MITIGATION PLAN

FINAL

January 2022

COOL SPRINGS MITIGATION SITE

Harnett County, NC
NCDEQ Contract No. 0302-02
DMS ID No. 100166

Cape Fear River Basin
HUC 03030004

USACE Action ID No. SAW-2020-01400
DWR No. 20201279
RFP No. 16-20190302

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
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January 5, 2022

U.S. Army Corps of Engineers
Regulatory Division
Raleigh Field Office
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Attention: Kim Browning

Subject: Mitigation Plan
Cool Springs Mitigation Project, Harnett County
Cape Fear River Basin HUC 03030004
USACE Action ID No. SAW-2020-01400/DWR No. 20201279

Dear Kim:

We have reviewed the IRT's comments on the draft mitigation plan for the Cool Springs Stream and Wetland Mitigation Site. We have made the necessary revisions to the draft documents and we are submitting revised versions of the documents along with this letter. Below are responses to each of the IRT's comments in your letter dated November 22, 2021. Your original comments are provided below followed by our responses in bold italics.

We would also like to point out that the wetland mitigation areas changed in Table 21. The minor changes in wetland area are related to finalizing the top of bank lines for the stream designs on the site. For example, the top of bank lines for the streams now show the pools wider than the riffles, which was not always the case with the draft top of bank lines shown in the previous submittal. These minor changes in final stream width effect the area of the wetland zones to a small degree. The top of bank lines and wetland mitigation areas are now final.

DWR Comments, Erin Davis:

1. Table of Contents – In the final mitigation plan please add an appendix for the design plans.

The design plans are now included in Appendix 11.

2. Page 6, Table 4 – Figures 2 and 6 show T2 as an intermittent reach. Please update the table/figures to be consistent.

Table 4 has been updated to state that T2 is intermittent.

3. Page 8, Section 3.8.1 – Please update the LSS site investigation date to match Appendix 4.

The date of the LSS soils investigation has been revised to March 11, 2020.

4. Page 8, Table 8 – Please update the Gage 4 total days to match the graph in Appendix 4.

In Table 8, the number of consecutive days for Gage 4 has been changed to 52 and the consecutive percent of the growing season has been changed to 20.8%.

5. Page 11, Table 11 – Second Row: Are there existing or proposed vernal pools onsite? Sixth Row: Are livestock proposed to be relocated as part of this project?

There are no plans for vernal pools on site. We have removed the mention of vernal pools from the second row of the table. We expect that the farm will be used to graze livestock in the future. However, we have left the text in the sixth row unchanged in the unlikely case that livestock are permanently removed and the fencing would then be unnecessary. If livestock are kept on site, the conservation easement will be fenced.

6. Page 12, Section 6.1; Page 16, Sections 6.6; Page 20, Section 7.0 – Please add enhancement I as a proposed approach.

Enhancement I has been added as an approach in each of the sections mentioned.

7. Page 13, Section 6.3 – DWR appreciates the site specific design discharge analysis discussion. Are the larger design channels still expected to achieve the bankfull event performance standard and support abutting wetland reestablishment and rehabilitation credit areas?

The smaller tributaries on site were designed to be slightly larger to help prevent them from becoming clogged. However, yes, they are still expected to meet the bankfull event performance standard.

8. Page 18, T4 – DWR appreciates the note that existing trees with be preserved and we fully support this effort in the larger project buffer. However, we have some concerns that trees along the channel may be stressed during construction and could possibly result in localized channel instability post-construction. Was direct and/or indirect construction impacts to critical root zones a consideration in determining which streamside trees to preserve?

We always attempt to preserve as many existing trees within the conservation easement as possible. Impacts to root zones were considered as the designs were developed. However, it is possible that some tress could be impacted to a greater degree than expected. During construction, trees that are likely impacted will be removed and used for construction materials.

9. Page 20, Section 6.9.1 – How will onsite soil compaction be addressed?

This sentence has been added to the end of this section: All haul roads or other areas within the conservation easement compacted by construction equipment during construction will be ripped before planting.

10. Page 20, Section 6.10 – Please elaborate briefly on the statement that “activities that might take place in the watershed will have little to no impact on the site streams”.

This paragraph has been reworded somewhat to provide more detail on the watershed extent and the most likely types of disturbances that might occur in the future. However, the likelihood of these small disturbances remains small.

11. Page 20, Section 7.0 – Please note that wetland restoration credit areas must also meet vegetation performance criteria. Also, please remove the “up to” phrase from the last sentence.

The requirement for vegetation performance criteria within wetland restoration areas was noted in Section 7.0. The phrase “up to” was removed from the last sentence.

12. Page 21, Section 7.0 – DWR does not support a hydroperiod below 8% for the identified Aquic Kanhapludult. Please see comment 15 regarding multiple hydroperiods.

An 8% hydroperiod will be used for wetland 4 and the rehabilitation portion of wetland F.

13. Page 22, Table 18 – Please add the minimum 30 consecutive flow days' performance standard for each intermittent restoration reach (T2, T4 & T5 based on Figures 6 & 9).

The performance standard of a minimum 30 consecutive flow days for intermittent restoration reaches was added to Table 18.

14. Page 28, Table 21 – DWR believes a 2.5:1 wetland enhancement credit ratio is more appropriate for Wetlands A, B, D, E, H, I & J due to the lack of proposed monitoring within credit areas.

The IRT concurred with a ratio of 2:1 for enhancement areas during the post contract site visit. The random vegetation plots will be moved each year to represent different portions of the Site and will include portions of the Wetland Enhancement areas. A fixed vegetation plot will be added to Wetland E to assess species survival and recruitment. Visual monitoring will also be conducted annually across the entire Site to monitor and assess conditions.

15. DWR believes a 2:1 wetland enhancement credit ratio is more appropriate for Wetlands C and G based on baseline groundwater data indicating at least a 24.6% hydroperiod (entire duration of monitoring period) unless a higher hydroperiod is proposed to demonstrate hydrologic uplift.

The 1.5:1 wetland rehabilitation ratio is based on severe vegetation impairment and livestock trampling. Only sparse herbaceous vegetation is currently present in wetlands proposed for rehabilitation. Uplift is expected to be substantial through vegetation planting and cattle exclusion. Wildlands prefers to hold wetland rehabilitation ratios at 1.5:1 as discussed and agreed upon during the post-contract IRT site visit on September 29, 2020.

16. None of the proposed Wetland Enhancement credit areas have monitoring stations. Without veg plots or groundwater gages, how will the proposed hydrologic and/or vegetative functional uplift be measured? Without monitoring data to demonstrate success, DWR believes a 2.5:1 ratio for wetland enhancement credit is more appropriate.

Wetland enhancement will involve the removal of livestock encouraging the growth and recruitment of native understory species. A fixed vegetation plot will be added to Wetland E. Random vegetation plots will also move locations across the site annually and will capture portions of the wetland enhancement areas during monitoring. Visual monitoring will also be conducted annually across the entire Site to monitor and assess conditions. Wildlands prefers to maintain a 2:1 wetland enhancement ratio with proposed monitoring practices.

17. DWR is ok with the three hydroperiod criterion only if additional gages are installed to properly cover each hydroperiod criteria within each wetland credit area, which means adding a gage in the Wetland 1 - 12% area, Wetland 4 - 10% area, Wetland F - 10% area and Wetland F - 8% area (see comment 12 on the Aquic Kanhapludult % change).

With these proposed gage additions there would be 11 groundwater gages to monitor approximately 1 acre of wetland re-establishment and rehabilitation. Currently there are 7 groundwater gages with at least one representing each hydroperiod. Although there is not a gage proposed in each individual wetland, each hydroperiod is represented. The 3 hydroperiods were selected in order to comply with the requirements denoted in Table 1 of the IRT guidance.

18. DWR requests an additional veg plot at least partially within Wetland 3 and another veg plot within the Wetland 4/5/G complex.

Vegetation plots currently proposed along T6 and T3 have been moved to capture data within Wetland G and part of Wetland 3.

19. DWR understands the benefit of collocating monitoring stations. However, since the flow gauges on T6 or T8 do not appear to be in the upper 1/3 of the reach, DWR may request additional flow data be collected during monitoring if concerns arise.

Monitoring locations shown in Figure 10 are approximated and may shift slightly in the field during installation. Flow gages will be installed in the upper 1/3 of the reach and final locations will be recorded with a GPS and included in the as-built report during MY0.

20. Figures – DWR appreciates that contour lines derived from LiDAR data were included on multiple figures. However, DWR requests a separate LiDAR map be added in the final mitigation plan. A colored LiDAR map is very helpful in showing basic site and surrounding area information, including general floodplain extents, confined valleys and ephemeral drainages in an image that DWR can easily and quickly review. DWR would like to see a LiDAR map included at the proposal stage, but at minimum we will continue to request a map in our draft mitigation plan comments on every project moving forward.

A separate LiDAR map has been added in the final mitigation plan (Figure 11).

21. Appendix 4 – The soil investigation figure shows one to two soil borings per proposed wetland credit area. Please explain how the extents of the different credit areas were determined. Were there additional soil sample locations?

Additional soil sample locations were quickly assessed but not recorded. Soil borings shown in the figure were representative of the areas in which they were observed. Hydric soil polygon boundaries were determined using the field observations of soils as well as observation of landscape characteristics that are known to correlate with hydric soil occurrences such as topography, relief, evidence of groundwater discharge or water accumulation, and hydrophytic vegetation.

22. Appendix 6 – Please include IRT meeting minutes as agency correspondence (this is another item DWR will always request if it's not initially included).

IRT meeting minutes have been added to Appendix 6.

23. Sheet 0.2 – Are rock outlets proposed for this project? If so, please include a detail and show approximate locations on the plan view sheets.

There is only one location on T5 where a rock outlet is shown on the plans. Others may be added during construction as needed. These can be important to protect the stability of the channels. A detail will be added.

24. Sheets 1.1 – 1.9 – Will the old channel be filled to match the surrounding grade? Are any channel/ditch plugs proposed?

Old channels will be filled to match the surrounding grade. Channel plugs are not proposed. Properly compacted native soil and brush toes are all that is required to ensure stable banks for the new channel.

25. Sheet 1.3.1 – The first 250 feet of T2 is proposed to be raised 3-5 feet. Are there any concerns about this altering the flow regime?

No, there is channel above the beginning of restoration and surface runoff comes to the channel from the pasture areas upstream.

26. Sheet 3.0 – It appears that the buffer planting zone table is missing (unless everywhere beyond the streambank zone is considered the wetland planting zone). DWR requests that an updated version of this sheet be provided for review prior to formally submitting the final mitigation plan.

The buffer planting zone species list has been added to Sheet 3.0. We provided the updated sheet prior to resubmitting the mitigation plan.

27. Sheet 3.1 – The planting overview does not show any planting zones or extents (full vs. partial/shaded). This sheet does not have sufficient information for a draft mitigation plan review. DWR requests that an updated version of this sheet be provided for review prior to formally submitting the final mitigation plan.

Planting zones have been added to the Planting Overview Sheets. The revised planting sheets were provided to DWR prior to resubmitting the mitigation plan.

28. Sheet 5.1 – Is it possible to shift the fence line to along existing forest edge between Sta. 104+00 – 107+00? The proposed conservation easement presented to the IRT at the post-contract included this wooded buffer within the project site.

The landowner will have to approve this. We will discuss it with him prior to installing the fence. If he is OK with moving the location of the fence, it will be installed outside of the wood line.

29. DWR appreciates efforts made to enhance the overall project, including capturing stream origins and ephemeral drainages, adding BMP water quality features, and minimizing crossings.

Noted, thank you.

USACE Comments, Kim Browning:

1. Section 3.3: Please add a statement regarding the use of proper setbacks from the conservation easement when chicken litter is spread on the adjacent pastures.

As we discussed via email exchange on December 20, 2021, chicken litter can not be applied withing 25 feet of perennial streams and the USACE wants to be sure that no chicken litter is applied within the riparian buffer zone or within the conservation easement. A statement describing this has been added to Section 3.3.

2. Table 18: The Aquic Kanhapludult soils are best represented by the Helena series in the 2016 IRT Guidance, which requires a wetland saturation range of 6-8%. The revised draft IRT Guidance lists this soils series with a saturation range of 8-10%; while this guidance is not currently available for use, an 8% hydroperiod is more appropriate for wetland 4 and the rehabilitation portion of wetland F. Please update Table 18.

An 8% hydroperiod will be used for wetland 4 and the rehabilitation portion of wetland F, Table 18 has been updated.

3. Figure 10: a. Please include photos of the BMPs at as-built and at least once during monitoring.

Photos of the BMPs will be included in the MY0 report and at least one report for monitoring years 1 to 7.

b. Veg plots should be added to capture a portion of wetland 3 and wetland G/4/5.

Vegetation plots currently proposed along T6 and T3 will be moved to capture data within Wetland G and part of Wetland 3.

c. Please add photo points to the crossing on T3 and to the crossing on UT to Cedar Creek.

Upstream and downstream photos will be taken of the crossings on T3 and UT to Cedar Creek.

d. It is unclear how you propose to monitor the three different hydroperiods in Wetland F without groundwater gauges in each of the three areas (rehabilitation 8%, rehabilitation 10%, and rehabilitation 12%). I concur with DWR's comment #19 that additional gauges need to be added to wetland F and wetland 1.

With these proposed gage additions there would be 11 groundwater gages to monitor approximately 1 acre of wetland re-establishment and rehabilitation. Currently there are 7 groundwater gages with at least one representing each hydroperiod. Although there is not a gage proposed in each individual wetland, each hydroperiod is represented. The 3 hydroperiods were selected in order to comply with the requirements denoted in Table 1 of the IRT guidance.

4. Section 3.7 & 3.8: I appreciate the detail provided that describes existing stream and wetland conditions. This is very helpful for the review and to demonstrate the potential functional uplift. I would welcome the inclusion of existing wetland photos.

Two wetland photos have been added.

5. Section 3.8.2, page 9: Baseline gauge data in existing wetlands proposed for rehabilitation is 24.6%, which exceeds the proposed performance standard of 10% for wetland G and 12% for wetland C. In general, an area with the presence of hydric soils and hydrology would be appropriate for wetland enhancement credit at 2:1; however, at the September 29, 2020 IRT site visit, it was agreed that rehabilitation would be applicable to those areas without current woody vegetative cover. Therefore, the Corps accepts the 1.5:1 ratio, as proposed. Please document functional uplift in wetlands C and G throughout monitoring.

Functional uplift will be monitored through sitewide visual assessments. A vegetation plot will be moved into Wetland G, and random vegetation plots will move annually in order to capture different portions of the site.

6. Figure 9: Please label the wetlands on the concept map.

Wetlands have been labeled on Figure 9. Concept Map.

7. Section 4.2 and Appendix A: The Corps received correspondence from USFWS on October 20, 2020, stating that the action is not likely to adversely affect federally listed species or critical habitat. Please contact me if you do not have this letter and be sure to include it in the final mitigation plan.

This letter has been added to Appendix 6.

8. Appendix 7: I appreciate the detail in the invasive species management plan.

Noted, thank you.

9. Section 6.6: Please include the areas along UT to Cedar Creek that are being supplementally planted in random transects at least twice during monitoring and show which areas were planted on the final as-built.

We will add the random transects which will be monitored twice during the 7-year monitoring period. The areas that are planted will be shown on the as-built documents.

10. Design Sheet 2.6: BMP 5 appears to be placed in an existing wetland. Treatment areas should not be placed in jurisdictional waters. It appears that logs will be placed in wetland D. Please confirm that the BMP is not being placed in a wetland.

The stationing on the plan set has been updated to reflect that the BMP ends at the start of the wetland. Log sills will still be placed in the wetlands to stabilize an existing drainage feature and prevent further erosion and downcutting.

11. Design Sheets 3.0 and 3.1: Please provide a more detailed planting zone overview. It's difficult to discern which areas will be planted in the wetland zone, especially since several of the permanent riparian herbaceous species are FACU. Providing a figure with the planting zones would be helpful for the review.

The additional planting information including the planting zones is now included on the planting plan sheets. Note that the omission of the buffer planting zone species list has also been corrected.

12. Section 7.0: Please note that seven years of monitoring will be required. Language should be removed that references terminating monitoring after five years.

All language referencing termination of monitoring after five years has been removed.

13. Sections 7.0 and 3.8.2: If you intend on using the regional supplement to document vegetative indicators and soil temperature at the beginning of the growing season, you must also take these measurements at the end of the growing season to determine the end-date. If you intend on using the WETS table for establishing November 19 as the end of the growing season, you must also use what is listed in the WETS table to establish the beginning of the growing season. Only one method for determining the growing season dates should be used.

As we discussed on the phone on January 5, 2022, we would like to use vegetative indicators and soil temperature to establish the growing season rather than the WETS tables. We understand that you want the data used to set the growing season to be established before MY1, preferably before the mitigation plan is submitted. In this case, we do not have data for this site to support setting the growing season as different than the WETS tables at this stage. However, we will follow your recommendation to collect that data this year and submit it with the MY0 report along with the growing season dates we propose based on the data collected. Those dates stated in the MY0 report will be used as the growing season through closeout.

14. Table 18: Given the recent Technical Workgroup Discussion regarding pebble counts, do you want to include the substrate performance standard?

Sediment data and particle distribution was included in the mitigation plan prior to the recent Technical Workgroup discussion. Based on the Technical Workgroup agreement, we have taken the pebble counts out of the monitoring program.

15. Table 19: The monitoring criteria should be tied to the performance standards in Table 18, and as written, it's unclear which performance standard addresses fencing the conservation easement to exclude livestock. A narrative of performance standards with an accompanying monitoring table, as presented in past mitigation plans, is less confusing.

The performance standard for the first row in Table 19 has been reworded to indicate that there is no performance standard for fencing but that fence will be installed around the easement if cattle remain on the site.

16. Table 19: The Goal “Restore Wetland Function and hydrology” should reference Table 18, not 19.

Project monitoring criteria has been corrected to reference Table 18, not 19.

17. Since none of the proposed Wetland Enhancement credit areas are proposed for monitoring, how do you propose to demonstrate functional uplift? Fencing will certainly provide a benefit to the quality of the wetlands, but since vegetative and hydrologic monitoring is not proposed, a 2.5:1 ratio for wetland enhancement credit is more appropriate. I would support a 2:1 ratio only if vegetative monitoring was proposed.

The random vegetation plots will move locations across the site annually and will capture portions of the wetland enhancement areas during monitoring. A fixed vegetation plot will be added in Wetland E to assess and represent the survival and recruitment of species in enhancement areas. Visual assessments will be conducted sitewide and will monitor conditions as well as any potential issues. We have left the ratio at 2:1 for wetland enhancement since these monitoring activities will be conducted.

Please contact me at 919-851-9986 x103 if you have any questions.

Thank you,

Jeff Keaton, PE
Project Manager

DRAFT MITIGATION PLAN

COOL SPRINGS MITIGATION SITE

Harnett County, NC
NCDEQ Contract No. 0302-02
DMS ID No. 100166
Cape Fear River Basin
HUC 03030004

USACE Action ID No. SAW-2020-01400
DWR No. 20201279

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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:

Jeff Keaton, PE, *Project Manager*
John Hutton, *Principal in Charge*
Nicole Millns, PE, *Lead Designer*
Angela Allen, PE, *Lead Quality Assurance*
Carlynn Walker, *Lead Scientist*

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FIGURES

APPENDICES

1.0 INTRODUCTION

The Cool Springs Mitigation Site (Site) is in western Harnett County approximately 9.5 miles northwest of Lillington and approximately 4.7 miles east of Broadway (Figure 1). The project includes restoration and enhancement of streams and re-establishment, rehabilitation, and enhancement of riparian wetlands. The project is located within the Hydrologic Unit Code (HUC) 03030004010030 and is being submitted for mitigation credit in the Cape Fear River Basin Catalog Unit 03030004. The Site is within a catchment identified as a Targeted Resource Area (TRA) for water quality, habitat, and hydrology by the NC Department of Environmental Quality Division of Mitigation Services (NCDEQ DMS) (Catchment ID: 8845435) as shown in Figure 1.

The Site contains nine unnamed tributaries to Cedar Creek that, for the purpose of this project, are referred to as UT to Cedar Creek and T1 through T8 (Figure 2). The Site is located within DWR Subbasin 03-06-07. The largest of the streams on the Site is UT to Cedar Creek which flows northward through the property to join Cedar Creek at Cool Springs Road. From this point, Cedar Creek flows northeastward for approximately 2.25 miles to its confluence with the Cape Fear River.

Table 1: Project Background Information

Project Information	
Project Name	Cool Springs Mitigation Site
County	Harnett
Project Area (acres)	21.1
Project Coordinates (latitude and longitude)	35°26'50.17"N 78°58'5.78"W
Planted Acreage (acres of woody stems planted)	12

2.0 WATERSHED APPROACH AND SITE SELECTION

The Site drains to Cedar Creek which drains to the Cape Fear River near Raven Rock State Park. The Cape Fear River is classified as water supply IV (WS-IV). WS-IV waters used as sources of water supply for drinking, culinary, or food processing purposes where a WS-I, II or III classification is not feasible. These waters are also protected for Class C uses including secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival and maintenance of biological integrity, and agriculture.

The Site was selected based on its potential to support the goals and objectives of the current conservation and watershed planning documents outlined below:

- The 2009 Cape Fear River Restoration Priorities (RBRP) lists the following specific goals for the project HUC: low impact development, stormwater management, restoration, and buffer protection and preservation.
- The 2015 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP) notes that excessive sedimentation from agriculture and other sources is a primary causes of aquatic habitat degradation in the Cape Fear River Basin.

Restoration of the Site streams will directly and indirectly address stressors identified in the RBRP and the WAP by excluding livestock, creating stable streams, improving wetlands, and restoring a forest in a buffer currently used for grazing livestock. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to the Cape Fear River, as well as reconnect instream and terrestrial habitats on the Site.

3.0 BASELINE AND EXISTING CONDITIONS

3.1 Watershed Conditions

The Site watershed (Figure 3) is in the central portion of the Cape Fear River Basin 03030004 (Cape Fear 04). It is situated in the rural countryside in Harnett County. Table 2 summarizes the overall project watershed information.

The Site topography, as indicated on the Mamers, NC USGS 7.5-minute topographic quadrangle, shows a low, broad ridge running through the Site, flanked on the west side by an entrenched stream valley (Figure 4). The smaller tributaries on the Site flow through deep, narrow valleys. Drainage areas for the project reaches were delineated using 2-foot contour intervals derived from the 2015 QL2 LIDAR data (Figure 3). Land uses draining to the project reaches are a mix of forested and agricultural/pasture with some residential development and open water. There is a pine plantation in the southwestern corner of the watershed and eight chicken houses in the southern portion of the watershed. The land use was calculated using the National Land Cover Database (NLCD) for 2011. The impervious area within the project catchment at the downstream end was calculated to be approximately 0.5% of the project catchment. The watershed areas and current land uses are summarized in Table 2, below.

Table 2: Project Watershed Summary Information

Project Information	
Physiographic Province	Piedmont and Coastal Plain
Ecoregion	Northern Outer Piedmont
River Basin	Cape Fear
USGS HUC (8 digit, 14 digit)	03030004, 03030004010030
NCDWR Sub-basin	03-06-07
Project Drainage Area (acres)	255
Project Drainage Area Percentage of Impervious Area	<1%
2011 NLCD Land Use Classification	
Agricultural	43%
Forest	25%
Herbaceous	15%
Shrubland	8%
Barren	5%
Developed	4%

According to the Geologic Map of North Carolina (1985), the site lies within both the Piedmont and Coastal Plain however the Ecoregions of North Carolina (2002) map has the entire site within the Northern Inner or Outer Piedmont.

3.2 Land Use/Land Cover

The Site is currently an active cattle and chicken farm with wooded buffers along some of the project streams. Review of aerial photos indicates the landcover in the project watersheds was very consistent between 1950 and 1998. Most of the area was wooded during this period except for the southeastern portion of the UT to Cedar Creek watershed, which was cleared prior to 1950 and appears to have been used for grazing livestock. A small pond was constructed at the headwaters of UT to Cedar Creek at some point in the 1960's. Most of the landcover changes that have happened on the Site occurred between 1998 and 2006, including clearing of the pastures and construction of the chicken houses.

The existing farming activities within the floodplains and wetlands adjacent to Site streams are the most likely causes of channel instability and degraded habitat and water quality conditions at the Site. Trampling of banks from cattle, cattle waste in the streams, and runoff from heavily grazed pastures and feeding areas have contributed to the degradation of instream habitat.

3.3 Existing Site Conditions

All of the site is currently maintained for livestock pasture and chicken house operation with wooded buffer zones along some of the project streams. The Site is a large livestock operation with approximately 200 head of free-range beef cattle on site throughout the year. Cattle have free access to all of the streams on the project site. There is a feeding area adjacent to the chicken houses immediately upstream of T2 and four ephemeral gullies that discharge to UT to Cedar Creek. There are eight chicken houses on the property and the adjacent property to the south (owned by the same landowner). Each chicken house holds approximately 20,700 birds which are rotated out five times per year. The chicken litter is spread on the pastures as fertilizer each spring. Nitrogen/potash granular fertilizer is also applied regularly, and liquid nitrogen may be applied in middle of summer if needed. Herbicide is applied for weed control one time per year around May. Note: These fertilizers will not be applied to areas within the conservation easement once the easement is recorded.

3.4 Geology and Soils

The Site is located in two physiographic provinces: the Piedmont and the Coastal Plain The Piedmont Province is characterized by rolling, well rounded hills and long low ridges, with elevations ranging from 300 to 1500 feet above sea level. The Coastal Plain Province is characterized by flat land to gently rolling hills and valleys with elevations ranging from sea level to 600 feet. The site is underlain by two geologic units: the Raleigh Belt and the Coastal Plain (Figure 2). The Raleigh Belt primarily consists of granite, gneiss, and schist, while the Coastal Plain is comprised of marine sedimentary rocks.

The project is mapped by the NRCS Web Soil Survey for Harnett County. However, Chewacla, Wehadkee, and Aquic Kanhapludult soils are not found on the web soil survey maps due to the larger scale and soil mapping conventions used to produce the maps. These soils were identified on the site by a licensed soil scientist (LSS) focused on a much smaller scale. Project area soils are described below in Table 3. Figure 5 provides the NRCS soil map of the Site. A map of the Chewacla, Wehadkee, and Aquic Kanhapludult soils is included with the LSS report in Appendix 4.

Table 3: Project Soil Types

Soil Name	Description
CeB – Cecil Fine Sandy Loam, 2-8% Slopes	This soil series consists of very deep, well drained, moderately permeable soils. These soils are typically found on ridges and side slopes of the Piedmont uplands.
EnD – Enon Fine Sandy Loam, 8-15% Slopes	This soil series consists of very deep, well drained, slowly permeable soils. These soils are typically found on ridgetops and side slopes in the piedmont.
PaE – Pacolet Fine Sandy Loam, 15-25% Slopes	This soils series consists of very deep, well drained, moderately permeable soils. These soils are typically found on gently sloping to very steep piedmont uplands.
Chewacla Series	This soil series consists of very deep, somewhat poorly drained, moderately permeable soils. These soils are typically found on floodplains within Piedmont and Coastal Plain river valleys.
Wehadkee Series	This soil series consists of very deep, poorly drained and very poorly drained soils located on floodplains within the Piedmont and Mountains.
Aquic Kanhapludult	This taxonomic subgroup is derived from weathered piedmont residuum and is poorly drained.

Source: *Soil Survey of Harnett County, North Carolina, USDA-NRCS,* https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

3.5 Existing Vegetation

Project streams flow through a mixture of pasture, early successional forest, and mature forest. The growth of native vegetation is highly restricted on the Site because much of the Site is maintained as pasture. Pasture areas are dominated by a mix of pasture grasses, the dominant species being Bermuda grass (C*ynodon dactylon*). The jurisdictional wetland areas include species such as knotweed (*Polygonum persicaria*), blunt spikerush (*Eleocharis obtuse*), and common rush (*Juncus effusus*).

Successional and mature forest sections within the easement contain a mixture of species within the understory and canopy layers. Within the understory layer prominent native species include American holly (*IIex opaca*), black willow (*Salix nigra*), winged elm (*Ulmus alata*), American beech (*Fagus grandifolia*), and red maple (*Acer rubrum*). Prominent native canopy species include American Sycamore (*Platanus occidentalis*), White Oak (*Quercus alba*), Northern Red oak (*Quercus rubra*), Water Oak (*Quercus nigra*), Tulip Poplar (*Liriodendron tulipifera*), and Sweet Gum (*Liquidambar styraciflua*).

The most prominent invasive species identified within the conservation easement were Chinese privet (*Ligustrum sinense*) and Japanese honeysuckle (*Lonicera japonica*). Small populations were found scattered along the project streams.

3.6 Site Access, Utilities, and Site Constraints

One 60-foot internal crossing is proposed on UT to Cedar Creek, one 60-foot internal crossing is proposed to cross T4 Reach 1 and T5, and one internal crossing is proposed for the upstream end of T3 (Figure 9). All of these are existing crossings and will provide access to all pastures on the Site. The crossings will be gated culvert crossings and will be designed to integrate with the project alignments and profile designs. One existing ford on UT to Cedar Creek will be removed. No known utilities are present within the proposed conservation easement. The areas in the internal crossings are not proposed for credit. Maintenance of the crossings will be the responsibility of the landowner once the project is closed by the regulatory agencies (IRT) and transferred to NCDEQ stewardship. The Site will be accessible for construction, monitoring, and long-term stewardship from Holly Springs Church Road.

3.7 Project Resources – Streams

There are nine jurisdictional stream channels on site including UT to Cedar Creek and tributaries T1 – T8 (Figure 2). The streams are discussed in the sections below. Table 4 through Table 6 provide detailed summaries of each reach. Existing streams and cross section locations are illustrated in Figure 6. NCSAM field assessment forms with the rating calculator outputs and NCDWR stream identification forms are in Appendix 3. Surveyed cross sections and geomorphic summaries are in Appendix 4.

<u>Ut to Cedar Creek</u>


UT to Cedar Creek

UT to Cedar Creek flows over a mix of bedrock, cobble, gravel, and fines. The stream flows out of an adjacent wooded parcel south of the Site and flows northward across the Site to its confluence with Cedar Creek at Cool Springs Road. Cattle have access to the entire length of this stream on the project site and use it continuously for water and shade. However, due to the bedrock and wooded buffer, Reach 1 is one of the more stable streams on the Site. It is only slightly incised and bank erosion mostly occurs at areas of frequent cattle access. The stream is confined in a narrow valley with steep side slopes and has a steep longitudinal slope for much of its length on the Site. The stream pattern is generally straight. There are four badly eroding ephemeral gullies that flow into Reach 1 from the east side of the Site. Reach 2 is a short reach that is incised (bank height ratio is approximately 2.7) and unstable. This reach has no vegetated buffer along most of the left bank and cattle have trampled the banks of this reach. There is an existing culvert crossing on Reach 1 and a ford crossing at the break between Reaches 1 and 2.

<u>T1</u>

T1 is a short stream that originates south of the property and flows for several hundred feet to its confluence with UT to Cedar Creek. T1 flows through a wooded area but cattle have access to the stream and have caused some erosion. There is heavy erosion at the upstream end of the reach. It is in a

confined valley and has bed material comprised of bedrock, cobble, gravel, and fines. The stream is steep (slope is approximately 3.2%) and the pattern is straight.

T2

T2 originates from a spring in an open pasture downslope from the chicken houses and a feeding area for cattle. It flows northwestward for over 400 feet and joins UT to Cedar Creek Reach 1 near the midpoint of that reach. T2 is incised (bank height ratio is approximately 4.0), severely eroded, and cattle have access to the creek for its entire length. There are a few trees along the reach, but the buffer is mostly vegetated with pasture grass only. The reach has a steep slope (7.7%), and the bed material is comprised of cobble, gravel, and fines. The pattern is generally straight with two long meanders.


T2

T3

T3 is comprised of three reaches. Cattle have access to all of these reaches. Reach 1 originates off the property to the west. It is a small, intermittent stream that flows through an open cattle pasture with no wooded buffer. This reach is not incised, the banks are relatively stable except for areas cattle access, and it is in an unconfined valley. The bed material is gravel and cobble. The pattern of this reach is very straight. T3 Reach 2 begins where the stream becomes more incised (bank height ratio is approximately 2.6). This reach also has more severe erosion than Reach 1. Similar to Reach 1, the valley of this reach is well-defined but the stream is not deeply entrenched. The bed material is gravel and cobble, the pattern is very straight, and the slope is steep (4.8%). Reach 3 flows through a narrow, wooded buffer. A portion of the buffer on the right bank is open pasture. The slope is steep on this reach (6.0%) and the valley is less confined than the upstream reaches. This reach is less incised and has less erosion than Reach 2. The pattern is somewhat sinuous and the bed material is gravel and cobble. Reach 3 flows into UT to Cedar Creek downstream of the T2 confluence.


T3 Reach 2

T4

T4 originates off the property to the west and flows into UT to Cedar Creek parallel and to the north of T3. Cattle have access to the entire length of the stream. T4 has been broken into two reaches. Reach 1 is not incised and the bank erosion is minimal. It has a very narrow wooded buffer and it is in an unconfined valley. The channel is straight and fairly steep and it has cobble and gravel substrate. There is an existing crossing near the upstream end of this reach. Reach 2 is more incised than Reach 1 with a bank height ratio of approximately 3.5 and has some bank erosion. It flows through a narrow, wooded buffer in a fairly wide valley. The bed material is gravel and cobble, the stream is generally straight, and the slope is 2.8%.

T5

T5 is a short stream that originates near the western property line and flows into Reach 1 of T4. The stream is not incised and has minimal erosion, but cattle have access to this reach. It is straight and has a narrow, wooded buffer and a gravel and cobble bed. The T4 ford also crosses this reach.


T5

T6

T6 is another short stream that flows into T4. It originates in an open pasture and the buffer consists only of pasture grasses. It is incised (bank height ratio is approximately 3.2) and eroded. It is very steep (6.6%) and has a cobble and gravel bed.

T7

T7 flows onto the Site from an adjacent property near the downstream end of UT to Cedar Creek. It is a fairly straight reach that flows through a wooded area. Cattle have access to this reach and it is deeply incised (bank height ratio is approximately 2.6). It has a gravel and cobble bed and a moderate slope (2.5%).

T8

T8 originates in an open pasture on the Site and flows into UT to Cedar Creek on an adjacent parcel. It is fairly straight with only one long meander bend, steep, and has a cobble and gravel bed with fines mixed in. It is deeply incised downstream of a head cut (bank height ratio is approximately 3.0), severely eroded, has a steep slope (7.2%). The buffer consists of pasture grasses.

Table 4: Project Resources Part 1 – Streams

Parameter		UT to Cedar Creek Reach 1	UT to Cedar Creek Reach 2	T1	T2
Reach Length (lf)		2,351	446	449	473
Valley Confinement (confined, moderately confined, unconfined)		Moderately Confined	Unconfined	Confined	Confined
Drainage Area (acres)		176	255	44	6
Perennial, Intermittent, Ephemeral		Perennial	Perennial	Perennial	Intermittent
NCDWR Water Quality Class.		WS-IV	WS-IV	WS-IV	WS-IV
Stream Classification[1]	Existing	N/A	B4c	N/A	A4
	Proposed	N/A	C4/B4c	N/A	A4/B4a
Evolutionary Trend (Simon)		III	IV	III/IV	IV
FEMA Zone Classification		None			
NCSAM Rating		Low	Low	Medium	Low

Table 5: Project Resources Part 2 – Streams

Parameter		T3 Reach 1	T3 Reach 2	T3 Reach 3	T4 Reach 1
Reach Length (lf)		423	371	302	167
Valley Confinement (confined, moderately confined, unconfined)		Moderately confined	Confined	Moderately confined	Unconfined
Drainage Area (acres)		14	19	20	12
Perennial, Intermittent, Ephemeral		Intermittent	Perennial	Perennial	Intermittent
NCDWR Water Quality Class.		WS-IV	WS-IV	WS-IV	WS-IV
Stream Classification[1]	Existing	N/A	A4	N/A	N/A
	Proposed	N/A	B4/B4a	N/A	N/A
Evolutionary Trend (Simon)		I	IV	III	I
FEMA Zone Classification		None			
NCSAM Rating		Low	Low	Low	Low

Table 6: Project Resources Part 3 – Streams

Parameter		T4 Reach 2	T5	T6	T7	T8
Reach Length (lf)		924	142	499	124	722
Valley Confinement (confined, moderately confined, unconfined)		Moderately confined	Moderately Confined	Unconfined	Moderately Confined	Moderately Confined
Drainage Area (acres)		33	5	9	76	10
Perennial, Intermittent, Ephemeral		Perennial	Intermittent	Perennial	Perennial	Perennial
NCDWR Water Quality Class.		WS-IV	WS-IV	WS-IV	WS-IV	WS-IV
Stream Classification[1]	Existing	F4b	N/A	A4	B4	A4/B4a

Parameter		T4 Reach 2	T5	T6	T7	T8
	Proposed	B4/B4a	N/A	A4/B4a	B4/C4b	A4/B4a
Evolutionary Trend (Simon)		III	I	IV	III	IV
FEMA Zone Classification		None				
NCSAM Rating		Low	Low	Low	Low	Low

1. The Rosgen classification system (Rosgen, 1994) is for natural streams and Simon Channel Evolution Model (Simon, 1989) is for natural streams that have been channelized. These channels have been heavily manipulated for agricultural purposes and may not fit the classification category or channel evolution as described by these models. Results of the classification and model are provided for illustrative purposes only. Reaches not slated for restoration or enhancement I were not classified (NC).

3.8 Project Resources - Wetlands


Wetland D

Wildlands delineated jurisdictional waters of the U.S. within and adjacent to the Site in November 2020. Jurisdictional areas were delineated using the USACE Routine On-Site Determination Method. This method is defined by the 1987 Corps of Engineers (Corps) Wetlands Delineation Manual and subsequent Eastern Mountain and Piedmont Regional Supplement. The results of the delineation indicate that there are 10 jurisdictional wetlands located within the assessment area (Figure 6). The wetlands (Wetlands A – J) total 1.149 acres (ac) and range in size from 0.024 to 0.282 ac. The existing wetlands were all classified as Headwater forests. Existing wetlands exhibit indicators of wetland hydrology, hydrophytic vegetation, and hydric soils. Wetland hydrology indicators observed at the Site include surface water, saturation within the upper 12 inches of the soil profile, high water table, iron deposits, oxidized rhizospheres, and geomorphic position. Soils within the wetlands exhibited the hydric soil indicator F3 (depleted matrix). Dominant hydrophytic vegetation species within the wetlands include black willow (*Salix nigra),* Knotweed (*Polygonum persicaria*), Common Rush (*Juncus effusus*), and Blunt Spikerush (*Eleocharis obtusa*). The Site is maintained as cattle pasture and much of the native vegetation structure has been replaced with pasture grasses. Existing wetland data is summarized in Table 7. The preliminary jurisdictional determination (PJD) is included in Appendix 5.


Wetland E

Existing wetlands were classified and evaluated using the North Carolina Wetland Assessment Method (NCWAM). All wetlands scored low for the hydrology, water quality, and habitat function ratings as well as the overall wetland rating. Stream incision has negatively impacted wetland hydrology and has limited hydrologic connectivity between the streams and wetlands. The incised stream channels have also limited the sub-surface storage and retention of these wetlands by draining and lowering the water table. Cattle grazing and pasture management have also impacted water quality and habitat. Grazing has altered the ground surface condition, limiting growth of native vegetative communities and altering vegetative structure and condition. Pasture grasses have been seeded and managed on Site and have outcompeted many native herbaceous species. NCWAM field assessment forms and the rating calculator outputs are included in Appendix 3.

Table 7: Project Resources – Wetlands

Wetland	Area (ac)	Wetland Type	Mapped Soil Series	Drainage Class	Soil Hydric Status	Source of Hydrology	NCWAM Rating
A	0.069	Headwater Forest	Cecil Fine Sandy Loam and Pacolet Fine Sandy Loam	Well-drained	No	Groundwater	Low
B	0.064	Headwater Forest	Enon Fine Sandy Loam	Well-drained	No	Groundwater	Low
C	0.160	Headwater Forest	Enon Fine Sand Loam and Pacolet Fine Sandy Loam	Well-drained	No	Groundwater	Low
D	0.088	Headwater Forest	Pacolet Fine Sandy Loam	Well-drained	No	Groundwater	Low
E	0.162	Headwater Forest		Well-drained	No	Groundwater	Low
F	0.282	Headwater Forest		Well-drained	No	Groundwater	Low
G	0.132	Headwater Forest		Well-drained	No	Groundwater	Low
H	0.139	Headwater Forest		Well-drained	No	Groundwater	Low
I	0.024	Headwater Forest		Well-drained	No	Groundwater	Low
J	0.028	Headwater Forest		Well-drained	No	Groundwater	Low

3.8.1 Hydric Soil Investigation

A licensed soil scientist (LSS) visited the Site on March 11, 2020 to evaluate potential wetland mitigation areas. The soils investigation concluded there are three separate hydric soil types within the Site. The Wehadkee and Chewacla series are commonly observed in the North Carolina Piedmont. The third soil type exhibited hydric soil indicator F3, had an aquic moisture regime, and appeared to be derived from weathered Piedmont residuum but was not an appropriate match for any series with aquic conditions currently mapped in this part of North Carolina. Taxonomically it is best described as an Aquic Kanhapludult. The assumption that this soil belongs to the Kanhapludult great group instead of the Hapludult great group is based on proximity to the nearby mapped Pacolet series which is in the Kanhapludult great group. Presence of hydric soils in the absence of a contemporary wetland hydrology regime suggests such areas were likely wetlands prior to agricultural conversion. A complete copy of the hydric soil investigation report and hydric soils map can be found in Appendix 4.

3.8.2 Hydrologic Monitoring and Evaluation

Five groundwater gages were installed to evaluate the existing hydrologic conditions of the Site and help inform the wetland design approach discussed below in Section 6.8. Gages were strategically placed to allow evaluation of the existing water table across the existing and proposed wetland areas. Groundwater gages one, three, and five were placed in areas proposed for wetland re-establishment. Groundwater gages two and four were placed in existing wetlands C and F, which are proposed for rehabilitation.

Groundwater gages recorded data at the Site between February 26, 2021 and May 4, 2021. Table 8 shows the number of consecutive days and percentages that the water table was within 12 inches of the soil surface during the growing season. Full hydrologic data from the existing groundwater gages can be found in Appendix 4.

Table 8: Existing Groundwater Gage Summary

Gage	Consecutive Days in Growing Season Groundwater Table Above 12 in. Depth (Days)	Consecutive Percent Growing Season Wells Met Groundwater Depth Criterion Under Normal Rainfall Conditions (%)	Evaluated Dates	Wetland Approach
1	24	9.6%	2/26/2021 to 5/4/2021	Re-establishment
2	52	20.8%		Rehabilitation
3	1	0.4%		Re-establishment
4	52	20.8%		Rehabilitation
5	5	2.0%		Re-establishment

Growing season dates for existing hydrology observations were determined using observations from numerous Mitigation sites in the Piedmont region and NRCS WETS Tables. Based on conversations with the IRT, bud burst, and soil temperature data found at other sites in the region, growing season dates of March 1st- November 20th were assumed for this analysis. Note that the proposed method to establish growing season dates for monitoring success criteria for this site are described in Section 7.0.

Rainfall quantities were above normal in January and February and dropped below normal in March. Rainfall returned within the normal range during the month of April. A graph displaying the 30-70 percentile ranges and monthly rainfall during 2021 is included in Appendix 4.

Overall, gage data collected shows that groundwater within proposed re-establishment areas is only within 12 inches of the soil surface for relatively short durations. The incision of the adjacent streams drains the groundwater in the floodplain and limits the ability of these re-establishment areas to stay saturated. The presence of relic hydric soils identified by the LSS in these re-establishment zones suggests that they were once capable of supporting and maintaining a wetland hydrologic regime. Gage data in existing wetlands proposed for rehabilitation shows that water is present in the upper 12 inches of the soil surface for 24.6% of the growing season.

3.9 Potential for Functional Uplift and Project Justification

The primary stressors at the Site are cattle access to streams and wetlands, removal or narrowing of riparian buffers, and runoff from agricultural fields. These stressors have led to degradation of the Site streams, which is made apparent by stream bank erosion, poor aquatic habitat, and formation of headcuts and subsequent disconnection of streams from their floodplains and adjacent wetlands. Functional uplift at the Site can be achieved through the following measures:

- Restoring degraded stream channels to reduce erosion and reconnect streams to riparian wetlands to restore hydrologic connection;
- Planting riparian buffers to shade streams, help stabilize streams, and filter runoff and overbank flows;
- Providing grade control in streams to eliminate headcuts;
- Cattle exclusion; and
- Protecting the Site with a conservation easement.

These project components are described in Section 5.0 in terms of goals, objectives, and outcomes for the project and in greater detail in Section 6.0.

4.0 REGULATORY CONSIDERATIONS

Table 9 is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 4.1-4.3.

Table 9: Regulatory Considerations

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

1. PJD submitted to USACE on 5/11/2021 pending approval. PCN to be provided to IRT with Final Mitigation Plan.

4.1 401/404

Wetlands A, C, D, E, F, G, and J are wetlands located within the existing floodplain and will be partially impacted by stream restoration and enhancement activities. Wetlands on the Site that are 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 denoted in the final construction plans. Table 10 estimates the anticipated impacts to wetland areas on this project. These impacts will be minimized, where possible, and will be submitted in the Final Mitigation Plan. The Pre-Construction Notification, including this data, will be submitted to the IRT with the Final Mitigation Plan.

Table 10: Estimated Impacts to Project Wetlands

Jurisdictional Feature	Classification	Acreage	Impact Type	Type of Activity	Impact Area (acres)
A	Headwater Forest	0.069	Permanent	Stabilization	0.003
	Headwater Forest		Temporary	Floodplain Grading	0.001
B	Headwater Forest	0.064	Temporary	Floodplain Grading	0.002
D	Headwater Forest	0.088	Permanent	Crossing, Stabilization	0.002
	Headwater Forest		Temporary	Haul Road, Floodplain Grading	0.032
E	Headwater Forest	0.162	Temporary	Haul Road, Floodplain Grading	0.014
F	Headwater Forest	0.132	Permanent	Crossing	0.017
	Headwater Forest		Temporary	Haul Road, Floodplain Grading	0.040
G	Headwater Forest	0.282	Permanent	Channel Relocation	0.001
			Temporary	Floodplain Grading	0.046

4.2 Biological and Cultural Resources

A Categorical Exclusion for the Site was approved on October 28, 2020. 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 comment on the project from both the USFWS on September 14, 2020, and the North Carolina Wildlife Resources Commission (NCWRC) on September 18, 2020. The NCWRC responded on October 1, 2020 and did not have any concerns. USFWS responded on October 20, 2020 and stated that the action is not likely to adversely affect federally listed species or critical habitat. The project was approved through the USFWS self-certification process. All correspondence with the two agencies is included in the appendix. The conclusion for cultural resources per 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.

4.3 FEMA Floodplain Compliance and Hydrologic Trespass

The Site is represented on the Harnett County Flood Insurance Rate Map (FIRM) 3720060000J. There are no FEMA-regulated streams on the Cool Springs project site. Wildlands will coordinate with the local Floodplain Administrator to make sure that all regulatory requirements are met. A local floodplain development permit may be required but it is unlikely that any modeling will be required for this project. Coordination with the Harnett County Floodplain Administrator will be included with the final mitigation plan.

The proposed stream designs associated with the Site have little to no risk of potential hydrologic trespass for the following reasons:

- T2, T6, and T8 originate on-site;
- UT to Cedar Creek and T3 are proposed for enhancement only at the upstream extents and bed elevations will not be adjusted;
- T1 is proposed for enhancement with a short repair at the upstream extents with dimensions and bed elevations that closely match the existing stream;
- T4 and T5 originate at the property line at design bed elevations similar to the existing.
- T7 was designed specifically to avoid creating hydrologic trespass on the upstream landowner.

5.0 MITIGATION SITE GOALS AND OBJECTIVES

The major goals of the proposed stream mitigation project are to provide ecological and water quality enhancements to the Cape Fear River Basin while creating a functional riparian corridor at the site level. 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 Sections 7 and 8 of this report. Specific enhancements to water quality and ecological processes are outlined in Table 11.

Table 11: Mitigation Goals and Objectives

Goal	Objectives	Expected Outcomes
Improve the stability of stream channels	Construct stream channels that will maintain a stable pattern and profile considering hydrologic and sediment inputs to the system; install bank revetments and grade control; install bank vegetation.	Reduce erosion and sediment inputs; maintain appropriate bed forms and sediment size distribution; support water quality and habitat goals.
Reconnect channels with floodplains and riparian wetlands	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce shear stress on channel; hydrate adjacent wetland areas; filter pollutants out of overbank flows; provide surface storage of water on floodplain; increase groundwater recharge while reducing outflow of stormwater; support water quality and habitat goals.
Improve stream, wetland, and riparian habitat.	Install habitat features such as constructed steps, cover logs, and brush toes on restored reaches. Add woody materials/ LWD to channel beds. Construct pools of varying depth. Restore and enhance forested riparian wetland habitat.	Support biological communities and processes. Provide aquatic habitats for diverse populations of aquatic and riparian organisms.
Improve water quality	Stabilize stream banks. Plant riparian buffers with native trees. Construct BMPs to treat pasture runoff. Fence out livestock.	Reduce sediment and nutrient inputs from stream banks; reduce sediment, nutrient, and bacteria inputs from pasture runoff; keep livestock out of streams, further reducing pollutants in project streams.
Restore/improve riparian buffers	Plant native tree species in riparian zone where currently insufficient.	Provide a canopy to shade streams and reduce thermal loadings; stabilize stream banks and floodplain; support water quality and habitat goals.

Goal	Objectives	Expected Outcomes
Exclude livestock from stream channels.	Install livestock fencing or relocate livestock as needed to exclude livestock from stream channels, riparian areas, proposed wetland areas and/or remove livestock from adjacent fields.	Reduce sediment and nutrients from agriculture/bank erosion. Eliminate livestock waste in streams and trampling of stream substrate.
Permanently protect the project site from harmful uses	Establish conservation easements on the Site	Ensure that development and agricultural uses that would damage the site or reduce the benefits of the project are prevented.

6.0 DESIGN APPROACH AND MITIGATION WORK PLAN

6.1 Stream Design Approach Overview

The design approach for the Site was developed to maximize the goals and objectives described in Section 5, which were formulated based on the potential for uplift described in Section 3.9. The design is also intended to provide the expected outcomes in Section 5, though these are not tied to performance criteria. Stream restoration, enhancement I, and enhancement II approaches are proposed for streams at the Site. Restoration activities include reconstructing the channel with a more stable dimension, pattern, and profile and reconnecting streams to their floodplains. Instream structures will be constructed to help maintain stable channel morphology and improve aquatic habitat. Generally, enhancement II activities will consist of fencing out livestock, repairing localized bank erosion, stabilizing headcuts, planting a native riparian buffer, and treating invasive species. Enhancement I activities will be performed on T7 and will include a combination of enhancement II activities in the upstream section and restoration activities in the downstream section. Riparian buffers will be restored by converting pastureland to forested canopy, removing invasive species, and planting native vegetation. The entire project area will be protected in perpetuity by a conservation easement.

The design approach for this Site utilized a combination of analog and analytical approaches for stream restoration and relies on prior experience and observations. Reference reaches were identified to serve as the basis for design parameters in combination with past project experience in the Piedmont, site constraints, and best professional judgement. Channels were sized based on design discharge hydrologic analysis, which uses a combination of empirical and analytical data as described within this report. Designs were then verified and/or modified based on sediment transport analysis.

6.2 Reference Streams

Seven reference reaches were identified for this Site and used to support the stream design (Figure 8). These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. Reference reach information is provided in Table 12. Geomorphic parameters for these reference reaches are summarized in Appendix 4. Twelve additional reference reaches were used along with those in Table 12 to create the reference reach regional curve for the discharge analysis discussion below in Section 6.3.

Table 12: Reference Reach Data Used in Development of Design Parameters

Design Stream		UT to Cedar Creek	T2	T3-R2	T4-R2	T5	T6	T7	T8
Reference Stream	Stream Type								
UT to Daniels Creek	E4b	X						X	
Lake Norman DS	E5	X						X	

Design Stream		UT to Cedar Creek	T2	T3-R2	T4-R2	T5	T6	T7	T8
Reference Stream	Stream Type								
UT to Varnals Creek	C4/E4	X						X	
Raven Rock Site 1	B4a			X	X				
Scout East 1	E5b			X	X				
Shrew Trib A	B5a		X			X	X		X
Timber Trib R1	B4		X			X	X		X

6.3 Design Discharge Analysis

Stream restoration reaches on the Site will be hydraulically connected to their existing floodplains to allow for energy dissipation and prevent erosion. To achieve this, a design discharge must be selected that allows for frequent overbank events. The following methods were used to develop design discharges for the restoration reaches:

- Published regional curves for the North Carolina Rural Piedmont (Harman et al., 1999);
- Natural Resources Conservation Service regional curves for the from the North Carolina Rural Piedmont (Walker, unpublished)
- Regional flood frequency analysis performed by Wildlands using U.S. Geological Survey (USGS) gage sites;
- Site specific reference reach data;

Results for the design discharge analysis are shown in Table 13 and illustrated in Figure 8. The selected design discharge for each reach generally falls in the range of the 1.5-year flood event from the Wildlands Regional Flood Frequency analysis and the site-specific reference reach curve. Design discharges for smaller channels skew larger and result in larger design channels to prevent the channels from clogging and silting in over time. The streams with the smallest drainage areas (T2 and T5) required the largest difference in the design discharge compared to the flood frequency analysis and discharge curves. This method of preventing silting in of tiny channels has been used effectively on many past projects.

Table 13: Summary of Design Discharge Analysis

		UT to Cedar Creek	T1	T2	T3-R2	T4-R1	T4-R2	T5	T6	T7	T8
DA (acres)		257	44	5.7	19	12	33	4.7	9.0	76	10
DA (sq. mi.)		0.40	0.069	0.0089	0.029	0.019	0.052	0.0073	0.014	0.12	0.015
NC Piedmont Regional Curve (cfs)		46	13	2.9	6.9	5.0	10	2.5	4.1	19	4.3
Wildlands Regional Flood Frequency Analysis (cfs)	**1.2-year event**	40	11	2.4	5.7	4.1	8.8	2.1	3.4	16	3.6
	1.5-year event	57	16	3.6	8.6	6.2	13	3.2	5.1	24	5.4
Site Specific Reference Reach Curve		32	18	5.7	11	8.6	15	5.1	7.4	24	7.7
Final Design Q (cfs)		43	18	9.4	13	11	16	7.7	10	23	11

6.4 Design Channel Morphological Parameters

Reference reach data was the primary source of information used to develop the morphological parameters for each of the restoration reaches. Ranges of pattern parameters were developed within the reference range with some exceptions based on best professional judgement and knowledge from previous projects. Table 14 through Table 16 summarize the key morphological parameters for all restoration reaches, including UT to Cedar Creek Reach 2, T2, T3 Reach 2, T4 Reach 2, and T6 – T8. Complete design morphological parameters are included in Appendix 4.

Table 14: Summary of Morphological Parameters for UT to Cedar Creek and T7

Parameter	Existing		References			Proposed	
	UT to Cedar Creek Reach 2	T7	UT to Daniels Creek	Lake Norman DS	UT to Varnals Creek	UT to Cedar Creek Reach 2	T7
Contributing Drainage Area (acres)	257	76	160	64	262	257	76
Channel/Reach Classification	B4c	B4	E4b	E5	C4/E4	C4/B4c	B4/C4b
Design Discharge Width (ft)	19.4	8.2	6.7 – 8.2	9.9	9.3 – 10.5	12.5	9.5
Design Discharge Depth (ft)	0.8	0.5	0.8 – 1.0	1.5	1.1 – 1.2	0.9	0.7
Design Discharge Area (ft^2)	15.4	4.1	6.6 – 6.9	14.6	10.3 – 12.3	10.7	6.5
Design Discharge Velocity (ft/s)	2.7	4.2	5.3 – 5.3	1.3	4.4 – 5.2	4.0	3.7
Design Discharge (cfs)	42.3	17.1	36.7	18.3	54.0	43	23
Water Surface Slope (ft/ft)	0.011	0.034	0.028	0.018	0.017	0.0145	0.0217
Sinuosity	1.37	1.03	1.2	-	1.2	1.25	1.2
Width/Depth Ratio	24.3	16.4	6.7 – 9.7	6.7	8.1 – 9.3	15	14
Bank Height Ratio	1.4	3.4	1.4 – 2.1	1.3	1.0	1.0	1.0
Entrenchment Ratio	1.6	1.5	1.5 – 4.8	1.9	5.7 – 10.0	2.2 – 5.0	2.2 – 5.0
Reachwide d50 (mm)	9.7	5.5	-	22.0	-	-	-

Table 15: Summary of Morphological Parameters for T3 Reach 2 and T4 Reach 2

Parameter	Existing		References		Proposed	
	T3 Reach 2	T4 Reach 2	Raven Rock Site 1	Scout East 1	T3 Reach 2	T4 Reach 2
Contributing Drainage Area (acres)	19	33	25	14	19	33
Channel/Reach Classification	A4	F4b	B4a	E5b	B4/B4a	B4/B4a
Design Discharge Width (ft)	4.6	7.1	7.7 – 7.8	3.1	6.3	7.0
Design Discharge Depth (ft)	0.4	0.4	0.4	0.3	0.5	0.5
Design Discharge Area (ft^2)	1.7	2.8	3.0 – 3.1	0.9	2.9	3.7
Design Discharge Velocity (ft/s)	4.0	3.4	3.8 – 4.0	2.0	4.4	4.4
Design Discharge (cfs)	6.8	9.6	11.5 – 12.5	1.8	13	16
Water Surface Slope (ft/ft)	0.054	0.031	0.039	0.043	0.0522	0.0432
Sinuosity	1.04	1.23	1.22	1.04	1.15	1.10
Width/Depth Ratio	11.5	17.8	19.4 – 19.5	10.5	14	13
Bank Height Ratio	4.1	5.8	1.0 – 1.3	1.0	1.0	1.0

Parameter	Existing		References		Proposed	
	T3 Reach 2	T4 Reach 2	Raven Rock Site 1	Scout East 1	T3 Reach 2	T4 Reach 2
Entrenchment Ratio	1.1	1.1	1.8 – 3.0	3.2	>2.2	>2.2
Reachwide d50 (mm)	46	32	-	-	-	-

Table 16: Summary of Morphological Parameters for T2, T6, andT8

Parameter	Existing				References		Proposed			
	T2	T5	T6	T8	Shrew Trib A	Timber Trib R1	T2	T5	T6	T8
Contributing Drainage Area (acres)	6	5	9	10	13	26	6	5	9	10
Channel/Reach Classification	A4	C4b	A4	A4/B4a	B5a	B4	A4/B4a	A4/B4a	A4/B4a	A4/B4a
Design Discharge Width (ft)	2.9	3.6	1.3	5.1	3.6	8.9	5.4	5.0	5.8	6.0
Design Discharge Depth (ft)	0.3	0.3	0.6	0.3	0.3	0.5	0.4	0.4	0.4	0.4
Design Discharge Area (ft^2)	0.9	1.2	0.8	1.3	1.1	4.6	2.2	1.8	2.4	2.5
Design Discharge Velocity (ft/s)	3.6	4.0	5.1	3.3	3.3	3.7	4.4	4.4	4.2	4.4
Design Discharge (cfs)	3.1	5.0	4.0	4.3	3.5	17.0	9.4	7.7	10	11
Water Surface Slope (ft/ft)	0.051	.058	0.084	0.053	0.063	0.033	0.0768	0.085	0.065	0.068
Sinuosity	1.07	1.02	1.03	1.04	1.1	1.12	1.10	1.15	1.10	1.10
Width/Depth Ratio	9.7	12.0	2.2	17.0	12.1	17.0	14	14	14	14
Bank Height Ratio	12.6	1.6	4.8	7.7	1.0	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.4	2.8	1.3	18.0	2.1	1.5	>2.2	1.4-2.2	>2.2	>2.2
Reachwide d50 (mm)	25	29.5	19	20	2	7	-	-	-	-

6.5 Sediment Transport Analysis

To gain a better understanding of the quantity of sediment supplied to the project streams and how it is transported through the system, Wildlands performed a qualitative assessment of the sediment supply and sources in the project watershed based on visual inspection and review of historic aerial photos. Wildlands also performed a competence analysis to analyze the ability of the proposed streams to transport certain sizes of sediment and to support material sizing for constructed riffles.

6.5.1 Sediment Supply

The qualitative watershed assessment indicates that the watershed is stable and unlikely to change significantly in the near future. However, occasional clearcutting is expected to occur. Sediment load to the project streams is expected to be low and stable given the forested and rural nature of the watershed and consistent land use. Visual assessment of streams does not indicate significant bar formation and there are no other signs of a high sediment supply coming from the watershed. The focus of the sediment transport analysis is therefore based on an evaluation of stream competence.

6.5.2 Competence Analysis

Competence analyses were performed 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. The analysis utilized standard equations based on a methodology using the Shields (1936) curve and Andrews (1984) equation described by Rosgen (2001). In all but one case, results show that the moveable particle size of the proposed stream is greater than the largest particle size of the existing stream, which indicates that the proposed channels will be able to transport the sediment supplied to them by the watershed. For T7, the movable particle is slightly smaller than the largest particle indicating that all but the largest particles supplied will move.

Table 17: Results of Competence Analysis

	UT to Cedar Creek Reach 2	T2	T3 Reach 2	T4 Reach 2	T6	T7	T8
Dbkf (ft)	0.9	0.4	0.5	0.5	0.4	0.7	0.4
Schan (ft/ft)	0.0145	0.0781	0.0522	0.0432	0.0665	0.0217	0.0726
Bankfull Shear Stress, t (lb/sq ft)	0.75	1.91	1.45	1.37	1.66	0.90	1.83
Largest particle from bar sample (mm)	55	75	65	55	50	80	50
Movable particle size (mm)	57.8	153.4	115.1	107.9	132.2	69.7	146.1

6.6 Stream Design Implementation

Restoration and enhancement I and II approaches will be implemented throughout the Site. Further details on proposed design approaches are discussed below and illustrated in Figure 9. The preliminary design can be found in the plan set.

UT to Cedar Creek

UT to Cedar Creek Reach 1 is proposed for Enhancement II beginning at the property line and extending downstream of the existing culvert crossing. Four badly eroding, ephemeral gullies flow into UT to Cedar Creek from the east carrying runoff from the cattle pasture and chicken houses. UT to Cedar Creek has a sparce, intact buffer and bedrock grade control throughout the reach. The proposed treatments for Reach 1 include fencing out cattle, supplemental planting areas where the buffer is sparce or narrow, stabilization of areas where cattle access has eroded the banks, stabilization of eroded gullies, and BMPs to treat runoff on T2 and the four gullies. The gullies will also be planted, fenced to exclude cattle, and protected by the conservation easement. The existing culvert crossing on UT to Cedar Creek Reach 1 will remain. The existing pipes consist of one corrugated metal pipe and one corrugated plastic pipe. These pipes were recently replaced by the farmer and convey an appropriate flow through the channel. The pipes will be reused but the metal pipe will be the primary conduit and will be set at a lower elevation than the plastic pipe. Existing bedrock both upstream and downstream of the culvert crossing provide additional stability. A log j-hook will be added below the existing culvert crossing to back up water and allow for aquatic organism passage through the pipes.

Two additional stabilization areas are proposed on UT to Cedar Creek Reach 1 downstream of the culvert crossing. One steep ephemeral channel entering from the west will be stabilized with rock sills before it enters UT to Cedar Creek. This channel will be fenced and protected by the conservation easement. Additionally, there is a steep eroding cattle access point entering UT to Cedar Creek from the east, approximately 150 feet above the start of restoration. This will be stabilized with log sills.

UT to Cedar Creek Reach 2 will begin approximately 500 feet downstream of the culvert crossing. This reach will be restored as a C4 stream type using a priority 1 restoration approach in which the channel elevations will be raised so that the top of bank will be near the elevation of the existing floodplain.

Approximately 100 feet above the restoration start, structures will be added to the enhancement reach to begin raising grade so that the restoration reach can begin a priority 1. Restoration begins to transition back towards existing channel grade approximately 50 feet above the property line and continues (not for credit) approximately 50 feet below the property line to keep a priority 1 approach for most of the restoration reach. Instream structures along UT to Cedar Creek will consist of native material, angled log, log-rock-cascade, and chunky riffles. Having varying riffle types will add diversity and variation to the channel. All meander bends will be constructed with bank revetments including primarily brush toeas well as boulder toe and cover logs to prevent erosion and provide pool habitat. Log and rock sills, as well as log J-hooks will be strategically placed in several locations to provide grade control and help prevent erosion by redirecting flow around tighter meander bends.

T1

T1 is proposed for Enhancement II beginning at the property line and ending at its confluence with UT to Cedar Creek. T1 is relatively stable and in a wooded area, however cattle access the stream and there is a cleared, eroded area at the top of the reach that will be reconstructed. Reconstruction will look similar to restoration by rebuilding the stream cross-section and adding grade control and bank revetment structures including native material and angled log riffles, as well as log sills and brush toe. An eroded ephemeral channel enters T1 from the west near the upstream property line. This will be stabilized with log and rock sills as it enters the reconstructed stream. Additionally, approximately 100 feet of the left bank will be stabilized.

T2

T2 is badly eroded and incised and will be restored as a B4a stream with few gentle meanders and frequent step-pool sequences. Restoration will begin at the jurisdictional stream call. Above that point, a BMP is proposed to stabilize and treat runoff entering the stream from the cattle pasture area and chicken houses. The restored stream will be constructed within the existing incised channel, slightly meandering down valley. The steep nature of this stream will require constructed riffles, rock and log sills to create a step-pool channel. Cover logs and brush toe bank revetments will be used to reinforce bends, reducing erosion and providing pool habitat.

T3

T3 Reach 1 will begin with an existing internal crossing at the existing farm road location. The existing corrugated plastic pipe is poorly set, backing water upstream and is perched at the downstream end where it enters T3. This crossing will be replaced with a drop-inlet and outlet pipe to maintain the existing stream grades below the culvert, which serve to hydrate the existing wetlands. The outlet pipe will no longer be perched. T3 Reach 1 is bordered by two areas of wetland rehabilitation paralleling the existing stream. The upstream portion of this reach is relatively stable, although cattle access the stream, and the riparian buffer has been completely deforested. The lower half of T3 Reach 1 is moderately incised. Beginning at a headcut approximately halfway down this reach, both banks will be stabilized by laying back banks at a 3:1 slope and native vegetation will be planted. Starting approximately 150 feet above T3 Reach 2, stream structures will be incorporated to raise the stream bed to enable the restoration reach to begin with a priority 1 approach. Bed structures will include constructed riffles and log and rock sills to elevate the stream bed, also reducing the channel incision through this reach.

T3 Reach 2 will be restored as a B4/B4a stream between two wetland re-establishment areas on the left and right floodplain. Restoration will originate at an existing knickpoint that continues to migrate upstream. Restoration will include a few short meandering sections alternating with steeper step-pool sections controlled by in-stream structures including constructed riffles, log sills and rock sills. All meander bends will be constructed with bank revetments including primarily brush toe, as well as cover logs to prevent erosion and provide pool habitat. The restoration reach will tie at the downstream limits to existing bedrock in the channel.

Reach 3 extends from the restored Reach 2 to the confluence with UT to Cedar Creek. At the start of Reach 3, the right bank will be stabilized with boulder toe between existing bedrock knickpoints. Several trees will also be removed from the channel that are currently directing flow away from the center of the channel. Near the confluence with UT to Cedar Creek, the right bank of T3 Reach 3 will laid back and the left bank will be stabilized with a rock toe revetment.

T4

T4 Reach 1 begins at the property line and will gently meander for approximately 100 feet before flowing through the proposed internal crossing. Based on guidance from the IRT at the post-contract site meeting, it was decided that the existing farm road would remain in the current location where it crosses T4 below the confluence of T4 Reach 1 and T5. The existing corrugated plastic pipe will be replaced with a corrugated metal pipe with the farm road remaining in the current location and set within an internal easement break.

Similar to T3 Reach 2, T4 will be restored as a B4/B4a stream with short meandering sections alternating with steeper step-pool sections controlled by in-stream structures including a variety of constructed riffle types and log and rock sills to hold grade. Brush toe bank revetment structures are used throughout T4 in addition to a few cover logs for additional habitat. T4 Reach 2 has been designed using a priority 1 restoration approach. Where possible, existing trees will be preserved along the channel.

T5

With the change in crossing location during the IRT site visit, T5 was recommended for restoration. T5 begins at a headcut near the property line. The short 130 foot length of T5 will be restored as a B4a step-pool stream approach before its confluence with T4. Restoration will include rock and log sills to hold grade and create in-stream pools. Constructed riffles and brush toe bank revetment structures will also be used throughout.

T6 and T8

T6 and T8 originate on the site in open pasture areas, each beginning at an active headcut with a cattle wallow area upstream. The conservation easement will encompass these wet areas to prevent cattle from disturbing this area above the restoration. Stream restoration begins at the headcuts, preserving the existing spring grades to maintain flow after construction.

T6 and T8 will be restored as B4a streams with steeper slopes and low sinuosity. A combination of rock and log steps will be used to drop grade and create pools in the step-pool sections. Native material, chunky, angled log, and log-rock-cascade riffles will also be used to provide grade control throughout the design reaches.

T6 flows through parallel wetland reestablishment areas for approximately 300 feet of length through the middle and lower portion of the reach before its confluence with T4.

T8 also flows through wetland reestablishment areas for approximately 200 feet of the lower half of T8. T8 floodplain begins to flatten out as it enters the UT to Cedar Creek floodplain at the downstream 100 feet of stream. A short step-pool sequence on T8 and log structure will be installed on UT to Cedar Creek to transition T8 back to the confluence with UT to Cedar Creek approximately 20 feet downstream of the property line.

T7

T7 begins at an existing bedrock slide entering the site from off property. To maintain this bedrock bed feature and to prevent hydrologic trespass on the upstream property, this reach will be treated with an enhancement I approach. The upstream portion of the reach will keep the existing bed and a bankfull bench will be cut on the left floodplain. The downstream portion will be realigned and the channel will be fully reconstructed to the appropriate bankfull dimensions. In this lower section, the bed will be raised and riffle-pool bed forms will be constructed. The proposed channel will be a B4 stream type.

Instream structures along T7 will consist of native material and chunky riffles and log sills. Meander bends will be constructed with brush toe revetments to reduce erosion and provide pool habitat.

6.7 Wetland Design Approach Overview

The proposed wetland mitigation at the Site includes the re-establishment of historic riparian wetland areas and the enhancement and rehabilitation of degraded, existing jurisdictional wetland features. Areas proposed for wetland re-establishment contain relic hydric soils which indicate these areas were previously wetlands prior to agricultural and hydrologic manipulation. Wetland enhancement and rehabilitation areas are existing jurisdictional wetlands that are currently lacking some function due to current hydrologic or vegetation alterations.

6.8 Wetland Design Implementation

Wetland re-establishment is proposed on 0.597 acres that contain hydric soils but are lacking a wetland hydrologic regime. Wetland rehabilitation is proposed on 0.557 acres of existing jurisdictional features that exhibit significant impairments to habitat and water quality. Wetland enhancement is proposed on 0.574 acres of existing jurisdictional features that are contain some trees but exhibit impairments to habitat and water quality. Wetland areas will be restored to a headwater forest.

Re-establishment of wetland hydrology will be accomplished by raising the elevation of the streambeds and realigning stream channels closer to wetlands. Elevating the streambeds and restoring appropriate channel dimensions will reduce the drainage of the water table and increase the interaction between the streams and floodplain wetlands by increasing overbank flow. The realignment of stream channels will also increase connectivity between the floodplains and streams.

Both re-establishment and rehabilitation areas are dominated by pasture grasses and largely lacking woody stems and other herbaceous wetland vegetation. These wetlands will be planted with native trees and herbaceous plants suitable for the saturated conditions. In addition, the removal of cattle and establishment of a permanent conservation easement will help to promote the growth of native vegetation that was impacted by grazing and pasture management. Improving the vegetation composition and condition in these areas will provide numerous benefits to water quality and habitat.

Wetland enhancement will be achieved through the removal of livestock encouraging the growth and recruitment of native understory species. Livestock exclusion will promote functional uplift by promoting the growth of lower strata vegetation and nutrient cycling.

6.9 Vegetation and Planting Plan

The objective of the planting plan is to establish, over time, a minimum 50-foot thriving riparian buffer composed of native tree species which resembles mesic mixed hardwood forest and coastal plain small stream swamp community types. The restored buffer will improve riparian habitat, enhance stream stability, shade the streams, and provide a source for organic material to the streams. Non-forested areas within the conservation easement will be revegetated with a combination of trees, shrubs, forbs, and grasses. The selected species assemblage is based on the existing natural community types and professional judgement regarding species establishment in the anticipated Site conditions. The streambanks and the channel toe will be planted with regionally appropriate live stakes and herbaceous plugs to strengthen streambanks, provide habitat, and cool water temperatures via shading. Permanent native seed mixes were based on the proposed target communities, professional judgement regarding seed establishment, and commercial availability. Separate seed mixes were developed for riparian buffers and wetland areas and will be broadcast on all disturbed areas in the conservation easement. The complete planting plan is found in the preliminary design plans.

The proposed tree and shrub species compositions in this planting plan reflects the acidic Pacolet soils and topography found in the existing wooded riparian corridor and wetland. Some adaptations were made to the target natural community based on the need to include early successional tree species that

create more favorable conditions for climax species such as *Fagus grandifolia*, and to omit undesired tree species (*Acer rubrum*, *Liquidambar styraciflua*, and *Pinus taeda*).

An existing conditions floristic inventory found portions of the easement in pasture or in hardwood forest mostly devoid of herbaceous vegetation. Both upland and bottomland tree species were observed on the slopes. Dominant tree species were American beech, red maple, northern red oak, white oak, water oak, and eastern red cedar (*Juniperus virginiana*). Subcanopy trees included flowering dogwood (*Cornus florida*), ironwood (*Carpinus caroliniana*) and eastern redbud (*Cercis canadensis*). Several of these are indicator species of a Mesic Mixed Hardwood Forest (both Piedmont and Coastal Plain subtypes) as described by Schafale and Weakley, 2012. Though the Project is found within the at the border of the Piedmont and Coastal Plain regions in Harnett County. Distributions of both Piedmont and Coastal Plain subtype indicator species can be expected in this ecotonal region. In this way a mesic mixed hardwood forest in this area presents opportunity for harboring a wealth of biodiversity. A Coastal Plain small stream swamp is used as a model for the wetland vegetation plan (Schafale, 2020).

6.9.1 Vegetation and Planting Plan- Land Management Activities

Invasive species within the conservation easement will be treated using a combination of different techniques. Chinese privet and Japanese honeysuckle occur at low densities (<1%) in the riparian corridor. Where feasible, invasive species will be mechanically removed during construction. Otherwise, all invasive species will be controlled using a variety of mechanical and chemical methods based on species, size, extent, and professional judgement. The extent of invasive species coverage will be monitored, mapped, and controlled as necessary throughout the required monitoring period. Additional monitoring and maintenance issues regarding vegetation are in Sections 8 and 9 and Appendix 8.

To help ensure tree growth and survival, soil amendments may be added to areas of the floodplain throughout the Site where earthen material is removed. Soil tests may be performed in areas of cut and amendments may be applied based on results. Additionally, topsoil may be stockpiled and reapplied to grade before permanent seeding and planting activities take place. All haul roads or other areas within the easement compacted by construction equipment during construction will be ripped before planting.

6.10 Project Risk and Uncertainties

In general, the project has low risk. The project watersheds are rural and entirely contained on the same property as the project site and adjacent wooded properties. The potential for land development is very limited and unlikely which suggests that there is very little risk to changes in land use in the project watersheds. Forested areas in the watershed could be cut for timber and/or turned into pastureland. However, small residential development or timbering, which are the most likely future disturbances in the watershed, would have little impact on the Site streams, if they occur.

Foreseeable problems that may arise on the Site include easement encroachments, damage from large floods, beaver activity, and the spreading of invasive species. The easement boundary will be fenced where cattle currently have access. High visibility signs will be installed along the easement boundary to reduce chances of encroachment. Grade control structures and bank revetments will be installed to reduce erosion potential during high flows. Beaver activity will be addressed on an as-needed basis. Wildlands will contract with USDA Animal and Plant Health Inspection Services (APHIS) to remove beaver from the Site and dismantle the dams. Wildlands will implement an invasive species management plan including ongoing treatment of invasive species on Site throughout the monitoring period.

7.0 PERFORMANCE STANDARDS

The performance criteria for the Site will follow approved performance criteria presented in the DMS Stream and Wetland Mitigation Plan Template and Guidance (June 2017) and the October 2016 IRT Mitigation Monitoring Guidance. Annual monitoring and semi-annual site visits will be conducted to

assess the condition of the completed project. Specific performance standard components are proposed for stream morphology, hydrology, vegetation, and wetland hydrology. The stream restoration reaches of the project will be assigned specific performance criteria components for hydrology, vegetation, and geomorphology. The enhancement II reaches and T7 (a short section of enhancement I) will be assigned specific performance criteria components for vegetation only. Wetland restoration will be assigned specific performance criteria components for hydrology and will also be required to meet vegetation performance criteria. Performance criteria will be evaluated throughout the seven years of post-construction monitoring. Performance standards are summarized in Table 18. Based on conversations with the IRT, Wildlands proposes to establish the growing season based on observations of soil temperature, bud burst, and autumn leaf senescence at the site. The data to support establishment of the growing season will be collected during 2022 and presented in the Monitoring Year 0 report. That report will include proposed growing season start and end dates based on data collected. These dates will be used define the start and end of the growing season throughout the seven-year post-construction monitoring period.

The preliminary hydric soils investigation conducted by a licensed soil scientist indicated that there are three different classifications of hydric soil on site (Appendix 4). According to Table 1 in the Notification of Issuance of *Guidance for Compensatory Stream and Wetland Mitigation Conducted for the Wilmington District* (October 24, 2016), a hydroperiod criterion of 12% is proposed for areas with hydric soils most like the Wehadkee series. A 10% hydroperiod criterion is proposed for soil units most like the Chewacla series. The third soil type observed on site is not an appropriate match for any series currently mapped in North Carolina but is best taxonomically classified as an Aquic Kanhapludult. Table 1 in the USACE Mitigation Guidance update does not provide a hydroperiod range for any series of this taxonomic subgroup but does provide a range for two Piedmont soil series of the Aquic Hapludult subgroup (Helena and Dorian). The only difference in the two classifications at the subgroup level describes the activity level of clay particles which would not affect hydrologic properties. The revised IRT guidance lists the Helena soils series with a saturation range of 8-10%. Based on this information, the proposed hydroperiod criterion for units identified as Aquic Kanhapludults is 8%. Proposed hydroperiod criteria for wetland areas are shown on Figure 9 and 10.

Table 18: Summary of Performance Standards

Parameter	Monitoring Feature	Performance Standard
Dimension	Cross-Section Survey	BHR <1.2; ER >2.2 for C/E channels; ER >1.4 for B channels
Pattern and Profile	Visual Assessment	Should indicate stream stability
Photo Documentation	• Cross-Section Photos • Photo Points • Crossing Photos • BMP Photos	No excessive erosion or degradation of banks No mid-channel bars, Stable grade control Crossing photos will be taken on T3 and UT to Cedar Creek BMP photos will be included in MY0 and MY3 Reports
Hydrology	Gage/Transducer	Four bankfull events during the 7-year period; in separate years 30 consecutive days of flow on intermittent restoration reaches
Vegetation	Vegetation Plots	MY3 success criteria: 320 planted stems per acre MY5 success criteria: 260 planted stems per acre, average of 7 feet in height in each plot. MY7 success criteria: 210 planted stems per acre, average of 10 feet in height in each plot. Random transects will be done at least twice during the 7 year monitoring period in supplementally planted areas[1]
Wetlands	Groundwater Well	Wehadkee Soils: Hydroperiod criterion of 12% of the growing season representing a number to be determined of consecutive days of saturation within the upper 12 inches of the soil profile[2] Chewacla Soils: Hydroperiod criterion of 10% of the growing season representing a number to be determined of consecutive days of saturation within the upper 12 inches of the soil profile[2] Aquic Kanhapludult Soils: Hydroperiod criterion of 8% of the growing season representing a number to be determined of consecutive days of saturation within upper 12 inches of the soil profile[2]
Invasive Species	Visual Assessment	Invasives no more than 5% by area in easement
Visual Assessment	CCPV	No signs of encroachment, stream instability, increased invasive species

[1]Random transects in supplementally planted areas will not be tied to success criteria and will be for informational purposes only.
[2] Number of consecutive days will be determined based on soil temperature, bud burst, and leaf senescence data collected during 2022 which will be presented in the MY0 report.

8.0 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. Project monitoring criteria are shown in Table 19. Project monitoring components are listed in more detail in Table 20. Approximate locations of the proposed monitoring components are illustrated in Figure 10.

Table 19: Monitoring Criteria

Goal	Objective	Performance Standard	Monitoring Metric
Exclude livestock from stream channels.	Install and improve livestock fencing as needed to exclude livestock from stream channels, riparian areas, proposed wetland areas and/or remove livestock from adjacent fields.	There is no performance standard for this metric. However, the conservation easement will be fenced if cattle remain on the site.	Visual assessment

Goal	Objective	Performance Standard	Monitoring Metric
Restore and enhance native floodplain and wetland vegetation.	Convert active cattle pasture and previously maintained agricultural areas to forested riparian buffers along all Site streams and wetlands. Treat invasive vegetation along stream corridors. Protect and enhance existing forested riparian buffers.	MY3 success criteria: 320 planted stems per acre, MY5 success criteria: 260 planted stems per acre, average of 7 feet in height in each plot. MY7 success criteria: 210 planted stems per acre, average of 10 feet in height in each plot. Note: shrub and subcanopy species will be omitted from average height calculations	One hundred square meter vegetation plots will be placed on 2% of the planted area of the project and monitored annually. Vegetation monitoring will not be conducted during MY4 and MY6.
Improve the stability of stream channels.	Reconstruct stream channels slated for restoration with stable dimensions and appropriate depth relative to the existing floodplain. Add bank revetments and instream structures to protect restored/ enhanced streams.	Entrenchment ratio over 2.2 for C/E or 1.4 for B restoration reaches and bank height ratio below 1.2 with visual assessments showing progression towards stability.	Cross-section monitoring and visual inspections.
Improve instream and wetland habitat.	Install habitat features such as constructed steps, cover logs, and brush toes on restored reaches. Add woody materials/ LWD to channel beds. Improve bedform diversity by constructing riffle-pool sequences with pools of varying depth and step pool sequences. Remove farm pond and re-establish forested riparian wetland habitat.	There is no required performance standard for this metric.	N/A
Restore wetland function and hydrology.	Restore wetlands through re-establishment of hydrology. Remove the drainage effects of agricultural ditching and maintenance.	Free groundwater surface within 12 inches of the ground surface for a minimum number of days based on performance standards in Table 18.	Groundwater gages will be placed in wetland re-establishment and rehabilitation areas and monitored annually.
Reduce sediment and nutrient input from adjacent agricultural fields.	Restore riparian stream corridor and pocket wetland areas to slow and filter runoff from adjacent agricultural fields.	There is no required performance standard for this metric.	N/A
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site.	Prevent easement encroachment.	Visual Assessment

Table 20: Monitoring Components

Parameter	Monitoring Feature	Quantity/Length by Reach												Frequency	Notes
		UT to Cedar Creek R1	UT to Cedar Creek R2	T1	T2	T3 R1	T3 R2	T3 R3	T4 R1	T4 R2	T5	T6	T7	T8	
Dimension	Riffle Cross-sections		1		1		1			1		1		1	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections									1				1		
Pattern	Pattern														N/A	2
Profile	Longitudinal Profile														N/A	
Hydrology	Crest Gage (CG) and/or Flow Gage (FG)	1 CG			1 FG	1 FG			1 CG		1 FG	1 FG		1 FG	Quarterly	4
Vegetation	CVS Level 2	10 Fixed, 2 Random													Year 1, 2, 3, 5, and 7	5, 6
Wetlands	Groundwater Well	7													Quarterly	7
Visual Assessment															Semi-Annual	
Exotic and nuisance vegetation															Semi-Annual	8
Project Boundary															Semi-Annual	9
Reference Photos	Photographs	21													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 widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Substrate assessments will not be conducted for this site.
4. Crest gages will be inspected quarterly, evidence of bankfull events will be documented with a photo when possible.
5. Vegetation monitoring will follow CVS protocols.
6. The number and location of vegetation plots was determined using the area of planted acreage proposed for crediting.
7. Groundwater wells will be inspected and downloaded quarterly.
8. Locations of exotic and nuisance vegetation will be mapped
9. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

9.0 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. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. 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 Stewardship Program will periodically install signage as needed to identify boundary markings as needed. Any livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

The Site Protection Instrument can be found in Appendix 1.

