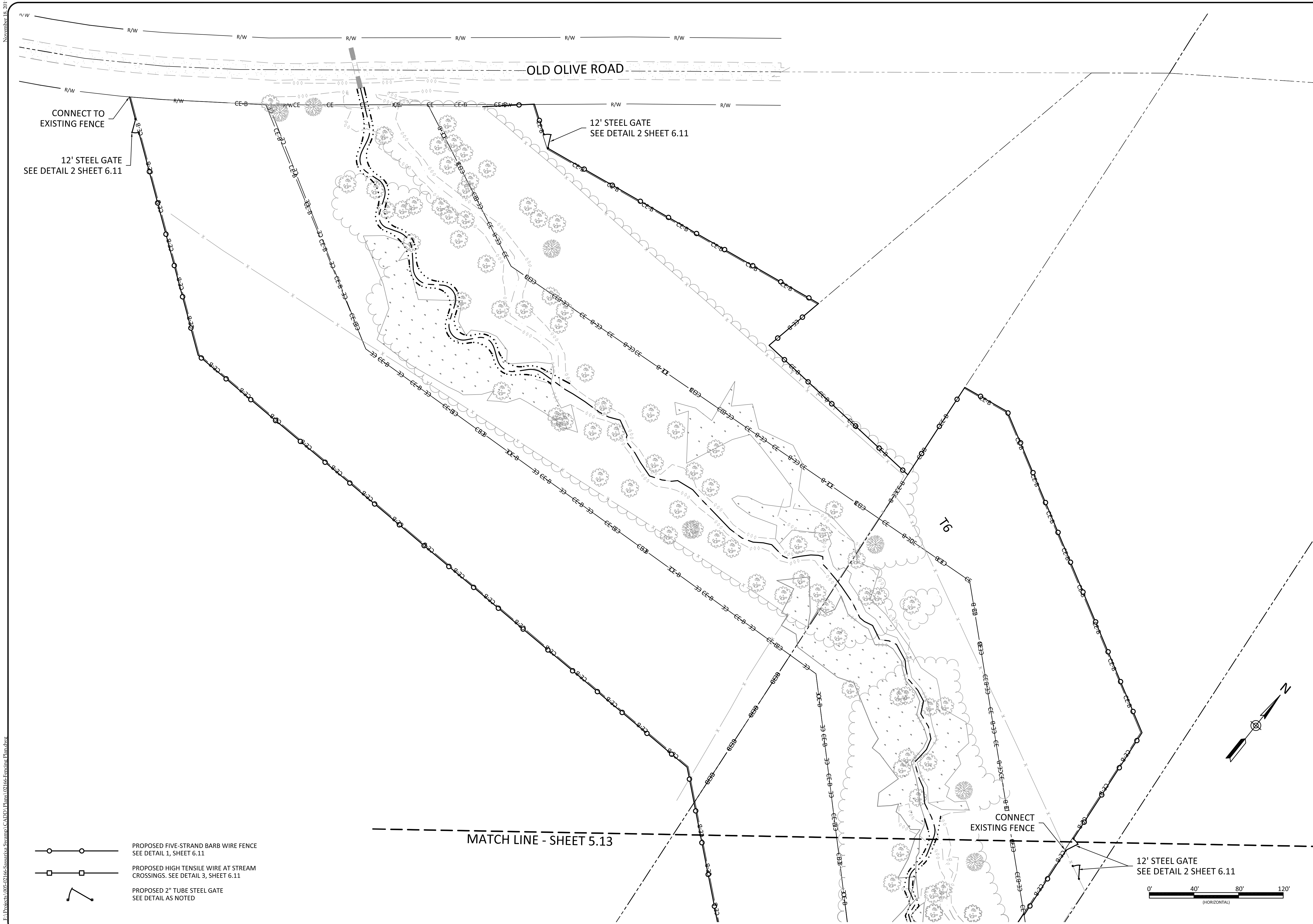

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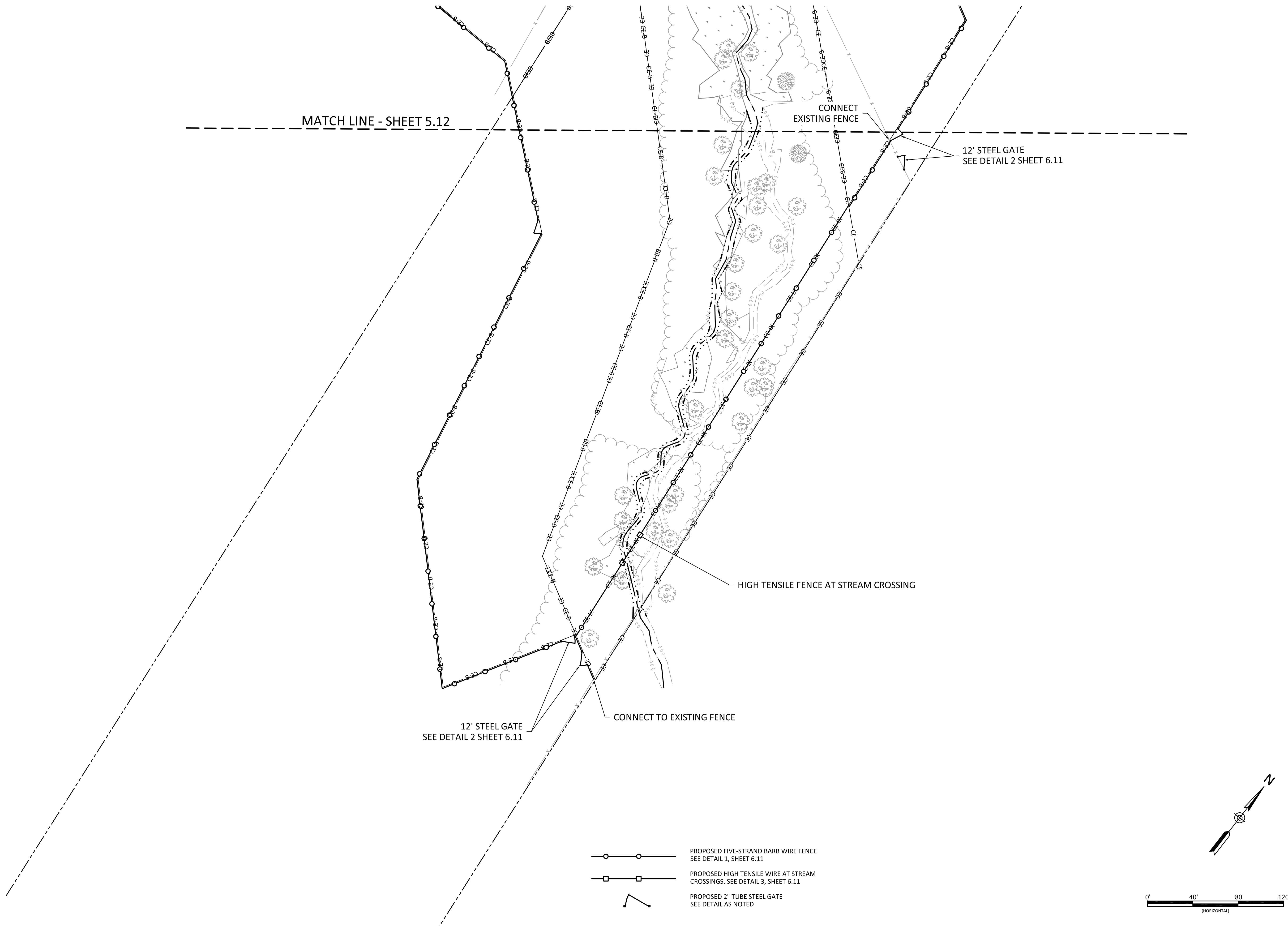

PROPOSED FIVE-STRAND BARB WIRE FENCE
SEE DETAIL 1, SHEET 6.11

PROPOSED HIGH TENSILE WIRE AT STREAM
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PROPOSED 2" TUBE STEEL GATE
SEE DETAIL AS NOTED

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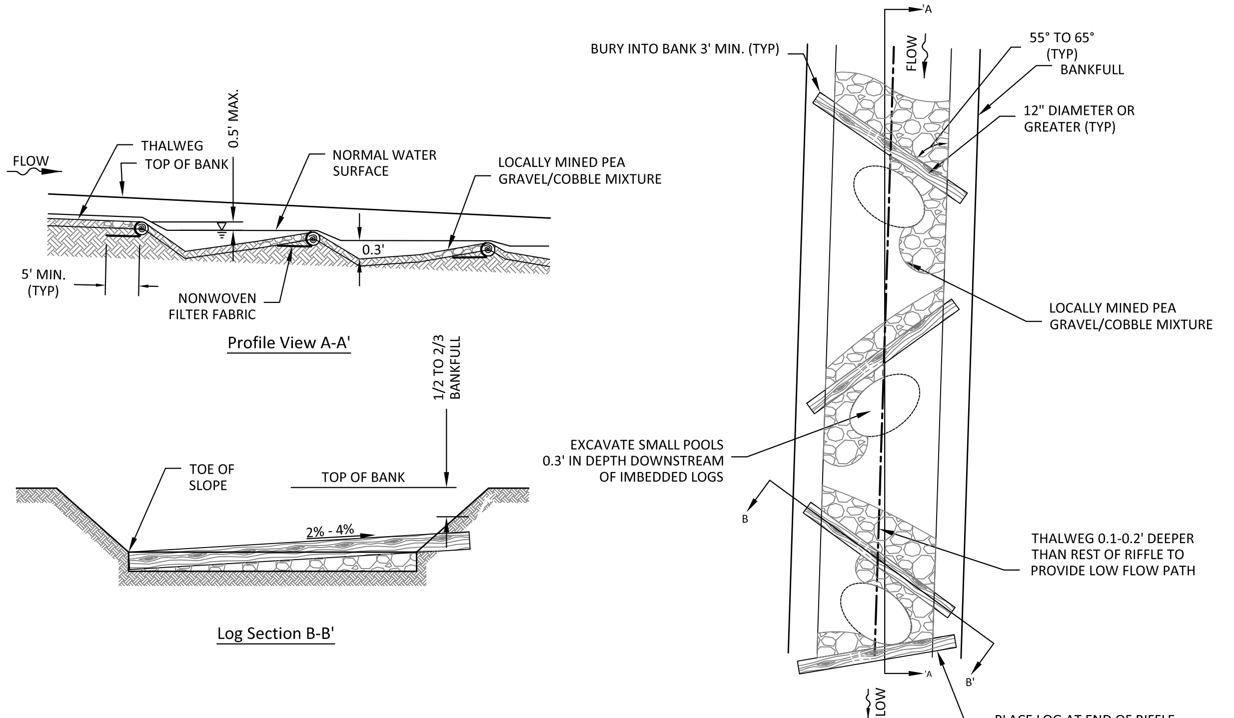
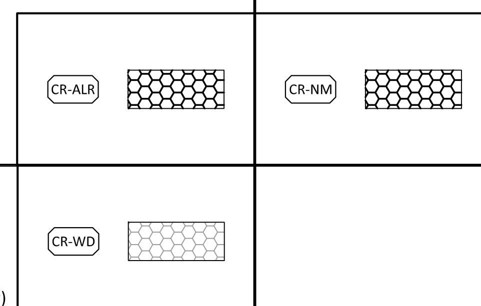
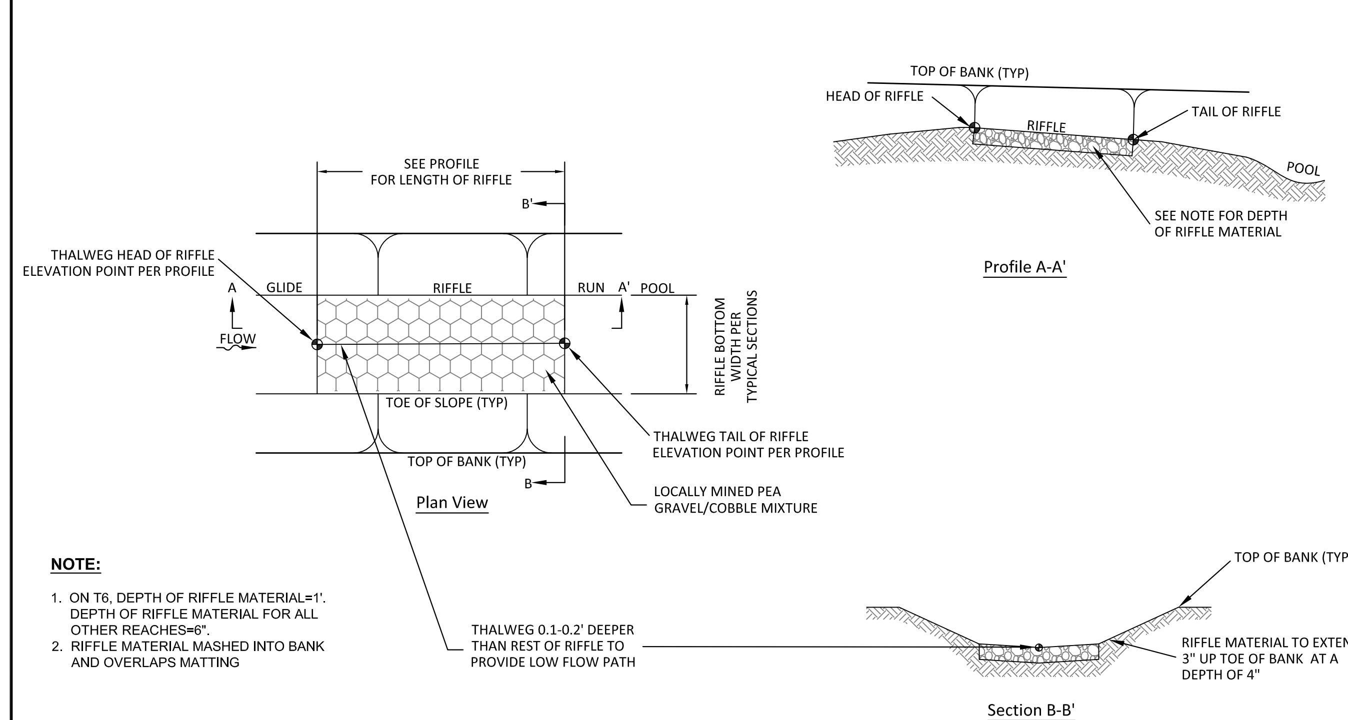


NOTES:

1. MINIMUM LOG DIAMETER 18" ON T6, OR USE FOOTER. MINIMUM LOG DIAMETER 12" ON ALL OTHER REACHES.
2. MINIMUM THREE LOGS PER STRUCTURE.

1/6.0 Angled Log Riffle
Not to Scale

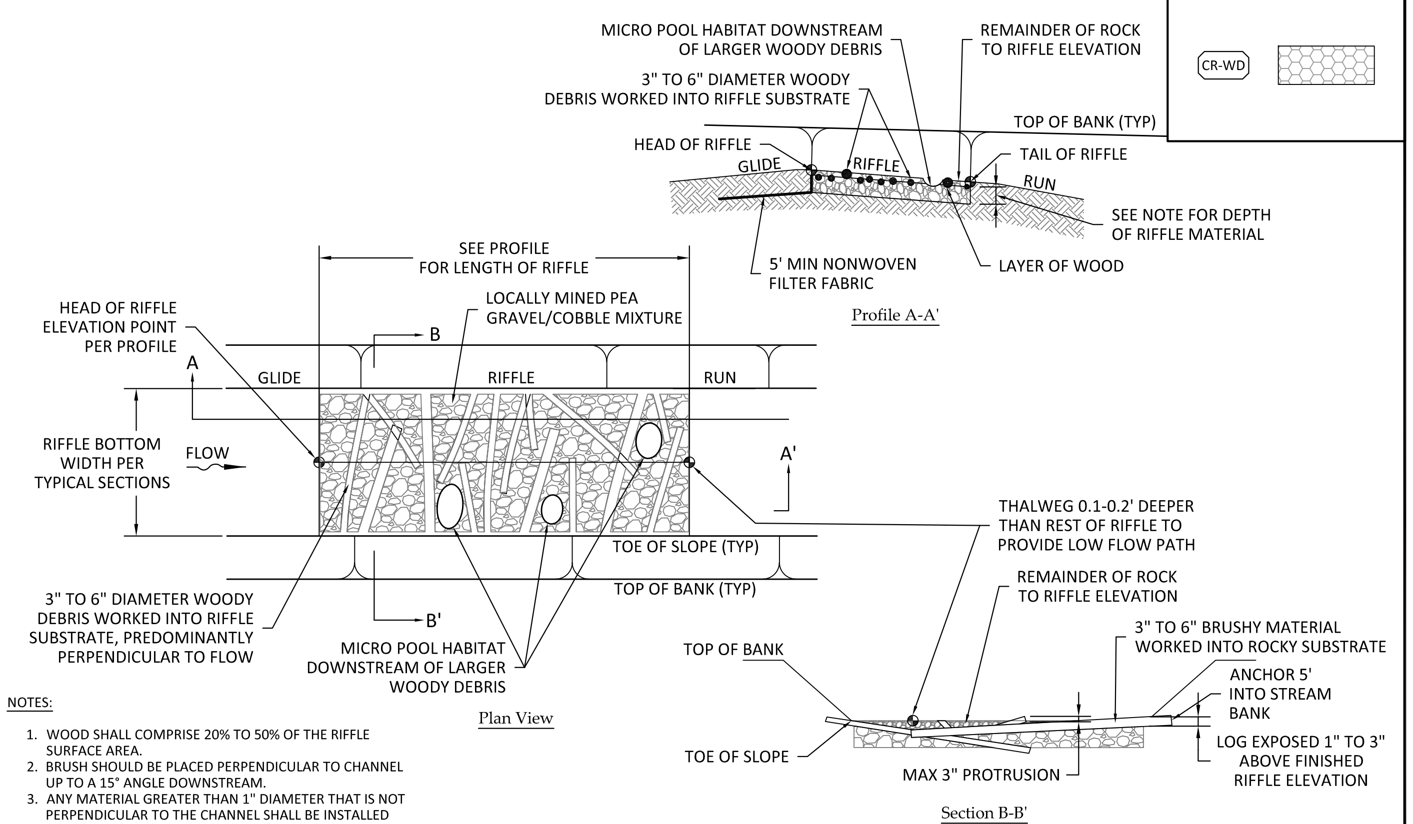




NOTE:

1. ON T6, DEPTH OF RIFFLE MATERIAL=1'. DEPTH OF RIFFLE MATERIAL FOR ALL OTHER REACHES=6".
2. RIFFLE MATERIAL MASHED INTO BANK AND OVERLAPS MATTING

2/6.0 Native Material Riffle
Not to Scale



NOTES:

1. WOOD SHALL COMPRISE 20% TO 50% OF THE RIFFLE SURFACE AREA.
2. BRUSH SHOULD BE PLACED PERPENDICULAR TO CHANNEL UP TO A 15° ANGLE DOWNSTREAM.
3. ANY MATERIAL GREATER THAN 1" DIAMETER THAT IS NOT PERPENDICULAR TO THE CHANNEL SHALL BE INSTALLED SUCH THAT THE EXPOSED END IS POINTING DOWNSTREAM.
4. WOODY MATERIAL SHOULD NOT PROTRUDE GREATER THAN 3" ABOVE RIFFLE BED.
5. BRUSH CUTTERS OR OTHER DEVICE MUST BE USED TO ENSURE PROTRUSION LIMITED TO TOLERANCE IN NOTE 2.
6. IF NECESSARY, QUARRY ROCK OF SIMILAR SIZE MAY BE SUBSTITUTED.

3/6.0 Woody Riffle
Not to Scale

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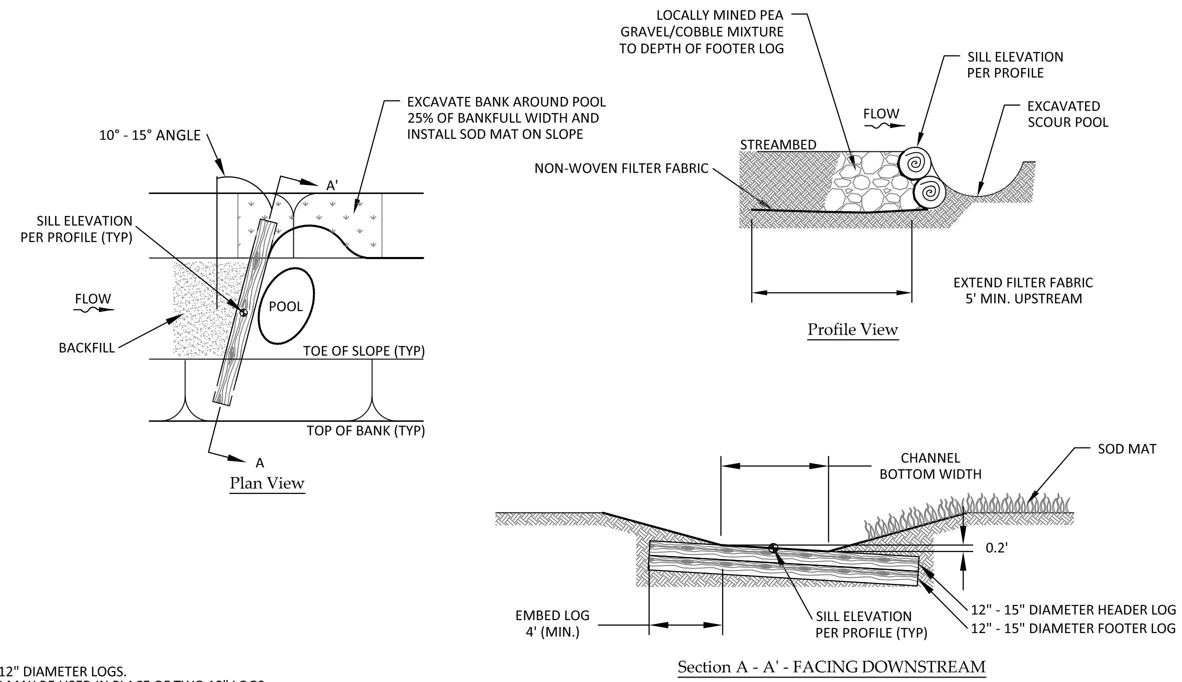
6.0

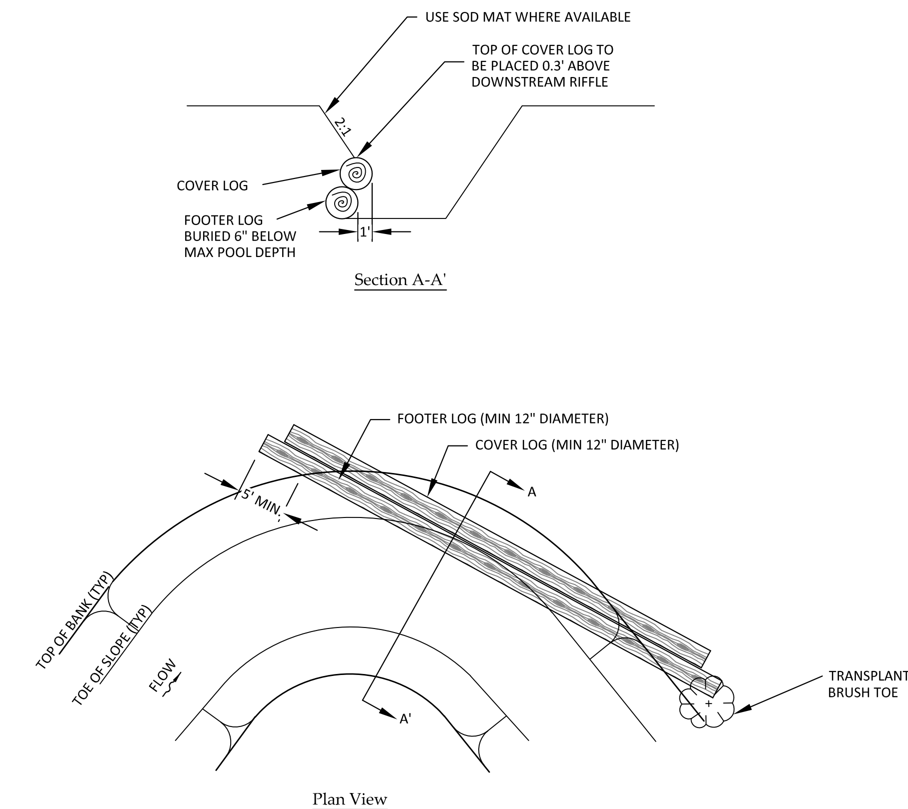
Sheet



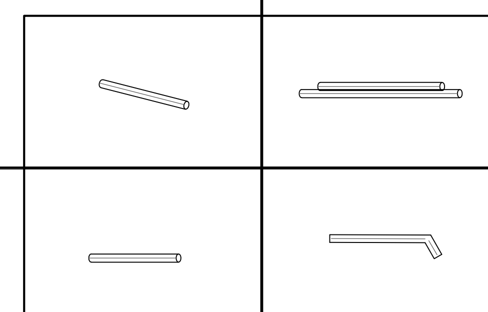
NOTES:

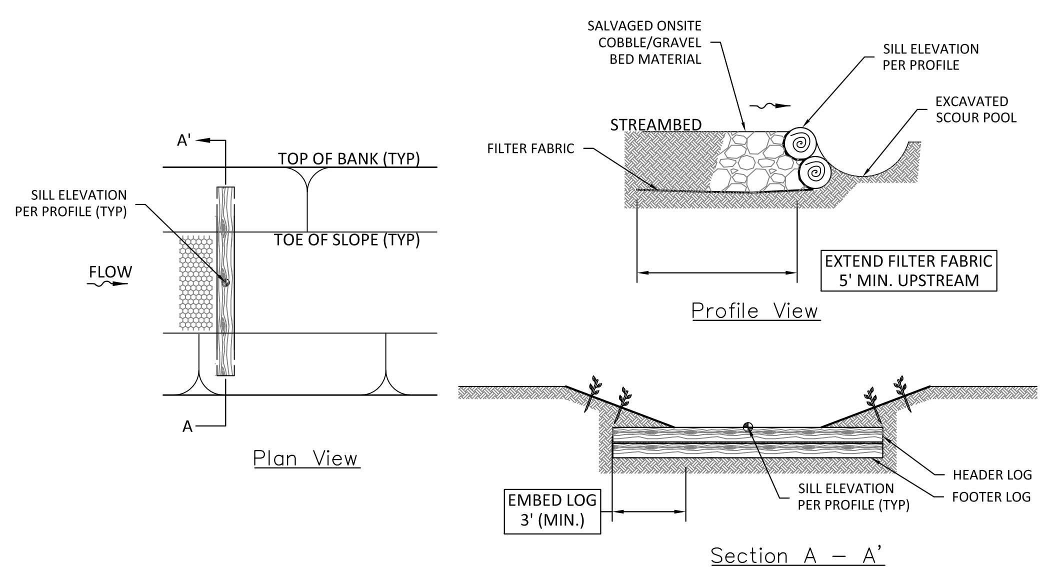
1. USE MINIMUM 12" DIAMETER LOGS.
2. ONE 24-30" LOG MAY BE USED IN PLACE OF TWO 12" LOGS
3. LOG IS TO BE AT GRADE IN CENTER OF CHANNEL.

