Stream Mitigation Plan – FINAL
Lochill Farm Stream Mitigation Project

Orange County, North Carolina

Neuse River Basin: 03020201-030030

DMS Project ID No. 97083, DEQ Contract No. 6828, DEQ RFP #16-006477

USACE Action ID No. SAW-2016-00881

Prepared for:

NC Department of Environmental Quality (DEQ)
NC Division of Mitigation Services (DMS)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

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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.
- North Carolina Administrative Code (NCAC), "Consolidated Buffer Mitigation Rule", Rule 15A NCAC 02B .0295, Effective November 1, 2015, for all Riparian Buffer Mitigation.
- Project monitoring will comply with the NCIRT guidance document *Wilmington District Stream and Wetland Compensatory Mitigation Update* dated October 24, 2016.

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

January 2018

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1.0 PROJECT INTRODUCTION

The Lochill Farm Stream Mitigation Project (project) is located on an active horse farm in Orange County, North Carolina, approximately 6.5 miles northeast of the Town of Hillsborough, as shown on the Project Vicinity Map (Figure 1). To access the site from Raleigh, take Interstate I-40 West to Durham. Exit onto NC-147 to downtown Durham (Exit 279B) and follow for 12.9 miles. Merge onto I-85 South and follow for 2.1 miles, then take Exit 170 to US-70 West. At the first stop light only 0.3 miles from the exit, turn right onto Pleasant Green Rd and follow for 5.8 miles. Turn right at a stop light onto St. Mary's Rd and follow for 0.5 miles. Turn into the site entrance at the Lochill Farm horse stables at 6120 St. Mary's Rd. The project site is located in the valley to the south of the stables, with an approximate center point at latitude 36.113419 North, and longitude -78.991165 West.

The project is located in the Neuse River Basin, within the Hydrologic Unit Code (HUC) 03020201-030030 (the Middle Eno River), which is identified as a Targeted Local Watershed (TLW) in DMS's 2010 Neuse River Basin Restoration Priority (RBRP) Plan and its March 2016 Update. The project is also located in what was formerly known as DWR Subbasin 03-04-01 (the Upper Neuse). The project is further located within the Piedmont Physiographic Region, within the Carolina Slate Belt Level IV Ecoregion. The project watershed drains into nearby Buckwater Creek, flowing into the Eno River, which ultimately empties into the Falls Lake reservoir.

The project will restore 2,925 linear feet (LF) of existing stream, enhance 2,287 LF of existing stream, and preserve 750 LF of spring-fed tributaries, along with the re-establishment of 3.9 acres of riparian buffer and the preservation of an additional 11.9 acres of riparian buffer.

Historic agricultural uses on the project site itself include horse, cattle, and sheep animal operations; tobacco and small grain row-cropping; and timber harvesting. These activities have negatively impacted both water quality and streambank stability along the project streams and their tributaries. The resulting observed stressors include excess nutrient input, streambank erosion, sedimentation, livestock access to streams, channel modification, the loss of significant wetland function, and the loss of riparian buffers.

The outcomes of this project include:

- Increased bankfull events, restoring a more natural flooding regime to the system
- Stable streams banks with appropriate channel dimensions
- Increased number of pools and woody structures from existing conditions, and a reduction in impediments to aquatic organism stream passage
- Establishment of a 50-foot minimum width vegetated riparian buffer
- Establishment of a permanent conservation easement on the entire project

The project is being conducted as part of the NCDMS In-Lieu Fee Program and is anticipated to generate at close-out a total of 4,113 stream mitigation credits and 176,511 buffer mitigation credits, and will be protected by a 15.8-acre permanent conservation easement. Please see the Project Components and Mitigation Credits table in Section 11 for complete credit determinations.

2.0 WATERSHED APPROACH AND SITE SELECTION

As described above, the Lochill Farm project is located within DMS's TLW 03020201-030030 in the 2010 *Neuse River Basin Restoration Priorities* (RBRP) report and its March 2016 Update. Part of the general basin-wide goals as described in the 2010 RBRP are to "promote nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers." The RBRP further describes the specific watershed of the Middle Eno River HUC in more detail, and states that "priority projects should increase or improve buffers." The March 2016 RBRP Update for the Neuse 01 noted the HUC's extensive forested and conserved land assets, and described the mix of watershed problems including "impervious surfaces, disturbed buffers, and agricultural lands/animal operations."

The RBRP also described specific goals for the Neuse 01, one of which is to support the Upper Neuse River Basin Association's *Upper Neuse Watershed Management Plan*. This plan focused its management strategies on two priority water resource issues of concern: 1) Nutrients/ Algae/ Total Organic Carbon, and 2) Sedimentation and Erosion. The plan subsequently identifies stream and wetland restoration projects as one of the five watershed management techniques recommended to improve the two priority issues. The report also states that "the protection and restoration of wetlands and riparian corridors is an *essential* component of the Upper Neuse Watershed Management Plan."

A second goal of the RBRP for the Neuse 01 is to "protect, augment and connect Natural Heritage Areas and other conservation lands." The project is located within the Upper Eno River Macrosite area, and roughly one mile upstream from the designated Significant Natural Heritage Area (SNHA) Eno River/Cates Ford Slopes and Uplands, both as described in the Inventory of the Significant Natural Areas of Orange County (NCNHP, 2004).

NCDWR's 2009 *Neuse River Basinwide Water Quality Plan* indicates that for the project subbasin 03-04-01, the major stressors contributing to decreased water quality are "high nutrient and sediment loading, high chlorophyll *a* levels due to the high nutrients, high fecal coliform, low dissolved oxygen, and habitat degradation." The report also describes the Eno River Corridor as "some of the most scenic and biologically important natural areas in the entire eastern piedmont." The Lochill Farm project is located only about two miles upstream from the Eno River and just one mile upstream of the Eno River State Park boundary (Figure 2). Therefore, the project will help restore and preserve some of the immediate watershed to this prized area.

The Lochill Farm project goals directly or indirectly address all the priority resource issues targeted in the watershed planning documents discussed above, through the implementation of their self-identified management practices. The project will reduce sedimentation and erosion by stabilizing eroding stream banks and gullies, and will help reduce nutrients and related algal blooms through the exclusion of all livestock and with the establishment of a minimum 50-foot wide planted riparian corridor, which includes within it roughly five acres of restored, enhanced, or preserved wetlands. All of which will be permanently protected with the establishment of a 15.8-acre conservation easement.

Therefore, the proposed project site location aligns well with overall NCDMS goals within the Compensation Planning Framework (CPF) for the upper Neuse watershed, which places a focus on improving water quality through the reduction of sediment and nutrient inputs through the restoration and protection of streams, wetlands, and riparian buffers.

The project is also located within a designated Water Supply Watershed (WS-IV) for the Falls Lake reservoir and is a designated nutrient sensitive water (NSW).

3.0 BASELINE AND EXISTING CONDITIONS

The Lochill Farm Stream Mitigation Project is located near the Town of Hillsborough in Orange County, North Carolina, within the upper Neuse River Basin. The following sections will describe the existing conditions found on the project, and include a description and history of the surrounding landscape and overall watershed land use and conditions, as well as a discussion of the specific environmental impacts and responses they have produced on the project.

Table 3.1 below provides a summary of the key project attributes and individual reach parameters for the existing conditions on site.

Table 3.1 Project Attributes for Existing Conditions
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Project Information				
Project Name	Lochill Farm Stream Mitigation Project			
County	Orange			
Project Area (acres)	15.8			
Project Coordinates (latitude and longitude)	36.113419 N and -78.991165 W			
Planted Acreage (Acres of Woody Stems Planted)	8.1			
Project Watershed Summary Information				
Physiographic Province	Piedmont			
River Basin	Neuse			
USGS Hydrologic Unit 8-digit 03020201	USGS Hydrologic Unit 14-digit 03020201-030030			
DWR Sub-basin	03-04-01			
Project Drainage Area (acres)	1,020 acres / 1.59 square miles (at downstream end of R1)			
Project Drainage Area Percentage of Impervious Area	< 1% impervious area			
CGIA Land Use Classification	80.6% forested, 12.7% agriculture, 6.5% developed, 0.2% open water			
Reach Summary Information				
Parameters	**Reach R1**	**Reach R2**	**Reach R3**	**Reach T1**
Existing length of reach (linear feet)	2,925	590	1,697	96
Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (acres)	1,020	12	190	0.8
Perennial, Intermittent, Ephemeral	Perennial	Intermittent	Perennial	Intermittent
NCDWR Water Quality Classification	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW
Stream Classification (existing / proposed)	E4 (incised) / C4	B5/B5	E4b to B4 / C4b	E5 / E5
Evolutionary trend (Simon)	IV – Degradation and Widening	I – Stable System	IV – Degradation and Widening	I – Stable System
FEMA classification	Zone X	Zone X	Zone X	Zone X
Reach Summary Information (continued)				
Parameters	**Reach T2**	**Reach T3**	**Reach T3b**	**Reach T4**
Length of reach (linear feet)	49	482	34	89

Valley confinement (Confined, moderately confined, unconfined)	Unconfined	Unconfined	Unconfined	Unconfined
Drainage area (acres)	0.7	37	36	2.9
Perennial, Intermittent, Ephemeral	Intermittent	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW	WS-IV, NSW
Stream Classification (existing / proposed)	E5 / E5	E5 / E5	E5 / E5	E5 / E5
Evolutionary trend (Simon)	I – Stable System	I – Stable System	I – Stable System	I – Stable System
FEMA classification	Zone X	Zone X	Zone X	Zone X
Regulatory Considerations				
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**	
Water of the United States - Section 404	Yes	Yes	PCN	
Water of the United States - Section 401	Yes	Yes	PCN	
Endangered Species Act	Yes	Yes	Categorical Exclusion	
Historic Preservation Act	Yes	Yes	Categorical Exclusion	
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	N/A	
Essential Fisheries Habitat	No	N/A	N/A	

3.1 Watershed Processes and Resource Conditions

3.1.1 Landscape Characteristics

The Lochill Farm Stream Mitigation Project (project) is located on a horse farm in the rolling hills of Orange County, North Carolina, approximately 6.5 miles northeast of the Town of Hillsborough. The project is located in the Neuse River Basin, within the Hydrologic Unit Code (HUC) 03020201-030030 (named the Middle Eno River). The project is located within the Piedmont Physiographic Region, within the Carolina Slate Belt Level IV Ecoregion.

Project Reaches R1 and R3 are both denoted as blue-line streams in the USGS Topographic Map (Northwest Durham Quadrangle – Figure 3), while R2, T1, T2, T3, and T4 are all spring-fed tributaries flowing into those main channels. The Orange County Soil Survey (1977) shows Reaches R1, R3, and T3 as streams. Historic aerial photographs of the site from 1955 and 1938 obtained from the Orange County NRCS office both have blue markings denoting Reaches R1, R2, R3, and T3 as streams, along with another tributary flowing south into R1 near its confluence with R3. Photographs of the project reaches themselves can be found in Appendix A.

Field evaluations of intermittent/perennial stream status were made in the summer of 2015. These evaluations were based on NCDWQ (now NCDWR) Methodology for Identification of Intermittent and Perennial Streams and Their Origins (v 4.11) stream assessment protocols. Table 3.2 below presents the assessed stream data for each project reach, while Figure 4 shows their intermittent and perennial status. Copies of the completed classification forms are located in Appendix F. These assessments were confirmed by the USACE in the Preliminary JD received on July 26, 2017, a copy of which can be found in Appendix H. Figures 5A and 5B show the drainage areas for each project reach.

Table 3.2 Summary of Field Investigations to Determine Intermittent/Perennial Status
Lochill Farm Stream Mitigation Plan - NCDMS Project No. 97083

Project Reach Designation	Existing Project Reach Length (ft)	NCDWQ Stream Classification Form Score	Watershed Drainage Area (acres) [1]	Stream Status Based on Field Analyses
R1	2,925	38, 39.75, 40	1,020	Perennial
R2*	590	22.75	12	Intermittent
R3	1,697	32.5, 33	190	Perennial
T1*	96	25.25	0.8	Intermittent
T2*	49	26.5	0.7	Intermittent
T3/T3b*	516	30	37	Perennial
T4*	89	34.75	2.9	Perennial

**These reaches are spring-fed in origin, thus their drainage areas can be quite small.*

Note 1: Watershed drainage area was estimated using the online USGS StreamStats program, as well as topographic and LiDAR information at the downstream end of each reach.

Weather data for Orange County from the Chapel Hill Station for the years 1971-2016, reveals a climate typical of the NC piedmont. The area receives an average of 47.16 inches of rain per year, in a relatively even annual distribution pattern, with a 30% chance of having less than 42.87 inches and 30% chance of having greater than 50.64 inches. The greatest average daily maximum temperature is 89.2° F in July, while the lowest average daily minimum temperature is 27.7° F in January. The growing season lasts for 230 days, beginning on March 23rd and ending on November 8th (using the 50% probability data, with a temperature of 28° F or higher).

Geologically, the project location is underlain by the Carolina Slate Belt (Figure 6). The intermediate metavolcanic rocks (metamorphic rock derived from volcanic rock sources) found beneath the site are primarily metamorphosed andesitic tuffs and flows. Basic dikes cut the slate, but most dikes are too narrow to delineate at the project-level map scale. The bedrock is overlain by the regolith, which is composed of saprolite, alluvium, and soil. Saprolite is formed from the in-situ weathering of bedrock and generally retains relict structures from the parent rock. These relict structures also retain the foliation and directional permeability of the parent rock (Daniel and Dahlen, 2002). Baker staff observed at least two instances of exposed bedrock in the channel bed, providing grade control in those locations.