10.0 ADAPTIVE MANAGEMENT PLAN

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

- Notify the USACE and NCIRT 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 and NCIRT.
- Obtain other permits as necessary.
- Implement the Corrective Action Plan.
- Provide the USACE and NCIRT a Record Drawing of Corrective Actions. This document shall depict the extent and nature of the work performed.

11.0 DETERMINATION OF CREDITS

The final stream credits associated with the Site are listed in 21 and the credit release schedule is located in Appendix 9. The credit ratios proposed for the Site are based on discussions with the Interagency Review Team (IRT):

1. Stream restoration is proposed at a credit ratio of 1:1 to reflect the moderate to severe channel incision and erosion that will require repair through channel realignment, profile and cross section adjustments, and structure placement.

2. Enhancement II is proposed at a 2.5:1 credit ratio to acknowledge that the stream requires only spot stabilization, buffer planting, cattle exclusion, BMPs to stabilize eroding gullies and treat runoff, and in some cases short sections of restoration-type stream work to better tie into restoration reaches.

3. Wetland re-establishment is proposed at a 1:1 credit ratio for areas with relic hydric soils that have been historically manipulated.
4. Wetland rehabilitation is proposed at 1.5:1 due to the impacts that cattle, invasive species, and ditching have had on wetland hydrology, vegetation, and overall function.
5. Wetland enhancement is proposed at a credit ratio of 2:1 to reflect that the wetland requires only livestock exclusion and encouragement of native habitat.
6. No credit is sought for stream restoration activities within internal easement crossings or outside of project parcels.

Buffers proposed throughout the Site meet the minimum required 50-foot standard width for Piedmont streams, and in some cases, exceed it. The upstream extents of streams on the property and cattle wallow areas about the origination points of streams will be included in the easement and fenced.

Table 21: Project Asset Table

Project Component or Reach ID	Existing Footage / Acreage	Mitigation Plan Footage/ Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio	Project Credits	Notes
UT to Cedar Creek Reach 1	2,351	1,808	Warm	EII	N/A	2.5	723.200	
UT to Cedar Creek Reach 1		64	Warm	EII	N/A	2.5	0.000	64 ft. not for credit due to Internal Culvert Crossing
UT to Cedar Creek Reach 1		489	Warm	EII	N/A	2.5	195.600	
UT to Cedar Creek Reach 2	446	354	Warm	R	P1	1	354.000	
T1	449	418	Warm	EII	N/A	2.5	167.200	
T2	473	466	Warm	R	P1	1	466.000	
T3 Reach 1	43	43	Warm	EII	N/A	2.5	0.000	43 ft. not for credit due to Internal Culvert Crossing
T3 Reach 1	380	379	Warm	EII	N/A	2.5	151.600	
T3 Reach 2	371	366	Warm	R	P1	1	366.000	
T3 Reach 3	302	295	Warm	EII	N/A	2.5	118.000	
T4 Reach 1	99	101	Warm	R	N/A	1	101.000	
T4 Reach 2	68	62	Warm	R	N/A	1	0.000	62 ft. not for credit due to Internal Culvert Crossing
T4 Reach 2	924	787	Warm	R	P1	1	787.000	
T5	142	134	Warm	R	N/A	1	134.000	
T6	499	499	Warm	R	P1	1	499.000	
T7	124	156	Warm	EI	N/A	1.5	104.000	
T8	722	697	Warm	R	P1	1	697.000	
Wetland A	0.069	0.066	Riverine	E	N/A	2.0	0.033	
Wetland B	0.064	0.064	Riverine	E	N/A	2.0	0.032	

Project Component or Reach ID	Existing Footage / Acreage	Mitigation Plan Footage/ Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio	Project Credits	Notes
Wetland C	0.160	0.160	Riverine	RH	N/A	1.5	0.107	
Wetland D	0.088	0.088	Riverine	E	N/A	2.0	0.044	
Wetland E	0.162	0.162	Riverine	E	N/A	2.0	0.081	
Wetland F	0.265	0.265	Riverine	RH	N/A	1.5	0.177	
Wetland G	0.132	0.138	Riverine	RH	N/A	1.5	0.092	
Wetland H	0.139	0.139	Riverine	E	N/A	2.0	0.070	
Wetland I	0.024	0.024	Riverine	E	N/A	2.0	0.012	
Wetland J	0.028	0.028	Riverine	E	N/A	2.0	0.014	
Wetland 1	N/A	0.087	Riverine	R	N/A	1.0	0.087	
Wetland 2	N/A	0.090	Riverine	R	N/A	1.0	0.090	
Wetland 3	N/A	0.227	Riverine	R	N/A	1.0	0.227	
Wetland 4	N/A	0.262	Riverine	R	N/A	1.0	0.262	

Project Credits

Restoration Level	Stream			Riparian Wetland		Non-Rip Wetland	Coastal Marsh
	Warm	Cool	Cold	Riverine	Non-Riverine		
Restoration[2]	3,404.000						
Re-establishment				0.666			
Rehabilitation				0.376			
Enhancement	104.000			0.286			
Enhancement II	1355.600						
Preservation							
Totals	**4,863.600**			**1.328**			

12.0 REFERENCES

Harman, W.H., et al. 1999. Bankfull Hydraulic Geometry Relationships for North Carolina

Montgomery County Department of Environmental Protection Division of Water Resources Management. 1996. *Rapid Stream Assessment Technique (RSAT) Field Methods.* Montgomery County, Maryland.

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

North Carolina Ecosystem Enhancement Program (EEP), 2009. Upper Yadkin River Basin Restoration Priorities. https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed_Planning/Yadkin_River_Basin/2009%20Upper%20Yadkin%20RBRP_Final%20Final%2C%2026feb%2709.pdf

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 Wildlife Resources Commission. 2015. North Carolina Wildlife Action Plan. Raleigh, NC. http://ncwildlife.org/Portals/0/Conserving/documents/2015WildlifeActionPlan/NC-WAP-2015-All-Documents.pdf

Rosgen, D. L. 1994. A classification of natural rivers. *Catena* 22:169-199.

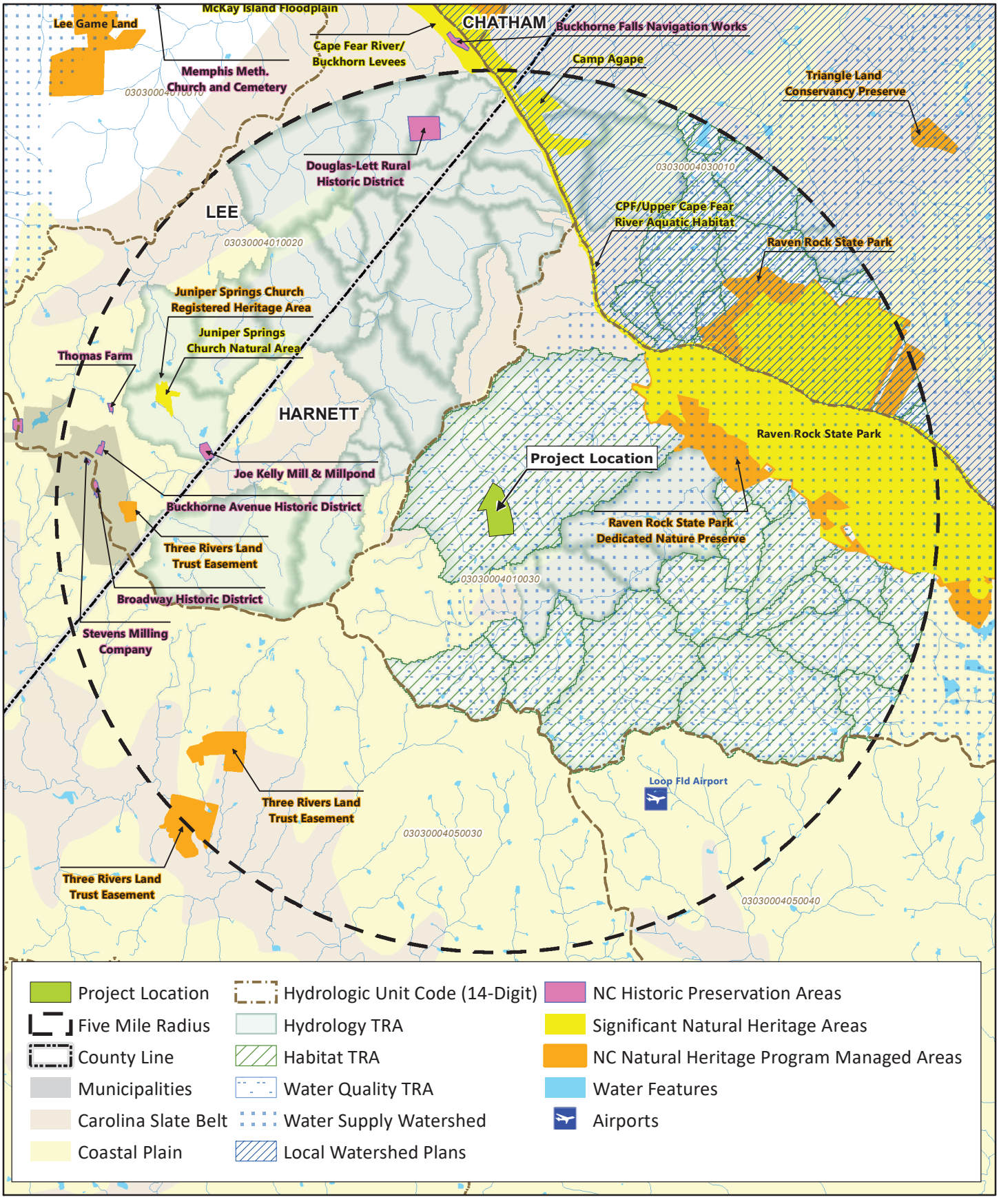
Rosgen, D.L. 2001. A stream channel stability assessment methodology. Proceedings of the Federal Interagency Sediment Conference, Reno, NV, March 2001.

Simon, A. 1989. A model of channel response in disturbed alluvial channels. Earth Surface Processes and Landforms 14(1):11-26.

United States Army Corps of Engineers (USACE). 2016. Federal Public Notice: Notification of Issuance of Guidance for Compensatory Stream and Wetland Mitigation Conducted for Wilmington District. October 24, 2016.

United States Fish and Wildlife Service (USFWS), 2014. Endangered Species, Threatened Species, Federal

Figures



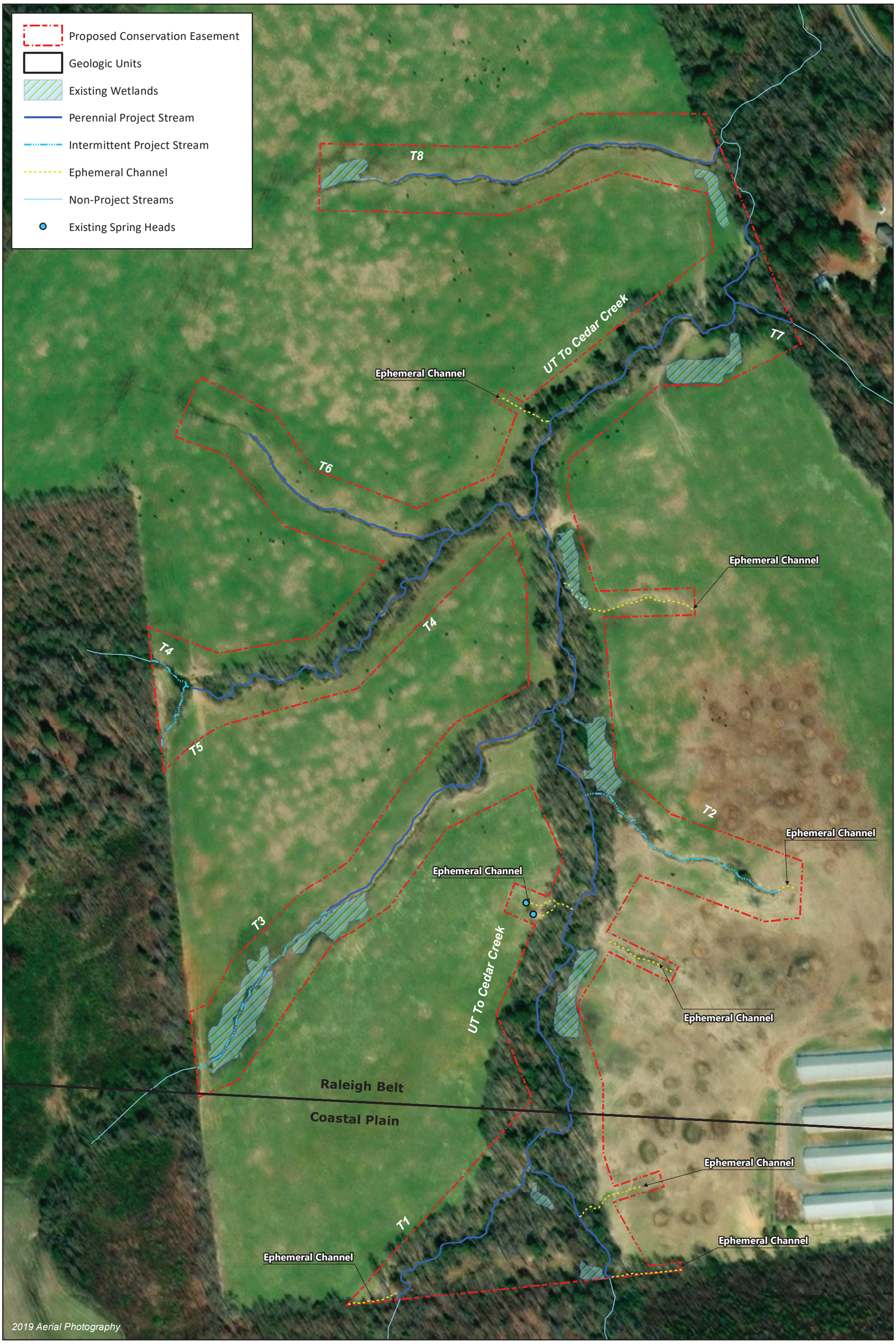
WILDLANDS ENGINEERING

0 0.75 1.5 Miles

N

Figure 1 Vicinity Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC



WILDLANDS ENGINEERING

0 175 350 Feet

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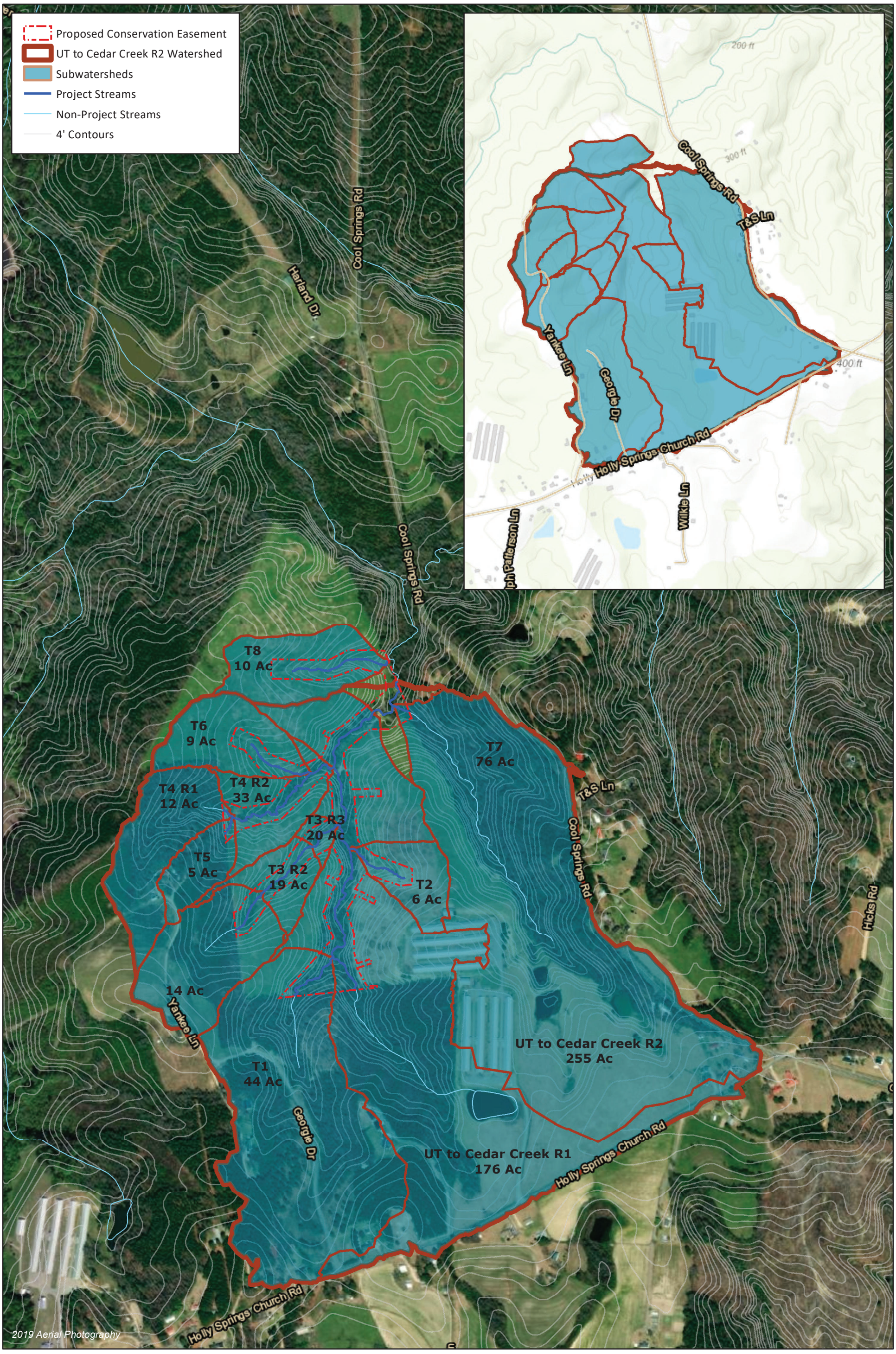
Figure 2 Site Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC



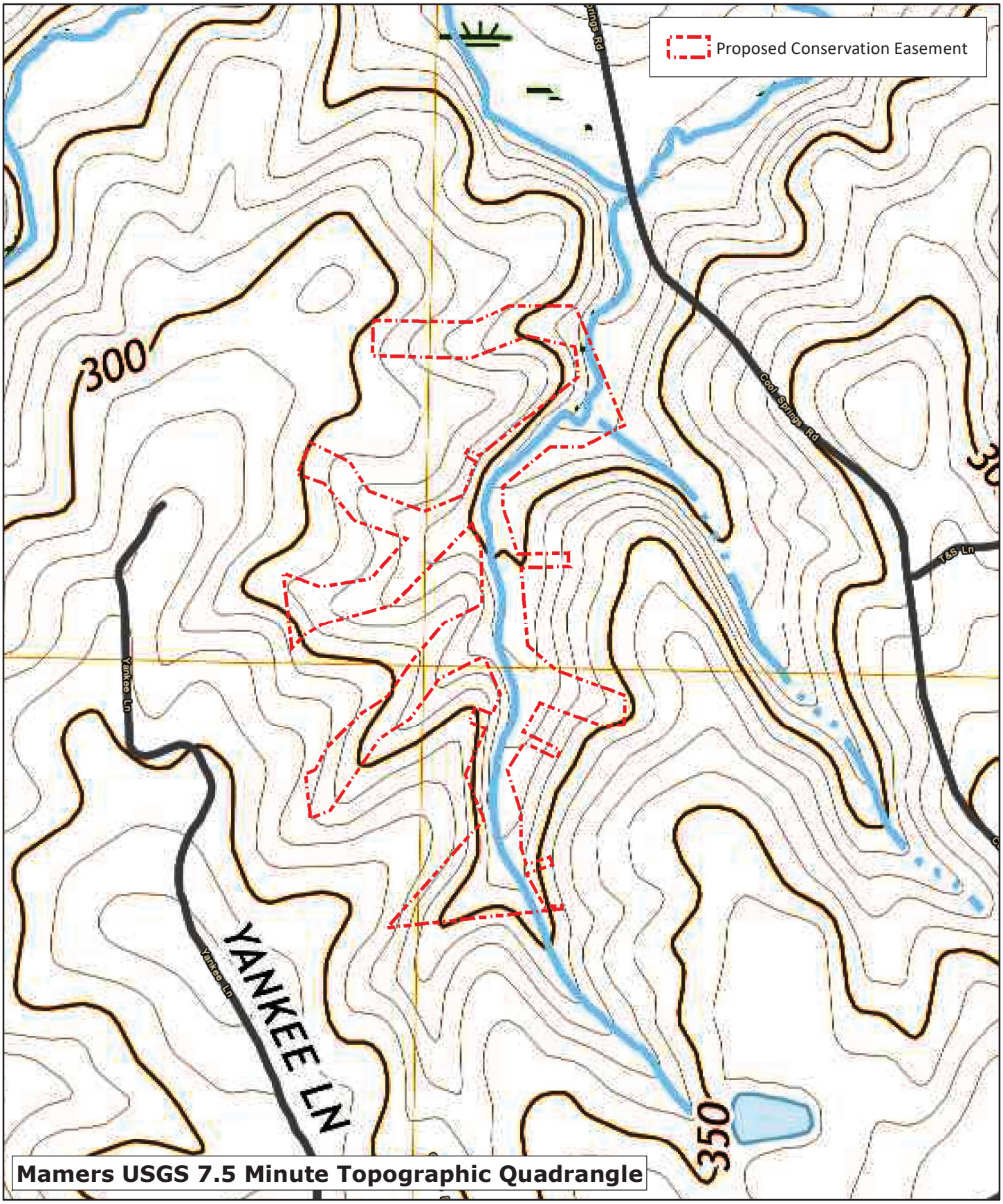
WILDLANDS ENGINEERING

0 600 1,200 Feet

N

Figure 3 Watershed Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC



WILDLANDS ENGINEERING

0 250 500 Feet

N

Figure 4 USGS Topographic Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC

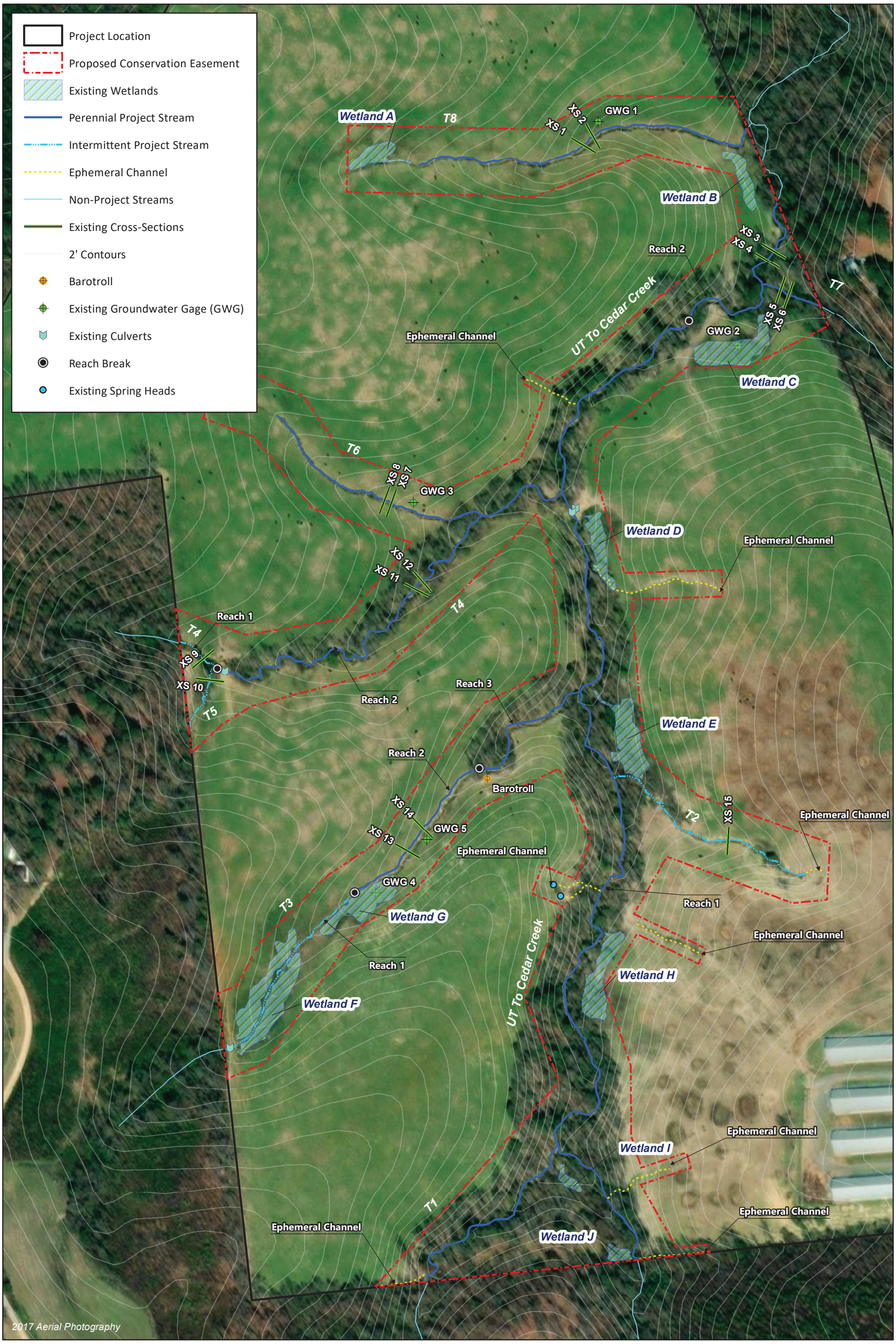
WILDLANDS ENGINEERING

0 175 350 Feet

N

Figure 5 Soils Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC



WILDLANDS ENGINEERING

0 175 350 Feet

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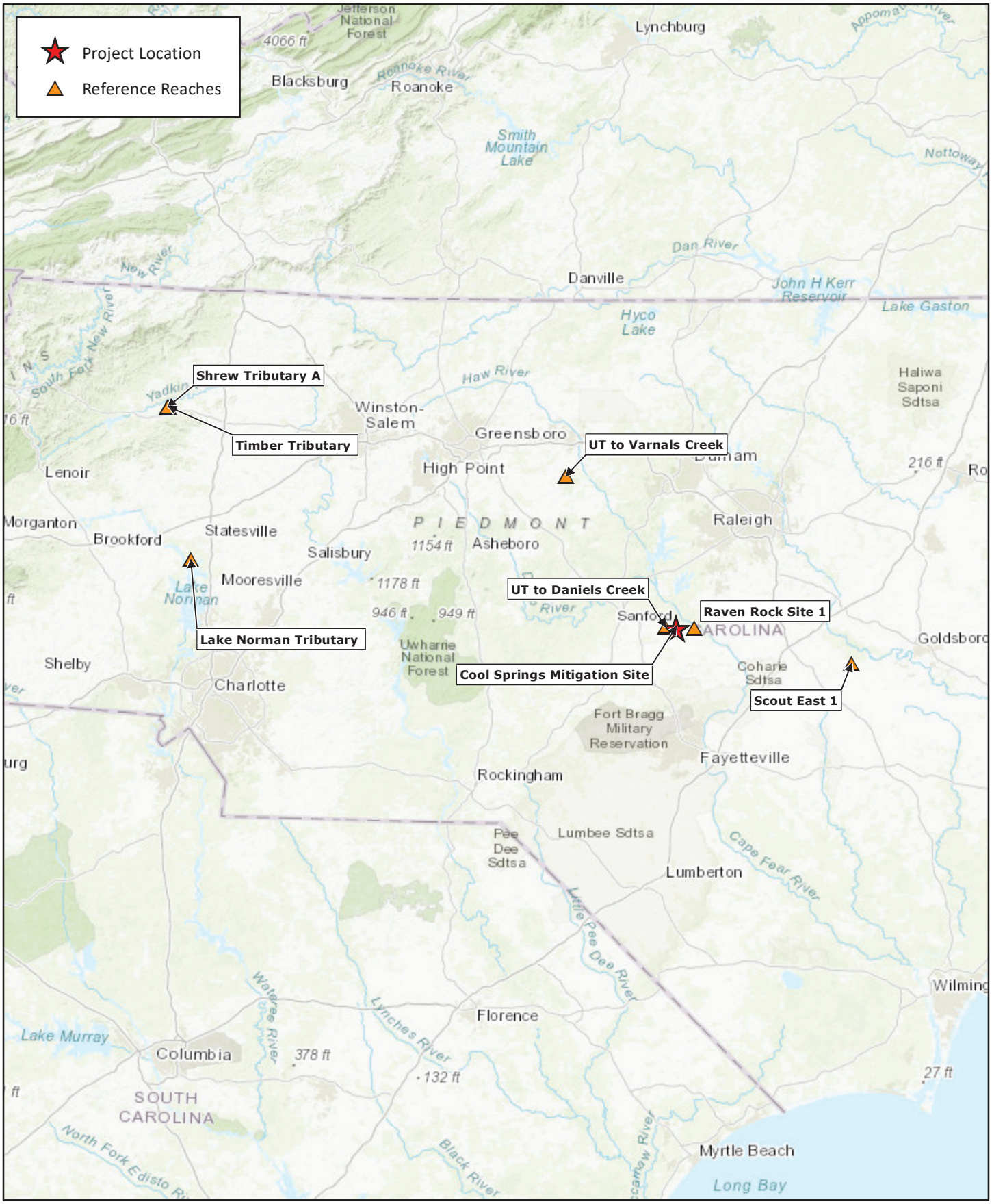
Figure 6 Existing Conditions Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC

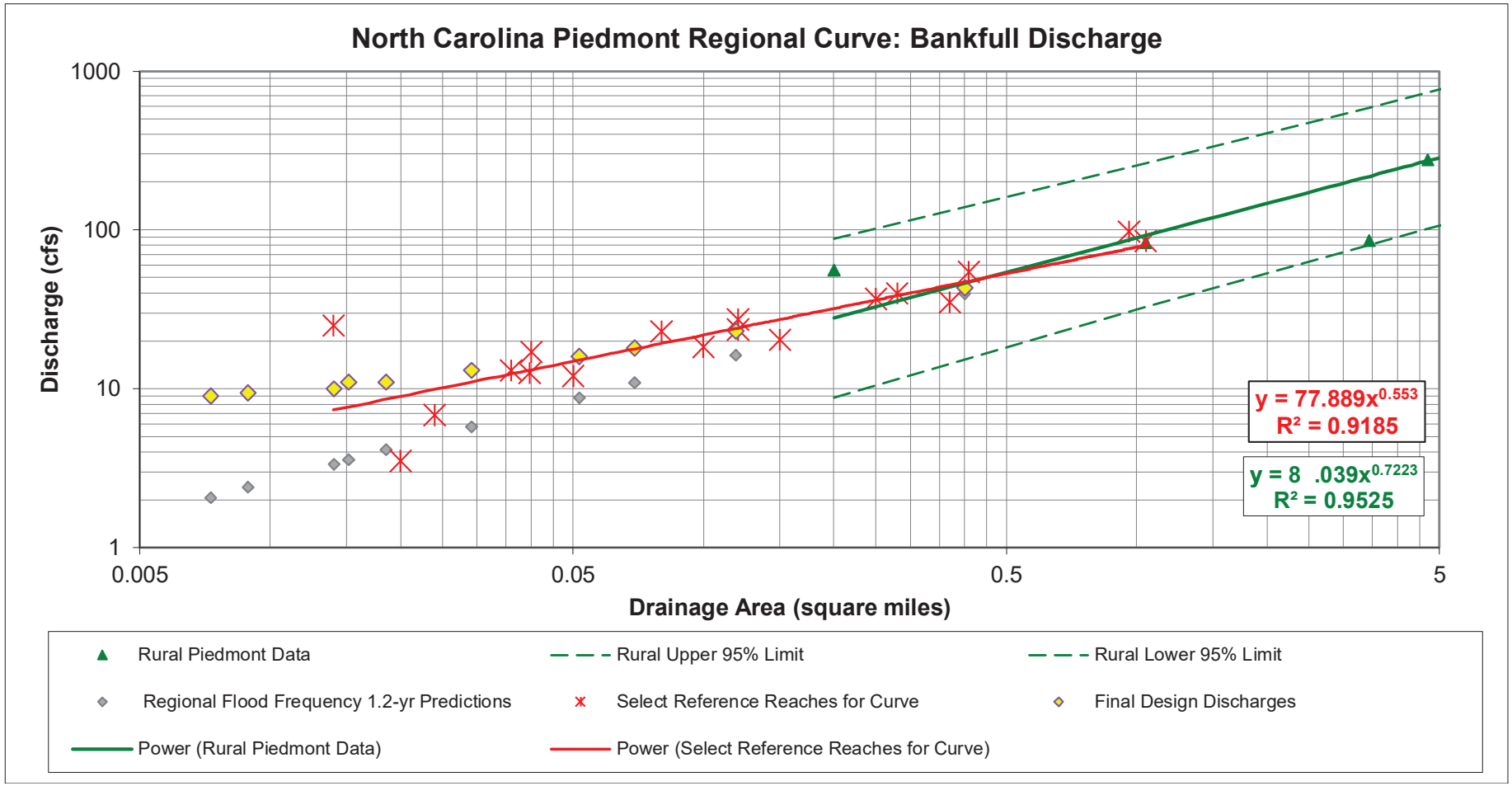


WILDLANDS ENGINEERING

0 15 30 Miles

Figure 7 Reference Reach Vicinity Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

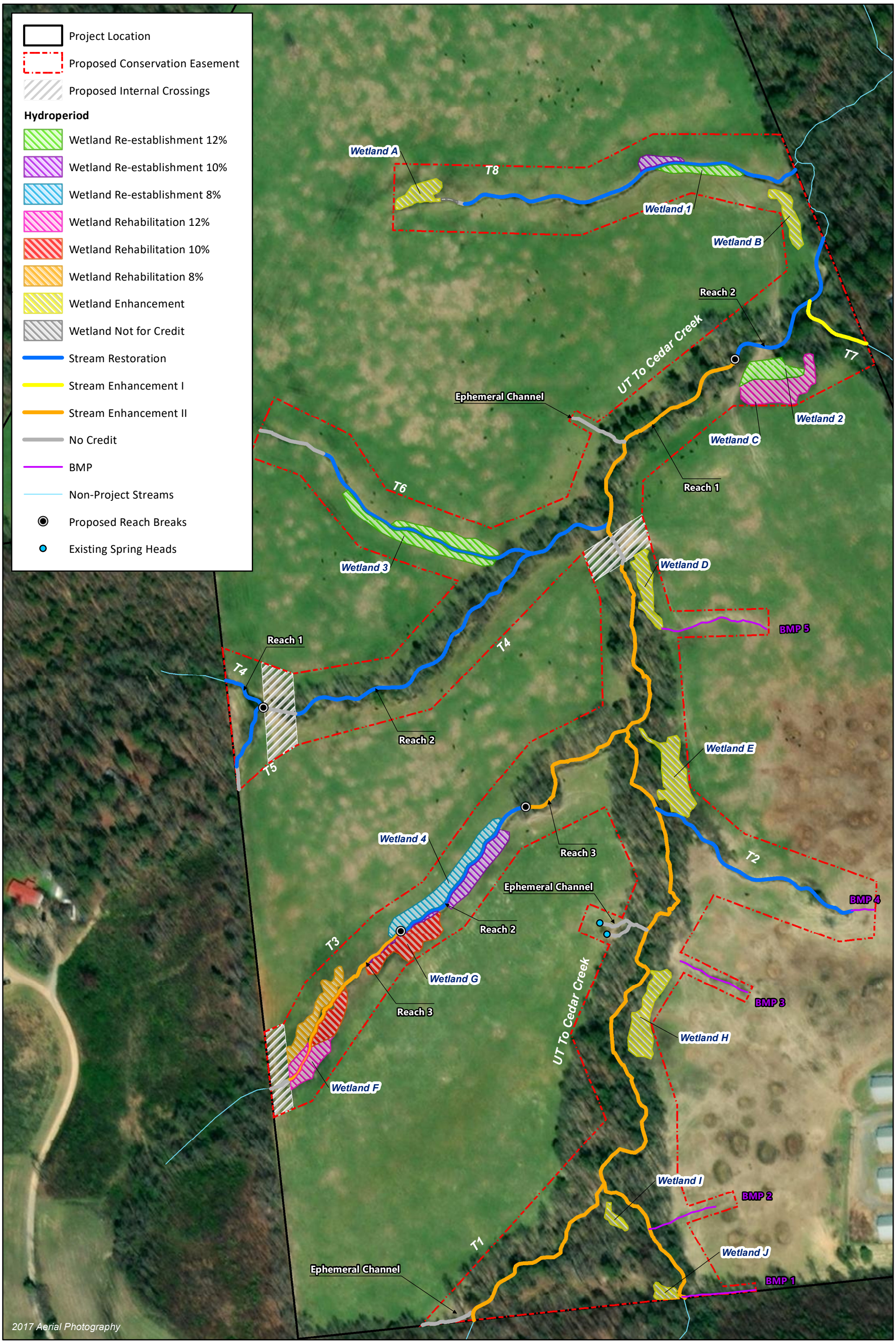
Harnett County, NC



WILDLANDS ENGINEERING

Figure 8 Discharge Analysis Graph
Cool Springs Mitigation Site
Cape Fear Basin 0303004

Harnett County, NC



WILDLANDS ENGINEERING

0 175 350 Feet

N

Figure 9 Concept Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC

Project Location
Proposed Conservation Easement
Proposed Internal Crossings
Stream Restoration
Stream Enhancement I
Stream Enhancement II
No Credit
BMP
Non-Project Streams
Proposed Cross Sections
Fixed Vegetation Plot
Random Vegetation Plot
Proposed Photo Points
Proposed Reach Breaks
Existing Spring Heads
Proposed Flow Gage
Proposed Crest Gage
Proposed Barotroll
Proposed Soil Temperature Probe
Proposed Groundwater Gage

Wetland A
T8
Wetland 1
Wetland B
Reach 2
UT To Cedar Creek
T7
Ephemeral Channel
Wetland 2
Wetland C
Reach 1
T6
Wetland 3
Wetland D
BMP 5
Reach 1
T4
T4
Reach 2
T5
Wetland E
Wetland 4
Reach 3
T2
Ephemeral Channel
Reach 2
BMP 4
T3
Wetland 5
Wetland G
Reach 3
UT To Cedar Creek
BMP 3
Wetland H
Wetland F
Wetland I
BMP 2
Ephemeral Channel
T1
Wetland J
BMP 1

2017 Aerial Photography

Hydroperiod

Wetland Re-establishment 12%
Wetland Re-establishment 10%
Wetland Re-establishment 8%
Wetland Rehabilitation 12%
Wetland Rehabilitation 10%
Wetland Rehabilitation 8%
Wetland Enhancement
Wetland Not for Credit

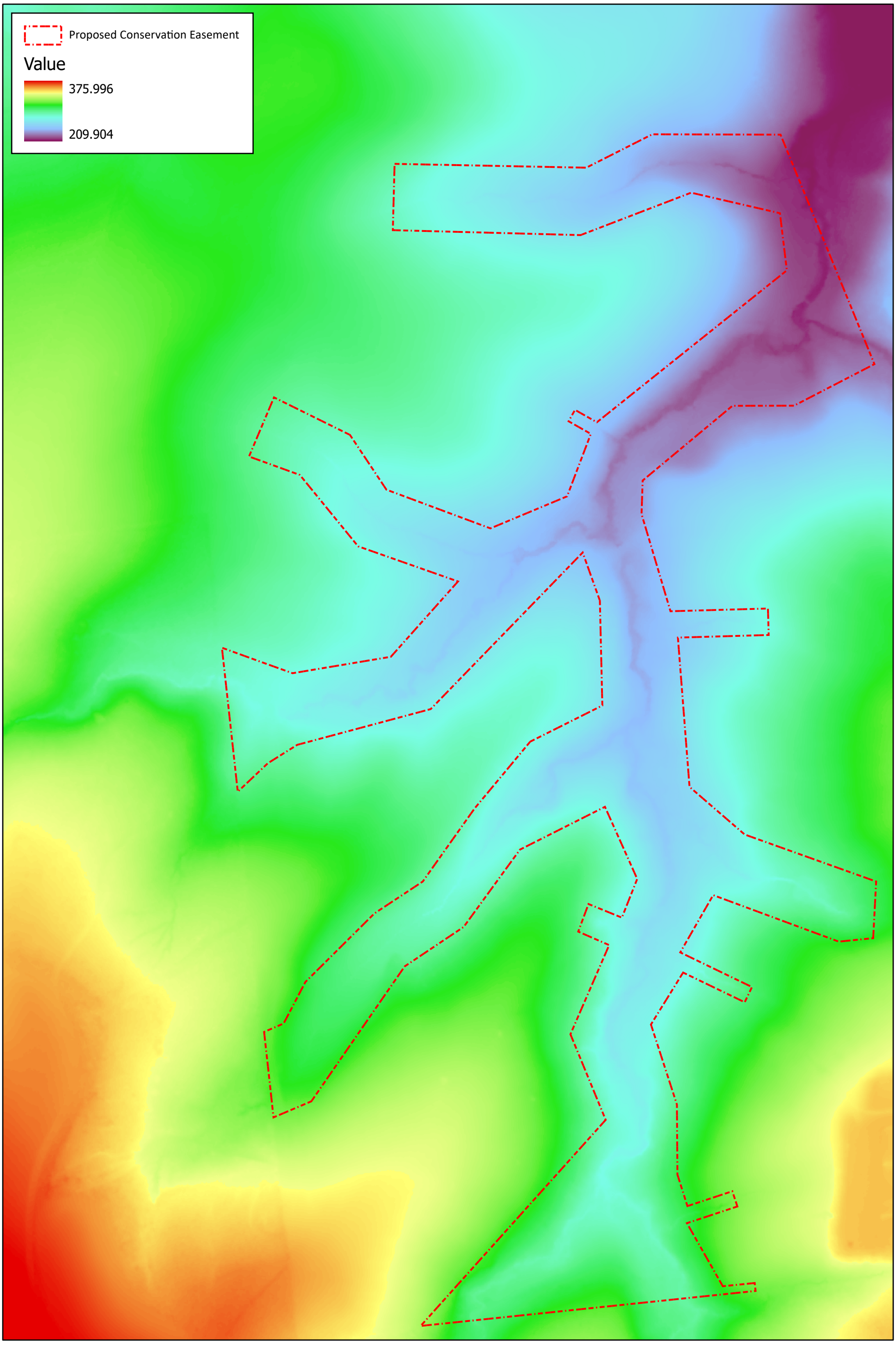
WILDLANDS ENGINEERING

0 175 350 Feet

N

Figure 10 Monitoring Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC



WILDLANDS ENGINEERING

0 175 350 Feet

N

Figure 11 LiDAR Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC

Appendix 1: Site Protection Instrument

Appendix 1 Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the parcels listed in Table 1. Parcels are optioned for easement purchase by Wildlands Engineering, Inc. (Wildlands). Upon transfer of lands to Wildlands, a conservation easement will be recorded on the parcels and includes streams and wetlands being restored and preserved along with their corresponding riparian buffers.

Table 1: Site Protection Instrument

Current Landowner	PIN	County	Under Option to Purchase by Wildlands?	Memorandum of Option Conservation Easement Deed Book (DB) and Page Number (PG)	Acreage to be Protected
Patterson and Sons, Inc.	0601-89-2857	Harnett	Yes	BK 3766 PG 252-255	21.12

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 2: Historic Aerials


INQUIRY #: 5999237.5
YEAR: 2016
= 500'
N
EDR

INQUIRY #: 5999237.5

YEAR: 2012

= 500'

N

EDR


INQUIRY #: 5999237.5
YEAR: 2009
= 500'
N
EDR


INQUIRY #: 5999237.5
YEAR: 2006
= 500'
N
EDR


INQUIRY #: 5999237.5
YEAR: 1998
= 750'
N
EDR

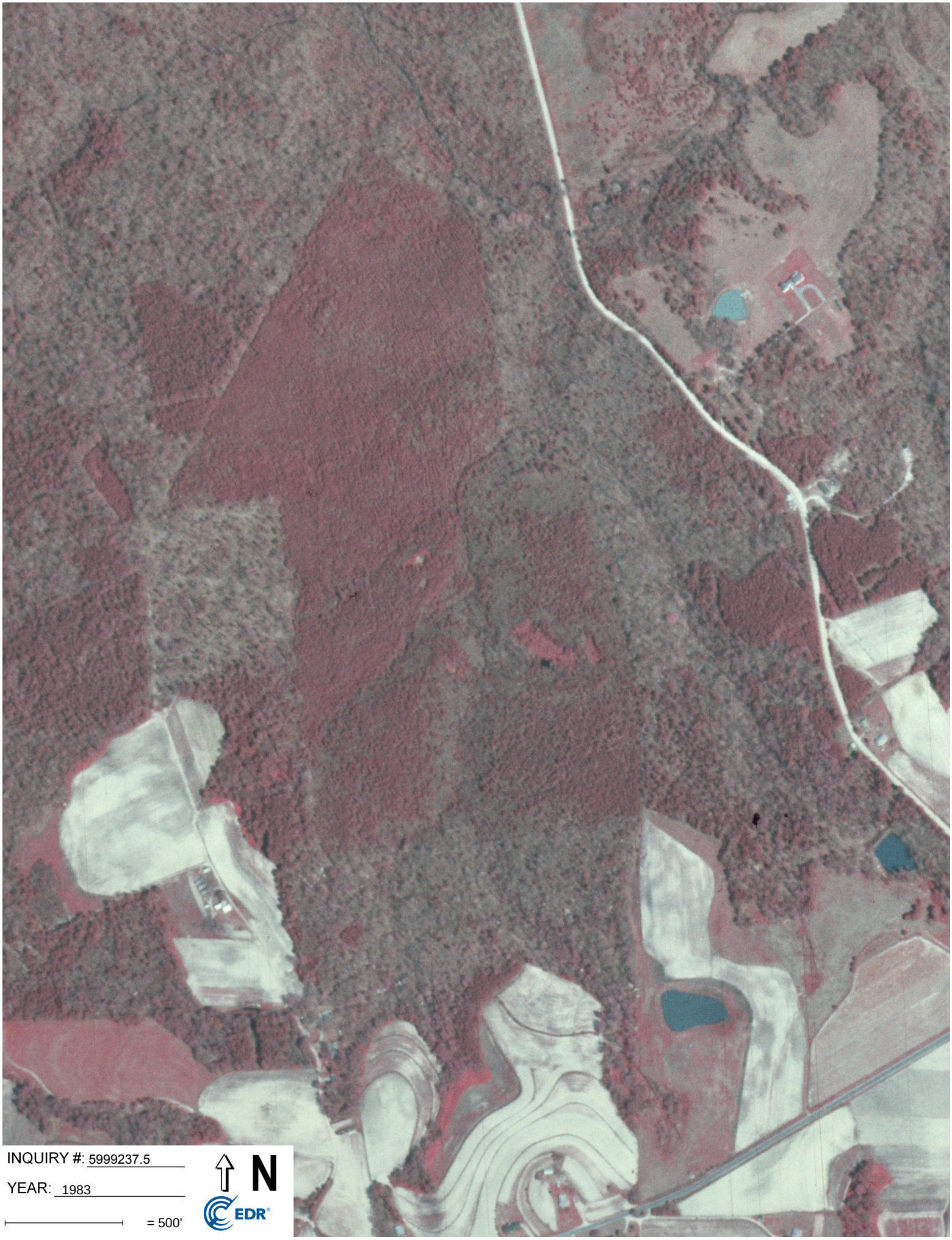
INQUIRY #: 5999237.5

YEAR: 1993

= 500'

N

EDR



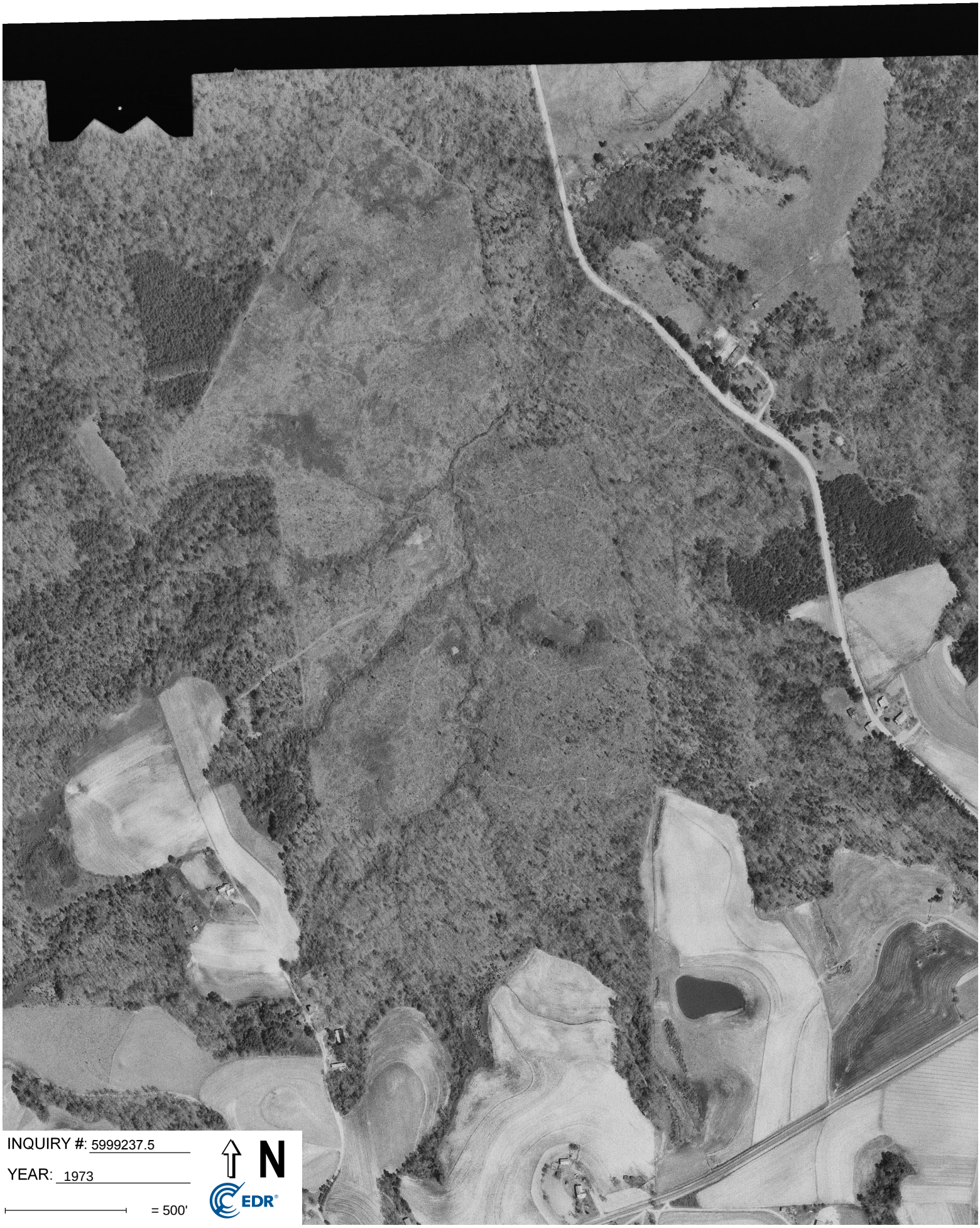
INQUIRY #: 5999237.5

YEAR: 1983

= 500'

N

EDR



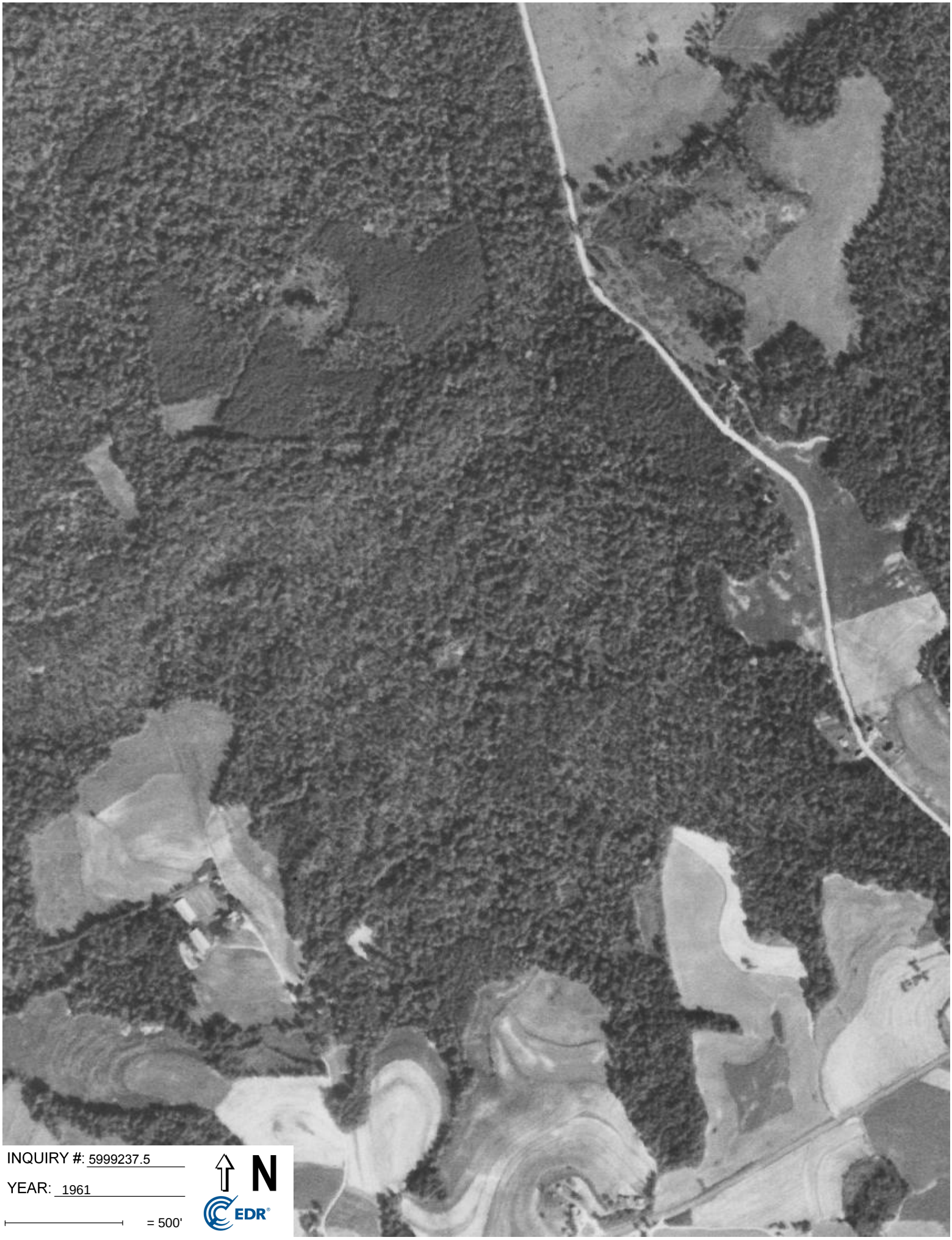
INQUIRY #: 5999237.5

YEAR: 1973

= 500'

N

EDR



INQUIRY #: 5999237.5

YEAR: 1961

= 500'

N

EDR

INQUIRY #: 5999237.5

YEAR: 1950

= 500'

N

EDR

Appendix 3: DWR, NCSM, and NCWAM Forms

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.451263
Evaluator: CW	**County:** Harnett	**Longitude:** -78.971359
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 44.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* UT to Cedar Creek

A. Geomorphology (Subtotal = 23.5)	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 = 9.5)				
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 = 11.5)				
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: Fish, Crayfish, Aquatic Beetles

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35,449300
Evaluator: CW	**County:** Harnett	**Longitude:** -78.972006
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* T1

A. Geomorphology (Subtotal = 19.5)

	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 = 8)

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: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.451178
Evaluator: CW	**County:** Harnett	**Longitude:** -78.970803
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 24.5	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* T2

A. Geomorphology (Subtotal = 12.5)	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 = 9.5)				
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 = 2.5)				
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:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.450463
Evaluator: CW	**County:** Harnett	**Longitude:** -78.973621
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27	**Stream Determination** (circle one) Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* T3 R1

A. Geomorphology (Subtotal = 12)	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)				
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	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: 11/16/20	Project/Site: Cool Springs	Latitude: 35.451527
Evaluator: CW	County: Harnett	Longitude: -78.972429
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 37.5	Stream Determination (circle one) Ephemeral Intermittent (Perennial)	Other *e.g. Quad Name:* T3 R2+R3

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	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 = 12.5)				
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:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.452182
Evaluator: CW	**County:** Harnett	**Longitude:** -78.974147
Total Points: 29 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* T4R1

A. Geomorphology (Subtotal = 12.5)	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 = 11)				
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 = 5.5)				
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:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.452310
Evaluator: CW	**County:** Harnett	**Longitude:** -78.972965
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 40	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** T4 R2 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 22)	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)				
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)				
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: Aquatic Beetles

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.451935
Evaluator: CW	**County:** Harnett	**Longitude:** -78.974121
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:* T5

A. Geomorphology (Subtotal = 13.5)	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 = 10)				
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 = 3.5)				
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:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.453071
Evaluator: CW	**County:** Harnett	**Longitude:** -78.973100
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* T6

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 = 11)				
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)				
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: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35,454124
Evaluator: CW	**County:** Harnett	**Longitude:** -78.970239
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 31	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* T7

A. Geomorphology (Subtotal = 15)	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 = 9.5)				
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:

NC DWQ Stream Identification Form Version 4.11

Date: 11/16/20	**Project/Site:** Cool Springs	**Latitude:** 35.455040
Evaluator: CW	**County:** Harnett	**Longitude:** -78.971405
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 35	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:* T8

A. Geomorphology (Subtotal = 19)	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 = 11)				
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	FACW = 0.75; OBL = 1.5 (Other = 0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Aquatic beetles

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.449353, -78.97195

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T1
10. Length of assessment reach evaluated (feet): 417
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 8
13. Is assessment reach a swamp stream? ○ Yes ☐ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
   - ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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 – 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.
( ) 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**MEDIUM**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	NA	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**MEDIUM**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**HIGH**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**MEDIUM**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**MEDIUM**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.452461, -78.972802

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T4R2
10. Length of assessment reach evaluated (feet): 856
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3.6 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 11.7
13. Is assessment reach a swamp stream? ○ Yes ☐ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
○ 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**HIGH**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**MEDIUM**	
(2) In-stream Habitat	**HIGH**	
(3) Baseflow	**HIGH**	
(3) Substrate	**HIGH**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.450633, -78.973461

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T3R1
10. Length of assessment reach evaluated (feet): 284
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 3
13. Is assessment reach a swamp stream? ○ Yes ○ No
14. Feature type: ○ Perennial flow ◉ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
◉ 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**MEDIUM**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**LOW**	**LOW**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**HIGH**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.451388, -78.972551

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T3R2
10. Length of assessment reach evaluated (feet): 337
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 7
13. Is assessment reach a swamp stream? ○ Yes ☐ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ○ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
(•) C	(•) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
(●) 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.451851, -78.971879

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T3R3
10. Length of assessment reach evaluated (feet): 273
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 5
13. Is assessment reach a swamp stream? ○ Yes ○ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
○ 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**MEDIUM**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**MEDIUM**	
(3) In-stream Habitat	**MEDIUM**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.452158, -78.973978

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T4R1
10. Length of assessment reach evaluated (feet): 75
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.7 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 5.2
13. Is assessment reach a swamp stream? ○ Yes ○ No
14. Feature type: ○ Perennial flow ◉ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ○ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
◉ 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(4) Channel Stability	**MEDIUM**	**MEDIUM**
(4) Sediment Transport	**HIGH**	**HIGH**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**LOW**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**MEDIUM**	**MEDIUM**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**HIGH**	**HIGH**
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.452017, -78.974011

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T5
10. Length of assessment reach evaluated (feet): 76
11. Channel depth from bed (in riffle, if present) to top of bank (feet): .75 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 4.5
13. Is assessment reach a swamp stream? ○ Yes ○ No
14. Feature type: ○ Perennial flow ◉ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 within assessment area (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 stream-side 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 – 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.
◉ 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Intermittent

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	**LOW**
(2) Baseflow	**HIGH**	**HIGH**
(2) Flood Flow	**LOW**	**LOW**
(3) Streamside Area Attenuation	**LOW**	**LOW**
(4) Floodplain Access	**MEDIUM**	**MEDIUM**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**LOW**	**LOW**
(4) Channel Stability	**LOW**	**LOW**
(4) Sediment Transport	**LOW**	**LOW**
(4) Stream Geomorphology	**LOW**	**LOW**
(2) Stream/Intertidal Zone Interaction	NA	NA
(2) Longitudinal Tidal Flow	NA	NA
(2) Tidal Marsh Stream Stability	NA	NA
(3) Tidal Marsh Channel Stability	NA	NA
(3) Tidal Marsh Stream Geomorphology	NA	NA
(1) Water Quality	**MEDIUM**	**MEDIUM**
(2) Baseflow	**HIGH**	**HIGH**
(2) Streamside Area Vegetation	**LOW**	**LOW**
(3) Upland Pollutant Filtration	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Indicators of Stressors	**YES**	**YES**
(2) Aquatic Life Tolerance	**HIGH**	NA
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**HIGH**	**HIGH**
(3) Substrate	**LOW**	**LOW**
(3) Stream Stability	**LOW**	**LOW**
(3) In-stream Habitat	**LOW**	**LOW**
(2) Stream-side Habitat	**LOW**	**LOW**
(3) Stream-side Habitat	**LOW**	**LOW**
(3) Thermoregulation	**LOW**	**LOW**
(2) Tidal Marsh In-stream Habitat	NA	NA
(3) Flow Restriction	NA	NA
(3) Tidal Marsh Stream Stability	NA	NA
(4) Tidal Marsh Channel Stability	NA	NA
(4) Tidal Marsh Stream Geomorphology	NA	NA
(3) Tidal Marsh In-stream Habitat	NA	NA
(2) Intertidal Zone Habitat	NA	NA
Overall	**LOW**	**LOW**

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.452986, -78.972819

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T6
10. Length of assessment reach evaluated (feet): 469
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 stream? ○ Yes ○ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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
- [x] 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).**

- [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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
(●) 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.454148, -78.970311

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T7
10. Length of assessment reach evaluated (feet): 143
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 17.2
13. Is assessment reach a swamp stream? ○ Yes ☐ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
○ 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb2
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**MEDIUM**	
(3) Substrate	**LOW**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**MEDIUM**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**MEDIUM**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.45503, -78.971047

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T8
10. Length of assessment reach evaluated (feet): 669
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.3 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 6.8
13. Is assessment reach a swamp stream? ○ Yes ☐ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
(•) 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb1
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.453692, -78.971403

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT to Cedar Creek R1
10. Length of assessment reach evaluated (feet): 2282
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 11
13. Is assessment reach a swamp stream? ○ Yes ○ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
( ) C	( ) C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 within assessment area (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 stream-side 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		Wooded		
LB	RB	LB	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		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	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.
( ) 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb2
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**MEDIUM**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**HIGH**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**HIGH**	
(2) In-stream Habitat	**HIGH**	
(3) Baseflow	**HIGH**	
(3) Substrate	**HIGH**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**HIGH**	
(2) Stream-side Habitat	**HIGH**	
(3) Stream-side Habitat	**MEDIUM**	
(3) Thermoregulation	**HIGH**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

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/Sketch" section if any 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): Cool Springs
2. Date of evaluation: 11/16/2020
3. Applicant/owner name: Wildlands Engineering
4. Assessor name/organization: C. Walker
5. County: Harnett
6. Nearest named water body on USGS 7.5-minute quad: Cedar Creek
7. River Basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.454461, -78.970336

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT to Cedar Creek R2
10. Length of assessment reach evaluated (feet): 321
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.3 ☐ Unable to assess channel depth.
12. Channel width at top of bank (feet): 22.7
13. Is assessment reach a swamp stream? ○ Yes ○ No
14. Feature type: ◉ Perennial flow ○ Intermittent flow ○ Tidal Marsh Stream

STREAM RATING 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 appy 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 adversely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impounded on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates).
- ◉ 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 the "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
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 riffles 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 Size 4 Coastal Plain streams and 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
☐	☐	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
○ C	○ C	Severe alteration to water storage capacity over a majority of the streamside area (examples include: 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 that passes some flow during low-flow periods within assessment area (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 stream-side 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 – 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.
( ) 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 a 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 Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Cool Springs
Date of Evaluation: 11/16/2020
Stream Category: Pb2
Assessor Name/Organization: C. Walker

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**HIGH**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**MEDIUM**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	**LOW**	

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Cool Springs Mitigation Site	Date of Evaluation	11/20/2020
Applicant/Owner Name	Wildlands Engineering Inc.	Wetland Site Name	Wetlands A, B, C
Wetland Type	Headwater Forest	Assessor Name/Organization	C.Walker (WEI)
Level III Ecoregion	Piedmont	Nearest Named Water Body	Cedar Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Harnett	NCDWR Region	Fayetteville
○ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ○ Yes ◉ No If Yes, check all that apply to the assessment area.

- ☐ Anadromous fish
- ☐ Federally protected species or State endangered or threatened species
- ☐ NCDWR riparian buffer rule in effect
- ☐ Abuts a Primary Nursery Area (PNA)
- ☐ Publicly owned property
- ☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- ☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- ☐ Designated NCNHP reference community
- ☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

- ○ Blackwater
- ◉ Brownwater
- ☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ○ Yes ◉ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
○ A	○ A	Not severely altered
◉ B	◉ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
◉ A	○ A	Water storage capacity and duration are not altered.
○ B	◉ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
○ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	○ C	○ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	◉ D	◉ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ◉ B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ◉ A Soil ribbon < 1 inch
- ○ B Soil ribbon ≥ 1 inch

4c.
- ◉ A No peat or muck presence
- ○ B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
◉ A	◉ A	Little or no evidence of pollutants or discharges entering the assessment area
○ B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☐ A	☐ A	≥ 10% impervious surfaces
☑ B	☑ B	☑ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☑ D	☐ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☑ E	☐ E	☐ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☐ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent dainage and/or overbank flow from affectio the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ◉ D From 5 to < 15 feet
- ○ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
◉ ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ◉ No

7e. Is tributary or other open water sheltered or exposed?
- ◉ Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
○ G	◉ G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

- ○ A Evidence of short-duration inundation (< 7 consecutive days)
- ◉ B Evidence of saturation, without evidence of inundation
- ○ C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

- ◉ A Sediment deposition is not excessive, but at approximately natural levels.
- ○ B Sediment deposition is excessive, but not overwhelming the wetland.
- ○ C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
○ A	○ A	○ A	≥ 500 acres
○ B	○ B	○ B	From 100 to < 500 acres
○ C	○ C	○ C	From 50 to < 100 acres
○ D	○ D	○ D	From 25 to < 50 acres
○ E	○ E	○ E	From 10 to < 25 acres
○ F	○ F	○ F	From 5 to < 10 acres
○ G	○ G	○ G	From 1 to < 5 acres
◉ H	◉ H	○ H	From 0.5 to < 1 acre
○ I	○ I	○ I	From 0.1 to < 0.5 acre
○ J	○ J	◉ J	From 0.01 to < 0.1 acre
○ K	○ K	○ K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

- ○ A Pocosin is the full extent (≥ 90%) of its natural landscape size.
- ○ B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
○ A	○ A	≥ 500 acres
○ B	○ B	From 100 to < 500 acres
○ C	○ C	From 50 to < 100 acres
○ D	○ D	From 10 to < 50 acres
○ E	◉ E	< 10 acres
◉ F	○ F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

○ Yes ○ No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."

- ○ A 0
- ◉ B 1 to 4
- ○ C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

- ○ A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
- ◉ B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
- ○ C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

- ○ A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
- ○ B Vegetation diversity is low or has > 10% to 50% cover of exotics.
- ○ C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

(•) Yes ( ) No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

( ) A ≥ 25% coverage of vegetation
( ) B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	( ) A	( ) A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	( ) B	( ) B	Canopy present, but opened more than natural gaps
	(•) C	(•) C	Canopy sparse or absent
Mid-Story	( ) A	( ) A	Dense mid-story/sapling layer
	( ) B	( ) B	Moderate density mid-story/sapling layer
	(•) C	(•) C	Mid-story/sapling layer sparse or absent
Shrub	( ) A	( ) A	Dense shrub layer
	( ) B	( ) B	Moderate density shrub layer
	(•) C	(•) C	Shrub layer sparse or absent
Herb	( ) A	( ) A	Dense herb layer
	(•) B	(•) B	Moderate density herb layer
	( ) C	( ) C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

( ) A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
(•) B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

( ) A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
( ) B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
(•) C Majority of canopy trees are < 6 inches DBH or no trees.

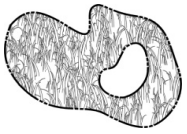
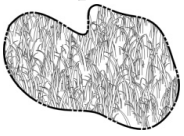
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.

( ) A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
(•) B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

( ) A 
( ) B 
( ) C 
( ) D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

( ) A Overbank and overland flow are not severely altered in the assessment area.
(•) B Overbank flow is severely altered in the assessment area.
( ) C Overland flow is severely altered in the assessment area.
( ) D Both overbank and overland flow are severely altered in the assessment area.

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands A, B, C	Date	11/20/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	C.Walker (WEI)

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Physical Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:		NCDWR #:	
Project Name	Cool Springs Mitigation Site	Date of Evaluation	11/20/2020
Applicant/Owner Name	Wildlands Engineering Inc.	Wetland Site Name	Wetlands D, E, H, I, and J
Wetland Type	Headwater Forest	Assessor Name/Organization	C.Walker (WEI)
Level III Ecoregion	Piedmont	Nearest Named Water Body	Cedar Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Harnett	NCDWR Region	Fayetteville
○ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ○ Yes ◉ No If Yes, check all that apply to the assessment area.

- ☐ Anadromous fish
- ☐ Federally protected species or State endangered or threatened species
- ☐ NCDWR riparian buffer rule in effect
- ☐ Abuts a Primary Nursery Area (PNA)
- ☐ Publicly owned property
- ☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- ☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- ☐ Designated NCNHP reference community
- ☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

- ○ Blackwater
- ◉ Brownwater
- ☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ◉ Yes ○ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
◉ A	○ A	Not severely altered
○ B	◉ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
◉ A	○ A	Water storage capacity and duration are not altered.
○ B	◉ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
○ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	◉ C	◉ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	○ D	○ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ◉ B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ○ A Soil ribbon < 1 inch
- ◉ B Soil ribbon ≥ 1 inch

4c.
- ◉ A No peat or muck presence
- ○ B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
◉ A	◉ A	Little or no evidence of pollutants or discharges entering the assessment area
○ B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☐ A	☐ A	≥ 10% impervious surfaces
☑ B	☑ B	☑ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☑ D	☑ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☑ E	☑ E	☐ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☐ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent dainage and/or overbank flow from affectio the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ◉ D From 5 to < 15 feet
- ○ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
◉ ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ◉ No

7e. Is tributary or other open water sheltered or exposed?
- ◉ Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
◉ G	◉ G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

- ○ A Evidence of short-duration inundation (< 7 consecutive days)
- ◉ B Evidence of saturation, without evidence of inundation
- ○ C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

- ◉ A Sediment deposition is not excessive, but at approximately natural levels.
- ○ B Sediment deposition is excessive, but not overwhelming the wetland.
- ○ C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
○ A	○ A	○ A	≥ 500 acres
○ B	○ B	○ B	From 100 to < 500 acres
○ C	○ C	○ C	From 50 to < 100 acres
○ D	○ D	○ D	From 25 to < 50 acres
○ E	○ E	○ E	From 10 to < 25 acres
○ F	○ F	○ F	From 5 to < 10 acres
○ G	○ G	○ G	From 1 to < 5 acres
○ H	○ H	○ H	From 0.5 to < 1 acre
○ I	○ I	○ I	From 0.1 to < 0.5 acre
◉ J	◉ J	○ J	From 0.01 to < 0.1 acre
○ K	○ K	◉ K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

- ○ A Pocosin is the full extent (≥ 90%) of its natural landscape size.
- ○ B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
○ A	○ A	≥ 500 acres
○ B	○ B	From 100 to < 500 acres
○ C	○ C	From 50 to < 100 acres
○ D	○ D	From 10 to < 50 acres
○ E	○ E	< 10 acres
◉ F	◉ F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

○ Yes ○ No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."

- ○ A 0
- ◉ B 1 to 4
- ○ C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

- ○ A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
- ◉ B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
- ○ C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

- ○ A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
- ○ B Vegetation diversity is low or has > 10% to 50% cover of exotics.
- ○ C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

(•) Yes ( ) No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

( ) A ≥ 25% coverage of vegetation
( ) B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	( ) A	( ) A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	( ) B	( ) B	Canopy present, but opened more than natural gaps
	(•) C	(•) C	Canopy sparse or absent
Mid-Story	( ) A	( ) A	Dense mid-story/sapling layer
	( ) B	( ) B	Moderate density mid-story/sapling layer
	(•) C	(•) C	Mid-story/sapling layer sparse or absent
Shrub	( ) A	( ) A	Dense shrub layer
	( ) B	( ) B	Moderate density shrub layer
	(•) C	(•) C	Shrub layer sparse or absent
Herb	( ) A	( ) A	Dense herb layer
	(•) B	(•) B	Moderate density herb layer
	( ) C	( ) C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

( ) A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
(•) B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

( ) A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
( ) B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
(•) C Majority of canopy trees are < 6 inches DBH or no trees.

20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.

( ) A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
(•) B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

( ) A (•) B ( ) C ( ) D

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

( ) A Overbank and overland flow are not severely altered in the assessment area.
(•) B Overbank flow is severely altered in the assessment area.
( ) C Overland flow is severely altered in the assessment area.
( ) D Both overbank and overland flow are severely altered in the assessment area.

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands D, E, H, I, and J	Date	11/20/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	C.Walker (WEI)

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**MEDIUM**
Water Quality	Pathogen Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	Physical Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:		NCDWR #:	
Project Name	Cool Springs Mitigation Site	Date of Evaluation	11/20/2020
Applicant/Owner Name	Wildlands Engineering Inc.	Wetland Site Name	Wetlands F and G
Wetland Type	Headwater Forest	Assessor Name/Organization	C.Walker (WEI)
Level III Ecoregion	Piedmont	Nearest Named Water Body	Cedar Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030004
County	Harnett	NCDWR Region	Fayetteville
○ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations - Were regulatory considerations evaluated? ☐ Yes ◉ No If Yes, check all that apply to the assessment area.

- ☐ Anadromous fish
- ☐ Federally protected species or State endangered or threatened species
- ☐ NCDWR riparian buffer rule in effect
- ☐ Abuts a Primary Nursery Area (PNA)
- ☐ Publicly owned property
- ☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
- ☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
- ☐ Designated NCNHP reference community
- ☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

- ○ Blackwater
- ◉ Brownwater
- ☐ Tidal (if tidal, check one of the following boxes) ○ Lunar ○ Wind ○ Both

Is the assessment area on a coastal island? ○ Yes ◉ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ○ Yes ◉ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ○ Yes ◉ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric
Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence of an effect.

GS	VS	
◉ A	○ A	Not severely altered
○ B	◉ B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
○ A	○ A	Water storage capacity and duration are not altered.
○ B	◉ B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
◉ C	○ C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	○ A	○ A	Majority of wetland with depressions able to pond water > 1 foot deep
	○ B	○ B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	○ C	○ C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	◉ D	◉ D	Depressions able to pond water < 3 inches deep

3b.	○ A	Evidence that maximum depth of inundation is greater than 2 feet
	○ B	Evidence that maximum depth of inundation is between 1 and 2 feet
	◉ C	Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ○ A Sandy soil
- ◉ B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ○ C Loamy or clayey soils not exhibiting redoximorphic features
- ○ D Loamy or clayey gleyed soil
- ○ E Histosol or histic epipedon

4b.
- ◉ A Soil ribbon < 1 inch
- ○ B Soil ribbon ≥ 1 inch

4c.
- ◉ A No peat or muck presence
- ○ B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
◉ A	◉ A	Little or no evidence of pollutants or discharges entering the assessment area
○ B	○ B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
○ C	○ C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
☐ A	☐ A	☐ A	≥ 10% impervious surfaces
☑ B	☑ B	☑ B	Confined animal operations (or other local, concentrated source of pollutants)
☑ C	☑ C	☑ C	≥ 20% coverage of pasture
☑ D	☑ D	☐ D	≥ 20% coverage of agricultural land (regularly plowed land)
☑ E	☑ E	☐ E	≥ 20% coverage of maintained grass/herb
☐ F	☐ F	☐ F	≥ 20% coverage of clear-cut land
☐ G	☐ G	☐ G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent dainage and/or overbank flow from affectio the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

7b. How much of the first 50 feet from the bank is weltand? (Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ◉ D From 5 to < 15 feet
- ○ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
◉ ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
○ Yes ◉ No

7e. Is tributary or other open water sheltered or exposed?
- ◉ Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
- ○ Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
○ A	○ A	≥ 100 feet
○ B	○ B	From 80 to < 100 feet
○ C	○ C	From 50 to < 80 feet
○ D	○ D	From 40 to < 50 feet
○ E	○ E	From 30 to < 40 feet
○ F	○ F	From 15 to < 30 feet
◉ G	◉ G	From 5 to < 15 feet
○ H	○ H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

- ○ A Evidence of short-duration inundation (< 7 consecutive days)
- ◉ B Evidence of saturation, without evidence of inundation
- ○ C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

- ◉ A Sediment deposition is not excessive, but at approximately natural levels.
- ○ B Sediment deposition is excessive, but not overwhelming the wetland.
- ○ C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
○ A	○ A	○ A	≥ 500 acres
○ B	○ B	○ B	From 100 to < 500 acres
○ C	○ C	○ C	From 50 to < 100 acres
○ D	○ D	○ D	From 25 to < 50 acres
○ E	○ E	○ E	From 10 to < 25 acres
○ F	○ F	○ F	From 5 to < 10 acres
○ G	○ G	○ G	From 1 to < 5 acres
○ H	○ H	○ H	From 0.5 to < 1 acre
○ I	○ I	○ I	From 0.1 to < 0.5 acre
◉ J	◉ J	○ J	From 0.01 to < 0.1 acre
○ K	○ K	◉ K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

- ○ A Pocosin is the full extent (≥ 90%) of its natural landscape size.
- ○ B Pocosin is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column). Involves a GIS effort with field adjustment.** This evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, fields (pasture open and agriculture), or water > 300 feet wide.

Well	Loosely	
○ A	○ A	≥ 500 acres
○ B	○ B	From 100 to < 500 acres
○ C	○ C	From 50 to < 100 acres
○ D	○ D	From 10 to < 50 acres
○ E	◉ E	< 10 acres
◉ F	○ F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

○ Yes ○ No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directiions? If the assessment area is clear-cut, select option "C."

- ○ A 0
- ◉ B 1 to 4
- ○ C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

- ○ A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
- ○ B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
- ◉ C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

- ◉ A Vegetation diversity is high and is composed primarily of native species (<10% cover of exotics).
- ○ B Vegetation diversity is low or has > 10% to 50% cover of exotics.
- ○ C Vegetation is dominated by exotic species (>50% cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?

(•) Yes ( ) No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.

( ) A ≥ 25% coverage of vegetation
( ) B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	( ) A	( ) A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	(•) B	(•) B	Canopy present, but opened more than natural gaps
	(•) C	( ) C	Canopy sparse or absent
Mid-Story	( ) A	( ) A	Dense mid-story/sapling layer
	( ) B	(•) B	Moderate density mid-story/sapling layer
	(•) C	( ) C	Mid-story/sapling layer sparse or absent
Shrub	( ) A	( ) A	Dense shrub layer
	( ) B	( ) B	Moderate density shrub layer
	(•) C	(•) C	Shrub layer sparse or absent
Herb	( ) A	( ) A	Dense herb layer
	(•) B	(•) B	Moderate density herb layer
	( ) C	( ) C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

( ) A Large snags (more than one) are visible (> 12-inches DBH, or large relative to species present and landscape stability).
(•) B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

( ) A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
(•) B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12-inch DBH.
( ) C Majority of canopy trees are < 6 inches DBH or no trees.

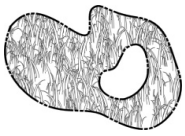
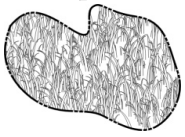
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.

( ) A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
(•) B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

( ) A 
( ) B 
( ) C 
(•) D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.

(•) A Overbank and overland flow are not severely altered in the assessment area.
( ) B Overbank flow is severely altered in the assessment area.
( ) C Overland flow is severely altered in the assessment area.
( ) D Both overbank and overland flow are severely altered in the assessment area.