1 / 6.1 **Angled Log Sill**
Not to Scale

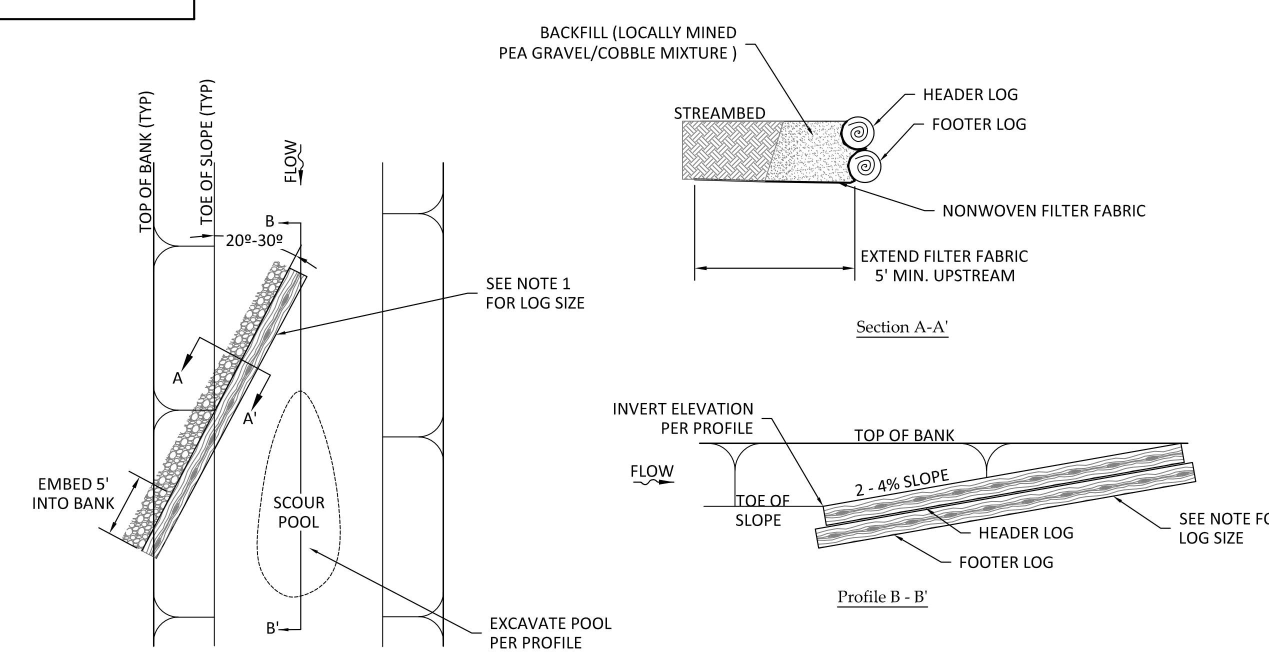


1 / 6.1 **Lunker Log**
Not to Scale





3 / 6.1 **Log Sill**
Not to Scale



4 / 6.1 **Log Vane**
Not to Scale

NOTE:

1. LOG DIAMETER SHALL BE 12" AT A MINIMUM.
2. LENGTHS OF LOGS MAY VARY. IN GENERAL, VANE WILL START AT TAIL OF RIFFLE AND ANGLE DOWNSTREAM AT 20°-30° HORIZONTALLY AND 2-4% VERTICALLY UNTIL IT EMBEDS 5' INTO OUTER MEANDER BEND.

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Sassarixa Swamp
Johnston County, North Carolina

Details

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Checked By:	ANA

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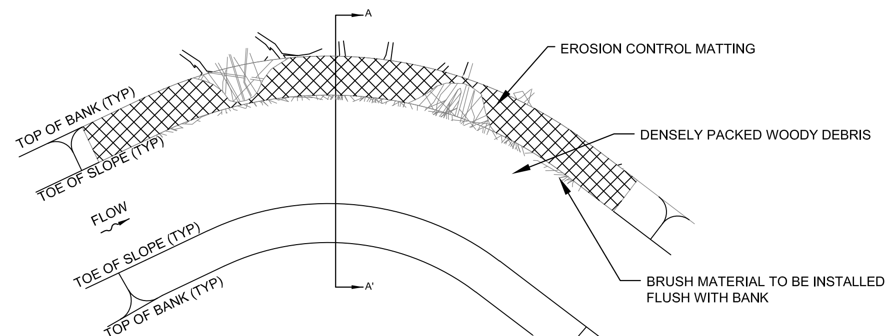
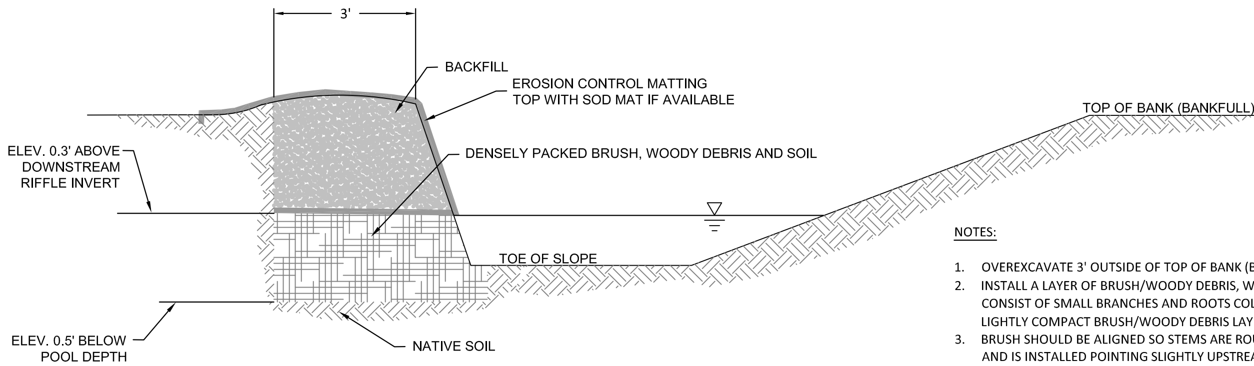


Plan View



Section A-A'

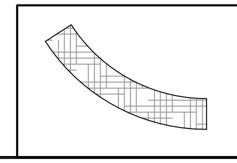
NOTES:

1. OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
2. INSTALL A LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
3. BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
4. LAY EROSION CONTROL MATTING OVER BRUSH/WOODY LAYER.
5. INSTALL EARTH BACKFILL OVER MATTING ACCORDING TO TYPICAL SECTION DIMENSIONS.
6. WRAP MATTING AROUND COMPACTED SOIL AND STABILIZE.
7. TOP MATTING WITH SOD MAT IF SOD MAT AVAILABLE.

1
6.2

Brush Toe

Not to Scale



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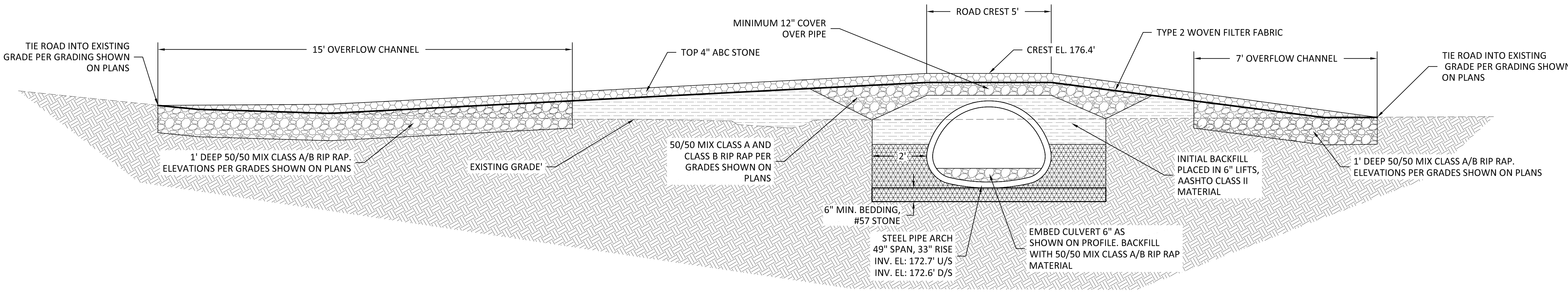
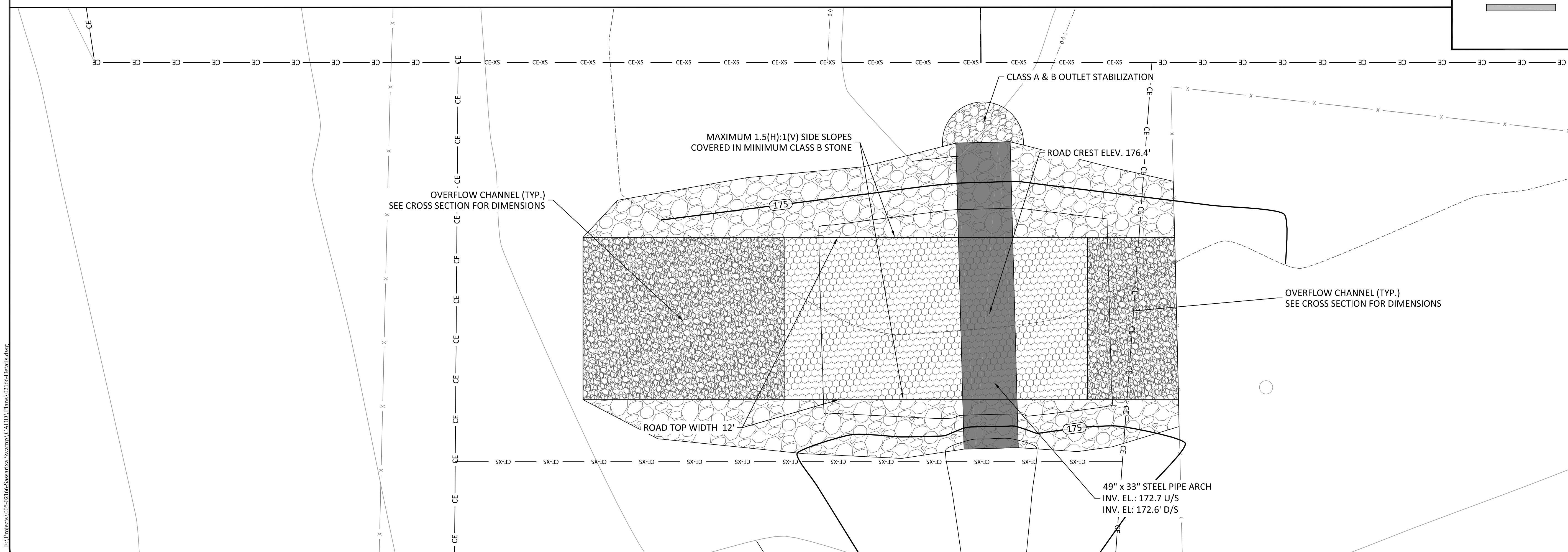


1 / 6.3 T1 Culvert Crossing

Not to Scale



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Culvert Crossing Detail

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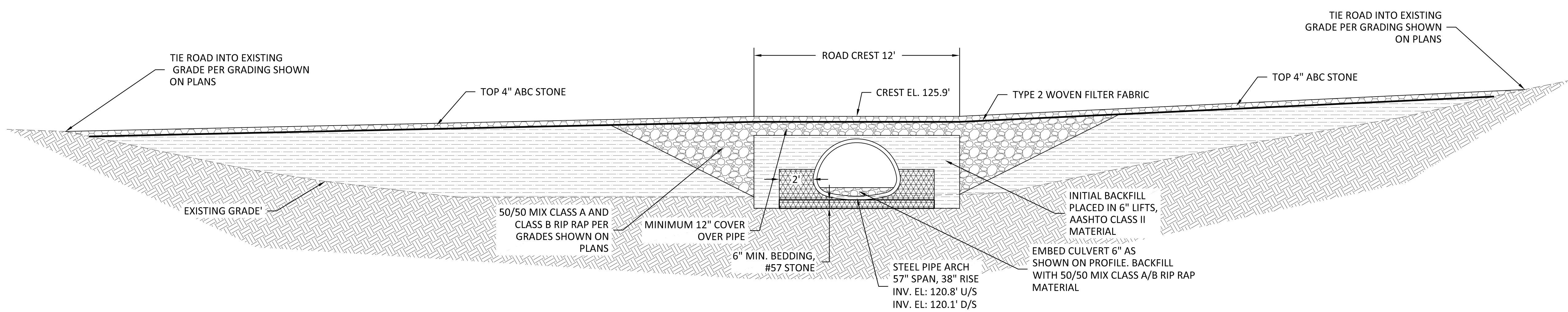
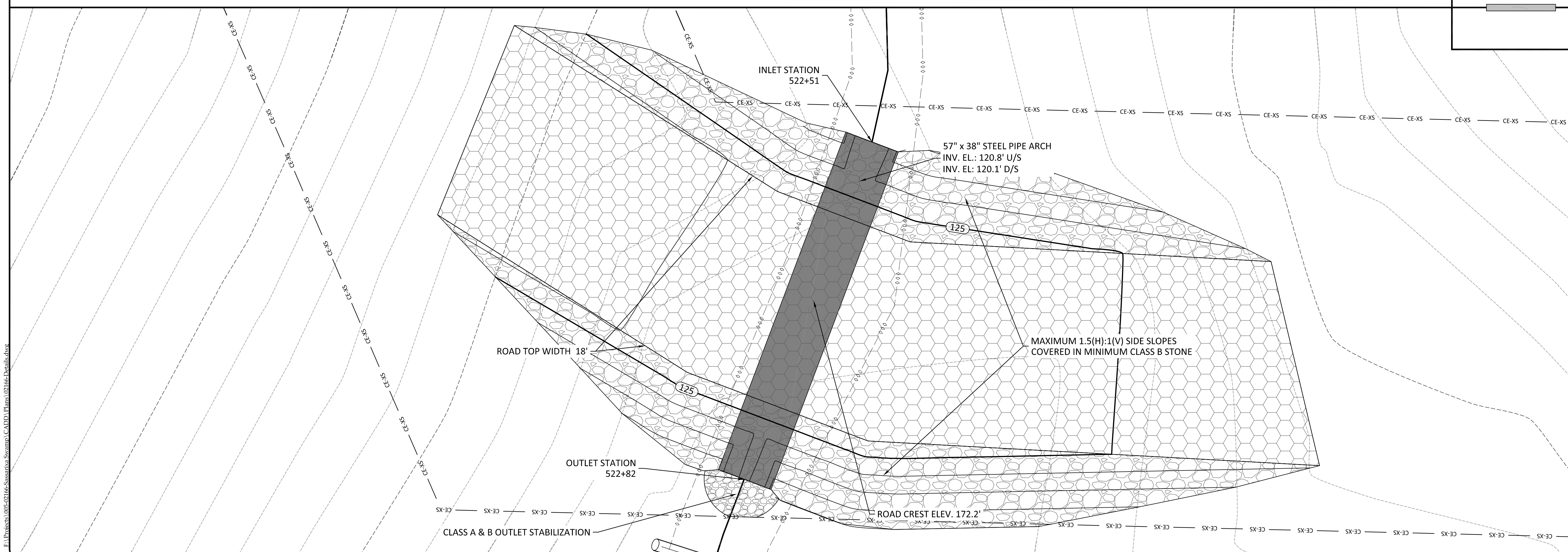


1/6.4 T4 Sta 522+66 Culvert Crossing
Not to Scale



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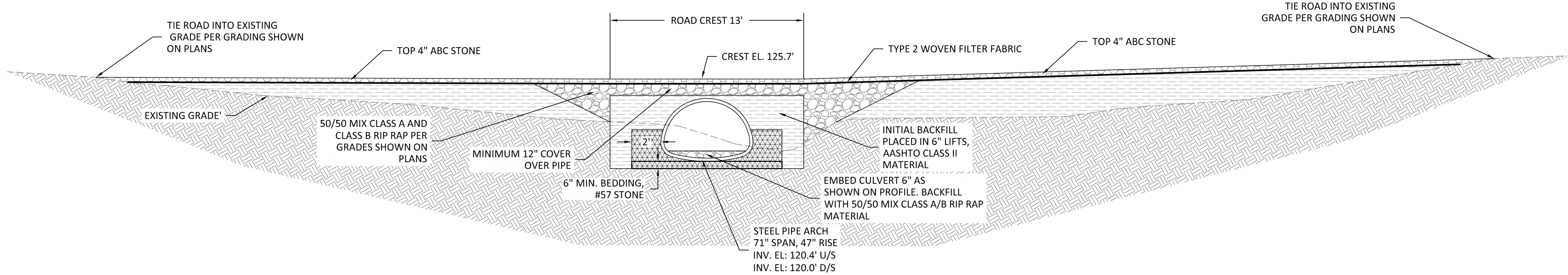
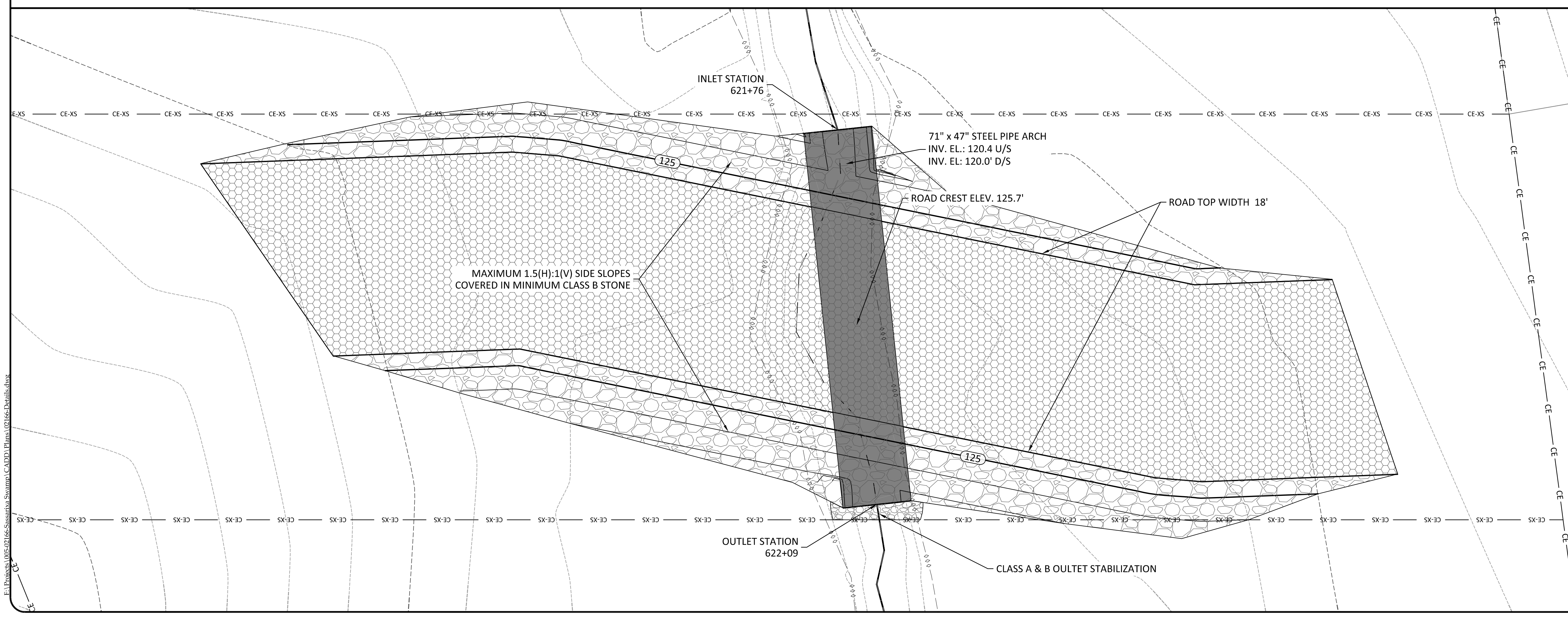


1
6.5
T5 Sta 621+93 Culvert Crossing
Not to Scale



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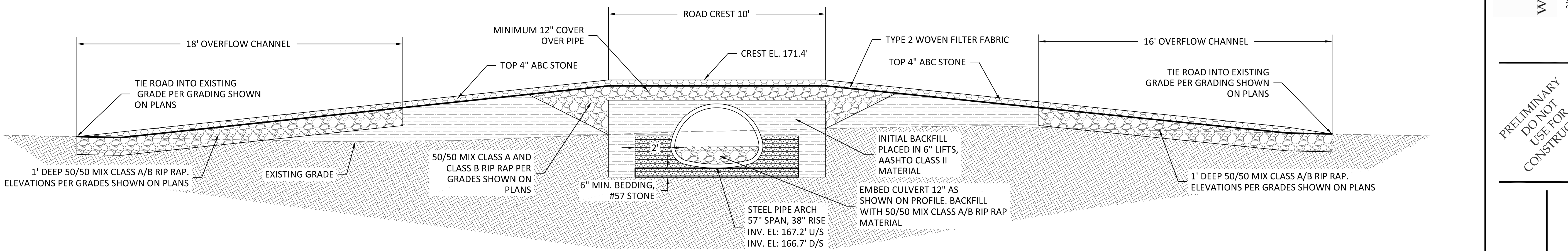
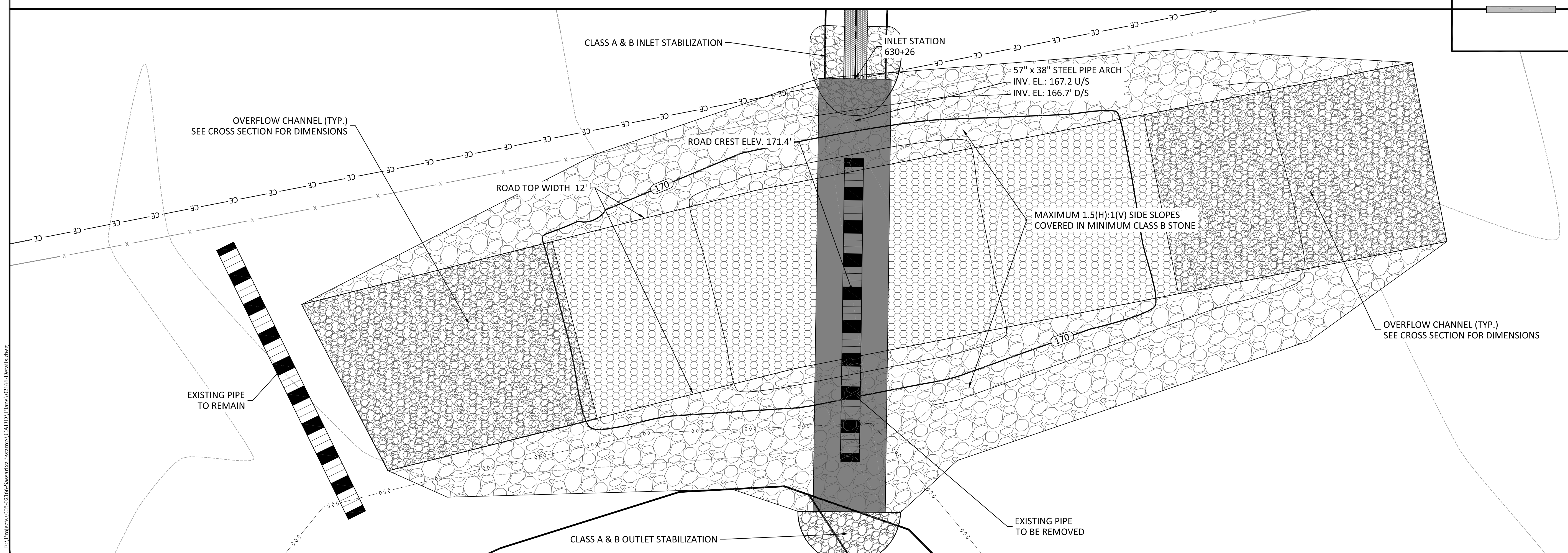


