MITIGATION PLAN

Hip Bone Creek Restoration Site
Chatham County, North Carolina
DMS Project Number 100059
DMS Contract 7528
USACE AID #: SAW 2018-01160
DWR #: 2018-0785

Cape Fear River Basin
Cataloging Unit 03030003

Prepared for:

NC Department of Environmental Quality
Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699
March 17, 2020

Prepared by:

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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 NCDMS operations and procedures for the delivery of compensatory mitigation.

KCI ASSOCIATES OF NC

ISO 9001:2015 CERTIFIED

ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS

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Date: March 17, 2020

To: Kim Browning, USACE

From: Tim Morris, Project Manager
KCI Associates of North Carolina, P.A.

Subject: Hip Bone Creek Restoration Site
Mitigation Plan Review – Response to IRT Comments
Cape Fear River Basin - 03030003
Chatham County, North Carolina
DEQ Contract No. #7528
DMS Project #100059
USACE AID #: SAW-2018-01160

Below are our responses to comments received on the mitigation plan for the Hip Bone Creek Restoration Site. All of the following changes have been completed in the revised mitigation plan. Please contact me if you have any questions or would like clarification concerning these responses.

Mac Haupt and Erin Davis, NCDWR:

1. Page 6, Section 3.1 – In addition to identifying the streams as headwater systems, it's important to note their origins as downstream of farm ponds.

   The wording has been changed to "The project streams begin as headwater systems on the site, with Tributary 1 (T1) and Tributary 2 (T2) beginning downstream of two farm ponds."

2. Page 8, Section 3.1.2

   a. It would be helpful see property boundaries in the vicinity of the project. Could a tax parcel layer please be added to Figure 2 or a zoomed out Figure 5?

      The Chatham County Parcel Data has been added to Figure 2.

   b. What are the anticipated future land uses for the project watershed?

      We have added at the bottom of 3.1.2.: "The development pressure for the project watershed is anticipated to be low to moderate. This section of Chatham County has retained its rural character and the majority of residences within the project watershed are farm homesteads or other rural acreages."

c. Please include a discussion of existing vegetation within the project site, in particular the species composition of the forested areas along the upper T1 and T3 wetlands.

We have added to the first paragraph in 3.1.2: "There are sections of narrow forested wetland area along T1 and T3. The overstory vegetation in these sections consists primarily of red maple (Acer rubrum) in the canopy with an understory of Chinese privet (Ligustrum sinense), and mixed rushes and sedges."

d. Please discuss any site constraints (e.g. existing utilities, existing crossings/paths). Are the existing stream crossings fords or culverts? Does the electrical line crossing the top of T3 have an associated easement?

We have added at the end of the first paragraph in 3.1.2: "There are five existing piped crossings at the site, most in disrepair, and one private power line that crosses the top of T3."

3. Page 12, Section 3.1.3

a. Besides Chinese privet, what other invasives have been documented on site?

In the second paragraph of 3.1.3, we added: There is an existing riparian buffer in this area with a sparse canopy of native hardwoods, and an understory that is comprised primarily of Chinese privet and other invasive species such as autumn olive (Elaeagnus umbellata) and callery pear (Pyrus calleryana).

b. In this section T2 is identified as a linear wetland; however, the JD lists it as a 368 linear foot non-wetland water. Please confirm this feature type.

We added to the end of the first paragraph of 3.1.3.: "Tributary 2 (T2), which was included as a stream in the jurisdictional determination, will be treated as contiguous wetland feature for the purpose of this project's accounting following a field decision with the North Carolina Interagency Review Team (IRT) (see Appendix 12.9)."

c. Please include a table or brief discussion of the NC SAM, NC WAM and DWQ Stream Id form results.

We added Table 3. Existing Stream and Wetland Conditions, which summarizes the results of these stream and wetland analyses. All other table numbering in the report has been adjusted as a result.

d. Side note, it was confusing having the appendices referred to as sections within the plan narrative.

These "Sections" have been changed to Appendices.

4. Page 18, Section 4.0 – Please state what assessment method was used to determine that "all stream channels have low functional values".

We have noted that he North Carolina Stream Assessment Method (NC SAM) was used to determine

the quality of the existing streams.

5. Page 20, Section 6.0 – It would be helpful to have the information in paragraph two stated earlier in the document, perhaps in the Introduction.

   We have now added the information regarding what stream reaches are not being used for stream mitigation credit in the last paragraph of Section 1.0.

6. Page 20, Section 6.1 - Flow is a general concern for this project. In particular, whether flow will be sustained in the upper 300-foot section of T1 Reach 1 that is proposed to be raised 1-2 feet.

   We believe that the riparian wetland at the base of the pond in addition to the surrounding seepage inputs from the hillsides will provide adequate hydrology for this reach of T1.

7. Page 20, Section 6.1 – Since establishment of vegetative cover and vigor can be a challenge on Priority 2 restoration banks/benches, please include a discussion on how the soil restoration will be addressed during construction and reference potential adaptive management.

   We have added the following: "Furnished or salvaged topsoil will be used to surface treat all planting areas within the floodplain extents shown on the plans. Adequate lime and fertilizer will be used to ensure adequate vegetative stabilization."

8. Page 21, Section 6.2 – In order to justify a 2.5:1 ratio, please include bank grading in list proposed work (as noted on Design Sheet 9).

   We have added this.

9. Page 21, Section 6.3 – Given that multiple wetland restoration areas abut the proposed conservation easement boundary, is there a concern about hydrologic trespass?

   No, we are not concerned at this location. The areas that we are including in the conservation easement encompass the lowest elevations of the site and then adjoin upland pasture. The conditions in these adjoining areas will be similar to the existing conditions and should not impede the landowner's future use of the land.

10. Page 21, Section 6.4 – The number of crossings for the project size is concerning. Fragmentation impacts the potential functional uplift.

    We try to minimize the number of crossings wherever we can, but landowners often desire crossings where they currently have them to continue using their land outside of the easement, which was the case at this site. We always do our best to install structures and roadways that minimize the impact of the crossings by having continuous flow through the pipes.

    a. Four of the five crossings are proposed to be 30 feet wide. However, the lower T1 crossing is proposed to be 60 feet wide. Can this crossing width be reduced to 30 feet? If not, please explain why.

We needed a 60-foot easement exception to accommodate a landowner request ensuring adequate access in future years. However, the current proposed configuration will not use the entire 60-foot length for the crossing. Approximately 30 feet will be used for the pipe and the 15-foot roadway. The remainder of stream in the exception will be restored similar to the rest of the project.

b. The T3 crossing is located approximately 150 feet north of the proposed conservation easement boundary. Can this crossing be relocated south of the easement boundary? If not, please explain why.

Unfortunately, the topography in that location doesn't allow for that type of reconfiguration.

c. Will the proposed crossings be gated and/or will the proposed fencing overlap the culvert to limit livestock access to the stream?

Yes, all of the crossings will be fenced to exclude livestock and gates will be installed at all crossings to allow easy access as necessary.

11. Page 23, Section 6.6 – Sheets 3 and 4 Details for proposed riffle enhancement, riffle grade control, and stabilized rock outlet differ from text included in this Section. The details have 30% native stream material while the text states 10%. The details do not include class 1 stone while the text does. Please make text and details consistent.

This has been corrected in the report to match the detail.

12. Page 26, Section 6.8

a. Please include native seed mix composition (species, quantity, wetland status).

Please see the planting lists on Sheet 17 of the Construction Plans.

b. Please identify target communities.

In general, we prefer not to designate a specified community type since a site can generally not be converted to that community within the timeframe of monitoring. We do select trees that are in line with the surrounding community types, though.

13. Page 30, Vegetation Performance – Note that only volunteer species that are included on the approved mitigation plan plant list may count toward the vegetation performance standard.

We added: "Volunteers that are included on the approved mitigation plan plant list must be present for a minimum of two growing seasons before being included in performance standards in Year 5 and Year 7." Additionally we added an extra list of native trees that could be used for substitutes or seen as desirable volunteers. This text reads, "Other native desirable species that have the potential to volunteer at the site or be used for planting substitutions towards the performance standard include other native oaks (Quercus sp.), native Celtis species (Celtis sp.), tulip poplar (Liriodendron tulipifera), native hickories (Carya sp.), native dogwoods (Cornus sp.), native elms (Ulmus sp.), black walnut (Juglans nigra), native Nyssa species (Nyssa sp.), and cottonwood (Populus deltoides)."

14. Page 30, Stream Hydrologic Performance – Please rephrase: The project streams must also show a minimum 30 days' continuous flow days within *each* calendar year.

    We rephrased to state: "The project streams must also show a minimum of 30 continuous flow days within each calendar year (assuming normal precipitation)."

15. Page 31, Section 8 – For installed gauges and wells, DWR recommends quarterly data download and inspection to reduce the risk of data loss due to instrument malfunction.

    We added: "Daily data will be collected and downloaded from the 8 automatic wells at a minimum frequency of once each quarter over the 7-year monitoring period following implementation."

16. Page 31, Vegetation Monitoring – Currently there are no wetland gauges or veg plots located within any of the proposed wetland rehabilitation areas or wetland enhancement areas to illustrate functional uplift. DWR requests two additional wetland gauges be located within proposed rehabilitation areas. Also, DWR would like to see at least two of the random veg plots be located annually within the proposed wetland rehabilitation planting areas or enhancement supplemental planting areas.

    Two wetland gauges have been added to the proposed rehabilitation areas. We have noted to place two of our 8 random vegetation plots within wetland rehabilitation or enhancement areas

17. Page 32, Visual Assessment – Please include photo locations at all crossings.

    Photo points have been added for all stream crossings.

18. Please add a Maintenance Plan as a new section or appendix summarizing the types of issues that may arise during monitoring and how those issues would be addressed, including invasive species treatment. DWR recommends a minimum annual treatment of Chinese privet.

    A Maintenance Plan has been added as Appendix 13.

19. Figure 9 – The flow documentation stations on T3 and T1 are very close to the stream reach start points. DWR requests these stations be shifted north approximately 50-75 feet.

    The flow stations have been moved 50 feet north on Figure 9.

20. Sheet 1 – The Sheet 1 table does not match the Table 11 values under the Existing Footage/Acreage and Mitigation Credits columns. Please update.

    We adjusted the significant digits in a previous draft of the report and have now made sure Sheet 1 matches the report.

21. Sheet 2 – Please add buried log sill and buried brush material icons to the project legend, as well as detail sheets.

    These have been added to the project legend.

22. Sheet 3 – DWR appreciated the riffle grade control note to include woody debris to enhance habitat.

23. Sheet 4 – Please add a culvert crossing detail.

    A culvert sheet (Sheet 5A) has been added with details for the structures.

24. Sheet 4 – Please confirm that the water quality treatment area will be self-sustaining and requires no long term maintenance. Also, will this treatment area be seeded and planted?

    Yes, the water quality treatment areas will not require any maintenance in the long term. They will be seeded with the native seed mix, but trees will not be planted within the treatment area itself.

25. Sheet 4 – The Project Legend includes channel filling. Please include a channel fill detail. If partial filling is proposed, please indicate the maximum depth from top of bank to be filled. Also, the plan narrative references "plugging surface ditches". Please confirm whether ditches will be plugged. If plugs are proposed, please include a detail identifying the minimum plug width (DWR recommends a minimum of 50 feet) and whether a restrictive material core will be used.

    A channel fill detail has been added to the plans. Most of the surface ditches to be plugged onsite are not especially deep or wide. These types of ditches will be filled similarly to the channel. Our experience with sites like this is that large plugs are not necessary for these small surface ditches. Those surface ditch locations are indicated with notations on the plans.

26. Sheet 9 – Please show floodplain grading extents associated with notes along T3 and T3-1.

    The extent of grading is shown in these areas.

27. Sheet 13 – Please show a wetland planting zone and include seed mix information.

    Given the size of the wetlands in relation to the stream riparian buffers, we are considering these as one contiguous planting zone. We anticipate the riparian wetlands to be integrated with the streamside vegetation and have designed a planting plan that incorporates species that will succeed across the site. Our permanent native seed mix information is shown on Sheet 17.

28. Sheet 13 – What does "per design representative guidance" refer to?

    Design representative guidance indicates areas where the designer may make minor adjustments during construction; these field adjustments allow us to ensure that all features are properly installed and achieve the desired function considering the specific conditions at each location.

29. Sheets 15 & 16 – Please show anticipated gate locations.

    These have been added to the specified sheets.

30. For future site submittals, please show the plan view and corresponding profile on the same design sheet.

Noted.

31. Appendix/Section 12.2 Soil delineation and Borings - The title reflects that a hydric soil delineation was completed, please show these boundaries on the included figure. While sufficient representative boring logs were submitted, it's assumed that additional sample points were taken in the field to delineate the hydric soil boundaries (i.e. more than one sample point per wetland area). In the future please, show all sample point locations on the associated soil report figure.

    The hydric soil areas have been added to the figure. The point locations will be added for future sites.

32. Appendix/Section 12.2 Groundwater Data – Please shift labels to align with corresponding lines.

    We have reformatted this slightly to improve columns.

USACE Comments, Kim Browning:

1. The correct USACE Action ID is SAW-2018-01160. Please correct the cover page.

    This has been corrected.

2. General Plan Comments:

    a. Please include a maintenance section with monitoring. For example, crossings, fence, invasives…and who will be responsible.

        A Maintenance Plan has been added as Appendix 13.

    b. This mitigation plan seemed to differ from the NCDMS template, and was difficult to follow at times. Also, the appendices were included as Section 12, which was confusing.

        Minor changes have been made to the plan format as the project progressed. We have changed the names of the appendices.

3. When submitting the PCN, please include an estimate of the number of trees, or acres, to be cleared for the NLEB 4(d) Rule.

    Noted.

4. Please label wetlands on Figures 8 and 9 to match the JD map. The asset tables should correspond to these labeled areas.

    The wetland labels have been added.

5. Table 4 and Page 21: Please describe the level of microtopography in regards to surface ponding.

   We have added "minor wetland microtopography (+/- 0.5 foot based on average ground elevation)." This development of microtopography will add roughness to the wetland terrain and encourage surface retention in the upper profile, but will not be installed as to allow large swaths of areas to be ponded more than others.

6. Page 18, last paragraph: "The consideration of future impacts to the areas that could limit functional uplift opportunities…" Please explain what considerations were given, such as utility installation through the easement, crossing failures, adjacent land development, pond dam breeches, etc.

   We have added "Consideration of future impacts to the area that could limit functional uplift opportunities is important when assessing project potential. For this site, the existing ponds onsite were deemed stable and the likelihood for development immediately adjacent to the site that could impact the streams after project completion was evaluated to be low. It is predicted that as the site matures, its ability to mitigate for any negative impacts within the project area and outside of the easement will continue to strengthen."

7. Page 21: In wetland rehabilitation areas, if hydrology and vegetation are proposed to be enhanced, functional uplift should be demonstrated by additional gauges and veg plots. Additionally, wetland enhancement areas should demonstrate functional uplift. Removal of debris and invasive treatment is expected on all reaches, so perhaps a discussion of the NCSAM functional assessment rating as LOW for habitat might be justification.

   As stated above, two wetland gauges have been added to the proposed rehabilitation areas. We have noted to place two of our 8 random vegetation plots within wetland rehabilitation or enhancement areas.

8. Page 26: Please list herbaceous seed mix and address how fescue will be treated/removed.

   We have added to the last paragraph: "Existing undesirable pasture grasses will be sprayed with herbicide and left fallow until full mortality is achieved. The areas will then be scarified or disked to break up any existing compaction prior to seeding and stabilizing with temporary and permanent seed mixes as prescribed in the project plans."

9. Section 7.0-Vegetation Performance: Please add 320 steams/acre for monitoring year 3.

   This has been added.

   a. Volunteers may only count towards success if they are in the approved planting plan.

      As noted in a previous DWR comment, we have added this.

10. Section 8-Veg Monitoring: Please add veg plots to wetland rehabilitation areas (random plots are fine).

    As stated above, we have noted to place two of our 8 random vegetation plots within wetland rehabilitation or enhancement areas

11. Wetland rehabilitation/reestablishment—It would be beneficial to add some coarse woody debris to the depressional areas and throughout the wetland for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events.

    At this site, we are showing woody debris installed along T2 and above T3. For the remaining wetland areas, we will add woody debris as available to encourage habitat development. However, because this site is not already wooded, there will be a limited amount of wood generated during construction to add to the site. A note about adding wood to the wetlands and stream floodplain has been added to the plans and this note was added to the mitigation plan "As available during construction, wood will be added to the wetlands and the stream floodplain for added habitat complexity, and to help store sediment, increase water storage/infiltration, and absorb energy during overbank events."

12. Page 32: Wetland hydrologic monitoring: Please add wells to all wetlands that propose hydrologic uplift and update Table 14 as necessary.

    As noted above, 2 additional wetland pressure transducer gauges have been added to wetland rehabilitation areas.

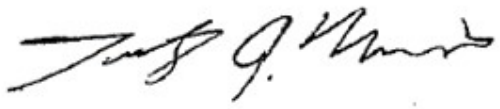
13. Page 32: Please depict fixed photo points on Figure 9.

    Fixed Photo Points have been added to Figure 9.

14. Please include the approved map for the PJD.

    The map was included in Appendix 12.7 with the PJD.

Sincerely,



Tim Morris
Project Manager

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FIGURES

TABLES

1.0 PROJECT INTRODUCTION

The Hip Bone Creek Restoration Site (HBCRS) is a full-delivery stream and wetland mitigation project being developed for the North Carolina Division of Mitigation Services (DMS) in the Cape Fear River Basin (03030003 8-digit cataloging unit) in Chatham County, North Carolina. The site's natural hydrologic regime has been substantially modified by relocation and straightening, impacts from cattle, installation of field ditches, and other anthropogenic impacts. This site offers the chance to restore impacted agricultural lands to a stable stream and wetland ecosystem with a functional riparian buffer, floodplain access, and riparian wetlands.

The HBCRS is situated in central Chatham County. HBCRS is located approximately 3.3 miles southeast of Siler City, North Carolina. Specifically, the site is on Carter Brooks Road just east of US-421. The center of the site is at approximately 35.6804 N and –79.4018 W in the Siler City USGS Quadrangle. The site location is shown in Figure 1.

The HBCRS will restore a stable stream and wetland ecosystem along an Unnamed Tributary to Meadow Creek (T1) and one of its tributaries (T3) with a combination of stream and wetland restoration and enhancement. A Priority 1 stream approach will be used to reconnect the streams to an active floodplain.

Certain streams on the project will not be included for credit: the upper portions of T1 and T3 that flow through existing wetlands with a diffuse channel and all of T2. All of these sections lack a distinct single-thread thalweg and will be improved instead through wetland mitigation actions. Once site grading is complete, the wetlands and riparian buffer will be planted with native tree species. The site will be monitored for seven years or until the success criteria are met.

Table 1. Credit Summary

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	
Type	R	RE	R	RE	R	RE	R	RE
Linear Feet/Acres	2,860 lf	1,166 lf	4.528	1.495				
Credits	2,860.000	466.400	4.032	0.598				
TOTAL CREDITS	**3,326.400**		**4.630**					

R=Restoration RE=Restoration Equivalent

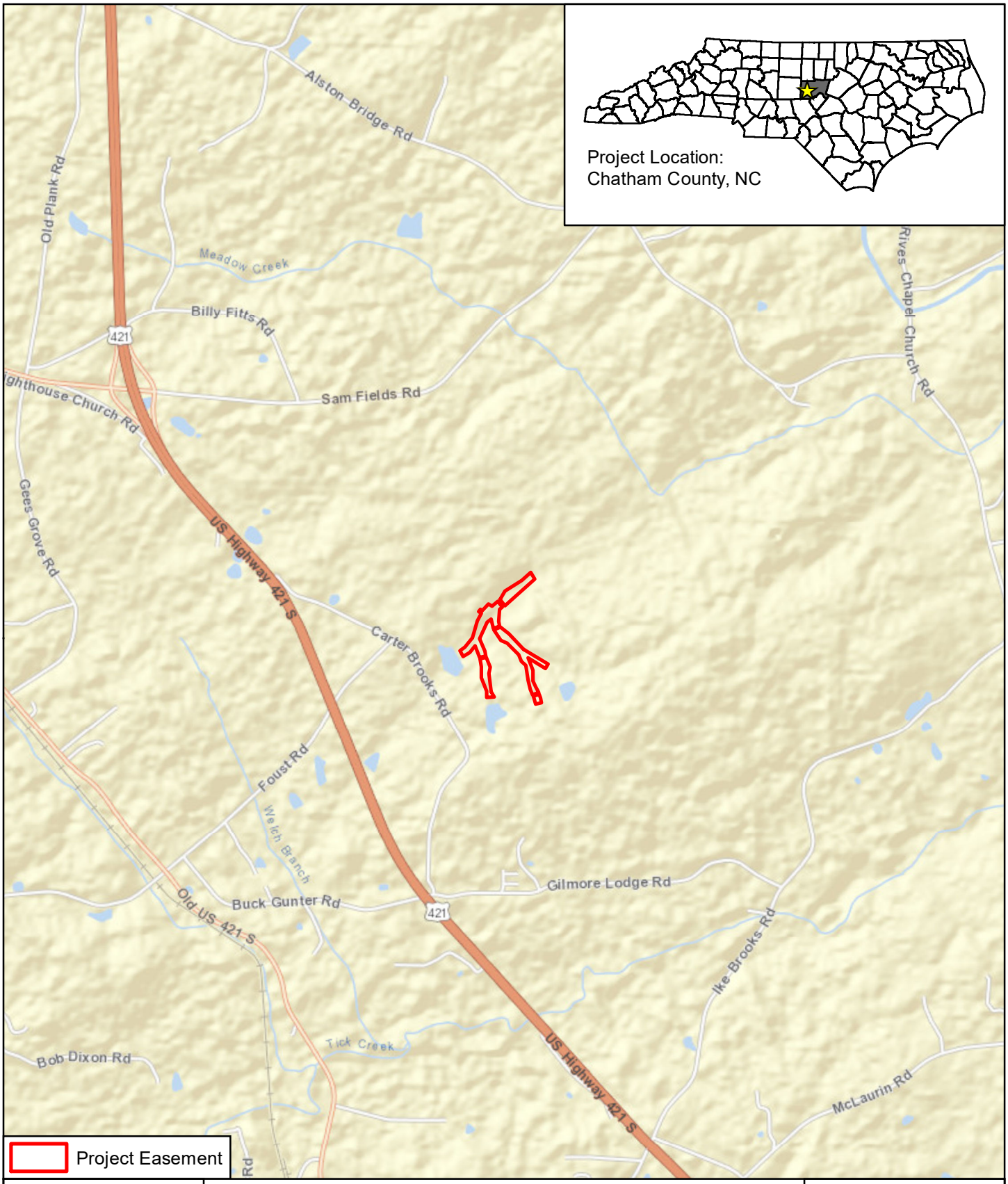

FIGURE 1. PROJECT SITE VICINITY MAP
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

2.0 WATERSHED APPROACH AND SITE SELECTION

The HBCRS is located within the Deep River Cataloging Unit (CU) (03030003) of the Cape Fear River Basin, where population growth and rapid development have produced a significant need for restoration projects. The project 14-digit CU 03030003070020 (Tick Creek/Rocky River) is included as a targeted local watershed (TLW) and is one of three 14-digit hydrologic units (HU) in the DMS Upper and Middle Rocky River Local Watershed Plan (LWP). The Cape Fear 03 faces challenges such as a high percentage of agricultural land and animal operations, disturbed riparian buffer, and increasing impervious surface from development (NCDENR, EEP 2009).

The 2009 Cape Fear River Basin Restoration Priorities in Unit 03030003 focus on restoring wetland and stream functions such as maintaining and enhancing water quality and improving fish and wildlife habitat (NCEEP 2009). The project goals for HBCRS are in line with the following TLW goals:

- Reduce and control sediment inputs.
- Reduce and manage nutrient inputs.

The project will also address the following stressors and sources listed in the Upper and Middle Rocky River Local Watershed Plan (LWP):

- Stream bank erosion
- Lack of adequate forested buffer
- Livestock access to streams
- Fecal coliform bacteria
- Nutrient inputs
- Floodplain alteration

The project aims to uphold the goals consistent with several CU-wide watershed improvement objectives by restoring channelized and livestock-impacted streams to a natural pattern within the landscape; reducing sediment impacts to the Cape Fear River and its tributaries from adjacent grazing and farming practices, and restoring riparian wetlands associated with the restored stream and the surrounding hillside seeps that contribute to these wetlands (NCEEP 2009). Restoring and enhancing the channelized and cattle impacted streams to C-type channels will improve stream stability and reduce sediment loading by limiting channel erosion. These channels will be raised to restore and enhance the hydrology of riparian wetlands along these channels.

The project watershed for the HBCRS is 0.25 square mile (158 acres). The confluence with Meadow Creek (17-43-12), the nearest named stream, is approximately 3,200 lf downstream of the project. Meadow Creek is rated by the Division of Water Resources (DWR) as a Class C water, and while it is not listed on the 2018 303(d) list, it did exceed the criteria for mercury found in fish tissue. Meadow Creek continues downstream until the confluence with the Rocky River. The project watershed is shown in a map in Figure 2, and another map illustrating the project's watershed location in relation to the 03030003070020 watershed identified in the TLW and LWP is shown in Figure 3.

There are no conservation or protected areas located adjacent to the project site, but it will connect with the forested area immediately downstream of the project and improve and restore the existing forested buffer on the site itself. DMS's Tick Creek mitigation project is located approximately 2 miles to the east of HBCRS.

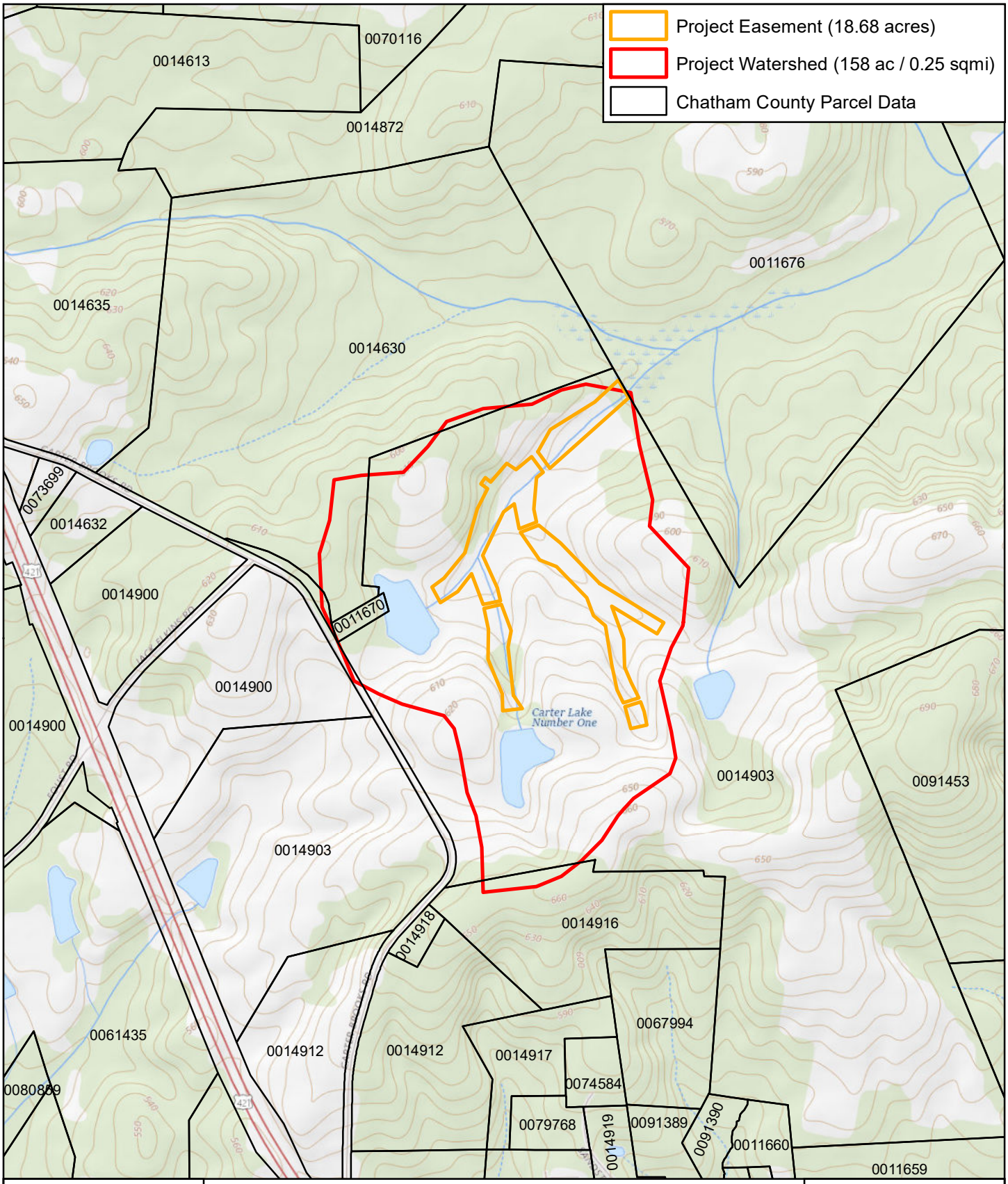

FIGURE 2. USGS TOPOGRAPHIC MAP
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

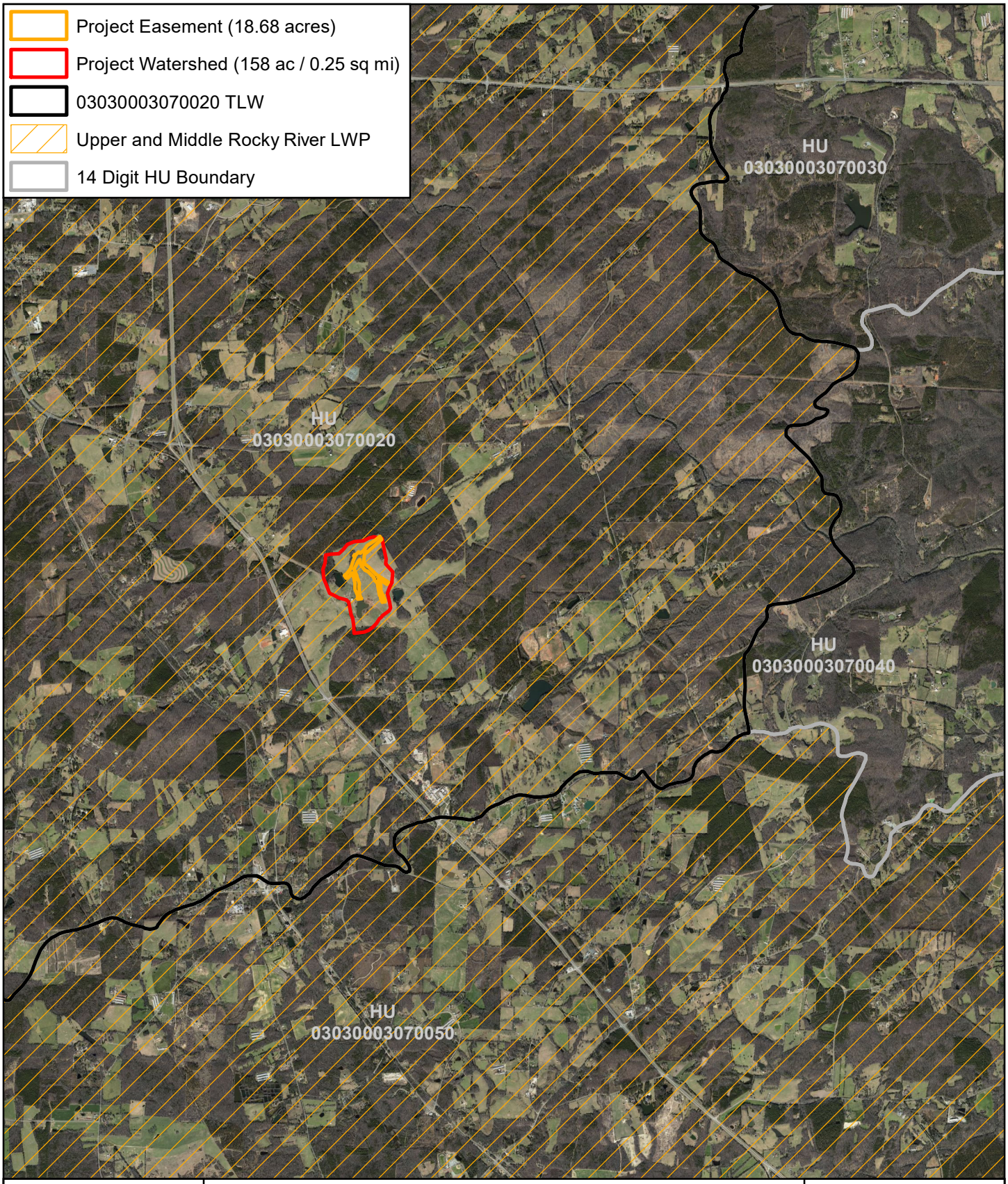

FIGURE 3. LWP WATERSHED MAP
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

3.0 BASELINE AND EXISTING CONDITIONS

3.1 Watershed Processes and Resource Conditions

3.1.1 Landscape Characteristics

The site lies within the Carolina Slate Belt (Level IV 45c) ecoregion of the Piedmont. The Carolina Slate Belt is characterized by mineral-rich, metavolcanic and metasedimentary rocks with slatey cleavage that are finer-grained and less metamorphosed than most Piedmont regions. Streams in this region tend to dry up and water yields to wells are low, as this region contains some of the lowest water-yielding rock units in the Carolinas. The natural vegetation is typically made up of oak-hickory-pine forests (Griffith et al 2002).

The geology of the site is mapped as Metamudstone and Meta-Argillite (CZmd) in the upper southern half of the site and Mafic Metavolcanic Rock (CZmv) in the lower northern half. CZmd is noted as having bedding planes with axial-planar cleavage, interbedded with metasandstone, meta-conglomerate, and metavolcanic rock. CZmv is described as a metavolcanic rock having abundant dark-colored minerals, typically feldspar, amphibole, and/or pyroxene, which are described as intrusive foliated to massive rocks (USGS 2019).

The project streams begin as headwater systems on the site, with Tributary 1 (T1) and Tributary 2 (T2) beginning downstream of two farm ponds. At the upper origins, the streambeds are generally silt/clay with a portion of small gravel; by the end of the project, the streams are primarily dominated by small gravels. There are limited areas of bedrock throughout the site.

According to the USDA (2016), the mapped soils at the site consist of the following: Chewacla and Wehadkee complex soils (ChA), which are frequently flooded, floodplain soils consisting of Chewacla (approximately 60%) and Wehadkee soils (approximately 35%); Georgeville silt clay loam (GeC2), which is moderately erodible to highly erodible upland soil found on broad ridges; and Georgeville-Badin complex soils (GkD, GkE), which are very highly erodible upland soils consisting of Georgeville (approximately 55-65%) and Badin (approximately 20-25%) soils. The soil survey for the project area is shown in Figure 4.

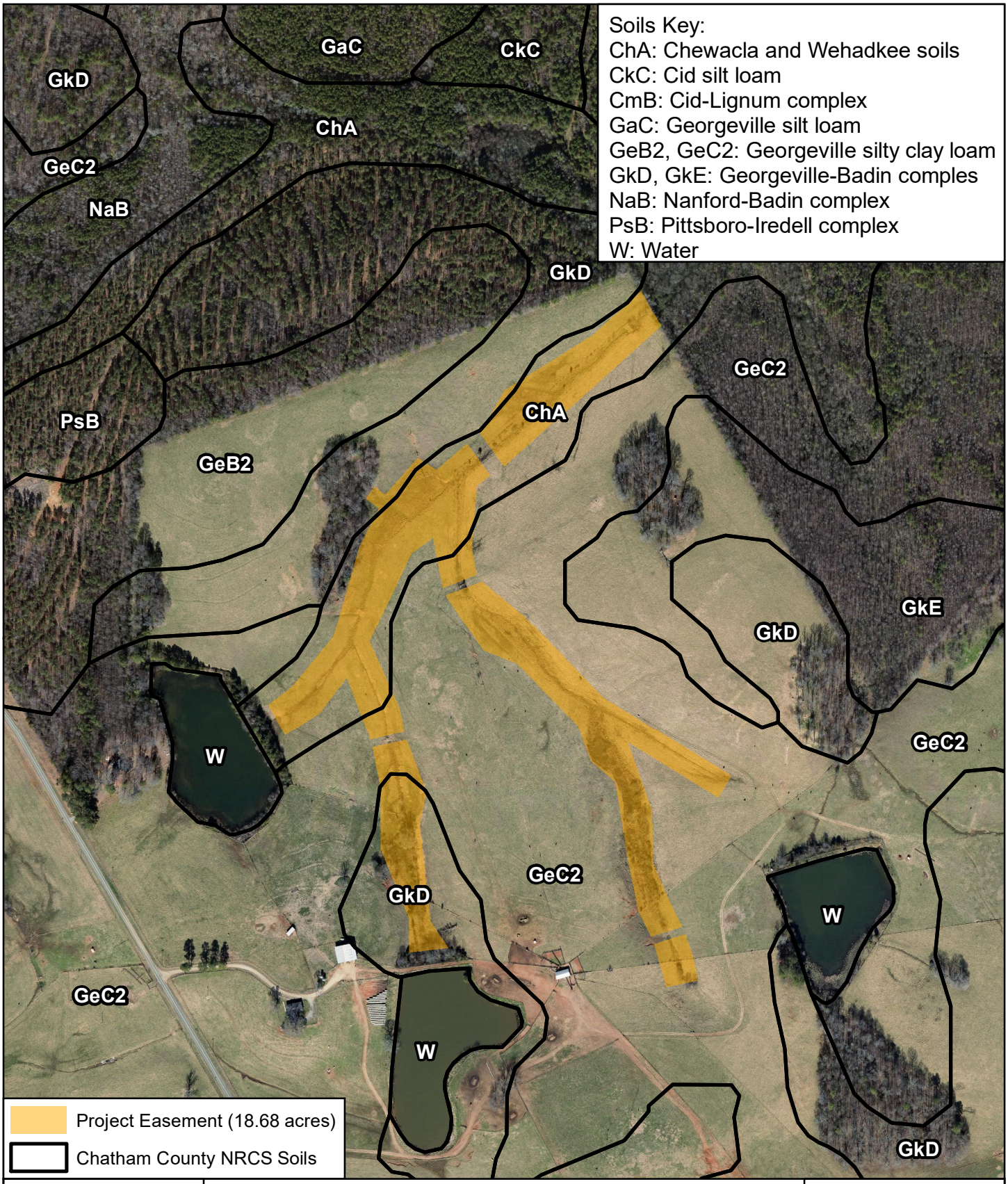

FIGURE 4. NRCS SOILS
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

3.1.2 Land Use/Land Cover and Chronology of Impacts

The project watershed for the HBCRS is 0.25 square mile (158 acres). Current land use in the project watershed (Figure 5) was derived from the 2017 orthoimagery and consists of pasture/farmland (85% / 133 ac), forest (9% / 14 ac), open water (5% / 9 acres), and rural development (1% / 2 ac). The current adjacent land use has a negative impact on water quality of the project streams. This is evidenced by livestock having direct access to all of the project reaches. KCI's measurement of the total impervious area for the project watershed is less than 1%, which is based on the land use delineated from the 2017 orthoimagery. There are sections of narrow forested wetland area along T1 and T3. The overstory vegetation in these sections consists primarily of red maple (*Acer rubrum*) in the canopy with an understory of Chinese privet (*Ligustrum sinense*), and mixed rushes and sedges. There are five existing piped crossings at the site, most in disrepair, and one private power line that crosses the top of T3.

The HBCRS has undergone significant modifications that have altered the site hydrology and vegetation. Historic aerials were examined for any information about how the site has changed over recent history and were obtained from the USGS EarthExplorer, NCDOT and NCOneMap for 1950, 1960, 1964, 1972, 1993, 1998, 2002, and 2010. Selected historic aerials are presented in Figures 6A and 6B.

The site has been systematically impacted by agriculture and grazing over the past 68 years. In the earliest aerial photo from 1950, the majority of the site is already cleared, with the exception of some areas around the edges of the project.

By 1960, a thin forested buffer is present along most of the project reaches that was not noticeable in the 1950 photo, and in 1964 the site continues the trend with reforestation along the upper and middle portions of T1 and the upper part of T3. In the 1972 photo, this buffer has expanded, especially along T1 of the project.

However, by 1993 the site is mostly cleared of vegetation again except along the top of T1. Additionally, most of the forested areas located adjacent to the project easement have been cleared. By 1998, no buffer is present anywhere along the project reaches and the site shows little change from this point on; only small areas of vegetation develop near the southern ends of T1 and T3.

The development pressure for the project watershed is anticipated to be low to moderate. This section of Chatham County has retained its rural character and the majority of residences within the project watershed are farm homesteads or other rural acreages.

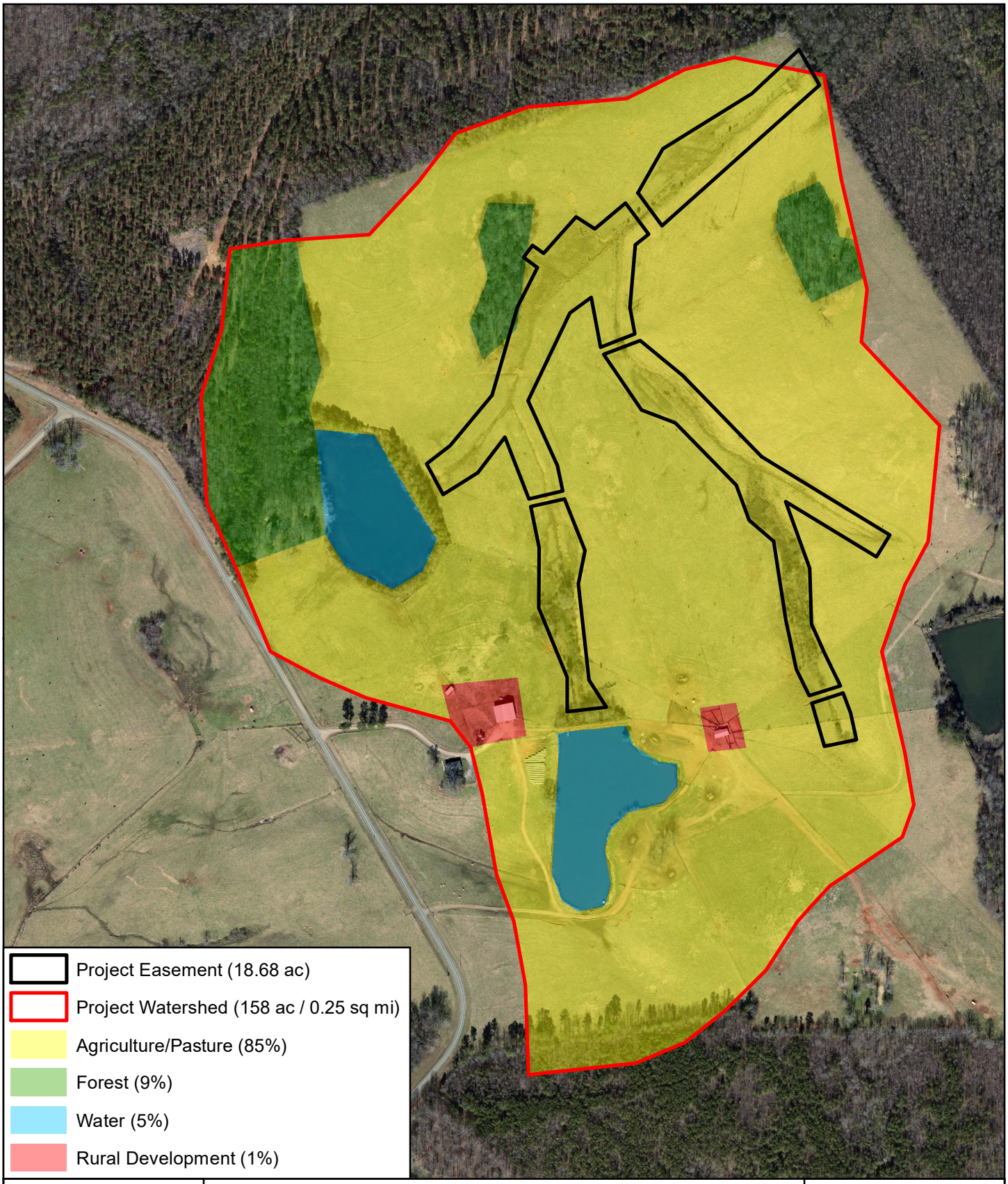

FIGURE 5. PROJECT WATERSHED LAND USE
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

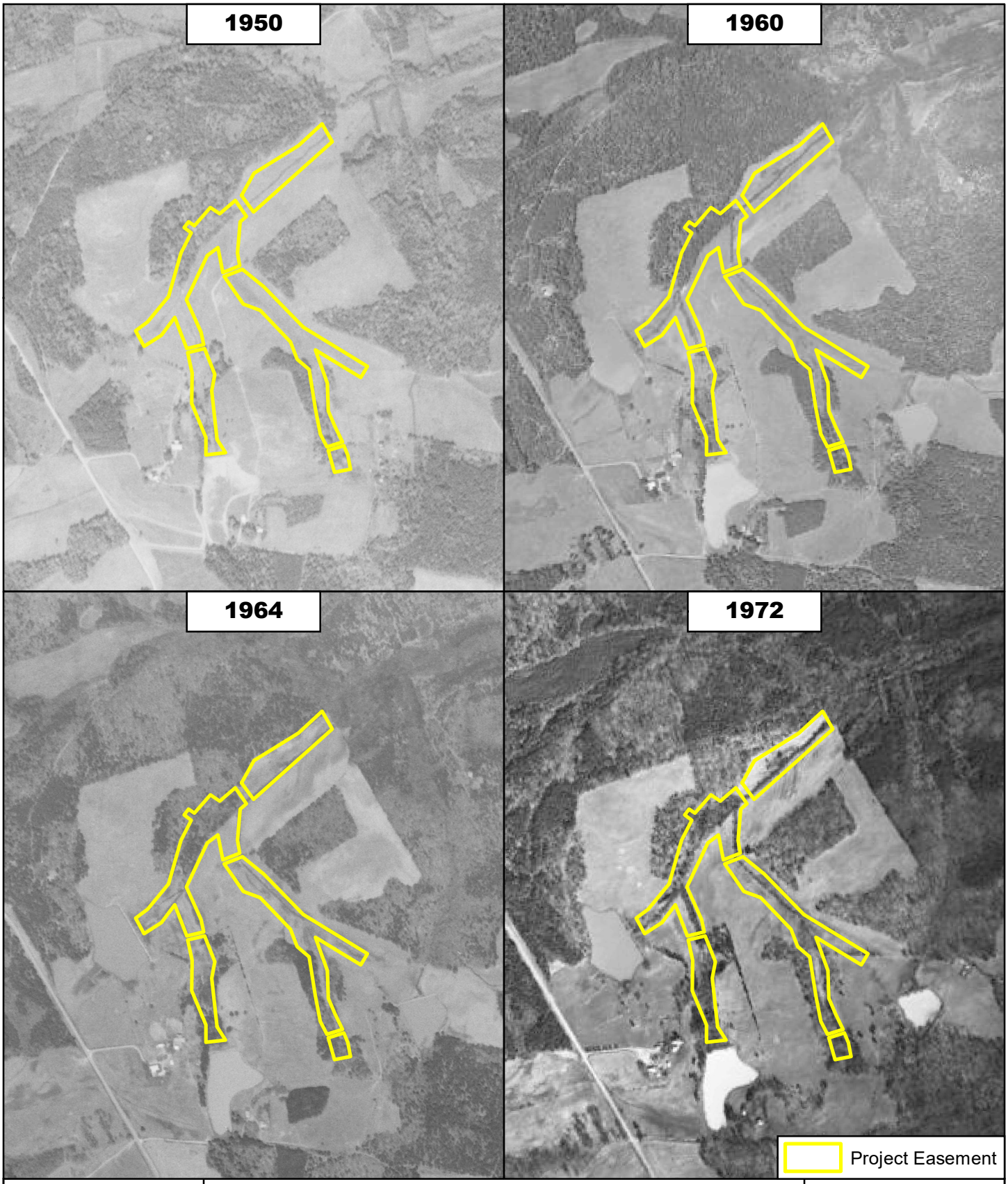

FIGURE 6A. HISTORIC AERIALS
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

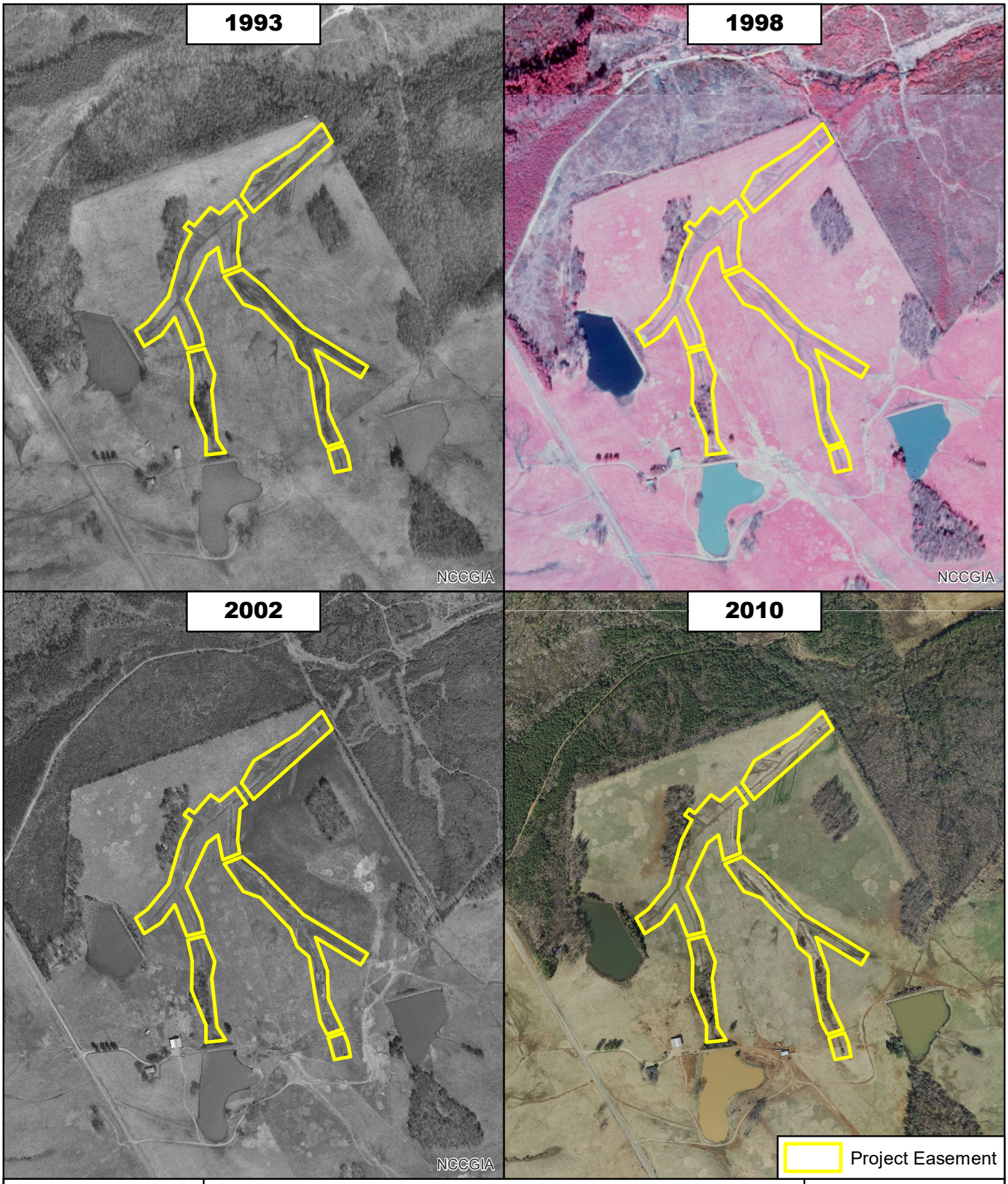

FIGURE 6B. HISTORIC AERIALS
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

3.1.3 Watershed Disturbance and Response

The project has experienced landscape and vegetative modifications to maximize the potential for agriculture and livestock on the site. As a result, stream adjustments have occurred as a response to these changes. Along the project streams of Tributary 1 (T1) and Tributary 3 (T3), the measured bank height ratios range up to 1.5 and 2.1, respectively, for the two streams, and show a high degree of channel incision. Additional existing conditions data are included in Appendix 12.2. Tributary 2 (T2), which was included as a stream in the jurisdictional determination, will be treated as contiguous wetland feature for the purpose of this project's accounting following a field decision with the North Carolina Interagency Review Team (IRT) (see Appendix 12.9).