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetlands F and G	Date	11/20/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	C.Walker (WEI)

Notes on Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-Surface Storage and Retention	Condition	**HIGH**
Water Quality	Pathogen Change	Condition	**HIGH**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**HIGH**
		Opportunity Presence? (Y/N)	**YES**
	Physical Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**YES**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**LOW**

Function Rating Summary

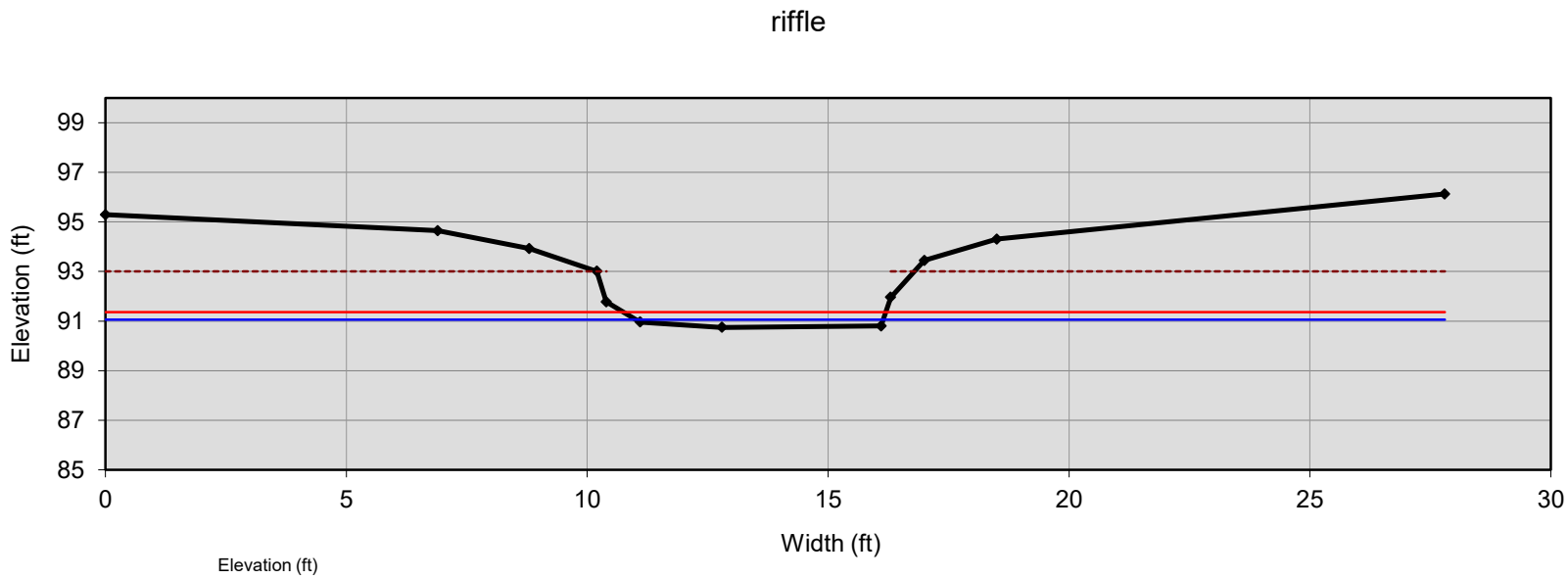
Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**HIGH**
	Opportunity Presence? (Y/N)	**YES**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

Appendix 4: Supplementary Design Information

Proposed Geomorphic Parameters																								
Parameter	Notation	Units	UT to Cedar Creek R1		UT to Cedar Creek R2		T1		T2		T3 R2		T4 R1		T4 R2		T5		T6		T7		T8	
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
stream type			C4/B4c		C4/B4c		B4/B4a		A4/B4a		B4/B4a		B4/B4a		B4/B4a		A4/B4a		A4/B4a		B4/C4b		A4/B4a	
drainage area	DA	sq. mi.	0.40		0.40		0.069		0.0089		0.03		0.02		0.05		0.01		0.01		0.12		0.02	
bankfull design discharge	Q_{bkf}	cfs	43		43		18		9.4		13		11		16		9		10		23		11	
bankfull cross-sectional area	v_{bkf}	sq. ft.	20.0		10.7		5.2		2.2		2.9		2.7		3.7		1.8		2.4		6.5		2.5	
average velocity during bankfull event	v_{bkf}	fps	7.7		4.0		4.6		4.4		4.4		3.9		4.4		4.4		4.2		3.7		4.4	
width at bankfull	w_{bkf}	feet	16.0		12.5		8.5		5.4		6.3		6.0		7.0		5.0		5.8		9.5		6.0	
mean depth at bankfull	d_{bkf}	feet	1.3		0.9		0.6		0.4		0.5		0.5		0.5		0.4		0.4		0.7		0.4	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		13.0		15.0		14.0		14.0		14.0		13.0		13.0		14.0		14.0		14.0		14.0	
maximum depth at bankfull	d_{max}	feet	1.5	1.9	1.0	1.3	0.7	0.9	0.5	0.6	0.6	0.7	0.5	0.7	0.6	0.8	0.4	0.5	0.5	0.6	0.8	1.0	0.5	0.6
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5	1.2	1.5
bank height ratio	BHR		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
floodprone area width	w_{fpa}	feet	35	80	28	63	12	19	8	12	9	14	8	13	10	15	7	11	8	13	21	48	8	13
entrenchment ratio	ER		2.2	5.0	2.2	5.0	1.4	2.2	1.4	2.2	1.4	2.2	1.4	2.2	1.4	2.2	1.4	2.2	1.4	2.2	2.2	5.0	1.4	2.2
valley slope	S_{valley}	feet/ foot	0.0301		0.0187		0.0410		0.0845		0.0583		0.0445		0.0445		0.0935		0.0712		0.0359		0.0747	
channel slope	$S_{channel}$	feet/ foot	0.0232	0.0251	0.0144	0.0156	0.0	0.0	0.0704	0.0768	0.0486	0.0530	0.0371	0.0405	0.0371	0.0405	0.078	0.085	0.059	0.065	0.030	0.033	0.062	0.068
riffle slope	S_{riffle}	feet/ foot	0.0348	0.0753	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.1	0.0371	0.0809	0.0	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.1
riffle slope ratio	$S_{riffle}/S_{channel}$		1.5000	3.0000	1.5	3.0	1.0	1.8	1.0	1.8	1.0	1.8	1.0	2.0	1.0	2.0	1.0	1.8	1.0	1.8	1.0	2.0	1.0	1.8
pool slope	S_{pool}	feet/ foot	0.0	0.0100	0.0	0.0062	0.0	0.0149	0.0	0.0307	0.0	0.0212	0.0	0.0162	0	0.0162	0	0.034	0	0.0259	0	0.0131	0	0.0272
pool slope ratio	$S_{pool}/S_{channel}$		0	0.4	0.0	0.4	0	0.4	0	0.4	0	0.4	0	0.4	0	0.4	0	0.4	0	0.4	0	0.4	0	0.4
pool-to-pool spacing	L_{p-p}	feet	48	105.6	37.5	82.5	12.75	46.75	8.1	27	9.45	34.65	9	33	10.5	38.5	7.5	25	8.7	29	28.5	65.075	9	30
pool spacing ratio	L_{p-p}/w_{bkf}		3	7	3	7	2	6	2	5	2	6	2	6	2	6	2	5	2	5	3	7	2	5
maximum pool depth at bankfull	d_{pool}	feet	3.8	5.0	2.6	3.4	1.2	2.5	0.8	1.8	0.9	1.9	0.9	1.8	1.1	2.1	0.9	1.6	1.0	1.9	2.1	2.7	1.1	1.9
pool depth ratio	d_{pool}/d_{bkf}		3	4	3	4	2	4	2	5	2	4	2	4	2	4	3	5	3	5	3	4	3	5
pool width at bankfull	w_{pool}	feet	19.2	24.0	15.0	18.8	9.4	13	5.9	8	6.9	9	6.6	9	8	11	5.5	8	6.4	9	11.4	14	6.6	9
pool width ratio	w_{pool}/w_{bkf}		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
pool cross-sectional area at bankfull	A_{pool}	SF	46.0	68.0	24.6	36.3	10.4	16	4.3	6.5	5.9	8.8	5.5	8.2	7.4	11.0	3.5	5.3	4.8	7.2	15.0	22.1	5.0	7.6
pool area ratio	A_{pool}/A_{bkf}		2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3	2	3
sinuosity	K		1.2	1.3	1.2	1.3	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2	1.1	1.2
belt width	w_{blt}	feet	32	128	25	100	17	68	0	0	12.6	50.4	12	48	14	56	0	0	0	0	19	76	0	0
meander width ratio	w_{blt}/w_{bkf}		2	8	2	8	2	8	N/A	N/A	2	8	2	8	2	8	N/A	N/A	N/A	N/A	2	8	N/A	N/A
linear wavelength	LW	feet	86	211	67.5	165	42.5	93.5	0	0	31.5	69.3	30	66	35	77	0	0	0	0	54	130	0	0
linear wavelength ratio	LW/w_{bkf}		5.4	13.2	5.4	13.2	5.0	11.0	N/A	N/A	5.0	11.0	5.0	11.0	5.0	11.0	N/A	N/A	N/A	N/A	5.7	13.7	N/A	N/A
meander length	L_m	feet	99	243	84	206	47	103	0	0	36	80	33	72.6	38.5	84.7	0	0	0	0	65.0	156.2	0	0
meander length ratio	L_m/w_{bkf}		6.2	15.2	6.75	16.5	5.5	12.1	N/A	N/A	5.8	12.7	5.5	12.1	5.5	12.1	N/A	N/A	N/A	N/A	6.8	16.4	N/A	N/A
radius of curvature	R_c	feet	32	64	25	50	17	29.75	0	0	12.6	22.05	12	21	14	24.5	0	0	0	0	19	38	0	0
radius of curvature ratio	R_c/w_{bkf}		2	4	2	4	2	3.5	N/A	N/A	2	3.5	2	3.5	2	3.5	N/A	N/A	N/A	N/A	2	4	N/A	N/A

Cross Section 1 - T8



Elevation (ft)

Bankfull Dimensions

1.3	x-section area (ft.sq.)
5.1	width (ft)
0.3	mean depth (ft)
0.3	max depth (ft)
5.4	wetted perimeter (ft)
0.2	hydraulic radius (ft)
17.0	width-depth ratio

Flood Dimensions

91.8	W flood prone area (ft)
18.0	entrenchment ratio
2.3	low bank height (ft)
7.7	low bank height ratio

Materials

35	D50 Riffle (mm)
100	D84 Riffle (mm)
39	threshold grain size (mm):

Rosgen Stream Type

Bankfull Flow

3.3	velocity (ft/s)
4.3	discharge rate (cfs)
1.19	Froude number

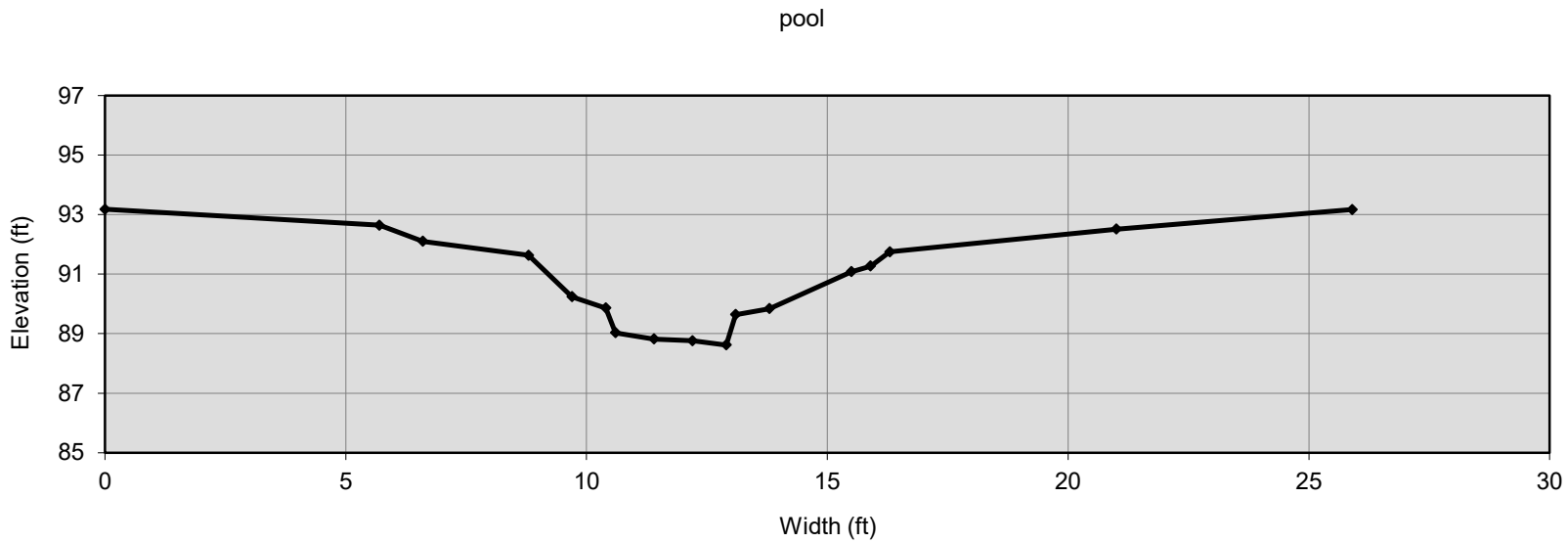
Flow Resistance

0.040	Manning's roughness
0.30	Darcy-Weisbach fric.
2.3	resistance factor u/u*
0.8	relative roughness

Forces & Power

5.3	channel slope (%)
0.79	shear stress (lb/sq.ft.)
0.64	shear velocity (ft/s)
2.8	unit strm power (lb/ft/s)

Cross Section 2 -T8



Bankfull Dimensions

0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted perimeter (ft)
0.0	hydraulic radius (ft)
0.0	width-depth ratio

Flood Dimensions

---	W flood prone area (ft)
---	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials

35	D50 Riffle (mm)
100	D84 Riffle (mm)
---	threshold grain size (mm):

Rosgen Stream Type

A4

Bankfull Flow

---	velocity (ft/s)
---	discharge rate (cfs)
---	Froude number

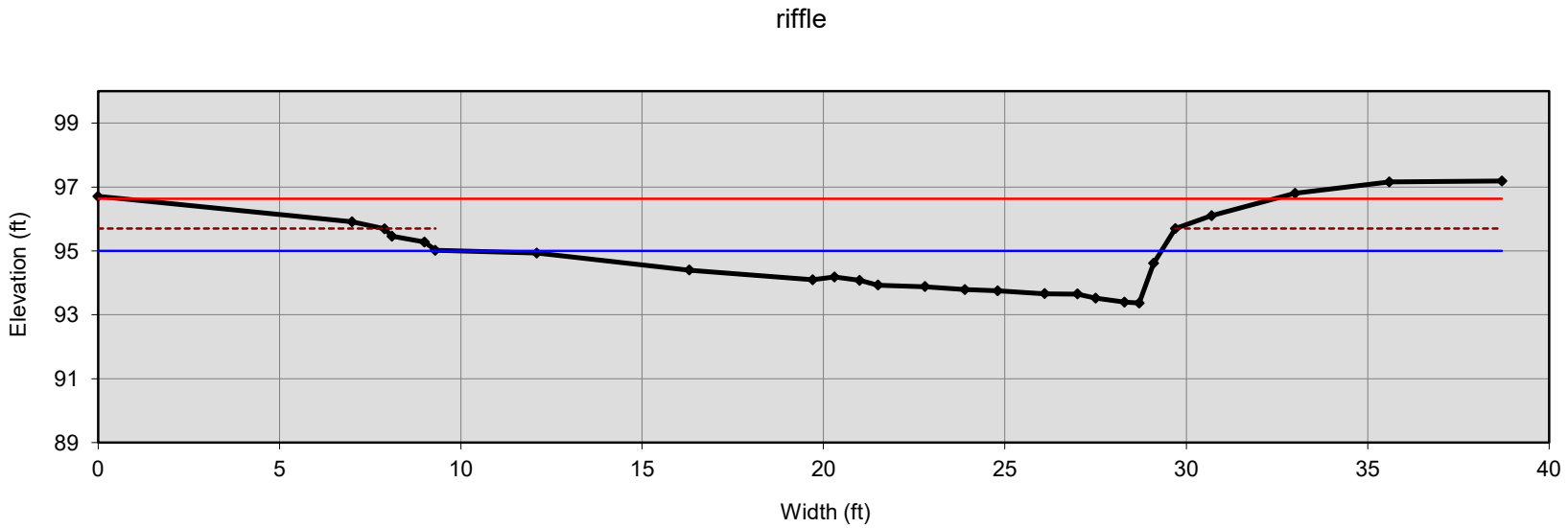
Flow Resistance

0.040	Manning's roughness
---	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

4.9	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

Cross Section 3 - UT to Cedar Creek R2



Bankfull Dimensions

15.4	x-section area (ft.sq.)
19.4	width (ft)
0.8	mean depth (ft)
1.6	max depth (ft)
20.6	wetted perimeter (ft)
0.7	hydraulic radius (ft)
24.3	width-depth ratio

Flood Dimensions

31.7	W flood prone area (ft)
1.6	entrenchment ratio
2.3	low bank height (ft)
1.4	low bank height ratio

Materials

18	D50 Riffle (mm)
48	D84 Riffle (mm)
18	threshold grain size (mm):

Rosgen Stream Type

B4c

Bankfull Flow

2.7	velocity (ft/s)
42.3	discharge rate (cfs)
0.56	Froude number

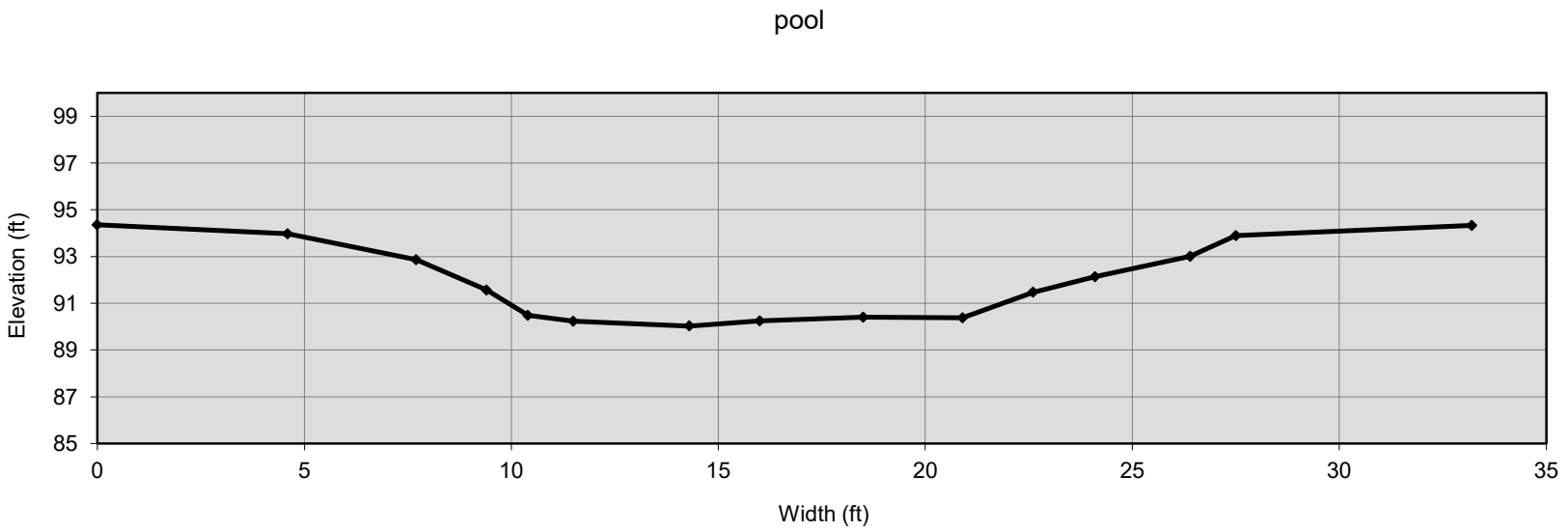
Flow Resistance

0.040	Manning's roughness
0.20	Darcy-Weisbach fric.
7.4	resistance factor u/u*
5.0	relative roughness

Forces & Power

0.8	channel slope (%)
0.37	shear stress (lb/sq.ft.)
0.44	shear velocity (ft/s)
1.09	unit strm power (lb/ft/s)

Cross Section 4 - UT to Cedar Creek R2



Bankfull Dimensions

0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted perimeter (ft)
0.0	hydraulic radius (ft)
0.0	width-depth ratio

Flood Dimensions

---	W flood prone area (ft)
---	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials

18	D50 Riffle (mm)
48	D84 Riffle (mm)
---	threshold grain size (mm):

Rosgen Stream Type

Bankfull Flow

---	velocity (ft/s)
---	discharge rate (cfs)
---	Froude number

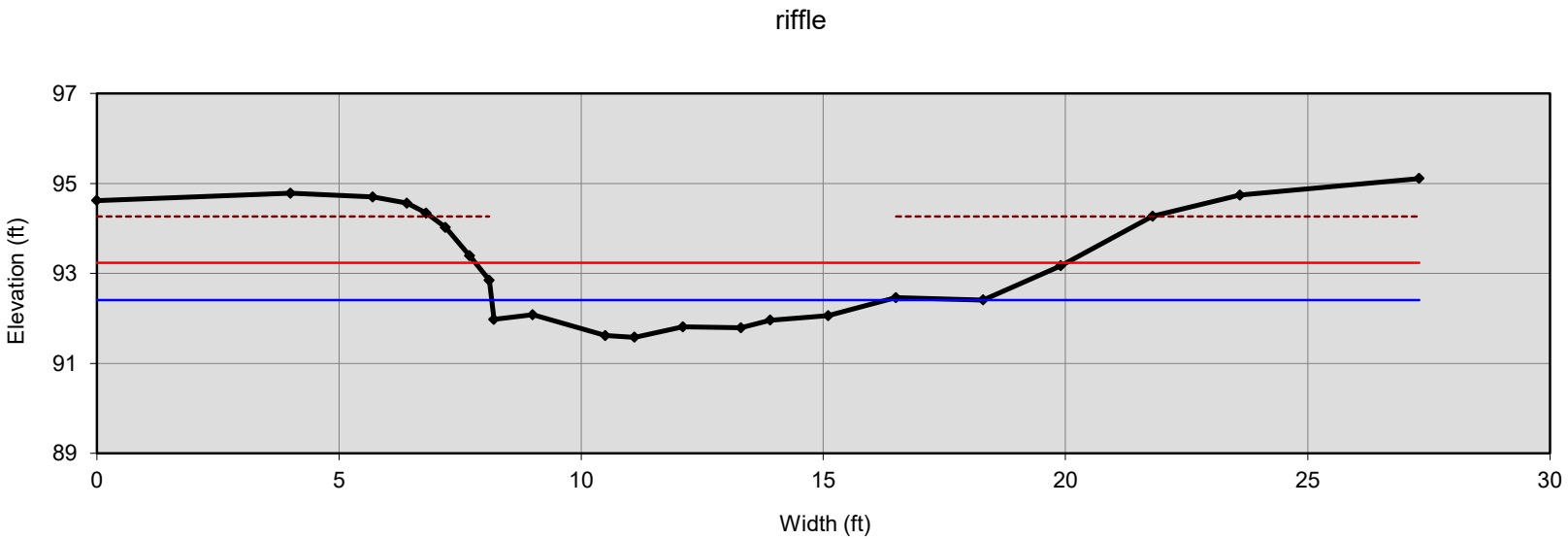
Flow Resistance

0.040	Manning's roughness
---	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

0.8	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

Cross Section 5 - T7



Bankfull Dimensions

4.1	x-section area (ft.sq.)
8.2	width (ft)
0.5	mean depth (ft)
0.8	max depth (ft)
8.7	wetted perimeter (ft)
0.5	hydraulic radius (ft)
16.4	width-depth ratio

Flood Dimensions

12.2	W flood prone area (ft)
1.5	entrenchment ratio
2.7	low bank height (ft)
3.4	low bank height ratio

Materials

18	D50 Riffle (mm)
76	D84 Riffle (mm)
49	threshold grain size (mm):

Rosgen Stream Type

B4

Bankfull Flow

4.2	velocity (ft/s)
17.1	discharge rate (cfs)
1.07	Froude number

Flow Resistance

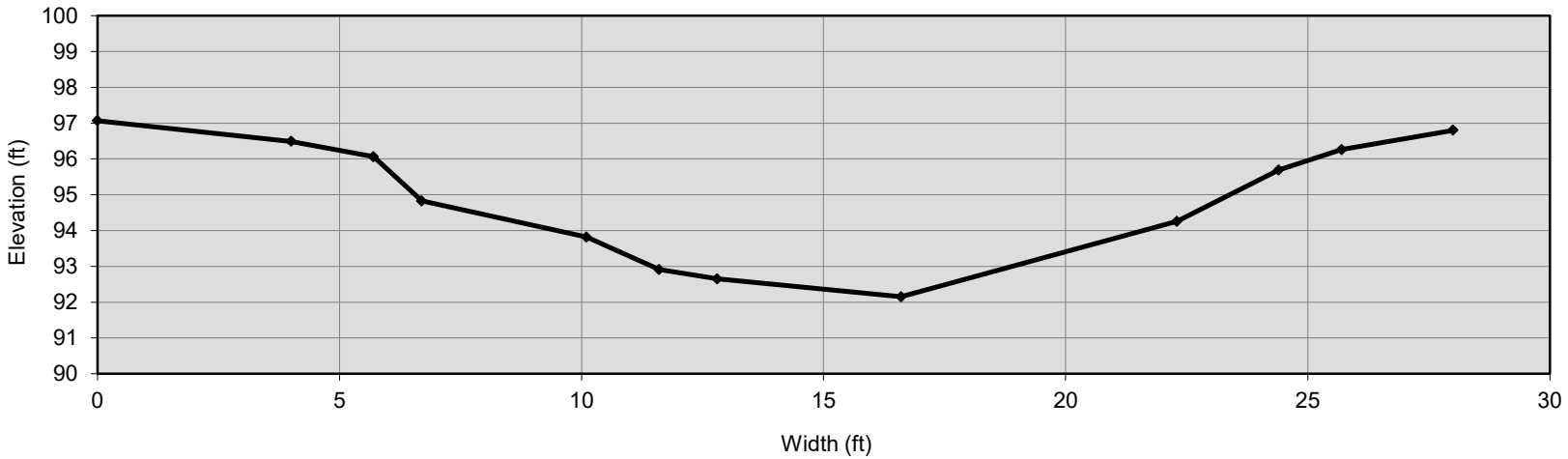
0.040	Manning's roughness
0.24	Darcy-Weisbach fric.
4.9	resistance factor u/u*
2.0	relative roughness

Forces & Power

3.4	channel slope (%)
1.00	shear stress (lb/sq.ft.)
0.72	shear velocity (ft/s)
4.4	unit strm power (lb/ft/s)

Cross Section 6 - T7

pool



Bankfull Dimensions

0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted perimeter (ft)
0.0	hydraulic radius (ft)
0.0	width-depth ratio

Flood Dimensions

---	W flood prone area (ft)
---	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials

18	D50 Riffle (mm)
76	D84 Riffle (mm)
---	threshold grain size (mm):

Rosgen Stream Type

Bankfull Flow

---	velocity (ft/s)
---	discharge rate (cfs)
---	Froude number

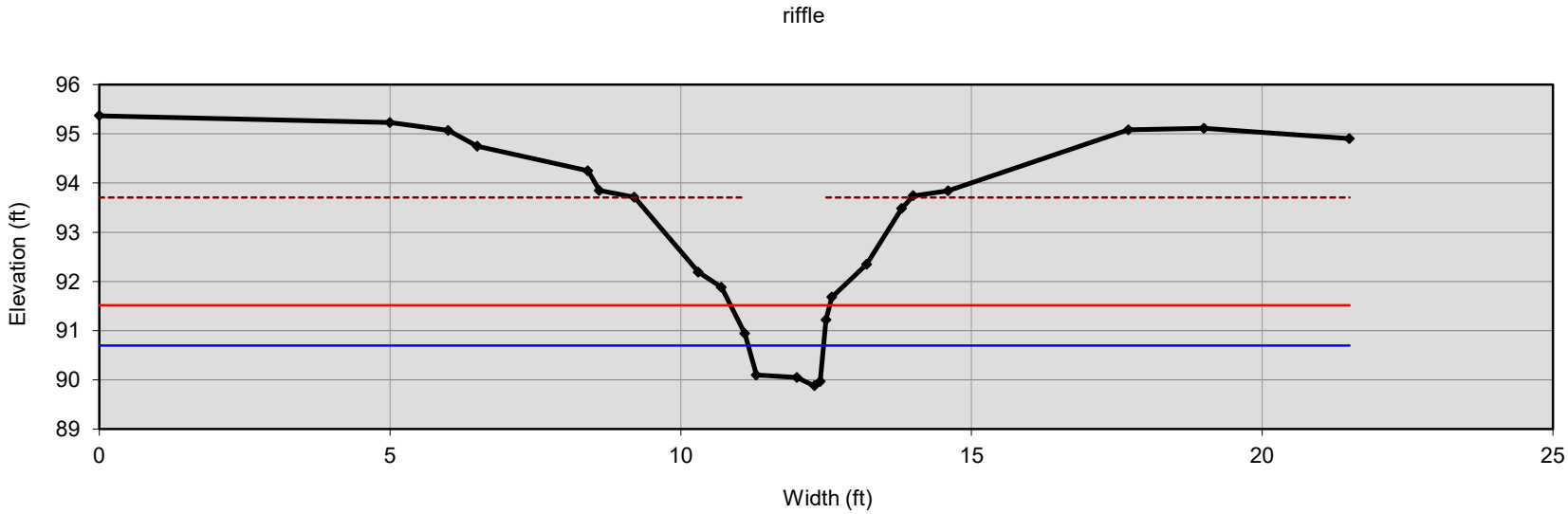
Flow Resistance

0.040	Manning's roughness
---	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

3.4	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

Cross Section 7 - T6



Bankfull Dimensions

0.8	x-section area (ft.sq.)
1.3	width (ft)
0.6	mean depth (ft)
0.8	max depth (ft)
2.5	wetted perimeter (ft)
0.3	hydraulic radius (ft)
2.2	width-depth ratio

Flood Dimensions

1.7	W flood prone area (ft)
1.3	entrenchment ratio
3.8	low bank height (ft)
4.8	low bank height ratio

Materials

20	D50 Riffle (mm)
69	D84 Riffle (mm)
81	threshold grain size (mm):

Rosgen Stream Type

A4

Bankfull Flow

5.1	velocity (ft/s)
4.0	discharge rate (cfs)
1.57	Froude number

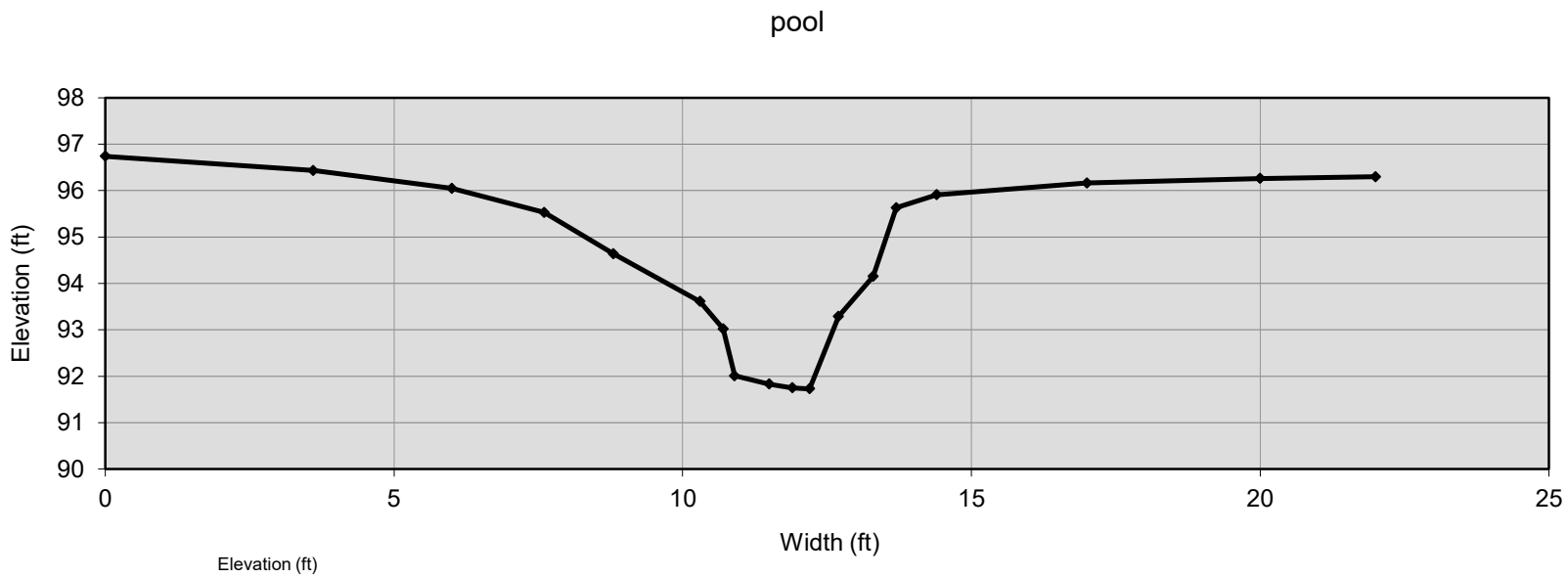
Flow Resistance

0.040	Manning's roughness
0.27	Darcy-Weisbach fric.
4.5	resistance factor u/u*
2.7	relative roughness

Forces & Power

8.4	channel slope (%)
1.66	shear stress (lb/sq.ft.)
0.92	shear velocity (ft/s)
16.3	unit strm power (lb/ft/s)

Cross Section 8 - T6



Elevation (ft)

Bankfull Dimensions

0.0	x-section area (ft.sq.)
0.0	width (ft)
0.0	mean depth (ft)
0.0	max depth (ft)
0.0	wetted perimeter (ft)
0.0	hydraulic radius (ft)
0.0	width-depth ratio

Flood Dimensions

---	W flood prone area (ft)
---	entrenchment ratio
---	low bank height (ft)
---	low bank height ratio

Materials

20	D50 Riffle (mm)
69	D84 Riffle (mm)
---	threshold grain size (mm):

Rosgen Stream Type

A4

Bankfull Flow

---	velocity (ft/s)
---	discharge rate (cfs)
---	Froude number

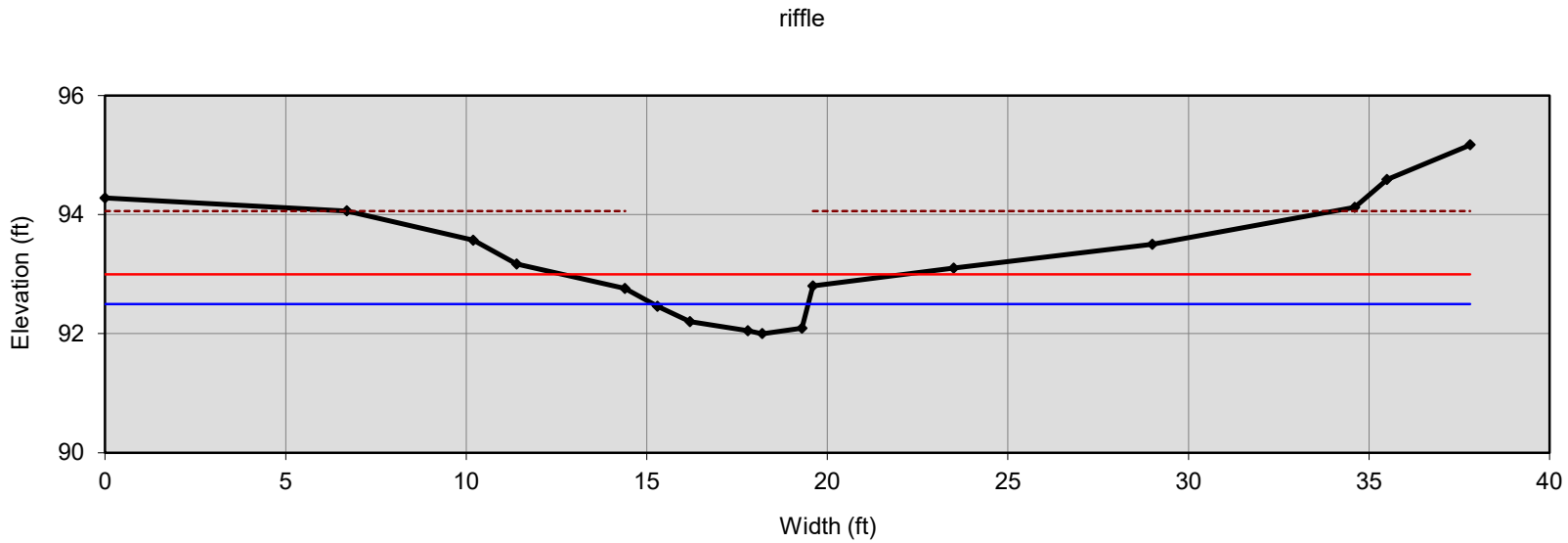
Flow Resistance

0.040	Manning's roughness
---	Darcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Forces & Power

8.4	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

Cross Section 9 - T4 R1



Bankfull Dimensions

1.5	x-section area (ft.sq.)
4.3	width (ft)
0.3	mean depth (ft)
0.5	max depth (ft)
4.6	wetted perimeter (ft)
0.3	hydraulic radius (ft)
14.3	width-depth ratio

Flood Dimensions

9.6	W flood prone area (ft)
2.2	entrenchment ratio
2.1	low bank height (ft)
4.2	low bank height ratio

Materials

31	D50 Riffle (mm)
53	D84 Riffle (mm)
47	threshold grain size (mm):

Rosgen Stream Type

Bankfull Flow

3.9	velocity (ft/s)
5.7	discharge rate (cfs)
1.19	Froude number

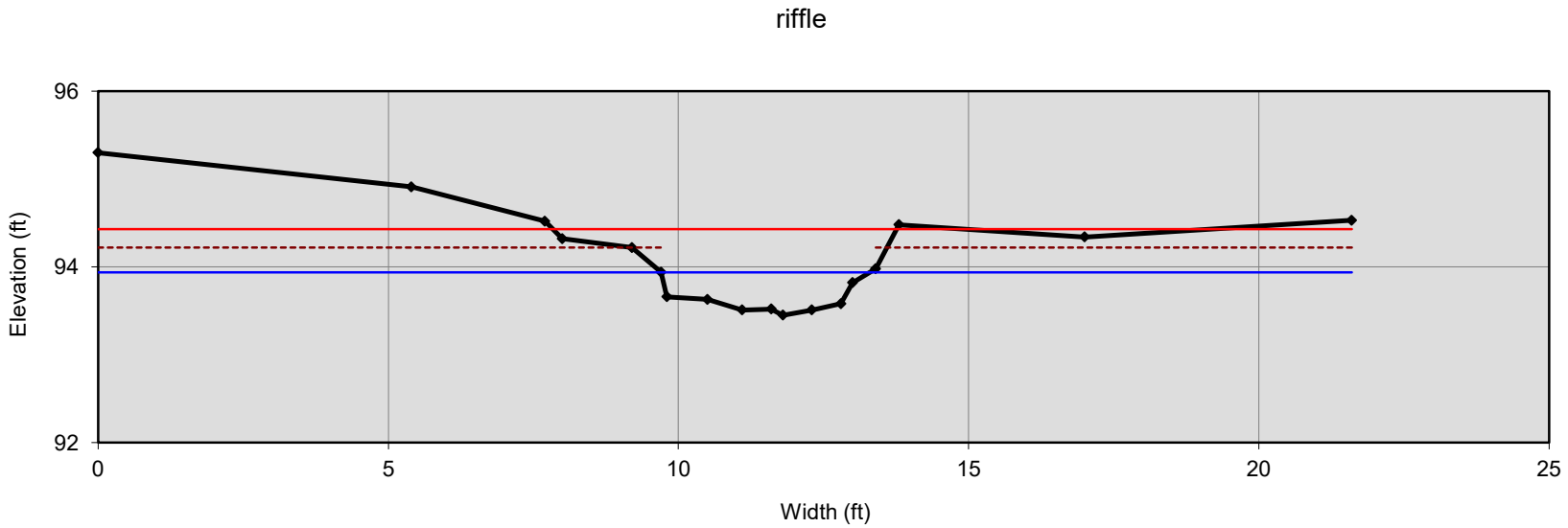
Flow Resistance

0.040	Manning's roughness
0.27	Darcy-Weisbach fric.
4.8	resistance factor u/u*
2.0	relative roughness

Forces & Power

4.8	channel slope (%)
0.96	shear stress (lb/sq.ft.)
0.70	shear velocity (ft/s)
4	unit strm power (lb/ft/s)

Cross Section 10 - T5



Bankfull Dimensions

1.2	x-section area (ft.sq.)
3.6	width (ft)
0.3	mean depth (ft)
0.5	max depth (ft)
4.0	wetted perimeter (ft)
0.3	hydraulic radius (ft)
12.0	width-depth ratio

Flood Dimensions

10.2	W flood prone area (ft)
2.8	entrenchment ratio
0.8	low bank height (ft)
1.6	low bank height ratio

Materials

40	D50 Riffle (mm)
99	D84 Riffle (mm)
56	threshold grain size (mm):

Rosgen Stream Type

/

Bankfull Flow

4.0	velocity (ft/s)
5.0	discharge rate (cfs)
1.29	Froude number

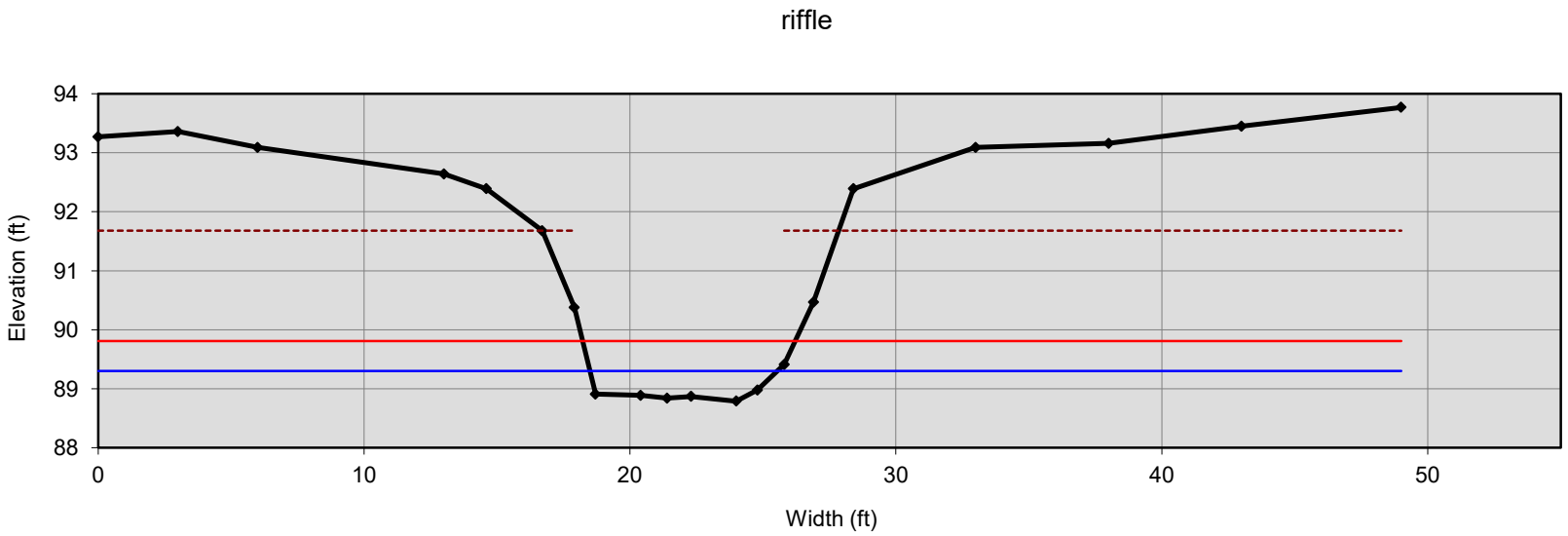
Flow Resistance

0.040	Manning's roughness
0.28	Darcy-Weisbach fric.
3.1	resistance factor u/u*
1.0	relative roughness

Forces & Power

5.8	channel slope (%)
1.13	shear stress (lb/sq.ft.)
0.76	shear velocity (ft/s)
5	unit strm power (lb/ft/s)

Cross Section 11 - T4 R2



Bankfull Dimensions

2.8	x-section area (ft.sq.)
7.1	width (ft)
0.4	mean depth (ft)
0.5	max depth (ft)
7.4	wetted perimeter (ft)
0.4	hydraulic radius (ft)
17.8	width-depth ratio

Flood Dimensions

8.0	W flood prone area (ft)
1.1	entrenchment ratio
2.9	low bank height (ft)
5.8	low bank height ratio

Materials

32	D50 Riffle (mm)
61	D84 Riffle (mm)
36	threshold grain size (mm):

Rosgen Stream Type

F4b

Bankfull Flow

3.4	velocity (ft/s)
9.6	discharge rate (cfs)
0.98	Froude number

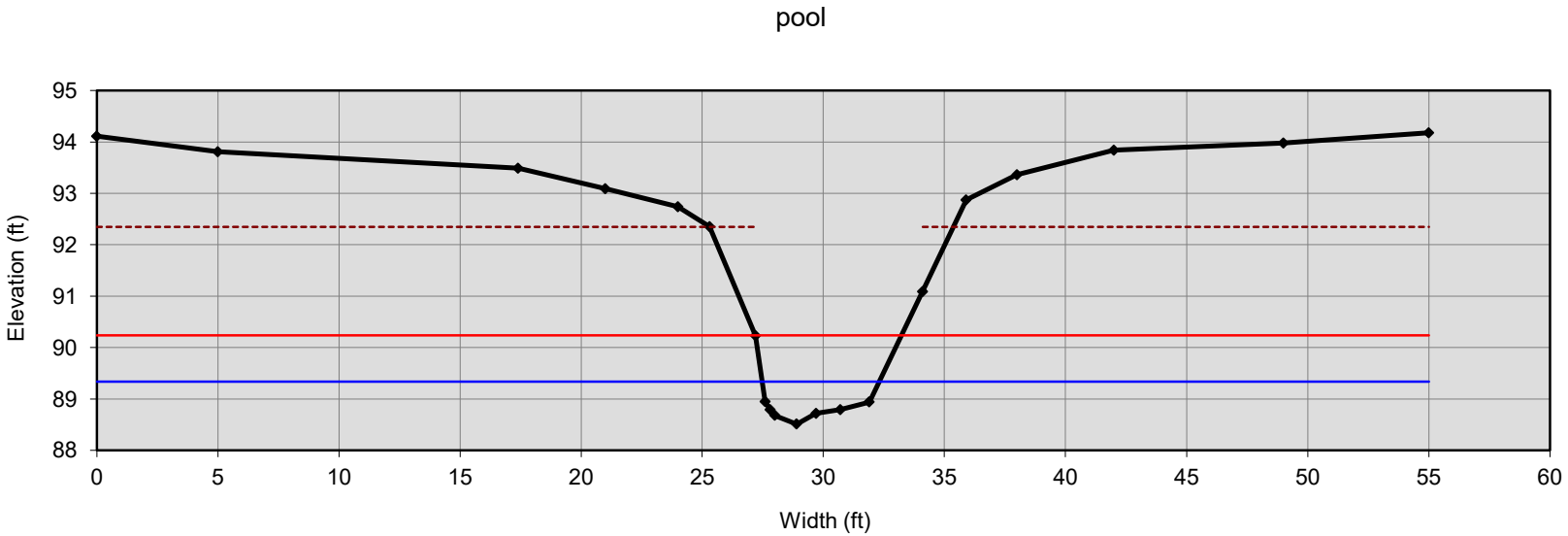
Flow Resistance

0.040	Manning's roughness
0.26	Darcy-Weisbach fric.
4.7	resistance factor u/u*
2.0	relative roughness

Forces & Power

3.1	channel slope (%)
0.74	shear stress (lb/sq.ft.)
0.62	shear velocity (ft/s)
2.6	unit strm power (lb/ft/s)

Cross Section 12 - T4 R2



Bankfull Dimensions

2.7	x-section area (ft.sq.)
4.8	width (ft)
0.6	mean depth (ft)
0.8	max depth (ft)
5.4	wetted perimeter (ft)
0.5	hydraulic radius (ft)
8.0	width-depth ratio

Flood Dimensions

6.0	W flood prone area (ft)
1.3	entrenchment ratio
3.8	low bank height (ft)
4.8	low bank height ratio

Materials

32	D50 Riffle (mm)
61	D84 Riffle (mm)
48	threshold grain size (mm):

Rosgen Stream Type

Bankfull Flow

4.1	velocity (ft/s)
11.3	discharge rate (cfs)
1.03	Froude number

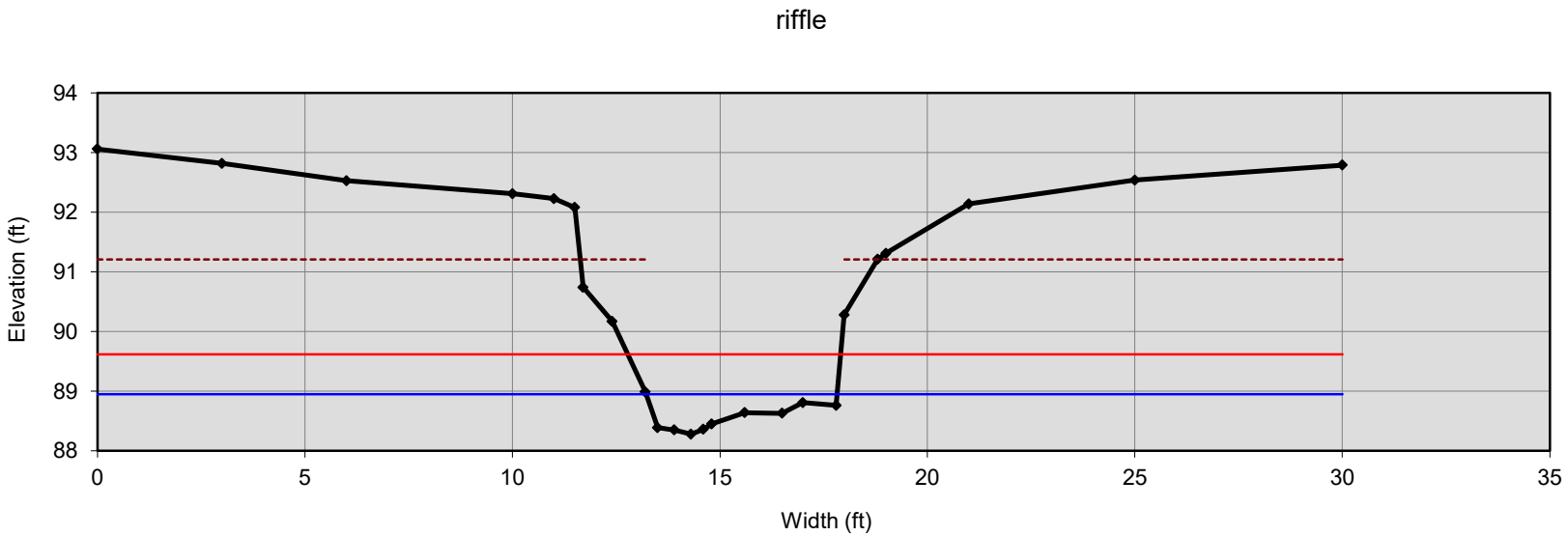
Flow Resistance

0.040	Manning's roughness
0.23	Darcy-Weisbach fric.
5.6	resistance factor u/u*
2.8	relative roughness

Forces & Power

3.1	channel slope (%)
0.97	shear stress (lb/sq.ft.)
0.71	shear velocity (ft/s)
4.5	unit strm power (lb/ft/s)

Cross Section 13 - T3 R2



Bankfull Dimensions

1.7	x-section area (ft.sq.)
4.6	width (ft)
0.4	mean depth (ft)
0.7	max depth (ft)
5.2	wetted perimeter (ft)
0.3	hydraulic radius (ft)
11.5	width-depth ratio

Flood Dimensions

5.1	W flood prone area (ft)
1.1	entrenchment ratio
2.9	low bank height (ft)
4.1	low bank height ratio

Materials

54	D50 Riffle (mm)
140	D84 Riffle (mm)
51	threshold grain size (mm):

Rosgen Stream Type

A4

Bankfull Flow

4.0	velocity (ft/s)
6.8	discharge rate (cfs)
1.22	Froude number

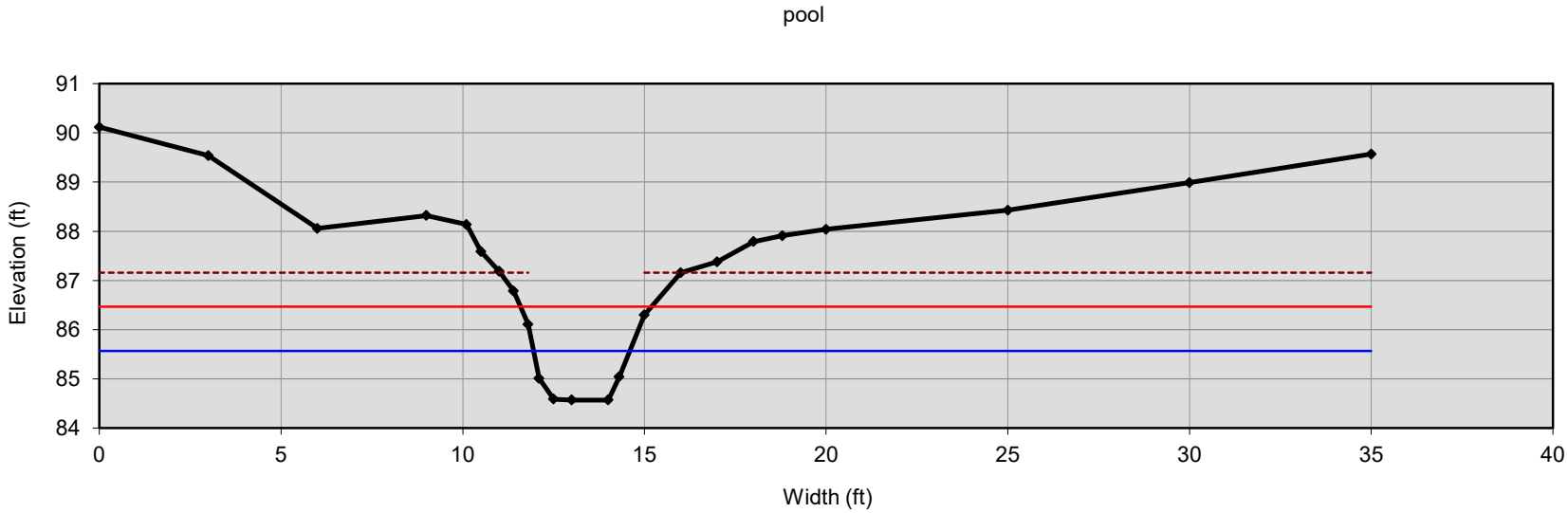
Flow Resistance

0.040	Manning's roughness
0.27	Darcy-Weisbach fric.
2.6	resistance factor u/u*
0.8	relative roughness

Forces & Power

5	channel slope (%)
1.03	shear stress (lb/sq.ft.)
0.73	shear velocity (ft/s)
4.6	unit strm power (lb/ft/s)

Cross Section 14 - T3 R2



Bankfull Dimensions

2.2	x-section area (ft.sq.)
2.6	width (ft)
0.8	mean depth (ft)
1.0	max depth (ft)
3.8	wetted perimeter (ft)
0.6	hydraulic radius (ft)
3.3	width-depth ratio

Flood Dimensions

3.6	W flood prone area (ft)
1.4	entrenchment ratio
2.6	low bank height (ft)
2.6	low bank height ratio

Materials

54	D50 Riffle (mm)
140	D84 Riffle (mm)
86	threshold grain size (mm):

Rosgen Stream Type

A4

Bankfull Flow

5.8	velocity (ft/s)
12.5	discharge rate (cfs)
1.34	Froude number

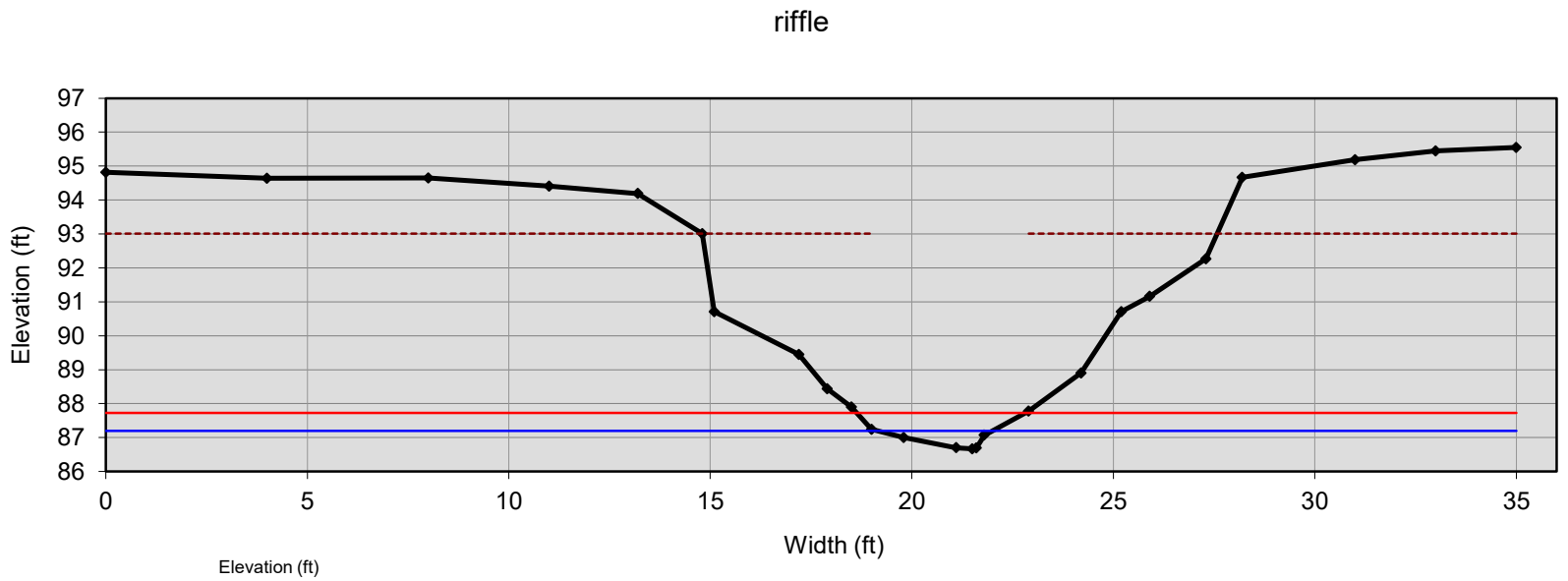
Flow Resistance

0.040	Manning's roughness
0.22	Darcy-Weisbach fric.
3.9	resistance factor u/u*
1.8	relative roughness

Forces & Power

5	channel slope (%)
1.76	shear stress (lb/sq.ft.)
0.95	shear velocity (ft/s)
14.7	unit strm power (lb/ft/s)

Cross Section 15 - T2



Elevation (ft)

Bankfull Dimensions

0.9	x-section area (ft.sq.)
2.9	width (ft)
0.3	mean depth (ft)
0.5	max depth (ft)
3.2	wetted perimeter (ft)
0.3	hydraulic radius (ft)
9.7	width-depth ratio

Flood Dimensions

4.2	W flood prone area (ft)
1.4	entrenchment ratio
6.3	low bank height (ft)
12.6	low bank height ratio

Materials

29	D50 Riffle (mm)
59	D84 Riffle (mm)
42	threshold grain size (mm):

Rosgen Stream Type

A4

Bankfull Flow

3.6	velocity (ft/s)
3.1	discharge rate (cfs)
1.20	Froude number

Flow Resistance

0.040	Manning's roughness
0.28	Darcy-Weisbach fric.
4.3	resistance factor u/u*
1.6	relative roughness

Forces & Power

5.1	channel slope (%)
0.85	shear stress (lb/sq.ft.)
0.66	shear velocity (ft/s)
3.4	unit strm power (lb/ft/s)

S&EC
Soil & Environmental Consultants, PA
11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
www.SandEC.com

PRELIMINARY HYDRIC SOIL INVESTIGATION

Cool Springs Mitigation Site

2930 Holly Springs Church Rd., Broadway, NC

PIEDMONT

Cape Fear River Basin

Harnett County, North Carolina

Prepared for:
Mr. John Hutton
Wildlands
312 West Millbrook Road, Suite 225
Raleigh, NC 27609

March 18th, 2020

INTRODUCTION

Soil & Environmental Consultants, PA (S&EC, PA) was retained to perform a preliminary evaluation to assess the presence and extent of hydric soils onsite. The project area is currently planted in herbaceous vegetation, with mixed hardwoods along some stream channels. The project area contained hydric soil indicator F3 throughout its extent with one exception. (see attached Figure A. Preliminary Soils Investigation Map)

METHODOLOGY

On March 11th, 2020 S&EC, PA staff performed a hydric soil evaluation at the site. Hand auger borings were advanced on the property at locations as appropriate to approximately estimate the location and extent of hydric soils within the project area (see attached Figure A. Preliminary Soils Investigation Map). Each soil boring was evaluated to assess the presence or absence of hydric soil indicators. Hydric soil indicators were identified utilizing the NRCS Field Indicators of Hydric Soils in the United States - A Guide for Identifying and Delineating Hydric Soils (Version 8.2, 2018).

Most of the evaluated area is mapped as the well drained Pacolet soil series (Typic Kanhapludults), with a small portion mapped as the well drained Enon soil series (Ultic Hapludalfs) in the north. Hydric soils observed onsite within the pink shaded areas were most like Wehadkee soil series (Fluvaquentic Endoaquepts). These soils were observed adjacent to the main channel flowing south to north in the evaluated area. Hydric soils observed within the area shaded purple on the Hydric Soils Map do not match a soil series currently mapped in North Carolina, however, taxonomically they are most like an aquic Kanhapludult. Hydric soils observed onsite within the light blue shaded areas were most like Chewacla soil series (Fluvaquentic Dystrudepts)

RESULTS

Approximately 17 soil borings were performed within the study area. Soil characteristics were evaluated and all areas identified as containing hydric soils met the hydric soil criteria described below.

Soil boring locations are indicated on the attached Preliminary Soils Investigation Map. All hydric soil areas had a depleted matrix (F3 indicator) within 6" of the current land surface. Except for SB15 which met the Redox Dark Surface (F6 indicator)

Indicator F3: Depleted Matrix

Technical Description: A layer that has a depleted matrix with 60 percent

or more chroma of 2 or less and that has a minimum thickness of either:

(a) 2 in. (5 cm) if the 2 in. (5 cm) is entirely within the upper 6 in. (15 cm)

of the soil, or

(b) 6 in. (15 cm) starting within 10 in. (25 cm) of the soil surface.

Indicator F6: Redox Dark Surface

Technical Description: A layer that is at least 4 in. (10 cm) thick, is entirely within the upper 12 in. (30 cm) of the mineral soil, and has a:

(a) Matrix value of 3 or less and chroma of 1 or less and 2 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings, or

(b) Matrix value of 3 or less and chroma of 2 or less and 5 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.

Soil Profile #1 / Boring Location SB17
Hydric Soil Indicator: F3
Series and Taxonomic Class: Wehadkee – Fine-loamy, mixed, active, nonacid, thermic Fluvaquentic Endoaquepts

Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-6	A	10YR 4/1	80	7.5YR 5/6	20	C	M	Sandy Loam	
6-14	Bg	10YR 6/1	70	7.5YR 5/6	30	C	M	Sandy Loam/Sandy Clay Loam	

Soil Profile #2 / Boring Location SB08
Hydric Soil Indicator: F3
Series and Taxonomic Class: No series mapped in NC – Fine, kaolinitic, thermic Aquic Kanhapludults

Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-10	A	10YR 4/1	80	5YR 3/4	20	C	PL	Loam	Oxidized Rhizospheres
10-30	Bt	5YR 4/6 7.5YR 5/8	100					Sandy Clay Loam	

Soil Profile #3 / Boring Location SB15
Hydric Soil Indicator: F6
Series and Taxonomic Class: Chewacla - Fluvaquentic Dystrudepts

Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-10	A	10YR 3/1	90	7.5YR 5/6	10		PL	Loam	Oxidized Rhizospheres
10-19	Bw1	2.5Y 6/3	90	7.5YR 5/6	10		PL	Sandy Clay Loam	Oxidized Rhizospheres
19-25	Bw2	2.5Y 5/3	100					Clay Loam	

Soil Profile #4 / Boring Location SB06
Hydric Soil Indicator: F3
Series and Taxonomic Class: Chewacla - Fluvaquentic Dystrudepts

Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-14	A	10YR 5/2	80	7.5YR 4/6	20	C	PL	Sandy Loam	Oxidized Rhizospheres
14-22	Bw1	10YR 5/3	100					Sandy Clay Loam	
22-30	Bw2	2.5Y 6/3	100					Sandy Clay Loam	

0 100 200 Feet

N

Figure A. Preliminary Soils Investigation Map
Cool Springs Mitigation Site
Cape Fear 03030004

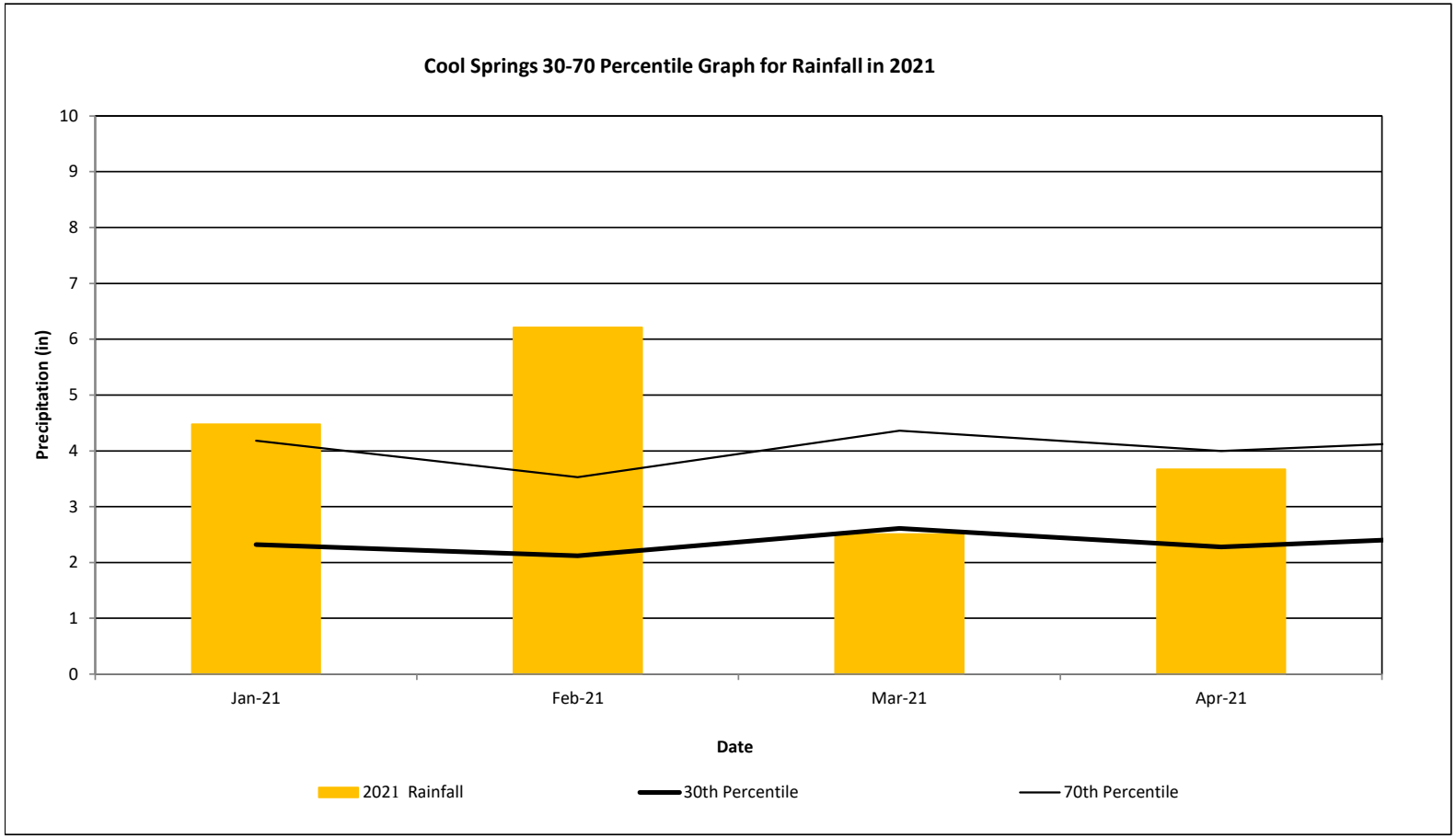
Harnett County, NC

Monthly Rainfall Plot

Cool Springs Mitigation Site

DMS Project No. 100166

Pre-Construction - 2021 Year



1 2021 monthly rainfall from USDA Station LILLINGTON 2.0 W (Harnett County, NC)

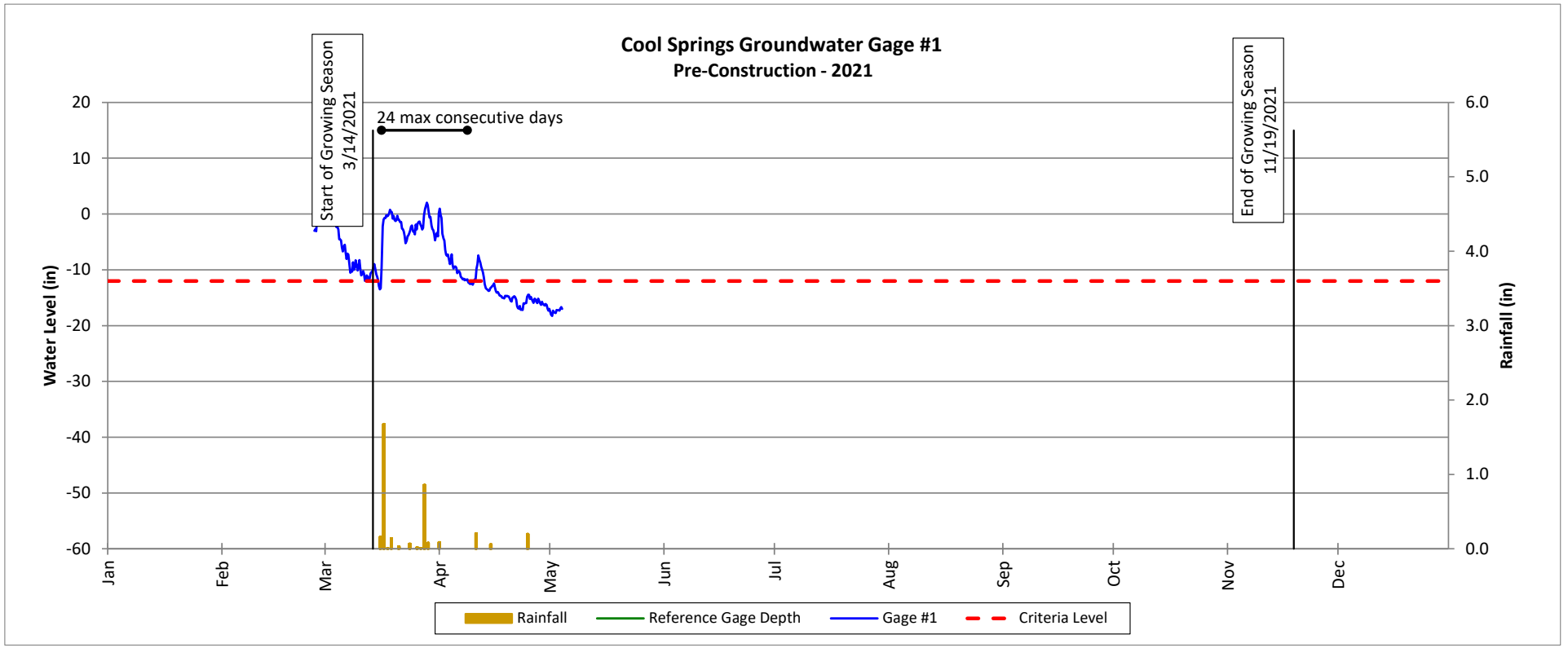
2 30th and 70th percentile rainfall data collected from weather station SANFORD 8 NE, NC (Lee County, NC)

Groundwater Gage Plots

Cool Springs Mitigation Site

DMS Project No. 100166

Pre-Construction - 2021

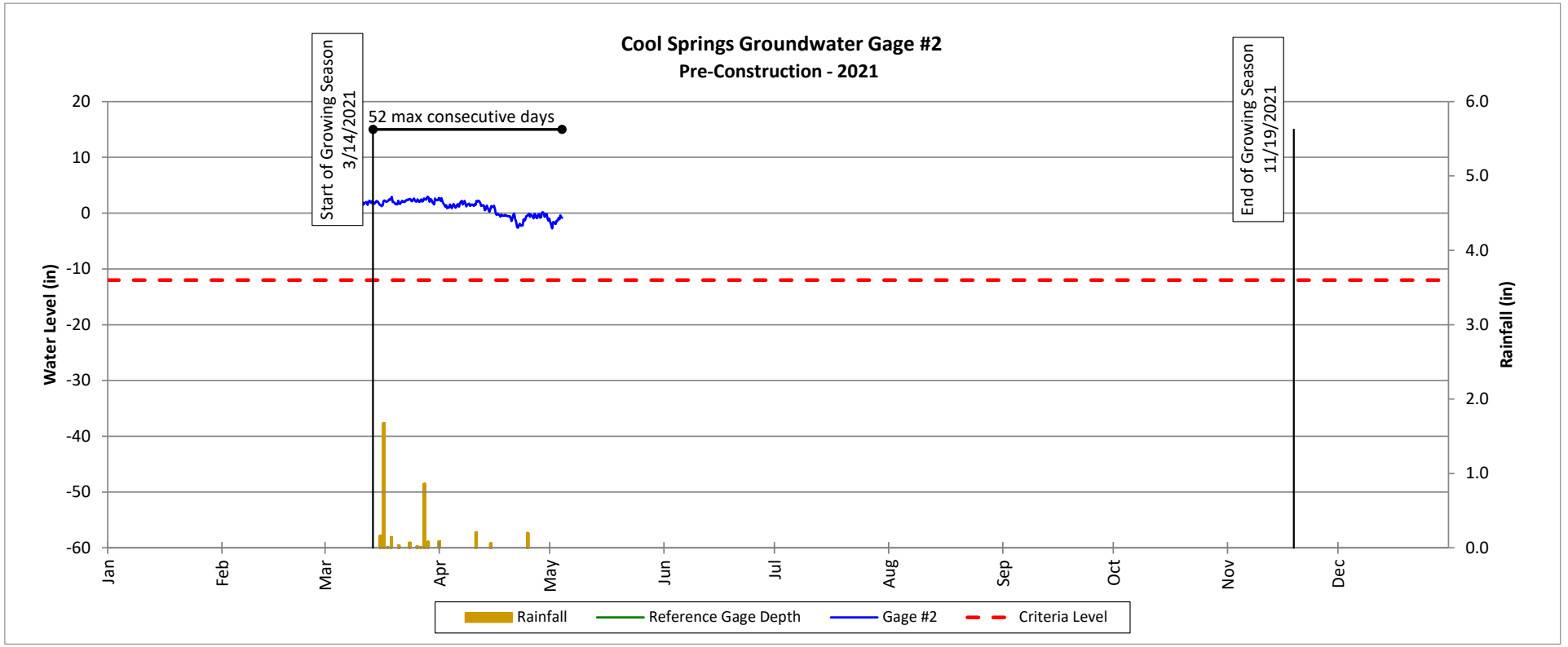


Groundwater Gage Plots

Cool Springs Mitigation Site

DMS Project No. 100166

Pre-Construction - 2021

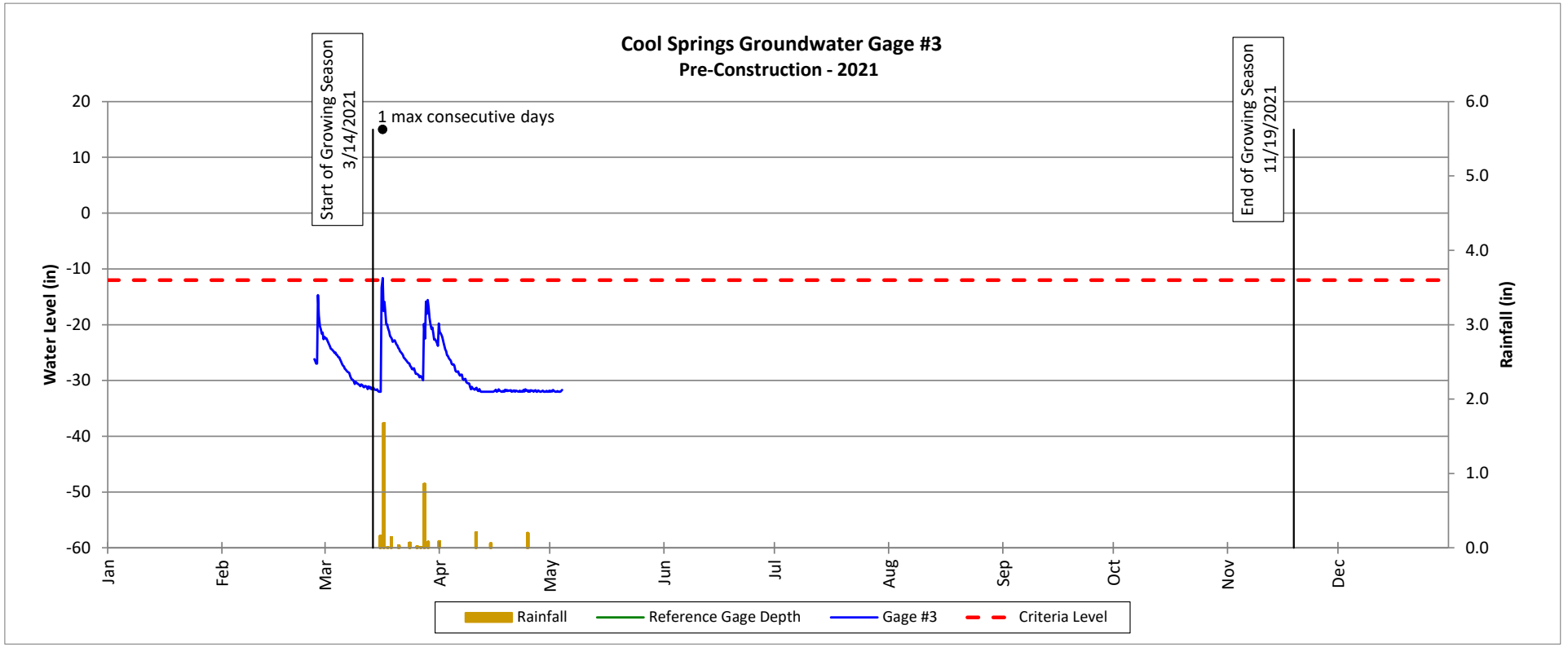


Groundwater Gage Plots

Cool Springs Mitigation Site

DMS Project No. 100166

Pre-Construction - 2021

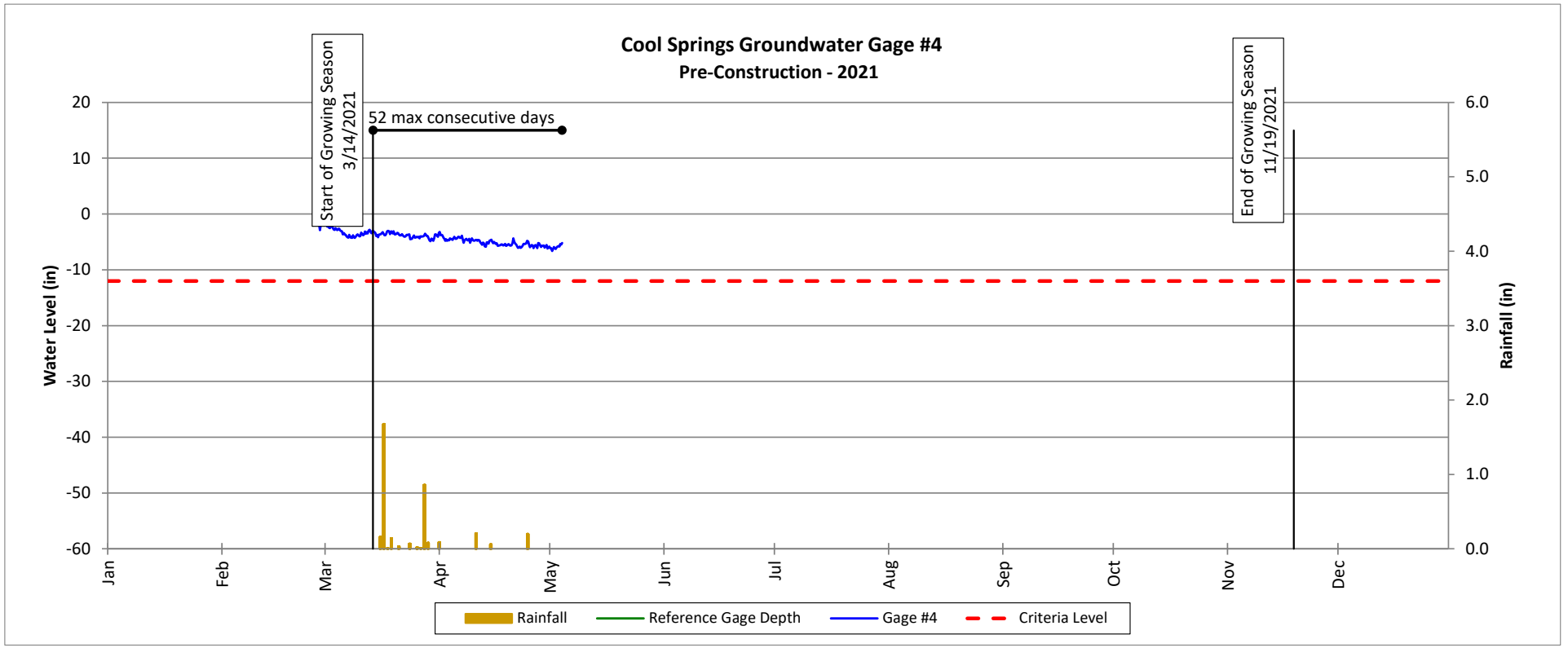


Groundwater Gage Plots

Cool Springs Mitigation Site

DMS Project No. 100166

Pre-Construction - 2021

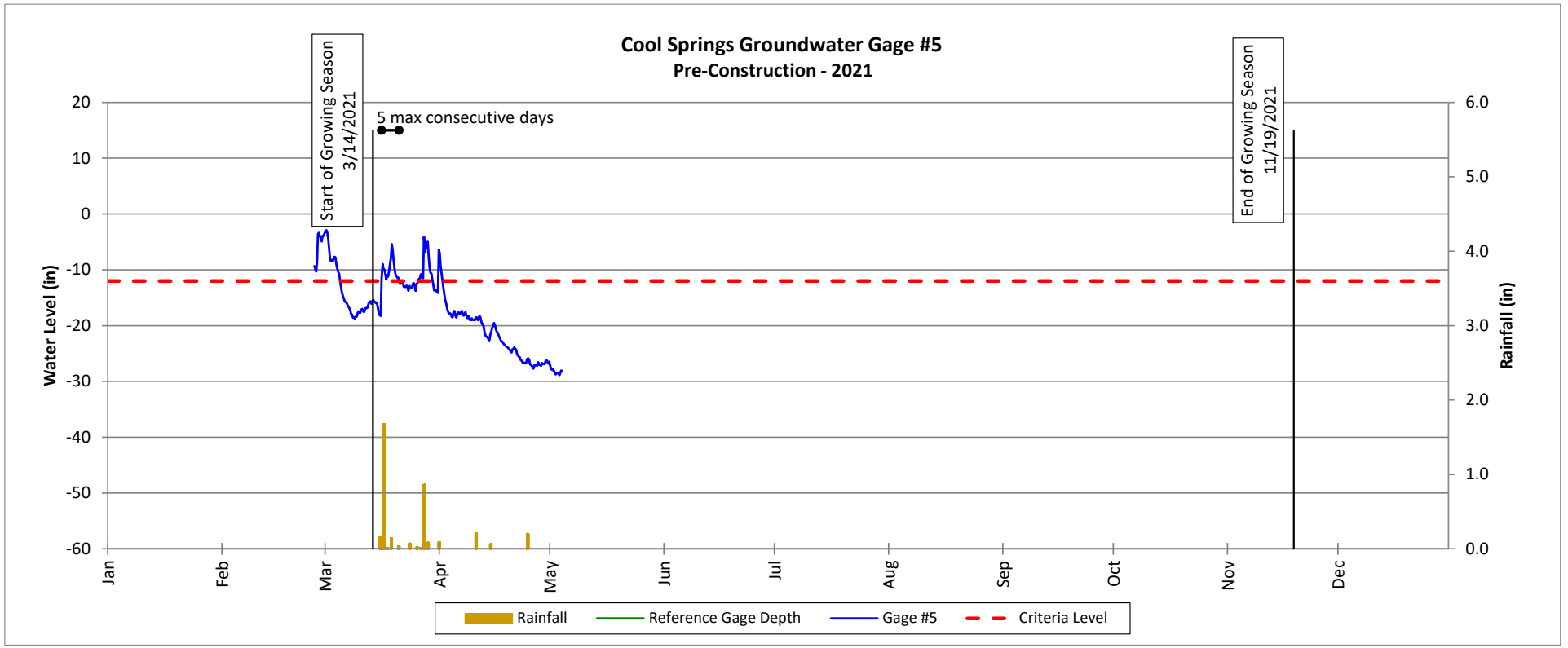


Groundwater Gage Plots

Cool Springs Mitigation Site

DMS Project No. 100166

Pre-Construction - 2021



Appendix 5: Preliminary Jurisdictional Determination

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2020-01400** County: **Harnett County** U.S.G.S. Quad: **Mamers**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Applicant: **North Carolina DEQ**
Division of Mitigation Services
Attn: Mr. Tim Baumgartner, Director
Address: **1652 Mail Service Center**
Raleigh, NC 27699
tim.baumgartner@ncdenr.gov

Telephone Number: 919-707-8543

Size (acres)	~**40.9 acres**	Nearest Town	**Broadway**
Nearest Waterway	**Cedar Creek**	River Basin	**Cape Fear**
USGS HUC	**03030004**	Coordinates	Latitude: **35.445345**
			Longitude: **-78.967513**

Location description: **The project site (Cool Springs Mitigation Site) is located on two parcels (PINs: 1306010074 and 1306020203), at 3085 Holly Springs Church Road, approximately 4.7 miles east of Broadway, in Harnett County, North Carolina.**

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 **Sarah Hair at (910) 251-4049 or Sarah.E.Hair@usace.army.mil**.