1/6.6 T5A Culvert Crossing
Not to Scale



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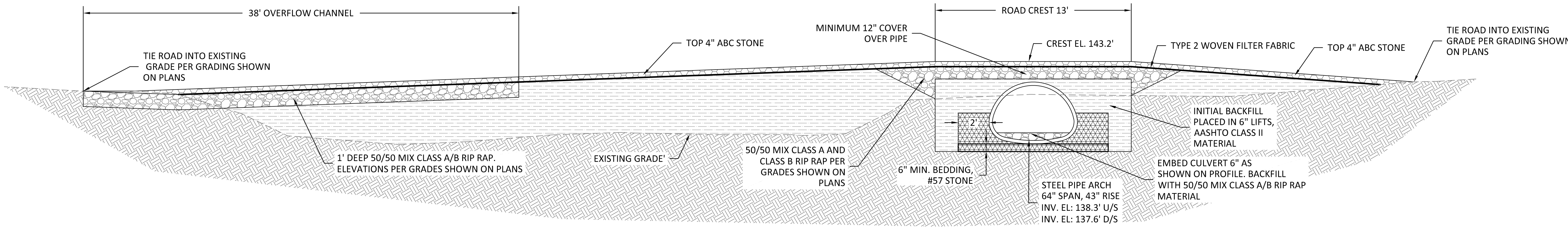
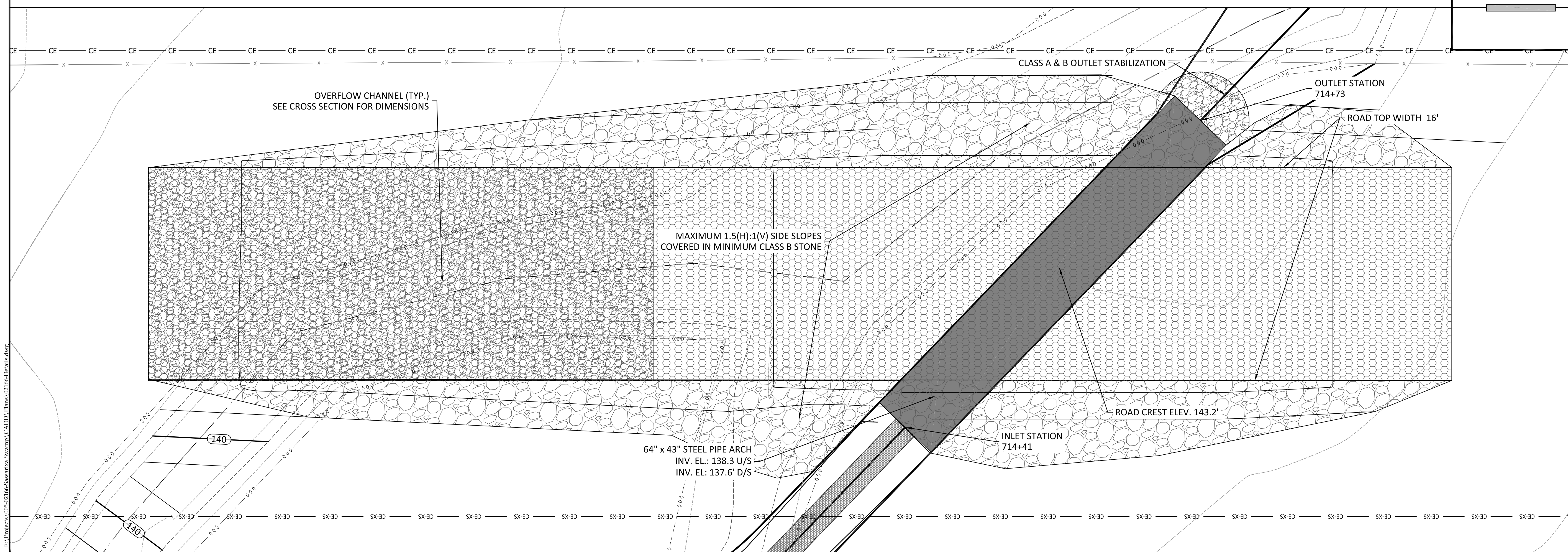


1/6.7 T6 Sta 714+57 Culvert Crossing

Not to Scale



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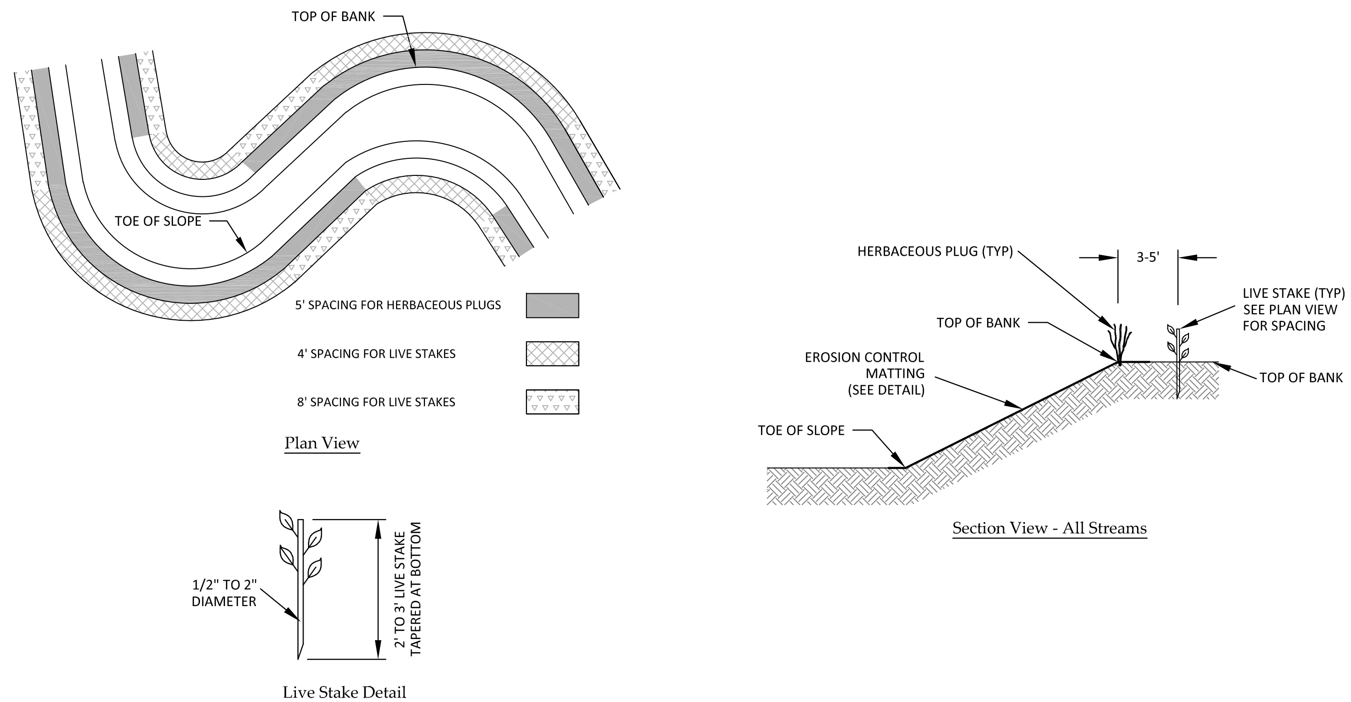
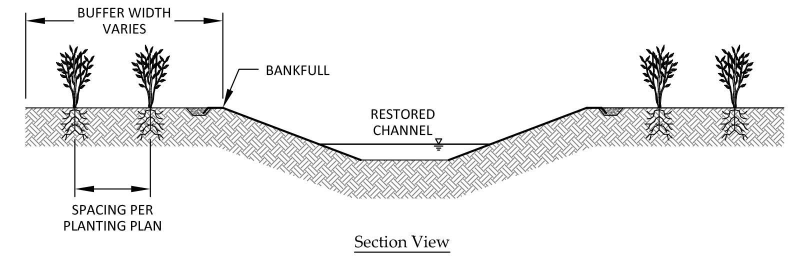


NOTE:

1. LIVE STAKES TO BE PLANTED IN AREAS AS SHOWN ON PLANS AND AS DIRECTED BY THE ENGINEER.

1/6.8 Live Staking & Herbaceous Plugs

Not to Scale



DIBBLE BAR

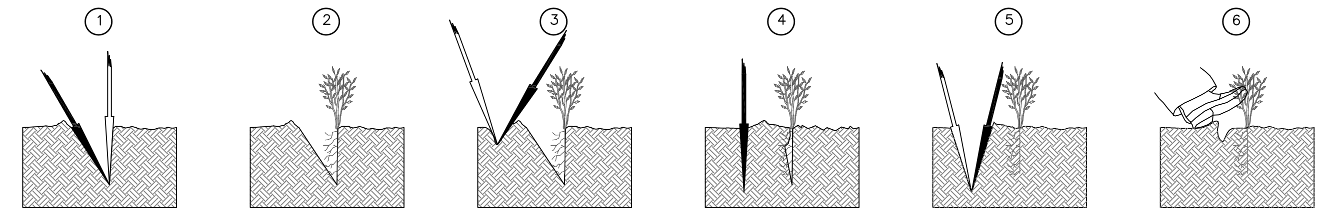
DIBBLE BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS-SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.

ROOTING PRUNING

ALL ROOTS SHALL BE PRUNED TO AN APPORIATE LENGTH TO PREVENT J-ROOTING.

NOTES:

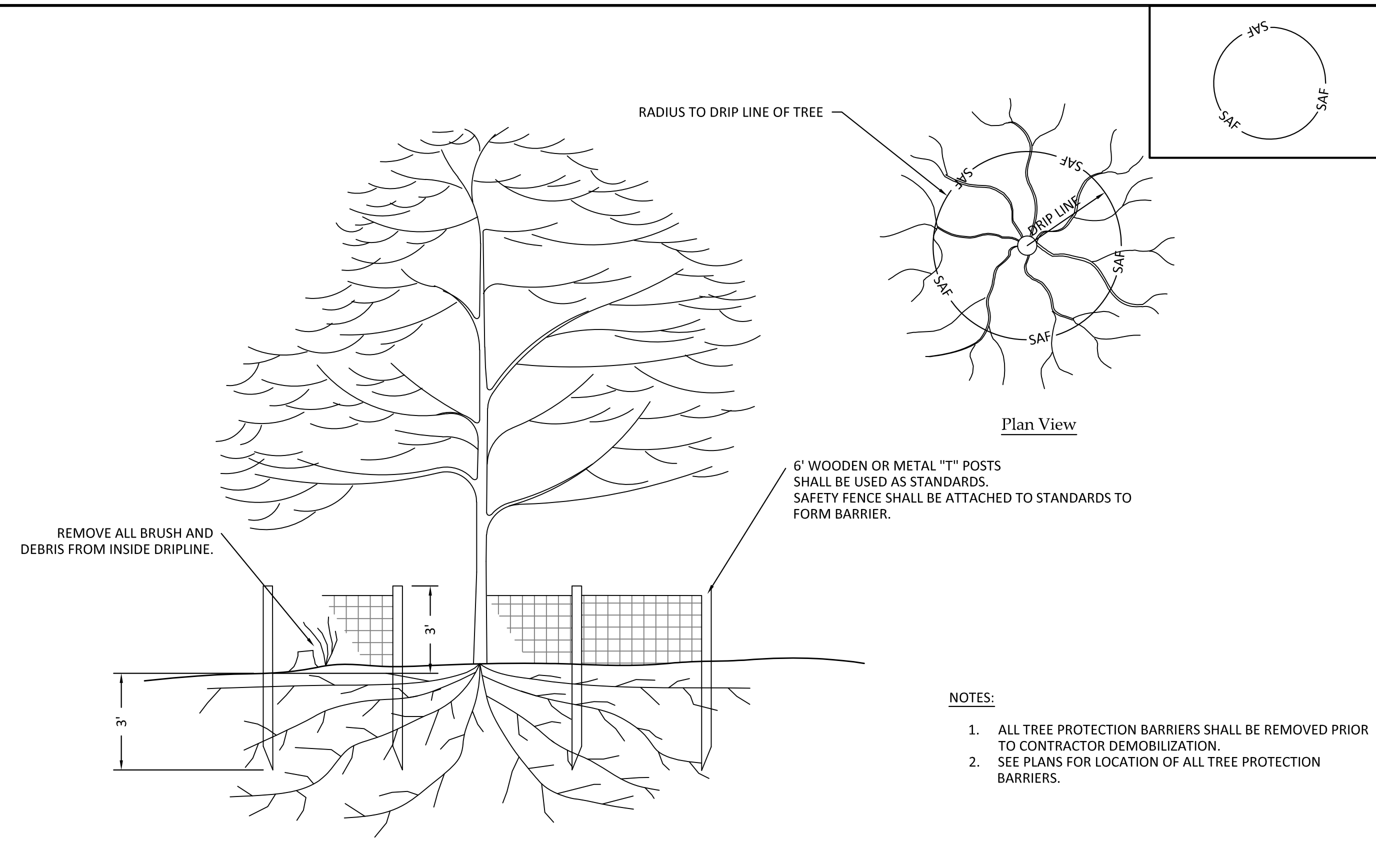
1. ALL SOILS WITHIN THE BUFFER PLANTING AREA SHALL BE DISKED, AS REQUIRED, PRIOR TO PLANTING.
2. ALL PLANTS SHALL BE PROPERLY HANDLED PRIOR TO INSTALLATION TO INSURE SURVIVAL.



1. INSERT THE DIBBLE, OR SHOVEL, STRAIGHT DOWN INTO THE SOIL TO THE FULL DEPTH OF THE BLADE AND PULL BACK ON THE HANDLE TO OPEN THE PLANTING HOLE. (DO NOT ROCK THE SHOVEL BACK AND FORTH AS THIS CAUSES SOIL IN THE PLANTING HOLE TO BE COMPACTED, INHIBITING ROOT GROWTH.
2. REMOVE THE DIBBLE, OR SHOVEL, AND PUSH THE SEEDLING ROOTS DEEP INTO THE PLANTING HOLE. PULL THE SEEDLING BACK UP TO THE CORRECT PLANTING DEPTH (THE ROOT COLLAR SHOULD BE 1 TO 3 INCHES BELOW THE SOIL SURFACE). GENTLY SHAKE THE SEEDLING TO ALLOW THE ROOTS TO STRAIGHTEN OUT. DO NOT TWIST OR SPIN THE SEEDLING OR LEAVE THE ROOTS J-ROOTED.
3. INSERT THE DIBBLE, OR SHOVEL, SEVERAL INCHES IN FRONT OF THE SEEDLING AND PUSH THE BLADE HALFWAY INTO THE SOIL. TWIST AND PUSH THE HANDLE FORWARD TO CLOSE THE TOP OF THE SLIT TO HOLD THE SEEDLING IN PLACE.
4. PUSH THE DIBBLE, OR SHOVEL, DOWN TO THE FULL DEPTH OF THE BLADE.
5. PULL BACK ON THE HANDLE TO CLOSE THE BOTTOM OF THE PLANTING HOLD. THEN PUSH FORWARD TO CLOSE THE TOP, ELIMINATING AIR POCKETS AROUND THE ROOT.
6. REMOVE THE DIBBLE, OR SHOVEL, AND CLOSE AND FIRM UP THE OPENING WITH YOUR HEEL. BE CAREFUL TO AVOID DAMAGING THE SEEDLING.

2/6.8 Bare Root Planting

Not to Scale



NOTES:

1. ALL TREE PROTECTION BARRIERS SHALL BE REMOVED PRIOR TO CONTRACTOR DEMOBILIZATION.
2. SEE PLANS FOR LOCATION OF ALL TREE PROTECTION BARRIERS.

3/6.8 Tree Protection Fencing

Not to Scale

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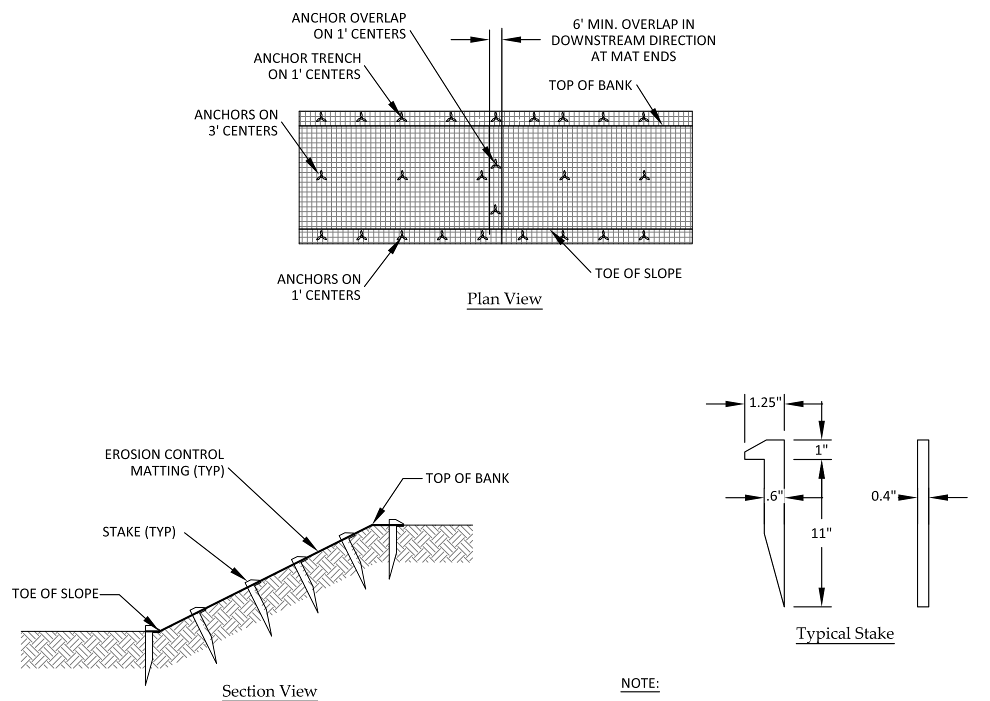
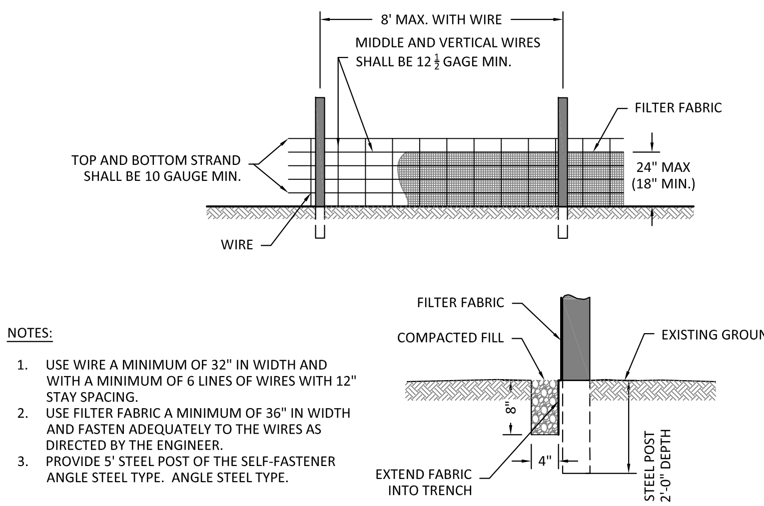


NOTE:

1. PER SPECIFICATIONS, ALL EROSION CONTROL MATTING SHALL BE COMPOSED OF NATURAL FIBERS.

1/6.9 Erosion Control Matting
Not to Scale



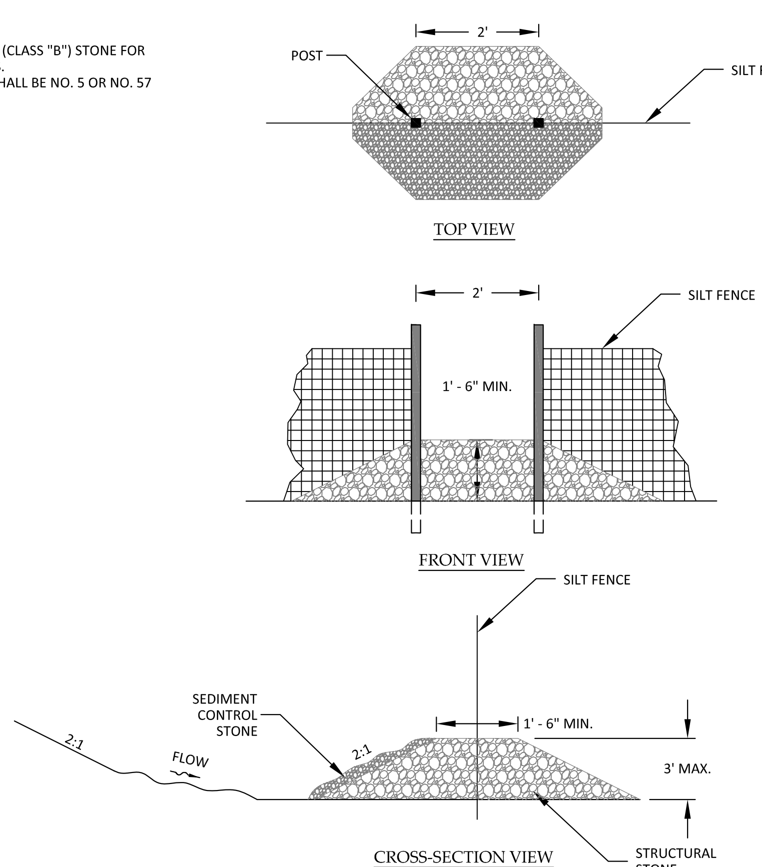
NOTES:

1. USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINES OF WIRES WITH 12" STAY SPACING.
2. USE FILTER FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE WIRES AS DIRECTED BY THE ENGINEER.
3. PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE. ANGLE STEEL TYPE.

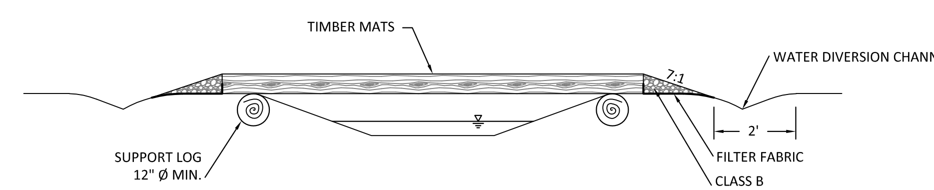
2/6.9 Temporary Silt Fence
Not to Scale

NOTES:

1. STRUCTURAL STONE SHALL BE (CLASS "B") STONE FOR EROSION CONTROL PURPOSES.
2. SEDIMENT CONTROL STONE SHALL BE NO. 5 OR NO. 57 STONE.



3/6.9 Stone Outlet
Not to Scale



NOTE:

1. CONSTRUCT STREAM CROSSING WHEN FLOW IS AT NORMAL BASEFLOW.
2. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
3. INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
4. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
5. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
6. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.
7. NO SPACES BETWEEN LOGS ON TIMBER MAT.
8. INSTALL SILT FENCING AT EACH CORNER OF THE CROSSING EXTENDING A MINIMUM OF 6' PARALLEL AND PERPENDICULAR TO THE CROSSING.