Table 2. Existing Stream Bank Height and Entrenchment Ratios

Stream	Existing Bank Height Ratio	Existing Entrenchment Ratio
T1	1.0 – 1.5	1.6 – 3.1
T3	1.0 – 2.1	2.0 – 5.4

The primary hydrologic feature at the site is T1, which has been impacted by channelization and cattle impacts. Primary flow for T1 begins at the project boundary, which is at the base of a farm pond dam. This stream receives hydrology from seepage at the bottom of the dam and from a small outlet pipe entering the upper slope of T1 on the eastern side. At the beginning of T1, the channel exists as a stream/wetland complex that has been severely degraded by cattle. The impacts from the livestock and pond upstream have caused there to be minimal stream form to the channel. There is an existing riparian buffer in this area with a sparse canopy of native hardwoods and an understory that is comprised primarily of Chinese privet, and other invasive species such as autumn olive (*Elaeagnus umbellata*) and callery pear (*Pyrus calleryana*). There are multiple seeps from the toe of the surrounding valley that contribute to the stream and wetland hydrology of T1 as the stream flows north.

As T1 flows north out of the vegetated area after approximately 600 linear feet (lf), it leaves an old fence line and a headcut defines the start of a transition to a single-thread channel. The stream becomes incised quickly and has a lack of distinct bed features. T1 turns northeast at the confluence with T2, a straightened channel surrounded by a linear wetland. T2 also originates from the outlet of a farm pond, but much of its hydrology is groundwater from adjacent hillside springs and seeps.

After the confluence with T2, T1 flows northeast and the channel becomes narrower and more incised. The stream was straightened historically and ditched to drain the hillside seepage that is evident throughout the length of T1. Many of these former wetlands have been cleared of vegetation, trampled by cattle, and have historic surface ditches that are still functioning to drain to T1. Where T1 continues to flow northeast, the channel alternates between a narrow single-thread channel and a poorly defined channel trampled by livestock.

Approximately 750 lf downstream of the confluence with T2, T3 enters T1. T3 starts at an old spring box and flows north for approximately 2,200 lf until reaching T1. Like the other project streams, the headwaters of this channel are poorly defined due to cattle impacts for the first 300 lf. Following this point, T3 enters an existing forested wetland. This area shows signs of having been previously fenced off from cattle, but the cattle currently have access to all of T3 and have significantly degraded both the stream and wetland. This wetland/stream area has a sparse riparian buffer of early successional trees and shrubs such as black willow and eastern baccharis. After approximately 775 lf, T3 exits the forested wetland and enters open pasture again. An existing piped farm crossing is holding grade for the stream, but is in disrepair and stream flow is going over and around this crossing. After the crossing, T3 begins to

incise as it nears the confluence with T1. There are spoil piles adjacent to the stream and other signs of past channelization as well.

After the confluence with T3, T1 continues to flow northeast until it meets the property line, after which it enters a forested property off-site and flows downstream to join Meadow Creek.

A jurisdictional determination for the project was submitted to the US Army Corps of Engineers and approved on November 16, 2018. The JD is included in Appendix 12.7. Gauge data from the existing wetland gauges in found in Appendix 12.2. Table 3 below summarizes the flow and quality results of the stream and wetland field investigations. A more detailed breakdown of the results can be found in the accompanying forms in Appendix 12.6.

Table 3. Existing Stream and Wetland Conditions

Reach Name	Flow Status	DWQ Score	NC SAM Rating
T1	Intermittent	19.0	Low
T1-1	Ephemeral	18.0	N/A
T2	Intermittent	19.5	Low
T3	Intermittent	23.0	Low
T3-1	Ephemeral	18.5	N/A
Wetland Name	**WAM Classification**	**Hydrologic Class**	**NC WAM Rating**
WA	Headwater Forest	Riparian	Medium
WB	Headwater Forest	Riparian	Low
WC	Headwater Forest	Riparian	Low
WD	Headwater Forest	Riparian	Low
WE	Headwater Forest	Riparian	Medium
WF	Headwater Forest	Riparian	Low
WG	Headwater Forest	Riparian	Low
WH	Headwater Forest	Riparian	Low

Table 4. Project Attribute Table

Project Name	Hip Bone Creek Restoration Site		
County	Chatham County		
Project Area (acres)	18.68 ac		
Project Coordinates (lat. and long.)	35.6804 N, –79.4018 W		
Planted Acreage (Acres of Woody Stems Planted)	17.40		
Project Watershed Summary Information			
Physiographic Province	Piedmont		
River Basin	Cape Fear		
USGS Hydrologic Unit 8-digit	03030003	**USGS Hydrologic Unit 14-digit**	03030003070020
DWR Sub-basin	03-06-12		
Project Drainage Area (acres)	158 acres		
Project Drainage Area Percentage of Impervious Area	1%		
Land Use Classification	Pasture/Farmland (85%), Forest (9%), Open Water (5%), and Rural Development (1%)		
Existing Reach Summary Information			
Parameters	**T1**		**T3**
Length of reach (linear feet)	2,439		2,202
Valley Confinement	Unconfined		Unconfined
Drainage area (acres)	158 acres		43 acres
Perennial, Intermittent, Ephemeral	Intermittent		Intermittent
NCDWQ Water Quality Classification	C		C
Rosgen Classification (Existing/Proposed)	G4/C4 and C4b		G4/C4
Evolutionary trend (Simon)	Channelized, Stage III		Channelized, Stage III
FEMA classification	None		None
Existing Wetland Summary Information			
Parameters			
Size of Wetland (acres)	2.52 ac (WA and WE)		0.99 ac (WB, WC, WD, WF, and WG)
Wetland Type	Headwater Forest		Headwater Forest
Mapped Soil Series	Georgeville		Chewacla/Wehadkee
Drainage class	Well Drained		Poorly Drained
Soil Hydric Status	Non-Hydric		Hydric
Source of Hydrology	Stream Floodplain		Stream Floodplain
Restoration or Enhancement Method	Enhancement		Re-establishment, Rehabilitation, and Enhancement

**Items addressed in the Categorical Exclusion in Appendix.

Table 4, continued

Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Applying for NWP 27	JD has been obtained.
Waters of the United States – Section 401	Yes	Applying for NWP 27	
Endangered Species Act**	Yes	Yes	USFWS
Historic Preservation Act**	No	Yes	NCSHPO
Coastal Zone Management Act ** (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	Yes	N/A
Essential Fisheries Habitat**	No	N/A	N/A

**Items addressed in the Categorical Exclusion in Appendix.

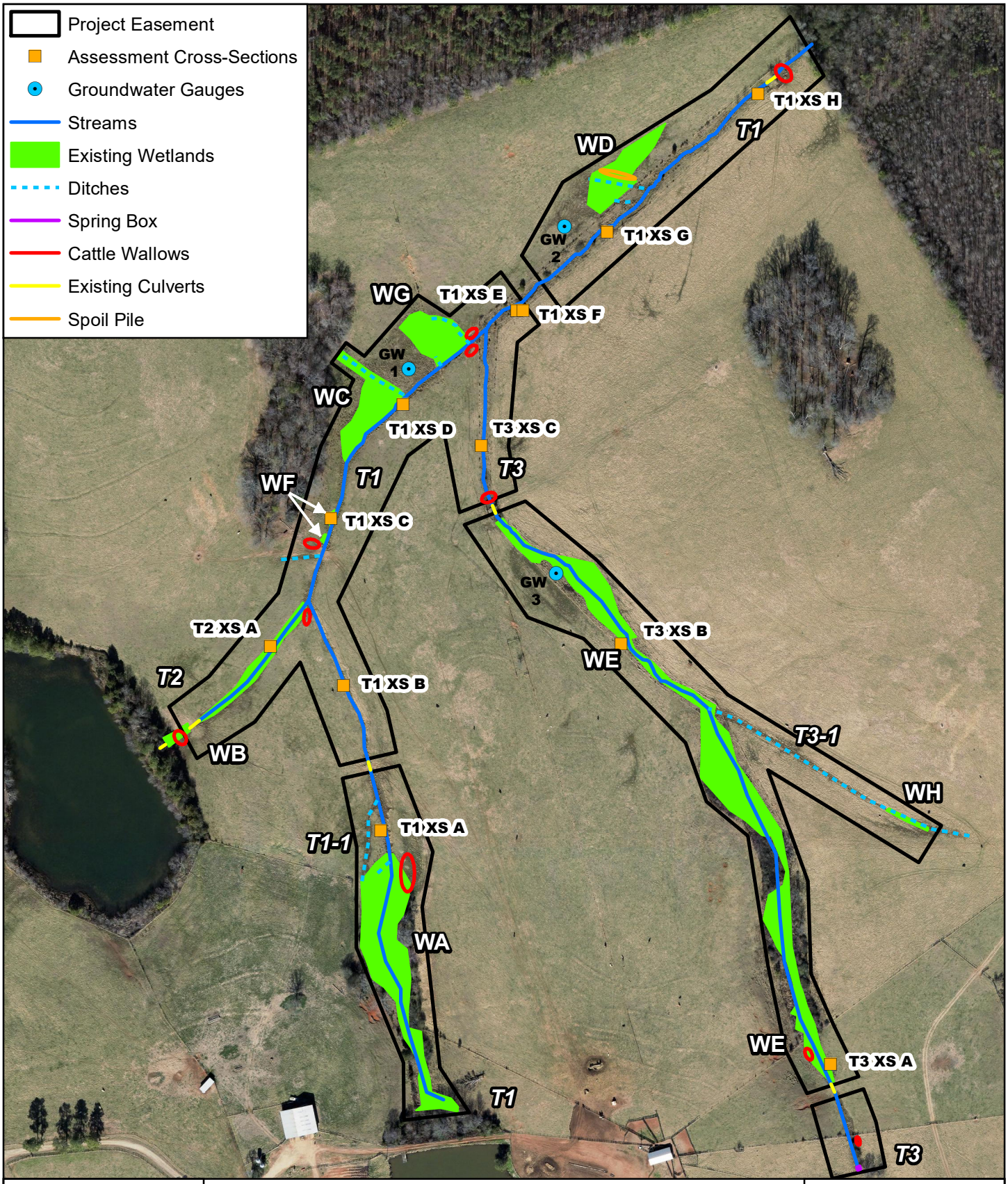

FIGURE 7. CURRENT CONDITIONS
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

3.1.4 Site Photographs

Photo 1: Degraded stream along beginning of T1.

Photo 2: Eroded and cattle impacted channel T1.

Photo 3: Drained wetland along T2.

Photo 4: Wetland restoration area along T1.

Photo 5: Cattle wallow on T1.

Photo 6: Channel just downstream of spring box on T3.

Photo 7: Incised stream along T3.

Photo 8: Cattle wallow and existing culvert along T3.

4.0 FUNCTIONAL UPLIFT POTENTIAL

Based on the current stream and watershed conditions at the HBCRS, there is a high potential for functional improvements at this site. Hydraulic functions have been affected by the direct modifications to the channel such as ditching and unrestricted livestock access and by indirect watershed processes causing incision and disconnection from the floodplain. These alterations have compromised the geomorphologic functions of the channel. This condition is exacerbated by the limited riparian buffer and sources of direct agricultural runoff. The North Carolina Stream Assessment Method (NC SAM) was used to determine the quality of the existing streams. The results indicate that all of the stream channels have low functional values. This project offers a chance to restore these degraded streams and wetlands, which would bring functional uplift to this entire system.

The primary uplift for the HBCRS will be achieved at the hydraulic and geomorphological levels. Reestablishing floodplain connectivity with a Priority 1 Restoration will allow stream flows to access the floodprone area more frequently, providing uplift of hydraulic functions within this system that will distribute flood flows through a wide area instead of within a confined channel and facilitating diffuse overland flow through the riparian buffers. Geomorphological functional uplift will be achieved through channels sized to the bankfull flow, a planform and profile design emphasizing bedform variation, and the reestablishment of a native riparian corridor with invasive species removed. As a result, bank migration and lateral stability will be restored to a sustainable level and the banks and bed will accommodate design flows in a stable manner. Sediment inputs will decrease due to reduced bank erosion and reduced livestock access to the stream channel and riparian areas, which will allow effective sediment transport to return to a stable level in equilibrium with watershed inputs. Riparian plantings will further support geomorphological functionality by increasing bank stability.

Consideration of future impacts to the area that could limit functional uplift opportunities is important when assessing project potential. For this site, the existing ponds onsite were deemed stable and the likelihood for development immediately adjacent to the site that could impact the streams after project completion was deemed low. It is predicted that as the site matures, its ability to mitigate for any negative impacts within the project area and outside of the easement will continue to strengthen. As mentioned above, the project will permanently protect the restored streams and wetlands and will connect forested

headwater systems within the Deep River Watershed. The table below summarizes the project goals and objectives that will lead to functional improvements and specific parameters that will be addressed.

5.0 MITIGATION PROJECT GOALS AND OBJECTIVES

Table 5. Project Goals, Objectives, and Functional Outcomes

Goals	Objective	Functional Level	Function-Based Parameter Effects
Restore a channelized stream to a meandering C-type channel with a floodplain	Relocate channelized streams to historic landscape positions	Hydraulics	Floodplain Connectivity
	Install a bankfull-sized channel cross-section	Geomorphology	Bank Migration/Lateral Stability
	Install bedform diversity with pools, riffles, and habitat structures	Geomorphology	Bed Form Diversity
Buffer and reduce sediment impacts to the project stream	Demarcate the project easement boundaries and fence out livestock.	Geomorphology	Bed Material Characterization
Restore a forested riparian community	Plant the site with native trees and shrubs and a herbaceous seed mix	Geomorphology/ Wetland Species Composition	Vegetation
Restore a wetland hydroperiod to drained and/or livestock-impacted land	Reconnect streams to floodplain; redevelop wetland microtopography to slow the flow of surface and subsurface drainage	Wetland Hydrology	Groundwater Saturation/ Surface Ponding

6.0 DESIGN APPROACH AND MITIGATION WORK PLAN

The project streams and wetlands were designed using a modified reference reach approach developed from stable on-site conditions. In addition to the data from the on-site references, common reference values from Harmon et al. 2011 were also used to aid the development of the stream design criteria. The proposed channel design values have been adjusted as necessary to accommodate the existing site conditions, such as the ponds as the top of T1 and T2 (see Section 6.5).

Certain streams on the project will not be included for credit: the upper portions of T1 and T3 that flow through existing wetlands with a diffuse channel and all of T2. All of these sections lack a distinct single-thread thalweg and will be improved instead through wetland mitigation actions.

6.1 Tributary 1 (T1)

T1 is the primary stream running through the project and its design will involve a combination of stream restoration and enhancement. This stream has been divided into five separate reaches as depicted in Figures 8 and 9. The uppermost portion of T1, directly below the pond and running through the existing forested wetland, will not be included for credit; the first reach will begin at STA 10+00 as it comes out of the treeline. Shortly after this point, there is a severe headcut. Restoration on this reach will focus on bringing the stream up from its current entrenched position and integrating it into a broad floodplain with a Priority 1 Approach and a meandering pattern. Furnished or salvaged topsoil will be used to surface treat all planting areas within the floodplain extents shown on the plans. Adequate lime and fertilizer will be used to ensure adequate vegetative stabilization. Soil lifts with live whips and offset step pool structures will provide habitat and grade control to this reach. Drained riparian wetlands will be restored along the first 200 feet of the reach.

T1 Reach 2, from STA 17+80 to STA 26+86 at the confluence with T3, will continue with a similar restoration approach as the upstream reach. After approximately 200 feet, there is an area of hillside seepage entering from the northwest; 1.4 acres of riparian fringe wetlands will be redeveloped and integrated into the T1 floodplain in this location.

After the confluence with T3, T1 continues with three separate reaches until the end of the project. T1 Reach 3 is a short section of restoration from STA 26+86 until STA 29+54; this reach will transition the stream with a larger cross-sectional area after T3 to a downstream Enhancement II reach, T1 Reach 4. This enhancement reach, from STA 29+54 to STA 32+49, has maintained an appropriately-sized bankfull channel, but is experiencing bank erosion, particularly on the right bank that is vertical in places. Enhancement work will focus on sloping back and planting banks that connect to a restored floodplain. A 0.8-acre area of wetland restoration runs along the left bank of T1 Reach 4, which will reconnect seepage flow from the northwestern hillside with the riparian zone of T1. The final reach of the stream, T1 Reach 5, shows increased incision and bank erosion and will be restored from STA 32+49 until the end of the project at STA 37+01 where it will connect to an existing forested reach. This last reach will have a short transitional section of Priority 2 restoration at the end.

6.2 Tributary 3 (T3)

T3 consists of three separate reaches. Similar to T1, there is an approximately 800-lf section of T3 that will not be included as credit, since the stream functions in concert with the forested wetland across a wide flowpath.

The first reach, T3 Reach 1, begins at the start of the stream at STA 300+00 and ends at STA 303+10 where T3 enters the forested wetland. This reach starts at a spring box and will be improved through Enhancement II. The work will include removing invasive vegetation and the old pipes that are in the channel formerly connected to the spring box, excluding livestock, bank grading, and replanting the riparian buffer.

Once T3 emerges from the downstream end of the vegetated wetland, T3 Reach 2 starts at STA 311+10, continuing Enhancement II. This reach will have selective bank grading, riparian buffer plantings, and exclusion of cattle.

T3 Reach 3, from STA 317+00 to STA 322+73, begins at the existing derelict culvert and ends at the confluence with T1. This reach will be restored in a manner similar to the lower reaches of T1 with riffle enhancement, step pools, and soil lifts providing grade control and bank protection in a newly-established meandering pattern.

6.3 Riparian Wetland Mitigation

Riparian mitigation will consist of a combination of wetland re-establishment, rehabilitation, and enhancement across the site's wetlands for a total of 6.023 acres. Wetland hydrology will be driven by seepage flow and overbank flooding that will support riparian wetlands along the restored streams.

Wetland restoration (re-establishment and rehabilitation) will improve 4.528 acres at HBCRS. Wetland re-establishment will restore wetland hydrology and vegetation to 3.040 acres of drained wetlands across the site, namely along the top of T1 Reach 1, throughout T2, a swale to the southeast of T3, and along the left bank of T1 Reach 2 and Reach 4. There are 1.488 acres of existing riparian wetland that will be improved as rehabilitation. These areas exist alongside the re-establishment wetlands, but have managed to maintain minimal wetland hydrology and vegetation. There are rehabilitation wetlands along the top of T1 Reach 1, along T2, T1 Reach 2 and Reach 4, and T3 Reach 2. Overall, these wetland restoration areas will be redeveloped by plugging surface ditches and reconnecting the wetlands to the floodplains of the newly restored stream channels. Overbank flooding will be one hydrologic source for the riparian wetlands in addition a shallow groundwater table, overland flow, and seepage from the adjacent uplands. Along T2 specifically, the existing eroding banks will be graded back to a stable angle and excess soil will be used to level out any remaining scour holes or deep spots. In addition, a combination of buried log sills and brush material will be used to stabilize the wetland grade and redistribute flow across the floodplain. Along T3 Reach 2, the re-establishment wetland will have a small berm removed that runs parallel to the stream and have minor wetland microtopography (+/- 0.5 foot based on average ground elevation) redeveloped to retain the hillside drainage that is currently running off quickly to the stream at a downstream point.

There will be 1.495 acres of wetland enhancement at the site located along the headwaters of T1 and along the forested section of T3. These wetlands have maintained woody vegetation and a more natural hydroperiod than other existing wetlands at the site, but will benefit from the treatment of invasive species and removal of debris and old fencing. Minor grading will remove spoil piles and flow obstructions into the enhanced wetlands. As available during construction, wood will be added to the wetlands and the stream floodplain for added habitat complexity, and to help store sediment, increase water storage/infiltration, and absorb energy during overbank events.

All of the project wetlands will have livestock exclusion fencing installed and be planted with a diverse riparian buffer as described in Section 6.8.

6.4 Crossings

There will be five culverted crossings at the HBCRS: two crossings on T1, one crossing at the top of T2, and two crossings on T3. All of these crossings will be fenced to exclude livestock and will have gates. These crossings are not included in the project easement.

6.5 Design Discharge Determination

KCI developed the design discharge values for the proposed streams by using a combination of on-site stable cross-sectional data and the Piedmont regional curve data (Harman et al 1999). Given that the timing and magnitude of the peak flows of two of the three headwater drainage areas (T1 and T2) are affected by upstream ponds, we adjusted the cross-sectional areas down by approximately 30% using indicators seen at the site. Table 6 below shows a comparison of the selected design discharge values.

Table 6. Summary of Project Discharge Values

Design Reach	Drainage Area (Acres)	Drainage Area (Sq Mi)	Piedmont Regional Curve		Proposed Project Values	
			XS Area (sf)	Q (cfs)	XS Area (sf)	Q (cfs)
T1 Reach 1	37.1	0.058	3.1	11	2.2	8
T1 Reach 2	76.4	0.119	5.1	19	4.0	14
T1 Reaches 3 & 5	132.0	0.206	7.3	29	6.0	20
T3 Reach 3	41.3	0.065	3.3	12	2.7	9

6.6 Sediment

The HBCRS project is fed by a series of headwater streams, two of which are ponded at the top. As a result, the sediment loading to the streams is limited in this portion of the watershed and the sediment regime will be supply-limited. Pebble counts were performed across the project streams and determined that the predominant material ranges from silt/clay to small gravel (pebble count data are provided in Appendix 12.2). Bank erosion is currently a contributing factor to the silt/clay and sand components of the streams. In general, the sediment range of the streams is expected to coarsen as there will be less fine material coming from the banks. At the heads of the project reaches, we anticipate there will be smaller-sized particles (small gravels and some sand) transitioning to larger gravels with limited cobble at the bottom of the site.

Based on the collected sediment and cross-sectional data, shear stress values were calculated using both average channel boundary shear stress and a modified critical shear stress (USDA, Forest Service 2008). The modified shear stress was calculated using the D84 values from field samples and compared to the average channel boundary shear stress based on the existing and proposed channel dimensions and slopes. There are certain sections of the project streams that have become overwidened due to cattle impacts with width to depth ratios ranging from 22 to 42 as seen in Appendix 12.2; in these instances, there may be an increase in average shear stress from the existing to proposed condition to produce a higher-functioning stream form with a narrower cross-section. The shear stress results are shown in the table below.

Table 7. Sediment Summary for Project Reaches

XS	Reach	Avg Shear Stress (lb/sf)	D50 (mm)	D84 (mm)	Sample Type	Modif. Critical Shear Stress (lb/sf)	Predicted Grain Size Movement (mm)
Existing	T1 Reach 1 XS A	0.45	0.062	4.9	PC	0.003	
Existing	T1 Reach 1 XS B	0.60	2.5	7.1	PC	0.045	
Existing	T1 Reach 2 XS C	0.29	2.1	8.2	PC	0.045	
Existing	T1 Reach 2 XS D	0.66	19	72	PC	0.448	
Existing	T1 Reach 3 XS E	0.36	7.4	37	PC	0.190	
Existing	T1 Reach 3 XS F	0.34	8.5	20	PC	0.166	
Existing	T1 Reach 4 XS G	0.20	2.3	8.8	PC	0.046	
Existing	T1 Reach 5 XS H	0.09	4.5	9.9	PC	0.081	
Existing	T2 XS A	0.34	0.062	9.0	PC	0.004	
Existing	T3 Reach 1 XS A	0.33	0.062	0.062	PC	0.001	
Existing	T3 Reach 2 XS B	0.12	0.062	1.0	PC	0.002	
Existing	T3 Reach 3 XS C	0.79	4.7	19	PC	0.103	
Proposed	T1 Reach 1	0.58	2.5	7.1	PC	0.045	44
Proposed	T1 Reach 2	0.51	19	72	PC	0.448	39
Proposed	T1 Reaches 3 - 5	0.34	4.5	9.9	PC	0.081	26
Proposed	T3 Reach 3	0.48	4.7	19	PC	0.103	36

Based on the calculated average channel boundary shear stress for the proposed channels, the stream will have adequate stream power to transport the existing D84 material during a bankfull event. However, since newly constructed, supply-limited headwater streams do not have a quick seeding of their riffles, we will install riffle reinforcement to protect the newly constructed riffles from excessive scour in the immediate post-construction period. Proposed riffle grade control structures have been designed with a mix of Class A and B stone with 30% native stream material; Class A (the smallest among Classes A and B) has a modified critical shear stress that is large enough to withstand all of the predicted average channel boundary stresses. The last column in Table 7 provides a predicted grain size that will move at the calculated modified critical shear stress for the proposed channel. The largest grain size predicted to be mobilized is 44 mm (1.7 inches). Given the mix of the constructed riffle, 106 mm equates to the midrange of the Class A Stone (approximately 4 in.). It can be expected that approximately 55% of the constructed riffle stone will be greater than this diameter. Additionally, our experience has revealed minimal movement of constructed riffle material when it is well mixed and placed in the stream bed in similar design conditions.

6.7 Morphological Essential Parameters Tables

Table 8. Morphological Essential Parameters for T1 Reach 1

Parameter	Existing Condition	Reference Condition	Proposed
Floodprone Belt Width (ft)	15	N/A	35-42
Contributing Drainage Area (acres)	37	Variable	37
Channel/Reach Classification	G4c	B4/C4	C4b
Design Discharge Width (ft)	5.2	N/A	5.4
Design Discharge Depth (ft)	0.5	N/A	0.4
Design Discharge Area (ft^2)	2.4	N/A	2.2
Design Discharge Velocity (ft/s)	3.5	N/A	3.6
Design Discharge (cfs)	8.6	N/A	8.0
Water Surface Slope	0.025	N/A	0.024
Sinuosity	1.0	1.1-1.3	1.2
Width/Depth Ratio	11.0	12-18	13.0
Bank Height Ratio	1.0	1.0-1.1	1.0
Entrenchment Ratio	2.9	2.2+	6.5-7.8
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	1.1/1.7/2.5/7.1/12/0.05/2.6	Gravel	Gravel

Table 9. Morphological Essential Parameters for T1 Reach 2

Parameter	Existing Condition	Reference Condition	Proposed
Floodprone Belt Width (ft)	12.6	N/A	42-56
Contributing Drainage Area (acres)	76	Variable	76
Channel/Reach Classification	G4	B4/C4	C4
Design Discharge Width (ft)	4.2	N/A	7.0
Design Discharge Depth (ft)	1.0	N/A	0.6
Design Discharge Area (ft^2)	4.2	N/A	4.0
Design Discharge Velocity (ft/s)	3.5	N/A	3.4
Design Discharge (cfs)	14.6	N/A	13.6
Water Surface Slope	0.015	N/A	0.015
Sinuosity	1.0	1.1-1.3	1.2
Width/Depth Ratio	4.5	12-18	12.2
Bank Height Ratio	1.2	1.0-1.1	1.0
Entrenchment Ratio	2.9	2.2+	6.0-8.0
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	0.6/3.1/19/72/120/-0.35/17.7	Gravel	Gravel

Table 10. Morphological Essential Parameters for T1 Reaches 3 – 5

Parameter	Existing Condition	Reference Condition	Proposed
Floodprone Belt Width (ft)	34-50	N/A	30-58
Contributing Drainage Area (acres)	132-158	Variable	132-158
Channel/Reach Classification	G4	B4/C4	C4
Design Discharge Width (ft)	19.3	N/A	8.6
Design Discharge Depth (ft)	0.5	N/A	0.7
Design Discharge Area (ft^2)	8.8	N/A	6.0
Design Discharge Velocity (ft/s)	2.6	N/A	3.3
Design Discharge (cfs)	22.7	N/A	19.8
Water Surface Slope	0.0034	N/A	0.0082
Sinuosity	1.0	1.1-1.3	1.14
Width/Depth Ratio	42.1	12-18	12.4
Bank Height Ratio	1.0	1.0-1.1	1.0
Entrenchment Ratio	2.6	2.2+	3.5-6.7
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	1.2/2/4.5/9.9/14/-0.12/3.0	Gravel	Gravel

Table 11. Morphological Essential Parameters for T3 Reach 3

Parameter	Existing Condition	Reference Condition	Proposed
Floodprone Belt Width (ft)	40-70	N/A	40-70
Contributing Drainage Area (acres)	41	Variable	41
Channel/Reach Classification	G4	C4	C4
Design Discharge Width (ft)	3.0	N/A	5.8
Design Discharge Depth (ft)	0.7	N/A	0.5
Design Discharge Area (ft^2)	2.1	N/A	2.7
Design Discharge Velocity (ft/s)	4.2	N/A	3.3
Design Discharge (cfs)	9.0	N/A	8.7
Water Surface Slope	0.024	N/A	0.017
Sinuosity	1.0	1.2-1.4	1.13
Width/Depth Ratio	4.2	10-15	12.7
Bank Height Ratio	1.3	1.0-1.1	1.0
Entrenchment Ratio	5.4	2.5+	5.2-6.9
d16 / d35 / d50 / d84 / d95 / dip / disp (mm)	1.1/2.6/4.7/19/75/-0.01/4.2	Gravel	Gravel

6.8 Planting

All unforested portions of the project easement will be planted to establish a forested riparian buffer. At a minimum, 17.4 acres will be reforested, but additional plantings may take place in the currently vegetated areas to ensure an adequate density across the site. The planting plan is shown in the attached project plan sheets (Appendix 12.1). Trees and shrubs will be planted at a density of 968 stems per acre (9 feet x 5 feet spacing) to achieve a mature survivability of 210 stems per acre after seven years. Woody vegetation planting will be conducted during dormancy. Species to be planted may consist of the following and any substitutions from the planting plan will be taken from this list:

Common Name	Scientific Name	Wetland Status (Eastern Mts & Piedmont)
River Birch	*Betula nigra*	FACW
American Persimmon	*Diospyros virginiana*	FAC
American Sycamore	*Platanus occidentalis*	FACW
Southern Red Oak	*Quercus falcata*	FACU
Swamp Chestnut Oak	*Quercus michauxii*	FACW
Pin Oak	*Quercus palustris*	FACW
Willow Oak	*Quercus phellos*	FAC

On the restored stream banks, live stakes will be used to provide natural stabilization. Species identified for live staking include:

Common Name	Scientific Name
Silky Dogwood	*Cornus amomum*
Black Willow	*Salix nigra*
Silky Willow	*Salix sericea*

Other native desirable species that have the potential to volunteer at the site or be used for planting substitutions towards the performance standard include other native oaks (*Quercus sp.*), native *Celtis* species (*Celtis sp.*), tulip poplar (*Liriodendron tulipifera*), native hickories (*Carya sp.*), native dogwoods (*Cornus sp.*), native elms (*Ulmus sp.*), black walnut (*Juglans nigra*), native *Nyssa* species (*Nyssa sp.*), and cottonwood (*Populus deltoides*).

A custom herbaceous seed mix composed of native species will also be developed and used to further stabilize the easement area as needed. Existing undesirable pasture grasses will be sprayed with herbicide and left fallow until full mortality is achieved. The areas will then be scarified or disked to break up any existing compaction prior to seeding and stabilizing with temporary and permanent seed mixes as prescribed in the project plans.

6.9 Project Assets

The tables below outline the anticipated project assets that will be produced from the HBCRS project, and Figure 8 shows the proposed mitigation assets for the site.

Table 12. Project Asset Table

Project Component -or- Reach ID	Existing Footage/ Acreage	Stationing	Restoration Footage or Acreage	Creditable Footage or Acreage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
T1 Reach 1	697	10+00 to 17+80	780	750	R	I	1:1	750.000	30' exception STA 13+12 to 13+42
T1 Reach 2	764	17+80 to 26+86	906	906	R	I	1:1	906.000	
T1 Reach 3	283	26+86 to 29+54	269	209	R	I	1:1	209.000	60' exception STA 27+77 to 28+37
T1 Reach 4	295	29+54 to 32+49	295	295	EII	N/A	2.5:1	118.000	
T1 Reach 5	400	32+49 to 37+01	452	452	R	I/II	1:1	452.000	
T3 Reach 1	310	300+00 to 303+10	310	280	EII	N/A	2.5:1	112.000	30' exception STA 301+57 to 301+87
T3 Reach 2	588	311+10 to 317+00	591	591	EII	N/A	2.5:1	236.400	
T3 Reach 3	505	317+00 to 322+73	573	543	R	I	1:1	543.000	30' exception STA 317+98 to 318+28
Riparian Enhancement	1.495	N/A	1.495	1.495	E	N/A	2.5:1	0.598	30' exception STA 13+12 to 13+42
Riparian Wetland Re-establishment	0	N/A	3.040	3.040	R (Re-est.)	N/A	1:1	3.040	
Riparian Wetland Rehabilitation	1.488	N/A	1.488	1.488	R (Rehab.)	N/A	1.5:1	0.992	

Table 13. Length and Summations by Mitigation Category

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)	Non-riparian Wetland (acres)	Buffer (square feet)
Restoration	2,860	4.528		
Enhancement		1.495		
Enhancement I				
Enhancement II	1,166			
Creation				
Preservation				
High Quality Preservation				

Table 14. Overall Assets Summary

Hip Bone Creek Restoration Site (Project ID - 100059)	
Overall Assets Summary	
Asset Category	Overall Credits
Stream	3,326.400
RP Wetland	4.630
NR Wetland	
Buffer	

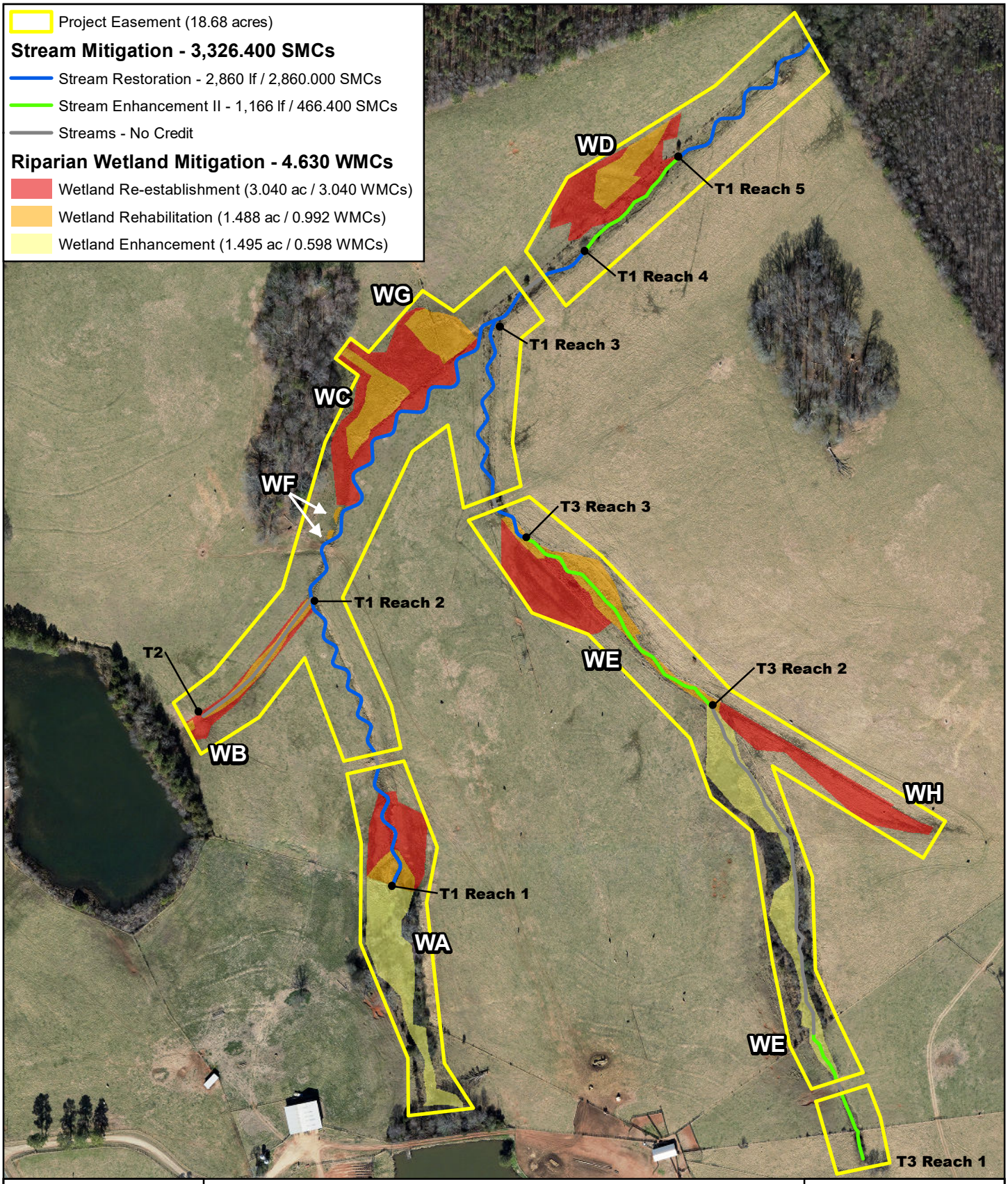

FIGURE 8. PROJECT ASSET MAP
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

7.0 PERFORMANCE STANDARDS

Monitoring of the site shall occur for a minimum of seven years following construction. The following performance standards for stream mitigation are based on the *Wilmington District Stream and Wetland Compensatory Mitigation Update* (NCIRT 2016) and will be used to judge site success.

Vegetation Performance
The site must achieve a woody stem density of320 stems/acre after three years, 260 stems/acre after five years, and 210 stems/acre after seven years to be considered successful. Trees in each plot must average 7 feet in height at Year 5 and 10 feet at Year 7. A single species may not account for more than 50% of the required number of stems within any plot. Volunteers that are included on the approved mitigation plan plant list must be present for a minimum of two growing seasons before being included in performance standards in Year 5 and Year 7. If monitoring indicates that any of these standards are not being met, corrective actions will take place.

Stream Hydrologic Performance
During the monitoring period, a minimum of four bankfull events must be recorded. These bankfull events must occur in separate monitoring years. Bankfull events will be verified using a minimum of two automatic stream monitoring gauges, one each on T1 and T3, to record daily stream depth readings. The project streams must also show a minimum of 30 continuous flow days within each calendar year (assuming normal precipitation). A "normal" year will be based on NRCS climatological data for Chatham County with the 30th to 70th percentile thresholds as the range of normal, as documented in the USACE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology, April 2000."

Stream Geomorphology Performance
The site's geomorphology for all reaches will be monitored per the NCIRT 2016 monitoring guidelines. The bank height ratio (BHR) should not exceed 1.2 and the entrenchment ratio (ER) must not fall below 2.2 for C and E channels. BHR and ER at any measured riffle cross-section should not change by more than 10% from the baseline condition during any given monitoring interval (e.g., no more than 10% between years 1 and 2, 2 and 3, 3 and 5, or 5 and 7). There will be an overall assessment for each reach to distinguish localized versus systemic concerns for that stream. Adjustment and lateral movement following construction and as the channel settles over the monitoring period are to be expected. Geomorphological measurements of cross-sections will be used to determine if any adjustments that occur are out of the range typically expected for this type of stream.

Wetland Hydrologic Performance
Wetland hydrology monitoring will be conducted to determine if the restored wetland areas meet the proposed performance criteria for wetland hydrology. The growing season for the project monitoring period will be April 2 through November 5 (217 days) based on the WETS table for Siler City 2 N Station in Siler City, NC. The site must present continuous saturated or inundated hydrologic conditions for at least 12% of the growing season (26 consecutive days) in the riparian wetlands during normal weather conditions. A "normal" year will be based on NRCS climatological data for Chatham County, and using the 30th to 70th percentile thresholds as the range of normal, as documented in the USACE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology, April 2000."

8.0 MONITORING PLAN

Monitoring of the HBCRS shall consist of the collection and analysis of stream and wetland hydrology, stream stability, and vegetation survivability data to support the evaluation of the project in meeting established performance standards described above. The Proposed Monitoring Plan in Figure 9 shows the proposed locations of monitoring features described below.

Vegetation Monitoring

Vegetation monitoring will take place between July 1st and leaf drop. Monitoring should occur later in the growing season to capture any effects of climatic or other conditions that may adversely affect vegetation survival. The success of the riparian and wetland plantings will be evaluated using eighteen 0.02-acre square or rectangular plots within the planted stream buffer. Ten plots will be permanently installed, while the remaining eight will be randomly placed at the time of each monitoring visit. Vegetation must be planted and plots established at least 180 days prior to the start of the first year of monitoring. The first monitoring event may take place no sooner than 180 days (6 months) after planting during the first growing season.

In the permanent plots, the plant's height, species, location, and origin (planted versus volunteer) will be noted. In the random plots, species and height will be recorded. In all plots, invasive stems will also be recorded to determine the percentage of invasive stems present. Additionally, a photograph will be taken of each plot. The site's vegetation will be monitored in years 1, 2, 3, 5, and 7.

Stream Hydrologic Monitoring

Bankfull events on-site will be verified using two automatic stream monitoring gauges on T1 Reach 5 and T3 Reach 3. A minimum of two additional gauges and/or recording devices such as cameras (set to record a photo or video a minimum of once per day) will be installed on the upper reaches of T1 and T3 to document the presence of flow.

Stream Geomorphology Monitoring

For stream monitoring, the purpose of monitoring is to evaluate the stability of the restored stream. Following the procedures established in the USDA Forest Service Manual, Stream Channel Reference Sites (Harrelson et al. 1994) and the methodologies utilized in the Rosgen stream assessment and classification system (1994 and 1996), data collected will consist of detailed dimension measurements, longitudinal profiles, and bed materials sampling.

<u>Dimension</u>

Sixteen permanent cross-sections will be established at the HSCMB, two sets of riffle and pool cross-sections on T1 Reach 1, two sets on T1 Reach 2, 1 set on T1 Reach 3, 1 set on T1 Reach 5, and 2 sets on T3 Reach 3. The extents of each cross-section will be recorded by either conventional survey or survey-grade GPS. The cross-sectional surveys shall provide a detailed measurement of the stream and banks and will include points on the adjacent floodplain or valley, at the top of bank, bankfull, at all breaks in slope, the edge of water, and thalweg. Width/depth, bank height and entrenchment ratios, as well as bankfull cross-sectional area, width, max depth and mean depth will be calculated for each riffle cross-section based on the survey data. The BHR will be measured by using a constant bankfull area over the monitoring period and adjusting the bankfull elevation each monitoring event based on how this area fits in the cross-sectional data. The revised bankfull elevation will then be used to calculate BHR along with the current

low bank height. Width/depth ratios, bankfull cross-sectional area, width, max depth and mean depth will be calculated for each pool cross-section. Cross-section measurements will take place in Years 1, 2, 3, 5, and 7.

Profile

A detailed longitudinal profile will be conducted along the lengths of T1 Reach 1, T1 Reach 2, T1 Reach 3, T1 Reach 5, and T3 Reach 3 during the as-built survey. Measurements will include slopes (average, pool, and riffle) as well as calculations of pool-to-pool spacing. No additional profile measurements will be taken during the monitoring period unless deemed necessary due to concerns about bed elevation adjustments.

Wetland Hydrologic Monitoring

Hydrologic performance will be determined through evaluation of automatic recording gauge data supplemented by documentation of wetland hydrology indicators as defined in the 1987 USACE Wetland Delineation Manual. Daily data will be collected and downloaded from the 8 automatic wells at a minimum frequency of once each quarter over the 7-year monitoring period following implementation.

Visual Assessment

An annual site walk will be conducted at the end of each monitoring period to document any problem areas. Specific problem areas could include low stem density or poor plant vigor, areas dominated by undesirable volunteer species, prolonged inundation, native and exotic invasive species, beaver activity, herbivory, encroachments, indicators of livestock access, or other areas of concern. The findings of the visual assessment as well as any recommended corrective actions for problem areas will be summarized in the monitoring reports by way of a Current Conditions Plan View (CCPV) figure.

Photograph reference points (PRPs) will be established to assist in characterizing the site and to allow qualitative evaluation of the site conditions. The location of each photo point will be marked in the monitoring plan and the bearing/orientation of the photograph will be documented to allow for repeated use. Photographs will also be takes annually at all stream crossings.

Reporting

Annual monitoring data will be reported using the most current DMS monitoring template. The monitoring report shall provide a project data chronology that will facilitate an understanding of project status and trends, population of DMS databases for analysis, research purposes, and assist in decision making regarding project close-out. The report will document the monitored components and include all collected data, analyses, and photographs. The first scheduled monitoring will be conducted during the first full growing season following project completion. The site will be monitored for performance standards for seven years as needed after completion of construction. Full monitoring reports will be completed in Years 1, 2, 3, 5, and 7. Limited monitoring reports (CCPV, photos, gauge data, and site narrative) will be submitted in Years 4 and 6.

Table 15. Monitoring Requirements

Hip Bone Creek Restoration Site				
Required	**Parameter**	**Quantity**	**Frequency**	**Notes**
Yes	Pattern and Profile	T1 Reaches 1-3 and Reach 5; T3 Reach 3	Once, during as-built survey	Additional measurements in later years may be taken as necessary.
Yes	Stream Dimension	16 cross-sections (8 riffles, 8 pools)	Monitoring Years 1, 2, 3, 5, and 7	
Yes	Stream Hydrology	2 pressure transducer gauges	Annual – throughout year	Includes flow documentation on T1 Reach 1 and T3 Reach 1
Yes	Wetland Hydrology	8 pressure transducer gauges	Annual – throughout year	
Yes	Vegetation	10 permanent and 8 random vegetation monitoring plots	Monitoring Years 1, 2, 3, 5, and 7	Minimum size of 0.02 acre
Yes	Visual Assessment		Annual	
Yes	Exotic and nuisance vegetation		Annual	Locations of exotic and nuisance vegetation will be mapped
Yes	Project boundary		Semi-annual	Locations of vegetation damage, boundary encroachments, etc. will be mapped

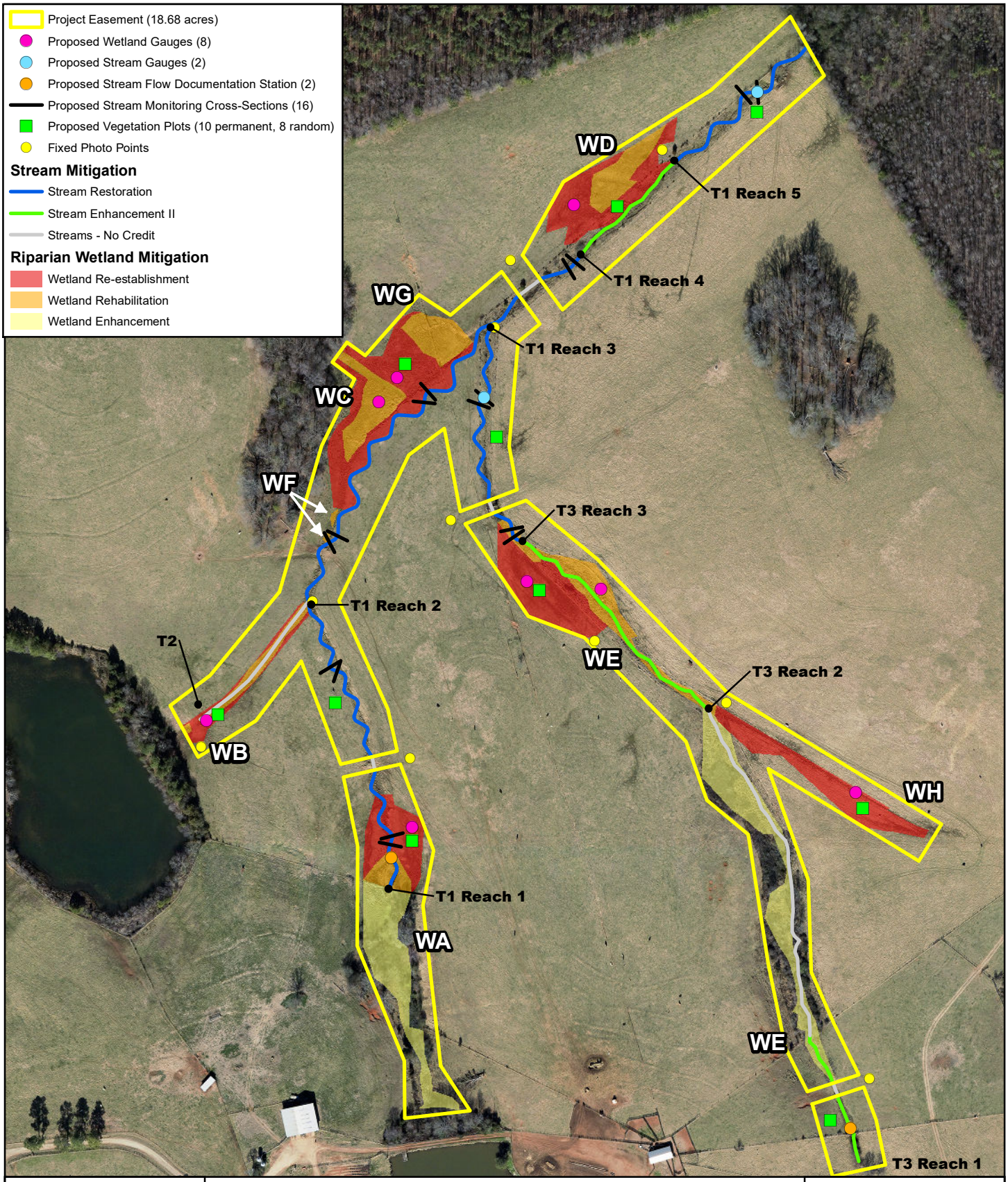

FIGURE 9. PROPOSED MONITORING
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

9.0 ADAPTIVE MANAGEMENT PLAN

In the event the mitigation site or a specific component of the mitigation site fails to achieve the necessary performance standards as specified in the mitigation plan, KCI shall notify DMS and members of the IRT and work with these two organizations to develop contingency plans and remedial actions.