The project is also located within the Carolina Slate Belt Soil System, whose soils are derived from the underlying metavolcanic parent material (Daniels et al., 1999). Topographically, soils found within the Carolina Slate Belt tend to have a few distinct features from other soil systems found in the Piedmont. The stream interfluves are irregular, and sharp topographic breaks such as knolls and saddles are common, while the valley sides are relatively short. The smaller first and second order streams tend to be shorter with high angle junctions, often joining the main stream channel at right angles. Right angle turns are also not uncommon on the main channels in these systems. Tributaries to main streams commonly flow parallel to one another, which is likely related to the underlying rock structures.

Carolina Slate Belt soils also tend to have relatively high silt content overlying a relatively thin saprolite layer, as compared to soils from much of the rest of the Piedmont. The high silt content typically make these more easily eroded soils. The project is located within a Georgeville-Herdon soil landscape, with those two silt loam soils dominating the surrounding greater project area (Figure 7). This soil landscape is quite common in the northern portion of the Carolina Slate Belt. However, Chewacla loam soils make up the vast majority of the soils found within the project conservation easement, found all along the

floodplain of Reach R1 and lower R3. Tarrus silt loam is the only other soil found in the project area, primarily in the upper portion of Reach R3. Chewacla loam is also listed as a hydric soil for Orange County by the NRCS. A soil investigation conducted as part of the wetlands work on site confirmed the presence of extensive hydric soils throughout the floodplain of the middle and lower portion of Reach R1 and in the seep/spring fed wetland area in the upper portion of Reach R3. High silt contents were also observed in soils found throughout the site, indicating a more easily eroded stream system.

The project area topography is dominated by a gently sloping valley running from the northeast to the southwest across the farm on site (Figure 8). The valley slope is about 0.9% with its side slopes ranging from 7-12%, and with a broad unconfined valley bottom width of about 200 ft. Reach R1 flows through this main valley at an average water surface slope of 0.7%. Several smaller, contributing valleys with steeper slopes (~2 to 3%) connect into the main valley at almost perpendicular angles, the largest of which contains Reach R3, which has a 2% average water surface slope. The average elevation for the entire project watershed is 593 feet above sea level, with a low-point elevation of 476 feet, and a high-point elevation of 743 feet.

A bed material analysis determined that both Reaches R1 and R3 are gravel bed systems with average D50 values of 20 mm and 23 mm respectively as explained in further detail in Section 6.4. A short ~100 ft section in the middle of Reach R1 has noticeably more sand in the substrate than in other areas, likely related to an old beaver dam once located in that area, that has since been removed. This section coincides with a particularly gentle section of stream slope, likely why some of the sand still remains in the channel bed. Reaches R2, T1, T2, T3, and T4 are all spring-fed tributaries with lower flow volumes and sand beds.

Streams located in the Slate Belt can be prone to drying out in the summer due to their inherent underlying geologic and soil conditions. However, the landowner has confirmed that perennial Reaches R1 and R3 have never dried out in the nearly 40 years he has lived on the property. Baker personnel working in the stream during the summers of 2015 and 2016 observed continuous significant flow in both reaches, despite the drought conditions present in the summer of 2015 (Orange County was in a D1 – Moderate Drought at that time according to the NC Drought Management Advisory Council). The significant network of seeps and springs that exist throughout site likely help contribute to maintain baseflow during the summer and in drier years.

A wetland delineation conducted on the site in June and December of 2016 determined there are 4.2 acres of riparian wetlands located on the project. Most of these are located along the floodplain of the middle and lower portions of Reach R1, while the rest are found at the top of Reach R3 within a network of hillside seeps and spring-fed small tributaries in the left floodplain of R3. Further information on the existing wetlands can be found in Section 3.2.3 and in Appendix H.

The existing vegetation on the project is dominated by common piedmont bottomland forest species, most notably *Platanus occidentalis* (sycamore), *Liriodendron tulipifera* (tulip poplar), *Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Ulmus americana* (American elm), and *Liquidambar styraciflua* (sweetgum) in the canopy, with *Lindera benzoin* (spicebush), *Aesculus sylvatica* (painted buckeye), *Acer negundo* (boxelder), and some *Juglans nigra* (black walnut) in the understory. Common herbaceous species include *Phryma leptostachya* (lopseed), *Smallanthus uvedalius* (bear's foot), *Polystichum acrostichoides* (Christmas fern), *Elephantopus carolinianus* (elephant's foot), and *Monarda fistulosa* (bee balm) in drier locations, with *Saururus cernuus* (lizard's tail), *Onoclea sensibilis* (sensitive fern), *Juncus effusus* (soft rush), *Carex crinite* (fringed sedge), and *Carex lurida* (shallow sedge) in the wetlands. Looking farther away from the project site itself, the vegetative community shifts to more of an oak-hickory piedmont mesic forest type with *Liriodendron tulipifera* (tulip poplar), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), *Juniperus virginiana* (Eastern redcedar), *Cornus florida* (dogwood), *Pinus echinata* (shortleaf pine), and *Pinus taeda* (loblolly pine) also present. Notable invasive species found on site include *Ligustrum sinense* (Chinese privet) along the forest/pasture

edge of Reach R3, and *Rosa multiflora* (multiflora rose) found scattered throughout the site. Additionally, two small (~0.1 acres each), isolated pockets of *Ailanthus altissima* (tree-of-heaven) and *Pueraria lobata* (kudzu) are located at the very bottom of Reach R1 along Pleasant Green Rd.

3.1.2 Land Use / Land Cover, Impacts, Historic, Current and Future

Relevant land use / land cover and their impacts were investigated for the project and surrounding watershed through landowner discussions, a review of historic aerial photographs, GIS analysis using historic datasets, and field reconnaissance.

The USGS National Land Cover Database (NLCD) for 2011 shows that the entire 1.59 mi^2 (1,020 acres) project drainage area was 6.5% developed, 8.2% cultivated crops and hay, 4.5% grass/pasture, 80.6% forested, and 0.2% open water. In 1992, it was just 2.9% developed, 3.5% cultivated crops and hay, 93.5% forested, and 0.1% open water (no separate data available for grass/pasture). Thus, significant increases in both development and cultivated crop use, along with a significant decrease in forested area were observed over that 19-year period. Of particular note within the project drainage area, a 175-acre low-density residential development (17% of the watershed) was built adjacent to the project in the 1980s, while farther upstream an 86-acre area (8% of the watershed) was cut for timber in 2012. There are also several additional farms with pasture located throughout the project drainage area as well, but they have not changed dramatically over the past 30 years.

Historic aerial photographs from 1938, 1955, 1966, and 1987 were reviewed for the project and its surrounding area (Figures 9A-9D). They reveal a generally forested watershed, but with consistent agriculture and silvaculture activities in cleared areas dating back to the earliest photograph. The project area itself is readily identifiable in all historic aerials, though the cleared area used for agriculture has changed over time as individual fields were cleared for timber and/or farming and sometimes allowed to become revegetated naturally. The main channel Reach R1 (called Finches Branch by locals) was straightened, deepened, and relocated against the side of the steeper northern valley wall, but most of that effort had been done prior to 1938 (the date of the earliest aerial photo). The spoil from stream dredging is still present in the field alongside much of R1, particularly in the downstream portion. An approximately 300-foot section of R1 in the middle of the reach just downstream from its confluence with R2 does appear to have been further straightened prior to 1955. In the field, the abandoned channel is now a vegetated wet drainage swale. Reaches R2 and R3 have likewise been dredged at some point in the past, with adjacent spoil piles still present. Also of note, virtually the entire riparian buffer along R1 appears to have been cleared at some point in the aerials. Most recently, the buffer on the left bank of lower R1 was timbered in the early 1980s. Adjacent parcel farm use followed a similar pattern with shifting field clearing efforts. While the percent of forested land within the watershed is decreasing and the percent of developed and agricultural lands are increasing, the watershed as a whole did not show any dramatic changes in overall land use since the earliest photo from 1938.

One of the project landowners has done some extensive research on the history of the farm and its surrounding area, and believes the farm has been active since the colonial era. He also noted that a significant portion of the forested area in the southeastern part of the property was timbered ~15 years ago, and that historically the farm had a working sawmill in the early 20th century to cut and process lumber on site. That effort presumably cut much of the forested area of the farm, and would have resulted in significant sediment loss and stream function impacts. However, the species composition currently found on site is similar to the natural communities found in similar landscapes in the piedmont.

The history of the land use / land cover of the site and surrounding watershed indicates that significant impacts to water quality have occurred, certainly resulting in increases in erosion/sedimentation and nutrient loss, and decreases in stream and riparian habitat and function.

Currently, the project is an active horse farm with approximately 28 acres of open field that is frequently used for hay production. Horses with their riders have full access to the entire site and often ride across

and within the channel as part of their trail rides. There are numerous crossings where the horses have damaged the stream banks and channel, with an additional bridge crossing across Reach R1, and another three pipe culvert crossings that have clogged and heavily scoured both above and below the pipes, causing a hydrologic disconnect with the stream (Figure 4). Additionally, there are two 30-ft wide powerline easements from Piedmont Electric Membership Corporation (PEMC) that cross Reach R1 in its downstream section.

The future for the project watershed likely shares a fate similar to that of this whole section of Orange County. Development pressure from Hillsborough to the west, Chapel Hill to the south, and Durham from the east has been steadily growing over the years. The project HUC has seen its developed area double in the past 20 years accordingly to the available NLCD data.

3.1.3 Watershed Disturbance and Response

As described previously, the main channel Reach R1 was straightened, deepened, and relocated against the side of the steeper northern valley wall, while Reaches R2 and R3 were also dredged and deepened (and perhaps straightened in parts). The spoil from the stream dredging effort is still present alongside many sections of these reaches. This action, though occurring prior to the 1938 aerial photographs, remains the greatest impact to the project stream system, and its effects are still observed today. It immediately increased stream shear stresses during storm events, which led to further stream downcutting, particularly on Reach R1 (Figure 10). This in turn led to steeper stream banks, vertical in many sections, that resulted in increased soil erosion (Figure 11). Channel incision on Reach R1 was eventually arrested by bedrock in a few locations. Downcutting is also observed on the lowermost portions of Reaches R2 and R3 as they connect into the incised Reach R1. As channel incision slowed, the streams began to widen as shear stresses became redirected towards the banks, which has led to even more sediment loss from erosion. The periodic exposure to livestock on the farm further destabilized the stream banks through hoof shear. These processes are not as evident on the four spring-fed tributaries on the project (T1, T2, T3, and T4), with the exception of the downstream end of T1, which does exhibit downcutting as it connects into the incised channel of Reach R1.

The channel incision also led to an abandonment of the adjacent floodplain and likely to a decreased water table level in the adjacent buffer and historic wetland areas. There are several drainage features running through the wetland areas that have noticeably downcut where they connect to R1, a result of the incision found in R1 itself. These drainage features further exacerbate the decreased water table levels in the riparian wetlands.

The sawmill operation on site in the early 20th century also presumably resulted in much of the contemporary forested area on the farm being cut. This would have increased the runoff volumes and peak flows, and the sediment loads entering the streams. As forest regrowth occurred, these effects would have quickly begun to fade but much of their impact would have remained. The increased volume and peak flow would have contributed to further shear stress in the streams, contributing to their continued incision, while the increased sediment load would have eventually moved into the Eno River.

The channel along Reach R1 has reestablished a basic riffle-pool morphology since their straightening/ dredging years prior, but lack deep pools and a more sinuous planform that would naturally be seen in this valley type and slope. Reach R3 has reestablished a basic riffle-step-pool morphology but again, lacks a more diverse bedform including numerous deep pools. These reaches also have a noted lack of in-stream wood structure or woody debris. Reach R1 has a maximum pool-to-pool spacing ratio of 20.8, far greater than the reference value of 7. There are also three pipe culvert crossings (one on R2 and two on R3) that have clogged and substantially scoured, resulting in a hydrologic disconnect with the stream itself. In addition, there are two frequently used but significantly impaired and eroding ford crossings on R1 that have contributed to soil losses.

The general historic and present day clearing efforts in maintaining pasture and farm fields has resulted in approximately 41% of the project stream length on site lacking a full 50-foot wide forested riparian buffer along both banks (Figure 12). A narrower buffer results in increased sediment and nutrient loads into the stream system.

3.2 Regulatory Review

3.2.1 Categorical Exclusion

The Categorical Exclusion (Cat-Ex) for the Lochill Farm Stream Mitigation Project was approved by FHWA and NCDMS on September 21, 2016. The Cat-Ex summarized impacts to natural, cultural, and historical resources and documented coordination with stakeholders and federal and state agencies. The project team reviewed the site for threatened and endangered species protected by The Endangered Species Act of 1973. Although suitable habitat for Michaux's sumac *(Rhus michauxii)* is present at the site, no individuals were found during a site inspection on 6/22/16. The Biological Conclusion is that the project will have No Effect on Michaux's sumac or any of the other federally protected species found in Orange County. The USFWS determined that the project is not likely to adversely affect any federally protected species and expressed concerns about possible sedimentation impacts to aquatic species and provided recommendations to minimize or avoid these impacts. The NCWRC noted that populations of sensitive (but not federally protected) species are located downstream of the site. NC-HPO verified that no known historic resources protected by the National Historic Preservation of 1966 will be impacted by the project. The project will convert or affect Farmland as defined by the Farmland Protection Policy Act. No other comments were received about this project. For a full record of agency and public communications, please refer to the Cat-Ex documents found in Appendix I.