4/6.9 Temporary Stream Crossing with Silt Fence - Timber Mat
Not to Scale

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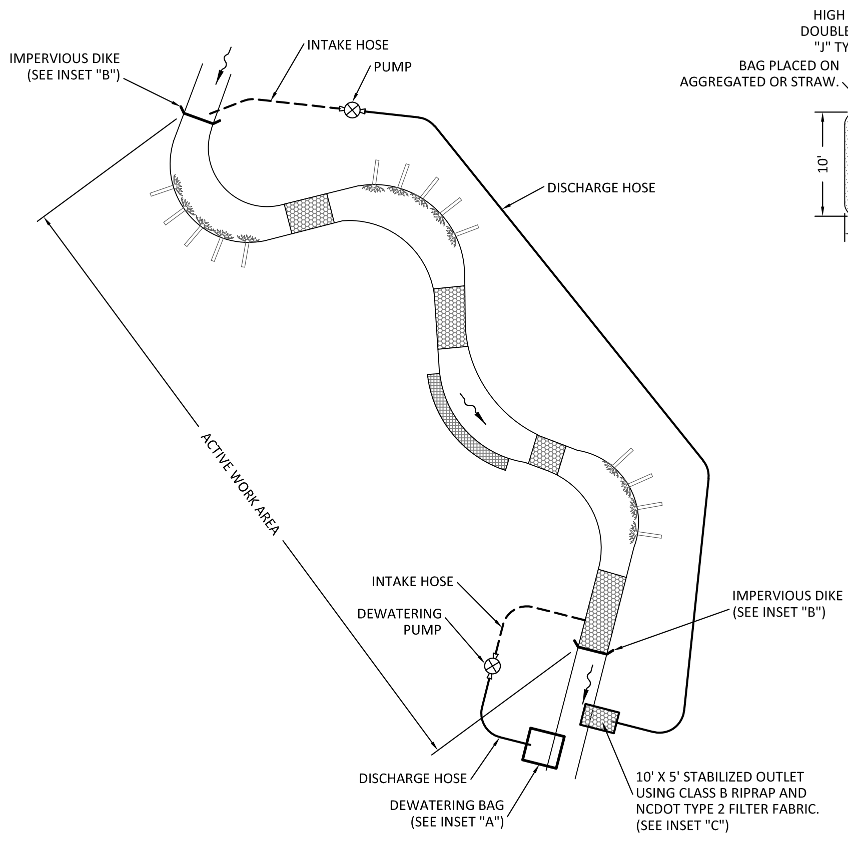
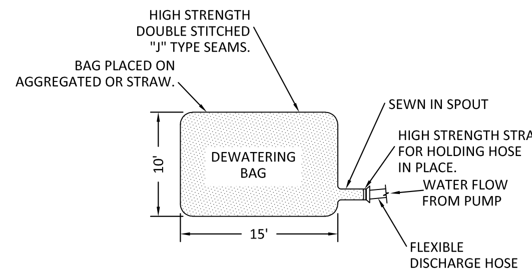
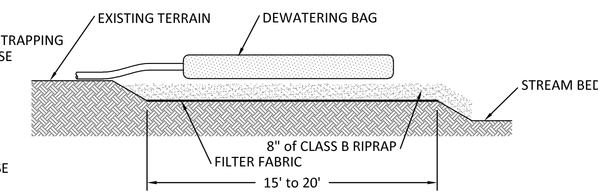


Plan View

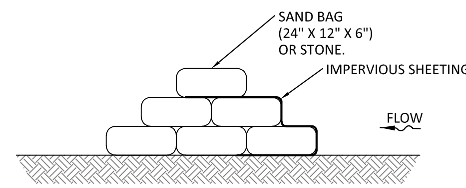




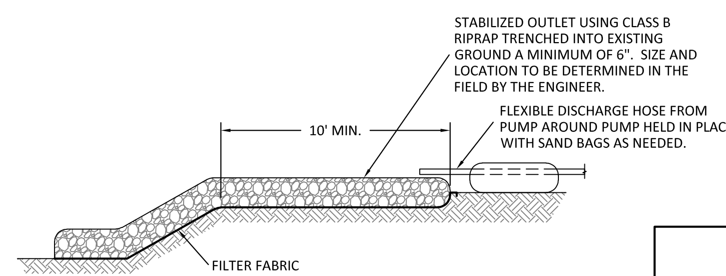
Inset "A"
Dewatering Bag

NOTE:

1. PROVIDE STABILIZED OUTLET TO STREAMBED.

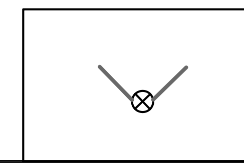


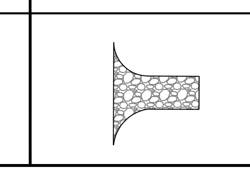
Inset "B"
Impervious Dike

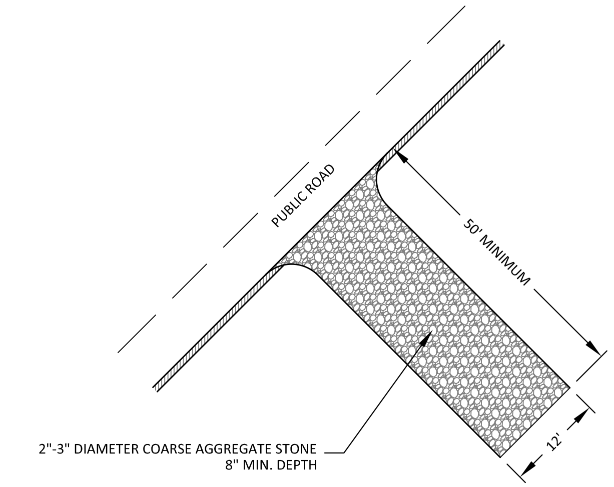


Inset "C"
Stabilized Outlet

1 / 6.10 Pump Around System
Not to Scale



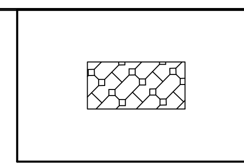


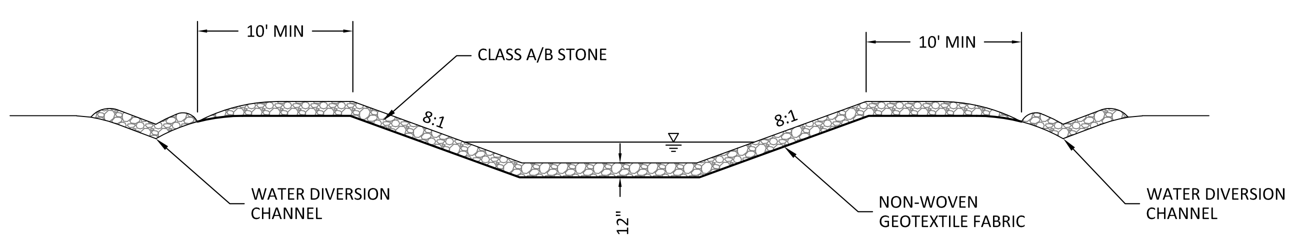


NOTES:

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
2. LOCATE CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
4. ENTRANCE WILL BE EXTENDED AS NEEDED TO PROVIDE ADEQUATE SEDIMENT REMOVAL.
5. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED IMMEDIATELY.
6. USE 2"-3" DIAMETER COARSE AGGREGATE STONE APPROVED BY THE ENGINEER.
7. PLACE FILTER FABRIC BENEATH STONE.

2 / 6.10 Construction Entrance
Not to Scale





NOTES:

1. FORD CROSSING SHALL BE INSTALLED PERPENDICULAR TO CHANNEL BANKS.
2. MAINTAIN DIVERSION CHANNEL TO INSURE RUNOFF DOES NOT ENTER CHANNEL.

2 / 6.10 Permanent Ford Crossing
Not to Scale

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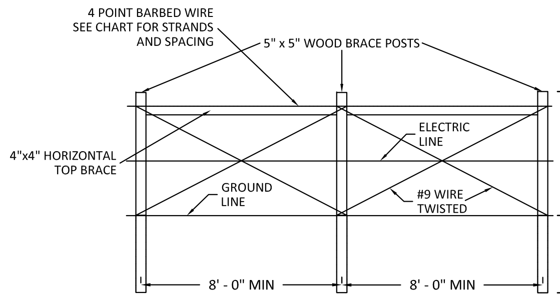
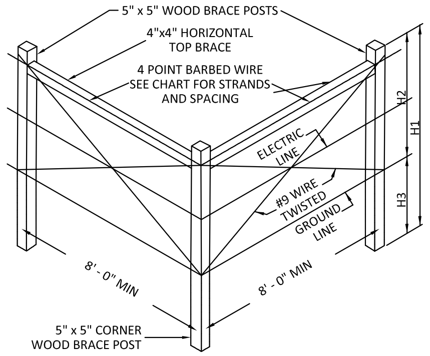
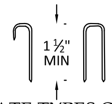


LINE BRACES



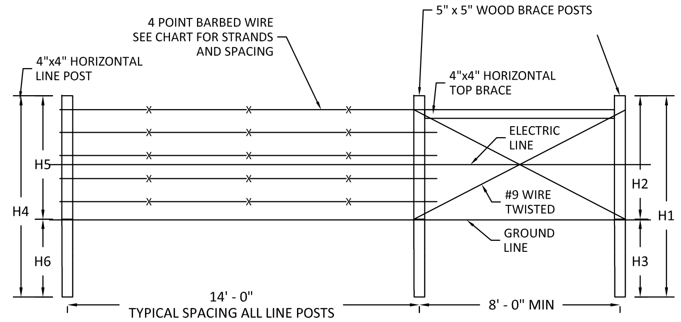
CORNER BRACE
USE WHEN CORNER ANGLE IS 15° OR GREATER

(MAXIMUM SPACING 330')



ALTERNATE TYPES OF STAPLES
USE ONE #9 STAPLE OR TWO #16 STAPLES
AT EACH POINT OF ATTACHMENT.

BARBED WIRE FENCE CHART								
NUMBER OF BARBED WIRE STRANDS			2	3	4	5	6	7
STRAND SPACING		A	8"	4"	3"	3"	3"	3"
		B	12"	12"	15"	12"	10"	8"
		C	21"	13"	11"	8"	6"	8"
BRACE POSTS	LENGTH	H1	6' - 0"	6' - 0"	8" - 0"	8" - 0"	8" - 0"	8" - 0"
	EXPOSED	H2	3' - 5"	3' - 5"	4' - 11"	4' - 11"	4' - 11"	4' - 11"
	EMBEDMENT	H3	2' - 7"	2' - 7"	3' - 1"	3' - 1"	3' - 1"	3' - 1"
LINE POSTS	LENGTH	H4	6' - 0"	6' - 0"	7' - 6"	7' - 6"	7' - 6"	7' - 6"
	EXPOSED	H5	3' - 5"	3' - 5"	4' - 11"	4' - 11"	4' - 11"	4' - 11"
	EMBEDMENT	H6	2' - 7"	2' - 7"	2' - 7"	2' - 7"	2' - 7"	2' - 7"
HORIZONTAL BRACE			8' - 0"	8' - 0"	8' - 0"	8' - 0"	8' - 0"	8' - 0"

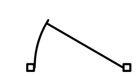


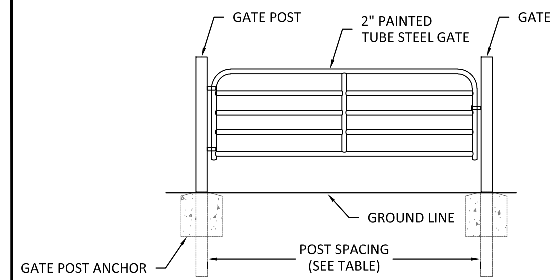
END OR GATE BRACES

1
6.11

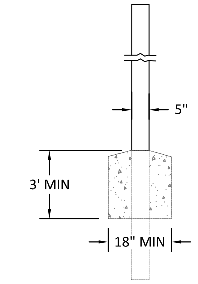
Five-Strand Barbed Wire Fence - Permanent CE Fencing
Not to Scale

Single Gate

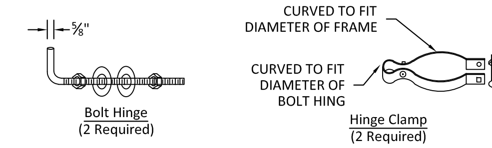




Access Gate



Detail of Gate
Post Anchor



Hinge Assembly

POST SPACING	
GATE SIZE	SPACING WIDTH
6'	6'
8'	8'
12'	12'
16'	16'
2 X 6'	12'
2 X 8'	16'
2 X 12'	24'

GATE POST:

USE CLASS "B" CONCRETE AT GATE POSTS OR WHERE REQUIRED BY SOIL CONDITIONS. CONCRETE MAY ALSO BE USED IN LIEU OF SETTING POSTS TO THEIR MAXIMUM DEPTH.

2
6.11

2" Tube Steel Gate
Not to Scale

GENERAL NOTES:

ALL POSTS AND BRACES MAY BE EITHER ROUND OR SQUARE AT THE OPTION OF THE CONTRACTOR, PROVIDED THE SAME TYPE IS USED THROUGHOUT THE PROJECT.

DIMENSIONS SHOWN ARE THE DIAMETER OF ROUND OR EDGE DIMENSIONS OF SQUARE POSTS AND BRACES.

ERECT LINE BRACES BETWEEN END, CORNER OR GATE POSTS. PLACE LINE BRACES AT INTERVALS NOT TO EXCEED 300' AND AT THE END OF THE WIRE ROLL.

THE 300' INTERVAL MAY BE REDUCED BY THE ENGINEER ON CURVES WHERE THE DEGREE OF CURVATURE IS GREATER THAN 3 DEGREES.

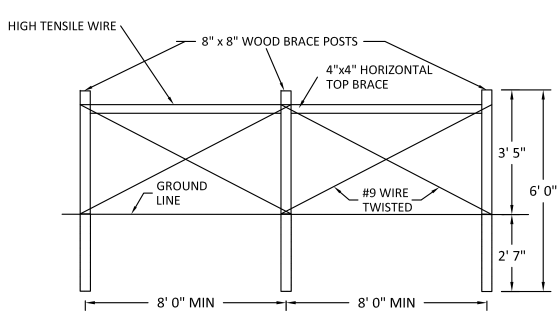
NOTCH BRACE POSTS 1" MINIMUM FOR HORIZONTAL BRACES. PLACE TWO GALVANIZED 12d OR THREE GALVANIZED 10d NAILS AT EACH END OF ALL BRACES.

PLACE THE BRACE WIRE AROUND THE POST. DRAW ALL BRACE WIRE TAUT BY TWISTING BETWEEN EACH POST.

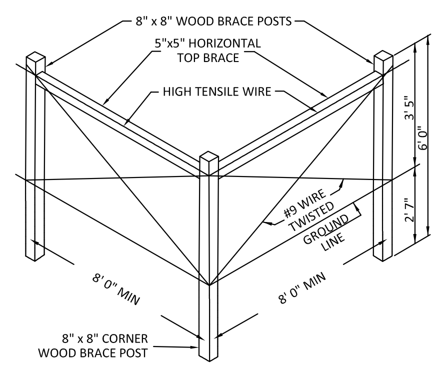
INSTALL THE FENCE FACING THE PROPERTY OWNER EXCEPT THAT ON HORIZONTAL CURVES GREATER THAN THREE DEGREES (3°) INSTALL THE FENCE TO PULL AGAINST ALL POSTS. SEE NCDOT STD. 866.02 FOR FENCING AT DITCH CROSSINGS, BREAKS IN GRADES AND R/W BREAKS.

USE LATCH DEVICE APPROVED BY THE ENGINEER. HINGE ASSEMBLY AS SHOWN IS SUGGESTED. SUBSTITUTION MAY BE SUBJECT TO APPROVAL BY THE ENGINEER. USED 2" PAINTED STEEL PIPE FOR GATE FRAME EXCEPT AS SHOWN HERE.

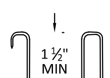
ANY COMBINATION OF GATE AND FENCE TYPE MEETING THE APPROVAL OF THE ENGINEER IS ACCEPTABLE AND IS NOT LIMITED TO THE EXAMPLES SHOWN HEREON.



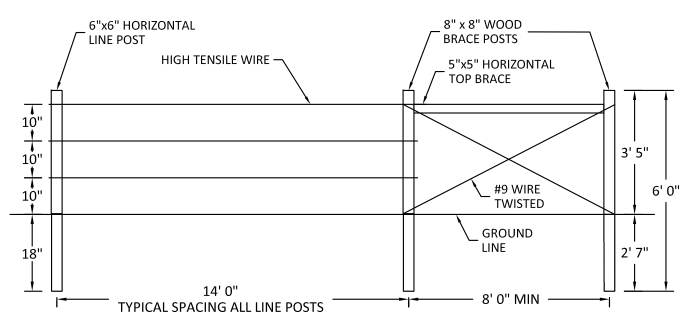
LINE BRACES
(MAXIMUM SPACING 330')



CORNER BRACE
USE WHEN CORNER ANGLE IS 15° OR GREATER



ALTERNATE TYPES OF STAPLES
USE ONE #9 STAPLE OR TWO #16 STAPLES
AT EACH POINT OF ATTACHMENT.



END OR GATE BRACES

3
6.11

Three-Strand High Tensile Wire Fence - Permanent Fencing at Crossings
Not to Scale

WILDLANDS
ENGINEERING
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919.851.9986
License No. F-0831

PRELIMINARY
DO NOT
USE FOR
CONSTRUCTION

Sassarixa Swamp
Johnston County, North Carolina

Details

Revisions:

Date: 11.15.2019
Job Number: 005-02166
Project Engineer: GAT
Drawn By: CAW
Checked By: ANA

6.11
Sheet

November 18, 201

F:\Projects\005-02166-Sassarixa Swamp\CADD\Plans\02166-Details.dwg

Appendix 8

Maintenance Plan

1.0 Maintenance Plan

The site shall be monitored on a regular basis and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two (2) years following site construction and may include the following:

Table1: Maintenance Plan – *Sassarixa Swamp Mitigation Site*

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank erosion. Beaver dams that inundate the stream channels shall be removed and the beaver shall be trapped if deemed necessary.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis.

Additional maintenance activities are discussed in the Vegetation and Land Management section of the mitigation plan.

Appendix 9

Credit Release Schedule

1.0 Credit Release Schedule

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary DA authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Table A: Credit Release Schedule – Stream Credits

Credit Release Milestone	Credit Release Activity	Interim Release	Total Released
1	Site establishment	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%*)
7	Year 5monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%*)
8	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%*)
9	Year 7 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	90% (100%*)

*10% reserve credits to be held back until the bankfull performance standard has been met.

1.1 Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by DMS without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan.
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property.
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; per the DMS Instrument, construction means that a mitigation site has been constructed in its entirety, to include planting, and an as-built

report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.

d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

1.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 10% of a site's total stream credits shall be released after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

Appendix 10

Financial Assurance

Financial Assurances

Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the US Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

RIPARIAN AREA MITIGATION PLAN

Final

November 2019

SASSARIXA SWAMP MITIGATION PLAN

Johnston County, NC
NCDEQ Contract No. 7425
DMS ID No. 100040

Neuse River Basin
HUC 03020201

USACE Action ID No. SAW 2018-00432
DWR Project No. 2018-0198
RFP #: 16-007279

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

FINAL RIPARIAN AREA MITIGATION PLAN

SASSARIXA SWAMP MITIGATION SITE
Johnston County, NC
NCDEQ Contract No. 7425
DMS ID No. 100040

Neuse River Basin
HUC 03020201

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

PREPARED BY:

Wildlands Engineering, Inc.
312 W Millbrook Road, Suite 225
Raleigh, NC 27609
Phone: (919) 851-9986

This Mitigation Plan has been written in conformance with the requirements of the following:

- 15A NCAC 02B .0295 Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers.
- 15A NCAC 02B. 0240, Nutrient Offset Payments Rule, amended effective September 1, 2010
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010.

These documents govern DMS operations and procedures for the delivery of compensatory mitigation.

Contributing Staff:

Angela Allen, PE, *Project Manager*
John Hutton, *Principal in Charge*
Jason Lorch, *Mitigation Plan Development*
Daniel Taylor, *Construction Administrator*
Carolyn Lanza, *Monitoring Lead*
Andrea Eckardt, *Lead Quality Assurance*

November 19, 2019

Mr. Jeremiah Dow
NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

RE: DMS Review comments for Mitigation Plan
Sassarixa Swamp Mitigation Site (DMS ID # 100040)
Neuse 03020201, Johnston County, NC
Contract No. 7425

Dear Mr. Dow,

Thank you for compiling and providing comments on the Sassarixa Mitigation Site draft Mitigation Plan.

1. The use of the term "buffer" or "riparian buffer" is used too loosely throughout the plan. These terms should only be used to describe an area that is within the Neuse Riparian Buffer. For this site, only the first 50' adjacent to streams subject to the rule are Neuse Riparian Buffers. Therefore, please correct applicable references to "buffer" or "riparian buffer" and replace incorrect references with "riparian areas" or "riparian restoration".

   References to "buffer" or "riparian buffer" were corrected to "riparian areas" and "riparian restoration".

2. The plan describes this site as a "Buffer Restoration Project" throughout the text. However, most of the site is actually buffer enhancement w/some preservation. I recommend "buffer mitigation project" or something other than "buffer restoration project" to avoid confusion.

   References to "Buffer Restoration Project" has been replaced to "Buffer Mitigation Project".

3. Section 2.2 page 6
   a. This section is titled "Project Location", but it includes references to the Alternative mitigation options being proposed onsite. I recommend separating this information out into its own section.

      "Project Location" has been separated out into "Project Location" and "Buffer Project Attributes".

   b. Some streams onsite are "not subject". Correct where applicable.
      Corrected to include non-subject streams too.

c. Enhancement via Cattle Exclusion is also an alternative option that should be added to this section.

Enhancement via Cattle Exclusion has been added as an alternative option.

d. For Ephemeral channels, last bullet, correct the rule reference to just be 15A NCAC 02B .0295 (n). Currently, the reference to 0295 (o) is too inclusive. For example, "enhancement" on Ephemerals can only be achieved by actually planting an area deemed "Enhancement Site" under 0295 (n). Areas deemed as "Enhancement" via cattle Exclusion are approved under 0295 (o) and cannot be achieved adjacent to Ephemeral channels. T3 Ephemeral is currently proposed as "Enhancement via Cattle Exclusion" and instead, should be Preservation according to viability letter.

The rule reference has been updated. T3 Ephemeral reach has been changed to Preservation to match the viability letter.

e. For coastal HW Streams, add additional information.
   i. The rule requires that the site meet success criteria for the stream mitigation. Therefore, this area requires 7 years of monitoring instead of 5.

   7 years of monitoring has been added

   ii. The rule requires the creditable areas to be planted to get buffer credit adjacent to HW streams. Therefore, areas currently forested on T5C must be excluded from credit, and only the restoration areas in the fields are viable.

   Forested areas along the HW streams have been excluded from credit.

   iii. Text says the buffer will be measured based on valley length, but where is that measurement provided or represented?

   The valley length is shown in Figure 6 and Figure 7.

4. Section 2.5
   a. The statement provided about the purpose of the internal crossings suggests that there may should be fencing on both sides of Sassarixa creek. No fencing is shown on the plan sheets or the figures for the right side of Sassarixa Creek. If "agriculture" in this section implies cattle, then sassaixa creek will require fencing on both sides of the easement in order to comply with 0295 (o)(6). Please explain.

   Fencing has been added to the right side of Sassarixa Creek.

5. Section 5.2 & Plan Sheet 3.0 lists Green Ash to be planted. Based on concerns of the Emerald Ash Borer and its ability to spread and attack saplings (>1-inch diameter), DWR highly recommends this tree not be included in the planting plan.

Green Ash has been removed from the planting plan.

6. Provide a reasonable justification to plant Cypress trees, a softwood, which are not considered an appropriate species to meet performance standards per 0295 (n)(2)(B). Provide specifics as to where Cypress will be planted in the Plan Sheets.

   Cypress has been removed from the planting plan.

7. Section 5.3 –
   a. The viability letter notes that there are two types of enhancement on this project. Enhancement under 0295 (n) indicates that the area requires plantings vs Enhancement under 0295 (o)(6) requires just the removal of cattle. The upper reach of T4 was determined to be Enhancement under 0295 (n). Other Enhancement areas met .0295(o)(6). Correct figures where cattle exclusion is shown on the upper reach of T4 and show as "Enhancement". Confirm that the planting sheets show plantings in this area as well.

      The upper reach of T4 will also be planted.

   b. How will cattle be "excluded" in the buffer enhancement areas?

      It has been noted in Section 5.3 that cattle will be "excluded" through fencing.

   c. Correct rule reference to be 15A NCAC 02B .0295(o). It currently reads .0296

      Rule reference has been corrected.

8. Section 6.2 Please revise plan to add that planted stems in the monitoring plats will all be flagged.

   Flagging planted stems has now been noted in Section 6.2.

9. Table 9 – add another parameter to account for T5C needing 7 years of monitoring.

   Table 9 is updated to reflect the 7 years of monitoring along T5C.

10. Section 7.1 – Add that "height" will be measured to assess the vigor of stems.

    Height has been added to assess the vigor of stems.

11. Section 7.4 – Add a note about T5C and its additional monitoring to meet performance standards. The rule also requires that the stream mitigation meets the performance criteria by the USACE as well. Therefore, DWR cannot accept the restoration area adjacent to T5C without knowing it meets the final performance criteria at closeout by the IRT. Please indicate that

closeout of credits adjacent to T5C will be done at Closeout with IRT. If T5C is removed from the buffer plan all together, then none of this applies.

The additional monitoring performance for T5C has been added.

12. Tables 7a & 7b
    a. Use newer version to the table (request from DMS) and attempt to keep the table all on one page. If needing to split 7a and 7b on separate pages that is fine. This may require a larger paper size to accommodate this request. Please do not reduce the font size in the table too much such that it makes the table difficult to read as hard copy.

       Newer version of the table is now being used.

    b. Correct table based on comments provided with this letter.

       Corrections have been incorporated.

    c. T4 should be "Enhancement" and not "Enhancement via Cattle Excl". See comment #7.

       T4 is now "Enhancement".

    d. Breakout T5C credits separate from others and as "not convertible to Nutrient".

       T5C credits are now separated from the others and listed as "NOC".

    e. T5C is not viable for Enhancement, remove from table.

       Enhancement for T5C has now been removed.

    f. T3 Ephemeral reach is not viable for Enhancement via Cattle Excl. Change this to preservation.

       T3 Ephemeral has been changed to preservation.

    g. T4 & T5 Restoration 0-1000' are both shown with"**". Explain why these two are different than other Restoration areas 0-100' shown in the table. If the explanation is due to widths, then why can't the Min-Max width be shown as different?

       The asterisks have been removed with the new table.

    h. Formulas may be off on table, so once newer version of the table is completed for this site, I will be able to decipher whether the subtotals and totals are compliant.

       Noted.

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i. T2 restoration area may need to be edited based on comment #15 below.

Noted.

13. Paragraph below Table 7b will need to be edited based on comments made in this letter. Specifically, the viability of certain streams/reaches that are stated incorrectly in the first sentence.