10.0 LONG-TERM MANAGEMENT PLAN

HBCRS will be transferred to the 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 fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

11.0 REFERENCES

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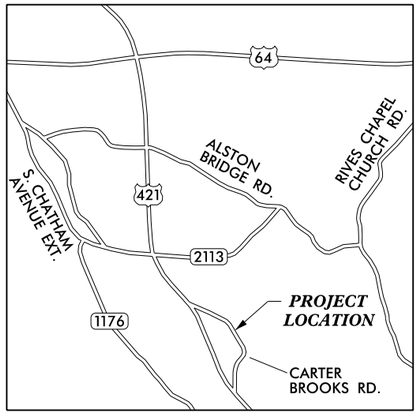
12.0 APPENDICES

12.1 Plan Sheets

KCI JOB# : 161802913

CONTRACT #: 7528



VICINITY MAP
NOT TO SCALE

NCDEQ DIVISION OF MITIGATION SERVICES

STATE	CONTRACT NUMBER	SHEET NO.	TOTAL SHEETS
N.C.	7528	1	26

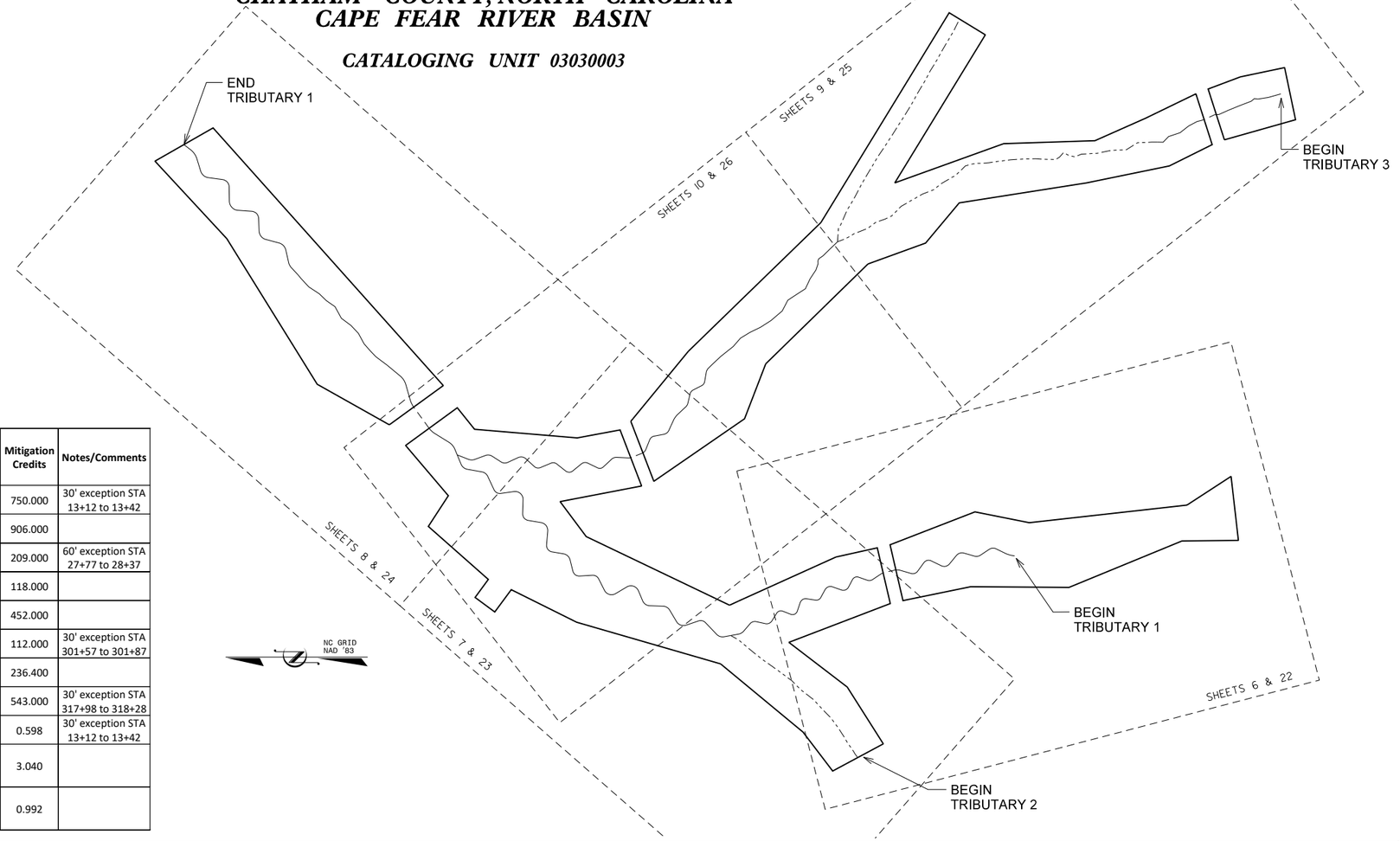
	REVISED PER IRT COMMENTS	MARCH 2020
A		

REVISIONS

HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA
CAPE FEAR RIVER BASIN

CATALOGING UNIT 03030003



Project Component -or- Reach ID	Existing Footage/ Acreage	Stationing	Restoration Footage or Acreage	Creditable Footage or Acreage	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits	Notes/Comments
T1 Reach 1	697	10+00 to 17+80	780	750	R	I	1:1	750.000	30' exception STA 13+12 to 13+42
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T1 Reach 5	400	32+49 to 37+01	452	452	R	I/II	1:1	452.000	
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T3 Reach 2	588	311+09 to 317+00	591	591	EII	N/A	2.5:1	236.400	
T3 Reach 3	505	317+00 to 322+73	573	543	R	I	1:1	543.000	30' exception STA 317+98 to 318+28
Riparian Enhancement	1.495	N/A	1.495	1.495	E	N/A	2.5:1	0.598	30' exception STA 13+12 to 13+42
Riparian Wetland Re-establishment	0	N/A	3.040	3.040	R (Re-est.)	N/A	1:1	3.040	
Riparian Wetland Rehabilitation	1.488	N/A	1.488	1.488	R (Rehab.)	N/A	1.5:1	0.992	

DIRECTIONS TO SITE

FROM RALEIGH, TAKE US–1 SOUTH TO SANFORD. FOLLOW US–421 NORTH FOR ABOUT 17 MILES. TAKE A RIGHT ONTO GILMORE LODGE ROAD AND THEN A QUICK LEFT ONTO CARTER BROOKS ROAD. THE ENTRANCE DRIVE TO THE SITE IS ABOUT 0.8 MILE ON THE RIGHT.

INDEX OF SHEETS

TOTAL DISTURBED AREA = 19.19 ACRES

Prepared In the Office of:

KCI ASSOCIATES OF NC
ENGINEERS•PLANNERS•ECOLOGISTS
4505 FALLS OF NEUSE ROAD
SUITE 400
RALEIGH, NC 27609

Prepared for:

JEREMIAH DOW
DMS PROJECT MANAGER

Prepared by:

KRISTIN E. KNIGHT, PE
PROJECT ENGINEER

ALEX FRENCH
PROJECT DESIGNER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

P.E.

SIGNATURE:

GENERAL NOTES:

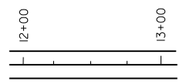
BEARINGS AND DISTANCES:
ALL BEARINGS ARE NAD 1983 GRID BEARINGS.
ALL DISTANCES AND COORDINATES SHOWN ARE HORIZONTAL (GROUND) VALUES.

UTILITY/SUBSURFACE PLANS:
NO SUBSURFACE PLANS ARE AVAILABLE ON THIS PROJECT.
EXISTING UNDERGROUND UTILITIES HAVE NOT BEEN VERIFIED.
THE CONTRACTOR IS RESPONSIBLE FOR CONTACTING A UTILITY LOCATOR AND ESTABLISHING THE EXACT LOCATION OF ANY AND ALL EXISTING UTILITIES IN THE PROJECT REACH.

CONTROL POINTS:

DESC.	NORTHING	EASTING	ELEV.
KCI 1	701625.776	1879718.481	629.123
KCI 2	701712.510	1879894.609	620.127
KCI 3	703752.172	1880314.628	540.939
KCI 4	704181.547	1880806.777	532.724
KCI 202	702248.618	1880085.473	581.800
KCI 2350	703084.707	1879381.782	593.723
KCI 2351	703437.593	1879194.325	609.394
KCI 3435	703364.309	1880175.674	544.562
KCI 3436	703124.279	1880429.116	557.758
KCI 6002	702695.204	1880923.665	577.314
KCI 6003	702695.185	1880923.664	577.213
KCI#10	702505.739	1879903.024	565.361
KCI#100	701885.646	1879944.050	605.221
KCI#102	701794.917	1880025.244	589.289
KCI#103	702563.769	1880201.336	582.528
KCI#104	703216.841	1879915.611	548.797
KCI#200	702027.681	1879960.307	586.037
KCI#201	702237.354	1879919.112	573.010
KCI#3663	703823.793	1880637.218	535.592
KCI#500	704124.913	1880920.594	530.633
KCI#501	702059.895	1879526.613	602.454
KCI#6004	702240.237	1881738.082	589.735
NAIL	702314.807	1881004.095	580.642
NAIL	702075.698	1881012.716	596.288
NAIL	701963.876	1881026.834	598.080
NAIL	702358.703	1881777.430	582.919

PROJECT LEGEND:

Proposed Thalweg w/Approximate Bankfull Limits ..... 

Proposed Riffle Enhancement ..... 

Proposed Riffle Grade Control ..... 

Proposed Step Pool ..... 

Proposed Live Lift ..... 

Floodplain Grading Extents ..... 

Existing Channel to be Filled ..... 

A Proposed Buried Brush Material and Log Sill ..... 

Minor Contour Line (1ft.) .....

Major Contour Line (5ft.) 720

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS			
SYM.	DESCRIPTION	DATE	
	REVISIONS PER IRT COMMENTS	MAR 2020	

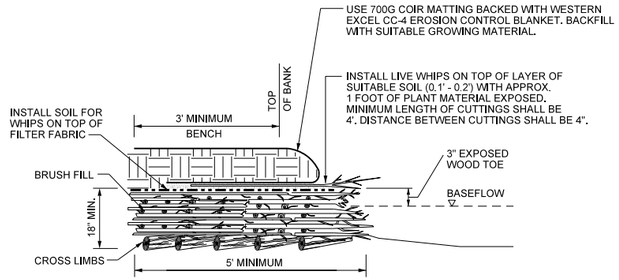
NCDEQ – DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: N.T.S.

GENERAL NOTES & PROJECT LEGEND



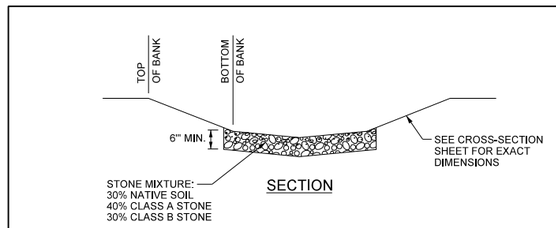
SECTION (WOOD BASE)

NOTES:

ALL LIFTS WILL BE BUILT WITH ONE LAYER. THICKNESS OF LAYER DEPENDENT ON TYPICAL CROSS-SECTION OF GIVEN REACH.

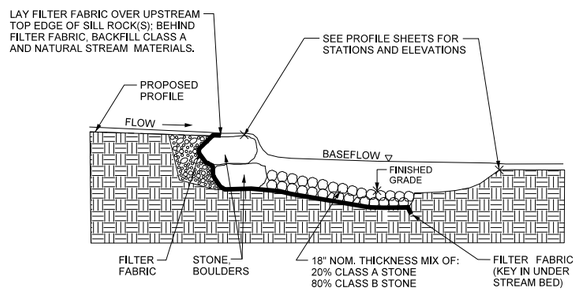
USE 1.5'x1"x2" WOODEN STAKES ON 2' CENTERS. STAKES SHALL HAVE A 'ROOFING' NAIL AT TOP TO KEEP FABRIC FROM SLIPPING OFF.

LIVE LIFT
SCALE: NTS



SECTION

RIFFLE ENHANCEMENT
SCALE: NTS



PROFILE VIEW

NOTES:

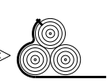
FOR DOUBLE STEP POOLS, CONTINUE ROCK MIXTURE FROM FIRST SILL ALL THE WAY TO THE SECOND SILL. DO NOT STOP AT THE 6FT MINIMUM AS SHOWN IN THE SINGLE STEP POOL PLAN VIEW.

BOULDERS SHOULD BE NATIVE STONES OR SHOT ROCK, ANGULAR AND OBLONG, WITH AN AXIS APPROXIMATELY 3' L x 2' W x 1.5' D.

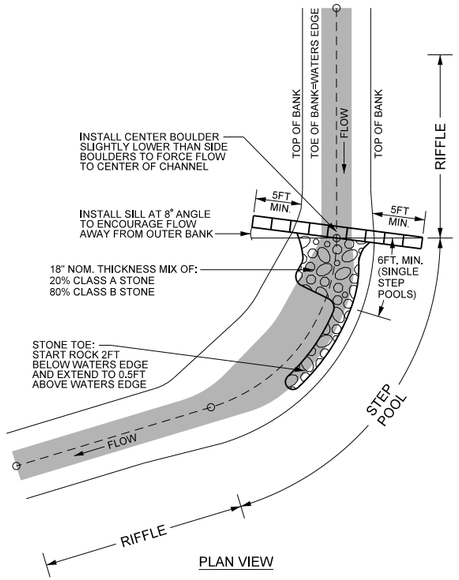
BOULDER SILLS TO EXTEND 5' MINIMUM INTO STREAM BANKS FOR STEP POOL STRUCTURES.

STONE INSTALLATION: START BY INSTALLING STONE MIXTURE, THEN ADD SURGE STONE TO FILL IN VOIDS. FINISH BY WASHING IN NATURAL STREAM MATERIAL TO OBTAIN FINAL GRADE.

IF APPROVED BY DESIGNER, BOULDER SILLS CAN BE REPLACED WITH LIVE HARDWOOD LOGS FOUND ON SITE. LOGS MUST BE A MINIMUM OF 10" DIAMETER AND STACKED IN A TRIANGLE FORMATION. NAIL (WITH PLASTIC WASHER) FILTER FABRIC TO THE TOP LOG AND CONTINUE DOWN AND UNDER STRUCTURE AS SHOWN ON STEP POOL DETAIL.

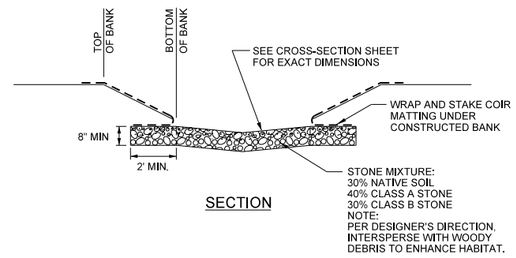


LOG SILL

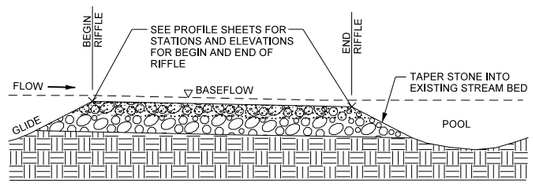


PLAN VIEW

STEP POOL
SCALE: NTS



SECTION



PROFILE

STONE INSTALLATION:

START BY INSTALLING STONE MIXTURE. FINISH BY WASHING IN NATURAL STREAM BED MATERIAL TO FILL IN VOIDS AND OBTAIN FINAL GRADE.

BEFORE REINTRODUCING FLOW INTO STREAM, ENSURE THAT ALL VOIDS ARE FILLED WITH NATIVE SOIL TO ELIMINATE PIPING THROUGH STONE MIXTURE.

RIFFLE GRADE CONTROL
SCALE: NTS

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

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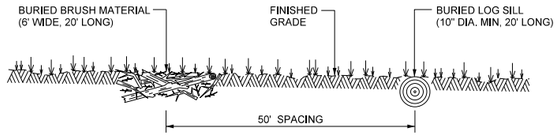
DETAILS

SHEET 3 OF 26



PROFILE VIEW

TRIBUTARY 2 AND WETLAND EAST OF TRIBUTARY 3 :

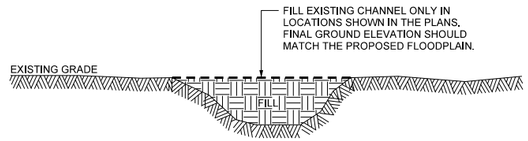
BURIED WOODY DEBRIS IS MEANT TO ADD HABITAT AND STABILIZATION THROUGHOUT REACH.

LOG SILLS AND BRUSH MATERIAL TO BE INSTALLED AT APPROX 50' SPACING. SEE PLAN SHEETS FOR QUANTITY AND LOCATIONS.

FINISHED GRADE OF ALL WOODY MATERIAL SHOULD MATCH THE SURROUNDING GROUND ELEVATION.

A BURIED BRUSH MATERIAL AND LOG SILL

SCALE: NTS



CHANNEL CROSS-SECTION VIEW

NOTES:

ALL CHANNEL FILL EARTH SHALL BE FREE OF VEGETATION AND ANY OTHER DEBRIS.

CONTRACTOR SHALL COMPACT FILL WITH TRACKS AND BUCKET TO ENSURE ALL VOIDS ARE ELIMINATED.

BEFORE SEEDING AND MULCHING, CONTRACTOR SHALL ROUGHEN SURFACE TO AID IN GERMINATION.

A CHANNEL FILL DETAIL

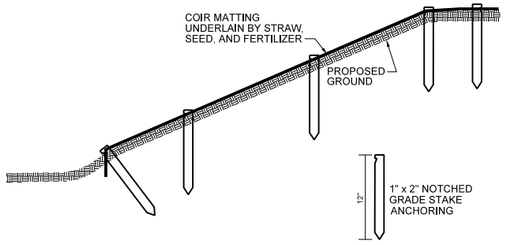
SCALE: NTS

NOTES:

-MATTING SHALL BE INSTALLED PRIOR TO THE INTRODUCTION OF WATER TO A STREAM SECTION.

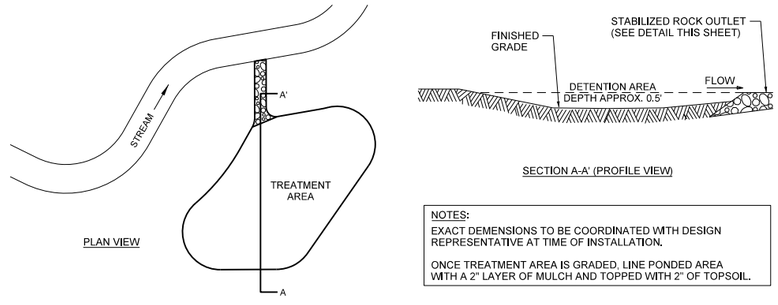
-MATTING SHALL BE INSTALLED ALONG BOTH SIDES OF NEW STREAM LENGTH.

-MATTING SHALL EXTEND FROM TOE OF SLOPE TO THE TOP OF BANK.



COIR MATTING

SCALE: NTS



PLAN VIEW

SECTION A-A' (PROFILE VIEW)

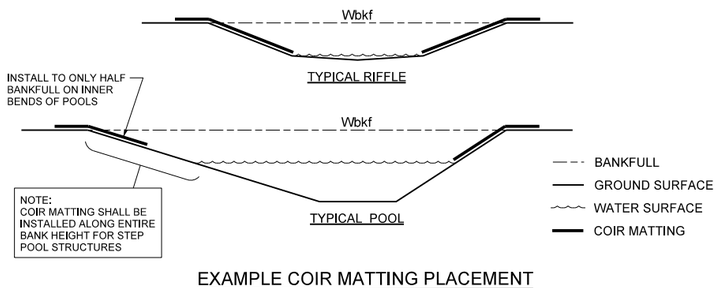
NOTES:

EXACT DEMENSIONS TO BE COORDINATED WITH DESIGN REPRESENTATIVE AT TIME OF INSTALLATION.

ONCE TREATMENT AREA IS GRADED, LINE PONDED AREA WITH A 2" LAYER OF MULCH AND TOPPED WITH 2" OF TOPSOIL.

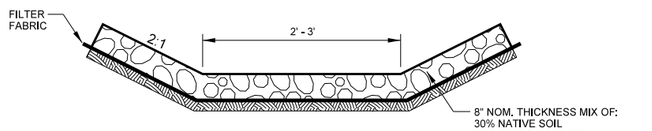
WATER QUALITY TREATMENT AREA

SCALE: NTS



EXAMPLE COIR MATTING PLACEMENT

SCALE: NTS



STONE INSTALLATION:

START BY INSTALLING STONE MIXTURE. FINISH BY WASHING IN NATURAL STREAM BED MATERIAL TO FILL IN VOIDS AND OBTAIN FINAL GRADE.

STABILIZED ROCK OUTLET

SCALE: NTS

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS

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1	REVISIONS PER IRT COMMENTS	MAR 2020

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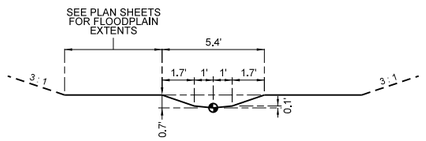
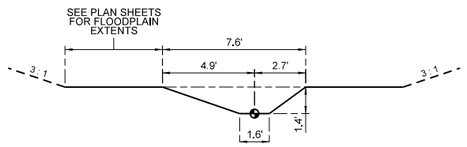
DETAILS

SHEET 4 OF 26

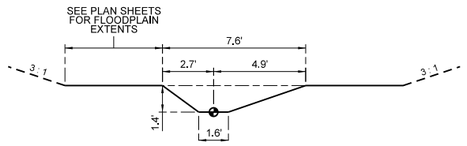
T1-REACH 1 - STATION 10+00 TO 17+80
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

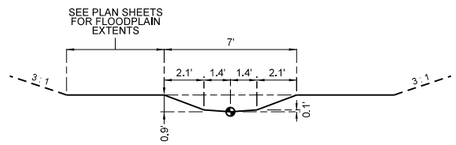


TYPICAL POOL - RIGHT MEANDER

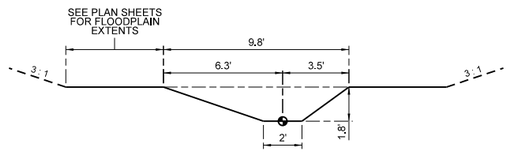


TYPICAL POOL - LEFT MEANDER

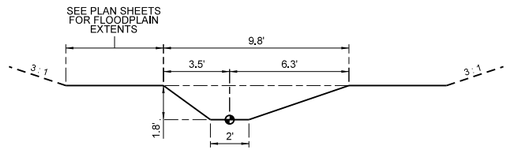
T1-REACH 2 - STATION 17+80 TO 26+86
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION

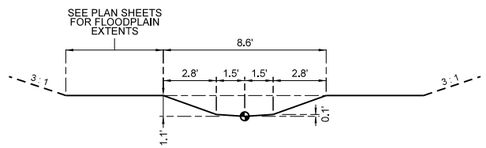


TYPICAL POOL - RIGHT MEANDER

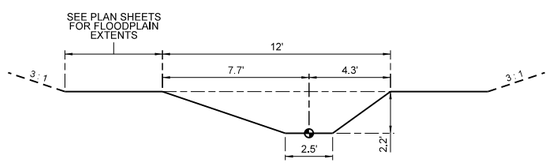


TYPICAL POOL - LEFT MEANDER

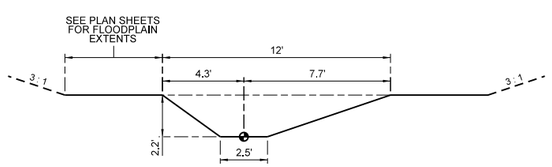
T1-REACH 3 - STATION 26+86 TO 37+01
"C4" STREAM TYPE



TYPICAL RIFFLE
= THALWEG LOCATION



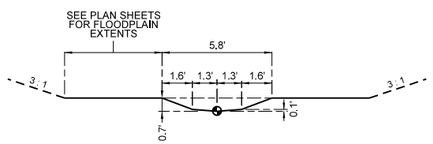
TYPICAL POOL - RIGHT MEANDER



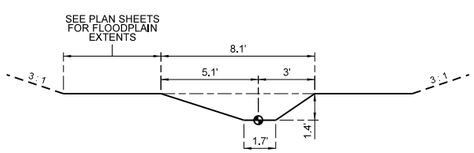
TYPICAL POOL - LEFT MEANDER

T3 - STATION 315+22 TO 322+73
"C4" STREAM TYPE

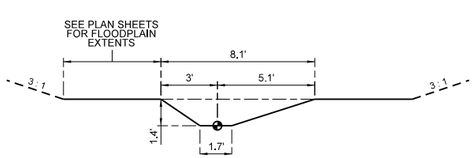
NOTE:
RIFFLE CROSS-SECTION ONLY FROM STATION 315+22 TO 317+00



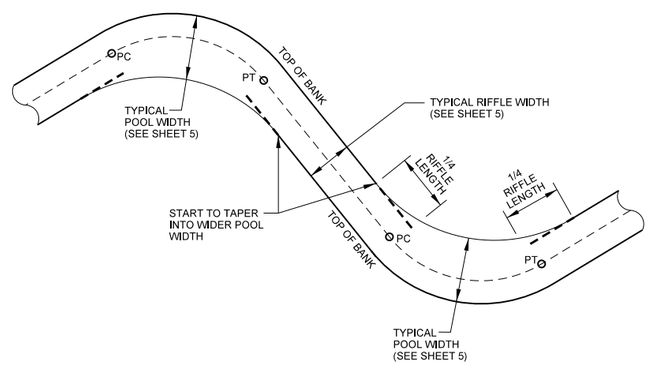
TYPICAL RIFFLE
= THALWEG LOCATION



TYPICAL POOL - RIGHT MEANDER



TYPICAL POOL - LEFT MEANDER



NOTE:

GRADING TRANSITIONS FROM THE SMALLER RIFFLE CROSS-SECTION WIDTH TO THE WIDER POOL CROSS-SECTION WIDTH SHALL START APPOXIMATLY 1/4 OF THE TOTAL LENGTH OF THE RIFFLE AT THE INNER BENDS.

TYPICAL RIFFLE-POOL TRANSITION GUIDANCE

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

−4′ −2′ 0′ 4′ 8′
GRAPHIC SCALE

NO.	DESCRIPTION	DATE
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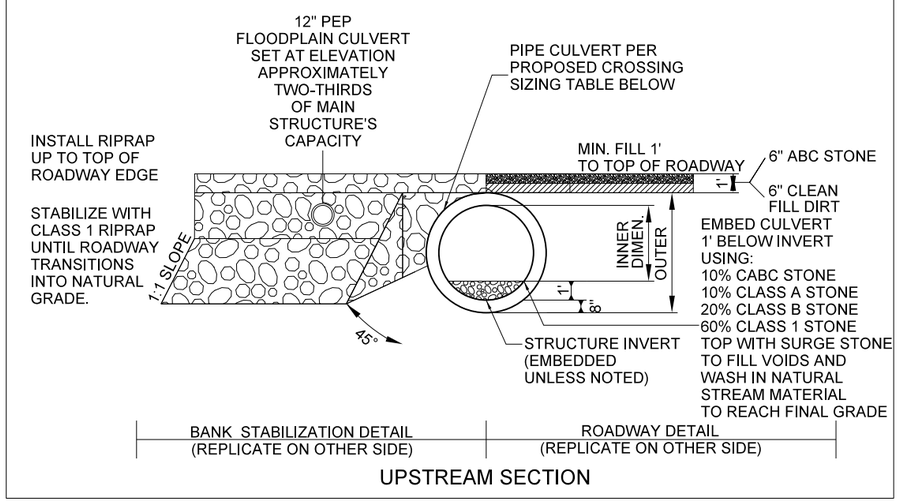
DATE: NOV 2019
SCALE: SEE SHEET

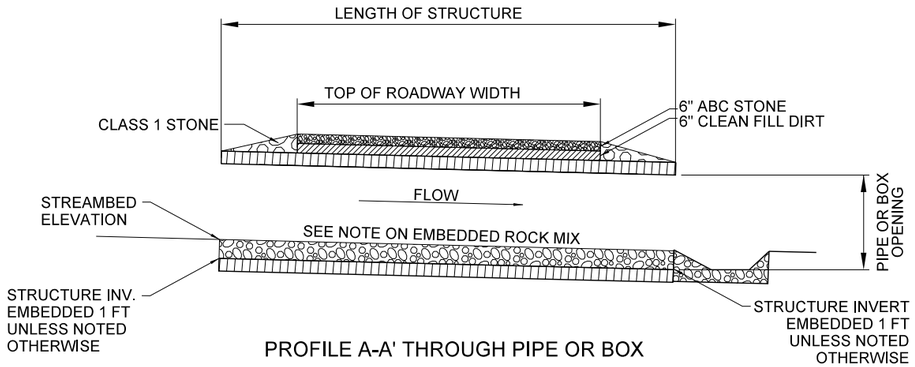
TYPICAL CROSS-SECTIONS

TYPICAL CROSSING - CROSS-SECTIONAL VIEW



UPSTREAM SECTION

TYPICAL CROSSING - PROFILE VIEW



PROFILE A-A' THROUGH PIPE OR BOX

PROPOSED CROSSING SIZING								
PROJECT REACH	WIDTH OF ROADWAY (FT)	APPROX. TOP OF ROADWAY ELEVATION (FT)	PROPOSED STRUCTURE (ALL EMBEDDED 1 FT BELOW STREAM THALWEG UNLESS NOTED)	LENGTH OF PROPOSED STRUCTURE (FT)	UPSTREAM ELEVATIONS (FT) STREAM BED / EMBEDDED STRUCTURE	DOWNSTREAM ELEVATIONS (FT) STREAM BED / EMBEDDED STRUCTURE	UPSTREAM STRUCTURE STATION	DOWNSTREAM STRUCTURE STATION
T1 Upper	12	567.1	48" HDPE	24	562.45 stream / 561.45 emb	562.09 stream / 561.09 emb	13+15.04	13+39.04
T1 Lower	15	542.5	60" HDPE	30	536.78 stream / 535.78 emb	536.13 stream / 535.13 emb	27+92.26	28+22.26
T2	12	562.4	36" HDPE	24	558.71 stream / 557.71 emb	557.86 stream / 556.86 emb	N/A	N/A
T3 Upper	12	593.0	36" HDPE	24	589.30 stream / 588.30 emb	588.56 stream / 587.56 emb	301+60.49	301+84.49
T3 Lower	12	551.5	48" HDPE	24	546.78 stream / 545.78 emb	546.60 stream / 545.60 emb	318+00.49	318+24.49

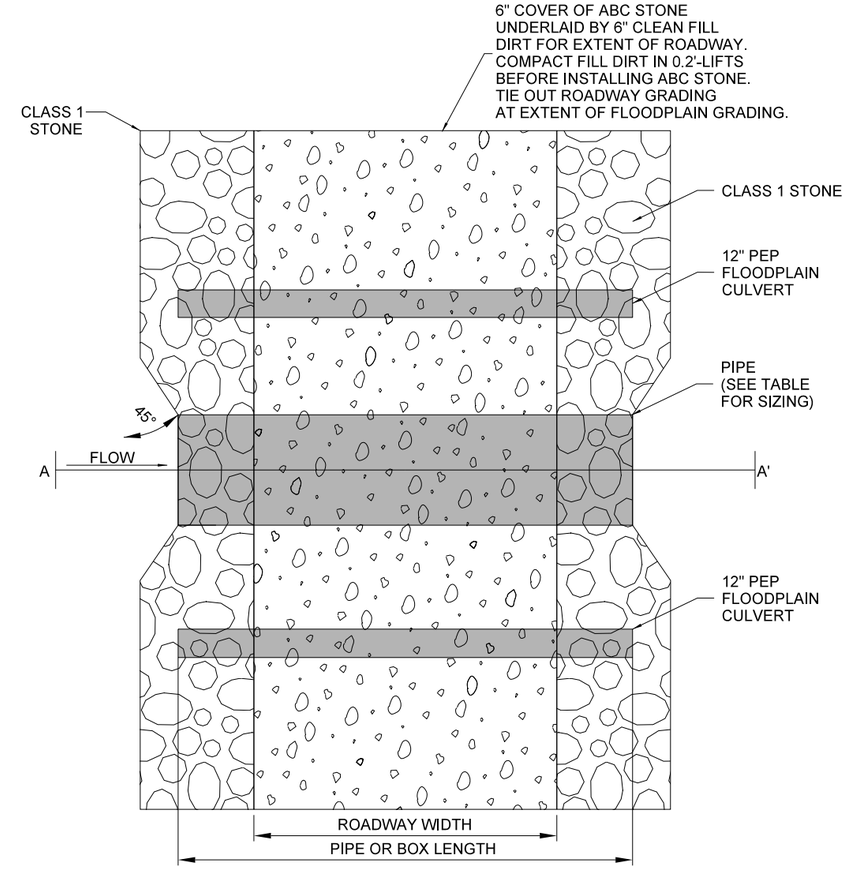
NOTES:

CULVERT THICKNESSES ASSUMED TO BE 8". ACTUAL THICKNESSES TO BE DETERMINED BY FABRICATOR.

DESIGN ROADWAY FILL IS A MINIMUM OF 1.0' AT ALL CROSSINGS.

IN LIEU OF WINGWALLS SEE RIPRAP PROTECTION/STABILIZATION.

TYPICAL CROSSING - PLANVIEW



NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

A	UPDATED CULVERT INFORMATION		MARCH 2020
		DESCRIPTION	DATE

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HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019

SCALE: NOT TO SCALE

CULVERT DETAILS

EXISTING GRAVEL DRIVE CONTINUES TO CARTER BROOKS ROAD

BARN

EXISTING WATER LINE TO BE RELOCATED THROUGH TRIBUTARY 2 CROSSING (APPROX. LOCATION)

TEMPORARY ACCESS PATH TO BE ENHANCED AS NEEDED

EXISTING GRAVEL DRIVE

EXISTING CONCRETE DEBRIS AND ABANDONED MATERIALS TO BE REMOVED FROM EASEMENT

EXISTING WETLAND 'WA'

CONSERVATION EASEMENT

BEGIN TRIBUTARY 1

PROPOSED FLOODPLAIN GRADING EXTENTS

PROPOSED 'LIVE LIFT'. SEE DETAIL SHEET.

FILL EXISTING CHANNEL (TYPICAL ALL HATCHING)

CONSERVATION EASEMENT

MATCHLINE - SEE SHEET 7

10+00 11+00 12+00 13+00 14+00 15+00

STABILIZE INCOMING DRAINAGE WITH ROCK OUTLET. SEE DETAIL SHEET.

EXISTING CATTLE PATH TO BE FILLED AND GRADED TO DISPERSE INCOMING DRAINAGE THROUGHOUT WETLAND

CONSERVATION EASEMENT

CONSERVATION EASEMENT

PROPOSED 'STEP POOL'. SEE DETAIL SHEET.

PROPOSED 'RIFFLE ENHANCEMENT'. SEE DETAIL SHEET.

PROPOSED 'RIFFLE GRADE CONTROL'. SEE DETAIL SHEET.

PROPOSED 12' WIDE ACCESS DRIVE

(1) 48" DIA. x 24' LONG HDPE STREAM CULVERT - 1' EMBEDDED
(2) 12" DIA., 24' LONG FLOODPLAIN CULVERTS (PEP)

TEMPORARY ACCESS PATH TO BE ENHANCED AS NEEDED

A ADD WOODY DEBRIS TO THE FLOODPLAIN AND WETLANDS AS AVAILABLE, BASED ON DIRECTION FROM THE DESIGNER.

NC GRID NAD '83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

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CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

SITE PLAN

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

NC GRID NAD '83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

⚠A ADD WOODY DEBRIS TO THE FLOODPLAIN AND WETLANDS AS AVAILABLE, BASED ON DIRECTION FROM THE DESIGNER.

EXISTING CATTLE DRINKER

EXISTING WATER LINE TO BE RELOCATED THROUGH TRIBUTARY 2 CROSSING (APPROX. LOCATION)

WIDEN EXISTING BANKS BACK TO FLOODPLAIN EXTENTS BOUNDARY AND TIE OUT AT A 3:1 SLOPE. USE EXCAVATED MATERIAL TO FILL IN EXCESSIVE VOIDS THROUGHOUT WETLAND PER DESIGNER DIRECTION.

PROPOSED 12' WIDE ACCESS DRIVE

(1) 36" DIA. x 24' LONG HDPE STREAM CULVERT - 1' EMBEDDED

PROPOSED 'LIVE LIFT'. SEE DETAIL SHEET.

REDIRECT AND STABILIZE INCOMING DRAINAGE WITH ROCK OUTLET. SEE DETAIL SHEET.

CONSERVATION EASEMENT

BEGIN TRIBUTARY 2

EXISTING WETLAND 'WB'

LOG SILLS AND BRUSH MATERIAL TO BE INSTALLED EVERY 50' TO AID IN STABILIZATION.

BURIED LOG SILL (10" DIA. MIN, 20' LONG)

BURIED BRUSH MATERIAL (6' WIDE, 20' LONG)

16+00

17+00

18+00

19+00

20+00

21+00

22+00

23+00

24+00

25+00

MATCHLINE - SEE SHEET 6 FOR TRIBUTARY 1

EXISTING WETLAND 'WF'

FILL EXISTING DITCH AND GRADE PER DESIGNER DIRECTION TO DISPERSE FLOW THROUGHOUT WETLAND. IF NEEDED, STABILIZE STREAM CONFLUENCE WITH ROCK OUTLET.

EXISTING WETLAND 'WC'

PROPOSED FLOODPLAIN GRADING EXTENTS

PROPOSED 'RIFFLE ENHANCEMENT'. SEE DETAIL SHEET.

PROPOSED 'STEP POOL'. SEE DETAIL SHEET.

PROPOSED 'RIFFLE GRADE CONTROL'. SEE DETAIL SHEET.

FILL EXISTING CHANNEL (TYPICAL ALL HATCHING)

MATCHLINE - SEE SHEET 7

CONSERVATION EASEMENT

319+00

320+00

PROPOSED 12' WIDE ACCESS DRIVE

318+00

(1) 48" DIA. x 24' LONG HDPE STREAM CULVERT - 1' EMBEDDED
(2) 12" DIA., 24' LONG FLOODPLAIN CULVERTS (PEP)

317+00

EXISTING WETLAND 'WE'

MATCHLINE - SEE SHEETS 9 AND 10 FOR TRIBUTARY 3

⚠	DESCRIPTION	DATE
	REVISIONS PER IRT COMMENTS	MAR 2020

REVISIONS

NCDEQ – DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

SITE PLAN

SHEET 7 OF 26

A ADD WOODY DEBRIS TO THE FLOODPLAIN AND WETLANDS AS AVAILABLE, BASED ON DIRECTION FROM THE DESIGNER.

NC GRID NAD 83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

EXISTING WETLAND 'WG'

FILL EXISTING DITCH AND GRADE PER DESIGNER DIRECTION TO DISPERSE FLOW THROUGHOUT WETLAND. IF NEEDED, STABILIZE STREAM CONFLUENCE WITH ROCK OUTLET.

CONSERVATION EASEMENT

EXISTING WETLAND 'WD'

FILL EXISTING DITCHES AND GRADE PER DESIGNER DIRECTION TO DISPERSE FLOW THROUGHOUT WETLAND

SPOIL PILE TO BE REMOVED

RESTORATION

ENHANCEMENT II

PROPOSED 'RIFFLE ENHANCEMENT'. SEE DETAIL SHEET.

PROPOSED 'LIVE LIFT'. SEE DETAIL SHEET.

END TRIBUTARY 3

MATCHLINE - SEE SHEET 7 FOR TRIBUTARY 1 / SEE SHEETS 9-10 FOR TRIBUTARY 3

PROPOSED 15' WIDE ACCESS DRIVE

PROPOSED 'STEP POOL'. SEE DETAIL SHEET.

PROPOSED 'RIFFLE GRADE CONTROL'. SEE DETAIL SHEET.

(1) 60" DIA. x 30' LONG HDPE STREAM CULVERT - 1' EMBEDDED
(2) 18" DIA., 30' LONG FLOODPLAIN CULVERTS (PEP)

PROPOSED 'WATER QUALITY TREATMENT AREA'. SEE DETAIL SHEET.

FILL EXISTING CHANNEL (TYPICAL ALL HATCHING)

PROPOSED FLOODPLAIN GRADING EXTENTS

END TRIBUTARY 1

REVISIONS	DESCRIPTION	DATE
1	REVISIONS PER IRT COMMENTS	MAR 2020

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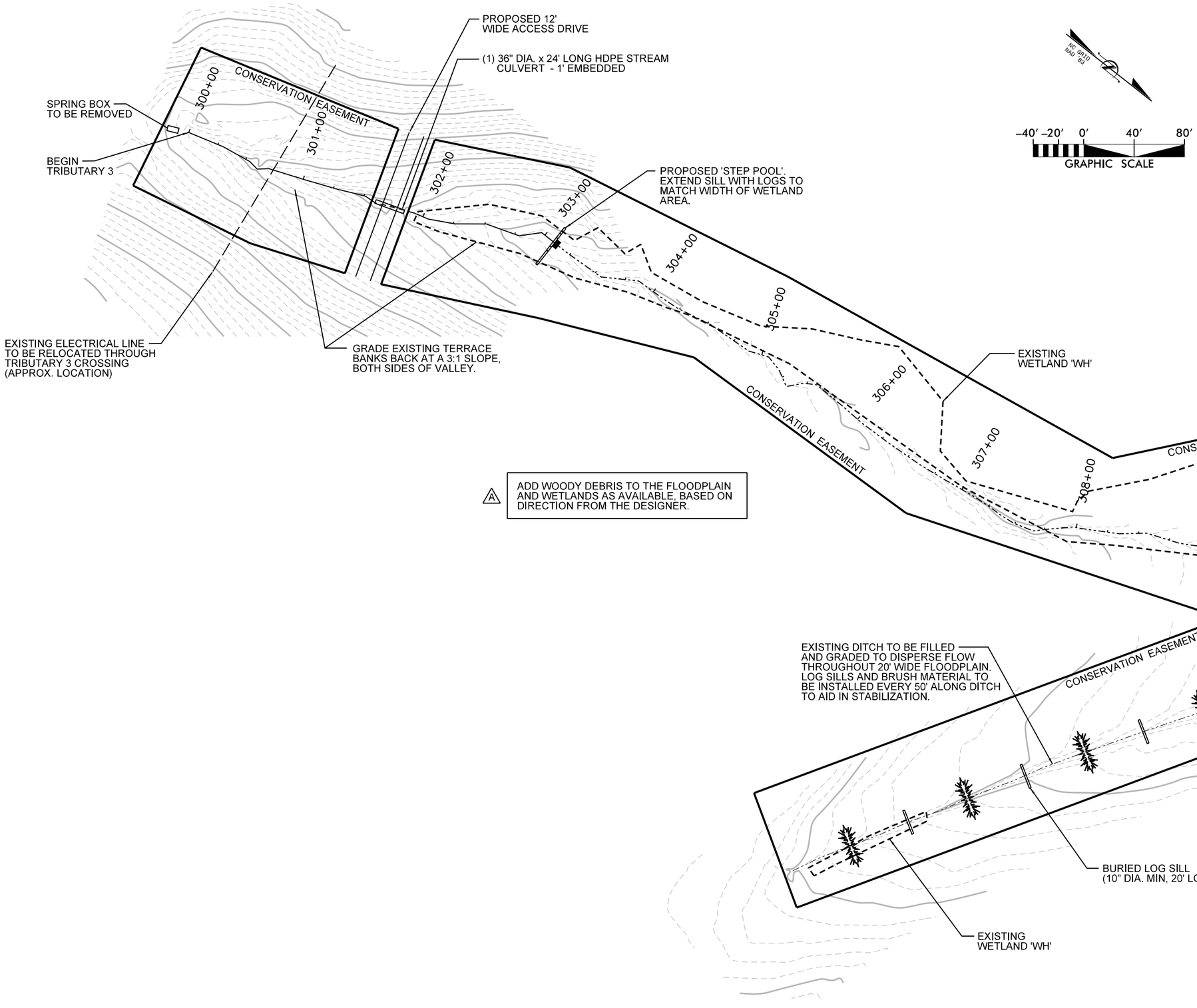
HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

SITE PLAN



A ADD WOODY DEBRIS TO THE FLOODPLAIN AND WETLANDS AS AVAILABLE, BASED ON DIRECTION FROM THE DESIGNER.

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS

	DESCRIPTION	DATE
A	REVISIONS PER IRT COMMENTS	MAR 2020

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HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

SITE PLAN

SHEET 9 OF 26

NC GRID
NAD 83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

TEMPORARY ACCESS PATH
TO BE ENHANCED AS NEEDED

A ADD WOODY DEBRIS TO THE FLOODPLAIN AND WETLANDS AS AVAILABLE, BASED ON DIRECTION FROM THE DESIGNER.

NORTH CAROLINA
PROFESSIONAL
SEAL
040899
ENGINEER
KRISTIN E. KNIGHT

MATCHLINE - SEE SHEET 9 FOR TRIBUTARY 3

CONSERVATION EASEMENT

312+00 313+00 314+00 315+00 316+00 317+00 318+00 319+00 320+00 321+00 322+00 23+00 24+00 25+00 26+00 27+00 28+00

ENHANCEMENT II RESTORATION

(1) 4.0' DIA. x 24' LONG HDPE
STREAM CULVERT
- 1' EMBEDDED

PROPOSED 12'
WIDE ACCESS DRIVE

A PROPOSED FLOODPLAIN
GRADING EXTENTS

CONSERVATION EASEMENT

EXISTING
WETLAND 'WC'

MATCHLINE - SEE SHEETS 6-8 FOR TRIBUTARY 1

EXISTING
WETLAND 'WE'

BEGIN GRADING
NEW PATH FOR
TRIBUTARY 3

FILL EXISTING CHANNEL
(TYPICAL ALL HATCHING)

PROPOSED 'STEP POOL'.
SEE DETAIL SHEET.

PROPOSED 'RIFFLE ENHANCEMENT'.
SEE DETAIL SHEET.

PROPOSED 'LIVE LIFT'.
SEE DETAIL SHEET.

CONSERVATION EASEMENT

EXISTING
WETLAND 'WG'

(1) 5.0' DIA. x 30' LONG HDPE
STREAM CULVERT
- 1' EMBEDDED

PROPOSED 15'
WIDE ACCESS DRIVE

MATCHLINE - SEE SHEETS 6-8 FOR TRIBUTARY 1

REVISIONS			
A	REVISIONS PER IRT COMMENTS	SWL	MAR 2020
	DESCRIPTION		DATE

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HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

SITE PLAN

SHEET 10 OF 26

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

SYM.	DESCRIPTION	DATE
	REVISIONS	

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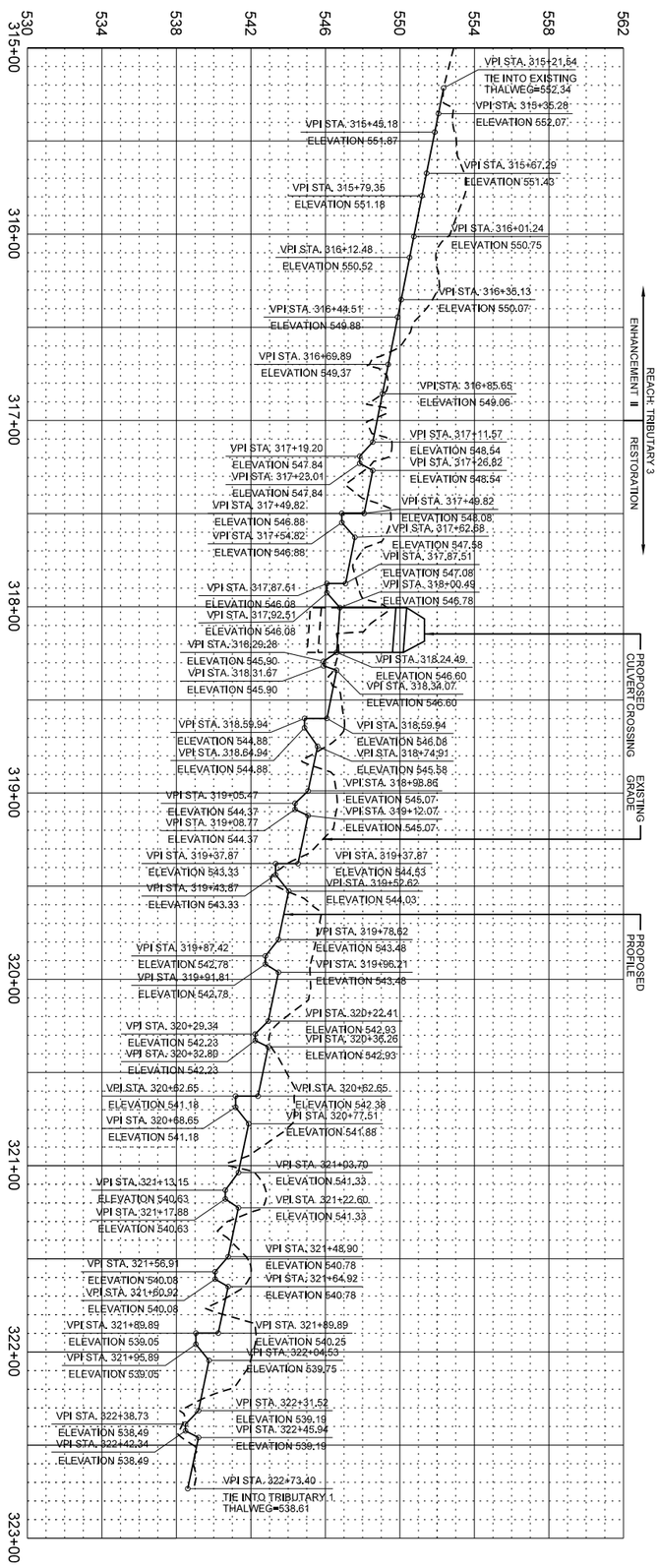
HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: 1"=40'

PROFILES

SHEET 11 OF 26



NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

SHEET 12 OF 26

PROFILES

DATE: NOV. 2019

SCALE: 1"=40'

HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

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SYM.	DESCRIPTION	DATE

REVISIONS

RIPARIAN FOREST PLANTING:

PLANTING ZONE 1 = 17.4 ACRES

12" - 18" BARE ROOT MATERIAL
968 STEMS/ACRE (9' X 5' SPACING), RANDOM SPECIES PLACEMENT

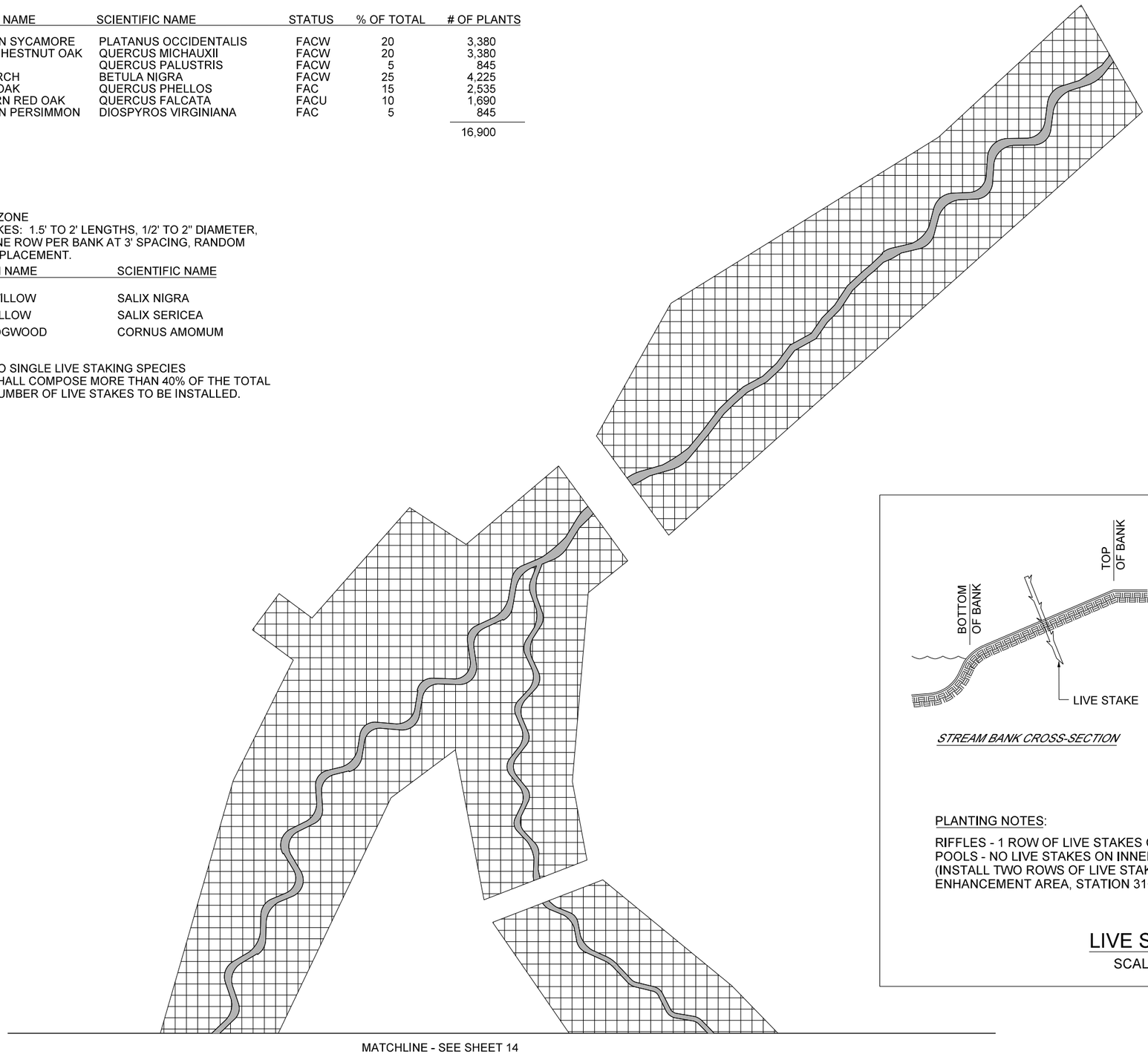
COMMON NAME	SCIENTIFIC NAME	STATUS	% OF TOTAL	# OF PLANTS
AMERICAN SYCAMORE	PLATANUS OCCIDENTALIS	FACW	20	3,380
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	FACW	20	3,380
PIN OAK	QUERCUS PALUSTRIS	FACW	5	845
RIVER BIRCH	BETULA NIGRA	FACW	25	4,225
WILLOW OAK	QUERCUS PHELLOS	FAC	15	2,535
SOUTHERN RED OAK	QUERCUS FALCATA	FACU	10	1,690
AMERICAN PERSIMMON	DIOSPYROS VIRGINIANA	FAC	5	845
				16,900

STREAM ZONE :

STREAM ZONE
LIVE STAKES: 1.5' TO 2' LENGTHS, 1/2' TO 2" DIAMETER, PLANT ONE ROW PER BANK AT 3' SPACING, RANDOM SPECIES PLACEMENT.