3.2.2 FEMA Regulated Floodplain Compliance

The Lochill Farm project is located in FEMA Zone X as noted on the Orange County Flood Insurance Rate Map Panels 3720080600K and 3720080500J (Figure 13). The topography of the site and location in the upper watershed supports the design without creating the potential for hydrologic trespass.

3.2.3 Section 404 / 401 Permitting

The proposed project area was reviewed for the presence of jurisdictional wetlands and waters of the United States in accordance with the provisions on Executive Order 11990, the Clean Water Act, and subsequent federal regulations and guidance. Wetlands have been defined by the USACE as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3(b) and 40 CFR 230.3 (t)). The areas in the project boundaries that displayed one or more wetland characteristics were reviewed to determine the presence of wetlands. The wetland characteristics include the prevalence of hydrophytic vegetation, permanent to periodic inundation or saturation, and the presence of hydric soils.

Following a desktop review of the National Wetland Inventory (NWI), NRCS soil survey, and USGS quadrangle maps, the project area was evaluated in the field for the presence of jurisdictional features. Baker wetland scientists conducted field surveys of the project area in June and December of 2016 to investigate potential wetlands, while field surveys had previously been conducted in July and August of 2015 to confirm the perennial and intermittent status of jurisdictional streams in the project area. In total, the field surveys confirmed the jurisdictional status of the seven project stream reaches, along with nine separate jurisdictional wetland areas, which were subsequently flagged, surveyed, and mapped as shown in the documentation found in Appendix H. The wetland areas are located in the floodplain of the middle and lower sections of Reaches R1, and in the uppermost portion of Reach R3. All of these jurisdictional features were confirmed by the USACE in March of 2017, and a Preliminary Jurisdictional Determination

(PJD) letter was received on July 26, 2017. A copy of the PJD is provided in Appendix H, along with all the associated USACE wetland data forms. The NCDWR stream identification forms are provided in Appendix F.

The proposed mitigation design for the site seeks to enhance the identified jurisdictional wetlands areas through the restoration of a more natural flooding regime and by raising their water table, though no wetland mitigation credits are being proposed for the project. The design will also avoid or minimize any disturbance or impact to the wetlands during project construction wherever possible. A copy of the Pre-Construction Notification (PCN) is included with the Final Mitigation Plan.

4.0 FUNCTIONAL UPLIFT POTENTIAL

The functional uplift potential for each project stream reach was evaluated using the general approach outlined in the Stream Functions Pyramid Framework methodology (Harman et al., 2012). This method attempts to tie stream functions to common function-based parameters that can be used to describe those stream functions. The functions are broken out into a hierarchy of categories, going from Level 1: Hydrology, Level 2: Hydraulic, Level 3: Geomorphology, Level 4: Physiochemical, and Level 5: Biology. Within this hierarchy, the lower level functions support the higher level functions. The methodology simply rates each function as 'Functioning', 'Functioning At Risk', or 'Not Functioning'. Each of the five individual functions is described below for the project stream reaches. For this evaluation, the NC Functional Lift Quantification Tool was used as a guide to assist in the qualitative evaluation of each of the five functions. The various parameters and their relative influence on each function were individually evaluated through the extensive site assessments conducted for the project. Additionally, the ratings correspond with the general functional lift discussions made with various review agencies (USACE, DWR, WRC, DMS) during site visits.

Please note that the four spring-fed tributaries to be preserved on the project do not appear to have undergone any appreciable manipulation or impact to their channels, and have high functional value for all five categories. Further, since they are for preservation only, no addition work is proposed that would significantly improve any function. As such, they are all rated as Functional for both the existing and proposed conditions, and are not discussed further in this evaluation.

4.1 Hydrology

The framework methodology describes the hydrology function as the transport of water from the watershed to the channel, with the parameters of channel-forming discharge, precipitation/runoff relationships, flood frequencies, and flow duration.

The historic clearing of portions of the project site and its watershed have very likely increased the overall runoff volume and the peak flow of precipitation events, particularly in the immediate aftermath of any logging event. However, there are no direct gauge measurements from the stream to quantitatively evaluate this assumption. Regardless, even with an increase, the project drainage area is still largely forested and has been fairly stable for some time. Thus, the entirety of the project area is currently assumed to be Functioning.

The project restoration itself cannot affect the majority of those parameters, as they are largely climate based. However, through the establishment of a complete network of forested riparian buffers along all project streams, a slight reduction in the amount of runoff resulting from precipitation could be expected. Yet any observed runoff reduction would very likely be quite small, and does not provide a realistic opportunity for any measurable functional hydrology uplift on the project. Therefore, it would remain rated as Functioning, with little improvement provided.

4.2 Hydraulics

The methodology describes the hydraulic function as the transport of water in the channel, on the floodplain, and through sediments, with the parameters of floodplain connectivity, flow dynamics, and groundwater/surface water exchange.

As previously described, the main project streams (Reaches R1, R2, and R3) have to varying degrees been straightened and/or relocated, as well as dredged. The resulting stream incision has led to a disconnect with their historic floodplains, reducing the appropriate level of hydraulic functioning for the system. This is more pronounced in R1 with bank height ratios (BHR) ranging from 1.4 to 2.6. Furthermore, due to stream incision, the riparian wetlands located along R1 have been impacted through

reduced flooding frequency and a lowered water table. Estimated bankfull flow velocity for R1 is 4.3 feet per second, which is within the normal functioning range. Reach R1 currently rates overall as Functioning At Risk. Reach R3 has BHR values ranging from a more stable 1.1 in the middle section, to 2+ in the upper and lower sections. It also has two clogged and scouring pipe culvert crossings that have resulted in stream disconnects. Estimated bankfull flow velocity for R3 is 4.4 feet per second, which is within the normal functioning range. As such, R3 is currently rated overall as Functioning At Risk. Reach R2 does have an average BHR of 2.8, but has much more stable and vegetated banks than R1 or R3. Also, being a spring-fed stream, it receives far less flow volumes than R1 or R3, even after significant storm events. As such, Reach R2 currently rates as Functioning.

As part of the project restoration, Reach R1 will be reconnected to its floodplain through a Priority I restoration effort, which will bring the BHR down to 1.0, and will restore a natural flood regime to the adjacent wetlands. This will result in a proposed conditions rating of Functioning. As part of their stream enhancement efforts, Reaches R2 and R3 will have all their clogged pipe culverts replaced (eliminating the stream disconnects). Additionally, Reach R3 will incorporate bankfull benches and bank sloping, which will increase floodplain connectivity. These actions will result in a proposed conditions rating of Functioning for all streams.

4.3 Geomorphology

The methodology describes the geomorphology function as the transport of wood and sediment to create diverse bed forms and dynamic equilibrium, with the parameters of sediment transport competency, sediment transport capacity, large woody debris transport and storage, channel evolution, bank migration/lateral stability, riparian vegetation, bed form diversity, sinuosity, and bed material characterization.

Reach R1 has tall, steep, frequently vertical banks that are largely bare throughout most of its length. It is currently an incised E4 stream type in the Rosgen classification and is in an E-Gc-F-C-E channel succession scenario. Incision has been stopped due to bedrock control, which will prevent the entrenchment ratio from becoming less than 1.4 and the stream from becoming a Gc stream type. The channel is eroding its banks to evolve into an F channel. R1 also has several highly eroding ford crossings that contribute to sediment loss in the system. As a result, sediment scouring and erosion are evident along 86% of the stream length, with an average BEHI score of 35 (a High value). There is a noted lack of woody structure or debris in the channel, and the maximum pool-to-pool spacing ratio for Reach R1 is 20, which is much greater than the reference value of 7. Further, roughly half of the stream banks have an inadequate riparian buffer. As a result, R1 currently rates as Not Functioning.

Reach R2 is a spring-fed stream that was partially dredged and has a spoil berm along the middle section of its right bank, resulting in tall, moderately steep bank slopes. They are largely vegetated however, and only 11% of the stream length was observed to be scouring or eroding, resulting in a BEHI score of 19 (a Low value). Towards the bottom of R2, an old pipe culvert crossing has almost completely clogged and is scouring out on the downstream end. The result is a stream disconnect that has resulted in the build-up and storage of sediment in a short section of the channel on the upstream side of the pipe, giving the stream a sandy/mucky bed there. There are very few pools found in R2, except for the spring at the head of the stream and a short backwater area created by the pipe culvert. Further, 64% of the reach banks lack an adequate riparian buffer. Therefore, Reach R2 currently rates as Functioning At Risk.

Reach R3 is a smaller stream than R1 and has generally shorter banks, but does have similarly steep, often vertical banks that are bare for much of its length. Spoil berms are found along the reach in many locations as well. There are two old pipe culvert crossings located at the very top and towards the middle of the reach. They are partially clogged and have scoured out both above and below the pipes, resulting in sediment losses and a stream disconnect at each location. The reach has an average BEHI score of 26 (a Moderate value), while 42% of the stream length was observed to be scouring or eroding. There was also

a noted lack of in-stream woody structure and a deficit of pools in the channel. Further, almost a third of the stream banks lack an adequate riparian buffer. Thus, Reach R3 currently rates as Functioning At Risk.

Sediment transport competency was rated as Functioning for the existing condition on all streams. Field investigation did not reveal any significant areas of sediment aggradation, and the sediment transport analysis of the system showed that the Competence values match reasonably well and within the ranges of predicted stable values.

As part of the proposed stream restoration and enhancement design all stream banks will be stabilized by either establishing a new channel with appropriate bankfull channel geometry through Priority 1 restoration (R1), by removing spoil berms wherever practicable (R2), and through Level 1 enhancement (R3) that will entail sloping failing banks and establishing bankfull benches, as well as by establishing vegetation on all bare slopes throughout the project. The proposed design will also involve the installation of in-stream structures for bed and bank stability, and to promote scour pools. Large woody debris (LWD) will be incorporated throughout the project. Bedform will be diversified by establishing the appropriate riffle-pool meander geometry along Reach R1 and by utilizing in-stream structures for scour pool formation along Reach R3. Sediment transport functions will be improved by reconnecting the streams to their floodplains and by improving stream pattern. This will allow the streams to have access to sediment storage on the floodplains and on point bars. Forested riparian buffers at a minimum 50-foot width will also be established along all project stream reaches. The highly eroding ford crossing will be stabilized with an improved rock crossing, while the remaining crossings will be replaced with correctly sized culvert crossings. All of these design changes will result in a proposed conditions rating of Functioning for all streams.

4.4 Physicochemical

The methodology describes the physicochemical functions as temperature and oxygen regulation, and the processing of organic matter and nutrients, with the parameters of water quality, nutrients, and organic carbon.

The current and historic land uses identified for the project site suggest that some level of water quality impairment likely resulted from the long term presence of agricultural activities and the lack of riparian buffer. However, as no water quality sampling effort has been conducted on the site, and there are no known water quality monitoring stations nearby, there is no way to quantitatively confirm this assumption. However, obvious nutrient and bacterial pathogen sources would include the animal activity present on the horse farm, along with the current manure fertilizer application regime utilized by the farm manager to maintain pasture and grow hay. Soil test results revealed that the adjacent pasture fields had a range of P-Index values between 19 to 41, with an average value of 27.

The field assessments conducted for the project discovered a few obvious indications of water quality impairment observed in Reaches R1 and R3. Horse manure was often found in the channels or along the banks, indicating both nutrient and fecal coliform concerns, and the presence of algae in the streams was noted on occasion, though no discolored or foul smelling water was ever observed. There also does appear to be ample leaf litter present in the system to supply the stream's organic carbon needs. Thus, Reaches R1 and R3 were subsequently rated as Functioning At Risk, while R2 was rated as Functioning.

The project restoration will involve the installation of a variety of in-stream structures that will help oxygenate the flowing water, as well as increase the number of large woody structures to improve organic carbon sources and trap detritus. By stabilizing banks and reducing erosion, the amount of soil-bound nutrients entering the stream will be greatly reduced, P in particular. The restoration will also reestablish a full 50-foot wide or greater riparian buffer around all the project reaches, while a conservation easement will permanently exclude livestock. This will further help to reduce nutrients and sediment from directly or indirectly entering the streams. The proposed design will result in a physiochemical functions rating of Functioning for Reaches R1 and R3, with an improved Functioning rating for Reach R2.

4.5 Biological

The methodology describes the biology function as biodiversity and the life histories of aquatic and riparian life, with the parameters of microbial communities, macrophyte communities, benthic macroinvertebrate communities, fish communities, and landscape connectivity.

While there are no known existing databases that describe or catalog the biodiversity of plant, animal, or microbial communities found on the project, the observed habitat present on site has been negatively impacted by the current and historic agricultural uses on the farm. Streambank erosion and the lack of deep pools and in-stream woody debris both negatively affect the aquatic habitat on site. The three pipe disconnects impact aquatic passage and stream connectivity. Additionally, the lack of a full riparian buffer negatively affects the terrestrial habitat on-site.