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

D. Remarks: Waters onsite flow to Cedar Creek, and ultimately to the Cape Fear River.

E. Attention USDA Program Participants

The delineation included herein has been conducted to identify the location and extent of the aquatic resource boundaries and/or the jurisdictional status of aquatic resources for purposes of the Clean Water Act for the particular site identified in this request. This delineation and/or jurisdictional determination may not be valid for the Wetland Conservation Provisions of the Food Security Act of 1985, as amended. If you or your tenant are USDA program participants, or anticipate participation in USDA programs, you should discuss the applicability of a certified wetland determination with the local USDA service center, 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: Mr. Philip A. Shannin
Administrative Appeal Review Officer
60 Forsyth Street SW, Floor M9
Atlanta, Georgia 30303-8803
AND
PHILIP.A.SHANNIN@USACE.ARMY.MIL

SAW-2020-01400
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 N/A_.

Corps Regulatory Official: Liz Hair

Date: **June 3, 2021** 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.

Copy Furnished:
Patterson and Sons, Inc.
3085 Holly Springs Church Road, NC 27505

Timothy N. Cameron and Donna L. Cameron
3445 Cool Springs Road
Broadway, NC 27505

Electronic copies furnished:
Ms. Carlynn Walker; Wildlands Engineering, Inc.
Ms. Kim Browning; USACE/RG Mitigation Project Manager

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: NC DEQ Division of Mitigation Services Mr. Tim Baumgartner, Director	File Number: **SAW-2020-01400**	Date: **June 3, 2021**

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,** **Attn: Sarah Hair** **69 Darlington Avenue** **Wilmington, North Carolina 28403**	If you only have questions regarding the appeal process you may also contact: **US Army Corps of Engineers** **South Atlantic Division** **Attn: Mr. Philip A. Shannin** **Administrative Appeal Review Officer** **60 Forsyth Street SW, Floor M9** **Atlanta, Georgia 30303-8803** **PHILIP.A.SHANNIN@USACE.ARMY.MIL**

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: Sarah Hair, 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. Philip Shannin, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801
Phone: (404) 562-5137, PHILIP.A.SHANNIN@USACE.ARMY.MIL

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: June 3, 2021

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Wildlands Engineering, Inc. Carlynn Walker, 312 W. Millbrook Road, Suite 225, NC, 27609.

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington, NCDMS ILF- Cool Springs Mitigation Site / 3805 Holly Springs Church Road / Broadway / Harnett / SAW-2020-01400

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:

(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: NC County/parish/borough: Harnett County City: Broadway

Center coordinates of site (lat/long in degree decimal format): Lat.: 35.445345° Long.:-78.967513°

Universal Transverse Mercator: UTM 17

Name of nearest waterbody: Cedar Creek

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☒ Office (Desk) Determination. Date: June 3, 2021

☐ Field Determination. Date(s):

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION.

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resources in review area (acreage and linear feet, if applicable	Type of aquatic resources (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
See attached table					

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 PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
Map: GIS Features including: Vicinity Map, USGS Topographic Map, Delineation and Soils Map

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report. Rationale:_____

☐ Data sheets prepared by the Corps:_____

☐ Corps navigable waters' study:_____

☐ U.S. Geological Survey Hydrologic Atlas:_____

☐ USGS NHD data.

☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name: Mamers USGS 7.5 Minute Quadrangle, 1:24,000

☒ Natural Resources Conservation Service Soil Survey. Citation: NRCS Web Soil Survey Website

☐ National wetlands inventory map(s). Cite name:_____

☐ State/local wetland inventory map(s):_____

☐ FEMA/FIRM maps:_____

☐ 100-year Floodplain Elevation is:_____ (National Geodetic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): 2020 Aerial on GIS Features

☒ Other (Name & Date): Representative site photos with the May 11, 2021 PJD request

☐ Previous determination(s). File no. and date of response letter:_____

☒ Other information (please specify): May 17, 2021 Corps LiDAR maps, ESRI

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.

Liz Hair **June 3, 2021**
Signature and date of Regulatory staff member completing PJD

_____
Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

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

SUPPORTING DATA. Data reviewed for PJD (check all that apply)

Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

- [x] Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:
  Map: GIS Figures including: Vicinity, USGS Topographic, Delineation & Soils.
- [x] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [ ] Office concurs with data sheets/delineation report.
  - [ ] Office does not concur with data sheets/delineation report. Rationale: _____.
- [ ] Data sheets prepared by the Corps: _____.
- [ ] Corps navigable waters' study: _____.
- [ ] U.S. Geological Survey Hydrologic Atlas: _____.
  - [ ] USGS NHD data.
  - [ ] USGS 8 and 12 digit HUC maps.
- [x] U.S. Geological Survey map(s). Cite scale & quad name: Mamers USGS 7.5 Minute Quadrangle, 1:24,000.
- [x] Natural Resources Conservation Service Soil Survey. Citation: NRCS Web Soil Survey Website.
- [ ] National wetlands inventory map(s). Cite name: _____.
- [ ] State/local wetland inventory map(s): _____.
- [ ] FEMA/FIRM maps: _____.
- [ ] 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- [x] Photographs: [x] Aerial (Name & Date): 2020 Aerial on GIS Figures.
  or [x] Other (Name & Date): Representative site photos with submittal.
- [ ] 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.

_____	Carlynn Walker 5-11-2021
Signature and date of Regulatory staff member completing PJD	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for 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. Table of Aquatic Resources in Review Area

Site Number	Latitude	Longitude	Estimate Amount of Aquatic Resource in Review Area	Class of Aquatic Resource	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
UT to Cedar Creek	35.451263	-78.971359	3,035	Potential Non-Wetland Waters of the US	Section 404
T1	35.449300	-78.972006	445	Potential Non-Wetland Waters of the US	Section 404
T2	35.451178	-78.970803	473	Potential Non-Wetland Waters of the US	Section 404
T3	35.451527	-78.972429	1,075	Potential Non-Wetland Waters of the US	Section 404
T4	35.452182	-78.974147	1,061	Potential Non-Wetland Waters of the US	Section 404
T5	35.451935	-78.974121	141	Potential Non-Wetland Waters of the US	Section 404
T6	35.453071	-78.973100	501	Potential Non-Wetland Waters of the US	Section 404
T7	35.454124	-78.970239	128	Potential Non-Wetland Waters of the US	Section 404
T8	35.455040	-78.971405	748	Potential Non-Wetland Waters of the US	Section 404
Wetland A	35.454875	-78.973045	0.069	Potential Wetland Waters of the US	Section 404
Wetland B	35.454772	-78.970566	0.064	Potential Wetland Waters of the US	Section 404
Wetland C	35.453806	-78.970649	0.160	Potential Wetland Waters of the US	Section 404
Wetland D	35.452743	-78.971508	0.089	Potential Wetland Waters of the US	Section 404
Wetland E	35.451680	-78.971306	0.162	Potential Wetland Waters of the US	Section 404
Wetland F	35.450891	-78.972986	0.132	Potential Wetland Waters of the US	Section 404
Wetland G	35.450336	-78.973637	0.282	Potential Wetland Waters of the US	Section 404
Wetland H	35.450325	-78.971527	0.139	Potential Wetland Waters of the US	Section 404
Wetland I	35.449344	-78.971730	0.024	Potential Wetland Waters of the US	Section 404
Wetland J	35.448945	-78.971390	0.028	Potential Wetland Waters of the US	Section 404

Assessment Area
Potential Wetland Waters of the US
Existing Culverts
Potential Non-Wetland Waters of the US
Data Points

A
B
C
D
E
F
G
H
I
J
DP1
DP2
DP3
DP4
DP5
DP6
T1
T2
T3
T4
T5
T6
T7
T8
UT to Cedar Creek
UT to Cedar Creek
2020 Aerial Photography

WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 3 Delineation Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC

Appendix 6: Categorial Exclusion and Resource Agency Correspondence

Appendix A

Categorical Exclusion Form for Division of Mitigation Services Projects
Version 2

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Cool Springs Mitigation
County Name:	Harnett
DMS Number:	100166
Project Sponsor:	Wildlands Engineering, Inc.
Project Contact Name:	Kirsten Gimbert
Project Contact Address:	1430 S. Mint Street, Suite 104, Charlotte, NC 28203
Project Contact E-mail:	kgimbert@wildlandseng.com
DMS Project Manager:	Lindsay Crocker

Project Description

The Cool Springs Mitigation Site is being developed to provide stream and wetland mitigation in the Cape Fear River basin. The project will include restoration and enhancement of unnamed tributaries to Cedar Creek and reestablishment, rehabilitation, and enhancement of 1. acres of wetlands. The major goals of the stream and wetland mitigation project are to provide ecological and water quality enhancements to the Cape Fear River Basin while creating a functional riparian corridor at the site level. This will be accomplished by e cluding livestock from stream channels, stabilizing eroding stream banks, restoring and enhancing native floodplain and wetland vegetation, improving the stability of stream channels, improving instream and wetland habitat, implementing stormwater BMPs, and permanently and preserving protecting the site through establishing a conservation easement.

For Official Use Only

Reviewed By:

10/28/2020 — 

Date — **DMS Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

☐ **Check this box if there are outstanding issues**

Final Approval By:

10-28-20 — Donald W. Brew

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

September 18, 2020

Gabriela Garrison
North Carolina Wildlife Resource Commission
Eastern Piedmont Coordinator
Sandhills Depot
PO Box 149
Hoffman, NC 28347

Subject: Cool Springs Mitigation Site
Harnett County, North Carolina

Dear Ms. Garrison,

Wildlands Engineering, Inc. requests review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with a potential stream and wetland restoration project on the Cool Springs Mitigation Site located in Harnett County, NC. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Mamers 7.5-Minute USGS Topographic Quadrangle, and the site is located at latitude 35.453 longitude -78.972.

The Cool Springs Mitigation Site is being developed to provide stream and wetland mitigation in the Cape Fear River basin. The project will include restoration and enhancement of nine unnamed tributaries to Cedar Creek and reestablishment, rehabilitation, and enhancement of 1.9 acres of wetlands. The streams onsite are severely eroded throughout and are routinely used by cattle for shade and water. Pockets of historic wetlands have been deforested and drained due to stream incision and cattle trampling. In addition, cattle feeding areas and chicken houses drain to several of the project streams.

The major goals of the stream and wetland mitigation project are to provide ecological and water quality enhancements to the Cape Fear River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, stabilizing eroding stream banks, restoring and enhancing native floodplain and wetland vegetation, improving the stability of stream channels, improving instream and wetland habitat, implementing stormwater BMPs to reduce nutrient and sediment loads to streams, and permanently and preserving protecting the site through establishing a conservation easement.

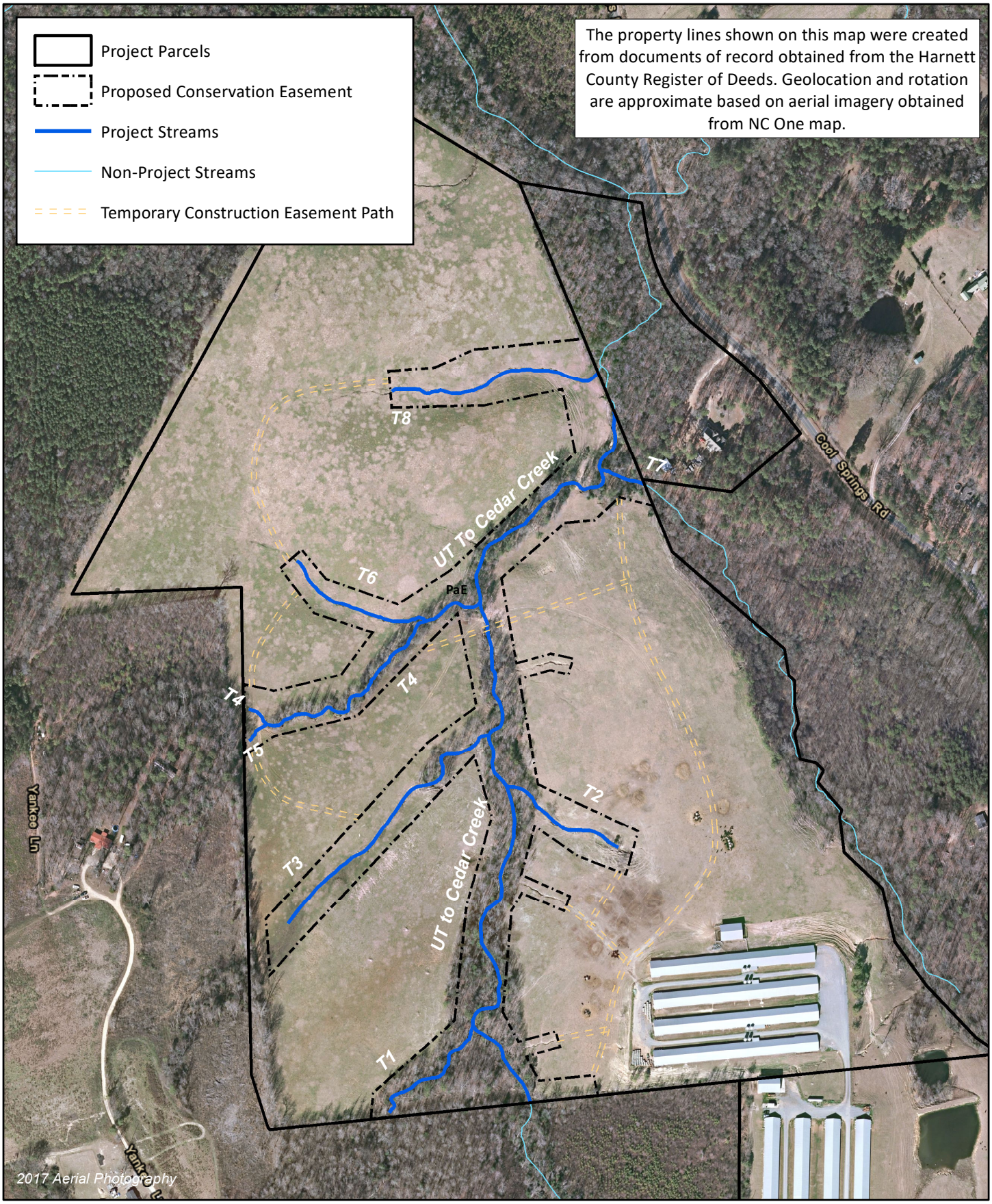
We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kirsten J. Gimbert

Kirsten Gimbert, *Senior Environmental Scientist*
kgimbert@wildlandseng.com
704.941.9093

Attachments: Figure 1 Site Map and Figure 2 USGS Topographic Map



WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 1 Site Map
Cool Springs Mitigation Site
Cape Fear River Basin 03030004

Harnett County, NC

WILDLANDS ENGINEERING

0 200 400 Feet

N

Figure 2 USGS Topographic Map
Cool Springs Mitigation Site
Cape Fear River Basin 03030004

Harnett County, NC

NORTH CAROLINA WILDLIFE RESOURCES COMMISSION
Cameron Ingram, Executive Director

October 1, 2020

Ms. Kirsten Gimbert
Wildlands Engineering, Inc.
1430 S. Mint Street, Suite 104
Charlotte, NC 28203

Subject: Request for Environmental Information for Cool Springs Mitigation Site, Harnett County, North Carolina.

Dear Ms. Gimbert,

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 Cool Springs Mitigation Site. Due to deforestation, wetland draining and presence of cattle, this area is severely degraded. Proposed work includes restoration and enhancement of nine unnamed tributaries to Cedar Creek and reestablishment, rehabilitation and enhancement of 1.9 acres of wetlands.

Work will be accomplished by excluding cattle from stream channels, stabilizing eroding stream banks and channels, enhancing the floodplain with wetland vegetation and implementing stormwater best management practices to reduce nutrient and sediment loads. Lastly, the site will be placed in a conservation easement. The project area is located northwest of the intersection of Cool Springs and Holly Spring Church Roads, east of Sanford.

The project area drains to Cedar Creek in the Cape Fear River basin. There are records for the state-significantly rare, ironcolor shiner (*Notropis chalybaeus*) downstream of the site in Cedar Creek. In addition, there are records for the following rare, freshwater mussels downstream of the project site in the Cape Fear River: the state-threatened, notched rainbow (*Villosa constricta*); the state-special concern, pod lance (*Elliptio folliculata*) and Roanoke slabshell (*Elliptio roanokensis*); and the state-significantly rare, eastern creekshell (*Villosa delumbis*). The Natural Heritage Natural Area – CPF/Upper Cape Fear River Aquatic Habitat – is located downstream along the Cape Fear River.

Stream restoration projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will improve both aquatic and terrestrial habitats and provide a travel corridor for wildlife species. In addition to stringent best management practices for erosion and sediment control during construction, 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.

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

September 18, 2020

Renee Gledhill-Earley
State Historic Preservation Office
4617 Mail Service Center
Raleigh, NC 27699-4617

Subject: Cool Springs Mitigation Site
Harnett 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 a potential stream and wetland restoration project on the Cool Springs Mitigation Site located in Harnett County, NC. A USGS Topographic Map and an Overview Site Map showing the approximate project area are enclosed. The topographic figure was prepared from the Mamers 7.5-Minute USGS Topographic Quadrangle, and the site is located at latitude 35.453 longitude -78.972.

The Cool Springs Mitigation Site is being developed to provide stream and wetland mitigation in the Cape Fear River basin. The project will include restoration and enhancement of nine unnamed tributaries to Cedar Creek and reestablishment, rehabilitation, and enhancement of 1.9 acres of wetlands. The streams onsite are severely eroded throughout and are routinely used by cattle for shade and water. Pockets of historic wetlands have been deforested and drained due to stream incision and cattle trampling. In addition, cattle feeding areas and chicken houses drain to several of the project streams.

The major goals of the stream and wetland mitigation project are to provide ecological and water quality enhancements to the Cape Fear River Basin while creating a functional riparian corridor at the site level. This will be accomplished by excluding livestock from stream channels, stabilizing eroding stream banks, restoring and enhancing native floodplain and wetland vegetation, improving the stability of stream channels, improving instream and wetland habitat, implementing stormwater BMPs to reduce nutrient and sediment loads to streams, and permanently and preserving protecting the site through establishing a conservation easement.

No surveyed sites listed on the North Carolina State Historic Preservation office are located within a mile of the Site. The Joe Kelly Mill and Millponds is the closest NC Historic Preservation Area located approximately 4 miles west of the site. Raven Rock State Park, Upper Cape Fear River Aquatic Habitat, Camp Agape, and Juniper Springs Church Natural Area are Significant Natural Heritage Areas located within five miles of the Site. Additional portions of Raven Rock State Park are managed by the NC Natural Heritage Program but are not Significant Natural Heritage Areas. No other architectural structures or archaeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. We ask that you review the site based on the attached information to determine the presence of any historic properties.

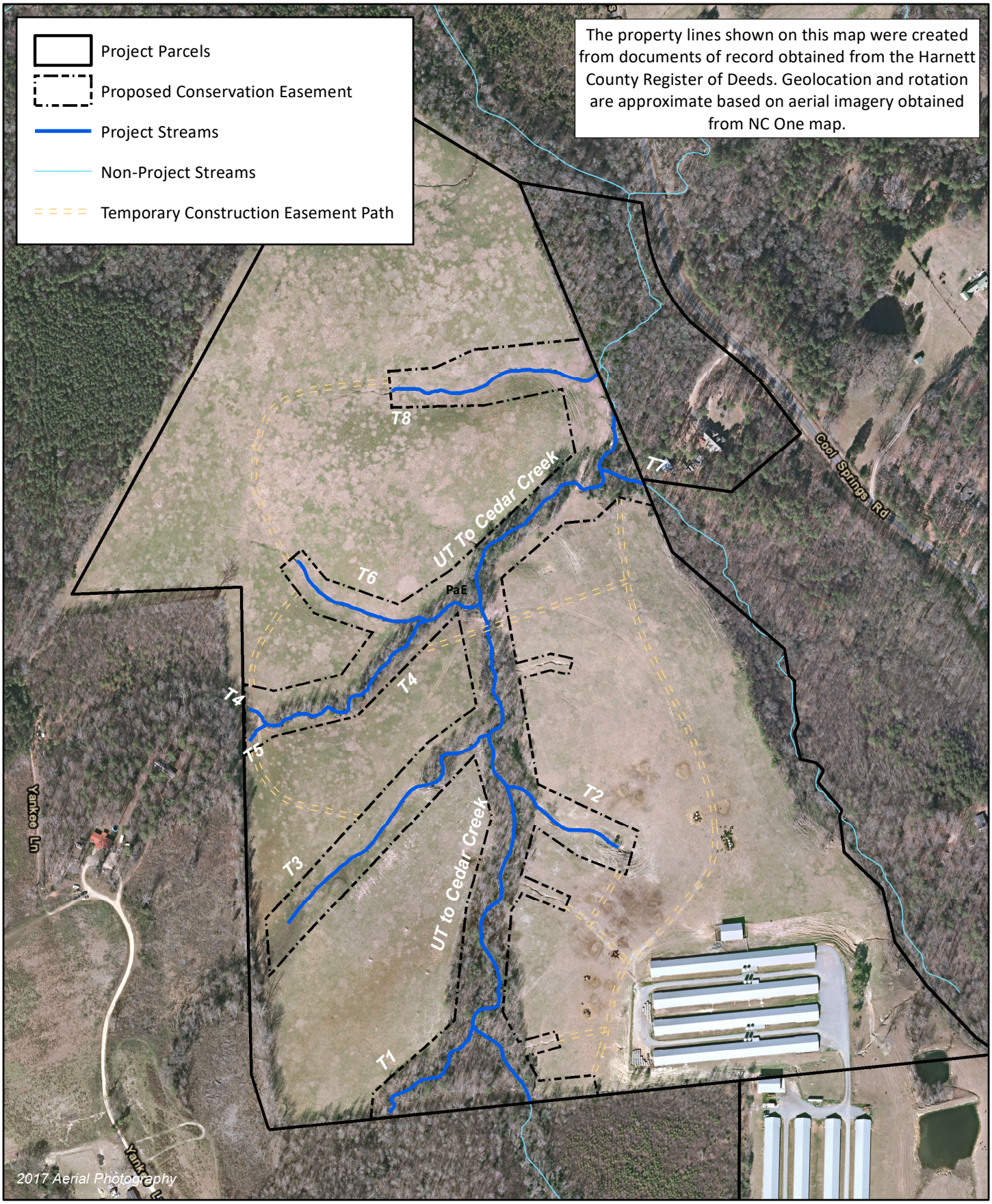
We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

Sincerely,

Kirsten G. Gimbert

Kirsten Gimbert, *Senior Environmental Scientist*
kgimbert@wildlandseng.com
704.941.9093

Attachments: Figure 1 Site Map and Figure 2 USGS Topographic Map



WILDLANDS ENGINEERING

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Figure 1 Site Map
Cool Springs Mitigation Site
Cape Fear River Basin 03030004

Harnett County, NC

WILDLANDS ENGINEERING

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Figure 2 USGS Topographic Map
Cool Springs Mitigation Site
Cape Fear River Basin 03030004

Harnett County, NC

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

October 26, 2020

Kirsten Gimbert
Wildlands Engineering, Inc.
1430 South Mint Street, Suite 104
Charlotte, NC 28203

kgimbert@wildlandseng.com

Re: Cool Springs Mitigation Site, adjacent to Yankee Lane, Broadway, Harnett County, ER 20-2170

Dear Ms. Gimbert:

Thank you for your email of September 18, 2020, regarding the above-referenced undertaking. We have reviewed the submittal and offer the following comments.

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 919-814-6579 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 Bartos, Deputy
State Historic Preservation Officer

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
551-F Pylon Drive
Raleigh, North Carolina 27606

October 20, 2020

Kim Browning
U.S. Army Corps of Engineers, Wilmington District
Mitigation Field Office
3331 Heritage Trade Drive, Suite 105
Wake Forest, NC 27587

Re: NCDMS Cool Springs Mitigation Site / SAW-2020-01400/ Harnett County

Dear Mrs. Browning:

The U.S. Fish and Wildlife Service (Service) has reviewed the project advertised in the above referenced Public Notice. The project, as advertised in the Public Notice, is expected to have minimal adverse impacts to fish and wildlife resources. Therefore, we have no objection to the activity as described in the permit application.

In accordance with the Endangered Species Act of 1973, as amended, (ESA) and based on the information provided, and other available information, it appears the action is not likely to adversely affect federally listed species or their critical habitat as defined by the ESA. We believe that the requirements of section 7 (a)(2) of the ESA have been satisfied for this project. Please remember that obligations under the ESA must be reconsidered if: (1) new information identifies impacts of this action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is 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.

For your convenience a list of all federally protected endangered and threatened species in North Carolina is now available on our website at <http://www.fws.gov/raleigh>. Our web page contains a complete and updated list of federally protected species, and a list of federal species of concern known to occur in each county in North Carolina.

The Service appreciates the opportunity to review and provide comments on the proposed action. Should you have any questions regarding the project, please contact Kathy Matthews at (919) 856-4520, extension 27.

Sincerely,

for Pete Benjamin,
Field Supervisor

cc: NMFS, Beaufort, NC
EPA, Atlanta, GA
WRC, Raleigh

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MEETING NOTES

MEETING: IRT Post-contract Site Walk
Cool Springs Mitigation Site
Cape Fear Basin CU 03030004; Harnett County, NC
DEQ Contract No. 0302-02
DMS Project No. 100166

DATE: Tuesday, September 29, 2020

LOCATION: Holly Springs Church Road
Broadway, NC

Attendees

Todd Tugwell, USACE
Erin Davis, DWR
Travis Wilson, WRC
Lindsay Crocker, DMS
Jeremiah Dow, DMS
Tim Baumgartner, DMS
John Hutton, Wildlands
Jeff Keaton, Wildlands
Nicole Millns, Wildlands
Charlie Neaves, Wildlands

Materials

- Wildlands Engineering Cool Springs Mitigation Site Proposal
- Maps of existing and proposed conditions for the site and proposed easements
- Map showing proposed treatments for enhancement II reaches

Meeting Notes

The primary purpose of this site visit was to provide an opportunity for the IRT members to see the site and for Wildlands staff to explain the various components of the project. The site is on an active cattle farm with eight chicken houses and will include stream restoration, stream enhancement II, and wetland re-establishment, rehabilitation, and enhancement. The site also includes five stormwater BMPs. This meeting summary is organized by stream reaches, rather than chronological order of the discussions, to make review more efficient. A revised map similar to the one used at the site walk, but also including revisions and additional treatments discussed at the site walk, is attached.

<u>UT to Cedar Creek Reach 1</u>

- This long stream reach is proposed as enhancement II.
- The proposed ratio is 2.5:1 due to five BMPs that will treat runoff from the site and the bank treatments that are proposed to stop ongoing erosion. The BMPs are shown on the attached map and discussed below. The proposed bank treatments are also shown on the attached map and were reviewed in the field.
- Wildlands agreed to supplemental planting in areas of the buffer where the canopy is open.

- Wildlands also agreed to adjust the conservation easement so that it extends to the edge of the existing woodline on the east side of UT to Cedar Creek near the upstream end of the reach as the easement boundary was shown on the original map to be very near the stream. The easement adjustment is shown on the attached map.
- At a point where the stream splits into two channels and is unstable downstream of the third BMP, Wildlands indicated that even though it was not shown on the map, that area would be repaired and all of the flow will be returned to the right channel.
- The existing ford crossing on this channel that separates Reach 1 and 2 will be removed.
- Near the downstream end of the reach on the left floodplain there is an eroding channel. Wildlands indicated that this channel would be stabilized as a vegetated swale and included in the easement but that no SPSC would be needed at this location. There is the possibility that the channel might be jurisdictional. If the channel is determined to be jurisdictional, it will be included as a short restoration reach.
- There are four areas of wetland enhancement in wooded portions of the site and an area of wetland re-establishment and rehabilitation along Reach 1. Wetlands are discussed below separately.

UT to Cedar Creek Reach 2

- This reach is proposed as restoration with a ratio of 1:1. The group agreed with the approach.
- An area where flow accumulates on the right floodplain and spills over into the channel will be stabilized with a step-pool sequence.
- Wildlands was asked if there was consideration of adding the short portion of UT to Cedar Creek that goes off the property before the confluence with T8. It was considered it but it would have been a short preservation reach and Wildlands was not sure the IRT would want it included.
- The conservation easement will continue along the western side of the floodplain along this reach so that the easement is continuous and the buffer is restored to the most downstream reach called T8 (see attached map). There is also an area of wetland enhancement in this area.

T1

- T1 is proposed as enhancement II with a ratio of 2.5:1.
- The top 75 feet of this reach will be reconstructed similar to a restoration approach.
- Near the middle of the reach the left bank will be stabilized. This reach can be accessed with construction equipment without much disturbance (see attached map).
- Wildlands was asked if there was a plan to put flow gauges on the small streams. Wildlands agreed to gauge all of the small streams. Later during the site visit, it was agreed that all streams with drainage areas smaller than 25 acres would be gauged.

T2

- This stream is badly eroded and incised and planned for restoration.
- A BMP will be installed above the jurisdictional point on the channel and will be similar to the other BMPs that will be built on the site consisting on a step-pool stormwater conveyance and vegetated swale. BMPs are described below.

T3 Reach 1

- Reach 1 of T3 is proposed as enhancement II with a ratio of 2.5:1.

- Reach 1 will be bordered by areas of wetland rehabilitation on each side of the stream.
- Bank stabilization is planned for both banks along much of this reach.
- The existing culvert crossing at the top of the reach is in poor shape and Wildlands will replace it even though it will remain outside of the easement.

T3 Reach 2

- Reach 2 is proposed as restoration with wetland re-establishment on both the left and right floodplain.
- The upstream end of the restoration reach will be at an existing knickpoint and the group agreed that was the appropriate transition to the upstream reach which will be enhancement II. Restoration will now extend further upstream than shown in the proposal.

T3 Reach 3

- Reach 3 of this stream is in a wooded area and is proposed for enhancement II with a ratio of 2.5:1.
- The right bank will be stabilized with boulder toe between existing bedrock knickpoints and several trees removed from the channel.
- Just above the confluence with UT to Cedar Creek, the right bank will be laid back and the left bank will be stabilized with a rock toe revetment.

T4 and T5

- An internal culvert crossing was proposed for the upstream extent of the easement that would cross both T4 and T5 to follow typical guidance from the IRT that crossings should be kept to the edges of the easement whenever possible. During the site visit, the group agreed it would be better to leave the crossing in its current location so that it will only cross UT4 and because it is in a more practical location. T4 will have one internal crossing and T5 will have no crossings.
- Due to this change, all of T4 and T5 will be restoration.
- The restoration of T4 will utilize a priority 1 approach of raising the stream channel. Where possible, existing trees will be preserved along the channel.

T6, T7, and T8

- T6 is proposed as restoration with wetland re-establishment on the floodplain on both sides of the channel. The group agreed with these approaches.
- T7 is a short reach near the downstream end of UT to Cedar Creek on the property. This stream is proposed as restoration and the group agreed with that approach.
- T8 is located at the downstream end of the project. This reach is badly incised and eroded and is proposed for restoration.
- While discussing T8, Wildlands was asked if the existing substrate in the channels would be reused. Wildlands indicated that it would along with native rock mined on site.

Wetlands

- All wetland mitigation areas are shown on the attached map. The IRT agreed with the approaches proposed by Wildlands.
- Todd Tugwell of the U.S. Army Corps of Engineers told Wildlands that a baseline map based on the jurisdictional determination would be needed to establish the areas that can be used for credit. He explained that wetlands should be delineated as they would have been prior to the Navigable Waters Protection Rule (NWPR). As a result, some delineated features may not be considered waters of the U.S.

under NWPR but are still viable for mitigation credit if they meet criteria explained in the 1987 Delineation Manual and subsequent Regional Supplements. This applies to all wetland areas on site.

- Wildlands plans to plant all wetland areas within the easement that are not currently wooded.

BMPs

- There are five BMPs proposed for the site (see attached map). The BMPs are part of the justification for a mitigation ratio of 2.5:1 for the enhancement II reaches.
- The BMPs are planned for badly eroded ephemeral channels that flow into the project streams from the east. Four flow directly into UT to Cedar Creek and one flows into T2. These channels drain runoff from the chicken houses and pasture including an intensely used cattle feeding area at the top of the adjacent ridge.
- The concept for the BMPs would include a step-pool stormwater conveyance (SPSC) with filter media to stabilize the badly eroding channels and treat runoff from the surrounding pastures and chicken houses with a vegetated swale above the SPSC to the extent of the existing channel. These BMPs in series will all be included within the easement.
- BMP 3 was specifically discussed during the site visit will have a sill at the bottom to act as a level spreader and create diffuse flow into the buffer of UT to Cedar Creek and wetland area.
- One of the BMPs will be installed just upstream of the crossing on UT to Cedar Creek on an eroded ephemeral channel that the group did not tour.

Summary

At the conclusion of the site visit Todd indicated that he approved of the site and had no issues with the proposed approaches and had no objections to the minor changes to the plan discussed during the site tour. Erin Davis and Travis Wilson also indicated that they were OK with the proposed approached discussed. Some modifications to the Concept Map used for the site walk were made during the tour. A revised map is attached showing bank treatments for the enhancement II reaches plus changes to approaches and other details discussed during the site walk.

These meeting notes were prepared by Jeff Keaton October 14, 2020 and reviewed by John Hutton on October 15, 2020 and represent the authors' interpretation of events.

Appendix 7: Invasive Species Plan

Appendix 7 Invasive Vegetation Treatment Plan

The presence of invasive species on Cool Springs Mitigation Site is scarce throughout the majority of riparian buffers and abruptly increases in density in the wooded wetland areas in the north portion of the project. The most prevalent species, Chinese privet (*Ligustrum sinense*) and Japanese honeysuckle (*Lonicera japonica*), are scattered throughout the length of the project at densities of <1%. A well-established population in the northern end of the Site will require ongoing treatment.

A goal of this project is to treat and reduce the exotic species found on site. During construction and post construction, the presence and extents of invasive species will be monitored, and 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. Generally, the treatment plan shall follow the below guidelines in Table 1 for common invasive species found in riparian areas; however, the treatment may be changed based on professional judgement and resources. All invasive species treatments will be reported in each monitoring report.

Table 1. Invasive Species Treatment Techniques

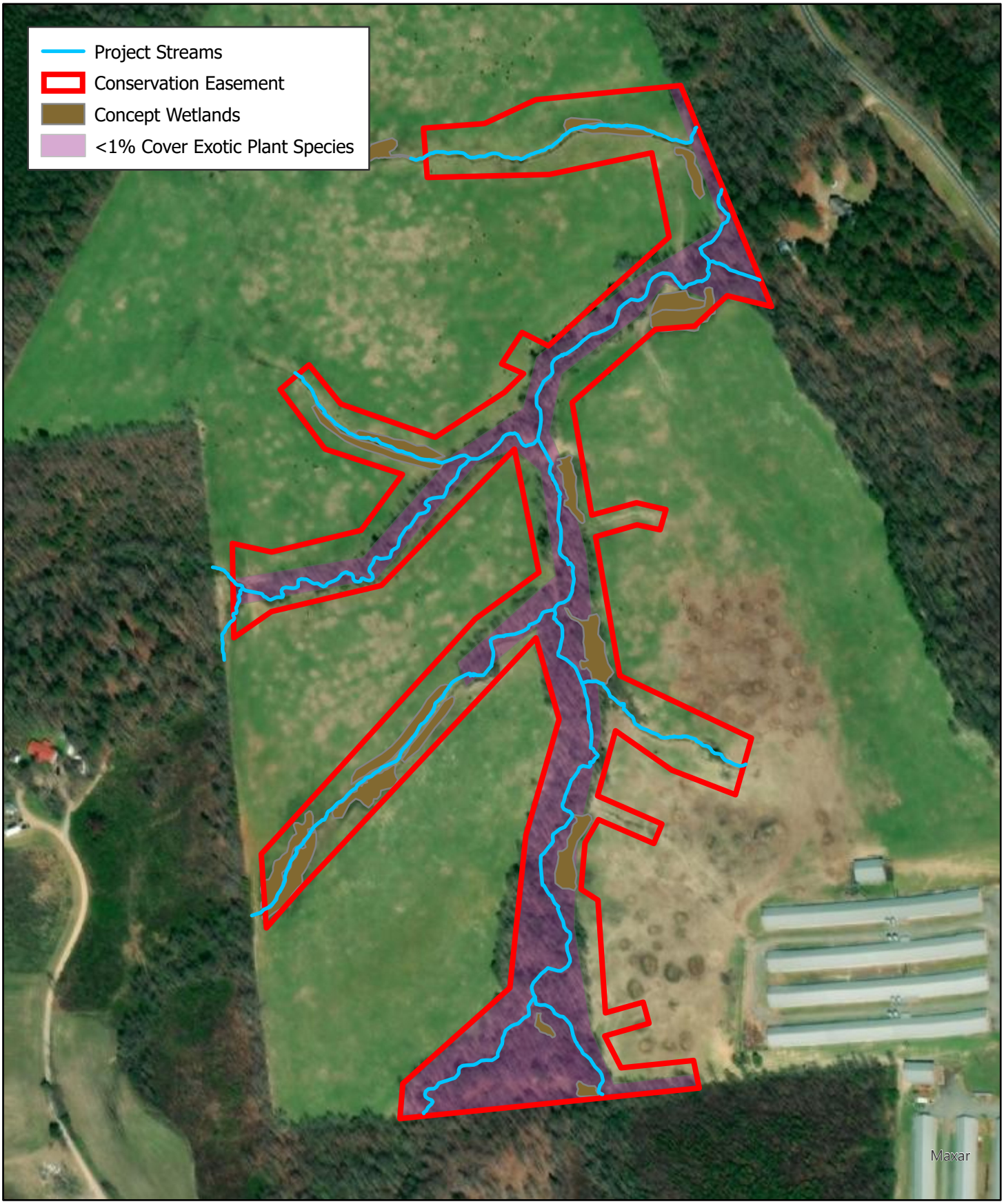
Invasive Species	Recommended Treatment Technique
Japanese Honeysuckle (*Lonicera japonica*)	Small infestations of *L. japonica* can be pulled by hand. Monitor to remove any re-sprouts. Large infestations of *L. japonica* will usually require a combination of cut stump and foliar herbicide treatments. Where vines have grown into the tree canopy, cut stems as close to the ground as possible. Treat the freshly cut surface of the rooted stem with a 25-50 percent solution of glyphosate or triclopyr. Groundcovers of *L. japonica* can be treated with a foliar solution of 2 percent glyphosate or triclopyr plus a 0.5 percent non-ionic surfactant to thoroughly wet all the leaves.
Chinese Privet (*Ligustrum sinense*)	For stems under 2 feet in height, thoroughly wet all leaves with triclopyr in water with a surfactant as a 2 - percent solution in the late fall or early winter at temperatures greater than 60 degrees. Summer applications may not be as effective as other times, often require a higher percent solution and increase risk of collateral damage to neighboring desirable species. For stems too tall for foliar sprays and when safety to surrounding vegetation is desired, apply a basal spray of Garlon 4 as a 20-percent solution (5 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted); or undiluted Pathfinder II. Elsewhere, apply Stalker* as a 6- to 9-percent solution (1.5 to 2 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant to young bark as a basal spray making certain to treat all stems in a clump; or cut and immediately treat the stump tops with Arsenal AC* as a 5-percent solution (20 ounces per 3-gallon mix) or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stump tops and sides with Garlon 3A or with a glyphosate herbicide as a 20-percent solution (5 pints per 3-gallon mix) in water with a surfactant. ORTHO Brush-B-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps. For large stems, make stem injections using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or a glyphosate herbicide using dilutions and cut-spacings specified on the herbicide label (anytime except March and April). An EZ-Ject tree injector can help to reach the lower part of the main stem; otherwise, every branching trunk can be hack-and-squirt injected.

Invasive Species	Recommended Treatment Technique
Exotic pasture grasses	Undesirable grasses will be mechanically removed during construction on large portions of the site. Following construction, if negative impact to tree establishment is observed these grasses will be treated using a number of methods including herbicide ring sprays, herbicide treatment and reseeding, and mechanical tree release.

Invasive species management will be conducted and monitored by Wildlands Engineering's Stewardship team with cooperation and assistance from the project engineer and environmental science teams. This management plan outlines timing and details of planned management actions throughout the length of the project along with an identification of species found on the project site. The management plan can be found below in Table 2.

Table 2. Invasive Species Management Plan

Treatment Season	Recommended Treatment Technique
During Construction	• *Monitor disposal of large stands of privet in restoration areas.* • *Manage privet treatment efforts on enhancement/preservation reaches.*
Summer/Spring 2022	• Monitor for emergence of invasive species
Fall/Winter 2022 - 2023	• Monitor emergence of invasive species on restoration reaches where previous invasive species populations existed before construction. Treat, as necessary.
Summer 2023	• Follow up treatment of invasive plants, as necessary.
Winter 2023 - 2024	• Follow up treatment of invasive plants, as necessary.
Summer 2024	• Follow up treatment of invasive plants, as necessary.
Winter 2024 - 2025	• Follow up treatment of invasive plants, as necessary.
Summer 2025	• Follow up treatment of invasive plants, as necessary.
Winter 2025 - 2026	• Follow up treatment of invasive plants, as necessary.
Summer 2026	• Follow up treatment of invasive plants, as necessary.
Winter 2026 - 2027	• Follow up treatment of invasive plants, as necessary.
Summer 2027	• Follow up treatment of invasive plants, as necessary.
Winter 2027 - 2028	• Follow up treatment of invasive plants, as necessary.
Summer 2028	• Follow up treatment of invasive plants, as necessary.
Winter 2028	• Follow up treatment of invasive plants, as necessary.



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Invasive Vegetation Map
Cool Springs Mitigation Site
Cape Fear River Basin (03030004)

Harnett County, NC

Appendix 8: Maintenance Plan

Appendix 8 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 years following site construction and may include the following:

Table 1. Maintenance Plan

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. If beaver become active on the site, Wildlands will contract with the USDA to trap the beaver and remove the dams.
Wetlands	Routine wetland maintenance and repair activities may include supplemental installations of target vegetation within the wetland. Areas where storm water and floodplain flows are intercepted by the wetland may also require maintenance to prevent scour that adversely and persistently threatens wetland habitat or function.
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. Invasive plant species requiring treatment per the Invasive Species Treatment Plan (Appendix 7) shall be treated in accordance with that plan and 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.

Appendix 9: Credit Release Schedule

Appendix 9 Credit Release Schedule and Supporting Information

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 Department of the Army (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	Monitoring Year	Credit Release Activity	Interim Release	Total Released
1	0	Site Establishment	0%	0%
2	0	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan – see requirements below	30%	30%
3	1	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	2	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	3	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6	4*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
7	5	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
8	6*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
9	7	Year 7 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	90% (100%**)

*Vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

**10% reserve of credits to be held back until the bankfull event performance standard has been met

Table B: Credit Release Schedule – Wetland Credits

Credit Release Milestone	Monitoring Year	Credit Release Activity	Interim Release	Total Released
1	0	Site Establishment	0%	0%
2	0	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan – see requirements below	30%	30%
3	1	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%

Credit Release Milestone	Monitoring Year	Credit Release Activity	Interim Release	Total Released
4	2	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%
5	3	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%
6	4*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%
7	5	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%
8	6*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%
9	7	Year 7 monitoring report demonstrates that interim performance standards have been met	10%	100%

*Vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

1.1 Initial Allocation of Released Credits

For this NCDMS project, no initial release of credits is provided. To account for this, the 15% credit release typically associated with the site establishment is held until completion of all initial physical and biological improvements made pursuant to the Mitigation Plan. In order for NCDMS to receive the 30% release (shown in Tables A and B as Milestone 2), they must comply with the credit release requirements stated in Section IV(I)(3) of the approved NCDMS instrument.

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.

The following conditions apply to credit release schedules:

a. A reserve of 10% of site's total stream credits will be release 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 four bankfull events occur during the monitoring period, release of these reserve credits is at the discretion of the NCIRT.
b. After the second milestone, the credit releases are scheduled to occur on an annual basis, assuming that the annual monitoring report has been provided to the USACE in accordance with Section IV (General Monitoring Requirements) of this document, and that the monitoring report demonstrates that interim performance standards are being met and that no other concerns have been identified on-site during the visual monitoring. All credit releases require written approval from the USACE.
c. The credits associated with the final credit release milestone will be released only upon a determination by the USACE, in consultation with the NCIRT, of functional success as defined in the Mitigation Plan.

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 Assurances

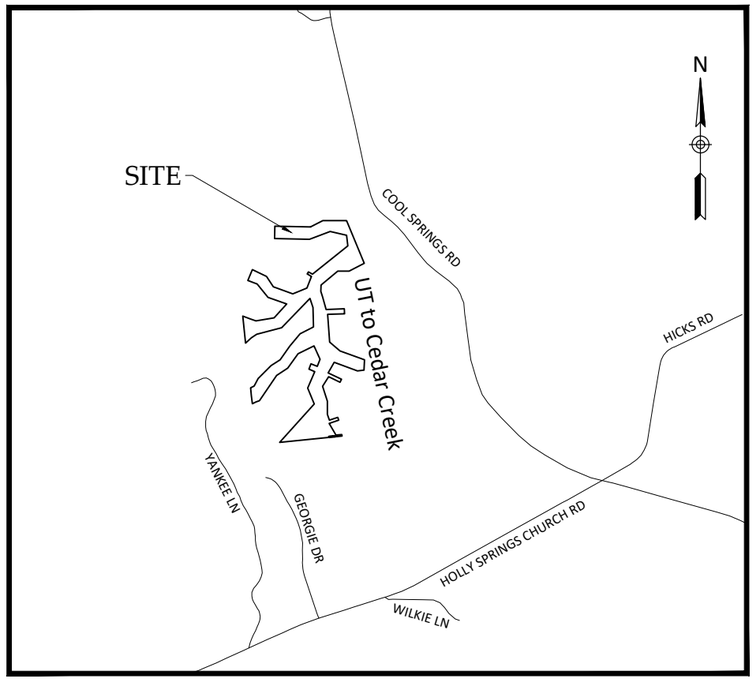
Appendix 10 Financial Assurances

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.

Appendix 11: Design Plans

September 3, 2021

Cool Springs Mitigation Site
Cape Fear River Basin 03030004
Harnett 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!

60% PLANS
ISSUED JANUARY 5, 2022

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Jeff Keaton, PE, Project Manager
Nicole Millns, PE, Project Engineer
919-851-9986

Surveying:
K2 Design Group
774 S Beston Road
La Grange, NC 28551
252-582-3097
www.k2designgroup.com
John A. Rudolph, PLS

Owner:
Patterson and Sons, Inc.
Holly Springs Church Rd
Broadway, NC 27505

NCDEQ Contract No. 0302-02
DMS ID No. 100166
USACE Action ID No.
SAW-2020-01400
RFP #: 16-20190302

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Tel: 919-851-9986
License No. F-0831

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Cool Springs Mitigation Site
Harnett County, North Carolina

Title Sheet

Revisions:

Date: 06.17.21
Job Number: 300-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 0.1

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September 1, 2021

General Construction Notes

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. Contractor shall operate and maintain the pump-around system 24 hours a day until all disturbed areas are stabilized. The disturbed area being pumped around must be stabilized with temporary seeding, mulch, and erosion control matting by the end of each work day. 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. A pump-around operation is required for all in-stream work, but is not required to be running if there is no flow. Contractor shall disturb only as much channel bank as can be stabilized with temporary seeding, mulch, and erosion control matting by the end of each work day.
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 short-term 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 disturbed areas can be stabilized within the timeframes stated in item #7 of General Construction Notes. Additional stockpile areas other than 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 the 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. Fertilizer and soil amendments are discussed in the Permanent Seeding Specification. Lime and fertilizer may be applied to assist with grass establishment in some disturbed areas. The limits of applications will be determined by the Engineer in the field.
12. Existing fence located inside the conservation easement shall be removed during construction.
13. Contractor is to make every effort to avoid damaging or removing existing trees.
14. Materials harvested on-site for construction of structures must be obtained within the conservation easement and approved by the Engineer.
15. Under no circumstances will the Contractor exceed the Limits of Disturbance as shown on the plans.
16. The construction site will be accessed from the construction entrance located off Austin Traphill Road southeast of the intersection with King Billings Road (SR 1935) as shown on the plans.

Initial Site Preparation

1. Notify DEMLR of construction start.
2. Contact the North Carolina "One Call" Center (1.800.632.4949) before any excavation.
3. Mobilize equipment and materials to the site.
4. Identify and establish construction entrances, 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.
5. 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.
6. Set up temporary facilities, locate equipment within the staging area, and stockpile materials needed for the initial stages of construction within the stockpile areas. Install and maintain an on-site rain gauge and log book to record rainfall amounts and dates. Maintain an approved copy of the ESC 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.
7. The Contractor shall conduct self-inspections of the erosion and sedimentation control measures and complete the combined self-inspection form found on the DEMLR website (DEMLR-CSW-Monitoring-Form-Rev-April-1-2019.pdf) as required by NCDEQ permit. Rainfall records, completed self-inspection forms, and permits should be maintained on site.
8. 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.

Pond Dewatering

1. Dewatering of the Swaim and Wood Ponds to be initiated by October 15, 2020 or as soon as permits are obtained by excavating a notch in the dam embankment.
2. Notch may be lowered periodically to drain pond area. A pump shall be used according to the pump around detail to draw down remaining water in pond area.
3. Allow pond bed to dry before placing fill. Remove unsuitable soils and replace with select fill as directed by Engineer.
4. Construct new channel in compacted fill material within stream corridor. Any remaining fill dirt may be spread along floodplain edges to rebuild natural valley shape.

Construction Sequence

1. This project may be constructed in phases according to construction entrances and regions of the site. Contractor shall not start construction on one phase and move to another phase before stabilizing the first, unless a crew is continuing to work on the initial phase.
2. Construction sequencing shall be determined by the Contractor and the Contractor shall provide a schedule to the Engineer prior to commencement.
3. Install temporary livestock fencing, as necessary, to secure the project area prior to construction. Conservation easement fencing may be installed prior to construction to reduce or eliminate the need for temporary fencing.
4. Perform any necessary clearing and grubbing in phases as work progresses. Stream bank vegetation and floodplain vegetation immediately adjacent to live channels shall be left undisturbed as long as possible. Remove all non-native and invasive vegetation prior to beginning channel construction. Take care with vegetation marked for transplant from the old channel to the new channel. Do not disturb transplant vegetation until time of transplant.
5. Construction of all channels is 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 system as shown on the plans and discussed in the General Notes.
6. Where feasible, multiple off-line sections may be constructed concurrently. Off-line sections shall be tied on-line sequentially from downstream to upstream.
7. As work progresses, remove and stockpile the top three (3) inches of soil from the active grading area. Stockpiled topsoil shall be kept separate for on-site replacement prior to floodplain seeding.
8. Construct the proposed stream channel to the grade specified in the cross sections and profiles. Transfer coarse material from abandoned channel riffles to new channel riffles utilizing a pump-around system when doing so.
9. Install permanent stream crossings according to the details and specifications.
10. Sod mats can be used in lieu of coir fiber matting, where available, to stabilize all stream banks on site as the preferred stabilization method. Coir fiber matting may be used where sod mats are not available or if coir fiber matting is preferred at the discretion of the Engineer. Material used for sod mats must be approved by the Engineer.
11. Install in-stream structures (constructed riffles, log sills, cover logs, log vanes, and boulder sills) and bank revetments such as brush toe and sod mats after channel grading is completed according to the details and specifications.
12. Pond BMPs located above UT1 and Big Bugaboo Creek to be installed per the elevations defined in the plans. Outlet swale material is defined in the plans and shall be installed and stabilized as specified. Stormwater Step Pool Conveyance BMP's located above UT2 and UT2A to be installed per the elevations and in-stream structures as shown in the plans.
13. Seed (with specified temporary and permanent seed mix) and straw mulch areas where coir fiber matting is to be installed.
14. Grade the adjacent floodplain areas according to the plans.
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 the floodplain for seeding by applying stockpiled topsoil to the floodplain between bankfull elevation and the grading limits, ripping, and raking/smoothing. All haul roads and other areas of compacted soil must be thoroughly ripped or disked to a depth of 6-8 inches. 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 newly-constructed channel and additional work must be done on the floodplain, erosion control devices will be installed to protect the newly-constructed channel from sedimentation.
18. Once all phases of channel and floodplain construction are complete, any remaining fence lines shall be staked according to fencing plan. Install fence outside of the conservation easement according to the fencing plan, details, and specifications.
19. Prepare the floodplain areas for planting per the specifications.
20. Install bare root plants on the floodplain and live stakes and herbaceous plugs along the stream banks according to the planting plan, details, and specifications.

Construction Demobilization

1. Remove temporary stream crossings, stockpile areas, and erosion and sediment control devices. Note: Permanent vegetation must be established before measures can be removed.
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 unless otherwise directed by the Engineer.
6. All areas, including but not limited to pasture areas, roads, and entrances outside the conservation easement shall be returned to pre-project conditions or better.
7. 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 and where shown on the planting plan.
8. Notify DEMLR when all construction and demobilization activities are complete.

Existing Features

- EXISTING TOP OF BANK (TB)
- EXISTING THALWEG
- EXISTING FENCE (X — X)
- EXISTING STORM PIPE
- EXISTING MAJOR CONTOUR (100)
- EXISTING MINOR CONTOUR
- EXISTING RIGHT-OF-WAY (R/W)
- EXISTING PROPERTY LINE
- EXISTING TREE LINE
- EXISTING BEDROCK
- EXISTING FARM PATH
- EXISTING WETLAND
- EXISTING SPRING
- EXISTING OAK TREE
- EXISTING PINE TREE
- EXISTING GUM TREE
- EXISTING HICKORY TREE
- EXISTING POPLAR/MAPLE/BIRCH/ASH TREE

Proposed Features

- PROPOSED THALWEG (100+00)
- PROPOSED BANKFULL
- PROPOSED MAJOR CONTOUR (100)
- PROPOSED MINOR CONTOUR
- PROPOSED CONSERVATION EASEMENT (CE)
- PROPOSED CONSERVATION EASEMENT INTERNAL CROSSING (CE-IX)
- BOULDER SILL SEE DETAIL 1 SHEET 6.3
- CURVED BOULDER SILL SEE DETAIL 2 SHEET 6.3
- ANGLED LOG SILL SEE DETAIL 3 SHEET 6.3
- LOG J-HOOK SEE DETAIL 2 SHEET 6.1
- BOULDER SILL WITH BOULDER TOE PROTECTION SEE DETAIL 3 SHEET 6.1
- PROPOSED PERMANENT CULVERT CROSSING
- PROPOSED DROP INLET SEE DETAIL 4 SHEET 6.3
- PROPOSED WETLAND RE-ESTABLISHMENT
- PROPOSED STEP-POOL STORMWATER CONVEYANCE SEE DETAIL 1 SHEET 6.4
- PROPOSED ANGLED LOG RIFFLE (CR-ALR) SEE DETAIL 2 SHEET 6.0
- PROPOSED CHUNKY RIFFLE (CR-CH) SEE DETAIL 3 SHEET 6.0
- PROPOSED LOG-ROCK CASCADE RIFFLE (CR-LRC) SEE DETAIL 4 SHEET 6.0
- PROPOSED NATIVE MATERIAL RIFFLE (CR-NM) SEE DETAIL 1 SHEET 6.1
- PROPOSED STREAM BANK GRADING
- PROPOSED BMP VEGETATED SWALE SEE DETAIL 2 SHEET 6.4
- PROPOSED ROCK OUTLET
- PROPOSED BRUSH TOE SEE DETAIL 2 SHEET 6.2
- PROPOSED BOULDER TOE SEE DETAIL 1 SHEET 6.2
- COVER LOG SEE DETAIL 3 SHEET 6.2
- PROPOSED FLOODPLAIN SILL SEE DETAIL 4 SHEET 6.2

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Cool Springs Mitigation Site
Harnett County, North Carolina

General Notes and Symbols

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 0.2

September 3, 2021

COOL SPRINGS RD

CAMERON
D.B. 1136, PG. 345
M.B. 2006, PG. 19

CAMERON
D.B. 1136, PG. 345

PATTERSON
& SONS, INC
D.B. 1323, PG. 001
M.B. 2002, PG.791
PIN 0601-97-9821

WICKER
D.B. 3148, PG. 857

PATTERSON
D.B. 2044, PG. 357

PATTERSON
& SONS, INC
D.B. 1622, PG.187
M.B. 2002, PG. 791
PIN 0601-89-2857

PATTERSON
D.B. 905, PG. 673
M.B. 2011, PG. 417

WELLS
D.B. 1031, PG. 956

WELLS
D.B. 681, PG. 673

TRUITT
D.B. 2779, PG. 623

UT to Cedar Creek

PROPOSED 30' ACCESS EASEMENT
ALONG CENTERLINE OF EXISTING
GRAVEL AREAS (2.01 ACRES)

STA. 907+59
END T8
(RESTORATION)

STA. 907+75
END T8
(RESTORATION)
NOT FOR CREDIT

STA. 900+62
T8 (RESTORATION)
CREDITS BEGIN

STA. 900+00
BEGIN T8
NOT FOR CREDIT

STA. 127+73
END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)
NOT FOR CREDIT

STA. 128+74
END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
NOT FOR CREDIT

STA. 801+80
END T7
(ENHANCEMENT I)
STA. 126+37
UT TO CEDAR CREEK
REACH 2 (RESTORATION)

STA. 800+24
BEGIN T7
(ENHANCEMENT I)

STA. 124+19
END UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)

STA. 180+00
BEGIN BMP5

STA. 411+01
END T3 REACH 3
(ENHANCEMENT II)
STA. 114+87
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 305+12
END T2
(RESTORATION)
STA. 112+99
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 300+00
BEGIN BMP4

STA. 300+46
END BMP4
BEGIN T2
(RESTORATION)

STA. 170+00
BEGIN BMP3

STA. 171+47
END BMP3

STA. 160+00
BEGIN BMP2

STA. 150+95
BEGIN BMP1

STA. 100+58
BEGIN UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 152+44
END BMP1
STA. 100+68
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 161+39
END BMP2
STA. 102+26
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 204+44
END T1
(ENHANCEMENT II)
STA. 103+68
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 200+27
BEGIN T1
(ENHANCEMENT II)

STA. 118+65
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 182+95
END BMP5

STA. 119+29
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 509+51
END T4 REACH 2
(RESTORATION)
STA. 119+53
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 706+32
END T6
(RESTORATION)
STA. 507+77
T4 REACH 2
(RESTORATION)

STA. 701+33
T6 (RESTORATION)
CREDITS BEGIN

STA. 700+00
BEGIN T6
NOT FOR CREDIT

STA. 501+64
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

STA. 501+02
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

STA. 500+98
END T4 REACH 1
(RESTORATION)
BEGIN T4 REACH 2
(RESTORATION)
STA. 601+80
END T5
(RESTORATION)

STA. 500+01
BEGIN T4 REACH 1
(RESTORATION)

STA. 600+46
T5 (RESTORATION)
CREDITS BEGIN

STA. 408+05
END T3 REACH 2
(RESTORATION)
BEGIN T3 REACH 3
(ENHANCEMENT II)

STA. 404+39
END T3 REACH 1
(ENHANCEMENT II)
BEGIN T3 REACH 2
(RESTORATION)

STA. 400+60
INTERNAL CROSSING
T3 REACH 1
(ENHANCEMENT II)

STA. 400+17
BEGIN T3 REACH 1
(ENHANCEMENT II)

1.9.4 1.1.7 1.8.1 1.1.6 1.1.5 1.1.4 1.3.3 1.3.2 1.3.1 1.1.3 1.1.2 1.1.1 1.9.3 1.9.2 1.9.1 1.5.5 1.5.4 1.7.3 1.7.2 1.7.1 1.5.3 1.5.2 1.5.1 1.6.1 1.4.5 1.4.4 1.4.3 1.4.2 1.4.1 1.2.2 1.2.1

T8 T7 T6 T4 T5 T3 T2 T1

CE CE-IX TB

0' 100' 200' 300'
(HORIZONTAL)

N

X:\Shared\Projects\WI0189_Cool_Springs\Cadd\Plans\02189 Project Overview.dwg

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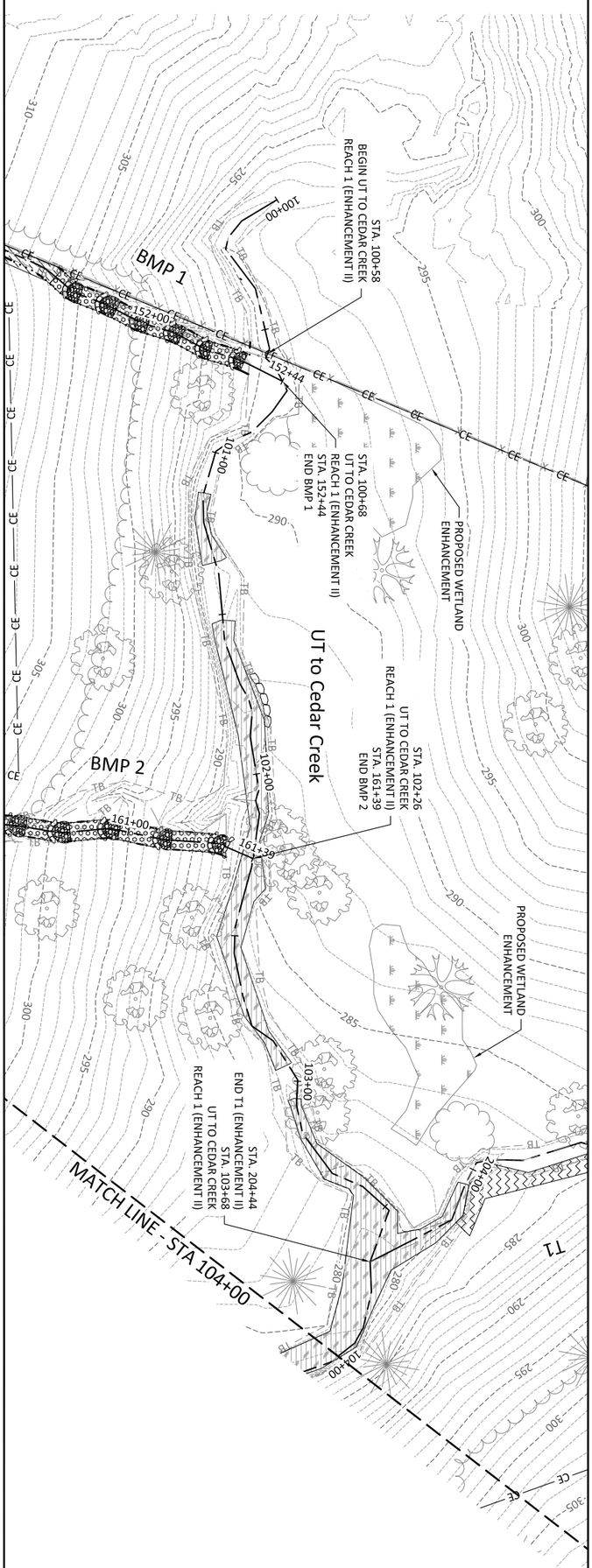
Harnett County, North Carolina

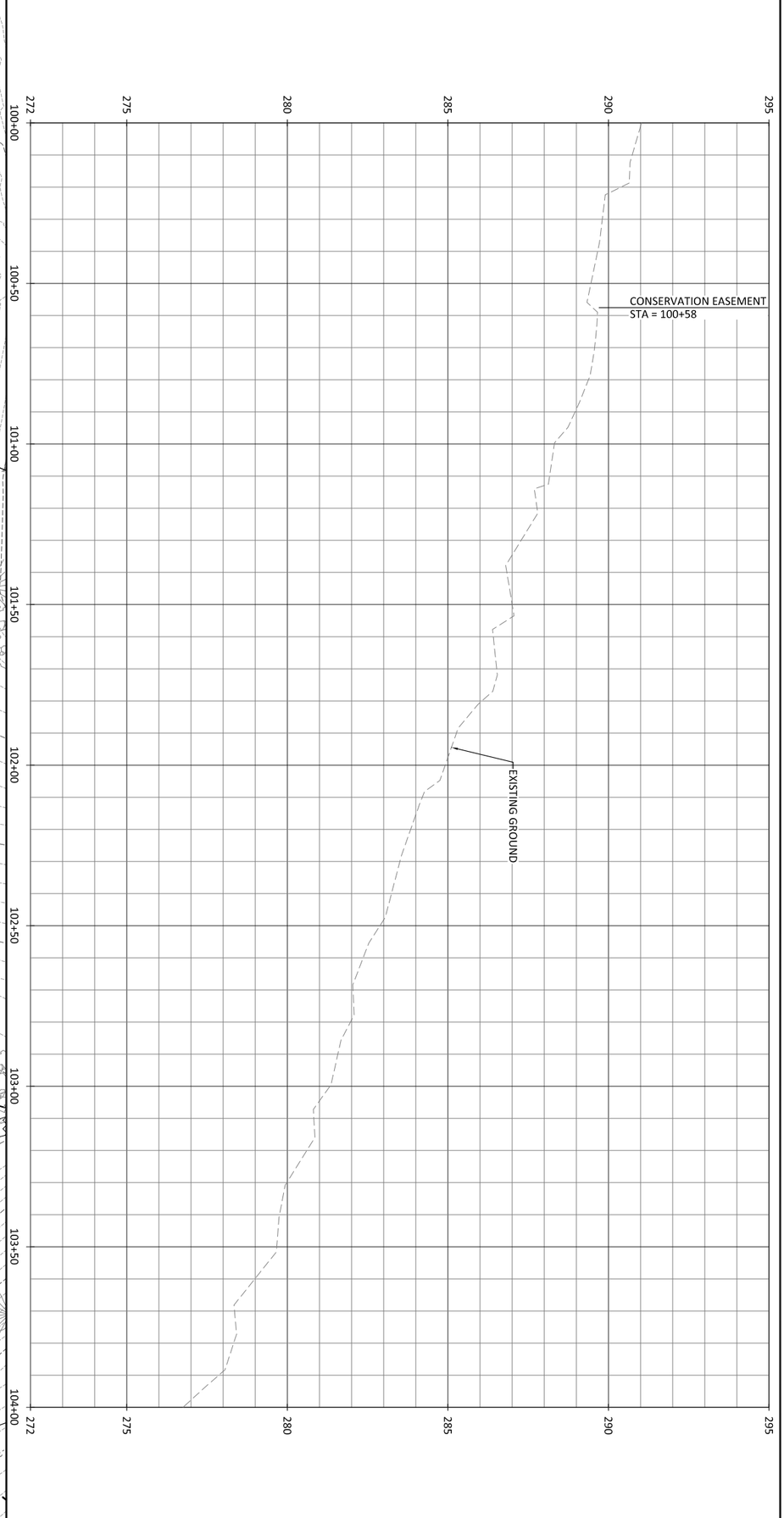
Project Overview

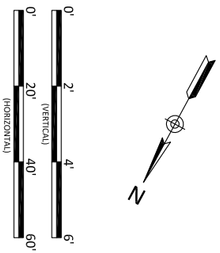
Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 0.3







Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
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1.1.1
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Cool Springs Mitigation Site
Harnett County, North Carolina

UT to Cedar Creek
Stream Plan and Profile

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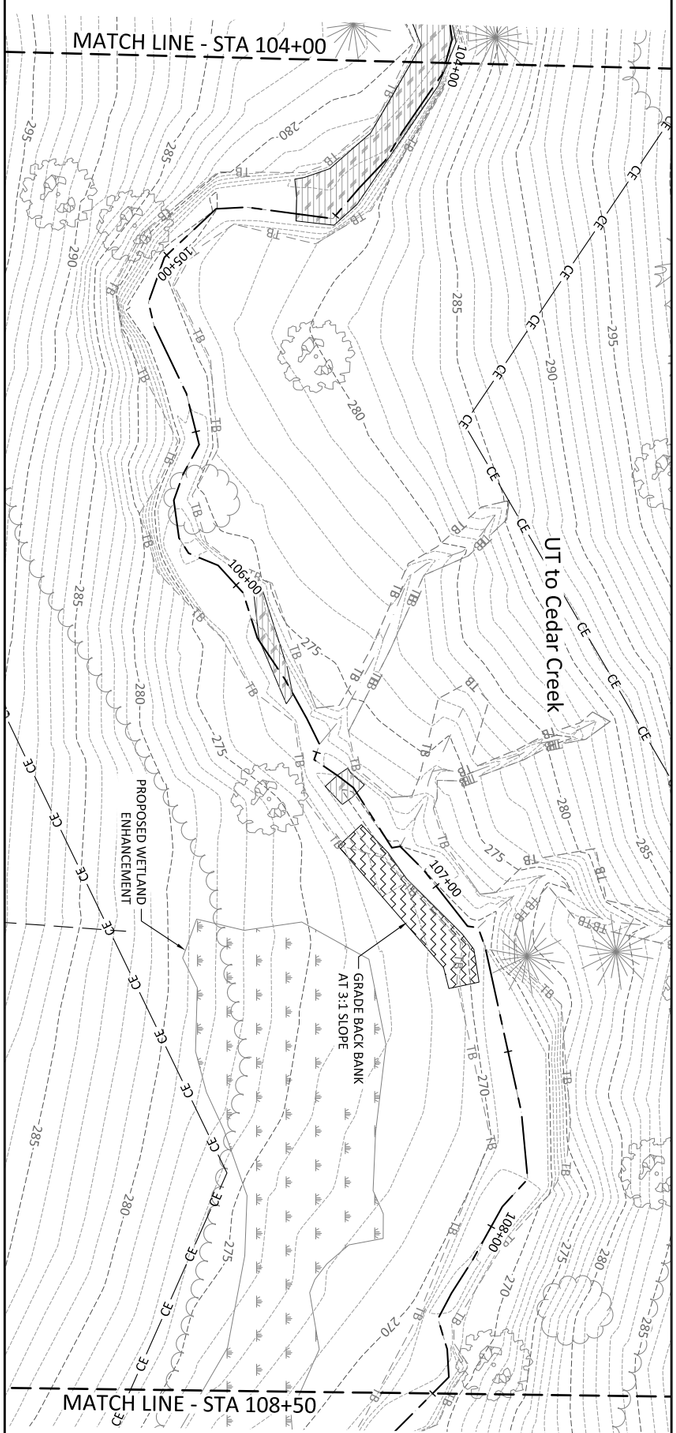

0' 20' 40' 60' (HORIZONTAL)
0' 2' 4' 6' (VERTICAL)

N

Date:	06.17.21
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UT to Cedar Creek
Stream Plan and Profile

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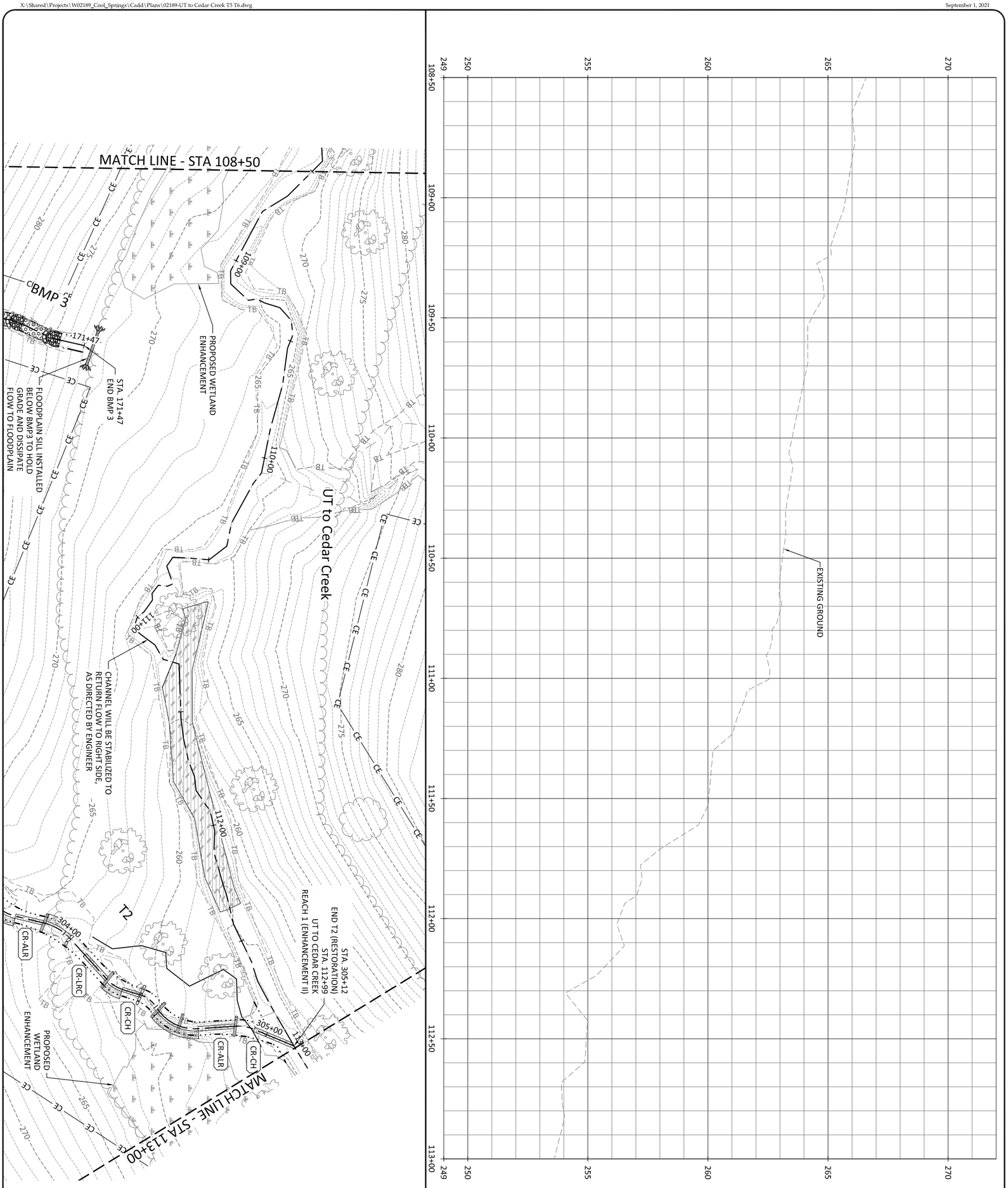

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Cool Springs Mitigation Site
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UT to Cedar Creek
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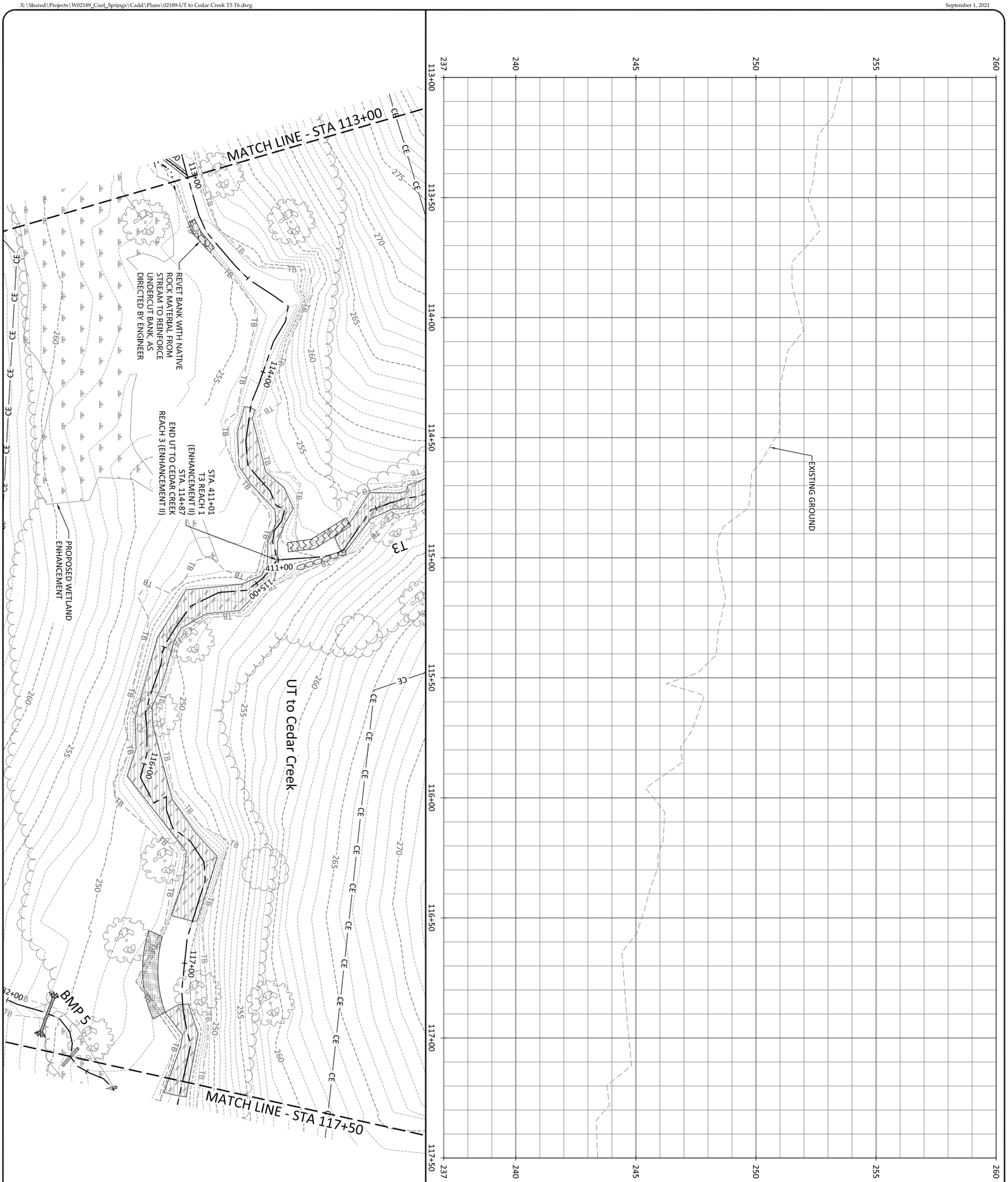

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1.1.4
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Cool Springs Mitigation Site
Harnett County, North Carolina

UT to Cedar Creek
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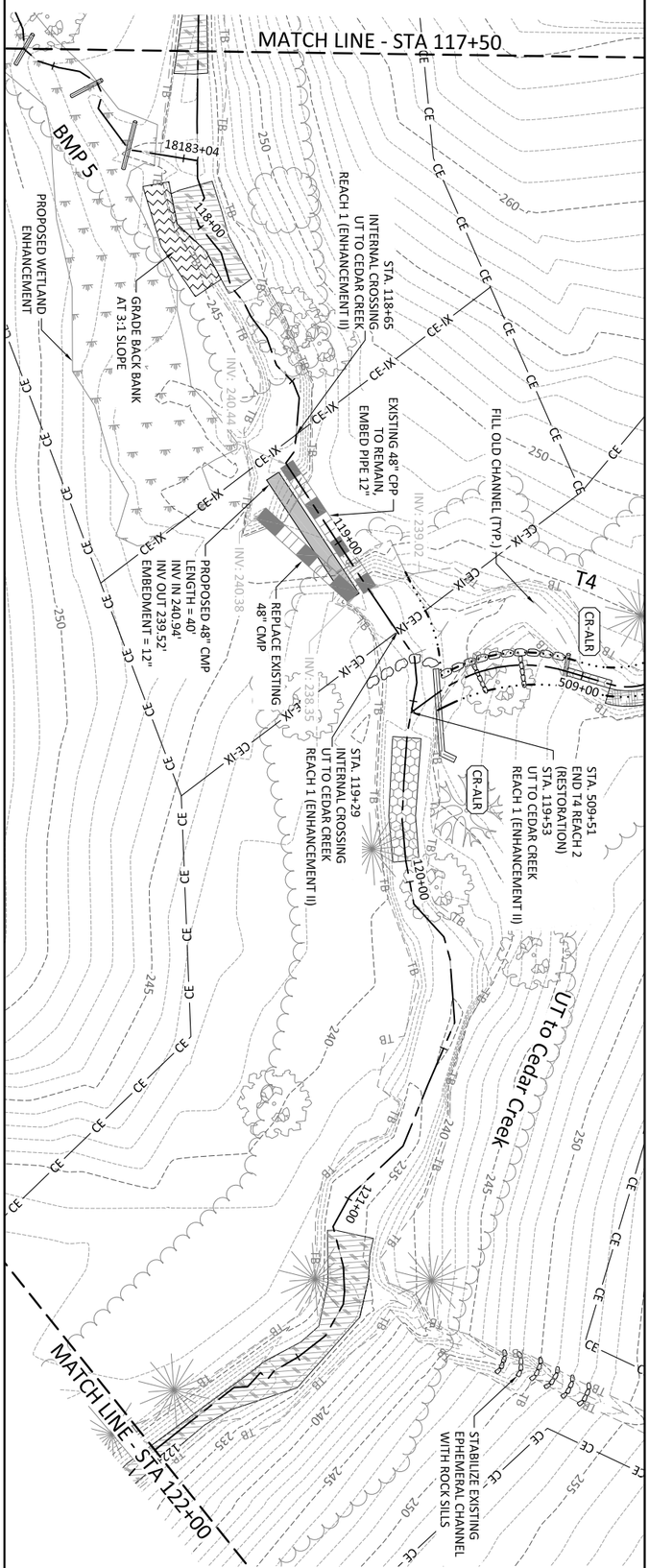

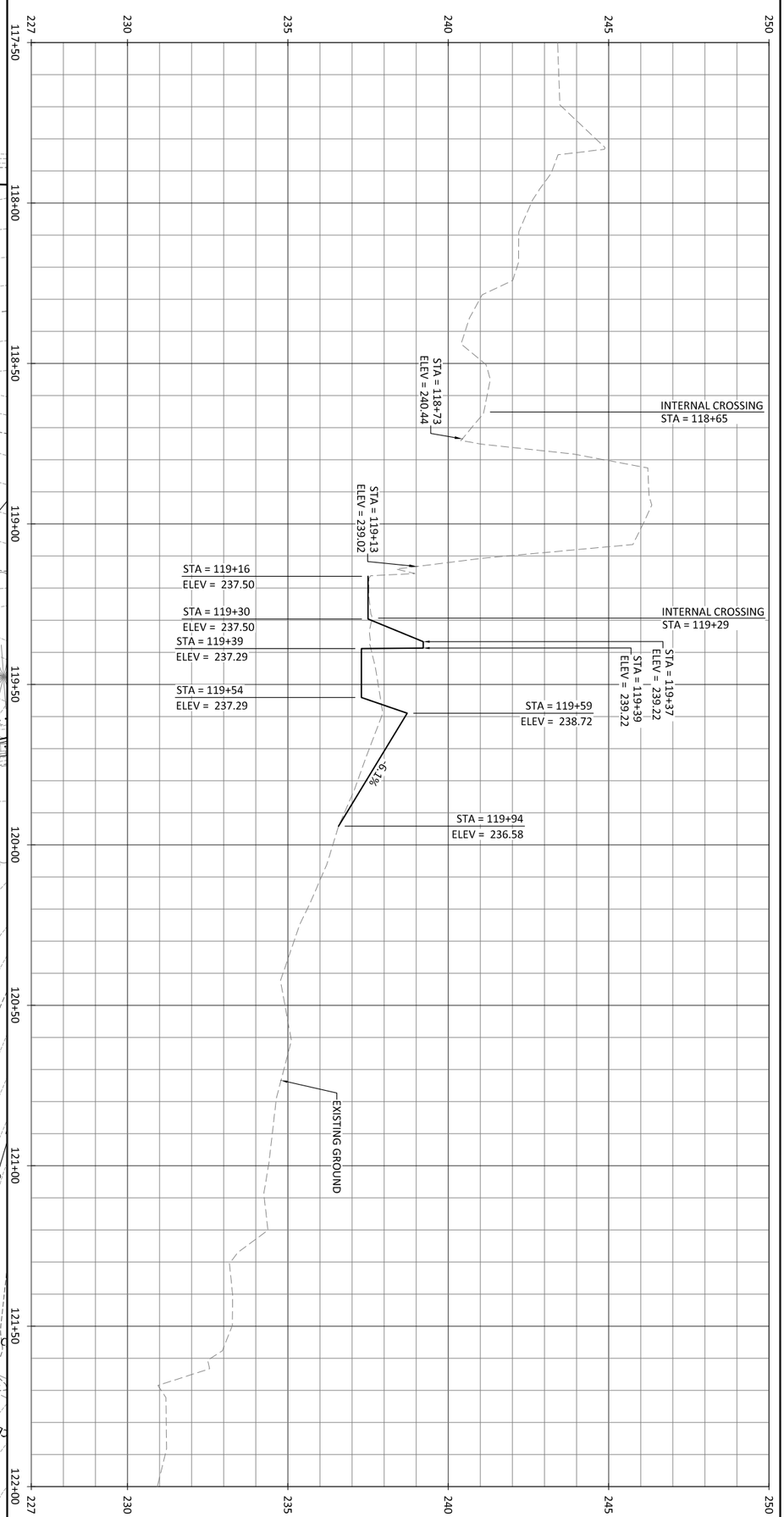

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Project Engineer:	NMM
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Revisions:

1.1.5
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Cool Springs Mitigation Site
Harnett County, North Carolina

UT to Cedar Creek
Stream Plan and Profile

60% PLANS DO NOT USE FOR CONSTRUCTION

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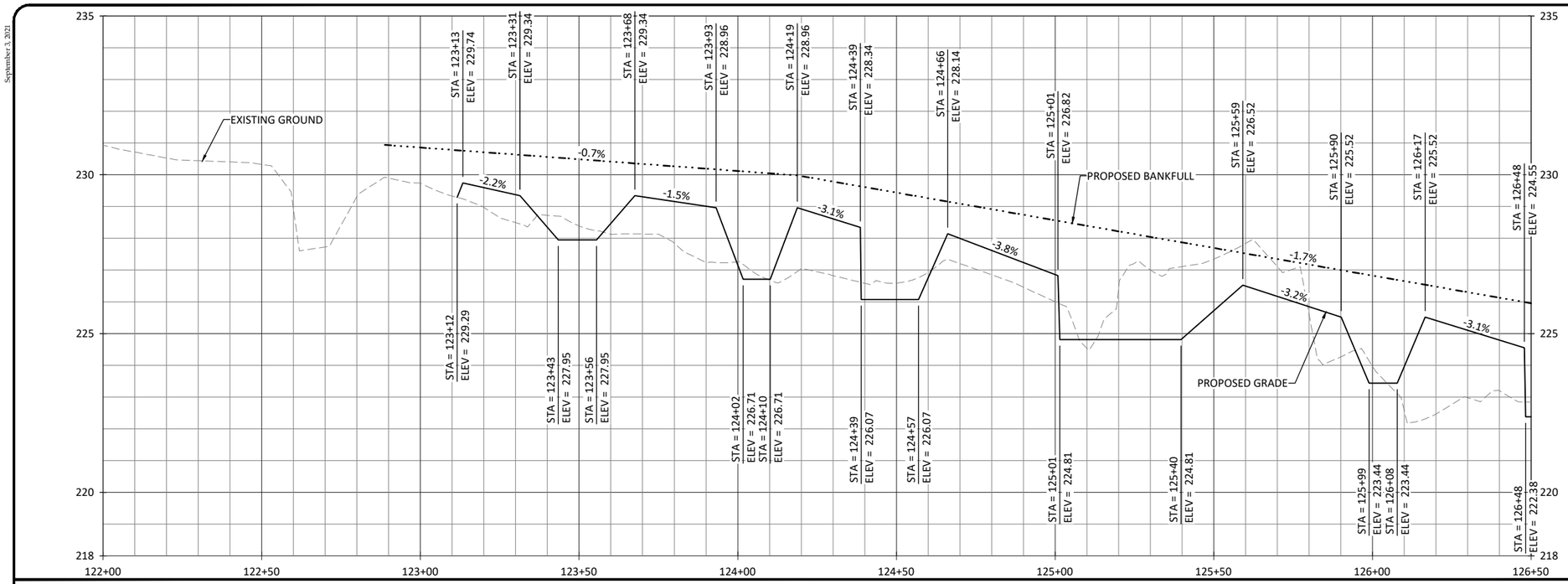
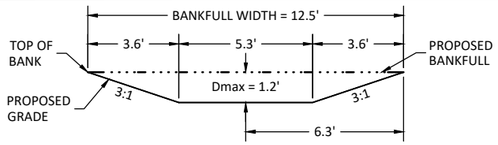
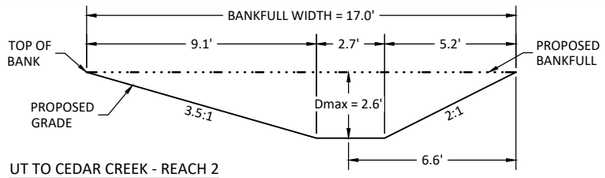
September 3, 2021

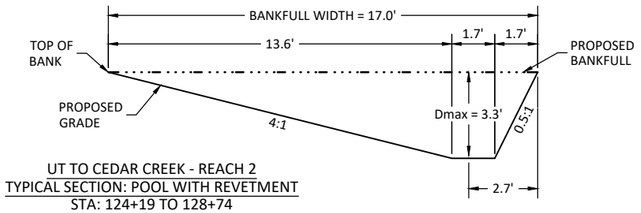




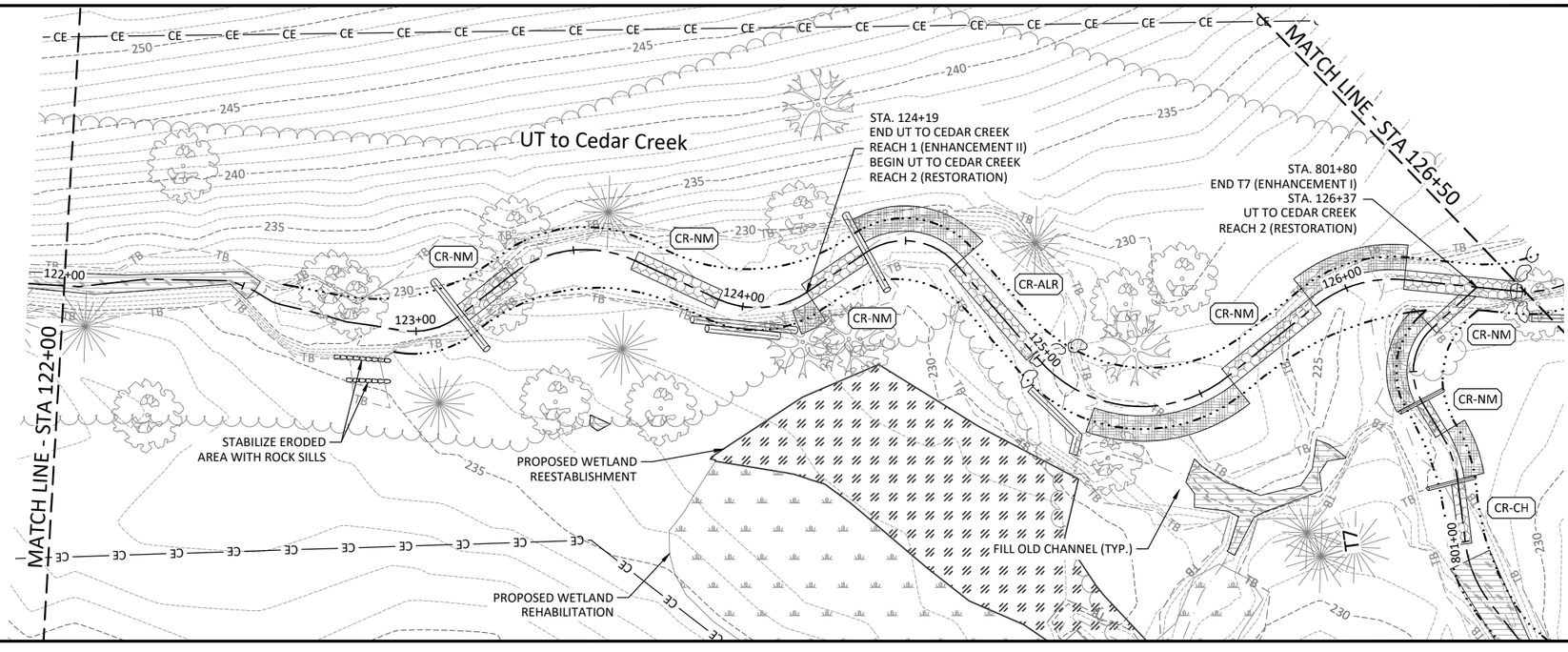
UT TO CEDAR CREEK - REACH 2
TYPICAL SECTION: RIFFLE
STA: 124+19 TO 128+74

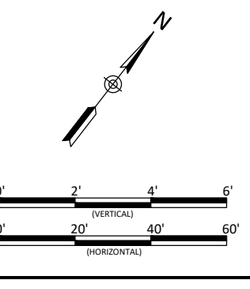


UT TO CEDAR CREEK - REACH 2
TYPICAL SECTION: SHALLOW POOL
STA: 124+19 TO 128+74



UT TO CEDAR CREEK - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 124+19 TO 128+74





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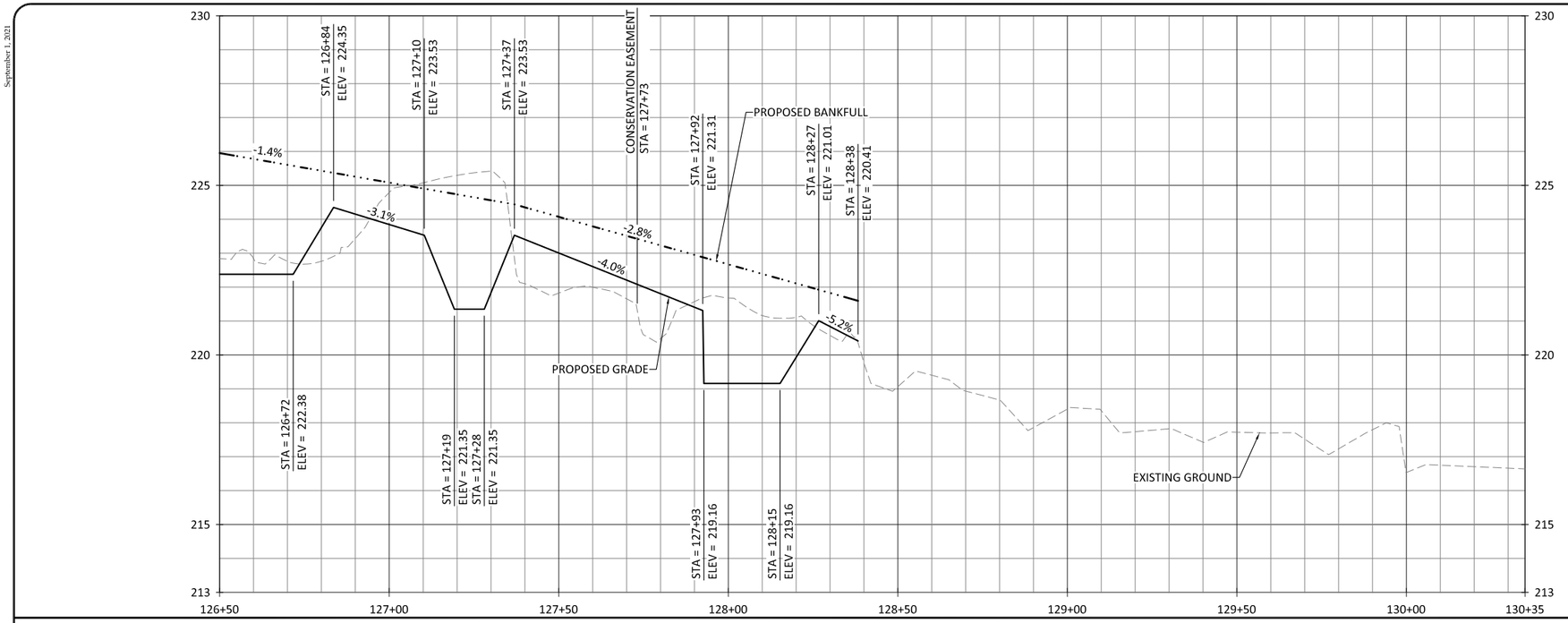
UT to Cedar Creek
Stream Plan and Profile

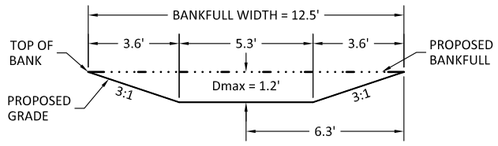
Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

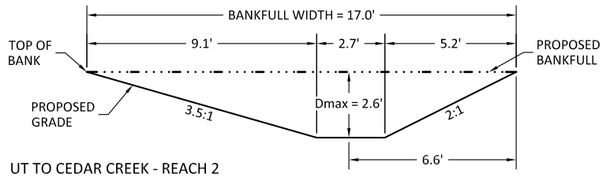
Sheet 1.1.6

September 1, 2021

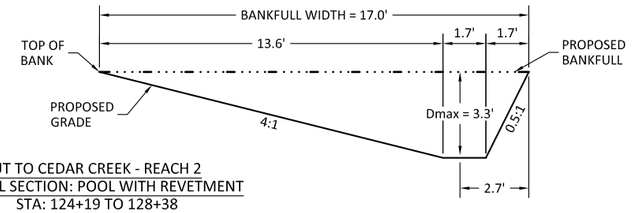




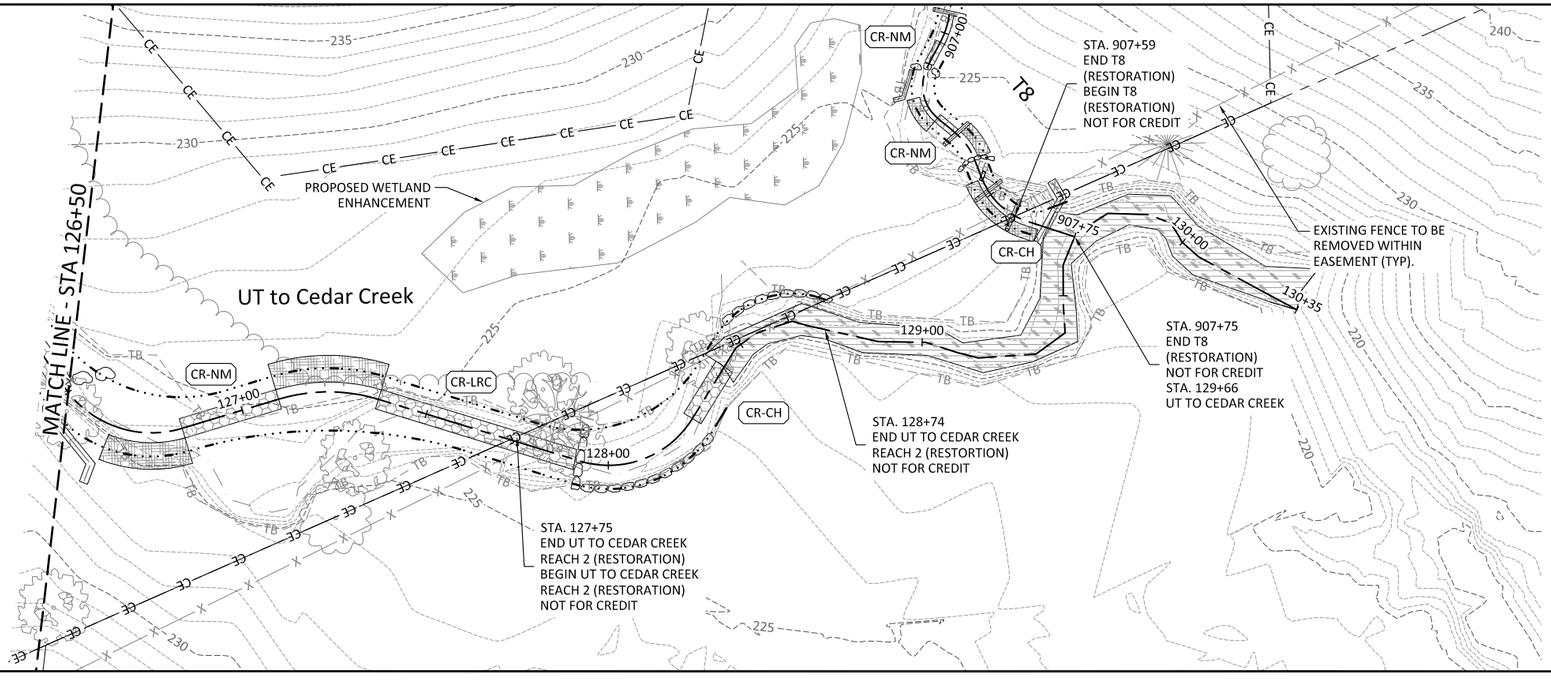
UT TO CEDAR CREEK - REACH 2
TYPICAL SECTION: RIFFLE
STA: 124+19 TO 128+38



UT TO CEDAR CREEK - REACH 2
TYPICAL SECTION: SHALLOW POOL
STA: 124+19 TO 128+38



UT TO CEDAR CREEK - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 124+19 TO 128+38



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UT to Cedar Creek
Stream Plan and Profile

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.1.7

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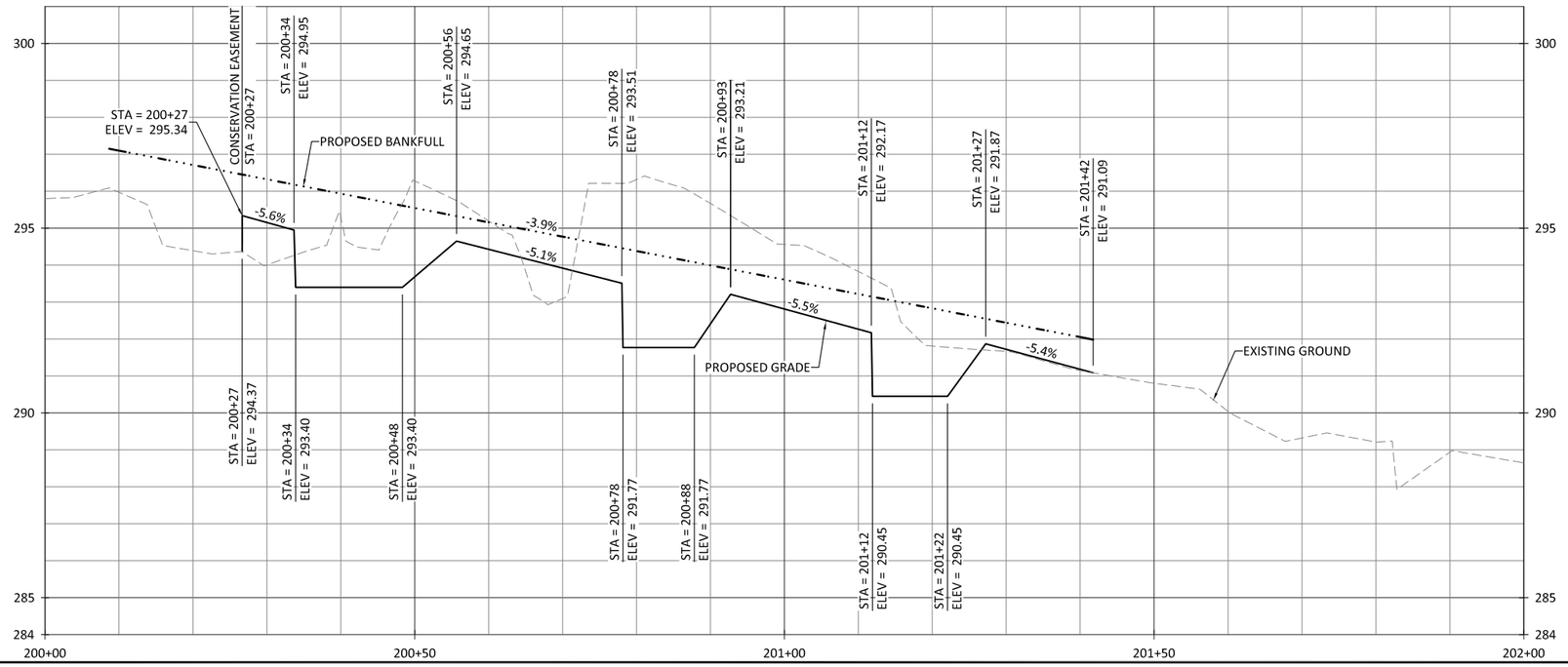
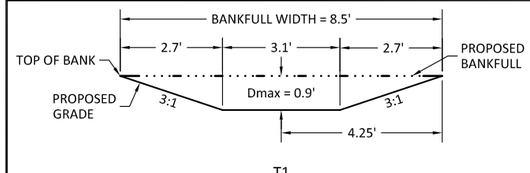
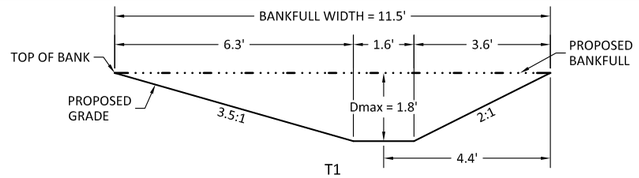
September 1, 2021

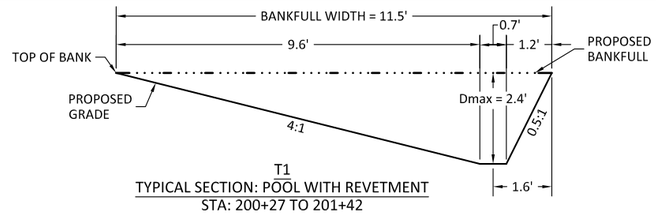




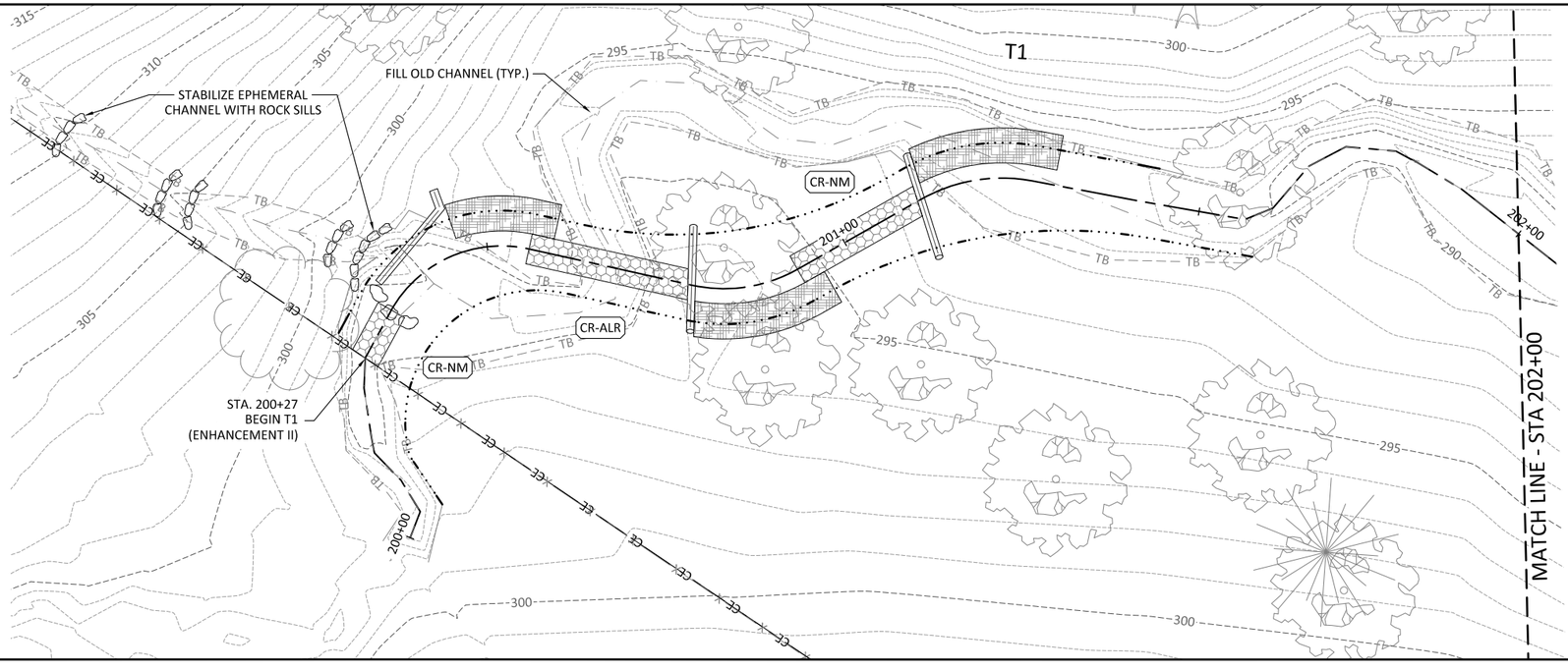
T1
TYPICAL SECTION: RIFFLE
STA: 200+27 TO 201+42

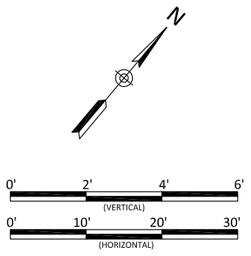


T1
TYPICAL SECTION: SHALLOW POOL
STA: 200+27 TO 201+42



T1
TYPICAL SECTION: POOL WITH REVETMENT
STA: 200+27 TO 201+42





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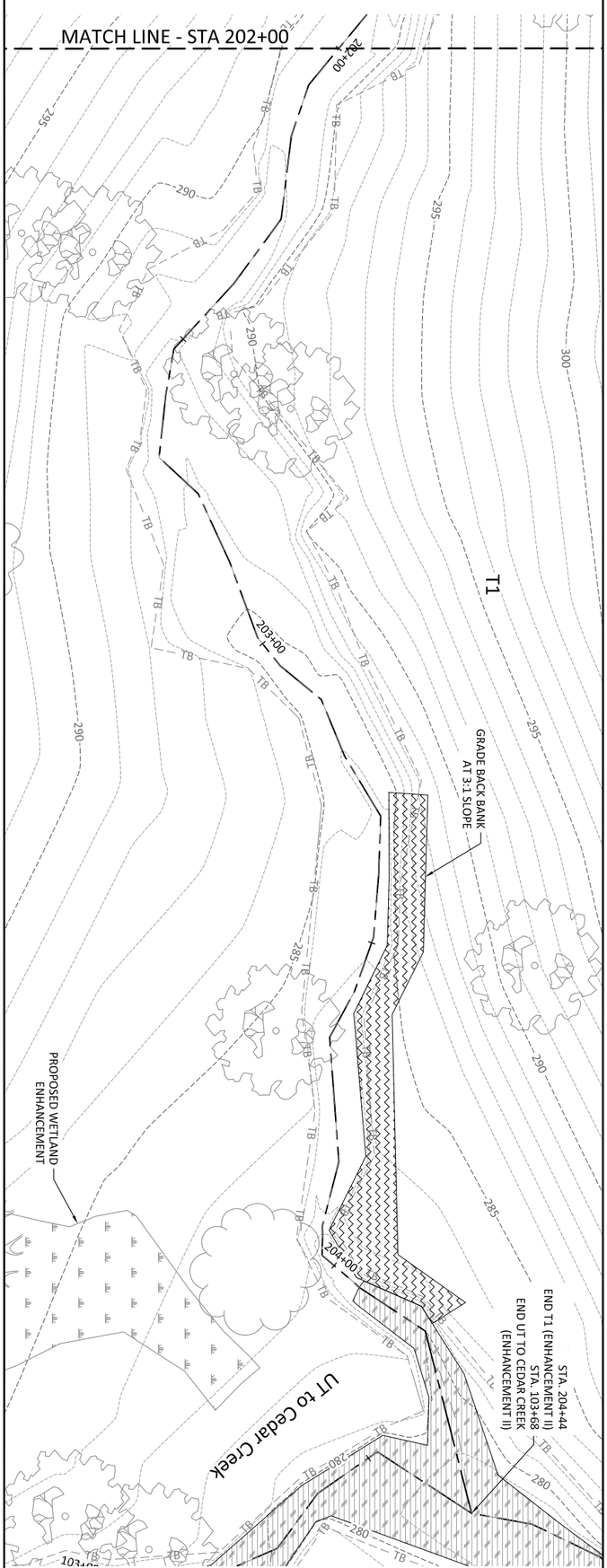
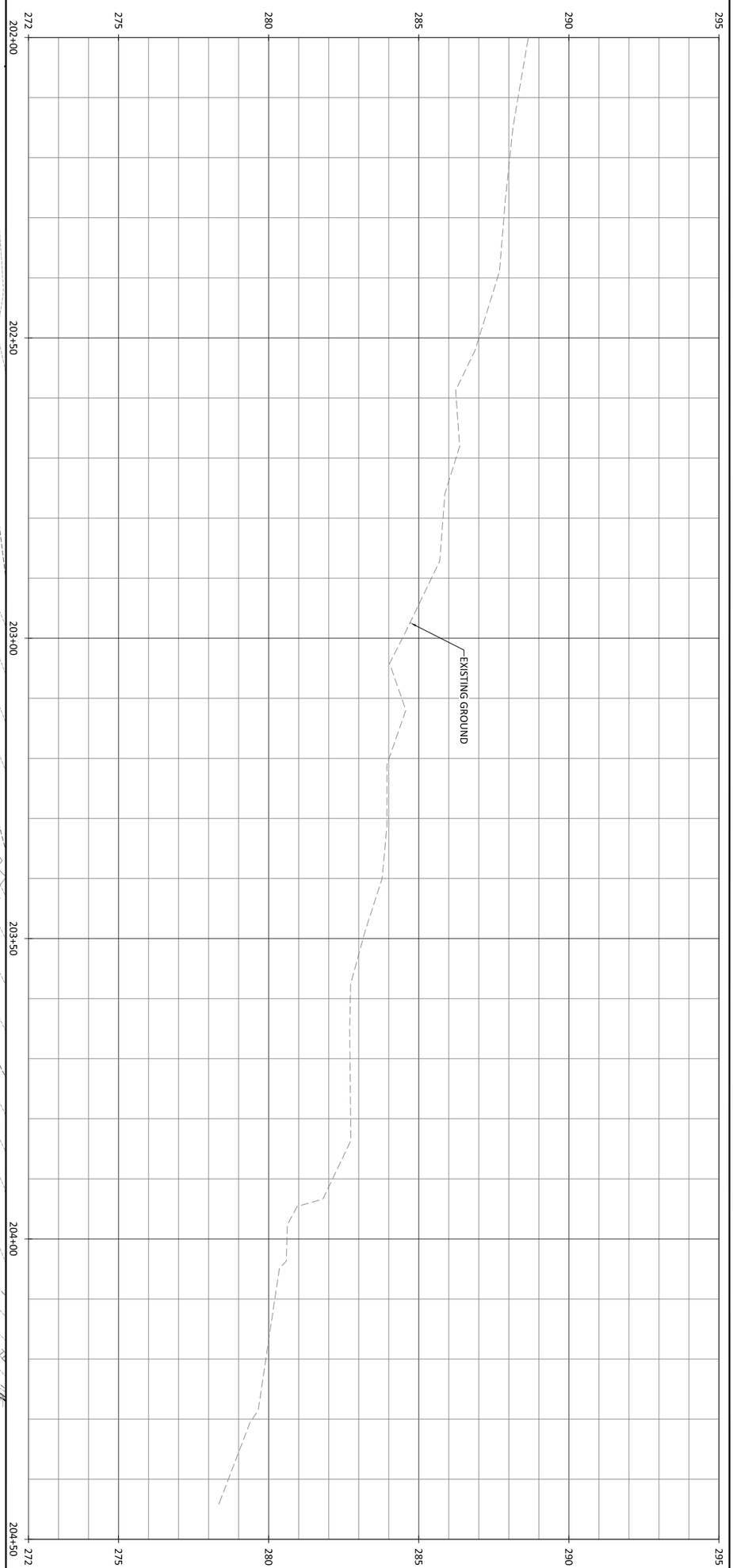
T1
T1 Stream Plan and Profile

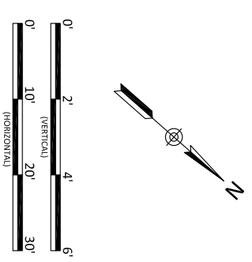
Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.2.1







Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
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1.2.2
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Cool Springs Mitigation Site
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T1
Stream Plan and Profile

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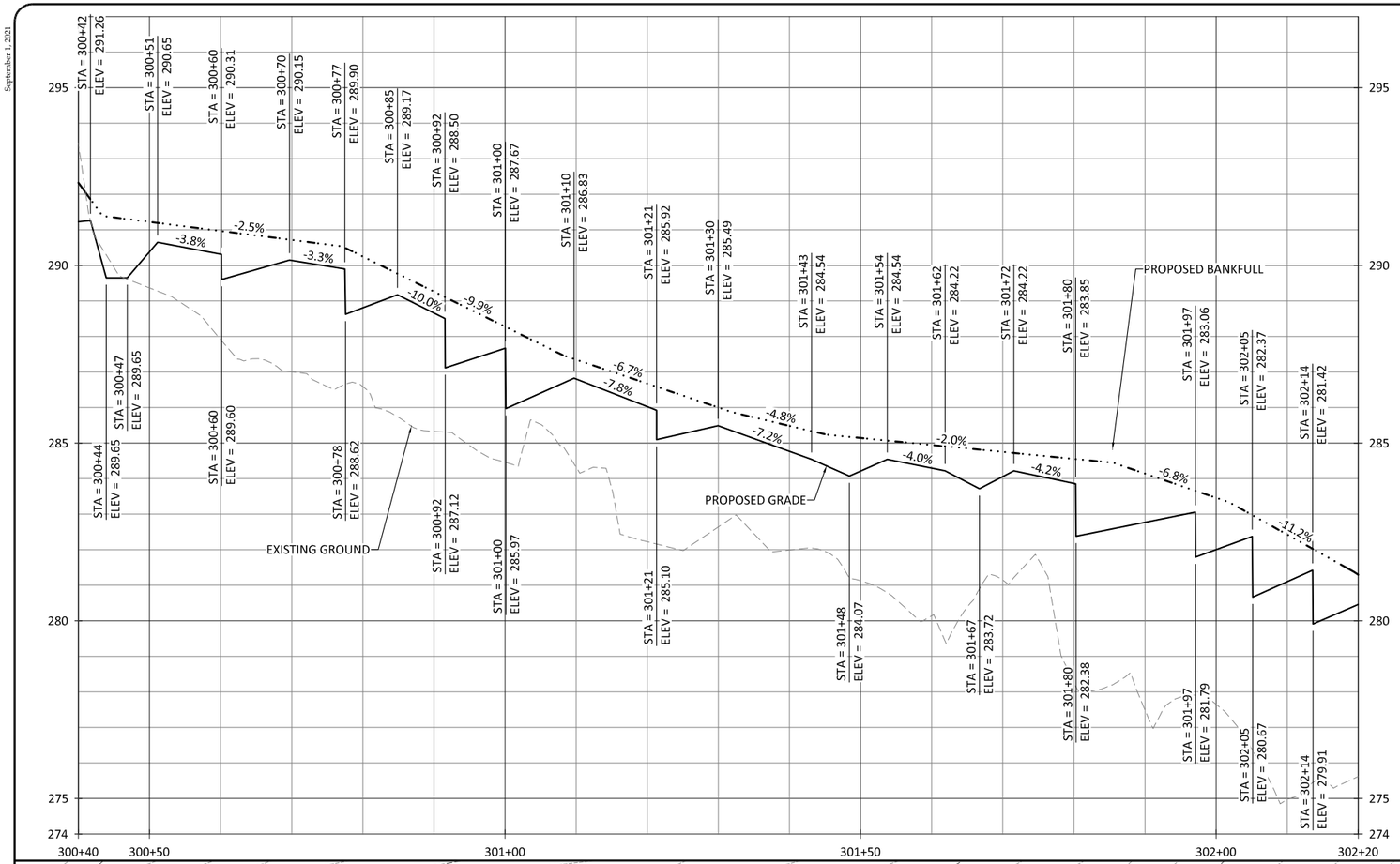
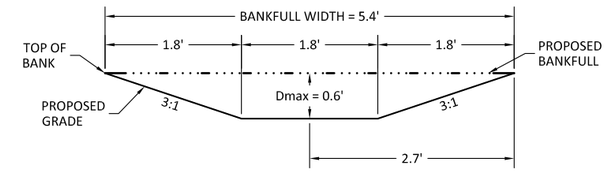
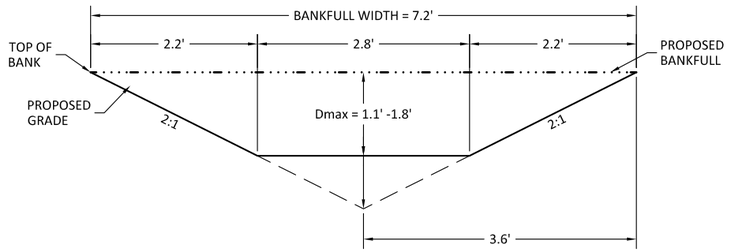
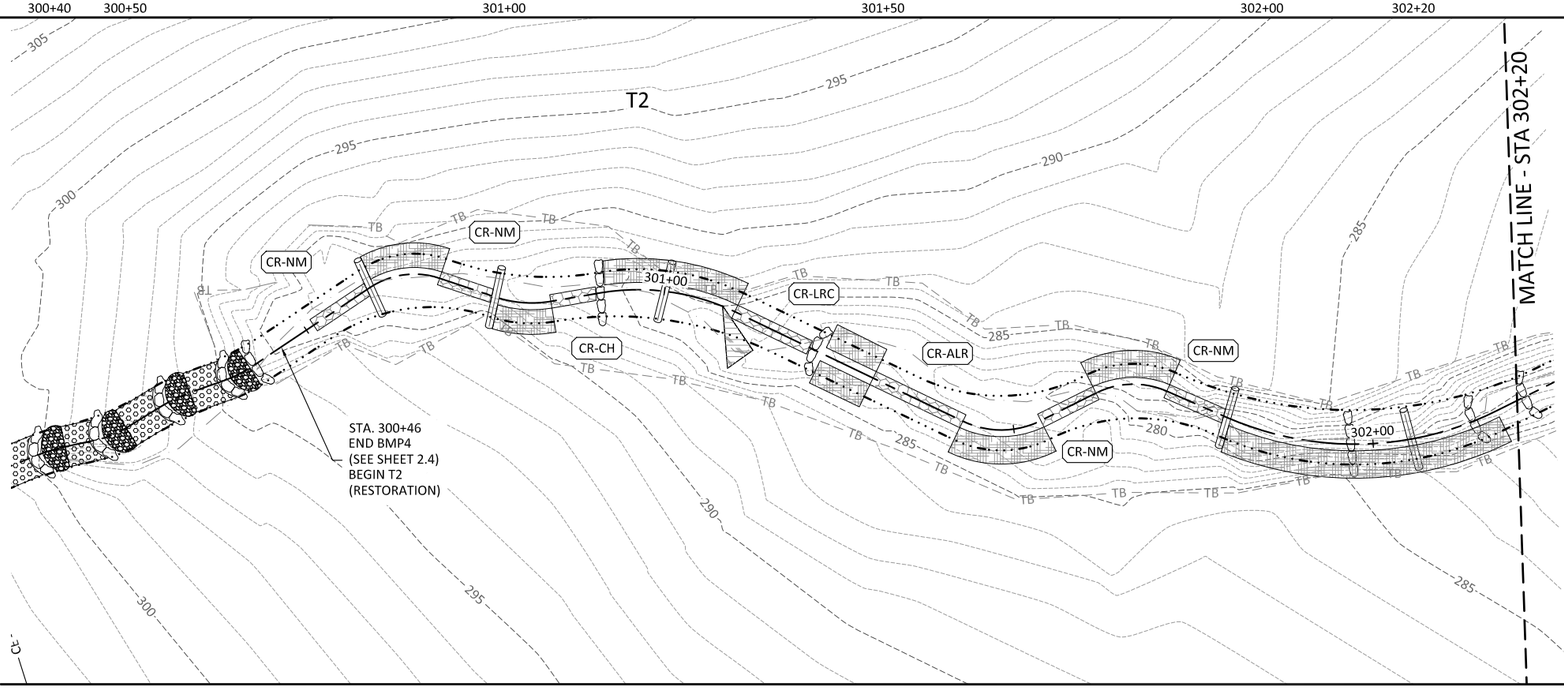




T2
TYPICAL SECTION: RIFFLE
STA: 300+46 TO 305+12



T2
TYPICAL SECTION: STEP POOL
STA: 300+46 TO 305+12



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T2
Stream Plan and Profile

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Checked By:	GAT

Sheet
1.3.1

September 1, 2021
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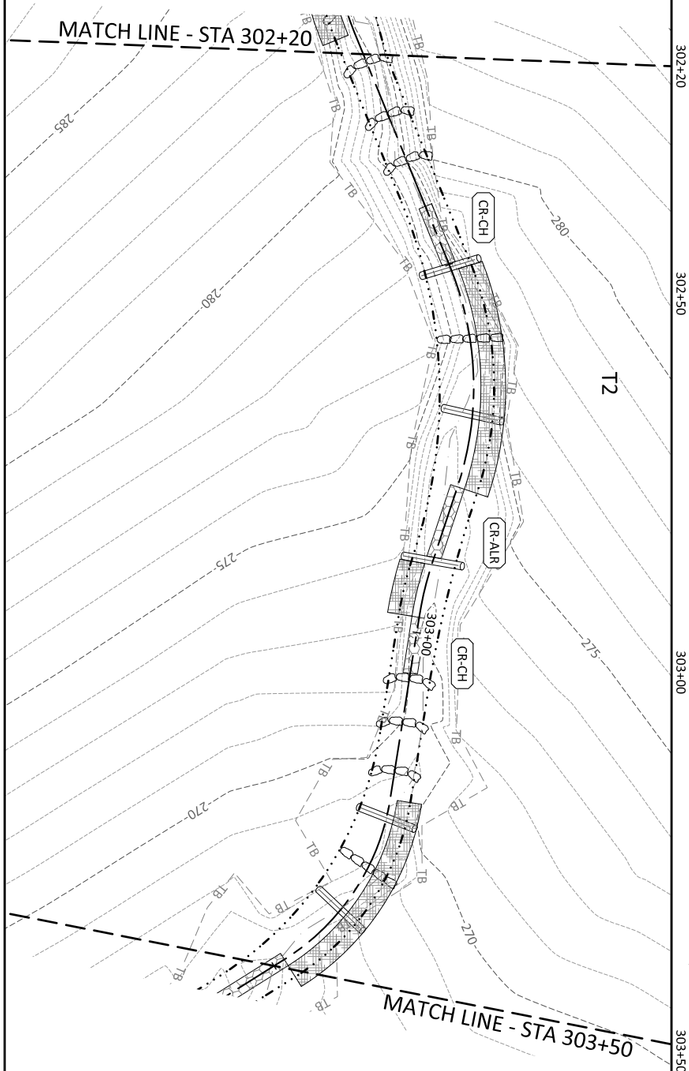

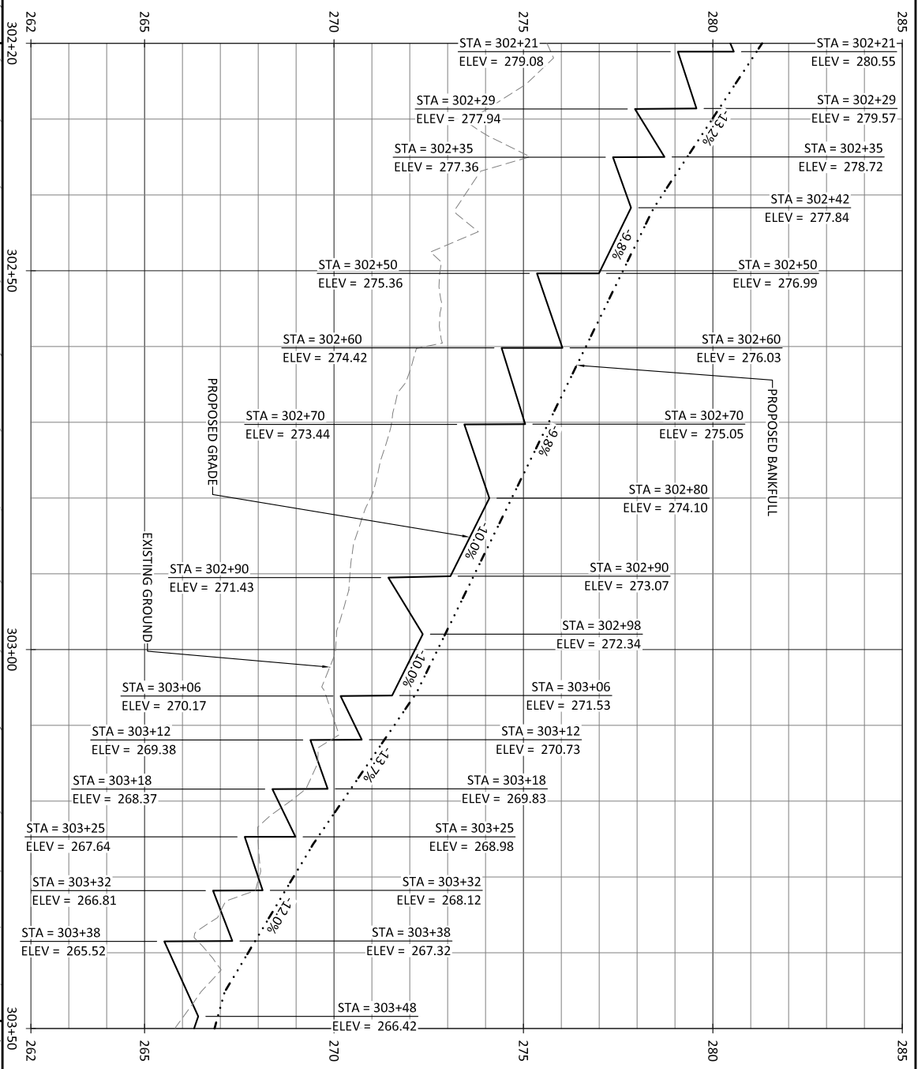

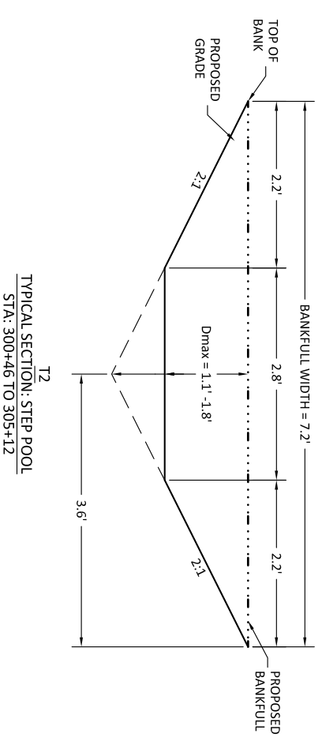

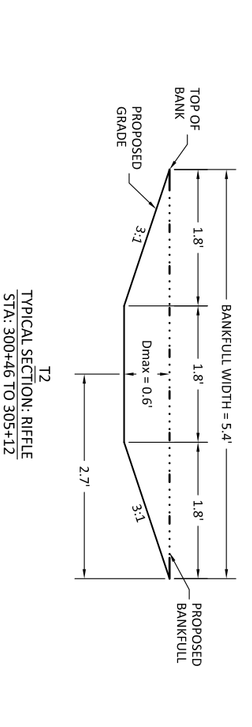

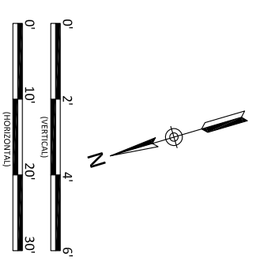

Date:	06.17.21
Job Number:	500-02189
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Cool Springs Mitigation Site
Harnett County, North Carolina

T2
Stream Plan and Profile

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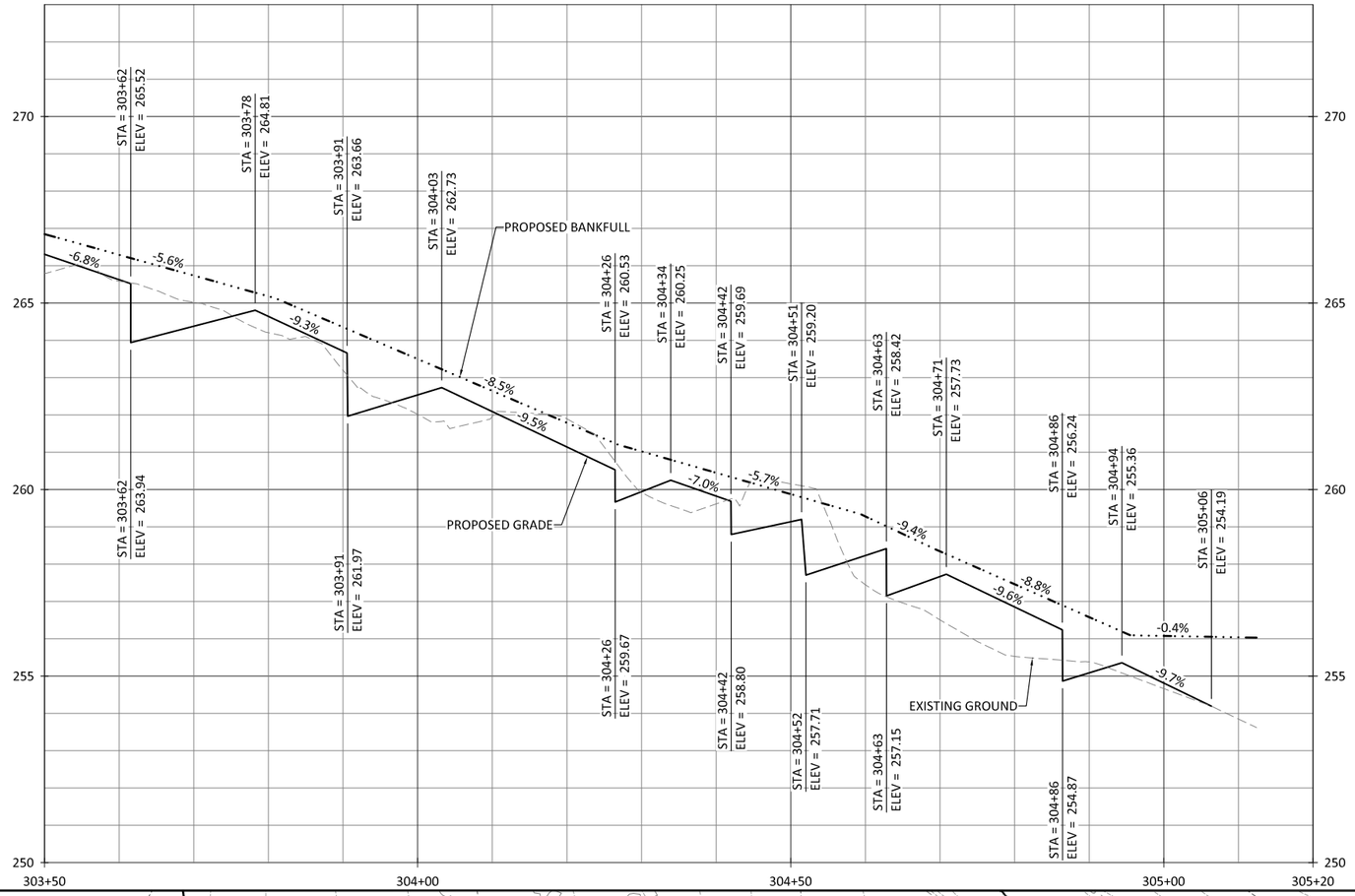
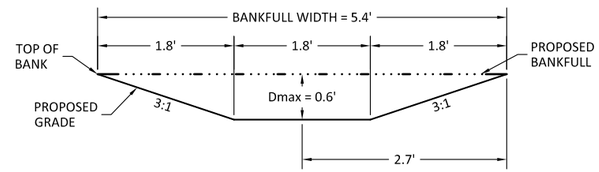
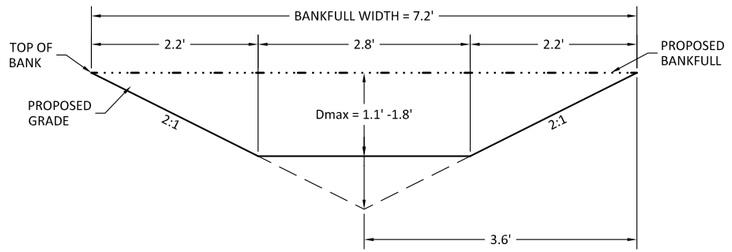
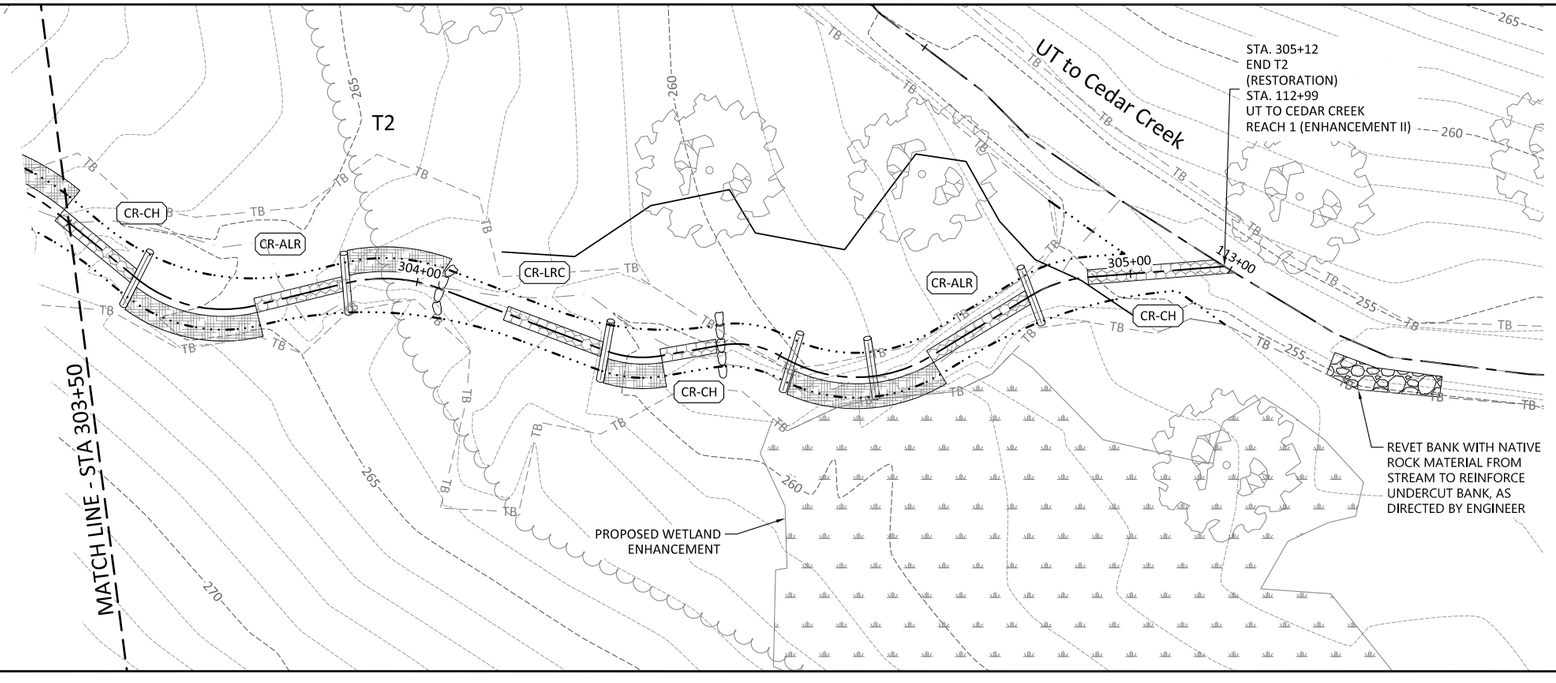


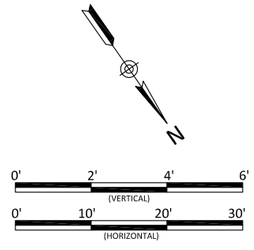


T2
TYPICAL SECTION: RIFFLE
STA: 300+46 TO 305+12



T2
TYPICAL SECTION: STEP POOL
STA: 300+46 TO 305+12





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T2
Stream Plan and Profile

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Date:	06.17.21
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Sheet 1.3.3

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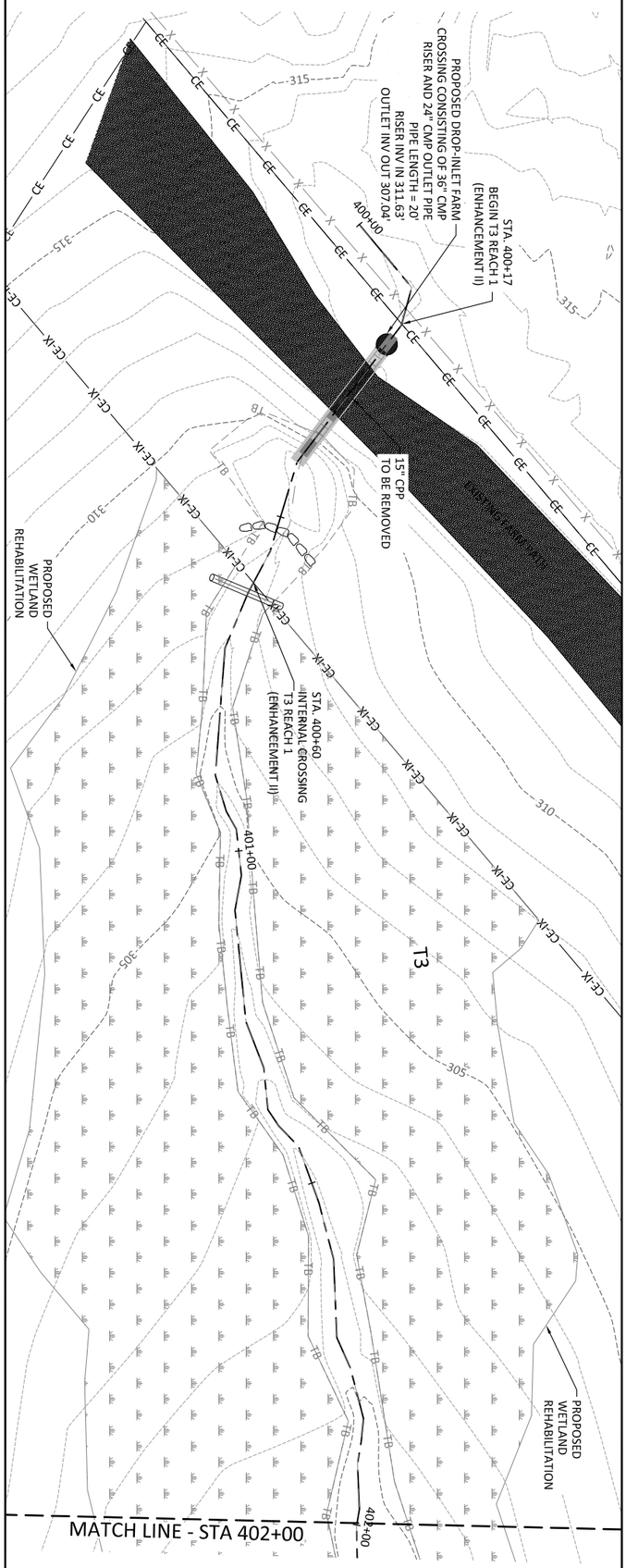

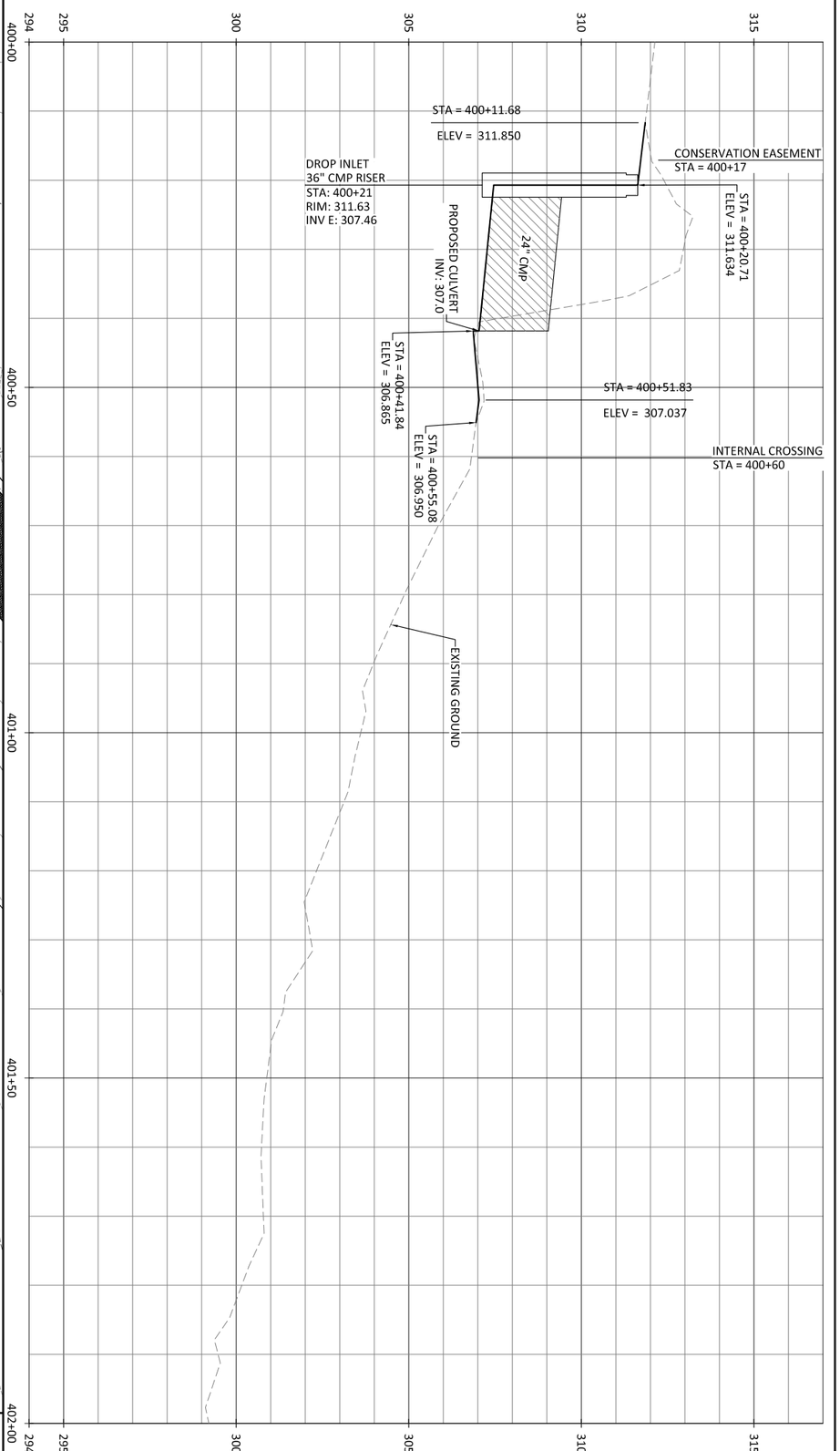

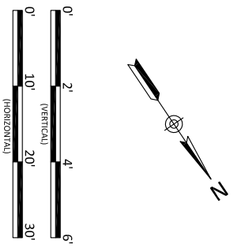

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Job Number:	500-02189
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Cool Springs Mitigation Site
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T3
Stream Plan and Profile

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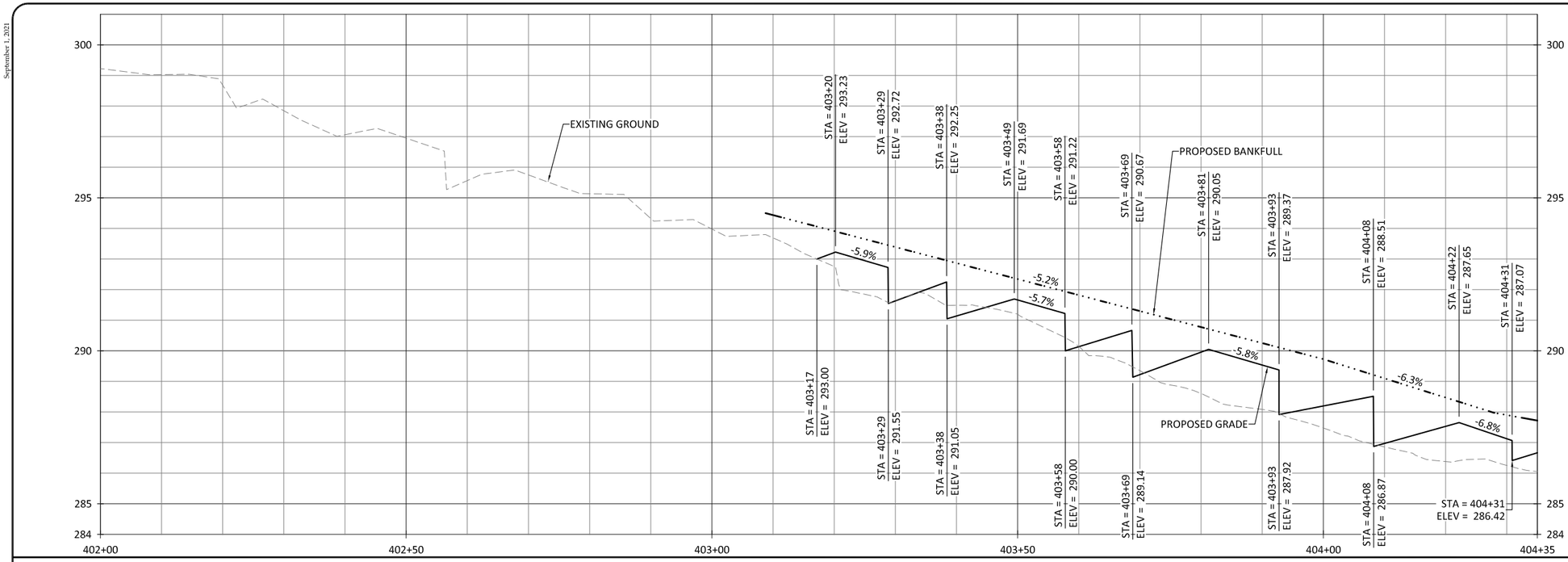
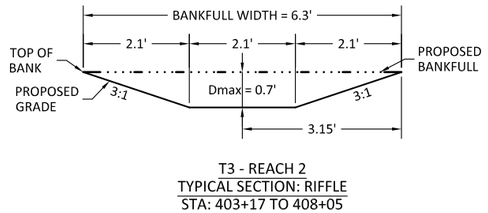
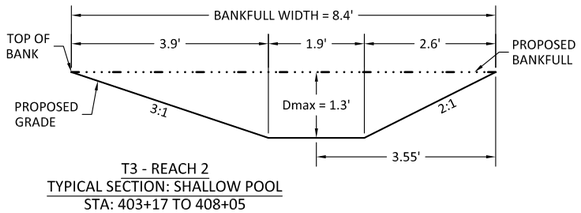
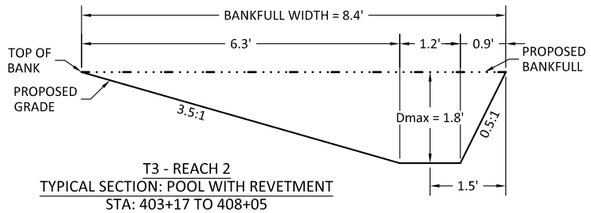




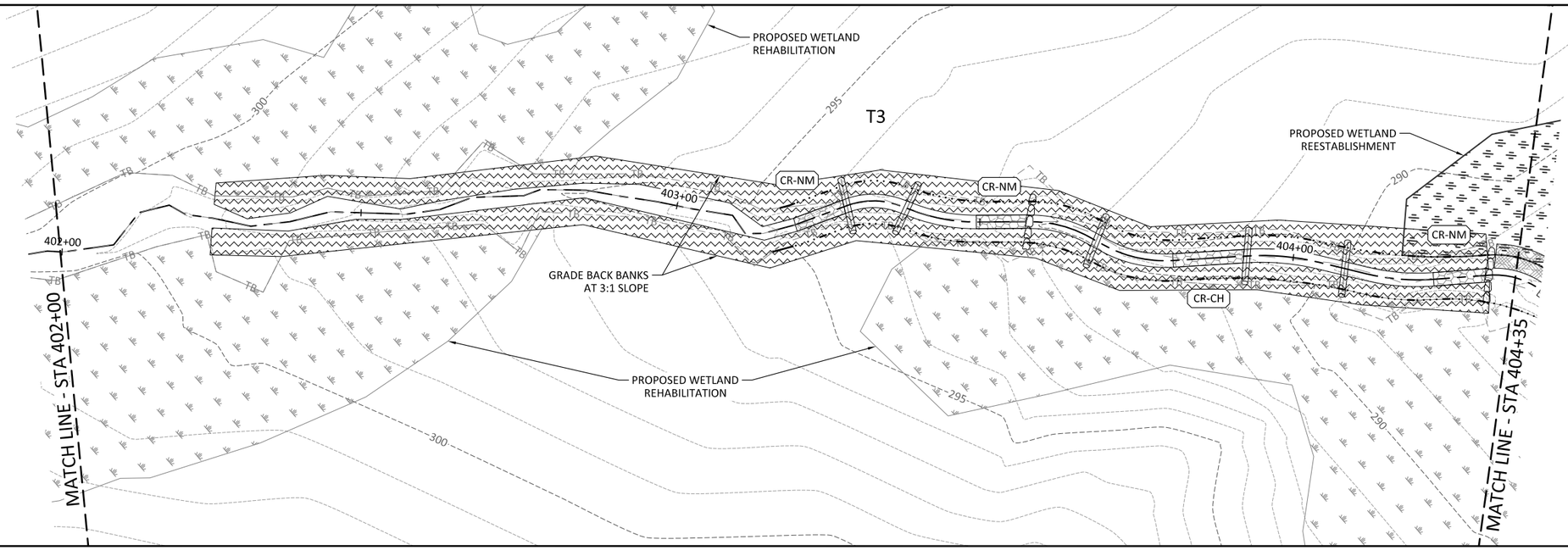
T3 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 403+17 TO 408+05



T3 - REACH 2
TYPICAL SECTION: SHALLOW POOL
STA: 403+17 TO 408+05



T3 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 403+17 TO 408+05



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T3
Stream Plan and Profile

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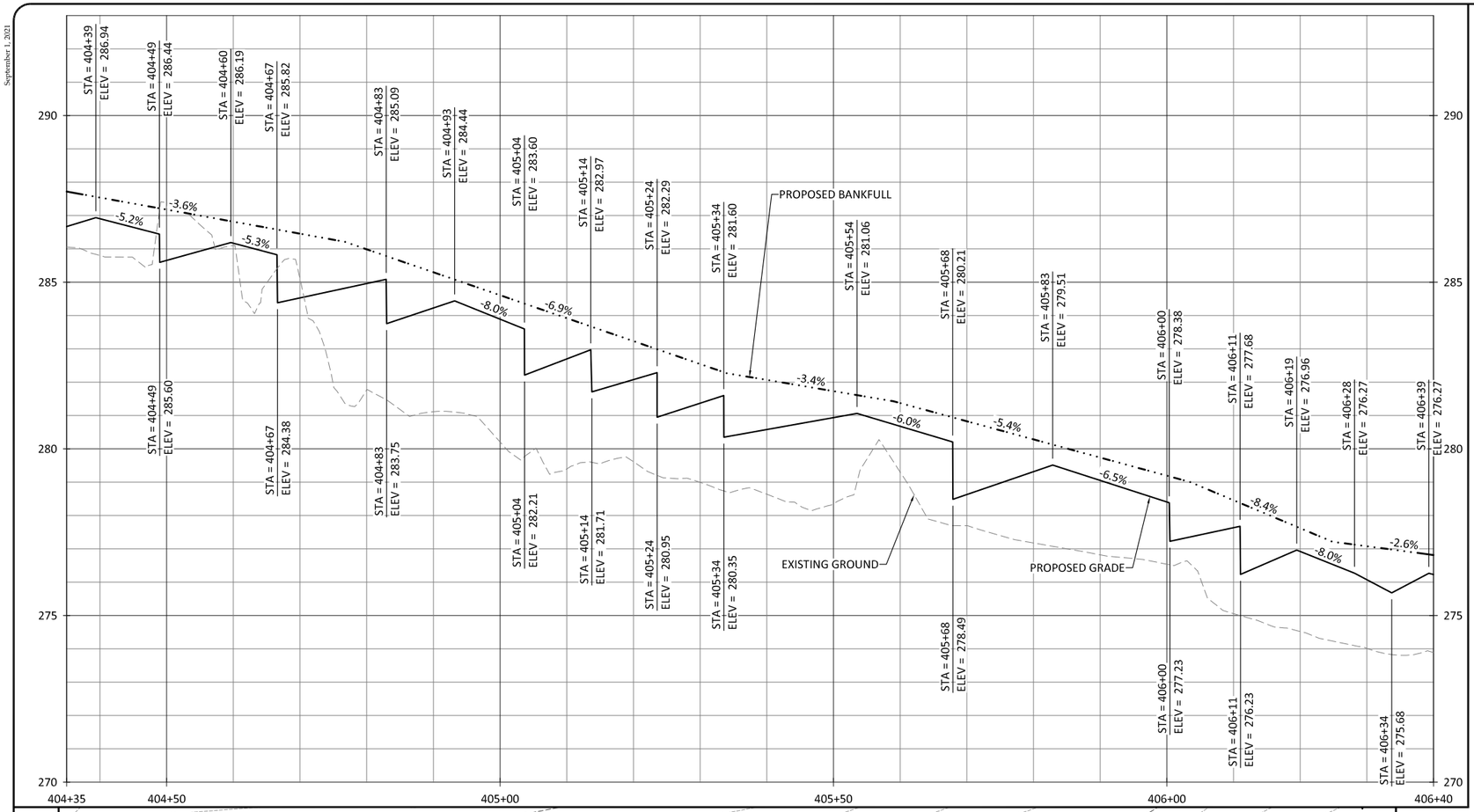
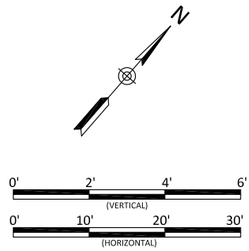
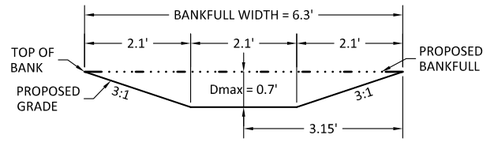
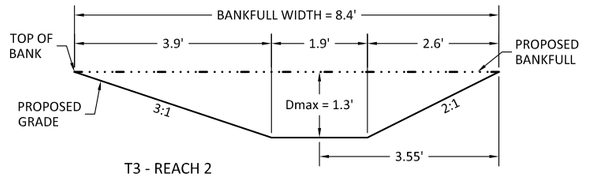


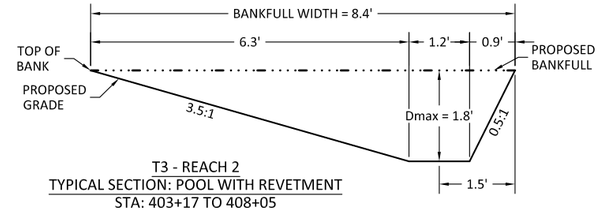




T3 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 403+17 TO 408+05



T3 - REACH 2
TYPICAL SECTION: SHALLOW POOL
STA: 403+17 TO 408+05



T3 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 403+17 TO 408+05

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T3
Stream Plan and Profile

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Drawn By: CAW
Checked By: GAT

Sheet 1.4.3

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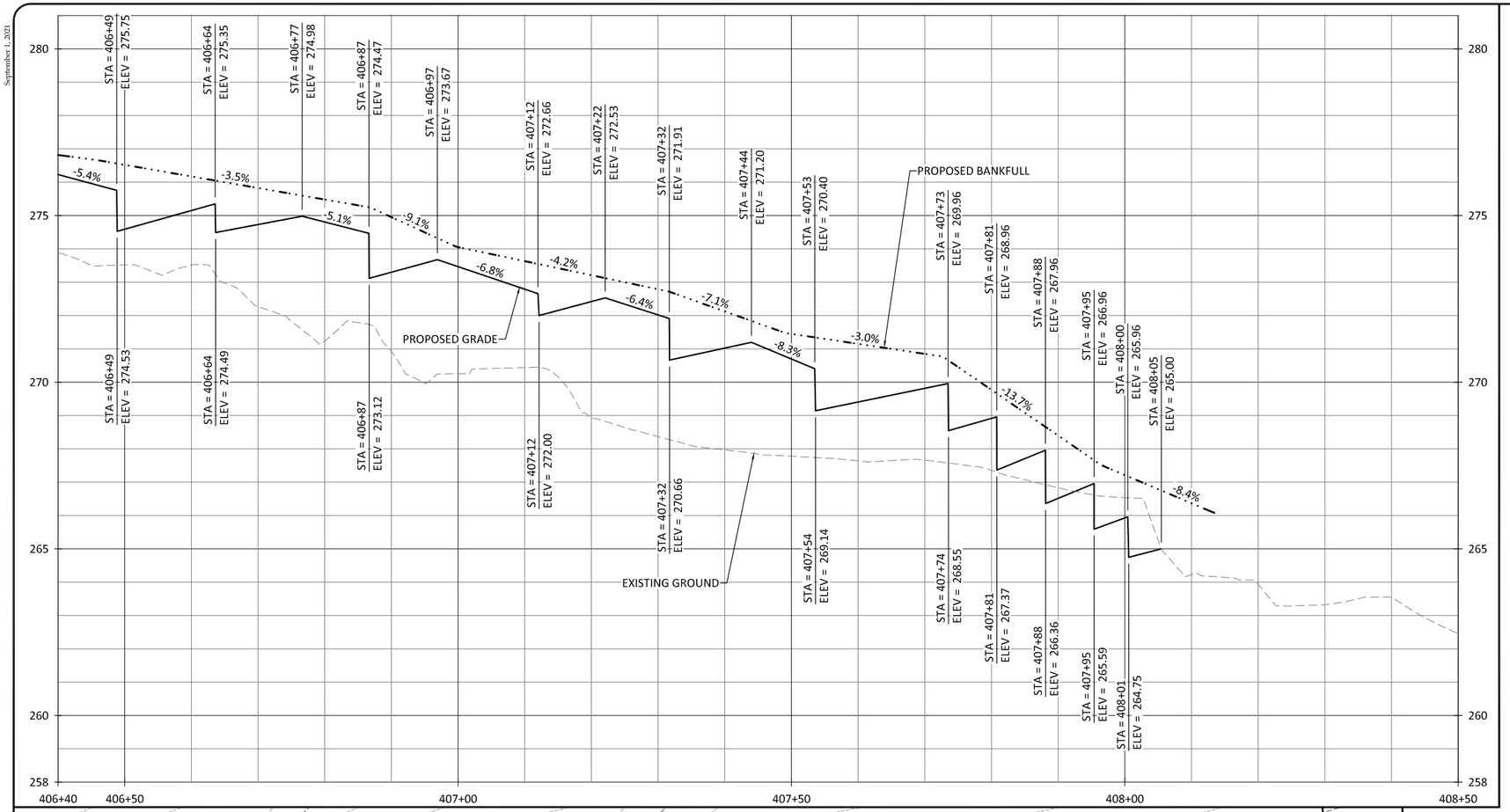
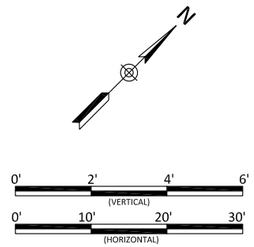
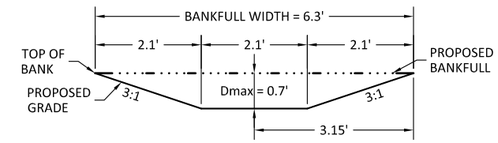
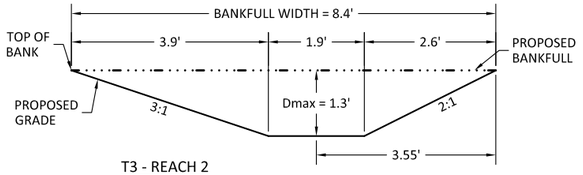


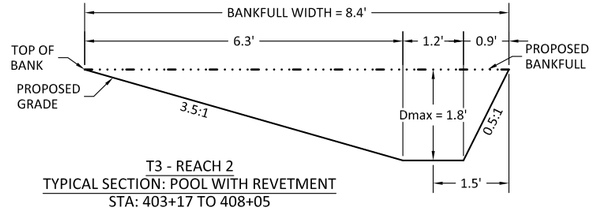




T3 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 403+17 TO 408+05



T3 - REACH 2
TYPICAL SECTION: SHALLOW POOL
STA: 403+17 TO 408+05



T3 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 403+17 TO 408+05

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T3
Stream Plan and Profile

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Date: 06.17.21
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Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.4.4

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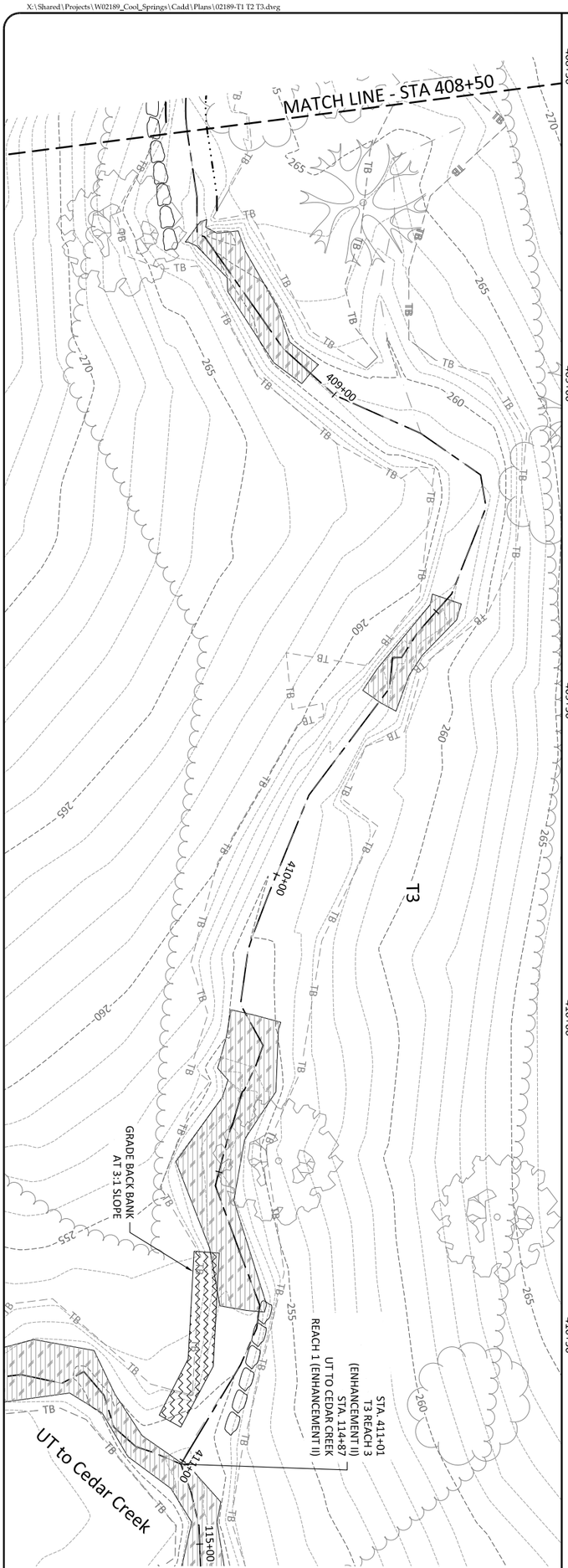