COMMON NAME	SCIENTIFIC NAME
BLACK WILLOW	SALIX NIGRA
SILKY WILLOW	SALIX SERICEA
SILKY DOGWOOD	CORNUS AMOMUM

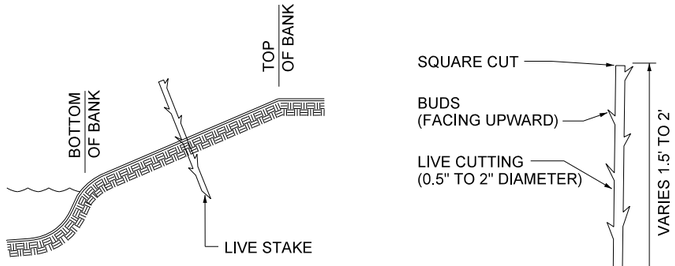
NOTE: NO SINGLE LIVE STAKING SPECIES SHALL COMPOSE MORE THAN 40% OF THE TOTAL NUMBER OF LIVE STAKES TO BE INSTALLED.



MATCHLINE - SEE SHEET 14

NC GRID NAD 83

–70 0′ 70′ 140′
GRAPHIC SCALE



STREAM BANK CROSS-SECTION

PLANTING NOTES:

RIFFLES - 1 ROW OF LIVE STAKES ON BOTH SIDES OF CHANNEL.
POOLS - NO LIVE STAKES ON INNER BENDS, 1 ROW ON OUTER BENDS.
(INSTALL TWO ROWS OF LIVE STAKES ALONG BANKS OF ENHANCEMENT AREA, STATION 31+38 TO STATION 47+51)

LIVE STAKES

SCALE: NTS

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS

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NCDEQ - DIVISION OF MITIGATION SERVICES

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RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

PLANTING PLAN

MATCHLINE - SEE SHEET 13

PLANTING ZONE 1

STREAM ZONE

* NOTE: SEE SHEET 13 FOR PLANTING QUANTITIES

ANY AREAS WITHIN THE FORESTED AREA DEEMED LOW DENSITY SHALL ALSO BE PLANTED PER DESIGN REPRESENTATIVE GUIDANCE

ANY AREAS WITHIN THE FORESTED AREA DEEMED LOW DENSITY SHALL ALSO BE PLANTED PER DESIGN REPRESENTATIVE GUIDANCE

NC GRID NAD '83

–70 0′ 70′ 140′

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

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HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019

SCALE: GRAPHIC

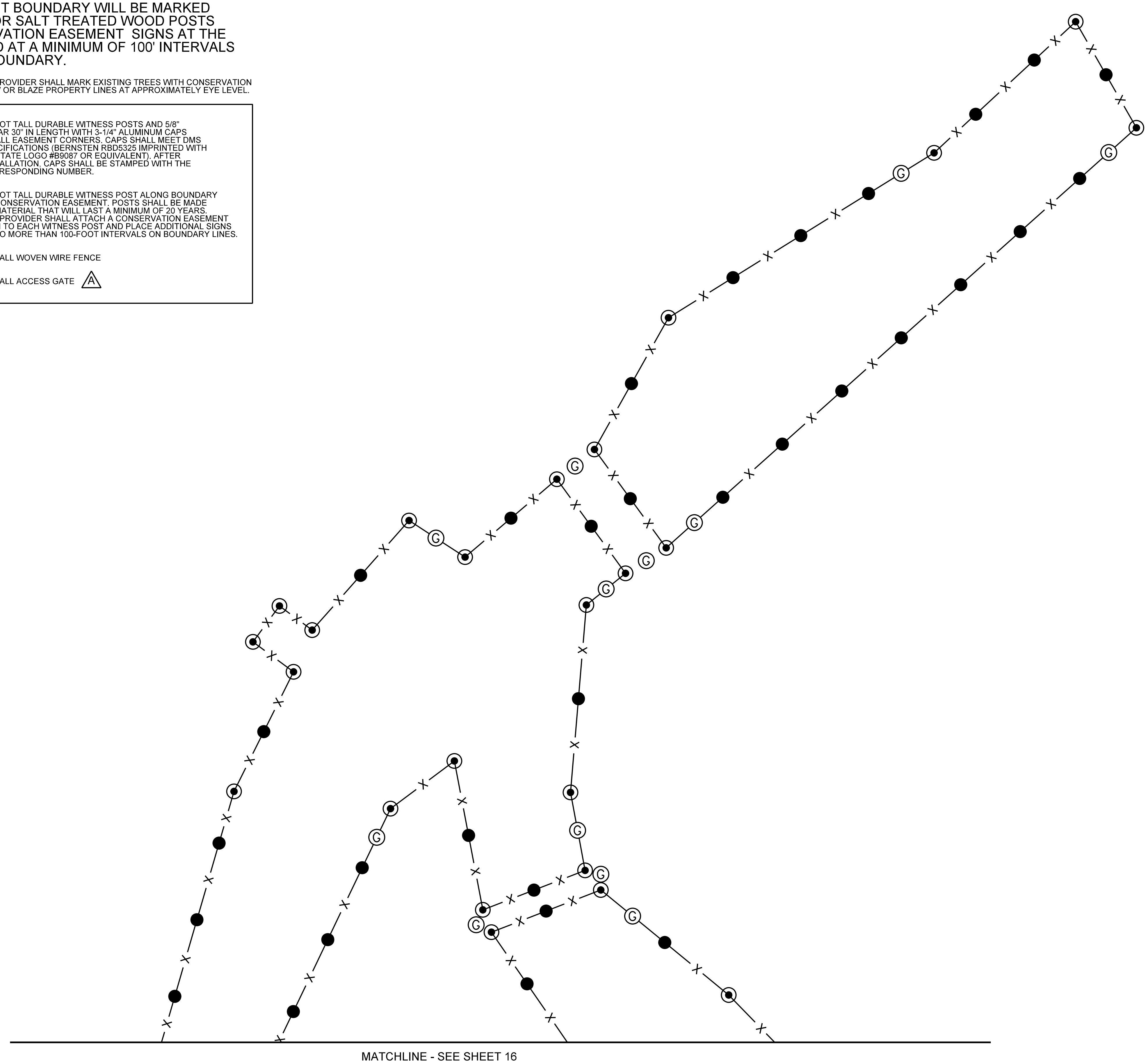
PLANTING PLAN

EASEMENT BOUNDARY MARKING

THE EASEMENT BOUNDARY WILL BE MARKED WITH METAL OR SALT TREATED WOOD POSTS AND CONSERVATION EASEMENT SIGNS AT THE CORNERS AND AT A MINIMUM OF 100' INTERVALS ALONG THE BOUNDARY.

WHEN APPROPRIATE, PROVIDER SHALL MARK EXISTING TREES WITH CONSERVATION EASEMENT SIGNS AND / OR BLAZE PROPERTY LINES AT APPROXIMATELY EYE LEVEL.

Symbol	Description
⦿	6-FOOT TALL DURABLE WITNESS POSTS AND 5/8" REBAR 30" IN LENGTH WITH 3-1/4" ALUMINUM CAPS ON ALL EASEMENT CORNERS. CAPS SHALL MEET DMS SPECIFICATIONS (BERNSTEN RBD5325 IMPRINTED WITH NC STATE LOGO #B9087 OR EQUIVALENT). AFTER INSTALLATION, CAPS SHALL BE STAMPED WITH THE CORRESPONDING NUMBER.
●	6-FOOT TALL DURABLE WITNESS POST ALONG BOUNDARY OF CONSERVATION EASEMENT. POSTS SHALL BE MADE OF MATERIAL THAT WILL LAST A MINIMUM OF 20 YEARS. THE PROVIDER SHALL ATTACH A CONSERVATION EASEMENT SIGN TO EACH WITNESS POST AND PLACE ADDITIONAL SIGNS AT NO MORE THAN 100-FOOT INTERVALS ON BOUNDARY LINES.
— X —	INSTALL WOVEN WIRE FENCE
Ⓖ	INSTALL ACCESS GATE (A)



NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

–70 0′ 70′ 140′

GRAPHIC SCALE

SYM.	DESCRIPTION	DATE
A	REVISIONS PER IRT COMMENTS	FEB 2020

REVISIONS

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HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

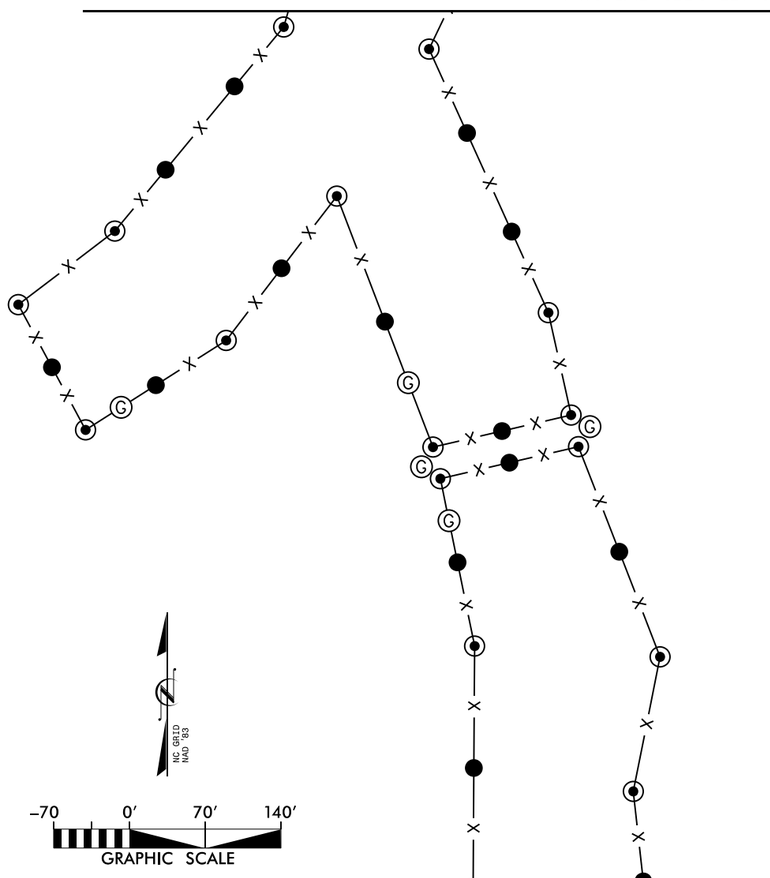
DATE: NOV 2019

SCALE: GRAPHIC

BOUNDARY MARKING PLAN

SHEET 15 OF 26

MATCHLINE - SEE SHEET 15



EASEMENT BOUNDARY MARKING

THE EASEMENT BOUNDARY WILL BE MARKED WITH METAL OR SALT TREATED WOOD POSTS AND CONSERVATION EASEMENT SIGNS AT THE CORNERS AND AT A MINIMUM OF 100' INTERVALS ALONG THE BOUNDARY.

WHEN APPROPRIATE, PROVIDER SHALL MARK EXISTING TREES WITH CONSERVATION EASEMENT SIGNS AND / OR BLAZE PROPERTY LINES AT APPROXIMATELY EYE LEVEL.

- 6-FOOT TALL DURABLE WITNESS POSTS AND 5/8" REBAR 30" IN LENGTH WITH 3-1/4" ALUMINUM CAPS ON ALL EASEMENT CORNERS. CAPS SHALL MEET DMS SPECIFICATIONS (BERNSTEN RBD5325 IMPRINTED WITH NC STATE LOGO #B9087 OR EQUIVALENT). AFTER INSTALLATION, CAPS SHALL BE STAMPED WITH THE CORRESPONDING NUMBER.
- 6-FOOT TALL DURABLE WITNESS POST ALONG BOUNDARY OF CONSERVATION EASEMENT. POSTS SHALL BE MADE OF MATERIAL THAT WILL LAST A MINIMUM OF 20 YEARS. THE PROVIDER SHALL ATTACH A CONSERVATION EASEMENT SIGN TO EACH WITNESS POST AND PLACE ADDITIONAL SIGNS AT NO MORE THAN 100-FOOT INTERVALS ON BOUNDARY LINES.
- — X — INSTALL WOVEN WIRE FENCE
- (G) INSTALL ACCESS GATE (A)

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

	DATE	DESCRIPTION
1	FEB 2020	REVISIONS PER IRT COMMENTS

REVISIONS

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HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

BOUNDARY MARKING PLAN

SHEET 16 OF 26

SEDIMENTATION AND EROSION CONTROL NOTES:

1. IT IS THE INTENT OF THESE PLANS THAT AS SOON AS AN AREA OF GRADING IS COMPLETE IT SHALL BE STABILIZED IN ACCORDANCE WITH THE EROSION CONTROL PRACTICES DESCRIBED IN THESE PLANS.DUE TO THE ANTICIPATED DURATION AND SEQUENCE OF THE CONSTRUCTION ACTIVITIES, THE CONTRACTOR IS REQUIRED TO MINIMIZE, AS MUCH AS POSSIBLE, THE AMOUNT OF THE AREA THAT IS DISTURBED AT ONE TIME.

2. THE CONTRACTOR SHALL EXERCISE EVERY REASONABLE PRECAUTION THROUGHOUT THE CONSTRUCTION OF THE PROJECT TO PREVENT EROSION AND SEDIMENTATION. EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED IN ACCORDANCE WITH THE PROJECT PLANS, NORTH CAROLINA SEDIMENT AND EROSION CONTROL GUIDELINES AND AS DIRECTED BY THE DESIGNER.

3. IN THE EVENT OF A STORM, THE CONTRACTOR WILL BE RESPONSIBLE FOR REMOVAL OR PROTECTION OF ANY EQUIPMENT, TOOLS, MATERIALS OR OTHER ITEMS NEEDED TO COMPLETE THE WORK THAT COULD BE AFFECTED BY STORMWATER.

4. EACH SEDIMENT CONTROL DEVICE WILL BE REMOVED AFTER ALL WORK IN THE CORRESPONDING CONSTRUCTION PHASE HAS BEEN COMPLETED AND ADEQUATE PERMANENT GROUND COVER HAS BEEN RE-ESTABLISHED ON THE DISTURBED AREAS, AS DETERMINED BY THE DESIGNER.

5. THE CONSTRUCTION ENTRANCES AND STAGING AREAS IDENTIFIED ON THE PLANS PROVIDE THE ONLY ACCESS POINTS INTO THE LIMITS OF DISTURBANCE. NO ADDITIONAL ACCESS POINTS SHALL BE USED WITHOUT APPROVAL OF THE DESIGNER.

6. ALL EXCAVATED MATERIAL SHALL BE STOCKPILED WITHIN THE LIMITS OF DISTURBANCE FOR LATER USE AS FILL MATERIAL. SILT FENCE SHALL BE INSTALLED ON THE LOW SIDE OF ANY TEMPORARY OR PERMANENT SPOIL AND TOPSOIL PILES. THESE SPOIL PILES SHALL ALSO BE SEEDED AND MULCHED FOR VEGETATIVE STABILIZATION WITHIN 7 DAYS THAT THEY ARE CREATED. ALL SPOIL MATERIAL SHALL STAY ON THE SITE AND SHALL NOT BE REMOVED FROM THE SUBJECT PROPERTY WITHOUT DESIGNER APPROVAL.

7. ALL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CHECKED FOR STABILITY AND FUNCTIONAL OPERATION FOLLOWING EVERY RUNOFF PRODUCING RAIN EVENT AND/OR AT LEAST ONCE PER WEEK. ANY NEEDED MAINTENANCE OR REPAIRS SHALL BE MADE IMMEDIATELY TO MAINTAIN ALL MEASURES AS DESIGNED. ACCUMULATED SEDIMENT SHALL BE REMOVED FROM CONTROL MEASURES WHEN THEY REACH APPROXIMATELY 50% OF THEIR FUNCTIONAL CAPACITY. THESE MEASURES SHALL BE REPAIRED IF DISTURBED DURING MAINTENANCE. ALL SEEDED AREAS SHALL BE FERTILIZED, RESEEDED AND MULCHED, AS NECESSARY, TO PROMOTE THE ESTABLISHMENT OF VEGETATION COVER.

8. THE CONSTRUCTION MANAGER AND EROSION CONTROL CONTACT FOR THIS SITE IS TIM MORRIS. OFFICE PHONE (919) 783-9214 / CELL PHONE (919) 793-6886.

9. ALL EXCESS WASTE MATERIAL SHALL BE DISPOSED OF AT A PERMITTED FACILITY OR SITE. (15A NCAC 04B .0110)

SEDIMENTATION & EROSION CONTROL PLAN LEGEND

LIMITS OF DISTURBANCE	LOD
SILT FENCE	SF
STRAW WADDLE	W
TEMPORARY BRIDGE MAT STREAM CROSSING	
STREAM TO BE FILLED	
STAGING AREA	
STOCK PILE	
TEMPORARY CHANNEL DIVERSION	TCD

SEEDING AND PLANTING NOTES:

TEMPORARY SEED MIX

THE CONTRACTOR SHALL UTILIZE THE FOLLOWING SEED/FERTILIZER MIX IN SEEDING ALL DISTURBED AREAS WITHIN THE PROJECT LIMITS:

SUMMER MIX (MAY 15 - AUGUST 15)
GERMAN MILLET. . . . . SETARIA ITALICA . . . . . 20 LBS / ACRE
BROWNTOP MILLET. . . . UROCHLOA RAMOSA. . . . 20 LBS / ACRE

WINTER MIX (AUGUST 15 - MAY 15)
RYE GRAIN. . . . . SECALE CEREALE. . . . . .120 LBS / ACRE

PERMANENT RIPARIAN SEED MIX

SUMMER MIX (MAY 15 -- AUGUST 15)

SPECIES	APPLICATION RATE (IN MIX) % OF MIX	LBS / ACRE
VIRGINIA WILDRYE -- ELYMUS VIRGINICUS (FACW)	15	4.6
BIG BLUESTEM – ANDROPOGON GERARDII (FAC)	8	2.3
SWITCHGRASS -- PANICUM VIRGATUM (FAC)	11	3.3
AUTUMN BENTGRASS -- AGROSTIS PERENNANS (FACU)	11	3.3
BLACK-EYED SUSAN -- RUDBECKIA HIRTA (FACU)	8	2.3
LANCELEAF COREOPSIS – COREOPSIS LANCEOLATA (FACU)	8	2.3
SOFT RUSH – JUNCUS EFFUSUS (FACW)	4	1.1
LITTLE BLUESTEM -- SCHIZACHYRIUM SCOPARIUM (FACU)	4	1.1
INDIAN GRASS -- SORGHASTRUM NUTANS (FACU)	4	1.1
EASTERN GAMMA -- TRIPSACUM DACTYLOIDES (FACW)	4	1.1
PEARL MILLET -- PENNISETUM GLAUCOMA (FACU)	25	7.5
TOTALS	100	30

WINTER MIX (AUGUST 15 -- MAY 15)

SPECIES	APPLICATION RATE (IN MIX) % OF MIX	LBS / ACRE
VIRGINIA WILDRYE -- ELYMUS VIRGINICUS (FACW)	15	4.6
BIG BLUESTEM – ANDROPOGON GERARDII (FAC)	8	2.3
SWITCHGRASS -- PANICUM VIRGATUM (FAC)	11	3.3
AUTUMN BENTGRASS -- AGROSTIS PERENNANS (FACU)	11	3.3
BLACK-EYED SUSAN -- RUDBECKIA HIRTA (FACU)	8	2.3
LANCELEAF COREOPSIS -- COREOPSIS LANCEOLATA (FACU)	8	2.3
SOFT RUSH – JUNCUS EFFUSUS (FACW)	4	1.1
LITTLE BLUESTEM – SCHIZACHYRIUM SCOPARIUM (FACU)	4	1.1
INDIAN GRASS -- SORGHASTRUM NUTANS (FACU)	4	1.1
EASTERN GAMMA – TRIPSACUM DACTYLOIDES (FACW)	4	1.1
RYE GRAIN – SECALE CEREALE (N/A)	25	7.5
TOTALS	100	30

FERTILIZER. . . . . 750 LBS / ACRE
LIMESTONE. . . . . 2000 LBS / ACRE

FERTILIZER SHALL BE 10-10-10 ANALYSIS. UPON SOIL ANALYSIS A DIFFERENT RATIO OF FERTILIZER MAY BE USED.

SEEDBED PREPARATION

THE SEEDBED SHALL BE COMPRISED OF LOOSE SOIL AND NOT COMPACTED. THIS MAY REQUIRE MECHANICAL LOOSENING OF THE SOIL. SOIL AMENDMENTS SHOULD FOLLOW THE FERTILIZER AND LIMING DESCRIPTION IN THE ABOVE SECTIONS. FOLLOWING SEEDING, MULCHING SHALL FOLLOW THE BELOW APPLICATION METHODS AND AMOUNTS. AREAS CONTAINING SEVERE SOIL COMPACTION WILL BE SCARIFIED TO A DEPTH OF 8 INCHES.

MULCHING

SEEDED AREAS ARE TO BE PROTECTED BY SPREADING STRAW MULCH UNIFORMLY TO FORM A CONTINUOUS BLANKET (75% COVERAGE = 2 TONS/ACRE).

NOTE: FERTILIZER IS ONLY TO BE APPLIED ONCE. IF TEMPORARY SEED AND FERTILIZER IS APPLIED PRIOR TO PERMANENT SEED, THEN FERTILIZER SHALL NOT BE APPLIED WITH THE PERMANENT SEED.

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

NO	DESCRIPTION	DATE
	REVISIONS	

NCDEQ - DIVISION OF MITIGATION SERVICES

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4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE NOV 2019
SCALE N.T.S.

EROSION CONTROL PLAN

GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

SECTION E: GROUND STABILIZATION

Required Ground Stabilization Timeframes

Site Area Description	Stabilize within this many calendar days after ceasing land disturbance	Timeframe variations
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

GROUND STABILIZATION SPECIFICATION

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
• Temporary grass seed covered with straw or other mulches and tackifiers • Hydroseeding • Rolled erosion control products with or without temporary grass seed • Appropriately applied straw or other mulch • Plastic sheeting	• Permanent grass seed covered with straw or other mulches and tackifiers • Geotextile fabrics such as permanent soil reinforcement matting • Hydroseeding • Shrubs or other permanent plantings covered with mulch • Uniform and evenly distributed ground cover sufficient to restrain erosion • Structural methods such as concrete, asphalt or retaining walls • Rolled erosion control products with grass seed

EQUIPMENT AND VEHICLE MAINTENANCE

1. Maintain vehicles and equipment to prevent discharge of fluids.
2. Provide drip pans under any stored equipment.
3. Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
4. Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
5. Remove leaking vehicles and construction equipment from service until the problem has been corrected.
6. Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE

1. Never bury or burn waste. Place litter and debris in approved waste containers.
2. Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
3. Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
4. Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
5. Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
6. Anchor all lightweight items in waste containers during times of high winds.
7. Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
8. Dispose waste off-site at an approved disposal facility.
9. On business days, clean up and dispose of waste in designated waste containers.

PAINT AND OTHER LIQUID WASTE

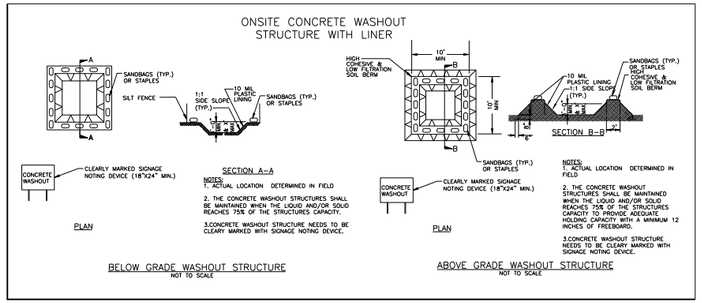
1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, sized and placed appropriately for the needs of site.
5. Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

PORTABLE TOILETS

1. Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
2. Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
3. Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

EARTHEN STOCKPILE MANAGEMENT

1. Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
2. Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
3. Provide stable stone access point when feasible.
4. Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

REVISIONS			
SYM.	DESCRIPTION	DATE	
A	REVISED PER LAND QUALITY DIVISION	OCT. 201	

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

NCDEQ – DIVISION OF MITIGATION SERVICES

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: N.T.S.

EROSION CONTROL PLAN

SHEET 17A OF 26

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDOs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION B: RECORDKEEPING

1. E&SC Plan Documentation

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

2. Additional Documentation to be Kept on Site

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

(a) This General Permit as well as the Certificate of Coverage, after it is received.

(b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

3. Documentation to be Retained for Three Years

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION C: REPORTING

1. Occurrences that Must be Reported

Permittees shall report the following occurrences:

(a) Visible sediment deposition in a stream or wetland.

(b) Oil spills if:
- They are 25 gallons or more,
- They are less than 25 gallons but cannot be cleaned up within 24 hours,
- They cause sheen on surface waters (regardless of volume), or
- They are within 100 feet of surface waters (regardless of volume).

(c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.

(d) Anticipated bypasses and unanticipated bypasses.

(e) Noncompliance with the conditions of this permit that may endanger health or the environment.

2. Reporting Timeframes and Other Requirements

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Department's Environmental Emergency Center personnel at (800) 858-0368.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis. • If the stream is named on the NC 303(d) list as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	• ***Within 24 hours***, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	• ***A report at least ten days before the date of the bypass, if possible***. The report shall include an evaluation of the anticipated quality and effect of the bypass.
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days,*** a report that includes an evaluation of the quality and effect of the bypass.
(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6). • Division staff may waive the requirement for a written report on a case-by-case basis.

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

REVISIONS			
	DESCRIPTION	DATE	
A	REVISED PER LAND QUALITY DIVISION	SML	OCT. 201

NCDEQ – DIVISION OF MITIGATION SERVICES

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HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: N.T.S.

EROSION CONTROL PLAN

SEQUENCE OF CONSTRUCTION:

THE CONTRACTOR IS RESPONSIBLE FOR FOLLOWING THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND THE FOLLOWING PROVISIONS, AS DIRECTED BY THE DESIGNER. CONSTRUCTION SHALL PROCEED IN THE SPECIFIED MANNER UNLESS OTHERWISE DIRECTED OR APPROVED BY THE DESIGNER. THE FOLLOWING PROVISIONS, ALONG WITH THE INSTRUCTIONS CONTAINED IN THE PLANS, CONSTITUTE THE SEQUENCE OF CONSTRUCTION.

GENERAL SITE NOTES:

1. THE CONTRACTOR SHALL ONLY CONDUCT STREAM WORK, INCLUDING ALL IN-STREAM STRUCTURES, GRADING, STABILIZATION MEASURES, AND SEEDING, MULCHING, AND MATTING WORK, ON A SECTION OF STREAM THAT SHALL BE ENTIRELY COMPLETED WITHIN A SINGLE DAY. EACH SECTION OF COMPLETED STREAM MUST BE STABILIZED AND MATTED BEFORE FLOW CAN BE RETURNED INTO THE CHANNEL.

2. WHEN WORKING IN STREAMS WITH NO ACTIVE FLOW THE CONTRACTOR IS REQUIRED TO HAVE APPROPRIATELY SIZED PUMPS AND MATERIALS TO INSTALL AND MAINTAIN A TEMPORARY STREAM DIVERSION IN ANTICIPATION OF PENDING STORM EVENTS. WORKING IN A DRY CHANNEL DOES NOT PRECLUDE THE CONTRACTOR FROM HAVING TO COMPLY WITH NOTE 1 ABOVE.

3. UPON APPROVAL FROM THE DESIGNER, PHASES 2 THROUGH 9 MAY BE CONSTRUCTED IN A DIFFERENT SEQUENCE THAN INDICATED BELOW OR CONCURRENTLY.

4. ALL CONSTRUCTION WORK SHALL BE DONE DURING PERIODS OF DRY WEATHER.

5. ALL STREAM/DITCH CROSSINGS WILL BE LOCATED IN AREAS OF THE STREAM WHERE LEFT AND RIGHT BANK HEIGHTS ARE SIMILAR OR CAN BE GRADED TO PROVIDE A LEVEL, OR NEAR LEVEL, CROSSING SURFACE. BRIDGE MATS CAN BE MADE OF WOOD OR STEEL, BUT MUST BE CAPABLE OFSUPPORTING THE GROUND PRESSURE OF THE EQUIPMENT THAT WILL BE UTILIZING THE CROSSING. UPON ENSURING A LEVEL CROSSING SURFACE, THE BRIDGE MATS WILL BE LAID ACROSS THE CHANNEL IN A MANNER THAT DOES NOT DISRUPT STREAM FLOW OR CAUSE EROSION IN THE CHANNEL. THIS IS TYPICALLY ACHIEVED USING AN EXCAVATOR TO LIFT THE MATS ACROSS THE CHANNEL WITH CHAINS AND GUIDED AND SET BY A GROUND CREW. THE MATS MUST BE CONTINUOUS ACROSS THE CHANNEL, WITH NO GAPS THAT COULD ALLOW SEDIMENT TO ENTER THE STREAM. 4" WOODEN BARRIERS WILL BE INSTALLED ON THE OUTER EDGE OF THE MATS TO PREVENT SOIL FROM SPILLING INTO THE CHANNEL DURING CROSSING. ACCUMULATED SEDIMENT ON THE MATS WILL BE REMOVED ON A FREQUENT BASIS TO MINIMIZE DISCHARGE OF SEDIMENT TO THE STREAM DURING USE. AFTER SETTING THE BRIDGE MATS, A CLASS 1 STONE APRON WILL BE APPLIED ON THE ENTRANCE AND EXIT OF THE BRIDGE AS PER THE DETAIL ON SHEET 20 OF THE PLANS. THIS APRON WILL BE MAINTAINED AND REPLACED AS NEEDED TO MINIMIZE SEDIMENT MOBILIZATION TO THE STREAM. PRIOR TO REMOVING THE CROSSINGS, THE MATS SHOULD BE CLEANED OF SEDIMENT. SIMILAR TO INSTALLATION, THE MATS SHOULD BE REMOVED USING AN EXCAVATOR AND CHAINS SO THEY CAN BE LIFTED UP AND OUT OF THE AREA WITHOUT DAMAGING THE STREAM OR ENTERING THE STREAM FLOW.

6. EROSION AND SEDIMENT CONTROL PERMIT MUST BE OBTAINED BEFORE ANY LAND DISTURBING ACTIVITIES OCCUR. A COPY OF THIS PERMIT AND A HARD COPY OF THE PLAN MUST BE KEPT ON SITE, PREFERABLY IN A PERMITS BOX, AND ACCESSIBLE DURING INSPECTION.

7. SELF-INSPECTIONS FOR EROSION AND SEDIMENTATION CONTROL MEASURES ARE TO BE PERFORMED AT LEAST ONCE EVERY SEVEN CALENDAR DAYS AND WITHIN 24 HOURS OF EVERY RAIN EVENT OF GREATER THAN 0.5 INCH. ANY NEEDED REPAIRS SHALL BE MADE IMMEDIATELY TO MAINTAIN MEASURES AS DESIGNED. ALL ESC MEASURES SHALL BE MAINTAINED AS SPECIFIED IN THE CONSTRUCTION DETAILS.

8. AFTER SITE IS STABILIZED, REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AND PROVIDE PERMANENT SEEDING WHERE TEMPORARY MEASURES HAVE BEEN REMOVED AND GROUND COVER IS NOT ADEQUATE.

9. PER NPDES REQUIREMENTS, A RAIN GAUGE, SELF-INSPECTIONS RECORDS, PERMIT, AND S&E PLAN ARE REQUIRED TO BE MAINTAINED ON SITE AND ACCESSIBLE DURING INSPECTION. IT IS RECOMMENDED THAT THESE ITEMS BE PLACED IN A PERMITS BOX AT THE BEGINNING OR ENTRANCE OF PROJECT.

10. CONTACT THE DEMLR RALEIGH REGIONAL OFFICE AT LEAST 48 HOURS PRIOR TO COMMENCING THE LAND DISTURBING ACTIVITY 336-776-9800.

PHASE 1: INITIAL SITE PREPARATION
A. IDENTIFY PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, STABILIZED ENTRANCES, TEMPORARY CROSSINGS AND ACCESS POINTS WITH THE DESIGNER.

B. CONSTRUCT ENTRANCE AND STAGING AREAS AND THEIR ASSOCIATED SEDIMENT AND EROSION CONTROL DEVICES IN A MANNER TO SUPPORT EXECUTION OF THE RESTORATION IN PHASES AS INDICATED IN THE PLANS AND AS DIRECTED BY THE DESIGNER.

PHASE 2: TRIBUTARY 1 - STA. 10+00 TO 17+80
COMPLETE CHANNEL WORK IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
A. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.

B. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).

C. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES.

D. SEED AND MULCH COMPLETED WORK AREAS ALONG COMPLETED STREAM BANKS.

PHASE 3: TRIBUTARY 2 (WETLAND AREA)
COMPLETE WORK IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
A. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.

B. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).

C. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES.

D. SEED AND MULCH COMPLETED WORK AREAS ALONG COMPLETED STREAM BANKS.

PHASE 4: TRIBUTARY 1 - STA. 17+80 TO 26+86
COMPLETE CHANNEL WORK IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
A. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.

B. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).

C. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES.

D. SEED AND MULCH COMPLETED WORK AREAS ALONG COMPLETED STREAM BANKS.

PHASE 5: TRIBUTARY 1 - STA. 26+86 TO 37+01
COMPLETE CHANNEL WORK IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
A. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.

B. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).

C. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES.

D. SEED AND MULCH COMPLETED WORK AREAS ALONG COMPLETED STREAM BANKS.

PHASE 6: TRIBUTARY 3 - STA. 300+00 TO 303+10
COMPLETE CHANNEL WORK IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
A. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.

B. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).

C. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES.

D. SEED AND MULCH COMPLETED WORK AREAS ALONG COMPLETED STREAM

PHASE 7: TRIBUTARY 3 - STA. 315+22 TO 322+73
COMPLETE CHANNEL WORK IN ACCORDANCE WITH THE FOLLOWING PROCEDURES:
A. INSTALL SEDIMENT AND EROSION CONTROL MEASURES ALONG EXISTING CHANNEL AS DEPICTED ON THE PLANS.

B. ESTABLISH AN ISOLATED WORK AREA BY INSTALLING IMPERVIOUS DIKES AND TEMPORARY CHANNEL DIVERSION AND DIVERT FLOWS AROUND THE DESIGNATED WORK AREA (LENGTH OF ISOLATED WORK AREA IS LEFT TO THE DISCRETION OF THE CONTRACTOR).

C. COMPLETE CHANNEL GRADING AS DIRECTED IN THE PLANS. INSTALL ANY BANK STABILIZATION TREATMENTS AND IN-STREAM STRUCTURES.

D. SEED AND MULCH COMPLETED WORK AREAS ALONG COMPLETED STREAM

PHASE 8: MISCELLANEOUS WETLAND GRADING AREAS

A. FILLING EXISTING DITCHES AND DEPRESSIONS:
i. ENSURE THAT ALL SEDIMENT AND EROSION CONTROL MEASURES HAVE BEEN INSTALLED ALONG EXISTING STREAM AND NEW CHANNEL AND ARE IN WORKING CONDITION.
ii. FILL EXISTING DITCHES AND DEPRESSIONS AS INDICATED IN THE PLANS USING ADJACENT SPOIL MATERIAL; MAKING SURE TO DEWATER ANY AREAS WITH STANDING WATER, AS INDICATED ON THE PLANS.
iii. SEED AND MULCH COMPLETED WORK AREAS. THIS SHALL BE DONE WITHIN 72 HOURS OF REACHING FINAL GRADE WHEN FILLING ANY AREAS.

B. SURFACE ROUGHENING AND WATER DISPERSION
i. ROUGHEN THE SOIL TO AN APPROXIMATE DEPTH OF 8" TO ALLEVIATE COMPACTION AND MIMIC NATURAL WETLAND MICROTOPOGRAPHY. THIS WILL INCREASE THE STORAGE OF SURFACE WATER IN THE WETLAND AND PROMOTE VEGETATION ESTABLISHMENT.
ii. PER DESIGNERS DIRECTION, GRADE LOW SWALES IN A MANNER TO BEST DISPERSE INCOMING FLOWS THROUGHOUT THE SURROUNDING WETLAND.
iii. SEED AND MULCH COMPLETED WORK AREAS. THIS SHALL BE DONE WITHIN 72 HOURS OF SURFACE ROUGHENING.

PHASE 9: TREE PLANTING
A. PLANTS SHOULD BE PLANTED DURING THE DORMANT SEASON (NOVEMBER 17 - MARCH 17).
B. PREPARE AND PLANT TREES IN ACCORDANCE WITH THE PLANTING PLAN AND AS DIRECTED BY THE DESIGNER.

PHASE 10: COMPLETION OF PROJECT SITE
A. PHASE 10 CAN BE INITIATED AFTER THE STREAM AND WETLAND GRADING WORK IS COMPLETED AND AFTER THE SITE IS STABILIZED WITH REQUIRED VEGETATIVE COVER.
B. REMOVE ALL REMAINING WASTE MATERIALS, AND THE EROSION CONTROL MEASURES AND RESTORE THE REMAINING STAGING AND STOCKPILING AREAS AND CONSTRUCTION ENTRANCES TO THEIR PRIOR CONDITION. SEED AND MULCH ALL DISTURBED AREAS UTILIZING THE SEED/MULCH MIXES SPECIFIED IN THE PLANS.

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

DATE	DESCRIPTION	SYM.
	REVISIONS	

NCDEQ – DIVISION OF MITIGATION SERVICES

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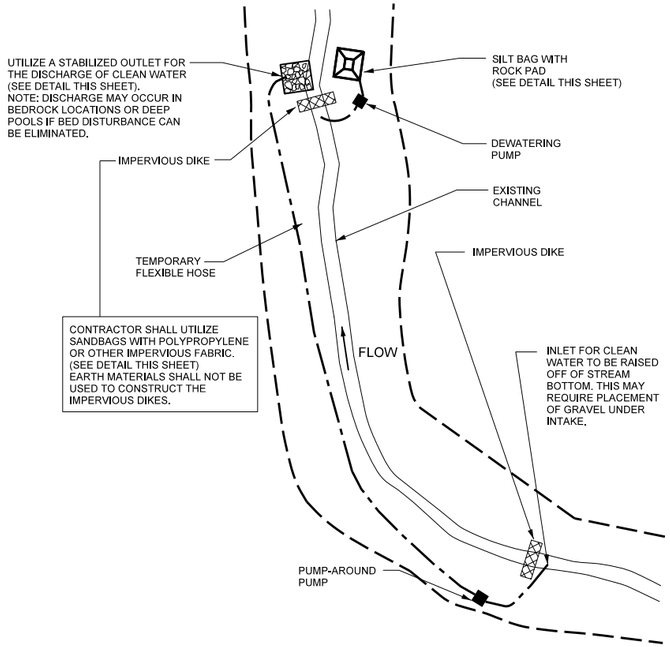
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: N.T.S.

EROSION CONTROL PLAN



SEQUENCE OF DEWATERING OPERATIONS

* ANY DEVIATION FROM ABOVE DEWATERING PLAN WILL REQUIRE DESIGNER APPROVAL.

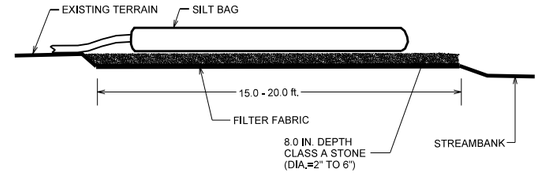
1. INSTALL SILT BAGS(S) AND ROCK PAD(S) AND STABILIZED OUTLET.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. PLACE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA.
5. PERFORM REPAIR WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF IMPERVIOUS DIKES. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE (DOWNSTREAM IMPERVIOUS DIKES FIRST).
7. REMOVE SILT BAG(S) AND STABILIZE DISTURBED AREA WITH SEED AND MULCH.

EXAMPLE OF PUMP-AROUND OPERATION

SCALE: NTS

STILLING BASIN MAINTENANCE:

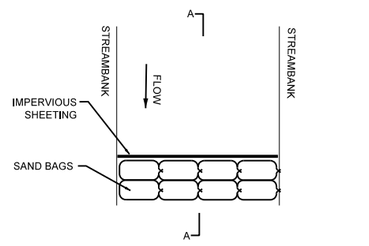
1. SEDIMENT BAGS SHALL BE REPLACED AND DISPOSED OF WHEN IT IS THREE-QUARTERS FULL OF SEDIMENT OR WHEN IT IS IMPRACTICAL FOR THE BAG TO FILTER THE SEDIMENT OUT AT A REASONABLE FLOW RATE.
2. ACCUMULATED SEDIMENT SHOULD BE DISPOSED OF IN A DESIGNATED DISPOSAL AREA.
3. SPENT BAGS SHOULD BE DISPOSED OF PROPERLY AND NOT BURIED.
4. GRAVEL PADS SHOULD BE CHECKED DAILY DURING USE TO ENSURE THAT GRAVEL HAS NOT BEEN WASHED AWAY OR BEEN CHOKED BY EXCESSIVE SEDIMENTATION.
5. REPLACE PAD WITH CLEAN GRAVEL, AS NEEDED.



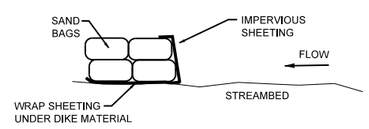
NOTE: PROVIDE STABILIZED OUTLET DOWN BANK TO STREAM

SPECIAL STILLING BASIN (SILT BAG) WITH ROCK PAD

SCALE: NTS



PLAN



SECTION AA

NOT TO SCALE

NOTES:

DIKE MATERIAL SHALL BE LARGE SANDBAGS. WATERBAGS MAY BE USED UPON APPROVAL OF THE DESIGNER.

DIKE MATERIAL MAY NOT BE EARTH OR DIRT.

DIKE MATERIAL MUST CONFORM TO THE SHAPE OF THE STREAM CHANNEL AND MUST BE HIGH ENOUGH IN THE CHANNEL TO NOT ALLOW FLOW TO OVERTOP THE DIKE.

IMPERVIOUS SHEETING SHOULD BE PLASTIC OR RUBBER SHEETING THICK ENOUGH TO NOT BE EASILY PUNCTURED GIVEN THE CONDITIONS OF THE CHANNEL.

ROCKS, SANDBAGS, OR OTHER WEIGHTS (NOT DIRT OR EARTH) MAY BE USED TO WEIGH DOWN THE SHEETING TO ENSURE THAT THERE IS PROPER CONTACT BETWEEN THE SHEETING AND THE BANKS AND BED OF THE CHANNEL.

IMPERVIOUS DIKE DETAIL

SCALE: NTS

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS

SYM.	DESCRIPTION	DATE

NCDEQ – DIVISION OF MITIGATION SERVICES

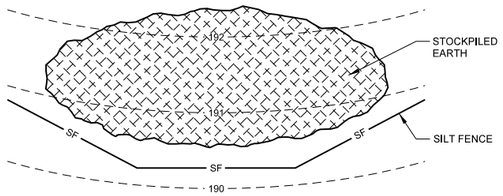
KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: N.T.S.

EROSION CONTROL PLAN

SHEET 19 OF 26



NOTES:

TEMPORARY SEEDING MUST BE APPLIED TO STOCKPILES IF NOT RELOCATED WITHIN 7 DAYS.

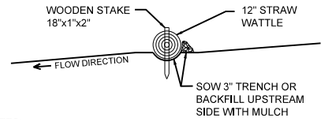
ALL STOCKPILES SHALL BE WITHIN LIMITS OF DISTURBANCE.

SILT FENCE SHALL BE INSTALLED DOWN GRADIENT OF ALL STOCK-PILES.

STOCKPILE LOCATIONS DEPICTED ON SITE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE DEPENDING ON THE AREA THAT IS BEING WORKED UPON. EXACT LOCATION AND QUANTITY OF STOCKPILES WILL BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.

TEMPORARY STOCKPILE DETAIL

SCALE: NTS



NOTES:

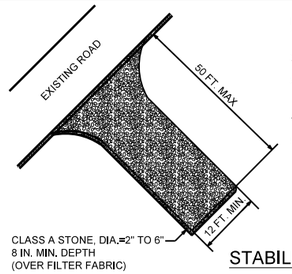
WATTLES SHALL BE INSTALLED ACCORDING TO THE MANUFACTURERS SPECIFICATIONS.

ALL WADDLE JUNCTIONS SHALL BE OVERLAPPED AND STAKED TO ENSURE CONTINUOUS PROTECTION.

STAKES SHALL BE INSTALLED ALONG WADDLES AT 5 FEET SPACING.

STRAW WATTLE DETAIL

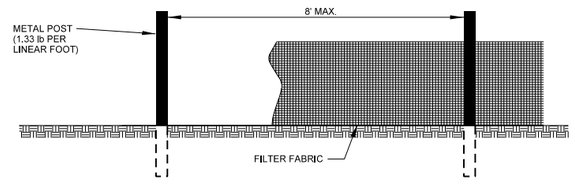
NOT TO SCALE



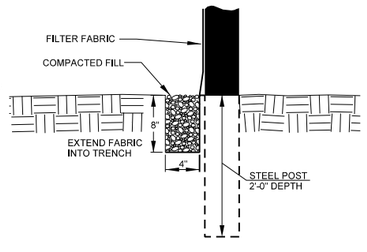
NOTES:
1. TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS SHALL BE PROVIDED.
2. ENTRANCE(S) SHOULD BE LOCATED TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. GRAVEL CONSTRUCTION ENTRANCE SHALL BE LOCATED AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE MUST BE PROVIDED.

STABILIZED CONSTRUCTION ENTRANCE DETAIL

SCALE: NTS



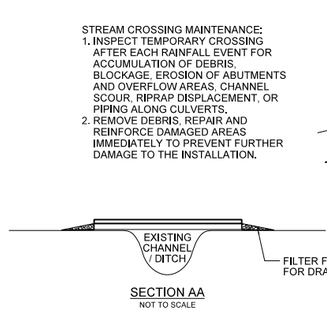
SILT FENCE MAINTENANCE
1. INSPECT SEDIMENT FENCES WEEKLY AND AFTER EACH RAINFALL EVENT.
2. SHOULD FABRIC TEAR, DECOMPOSE, OR IN ANY WAY BECOME INEFFECTIVE, REPLACE IT IMMEDIATELY.
3. REMOVE SEDIMENT DEPOSITS PROMPTLY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED, INSPECTED AND APPROVED. BRING THE DISTURBED AREA TO GRADE AND STABILIZE AS SHOWN IN THE VEGETATION PLAN.

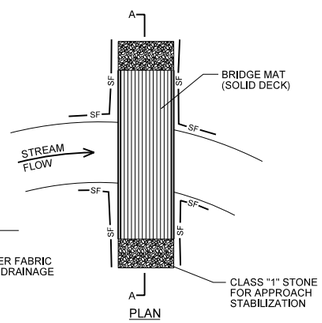


SILT FENCE DETAIL

SCALE: NTS

STREAM CROSSING MAINTENANCE:
1. INSPECT TEMPORARY CROSSING AFTER EACH RAINFALL EVENT FOR ACCUMULATION OF DEBRIS, BLOCKAGE, EROSION OF ABUTMENTS AND OVERFLOW AREAS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING ALONG CULVERTS.
2. REMOVE DEBRIS, REPAIR AND REINFORCE DAMAGED AREAS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.





1. BRIDGE LOCATIONS DEPICTED ON SITE PLANS ARE APPROXIMATE AND ARE SUBJECT TO CHANGE DEPENDING ON THE AREA THAT IS BEING WORKED UPON. EXACT LOCATION AND QUANTITY OF STOCK PILES WILL BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.
2. WIDTH OF EACH MAT IS DEPENDENT ON THE SIZE OF THE EQUIPMENT MEANT TO CROSS IT.
3. APPROACH STABILIZATION, COMPOSED OF CLASS 1 STONE, WILL BE REQUIRED FOR EACH SECTION OF THE BRIDGE.
4. BRIDGE SHALL BE CONSTRUCTED OF A SOLID DECK.

TEMPORARY BRIDGE MAT CROSSING

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS

SYM.	DESCRIPTION	DATE

NCDEQ – DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: N.T.S.

EROSION CONTROL PLAN

SHEET 20 OF 26

LIMITS OF DISTURBANCE = 19.19 ACRES
(GREY AREA)

N/F
TIMOTHY H. CRAIG
& WENONAH CRAIG
PIN 0011676
DB 655, PG 719
DB 90, PG 373

N/F
JOSEPH RAY JONES
PIN 0014903
DB 28, PG 7

SHEET 25

SHEET 26

N/F
JOSEPH RAY JONES
PIN 0014903
DB 28, PG 7

TEMPORARY
STAGING
AREAS

SHEET 24

SHEET 23

N/F
EMILY S. GROSS &
ELIZABETH S. MORIN
PIN 00146.30
DB 07E, PG 76

SHEET 22

STABILIZED
CONSTRUCTION
ENTRANCE

SITE ACCESS

N/F
RICHARD A. CARTER, SR.
& BETTY P. CARTER
PIN 0011670
DB 342, PG 443

N/F
JOSEPH RAY JONES
PIN 0014900
DB 30, PG 65

N/F
EMILY S. GROSS &
ELIZABETH S. MORIN
PIN 0014630
DB 07E, PG 76

CARTER BROOKS ROAD - SR 2210 - 60' R/W

–300′ 0′ 150′ 300′
GRAPHIC SCALE

NORTH CAROLINA
PROFESSIONAL
SEAL
040899
ENGINEER
KRISTIN E. KNIGHT

SYM.	DESCRIPTION	DATE
	REVISIONS	

NCDEQ – DIVISION OF
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HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

EROSION
CONTROL
PLAN
-OVERVIEW-

EXISTING GRAVEL DRIVE CONTINUES TO CARTER BROOKS ROAD

STABILIZED CONSTRUCTION ENTRANCE

BARN

EXISTING ACCESS PATH TO BE ENHANCED AS NEEDED

EXISTING GRAVEL DRIVE

EXISTING CONCRETE DEBRIS AND ABANDONED MATERIALS TO BE REMOVED

EXISTING WETLAND 'WA'

BEGIN TRIBUTARY 1

TEMPORARY STOCK PILE: TYP. EXACT LOCATION AND QUANTITY TO BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD. (SEE DETAIL ON SHEET 20)

PROPOSED CULVERT ROAD CROSSING (SEE SHEET 6)

TEMPORARY STAGING AREA

MATCHLINE - SEE SHEET 23

STABILIZE INCOMING DRAINAGE WITH ROCK OUTLET. SEE DETAIL SHEET.

EXISTING CATTLE PATH TO BE FILLED AND GRADED TO DISPERSE INCOMING DRAINAGE THROUGHOUT WETLAND

FILL EXISTING CHANNEL (TYPICAL ALL HATCHING)

TEMPORARY ACCESS PATH TO BE ENHANCED AS NEEDED

TCD EXAMPLE OF PUMP AROUND OPERATION EXACT LOCATION AND SETUP WILL BE DETERMINED BY HOW MUCH WORK THE CONTRACTOR PLANS TO COMPLETE AT THE TIME. TYPICAL ALL EROSION CONTROL PLAN SHEETS. (SEE DETAIL ON SHEET 19).