The project restoration will reestablish or enhance habitat on the site, which should result in an uplift of biological function to the project as a whole. In-stream habitat for fish and benthic invertebrates will be directly improved through the addition of pools and woody structures, by the stabilization of eroding banks, and by the replacement of the clogged pipes on R2 and R3 that have resulted in stream disconnects. Additionally, improved overall water quality will help support a range of aquatic organisms by reducing sediment and nutrient inputs, and by increasing water oxygenation. The restoration or enhancement of adjacent wetland functions along with the reestablishment of full forested riparian buffers to each reach will provide permanent protection for the trees and shrubs that will restore botanically diverse native plant communities and the native animal populations dependent on them and will aid in reducing water temperatures. No direct biological measurements or sampling is proposed for the project but it is anticipated that through the improvement of the lower level functions in the hierarchy of the functional pyramid that biology should also likely be improved. Therefore, all of the project reaches are currently rated as Functioning At Risk, and will be improved to a rating of Functioning.

The restored and protected forested headwater riparian corridor will also compliment other nearby protected conservation areas such as the Significant Natural Heritage Area (SNHA) Middle Eno River / Cates Ford Slopes and Uplands located 1 mile away, and the Eno River State Park 1.5 miles away. Additionally, there are known populations of sensitive aquatic species downstream including Atlantic pigtoe (*Fusconaia masoni*: state E, FSC), Yellow lampmussel (*Lampsilis cariosa*: state E, FSC), and the dwarf wedgemussel (*Alasmidonta heterodon*) a Federally listed Endangered species. The project should improve the habitat and conditions for those species, encouraging a return upstream to their historic range.

4.6 Project Constraints

The principle constraints to achieving maximum uplift potential for the project are the two powerline easements located on the downstream section of Reach R1, and the four retained improved stream crossings on site. The two 30-ft wide overhead powerlines are managed by PEMC and represent breaks in the conservation easement. While stream restoration work will continue through these breaks, no tree species will be planted in the buffer (only live-stakes along stream banks), and no mitigation credits will be provided here. The four improved stream crossings will also be removed from the conservation easement, though they will be narrow and represent a substantial reduction in the number of crossings currently found on site. The improved crossings will also entail a significant functional improvement to the existing conditions of either a clogged and scouring pipe culvert, or a highly eroding ford crossing.

The stream restoration design can be implemented without major constraints to the proposed pattern, dimension, or profile. The valley is wide enough and the relief steep enough to accommodate the appropriate natural channel design. The presence of on-site canopy trees, particularly in upper and lowermost sections of Reach R1 where benching is proposed, represents a type of constraint to restoration. The number of trees removed will be minimized wherever possible, especially for larger

specimens. Many are likely to be used in the stream itself given the extent of woody structures in the design. There are no other known constraints on the project site itself.

Any other potential constraint would be related to upstream and offsite issues. Existing off-site conditions within the project watershed will have significant impacts to physicochemical and biological improvements. Examples of these impacts are upstream water quality issues and the existence of diverse biology near the site to repopulate the improved habitat.

4.7 Functional Uplift Summary

The substantial functional uplift potential for the Lochill Farm restoration project as described above is expected to improve the site from an overall Functioning-at-Risk rating in its current condition, to a proposed condition rating of Functioning (see Table 4.1 below). Improvements to site hydraulics and geomorphology will be clear and measurable post-construction, while improvements to physicochemical and biological functions may not be as easily determined and can be greatly affected by offsite conditions. Since only the hydraulics and geomorphology of the project can be directly measured at this time, project goals are primarily linked to these functions.

Table 4.1 Overview of Project Functional Uplift Potential
Lochill Farm Stream Restoration Project – NCDMS Project No. 97083

	Reach R1		Reach R2		Reach R3	
Functional Category	Existing Conditions	Proposed Conditions	Existing Conditions	Proposed Conditions	Existing Conditions	Proposed Conditions
Hydrology	Functioning	Functioning	Functioning	Functioning	Functioning	Functioning
Hydraulics	Functioning at Risk	Functioning	Functioning	Functioning	Functioning at Risk	Functioning
Geomorphology	Not Functioning	Functioning	Functioning at Risk	Functioning	Functioning at Risk	Functioning
Physicochemical	Functioning at Risk	Functioning	Functioning	Functioning	Functioning at Risk	Functioning
Biology	Functioning at Risk	Functioning	Functioning at Risk	Functioning	Functioning at Risk	Functioning
Average/Overall	Not Functioning	Functioning	Functioning at Risk	Functioning	Functioning at Risk	Functioning

5.0 MITIGATION PROJECT GOALS AND OBJECTIVES

The goals and objectives for the Lochill Farm project are detailed below in Table 5.1. They represent the logical conclusion to the previous discussions of current site conditions and historic use, watershed disturbance and response, and the functional uplift potential for the project. The listed goals are broad statements about intended project accomplishments and are consistent with the identified watershed priorities as outlined in the Watershed Approach and Site Selection discussion in Section 2. By comparison, the objectives and outcomes are intended to be more specific and measureable, and represent direct steps towards accomplishing the associated goal. The project objectives will have performance standards and success criteria associated with them as described later in Section 7 of this report, and will be evaluated throughout the monitoring phase of the project. Functional uplift categories shown in parenthesis in Table 5.1 below are functions that will likely see uplift after construction of the project but no direct measurements are proposed and are therefore not linked directly to the project objectives.

Table 5.1 Mitigation Project Goals and Objectives
Lochill Farm Stream Restoration Project – NCDMS Project No. 97083

Goals	Objectives	Predicted Outcomes	Functional Uplift Category
Reconnect stream reaches to their floodplains	To restore appropriate bankfull dimensions, remove spoil berms, and/or raise channel beds, by utilizing either a Priority I Restoration approach (R1) or an Enhancement Level I approach (R3).	A natural flooding regime will be restored to the stream and wetland system. Elevated groundwater levels in wetlands will be restored to adjacent riparian areas. Restored wetland areas will support a more diverse plant community.	Hydraulics (Biology)
Stabilize steep and/or eroding stream banks	To construct streams of appropriate dimensions, pattern and profile in restored reaches, slope stream banks and provide bankfull benches on enhanced streams, and utilize bio-engineering to provide long term stability.	This will reduce sediment and nutrient losses to the stream system. Appropriate riffle pool morphology will reduce in-stream shear stresses and increase aquatic habitat by increasing pools. Bio-engineering will help to reduces water temperatures.	Geomorphology (Physiochemical, Biology)
Improve in-stream habitat	Construct an appropriate channel morphology to all streams increasing the number and depths of pools, with structures including geo-lifts with brush toe, log vanes/weirs, root wads, and/or J-hooks. Also repair stream disconnects in the channels caused by clogged pipe culverts.	These improvements will increase woody debris and organic carbon in streams, increase dissolved oxygen, and improve the quality and quantity of habitats for a diverse range of aquatic organisms and ease their passage through the stream system.	Geomorphology (Physiochemical, Biology)
Reestablish forested riparian buffers	Establish riparian buffers at a 50-ft minimum width along all stream reaches, planted with native tree and shrub species.	This will improve the buffer's ability to remove or reduce sediment and nutrients from runoff and groundwater, as well as enhance riparian corridor habitat	Geomorphology (Physiochemical, Biology)

		for a range of native plants and wildlife. Additionally, this will provide sources of organic carbon and LWD to the stream system supporting aquatic fauna and decreasing stream temperatures.	
Permanently protect the project	Establish a permanent conservation easement restricting land use in perpetuity. This will prevent site disturbance and allow the project to mature and stabilize.	This will prevent site disturbance and allow the project to mature, stabilize and support all functional categories.	Hydraulic, Geomorphology (Physicochemical, Biology)

6.0 DESIGN APPROACH AND MITIGATION WORK PLAN

6.1 Project Design Approach

The selection of project design criteria were based on a combination of approaches, including a review of applicable streams from a reference database, regime equations, evaluation of monitoring results from numerous past projects, and best professional judgment. Evaluating data from previous reference reach surveys and the monitoring results from multiple Piedmont stream projects, including some located in the Carolina Slate Belt, provided the most pertinent background information to determine the appropriate design parameters given the existing conditions and overall site functional uplift potential. The design parameters for the site also took into consideration all current guidelines from the USACE and NCDMS.

While reference reach data can be a useful aid in designing channel dimension, pattern, and profile, there are limitations in smaller stream systems. The flow patterns and channel formation for most reference reach quality streams is often controlled by slope, drainage areas, and larger trees and/or other deep rooted vegetation. Some meander geometry parameters, such as radius of curvature, are particularly affected by vegetation control. Pattern ratios observed in reference reaches may not be applicable or are often adjusted in the design criteria to create more conservative designs that are less likely to erode after construction, before the permanent vegetation is established.

Baker selected reference reaches from the NCDOT database. These reference reaches have successfully been used on similar stream restoration projects within the Carolina Slate Belt. Additionally, reference parameters from Baker's internal database based on successful past projects were consulted and analyzed. The data shown on Table 6.1 helped to provide a basis for evaluating the project site and determining the stream systems that may have been present historically and/or how they may have been influenced by changes within the watershed.

The reference sites are examples of a small "Rural Piedmont Stream," and fall within the same climatic, topographical, physiographic and ecological region as the Project site. All of the reference sites listed below are located within the Carolina Slate Belt region. These stream systems have a tendency to dry up as a result of the underlying geology.

Table 6.1 Reference Reach Parameters Used to Inform Design Ratios

Lochill Farm Stream Restoration Project – NCDMS Project No. 97083

Parameter	Tributary to the South Fork of Cane Creek		Spencer Creek Upstream		Richland Creek		Morgan Branch		Baker Composite Reference Data	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
County	Chatham		Montgomery		Moore		Orange			
Stream Type	C4		E4/C4		C4		C4		C4	
Drainage Area – square miles	0.41		0.50		1.00		8.35			
Bankfull Width (w_{bkf}) – feet	13.0	13.1	8.7		16.2	16.7	33.2			

Table 6.1 Reference Reach Parameters Used to Inform Design Ratios

Lochill Farm Stream Restoration Project – NCDMS Project No. 97083

Parameter	Tributary to the South Fork of Cane Creek		Spencer Creek Upstream		Richland Creek		Morgan Branch		Baker Composite Reference Data	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Bankfull Mean Depth (d_{bkf}) – feet	0.9		1.2		0.9	0.9	2.3			
Width/Depth Ratio (w/d ratio)	14.4	14.6	7.3		18.0	18.6	14.1		10.0	15.0
Cross sectional Area (A_{bkf}) – SF	11.6	12.2	10.6		15.0	15.5	75.1			
Bankfull Mean Velocity (v_{bkf}) - fps	N/P		N/P		N/P		6.6		3.5	5.0
Bankfull Discharge (Q_{bkf}) – cfs	N/P		N/P		N/P		524.0			
Bankfull Max Depth (d_{mbkf}) - feet	1.4		1.9		1.4	1.5	2.8			
d_{mbkf} / d_{bkf} ratio	1.6		1.6		1.6	1.7	1.2		1.2	1.5
Low Bank Height to d_{mbkf} Ratio	N/P		1.0		1.0		1.0		1.0	
Floodprone Area Width (w_{fpa}) – feet	26	36	228.5		50	53	77.5			
Entrenchment Ratio (ER)	2.0	2.75	26.3		3.0	3.3	2.3			
Meander length (L_m) – feet	32	58	54.0	196.0	90	94	N/P			
Ratio of meander length to bankfull width (L_m/w_{bkf})	2.45	4.44	6.2	22.5	5.5	5.7	N/P		7.0	14.0
Radius of curvature (R_c) – feet	16	25	5.4	22.1	14.3	26.1	N/P			
Ratio of radius of curvature to bankfull width (R_c / w_{bkf})	1.23	1.92	0.6	2.5	0.9	1.6	N/P		2.0	3.0
Belt width (w_{blt}) – feet	14	30	24.0	52	25	40	N/P			
Meander Width Ratio (w_{blt}/W_{bkf})	1.07	2.3	2.8	6.0	1.5	2.4	N/P		3.5	8.0
Sinuosity (K) Stream Length/ Valley Distance	N/P		1.1		1.2		N/P		1.2	1.4
Valley Slope – feet per foot	N/P		0.0139		0.0136		N/P		0.005	0.0015
Channel Slope ($s_{channel}$) – feet per foot	N/P		0.0132		0.0133		0.0070			

Table 6.1 Reference Reach Parameters Used to Inform Design Ratios

Lochill Farm Stream Restoration Project – NCDMS Project No. 97083

Parameter	Tributary to the South Fork of Cane Creek		Spencer Creek Upstream		Richland Creek		Morgan Branch		Baker Composite Reference Data	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Pool Slope (s_{pool}) – feet per foot	N/P	N/P	0.0001		0.00	0.0014	0.0001			
Ratio of Pool Slope to Average Slope (s_{pool} / $s_{channel}$)	N/P	N/P	0.01		0.00	0.11	0.01		0.00	0.20
Maximum Pool Depth (d_{pool}) – feet	1.8	2.1	2.5		2.5		4.1			
Ratio of Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	2.0	2.3	2.1		2.8		1.8		1.5	3.5
Pool Width (w_{pool}) – feet	10.1	15.0	8.4		11.1		25.9			
Ratio of Pool Width to Bankfull Width (w_{pool} / w_{bkf})	0.77	1.15	1.0		0.7		0.8		1.2	1.7
Pool Area (A_{pool}) – square feet	15.3	17.4	12.8		20.1		88.9			
Ratio of Pool Area to Bankfull Area (A_{pool}/A_{bkf})	1.29	1.46	1.2		1.3		1.2			
Pool-to-Pool Spacing – feet	37.0	81.0	13.0	46.5	37.3	95.8	146.0	277.0		
Ratio of Pool-to-Pool Spacing to Bankfull Width (p-p/w_{bkf})	2.2	6.7	1.5	5.3	2.3	5.8	4.4	8.3	3.5	7.0
Riffle Slope (s_{riffle}) – feet per foot	N/P	N/P	0.010	0.067	0.013	0.0413	0.014	0.024		
Ratio of Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	N/P	N/P	0.8	5.1	1.0	3.1	2.0	3.4	1.2	1.5
Particle Size Distribution of Riffle Material										
Material (d_{50})	Medium Gravel		Medium Gravel		Very Coarse Gravel		Very Fine Gravel			
d_{16} – mm	N/P		0.06		6.0		N/P			
d_{35} – mm	1.82		3		N/P		1.2			
d_{50} – mm	11.26		8.6		45.0		3			

Table 6.1 Reference Reach Parameters Used to Inform Design Ratios

Lochill Farm Stream Restoration Project – NCDMS Project No. 97083

Parameter	Tributary to the South Fork of Cane Creek		Spencer Creek Upstream		Richland Creek		Morgan Branch		Baker Composite Reference Data	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
d_{84} – mm	43.38		77		125.0		77			
d_{95} – mm	82.57		180		N/P		800			
Notes: NC Department of Transportation, Reference Reach Database N/A: Channel had minimal meander geometry - no pattern measured N/P: Data was not provided in the NCDOT reference reach database Values in this chart were rounded and may differ slightly from actual values.										