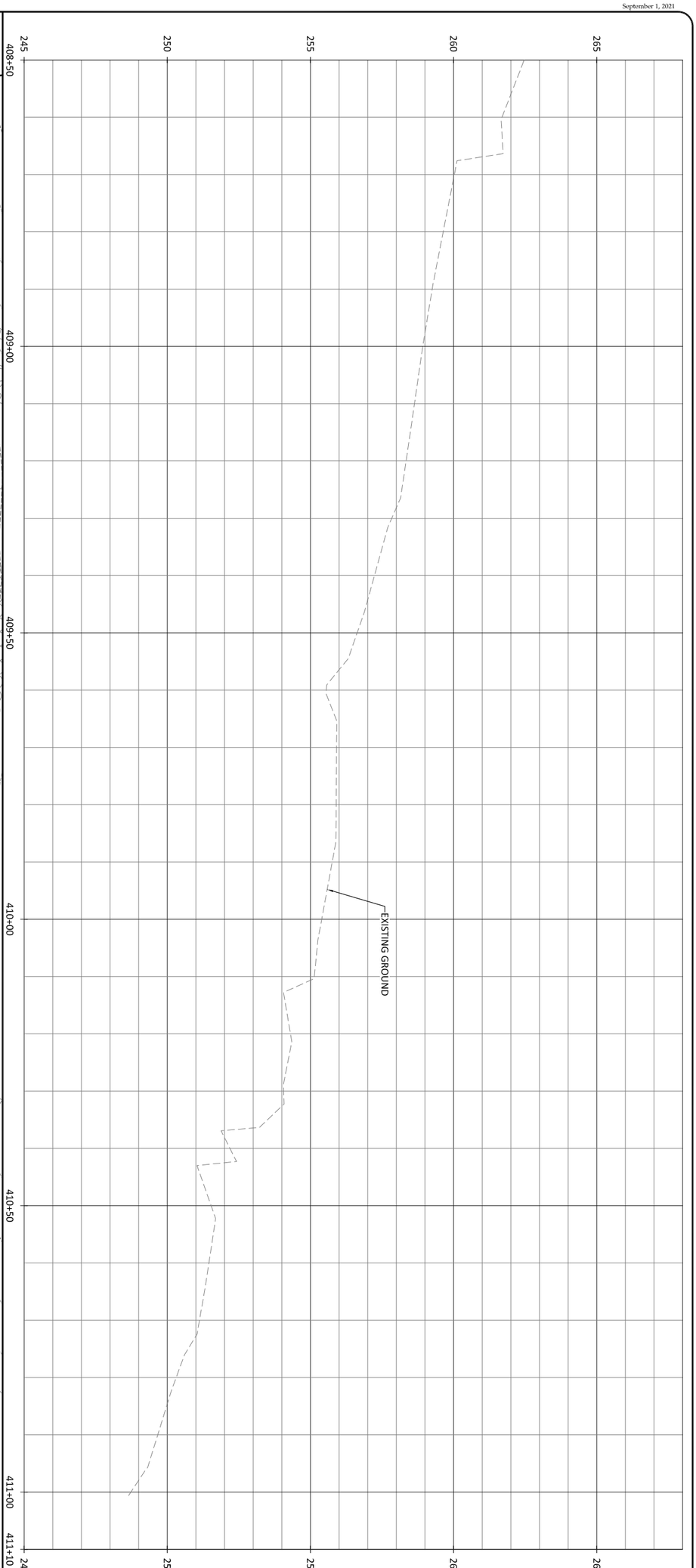

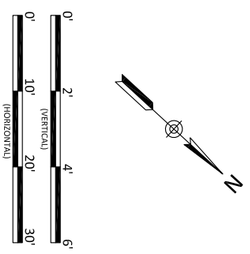

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

1.4.5
Sheet

Revisions:

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T3
Stream Plan and Profile

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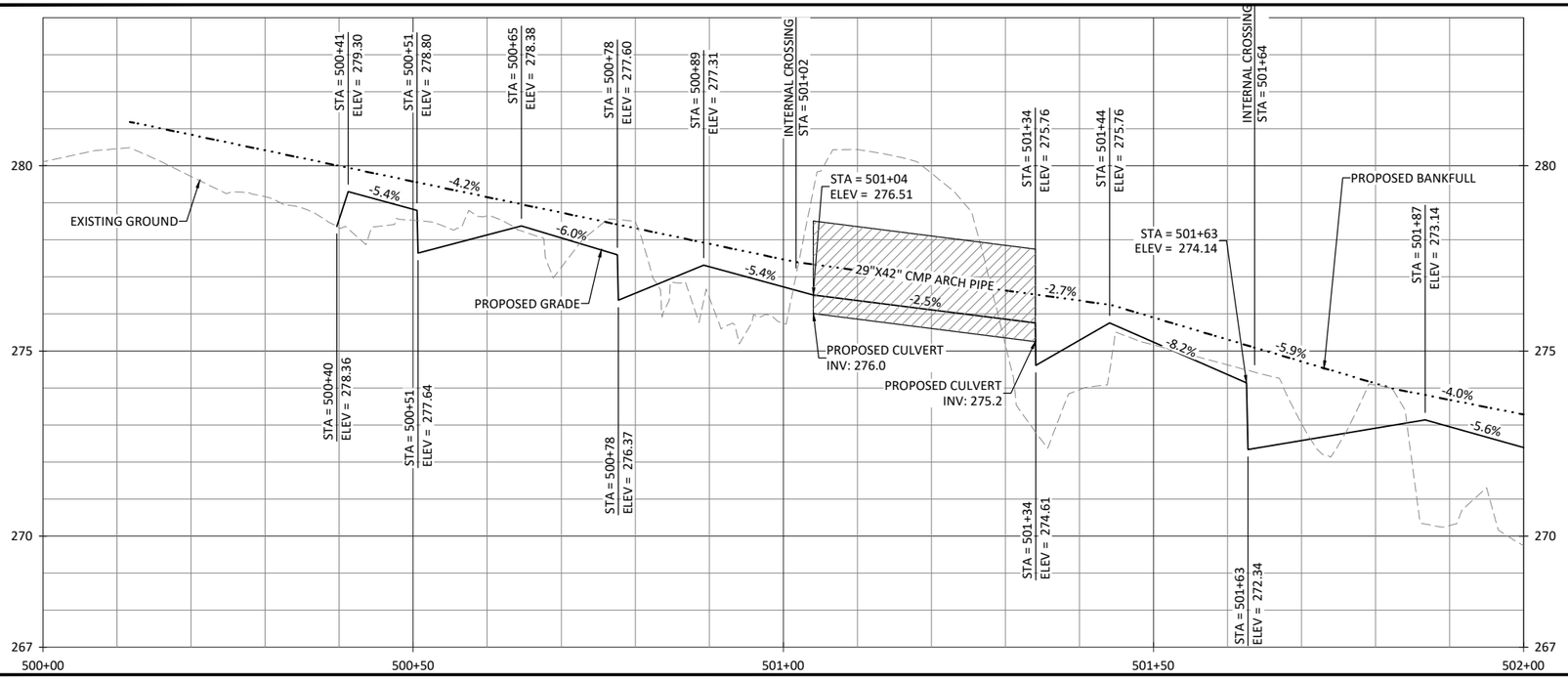
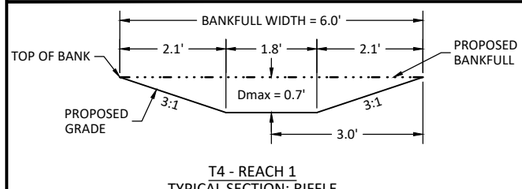
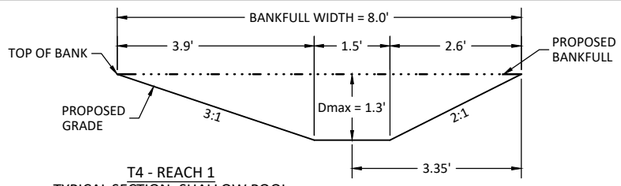
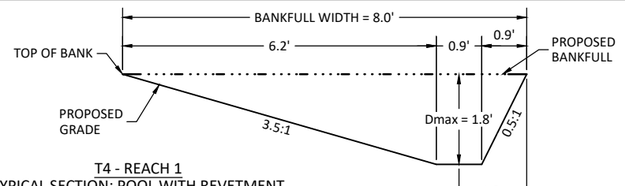




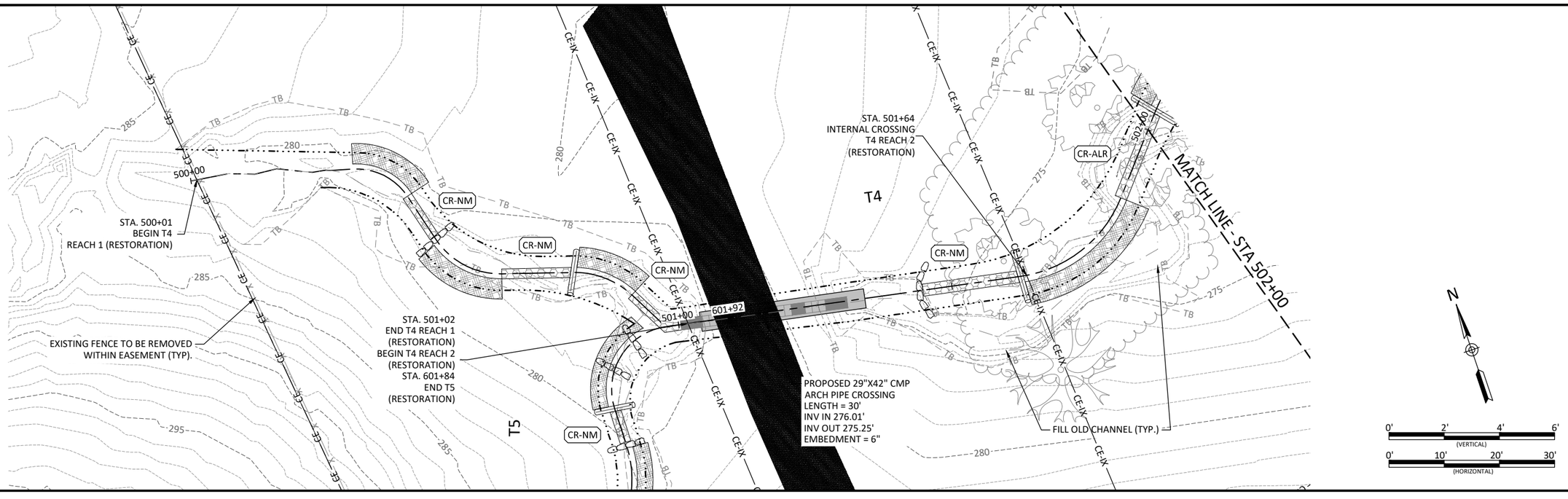
T4 - REACH 1
TYPICAL SECTION: RIFFLE
STA: 500+01 TO 501+02



T4 - REACH 1
TYPICAL SECTION: SHALLOW POOL
STA: 500+01 TO 501+02



T4 - REACH 1
TYPICAL SECTION: POOL WITH REVETMENT
STA: 500+01 TO 501+02



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T4
Stream Plan and Profile

Revisions:

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

Sheet 1.5.1

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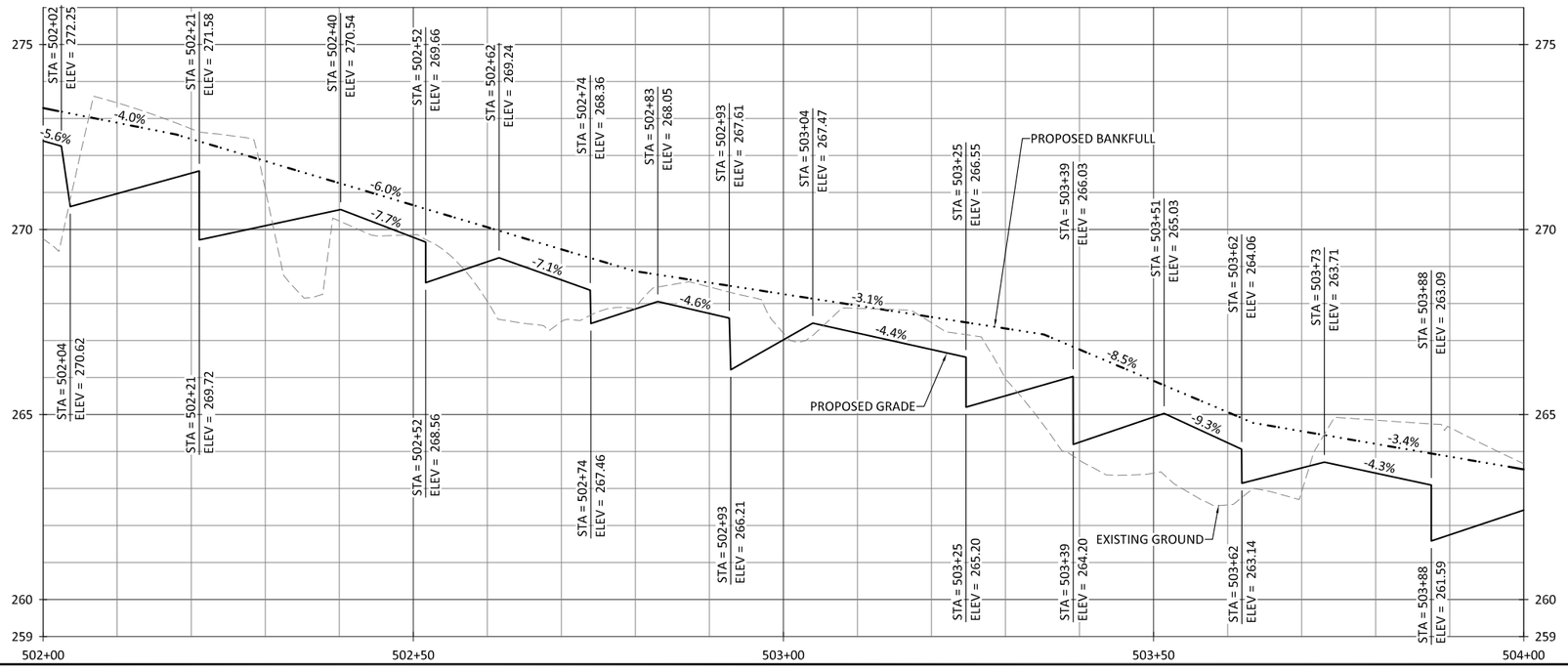
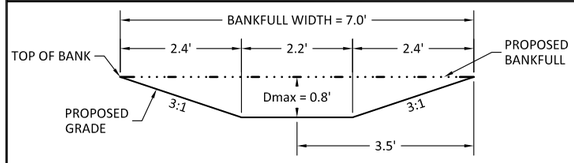
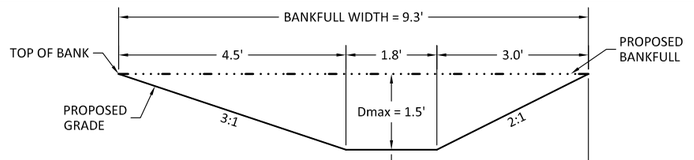
September 1, 2021

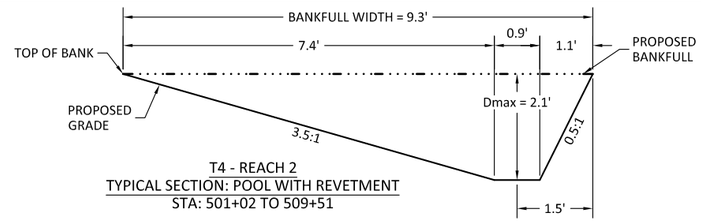




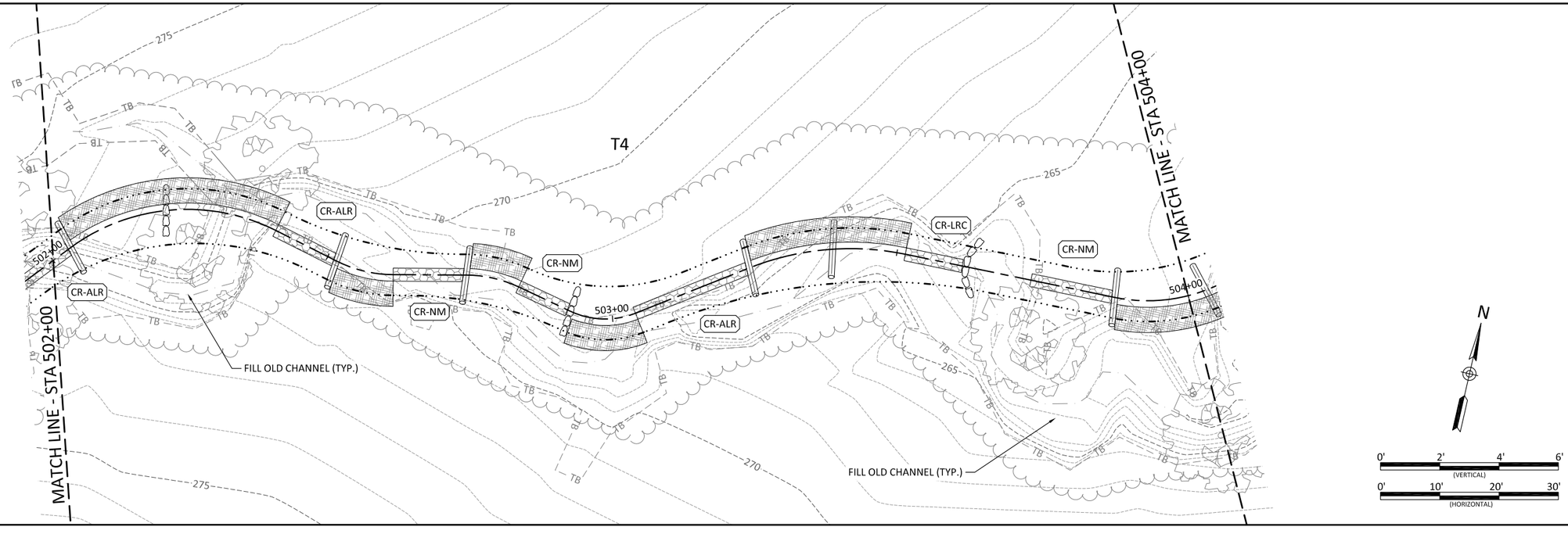
T4 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: STEP POOL
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 501+02 TO 509+51



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T4
Stream Plan and Profile

Revisions:

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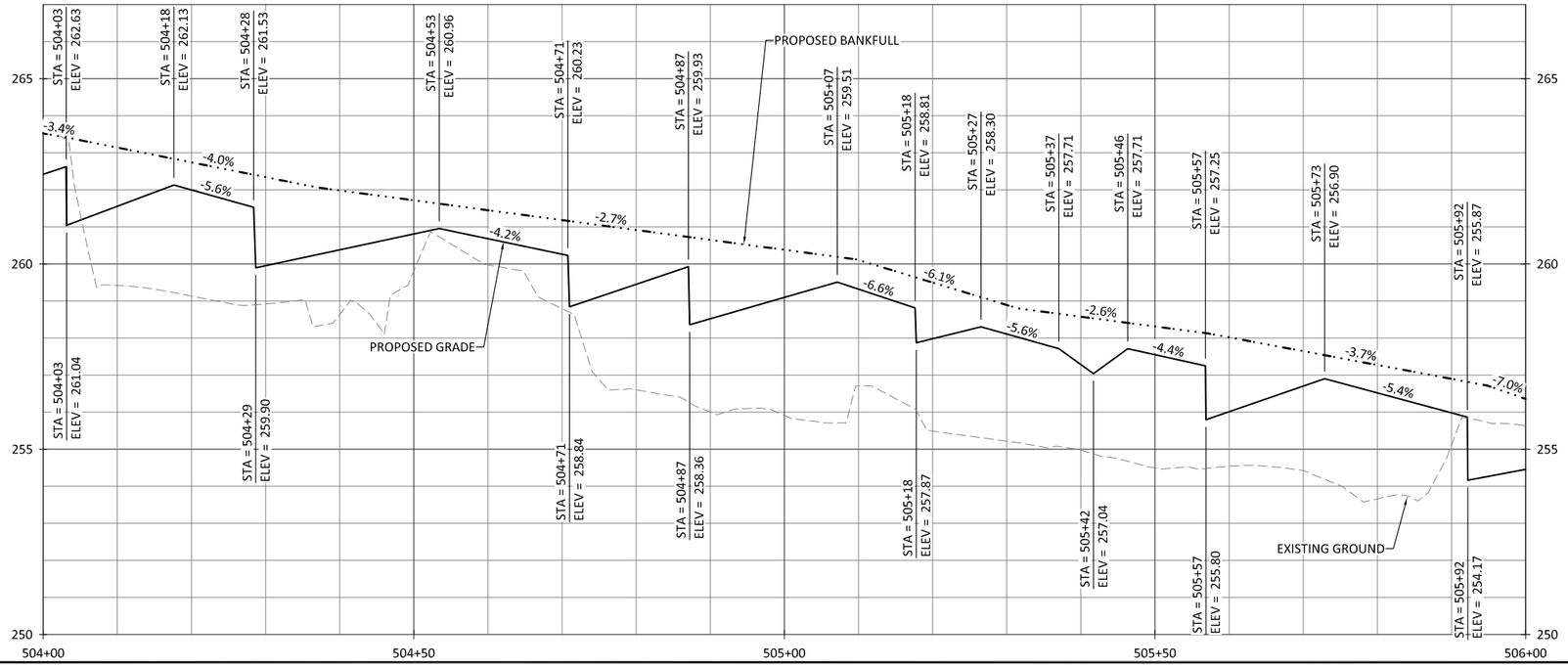
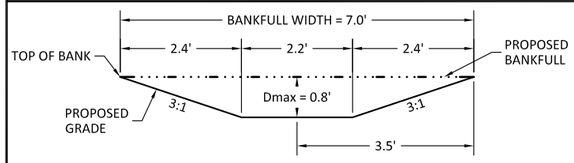
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

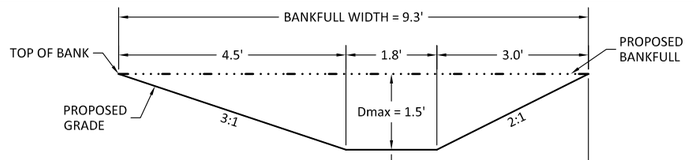
Sheet 1.5.2

September 1, 2021

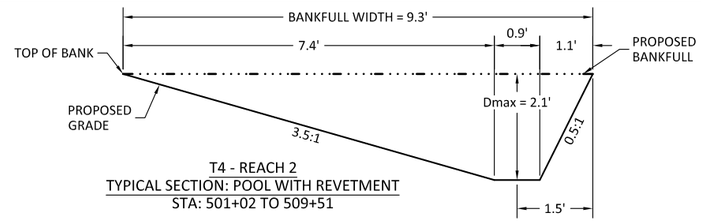




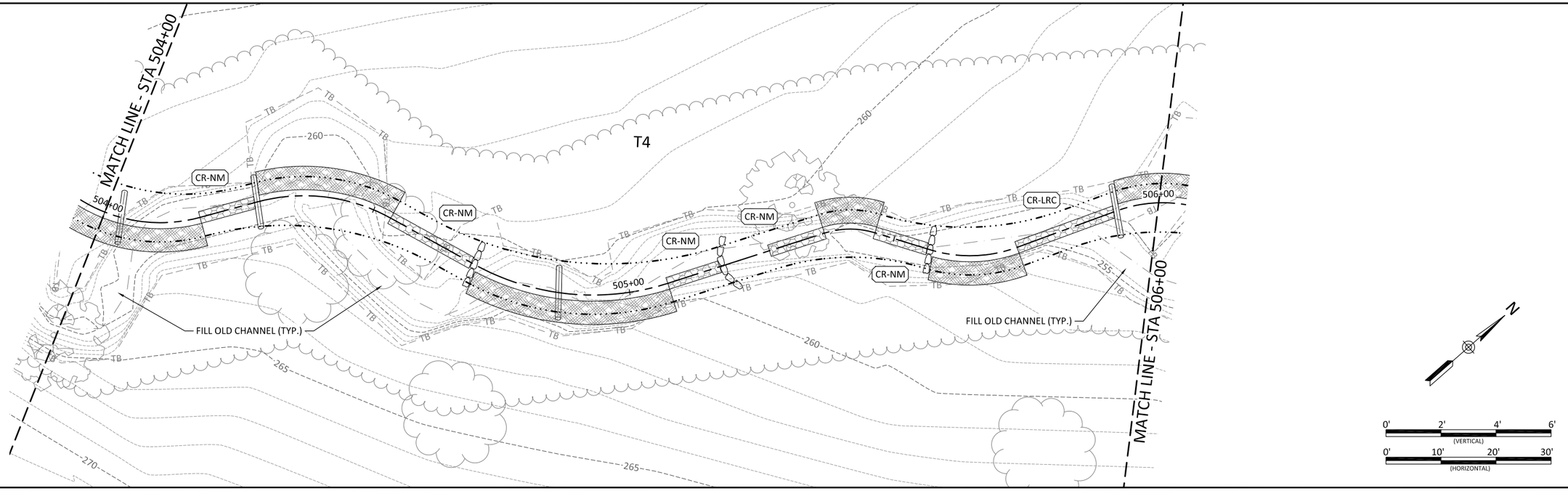
T4 - REACH 2
TYPICAL SECTION: RIFFLE
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: STEP POOL
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 501+02 TO 509+51



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T4
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Revisions:

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Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.5.3

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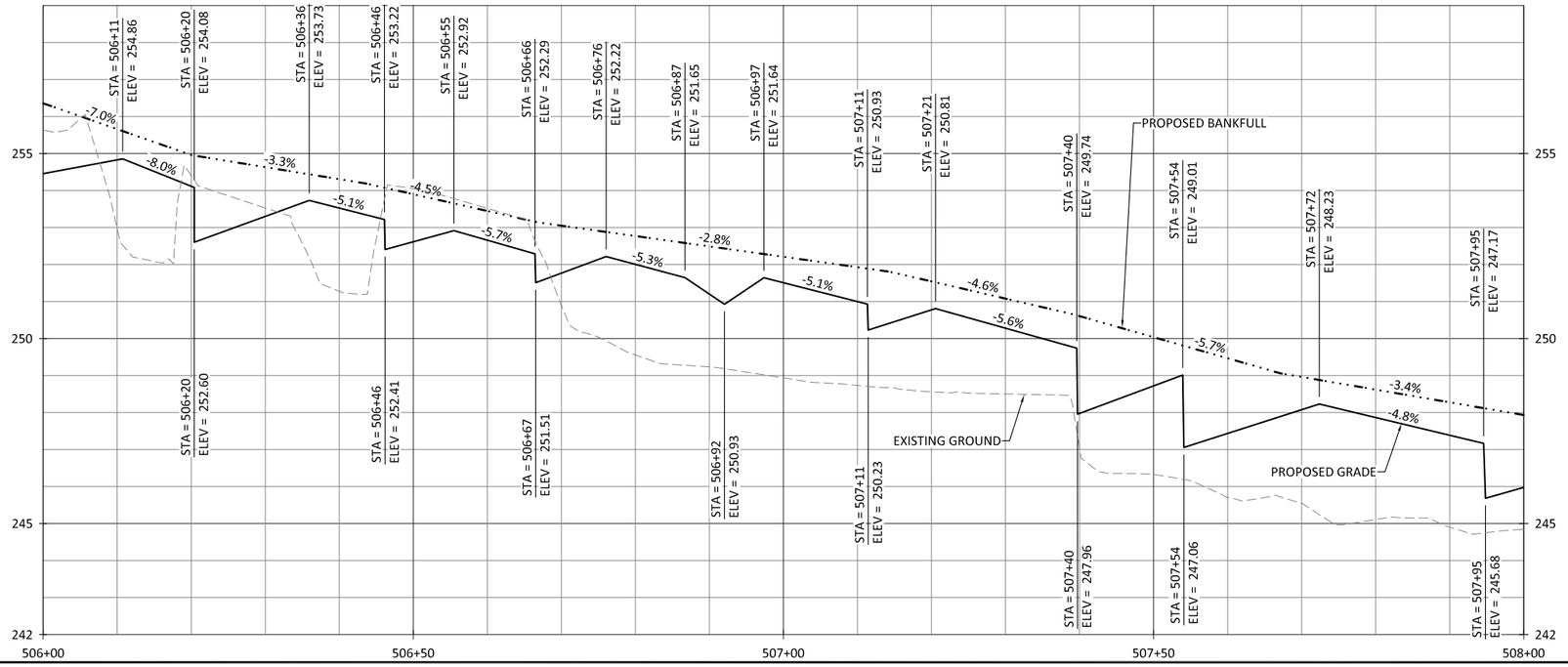

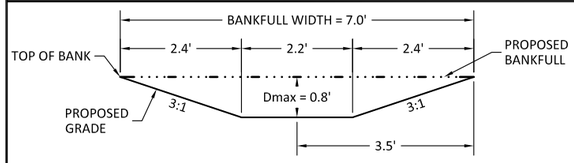

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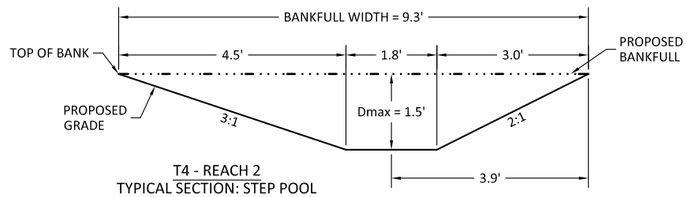
STA: 501+02 TO 509+51



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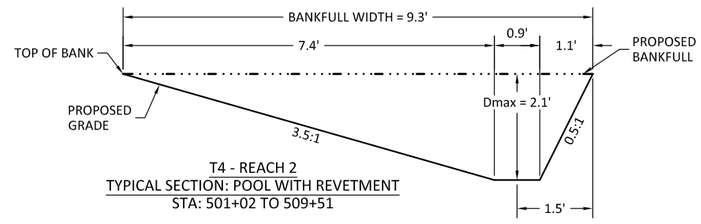
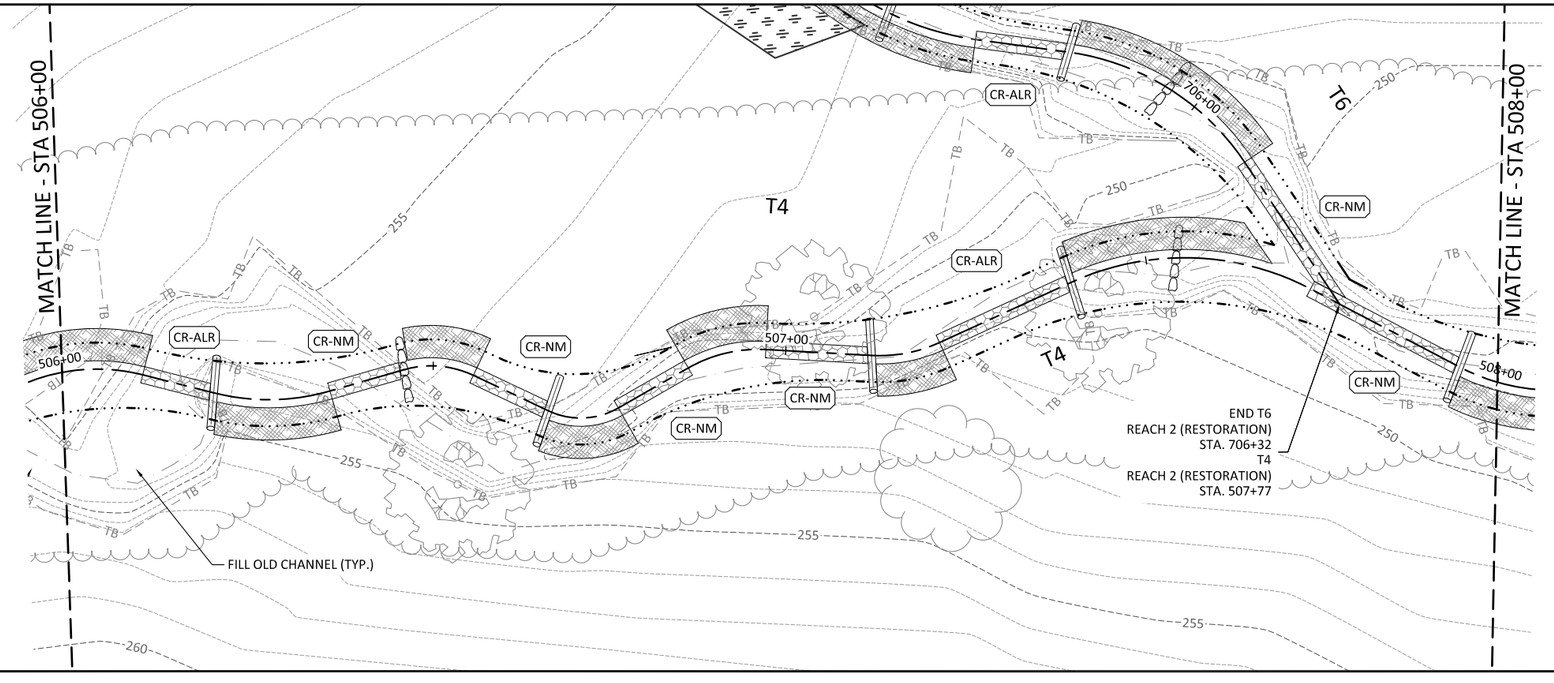
TYPICAL SECTION: STEP POOL
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 501+02 TO 509+51



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T4
Stream Plan and Profile

Revisions:

Date: 06.17.21
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Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.5.4

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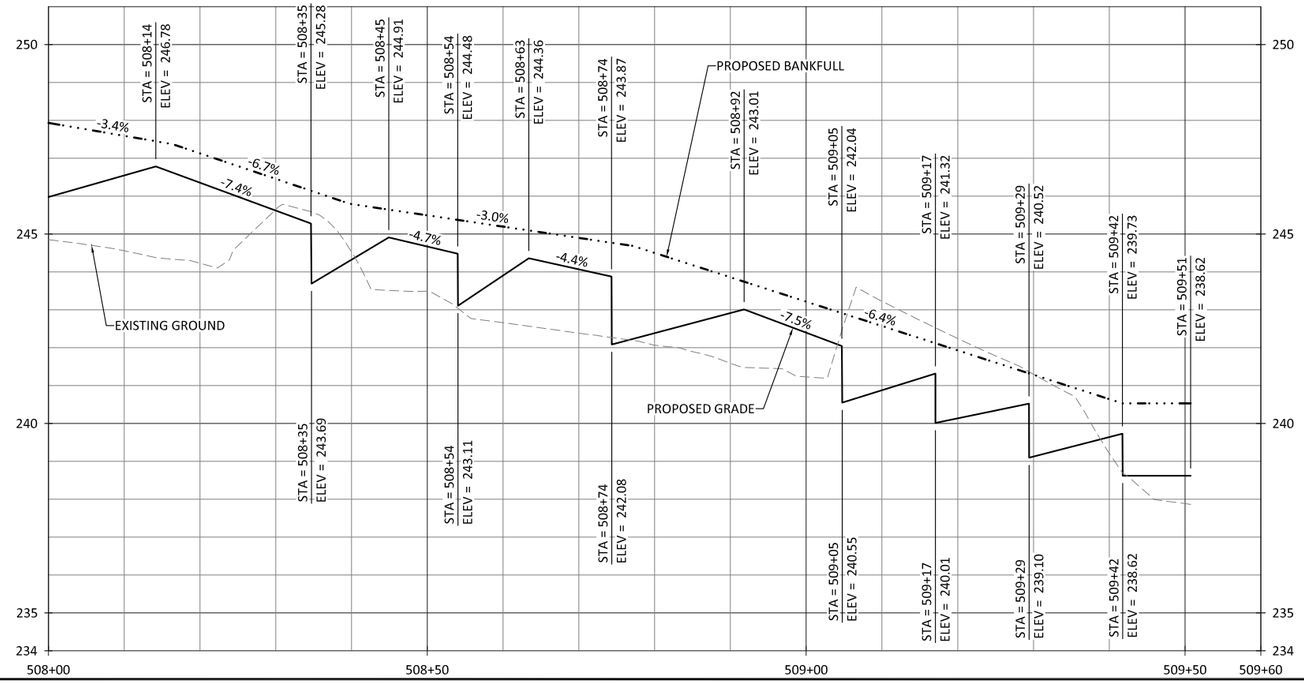

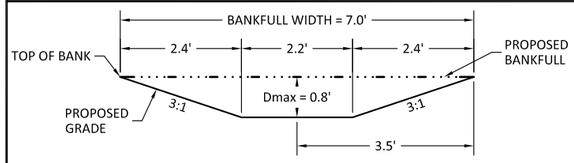

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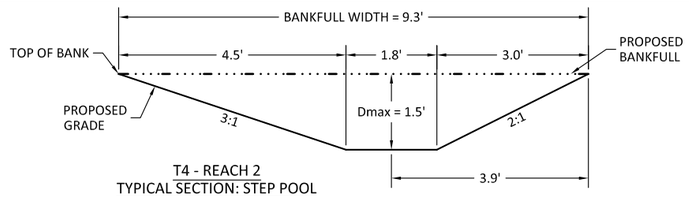
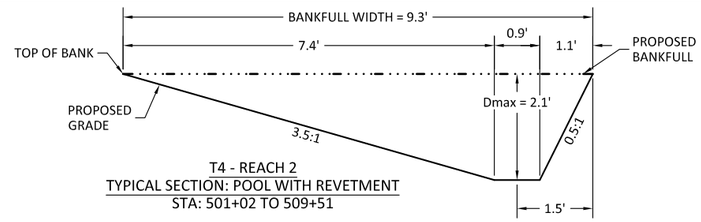
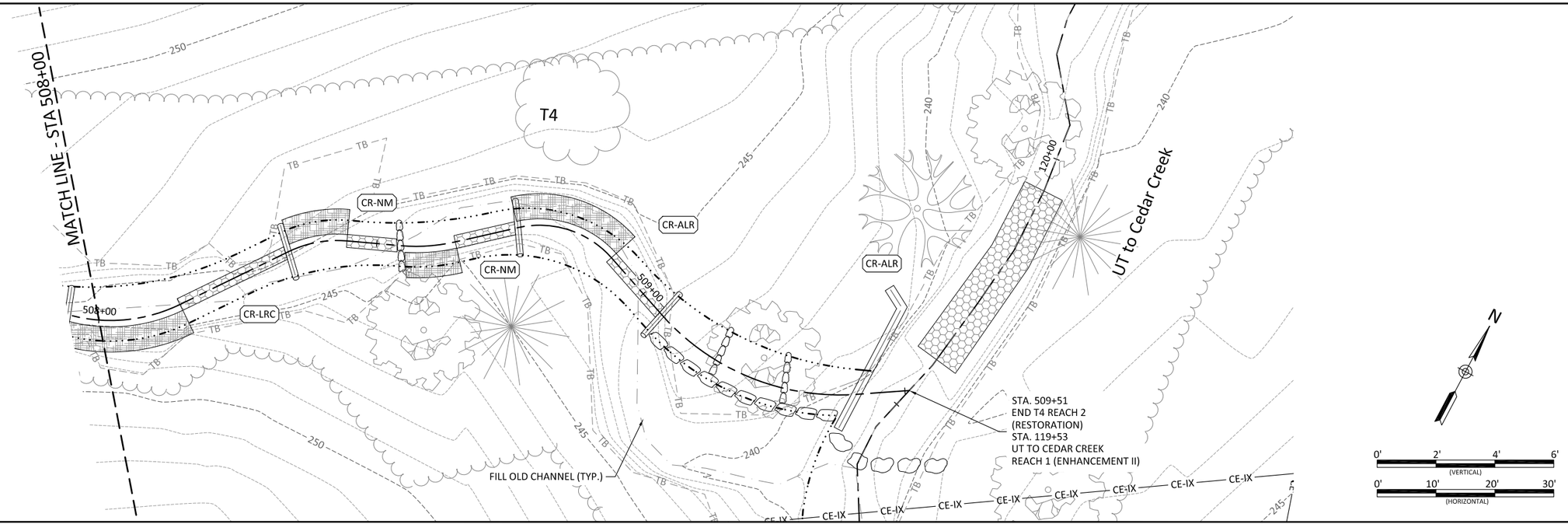
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: STEP POOL
STA: 501+02 TO 509+51



T4 - REACH 2
TYPICAL SECTION: POOL WITH REVETMENT
STA: 501+02 TO 509+51



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Revisions:

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Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.5.5

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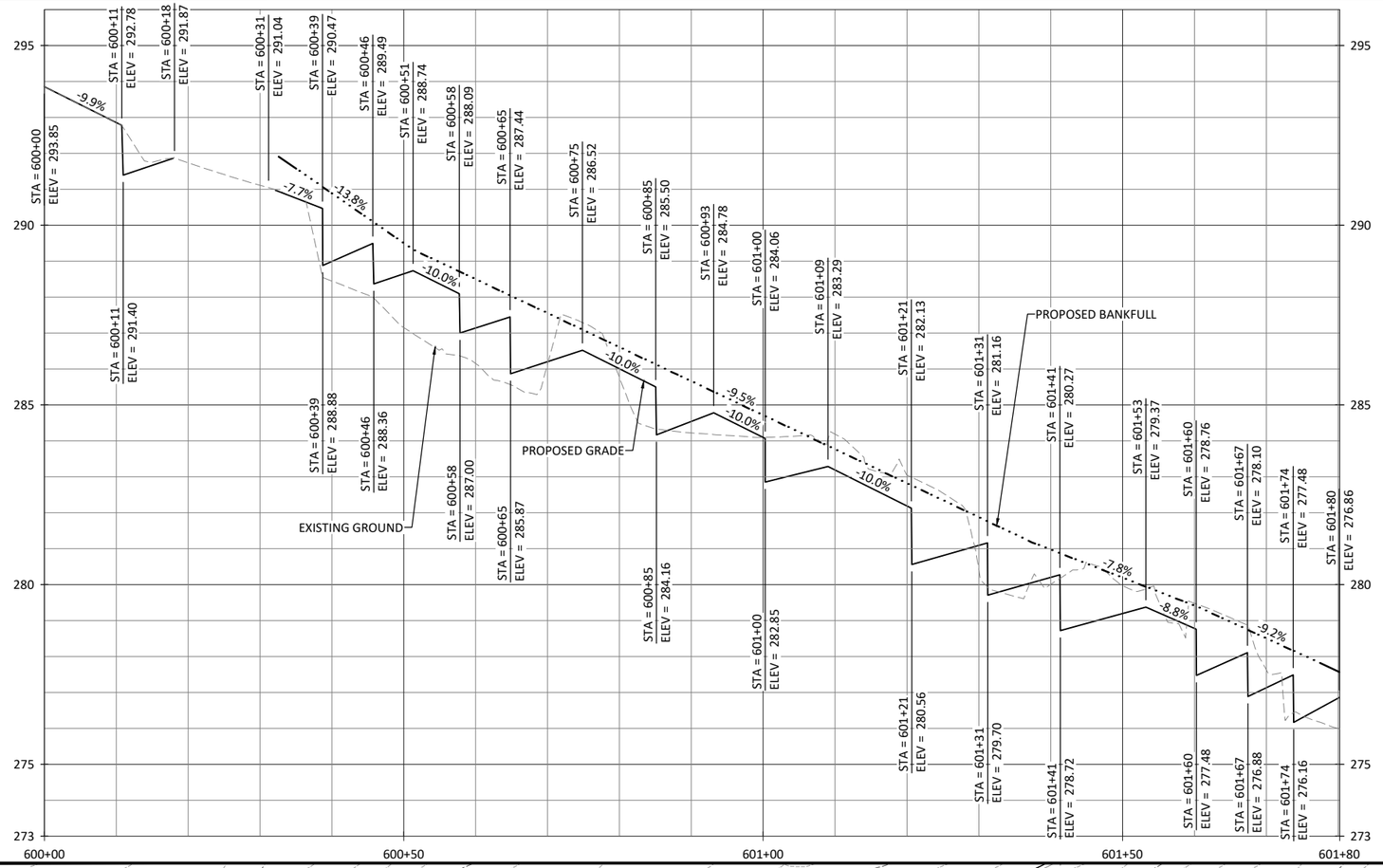

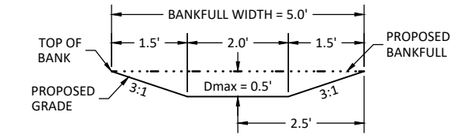

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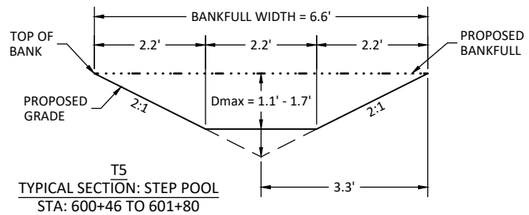
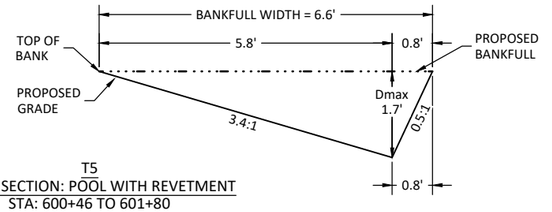
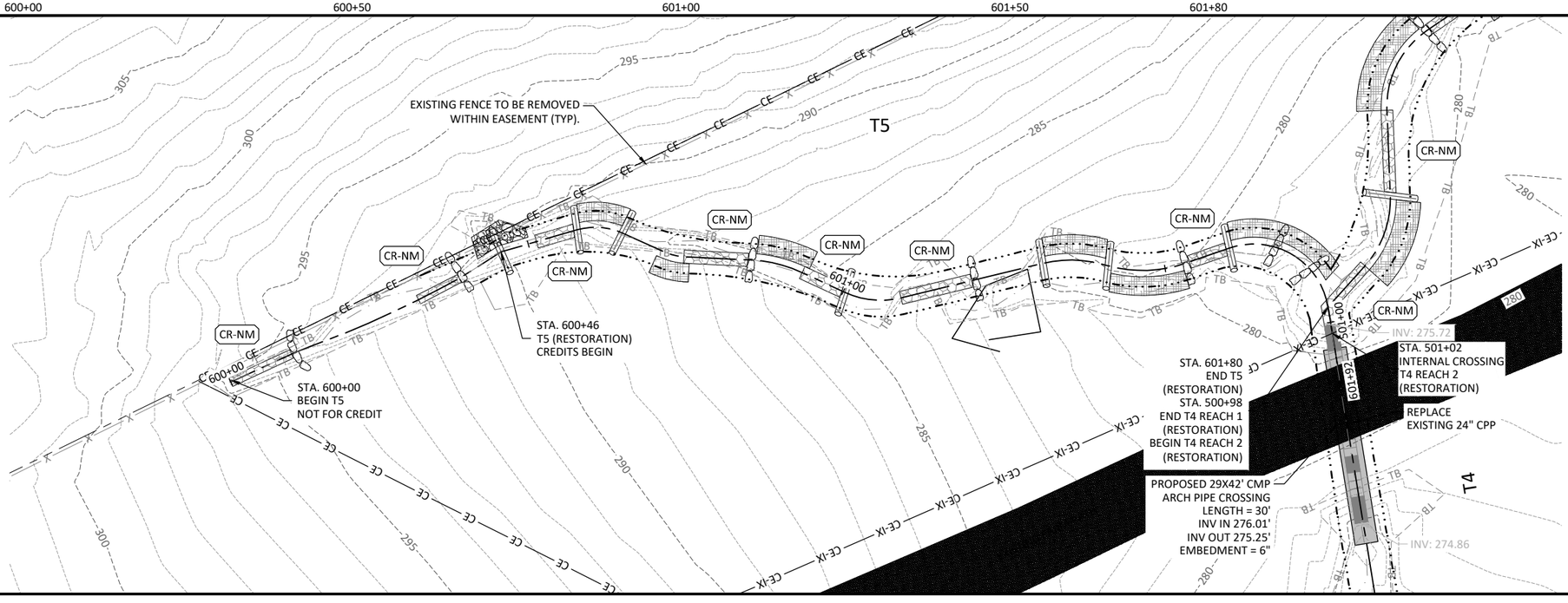
STA: 600+46 TO 601+80



T5
TYPICAL SECTION: STEP POOL
STA: 600+46 TO 601+80



T5
TYPICAL SECTION: POOL WITH REVETMENT
STA: 600+46 TO 601+80



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T5
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Revisions:

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Job Number:	500-02189
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Checked By:	GAT

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September 3, 2021

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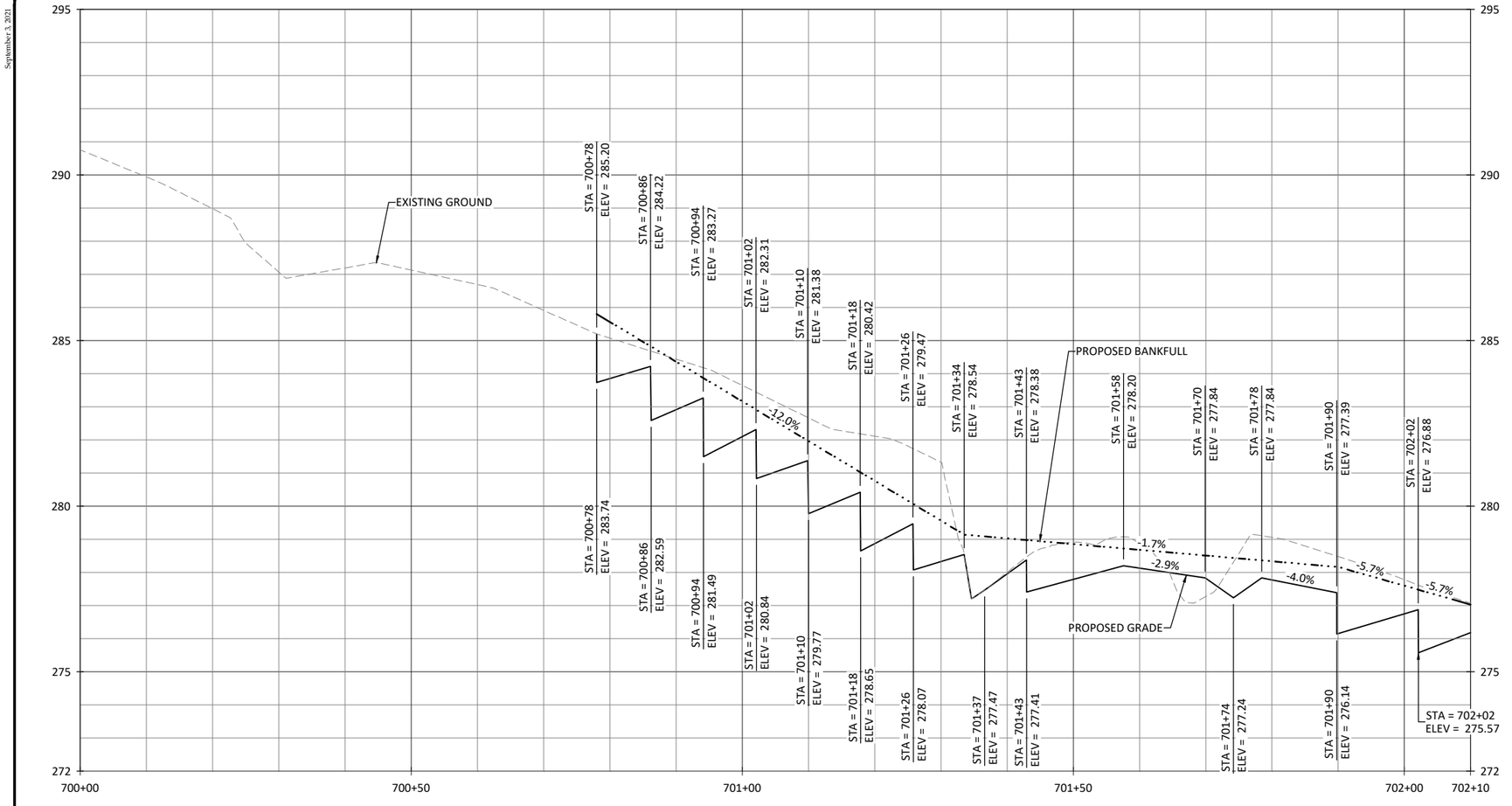

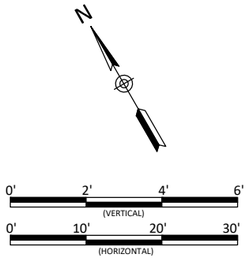

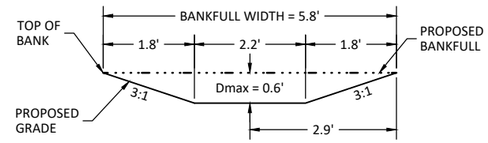

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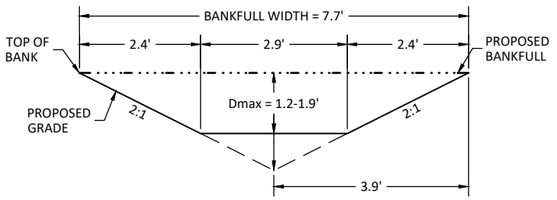
TYPICAL SECTION: RIFFLE
STA: 701+33 TO 706+32



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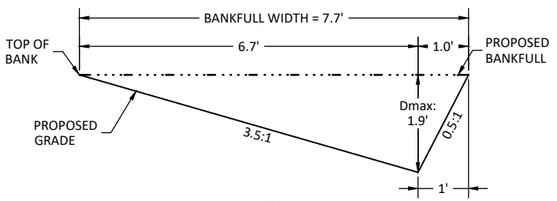
TYPICAL SECTION: STEP POOL
STA: 701+33 TO 706+32



T6
TYPICAL SECTION: POOL WITH REVETMENT
STA: 701+33 TO 706+32

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Drawn By:	CAW
Checked By:	GAT

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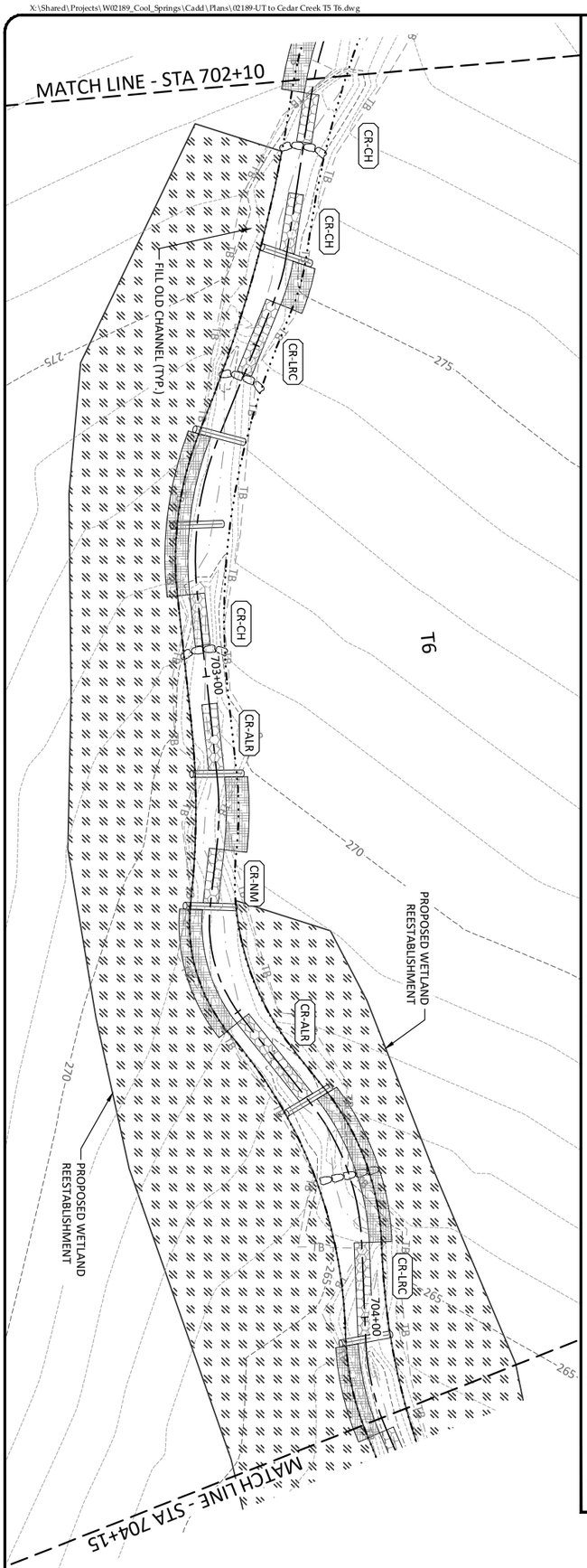

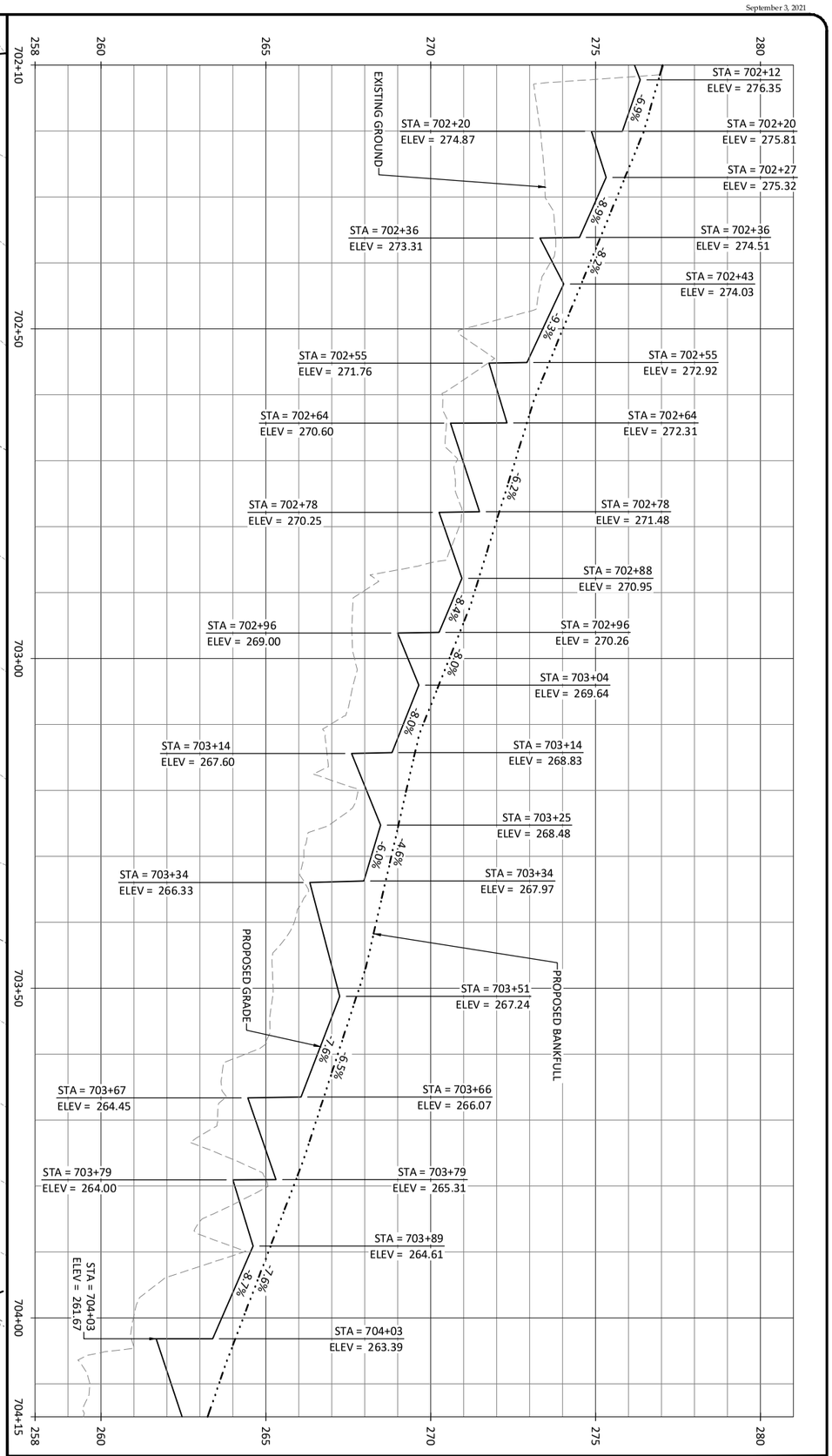

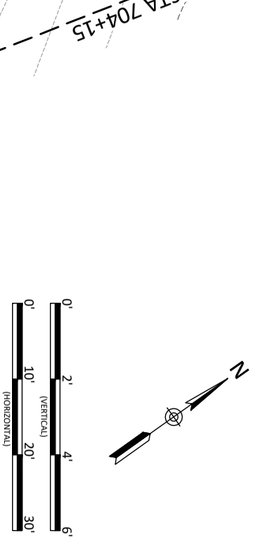

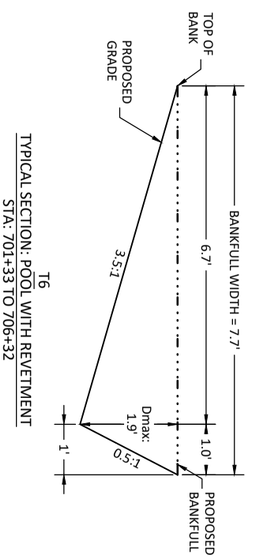

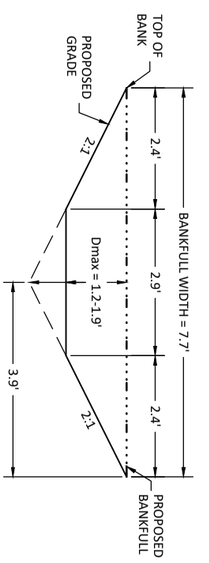

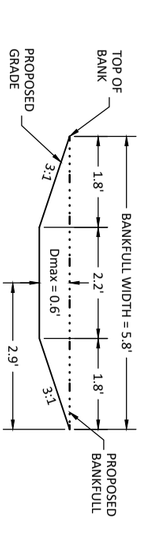

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

Revisions:

1.7.2
Sheet

Cool Springs Mitigation Site
Harnett County, North Carolina

T6
Stream Plan and Profile

60% PLANS DO NOT USE FOR CONSTRUCTION

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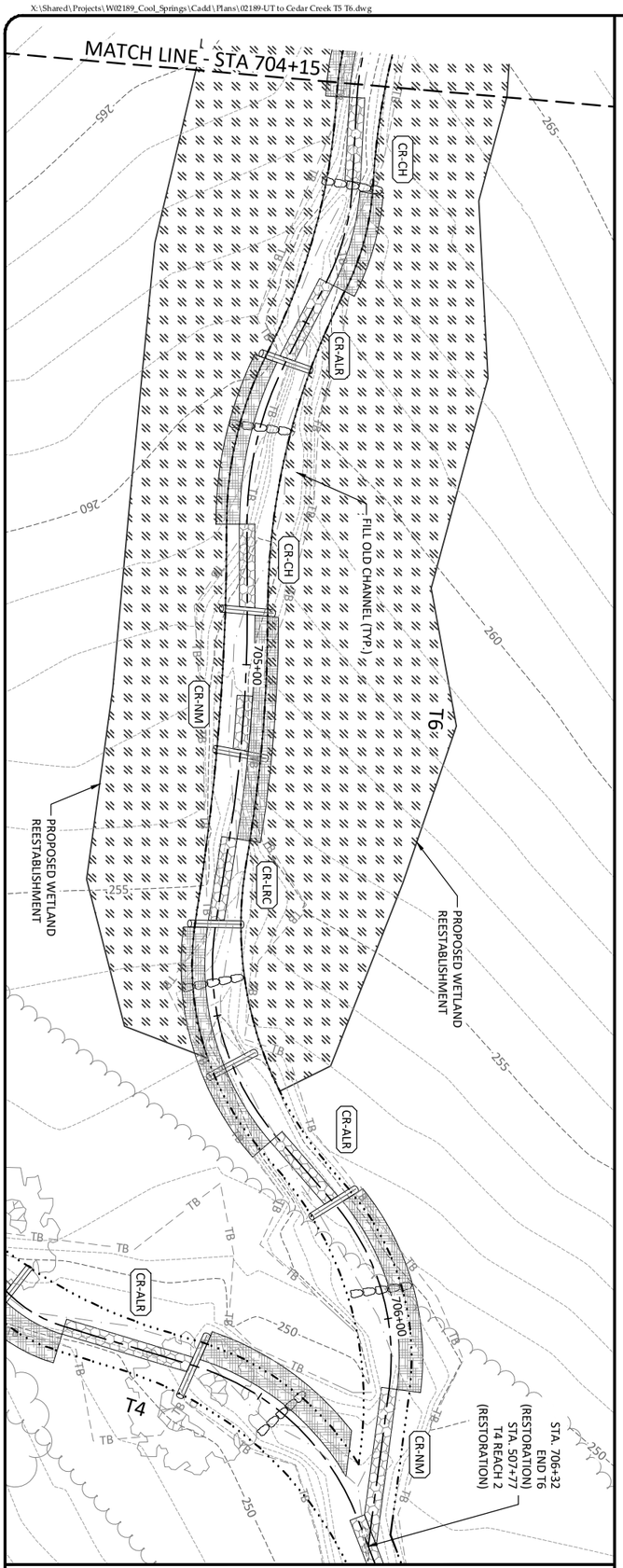
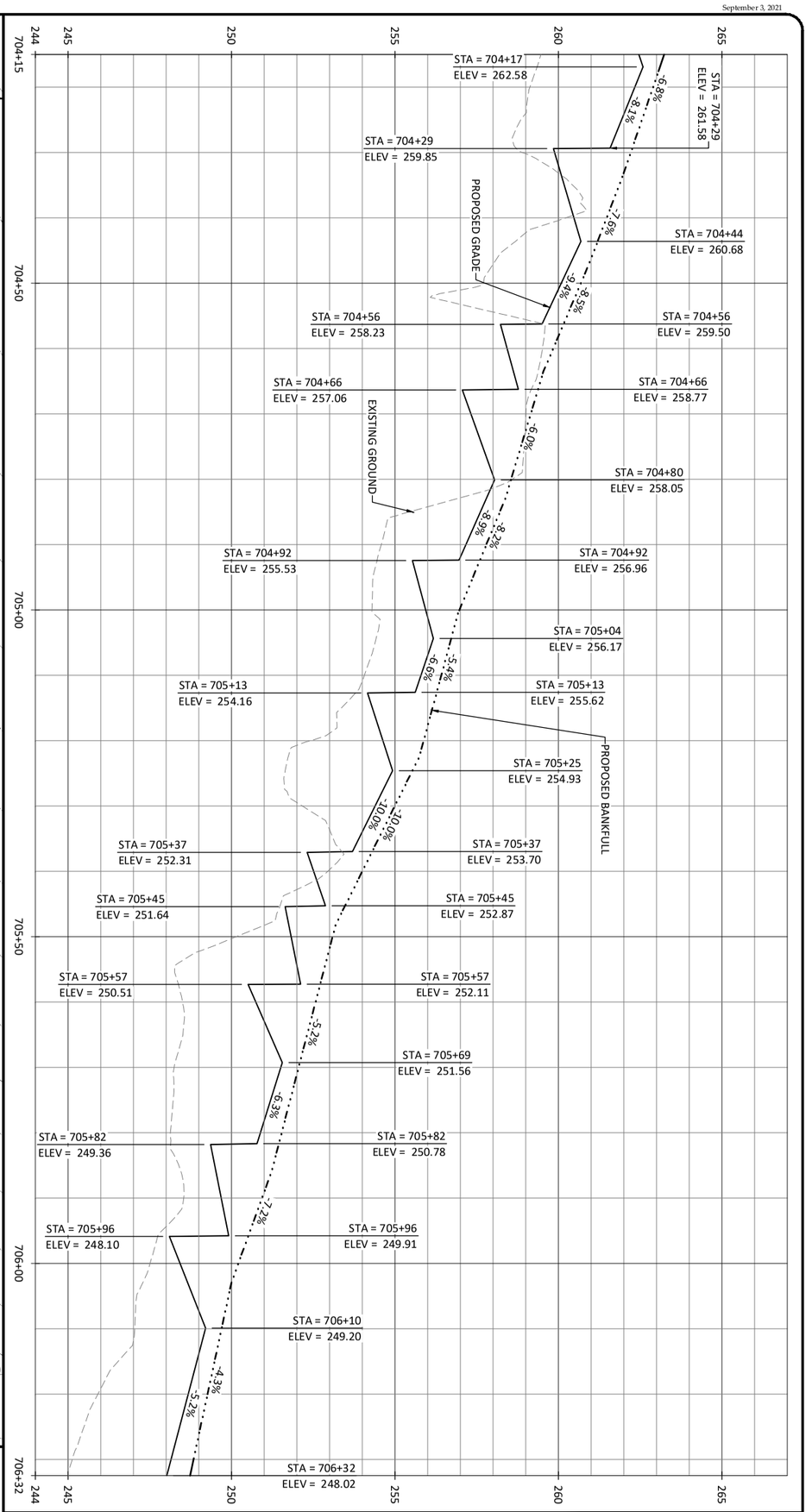
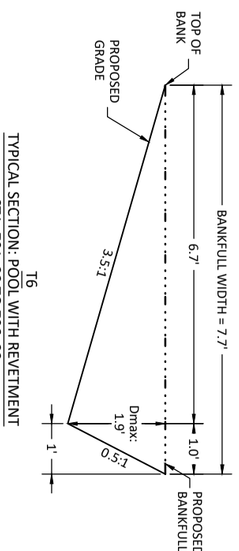
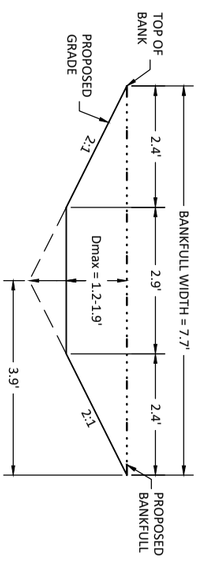


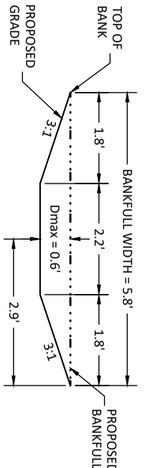




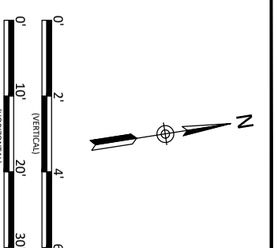
T6
TYPICAL SECTION: POOL WITH REVETMENT
STA: 701+33 TO 706+32



T6
TYPICAL SECTION: STEP POOL
STA: 701+33 TO 706+32



T6
TYPICAL SECTION: RIFFLE
STA: 701+33 TO 706+32



Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

Revisions:

1.7.3
Sheet

Cool Springs Mitigation Site
Harnett County, North Carolina

T6
Stream Plan and Profile

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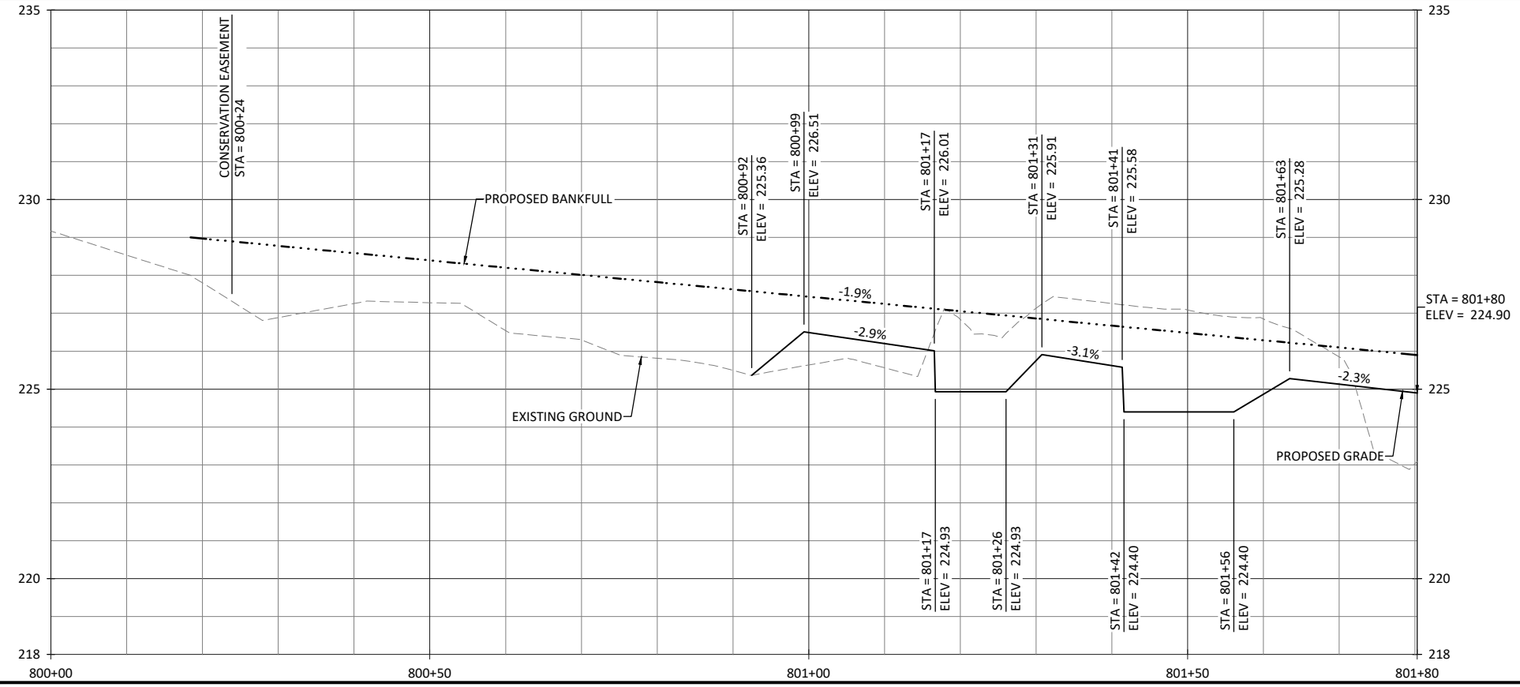
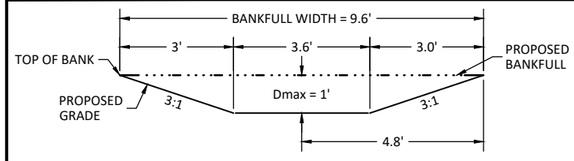
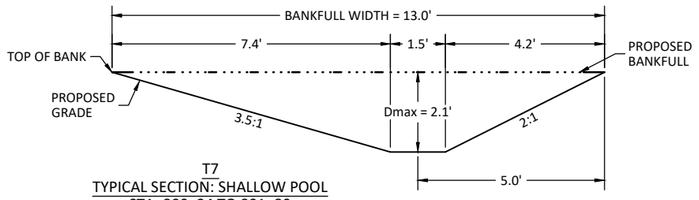
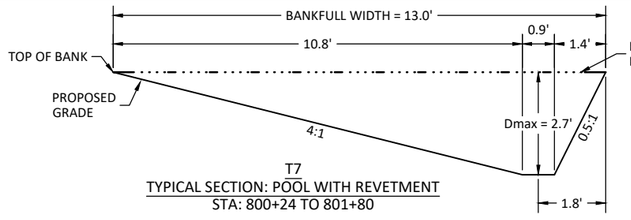




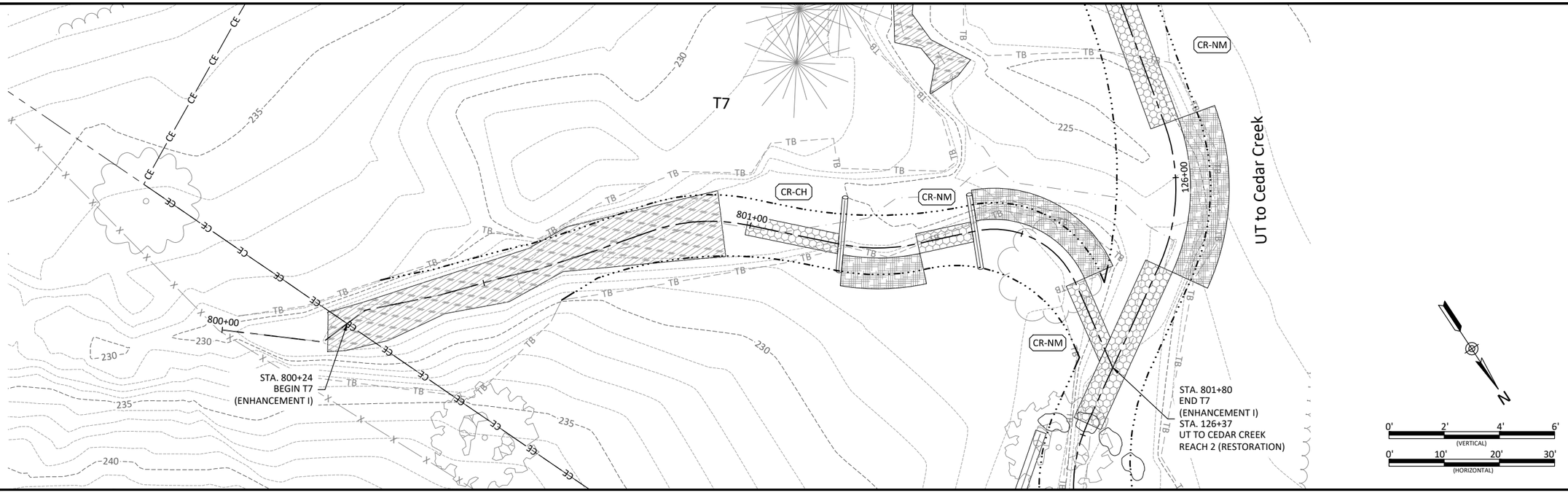
T7
TYPICAL SECTION: RIFFLE
STA: 800+24 TO 801+80



T7
TYPICAL SECTION: SHALLOW POOL
STA: 800+24 TO 801+80



T7
TYPICAL SECTION: POOL WITH REVETMENT
STA: 800+24 TO 801+80



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Harnett County, North Carolina

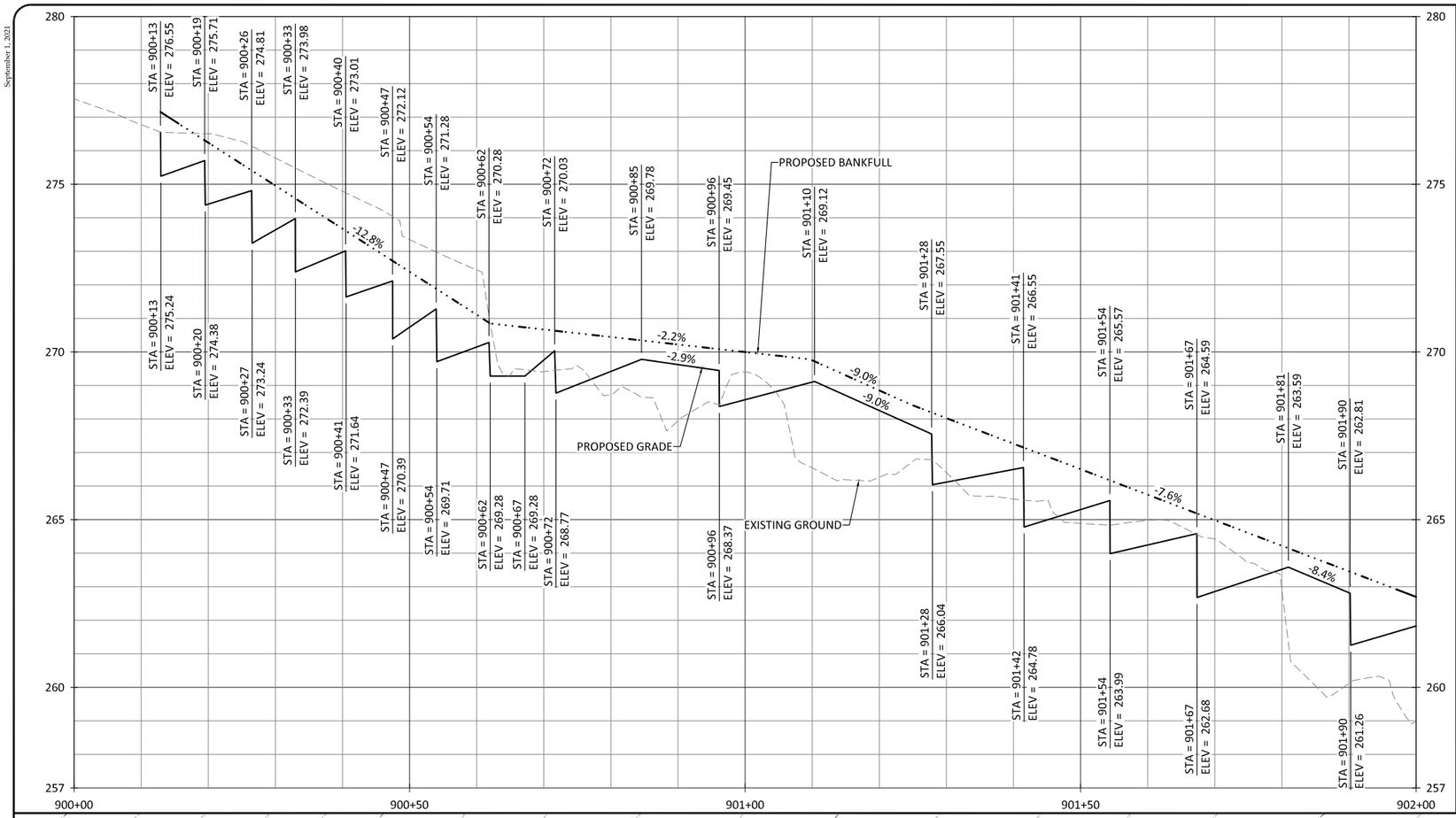
T7
Stream Plan and Profile

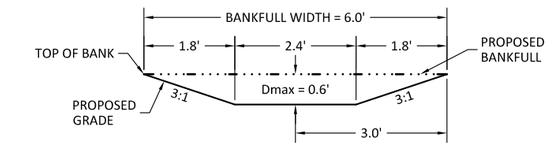
Revisions:

Date: 06.17.21
Job Number: 300-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