NC GRID NAD '83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

REVISIONS

SYM.	DESCRIPTION	DATE

NCDEQ – DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES OF NC
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4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

EROSION CONTROL PLAN

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

NC GRID NAD 83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

PROPOSED CULVERT ROAD CROSSING (SEE SHEET 7)

BEGIN TRIBUTARY 2

EXISTING WETLAND 'WB'

EXISTING WETLAND 'WF'

TEMPORARY BRIDGE MAT STREAM CROSSING. EXACT LOCATION AND QUANTITY OF CROSSINGS WILL BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.

EXISTING WETLAND 'WC'

FILL EXISTING CHANNEL (TYPICAL ALL HATCHING)

TEMPORARY STAGING AREA

TEMPORARY STOCK PILE; TYP. EXACT LOCATION AND QUANTITY TO BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD. (SEE DETAIL ON SHEET 20)

PROPOSED CULVERT ROAD CROSSING (SEE SHEET 7)

EXISTING WETLAND 'WE'

LOD

SF

16+00 17+00 18+00 19+00 20+00 21+00 22+00 23+00 24+00 25+00 317+00 318+00 319+00 320+00

MATCHLINE - SEE SHEET 22 FOR TRIBUTARY 1

MATCHLINE - SEE SHEET 24

MATCHLINE - SEE SHEETS 25 AND 26 FOR TRIBUTARY 3

REVISIONS

SYM.	DESCRIPTION	DATE

NCDEQ – DIVISION OF MITIGATION SERVICES

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4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

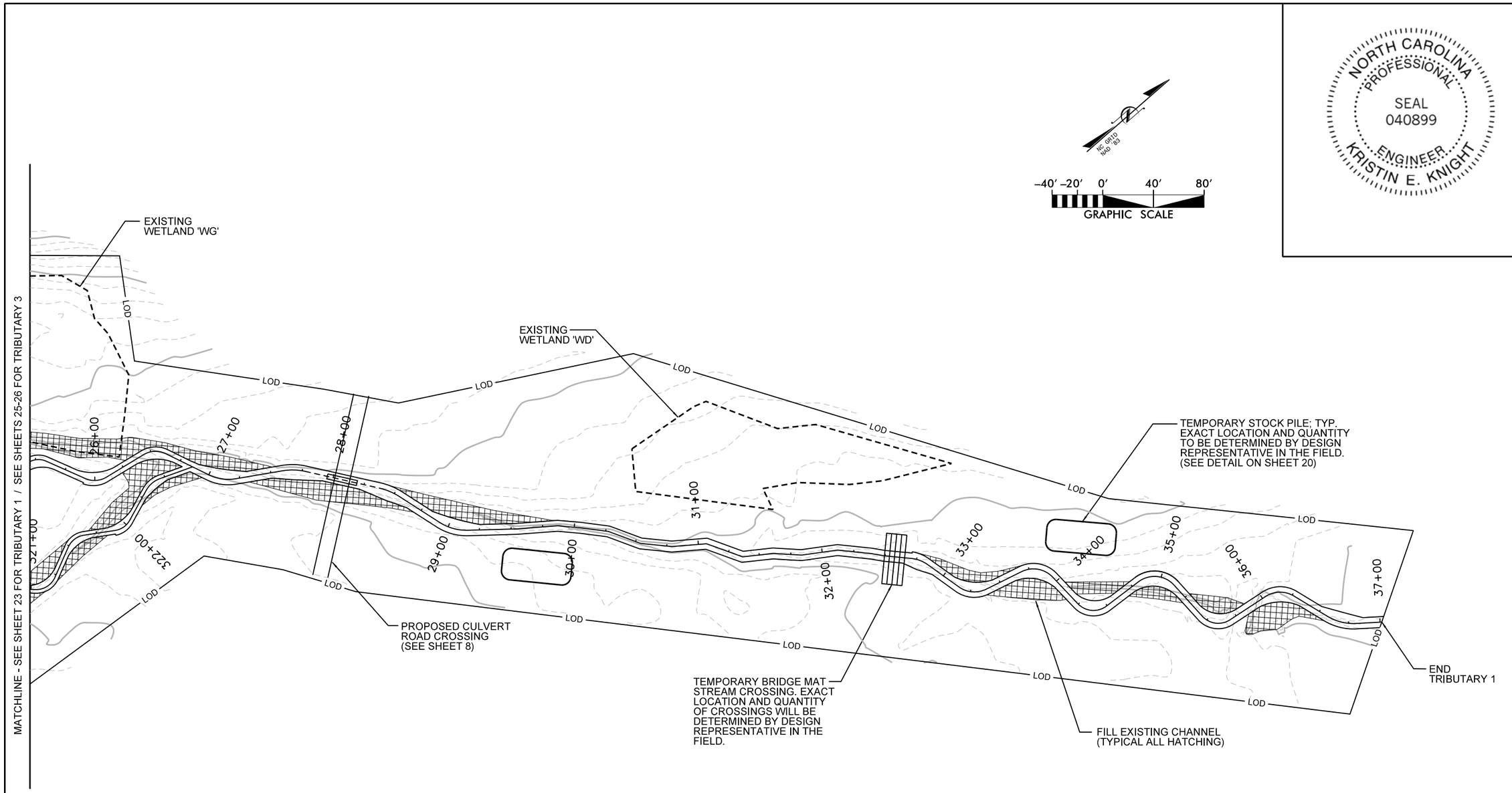
HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019

SCALE: GRAPHIC

EROSION CONTROL PLAN



NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

SYM.	DESCRIPTION	DATE
	REVISIONS	

NCDEQ – DIVISION OF MITIGATION SERVICES

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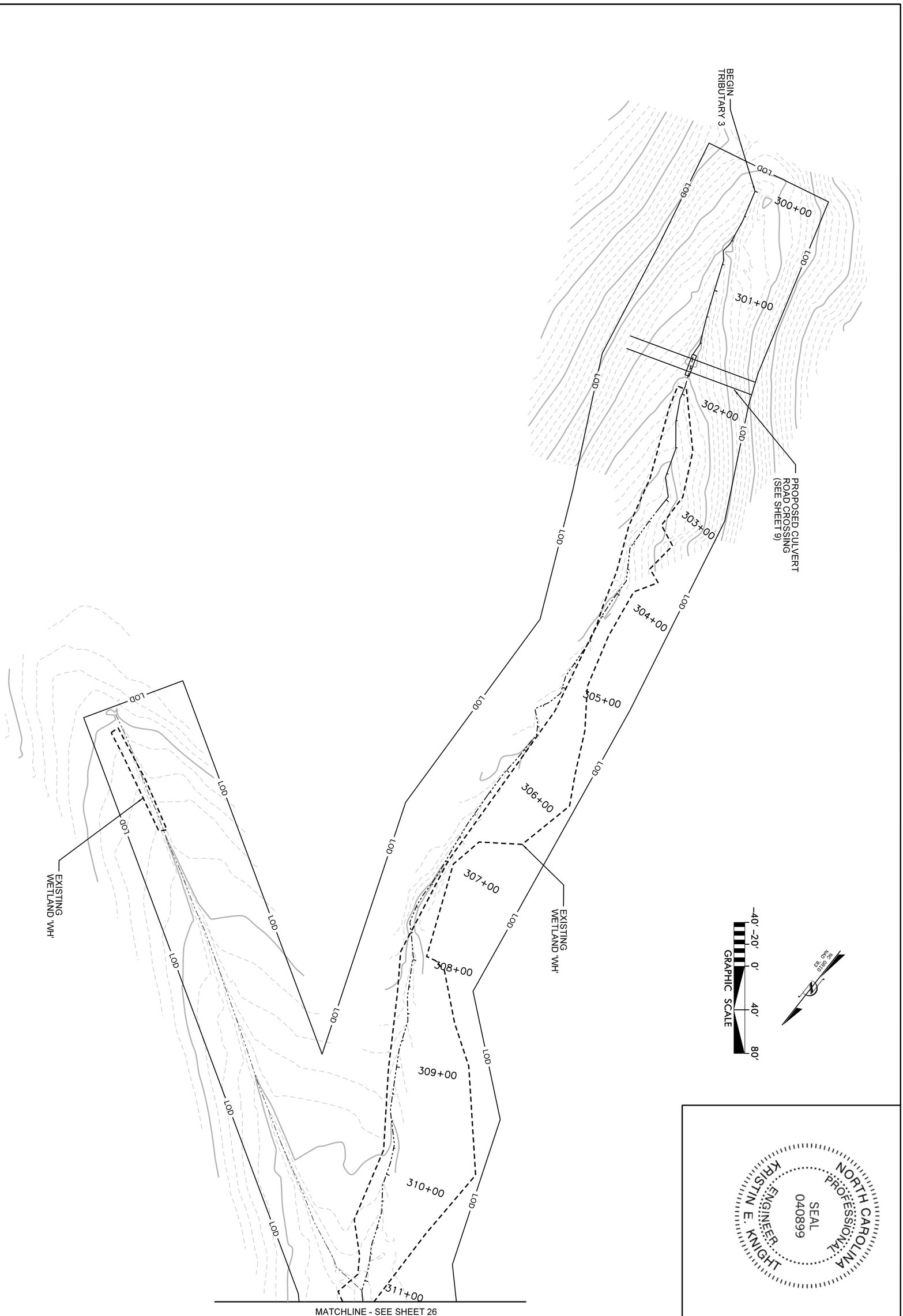
4505 FALLS OF NEUSE ROAD, SUITE 400
RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

EROSION CONTROL PLAN



NORTH CAROLINA PROFESSIONAL ENGINEER KRISTIN E. KNIGHT SEAL 040899

SYM.	DESCRIPTION	DATE
	REVISIONS	

NCDEQ – DIVISION OF MITIGATION SERVICES

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RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK RESTORATION SITE

CHATHAM COUNTY, NORTH CAROLINA

EROSION CONTROL PLAN

DATE: NOV. 2019
SCALE: GRAPHIC

SHEET 25 OF 26

NC GRID
NAD 83

–40′ –20′ 0′ 40′ 80′

GRAPHIC SCALE

MATCHLINE - SEE SHEET 25 FOR TRIBUTARY 3

MATCHLINE - SEE SHEETS 22-24 FOR TRIBUTARY 1

TEMPORARY BRIDGE MAT STREAM CROSSING. EXACT LOCATION AND QUANTITY OF CROSSINGS WILL BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD.

PROPOSED CULVERT ROAD CROSSING (SEE SHEET 10)

TEMPORARY STAGING AREA

EXISTING WETLAND 'WC'

EXISTING WETLAND 'WE'

FILL EXISTING CHANNEL (TYPICAL ALL HATCHING)

TEMPORARY STOCK PILE; TYP. EXACT LOCATION AND QUANTITY TO BE DETERMINED BY DESIGN REPRESENTATIVE IN THE FIELD. (SEE DETAIL ON SHEET 20)

EXISTING WETLAND 'WG'

PROPOSED CULVERT ROAD CROSSING (SEE SHEET 10)

LOD

SF

312+00 313+00 314+00 315+00 316+00 317+00 318+00 319+00 320+00 321+00 322+00 23+00 24+00 25+00 26+00 27+00 28+00

NORTH CAROLINA PROFESSIONAL SEAL 040899 ENGINEER KRISTIN E. KNIGHT

SYM.	DESCRIPTION	DATE
	REVISIONS	

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RALEIGH, NORTH CAROLINA 27609

HIP BONE CREEK
RESTORATION SITE
CHATHAM COUNTY, NORTH CAROLINA

DATE: NOV 2019
SCALE: GRAPHIC

EROSION CONTROL PLAN

SHEET 26 OF 26

12.2 Data Analysis/Supplemental Information and Maps

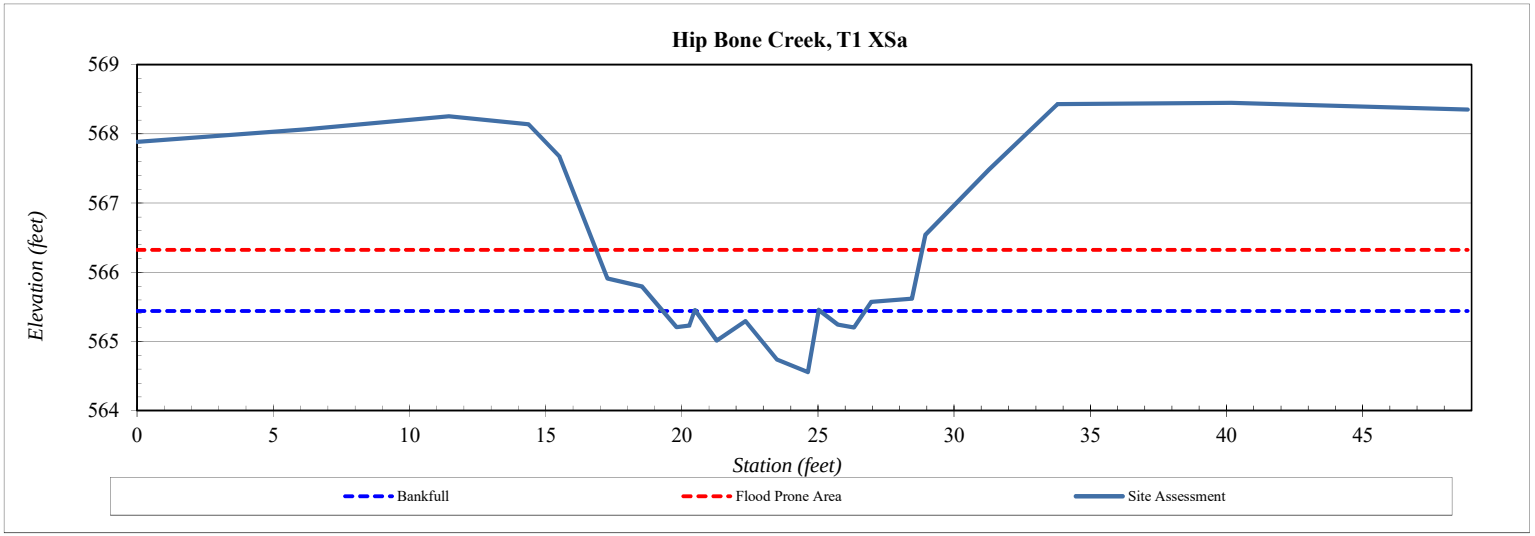
Existing Conditions Cross-Sections
Pebble Count Tables
Stream Morphological Tables
Soil Delineation and Borings
Groundwater Data

Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSa
Drainage Area (sq mi):	0.06
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	567.89
6.16	568.07
11.45	568.26
14.37	568.14
15.50	567.67
17.28	565.91
18.54	565.80
19.81	565.21
20.29	565.23
20.48	565.45
21.28	565.01
22.34	565.29
23.51	564.74
24.63	564.56
25.02	565.46
25.73	565.24
26.32	565.20
26.95	565.57
28.45	565.62
28.94	566.54
31.28	567.48
33.79	568.43
40.18	568.45
48.85	568.35

SUMMARY DATA	
Current Bankfull Elevation:	565.44
Bankfull Cross-Sectional Area:	2.5
Bankfull Width:	7.3
Flood Prone Area Elevation:	566.3
Flood Prone Width:	12.0
Max Depth at Bankfull:	0.9
Mean Depth at Bankfull:	0.3
W / D Ratio:	21.8
Entrenchment Ratio:	1.6
Bank Height Ratio:	1.2

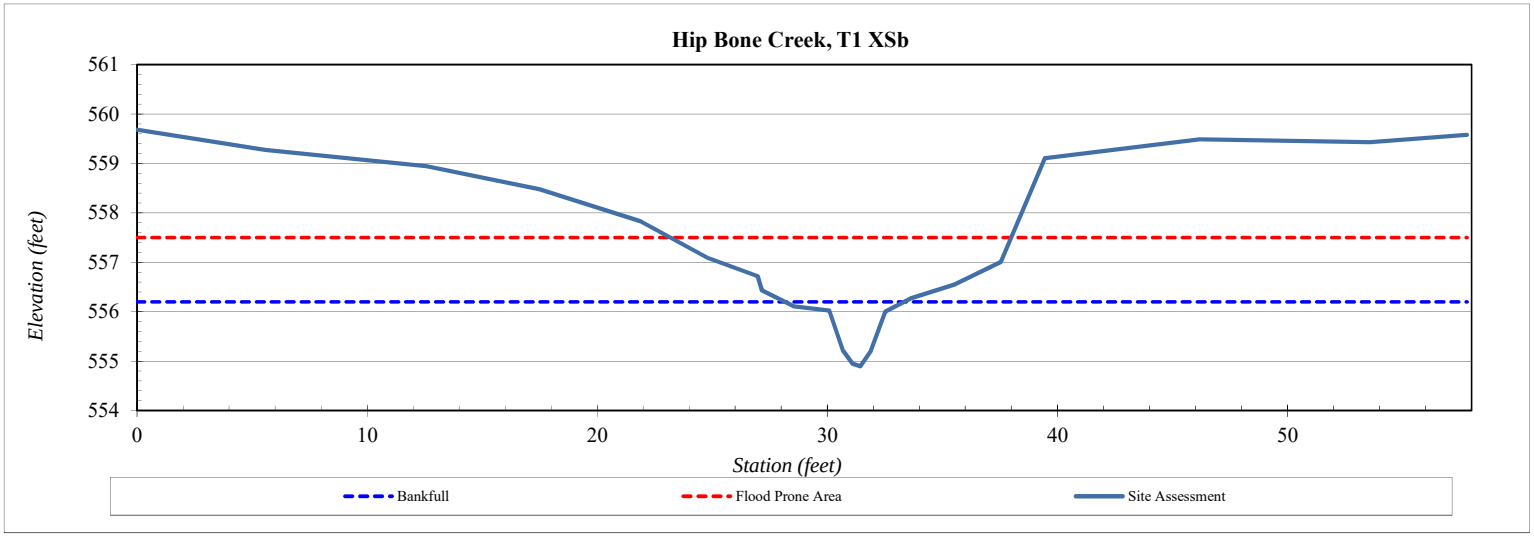


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSb
Drainage Area (sq mi):	0.06
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	559.69
5.57	559.28
12.57	558.95
17.48	558.48
21.88	557.83
24.83	557.08
26.96	556.72
27.15	556.44
28.53	556.11
30.08	556.03
30.68	555.21
31.08	554.95
31.44	554.90
31.88	555.21
32.52	556.00
33.67	556.28
35.57	556.56
37.54	557.01
39.46	559.11
46.18	559.49
53.58	559.43
57.80	559.58

SUMMARY DATA	
Current Bankfull Elevation:	556.20
Bankfull Cross-Sectional Area:	2.4
Bankfull Width:	5.2
Flood Prone Area Elevation:	557.5
Flood Prone Width:	14.8
Max Depth at Bankfull:	1.3
Mean Depth at Bankfull:	0.5
W / D Ratio:	11.0
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0

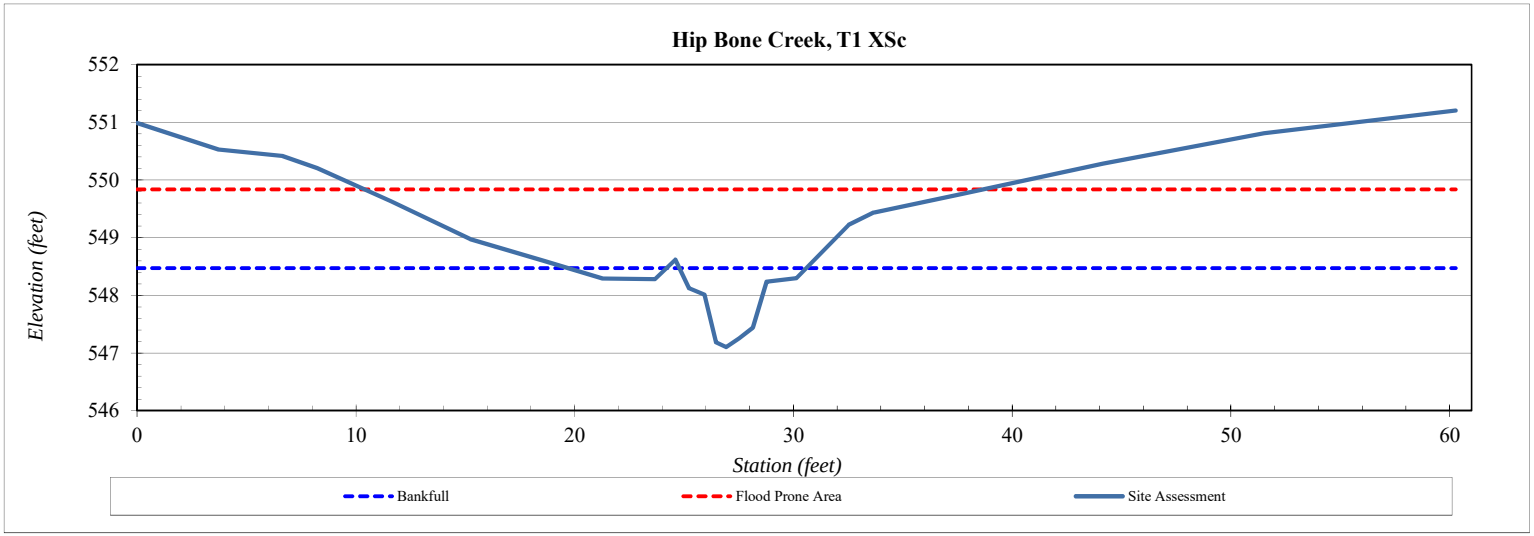


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSc
Drainage Area (sq mi):	0.13
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	550.99
3.73	550.53
6.64	550.42
8.24	550.21
11.61	549.63
15.23	548.97
18.61	548.60
21.28	548.29
23.67	548.28
24.61	548.62
25.23	548.12
25.94	548.01
26.46	547.18
26.92	547.10
27.51	547.25
28.14	547.44
28.78	548.24
30.13	548.30
32.52	549.22
33.67	549.44
37.68	549.76
44.14	550.28
51.51	550.81
60.27	551.21

SUMMARY DATA	
Current Bankfull Elevation:	548.47
Bankfull Cross-Sectional Area:	4.2
Bankfull Width:	10.2
Flood Prone Area Elevation:	549.8
Flood Prone Width:	28.2
Max Depth at Bankfull:	1.4
Mean Depth at Bankfull:	0.4
W / D Ratio:	24.8
Entrenchment Ratio:	2.8
Bank Height Ratio:	1.0

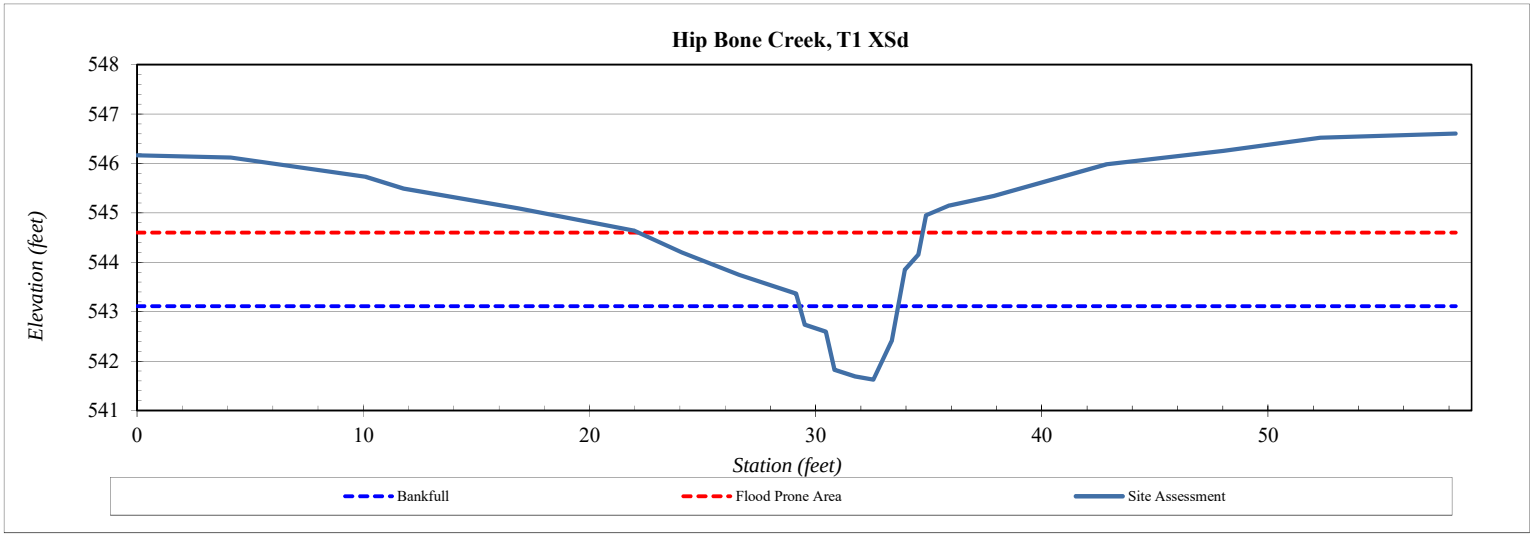


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSd
Drainage Area (sq mi):	0.13
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	546.17
4.15	546.12
10.10	545.73
11.78	545.50
16.88	545.09
21.94	544.65
24.08	544.20
26.61	543.75
29.13	543.37
29.51	542.74
30.44	542.60
30.83	541.83
31.74	541.69
32.56	541.63
33.35	542.40
33.95	543.85
34.54	544.16
34.87	544.95
35.91	545.15
37.88	545.34
42.87	545.98
48.05	546.26
52.32	546.52
58.30	546.61

SUMMARY DATA	
Current Bankfull Elevation:	543.12
Bankfull Cross-Sectional Area:	4.2
Bankfull Width:	4.4
Flood Prone Area Elevation:	544.6
Flood Prone Width:	12.6
Max Depth at Bankfull:	1.5
Mean Depth at Bankfull:	1.0
W / D Ratio:	4.5
Entrenchment Ratio:	2.9
Bank Height Ratio:	1.0

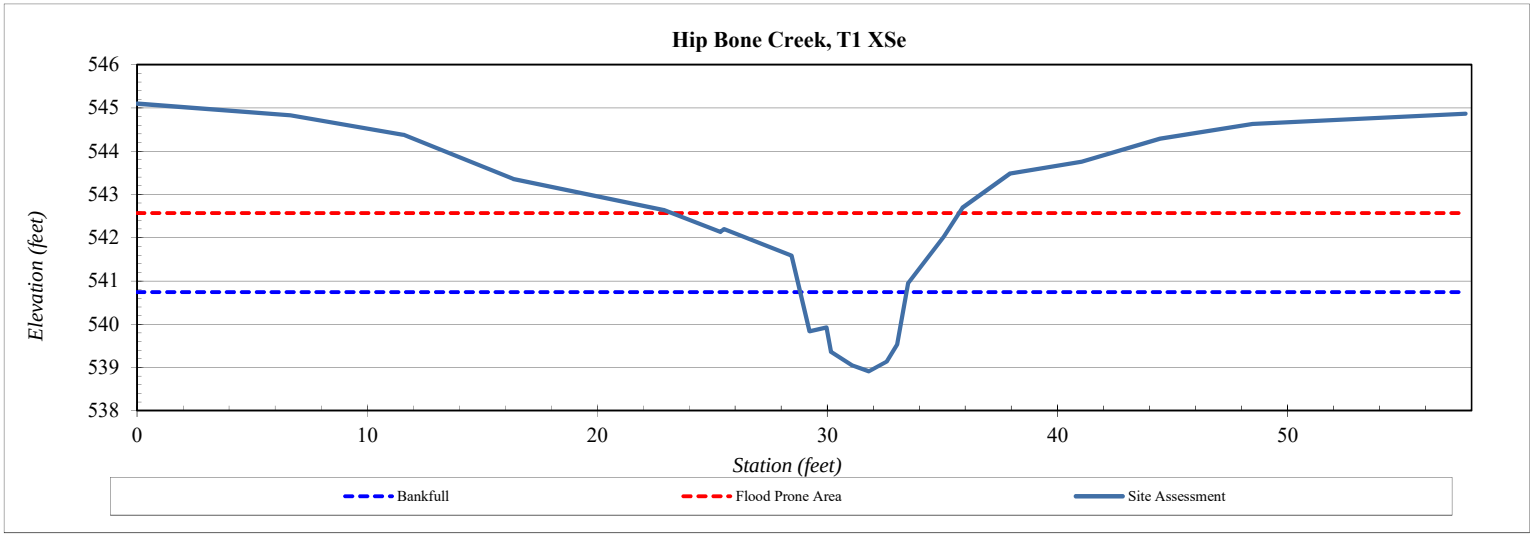


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSe
Drainage Area (sq mi):	0.14
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	545.10
6.66	544.83
11.57	544.38
16.35	543.36
22.87	542.64
25.35	542.13
25.51	542.20
28.44	541.58
29.22	539.84
29.96	539.93
30.16	539.36
31.08	539.05
31.80	538.91
32.57	539.14
33.03	539.53
33.51	540.94
35.06	542.02
35.87	542.69
37.94	543.48
41.06	543.76
44.47	544.29
48.48	544.63
57.73	544.86

SUMMARY DATA	
Current Bankfull Elevation:	540.74
Bankfull Cross-Sectional Area:	5.9
Bankfull Width:	4.6
Flood Prone Area Elevation:	542.6
Flood Prone Width:	12.5
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	1.3
W / D Ratio:	3.6
Entrenchment Ratio:	2.7
Bank Height Ratio:	1.5

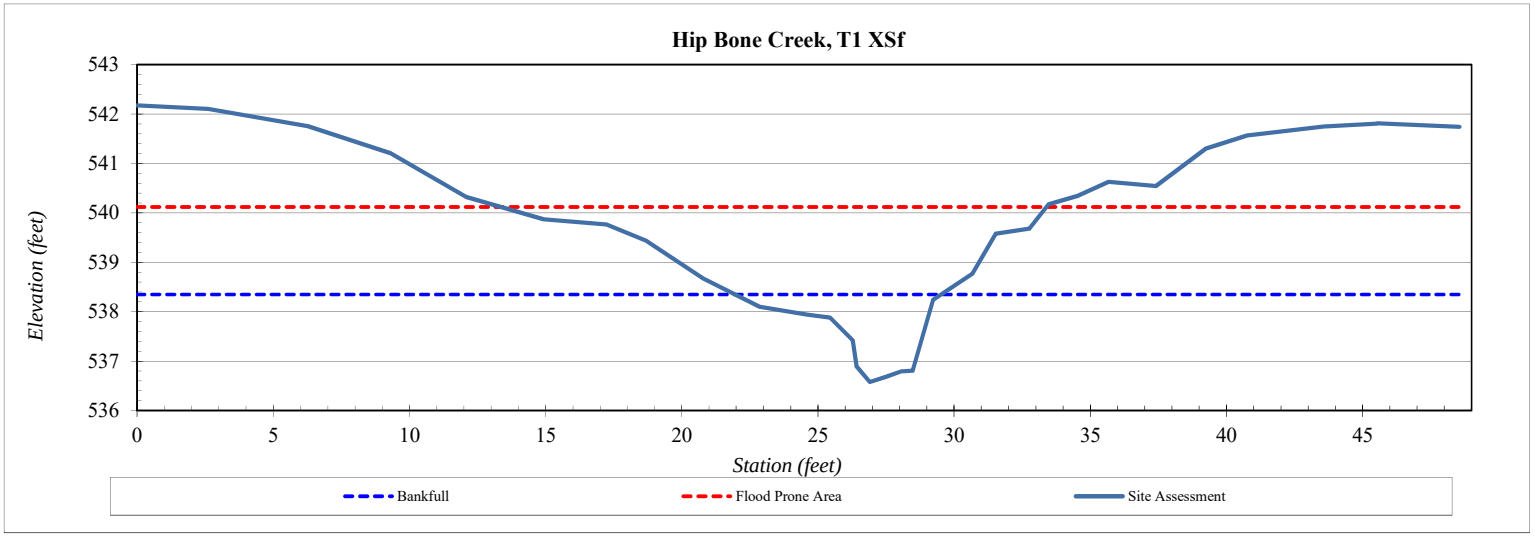


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSf
Drainage Area (sq mi):	0.21
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	542.18
2.62	542.11
6.28	541.76
9.30	541.21
12.08	540.32
14.94	539.87
17.21	539.77
18.71	539.43
20.78	538.68
22.84	538.10
24.61	537.94
25.43	537.89
26.27	537.43
26.41	536.90
26.90	536.58
27.50	536.69
28.08	536.80
28.48	536.81
29.23	538.25
30.66	538.77
31.52	539.58
32.77	539.69
33.47	540.18
34.57	540.35
35.68	540.63
37.41	540.55
39.25	541.31
40.76	541.57
43.57	541.75
45.53	541.81
45.55	541.81
48.55	541.74

SUMMARY DATA	
Current Bankfull Elevation:	538.35
Bankfull Cross-Sectional Area:	5.8
Bankfull Width:	7.6
Flood Prone Area Elevation:	540.1
Flood Prone Width:	20.0
Max Depth at Bankfull:	1.8
Mean Depth at Bankfull:	0.8
W / D Ratio:	9.8
Entrenchment Ratio:	2.6
Bank Height Ratio:	1.0

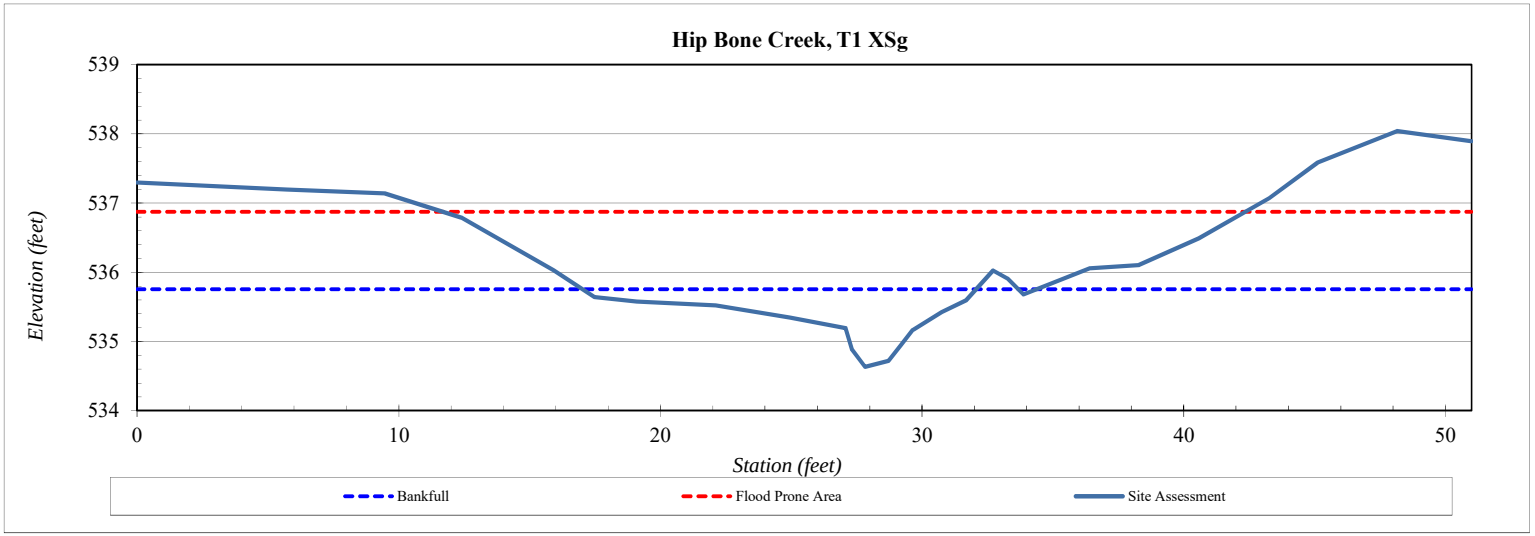


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSg
Drainage Area (sq mi):	0.23
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	537.30
5.73	537.20
9.46	537.14
12.40	536.79
15.91	536.03
17.48	535.64
19.09	535.58
22.11	535.52
24.95	535.35
27.08	535.20
27.32	534.88
27.82	534.63
28.72	534.72
29.18	534.94
29.64	535.17
30.74	535.42
31.67	535.59
32.72	536.03
33.27	535.91
33.88	535.68
34.90	535.83
36.42	536.06
38.29	536.10
40.57	536.49
43.27	537.07
45.12	537.59
48.14	538.04
50.99	537.89

SUMMARY DATA	
Current Bankfull Elevation:	535.75
Bankfull Cross-Sectional Area:	6.0
Bankfull Width:	15.7
Flood Prone Area Elevation:	536.9
Flood Prone Width:	30.7
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.4
W / D Ratio:	41.4
Entrenchment Ratio:	2.0
Bank Height Ratio:	1.0

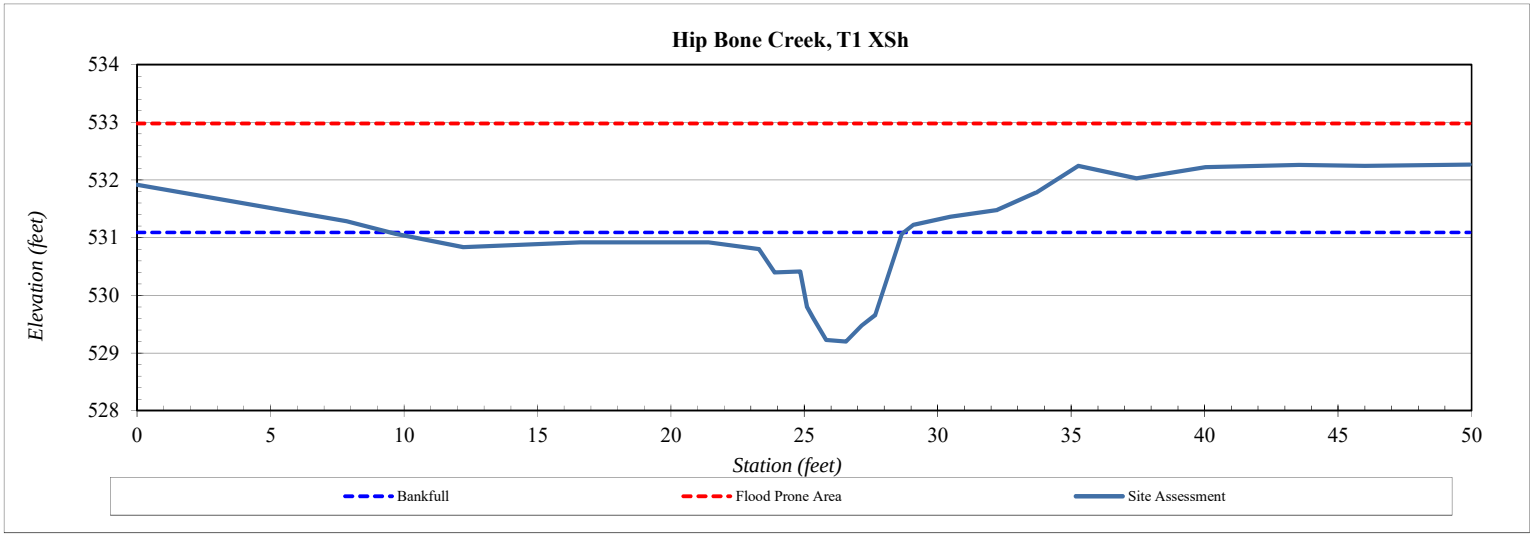


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T1 XSh
Drainage Area (sq mi):	0.24
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	531.92
7.86	531.29
9.66	531.07
12.22	530.83
16.61	530.92
21.41	530.92
23.29	530.81
23.88	530.40
24.85	530.41
25.09	529.80
25.33	529.61
25.81	529.23
26.56	529.20
27.15	529.48
27.66	529.66
28.65	531.06
29.10	531.22
30.47	531.36
32.22	531.48
33.67	531.78
35.26	532.25
37.44	532.03
40.03	532.22
43.53	532.27
46.01	532.25
49.93	532.27

SUMMARY DATA	
Current Bankfull Elevation:	531.09
Bankfull Cross-Sectional Area:	8.8
Bankfull Width:	19.3
Flood Prone Area Elevation:	533.0
Flood Prone Width:	49.9
Max Depth at Bankfull:	1.9
Mean Depth at Bankfull:	0.5
W / D Ratio:	42.1
Entrenchment Ratio:	2.6
Bank Height Ratio:	1.0

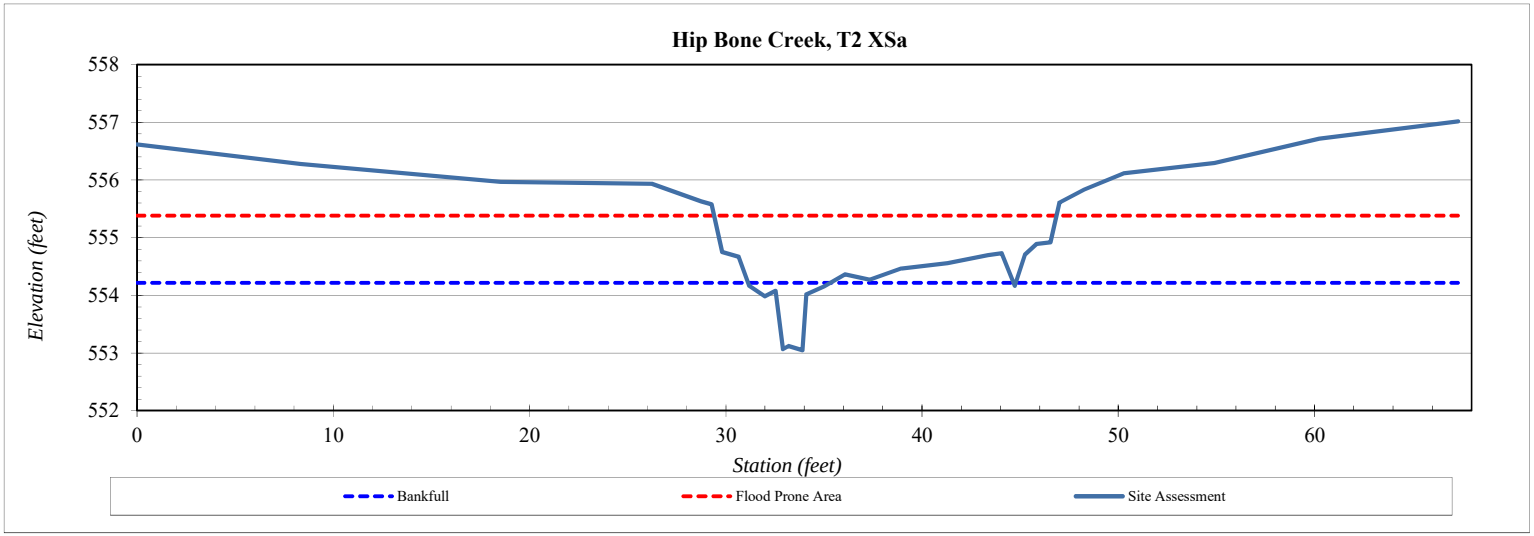


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T2 XSa
Drainage Area (sq mi):	0.05
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	556.62
8.32	556.28
18.53	555.97
26.24	555.94
28.74	555.63
29.27	555.58
29.81	554.75
30.66	554.67
31.20	554.16
31.99	553.98
32.54	554.08
32.90	553.07
33.20	553.12
33.90	553.05
34.10	554.02
35.01	554.15
36.08	554.36
37.34	554.27
38.93	554.47
41.30	554.56
43.36	554.70
44.06	554.73
44.73	554.17
45.25	554.71
45.83	554.89
46.53	554.92
47.00	555.61
48.27	555.84
50.30	556.12
54.91	556.29
60.23	556.72
67.31	557.02

SUMMARY DATA	
Current Bankfull Elevation:	554.22
Bankfull Cross-Sectional Area:	1.8
Bankfull Width:	4.3
Flood Prone Area Elevation:	555.4
Flood Prone Width:	17.4
Max Depth at Bankfull:	1.2
Mean Depth at Bankfull:	0.4
W / D Ratio:	10.0
Entrenchment Ratio:	4.1
Bank Height Ratio:	2.2

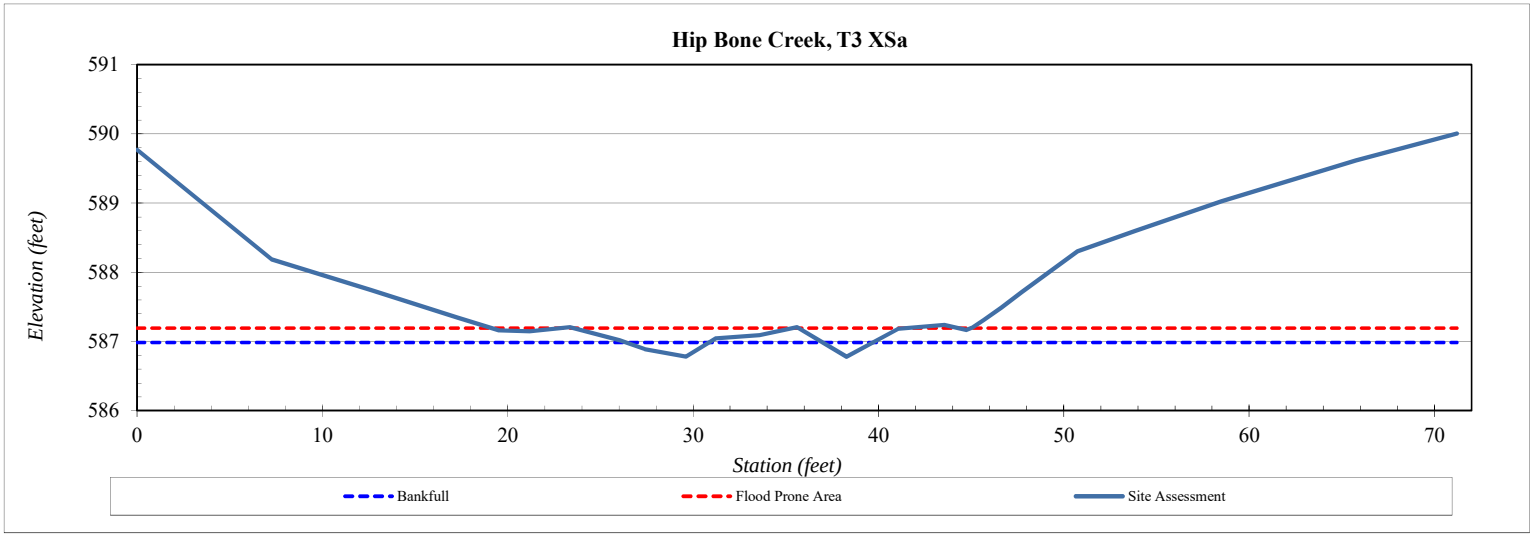


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T3 XSa
Drainage Area (sq mi):	0.01
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	589.77
7.26	588.19
12.62	587.74
17.29	587.35
19.53	587.16
21.18	587.15
23.35	587.21
26.04	587.02
27.41	586.89
29.61	586.78
31.22	587.05
33.59	587.09
35.60	587.21
38.28	586.78
41.08	587.18
43.55	587.24
44.75	587.17
45.05	587.20
45.66	587.31
46.63	587.49
47.72	587.71
50.75	588.30
53.86	588.60
58.49	589.02
65.77	589.62
71.21	590.00

SUMMARY DATA	
Current Bankfull Elevation:	586.99
Bankfull Cross-Sectional Area:	0.8
Bankfull Width:	7.2
Flood Prone Area Elevation:	587.2
Flood Prone Width:	21.8
Max Depth at Bankfull:	0.2
Mean Depth at Bankfull:	0.1
W / D Ratio:	65.0
Entrenchment Ratio:	3.0
Bank Height Ratio:	2.1

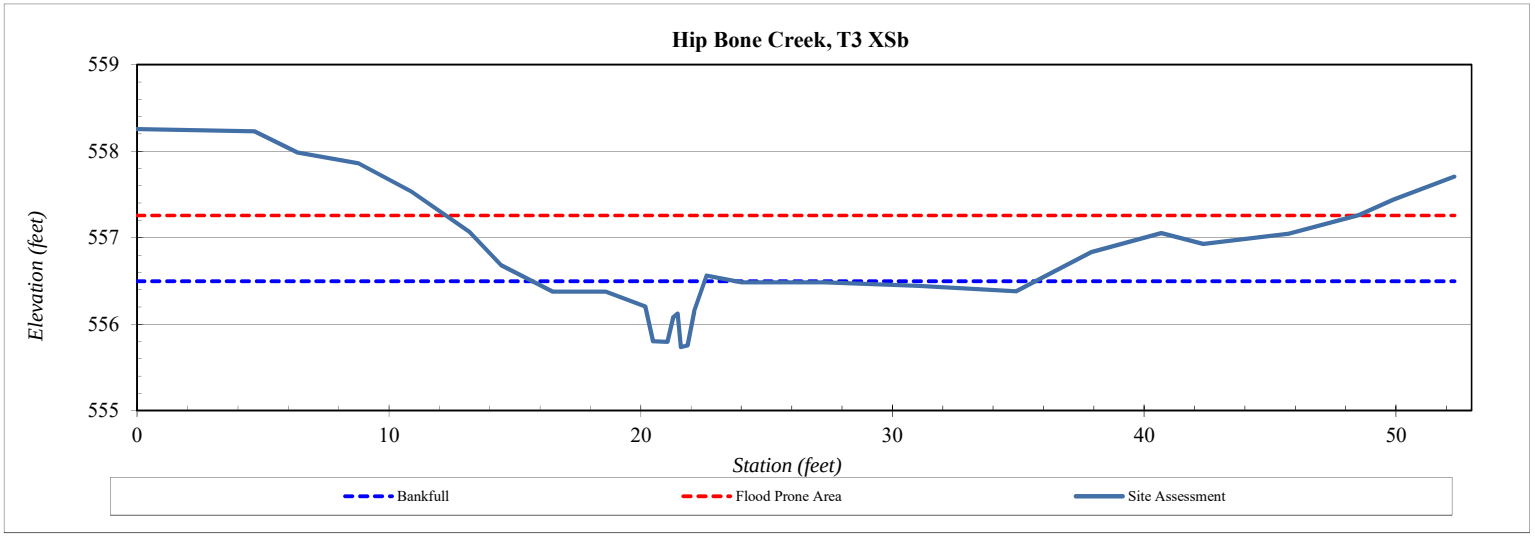


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T3 XSb
Drainage Area (sq mi):	0.05
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

Station	Elevation
0.00	558.26
4.65	558.23
6.36	557.99
8.80	557.86
10.89	557.53
13.19	557.07
14.46	556.68
16.50	556.38
18.60	556.38
20.18	556.20
20.48	555.80
21.06	555.79
21.29	556.08
21.46	556.12
21.60	555.73
21.86	555.75
22.12	556.15
22.63	556.56
24.02	556.48
27.28	556.48
31.05	556.44
34.92	556.38
37.93	556.84
40.68	557.05
42.34	556.93
45.74	557.05
48.56	557.27
49.89	557.44
52.32	557.70

SUMMARY DATA	
Current Bankfull Elevation:	556.50
Bankfull Cross-Sectional Area:	2.4
Bankfull Width:	18.7
Flood Prone Area Elevation:	557.3
Flood Prone Width:	36.2
Max Depth at Bankfull:	0.8
Mean Depth at Bankfull:	0.1
W / D Ratio:	146.8
Entrenchment Ratio:	1.9
Bank Height Ratio:	1.0