The paragraph below Table 7b has been removed due to the clarification from correspondence with Ms. Katie Merritt sent on August 16. 2019.

14. Table 7a-b shows nutrient offset conversions. However, there is no reference to this in the introduction of the Plan. If this site is to be reviewed by DWR to generate nutrient and/or buffer, please include language to the effect in the introduction.

Nutrient offset credits are not being request at this time, but areas may be converted to nutrient offset credits by DMS later. Since nutrients are not being requested at this time, language is not needed in the introduction. A note below Table 7a has been added indicating potential nutrient request in the future.

15. Figure 6 –
    a. Identify the location of the Ephemeral channel along T3.

    The location of the Ephemeral channel along T3 has been noted.

    b. Show Preservation instead of Cattle Excl. along T3 ephemeral reach.

    T3 has been changed to Preservation.

    c. Add Enhancement (non-cattle excl) along T4 (R1 & R2) (see plan sheet 3.3)

    T4 (R1 &2) has been changed to Enhancement (non-cattle exclusion)

    d. Remove Enhancement adjacent to T5C.

    T5C Enhancement has been removed.

    e. T2 restoration area should only be measured from Top of Bank of the Stream Determination point by DWR or the "radius/bubble" above the point. When comparing this area to Figure 7, the top of bank appears to be measured from the proposed stream alignment beyond the wood line.

    Figure 7 has been corrected to the Top of Bank of the Stream Determination point by DWR.

f. T4 Preservation area needs to be excluded from credit unless the DWR has confirmed this feature is a stream.

T4 Reach 3 has now been confirmed a stream based on the On-Site Determination for Applicability to the Neuse Riparian Area Protection Rules (15A NCAC 02B .0233) dated October 28. 2019. Supporting documentation is located in the Appendix.

g. I prefer the legend also identify the Coastal HW credits (instead of blue, use a different color)

Coastal HW credits have been identified in another color.

16. Figure 8 –
    a. Show the non-cattle exclusion Enhancement Area & Coastal HW area.

    Figure 8 has been updated according to above changes.

    b. All plots along T1 are on the same side. Please move a plot to represent the other side of T1 as well.

    The vegetations plots along T1 have been moved to represent the other side.

    c. There is a plot located within Cattle Exclusion areas along T4. Why?

    The plot located within the Cattle Exclusion has been removed.

17. Figure 9-
    a. Remove T5C from being able to be converted to NOC. NOC is not viable adjacent to coastal HW stream sites as shown in the viability letter.

    T5C has been removed from being converted to NOC.

18. Service Area map – This map does not comply with Rule .0295. The service area for buffer mitigation projects in the Neuse 01 below Falls Lake is the Neuse 01below Falls Lake and does not include the Falls Lake WS. Edit this map to exclude the Falls Lake completely from the service area.

    The Service Area Map has been updated to exclude the Falls Lake WS.

19. There are not dates on the site photos, when were these photos taken.

    Dates have been added to the site photos.

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20. Overall, if the riparian efforts are done according to the plan and addresses all comments and corrections provided by DWR, the site should provide a good buffer mitigation and/or nutrient offset project.
    Noted.

If you have any questions please contact me at aallen@wildlandseng.com, (919)851-9986 x 106.

Sincerely,

Angela Allen, P.E., *Project Manager*

TABLE OF CONTENTS

TABLES

FIGURES

APPENDIX

1.0 Introduction

The Sassarixa Swamp Mitigation Site (Site) is a buffer and nutrient mitigation project in conjunction with a stream mitigation project. Construction of the stream restoration project will occur concurrently with planting and excluding livestock from the riparian buffers. The Site is located in Johnston County approximately six miles southwest of Smithfield and five miles north of Four Oaks (Figures 1). The Site is comprised of approximately 65.1 acres along Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek. Currently, the Site is characterized by a mix of active pastures, fields, and woodlands. The project will restore, enhance, and preserve riparian buffer area within the project area, which will provide 1,098,146.503 buffer credits or 55.9 acres worth of buffer mitigation.

The Site is located within the Hydrologic Unit Code (HUC) 03020201130030 and North Carolina Division of Water Resources (NCDWR) Sub-basin 03-04-04 Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek, along with six unnamed tributaries to Black Creek on the Site flow into Holts Lake, which drains to the Neuse River. Holts Lake is a recreational lake classified as a Nutrient Sensitive Water (NSW) and the Neuse River is a water supply for the City of Goldsboro.

The Sassarixa Swamp Mitigation Site is located in a new Targeted Local Watershed (TLW) that is not described in the 2010 Neuse River Basin Restoration Priorities (RBRP) Plan. The TLW was added in the 2015 Neuse 01 CU Update because there were more water quality issues than assets. Stressors for this TLW include impervious surfaces, disturbed riparian areas, and agricultural land use/animal operations. The Site addresses the TLW stressors of agricultural land use/animal operations and the lack of protected riparian areas. The project will also address key Cataloging Unit (CU) wide restoration goals for the Neuse River 03020201 described in the RBRP including reduction of sediment and nutrient loads from agricultural lands and increasing or improving riparian buffers (NC DWR 2009).

This buffer mitigation project will reduce sediment and nutrient loading, improve terrestrial and in stream habitats, and improve stream and bank stability. The area surrounding the streams proposed for restoration is a mixture of active pasture, fields, and woodlands. By removing cattle access to onsite tributaries to Holts Lake, restoring a forest to maintained riparian areas and protecting and preserving existing forested areas; the project will reduce nutrient and sediment inputs to project streams, and ultimately to Holts Lake. The restored floodplain areas will filter sediment during rainfall events. The establishment of riparian areas will create shading to minimize thermal pollution. Finally, invasive vegetation will be treated within the project area as needed and the proposed native vegetation will provide cover and food for wildlife.

2.0 Mitigation Project Summary

The major goals of the proposed buffer mitigation project are to provide ecological and water quality enhancements to the Neuse River Basin by creating a functional riparian corridor and restoring the riparian area. Specific enhancements to water quality and ecological processes are outlined below in Table 1.

Table 1: Ecological and Water Quality Goals – *Sassarixa Swamp Mitigation Site*

Goal	Objective	CU-Wide and RBRP Objectives Supported
Decrease nutrient levels	Filtering runoff from the agricultural fields through restored native buffer zones. The off-site nutrient input will also be absorbed on-site by filtering flood flows through restored floodplain areas, where flood flows can disperse through native vegetation.	Reduce nutrient inputs to waters of the Neuse River Basin.
Exclude cattle from project streams.	Install fencing around project areas adjacent to cattle pastures.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Contribute to protection of or improvement to a Water Supply Waterbody.
Decrease water temperature and increase dissolved oxygen concentrations	Establishment and maintenance of riparian buffers will create additional long-term shading of the channel flow to reduce thermal pollution.	Improve habitat to wildlife by providing additional habitat.
Restore and enhance native floodplain vegetation.	Plant native tree species in riparian zone where currently insufficient.	Reduce and control sediment inputs; Reduce and manage nutrient inputs; Provide a canopy to shade streams and reduce thermal loadings; Contribute to protection of or improvement to a Water Supply Waterbody.
Permanently protect the project Site from harmful uses.	Establish a conservation easement on the Site.	Protect aquatic habitat; protect water supply waters.

2.1 Existing Site Conditions

The buffer mitigation project will place put 65.1 acres of agricultural fields and woodlands along Sassarixa Creek and several unnamed tributaries that drain into the Holts Lake watershed, part of the Neuse River Basin under a conservation easement. Out of the 65.1 acres, 55.9 acres will be proposed for a combination of riparian buffer restoration, enhancement, and preservation.

The project includes several adjacent properties that have been owned and operated as a livestock farm by a single family since 1850, where livestock are continually rotated through all fields (with access to their associated streams). The western portion of the project includes Sassarixa Creek and seven unnamed tributaries to Sassarixa Creek (T1, T1A, T1B, T1C, T1D, T2, and T3) (Figure 2). The eastern portion of the site contains six unnamed tributaries to Black Creek (T4, T5, T5A, T5B, T5C, and T6). A review of historic aerials from 1950 to 2012, located in the appendix, show that onsite streams have existed in their approximate locations with very little change to riparian zones since 1950. Two alterations to the Site visible from aerial photography are the addition of the pond on T2 between 1964 and 1973, and the addition of the large pond below T5A, T5B, and T5C, between 1950 and 1961.

Sassarixa Creek is a perennial stream that enters the Site from Black Creek Road and flows southeast. A mature hardwood forest surrounds the stream on both sides.

T1 enters the site at Old Olive Road in the northeast section of the project. T1A and T1D enter the right bank of T1, while T1B enters from the left bank downstream of T1A and T1D. The canopy is dominated by loblolly pine (*Pinus taeda*) with an understory of Japanese stilt grass (*Microstegium vimeneum*).

T1C is a short reach that starts at the tree line and flows into Sassarixa Creek.

The origin of T2 is a farm pond located in the natural valley of this drainage area that is dominated by fescue and hay production. There is a grass swale at the outlet of the pond, and once the swale reaches the edge of the forest, there is a large (>5') headcut as it enters the valley of Sassarixa Creek.

A ditch originates south of Old Olive Road, flowing into T3 which starts as an ephemeral channel. T3 continues along a forested buffer transitioning into an intermittent stream. While the channel along T3 is forested, livestock access has impacted most of the understory.

T4 starts as an intermittent stream that enters the Site through a culvert at Old Olive Road. Roughly 200 feet down the stream breaks and becomes a degraded wetland picking back up another 300 feet to continue being an intermittent channel. The upper portion of T4 has sporadic conifer trees, while the understory has been trampled by cattle.

T5A, T5B, and T5C are the intermittent headwater streams to T5. They originate in the northernmost region of the project, upstream of a large pond. Their watersheds are primarily livestock grazing areas and row crops.

T5 and T6 are intermittent streams that enter the project area at Old Olive Road. A mature hardwood canopy extends the length of both streams.

2.2 Parcel Location

The Site is approximately six miles southwest of Smithfield and five miles north of Four Oaks (Figure 1). The site is within the DMS targeted Neuse River Basin HUC 03020201130030 and NCDWR Subbasin 03-04-04.

From Raleigh take I-40 E. Take exit 319 for NC-210 toward Smithfield/Angier. Turn left onto NC-210 E (signs for Smithfield). Continue on NC-210 E for 2.4 miles and turn right onto Lassiter Roads. After 4.6 miles, turn left onto Black Creek Road. Continue on Black Creek Road for 0.7 miles and then turn right onto Old Olive Road. The first parcel is 0.1 mile on the right of Old Olive Road. The other parcels are at various locations further down Old Olive Road.

2.3 Buffer Project Attributes

Table 2: Buffer Project Attributes – *Sassarixa Swamp Mitigation Site*

Project Name	Sassarixa Swamp Mitigation Site
Hydrologic Unit Code	03020201130030
River Basin	Neuse River
Geographic Location (Lat, Long)	35°28'19.75"N 78°26'9.60"W
Site Protection Instrument (DB, PG)	To be recorded
Total Credits (BMU)	1,080,086
Types of Credits	Riparian Buffer
Mitigation Plan Date	May 2019
Initial Planting Date	March 2020
Baseline Report Date	May 2020
MY1 Report Date	November 2020
MY2 Report Date	November 2021
MY3 Report Date	November 2022
MY4 Report Date	November 2023
MY5 Report Date	November 2024

2.4 Alternative Mitigation

In addition to buffer restoration on subject streams, per the Consolidated Buffer Mitigation Rules (15A NCAC 02B 0.0295 (o)), alternative mitigation is proposed on the Site in the form of buffer restoration on ephemeral channels and coastal headwater streams, and preservation of forested buffer on subject and non-subject streams. The proposed project is in compliance with these rules in the following ways:

Buffer Restoration on Ephemeral Channels 15A NCAC 02B .0295 (n):

- The ephemeral channel is directly connected to intermittent or perennial stream channels and will be protected under the same contiguous easement boundary (Figure 2).
- The area of the mitigation site on ephemeral channels does not compromise more than 25 percent of the total area of buffer mitigation.
- The mitigation area on the Site's ephemeral channels is located completely within its drainage area.
- The proposed area meets all applicable requirements of Paragraph (n) of (15A NCAC 02B .0295), for restoration or enhancement.

Buffer Restoration on Coastal Headwater Streams 15A NCAC 02B .0295 (o)(2):

- Wooded buffers planted along Outer Coastal Plain headwater stream mitigation sites may also be approved as riparian buffer mitigation credit if the Site meets all applicable requirements of 15A NCAC 02B .0295 (n).
- All success criteria specified in the approval of the stream mitigation site by the Division shall be met. Seven years of monitoring is required.

- Area of the buffer shall be measured perpendicular to the length of the valley being restored.
- The area within the proposed buffer mitigation site shall not also be used as wetland mitigation.

Enhancement via Cattle Exclusion 15A NCAC 02B .0295 (o)(6)

- Livestock is permanently excluded from riparian area.
- An enhancement plan must be provided in accordance by Paragraph (n) of 15A NCAC 02B .0295
- Grazing must be the predominant land use since the effective date of the applicable buffer rule.

Preservation on Subject Streams 15A NCAC 02B .0295 (o)(5):

- The buffer width is at least 30 feet from the stream (Figure 7).
- The area meets the requirements of 15A NCAC 02R 0.0403(c)(7), (8), and (11) with no known structures, infrastructure, hazardous substances, solid waste, or encumbrances within the mitigation boundary (see Section 4.4 for more detail).
- Preservation mitigation is being requested on no more than 25% of the total area of buffer mitigation (Table 8).

Preservation on Non-Subject Streams 15A NCAC 02B .0295 (o)(4):

- The streams were confirmed as intermittent or perennial by DWR per the On-Site Determination for Applicability to the Neuse River Riparian Buffer Rules and Water Quality Standards dated April 4, 2018
- The buffer width is at least 30 feet from the stream (Figure 7).
- Preservation mitigation is being requested on no more than 25% of the total area of buffer mitigation (Table 8).

2.5 Watershed Characterization

The Site topography, as indicated on the Four Oaks, NC USGS 7.5-minute topographic quadrangle shows a series of moderately sloped valleys (1-3%) that increase in width as they approach the floodplains of Sassarixa Creek and Black Creek (Figure 3).

Drainage areas for the streams and riparian areas were determined by delineating watersheds on the Four Oaks USGS 7.5-minute topographic quadrangles. Figure 4 shows the watershed boundaries for each area. Each of the riparian watersheds are mix of active pastures, fields, and woodlands. The watershed and current land use are summarized in Table 3 below.

Table 3: Drainage Areas and Associated Land Use – *Sassarixa Swamp Mitigation Site*

Reach Name	DWR Stream Designation	Buffer Area (Acres)	Watershed Area (acres)	Land Use
Sassarixa Creek	Perennial	14.3	4,726	47% agricultural, 7% developed, 46% forested
T1	Intermittent	6.44	45	63% agricultural, 20% developed, 17% forested
T1A	Intermittent	0.39	6	80% agricultural, 0% developed, 20% forested
T1B	Intermittent	0.56	2	80% agricultural, 0% developed, 20% forested
T1C	Intermittent	1.20	6	80% agricultural, 0% developed, 20% forested
T1D	Intermittent	.09	0.5	80% agricultural, 0% developed, 20% forested
T2	Intermittent	1.05	13	80% agriculture, 7% developed, 13% forested
T3 R1	Ephemeral	0.80	17	80% agricultural, 7% developed, 13% forested
T3 R2	Intermittent	3.52	26	80% agricultural, 7% developed, 13% forested
T4	Intermittent	7.00	40	52% agricultural, 4% developed, 44% forested

Reach Name	DWR Stream Designation	Buffer Area (Acres)	Watershed Area (acres)	Land Use
T5	Intermittent	7.28	136	60% agricultural, 4% developed, 36% forested
T5A*	Wetland (Impacts from cattle in T5 stream resulted in a wetland)	4.33	24	80% agricultural, 0% developed, 20% forested
T5B	Intermittent	4.54	25	80% agricultural, 0% developed, 20% forested
T5C	Headwater Wetlands	0.29	10	90% agriculture, 10% forested
T6	Intermittent	4.11	130	60% agricultural, 4% developed, 36% forested

**Proposing stream restoration to reconnect T5A stream throughout. If stream restoration is approved by the IRT and a stream channel is constructed, then the new riparian areas will be viable as an Enhancement Site per 15A NCAC 02B .0295 (o) (6).*

2.6 Vegetation

Three reaches on site lack a riparian buffer: T1-R1, the upstream end of T2, and the upstream end of T3. The riparian buffer in these areas consist primarily of fescue (*Festuca* sp.) and some areas of hay production to feed livestock. The canopy on T1-R2 is unique in that it is dominated by loblolly pine (*Pinus taeda*) with an understory of Japanese stiltgrass (*Microstegium vimeneum*). All other riparian areas include a mix of canopy species including red maple (*Acer rubrum*), sweetgum (*Liquidambar straciflua*), willow oak (*Quercus phellos*), tulip poplar (*Liriodendron tulipifera*), ironwood (*Carpinus caroliniana*), sycamore (*Platanus occidentalis*), water oak (*Quercus nigra*), and black willow (*Salix nigra*). While the understory of all reaches is dominated by Japanese stiltgrass, there is still a diverse mix of understory species present, especially along Sassarixa Creek and T4-R3. Understory species include Christmas fern (*Polystichum acrostichoides*), dogfennel (*Eupatorium caplilifolium*), greenbrier (*Smilax sp.*), Virginia creeper (*Parthenocissus quinuefolia*), sawtooth blackberry (*Rubus argutus*), common ragweed (*Ambrosia artemisifolia*), poison ivy (*Toxicodendron radicans*), common rush (*Juncus effesus*), and common sedge (*Carex sp.*). Invasive species located in the riparian buffers include Chinese privet (*Ligustrum sinese*) and Japanese honeysuckle (*Lonicera japonica*).

2.7 Site Constraints and Access

The Site is accessible in multiple locations off Old Olive Road. Several culverts and two ford crossing will be constructed on project streams to allow for continued use of the land outside of the project area for agriculture. Each crossing is a 35-foot crossing internal to the easement. Wherever possible, culverts will be located at the start or end of the project reach to limit impact on stream pattern, plan, and profile. There are no known airport facilities within five miles of the project area (Figure 1). There is one utility easement at the start of T4 and will be used as a ford crossing. There are no other known constraints on the proposed Site.

2.8 Current Site Resources

On February 9, 2018 (dated May 21, 2018) Ms. Katie Merritt, with DWR, conducted on-site determinations to review features and land use within the project boundary. In March 2019 Ms. Sam Dailey, with USACE, determined two additional features, T1B and T1C, within the project boundary as intermittent channels, resulting in an additional site-viability letter from Ms. Katie Merritt. The resulting DWR site viability letters and maps confirming the Site as suitable for riparian buffer mitigation is enclosed in the Appendix. The on-site determination approval letter from NCDWR is also included in the Appendix.

2.9 Historic Site Resources

A review of historic aerials from 1950 to 2012, located in the appendix, show that onsite streams have existed in their approximate locations with very little change to riparian area extents since 1950. Two alterations to the Site visible from historical aerial photography are the addition of the pond on T2 between 1964 and 1973, and the addition of the large pond below T5A, T5B, and T5C between 1950 and 1961.

3.0 Site Protection Instrument

3.1 Site Protection Instruments Summary Information

The land required for riparian planting, management, and stewardship of the mitigation project includes portions of the parcels listed in Table 4. Option agreements for the project area have been signed by the property owners and a Memorandum of Option have been recorded at the Johnston County Register of Deeds. The proposed conservation easements on these properties has not yet been recorded.

Table 4: Site Protection Instrument – *Sassarixa Swamp Mitigation Site*

Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Number	Acreage to be Protected
Hunter E. Oliver Janie E. Oliver	166200-58-6572 166200-59-2333	Johnston	Conservation Easement	DB: 3624 PG: 581	25.94
Junes Jones Olive Revocable Trust	166200-88-5084 166200-85-0452	Johnston	Conservation Easement	DB: 3719 PG: 717	15.73
Junes Jones Olive Revocable Trust Hunter E. Oliver	166200-57-0481 167200-17-2303	Johnston	Conservation Easement	DB: 3719 PG: 717	9.66
Mary Hunter Olive-Waller Todd Franklin Waller Amanda J. Olive	166200-49-5125	Johnston	Conservation Easement	DB: 4358 PG: 908	1.52
Tami Olive Thompson David Thompson Junes Jones Olive Revocable Trust	166200-66-6896	Johnston	Conservation Easement	DB: 3719 PG: 717	5.46
Matthew T. Keen	167200-06-5717	Johnston	Conservation Easement	DB: 4606 PG: 183	2.04
Tami Olive Thompson	166200-79-8148	Johnston	Conservation Easement	DB: 3719 PG: 717	4.71

All site protection instruments require 60-day advance notification to the Corps and the State prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

4.0 Regulatory Considerations

Table 5, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 4.1-4.3. A copy of the signed Categorical Exclusion Form for the project can be found in the Sassarixa Swamp Mitigation Plan for the stream project.

Table 5: Project Attribute Table – *Sassarixa Swamp Mitigation Site*

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	Yes	(Appendix) Site Viability Letter
Water of the United States - Section 401	Yes	Yes	(Appendix) Site Viability Letter
Endangered Species Act	Yes	Yes	Sassarixa Swamp Mitigation Plan Appendix (Categorical Exclusion)
Historic Preservation Act	Yes	Yes	Sassarixa Swamp Mitigation Plan Appendix (Categorical Exclusion)
Coastal Zone Management Act	No	No	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

4.1 Threatened and Endangered Species

The NC Natural Heritage Program (NHP) database and the US Fish and Wildlife Service (USFWS) database were searched for federally listed threatened and endangered plant and animal species in Johnston County, NC. Five federally listed species, the red-cockaded woodpecker (*Picoides borealis*), dwarf wedgemussel (*Alasmidonta heterodon*), Tar River spinymussel (*Parvaspina steinstansana*), yellow lance (*Elliptio lanceolata*), and Michaux's sumac *(Rhus michauxii*) are currently listed in Johnston County. Table 6. list their federal status and habitat.

Table 6: Listed Threatened and Endangered Species in Johnston County, NC – *Sassarixa Swamp Mitigation Site*

Species	**Federal Status**	**Habitat**
Vertebrate		
Red-cockaded woodpecker (*Picoides borealis*)	E	Found in mature pine forests, these birds bore cavities inside of living pine trees
Invertebrate		
Dwarf wedge mussel *(Alasmidonta heterodon)*	E	Inhabit a wide range of stream sizes and types from small streams to large rivers. Known to live in substrates including clay, sand, gravel, pebble, and some silt depositional areas
Tar River spinymussel *(Parvaspina steinstansana)*	E	Live mostly in silt-free unconsolidated beds of coarse sand and gravel. Prefer faster flowing, well oxygenated streams.
Yellow lance *(Elliptio lanceolate)*	T	Lives in coarse to medium clean sand, and sometimes gravel. Usually found in the downstream portion of sand and gravel bars. Requires clean, well oxygenated water with moderate flows. Found in small to medium streams.
Vascular Plant		
Michaux's sumac *(Rhus michauxii*)	E	Woodland edges, woodland, sandhills and sandy forest.

E = Endangered;
T= Threatened

Wildlands requested review and comment from the United States Fish and Wildlife Service on February 5, 2018 in respect to the Sassarixa Swamp Mitigation Site and its potential impacts on threatened or endangered species. USFWS responded on March 2, 2018 and stated the "proposed action is not likely to adversely affect any federally listed endangered or threatened species, their formally designated critical habitat or species currently proposed for listing under the Act". A follow up email was sent to USFWS on April 6, 2018 regarding the new addition of the yellow lance on April 4, 2018 to Johnston

County's endangered species list. USFWS responded on April 9, 2018 with no additional objection. All correspondence with USFWS is include in the approved Categorical Exclusion found in the Sassarixa Swamp Mitigation Plan.

A pedestrian survey conducted on April 10, 2018, indicated that the Site did not provide suitable habitat for the red-cockaded woodpecker and yellow lance. The pedestrian survey did indicate that the site provides suitable habitat for the dwarf wedgemussel, Tar River spinymussel, and Michaux's sumac but no species were identified on the site. Therefore, due to the absence of the listed species on the site, the project has been determined by Wildlands to "may affect, but not likely to adversely affect" the dwarf wedgemussel and Tar River spinymussel, and to have "no effect" on the Michaux's sumac. The project will have "no effect" on the red-cockaded woodpecker and yellow lance due to the absence of suitable habitat.

4.2 Cultural Resources and Significant Natural Heritage Areas

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

There are no existing structures in the project area. The Site is not located near any sites listed on the National Register with the State Historic Preservation Office (SHPO). SHPO was contacted February 2, 2018 and had no concerns or comments on the project site. The approved Categorical Exclusion for the project is in the Sassarixa Swamp Mitigation Plan.

4.3 FEMA Floodplain Compliance

The Site is represented on the Johnston County Flood Insurance Rate Map Panel 1662. Sassarixa Creek and the downstream portions of T4, T5, and T6 are mapped in Zone AE from the modeled Black Creek, however no streams on Site are modeled. Areas within the mapping are slated for stream enhancement and preservation as part of them stream mitigation project and will not require net fill within the floodplain. Wildlands will coordinate with the Johnston County floodplain administrator to obtain the appropriate floodplain development permit for the project, if required.