After examining the assessment data collected at the site and exploring the potential for functional uplift, specific approaches were developed for each reach that would address the restoration or enhancement of stream functions within the project area while minimizing disturbances to existing wooded areas and verified jurisdictional wetlands. Prior to impacts from past channel manipulation, the topography and soils on site indicate that the project area most likely functioned in the past as a small stream and wetland system. Therefore, design approaches were formulated to best restore and/or enhance this type of system. First, an appropriate stream type for the valley type, slope, and desired stream functions was selected and designed for each reach. A design plan was then developed in order to improve the floodplain hydrology and base flow interaction impaired by current and historic agricultural impacts, active degradation, and other historic land manipulations.

6.2 Design Morphological Parameters

For design purposes, the stream channels were divided into seven reaches identified as Reaches R1, R2, R3, T1, T2, T3/T3b, and T4, as described previously in Table 3.1. The selected design approaches chosen for each reach were based on the maximum potential for functional uplift as determined during the site field assessments as previously described in Section 4. The specific design parameters were developed based on those approaches so that planform geometry, cross-section dimensions, and reach profiles could be accurately described for developing construction plan documents. The overall design philosophy is to use these design parameters as conservative values for the selected stream types and to allow natural variability in stream dimension, facet slope, and bed features to form over longer periods of time under the processes of flooding, re-colonization of vegetation, sediment deposition, and other watershed influences.

Tables 6.2 and 6.3 present the design stream morphology parameters proposed for Reaches R1 and R3. As no significant channel modifications are being proposed for the Enhancement Level II on Reach R2, or for the preservation Reaches T1, T2, T3, and T4, no design morphological data is presented. The proposed stream design values and design criteria were selected using existing conditions surveys and bankfull identification, sediment collection and analysis, regional curve analysis, NCDOT reference reach data, and Baker's internal reference ratios proven to be successful on numerous past projects. Following the initial application of the design criteria, Baker staff made detailed refinements to accommodate the existing valley and channel morphology. This step minimizes unnecessary disturbance of the riparian area and wetlands,

makes adjustments around specific features in the field, maximizes the uplift to the ecological resources, and allows for some natural channel adjustment following construction.

Reach R1 Restoration

Reach R1, known locally as Finches Branch, is the largest reach and main stem of the project running southwest across the site at a slope of 0.8%. It has been straightened, dredged, and relocated against the northern edge of the valley. As a result, it is an incised E4 stream type with steep or vertical eroding banks found throughout its length, and has cut down to bedrock.

A Priority Level I Restoration approach was selected for this reach. The restored channel will be raised and relocated to the center of the valley, and will be designed as a C4 stream type. In the downstream portion, the channel will be returned to existing grade approximately 100 feet before the large pipe culvert crossing under Pleasant Green Road. The abandoned channel will be filled and plugged.

The design width-to-depth ratio for the channel will be 13, though over time the channel may narrow due to deposition of sediment and streambank vegetation growth. Channel narrowing should not risk downcutting because any narrowing would be in response to stabilizing processes (i.e., vegetation establishment, point bar formation, etc.). The entrenchment ratio will be greater than 4.1 as the adjacent flood-prone width allows. Channel banks will be graded to stable, 2:1 or flatter slopes. In transitional areas, bankfull benches will be excavated to provide the stream a floodplain until the stream bed elevation is sufficiently raised enough to connect to the historic floodplain. Spoil piles located alongside the stream will be removed, and riparian vegetation will be re-established in all disturbed areas and where it is currently in open pasture.

In-stream structures such as constructed riffles and log J-hook vanes will be installed to control grade, encourage pool scour, protect newly constructed streambanks, and dissipate energy. Additionally, structures such as geo-lifts and brush toes will be incorporated for bank stability, increased woody debris and organic matter, and habitat diversity. The overall number of pool features will also be increased from the existing conditions.

This approach will allow for the restoration of a stable channel form with appropriate bedform diversity, as well as improved channel function through improved aquatic habitat, more frequent overbank flooding, restoration of riparian and terrestrial habitats, exclusion of livestock and associated pollutants, and decreased erosion and sediment loss from streambank erosion.

Mapped jurisdictional wetlands in the floodplain of the middle and lower portion of Reach R1 will be either protected during the construction process wherever practicable or enhanced through the grading activities. Wetland enhancement will be achieved by raising the streambed and thus increasing the flooding frequency and raising the water table, as well as through wetland vegetation plantings.

Riparian buffers in excess of 50 feet will be restored along all of Reach R1. There are four breaks in the easement along Reach R1. Two of the breaks are associated with powerline easements and are 30-ft wide each, one is an existing bridge crossing that will be converted to a pipe culvert crossing, while the final 30-ft break is not associated with any current crossing but was requested by the landowner for any potential, future need. There is also one existing ford crossing located immediately upstream of the project easement, which will be improved and stabilized.

Invasive species treatment will also be conducted throughout this reach, with *Rosa muliflora* (multiflora rose) as the primary species of concern, although two small pockets (~0.1 acres each) of *Ailanthus altissima* (tree of heaven) and *Pueraria lobata* (kudzu) are found at the very bottom alongside Pleasant Green Rd.

Table 6.2 Reach R1 Stream Design Morphology Parameters
Lochill Farm Stream Mitigation Project – DMS 97083

Parameter	Existing Stream Values		Design Stream Values		Reference Data	
	MIN	MAX	MIN	MAX	MIN	MAX
Drainage Area, DA (sq mi)	1.59		1.59			
Stream Type (Rosgen)	E4 (incised)		C4		C4	
Bankfull Discharge, Qbkf (cfs)	75		75			
Bankfull Riffle XSEC Area, Abkf (sq ft)	15.3	23.5	19.0			
Bankfull Mean Velocity, Vbkf (ft/s)	3.2	4.3	3.9		3.5	5.0
Bankfull Riffle Width, Wbkf (ft)	10.1	14.6	15.7			
Bankfull Riffle Mean Depth, Dbkf (ft)	1.3	1.9	1.2			
Width to Depth Ratio, W/D (ft/ft)	5.2	10.6	13		10	15
Width Floodprone Area, Wfpa (ft)	13.1	98.6	65.0	100.0		
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	1.5	8.5	4.1	6.4		
Riffle Max Depth @ bkf, Dmax (ft)	1.9	2.6	1.5			
Riffle Max Depth Ratio, Dmax/Dbkf	1.1	1.5	1.25		1.2	1.5
Max Depth @ tob, Dmaxtob (ft)	3.7	5.2	1.5			
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.7	2.6	1.0		1.0	1.1
Meander Length, Lm (ft)	52	121	112	192		
Meander Length Ratio, Lm/Wbkf	3.5	11.9	7	12	7.0	14.0
Radius of Curvature, Rc (ft)	23	65	31	47		
Rc Ratio, Rc/Wbkf	1.5	6.4	2.0	3.0	2.0	3.0
Belt Width, Wblt (ft)	25	68	56	125		
Meander Width Ratio, Wblt/Wbkf	1.7	6.7	3.6	8.0	3.5	8.0
Valley Slope, Sval (ft/ft)	0.0085		0.0085		0.005	0.015
Sinuosity, K SL/VL	1.15		1.27		1.20	1.40
Stream Length, SL	2936		3252			
Valley Length, VL	2559		2559			
Slope Riffle, Srif (ft/ft)**	0.0260		0.0062/0.0101			
Riffle Slope Ratio, Srif/Schan**	3.3		1.19	1.49	1.2	1.5
Slope Pool, Spool (ft/ft)***	0.0000	0.0017	0.000	0.0013		
Pool Slope Ratio, Spool/Schan***	0.0	0.2	0.00	0.19	0	0.2

Table 6.2 Reach R1 Stream Design Morphology Parameters
Lochill Farm Stream Mitigation Project – DMS 97083

Parameter	Existing Stream Values		Design Stream Values		Reference Data	
	MIN	MAX	MIN	MAX	MIN	MAX
Pool Max Depth, Dmaxpool (ft)	4.2	6.8	2.5	4.0		
Pool Max Depth Ratio, Dmaxpool/Dbkf	2.2	5.2	2.1	3.3	1.5	3.5
Pool Width, Wpool (ft)			24.0			
Pool Width Ratio, Wpool/Wbkf			1.5		1.2	1.7
Pool-Pool Spacing, Lps (ft)	48.6	210.5	64.0	110.0		
Pool-Pool Spacing Ratio, Lps/Wbkf	3.3	20.8	4.1	7.0	3.5	7
Note: Downstream connection to the existing channel bed requires utilizing a step-pool system. This short section will be steeper than the rest of R1. Riffle and pool design slopes and associated ratios shown in the table above are only for stations 10+00 to 39+29.						
Station	Upper (10+00 to 18+93)		Middle (18+93 to 39+29)		Lower (39+29 to 42+09)	
* Channel Slope, Schan (ft/ft)	0.0052		0.0067		0.0153	
** Slope Riffle, Srif (ft/ft)	0.0062	0.0078	0.0080	0.0101	0.0184	0.0230
*** Slope Pool, Spool (ft/ft)	0.0000	0.001	0.0000	0.0013	0.0000	0.0031

Reach R2 Enhancement Level II

Reach R2 is a spring-fed stream located near the upper section of Reach R1. Originating at a spring pool at the base of the adjacent hillside, it flows west along the toe of the hillslope until it reaches the open pasture, whereupon it turns to the northwest and flows into R1. A pipe culvert crossing is located in its lower portion, although it is almost completely clogged resulting in a stream disconnect, and with obvious overflow scouring observed. Sediment has built up in the channel immediately upstream of the pipe, and flow is slightly ponded. Additionally, the right bank of the reach lacks a full buffer, averaging only about 15 to 20 feet in width, while the left bank has almost no buffer along its most downstream portion.

The reach has also been subject to ditching as apparent from the spoil piles adjacent to stream in several locations and has a noted lack of pool features and in-stream structure. During the IRT field visit, it was agreed that the overall existing functional value of the stream was still significant enough that an extensive enhancement effort was not warranted. As such, enhancement activities will consist of replacing the culvert crossing with an appropriately-sized pipe, thus correcting the stream disconnect, repairing and stabilizing the associated sections of bank scour, and then planting a full 50 foot buffer along both banks.

Additionally, as Reach R1 will be relocated and raised as part of its Priority 1 restoration approach, the lower portion of R2 will need to be modified and extended in order to appropriately connect back into the channel. The new section of channel will mimic the cross-sectional dimensions of the existing conditions.

Reach R3 Enhancement Level I

Reach R3 is the second largest stream on the project site, flowing northwest out of the wooded portion of the property and alongside the open pasture at a 2% slope, joining Reach R1 at a perpendicular angle. It appears to have been straightened and dredged as evidenced by the spoil piles adjacent to much of the channel. The upstream portion has a large wetland area located along its left floodplain, with a series of small seeps and streams flowing through it, including preservation Reaches T2 and T3. The upper and middle portions of R3 currently classify as an E4b stream type, while the lower portion classifies as a B4 type.

Reach R3 was originally proposed to be broken up into three equal segments, with the upper and lower receiving Enhancement I work and credit ratios, and the middle receiving Enhancement II work and credit ratios. However, during the IRT field visit, it was agreed that the differences between the segments were negligible and that the entire reach should be combined under a single Enhancement Level I approach and receive credit at a 2:1 ratio. Also during the IRT field visit, it was agreed there was a notable lack of in-stream woody debris and structure, along with a deficiency of good pool features.

The majority of Reach R3 will remain in its current alignment and retain its profile and channel dimensions. In-stream structures will be included to promote bedform diversity and to protect stream banks. The upper design channel will be a C4b stream type with a width-to-depth ratio of 12. The entrenchment ratio will vary between 2.2 and 5.5 as the adjacent flood-prone width allows. The upper ~400' section of R3 is the most degraded with scouring, vertical banks and will have the new, raised channel constructed alongside the existing channel. The lower ~100' section of R3 will also be raised and relocated in order to properly connect back into the restored Reach R1. Throughout the reach, unstable banks will be graded wherever practicable to stable, 2:1 or flatter slopes, and spoil piles located along the stream will also be removed wherever practicable.