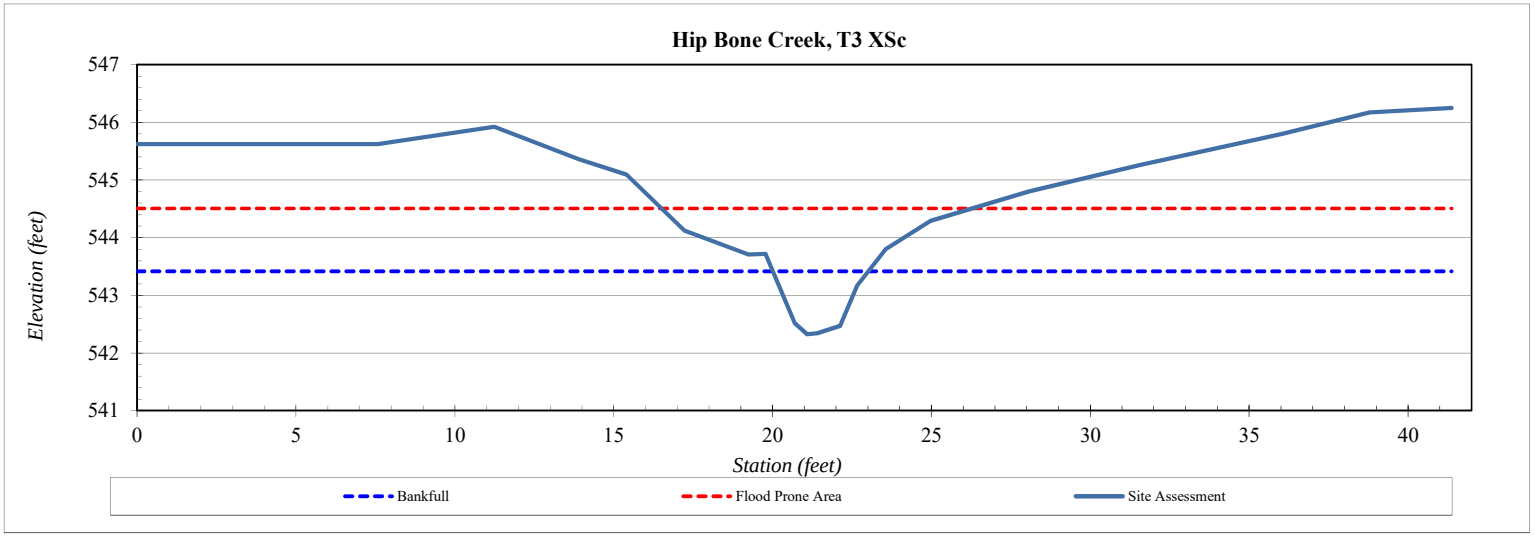


Cross-Section Plots

River Basin:	Cape Fear
Site:	Hip Bone Creek
XS ID	T3 XSc
Drainage Area (sq mi):	0.06
Date:	2/5/2019
Field Crew:	T. Seelinger, J. Sullivan

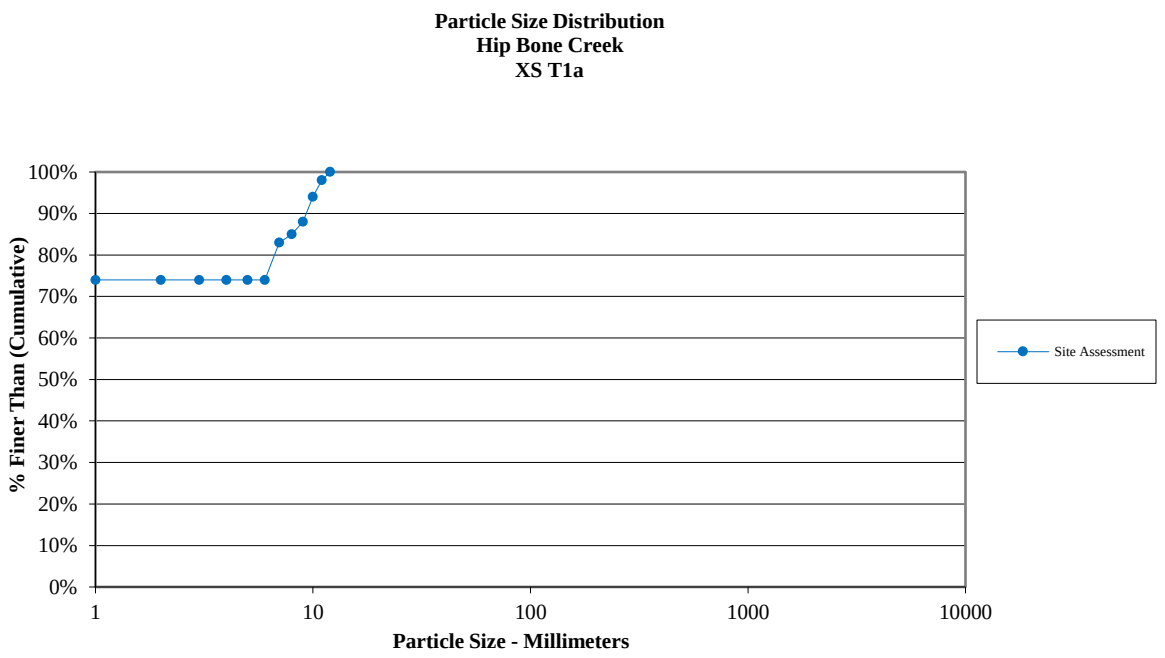
Station	Elevation
0.00	545.63
7.57	545.62
11.23	545.93
13.90	545.36
15.40	545.10
17.23	544.12
19.22	543.71
19.78	543.72
20.71	542.51
21.08	542.32
21.41	542.34
22.12	542.47
22.66	543.16
23.57	543.81
24.97	544.29
28.07	544.80
31.58	545.27
36.04	545.80
38.78	546.17
41.37	546.25

SUMMARY DATA	
Current Bankfull Elevation:	543.42
Bankfull Cross-Sectional Area:	2.1
Bankfull Width:	3.0
Flood Prone Area Elevation:	544.5
Flood Prone Width:	9.8
Max Depth at Bankfull:	1.1
Mean Depth at Bankfull:	0.7
W / D Ratio:	4.2
Entrenchment Ratio:	3.2
Bank Height Ratio:	1.3



Tributary 1 Cross-Section A			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	74
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		9
Fine	4 - 5.7	G	2
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



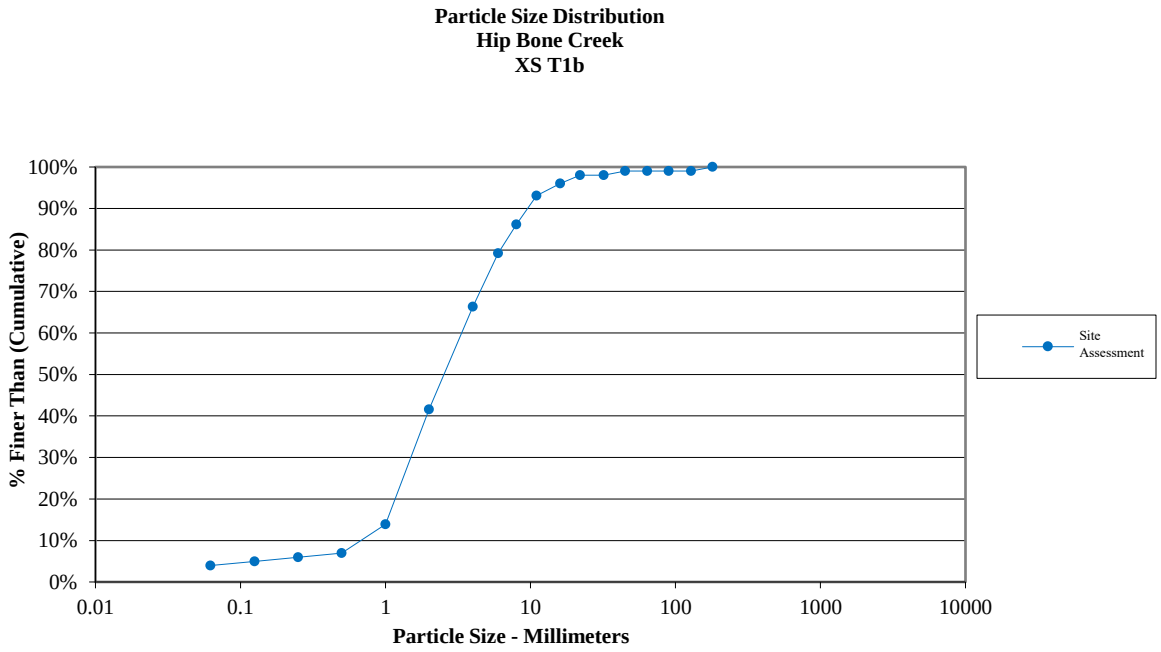
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	4.9
D95	12

Size Distribution	
mean	0.6
dispersion	40.0
skewness	0.69

Type	
silt/clay	74%
sand	0%
gravel	26%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section B			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	4
Very Fine	.062 - .125	S	1
Fine	.125 - .25	A	1
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	28
Very Fine	2 - 4		25
Fine	4 - 5.7	G	13
Fine	5.7 - 8	R	7
Medium	8 - 11.3	A	7
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	2
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note: Removed outlier in 128-180 category



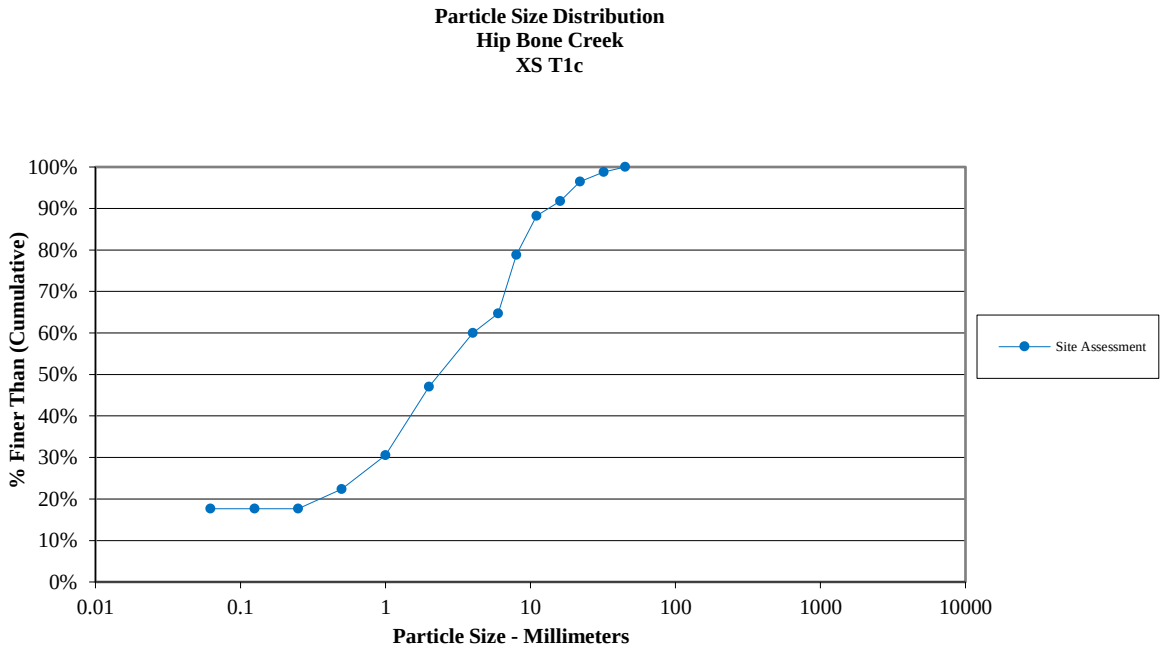
Size (mm)	
D16	1.1
D35	1.7
D50	2.5
D65	3.8
D84	7.1
D95	12

Size Distribution	
mean	2.8
dispersion	2.6
skewness	0.05

Type	
silt/clay	4%
sand	38%
gravel	58%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section C			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	15
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	4
Coarse	.50 - 1	D	7
Very Coarse	1 - 2	S	14
Very Fine	2 - 4		11
Fine	4 - 5.7	G	4
Fine	5.7 - 8	R	12
Medium	8 - 11.3	A	8
Medium	11.3 - 16	V	3
Coarse	16 - 22.6	E	4
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	85

Note:



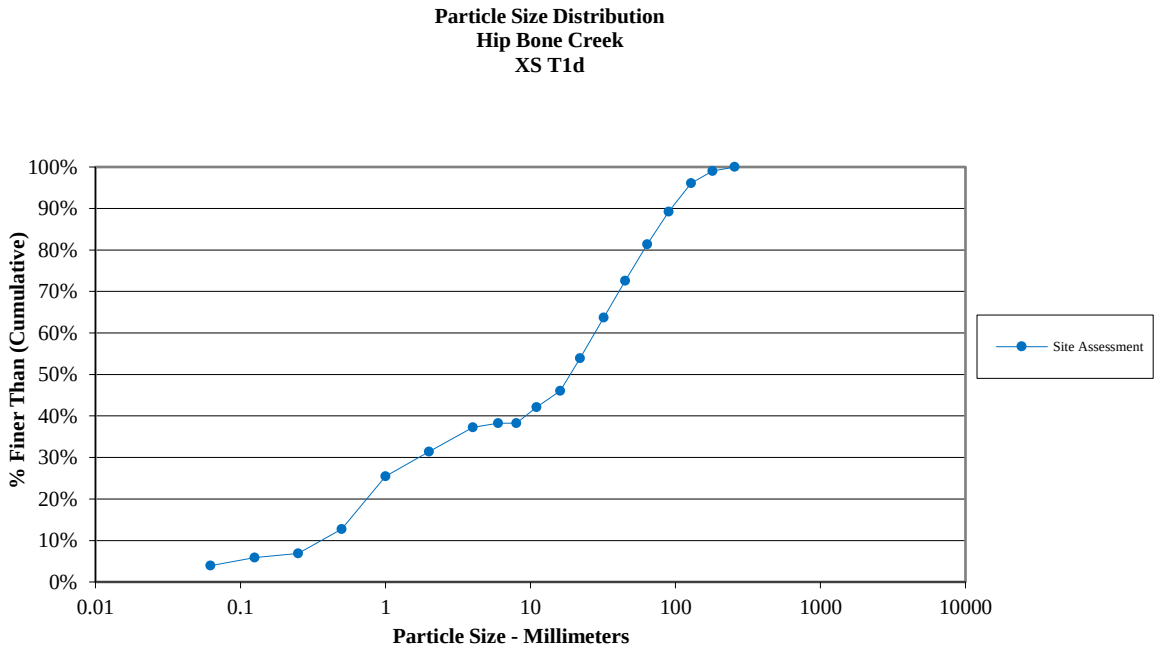
Size (mm)	
D16	0.35
D35	1.3
D50	2.1
D65	3.5
D84	8.2
D95	18

Size Distribution	
mean	1.7
dispersion	5.0
skewness	-0.08

Type	
silt/clay	18%
sand	29%
gravel	53%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section D			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	4
Very Fine	.062 - .125	S	2
Fine	.125 - .25	A	1
Medium	.25 - .50	N	6
Coarse	.50 - 1	D	13
Very Coarse	1 - 2	S	6
Very Fine	2 - 4		6
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	4
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	10
Very Coarse	32 - 45	S	9
Very Coarse	45 - 64		9
Small	64 - 90	C	8
Small	90 - 128	O	7
Large	128 - 180	B	3
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	1
		Total	103

Note:



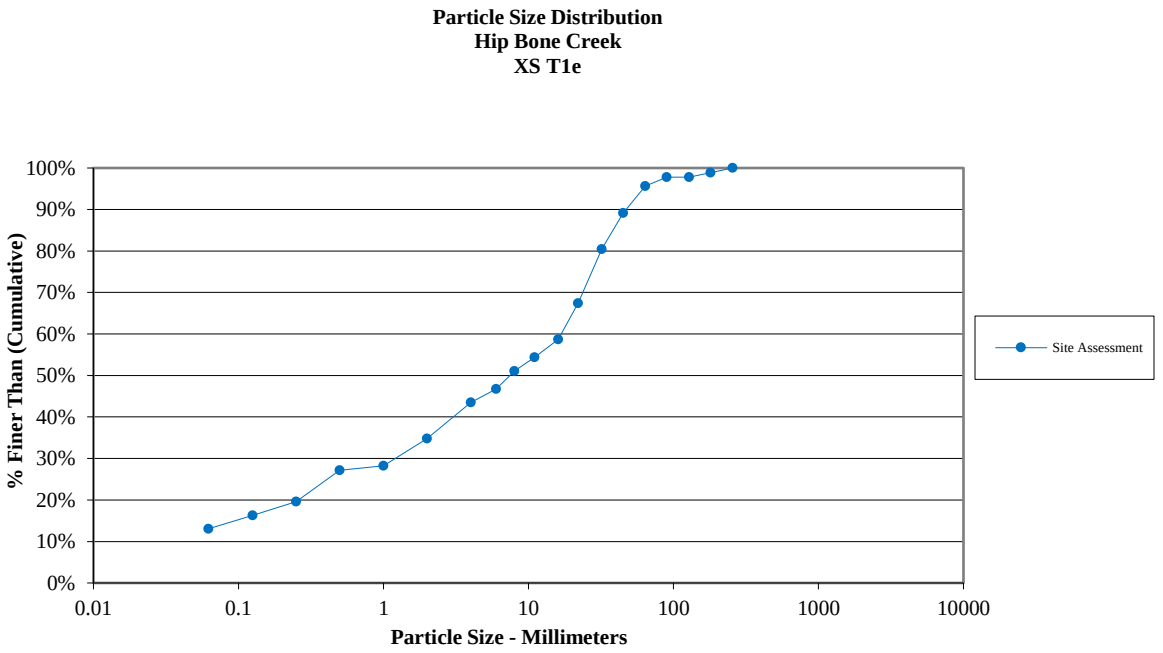
Size (mm)	
D16	0.6
D35	3.1
D50	19
D65	34
D84	72
D95	120

Size Distribution	
mean	6.6
dispersion	17.7
skewness	-0.32

Type	
silt/clay	4%
sand	27%
gravel	50%
cobble	18%
boulder	0%
bedrock	1%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section E			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	12
Very Fine	.062 - .125	S	3
Fine	.125 - .25	A	3
Medium	.25 - .50	N	7
Coarse	.50 - 1	D	1
Very Coarse	1 - 2	S	6
Very Fine	2 - 4		8
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	4
Medium	8 - 11.3	A	3
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	8
Coarse	22.6 - 32	L	12
Very Coarse	32 - 45	S	8
Very Coarse	45 - 64		6
Small	64 - 90	C	2
Small	90 - 128	O	
Large	128 - 180	B	1
Large	180 - 256	L	1
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	4
		Total	96

Note:



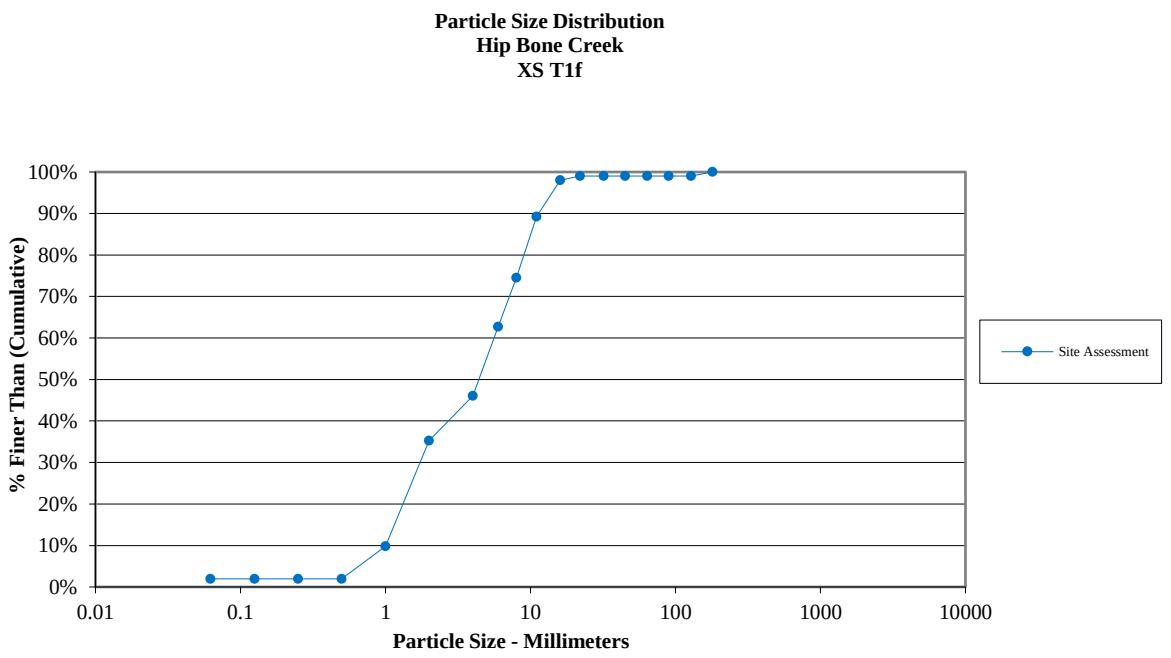
Size (mm)	
D16	0.12
D35	2
D50	7.4
D65	20
D84	37
D95	62

Size Distribution	
mean	2.1
dispersion	33.3
skewness	-0.35

Type	
silt/clay	13%
sand	21%
gravel	58%
cobble	4%
boulder	0%
bedrock	4%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section F			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	2
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	8
Very Coarse	1 - 2	S	26
Very Fine	2 - 4		11
Fine	4 - 5.7	G	17
Fine	5.7 - 8	R	12
Medium	8 - 11.3	A	15
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	102

Note:



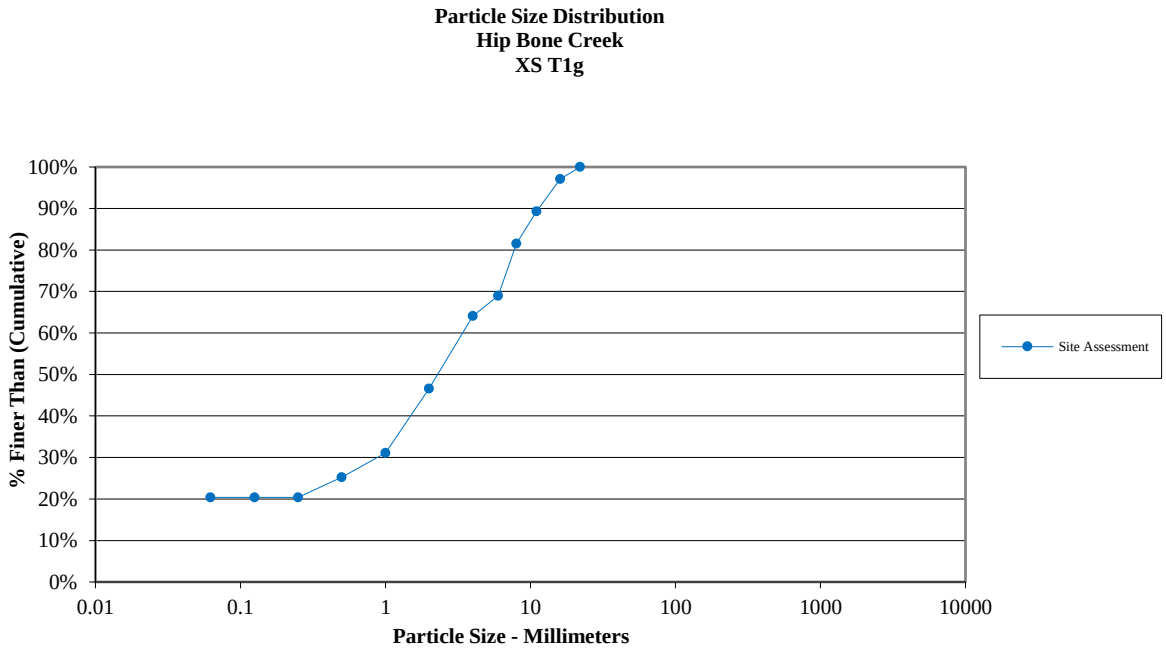
Size (mm)	
D16	2
D35	5
D50	8.5
D65	11
D84	20
D95	32

Size Distribution	
mean	6.3
dispersion	3.3
skewness	-0.13

Type	
silt/clay	2%
sand	33%
gravel	64%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section G			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	21
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	5
Coarse	.50 - 1	D	6
Very Coarse	1 - 2	S	16
Very Fine	2 - 4		18
Fine	4 - 5.7	G	5
Fine	5.7 - 8	R	13
Medium	8 - 11.3	A	8
Medium	11.3 - 16	V	8
Coarse	16 - 22.6	E	3
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	103

Note:



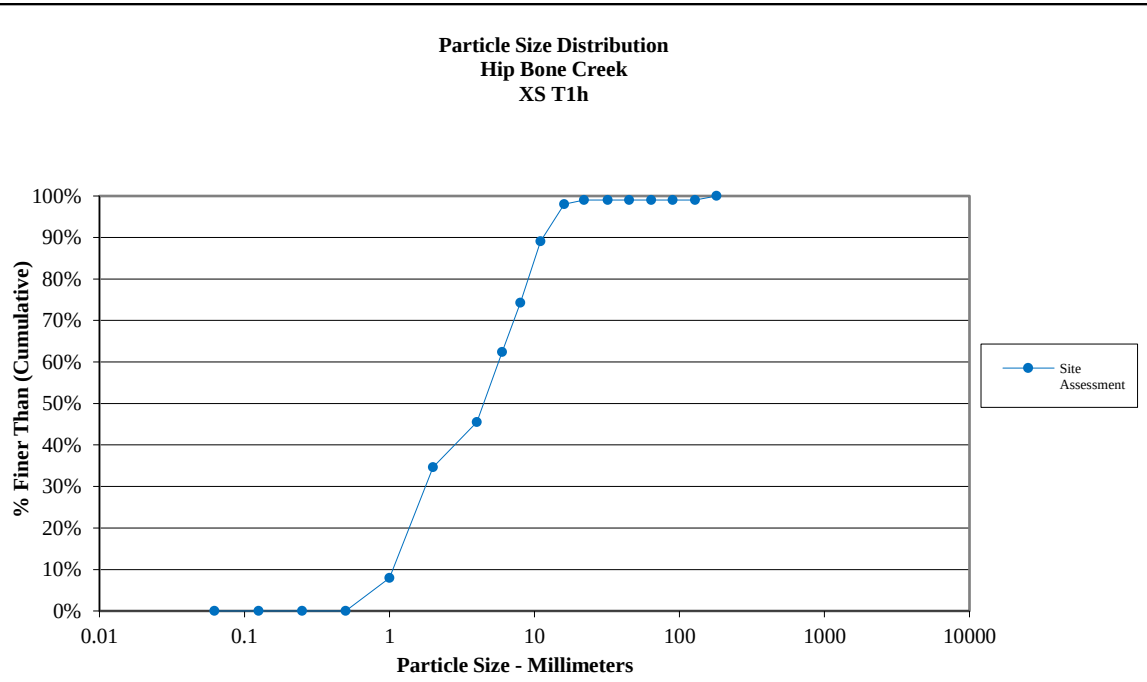
Size (mm)	
D16	0.062
D35	1.2
D50	2.3
D65	4.3
D84	8.8
D95	14

Size Distribution	
mean	0.7
dispersion	20.5
skewness	-0.34

Type	
silt/clay	20%
sand	26%
gravel	53%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 1 Cross-Section H			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	8
Very Coarse	1 - 2	S	27
Very Fine	2 - 4		11
Fine	4 - 5.7	G	17
Fine	5.7 - 8	R	12
Medium	8 - 11.3	A	15
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



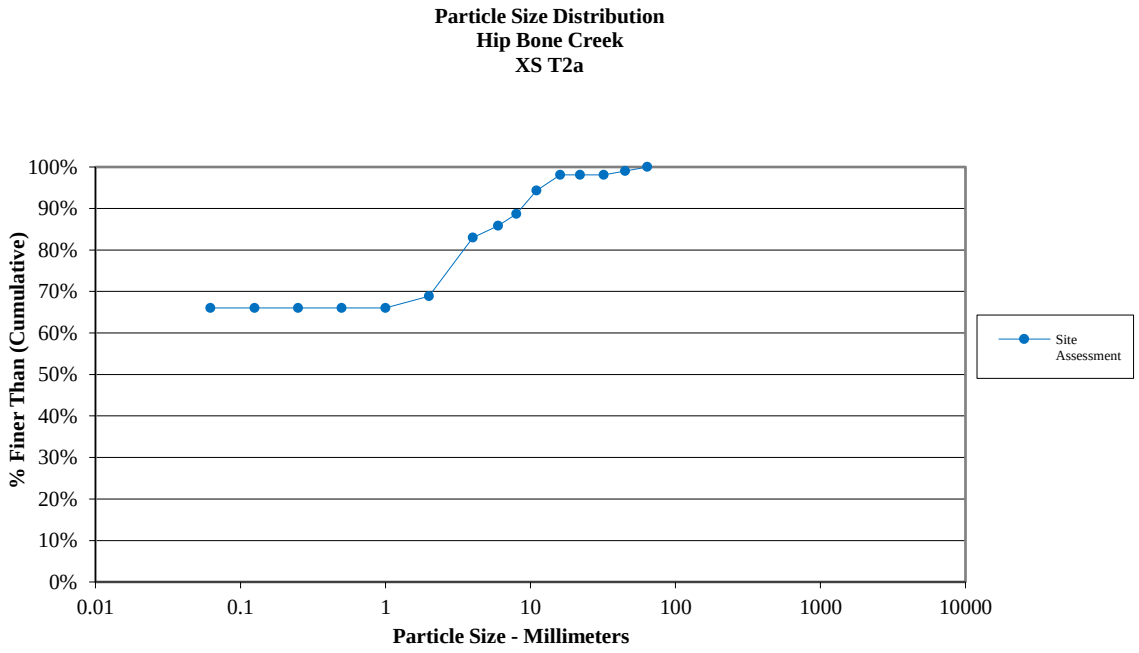
Size (mm)	
D16	1.2
D35	2
D50	4.5
D65	6.4
D84	9.9
D95	14

Size Distribution	
mean	3.4
dispersion	3.0
skewness	-0.12

Type	
silt/clay	0%
sand	35%
gravel	64%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 2 Cross-Section A			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	70
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	3
Very Fine	2 - 4		15
Fine	4 - 5.7	G	3
Fine	5.7 - 8	R	3
Medium	8 - 11.3	A	6
Medium	11.3 - 16	V	4
Coarse	16 - 22.6	E	
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		1
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	106

Note:



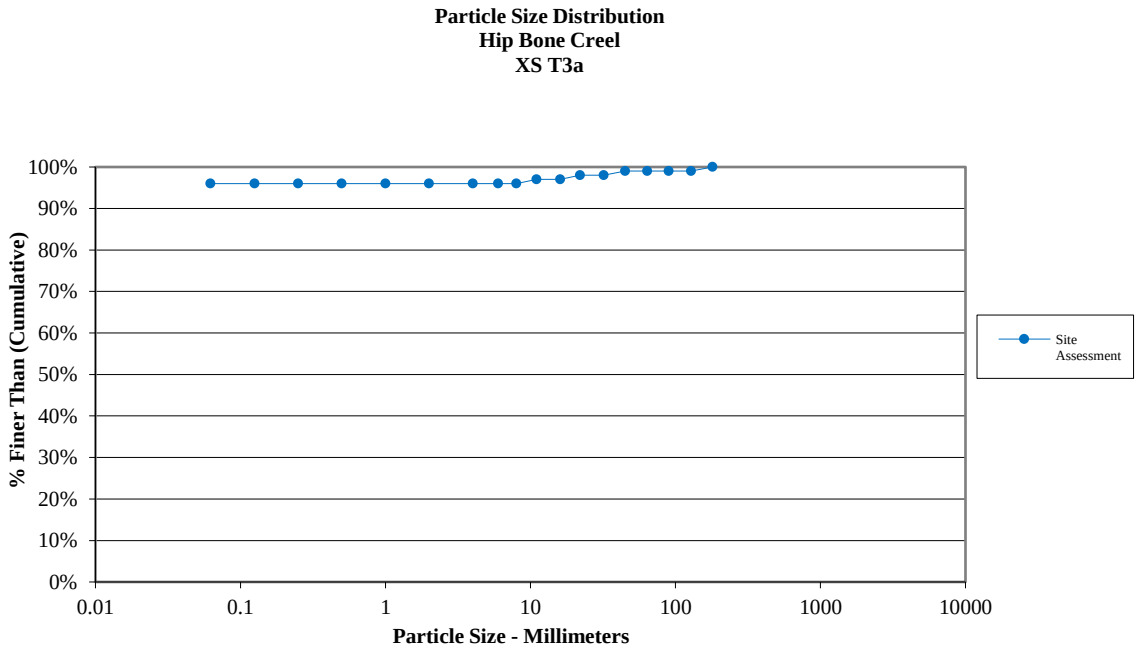
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	2.9
D84	9
D95	12

Size Distribution	
mean	0.7
dispersion	73.1
skewness	0.74

Type	
silt/clay	66%
sand	3%
gravel	31%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 3 Cross-Section A			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	96
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	
Very Coarse	1 - 2	S	
Very Fine	2 - 4		
Fine	4 - 5.7	G	
Fine	5.7 - 8	R	
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	1
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	1
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



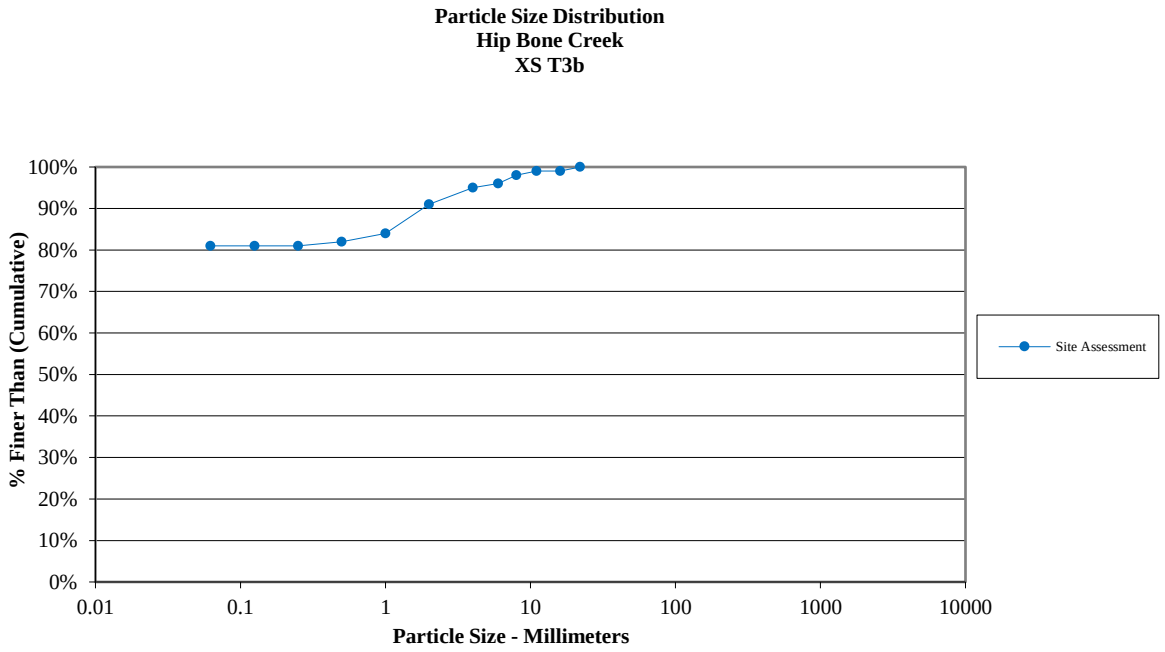
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	0.062
D95	0.062

Size Distribution	
mean	0.1
dispersion	1.0
skewness	---

Type	
silt/clay	96%
sand	0%
gravel	3%
cobble	1%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 3 Cross-Section B			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	81
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	1
Coarse	.50 - 1	D	2
Very Coarse	1 - 2	S	7
Very Fine	2 - 4		4
Fine	4 - 5.7	G	1
Fine	5.7 - 8	R	2
Medium	8 - 11.3	A	1
Medium	11.3 - 16	V	
Coarse	16 - 22.6	E	1
Coarse	22.6 - 32	L	
Very Coarse	32 - 45	S	
Very Coarse	45 - 64		
Small	64 - 90	C	
Small	90 - 128	O	
Large	128 - 180	B	
Large	180 - 256	L	
Small	256 - 362	B	
Small	362 - 512	L	
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	100

Note:



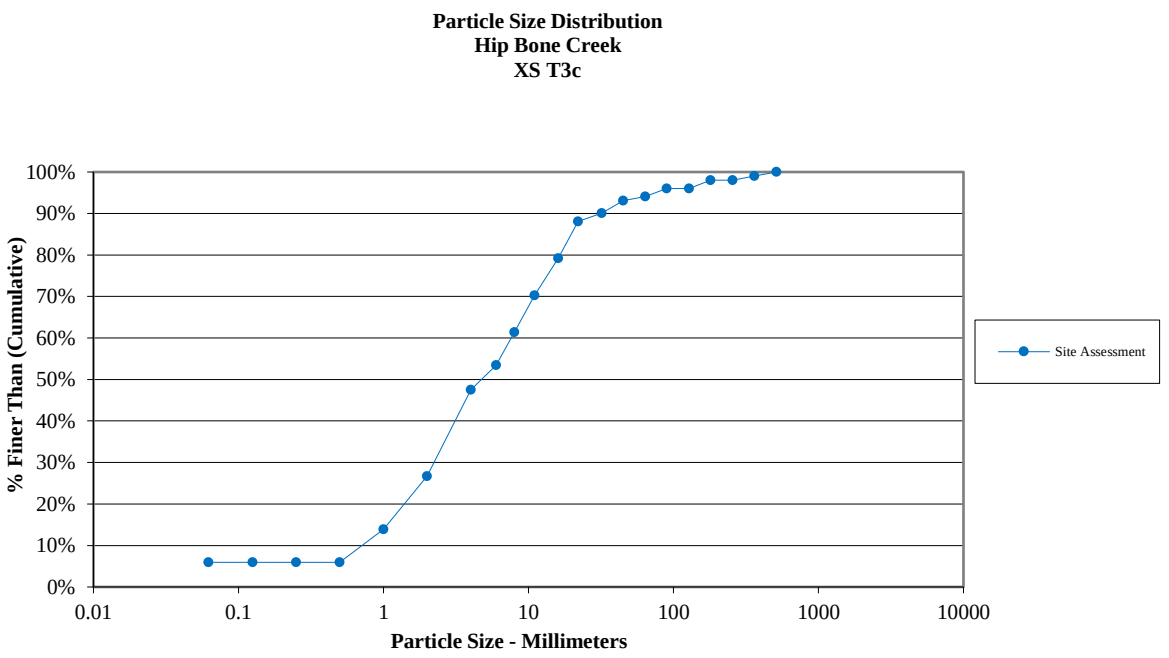
Size (mm)	
D16	0.062
D35	0.062
D50	0.062
D65	0.062
D84	1
D95	4

Size Distribution	
mean	0.2
dispersion	8.6
skewness	0.55

Type	
silt/clay	81%
sand	10%
gravel	9%
cobble	0%
boulder	0%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Tributary 3 Cross-Section C			
Particle	Millimeter		Count
Silt/Clay	< 0.062	S/C	6
Very Fine	.062 - .125	S	
Fine	.125 - .25	A	
Medium	.25 - .50	N	
Coarse	.50 - 1	D	8
Very Coarse	1 - 2	S	13
Very Fine	2 - 4		21
Fine	4 - 5.7	G	6
Fine	5.7 - 8	R	8
Medium	8 - 11.3	A	9
Medium	11.3 - 16	V	9
Coarse	16 - 22.6	E	9
Coarse	22.6 - 32	L	2
Very Coarse	32 - 45	S	3
Very Coarse	45 - 64		1
Small	64 - 90	C	2
Small	90 - 128	O	
Large	128 - 180	B	2
Large	180 - 256	L	
Small	256 - 362	B	1
Small	362 - 512	L	1
Medium	512 - 1024	D	
Lrg- Very Lrg	1024 - 2048	R	
Bedrock	>2048	BDRK	
		Total	101

Note:



Size (mm)	
D16	1.1
D35	2.6
D50	4.7
D65	9.1
D84	19
D95	75

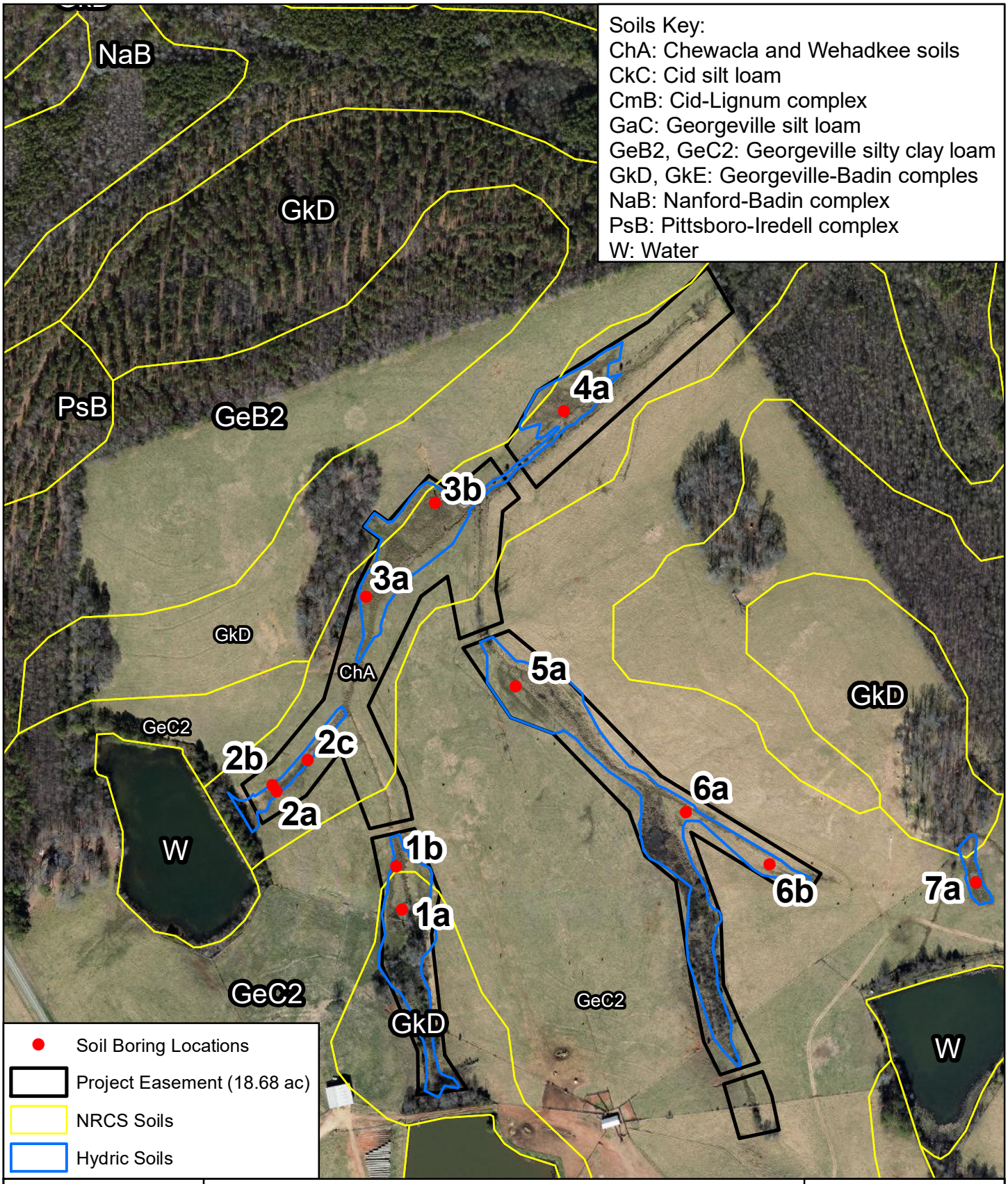
Size Distribution	
mean	4.6
dispersion	4.2
skewness	-0.01

Type	
silt/clay	6%
sand	21%
gravel	67%
cobble	4%
boulder	2%
bedrock	0%
hardpan	0%
wood/det	0%
artificial	0%

Morphological Criteria

		Existing Channel		Stable Design Ratios	Stable Design Ratios	Stable Design Ratios	Restored Reaches			
		T1 T1A-T1H	T3 T3A-T3C				T1 Reach 1	T1 Reach 2	T1 Reaches 3 and 5	T3 Reach 3
Stream Type (Rosgen)		G4c/G4	G4	B4	B4c	C4	C4b	C4	C4	C4
Drainage Area (mi^2)		0.06, 0.06, 0.13, 0.14, 0.21, 0.23, 0.24	0.01, 0.05, 0.06	~	~	~	0.058	0.119	0.247	0.065
Bankfull Width (W_{bkf}) (ft)		7.3, 5.2, 10.2, 4.4, 4.6, 7.6, 15.7, 19.3	7.2, 18.7, 3.0	~	~	~	5.4	7.0	8.6	5.8
Bankfull Mean Depth (D_{bkf}) (ft)		0.3, 0.5, 0.4, 1.0, 1.3, 0.8, 0.4, 0.5	0.1, 0.1, 0.7	~	~	~	0.4	0.6	0.7	0.5
Bankfull Cross-Sectional Area (A_{bkf}) (ft^2)		2.5, 2.4, 4.2, 4.2, 5.9, 5.8, 6.0, 8.8	0.8, 2.4, 2.1	~	~	~	2.2	4.0	6.0	2.7
Width / Depth Ratio (W_{bkf} / D_{bkf})		21.8, 11.0, 24.8, 4.5, 3.6, 9.8, 41.4, 42.1	65.0, 25.2, 4.2	12 -- 18	12 -- 18	10 -- 15	13.0	12.2	12.4	12.7
Maximum Depth (d_{mbkf}) (ft)		0.9, 1.3, 1.4, 1.5, 1.8, 1.8, 1.1, 1.9	0.2, 0.8, 1.1	~	~	~	0.7	0.9	1.1	0.7
Width of Flood Prone Area (W_{fpa}) (ft)		12.0, 14.8, 28.2, 12.6, 12.5, 23.8, 33.5, 49.9	27.2, 36.8, 16.1	~	~	~	35 -- 42	42 -- 56	30 -- 58	30 - 40
Entrenchment Ratio (ER)		1.6, 2.9, 2.8, 2.9, 2.7, 3.1, 2.1, 2.6	3.8, 2.0, 5.4	1.4 -- 2.2	>2.2	>2.2	6.5 -- 7.8	6.0 -- 8.0	3.5 -- 6.7	5.2 -- 6.9
Sinuosity (stream length/valley length) (K)		1.0	1.0	1.1 -- 1.2	1.1 -- 1.3	1.2 -- 1.4	1.2	1.2	1.14	1.13
Dimension	Pool Mean Depth (ft)	*	*	~	~	~	0.8	1.1	1.3	0.9
	Riffle Mean Depth (ft) (Dbkf)	0.3, 0.5, 0.4, 1.0, 1.3, 0.8, 0.4, 0.5	0.1, 0.1, 0.7	~	~	~	0.4	0.6	0.7	0.5
	Pool Width (ft)	*	*	~	~	~	7.8	9.8	12.0	8.1
	Riffle Width (ft)	7.3, 5.2, 10.2, 4.4, 4.6, 7.6, 15.7, 19.3	7.2, 18.7, 3.0	~	~	~	5.4	7.0	8.6	5.8
	Pool XS Area (sf)	*	*	~	~	~	6.4	10.6	16.0	6.9
	Riffle XS Area (sf)	2.5, 2.4, 4.2, 4.2, 5.9, 5.8, 6.0, 8.8	0.8, 2.4, 2.1	~	~	~	2.2	4.0	6.0	2.7
	Pool Width / Riffle Width	*	*	1.1 -- 1.5	1.1 -- 1.5	1.2 -- 1.7	1.4	1.4	1.4	1.4
	Pool Max Depth / D_{bkf}	*	*	2.0 -- 3.5	2.0 -- 3.5	1.5 -- 3.5	3.5	3.0	3.1	2.8
	Bank Height Ratio	1.2, 1.0, 1.0, 1.2, 1.5, 1.0, 1.0, 1.0	2.1, 1.0, 1.3	1.0 -- 1.1	1.0 -- 1.1	1.0 -- 1.1	1.0	1.0	1.0	1.0
	Mean Bankfull Velocity (V) (fps)	3.3, 3.5, 3.3, 3.5, 2.6, 3.5, 3.6, 2.6	3.4, 4.7, 4.2	4.0 -- 6.0	4.0 -- 6.0	3.5 -- 5.0	3.6	3.4	3.3	3.3
	Bankfull Discharge (Q) (cfs)	8.1, 8.6, 14.1, 14.6, 15.3, 20.3, 21.3, 22.7	2.7, 8.8, 9.0	~	~	~	8.0	13.6	19.8	8.7
Pattern	Radius of Curvature (Rc) (ft)	*	*	~	~	~	11 -- 16	15 -- 18	17 -- 21	12 -- 16
	Belt Width (Wblt) (ft)	*	*	~	~	~	22 -- 30	27 -- 43	33 -- 41	21 -- 29
	Meander Length (Lm) (ft)	*	*	~	~	~	60 -- 76	80 -- 95	93 -- 99	67 -- 76
	Radius of Curvature / Bankfull Width	*	*	n/a	n/a	2 -- 3	2.0 -- 3.0	2.1 -- 2.6	2.0 -- 2.4	2.1 -- 2.8
	Meander Width Ratio (Wblt / Wbkf)	*	*	n/a	n/a	3.5 -- 8	4.1 -- 5.6	3.9 -- 6.1	3.8 -- 4.8	3.6 -- 5.0
	Meander Length / Bankfull Width	*	*	n/a	n/a	7 -- 14	11.1 -- 14.1	11.4 -- 13.6	10.8 -- 11.5	11.6 -- 13.1
Profile	Valley slope	0.011 -- 0.027	0.02 -- 0.039	0.020 -- 0.030	0.005 -- 0.015	0.005 -- 0.015	0.028	0.018	0.0093	0.019
	Average water surface slope	0.003 -- 0.025	0.047, 0.015, 0.024	~	~	~	0.024	0.015	0.0082	0.017
	Riffle slope	*	*	~	~	~	0.021 -- 0.036	0.019 -- 0.020	0.013 -- 0.019	0.020 -- 0.021
	Pool slope	*	*	~	~	~	0	0	0	0
	Pool to pool spacing	*	*	~	~	~	33 -- 41	47 -- 54	48 -- 59	38 -- 41
	Pool length	*	*	~	~	~	10 -- 21	17 -- 32	14 -- 31	10 -- 19
	Riffle Slope / Avg. Water Surface Slope	*	*	1.1 -- 1.8	1.1 -- 1.8	1.2 -- 1.5	0.9 -- 1.5	1.3	1.6 -- 2.3	1.2
	Pool Slope / Avg. Water Surface Slope	*	*	0 -- 0.4	0 -- 0.4	0 -- 0.2	0	0	0	0
	Pool to Pool Spacing / Bankfull Width	*	*	0.5 -- 5.0	1.5 -- 6.0	3.5 -- 7	6.1 -- 7.6	6.7 -- 7.7	5.6 -- 6.8	6.6 -- 7.0

* : no data shown for pools, radius of curvature or meanders in existing stream do to nature of channel


Soils Key:
ChA: Chewacla and Wehadkee soils
CkC: Cid silt loam
CmB: Cid-Lignum complex
GaC: Georgeville silt loam
GeB2, GeC2: Georgeville silty clay loam
GkD, GkE: Georgeville-Badin comples
NaB: Nanford-Badin complex
PsB: Pittsboro-Iredell complex
W: Water
NaB
GkD
PsB
GeB2
4a
3b
3a
GkD
ChA
5a
GkD
GeC2
2b
2c
2a
W
6a
1b
6b
7a
1a
GeC2
GeC2
GkD
W
Soil Boring Locations
Project Easement (18.68 ac)
NRCS Soils
Hydric Soils
0
200
400
Feet
SOIL BORINGS
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC
N
Image Source: SSURGO Soils for Chatham County, NRCS

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 1a
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: 24" **SHWT:** 6-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 36 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-6	10YR 4/3		l	1fgr	mfr	cs	
Bt1	6-11	10YR 5/1	10YR 4/3c2f	l	1fsbk	mfr	cw	20% redox
			10YR 4/6c2d					2% redox
			10YR 2/2c2f					15% redox
Bt2	11-24	10YR 5/2	10YR 4/6c1d	l	1fsbk	mfr	gw	10% redox
			10YR2/2c1f					2% redox
Bt3	24-36	10YR 4/1	7.5YR 4/6f1d	cl	1fsbk	mfr		