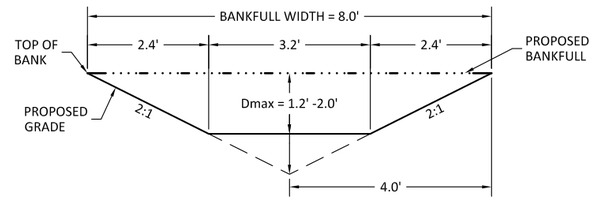
Sheet 1.8.1

September 1, 2021

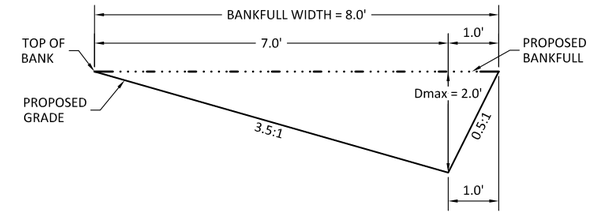




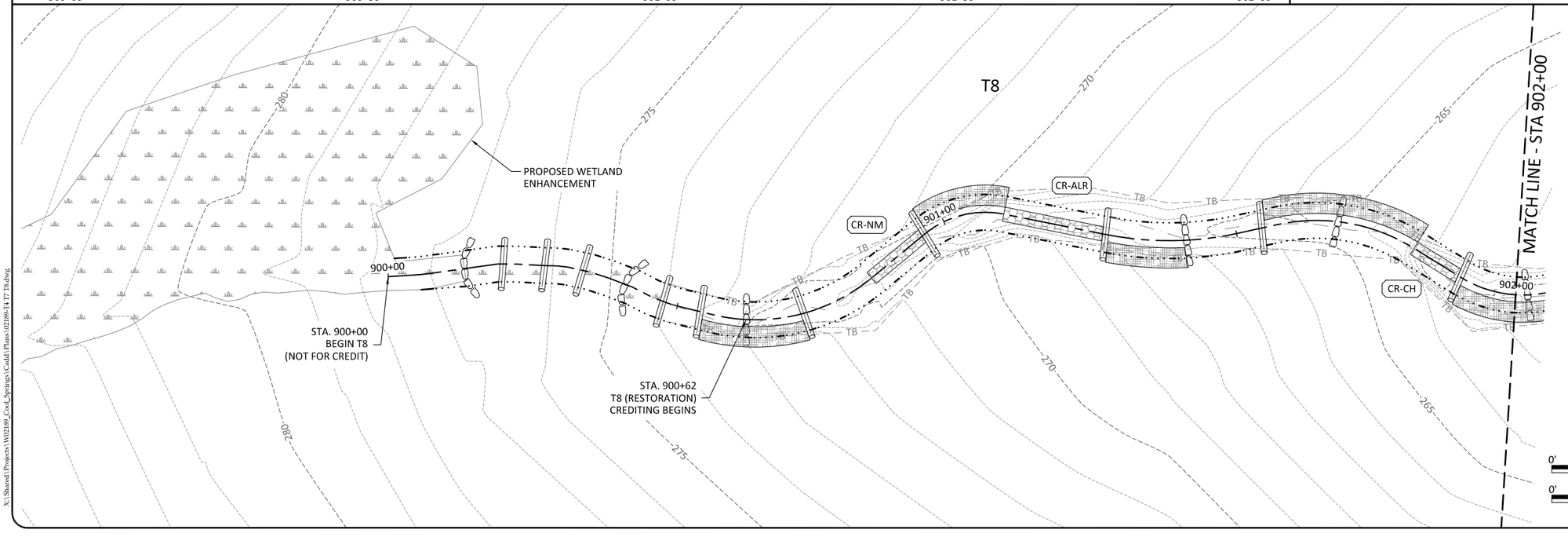
T8
TYPICAL SECTION: RIFFLE
STA: 900+62 TO 907+59



T8
TYPICAL SECTION: STEP POOL
STA: 900+62 TO 907+59



T8
TYPICAL SECTION: POOL WITH REVETMENT
STA: 900+62 TO 907+59



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T8
Stream Plan and Profile

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.9.1

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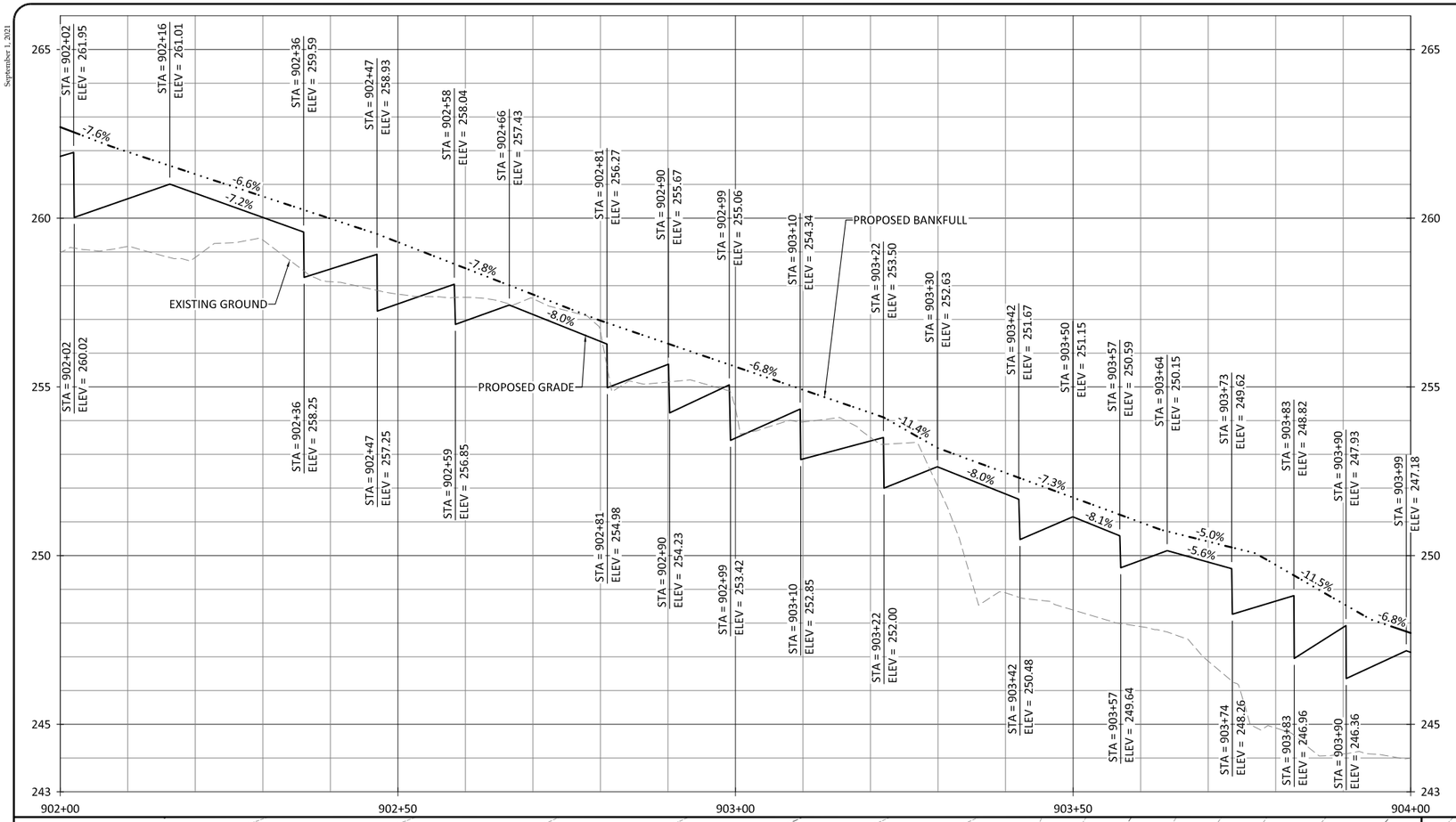
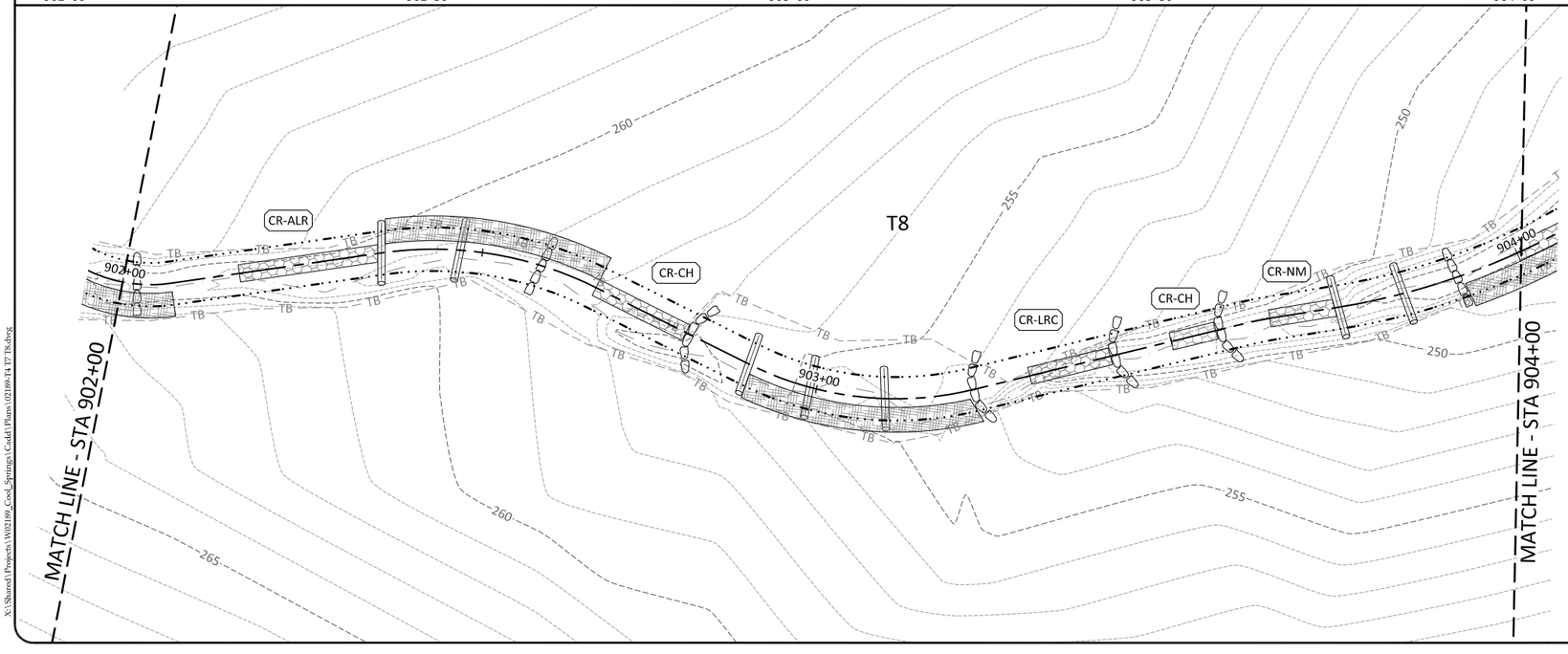
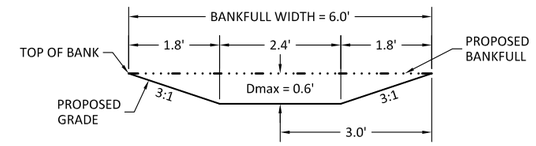
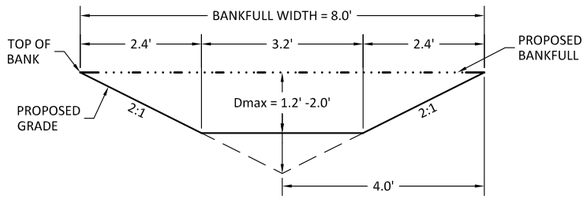


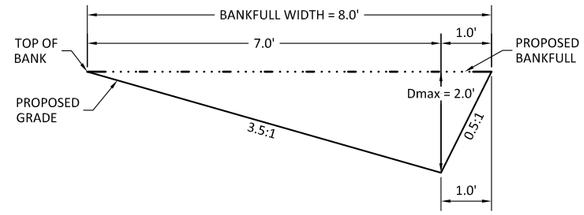




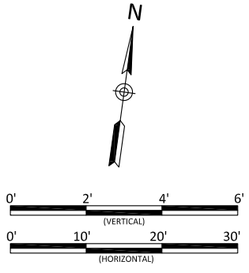
T8
TYPICAL SECTION: RIFFLE
STA: 900+62 TO 907+59



T8
TYPICAL SECTION: STEP POOL
STA: 900+62 TO 907+59



T8
TYPICAL SECTION: POOL WITH REVETMENT
STA: 900+62 TO 907+59



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Harnett County, North Carolina

T8
Stream Plan and Profile

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 1.9.2

September 1, 2021

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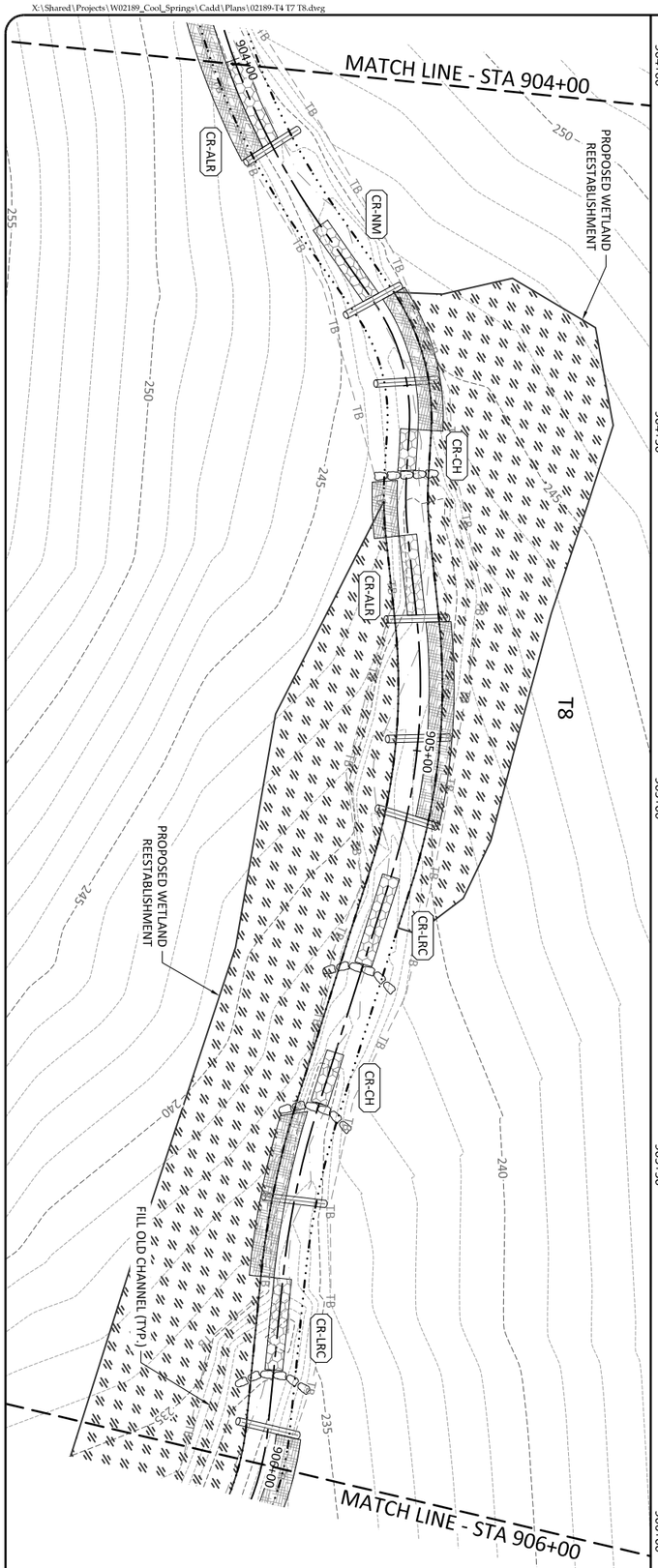

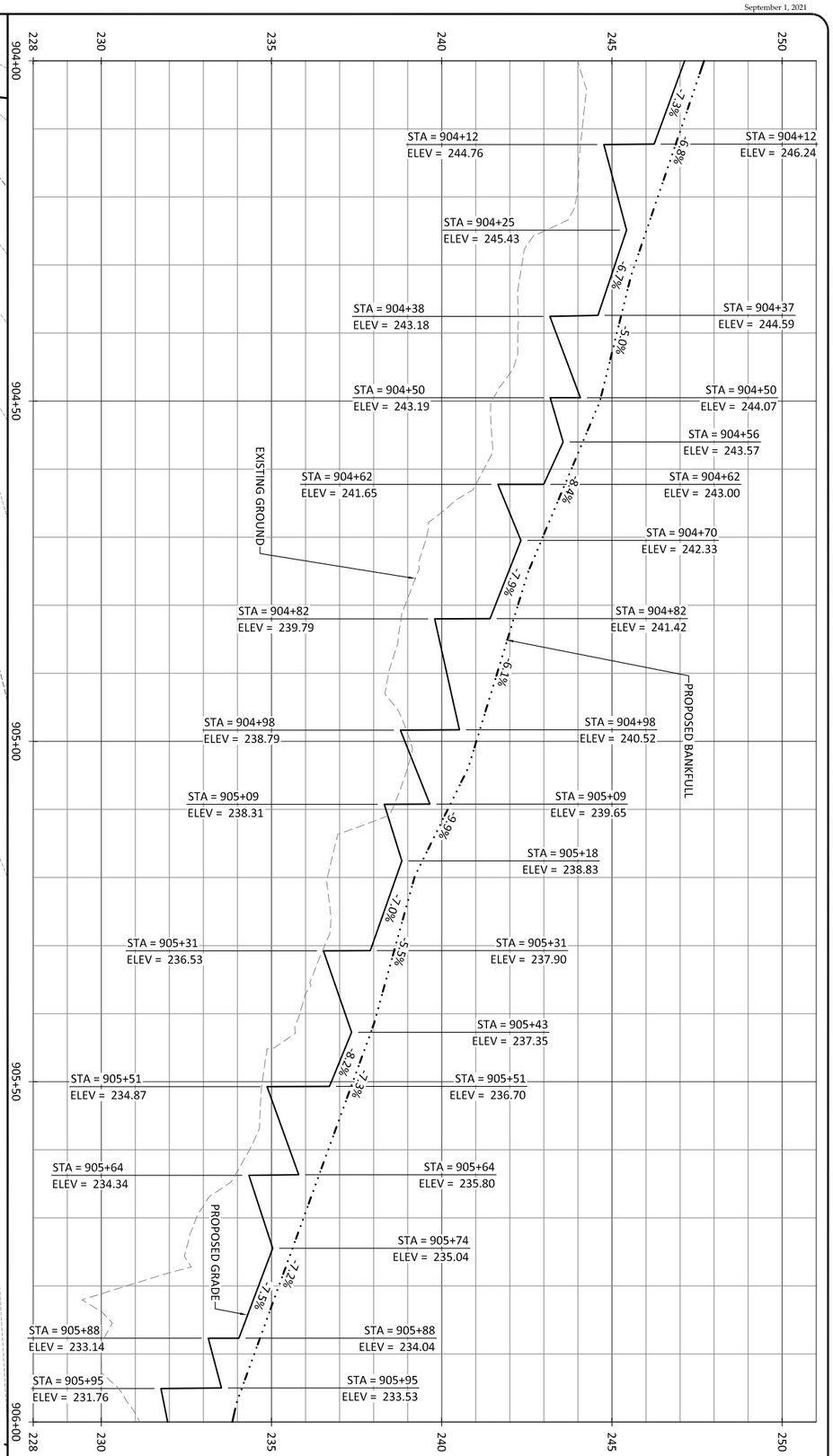

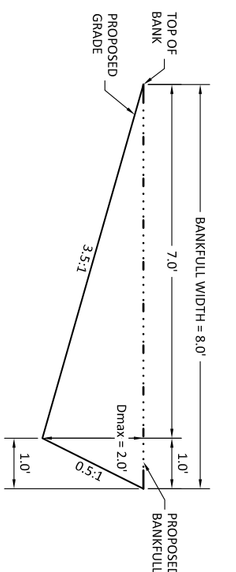

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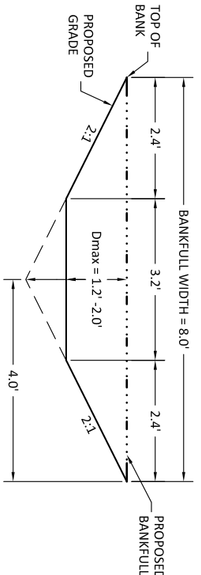
STA: 900+62 TO 907+59



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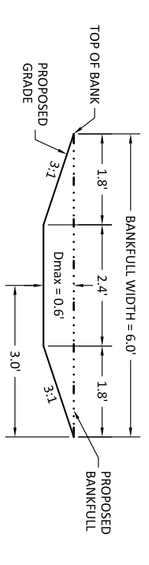
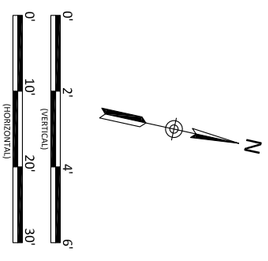
STA: 900+62 TO 907+59



T8
TYPICAL SECTION: RIFFLE
STA: 900+62 TO 907+59



Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

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Revisions:

Cool Springs Mitigation Site
Harnett County, North Carolina

T8
Stream Plan and Profile

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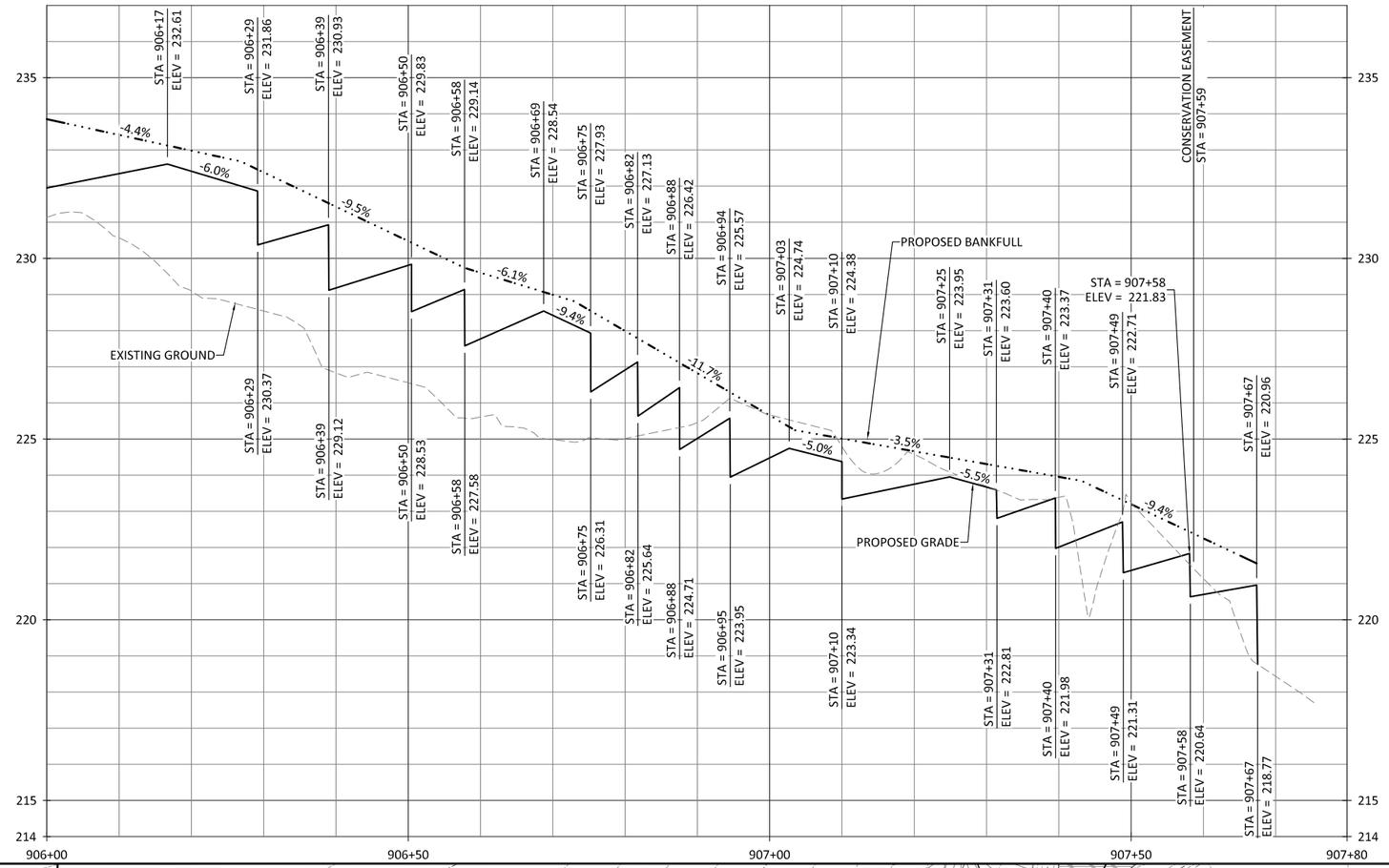

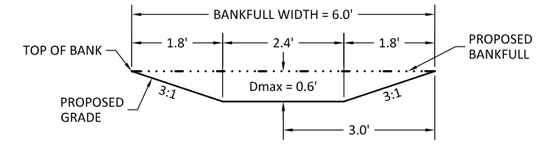

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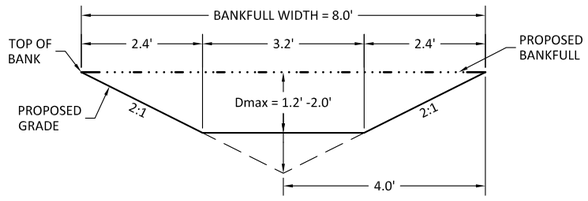
STA: 900+62 TO 907+59



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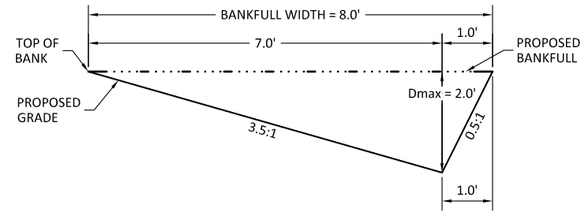

T8
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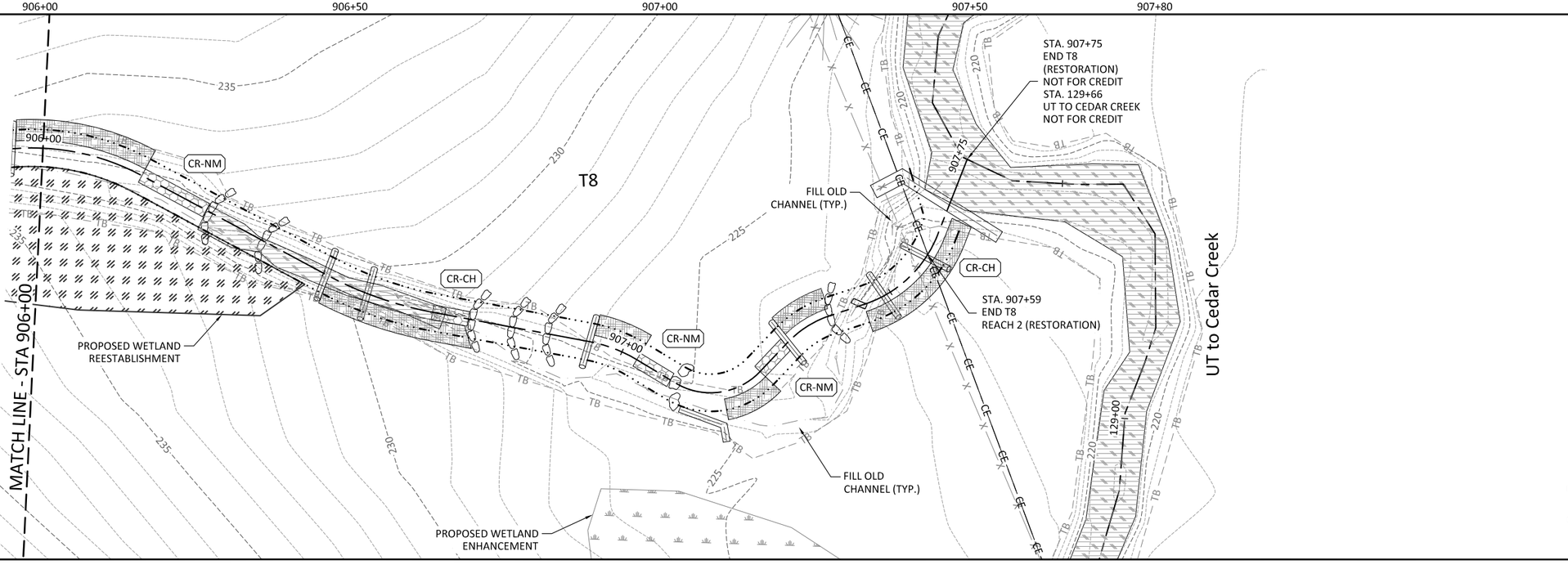
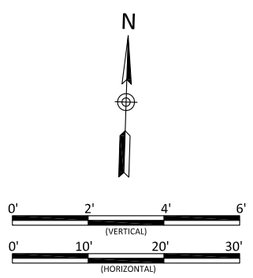
STA: 900+62 TO 907+59





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Harnett County, North Carolina

T8
Stream Plan and Profile

Revisions:

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

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1.9.4

September 1, 2021

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September 2, 2021

COOL SPRINGS RD

STA. 801+80
END T7
(ENHANCEMENT I)
UT TO CEDAR CREEK
REACH 2 (RESTORATION)
STA. 126+37

STA. 127+73
END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)
NOT FOR CREDIT

STA. 800+24
BEGIN T7
(ENHANCEMENT I)

STA. 128+74
END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
NOT FOR CREDIT

STA. 907+59
END T8
(RESTORATION)

STA. 907+75
END T8
(RESTORATION)
NOT FOR CREDIT

STA. 124+19
END UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)

STA. 118+65
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 180+00
BEGIN BMP 5

STA. 411+01
END T3 REACH 3
(ENHANCEMENT II)
STA. 114+87
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 305+12
END T2
(RESTORATION)
STA. 112+99
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 300+00
BEGIN BMP 4

PROPOSED 30' ACCESS EASEMENT
ALONG CENTERLINE OF EXISTING
GRAVEL AREAS (2.01 ACRES)

STA. 300+46
END BMP4
BEGIN T2
(RESTORATION)

STA. 170+00
BEGIN BMP 3

STA. 171+47
END BMP 3

STA. 150+95
BEGIN BMP 1

STA. 160+00
BEGIN BMP 2

STA. 100+58
BEGIN UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 152+44
END BMP 1
STA. 100+68
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 161+39
END BMP 2
STA. 102+26
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 204+44
END T1
(ENHANCEMENT II)
STA. 103+68
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 200+27
BEGIN T1
(ENHANCEMENT II)

STA. 182+95
END BMP 5

STA. 119+29
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 509+51
END T4 REACH 2
(RESTORATION)
STA. 119+53
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 408+05
END T3 REACH 2
(RESTORATION)
BEGIN T3 REACH 3
(ENHANCEMENT II)

STA. 706+32
END T6
(RESTORATION)
STA. 507+77
T4 REACH 2
(RESTORATION)

STA. 501+64
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

STA. 404+39
END T3 REACH 1
(ENHANCEMENT II)
BEGIN T3 REACH 2
(RESTORATION)

STA. 400+60
INTERNAL CROSSING
T3 REACH 1
(ENHANCEMENT II)

STA. 701+33
T6 (RESTORATION)
CREDITS BEGIN

STA. 900+62
T8 (RESTORATION)
CREDITS BEGIN

STA. 900+00
BEGIN T8
NOT FOR CREDIT

STA. 700+00
BEGIN T6
NOT FOR CREDIT

STA. 500+01
BEGIN T4 REACH 1
(RESTORATION)

STA. 500+98
END T4 REACH 1
(RESTORATION)
BEGIN T4 REACH 2
(RESTORATION)
STA. 601+80
END T5
(RESTORATION)

STA. 501+02
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

STA. 600+46
T5 (RESTORATION)
CREDITS BEGIN

STA. 400+17
BEGIN T3 REACH 1
(ENHANCEMENT II)

UT to Cedar Creek

T8 T7 T6 T5 T4 T3 T2 T1

2.1 2.2 2.3 2.4 2.5 2.6

CE CE-IX TB

0' 100' 200' 300'
(HORIZONTAL)

N

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Cool Springs Mitigation Site
Harnett County, North Carolina

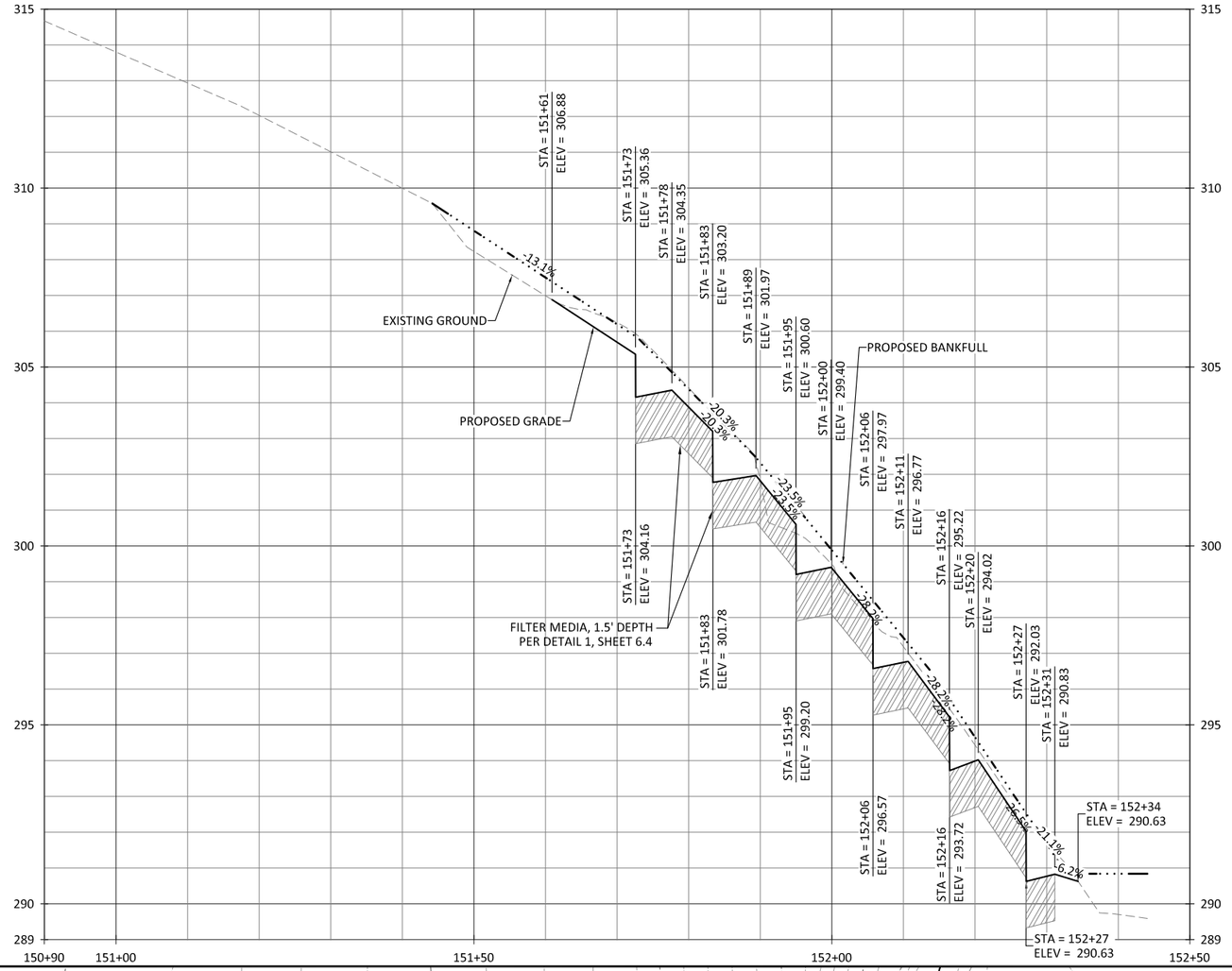
BMP Overview

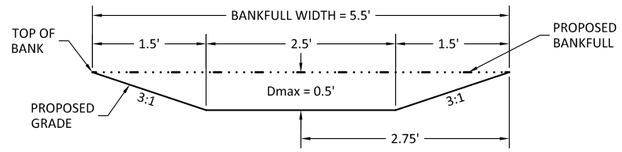
Revisions:

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

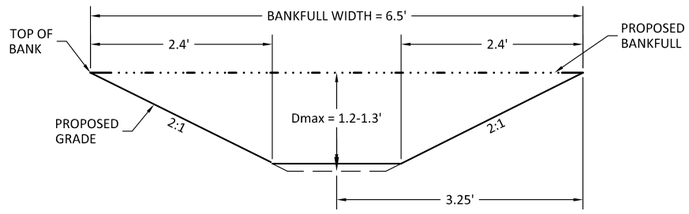
Sheet 2.0

September 1, 2021





BMP 1
TYPICAL SECTION: RIFFLE
STA: 151+73 to 152+31



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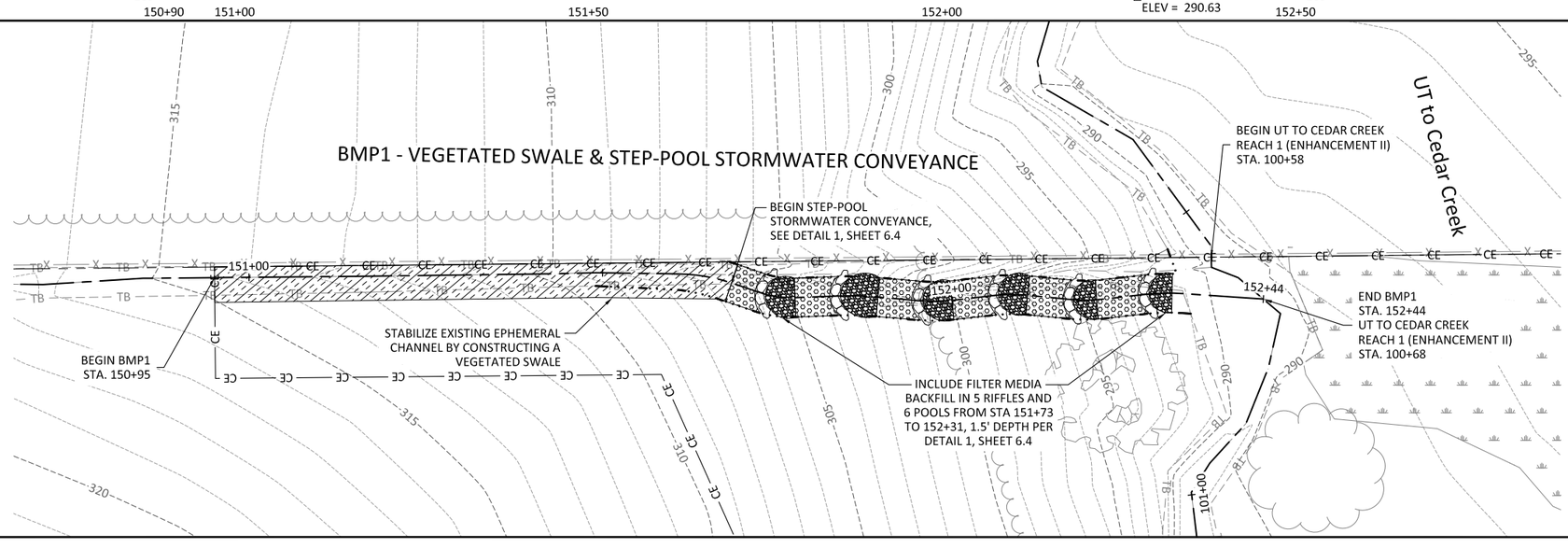
TYPICAL SECTION: STEP POOL
STA: 151+73 to 152+31



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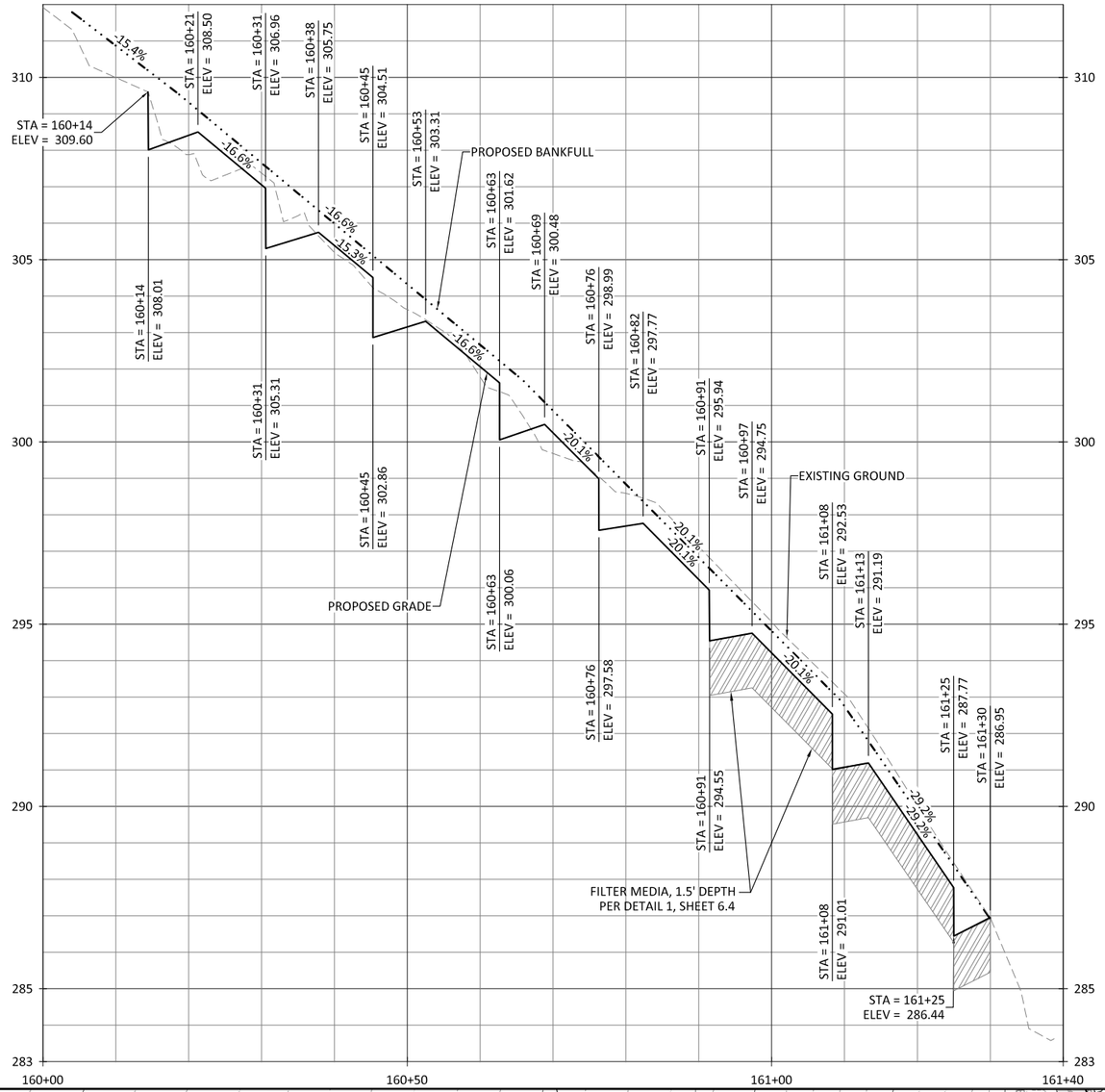
BMP1-VEGETATED SWALE & STEP-POOL STORMWATER CONVEYANCE BMPs

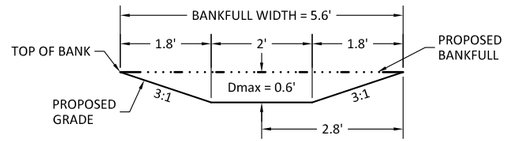
Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 2.1

September 1, 2021





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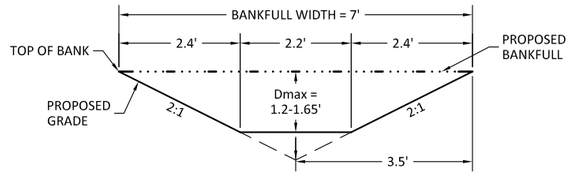
TYPICAL SECTION: RIFFLE
STA: 160+14 TO 161+30



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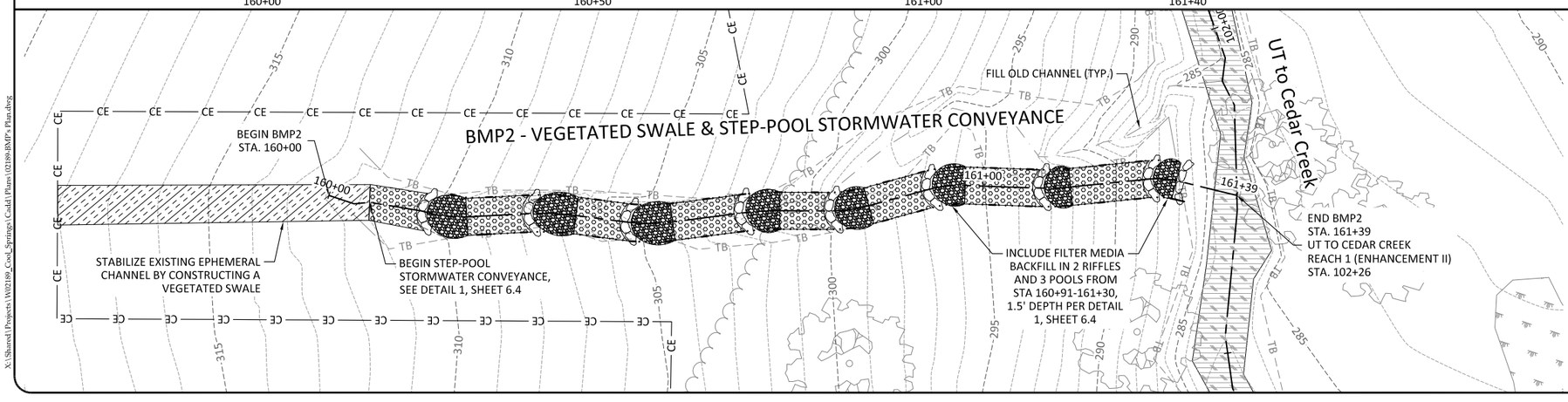
STA: 160+14 TO 161+30



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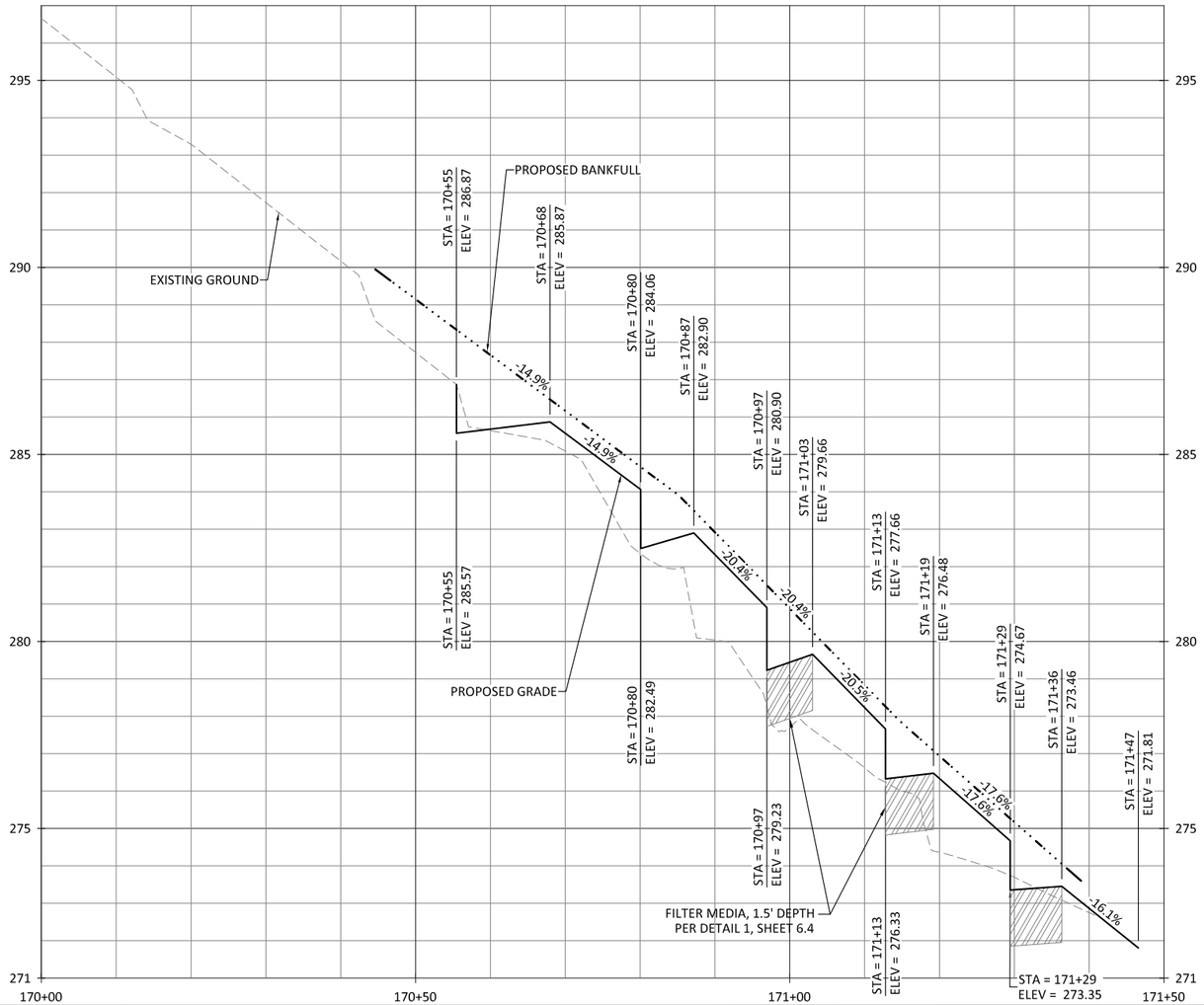
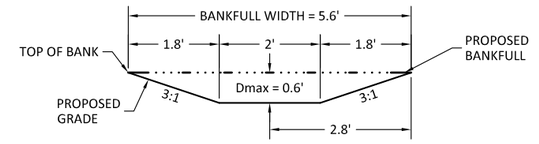
BMP2-VEGETATED SWALE & STEP-POOL STORMWATER CONVEYANCE
BMPs

Revisions:

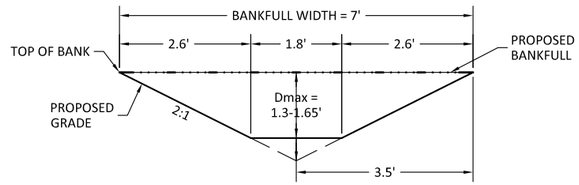
Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 2.2





BMP 3
TYPICAL SECTION: RIFFLE
STA: 170+55 TO 171+47



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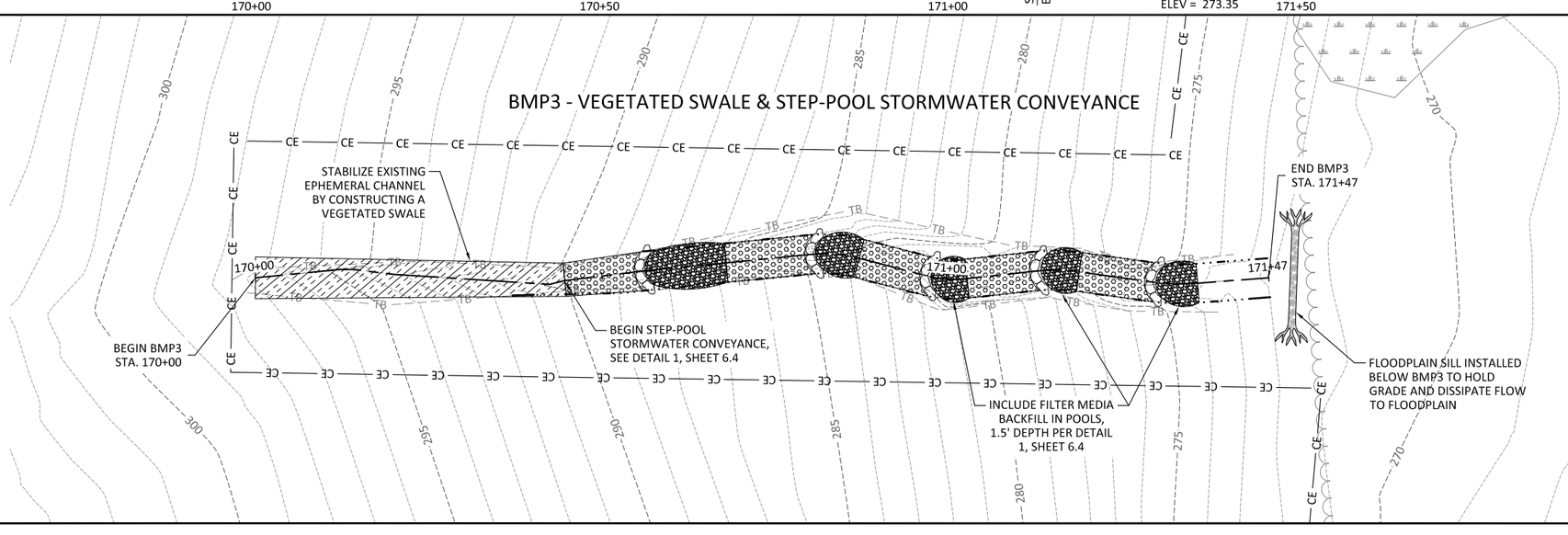
STA: 170+55 TO 171+47



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BMP3-VEGETATED SWALE & STEP-POOL STORMWATER CONVEYANCE
BMPs

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
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Sheet 2.3

September 1, 2021

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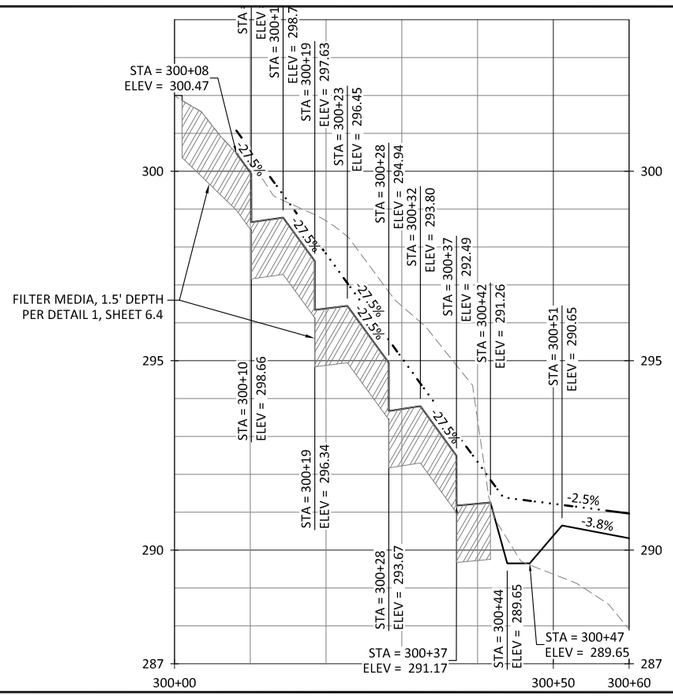
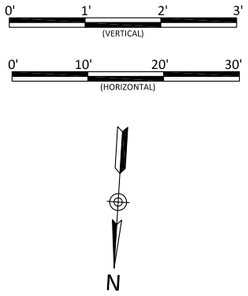
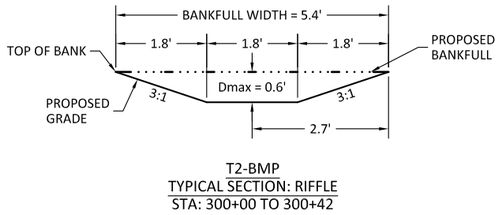
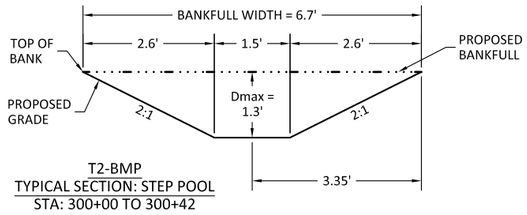
September 1, 2021



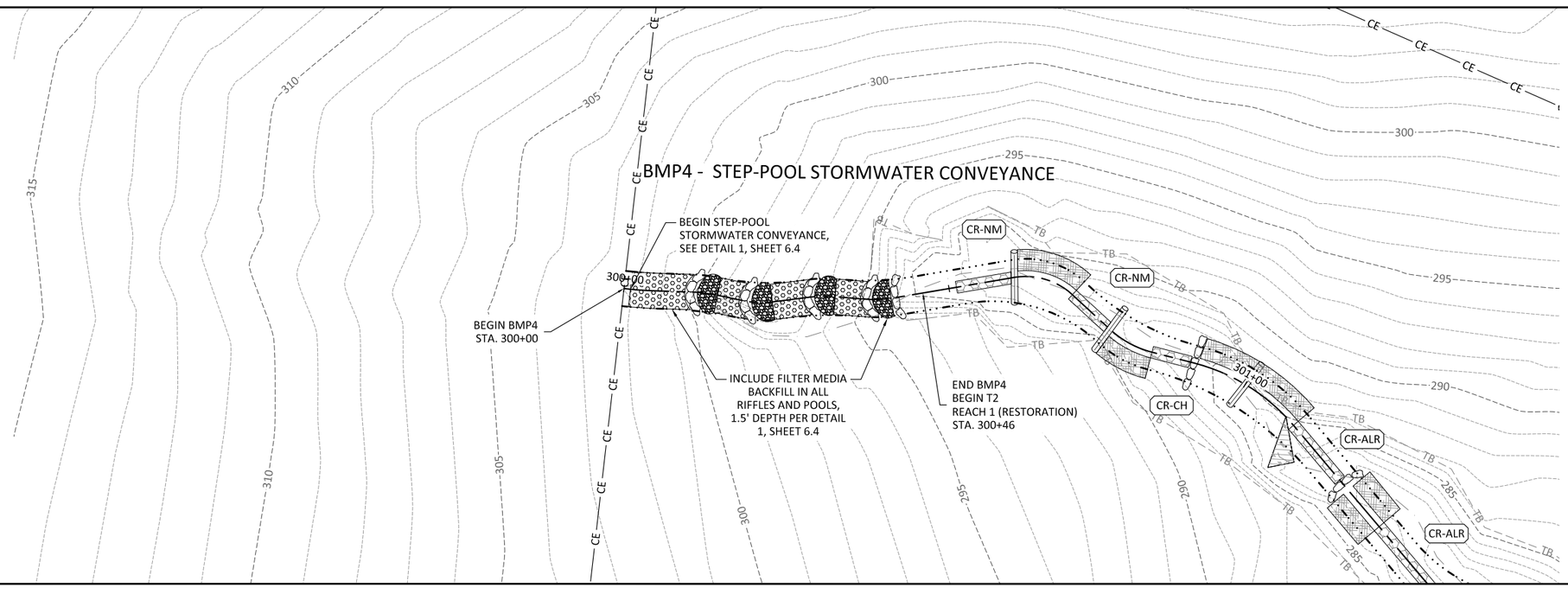




T2-BMP
TYPICAL SECTION: RIFFLE
STA: 300+00 TO 300+42



T2-BMP
TYPICAL SECTION: STEP POOL
STA: 300+00 TO 300+42



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BMP4 - STEP-POOL STORMWATER CONVEYANCE
BMPs

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
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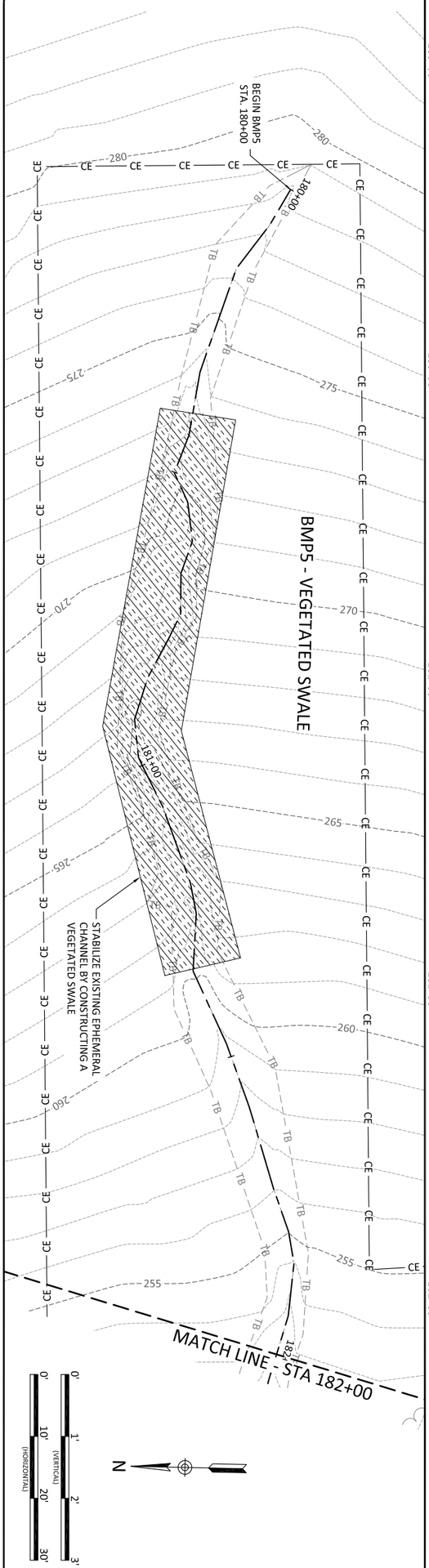
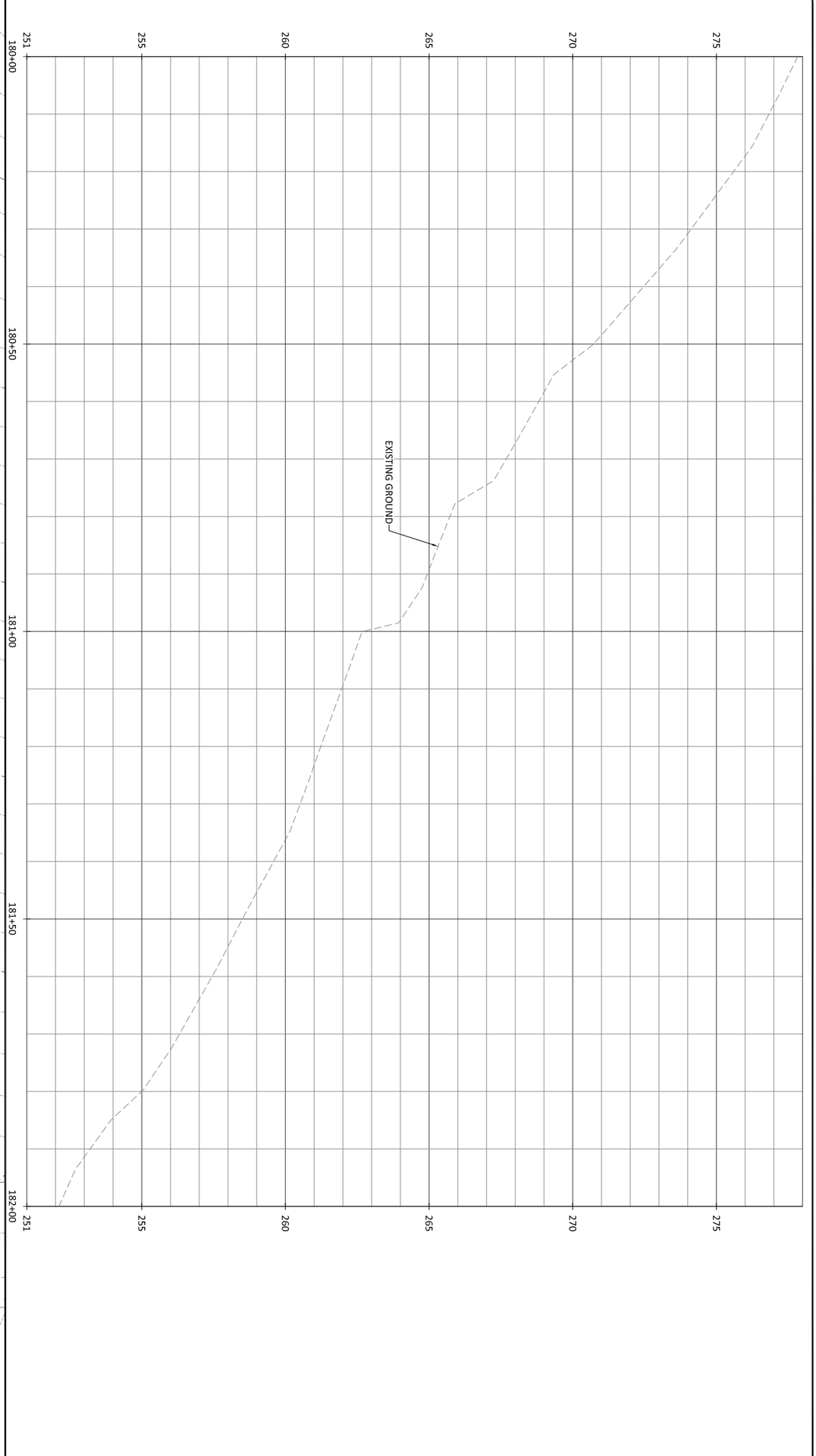
Sheet 2.4





Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

2.5
Sheet

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Cool Springs Mitigation Site
Harnett County, North Carolina

BMP5 - VEGETATED SWALE
BMPs

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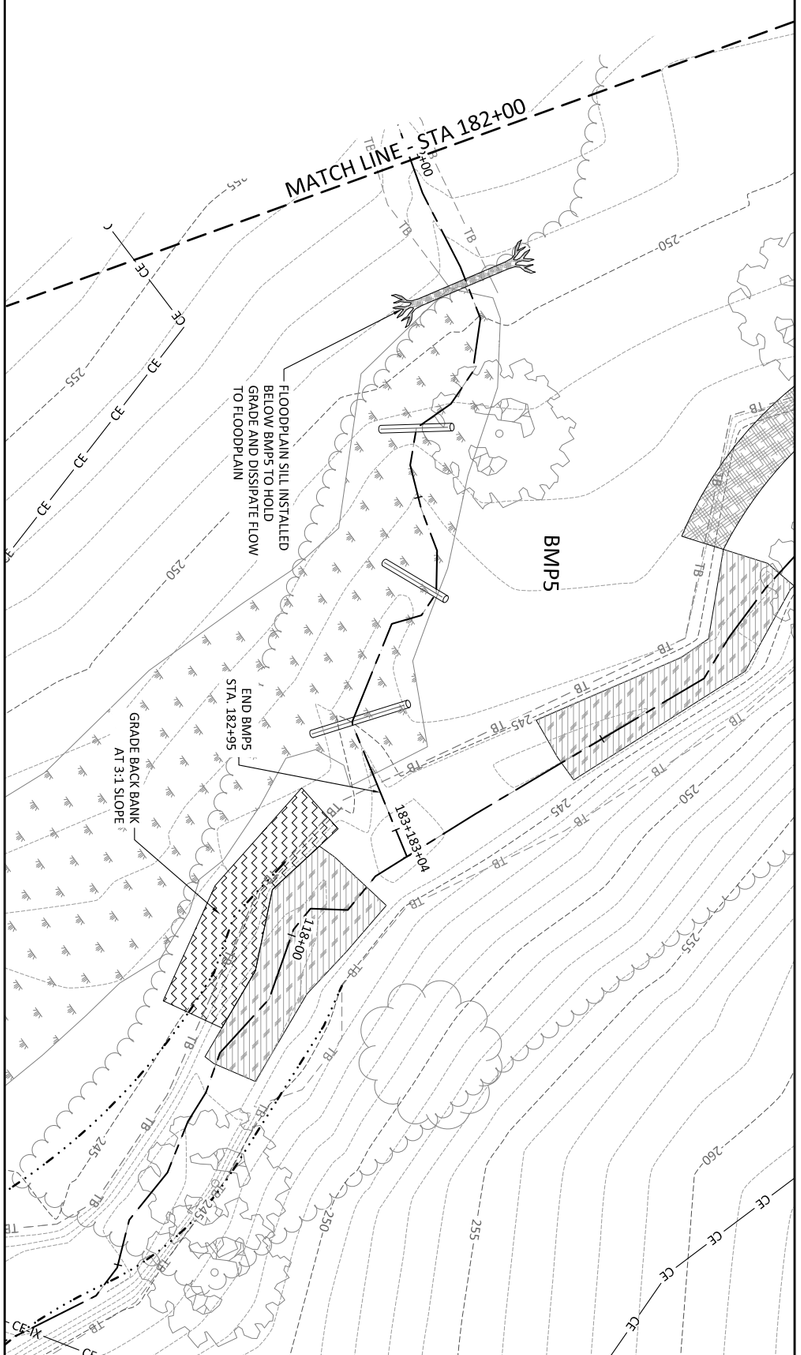

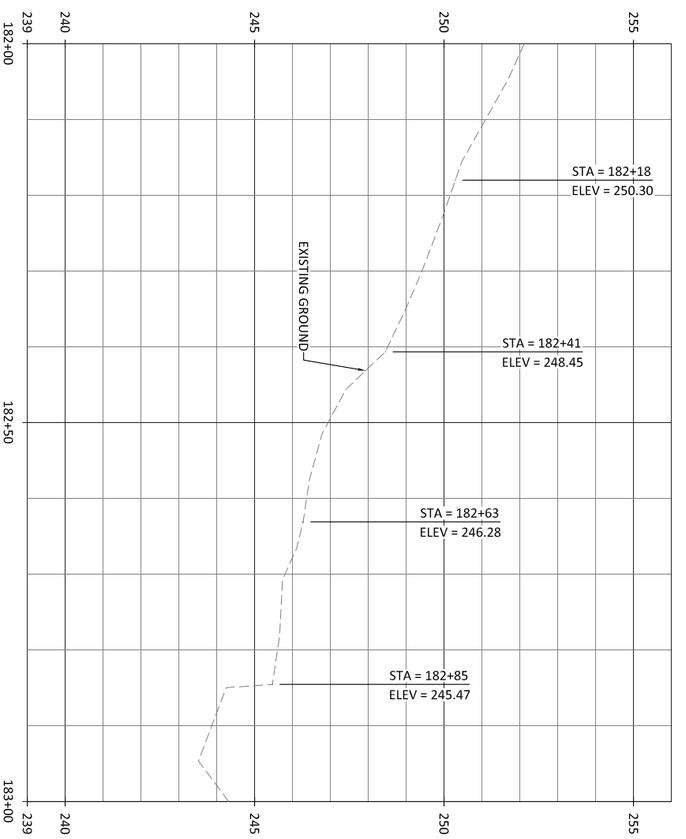

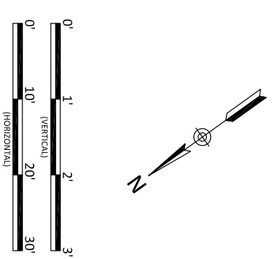

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
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Sheet

Revisions:

Cool Springs Mitigation Site
Harnett County, North Carolina

BMP5
BMPs

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January 3, 2022

Streambank Planting Zone 1 - UT to Cedar Creek (0.3 acres)

Live Stakes						
Species	**Common Name**	**Indiv. Spacing**	**Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Salix nigra	Black Willow	3-6 ft.	0.5”-1.5” cal.	Canopy	OBL	40%
Salix sericea	Silky Willow	3-6 ft.	0.5”-1.5” cal.	Subcanopy	OBL	25%
Cornus amomum	Silky Dogwood	3-6 ft.	0.5”-1.5” cal.	Subcanopy	FACW	15%
Cephalanthus occidentalis	Buttonbush	3-6 ft.	0.5”-1.5” cal.	Shrub	OBL	10%
Sambucus canadensis	Elderberry	3-6 ft.	0.5”-1.5” cal.	Shrub	FACW	10%
						100%
Herbaceous Plugs						
Juncus Effusus	Soft Rush	4 ft.	1.0”- 2.0” plug	Herb	FACW	40%
Carex lurida	Lurid Sedge	4 ft.	1.0”- 2.0” plug	Herb	OBL	20%
Carex crinita	Fringed Sedge	4 ft.	1.0”- 2.0” plug	Herb	OBL	20%
Scirpus cyperinus	Woolgrass	4 ft.	1.0”- 2.0” plug	Herb	OBL	15%
Hibiscus moschuetos	Crimson-eyed Rosemallow	4 ft.	1.0”- 2.0” plug	Herb	OBL	5%
						100%

Streambank Planting Zone 2 - T2, T3-R2, T4, T5, T6, T7, and T8 (0.6 acres)

Live Stakes						
Species	**Common Name**	**Indiv. Spacing**	**Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Salix nigra	Black Willow	3-6 ft.	0.5”-1.5” cal.	Canopy	OBL	10%
Salix sericea	Silky Willow	3-6 ft.	0.5”-1.5” cal.	Subcanopy	OBL	30%
Cornus amomum	Silky Dogwood	3-6 ft.	0.5”-1.5” cal.	Subcanopy	FACW	20%
Cephalanthus occidentalis	Buttonbush	3-6 ft.	0.5”-1.5” cal.	Shrub	OBL	20%
Sambucus canadensis	Elderberry	3-6 ft.	0.5”-1.5” cal.	Shrub	FACW	20%
						100%
Herbaceous Plugs						
Juncus Effusus	Soft Rush	4 ft.	1.0”- 2.0” plug	Herb	FACW	40%
Carex lurida	Lurid Sedge	4 ft.	1.0”- 2.0” plug	Herb	OBL	20%
Carex crinita	Fringed Sedge	4 ft.	1.0”- 2.0” plug	Herb	OBL	20%
Scirpus cyperinus	Woolgrass	4 ft.	1.0”- 2.0” plug	Herb	OBL	15%
Hibiscus moschuetos	Crimson-eyed Rosemallow	4 ft.	1.0”- 2.0” plug	Herb	OBL	5%
						100%

Streambank Planting Zone 1
UT to Cedar Creek
(See Detail 2, Sheet 6.11)

Streambank Planting Zone 2
T1, T2, T3-R2, T4, T5, T6, T7, & T8
(See Detail 3, Sheet 6.11)

BMP Planting Zone 3
(See Detail 4, Sheet 6.11)

Buffer Planting Zone 4
(See Detail 1, Sheet 6.11)

Floodplain and Wetland Planting Zone 5
(See Detail 1, Sheet 6.11)

Permanent Seeding Outside Easement

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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Buffer Planting Zone (11.9 acres)

Bare Root						
Species	**Common Name**	**Indiv. Spacing**	**Caliper Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Quercus alba	White Oak	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Quercus michauxii	Swamp Chestnut Oak	6-12 ft.	0.25"-1.0"	Canopy	FACW	13%
Platanus occidentalis	Sycamore	6-12 ft.	0.25"-1.0"	Canopy	FACW	13%
Ulmus americana	American Elm	6-12 ft.	0.25"-1.0"	Canopy	FAC	13%
*Carya tomentosa**	Mockernut Hickory	6-12 ft.	0.25"-1.0"	Canopy	FACU	3%
Quercus rubra	Northern Red Oak	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Juniperus virginiana	Eastern Red Cedar	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Liriodendron tulipifera	Tulip-poplar	6-12 ft.	0.25"-1.0"	Canopy	FACU	3%
Fraxinus pennsylvanica	Green Ash	6-12 ft.	0.25"-1.0"	Canopy	FACW	3%
*Cornus florida**	Flowering Dogwood	6-12 ft.	0.25"-1.0"	Subcanopy	FACU	1%
*Cercis canadensis**	Eastern Red Bud	6-12 ft.	0.25"-1.0"	Subcanopy	UPL	1%
Ulmus alata	Winged Elm	6-12 ft.	0.25"-1.0"	Canopy	FACU	7%
Betula nigra	River Birch	6-12 ft.	0.25"-1.0"	Canopy	FACW	13%
						100%

*Species not subject to monitoring height requirement due to species growth habit.

BMP Planting Zone (0.1 acres)

Herbaceous Plugs						
Species	**Common Name**	**Indiv. Spacing**	**Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Carex albolutescens	Greenwhite sedge	4 ft.	1.0”- 2.0” plug	Herb	FACW	20%
Juncus tenuis	Path rush	4 ft.	1.0”- 2.0” plug	Herb	FAC	30%
Juncus coriaceus	Leathery rush	4 ft.	1.0”- 2.0” plug	Herb	FACW	30%
Juncus effusus	Soft rush	4 ft.	1.0”- 2.0” plug	Herb	OBL	20%
						100%

Wetland Planting Zone (1.9 acres)

Bare Root						
Species	**Common Name**	**Indiv. Spacing**	**Caliper Size**	**Stratum**	**Wetland Indicator Status**	**% of Stems**
Nyssa biflora	Swamp Tupelo	6-12 ft.	0.25"-1.0"	Canopy	OBL	15%
Betula nigra	River Birch	6-12 ft.	0.25"-1.0"	Canopy	FACW	10%
Platanus occidentalis	Sycamore	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Ulmus americana	American Elm	6-12 ft.	0.25"-1.0"	Canopy	FAC	15%
Taxodium distichum	Bald Cypress	6-12 ft.	0.25"-1.0"	Canopy	OBL	15%
*Cephalanthus occidentalis**	Buttonbush	6-12 ft.	0.25"-1.0"	Shrub	OBL	5%
*Rosa palustris**	Swamp Rose	6-12 ft.	0.25"-1.0"	Shrub	OBL	5%
*Sambucus canadensis**	Common Elderberry	6-12 ft.	0.25"-1.0"	Shrub	FACW	5%
Live Stake						
Salix nigra	Black Willow	6-12 ft.	0.25"-1.0"	Canopy	OBL	15%
						100%

*Species not subject to monitoring height requirement due to species growth habit.

Note: Wetland zone species to be planted on 6' spacing in rows spaced 12' apart.

Temporary Seeding (14.4 acres)

Pure Live Seed				
Approved Dates	**Species Name**	**Common Name**	**Stratum**	**Density (lbs/acre)**
August 15 - April 15	*Secale cereale*	Rye Grain	Herb	90
August 15 - April 15	*Avena sativa*	Winter Oats	Herb	30
April 15 - August 15	*Urochloa racemosa*	Browntop Millet	Herb	50
All Year	*Trifolium incarnatum*	Crimson Clover	Herb	5
All Year	*Trifolium repens*	Ladino Clover	Herb	5

Permanent Seeding Outside Easement (0.5 acres)

Approved Dates	Species Name	Common Name	Stratum	Density (lbs/acre)	Percentage
All Year	*Festuca arundinacea*	Tall Fescue	Herb	30	55%
All Year	*Dactylis glomerata*	Orchardgrass	Herb	20	35%
All Year	*Trifolium repens*	Ladino Clover	Herb	5	10%
					100%

Permanent Wetland Seeding (1.9 acres)

Pure Live Seed (20 lbs/acre)					
Approved Dates	**Species Name**	**Common Name**	**Stratum**	**Wetland Indicator Status**	**Density (lbs/acre)**
All Year	*Coleataenia rigidula*	Redtop Panicgrass	Herb	FACW	*3*
All Year	*Elymus virginicus*	Virginia Wildrye	Herb	FACW	*3*
All Year	*Panicum virgatum*	Switchgrass	Herb	FAC	*1*
All Year	*Juncus effusus*	Soft Rush	Herb	FACW	*1*
All Year	*Juncus coriaceus*	Leathery Rush	Herb	FACW	*1*
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	OBL	*2*
All Year	*Carex lurida*	Lurid Sedge	Herb	OBL	*1*
All Year	*Carex lupulina*	Hop Sedge	Herb	OBL	*1*
All Year	*Carex albolutescens*	Greenwhite Sedge	Herb	FACW	*1*
All Year	*Carex crinita*	Fringed Sedge	Herb	FACW	*1*
All Year	*Bidens aristosa*	Bur Marigold	Herb	FACW	*1.5*
All Year	*Helianthus angustifolia*	Swamp Sunflower	Herb	FACW	*2*
All Year	*Scirpus cyperinus*	Woolgrass	Herb	OBL	1
All Year	*Tripsacum dactyloides*	Eastern Gamagrass	Herb	FAC	0.5
					20.0

Permanent Riparian Seeding (11.9 acres)

Pure Live Seed (20 lbs/acre)					
Approved Dates	**Species Name**	**Common Name**	**Stratum**	**Wetland Indicator Status**	**lbs/acre**
All Year	*Elymus virginicus*	Virginia Wildrye	Herb	FACW	3.0
All Year	*Panicum virgatum*	Switchgrass	Herb	FAC	1.0
All Year	*Schizachyrium scoparium*	Little Bluestem	Herb	FACU	2.5
All Year	*Tripsacum dactyloides*	Eastern Gamagrass	Herb	FACW	2.0
All Year	*Dichanthelium clandestinum*	Deertongue	Herb	FAC	3.0
All Year	*Chasmanthium latifolium*	River Oats	Herb	FACU	1.0
All Year	*Sorghastrum nutans*	Indiangrass	Herb	FACU	1.5
All Year	*Juncus tenuis*	Path Rush	Herb	FAC	0.5
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	FACU	1.0
All Year	*Bidens aristosa*	Bur Marigold	Herb	FACW	1.0
All Year	*Helianthus angustifolia*	Swamp Sunflower	Herb	FACW	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	FACU	1.0
All Year	*Chamaecrista fasciculata var. fasciculata*	Partridge Pea	Herb	FACU	1.0
All Year	*Pycnanthemum tenuifolium*	Narrowleaf Mountain-Mint	Herb	FACW	0.5
					20.0

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Cool Springs Mitigation Site
Harnett County, North Carolina

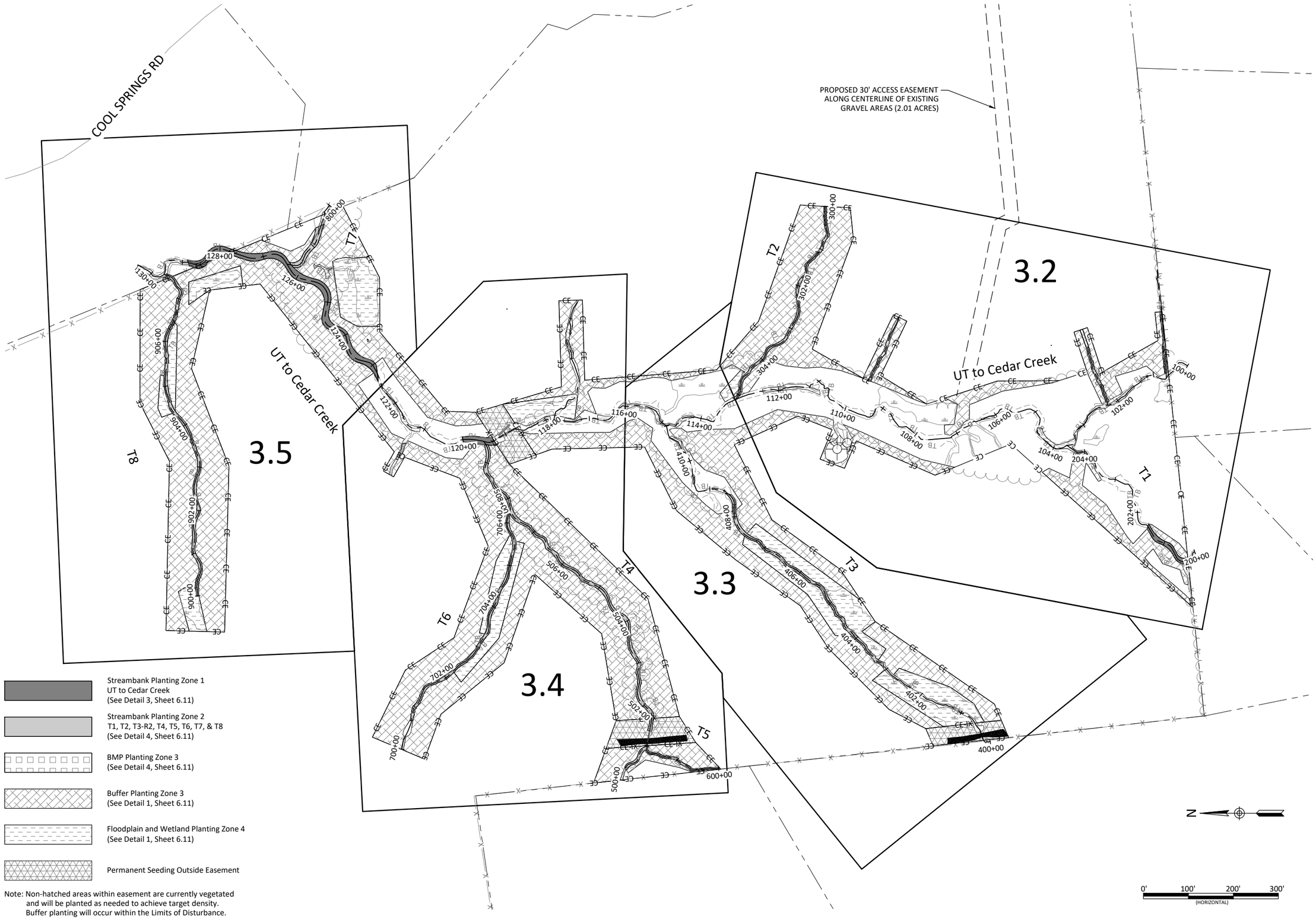
Planting Tables

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 3.0

December 23, 2021



Streambank Planting Zone 1
UT to Cedar Creek
(See Detail 3, Sheet 6.11)

Streambank Planting Zone 2
T1, T2, T3-R2, T4, T5, T6, T7, & T8
(See Detail 4, Sheet 6.11)

BMP Planting Zone 3
(See Detail 4, Sheet 6.11)

Buffer Planting Zone 3
(See Detail 1, Sheet 6.11)

Floodplain and Wetland Planting Zone 4
(See Detail 1, Sheet 6.11)

Permanent Seeding Outside Easement

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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Planting Overview

Revisions:

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

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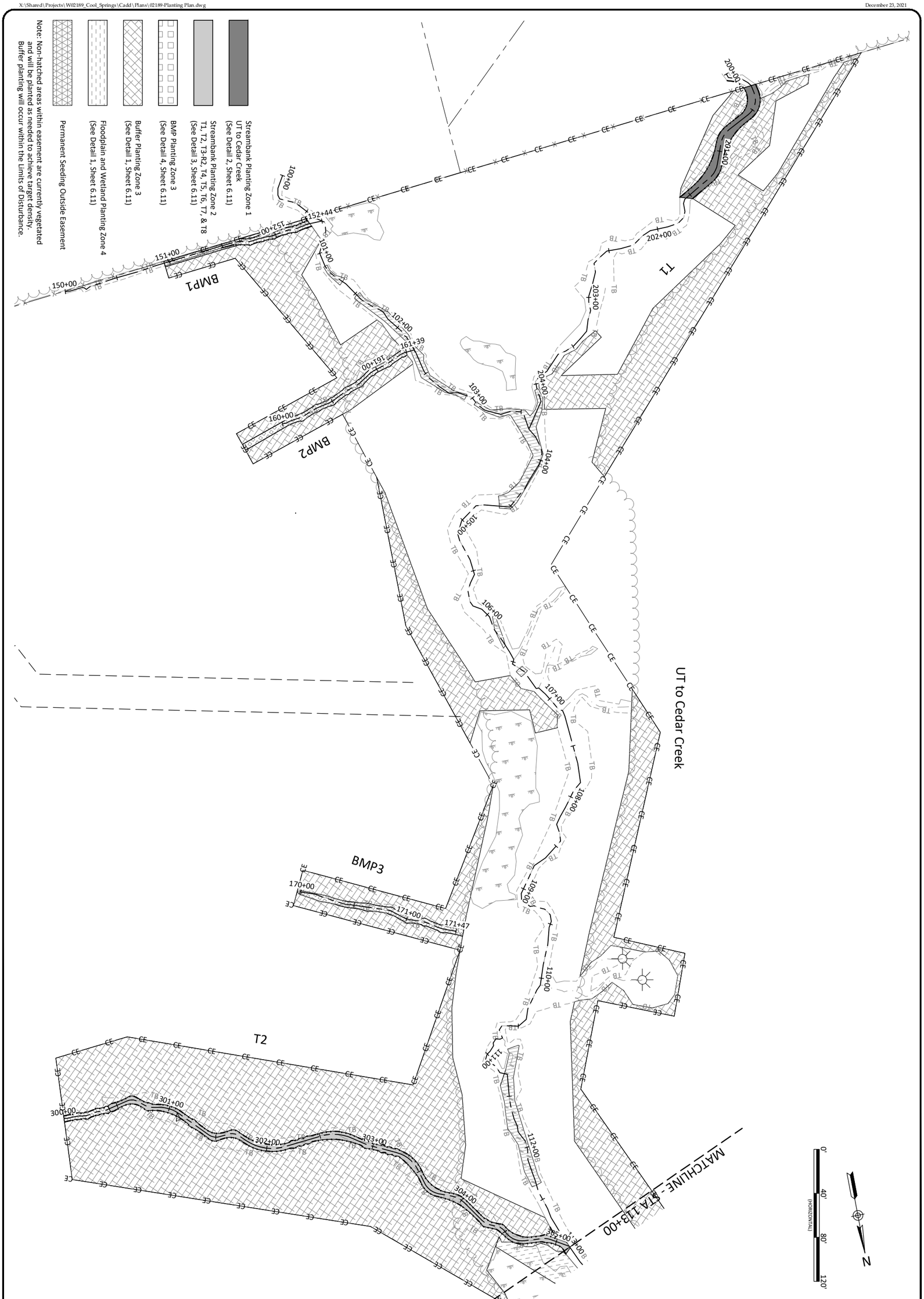

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
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Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
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Revisions:

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Job Number:	500-02189
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Drawn By:	CAW
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September 3, 2021

COOL SPRINGS RD

CAMERON
D.B. 1136, PG. 345

WICKER
D.B. 3148, PG. 857

PATTERSON
D.B. 905, PG. 673
M.B. 2011, PG. 417

,TTERSON
SONS, INC
.622, PG.187
!002, PG. 791
601-89-2857

END T7
(ENHANCEMENT I)
STA. 801+80
UT TO CEDAR CREEK
REACH 2 (RESTORATION)
STA. 126+37

BEGIN T7
(ENHANCEMENT I)
STA. 800+24

END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
STA. 127+74

END T8
(RESTORATION)
STA. 907+59

END UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)
STA. 124+19

STA. 118+79
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

END T3 REACH 3
(ENHANCEMENT II)
STA. 411+01
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
STA. 114+87

END T2
(RESTORATION)
STA. 305+12
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
STA. 112+99

BEGIN T2 BMP
STA. ???