In-stream structures such as vanes, weirs, geo-lifts, boulder revetments, and rootwads will be incorporated for step-pool formation, bank stability, increased woody debris and organic matter, and habitat diversity. Bankfull benches will also be incorporated to further promote stability. Constructed riffles and pools will also be installed in the upper and lower sections where new channels are being constructed. The overall number of pool features will increase from the existing conditions.

This approach will result in a stable channel with appropriate bedform diversity, as well as improved channel function through improved aquatic habitat, more frequent overbank flooding, restoration of riparian and terrestrial habitats, exclusion of livestock and associated pollutants, and decreased erosion and sediment loss from streambank erosion.

Mapped jurisdictional wetlands in the left floodplain in the upper portion of R3 will be protected during the construction process wherever practicable (construction activity in this area will be conducted from the right bank in all practical areas).

Riparian buffers in excess of 50 feet will be restored along all of Reach R3, with woody vegetation re-established in all disturbed areas and where it is currently in open pasture. There is one 15-ft break in the easement along Reach R3, a pipe crossing that is currently clogged and heavily scouring. The crossing will be fully stabilized and have an appropriately sized pipe installed. There is also a second clogged, heavily scouring pipe crossing located immediately upstream of R3, outside of the project easement, which represents another stream disconnect. This crossing will be relocated farther upstream with an appropriately sized pipe.

Invasive species treatment will also be conducted throughout the reach, with significant *Ligustrum sinense* (Chinese privet) located along the stream/pasture edge of the middle and lower sections. Some *Rosa muliflora* (multiflora rose) is also found scattered along the stream banks as well.

Table 6.3 Reach R3 Stream Design Morphology Parameters
Lochill Farm Stream Mitigation Project – DMS 97083

Parameter	Existing Stream Values		Design Stream Values		Reference Data	
	MIN	MAX	MIN	MAX	MIN	MAX
Drainage Area, DA (sq mi)	0.3		0.3			
Stream Type (Rosgen)*	B4 to E4b		C4b		C4b	
Bankfull Discharge, Qbkf (cfs)	45		45			
Bankfull Riffle XSEC Area, Abkf (sq ft)	7.5	10.6	10.3			
Bankfull Mean Velocity, Vbkf (ft/s)	3.6	7.4	4.4		4.0	6.0
Bankfull Riffle Width, Wbkf (ft)	6.2	11.0	11.0			
Bankfull Riffle Mean Depth, Dbkf (ft)	0.9	1.2	0.9			
Width to Depth Ratio, W/D (ft/ft)	5.2	11.3	12.2		12	18
Width Floodprone Area, Wfpa (ft)	14.3	60.1	24.0	60.0		
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	2.3	5.4	2.2	5.5		
Riffle Max Depth @ bkf, Dmax (ft)	1.3	1.4	1.2			
Riffle Max Depth Ratio, Dmax/Dbkf	1.2	1.3	1.33		1.2	1.4
Max Depth @ tob, Dmaxtob (ft)	2.1	2.4	1.2			
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.6	1.7	1.0		1.0	1.1
Meander Length, Lm (ft)*	N/A	N/A	96	150		
Meander Length Ratio, Lm/Wbkf *	N/A	N/A	8.7	13.6	7	14
Radius of Curvature, Rc (ft)*	N/A	N/A	27	33		
Rc Ratio, Rc/Wbkf *	N/A	N/A	2	3	2	3
Belt Width, Wblt (ft)*	N/A	N/A	54	60		
Meander Width Ratio, Wblt/Wbkf *	N/A	N/A	4.9	5.5	3.5	10
Valley Slope, Sval (ft/ft)	0.0235		0.0235		0.02	0.03
Channel Slope, Schan (ft/ft)	0.0220		0.0216			
Sinuosity, K SL/VL	1.07		1.09		1.1	1.3
Stream Length, SL	1599		1616			
Valley Length, VL	1488		1488			
Slope Riffle, Srif (ft/ft)	0.0258		0.027			
Riffle Slope Ratio, Srif/Schan	1.2		1.3		1.2	1.5
Slope Pool, Spool (ft/ft)	0.0000	0.0053	0.000	0.004		
Pool Slope Ratio, Spool/Schan	0.0	0.2	0.00	0.20	0	0.2
Pool Max Depth, Dmaxpool (ft)*	1.4	2.0	2.5			
Pool Max Depth Ratio, Dmaxpool/Dbkf*	1.1	2.2	2.8		2.0	3.5
Pool Width, Wpool (ft)*	7.1	11.2	15			
Pool Width Ratio, Wpool/Wbkf	0.6	1.8	1.4		1.2	1.7
Pool-Pool Spacing, Lps (ft)	19.8	51.4	20.0	57.0		
Pool-Pool Spacing Ratio, Lps/Wbkf**	1.8	8.3	1.8	5.2	1.5	6.0
*Design parameter apply to re-aligned section of R3						
**Design minimum low due to steep transition slopes						

Reach T1 Preservation

Reach T1 is a small, spring-fed stream located near the middle section of Reach R1 that was originally proposed for preservation at a 10:1 ratio in its entirety from its spring head origin to the confluence with R1. However, during the field review with the IRT, the upper section was considered to be a linear wetland and would not count towards stream credit. Yet, provided that the spring pool head and wetland were ultimately protected within the conservation easement, the IRT stated that the clearly defined stream section located below the linear wetland would be accepted as preservation credit at a 5:1 ratio.

As Reach R1 will be relocated and raised as part of its Priority 1 restoration approach, the lower portion of T1 will need to be modified as well in order to connect back into the channel. This short new section of channel will mimic the cross-sectional dimensions of the current existing conditions.

Reach T2 Preservation

Reach T2 is a small, spring-fed stream located in the uppermost section of Reach R3 that was originally proposed for preservation at a 10:1 ratio in its entirety from its spring origin to the confluence with R3. However, during the field review with the IRT, the upper half was considered to be a wetland area and would not count towards stream credit. Only the lower half of the channel after it makes a sharp turn towards R3 and becomes more clearly defined will count for stream preservation credit.

As this upper section of Reach R3 will be relocated as part of its Enhancement approach, the bottom of T2 will need to be extended out a short length to connect back into R3. The new section of channel will mimic the cross-sectional dimensions of the current existing conditions.

Reach T3 Preservation

Reach T3 is a small, spring-fed stream located in the upper section of Reach R3 that was proposed and accepted for preservation at a 10:1 ratio. During the field review with the IRT, a series of headcuts were identified on T3 approximately 400 feet upstream of its confluence with Reach R3. It was agreed that stream credit could begin at that location, provided the headcuts were appropriately repaired stabilized. This repaired section will mimic the cross-sectional dimensions of the stable stream located above the headcuts. Additionally, there is a short (~30 ft) tributary to T3 originating at a small spring pool that was also accepted for preservation credit and has subsequently been identified as Reach T3b. As the section of Reach R3 where T3 connects in will not be raised or relocated, no modification to the T3 channel will be required.

Reach T4 Preservation

Reach T4 is a small, spring-fed stream located in the middle section of Reach R3 that was proposed and accepted for preservation at a 10:1 ratio from its spring origin to its confluence with R3. As this section of R3 will not be relocated, no modification to the T4 channel will be required. Of note, a small, spring-fed pond is located to the west of T4. The pond is used for landowner aesthetic enjoyment and not for any farm operations. It has a small drainage area (~3 acres) and is not strongly affected by stormwater runoff. Its small (~2 ft tall) berm is stable and vegetated. Over time it has slowly filled with sediment, which the landowners wish to have removed as much as is practicable. As such, Baker will remove sediment from around the edge of the pond wherever access allows.

6.3 Design Discharge Analysis

6.3.1 Bankfull Stage Discharge

Bankfull stage and its corresponding discharge are the primary variables used by Baker to develop a natural channel design. The correct identification of bankfull stage in the humid Southeast can be especially difficult and subjective because of dense understory vegetation and a long history of channel modification and subsequent adjustment in channel morphology. The most consistent bankfull indicators

for streams in the Piedmont of North Carolina are the backs of point bars, breaks in slope at the front of flat bankfull benches, or the top of the streambanks (Harman et al., 1999).

Upon completion of the geomorphic field survey, identification of bankfull stages and corresponding discharges were made at various locations on Reaches R1 and R3. However, on incised streams with vertical banks such as these, discernible indicators can be difficult to obtain, and the reliability of the indicators can be inconsistent due to the altered condition of the stream channels. For this reason, regional curve relationships (based on drainage areas) were also used to develop the bankfull discharge estimates for the project reaches. The curve relationships were compared to representative cross sections on site to confirm the bankfull field calls and to ultimately select an appropriate design discharge estimate.

6.3.2 Bankfull Hydraulic Geometry Relationships (Regional Curve Predictions)

Hydraulic geometry relationships are often used to predict channel morphology features and their corresponding dimensions. The stream channel hydraulic geometry theory developed by Leopold and Maddock (1953) describes the interrelations between dependent variables such as width, depth, and area as functions of independent variables such as watershed area or discharge. These rainfall/runoff relationships can be developed at a single cross section or across many stations along a reach (Merigliano, 1997). Hydraulic geometry relationships are empirically derived and can be developed for a specific river or extrapolated to a watershed in the same physiographic region with similar rainfall/runoff relationships (FISRWG, 1998).

Regional curves developed by Dunne and Leopold (1978) relate bankfull channel dimensions to drainage area. A primary purpose for developing regional curves is to aid in identifying bankfull stage and dimension in ungaged watersheds, as well as to help estimate the bankfull dimension and discharge for natural channel designs (Rosgen, 1994). Gage station analyses throughout the United States have shown that the bankfull discharge has an average return interval of 1.5 years or 66.7% annual exceedance probability on the maximum annual series (Dunne and Leopold, 1978; Leopold, 1994).

Regional curves are available for a range of stream types and physiographic provinces. The published NC Rural Piedmont Regional Curve (Harman et al., 1999) and the updated NC Piedmont Regional Curve developed by the Natural Resources Conservation Service (Walker, 2012) were used for comparison with other site-specific methods of estimating bankfull discharge. Baker has successfully implemented a significant number of stream restoration projects in North Carolina using the curve data. The NC Rural Piedmont Regional curve equations developed from the studies are shown below in Table 6.4, while Table 6.5 compares the estimated regional curve bankfull areas for Reaches R1 and R3 with those measured from bankfull indicators in the field.

Table 6.4 NC Rural Piedmont Regional Curve Equations
Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

NC Piedmont Rural Regional Curve Equations (Harman et al., 1999)		NC Piedmont Rural Regional Curve Equations: Revised NC Rural Regional Curve (Walker, 2012)	
$Q_{bkf} = 89.04\ A_w^{0.72}$	$R^2=0.91$	$Q_{bkf} = 58.26\ A_w^{0.78}$	$R^2=0.99$
$A_{bkf} = 21.43\ A_w^{0.68}$	$R^2=0.95$	$A_{bkf} = 15.65 A_w^{0.69}$	$R^2=0.99$
$W_{bkf} = 11.89\ A_w^{0.43}$	$R^2=0.81$	$W_{bkf} = 11.64\ A_w^{0.45}$	$R^2=0.98$
$D_{bkf} = 1.50\ A_w^{0.32}$	$R^2=0.88$	$D_{bkf} = 1.15\ A_w^{0.28}$	$R^2=0.96$

Table 6.5 Comparison of Bankfull Areas

Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Reach	DA (sq mi)	Bankfull Area Estimates from 1999 / 2012 Regional Curves (sq ft)	Measured At Bankfull Indicator (sq ft)
R1	1.59	29.4 / 21.6	18.1, 24.0
R3	0.30	9.5 / 6.8	7.5

6.3.3 Bankfull Discharge Summary and Conclusions

As described above in Section 6.1.1 Rosgen's stream classification system (Rosgen, 1996) depends on the proper field identification of consistent geomorphic features related to the active floodplain. Although bankfull stage verification was sometimes challenging in the field for some sections of the reaches under their current conditions, the cross-section data used for the above regional curve comparisons are within an acceptable range of values given the existing channel conditions, geologic features, and flow regime.

Table 6.6 provides a bankfull discharge analysis based on the bankfull regional curves, the Manning's equation discharges calculated from the representative cross sections for each reach, and the bankfull design discharge estimations.

Manning's roughness (n) was estimated using friction factor and relative roughness, and by stream type (WARSSS, 2006). Discharge estimates for Reach R1 ranged from 50.3 cfs (Manning's n from stream type) to 124.3 cfs (NC Rural Piedmont Regional Curve). The corresponding velocities associated with these bankfull discharge estimates are 2.9 and 7.1 feet per second respectively. Reference reach data shows that stream velocities at the bankfull discharge for this stream type typically range from 3.5 to 5 feet per second. The broad range of these estimates and out of range velocities provides evidence to conclude that these estimates are too high and too low and are therefore taken out of consideration for the discharge estimate along Reach R1. The remainder of the estimation methods provided results that were reasonably close to each other providing converging lines of evidence towards the correct bankfull discharge. The results ranged from 70 cfs to 83.6 cfs. The design discharge estimate of 75 cfs was chosen for Reach R1.