4.4 Other Environmental Issues

An EDR Radius Map Report with Geocheck was ordered for the Site through Environmental Data Resources, Inc. on January 29, 2018. The target property and the adjacent properties are not listed in any of the Federal, State, or Tribal environmental databases searched by EDR. There were no known or potentially hazardous waste sites identified within one mile of the Parcel.

4.5 Determination of Credits

Mitigation credits presented in Table 7a and 7b and Figures 6 and 9 are projections based upon site design and are intended to be used as either riparian buffer credits or nutrient offset credits, dependent on the need. Sassarixa Creek's anabranching streams have been remove for credit calculation purposes. Upon completion of site construction, the project components and credits data will be revised to be consistent with the as-built condition.

Table 7a: Riparian Buffer Credit Generation Summary for Restoration and Cattle Exclusion - *Sassarixa Swamp Mitigation Site*

Neuse 03020201 - Outside Falls Lake	**Service Area**
19.16394	**N Credit Ratio (sf/credit)**

Credit Type	Location	Subject? (enter NO if ephemeral or ditch [1])	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Total (Creditable) Area of Buffer Mitigation (sf)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Convertible to Riparian Buffer?	Riparian Buffer Credits	Convertible to Nutrient Offset?	Delivered Nutrient Offset: N (lbs)
Buffer	Rural	No	Ephemeral	Restoration	0-100	T3	18,165	18,165	1	100%	1.00000	Yes	18,165.000	Yes	947.874
Buffer	Rural	Yes	I / P	Restoration	0-50	T4, T5B	3,930	3,930	1	100%	1.00000	Yes	3,930.000	No	—
Buffer	Rural	Yes	I / P	Restoration	0-100	T1, T1A, T1B, T1D, T3, T4, T5, T5A, T5B, T6	356,364	356,364	1	100%	1.00000	Yes	356,364.000	Yes	18,595.550
Buffer	Rural	Yes	I / P	Restoration	101-200	T2, T4, T5, T5B	43,678	43,678	1	33%	3.03030	Yes	14,413.754	Yes	2,279.176
Buffer	Rural	Yes	I / P	Enhancement	0-50	T4	210	210	2	100%	2.00000	Yes	105.000	Yes	10.958
Buffer	Rural	Yes	I / P	Enhancement	0-100	T4	59,388	59,388	2	100%	2.00000	Yes	29,694.000	Yes	3,098.945
Buffer	Rural	Yes	I / P	Enhancement	101-200	T4	3,106	3,106	2	33%	6.06061	Yes	512.490	Yes	162.075
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	20-29	Sassarixa Creek, T5, T6	1,209	1,209	2	75%	2.66667	Yes	453.374	No	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-50	Sassarixa Creek, T5, T6	6,420	6,420	2	100%	2.00000	Yes	3,210.000	No	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	Sassarixa Creek, T1A, T1B, T1C, T2, T3, T5, T5A, T5B, T6	1,080,633	1,080,633	2	100%	2.00000	Yes	540,316.500	No	—
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	101-200	Sassarixa Creek, T5 T5A, T5B	377,045	377,045	2	33%	6.06061	Yes	62,212.385	No	—
Buffer	Rural	Yes	Coastal Headwater	Restoration	0-100	T5C	12,481	12,481	1	100%	1.00000	Yes	12,481.000	No	—
						Totals:	1,962,629	1,962,629							

*Per the Site Viability for Buffer Mitigation and Nutrient Offset Letter dated May 21, 2018, certain project reaches were deemed viable by DWR for nutrient offset credit at 2,273 lbs. Nitrogen per acre. The nutrient offset viable areas are depicted in Figure 9 and their associated potential nutrient offset credits are listed in Table 7a. These select project areas have a minimum easement width of 50 feet from the top of bank and will be restored, per Section 5.2. While nutrient offset credits are not being requested at this time, these areas may be converted to nutrient offset credits by DMS later.

Table 7b: Riparian Buffer Credit Generation Summary for Preservation - *Sassarixa Swamp Mitigation Site*

Enter Preservation Credits Below	
Eligible for Preservation (sf):	654,210

Credit Type	Location	Subject?	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Total (Creditable) Area for Buffer Mitigation (sf)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits
Buffer	Rural	No	Ephemeral	Preservation	0-100	T3	16,744	16,744	10	100%	10.00000	1,674.400
	Rural	Yes	I / P		20-29	T5	235	235	10	75%	13.33333	17.625
	Rural	Yes	I / P		0-100	T3, T4, T5	545,794	545,794	10	100%	10.00000	54,579.400
	Rural	Yes	I / P		101-200	T3	544	544	10	33%	30.30303	17.952

Preservation Area Subtotal (sf):	563,317
Preservation as % Total Area of Buffer Mitigation:	21.5%
Ephemeral Reaches as % Total Area of Buffer Mitigation:	1.4%

*Area eligible for preservation may be no more than 25% of total area, where total area is back calculated with the equation R+E/0.75.
*Ephemeral channels may be no more than 25% of mitigation area for buffer credits, no limit on nutrients

Table 7c: Total Riparian Buffer Credit Generation Summary – *Sassarixa Swamp Mitigation Site*

TOTAL AREA OF BUFFER MITIGATION (TABM)			
Mitigation Totals		**Square Feet**	**Credits**
Restoration:		434,618	405,353.754
Enhancement:		1,528,011	636,503.749
Preservation:		563,317	56,289.000
Total Riparian Buffer:		2,525,946	1,098,146.503
TOTAL NUTRIENT OFFSET MITIGATION			
Mitigation Totals		**Square Feet**	**Credits**
Nutrient Offset:	**Nitrogen:**	0	0.000
	Phosphorus:		0.000

5.0 Implementation Plan

The Wildlands Team proposes to restore high quality ecological function to Sassarixa Creek and 13 unnamed tributaries on the Site. The ecological uplift can be summarized as transforming agriculturally impacted areas to a protected forested riparian corridor. The project design will ensure that no adverse impacts to wetlands or existing riparian areas occur. All riparian restoration activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where riparian restoration is being performed may be altered slightly depending on the implementation of the Sassarixa Swamp Stream Mitigation Plan. Planting and fencing will happen in conjunction with the Sassarixa Swamp Nutrient Offset and Buffer Mitigation Bank Parcel. Figure 7 illustrates the conceptual design for the Site.

5.1 Parcel Preparation

The current land uses adjacent to the streams proposed for riparian restoration are active agricultural lands. Areas slated for riparian restoration that are not impacted by the construction of the stream mitigation project will require little site preparation including select herbicide treatments or limited mechanical clearing to remove undesirable underbrush or invasive species. Other areas of the easement will be graded in accordance with the Interagency Review Team (IRT) approved stream mitigation plan. After the grading for the stream mitigation is complete, the floodplain will be prepared for seeding and planting by applying stockpiled topsoil to the floodplain between bankfull elevation of the stream and the grading limits. All haul roads and other areas of compacted soil within the easement boundary will be ripped prior to planting.

As part of the stream mitigation project, the farm pond and drainpipe that currently impounds water at the headwaters of T2 will be eliminated and the channel restored. Several field drains were installed near the area at the top of the pond to direct stream water and field drainage into the pond. Those will be severed at the edge of buffer to provide diffuse flow into the easement. The earthen dam is proposed to be removed and a portion of the dam will be used to fill the pond bottom to provide stable foundation for construction of the new channel. The path of the future channel will be over-excavated, and fill material from the old dam will be used to stabilize the pond bed for the construction of the bed and banks of the new channel. Once the dam is removed, the stream restoration will begin near the upstream extent of the existing impoundment. Below the existing dam the restored channel will follow the existing valley flowing southwest until it reaches the confluence with Sassarixa Creek. Sheets 1.25-1.29 from the Sassarixa Swamp Stream Mitigation Plan (SAW# 2018-00432) set depicts the pond footprint, conservation easement boundary, and new stream alignment, which is included in Appendix 7 of the Sassarixa Swamp Stream Mitigation Plan.

The specifics of the stream restoration project, including breaching the pond on T2 and grading plan, are included in the Sassarixa Swamp Stream Mitigation Plan. A 401 permit will be required for all stream restoration work, including work within the pond on T2 and will be obtained before any work in the waters begins.

5.2 Riparian Area Restoration Activities

The revegetation plan for the riparian mitigation area will include permanent seeding, planting bare root trees, live stakes, and herbaceous plugs. These revegetation efforts will be coupled with controlling invasive species population. The specific species composition to be planted was selected based on the community type, observation of occurrence of species in riparian areas adjacent to the Parcel, and best professional judgement on species establishment and anticipated site conditions in the early years following project implementation. Table 8 list woody species that are native to the area and may become established in the Site during the duration of the project. Refer to Sheet 3.0 of the Draft Plans located in Appendix 7 of the Sassarixa Swamp Stream Mitigation Plan for the planting plan.

Table 8: Native Woody Species to be Established – *Sassarixa Swamp Mitigation Site*

Scientific Name	Common Name	Dominant Method of Establishment
Acer rubrum	Red Maple	Natural Colonization
Acer negundo	Box Elder	Hand Planting
Betula nigra	River Birch	Hand Planting
Carpinus caroliniana	Ironwood	Natural Colonization
Liriodendron tulipifera	Tulip Poplar	Natural Colonization
Liquidambar straciflua	Sweetgum	Natural Colonization
Magnolia virginiana	Sweetbay Magnolia	Hand Planting
*Platanus occidentalis**	American Sycamore	Hand Planting
Populus deltoides	Eastern Cottonwood	Hand Planting
Quercus michauxii	Swamp Chestnut Oak	Hand Planting
*Quercus nigra**	Water Oak	Hand Planting
Quercus pagoda	Cherry Bark Oak	Hand Planting
*Quercus phellos**	Willow Oak	Hand Planting
*Salix nigra**	Black Willow	Hand Planting
Ulmus alata	Winged Elm	Hand Planting

*These late successional species may naturally colonize but are not expected to reach high-density numbers, height, and/or vigor after disturbance.

Trees will be planted at a density sufficient to meet the performance standards outlined in the Rule 15A NCAC 02B .0295 of 260 trees per acre at the end of five years. No one tree species will be greater than 50% of the established stems. An appropriate seed mix will also be applied as necessary to provide temporary ground cover for soil stabilization and reduction of sediment loss during rain events in disturbed areas. This will be followed by an appropriate permanent seed mixture. Planting is scheduled to begin in March 2020.

Vegetation management and herbicide applications may be needed during tree establishment in the restoration areas to prevent establishment of invasive species that could compete with the planted native species.

5.3 Riparian Area Enhancement Activities

The revegetation plan for the enhancement areas under NCAC 02B .0295 (n) will include planting supplemental bare root trees and controlling invasive species growth. The tree species to be planted are listed in Table 8.

For enhancement areas under NCAC 02B .0295 (o), cattle exclusion, planting isn’t anticipated to be needed except where required in the stream mitigation plan. A seed mix will be applied where cattle have caused bare soils and cattle will be excluded from the riparian enhancement areas by fencing.

5.4 Riparian Area Preservation Activities

There will be no parcel preparation work done in the riparian preservation areas, as allowed under 15A NCAC 02B .0295(o). The preservation area will be protected in perpetuity under a conservation easement.

6.0 Monitoring Plan

The Site monitoring plan has been developed to ensure that the required performance standards are met, and project goals and objectives are achieved. The monitoring report shall provide project data chronology that will facilitate an understanding of project status and trends, ease population of DMS databases for analysis and research purposes and assist in close-out decision making.

6.1 Monitoring Components

Project monitoring components are listed in more detail in Table 9 and Figure 8.

6.2 Vegetation

Vegetation monitoring quadrants will be installed across the Site to measure the survival of the planted trees (Figure 8). The first annual monitoring activities will commence at the end of the first growing season, at least six months after planting has been completed, and will be reassessed annually no earlier than the Fall of each year. Species composition, density, height, and survival rates will be evaluated on an annual basis by plot and for the entire site. The number of monitoring quadrants required, and frequency of monitoring will be based on the DMS monitoring guidance documents. Vegetation monitoring will follow the CVS-EEP Protocol for Recording Vegetation (2008) or another DMS approved protocol. Planted stems will be flagged each monitoring year. Reference photographs of the vegetation plots and Site will be taken during the annual vegetation assessments.

6.3 Overview Photographs

Overview photographs will be taken of the project area once a year to visually document stability for five years following construction.

6.4 Visual Assessment

Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species or encroachment).

Table 9: Monitoring Components – *Sassarixa Swamp Mitigation Site*

Parameter	Monitoring Feature	Quantity	Frequency
Vegetation	CVS Level 2	9	Year 1-5
	Visual	T5C	Year 1-7
Visual Assessment		Yes	Semi-Annual
Exotic and Nuisance Vegetation			Semi-Annual
Project Boundary			Semi-Annual

7.0 Project Success Criteria

The project success criteria for the Site follows approved performance criteria presented in the guidance documents outlined in RFP 16-007279 and the Consolidated Buffer Rule (15A NCAC 02B .0295). Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. The buffer mitigation project has been assigned specific performance criteria components for vegetation. Performance criteria will be evaluated throughout the five-year post-construction monitoring. An outline of the performance criteria components follows.

7.1 Vegetation

The final vegetative success criteria will be the health, survival, height, and density of at least 260 stems per acre at the end of the fifth year of monitoring, with a minimum of four native hardwood tree or shrub species composition and no one species comprises more than 50 percent of stems. Vigor, species composition, and density will all be assessed. The extent of invasive species coverage will also be monitored and controlled as necessary throughout the required monitoring period.

7.2 Overview Photographs

Overview photographs will be taken of the project area once a year to visually document stability for five years following construction.

7.3 Visual Assessments

Visual assessments should support the specific performance standards for each metric as described above. Visual assessments will be performed within the Site on a semi-annual basis during the five-year monitoring period. Problem areas with vegetative health will be noted (e.g. low stem density, vegetation mortality, invasive species or encroachment). Areas of concern will be mapped and photographed accompanied by a written description in the annual report. Problem areas with be re-evaluated during each subsequent visual assessment. Should remedial actions be required, recommendations will be provided in the annual monitoring report.

To ensure compliance with 0295 (0) (6): A visual assessment of the cattle exclusion and preservation areas within the conservation easement will also be performed each year to confirm:

- No cattle access within the conservation easement area; no encroachment has occurred; diffuse flow is being maintained in the conservation easement area; and there has not been any cutting, clearing, filling, grading, or similar activities that would negatively affect the functioning of the buffer.
- Any issues identified during the visual assessment of the cattle exclusion and preservation areas will be photographed and mapped as part of the annual monitoring report with remedial efforts proposed or documented.

7.4 Reporting Performance Criteria

Using the DMS Riparian Buffer and Nutrient Offset Buffer Baseline and Annual Monitoring Report Template version 2.0 (May 2017), a baseline monitoring document and as-built record drawings of the project will be developed for the constructed Site. Complete monitoring reports will be prepared in the fall of each monitoring year and submitted to DMS. Annual monitoring reports will be based on the above referenced DMS Template (May 2017). The monitoring period will extend five years beyond completion of construction or until performance criteria have been met. Additional visual monitoring period for Coastal Headwaters will extend seven years beyond completion of construction or until performance criteria have been met. Closeout of buffer mitigation credits adjacent to the Coastal Headwaters will be done at IRTcloseout of the stream and wetland mitigation project.

7.5 Maintenance and Contingency Plans

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions in the event that the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

8.0 Stewardship

8.1 Long Term Stewardship

The Site will be transferred to the North Carolina Department of Environmental Quality (NCDEQ) Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statue GS 113A-232(d)(3). Interest gained by the endowment fund may be used for stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

8.2 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Section 7. Project maintenance will be performed during the monitoring years to address minor issues as necessary. If, during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized, Wildlands will notify the members of DMS/NCDWR and work with the DMS/NCDWR to develop contingency plans and remedial actions.

The Wildlands Team will develop necessary adaptive measures or implement appropriate remedial actions if the Site or a specific component of the Site fails to achieve the success criteria outlined above. The project-specific monitoring plan developed during the design phase will identify an appropriate threshold for maintenance intervention based on the monitored items. Any actions implemented will be designed to achieve the success criteria specified previously and will include a work schedule and updated monitoring criteria (if applicable).

9.0 References

National Land Cover Database 2011 (NLCD 2011), Multi-Resolution Land Characteristics (MRLC) consortium, https://www.mrlc.gov/nlcd2011.php

Natural Resources Conservation Service (NRCS). Web Soil Survey of Johnston County. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

North Carolina Division of Mitigation Services (DMS), 2016. River Basin Restoration Priority Transition Approach.

North Carolina Division of Water Quality (NCDWQ), 2011. Surface Water Classifications. http://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications

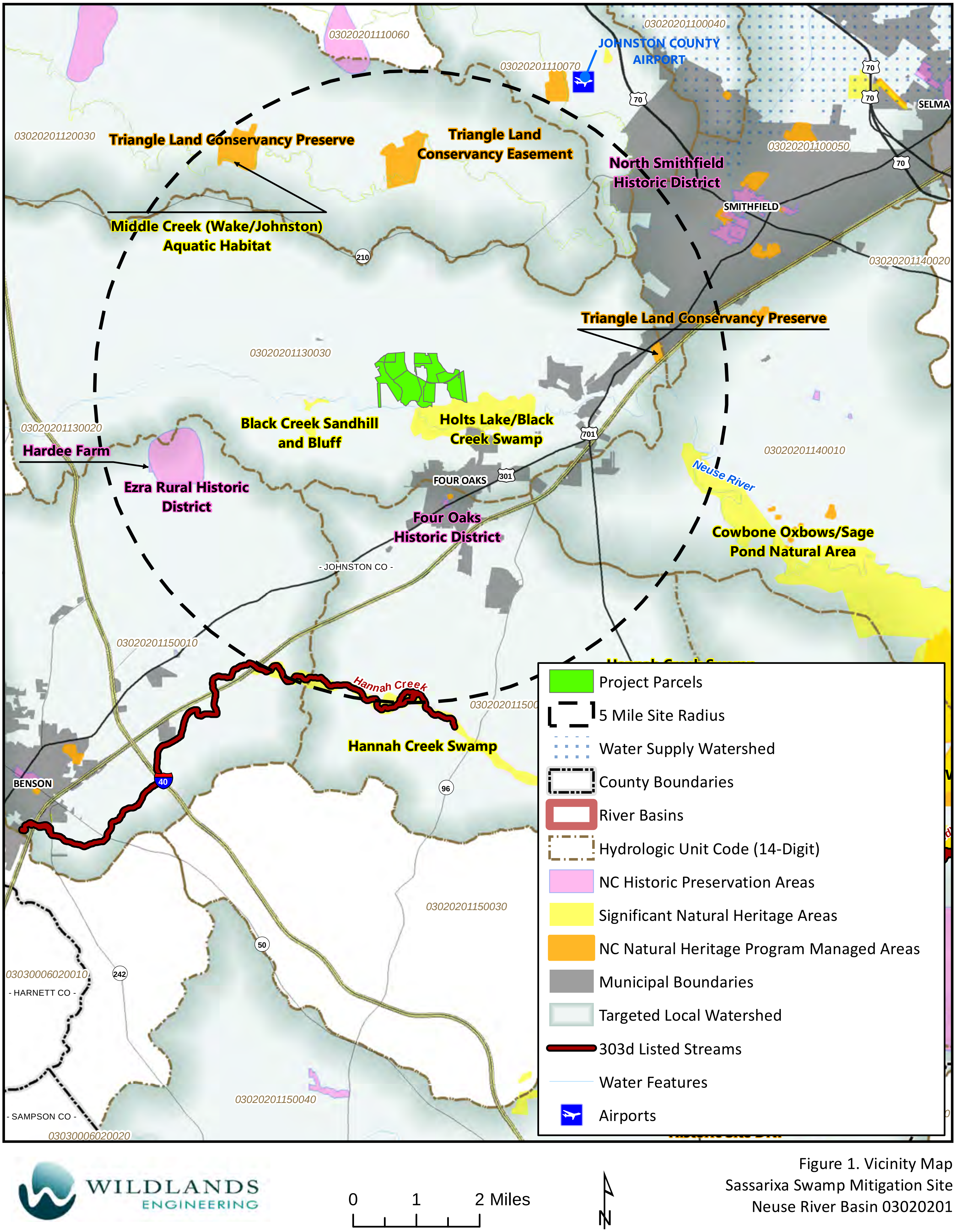
North Carolina Geological Survey (NCGS), 1985, Geologic Map of North Carolina: Raleigh, North Carolina Department of Natural Resources and Community Development, Geological Survey Section, scale 1:500,00, in color.

NCGS, 2013. Mineral Resources. http://deq.nc.gov/about/divisions/energy-mineral-land-resources/north-carolina-geological-survey/mineral-resources

North Carolina Natural Heritage Program (NHP), 2018. Natural Heritage Element Occurrence Database, Johnston County, NC.

Rob Breeding, Eastern Watershed Planner, North Carolina Ecosystem Enhancement Program (NCEEP), 2010. Neuse River Basin Restoration Priorities.

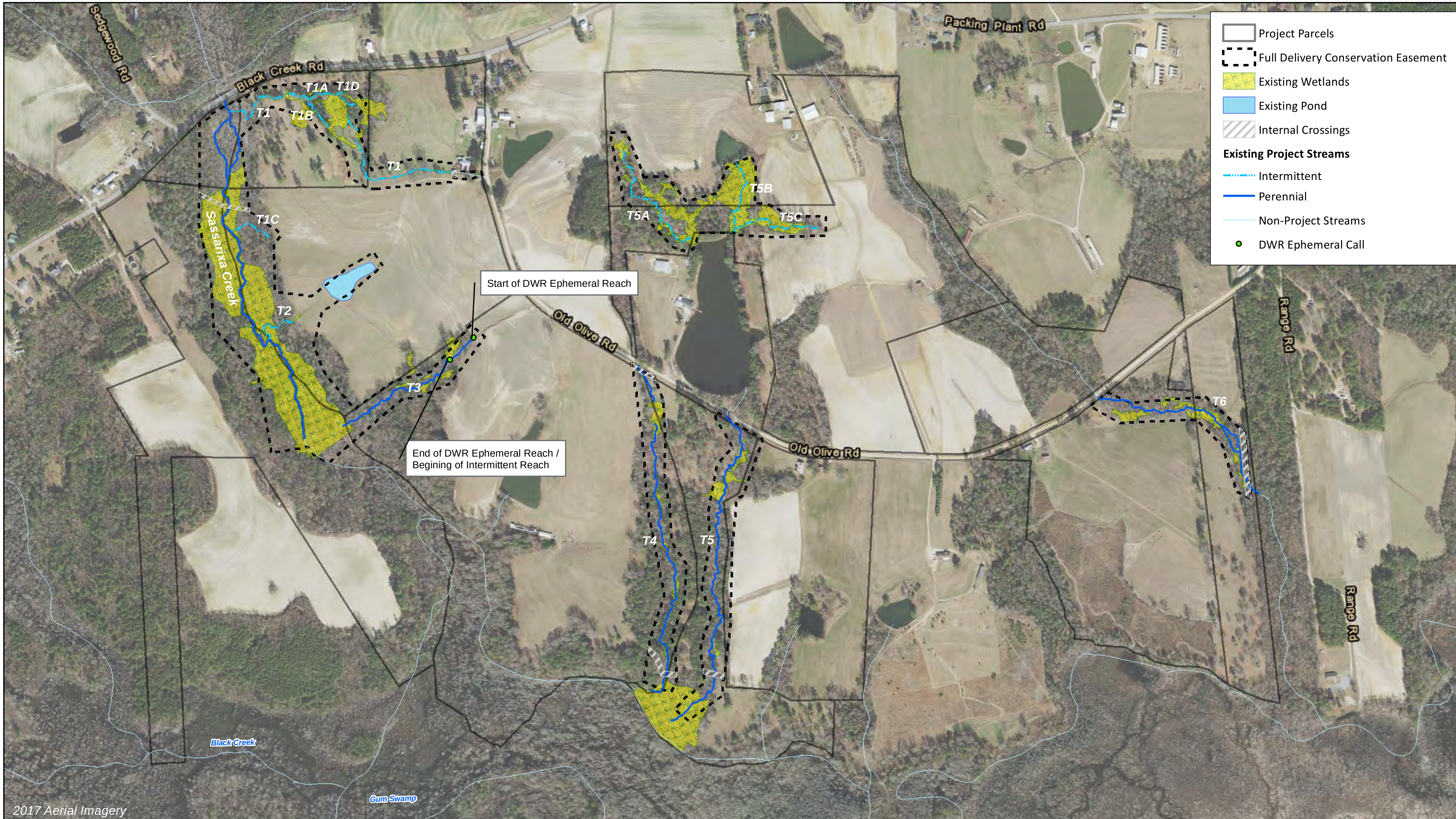
United States Fish and Wildlife Service (USFWS), 2018. Endangered Species, Threatened Species, Federal Species of Concern and Candidate Species, Johnston County, NC.