END T2 BMP
BEGIN T2
(RESTORATION)
STA. 300+42

BEGIN UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
STA. 100+58

UT to Cedar Creek

T8 (RESTORATION)
CREDITING BEGINS
STA. 900+62

BEGIN T8
(NOT FOR CREDIT)
STA. 900+00

END T4 REACH 2
(RESTORATION)
STA. 500+89
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
STA. 119+75

STA. 119+47
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

END T6
(RESTORATION)
STA. 706+32
T4 REACH 2
(RESTORATION)
STA. 507+77

T6 (RESTORATION)
CREDITS BEGIN
STA. 701+34

BEGIN T6
NOT FOR CREDIT
STA. 700+00

STA. 501+42
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

END T3 REACH 2
(RESTORATION)
BEGIN T3 REACH 3
(ENHANCEMENT II)
STA. 408+40

END T3 REACH 1
(ENHANCEMENT II)
BEGIN T3 REACH 2
(RESTORATION)
STA. 404+39

STA. 400+60
INTERNAL CROSSING
T3 REACH 1
(ENHANCEMENT II)

BEGIN T3 REACH 1
(ENHANCEMENT II)
STA. 400+17

END T1
(ENHANCEMENT II)
STA. 204+44
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
STA. 103+68

BEGIN T1
(ENHANCEMENT II)
STA. 200+27

BEGIN T4 REACH 1
(RESTORATION)
STA. 500+01

END T4 REACH 1
(RESTORATION)
BEGIN T4 REACH 2
(RESTORATION)
STA. 500+98
END T5
(RESTORATION)
STA. 601+80

STA. 501+02
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

T5 (RESTORATION)
CREDITS BEGIN
STA. 600+46

1.8.1 1.1.7 1.9.4 1.9.3 1.9.2 1.9.1 1.1.6 1.1.5 1.5.5 1.5.4 1.7.3 1.5.3 1.7.2 1.5.2 1.7.1 1.5.1 1.6.1 1.1.4 1.4.5 1.4.4 1.4.3 1.4.2 1.4.1 1.3.3 1.3.2 1.3.1 1.1.3 1.1.2 1.1.1 1.2.2 1.2.1 T1 T2 T3 T4 T5 T6 T8

N

0' 10' 20' 30'
(HORIZONTAL)

6

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Harnett County, North Carolina

Erosion and Sediment Control Overview
Erosion and Sediment Control Plan

Revisions:

Date: 06.17.21
Job Number: 500-02169
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 4.0

September 3, 2021

COOL SPRINGS RD

STA. 801+80
END T7
(ENHANCEMENT I)
STA. 126+37
UT TO CEDAR CREEK
REACH 2 (RESTORATION)

STA. 127+73
END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)
NOT FOR CREDIT

STA. 800+24
BEGIN T7
(ENHANCEMENT I)

STA. 128+74
END UT TO CEDAR CREEK
REACH 2 (RESTORATION)
NOT FOR CREDIT

STA. 907+59
END T8
(RESTORATION)

STA. 907+75
END T8
(RESTORATION)
NOT FOR CREDIT

STA. 124+19
END UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)
BEGIN UT TO CEDAR CREEK
REACH 2 (RESTORATION)

STA. 180+00
BEGIN BMP 5

STA. 118+65
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 305+12
END T2
(RESTORATION)
STA. 112+99
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 411+01
END T3 REACH 3
(ENHANCEMENT II)
STA. 114+87
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 300+00
BEGIN T2-BMP

STA. 300+46
END T2-BMP
BEGIN T2
(RESTORATION)

PROPOSED 30' ACCESS EASEMENT
ALONG CENTERLINE OF EXISTING
GRAVEL AREAS (2.01 ACRES)

STA. 170+00
BEGINBMP 3

STA. 171+47
END BMP 3

STA. 150+95
BEGIN BMP 1

STA. 100+58
BEGIN UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 152+44
END BMP 1
STA. 100+68
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 161+39
END BMP 2
STA. 102+26
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 204+44
END T1
(ENHANCEMENT II)
STA. 103+68
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 200+27
BEGIN T1
(ENHANCEMENT II)

STA. 900+62
T8 (RESTORATION)
CREDITING BEGINS

STA. 900+00
BEGIN T8
NOT FOR CREDIT

STA. 509+51
END T4 REACH 2
(RESTORATION)
STA. 119+53
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 119+29
INTERNAL CROSSING
UT TO CEDAR CREEK
REACH 1 (ENHANCEMENT II)

STA. 182+95
END BMP 5

STA. 408+05
END T3 REACH 2
(RESTORATION)
BEGIN T3 REACH 3
(ENHANCEMENT II)

STA. 706+32
END T6
(RESTORATION)
STA. 507+77
T4 REACH 2
(RESTORATION)

STA. 501+64
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

STA. 404+39
END T3 REACH 1
(ENHANCEMENT II)
BEGIN T3 REACH 2
(RESTORATION)

STA. 400+60
INTERNAL CROSSING
T3 REACH 1
(ENHANCEMENT II)

STA. 701+33
T6 (RESTORATION)
CREDITS BEGIN

STA. 700+00
BEGIN T6
NOT FOR CREDIT

STA. 500+01
BEGIN T4 REACH 1
(RESTORATION)

STA. 500+98
END T4 REACH 1
(RESTORATION)
BEGIN T4 REACH 2
(RESTORATION)
STA. 601+80
END T5
(RESTORATION)

STA. 501+02
INTERNAL CROSSING
T4 REACH 2
(RESTORATION)

STA. 600+46
T5 (RESTORATION)
CREDITS BEGIN

STA. 400+17
BEGIN T3 REACH 1
(ENHANCEMENT II)

5.1
5.2
5.3
5.4

T1
T2
T3
T4
T5
T6
T7
T8

UT to Cedar Creek

CE
CE-IX
TB

0' 100' 200' 300'
(HORIZONTAL)

N

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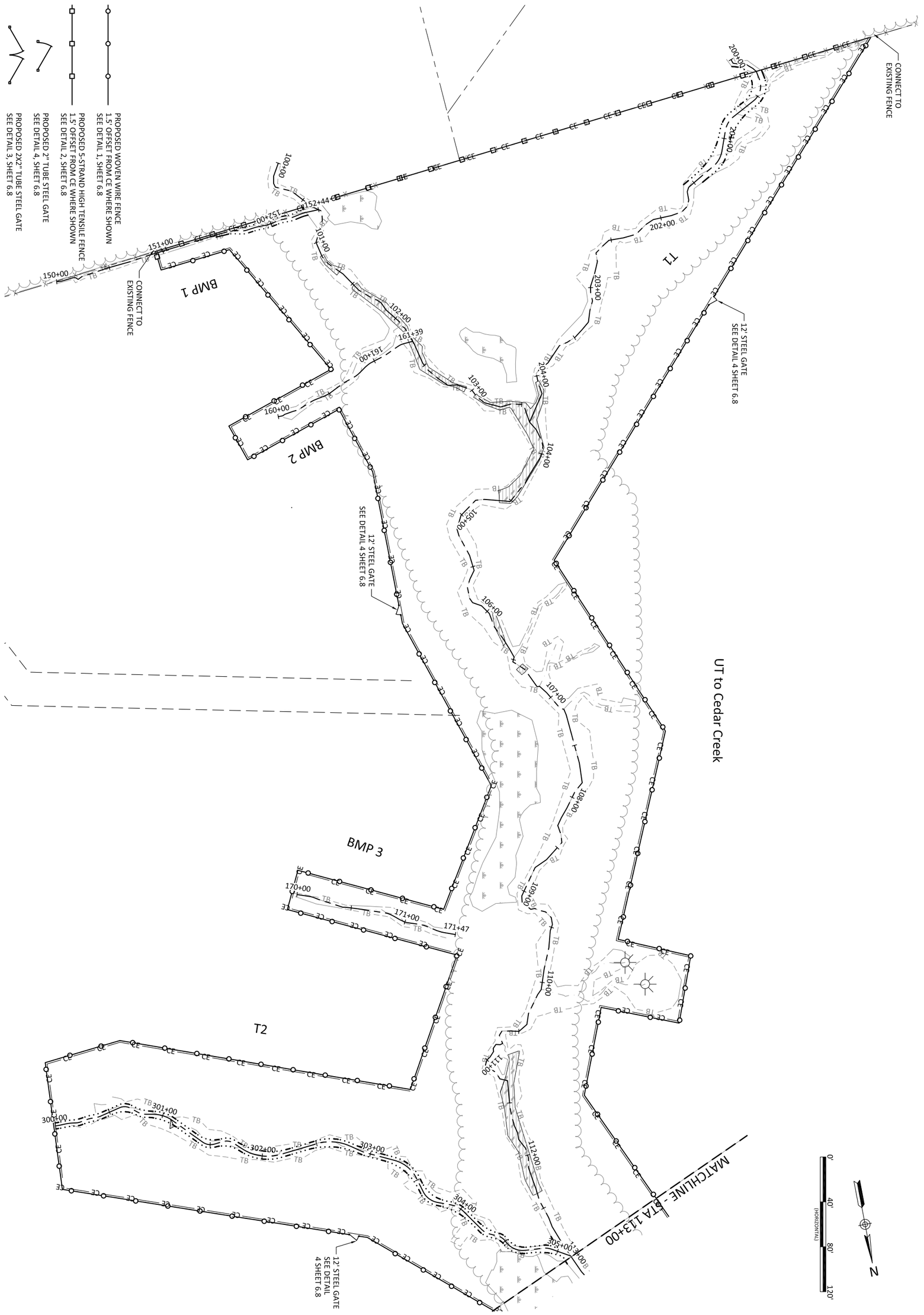
Harnett County, North Carolina

Fencing Overview

Revisions:

Date: 06.17.21
Job Number: 300-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 5.0



Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

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Revisions:

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Harnett County, North Carolina

Fencing Plan

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September 1, 2021

PROPOSED WOVEN WIRE FENCE
1.5' OFFSET FROM CE WHERE SHOWN
SEE DETAIL 1, SHEET 6.8

PROPOSED 5-STRAND HIGH TENSILE FENCE
1.5' OFFSET FROM CE WHERE SHOWN
SEE DETAIL 2, SHEET 6.8

PROPOSED 2" TUBE STEEL GATE
SEE DETAIL 4, SHEET 6.8

PROPOSED 2X2" TUBE STEEL GATE
SEE DETAIL 3, SHEET 6.8

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Harnett County, North Carolina

Fencing Plan

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
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Sheet 5.2

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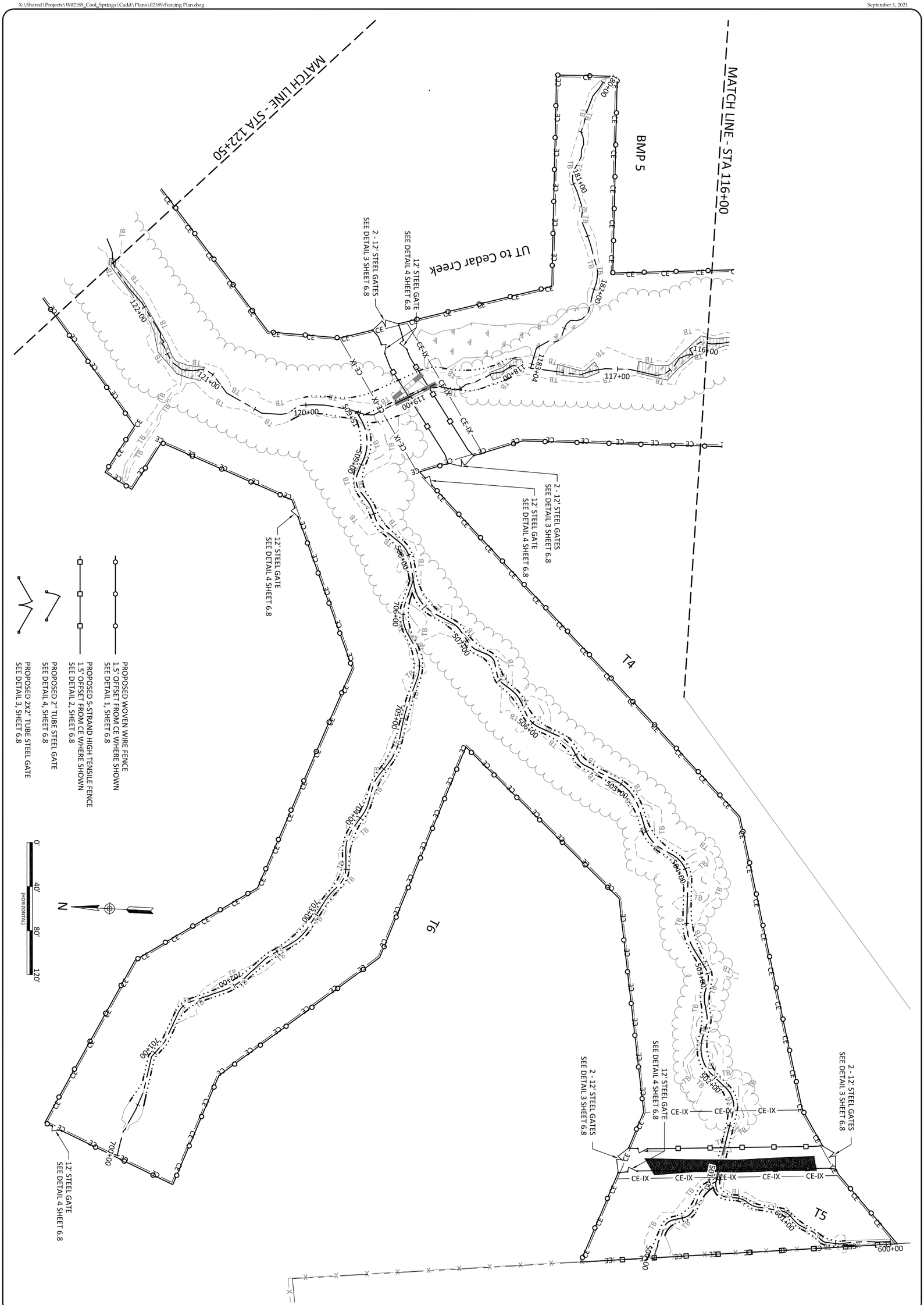

Date:	06.17.21
Job Number:	500-02189
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Cool Springs Mitigation Site
Harnett County, North Carolina

Fencing Plan

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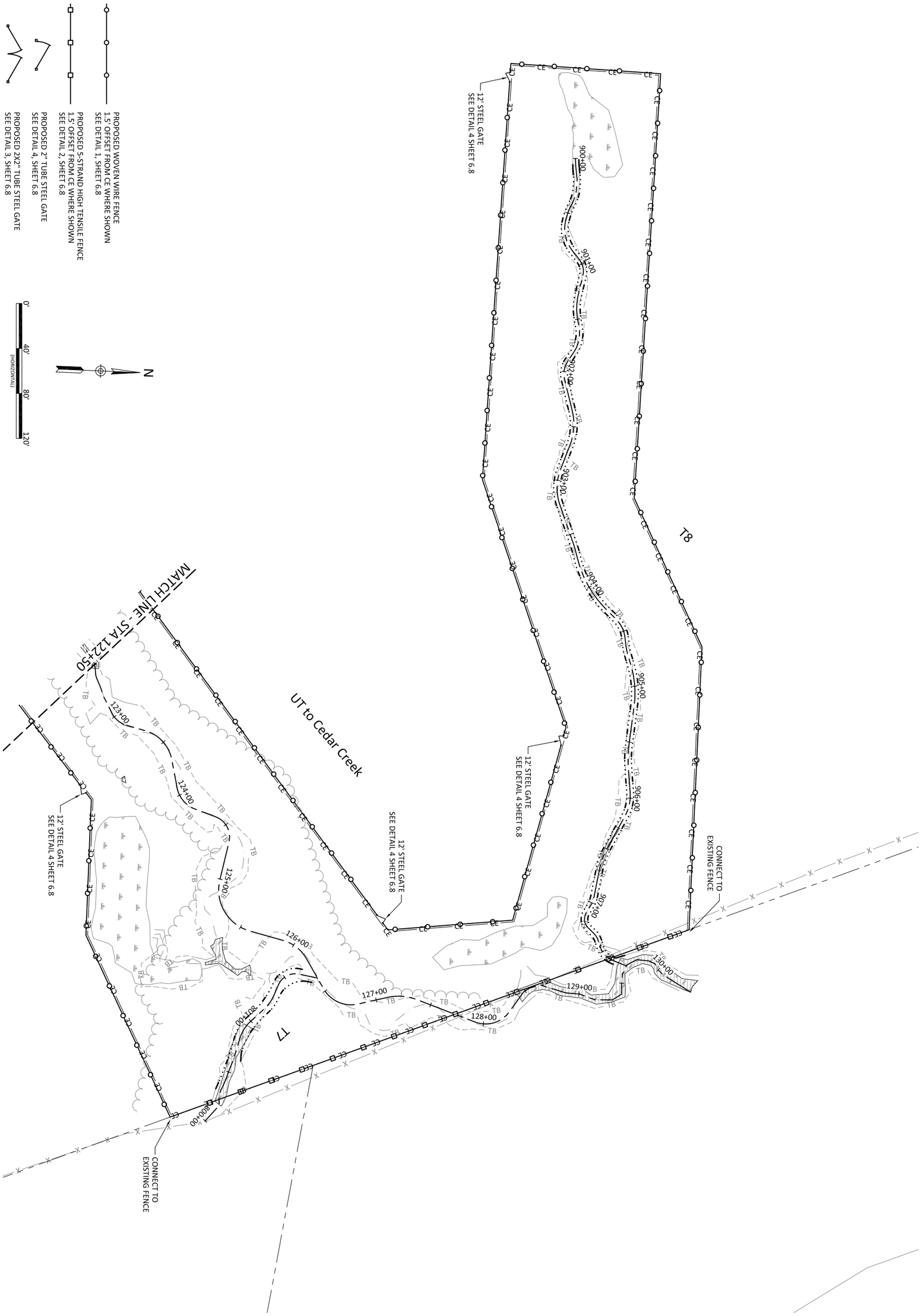

Date:	06.17.21
Job Number:	500-02189
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Harnett County, North Carolina

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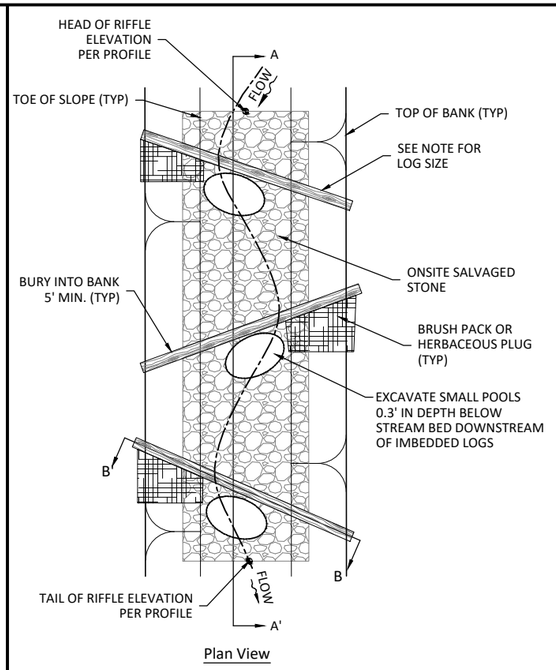
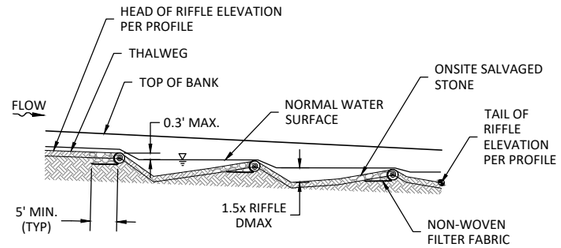
September 3, 2021

RIFFLE MATERIAL TABLE - ALL RIFFLE TYPES			
REACH	BOTTOM WIDTH (FT)	RIFFLE THICKNESS (IN)	RIFFLE MATERIAL STONE SIZE EQUIVALENTS (% OF MATRIX)
UT TO CEDAR CREEK-REACH 2	5.3	12	CLASS B (65%), CLASS A (25%), ABC STONE (10%)
T1	3.1	12	CLASS B (45%), CLASS A (45%), ABC STONE (10%)
T2	1.8	12	CLASS B (65%), CLASS A (25%), ABC STONE (10%)
T3-REACH 2	2.1	12	CLASS B (45%), CLASS A (45%), ABC STONE (10%)
T4	1.8-2.2	12	CLASS B (45%), CLASS A (45%), ABC STONE (10%)
T5	2	12	CLASS B (45%), CLASS A (45%), ABC STONE (10%)
T6	2.2	12	CLASS B (65%), CLASS A (25%), ABC STONE (10%)
T7	3.5	12	CLASS B (65%), CLASS A (25%), ABC STONE (10%)
T8	2.4	12	CLASS B (65%), CLASS A (25%), ABC STONE (10%)
BMP1, BMP2, BMP3, BMP4	1.5-2.0	12	CLASS B (45%), CLASS A (45%), ABC STONE (10%)

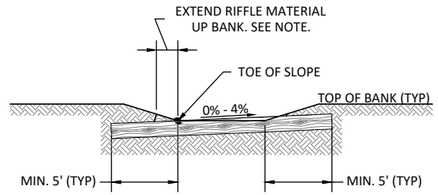
1 / 6.0 Riffle Material Table
Not to Scale



Plan View



Profile View A-A'



Log Section B-B'

NOTES:

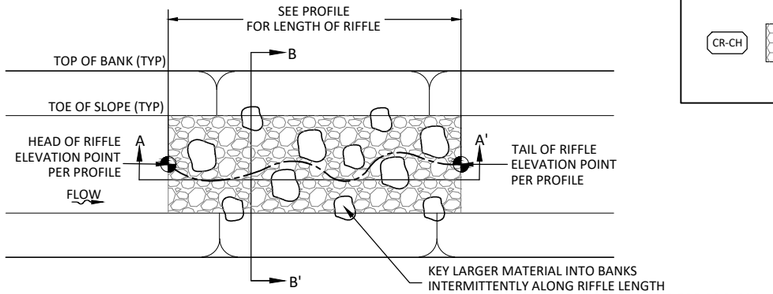
1. SEE DETAIL 1 SHEET 6.0 FOR RIFFLE MATERIAL STONE SIZING AND THICKNESS.
2. MINIMUM LOG DIAMETER 12".
3. MINIMUM ONE LOG PER 10 LF OF RIFFLE LENGTH OR ONE LOG PER 0.3' OF DROP WHICHEVER IS LESSER.
4. FILTER FABRIC SHOULD EXTEND THE LENGTH OF THE LOG.
5. IF NECESSARY, SALVAGED ONSITE ROCK MAY BE SUBSTITUTED WITH QUARRY ROCK OF SIMILAR SIZE.
6. IF A RIFFLE ENDS WITH A SILL, IT WILL BE SHOWN IN THE PLANS.
7. IF THERE IS A DROP OVER THE DOWNSTREAM POOL, THE LAST LOG WILL BE PLACED AT THE TAIL OF THE RIFFLE
8. EXTEND RIFFLE MATERIAL 0.3' UP BANK.

2 / 6.0 Angled Log Riffle
Not to Scale

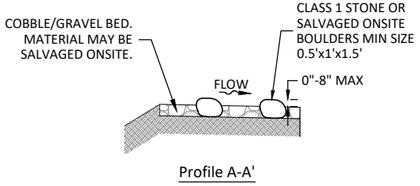
CR-ALR

CR-CH

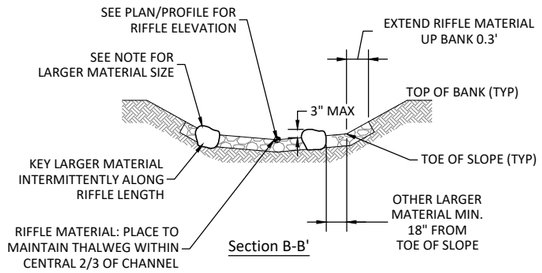
CR-LRC



Plan View



Profile A-A'

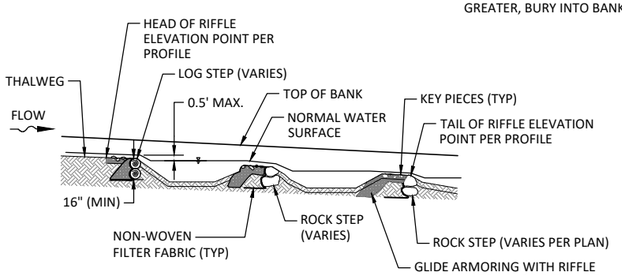


Section B-B'

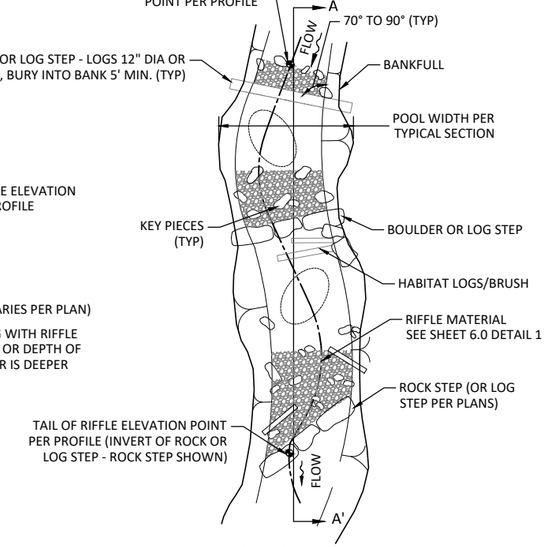
NOTES:

1. CHUNKY MATERIAL ELEVATION SHALL BE 0"-8" ABOVE RIFFLE MATERIAL OR PER ENGINEER'S DISCRETION.
2. SEE DETAIL 1 SHEET 6.0 FOR RIFFLE MATERIAL STONE SIZING AND THICKNESS.
3. THE MAXIMUM DIMENSION OF THE BOULDER SHALL NOT EXCEED THREE TIMES ITS MINIMUM DIMENSION. THE LAYOUT OF THE BOULDERS IS SHOWN IN THE DETAIL. MAXIMUM 3" OF BOULDERS PROTURSION ABOVE THE RIFFLE BED MATERIAL TO CREATE CONCENTRATED FLOW PATHS AND MICRO-POOLS THROUGH THE RIFFLE TO ENHANCE INSTREAM HABITAT.

3 / 6.0 Chunky Riffle
Not to Scale



Profile View A-A'



Plan View

NOTES:

1. CONSTRUCT GRADE DROPS IN CASCADE BASED ON ROCK AND LOG STEP DETAIL.
2. VARY THE SEQUENCE, TYPE AND ORIENTATION OF STEPS (DROPS). USE ROCK STEP DETAIL AS A GUIDE FOR VARIATIONS IN ORIENTATION/CONFIGURATION.
3. KEY PIECES ARE LOWER MOBILITY STONE THAT PROVIDE GRADE CONTROL AND TOE PROTECTION. USE CLASS 1 STONE OR SALVAGED ONSITE BOULDERS MIN 0.5'x1'x1.5'. HABITAT LOGS SHOULD BE WORKED IN AS EQUIVALENT OF KEY PIECES.
4. ROCK/LOG STEP BOULDERS AND LOGS TO BE EMBEDDED MINIMUM 5' INTO STREAM BANKS.
5. NUMBER OF INTERNAL STEPS VARIES BASED ON LENGTH AND SLOPE. RIFFLE SLOPES SHALL BE 1.2 - 1.8 TIMES THE AVERAGE CHANNEL SLOPE. STEP DROPS SHALL BE BETWEEN 0.2-0.5' MEASURED AT THE NORMAL WATER SURFACE.
6. FOOTER ROCK OR LOG SHOWN. FOOTER ONLY REQUIRED WHEN MINIMUM UNFOOTERED DIMENSION OF ROCK OR LOG IS NOT MET. A MINIMUM OF 16" OF RIFFLE MATERIAL SHALL BE PLACED OVER FILTER FABRIC TO PROTECT.
6. IF A RIFFLE ENDS WITH A SILL, IT WILL BE SHOWN IN THE PLANS.
7. IF THERE IS A DROP OVER THE DOWNSTREAM POOL, THE LAST LOG WILL BE PLACED AT THE TAIL OF THE RIFFLE.
8. REFER TO RIFFLE MATERIAL TABLE ON DETAIL 1 SHEET 6.0 FOR RIFFLE MATERIAL SIZING.

4 / 6.0 Log-Rock Cascade Riffle
Not to Scale

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Harnett County, North Carolina

Details

Revisions:

Date: 06.17.21
Job Number: 500-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 6.0

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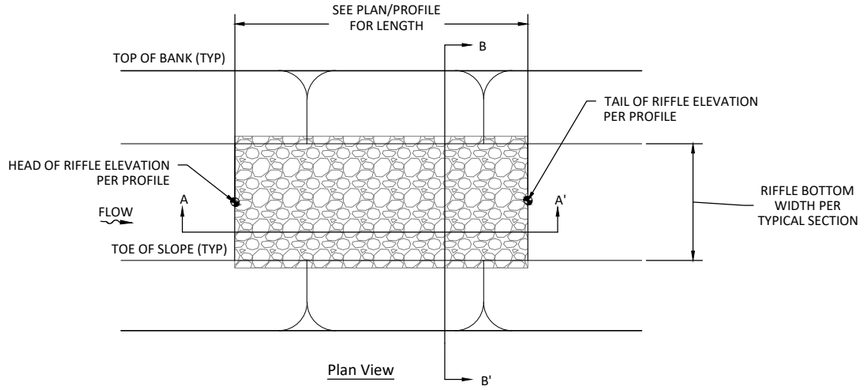
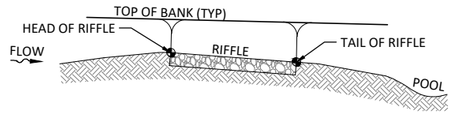
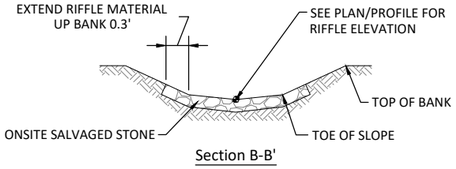


Plan View



Profile View A-A'

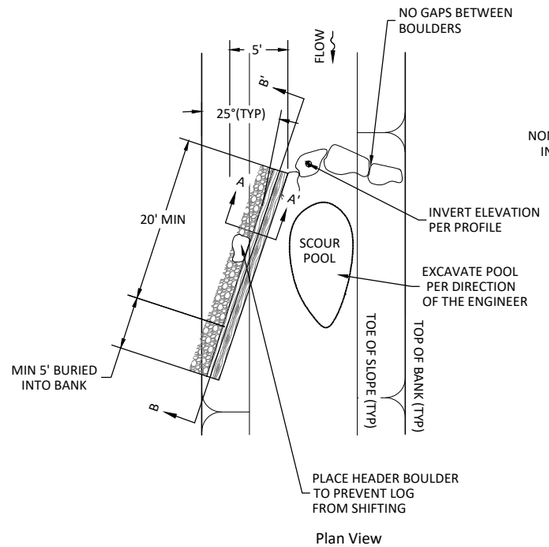


Section B-B'

NOTES:

1. SEE DETAIL 1 SHEET 6.0 FOR RIFFLE MATERIAL STONE SIZING AND THICKNESS.
2. COBBLE/GRAVEL MAY BE SALVAGED ONSITE OR CONSIST OF ROUGH UNHEWN QUARRY STONE.
3. ONSITE SALVAGED STONE SHALL BE HETEROGENEOUS AND WELL MIXED.

1 / 6.1 Native Material Riffle
Not to Scale



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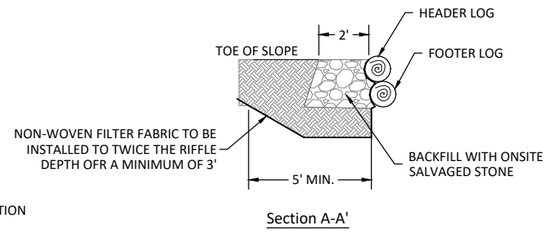
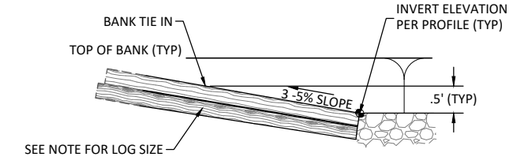


Section A-A'

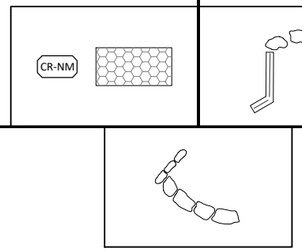


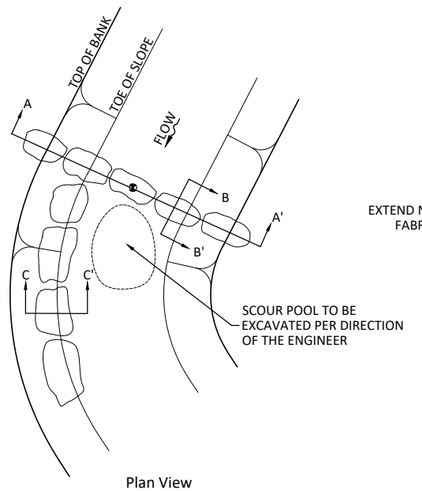
Profile B-B'

NOTE:

1. MINIMUM LOG DIAMETER IS 12 INCHES
2. MINIMUM BOULDER DIMENSION IS 1.5' X 1.5' X 1'

2 / 6.1 Log J-Hook
Not to Scale





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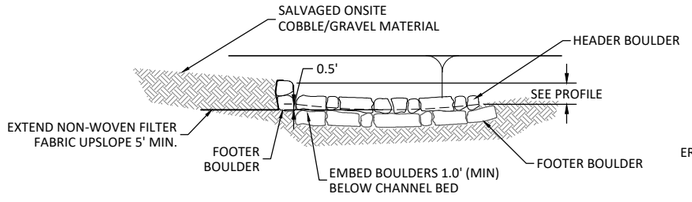
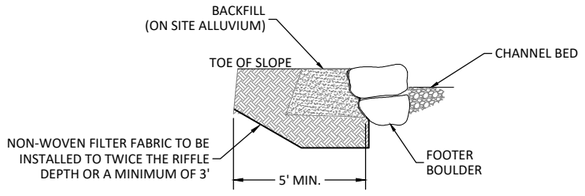
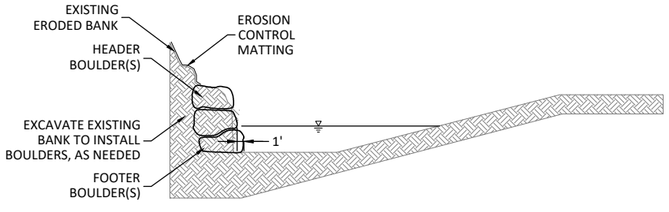


Profile A-A'



Section B-B'



Section C-C'

NOTES:

1. BOULDERS TO BE MINIMUM 2x2x1.
2. KEY-IN SILL PORTION OF STRUCTURE PAST FILL MATERIAL ON EACH BANK.
3. DIMENSION TO BE DETERMINED ON SITE AS DIRECTED BY THE ENGINEER.
4. FOR STREAMBEDS WITH COARSE SUBSTRATE, PROVIDE FOOTER BOULDERS.

3 / 6.1 Boulder Sill With Boulder Toe Protection
Not to Scale

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Harnett County, North Carolina

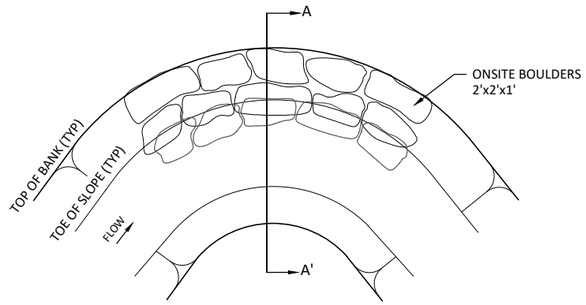
Details

Revisions:

Date: 06.17.21
Job Number: 580-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 6.1

September 3, 2021



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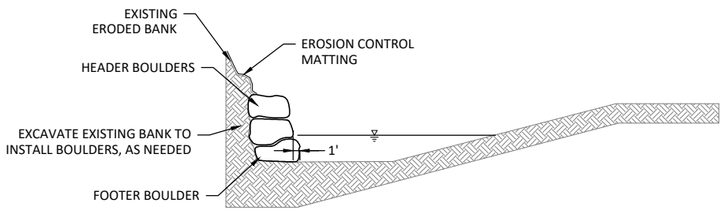
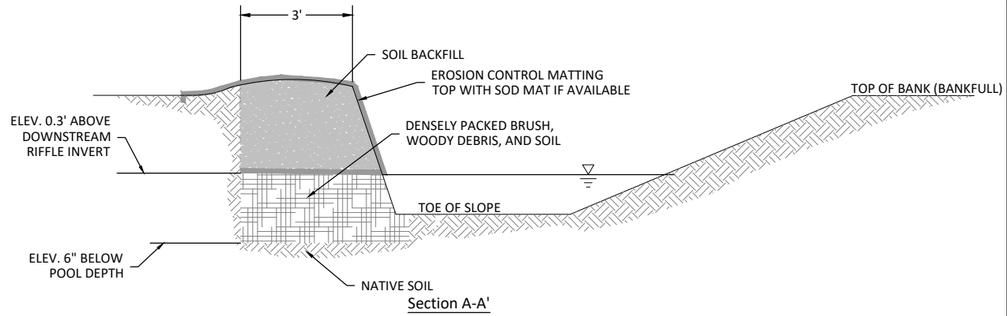


Section A-A'

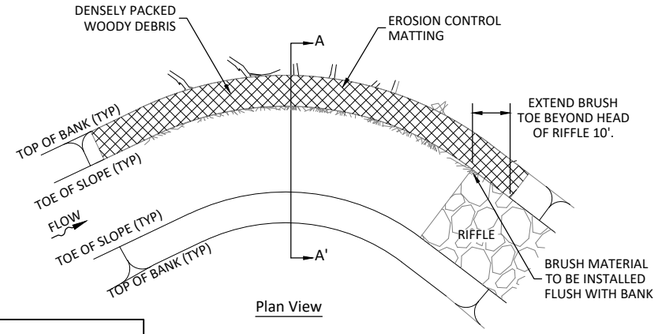
NOTE:

1. FOR STREAMBEDS WITH COARSE SUBSTRATE, PROVIDE FOOTER ROCKS.

1 6.2 Boulder Toe
Not to Scale



Section A-A'

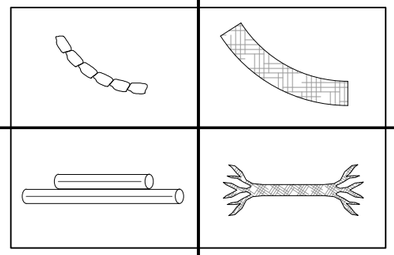


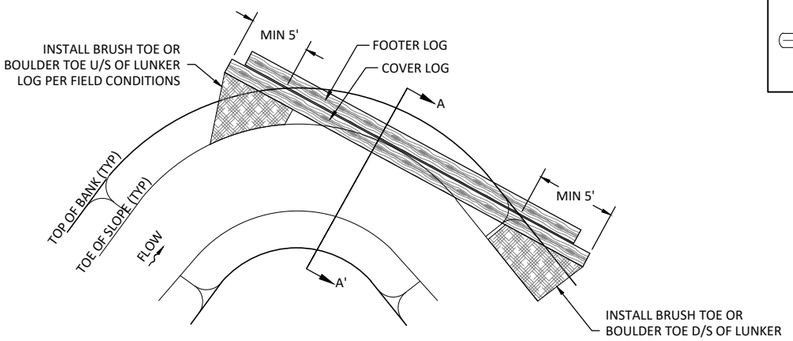
Plan View

2 6.2 Brush Toe
Not to Scale

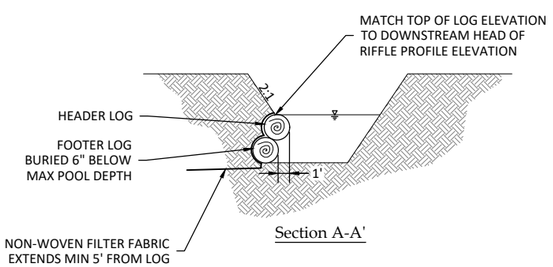
NOTES:

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 ONSITE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
3. BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND ARE INSTALLED POINTING SLIGHTLY UPSTREAM.
4. INSTALL MATTING OVER BRUSH/WOODY DEBRIS
5. INSTALL EARTH BACKFILL OVER MATTING ACCORDING TO TYPICAL SECTION DIMENSIONS.
6. SEED, MULCH, AND WRAP EROSION CONTROL MATTING UP OVER BACKFILL
7. TOP MATTING WITH SOD MAT IF SOD MAT AVAILABLE.



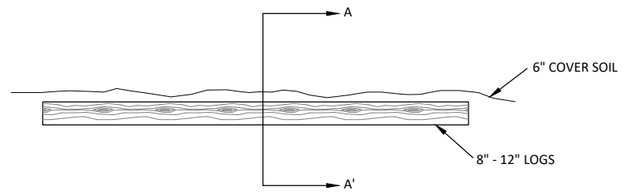


Plan View

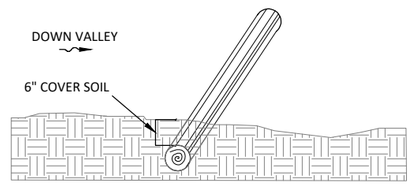


Section A-A'

3 6.2 Cover Log
Not to Scale



Profile View



Section A-A'

4 6.2 Floodplain Sill
Not to Scale

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Revisions:

Date: 06.17.21
Job Number: 300-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

6.2

Sheet

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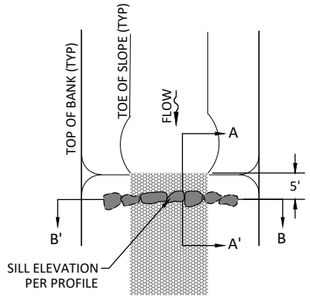
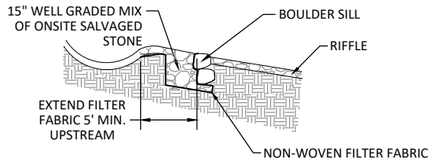
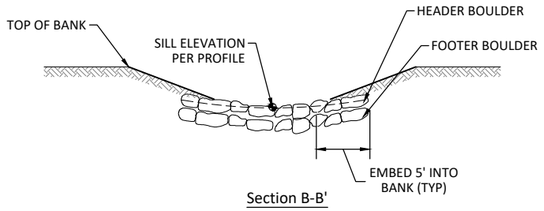
September 3, 2021



Plan View



Section A-A'

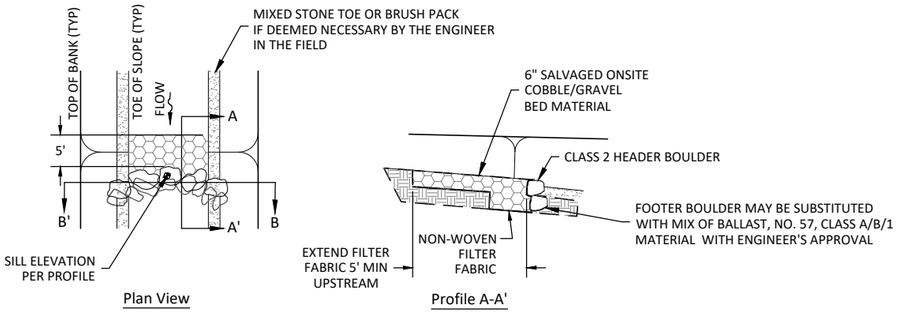


Section B-B'

NOTES:

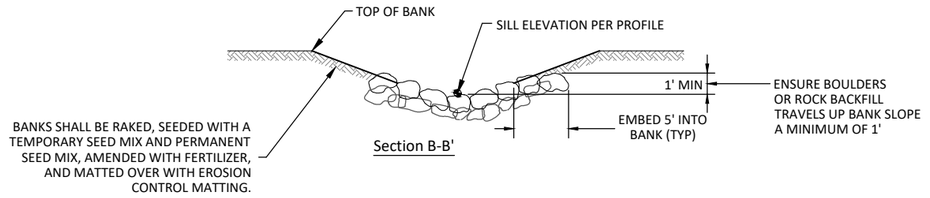
1. BOULDERS TO BE MINIMUM 2X2X1 FT.
2. BOULDERS CAN BE SALVAGED ONSITE OR CONSIST OF ROUGH UNHEWN QUARRY STONE.
3. BOULDERS SHALL BE SOUND, DENSE, AND FREE OF FRACTURES.
4. BOULDERS SHALL BE BLOCKY IN SHAPE SUCH THAT THEY ARE STACKABLE.

1 / 6.3 Boulder Sill
Not to Scale



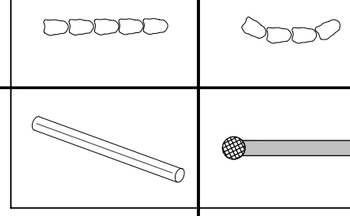
Plan View

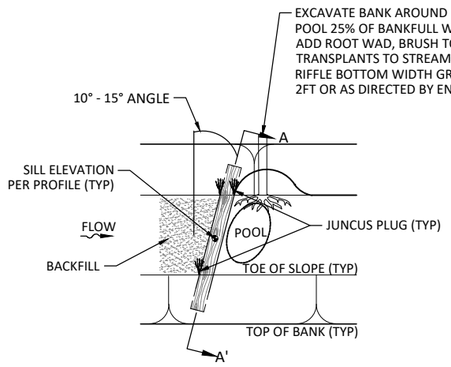
Profile A-A'



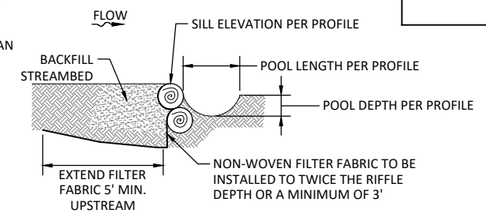
Section B-B'

2 / 6.3 Curved Boulder Sill
Not to Scale

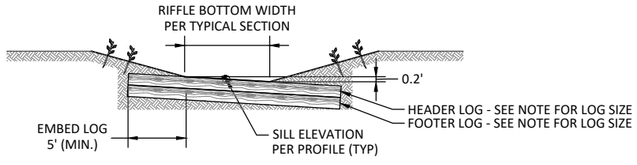




Plan View



Profile View

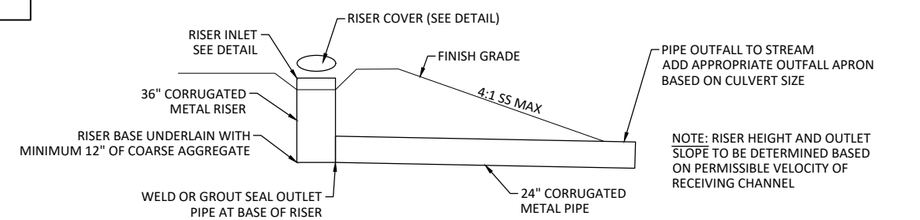


Section A - A'

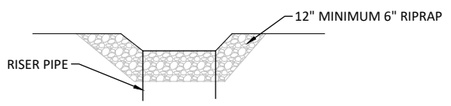
NOTES:

1. LOGS SHALL BE A MINIMUM OF 12" IN DIAMETER.
2. FOOTER LOGS TO BE ADDED AS NECESSARY WHERE POOL DEPTH IS MORE THAN HEADER LOG DIAMETER.
3. ONE 24"-30" LOG MAY BE USED IN PLACE OF TWO 12" LOGS
4. LOG IS TO BE AT GRADE IN CENTER OF CHANNEL.
5. JUNCUS PLUGS TO BE INSTALLED ABUTTING LOG AT TOE OF SLOPE UP AND DOWNSTREAM OF LOG DROP
6. FILTER FABRIC SHALL BE INSTALLED ALONG ENTIRE LENGTH OF LOG SILLS. DOWNSTREAM EDGE OF FILTER FABRIC SHALL BE FOLDED UNDERNEATH PRECEDING FABRIC AND NAILED INTO LOG USING 3" 10D GALVANIZED NAILS OR STANDARD 3" ROOFING NAILS AT 12" MAX SPACING.

3 / 6.3 Angled Log Sill
Not to Scale



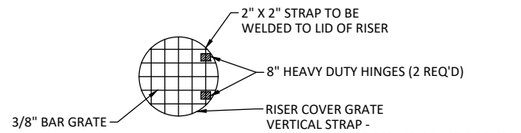
Riser Barrel Structure Plan View



Riser Inlet Detail

NOTES:

1. CONSTRUCT FLOW PATH TO TOP OF RISER MINIMUM 6" BELOW SURROUNDING GRADE.
2. INSTALL 5' X 5' RIPRAP APRON AROUND RISER (D50 = 6") UNDERLAIN WITH NON-WOVEN GEOTEXTILE FILTER FABRIC.



Riser Cover Detail

NOTES:

1. WELD A 2" X $\frac{3}{8}$" STRAP TO THE BOTTOM EDGE OF THE COVER (AROUND ENTIRE CIRCUMFERENCE)
2. COVER SIZE SHALL BE DETERMINED BY THE RISER DIAMETER PLUS 2".
3. HINGED DOOR LENGTH SHALL BE DETERMINED BY THE RISER DIAMETER MINUS 1" EITHER SIDE OF THE RISER.

4 / 6.3 Drop Inlet
Not to Scale

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Revisions:

Date: 06.17.21
Job Number: 300-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

6.3

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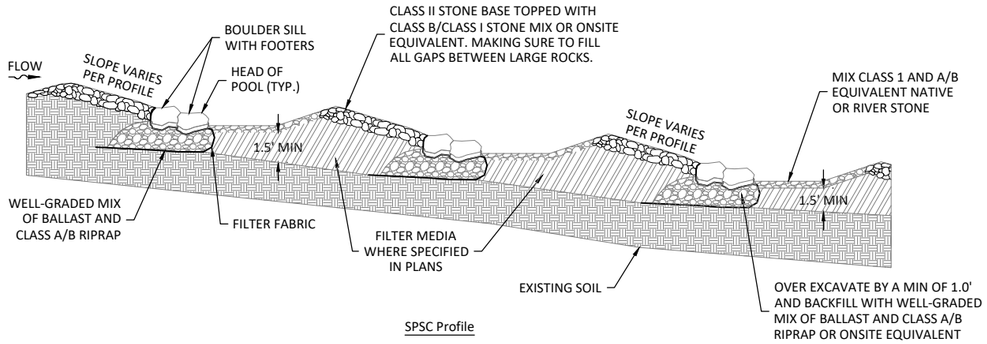
September 3, 2021



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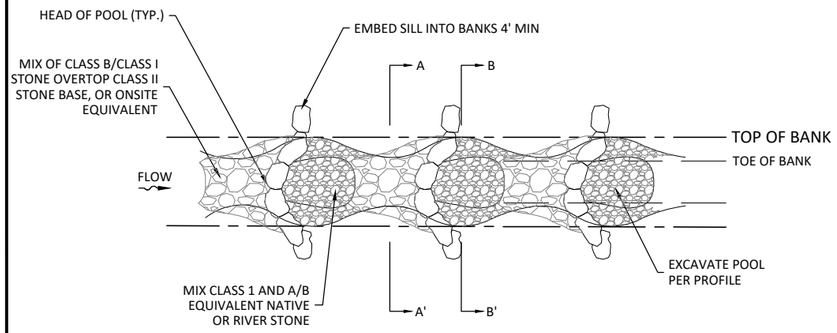
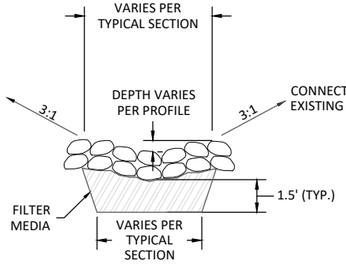
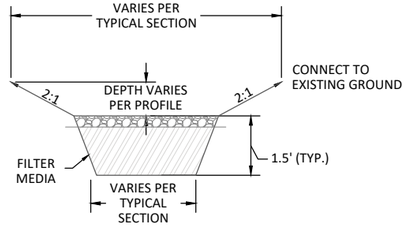


Plan View



Section A-A'



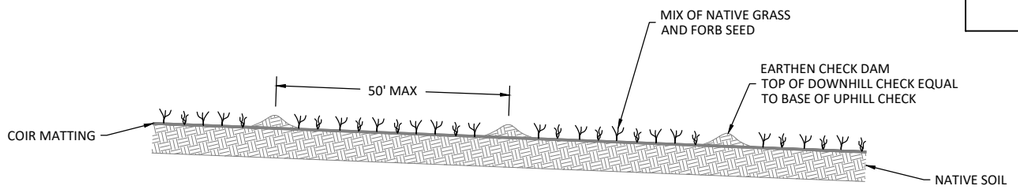
Section B-B'

NOTES:

1. FILTER MEDIA SHALL BE WELL MIXED AND CONSIST OF 90% SAND AND 10% WOODCHIPS COMPACTED IN 6" LIFTS.
2. FILTER MEDIA SHALL BE APPLIED AS SPECIFIED ON SHEETS 2.1-2.6.
3. MINIMUM SIZE FOR BOULDERS SHALL BE 2' x 2' x 1'.
4. VOID SPACES BETWEEN CLASS I/II STONE SHALL BE FILLED WITH SMALLER NATIVE ROCK.
5. IF NATIVE ROCK IS NOT AVAILABLE, QUARRIED ROCK MAY BE SUBSTITUTED IN THE SAME SIZES.
6. ALL SMALLER ROCK SHALL BE HETEROGENEOUS AND WELL MIXED.
7. WHERE HYDROLOGIC CONDITIONS ARE APPROPRIATE, LIVESTAKES AND/OR JUNCUS PLUGS MAY BE PLANTED ON BANKS AS DETERMINED BY THE ENGINEER.

1/6.4 Step Pool Stormwater Conveyance

Not to Scale



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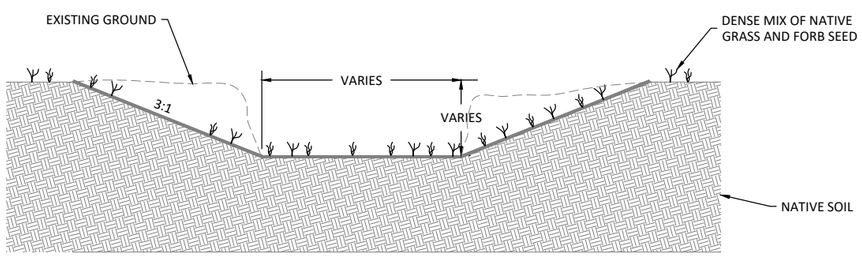
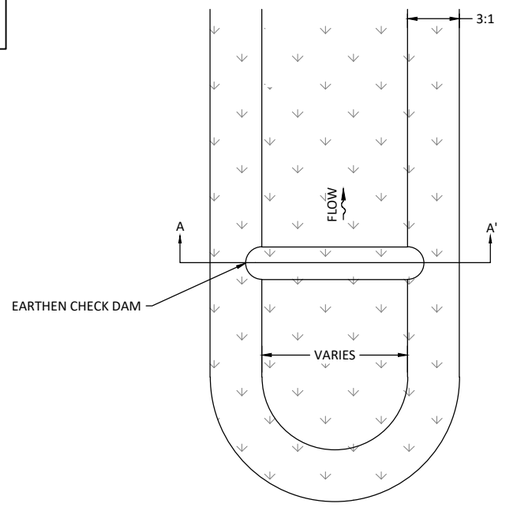


Section A-A'



Vegetated Swale Plan View

NOTES:

1. SWALES TO BE INSTALLED PER PLAN AND PROFILE SHEETS.
2. LEAVE EXISTING BOTTOM WIDTH AND DEPTH AND GRADE SIDES SLOPES BACK AT 3:1 SLOPE.
3. REGRADE SOIL, APPLY TEMPORARY AND PERMANENT SEED MIX, AND THEN INSTALL COIR MATTING.
4. IF LONGITUDINAL SLOPE IS GREATER THAN 5%, INSTALL CHECK DAMS WITH A MAXIMUM SPACING OF 50'. MINIMUM OF TWO CHECK DAMS.
5. CHECK DAMS SHALL BE A MINIMUM OF 6" TALL WITH A MINIMUM 6" OF FREE BOARD AND HAVE A MINIMUM WIDTH OF 2'.
6. CHECK DAMS SHOULD BE CAPPED WITH SOD MATS, IF AVAILABLE.

2/6.4 Vegetated Swale

Not to Scale

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Revisions:

Date: 06.17.21
Job Number: 300-02189
Project Engineer: NMM
Drawn By: CAW
Checked By: GAT

Sheet 6.4

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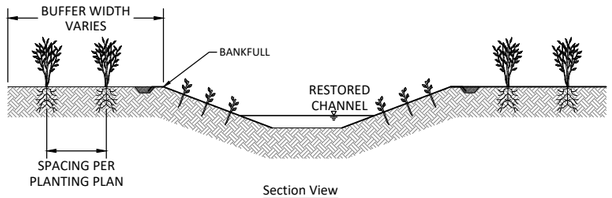
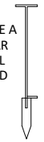


Section View

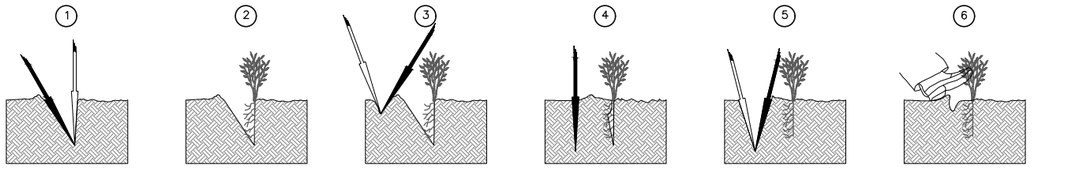
DIBBLE BAR

PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION AND SHALL BE 12" LONG, 4" WIDE, AND 1" THICK AT CENTER.



ROOTING PRUNING

ALL ROOTS SHALL BE PRUNED TO AN APPROPRIATE LENGTH TO PREVENT J-ROOTING.

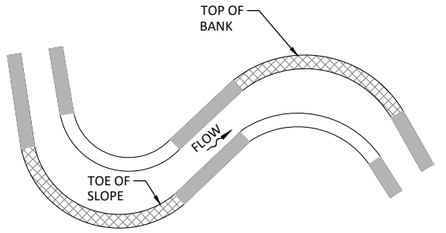


1. INSERT THE DIBBLE, OR SHOVEL, STRAIGHT DOWN INTO THE SOIL TO THE FULL DEPTH OF THE BLADE AND PULL BACK ON THE HANDLE TO OPEN THE PLANTING HOLE. (DO NOT ROCK THE SHOVEL BACK AND FORTH AS THIS CAUSES SOIL IN THE PLANTING HOLE TO BE COMPACTED, INHIBITING ROOT GROWTH.
2. REMOVE THE DIBBLE, OR SHOVEL, 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 1-3" 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.

NOTES:

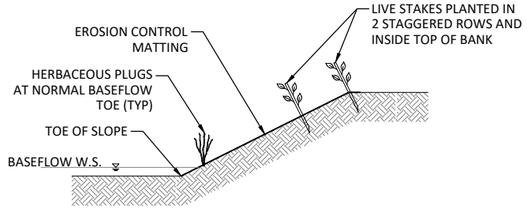
1. ALL SOILS WITHIN THE BUFFER PLANTING AREA SHALL BE DISKED, AS REQUIRED, PRIOR TO PLANTING.
2. ALL PLANTS SHALL BE PROPERLY HANDLED PRIOR TO INSTALLATION TO INSURE SURVIVAL.

1 6.11 Bare Root Planting
Not to Scale

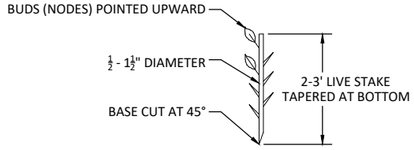


LINEAR SPACING
4' SPACING FOR HERBACEOUS PLUGS
6' SPACING FOR LIVE STAKES
3' SPACING FOR HERBACEOUS PLUGS
3' SPACING FOR LIVE STAKES, 2 ROWS

Plan View
Zone 1 (UT to Cedar Creek)



Section View
Zone 1 (UT to Cedar Creek)

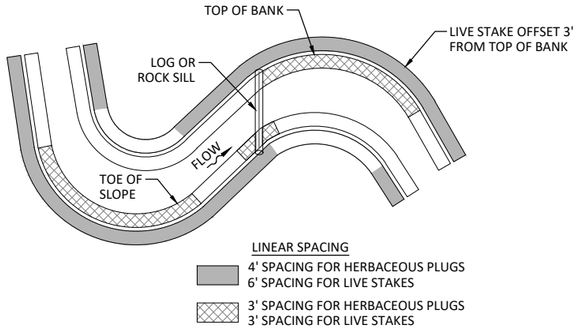


Live Stake Detail

NOTES:

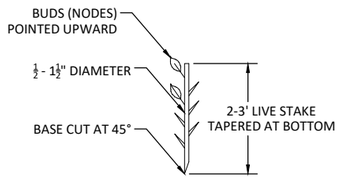
1. CONTRACTOR RESPONSIBLE TO FOLLOW PLAN VIEW DETAILS BY REACH SHOWN ABOVE
2. REFER TO SPECIFICATIONS FOR PROPER STORAGE, HANDLING AND INSTALLATION.
3. FORM PILOT HOLE IN HARD SOIL OR STONY CONDITIONS TO PREVENT DAMAGE TO LIVE STAKES.
4. LIVE STAKES TO BE INSTALLED TO A DEPTH AT LEAST ⅔ THE LENGTH OF THE LIVE STAKE, PLANTED IN AREAS AS SHOWN ON PLANS AND DIRECTED BY THE ENGINEER.
5. INSTALL DORMANT PRIOR TO LEAF OUT. DEPICTED CONDITION WITH LEAVES NOT REPRESENTATIVE OF STAKES AT TIME OF INSTALLATION.

2 6.11 Zone 1 Streambank Planting
Not to Scale

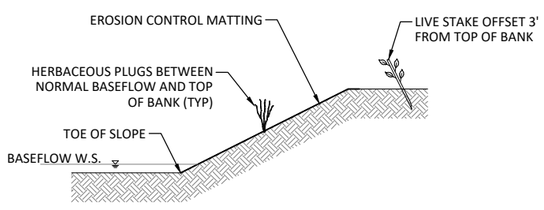


LINEAR SPACING
4' SPACING FOR HERBACEOUS PLUGS
6' SPACING FOR LIVE STAKES
3' SPACING FOR HERBACEOUS PLUGS
3' SPACING FOR LIVE STAKES

Plan View
Zone 2 (T1, T2, T3-R2, T4, T5, T6, T7, and T8)



Live Stake Detail

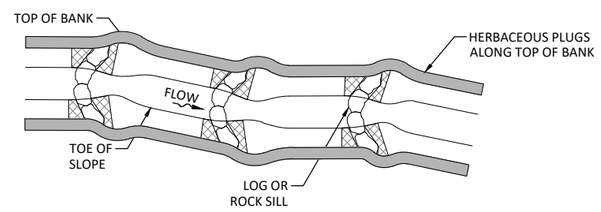


Section View
Zone 2 (T1, T2, T3-R2, T4, T5, T6, T7, and T8)

NOTES:

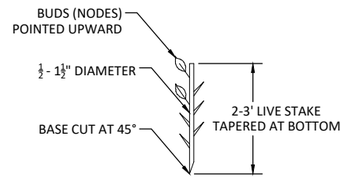
1. CONTRACTOR RESPONSIBLE TO FOLLOW PLAN VIEW DETAILS BY REACH SHOWN ABOVE
2. REFER TO SPECIFICATIONS FOR PROPER STORAGE, HANDLING AND INSTALLATION.
3. FORM PILOT HOLE IN HARD SOIL OR STONY CONDITIONS TO PREVENT DAMAGE TO LIVE STAKES.
4. LIVE STAKES TO BE INSTALLED TO A DEPTH AT LEAST ⅔ THE LENGTH OF THE LIVE STAKE, PLANTED IN AREAS AS SHOWN ON PLANS AND DIRECTED BY THE ENGINEER.
5. INSTALL DORMANT PRIOR TO LEAF OUT. DEPICTED CONDITION WITH LEAVES NOT REPRESENTATIVE OF STAKES AT TIME OF INSTALLATION.
6. ZONE 2 HERBACEOUS PLUGS TO BE PLANTED ALONG OUTSIDE BENDS WHERE BANK REVETMENT STRUCTURES ARE NOT SHOWN AND PLANTED ABOVE AND BELOW LOG AND ROCK SILLS AS SHOWN.

3 6.11 Zone 2 Streambank Planting
Not to Scale

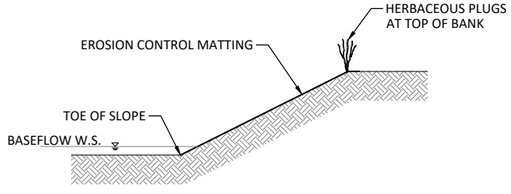


LINEAR SPACING
4' SPACING FOR HERBACEOUS PLUGS

Plan View
Zone 3 (BMP1, BMP2, BMP3, BMP4, and BMP5)



Live Stake Detail



Section View
Zone 3 (BMP1, BMP2, BMP3, BMP4, and BMP5)

NOTES:

1. CONTRACTOR RESPONSIBLE TO FOLLOW PLAN VIEW DETAILS FOR SPECIFIED BMPS SHOWN ABOVE
2. REFER TO SPECIFICATIONS FOR PROPER STORAGE, HANDLING AND INSTALLATION.
2. FOR STORMWATER STEP POOL CONVEYANCE BMPs, HERBACEOUS PLUGS TO BE PLANTED ALONG BANKS AT SPACING SHOWN ABOVE AND ABOVE AND BELOW LOG AND ROCK SILLS AS SHOWN.
3. FOR VEGETATED SWALE BMPs, HERBACEOUS PLUGS TO BE PLANTED ALONG BANKS AT SPACING SHOWN ABOVE.

4 6.11 Zone 3 BMP Planting
Not to Scale

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Raleigh, NC 27609
Tel: 919-851-9986
License No. F-0831

DRAFT

Cool Springs Mitigation Site
Harnett County, North Carolina

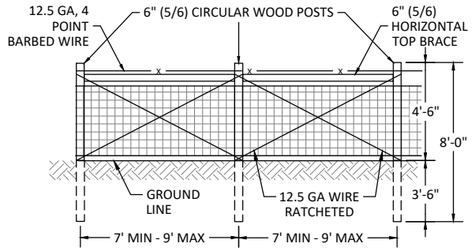
Planting Details

Revisions:

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

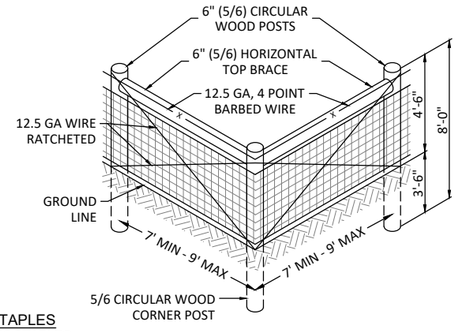
Sheet 6.7

September 3, 2021



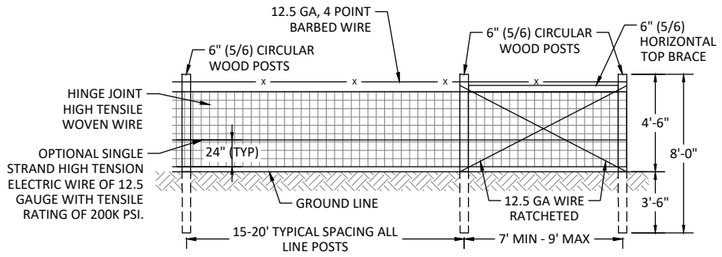
LINE BRACES
(MAXIMUM SPACING 330')

ALTERNATE TYPES OF STAPLES
USE ONE #9 STAPLE OR TWO #16 STAPLES AT EACH POINT OF ATTACHMENT



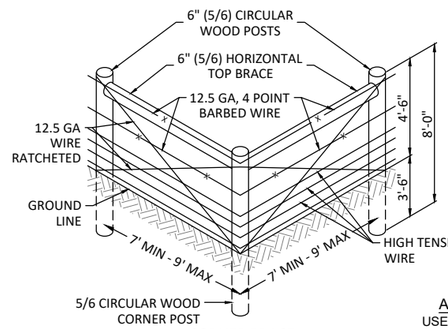
CORNER BRACE
USE WHEN CORNER ANGLE IS 15° OR GREATER

NOTES:
1. THE FENCE SHALL MEET CLASSIFICATION FOR HINGE JOINT HIGH TENSILE WOVEN WIRE.
2. A SINGLE STRAND HIGH TENSION ELECTRIC WIRE OF 12.5 GAUGE WITH A TENSILE RATING OF 200K PSI SHALL BE INSTALLED 24 INCHES ABOVE THE GROUND ON THE LIVESTOCK SIDE OF THE FENCE.
3. MAXIMUM SPACING BETWEEN LINE POSTS SHALL BE 15 FEET ON CENTER AND SET AT LEAST 30 INCHES INTO THE GROUND.
4. LINE POSTS SHALL BE 6" (5/6) CIRCULAR WOOD POSTS.
5. BRACE POSTS SHALL BE 6" (5/6) CIRCULAR WOOD POSTS AND SET 36" IN THE GROUND.
6. ALL CORNERS, FENCE LINE ENDS, AND GATE OPENINGS REQUIRE DOUBLE H BRACE ASSEMBLIES. STRAIGHT LINE FENCE SHALL BE 660 FEET MAXIMUM SPACING. STRAIGHT FENCE SPANS 330 FEET OR LESS SHALL USE SINGLE H BRACE ASSEMBLIES.
7. REFER TO THE SPECIFICATIONS FOR MORE INFORMATION ON FENCING.

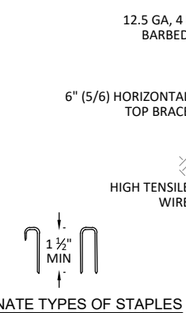


END OR GATE BRACES

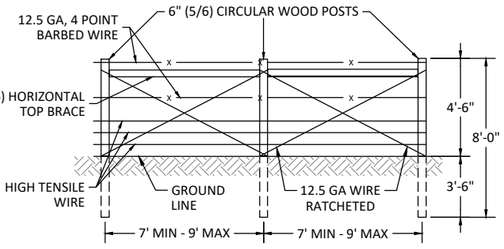
1 / 6.8 Woven Wire Fence - Permanent CE Fencing
Not to Scale



CORNER BRACE
USE WHEN CORNER ANGLE IS 15° OR GREATER

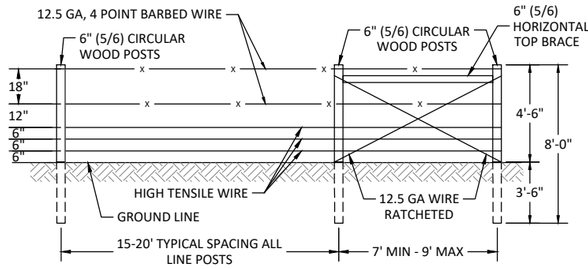


ALTERNATE TYPES OF STAPLES
USE ONE #9 STAPLE OR TWO #16 STAPLES AT EACH POINT OF ATTACHMENT



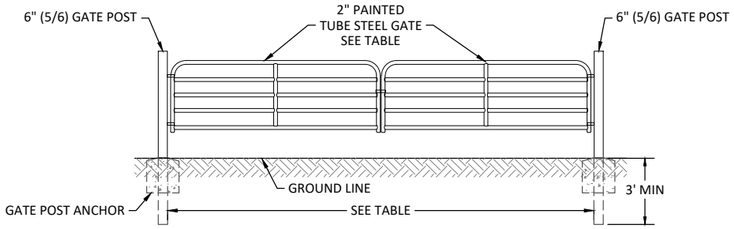
LINE BRACES
(MAXIMUM SPACING 300')

NOTES:
1. THE FENCE SHALL MEET CLASSIFICATION FOR HINGE JOINT HIGH TENSILE WOVEN WIRE.
2. THE FENCE SHALL BE BUILT ACCORDING TO NRCS SPECIFICATION 382 FOR 5-STRAND ELECTRIC WIRE HIGH TENSILE FENCE (MARCH 2014).
3. WIRE SHALL BE 12.5 GAUGE, CLASS 3 GALVANIZED ZINC (ASTM-116 STANDARD) WITH 170,000 PSI TENSILE STRENGTH. WIRE SHALL BE INSTALLED ON THE LIVESTOCK SIDE OF THE FENCE.
4. LINE POSTS SHALL BE 6" (5/6) CIRCULAR WOOD POSTS WITH A MAXIMUM SPACING OF 15 FEET AND A MINIMUM POST HEIGHT OF 68".
5. BRACE POSTS SHALL BE 6" (5/6) CIRCULAR WOOD POSTS AND SET 36" IN THE GROUND. HORIZONTAL BRACE POSTS SHALL BE 6" (5/6) PRESSURE TREATED WOOD.
6. ALL CORNERS, FENCE LINE ENDS, AND GATE OPENINGS REQUIRE DOUBLE H BRACE ASSEMBLIES. STRAIGHT LINE FENCE SHALL BE 660 FEET MAXIMUM SPACING. STRAIGHT FENCE SPANS 330 FEET OR LESS SHALL USE SINGLE H BRACE ASSEMBLIES.
7. REFER TO THE SPECIFICATIONS FOR MORE INFORMATION ON FENCING.

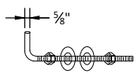


END OR GATE BRACES

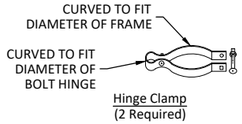
2 / 6.8 Five-Strand Wire Fence - CE Crossing
Not to Scale



Access Gate

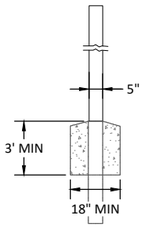


Bolt Hinge
(2 Required)



Hinge Clamp
(2 Required)

Hinge Assembly



Detail of Gate Post Anchor

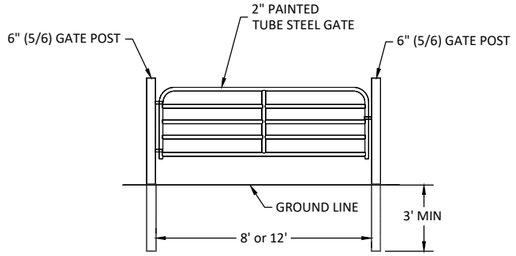
DOUBLE GATE POST SPACING	
GATES	POST SPACING
2 - 8'	16'
2 - 12'	24'
2 - 14'	28'

GATE POST NOTES:

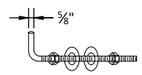
USE CLASS "B" CONCRETE AT GATE POSTS OR WHERE REQUIRED BY SOIL CONDITIONS. CONCRETE MAY ALSO BE USED IN LIEU OF SETTING POSTS TO THEIR MAXIMUM DEPTH.

NOTES:
1. DIMENSIONS SHOWN ARE THE DIAMETER OF ROUND POSTS AND BRACES.
2. NOTCH BRACE POSTS 1" MINIMUM OF HORIZONTAL BRACES. PLACE TWO GALVANIZED 12d OR THREE GALVANIZED 10d NAILS AT EACH END OF ALL BRACES.
3. PLACE THE WIRE AROUND THE POST. DRAW ALL BRACE WIRE TAUT BY RATCHETING BETWEEN EACH POST.
4. INSTALL THE FENCE FACING THE PROPERTY OWNER EXCEPT THAT ON HORIZONTAL CURVES GRATER THAN THREE DEGREES (3°) INSTALL THE FENCE TO PULL AGAINST ALL POSTS.
5. 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.
6. ANY COMBINATION OF GATE AND FENCE TYPE MEETING THE APPROVAL OF THE ENGINEER IS ACCEPTABLE AND IS NOT LIMITED TO THE EXAMPLES SHOWN HEREON.

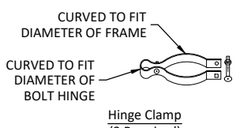
3 / 6.8 Double 2" Tube Steel Gates
Not to Scale



Access Gate

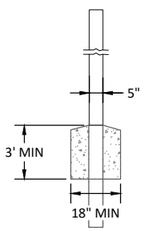


Bolt Hinge
(2 Required)



Hinge Clamp
(2 Required)

Hinge Assembly



Detail of Gate Post Anchor

GATE POST NOTES:

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.

NOTES:
1. DIMENSIONS SHOWN ARE THE DIAMETER OF ROUND POSTS AND BRACES.
2. NOTCH BRACE POSTS 1" MINIMUM OF HORIZONTAL BRACES. PLACE TWO GALVANIZED 12d OR THREE GALVANIZED 10d NAILS AT EACH END OF ALL BRACES.
3. PLACE THE WIRE AROUND THE POST. DRAW ALL BRACE WIRE TAUT BY RATCHETING BETWEEN EACH POST.
4. INSTALL THE FENCE FACING THE PROPERTY OWNER EXCEPT THAT ON HORIZONTAL CURVES GRATER THAN THREE DEGREES (3°) INSTALL THE FENCE TO PULL AGAINST ALL POSTS.
5. 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.
6. ANY COMBINATION OF GATE AND FENCE TYPE MEETING THE APPROVAL OF THE ENGINEER IS ACCEPTABLE AND IS NOT LIMITED TO THE EXAMPLES SHOWN HEREON.

4 / 6.8 2" Tube 8' Steel Gate
Not to Scale

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312 W. Millbrook Rd, Suite 225
Raleigh, NC 27609
Tel: 919-851-9986
License No. F-0831

60% PLANS DO NOT USE FOR CONSTRUCTION

Cool Springs Mitigation Site
Harnett County, North Carolina
Fencing Details

Revisions:

Date:	06.17.21
Job Number:	500-02189
Project Engineer:	NMM
Drawn By:	CAW
Checked By:	GAT

Sheet 6.8

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