The same discharge estimation methods were used for Reach R3. Results of this analysis ranged from 22.8 cfs (NRCS NC Rural Piedmont Regional Curve) to 46.21 (Manning's n from friction factor and relative roughness). The velocity associated with the discharge estimate provided from the NRCS NC Rural Piedmont Regional Curve is 2.1 feet per second, which is much too low this stream type (E4b). That discharge was eliminated from consideration. The remainder of the bankfull discharge estimation results for Reach R3 ranged from 37.4 to 46.2 cfs. The design discharge estimate of 45 cfs was chosen for Reach R3.

Table 6.6 Bankfull Discharge Analysis Summary

Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Estimating Method	Bankfull Velocity (ft/sec)	Bankfull Discharge (cfs)
	Reach R1	
NC Rural Piedmont Regional Curve[1]	7.1	124.3
NRCS NC Rural Piedmont Regional Curve[2]	4.7	83.6
Friction Factor to Relative Roughness Ratio method[3]	4.0	70.0
Manning's "n" from friction factor and relative roughness[3]	4.2	74.3
Manning's "n" from stream type[3]	2.9	50.3
Design Estimate	3.9	75
	Reach R3	
NC Rural Piedmont Regional Curve[1]	4.1	37.4
NRCS NC Rural Piedmont Regional Curve[2]	2.1	22.8
Friction Factor to Relative Roughness Ratio method[3]	4.1	43.7
Manning's "n" from friction factor and relative roughness[3]	4.4	46.2
Manning's "n" from stream type[3]	4.1	43.3
Design Estimate	4.4	45

Notes:
[1]NC Piedmont Regional Curve (Harman et al., 1999).
[2] Revised NC Rural Piedmont Regional Curve developed by NRCS (Walker, 2012).
[3]WARSSS, 2006 spreadsheet. Bankfull discharge estimates vary based on Manning's Equation for the riffle cross section. Bankfull stage roughness estimates (*n*-values) ranged from approximately 0.0325 to 0.048 along R1 and .045 to .048 along R3.

6.4 Sediment Transport Analysis

For this project, a qualitative sediment supply analysis was conducted from visual inspections of the project reaches and from aerial photography. Current supply appears to be primarily from localized bank erosion, as no major livestock or row crop agriculture currently exist within the watershed. Bank erosion is present throughout Reach R1. Field conditions also show that aggradation is not a problem so it is likely, as with other Slate Belt streams, that Reach R1 has a low bedload. Once the project is complete, on-site sediment sources from bank erosion will be stabilized. The lack of evidence for aggradation shows that the stream has enough capacity to appropriately transport the anticipated sediment load. The focus of this project's sediment transport analysis will focus on competency.

6.4.1 Sediment Competency Analysis

To conduct the sediment competency analyses, pavement (pebble count) and subpavement sediment samples were taken on the project design Reach R1 at surveyed cross sections. The sediment samples were weighed to generate cumulative frequency plots. The sediment competence analysis was conducted using the methodologies presented in WARSSS (2006). Design mean depth and slope were adjusted iteratively to ensure agreement with the predicted required depth and slopes. Reach R1 was analyzed using the slope in the upper section (10+00-18+93) and the slope in the middle section (18+93-39+29). Due to the size distributions of the pavement and subpavement samples collected at cross section in the middle section of Reach R1, utilization of equations to determine critical dimensionless shear stress and corresponding depths and slopes (Andrews, et al. 1984, 1986), were not appropriate. The competence analysis for the middle section focused on the dimensional shear stress and results provided from the modified Shield's Curve (Rosgen and Silvey, 2005). The Results from this analysis are presented below in Table 6.7.

Table 6.7 Competence Analysis for Reach R1

Lochill Farm Stream Mitigation Project - NCDMS Project No. 97083

Parameter	R1 Upper	R1 Middle
Design Bankfull Slope (ft/ft)	0.005	0.0067
Design Mean Depth (ft)	1.2	1.2
D50 Pavement (mm)	25.6	17.7
D50 Subpavement (mm)	7.7	8.9
D100 Subpavement (mm)	42.6	84.0
Critical Dimensionless Shear	0.018	N/A
Dimensional Shear (lbs/sq-ft)	0.412	0.502
Required Mean Depth (ft)	1.07[1]	1.07
Required Slope (ft/ft)	0.0049[1]	0.00596
Predicted Largest Movable Particle (mm)	79.2	91.5
1. From Dimensionless Shear Stress using D100/D50 pavement equation.		

The sediment transport analysis using the design geometry and profile matches well with the predicted values lending confidence that the stream will move the bed load that is supplied. The downstream section of Reach R1 has a design slope of .0153 ft/ft due to needing to reconnect to the existing culvert elevation under Pleasant Green Road. This section will step down the bed elevation using grade control structures and constructed riffles. This short section will have no issues transporting bedload and the stone will be large enough to prevent movement of the constructed bed material.

6.5 Vegetation and Planting Plan

6.5.1 Existing Vegetation and Plant Community Characterization

The existing vegetation on the project is dominated by common piedmont bottomland forest species, most notably *Platanus occidentalis* (sycamore), *Liriodendron tulipifera* (tulip poplar), *Celtis laevigata* (sugarberry), *Fraxinus pennsylvanica* (green ash), *Ulmus rubra* (slippery elm), and *Liquidambar styraciflua* (sweetgum) in the canopy, with *Lindera benzoin* (spicebush), *Aesculus sylvatica* (painted buckeye), *Acer negundo* (boxelder), and some *Juglans nigra* (black walnut) in the understory. Common herbaceous species include *Phryma leptostachya* (lopseed), *Smallanthus uvedalius* (bear's foot), *Polystichum acrostichoides* (Christmas fern), *Elephantopus carolinianus* (elephant's foot), and *Monarda fistulosa* (bee balm) in drier locations, with *Saururus cernuus* (lizard's tail), *Onoclea sensibilis* (sensitive fern), *Juncus effusus* (soft rush), *Carex crinita* (fringed sedge), and *Carex lurida* (shallow sedge) in the wetlands. Common vines include *Smilax rotundifolia* (greenbriar), *Rubus spp*. (blackberry), and *Toxicodendron radicans* (poison ivy). Looking farther away from the project site itself, the vegetative community shifts to more of an upland oak-hickory piedmont mesic forest type with *Liriodendron tulipifera* (tulip poplar), *Oxydendrum arboreum* (sourwood), *Fagus grandifolia* (American beech), *Juniperus virginiana* (red cedar), *Cornus florida* (flowering dogwood), *Pinus echinata* (shortleaf pine), and *Pinus taeda* (loblolly pine) also present.

The primary invasive species vegetation present on the project site are *Ligustrum sinense* (Chinese privet) found throughout the forest/pasture edge of the right bank of Reach R3, and *Rosa multiflora* (multiflora rose), which is found interspersed throughout the riparian buffer areas. Additionally, two small (~0.1 acres each), isolated pockets of *Ailanthus altissima* (tree of heaven) and *Pueraria lobata* (kudzu) are located at the very bottom of Reach R1 along Pleasant Green Rd. Invasive species vegetation will be sprayed, cut and painted, and/or grubbed in areas infested within the easement. Further treatment will be conducted to control the invasive species vegetation within the easement throughout the monitoring period as needed.

6.5.2 Proposed Riparian Vegetation Plantings

The vegetative components of this restoration project include streambank, floodplain, and wetland planting zones within the riparian buffer. These planting boundaries will be comprised of species found within native plant communities as presented below in Table 6.8 and shown on the revegetation plan sheets in Appendix J. In addition to the riparian buffer zones noted above, any areas of the site that lack diversity or were disturbed or adversely impacted by the construction process will also be planted.

Bare-root trees and live stakes will be planted within designated areas of the conservation easement, with the objective of establishing a minimum 50-foot buffer along all proposed streambanks for all of the stream reaches within the project boundary. In many areas, the buffer width will be in excess of 50 feet along one or both streambanks and will often encompass adjacent jurisdictional wetland areas. However, in no location does the buffer width exceed 100 feet (see Figure 15B). In general, bare-root vegetation will be planted at a total target density of 680 stems per acre. Planting will be conducted during the dormant season, with trees installed between mid-November and late March.

Selected species for hardwood revegetation planting are presented in Table 6.8. Tree species selected for restoration and enhancement areas will be at least somewhat tolerant of flooding, while the species slated for the wetland areas will be at least moderately flood tolerant. Observations will be made during construction of the site regarding the relative wetness of areas to be planted as compared to the revegetation plan, which will also incorporate the location of the jurisdictional wetlands to facilitate the accurate planting of appropriate species in their correct planting zone.

Once trees are transported to the site, they will be planted within two days. Disturbed soils across the site will be prepared by sufficiently loosening to a depth of four inches prior to planting as described in the technical specifications. Heavily compacted soils (e.g., hardpans or areas that experienced heavy equipment use) will be loosened to a depth of eight to ten inches by disking or ripping to prepare for tree planting. In any areas where excavation depths exceed ten inches, topsoil shall be separated from rocks, brush, or roots, stockpiled, and placed back over these areas to achieve design grades and create a soil base for vegetation. Trees will be planted by manual labor using a dibble bar, mattock, planting bar, or other approved method. Planting holes for the trees will be sufficiently deep to allow the roots to spread out and down without "J-rooting." Soil will be loosely compacted around trees once they have been planted to prevent roots from drying out. Soil tests will be conducted in the riparian buffer areas at appropriate intervals, and soil amendments such as fertilizer or lime may be added as recommended to improve growing conditions.

Live stakes will be installed at a minimum of 40 stakes per 1,000 square feet and stakes will be spaced two to three feet apart in meander bends and six to eight feet apart in the riffle sections using triangular spacing along the streambanks between the toe of the streambank and bankfull elevation. Site variations may require slightly different spacing.

Permanent seed mixtures will be applied to all disturbed areas of the project site. Table 6.9 lists the species, mixtures, and application rates that will be used. A mixture is provided that is suitable for streambank, floodplain, and adjacent wetland areas. Mixtures will also include temporary seeding (rye grain or browntop millet) to allow for application with mechanical broadcast spreaders. To provide rapid growth of herbaceous ground cover and biological habitat value, the permanent seed mixture specified will

be applied to all disturbed areas outside the streambanks of the restored stream channel. The species provided are deep-rooted and have been shown to proliferate along restored stream channels, providing long-term stability. This seed mix will also be applied to the streambanks through the existing utility crossing.

Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Through the establishment of riparian buffers of 50-ft minimum width, the project will also generate Riparian Buffer Mitigation Credits as per the Consolidated Buffer Mitigation Rule 15A NCAC 02B .0295 effective November 2015, and the DWR-issued Clarifications on Implementation of Buffer Mitigation Rule from March 2017. All riparian planting activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where buffer mitigation credits are being generated may be altered slightly depending on the final stream bank design. The planted areas will be surveyed and information provided in the Baseline/As-Built report. Please see Appendix F for the DWR approval letter of site viability for buffer mitigation (dated April 18, 2016).

Table 6.8 Proposed Bare-Root and Live Stake Species
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
All Buffer Plantings at 8' x 8' spacing for 680 stems/acre Riparian Floodplain – Overstory Species			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Liriodendron tulipifera	Tulip Poplar	10%	FAC
Quercus phellos	Willow Oak	5%	FAC
Acer negundo	Box Elder	5%	FACW
Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	10%	FACW
Riparian Floodplain – Understory Species			
Carpinus caroliniana	American Hornbeam	10%	FAC
Asimina triloba	Pawpaw	10%	FAC
Viburnum dentatum	Arrowwood Viburnum	10%	FAC
Aesculus sylvatica	Painted Buckeye	10%	FAC
Wetland Buffer Plantings – Overstory			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Quercus michauxii	Swamp Chestnut Oak	10%	FACW
Acer negundo	Box Elder	10%	FACW

Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	5%	FACW
Nyssa sylvatica	Black gum	5%	FAC
Wetland Buffer Plantings – Understory			
Lindera benzoin	Spicebush	10%	FAC
Alnus serrulata	Tag Alder	10%	OBL
Ilex verticillata	Winterberry	10%	FACW
Viburnum nudum	Possumhaw	10%	OBL
Streambank Live Stake Plantings			
Salix sericea	Silky Willow	25%	OBL
Sambucus canadensis	Elderberry	25%	FACW
Cephalanthus occidentalis	Buttonbush	15%	OBL
Cornus amomum	Silky Dogwood	25%	FACW
Salix nigra	Black Willow	10%	OBL
Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.			

Table 6.9 Proposed Permanent Seed Mixture
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Botanical Name	Common Name	% Planted by Species	Density (lbs/ac)	Wetland Tolerance
Andropogon gerardii	Big blue stem	10%	1.50	FAC
Dichanthelium clandestinum	Deer tongue	15%	2.25	FAC
Carex crinita	Fringed sedge	10%	1.50	OBL
Elymus virginicus	Virginia wild rye	10%	1.50	FACW
Juncus effusus	Soft rush	10%	1.50	FACW
Panicum virgatum	Switchgrass	15%	2.25	FAC
Schizachyrium scoparium	Little blue stem	10%	1.50	FACU
Sorghastrum nutans	Indiangrass	10%	1.50	FACU
Impatiens capensis	Jewelweed	10%	1.50	FACW
	Total	100%	15.00	
Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.				

6.6 Project Work Plan

The project work plan is included in the plan sheet set for the project and provides a detailed description of proposed construction timing and sequencing, specific in-stream structure and other construction element designs, as well as a description of all grading and planting activities. All work will be conducted using common machinery, tools, equipment, and techniques for the successful implementation of the project. The complete plan sheets can be found in Appendix J.