COMMENTS:

DESCRIBED BY: SFS, KO

LICENSED SOIL SCIENTIST STEVEN F. STOKES 1087 STATE OF NORTH CAROLINA

DATE: 2/6/2018

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 1b
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: 7" **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 13 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-4	10YR 4/2	5YR 4/6c2p	l	1fgr	mfr	cs	20% redox
Bt1	4-13	10YR 5/2	5YR 4/6m1p	l	1fsbk	mfr		30% redox-pore linings, ped surfaces

COMMENTS:

DESCRIBED BY: SFS, KO DATE: 2/6/2018

LICENSED SOIL SCIENTIST STEVEN F. STOKES NORTH CAROLINA 1087 STATE OF NORTH CAROLINA

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 2a
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: surface **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 30 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-5	10YR 5/2	5YR 4/6c2p	l	1fgr	mfr	cs	10% redox
Bt1	5-14	10YR 6/1	10YR5/8m2d	cl	1fsbk	mfi	cw	30% redox
Bt2	14-18	10YR 5/1	10YR5/8c2d	c	1fsbk	mfi	cw	
Cg	18-30	10YR5/1	10YR5/8c2d	c	massive	mfi		

COMMENTS:

DESCRIBED BY: SFS, KO DATE: 2/6/2018

LICENSED SOIL SCIENTIST STEVEN F. STOKES 1087 STATE OF NORTH CAROLINA

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 2b
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: surface **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 24 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-6	10YR5/3		muck		mfr	cs	
Bt1	6-12	10YR 5/1	10YR4/1c2f	c	massive	mfi	cw	hoof compaction
			5YR4/4m2p					redox 30%
Bt2	12-24	10YR 4/1	7.5YR4/3m1d	cl	1fsbk	mfr		redox 40%, concretions in matrix

COMMENTS:

DESCRIBED BY: SFS, KO DATE: 2/6/2018

LICENSED SOIL SCIENTIST STEVEN F. STOKES STATE OF NORTH CAROLINA 1087

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 2c
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: surface **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 30 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-18	10YR4/2		muck	massive	mfr	cs	hoof compaction
Cg1	18-24	10YR4/2	6/10BG	1	massive	mfr	cw	
Cg2	24-30	10YR4/2	6/10BG	1	massive	mfr		

COMMENTS:

DESCRIBED BY: SFS, KO

LICENSED SOIL SCIENTIST STEVEN F. STOKES 1087 STATE OF NORTH CAROLINA

DATE: 2/6/2018

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 3a
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: surface **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 36 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-6	5YR5/2	2.5YR 4/6m1d	l	1fsbk	mfr	cs	redox pore linings and ped surfaces
Bt1	6-12	10YR4/2		l	massive	mfi	cw	hoof compaction
Bt2	12-15	10YR4/1	7.5YR4/4f1d	l	massive	mfr	cw	pore linings
Bt3	15-24	2.5YR4/4	10YR4/1f1p	cl	1fsbk	mfr	gw	
Cg	24-36	10YR4/1	10YR5/4c2d	scl	massive	mfr		20% mottles

COMMENTS:

DESCRIBED BY: SFS, KO

DATE: 2/6/2018

KCI
ASSOCIATES OF
NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A.
Date: February 6, 2018
Project: Hip Bone Creek
Project #: 161803280P
County: Chatham
State: NC
Location: 865 Carter-Brooks Road
Site/Lot: Boring # 3b
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: surface **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 30 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-6	10YR5/1	2.5YR3/6m1p	l	1fsbk	mfr	cs	
Cg1	6-12	10YR4/1	2.5YR3/6f2p	c	massive	mfi	cw	
Cg2	12-28	10YR5/1	10YR5/6c2d	c	massive	mfi	cw	
Cg3	28-30	7/10B	10YR5/6c2p	c	massive	mfi		

COMMENTS:

DESCRIBED BY: SFS, KO

DATE: 2/6/2018

KCI ASSOCIATES OF NORTH CAROLINA, PA

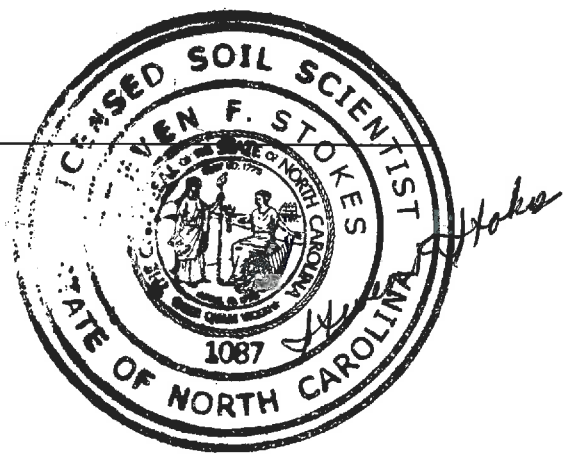
SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 4a
Soil Series: Wehadkee
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: 8" **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 45 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-4	10YR5/2	5YR4/4c2p	l	1fgr	mfr	cs	redox-pore linings, ped surfaces
Bt1	4-7	10YR5/2	5YR3/4c2p	l	1fsbk	mfr	cw	redox ped surfaces
			10YR2/1c2f					
Bt2	7-14	10YR5/1	5YR3/2m3p	l	1fsbk	mfr	cw	more than 30% pore linings, ped surfaces
Bt3	14-28	10YR5/1	5YR4/4c2p	cl	1fsbk	mfr	gw	10% redox
Cg1	28-36	10YR 4/1	10YR2/1m1d	sc	massive	mfi	gw	
			10YR5/6c2d					
Cg2	36-45	5/10B	10YR4/4f2p	cl	massive	mfr		

COMMENTS:

DESCRIBED BY: SFS, KO



DATE: 2/6/2018

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 5a
Soil Series: Wehadkee Variant
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: 2" **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 38 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-3	10YR4/3	10YR5/2c2f	l	1fgr	mfr	cs	20% redox, linings and ped surface
Bt1			5YR3/4c2p			mfr	cw	
Bt2	3-7	10YR4/2	5YR3/4c2p	l	1fsbk	mfr	cw	pore linings and ped surfaces
Bt3	7-36	10YR4/1	10YR5/3	l	1msbk	mfr	gw	depletions
Bt4	36-38	10YR4/1	7.5YR5/8f2d	l	1msbk	mfr		Gravelly, Auger Refusal
			5YR4/4c3p	l	1msbk			

COMMENTS:

DESCRIBED BY: SFS, KO

LICENSED SOIL SCIENTIST STEVEN F. STOKES STATE OF NORTH CAROLINA 1087

DATE: 2/6/2018

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 6a
Soil Series: Wehadkee Variant
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: 10" **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 30 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-2	10YR 5/3	10YR5/2c2f	l	1fgr	mfr	cs	
Bt1	2-6	10YR 5/3	5YR4/4c2p	l		mfr	cw	redox-pore linings, ped surfaces
Bt2	6-9	10YR 5/3	5YR4/3c2p	l	1fsbk			redox-pore linings, ped surfaces
Bt3	9-14	10YR4/1	5YR4/3c2p	l	1fsbk	mfr	gw	redox pore linings, ped surfaces
Bt4	14-30	10YR4/1	5YR4/3c2p	cl	1fsbk	mfr		20% redox pore linings, ped surfaces

COMMENTS:

DESCRIBED BY: SFS, KO DATE: 2/6/2018

LICENSED SOIL SCIENTIST STEVEN F. STOKES 1067 STATE OF NORTH CAROLINA

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A. **Date:** February 6, 2018
Project: Hip Bone Creek **Project #:** 161803280P
County: Chatham **State:** NC
Location: 865 Carter-Brooks Road **Site/Lot:** Boring # 6b
Soil Series: Wehadkee Variant
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: 13" **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 20 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-2	10YR 5/3		1	1fgr	mfr	cs	
Bt1	2-13	10YR 5/2	10YR4/4f2p	1	1fsbk	mfr	cw	10% redox pore linings, ped surfaces
Bt2	13-20	10YR6/4	5YR5/6c2p	1	1fsbk	mfr		auger refusal-gravel

COMMENTS:

DESCRIBED BY: SFS, KO

LICENSED SOIL SCIENTIST STEVEN F. STOKES 1087 STATE OF NORTH CAROLINA

DATE: 2/6/2018

KCI ASSOCIATES OF NORTH CAROLINA, PA

SOIL PROFILE DESCRIPTION

Client: KCI Associates of North Carolina, P.A.
Date: February 6, 2018
Project: Hip Bone Creek
Project #: 161803280P
County: Chatham
State: NC
Location: 865 Carter-Brooks Road
Site/Lot: Boring # 7a
Soil Series: Wehadkee Variant
Soil Classification: Fine-loamy, mixed , active, thermic Fluvaquentic Endoaquepts
AWT: surface **SHWT:** 0-12" **Slope:** 0-2% **Aspect:**
Elevation: **Drainage:** Poorly drained **Permeability:** Moderate
Vegetation: Pasture
Borings terminated at 36 **Inches**

HORIZON	DEPTH (IN)	MATRIX	MOTTLES	TEXTURE	STRUCTURE	CONSISTENCE	BOUNDARY	NOTES
A	0-6	10YR4/1		muck	massive	mfr	cs	10YR4/1 or maybe 10YR3/1
Cg1	6-24	10YR4/1		l	massive	mfr	cw	
Cg2	24-36	5/10B	10YR4/3c2p	cl	massive	mfr		depletetions-matrix

COMMENTS:

DESCRIBED BY: SFS, KO

LICENSED SOIL SCIENTIST STEVEN F. STOKES 1087 STATE OF NORTH CAROLINA

DATE: 2/6/2018

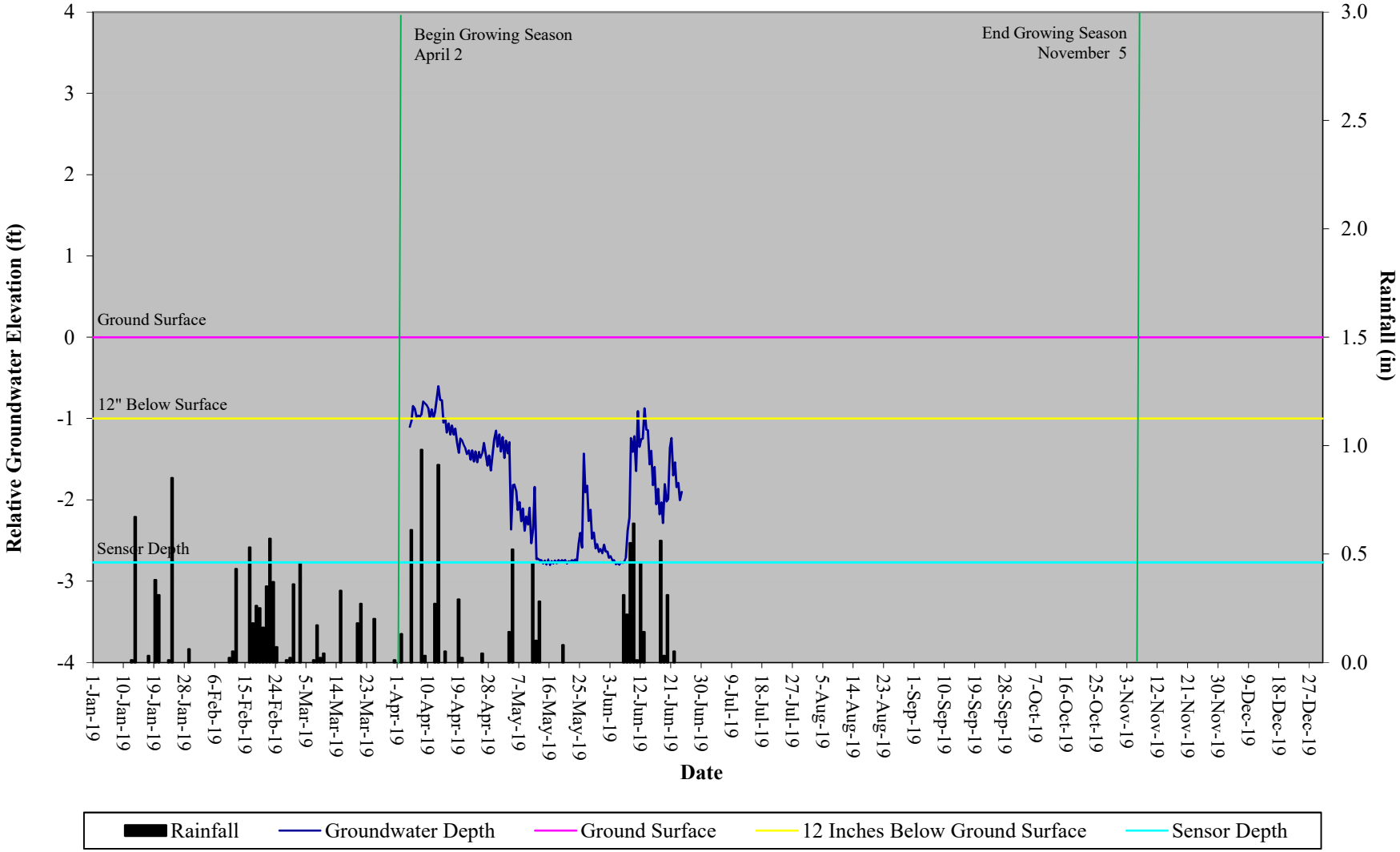
Project:	Hip Bone Creek		
DMS Project ID:	100059		
Wetland Component:	Riparian Wetlands		
Growing Season:	April 2 through November 5 (217 days)		
Units	Feet		
Gauge Type	Groundwater		
Date and Time	Gauge ID : 1	Gauge ID: 2	Gauge ID: 3
	Offset: 0	Offset: 0	Offset: 0
	Depth below surface (ft)	Depth below surface (ft)	Depth below surface (ft)
4/4/2019 18:00	1.10	0.84	0.71
4/5/2019 6:00	1.03	0.60	0.55
4/5/2019 18:00	0.85	0.25	0.14
4/6/2019 6:00	0.88	0.24	0.17
4/6/2019 18:00	0.98	0.22	0.24
4/7/2019 6:00	0.97	0.22	0.30
4/7/2019 18:00	0.98	0.22	0.37
4/8/2019 6:00	0.95	0.23	0.34
4/8/2019 18:00	0.79	0.27	0.12
4/9/2019 6:00	0.81	0.24	0.15
4/9/2019 18:00	0.83	0.24	0.19
4/10/2019 6:00	0.88	0.24	0.19
4/10/2019 18:00	1.00	0.13	0.49
4/11/2019 6:00	0.89	0.14	0.41
4/11/2019 18:00	1.00	0.15	0.81
4/12/2019 6:00	0.92	0.36	0.56
4/12/2019 18:00	0.75	0.27	0.13
4/13/2019 6:00	0.60	0.40	0.02
4/13/2019 18:00	0.77	0.23	0.17
4/14/2019 6:00	0.78	0.24	0.18
4/14/2019 18:00	1.05	0.23	0.18
4/15/2019 6:00	1.00	0.25	0.16
4/15/2019 18:00	1.17	0.19	0.40
4/16/2019 6:00	1.06	0.23	0.39
4/16/2019 18:00	1.20	0.06	0.83
4/17/2019 6:00	1.09	0.08	0.57
4/17/2019 18:00	1.20	0.45	1.06
4/18/2019 6:00	1.12	0.58	0.66
4/18/2019 18:00	1.30	1.02	1.25
4/19/2019 6:00	1.42	1.32	0.78
4/19/2019 18:00	1.25	0.29	0.18
4/20/2019 6:00	1.27	0.31	0.22
4/20/2019 18:00	1.32	0.31	0.25
4/21/2019 6:00	1.37	0.31	0.22
4/21/2019 18:00	1.44	0.34	0.35
4/22/2019 6:00	1.39	0.31	0.34
4/22/2019 18:00	1.51	0.45	0.69
4/23/2019 6:00	1.39	0.45	0.50
4/23/2019 18:00	1.53	0.79	1.06
4/24/2019 6:00	1.41	0.96	0.67
4/24/2019 18:00	1.54	1.19	1.29
4/25/2019 6:00	1.41	1.25	0.78

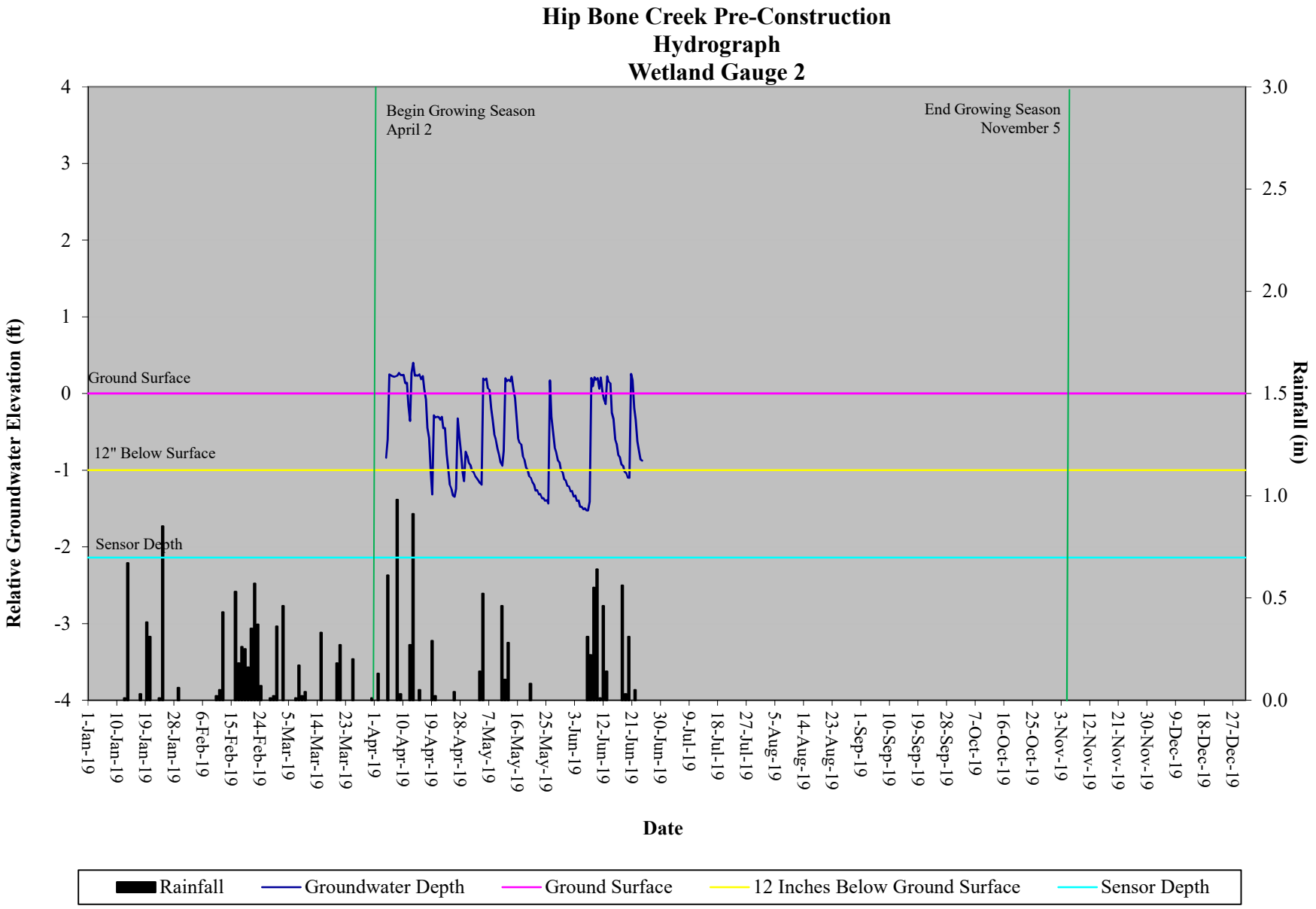
Date and Time	Gauge ID : 1	Gauge ID: 2	Gauge ID: 3
	Offset: 0	Offset: 0	Offset: 0
	Depth below surface (ft)	Depth below surface (ft)	Depth below surface (ft)
4/25/2019 18:00	1.48	1.33	1.05
4/26/2019 6:00	1.42	1.35	0.65
4/26/2019 18:00	1.30	1.24	0.32
4/27/2019 6:00	1.44	0.33	0.29
4/27/2019 18:00	1.58	0.57	0.68
4/28/2019 6:00	1.46	0.75	0.53
4/28/2019 18:00	1.64	1.02	1.10
4/29/2019 6:00	1.46	1.14	0.79
4/29/2019 18:00	1.26	0.76	1.23
4/30/2019 6:00	1.15	0.82	0.82
4/30/2019 18:00	1.34	0.91	2.04
5/1/2019 6:00	1.20	0.93	1.58
5/1/2019 18:00	1.40	1.01	2.13
5/2/2019 6:00	1.23	1.03	1.67
5/2/2019 18:00	1.48	1.08	2.20
5/3/2019 6:00	1.27	1.10	1.76
5/3/2019 18:00	1.43	1.14	2.13
5/4/2019 6:00	1.29	1.17	1.73
5/4/2019 18:00	2.36	1.19	2.15
5/5/2019 6:00	1.82	0.20	1.99
5/5/2019 18:00	1.81	0.18	2.00
5/6/2019 6:00	1.89	0.20	2.01
5/6/2019 18:00	2.13	0.07	2.23
5/7/2019 6:00	2.03	0.05	1.49
5/7/2019 18:00	2.26	0.20	1.92
5/8/2019 6:00	2.11	0.34	1.63
5/8/2019 18:00	2.38	0.53	2.29
5/9/2019 6:00	2.21	0.59	1.82
5/9/2019 18:00	2.30	0.72	2.31
5/10/2019 6:00	2.10	0.80	1.96
5/10/2019 18:00	2.53	0.90	2.27
5/11/2019 6:00	2.36	0.94	1.95
5/11/2019 18:00	1.84	0.75	1.27
5/12/2019 6:00	2.73	0.20	1.15
5/12/2019 18:00	2.73	0.16	1.22
5/13/2019 6:00	2.74	0.18	1.20
5/13/2019 18:00	2.75	0.16	1.22
5/14/2019 6:00	2.78	0.22	1.17
5/14/2019 18:00	2.75	0.06	1.47
5/15/2019 6:00	2.80	0.06	1.46
5/15/2019 18:00	2.74	0.30	2.08
5/16/2019 6:00	2.80	0.58	1.89
5/16/2019 18:00	2.75	0.64	2.32
5/17/2019 6:00	2.78	0.66	2.04

Date and Time	Gauge ID : 1	Gauge ID: 2	Gauge ID: 3
	Offset: 0	Offset: 0	Offset: 0
	Depth below surface (ft)	Depth below surface (ft)	Depth below surface (ft)
5/17/2019 18:00	2.75	0.82	2.45
5/18/2019 6:00	2.78	0.86	2.21
5/18/2019 18:00	2.74	0.97	2.58
5/19/2019 6:00	2.77	1.00	2.21
5/19/2019 18:00	2.74	1.08	2.51
5/20/2019 6:00	2.75	1.10	2.74
5/20/2019 18:00	2.74	1.16	2.91
5/21/2019 6:00	2.78	1.19	2.83
5/21/2019 18:00	2.76	1.27	3.02
5/22/2019 6:00	2.76	1.26	2.92
5/22/2019 18:00	2.74	1.32	3.01
5/23/2019 6:00	2.75	1.31	2.96
5/23/2019 18:00	2.74	1.37	3.03
5/24/2019 6:00	2.76	1.36	2.94
5/24/2019 18:00	2.53	1.40	2.26
5/25/2019 6:00	2.41	1.39	2.23
5/25/2019 18:00	2.59	1.43	2.32
5/26/2019 6:00	1.44	0.17	1.90
5/26/2019 18:00	1.91	0.30	1.73
5/27/2019 6:00	1.83	0.50	1.64
5/27/2019 18:00	2.26	0.70	1.87
5/28/2019 6:00	2.13	0.76	1.88
5/28/2019 18:00	2.48	0.87	2.09
5/29/2019 6:00	2.40	0.90	2.12
5/29/2019 18:00	2.60	1.01	2.31
5/30/2019 6:00	2.55	1.03	2.32
5/30/2019 18:00	2.64	1.12	2.42
5/31/2019 6:00	2.61	1.14	2.42
5/31/2019 18:00	2.66	1.21	2.48
6/1/2019 6:00	2.55	1.21	2.44
6/1/2019 18:00	2.63	1.28	2.50
6/2/2019 6:00	2.64	1.27	2.45
6/2/2019 18:00	2.71	1.34	2.54
6/3/2019 6:00	2.69	1.33	2.52
6/3/2019 18:00	2.75	1.40	2.60
6/4/2019 6:00	2.74	1.40	2.58
6/4/2019 18:00	2.79	1.48	2.66
6/5/2019 6:00	2.78	1.48	2.66
6/5/2019 18:00	2.80	1.51	2.70
6/6/2019 6:00	2.77	1.50	2.66

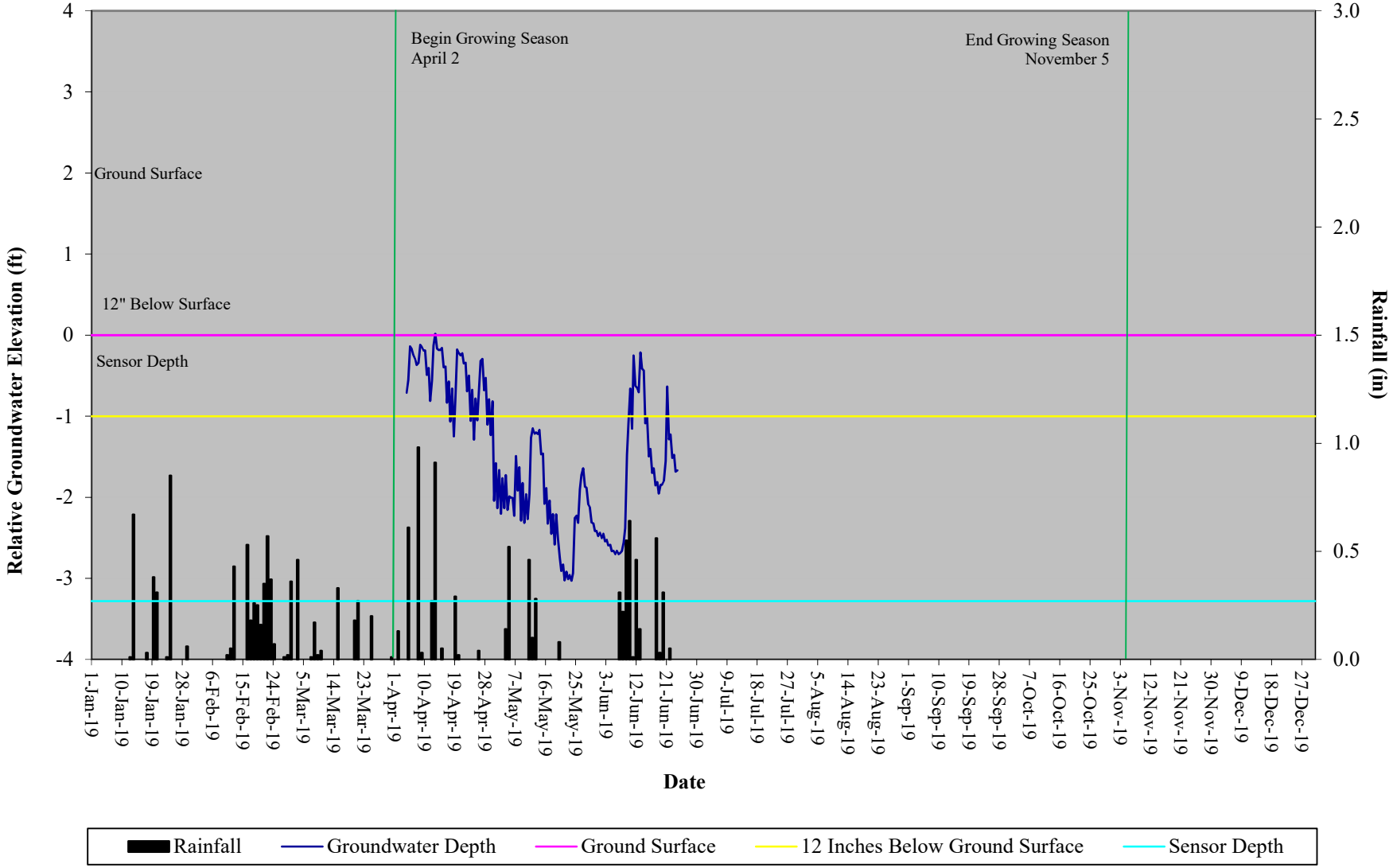
Date and Time	Gauge ID : 1	Gauge ID: 2	Gauge ID: 3
	Offset: 0	Offset: 0	Offset: 0
	Depth below surface (ft)	Depth below surface (ft)	Depth below surface (ft)
6/6/2019 18:00	2.78	1.53	2.70
6/7/2019 6:00	2.76	1.52	2.69
6/7/2019 18:00	2.71	1.41	2.66
6/8/2019 6:00	2.38	0.20	2.56
6/8/2019 18:00	2.22	0.10	2.38
6/9/2019 6:00	1.24	0.21	1.47
6/9/2019 18:00	1.41	0.18	1.07
6/10/2019 6:00	1.22	0.20	0.66
6/10/2019 18:00	1.65	0.06	1.15
6/11/2019 6:00	0.91	0.21	0.25
6/11/2019 18:00	1.35	0.03	0.63
6/12/2019 6:00	1.25	0.07	0.65
6/12/2019 18:00	1.25	0.14	0.70
6/13/2019 6:00	0.88	0.22	0.21
6/13/2019 18:00	1.14	0.15	0.41
6/14/2019 6:00	1.14	0.13	0.44
6/14/2019 18:00	1.56	0.25	1.09
6/15/2019 6:00	1.40	0.33	1.01
6/15/2019 18:00	1.82	0.59	1.50
6/16/2019 6:00	1.60	0.66	1.40
6/16/2019 18:00	2.06	0.80	1.70
6/17/2019 6:00	1.87	0.83	1.64
6/17/2019 18:00	2.18	0.93	1.85
6/18/2019 6:00	2.03	0.95	1.81
6/18/2019 18:00	2.29	1.02	1.95
6/19/2019 6:00	1.81	1.04	1.85
6/19/2019 18:00	2.02	1.09	1.84
6/20/2019 6:00	1.99	1.10	1.80
6/20/2019 18:00	1.36	0.26	1.55
6/21/2019 6:00	1.24	0.17	0.63
6/21/2019 18:00	1.70	0.19	1.29
6/22/2019 6:00	1.54	0.34	1.23
6/22/2019 18:00	1.84	0.62	1.52
6/23/2019 6:00	1.79	0.75	1.48
6/23/2019 18:00	2.00	0.86	1.68
6/24/2019 6:00	1.90	0.88	1.67

Hip Bone Creek Pre-Construction
Hydrograph
Wetland Gauge 1




Hip Bone Creek Pre-Construction
Hydrograph
Wetland Gauge 2
Begin Growing Season
April 2
End Growing Season
November 5
Ground Surface
12" Below Surface
Sensor Depth
Relative Groundwater Elevation (ft)
Rainfall (in)
Date
Rainfall
Groundwater Depth
Ground Surface
12 Inches Below Ground Surface
Sensor Depth

Hip Bone Creek Pre-Construction Hydrograph Wetland Gauge 3



12.3 Site Protection Instrument

LINE TABLE		
Line #	Length	Direction
L1	152.71'	N 36°05'49" W
L2	60.15'	S 57°54'51" W
L3	63.12'	S 51°02'47" W
L4	99.50'	S 10°35'32" E
L5	137.43'	S 68°54'01" W
L6	190.11'	N 10°48'47" W
L7	99.93'	S 53°15'07" W
L8	96.89'	S 12°30'42" E
L9	131.00'	S 76°56'45" W
L10	168.05'	S 37°28'40" W
L11	153.99'	S 57°32'33" W
L12	131.36'	N 28°13'55" W
L13	112.15'	N 52°41'32" E
L14	167.50'	N 26°28'00" E
L15	63.29'	N 53°34'41" W
L16	56.00'	N 36°25'19" E
L17	51.00'	S 53°34'41" E

LINE TABLE		
Line #	Length	Direction
L18	183.41'	N 41°27'45" E
L19	83.90'	S 56°50'40" E
L20	150.94'	N 49°40'05" E
L21	146.12'	S 36°05'49" E
L22	60.05'	N 51°37'31" E
L23	31.48'	S 38°44'11" E
L24	96.88'	S 31°27'15" W
L25	254.78'	S 24°56'43" E
L26	122.23'	S 72°15'41" W
L27	109.42'	N 26°29'32" W
L28	193.24'	N 11°31'23" W
L29	139.97'	N 19°52'08" W
L30	327.28'	N 44°18'01" W
L31	251.96'	N 34°33'40" W
L33	30.00'	N 21°05'59" W
L34	30.06'	S 21°14'55" E
L35	78.70'	S 20°34'26" E

LINE TABLE		
Line #	Length	Direction
L36	103.56'	S 11°54'15" E
L37	122.00'	S 78°05'45" W
L38	169.32'	N 15°46'18" W
L39	122.19'	N 72°15'41" E
L40	30.06'	N 21°19'18" W
L41	30.00'	S 13°09'48" E
L42	126.75'	S 11°15'10" W
L43	120.33'	S 33°00'51" E
L44	147.52'	S 83°28'24" W
L45	128.89'	N 0°29'47" W
L46	157.84'	N 11°34'09" W
L47	131.00'	N 76°56'45" E
L48	30.00'	N 13°09'48" W

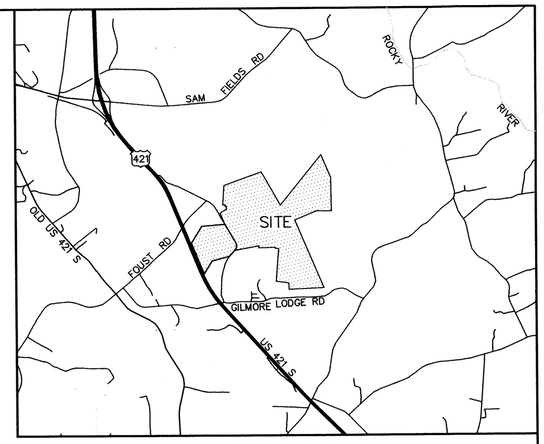
LEGEND

- EXISTING PK NAIL
- EXISTING IRON
- 30"x5/8" REBAR SET W/ 3.25" ALUMINUM CAP WITH STATE SEAL
- NEW CONSERVATION EASEMENT
- EXISTING WETLANDS
- EXISTING DITCH
- BOUNDARY LINE SURVEYED
- LINE NOT SURVEYED

MONUMENT TABLE		
Corner #	Northing	Easting
5	704,250.72	1,880,885.07
6	704,117.65	1,880,961.20
7	703,590.83	1,880,371.72
8	703,714.23	1,880,281.75
9	703,879.47	1,880,374.58

MONUMENT TABLE		
Corner #	Northing	Easting
10	704,086.23	1,880,707.57
11	703,558.89	1,880,320.76
12	703,519.20	1,880,271.67
13	703,284.14	1,880,251.76
14	703,186.34	1,880,270.05
15	703,136.87	1,880,141.83
16	703,323.60	1,880,106.17
17	703,263.81	1,880,026.10
18	702,935.72	1,879,869.10
19	702,692.17	1,879,979.36
20	702,597.57	1,880,000.35
21	702,567.98	1,879,872.74
22	702,799.86	1,879,783.90
23	702,666.50	1,879,681.65
24	702,583.86	1,879,551.72
25	702,699.59	1,879,489.58
26	702,767.56	1,879,578.78
27	702,956.14	1,879,734.81
28	703,285.40	1,879,829.91
29	703,435.34	1,879,904.56
30	703,472.92	1,879,853.63

MONUMENT TABLE		
Corner #	Northing	Easting
31	703,517.98	1,879,886.88
32	703,487.70	1,879,927.92
33	703,625.14	1,880,049.36
34	703,579.26	1,880,119.60
35	703,676.95	1,880,234.67
36	703,161.78	1,880,289.75
37	703,030.07	1,880,450.10
38	702,726.71	1,880,744.75
39	702,433.06	1,881,224.82
40	702,350.41	1,881,174.26
41	702,557.61	1,880,835.54
42	702,308.30	1,880,925.14
43	702,099.59	1,880,931.87
~~44~~	~~701,984.00~~	~~1,880,983.13~~
45	701,868.57	1,881,039.33
46	701,831.33	1,880,922.91
47	701,929.27	1,880,874.10
48	702,118.61	1,880,835.49
49	702,410.17	1,880,789.64
50	702,487.15	1,880,697.56
51	702,618.79	1,880,649.99
52	702,853.02	1,880,421.41
53	702,901.38	1,880,295.57
54	703,108.88	1,880,152.63
55	701,840.56	1,881,050.22
56	701,766.88	1,881,077.88
57	701,665.55	1,881,099.24
58	701,640.39	1,880,979.86
59	701,803.33	1,880,933.84
60	702,568.36	1,880,007.19
61	702,374.16	1,880,082.59
62	702,249.85	1,880,057.85
63	701,889.01	1,880,098.18
64	701,788.11	1,880,163.74
65	701,771.35	1,880,017.18
66	701,900.23	1,880,016.07
67	702,158.79	1,879,909.81
68	702,384.14	1,879,911.23
69	702,538.77	1,879,879.57



VICINITY MAP
SCALE: 1" = 1 mile

SURVEYOR NOTES

1. THIS PLAT DOES NOT REPRESENT A BOUNDARY SURVEY OF THE PARENT TRACT. THE PARENT TRACT BOUNDARIES ADJACENT TO THIS EASEMENT ARE NOT CHANGED BY THIS PLAT. BOUNDARY INFORMATION SHOWN HEREON WAS DERIVED FROM DEEDS AND MAPS OF RECORD IN CHATHAM COUNTY AND MONUMENTATION FOUND IN THE FIELD.
2. DISTANCES SHOWN ARE HORIZONTAL GROUND DISTANCES IN U.S. SURVEY FEET UNLESS OTHERWISE NOTED.
3. AREA COMPUTED BY COORDINATE METHOD.
4. THE BASIS OF THE MERIDIANS AND COORDINATES FOR THIS PLAT IS THE NORTH CAROLINA STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM 1983 (NAD 83), BASED ON DIFFERENTIAL GPS OBSERVATIONS PERFORMED IN JULY 2018.
5. DEED REFERENCES: AS SHOWN HEREON.
6. SUBJECT PROPERTY KNOWN AS PARCEL NUMBER: 0014903.
7. SUBJECT EASEMENT LIES WITHIN THE AREA DESIGNATED AS ZONE "X", BASED ON FEDERAL FLOOD INSURANCE RATE MAP 3710877000J AND 3710878000J, EFFECTIVE FEBRUARY 2, 2007.
8. NO UNDERGROUND UTILITY LOCATING PERFORMED DURING THE COURSE OF THIS SURVEY.
9. THE STATE PLANE COORDINATES FOR THIS PROJECT WERE DETERMINED USING REAL TIME KINEMATIC GPS OBSERVATIONS (VRS) TAKEN IN JULY 2018 BASED ON THE CORDS ID "NCJL" IN CHATHAM COUNTY.
10. EXISTING FENCING ON SITE WILL BE REMOVED.

SURVEYOR CERTIFICATION

I, JAMES M. GELLENTHIN, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION (DEED DESCRIPTION RECORDED IN BOOK 663, PAGE 619); THAT THE BOUNDARIES SURVEYED AND NOT SURVEYED ARE CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN REFERENCES SHOWN HEREON; THAT THE RATIO OF PRECISION OR POSITIONAL ACCURACY AS CALCULATED IS GREATER THAN 1:10,000; THAT THIS MAP DOES REPRESENT AN OFFICIAL BOUNDARY SURVEY AND HAS BEEN PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION LICENSE NUMBER AND SEAL THIS 31ST DAY OF JANUARY, 2020.

NORTH CAROLINA REGISTRATION NUMBER L-3860
JAMES M. GELLENTHIN

NORTH CAROLINA PROFESSIONAL SEAL L-3860 LAND SURVEYOR JAMES M. GELLENTHIN

I, JAMES M. GELLENTHIN, PROFESSIONAL LAND SURVEYOR, NO. L-3860 CERTIFY TO THE FOLLOWING AS REQUIRED IN G.S. 47-30 F11:

THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY OR OTHER EXEMPTION TO THE DEFINITION OF SUBDIVISION;

NORTH CAROLINA REGISTRATION NUMBER L-3860
JAMES M. GELLENTHIN

NORTH CAROLINA PROFESSIONAL SEAL L-3860 LAND SURVEYOR JAMES M. GELLENTHIN

OWNER CERTIFICATION

I HEREBY CERTIFY THAT I AM THE OWNER OF THE PROPERTY SHOWN AND DESCRIBED HEREON, WHICH IS LOCATED IN THE SUBDIVISION JURISDICTION OF THE COUNTY OF CHATHAM AND THAT I HEREBY ADOPT THIS PLAN OF SUBDIVISION WITH MY FREE CONSENT AND ESTABLISH MINIMUM SETBACK LINES AS NOTED.

JOSEPH RAY JONES

REVIEW OFFICER CERTIFICATE
STATE OF NORTH CAROLINA, COUNTY OF CHATHAM

I, Amy W. Moore, REVIEW OFFICER OF CHATHAM COUNTY, CERTIFY THAT THE MAP OR PLAT WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

Amy W. Moore REVIEW OFFICER, 2/10/2020 DATE

BY: Amy W. Moore TITLE: Mapper

FILED Feb 10, 2020 12:29:14 pm
PLAT SLIDE 02020 — 0026
INSTRUMENT 01461

FILED CHATHAM COUNTY, NC LUNDAY A. RIGGSBEE REGISTER OF DEEDS

GRAPHIC SCALE
200' 0' 100' 200' 400'
1 INCH = 200 FEET

161802193

FINAL PLAT CONSERVATION EASEMENT ON THE LANDS OF JOSEPH RAY JONES FOR STATE OF NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY DIVISION OF MITIGATION SERVICES PROJECT NAME: HIP BONE CREEK DMS PROJECT #: 100059 SPO FILE NO. 19-BM MATTHEWS TOWNSHIP, CHATHAM COUNTY NORTH CAROLINA

DATE:	SCALE:	SHEET:
JAN 31, 2020	1" = 200'	1 OF 1

KCI ASSOCIATES OF N.C.
ENGINEERS, SURVEYORS AND PLANNERS
4505 FALLS OF NEUSE ROAD, FLOOR 4
RALEIGH, NC 27607
PHONE (919) 783-9214 * FAX (919) 783-9266
KCI ASSOCIATES OF NORTH CAROLINA C-0764

2020-26

12.4 Credit Release Schedule

All credit releases will be based on the total credit generated as reported in the final design plans unless otherwise documented and provided to the Interagency Review Team following construction. Under no circumstances shall any mitigation project be debited until the necessary DA authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Stream Credit Release Schedule			
Monitoring Year	**Credit Release Activity**	**Interim Release**	**Total Released**
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	10%	60%
4	Fourth year monitoring report demonstrates performance standards are being met	5%	65% (75%*)
5	Fifth year monitoring report demonstrates performance standards are being met	10%	75% (85%*)
6	Sixth year monitoring report demonstrates performance standards are being met	5%	80% (90%*)
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval from IRT	10%	90% (100%*)

**See Subsequent Credit Releases description below*

Wetland Credit Release Schedule			
Monitoring Year	**Credit Release Activity**	**Interim Release**	**Total Released**
0	Initial Allocation – see requirements below	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50%
3	Third year monitoring report demonstrates performance standards are being met	15%	65%
4	Fourth year monitoring report demonstrates performance standards are being met	5%	70%
5	Fifth year monitoring report demonstrates performance standards are being met	15%	85%
6	Sixth year monitoring report demonstrates performance standards are being met	5%	90%
7	Seventh year monitoring report demonstrates performance standards are being met, and project has received close-out approval from IRT	10%	100%

Initial Allocation of Released Credits

The initial allocation of released credits, as specified in the mitigation plan can be released by the NCDMS without prior written approval of the DE upon satisfactory completion of the following activities:

a. Approval of the final Mitigation Plan
b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property
c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NCDMS Instrument, construction means that a mitigation sit\e has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.
d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved. For stream project with a 7-year monitoring period, a reserve of 10% of a site's total stream credits shall be released after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the IRT. As projects approach milestones associated with credit release, the NCDMS 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.

12.5 Financial Assurance

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 Environmental Quality (formerly NCDENR) has provided the U.S. 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.

12.6 DWR Stream Identification Forms, Wetland JD Forms, and NC SAM & WAM Forms

NC DWQ Stream Identification Form Version 4.11

Date: 1/31/2018	**Project/Site:** Hip Bone Creek	**Latitude:** 35.6792
Evaluator: A. French	**County:** Chatham	**Longitude:** -79.4041
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 23	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 8)	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 = 7.5)				
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 = 7.5)				
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: 5/9/18	**Project/Site:** Hip Bone Creek	**Latitude:** 35.6083
Evaluator: J. Sullivan	**County:** Chatham	**Longitude:** -79.4052
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 19	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 7)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5.5)				
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: Many tadpoles, midges, and 2 backswimmers

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 5/9/18	**Project/Site:** Hip Bone Creek	**Latitude:** 35.6811
Evaluator: J. Sullivan	**County:** Chatham	**Longitude:** -79.4031
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 19.5	**Stream Determination (circle one)** Ephemeral **Intermittent** Perennial	**Other** *e.g. Quad Name*:

A. Geomorphology (Subtotal = 8)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 6.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 5)				
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: 1 amphipod, midges

Sketch:

T1-1

NC DWQ Stream Identification Form Version 4.11

Date: 10/30/18	**Project/Site:** Hip Bone Creek	**Latitude:** 35.6794
Evaluator: J. Sullivan	**County:** Chatham	**Longitude:** -79.4043
Total Points: 18 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 6.5)	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 = 6.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 5)				
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:

T3-1

NC DWQ Stream Identification Form Version 4.11

Date: 10/30/18	**Project/Site:** Hip Bone Creek	**Latitude:** 35.6798
Evaluator: J. Sullivan	**County:** Chatham	**Longitude:** -79.4011
Total Points: 19.5 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 5.5)	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 = 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:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Hip Bone Creek City/County: Chatham Sampling Date: 5/9/18

Applicant/Owner: KCI State: NC Sampling Point: WAwet

Investigator(s): J. Sullivan Section, Township, Range:

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

Subregion (LRR or MLRA): P-136 Lat: 35.6777 Long: -79.4038 Datum: NAD83

Soil Map Unit Name: Georgeville-Badin Complex NWI classification: PSS

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

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes x No _____

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

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

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

Remarks:

Cattle have access to floodplain

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- X Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No X Depth (inches): _____

Water Table Present? Yes _____ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): _____

Wetland Hydrology Present? **Yes** X **No** _____

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WAwet

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	10	x	FAC
2.			
3.			
4.			
5.			
6.			
7.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		
Sapling/Shrub Stratum (Plot size: 15)			
1. Ligustrum sinense	60	X	FACU
2. Acer rubrum	5		FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	65 = Total Cover		
50% of total cover: 32.5	20% of total cover: 13		
Herb Stratum (Plot size: 5)			
1. Juncus effusus	20	X	FACW
2. Carex sp.	20	X	FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		
Woody Vine Stratum (Plot size: 30)			
1. Lonicera japonica	10	X	FAC
2.			
3.			
4.			
5.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 80% (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No ___

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL

Sampling Point: WAwet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 4/3	100					L	
2-9	10YR 5/3	90	10YR 5/6	10	C	PL	CL	Oxidized rhizospeheres
9-18+	10YR 5/1	90	7.5YR 5/6	10	C	PL	CL	Oxidized rhizospheres

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Hip Bone Creek City/County: Chatham Sampling Date: 5/9/18

Applicant/Owner: KCI State: NC Sampling Point: WCwet

Investigator(s): J. Sullivan Section, Township, Range:

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

Subregion (LRR or MLRA): P-136 Lat: 35.6820 Long: -79.4042 Datum: NAD83

Soil Map Unit Name: Chewacla and Wehadkee soils NWI classification: PEM

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

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

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

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

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

Remarks:

Cattle pasture

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- X Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- X FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches): _____
Water Table Present?	Yes _____	No X	Depth (inches): _____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches): _____

Wetland Hydrology Present? **Yes** X **No** _____

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WCwet

Tree Stratum (Plot size: 30')	Absolute % Cover	Dominant Species?	Indicator Status
1. None			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size: 15')			
1. None			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5')			
1. Juncus effusus	70	X	FACW
2. Ranunculus sp.	10		NI
3. Schedonorous arundinaceus	15		FACU
4. Trifollium repens	5		FACU
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

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

Woody Vine Stratum (Plot size: 30')			
1. None			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? **Yes** X **No** _____

Remarks: (Include photo numbers here or on a separate sheet.)

Cattle are grazing in wetland

SOIL Sampling Point: WCwet

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-2	10YR 5/3	90	7.5 YR 5/6	10	C	PL	CL	Oxidized rhizospheres
2-6	10YR 5/2	80	7.5 YR 5/6	20	C	PL	C	Oxidized rhizospheres
6-18+	7.5YR 4/6	90					C	
	10YR 5/3	10						

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** X **No** _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Hip Bone Creek City/County: Chatham Sampling Date: 5/9/18

Applicant/Owner: KCI State: NC Sampling Point: WCup

Investigator(s): J. Sullivan Section, Township, Range:

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

Subregion (LRR or MLRA): P-136 Lat: 35.6819 Long: -79.4040 Datum: NAD83

Soil Map Unit Name: Chewacla and Wehadkee Soils NWI classification: -

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

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

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

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

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

Remarks:

Cattle pasture

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ True Aquatic Plants (B14)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres on Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- ___ Surface Soil Cracks (B6)
- ___ Sparsely Vegetated Concave Surface (B8)
- ___ Drainage Patterns (B10)
- ___ Moss Trim Lines (B16)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Stunted or Stressed Plants (D1)
- ___ Geomorphic Position (D2)
- ___ Shallow Aquitard (D3)
- ___ Microtopographic Relief (D4)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes _____	No X	Depth (inches):_____
Water Table Present?	Yes _____	No X	Depth (inches):_____
Saturation Present? (includes capillary fringe)	Yes _____	No X	Depth (inches):_____

Wetland Hydrology Present? Yes _____ No X

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

Remarks:

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: WCup

Tree Stratum (Plot size: 30)	Absolute % Cover	Dominant Species?	Indicator Status
1. None			
2.			
3.			
4.			
5.			
6.			
7.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Sapling/Shrub Stratum (Plot size: 15)			
1. None			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Herb Stratum (Plot size: 5)			
1. Schedonorus arundinaceus	95	X	FACU
2. Ranunculus sp.	5		NI
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	100 = Total Cover		

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

Woody Vine Stratum (Plot size: 30)			
1. None			
2.			
3.			
4.			
5.			
	= Total Cover		

50% of total cover: _____ 20% of total cover: _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

___ 4 - Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.

Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks: (Include photo numbers here or on a separate sheet.)