WILDLANDS ENGINEERING

Figure 1. Vicinity Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

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Figure 2. Site Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

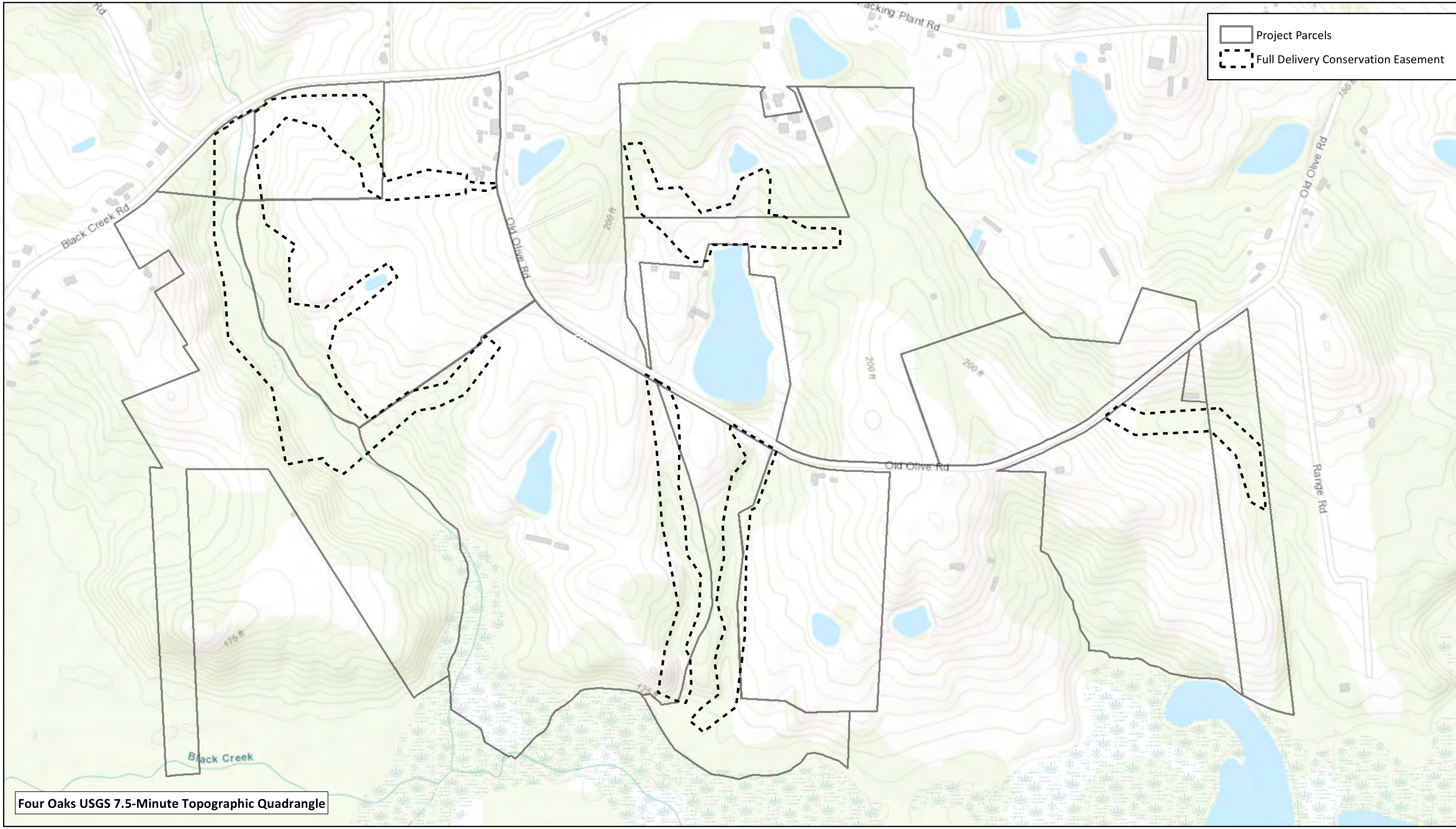

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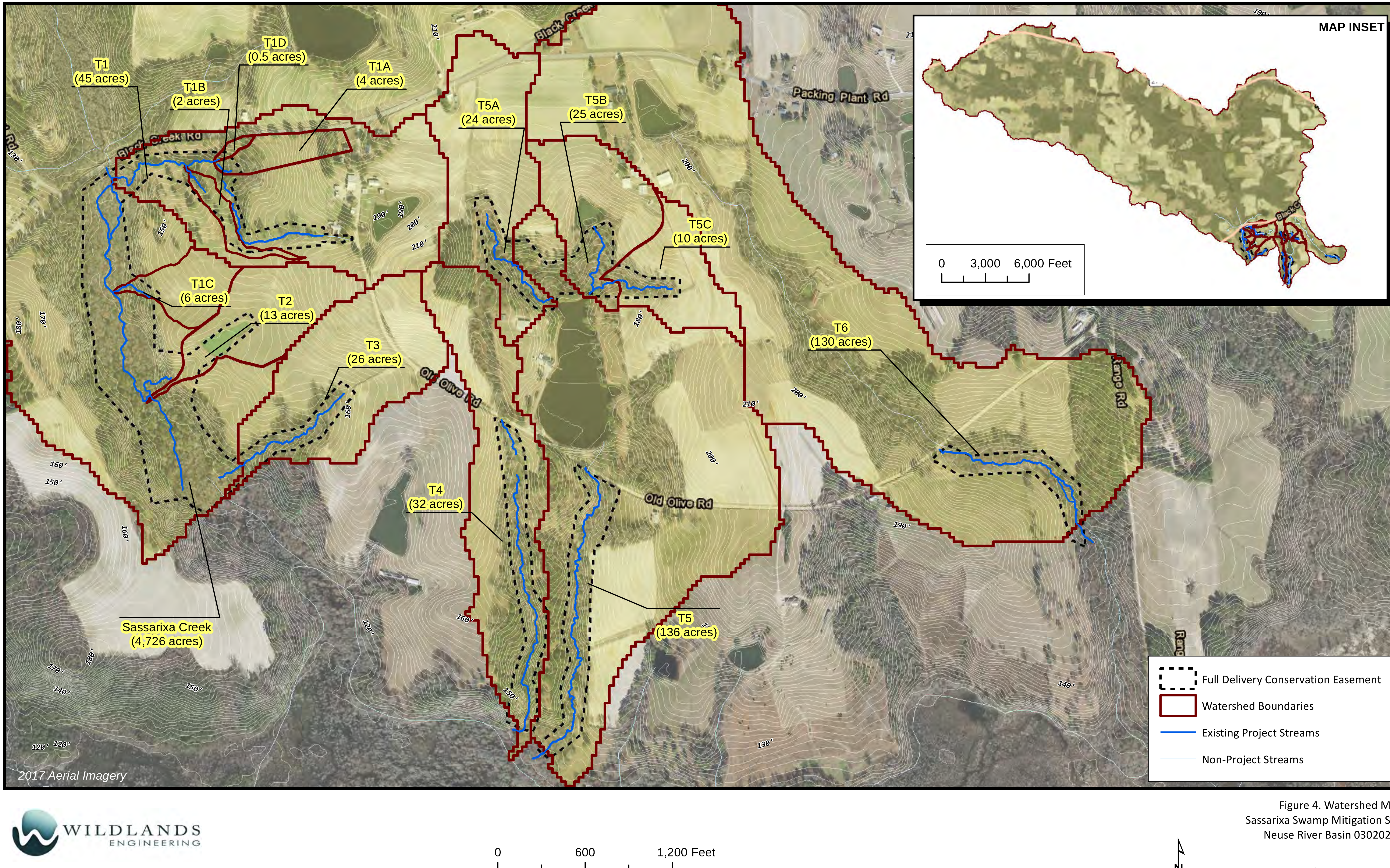
Figure 3. USGS Topographic Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

Figure 4. Watershed Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

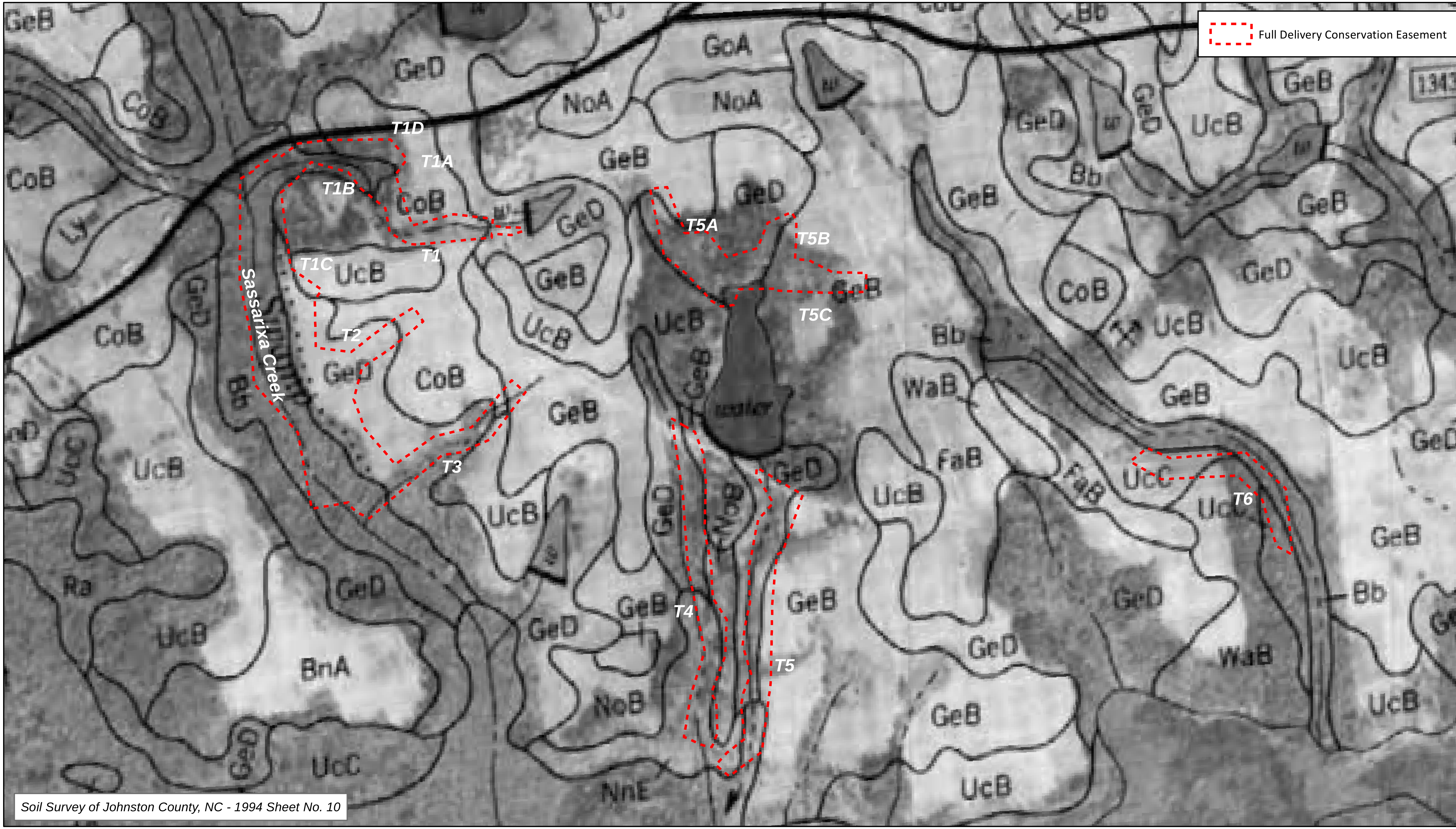


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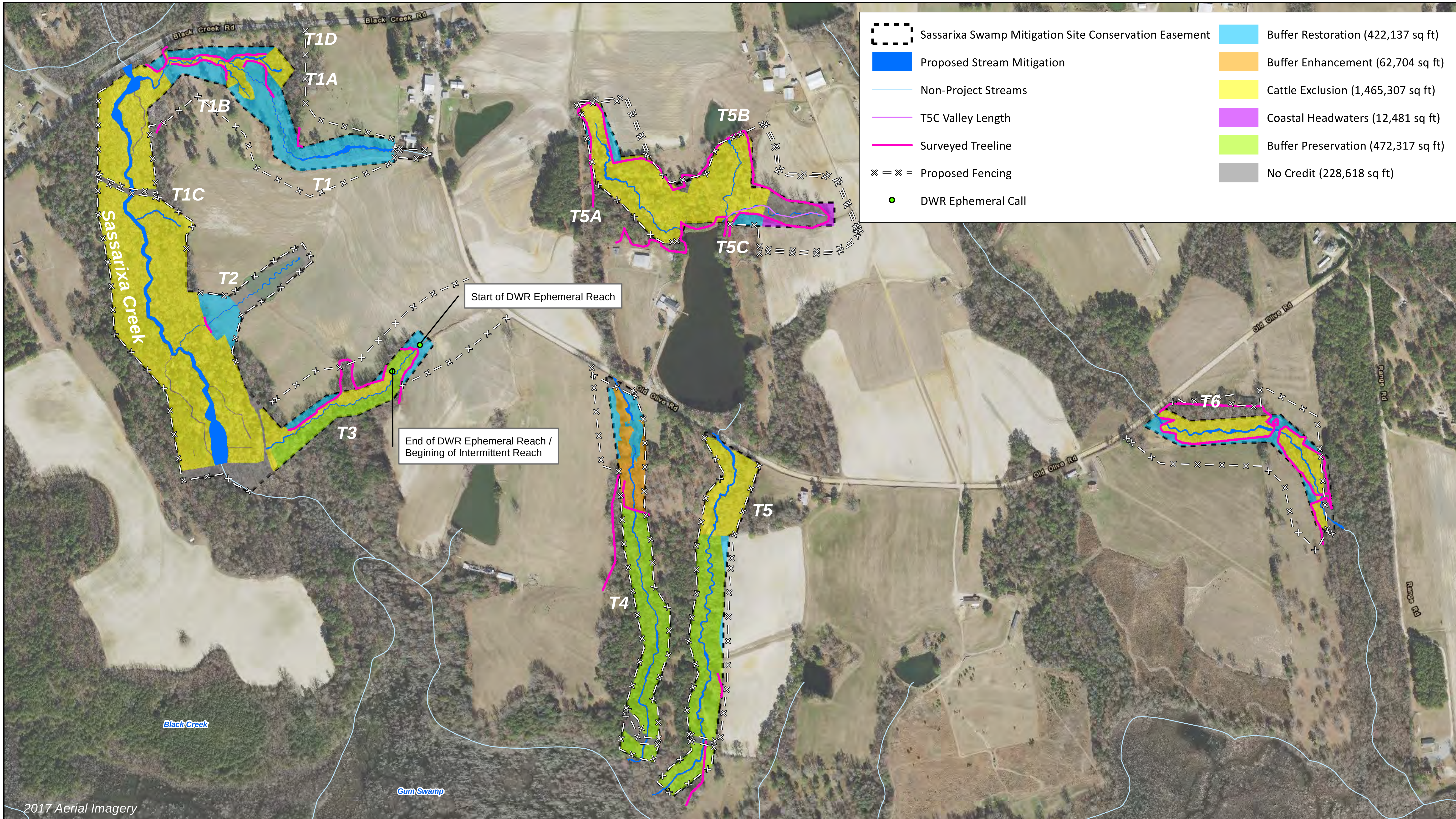
Figure 5. Soils Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

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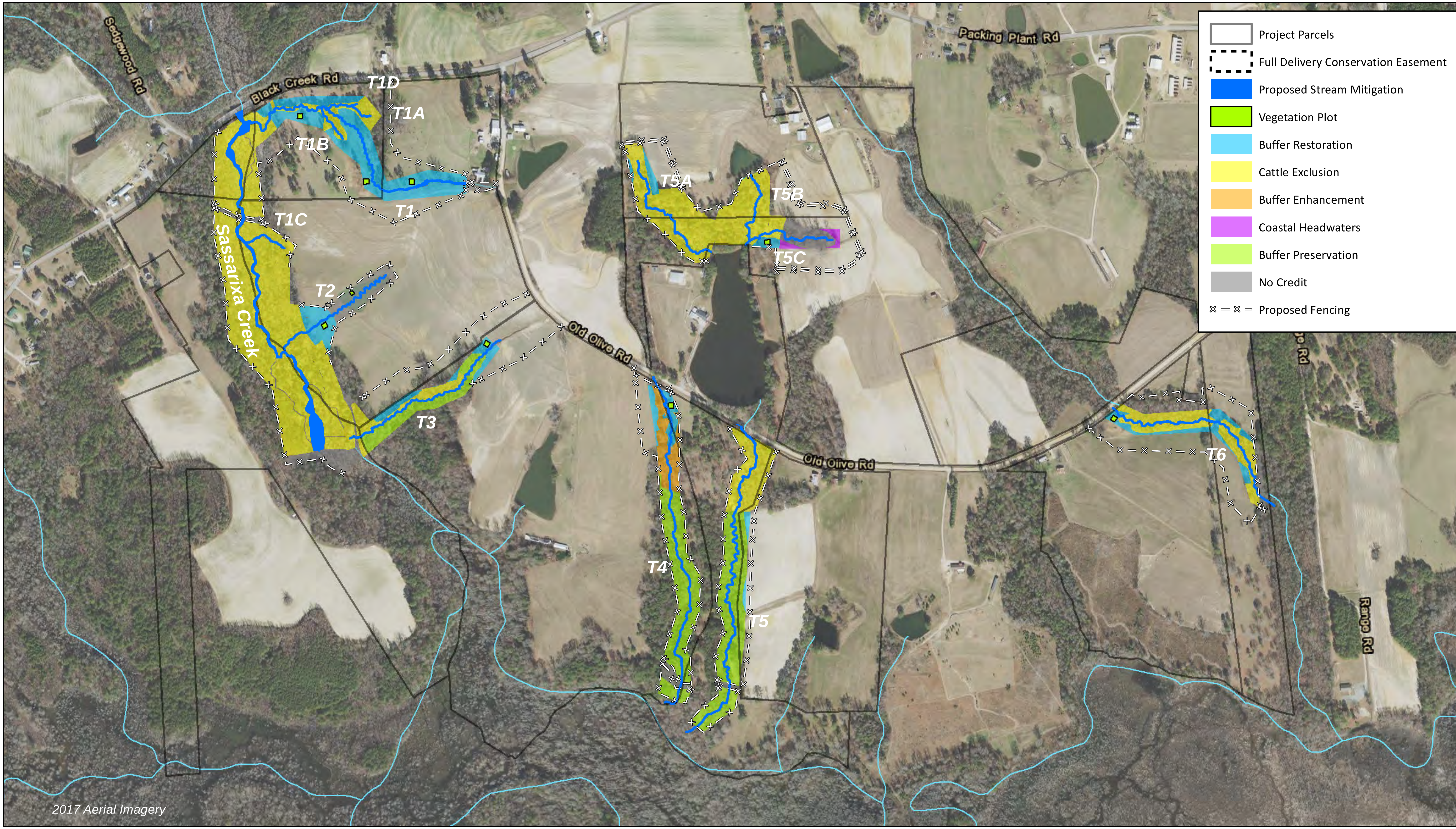
Figure 6. Credit Calculations Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

WILDLANDS ENGINEERING

Figure 7. Riparian Buffer Zones Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

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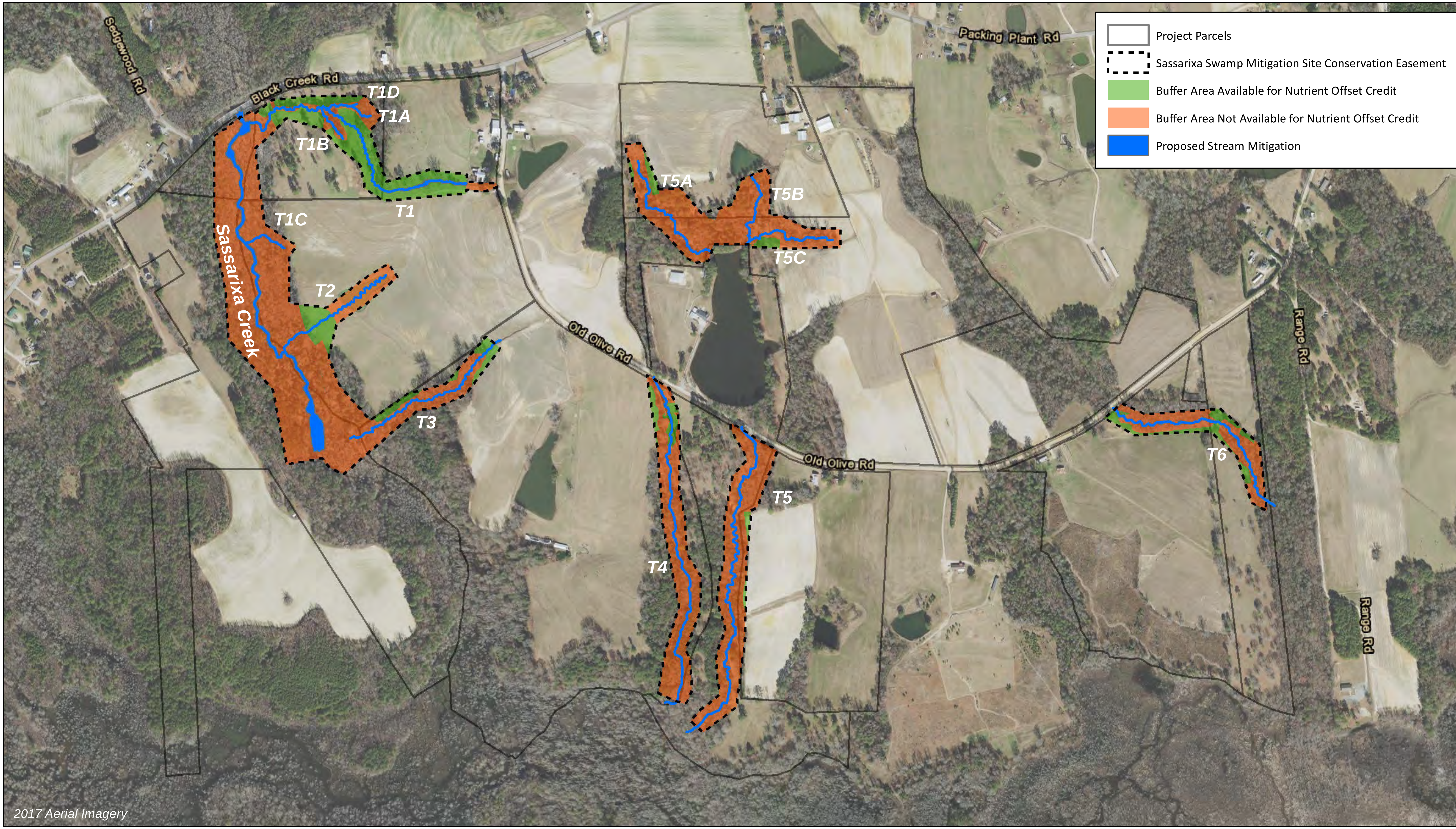
Figure 8. Proposed Monitoring Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

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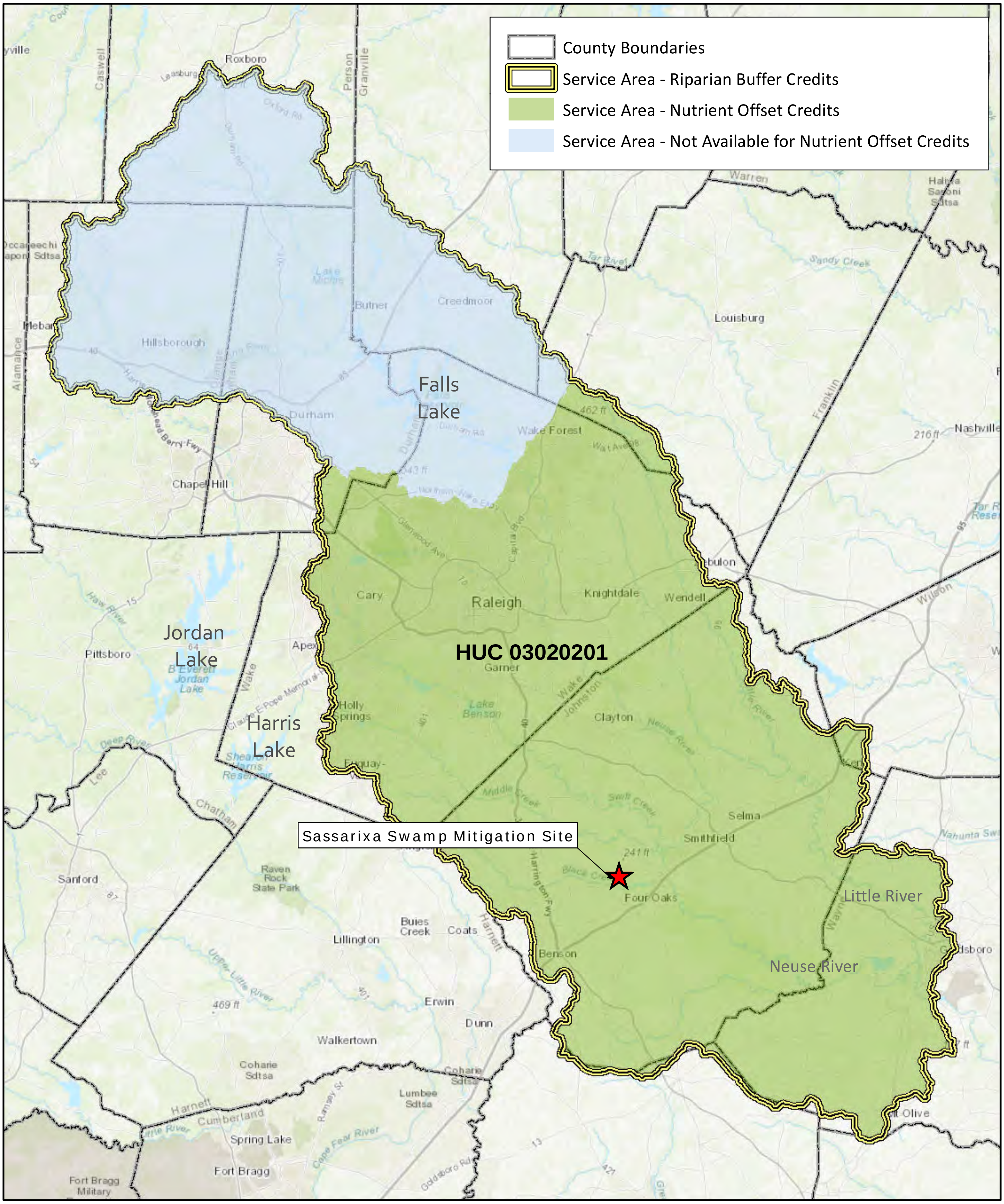
Figure 9. Nutrient Offset Zones Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

Figure 10. Service Area Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC

APPENDIX

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Interim Director

Water Resources
ENVIRONMENTAL QUALITY

May 21, 2018

John Hutton
Wildlands Engineering, Inc.
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: jhutton@wildlandseng.com)

DWR ID# 2018-0198
Johnston County

Re: Site Viability for Buffer Mitigation and Nutrient Offset & Buffer- Sassarixa Swamp Site
2-162 Olive Rd, Smithfield, NC
Neuse 03020201 (not in Falls WS)

Dear Mr. Hutton,

On February 9, 2018, Katie Merritt, with the Division of Water Resources (DWR), received a request from Wildlands Engineering, Inc. (WEI) for an onsite mitigation determination near the above-referenced site (Site). The Site is located in the Neuse River Basin within the 8-digit Hydrologic Unit Code 03020201. The Site is being proposed as part of a full-delivery stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007279). Members of the Interagency Review Team (IRT) and Division of Mitigation Services were also present onsite. At your request, on February 23, 2018, Ms. Merritt performed an onsite assessment of riparian land uses adjacent to streams onsite, which are shown on the attached map labeled "Figure 6A".