SOIL Sampling Point: WCup

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

Depth (inches)	Matrix Color (moist)	%	Redox Features Color (moist)	%	Type[1]	Loc[2]	Texture	Remarks
0-12	10YR 4/6	100					L	
12-14	10 YR 5/3	90	7.5 YR 4/6	10	C	PL	C	
14-18+	10 YR 5/5	100					C	

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

Hydric Soil Indicators:

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5)
- ___ 2 cm Muck (A10) **(LRR N)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1) **(LRR N, MLRA 147, 148)**
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Dark Surface (S7)
- ___ Polyvalue Below Surface (S8) **(MLRA 147, 148)**
- ___ Thin Dark Surface (S9) **(MLRA 147, 148)**
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Iron-Manganese Masses (F12) **(LRR N, MLRA 136)**
- ___ Umbric Surface (F13) **(MLRA 136, 122)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 148)**
- ___ Red Parent Material (F21) **(MLRA 127, 147)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
- ___ Coast Prairie Redox (A16) **(MLRA 147, 148)**
- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? **Yes** _____ **No** X

Remarks:

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Hip Bone Creek Restoration Site
2. Date of evaluation: 1/31/2018
3. Applicant/owner name: KCI
4. Assessor name/organization: J. Sullivan / KCI
5. County: Chatham
6. Nearest named water body on USGS 7.5-minute quad: Meadow Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.6792 / -79.4041

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T1
10. Length of assessment reach evaluated (feet): 100
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 steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☐A  (more sinuous stream, flatter valley slope)
☒B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
- ☒A Water throughout assessment reach.
- ☐B No flow, water in pools only.
- ☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
- ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
- ☒B Not A

3. Feature Pattern – assessment reach metric
- ☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
- ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☐A < 10% of channel unstable
- ☒B 10 to 25% of channel unstable
- ☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☒	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☐A	Streams and/or springs (jurisdictional discharges)
☒B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☒D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☒E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☒C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Hip Bone Creek Restoration Site	Date of Assessment	1/31/2018
Stream Category	Pb2	Assessor Name/Organization	J. Sullivan / KCI

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	YES
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	**MEDIUM**	**MEDIUM**
(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	**MEDIUM**	**MEDIUM**
(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	**MEDIUM**	**MEDIUM**
(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	NA	NA
Overall	**LOW**	**LOW**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Hip Bone Creek Restoration Site
2. Date of evaluation: 5/9/2018
3. Applicant/owner name: KCI
4. Assessor name/organization: J. Sullivan / KCI
5. County: Chatham
6. Nearest named water body on USGS 7.5-minute quad: Meadow Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.6803 / -79.4052

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T2
10. Length of assessment reach evaluated (feet): 50
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): 4
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☐A  (more sinuous stream, flatter valley slope)
☒B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
- ☒A Water throughout assessment reach.
- ☐B No flow, water in pools only.
- ☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
- ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
- ☒B Not A

3. Feature Pattern – assessment reach metric
- ☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
- ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☒A < 10% of channel unstable
- ☐B 10 to 25% of channel unstable
- ☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

*************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☒	☐	☐	Sand (.062 – 2 mm)
☐	☐	☐	☒	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☒	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☒	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☐D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☐A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☒D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☒E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Hip Bone Creek Restoration Site	Date of Assessment	5/9/2018
Stream Category	Pb1	Assessor Name/Organization	J. Sullivan / KCI

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**MEDIUM**	**MEDIUM**
(2) Baseflow	**MEDIUM**	**MEDIUM**
(2) Flood Flow	**MEDIUM**	**MEDIUM**
(3) Streamside Area Attenuation	**MEDIUM**	**MEDIUM**
(4) Floodplain Access	**HIGH**	**HIGH**
(4) Wooded Riparian Buffer	**LOW**	**LOW**
(4) Microtopography	NA	NA
(3) Stream Stability	**MEDIUM**	**MEDIUM**
(4) Channel Stability	**HIGH**	**HIGH**
(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	**MEDIUM**	**MEDIUM**
(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	**MEDIUM**	**NA**
(2) Intertidal Zone Filtration	NA	NA
(1) Habitat	**LOW**	**LOW**
(2) In-stream Habitat	**LOW**	**LOW**
(3) Baseflow	**MEDIUM**	**MEDIUM**
(3) Substrate	**LOW**	**LOW**
(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	NA	NA
Overall	**LOW**	**LOW**

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Hip Bone Creek Restoration Site
2. Date of evaluation: 5/9/2018
3. Applicant/owner name: KCI
4. Assessor name/organization: J. Sullivan / KCI
5. County: Chatham
6. Nearest named water body on USGS 7.5-minute quad: Meadow Creek
7. River basin: Cape Fear
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.6811 / -79.4031

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): T3
10. Length of assessment reach evaluated (feet): 100
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): 3
13. Is assessment reach a swamp steam? ☐Yes ☐No
14. Feature type: ☐Perennial flow ☒Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☒ Piedmont (P) ☐ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☐A  (more sinuous stream, flatter valley slope)
☒B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☒Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
- ☒A Water throughout assessment reach.
- ☐B No flow, water in pools only.
- ☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
- ☒A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
- ☐B Not A

3. Feature Pattern – assessment reach metric
- ☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
- ☐B Not A

4. Feature Longitudinal Profile – assessment reach metric
- ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
- ☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
- ☒A < 10% of channel unstable
- ☐B 10 to 25% of channel unstable
- ☐C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☒F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☐Yes ☒No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☐	☒	☐	☐	Gravel (2 – 64 mm)
☐	☐	☒	☐	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☒	☐	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☐Yes ☒No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☒	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☒	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☐B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☒D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☒E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☒C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☒B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☐C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Hip Bone Creek Restoration Site	Date of Assessment	5/9/2018
Stream Category	Pb1	Assessor Name/Organization	J. Sullivan / KCI

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	YES
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	**MEDIUM**	**MEDIUM**
(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	**HIGH**	**HIGH**
(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	**MEDIUM**	**MEDIUM**
(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	**MEDIUM**	**MEDIUM**
(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	NA	NA
Overall	**LOW**	**LOW**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Hip Bone Creek Restoration Site	Date of Evaluation	5/9/18
Applicant/Owner Name	KCI	Wetland Site Name	WA, WE
Wetland Type	Headwater Forest	Assessor Name/Organization	J. Sullivan / KCI
Level III Ecoregion	Piedmont	Nearest Named Water Body	Meadow Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030003
County	Chatham	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.6777 / -79.4038

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, 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 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. 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 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 top 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).

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 drainage and/or overbank flow from affecting 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.
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.

7b. How much of the first 50 feet from the bank is wetland? (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 stream 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 for riverine wetlands only. 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 type 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 metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous 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, maintained fields (pasture and agriculture), or open 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 directions? 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)

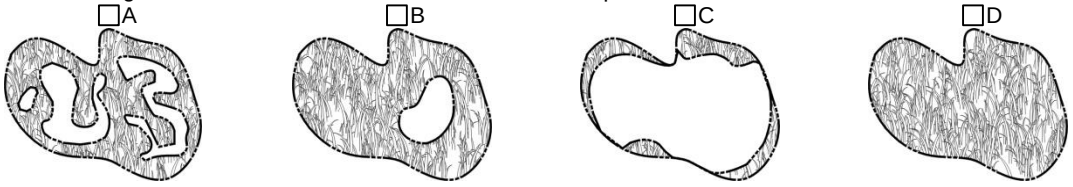
Include both natural debris and man-placed natural debris.

☐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	WA, WE	Date of Assessment	5/9/18
Wetland Type	Headwater Forest	Assessor Name/Organization	J. Sullivan / KCI

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	**MEDIUM**
	Sub-surface Storage and Retention	Condition	**MEDIUM**
Water Quality	Pathogen Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Particulate Change	Condition	**MEDIUM**
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		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	**LOW**

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Hip Bone Creek Restoration Site	Date of Evaluation	5/9/18
Applicant/Owner Name	KCI	Wetland Site Name	WB, WF, WH
Wetland Type	Headwater Forest	Assessor Name/Organization	J. Sullivan / KCI
Level III Ecoregion	Piedmont	Nearest Named Water Body	Meadow Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030003
County	Chatham	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.6860 / -79.4048

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, 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 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. 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 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 top 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).

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 drainage and/or overbank flow from affecting 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.
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.

7b. How much of the first 50 feet from the bank is wetland? (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 stream 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 for riverine wetlands only. 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 type 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 metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous 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, maintained fields (pasture and agriculture), or open 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 directions? 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)

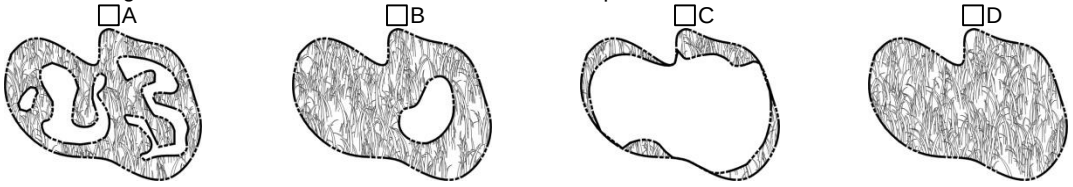
Include both natural debris and man-placed natural debris.

☐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	WB, WF, WH	Date of Assessment	5/9/18
Wetland Type	Headwater Forest	Assessor Name/Organization	J. Sullivan / KCI

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	**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	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 FIELD ASSESSMENT FORM
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Hip Bone Creek Restoration Site	Date of Evaluation	5/9/18
Applicant/Owner Name	KCI	Wetland Site Name	WC, WD, WG
Wetland Type	Headwater Forest	Assessor Name/Organization	J. Sullivan / KCI
Level III Ecoregion	Piedmont	Nearest Named Water Body	Meadow Creek
River Basin	Cape Fear	USGS 8-Digit Catalogue Unit	03030003
County	Chatham	NCDWR Region	Raleigh
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.6820 / -79.4042

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, 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 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. 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 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 top 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).

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 drainage and/or overbank flow from affecting 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.
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.

7b. How much of the first 50 feet from the bank is wetland? (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 stream 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 for riverine wetlands only. 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 type 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 metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous 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, maintained fields (pasture and agriculture), or open 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 directions? 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)

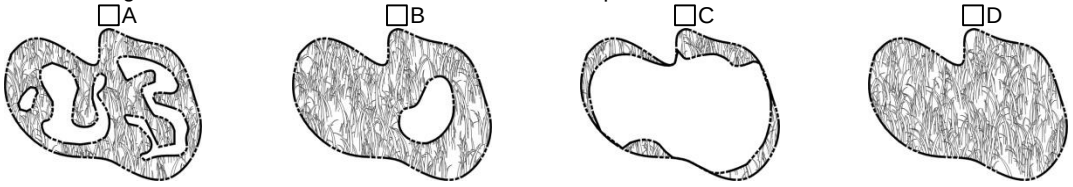
Include both natural debris and man-placed natural debris.

☐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	WC, WD, WG	Date of Assessment	5/9/18
Wetland Type	Headwater Forest	Assessor Name/Organization	J. Sullivan / KCI

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

Overall Wetland Rating **LOW**

12.7 Approved Jurisdictional Determination

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2018-01983** County: **Chatham County** U.S.G.S. Quad: **Siler City**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner/Applicant: **KCI Technologies, Inc.**
Joe Sullivan
Address: **4505 Falls of Neuse Rd Suite 400**
Raleigh, North Carolina 27609

Telephone Number: **919-278-2533**

Size (acres)	**18 (approximately)**	Nearest Town	**Siler City**
Nearest Waterway	**Meadow Creek**	River Basin	**Cape Fear**
USGS HUC	**03030003**	Coordinates	Latitude: **35.680758**
			Longitude: **-79.402617**

Location description: **The site is located at 865 Carter Brooks Road, approximately 2000 feet east of the Carter Brooks Road, Jack Elkins Road intersection, near Siler City, Chatham County, North Carolina. The Site is identified as the Hipbone Creek Restoration Site (See map attached to PJD form).**

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 **Andrew Williams at (919) 554-4884 or Andrew.E.Williams2@usace.army.mil**.

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

D. Remarks: None

E. Attention USDA Program Participants

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

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

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

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

SAW-2018-01983

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

Corps Regulatory Official: Andrew Williams Digitally signed by WILLIAMS.ANDREW.E.1244561655 DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=WILLIAMS.ANDREW.E.1244561655 Date: 2018.11.16 08:54:51 -05'00'

Date: **November 16, 2018**

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 (via emai):

Stephanie Goss
North Carolina Department of Environmental Quality
Water Resources Water Quality Regional Operations Section
1628 Mail Service Center
Raleigh, NC 27699-1628

Todd Tugwell
Regulatory Project Manager
U.S. Army Corps of Engineers
3331 Heritage Trade Drive, Suite 106
Wake Forest, North Carolina 27587

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Joe Sullivan KCI Technologies Inc**	File Number: **SAW-2018-01983**	Date: **November 16, 2018**

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

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

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

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

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

Appendix 2 - PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: November 15, 2018

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: Joseph Sullivan, 4505 Falls of Neuse Rd; Suite 400, Raleigh, NC 27609

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington District; SAW-2018-01983 (Hip Bone Creek Restoration Site

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: Chatham City: Siler City

Center coordinates of site (lat/long in degree decimal format):

Lat.: 35.6804 Long.: -79.4018

Universal Transverse Mercator:

Name of nearest waterbody: Meadow Creek

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

[X] Office (Desk) Determination. Date: November 15, 2018

[X] Field Determination. Date(s): October 30, 2018

Table of Aquatic Resources In Review Area Which "May Be" Subject to Regulatory Jurisdiction

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resource in review area (acreage and linear feet, if applicable)	Type of aquatic resource (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource "may be" subject (i.e., Section 404 or Section 10/404)
T1	35.6792	-79.4041	2957 linear feet	non-wetland waters	Section 404
T1-1	35.6794	-79.4043	187 linear feet	non-wetland waters	Section 404
T2	35.6803	-79.4052	368 linear feet	non-wetland waters	Section 404
T3	35.6811	-79.4031	2188 linear feet	non-wetland waters	Section 404
T3-1	35.6798	-79.4011	465 linear feet	non-wetland waters	Section 404
WA	35.6777	-79.4038	0.79 acre	wetland waters	Section 404
WB	35.6806	-79.4048	0.18 acre	wetland waters	Section 404
WC	35.682	-79.4042	0.27 acre	wetland waters	Section 404
WO	35.6833	-79.4025	0.26 acre	wetland waters	Section 404
WE	35.6807	-79.4025	1.73 acres	wetland waters	Section 404
WF	35.6813	-79.4046	0.01 acre	wetland waters	Section 404
WG	35.6824	-79.4038	0.25 acre	wetland waters	Section 404
WH	35.6794	-79.4002	0.02 acre	wetland waters	Section 404

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: Vicinity Map ; Delineation Map.
- [X] Data sheets prepared/submitted by or on behalf of the PJD requestor.
  - [X] 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: Siler City 1:24K.
- [ ] Natural Resources Conservation Service Soil Survey. Citation: _____.
- [ ] National wetlands inventory map(s). Cite name: _____.
- [ ] State/local wetland inventory map(s): _____.
- [ ] FEMA/FIRM maps: _____.
- [ ] 100-year Floodplain Elevation is: _____.(National Geodetic Vertical Datum of 1929)
- [■] Photographs: [■] Aerial (Name & Date): 2017 Statewide Aerial Photographs.
  or [X] Other (Name & Date): NCDWQ, Stream Identification Forms 4.11.
- [ ] Previous determination(s). File no. and date of response letter: _____.
- [X] Other information (please specify): USACE 30 October 2018 site visit.

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.

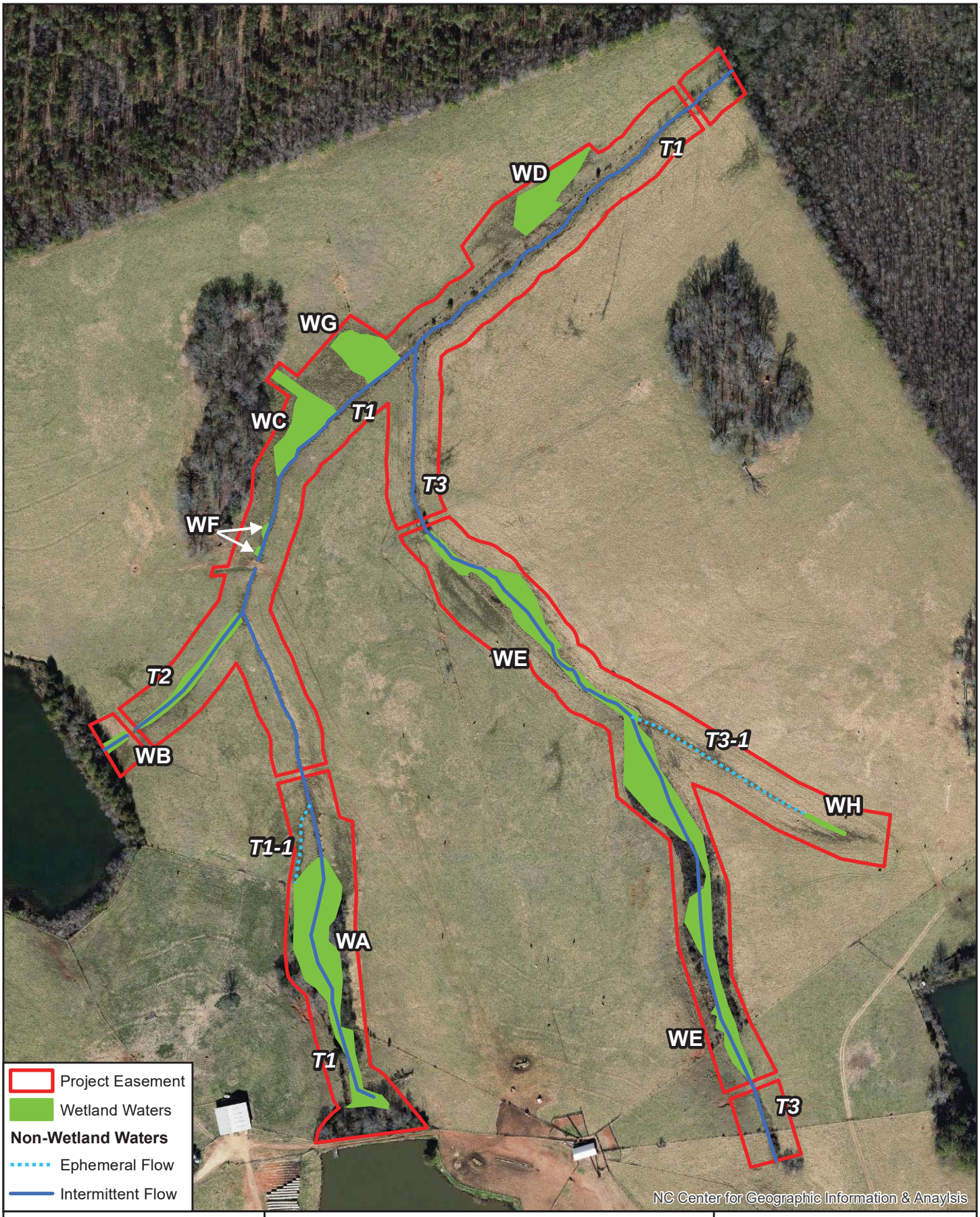
Andrew Williams
Digitally signed by WILLIAMS.ANDREW.E.1244561655
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=WILLIAMS.ANDREW.E.1244561655
Date: 2018.11.16 08:34:39 -05'00'

Signature and date of Regulatory staff member completing PJD

Joseph Sullivan
Digitally signed by Joseph Sullivan
DN: cn=Joseph Sullivan, o=KCI, ou, email=joe.sullivan@kci.com, c=US
Date: 2018.10.31 09:44:37 -04'00'

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.



0 150 300 Feet

FIGURE 3. POTENTIAL WOTUS MAP
HIP BONE CREEK RESTORATION SITE
CHATHAM COUNTY, NC

N

Source: NC OneMap Orthoimagery, 2017.

12.8 Approved FHWA Categorical Exclusion Form

Categorical Exclusion Form for Division of Mitigation Services Projects
Version 1.4

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

Part 1: General Project Information	
Project Name:	Hipbone Creek Stream Restoration Site
County Name:	Chatham County, NC
DMS Number:	100059
Project Sponsor:	KCI Technologies, Inc.
Project Contact Name:	Tim Morris
Project Contact Address:	4505 Falls of Neuse Road Suite 400 Raleigh NC 27609
Project Contact E-mail:	tim.morris@kci.com
DMS Project Manager:	Jeff Schaffer

Project Description

.

For Official Use Only

Reviewed By:

7/10/2018
Date

Jeff Schaffer
DMS Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

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

Final Approval By:

7-10-18
Date

For Division Administrator FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☒ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☒ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☒ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☒ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☒ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☒ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☒ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☒ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☒ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☒ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☒ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☒ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☒ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☒ Yes ☐ No
2. Does the project require the acquisition of real estate?	☒ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☒ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☒ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☒ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☒ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☒ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☒ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☒ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☒ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☒ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☒ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☒ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☒ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☒ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☒ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☒ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☐ Yes ☒ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☐ No ☒ N/A
4. Is the project "likely to adversely affect" the specie and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☒ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination? (By virtue of no-response)	☒ 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 local 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

12.9 Agency Correspondence

KCI ASSOCIATES OF NC

ISO 9001:2015 CERTIFIED

ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Rd., Suite 400 • Raleigh, NC 27609 • Phone 919-783-9214 • Fax 919-783-9266

Date: June 26, 2018

Attendees: Kim Browning, ACOE
Jeff Schaffer, NC DMS
Mac Haupt, NC DWR
Periann Russell, NC DMS
Todd Bowers, US EPA
Tim Morris, KCI
Charlie Morgan, KCI
Steve Stokes, KCI
Adam Spiller, KCI

From: Tim Morris, Project Manager
KCI Associates of North Carolina, P.A.

Subject: Hipbone Creek Restoration Site
Post Contract IRT Site Review Meeting
Cape Fear 03
Chatham County, North Carolina
Contract No. #7528
DMS Project #100059

An IRT field review was conducted for the above referenced project on June 26, 2018 starting at 9:00 am. Weather was overcast with periods of steady rain. Approximately 0.10" of rainfall had fallen earlier in the morning. Rainfall for the year was approximately 4.74" below normal and 2.93" below normal for the month of June (Source U.S. Climate Data). Tributary 1 was primarily dry. Other tributaries were flowing at the time of the meeting, although isolated sections of T3 appeared to be dry.

The comments follow the order of the site walk. There was overall agreement on the proposed levels of intervention and the proposed credit strategy unless specified below.

T1 to T2

- Flow monitoring (pressure transducers, photo/video documentation) should be used on T1 to ensure adequate hydrology in the system to support the stream call.
- IRT Requested that KCI check with landowner to see if he had a maintenance plan for the trees on the pond dam.
- IRT was concerned with the lack of a dedicated emergency spillway for the pond up-gradient of T1.
- KCI indicated that the easement would not include the pond dam or spillway and livestock were excluded from all ponds upgradient of the proposed easement areas.

- Cattle had access through the fence to the wetland enhancement portions along T1. The degree of cattle access and impact prompted the IRT (DWR) to inform KCI that stream credit (Enhancement 2) may be warranted for this section of stream within the wetland to the point where cattle impacts were obvious.
- Since the restoration section of T-1 would be Priority 1, the IRT cautioned KCI that bringing the channel up could result in hydrology loss for all or a portion of the reach.

T2 to T1

- The IRT felt that the upper reach of T2 above the confluence of T1 could become more wetland-like if an adequate channel was not designed into the plan. Although this channel will be small in cross section, it should be created to allow the documentation of flow in this reach. Credit losses may be realized in this reach if vegetation takes over.

T1 from T2 to T3

- Flow in the channel increased through this reach.
- Plugging of existing ditches in the wetland rehabilitation and wetland reestablishment areas and the filling of T1 to create a Priority 1 channel was thought to be appropriate justification for the proposed crediting for the wetland area north of T1 just above T3.

T1 from T3 to end of T1

- No specific comments were raised. KCI showed the IRT the small section of Enhancement 2 stream where the profile of the stream and the pattern did not justify Restoration in this section. Some minor profile work may still take place here but on a smaller scale.
- The wetland area north of the Enhancement 2 section was examined as well, including the two small drainage features that would be plugged to rehabilitate the existing wetlands and re-establish the drained wetlands. No specific comments were generated.

T3

- The IRT indicated that the Enhancement 2 portion of T3 may be eligible for Enhancement 1 credit (1.5:1 Ratio) since the cattle impacts are so significant that a channel would have to be graded through that area. Similar to T2, the IRT indicated that the strong wetland component through this area could take over the channel and potentially cause a credit loss. Flow monitoring would be important in this reach as well as the creation of an appropriately sized channel to maintain channel continuity.
- The IRT indicated that the upper portion of T3 where no credit was proposed for stream but wetland enhancement was proposed for the wetland elements was not as impacted by cattle as other sections of the project and the justification (invasive species control, fencing, selective planting, hydrology augmentation in areas of small headcuts) for the enhancement would need to be well documented in the Mitigation Plan.

Meeting was adjourned at approximately 11:15am.

If there are questions or concerns regarding the content in these minutes please call (919-278-2511) or email me tim.morris@kci.com.

KCI ASSOCIATES OF NC

ISO 9001:2015 CERTIFIED

ENGINEERS • PLANNERS • SCIENTISTS • CONSTRUCTION MANAGERS

4505 Falls of Neuse Rd., Suite 400 • Raleigh, NC 27609 • Phone 919-783-9214 • Fax 919-783-9266

Date: 12/6/2019

To: Jeremiah Dow, Project Manager

From: Tim Morris, Project Manager
KCI Associates of North Carolina, P.A.

Subject: Hip Bone Creek Restoration Site
Draft Mitigation Plan Review
Cape Fear River Basin - 03030003
Chatham County, North Carolina
Contract No. #7528
DMS Project #97136

Dear Mr. Dow,

Please see the below responses to your comments from November 5, 2019 on the draft of the Hip Bone Creek Mitigation Plan. We have addressed your comments in the report, plus additional comments received November 25, and have outlined our changes. Following your acceptance of these changes, we will submit 3 hard copies of the final report along with a flash drive or CD with an electronic copy of the report and supporting digital files submission.

1. Per Contract, specifically Sections 3.2 and 6.2 of RFP 16-007331, DMS needs the final approved Financial Assurance (performance bond) before the Final Mitigation Plan can be approved or any payment made.

   Noted.

2. Cover Page – please add the following:
   a. USACE#: 2017 001160
   b. DWR#: 2018-0785

   We have added these.

3. Table 1 – Verify total linear footage for stream Enhancement II.

   We verified 1,166 lf as the correct total amount for Enhancement II after adjusting the amounts for significant digits as requested.

4. Figure 1 – site is not shown on figure.

This has been corrected.

5. Section 3.1.2, page 8 – The first paragraph references Figure 4 and should reference Figure 5. The current land use breakdown of the project watershed totals 339 acres, but the project watershed is defined as 158 acres.

   The figure number reference has been corrected. The breakdown acreages and percentages were incorrect and fixed; total project watershed acreage is 158 acres.

6. Last paragraph, page 13 – the USACE jurisdictional determination is in Section 12.7 not 12.8.

   This has been corrected.

7. Table 3
   a. Verify existing linear footage of T3

   2,202 lf is the correct value for T3; this includes the entire existing jurisdictional length through the uncredited stream section in the middle.

   b. Verify drainage areas for both T1 and T3. They add up to more than what was shown on Figure 5.

   T1 is inclusive of the T3 drainage area. These are the drainage areas to the end of each reach.

8. Section 6.1, page 20
   a. T1's five reaches are depicted on both Figures 8 and 9.

   We have noted that it applies for both Figures 8 and 9 in the text.

   b. The 3rd paragraph, second sentence states that "T1 Reach 4 is a short section of restoration from STA 26+86 until STA 32+49…" T1 Reach 4 is an Enhancement II reach.

   This actually should read "T1 Reach 3 is a short section of restoration from STA 26+86 until STA 29+54…". It has been corrected.

9. Section 6.3,
   a. Methodology for wetland re-establishment for portions of T2 is somewhat unclear in this section as there are no ditches being plugged and no discussion of bringing the "stream" bed up. Please consider adding a brief explanation in this section.

   We have elaborated on this at the end of the second paragraph in this section:
   "Along T2 specifically, the existing eroding banks will be graded back to a stable angle and excess soil will be used to level out any remaining scour holes or deep spots. In addition, a combination of buried log sills and brush material will be used to stabilize the wetland grade and redistribute flow across the floodplain."

b. Briefly address how wetland re-establishment along the left bank of T3 Reach 2 (an EII reach) will be achieved since the maps do not show ditches to be plugged, and presumably the groundwater gradient will not be significantly altered.

We added:
"Along T3 Reach 2, the re-establishment wetland will have a small berm removed that runs parallel to the stream and have wetland microtopography redeveloped to retain the hillside drainage that is currently running off quickly to the stream at a downstream point."

10. Section 6.6
    a. Please clarify why it is appropriate to use existing or proposed D84 to estimate critical shear stress when D84 represents 1 data point in the distribution (T1 reach 2).

For T1 Reach 2, the D84 values are representative of the spread shown in the pebble counts for the two assessment cross-sections (XS T1C and T1D). While the D84 on XS T1D is higher than the rest of the site at 72 mm, the modified critical shear stress of 0.448 lb/sf is comparable to the average channel shear stress values. For XS T1B on T1 Reach 1, there was a large outlier particle that we took out, but the D84 only changed slightly from 7.3 to 7.1 mm, and the modified critical shear stress did not change (0.045 lb/sf).

b. Please explain and/or clarify the increase in shear stress proposed for the restored stream conditions. Describe the size distribution intended for the restored stream. Clarify if there is a difference in the distribution from upstream to downstream that may account for the proposed conditions discussed in the text.

Regarding the increase in shear stress, there are certain parts of the stream that have become overwidened due to cattle impacts. The table below shows the relation of the overwidened sections to the increase in average shear stress.

XS	Existing W/D Ratio	Existing Avg Shear Stress (lb/sf)	Proposed Avg Shear Stress (lb/sf)	Modif. Critical Shear Stress (lb/sf)
T1 Reach 1 XS A	21.8	0.45	0.58	0.003
T1 Reach 1 XS B	11.0	0.60		0.045
T1 Reach 2 XS C	24.8	0.29	0.51	0.045
T1 Reach 2 XS D	4.5	0.66		0.448
T1 Reach 3 XS E	3.6	0.36	0.34	0.190
T1 Reach 3 XS F	9.8	0.34		0.166
T1 Reach 4 XS G	41.4	0.20		0.046
T1 Reach 5 XS H	42.1	0.09		0.081
T3 Reach 3 XS C	4.2	0.79	0.48	0.103

We anticipate there to be smaller-sized particles (small gravels with limited sand) at the heads of the project reaches, transitioning to larger gravels with limited cobble at the bottom of the site. However, we expect the upper reaches will be more vulnerable to bed degradation, because they will not be seeded as quickly as the lower reaches and will also have steeper slopes. As a result, we are proposing riffle stabilization to prevent bed degradation.

We have updated the sediment section with these discussion points.

11. Tables 7, 8, 9 and 10
    a. Verify drainage areas in each table, i.e., the drainage area for T1 Reach 2 is different for existing and proposed conditions, and T3 Reach 3 drainage area in Table 10 does not match the drainage are for T3 in Table 5.

    The drainage areas for T1 Reach 2 were incorrect and have been corrected. In addition, we went through and verified that all of the drainage areas shown in Tables 5, 7-10 and the Morphological Criteria Table in Section 12.2 are in agreement. The drainage areas are all now set at the values used in design (top of reach) instead of some of the assessment values that were in the draft.

    b. Please explain how the valley width will increase from existing condition to proposed condition.

    In this type of project with small streams, we understand the valley to be the floodprone meander belt width. If the channel is extremely incised and either lateral or vertical changes are made in the proposed condition, then the valley width may change relative to the stream.

    Per discussions from 11/25/19, we have changed this to "floodprone belt width" to be more representative of the measurement.

    c. Please explain (Table 8) how the drainage area will decrease from existing condition to proposed condition.

    There can be slight variations in drainage area in the existing and proposed conditions depending on how the new stream alignments and confluences are designed. The one instance at this site where that occurs is at the confluence of T1 and T3. However, we have adjusted the drainage areas to what we used in design, which are now consistent between existing and proposed.

12. Table 10 proposed parameters do not match the restored reach parameters in the Morphological Criteria table in Appendix 12.2.

    These tables have been corrected so that they have the same values.

13. Section 6.8 – be advised that the IRT has been having concerns regarding the planting of green ash (*Fraxinus pennsylvanica*) due to issues with the emerald ash borer (*Agrilus planipennis*). KCI may want to look at an alternative species.

    We have removed green ash and substituted pin oak in its place.

14. Table 11
    a. Please verify the stationing and restoration footage for T3 Reach 1.

    We have corrected the stationing shown for this reach to ending at STA 303+10.

    b. To better match DMS tracking of credits, please take stream credits out to three (3) decimals.

    We have changed all the stream linear footage to whole numbers and then calculated the credits to three decimals off of these whole numbers.

15. Table 12 - Verify total linear footage for stream Enhancement II.

    The linear footage is correct as shown for EII after adjustments were made per #14b.

16. Table 13 – To better match DMS tracking of credits, please take stream credits out to three (3) decimals.

    Corrected to comply with #14b.

17. Figure 8
    a. Please label T2.

    We have added a label to T2.

    b. Stream Enhancement II linear feet (lf) in the map legend is incorrect.

    This has been corrected to comply with #14b and the values are 1,166 lf and 466.400 stream credits.

18. Section 8.0, Vegetation Monitoring - The report states that "Vegetation monitoring will be conducted between July 1st and leaf drop." DMS recommends adding language to indicate that vegetation monitoring will typically be done later in the growing season to capture any effects of climatic or other conditions that may adversely affect vegetation survival so that this more closely matches the IRT's 2016 Monitoring Guidance.

    We added: "Monitoring should occur later in the growing season to capture any effects of climatic or other conditions that may adversely affect vegetation survival."

19. Table 14 – Please add wetland hydrologic monitoring to Table 14.

    We have added a row for wetland hydrology to shown the six proposed groundwater gauges.

20. Section 9.0 – KCI must notify and work with DMS to develop any adaptive management strategy.

    We have added DMS to this section.

21. Appendix 12.1
    a. Cover Sheet/Sheet 1 of 26 – Change DMS Project Manager to Jeremiah Dow

    This has been corrected.

    b. Sheet 13 of 26 – see comment for section 6.8 regarding green ash.

    As noted above, we have removed green ash and substituted pin oak in its place.

22. Appendix 12.2
    a. In the Morphological Criteria table, there are numerous BHRs less than 1.0 for the existing channel. Please elaborate on this.

    This has been corrected. In some of our analyses, we evaluated some of the lower elevations in the channel, but have now set them all equal to bankfull (1.0).

    b. In the Morphological Criteria table, please verify the valley slope and average water surface slope of T1 Reach 3.

    These have been corrected to 0.0093 and 0.0082 for valley and average water surface slopes, respectively.

    c. See comment 12 above.

    These tables have been adjusted so that they have the same values.

23. Appendix 12.3 – DMS requires land acquisition to be completed and all required easement documentation be provided prior to submitting for permits.

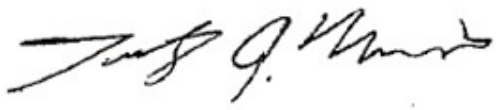
    We understand that the easement acquisition must be complete; the easement is currently in progress.

24. Appendix 12.6 – Please exclude (on the plot) particle size data that was not collected. For example, according to the XS T1a size data table, the largest particle observed was between 16-22.2mm. The plot indicates data points up to 10,000 mm.

    We have removed points along then 100% line that did not represent any actual collected data.

Please contact me if you have any questions or would like clarification concerning these responses.

Sincerely,



Tim Morris
Project Manager

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Date: March 17, 2020

To: Kim Browning, USACE

From: Tim Morris, Project Manager
KCI Associates of North Carolina, P.A.

Subject: Hip Bone Creek Restoration Site
Mitigation Plan Review – Response to IRT Comments
Cape Fear River Basin - 03030003
Chatham County, North Carolina
DEQ Contract No. #7528
DMS Project #100059
USACE AID #: SAW-2018-01160

Below are our responses to comments received on the mitigation plan for the Hip Bone Creek Restoration Site. All of the following changes have been completed in the revised mitigation plan. Please contact me if you have any questions or would like clarification concerning these responses.

Mac Haupt and Erin Davis, NCDWR:

1. Page 6, Section 3.1 – In addition to identifying the streams as headwater systems, it's important to note their origins as downstream of farm ponds.

   The wording has been changed to "The project streams begin as headwater systems on the site, with Tributary 1 (T1) and Tributary 2 (T2) beginning downstream of two farm ponds."

2. Page 8, Section 3.1.2

   a. It would be helpful see property boundaries in the vicinity of the project. Could a tax parcel layer please be added to Figure 2 or a zoomed out Figure 5?

      The Chatham County Parcel Data has been added to Figure 2.

   b. What are the anticipated future land uses for the project watershed?

      We have added at the bottom of 3.1.2.: "The development pressure for the project watershed is anticipated to be low to moderate. This section of Chatham County has retained its rural character and the majority of residences within the project watershed are farm homesteads or other rural acreages."

c. Please include a discussion of existing vegetation within the project site, in particular the species composition of the forested areas along the upper T1 and T3 wetlands.

We have added to the first paragraph in 3.1.2: "There are sections of narrow forested wetland area along T1 and T3. The overstory vegetation in these sections consists primarily of red maple (Acer rubrum) in the canopy with an understory of Chinese privet (Ligustrum sinense), and mixed rushes and sedges."

d. Please discuss any site constraints (e.g. existing utilities, existing crossings/paths). Are the existing stream crossings fords or culverts? Does the electrical line crossing the top of T3 have an associated easement?

We have added at the end of the first paragraph in 3.1.2: "There are five existing piped crossings at the site, most in disrepair, and one private power line that crosses the top of T3."

3. Page 12, Section 3.1.3

a. Besides Chinese privet, what other invasives have been documented on site?

In the second paragraph of 3.1.3, we added: There is an existing riparian buffer in this area with a sparse canopy of native hardwoods, and an understory that is comprised primarily of Chinese privet and other invasive species such as autumn olive (Elaeagnus umbellata) and callery pear (Pyrus calleryana).

b. In this section T2 is identified as a linear wetland; however, the JD lists it as a 368 linear foot non-wetland water. Please confirm this feature type.

We added to the end of the first paragraph of 3.1.3.: "Tributary 2 (T2), which was included as a stream in the jurisdictional determination, will be treated as contiguous wetland feature for the purpose of this project's accounting following a field decision with the North Carolina Interagency Review Team (IRT) (see Appendix 12.9)."

c. Please include a table or brief discussion of the NC SAM, NC WAM and DWQ Stream Id form results.

We added Table 3. Existing Stream and Wetland Conditions, which summarizes the results of these stream and wetland analyses. All other table numbering in the report has been adjusted as a result.

d. Side note, it was confusing having the appendices referred to as sections within the plan narrative.

These "Sections" have been changed to Appendices.

4. Page 18, Section 4.0 – Please state what assessment method was used to determine that "all stream channels have low functional values".

We have noted that he North Carolina Stream Assessment Method (NC SAM) was used to determine

the quality of the existing streams.

5. Page 20, Section 6.0 – It would be helpful to have the information in paragraph two stated earlier in the document, perhaps in the Introduction.

   We have now added the information regarding what stream reaches are not being used for stream mitigation credit in the last paragraph of Section 1.0.

6. Page 20, Section 6.1 - Flow is a general concern for this project. In particular, whether flow will be sustained in the upper 300-foot section of T1 Reach 1 that is proposed to be raised 1-2 feet.

   We believe that the riparian wetland at the base of the pond in addition to the surrounding seepage inputs from the hillsides will provide adequate hydrology for this reach of T1.

7. Page 20, Section 6.1 – Since establishment of vegetative cover and vigor can be a challenge on Priority 2 restoration banks/benches, please include a discussion on how the soil restoration will be addressed during construction and reference potential adaptive management.

   We have added the following: "Furnished or salvaged topsoil will be used to surface treat all planting areas within the floodplain extents shown on the plans. Adequate lime and fertilizer will be used to ensure adequate vegetative stabilization."

8. Page 21, Section 6.2 – In order to justify a 2.5:1 ratio, please include bank grading in list proposed work (as noted on Design Sheet 9).

   We have added this.

9. Page 21, Section 6.3 – Given that multiple wetland restoration areas abut the proposed conservation easement boundary, is there a concern about hydrologic trespass?

   No, we are not concerned at this location. The areas that we are including in the conservation easement encompass the lowest elevations of the site and then adjoin upland pasture. The conditions in these adjoining areas will be similar to the existing conditions and should not impede the landowner's future use of the land.

10. Page 21, Section 6.4 – The number of crossings for the project size is concerning. Fragmentation impacts the potential functional uplift.

    We try to minimize the number of crossings wherever we can, but landowners often desire crossings where they currently have them to continue using their land outside of the easement, which was the case at this site. We always do our best to install structures and roadways that minimize the impact of the crossings by having continuous flow through the pipes.

    a. Four of the five crossings are proposed to be 30 feet wide. However, the lower T1 crossing is proposed to be 60 feet wide. Can this crossing width be reduced to 30 feet? If not, please explain why.

We needed a 60-foot easement exception to accommodate a landowner request ensuring adequate access in future years. However, the current proposed configuration will not use the entire 60-foot length for the crossing. Approximately 30 feet will be used for the pipe and the 15-foot roadway. The remainder of stream in the exception will be restored similar to the rest of the project.

b. The T3 crossing is located approximately 150 feet north of the proposed conservation easement boundary. Can this crossing be relocated south of the easement boundary? If not, please explain why.

Unfortunately, the topography in that location doesn't allow for that type of reconfiguration.

c. Will the proposed crossings be gated and/or will the proposed fencing overlap the culvert to limit livestock access to the stream?

Yes, all of the crossings will be fenced to exclude livestock and gates will be installed at all crossings to allow easy access as necessary.

11. Page 23, Section 6.6 – Sheets 3 and 4 Details for proposed riffle enhancement, riffle grade control, and stabilized rock outlet differ from text included in this Section. The details have 30% native stream material while the text states 10%. The details do not include class 1 stone while the text does. Please make text and details consistent.

This has been corrected in the report to match the detail.

12. Page 26, Section 6.8

a. Please include native seed mix composition (species, quantity, wetland status).

Please see the planting lists on Sheet 17 of the Construction Plans.

b. Please identify target communities.

In general, we prefer not to designate a specified community type since a site can generally not be converted to that community within the timeframe of monitoring. We do select trees that are in line with the surrounding community types, though.

13. Page 30, Vegetation Performance – Note that only volunteer species that are included on the approved mitigation plan plant list may count toward the vegetation performance standard.

We added: "Volunteers that are included on the approved mitigation plan plant list must be present for a minimum of two growing seasons before being included in performance standards in Year 5 and Year 7." Additionally we added an extra list of native trees that could be used for substitutes or seen as desirable volunteers. This text reads, "Other native desirable species that have the potential to volunteer at the site or be used for planting substitutions towards the performance standard include other native oaks (Quercus sp.), native Celtis species (Celtis sp.), tulip poplar (Liriodendron tulipifera), native hickories (Carya sp.), native dogwoods (Cornus sp.), native elms (Ulmus sp.), black walnut (Juglans nigra), native Nyssa species (Nyssa sp.), and cottonwood (Populus deltoides)."

14. Page 30, Stream Hydrologic Performance – Please rephrase: The project streams must also show a minimum 30 days' continuous flow days within *each* calendar year.

    We rephrased to state: "The project streams must also show a minimum of 30 continuous flow days within each calendar year (assuming normal precipitation)."

15. Page 31, Section 8 – For installed gauges and wells, DWR recommends quarterly data download and inspection to reduce the risk of data loss due to instrument malfunction.

    We added: "Daily data will be collected and downloaded from the 8 automatic wells at a minimum frequency of once each quarter over the 7-year monitoring period following implementation."

16. Page 31, Vegetation Monitoring – Currently there are no wetland gauges or veg plots located within any of the proposed wetland rehabilitation areas or wetland enhancement areas to illustrate functional uplift. DWR requests two additional wetland gauges be located within proposed rehabilitation areas. Also, DWR would like to see at least two of the random veg plots be located annually within the proposed wetland rehabilitation planting areas or enhancement supplemental planting areas.

    Two wetland gauges have been added to the proposed rehabilitation areas. We have noted to place two of our 8 random vegetation plots within wetland rehabilitation or enhancement areas

17. Page 32, Visual Assessment – Please include photo locations at all crossings.

    Photo points have been added for all stream crossings.

18. Please add a Maintenance Plan as a new section or appendix summarizing the types of issues that may arise during monitoring and how those issues would be addressed, including invasive species treatment. DWR recommends a minimum annual treatment of Chinese privet.

    A Maintenance Plan has been added as Appendix 13.

19. Figure 9 – The flow documentation stations on T3 and T1 are very close to the stream reach start points. DWR requests these stations be shifted north approximately 50-75 feet.

    The flow stations have been moved 50 feet north on Figure 9.

20. Sheet 1 – The Sheet 1 table does not match the Table 11 values under the Existing Footage/Acreage and Mitigation Credits columns. Please update.

    We adjusted the significant digits in a previous draft of the report and have now made sure Sheet 1 matches the report.

21. Sheet 2 – Please add buried log sill and buried brush material icons to the project legend, as well as detail sheets.

    These have been added to the project legend.

22. Sheet 3 – DWR appreciated the riffle grade control note to include woody debris to enhance habitat.

23. Sheet 4 – Please add a culvert crossing detail.

    A culvert sheet (Sheet 5A) has been added with details for the structures.

24. Sheet 4 – Please confirm that the water quality treatment area will be self-sustaining and requires no long term maintenance. Also, will this treatment area be seeded and planted?

    Yes, the water quality treatment areas will not require any maintenance in the long term. They will be seeded with the native seed mix, but trees will not be planted within the treatment area itself.

25. Sheet 4 – The Project Legend includes channel filling. Please include a channel fill detail. If partial filling is proposed, please indicate the maximum depth from top of bank to be filled. Also, the plan narrative references "plugging surface ditches". Please confirm whether ditches will be plugged. If plugs are proposed, please include a detail identifying the minimum plug width (DWR recommends a minimum of 50 feet) and whether a restrictive material core will be used.

    A channel fill detail has been added to the plans. Most of the surface ditches to be plugged onsite are not especially deep or wide. These types of ditches will be filled similarly to the channel. Our experience with sites like this is that large plugs are not necessary for these small surface ditches. Those surface ditch locations are indicated with notations on the plans.

26. Sheet 9 – Please show floodplain grading extents associated with notes along T3 and T3-1.

    The extent of grading is shown in these areas.

27. Sheet 13 – Please show a wetland planting zone and include seed mix information.

    Given the size of the wetlands in relation to the stream riparian buffers, we are considering these as one contiguous planting zone. We anticipate the riparian wetlands to be integrated with the streamside vegetation and have designed a planting plan that incorporates species that will succeed across the site. Our permanent native seed mix information is shown on Sheet 17.

28. Sheet 13 – What does "per design representative guidance" refer to?

    Design representative guidance indicates areas where the designer may make minor adjustments during construction; these field adjustments allow us to ensure that all features are properly installed and achieve the desired function considering the specific conditions at each location.

29. Sheets 15 & 16 – Please show anticipated gate locations.

    These have been added to the specified sheets.

30. For future site submittals, please show the plan view and corresponding profile on the same design sheet.

Noted.

31. Appendix/Section 12.2 Soil delineation and Borings - The title reflects that a hydric soil delineation was completed, please show these boundaries on the included figure. While sufficient representative boring logs were submitted, it's assumed that additional sample points were taken in the field to delineate the hydric soil boundaries (i.e. more than one sample point per wetland area). In the future please, show all sample point locations on the associated soil report figure.

    The hydric soil areas have been added to the figure. The point locations will be added for future sites.

32. Appendix/Section 12.2 Groundwater Data – Please shift labels to align with corresponding lines.

    We have reformatted this slightly to improve columns.

USACE Comments, Kim Browning:

1. The correct USACE Action ID is SAW-2018-01160. Please correct the cover page.

    This has been corrected.

2. General Plan Comments:

    a. Please include a maintenance section with monitoring. For example, crossings, fence, invasives…and who will be responsible.

        A Maintenance Plan has been added as Appendix 13.

    b. This mitigation plan seemed to differ from the NCDMS template, and was difficult to follow at times. Also, the appendices were included as Section 12, which was confusing.

        Minor changes have been made to the plan format as the project progressed. We have changed the names of the appendices.

3. When submitting the PCN, please include an estimate of the number of trees, or acres, to be cleared for the NLEB 4(d) Rule.

    Noted.

4. Please label wetlands on Figures 8 and 9 to match the JD map. The asset tables should correspond to these labeled areas.

    The wetland labels have been added.

5. Table 4 and Page 21: Please describe the level of microtopography in regards to surface ponding.

   We have added "minor wetland microtopography (+/- 0.5 foot based on average ground elevation)." This development of microtopography will add roughness to the wetland terrain and encourage surface retention in the upper profile, but will not be installed as to allow large swaths of areas to be ponded more than others.

6. Page 18, last paragraph: "The consideration of future impacts to the areas that could limit functional uplift opportunities…" Please explain what considerations were given, such as utility installation through the easement, crossing failures, adjacent land development, pond dam breeches, etc.

   We have added "Consideration of future impacts to the area that could limit functional uplift opportunities is important when assessing project potential. For this site, the existing ponds onsite were deemed stable and the likelihood for development immediately adjacent to the site that could impact the streams after project completion was evaluated to be low. It is predicted that as the site matures, its ability to mitigate for any negative impacts within the project area and outside of the easement will continue to strengthen."

7. Page 21: In wetland rehabilitation areas, if hydrology and vegetation are proposed to be enhanced, functional uplift should be demonstrated by additional gauges and veg plots. Additionally, wetland enhancement areas should demonstrate functional uplift. Removal of debris and invasive treatment is expected on all reaches, so perhaps a discussion of the NCSAM functional assessment rating as LOW for habitat might be justification.

   As stated above, two wetland gauges have been added to the proposed rehabilitation areas. We have noted to place two of our 8 random vegetation plots within wetland rehabilitation or enhancement areas.

8. Page 26: Please list herbaceous seed mix and address how fescue will be treated/removed.

   We have added to the last paragraph: "Existing undesirable pasture grasses will be sprayed with herbicide and left fallow until full mortality is achieved. The areas will then be scarified or disked to break up any existing compaction prior to seeding and stabilizing with temporary and permanent seed mixes as prescribed in the project plans."

9. Section 7.0-Vegetation Performance: Please add 320 steams/acre for monitoring year 3.

   This has been added.

   a. Volunteers may only count towards success if they are in the approved planting plan.

      As noted in a previous DWR comment, we have added this.

10. Section 8-Veg Monitoring: Please add veg plots to wetland rehabilitation areas (random plots are fine).

    As stated above, we have noted to place two of our 8 random vegetation plots within wetland rehabilitation or enhancement areas

11. Wetland rehabilitation/reestablishment—It would be beneficial to add some coarse woody debris to the depressional areas and throughout the wetland for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events.

    At this site, we are showing woody debris installed along T2 and above T3. For the remaining wetland areas, we will add woody debris as available to encourage habitat development. However, because this site is not already wooded, there will be a limited amount of wood generated during construction to add to the site. A note about adding wood to the wetlands and stream floodplain has been added to the plans and this note was added to the mitigation plan "As available during construction, wood will be added to the wetlands and the stream floodplain for added habitat complexity, and to help store sediment, increase water storage/infiltration, and absorb energy during overbank events."

12. Page 32: Wetland hydrologic monitoring: Please add wells to all wetlands that propose hydrologic uplift and update Table 14 as necessary.

    As noted above, 2 additional wetland pressure transducer gauges have been added to wetland rehabilitation areas.

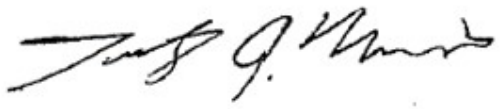
13. Page 32: Please depict fixed photo points on Figure 9.

    Fixed Photo Points have been added to Figure 9.

14. Please include the approved map for the PJD.

    The map was included in Appendix 12.7 with the PJD.

Sincerely,



Tim Morris
Project Manager

12.10 Maintenance Plan

The site will be monitored on a regular basis, with a physical inspection of the site 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. Maintenance needs or actions will be recorded in the annual monitoring reports.

Planned Maintenance

Component/Feature	Maintenance Through Project Close-Out
Stream	Routine channel maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel (such as the proposed water quality treatment areas) may also require maintenance to prevent bank failures, knick points, and erosion.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis up until the project is closed out.
Beaver and Other Nuisance Fauna	The site will be monitored for the presence of beaver or other fauna that may impact the success of the project. Adaptive management approaches will be used to evaluate whether or not beaver or their structures or other animals should be controlled or managed at the site.