Ms. Merritt's evaluation of the features and their associated mitigation determination for the riparian areas are provided in the table below. The evaluation was made from Top of Bank (TOB) out to 200' from each existing or *proposed* feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to proposed Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Credit Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
T1A	Stream @ DWR flag	No	Forested pasture actively grazed by cattle	Yes[4]	Yes *(non-forested areas only)*	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T1	Stream	Yes	Forested & Non-forested pasture actively grazed by cattle	Yes[4]	Yes *(non-forested areas only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
Sassarixa Creek (R2-R3)	Stream	Yes	Forested pasture grazed by cattle	Yes[4]	No	**Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6) No cattle observed in riparian areas below R-3 (see map)

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to proposed Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Credit Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
T2 Pond	Pond (not in line)	No	Agriculture	No	No	N/A
T2 (inside woodline)	Stream	Yes	*(starts in the woodline)* Forested pasture grazed by cattle	Yes[4]	No	**Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T3 (R1)	Ditch	No	Left Bank – Hay crop fields Right Bank – Non-forested pasture grazed by cattle	No	Yes	Restoration Site per 15A NCAC 02B .0295 (n)
T3 (R2)	Ephemeral	No	Left Bank- hay crop fields and forest Right Bank – a narrow fringe of forested areas; fields are actively grazed by cattle.	*Yes[3,5]	Yes *(non-forested areas only)*	**Forested Areas** - Preservation Site per 15A NCAC 02B .0295 (o)(7) **Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(7) **Must meet additional requirements under .0295 (o)(7) to be viable for buffer mitigation*
T3 (R3)	Stream	Yes	Forested, no cattle present	Yes[3]	No	Preservation Site per 15A NCAC 02B .0295 (o)(5)
T4 (R1)	Stream	Yes	Partial canopy forested pasture actively grazed by cattle	Yes[4]	Yes	**Buffer Mitigation** – Enhancement Site per 15A NCAC 02B .0295 (o) (6) **Nutrient Offset** – Enhancement Site per 15A NCAC 02B .0295 (n) *(planting required)*
T4 (R2)	Stream	Yes	Partial canopy forested pasture actively grazed by cattle	Yes[4]	Yes	**Buffer Mitigation** – Enhancement Site per 15A NCAC 02B .0295 (o) (6) **Nutrient Offset** – Enhancement Site per 15A NCAC 02B .0295 (n) *(planting required)*
T4 (R3)	Wetland/ Inconsistent channelization	No	Forested	No	No	N/A
T5 (R1)	Stream	Yes	Full-canopy forested pasture actively grazed by cattle	Yes[4]	No	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5 (R2-R3)	Stream	Yes	Right Bank- Forested Left Bank- mostly forested with a crop field	Yes[3]	Yes *(field only)*	**Forested Areas** - Preservation Site per 15A NCAC 02B (o)(5) **Fields** - Restoration Site per 15A NCAC 02B .0295 (n)

Feature	Classification	[1]Subject to Buffer Rule	Riparian Land uses adjacent to proposed Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Credit Viable at 2,273 lbs/acre	Mitigation Type Determination w/in riparian areas
T5A	Stream	No	Full-canopy forested pasture actively grazed by cattle with adjacent ag fields	Yes[4]	No	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5A Wetland (see map)	Wetland *(impacts from cattle in T5 stream resulted in a wetland)*	No	Full-canopy forested pasture actively grazed by cattle	(see note)	No	Mitigation Note: Proposing stream restoration to reconnect T5A stream throughout. If stream restoration is approved by the IRT and a stream channel is constructed, then the new riparian areas will be viable as an Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5B	Stream	Yes	Full-canopy forested pasture actively grazed by cattle	Yes[4]	No	Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T5C	Headwater Stream/ Wetland complex	No	Full canopy forested pasture surrounded by agriculture fields	*Yes *(fields only)*	No	**Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(2) **Must be approved by the IRT as a Coastal Headwater Stream Mitigation Site to be viable for credit.*
T6	Stream	Yes	Combination of forested pasture and agriculture fields	Yes[4]	Yes *(field only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (n) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated April 5, 2018 and April 6, 2018 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS.

[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*

[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation only site to comply with this rule.

[4]The area described as an Enhancement Site was assessed and determined to comply with all of 15A NCAC 02B .0295(o)(6).

[5]The area of the mitigation site on ephemeral channel shall comprise no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 02B .0295 (o)(7).

Maps that are attached to this letter were provided by WEI and were initialed by Ms. Merritt on May 21, 2018. This letter should be provided in all stream, wetland, buffer and/or nutrient offset mitigation plans for this Site.

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on May 21, 2020 or upon the submittal of an As-Built Report to the DWR, whichever comes first. Please contact Katie Merritt at (919)-807-6371 if you have any questions regarding this correspondence.

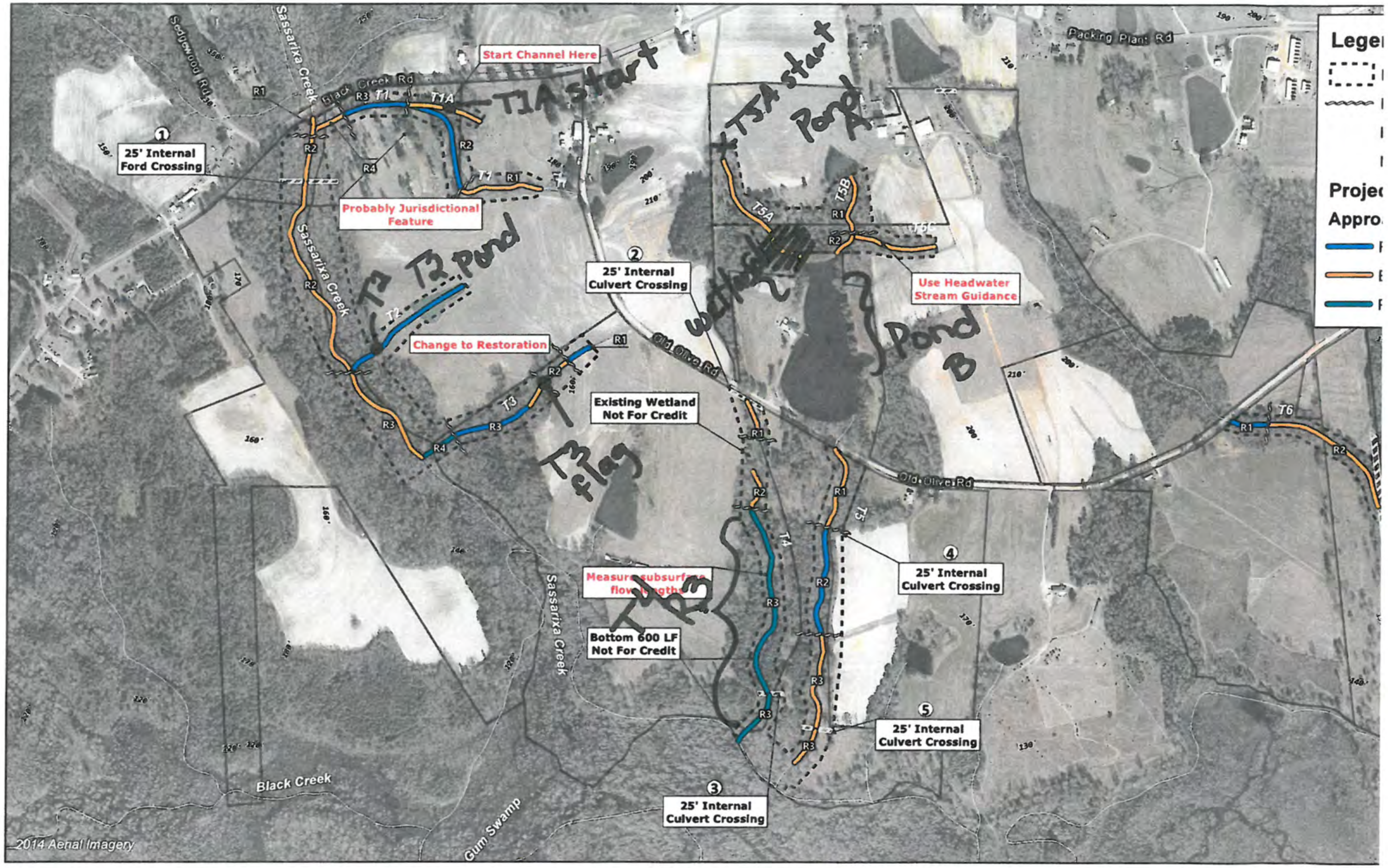
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Figure 6A

cc: File Copy (Katie Merritt)
DMS – Jeff Schaffer (via electronic mail)



WILDLANDS ENGINEERING

DWR#-2018-0198

kym 4/4/18

(stream determination)

kym

5/21/2018

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Figure 6A

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

April 3, 2019

Angela Allen
Wildlands Engineering, Inc.
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: aallen@wildlandseng.com)

DWR ID# 2018-0198
Johnston County

Re: Site Viability for Buffer Mitigation and Nutrient Offset & Buffer- Sassarixa Swamp (T1)
2-162 Olive Rd, Smithfield, NC
Neuse 03020201 (not in Falls WS)

Dear Ms. Allen,

On February 20, 2019, Katie Merritt, with the Division of Water Resources (DWR), received a request from you on behalf of Wildlands Engineering, Inc (WEI) to evaluate the potential for riparian buffer mitigation and nutrient offset on two additional features on the subject site. Features labeled T1B and T1C on the attached map labeled "Figure 3a Site Map" were evaluated by Sam Dailey with the US Army Corps of Engineers in March 2019 and these features were determined to be at least intermittent channels. The Site is also being proposed as part of a full-delivery stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007279).

Ms. Merritt's evaluation of the features and their associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) and landward 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240.

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
T1B	Stream	No	Combination of forested and non-forested pasture actively grazed by cattle	[4]Yes	Yes *(non-forested areas only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(3) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)
T1C	Stream	No	Forested pasture actively grazed by cattle; ag fields at the upstream portion	[4]Yes	Yes *(ag fields only)*	**Fields** - Restoration Site per 15A NCAC 02B .0295 (o)(3) **Forested Areas** - Enhancement Site per 15A NCAC 02B .0295 (o) (6)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated March 21, 2019 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS .
[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*
[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation Only site to comply with this rule.
[4]The area described as an Enhancement Site was assessed and determined to comply with all 15A NCAC 02B .0295(o)(6). Cattle exclusion fencing is required to be installed around the mitigation area to get buffer credit under this part of the rule.
[5]The area of the mitigation site on ephemeral channels shall comprise no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 02B .0295 (o)(7). Cattle exclusion fencing is required to be installed around the mitigation area to get buffer credit under this part of the rule.

Maps that are attached to this letter were prepared by WEI and initialed by Ms. Merritt on April 3, 2019. **This letter should be provided in all stream and wetland, buffer and/or nutrient offset mitigation plans for this Site.**

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

All vegetative plantings, performance criteria and other mitigation requirements for riparian restoration, enhancement and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and/or nutrient offset mitigation credits. For any areas depicted as not being viable for nutrient offset credit above, one could propose a different measure, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset in accordance with 15A NCAC 02B .0240.

This viability assessment will expire on April 3, 2021 or upon the submittal of an As-Built Report to the DWR, whichever comes first. This letter should be provided in all stream, wetland or buffer mitigation plans for this Site.

Please contact Katie Merritt at (919) 707-3637 if you have any questions regarding this correspondence.

Sincerely,

Chonticha McDaniel

for Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Figure 3a

cc: File Copy (Katie Merritt)

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

October 28, 2019

Angela Allen
Wildlands Engineering, Inc.
312 West Millbrook Rd, Suite 225
Raleigh, NC 27609
(via electronic mail: aallen@wildlandseng.com)

DWR ID# 2018-0198
Johnston County

Re: Site Viability for Buffer Mitigation and Nutrient Offset & Buffer- Sassarixa Swamp
Re-evaluation of T4-Reach 3
2-162 Olive Rd, Smithfield, NC
Neuse 03020201 (not in Falls WS)

Dear Ms. Allen,

On April 4, 2018 and May 21, 2018, the Division of Water Resources (DWR) issued a stream/buffer determination letter and Site Viability letter respectively, for the subject site. On October 15, 2019, DWR received a stream determination appeal request from Wildlands Engineering, Inc (Wildlands) requesting that a feature labeled T4-R3 on the subject site be re-evaluated based on a preliminary Jurisdictional Determination (JD) by the USACE showing the feature to be a perennial stream and not a linear wetland. In support of this JD, DWR issued a revised stream /buffer determination letter on October 28, 2019. T4-R3 and its riparian areas are also being proposed as part of a full-delivery stream and riparian buffer mitigation project for the Division of Mitigation Services (RFP #16-007279).

On October 15, 2019, DWR also received a request from Wildlands to re-evaluate the potential for riparian buffer mitigation and nutrient offset along T4-R3 based on the JD by USACE.

DWR's evaluation of T4-R3 and its associated mitigation determination for the riparian areas are provided in the table below. This evaluation was made from Top of Bank (TOB) and landward 200' from each feature for buffer mitigation pursuant to 15A NCAC 02B .0295 (effective November 1, 2015) and for nutrient offset credits pursuant to 15A NCAC 02B .0240. ***This evaluation replaces the evaluation made on T4-R3 issued on May 21, 2018.***

Feature	Classification onsite	[1]Subject to Buffer Rule	Riparian Land uses adjacent to Feature (0-200')	Buffer Credit Viable	[2]Nutrient Offset Viable at 2,273.02 lbs-N per acre	Mitigation Type Determination w/in riparian areas
T4 (R3)	Stream (see map)	Yes	Forested	[3]Yes	No	Preservation Site per 15A NCAC 02B .0295 (o)(5)

[1]Subjectivity calls for the features were determined by DWR in correspondence dated October 28, 2019 using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS .
[2] *NC Division of Water Resources - Methodology and Calculations for determining Nutrient Reductions associated with Riparian Buffer Establishment*
[3]The area of preservation credit within a buffer mitigation site shall comprise of no more than 25 percent (25%) of the total area of buffer mitigation per 15A NCAC 0295 (o)(5) and 15A NCAC 0295 (o)(4). Site cannot be a Preservation Only site to comply with this rule.

The map that is attached to this letter was prepared by Wildlands. **This letter should be provided in all stream and wetland, buffer and/or nutrient offset mitigation plans for this Site.**

This letter does not constitute an approval of this site to generate mitigation credits. Pursuant to 15A NCAC 02B .0295, a mitigation proposal and a mitigation plan shall be submitted to DWR for written approval **prior** to conducting any mitigation activities in riparian areas and/or surface waters for buffer mitigation credit. Pursuant to 15A NCAC 02B .0240, a proposal regarding a proposed nutrient load-reducing measure for nutrient offset credit shall be submitted to DWR for approval prior to any mitigation activities in riparian areas and/or surface waters.

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This viability assessment will expire on April 3, 2021 or upon the submittal of an As-Built Report to the DWR, whichever comes first. This letter should be provided in all stream, wetland or buffer mitigation plans for this Site.

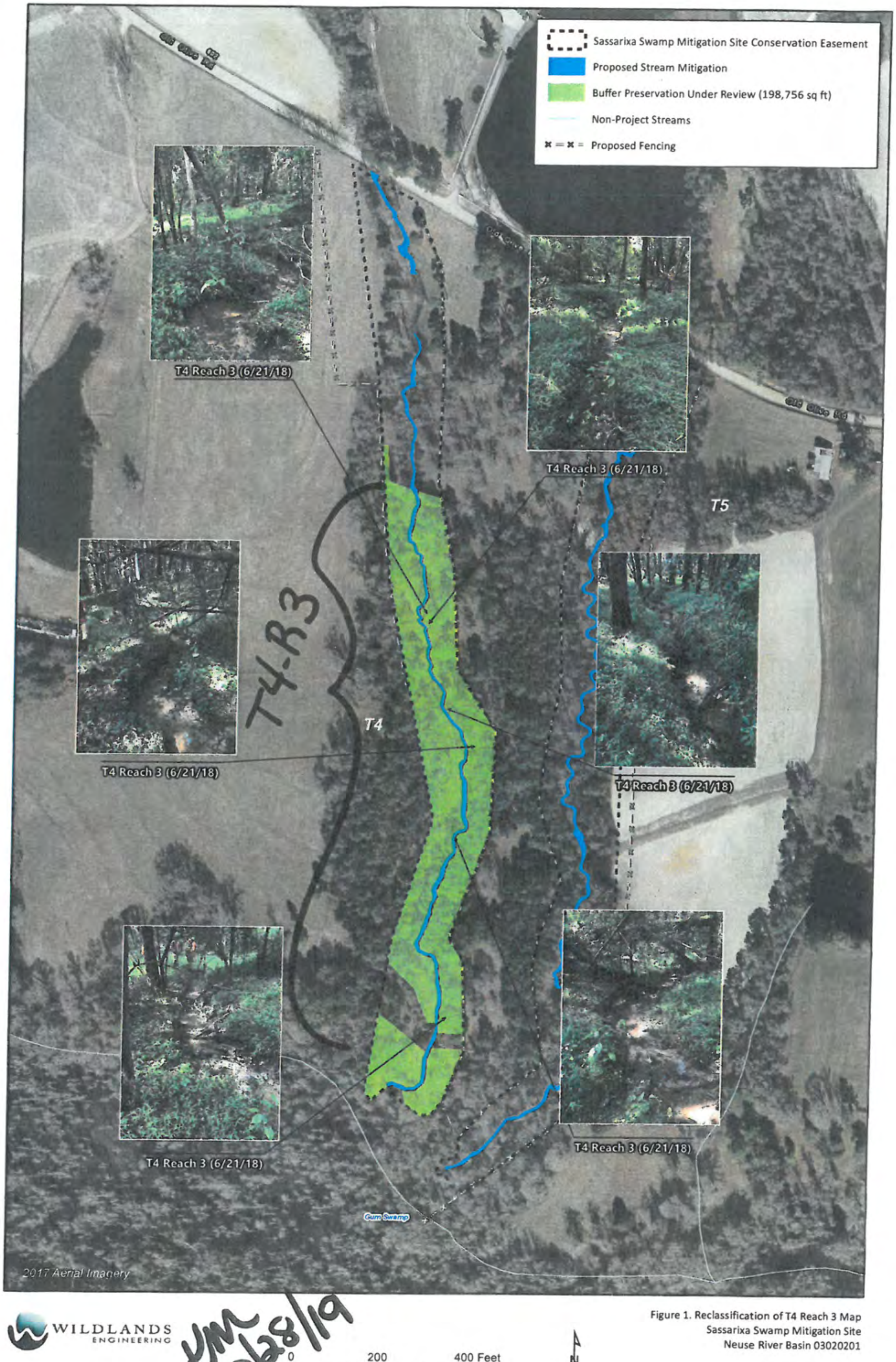
Please contact Katie Merritt at (919) 707-3637 if you have any questions regarding this correspondence.

Sincerely,

Mac Haupt, Acting Supervisor
401 and Buffer Permitting Branch

MH/*km*
Attachments: Figure 1. Reclassification of T4 Reach 3 map

cc: File Copy (Katie Merritt)

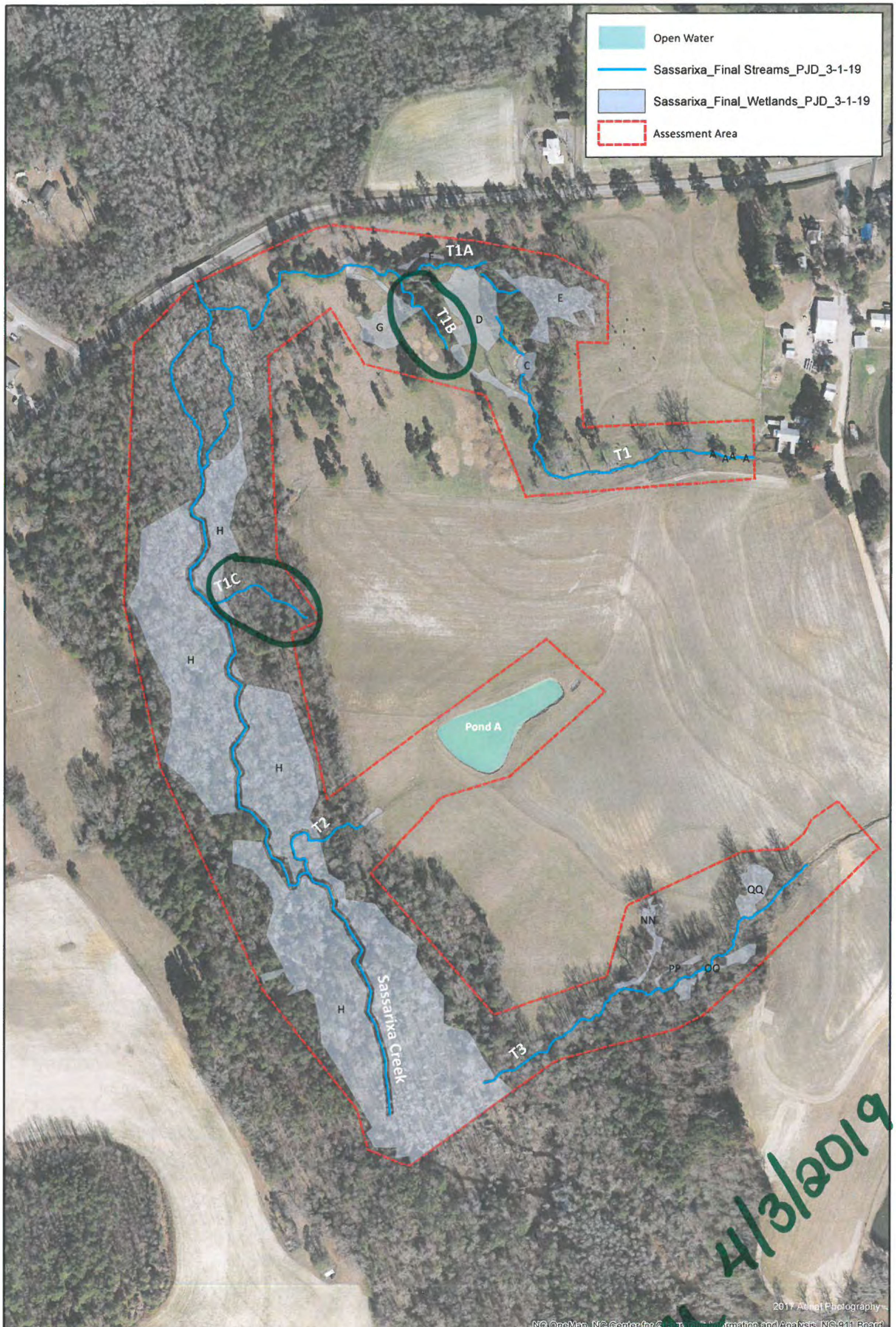


WILDLANDS ENGINEERING

KM 10/28/19

Figure 1. Reclassification of T4 Reach 3 Map
Sassarixa Swamp Mitigation Site
Neuse River Basin 03020201

Johnston County, NC



WILDLANDS ENGINEERING

0 112.5 225 Feet

4/3/2019

Figure 3a Site Map - Sheet 1
Sassarixa Swamp Mitigation Site
Neuse River Basin (03020201)

Johnston County, NC