6.7 Project Risks and Uncertainties

Due to the rural and primarily forested nature of the project watershed, the project risk is low. Anticipated potential project risk include future logging within the watershed and the existing utility crossings along Reach R1. A large portion of the headwaters of the project watershed was logged between 2010 and 2013 so additional logging in the near-term is unlikely. Maintenance along the existing utility crossing will likely be conducted by Piedmont Electrical Membership Corporation. The buffer through the easement crossing will only be planted with low growing herbaceous vegetation and the stream is aligned such that the easement breaks are at constructed riffles. The adjacent landuse on the project property outside of the conservation easement will remain in hay production and for horse riding. Generally, very limited if any grazing takes place on the project property.

7.0 PERFORMANCE STANDARDS

The performance standards and success criteria for the project will follow the NCIRT guidance document *Wilmington District Stream and Wetland Compensatory Mitigation Update* dated October 24, 2016. Monitoring activities will be conducted for a period of 7 years unless otherwise noted.

Based on the design approaches, different monitoring methods are proposed for the project reaches. Reach R1 involves traditional Restoration (Rosgen Priority Level I), while Reach R3 utilizes a combination of approaches with some Restoration at the very top but mostly following an Enhancement Level I effort with stream bed/bank stabilization and structure installation. For these reaches, geomorphic monitoring methods will follow those recommended by the October 2016 IRT guidance as described below. For Reaches R2, T1, T2, T3, and T4, that involve either an Enhancement Level II or Preservation approach, monitoring efforts will focus on visual inspections, photo documentation, and/or vegetation assessments. Specific success criteria components and evaluation methods are described below and report documentation will follow the NCDMS's templates *As-Built Baseline Monitoring Report Format, Data Requirements, and Content Guidance* (February 2014), and the *Annual Monitoring Report Format, Data Requirements, and Content Guidance* (April 2015).

7.1 Stream Monitoring

Geomorphic monitoring of the proposed restoration reaches will be conducted once a year for seven years following the completion of construction to evaluate the effectiveness of the restoration practices. The methods used and related success criteria for each monitored stream parameter are described below. The success criteria for the proposed Enhancement Level II and Preservation reaches will follow the methods described under the Visual Assessment and/or Vegetation Monitoring. Figure 14 shows the approximate locations of the proposed monitoring devices throughout the project site.

7.1.1 Bankfull Events and Flooding Functions

The occurrence of bankfull events within the monitoring period will be documented by the use of crest gauges, flow gauges (pressure transducers), and photographs. A flow gauge (pressure transducer) will be installed adjacent to the restored Reach R1 to record flood water depth and duration. Additionally, a crest gauge will be installed on the floodplain within five to ten feet (horizontal) from the top of stream bank on Reaches R1 and R3. Photographs will also be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Four bankfull events must be documented in separate years within the seven-year monitoring period. Otherwise, monitoring will continue until the required four bankfull events have been documented.

7.1.2 Cross Sections

Permanent cross sections will be installed at an approximate rate of one cross section per twenty bankfull widths of restored stream, with approximately half of the cross sections located at riffles and half located at pools. Each cross section will be marked on both streambanks with permanent monuments using rebar cemented in place to establish the exact transect used. A common benchmark will be used for cross sections and to facilitate easy comparison of year-to-year data. The cross section surveys will occur in years one, two, three, five, and seven, and must include measurements of Bank Height Ratio (BHR) and Entrenchment Ratio (ER). The monitoring survey will include points measured at all breaks in slope, including top of streambanks, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross sections will be classified using the Rosgen Stream Classification System.

There should be little change in as-built cross sections. If changes do take place, they will be documented in the survey data and evaluated to determine if they represent a movement toward a more unstable

condition (e.g., down-cutting or erosion) or a movement toward increased stability (e.g., settling, vegetative changes, deposition along the streambanks, or decrease in width/depth ratio). Using the Rosgen Stream Classification System, all monitored cross sections should fall within the quantitative parameters (i.e. BHR no more than 1.2 and ER no less than 2.2 for 'C' stream types) defined for channels of the design stream type. Given the smaller channel sizes and meander geometry of the proposed steams, bank pins will not be installed unless monitoring results indicate active lateral erosion.

Reference photo transects will be taken at each permanent cross section. Lateral photos should not indicate excessive erosion or continuing degradation of the streambanks. The survey tape will be centered in the photographs of the streambanks. Photographers shall make an effort to consistently maintain the same area in each photo over time.

7.1.3 Longitudinal Profile and Pattern

A longitudinal profile will be surveyed for the entire length of restored channel immediately after construction to document as-built baseline conditions. The survey will be tied to a permanent benchmark and measurements will include thalweg, water surface, bankfull, and top of low bank. Each of these measurements will be taken at the head of each feature (e.g., riffle, pool) and at the maximum pool depth. The longitudinal profile should show that the bedform features installed are consistent with intended design stream type. The longitudinal profile will not be taken during subsequent monitoring years unless vertical channel instability has been documented or remedial actions/repairs are deemed necessary.

Pattern measurements such as sinuosity, radius of curvature, and meander width ratio will be calculated on newly constructed meanders using the plan views from the as-built plan sheets, and reported in the as-built baseline document. Subsequent visual monitoring will be conducted annually to document any changes or excessive lateral movement in the plan view of the restored channel.

7.1.4 Visual Assessment

Visual monitoring assessments of all stream sections will be conducted at least once per monitoring year. Photographs will be used to visually document system performance and any areas of concern related to streambank stability, condition of in-stream structures, channel migration, headcuts, channel aggradation (bar formation) or degradation, live stake mortality, impacts from invasive plant species or animal species, riparian vegetation success, and condition of pools and riffles. The photo locations will be shown in the appropriate figure in the baseline and annual monitoring reports.

7.2 Vegetation Monitoring

Restoration of the riparian vegetation on a site is dependent upon the successful planting and establishment of native hardwood species, along with the volunteer regeneration of the plant community. In order to determine if the success criteria are achieved, vegetation monitoring plots will be installed and monitored across the restoration site in accordance with the CVS-DMS Protocol for Recording Vegetation, Version 4.2 (Lee at al., 2008). These vegetation plots shall consist of both permanent and random plots, totaling a minimum of 2% of the planted portion of the site with a minimum of four (4) plots established within the planted riparian buffer areas per CVS Monitoring Levels 1 and 2. The number of random plots will make up no more than 50% of the total number of plots for the project. The size of each individual plot will be 100 square meters. No plots will be established within the undisturbed wooded areas or within the buffers of the preservation Reaches T1, T2, T3, or T4.

Vegetation monitoring will occur in the fall, prior to the loss of leaves. Data from the permanent vegetation plots will include: species, height, planted vs. volunteer, tree vs. shrub, and age (based on the year the stem was planted, or first observed if a volunteer). Data from the random plots will include only the species and height. Plot densities will also be calculated for each plot. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the

difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first full growing season from baseline (MY0), after a minimum of 180 days, species composition, heights, stem density, and survival will be evaluated for monitoring year one (MY1). Vegetation plots shall subsequently be monitored in years 2, 3, 5 and 7 or until the final success criteria are achieved. The interim measure of vegetative success for the site will require the survival of at least 320 stems per acre at the end of the year 3 monitoring period. At year 5, density must be no less than 260 stems per acre. The final vegetative success criteria will be the survival of 210 stems per acre at the end of the year 7 monitoring period.

Additionally, the average height of the vegetation at year 7 should range from 7 feet to 10 feet tall. Certain native species, which are appropriate to plant on-site to provide a diverse vegetation community, do not typically grow to these heights in 7 years and will be excluded from the height performance standard. For this project, these excluded species are *Quercus michauxii* (swamp chestnut oak), *Aesculus sylvatica* (painted buckeye), *Quercus phellos* (willow oak), *Carpinus caroliniana* (American hornbeam), *Nyssa sylvatica* (black gum), and *Ilex verticillata* (winterberry).

While measuring species density and height is the current accepted methodology for evaluating vegetation success on mitigation projects, species density and height alone may be inadequate for assessing plant community health. For this reason, the vegetation monitoring plan may incorporate the evaluation of additional plant community indices, native volunteer species, and the presence of invasive species vegetation to assess overall vegetative success.

Baker will provide required remedial action on a case-by-case basis, such as: replanting more wet/drought tolerant species vegetation as appropriate, conducting beaver management/dam removal, and the treatment of undesirable/ invasive species vegetation, and will continue to monitor vegetation performance until the corrective actions demonstrate that the site is trending towards or meeting the standard requirement. Existing mature woody vegetation will be visually monitored during annual site visits to document any mortality, due to construction activities or changes to the water table, that negatively impact existing forest cover or favorable buffer vegetation.

Additionally, herbaceous vegetation, primarily native species grasses, will be seeded/planted throughout the site. During and immediately following construction activities, all ground cover at the project site must be in compliance with the NC Erosion and Sedimentation Control Ordinance.

A buffer monitoring report will be submitted to NCDWR at the end of each monitoring year (MY1, MY2, MY3, MY4, and MY5) by December 31st. Performance standards for buffer vegetation associated with Riparian Buffer Credits will be in accordance with 15A NCAC 02B.0295(n)(2)(B) and 15A NCAC 02B.0295(n)(4). Monitoring protocol for Riparian Buffer Credits will follow the methodologies described above except that vegetation will be monitored in MY4 as well.

7.3 Wetland Monitoring

No wetland credits are proposed for this project, therefore no wetland-specific monitoring will be conducted. However, a visual inspection of the site's jurisdictional wetlands will be conducted yearly and qualitatively described in the annual monitoring report.

8.0 MONITORING PLAN

The monitoring plan for the Lochill Farm project is outlined below in Table 8.1 and describes the measurable connections between the previously stated goals and objectives to the performance standards and expected functional uplift. The existing conditions monitoring feature locations can be found in Figure 4, while the estimated post-construction monitoring feature locations can be found in Figure 14.

Table 8.1 Monitoring Plan Overview

Lochill Farm Stream Restoration Project – NCDMS Project 97083

Goal	Treatment	Performance Standards	Monitoring Metric	Outcome	Likely Functional Uplift
Reconnect stream reaches to their floodplains.	Restore streams with appropriate channel dimensions, and remove spoil berms.	Four bankfull events during the 7-year monitoring period.	Crest gauges and/or pressure transducers used to record bankfull events.	Increased bankfull events, restoring a more natural flooding regime to the system.	A dissipation of damaging high flows during flood events, hydrologic enhancement of adjacent wetlands, and increased floodplain access for sediment storage.
Stabilize steep and/or eroding stream banks.	Restore streams with appropriate bank slopes, and stabilize with bank structures and/or plant with live-stake vegetation.	Restored streams will maintain bank-height-ratios of less than 1.2 and entrenchment ratios greater than 1.4 (provided visual inspections also reveal stabilization).	Cross section surveys and visual inspections with photographic documentation.	Stable stream banks with appropriate channel dimensions.	A reduction in sediment loss to streams from bank erosion, along with the resulting nutrient loss, increased woody debris and organic material in stream.
Improve in-stream habitat.	Install a variety of in-stream structures, increasing the woody debris and the number and types of pools. Repair stream disconnects from clogged culverts.	N/A	Inventory comparisons of bed features from existing conditions and as-built project surveys and assessments.	Increased number of pools and woody structures from the existing conditions. Demonstrate reduced aquatic organism impediments through stream system.	An increase in the quantity and quality of aquatic habitat features for macroinvertebrates and fish.
Reestablish	Plant appropriate	Interim survival	Vegetation	At the end of	Improved riparian

forested riparian buffers.	native hardwood tree and shrub species on streambanks and in the riparian buffer at a 50-foot minimum width in all areas within the conservation easement where established native trees and shrubs do not exist.	rates of 320 stems/acre at MY3 and 260 steams/acre at MY5, with final rate of 210 stems/acre at MY7.	monitoring plots (100 m2 each covering 2% of the total planted area).	monitoring, a vegetated riparian buffer will be have been established at a minimum 50-foot width and at a minimum 210 stems/acre of native species, including volunteers.	corridor habitat for native species, improved stabilization of stream floodplain (reducing sediment loss), increased woody and organic material in buffer/stream system.
Permanently protect the project.	Establish a permanent Conservation Easement (CE) for the entire project.	N/A	Visual inspections to confirm no encroachments into CE.	Restored streams and buffers protected from damaging encroachments.	The functional uplift improvements from the project are maintained and protected in perpetuity.

The as-built / baseline report will be submitted within 90 days of the completion of project construction (to include complete as-built record drawings with all vegetation planted and monitoring devices installed), and will follow the NCDMS As-Built Baseline Monitoring Report template (February 2014). The annual monitoring reports will follow the Annual Monitoring Report template (April 2015), while the closeout report will follow the Closeout Report Template – ver. 2.1 (March 2015). There will be at least a minimum of 6 months between the submission of the As-Built Baseline Report and the Year 1 Annual Monitoring Report.

The annual monitoring reports will provide the information defined below within Table 8.2 and will be submitted to NCDMS by December 1st of the year during which the monitoring was conducted. The monitoring will be conducted in accordance with the guidance and requirements found in the Wilmington District Stream and Wetland Compensatory Mitigation Update document (NCIRT, October 2016). The monitoring reports will provide a project data chronology for NCDMS to document the project status and trends, will assist with the population of NCDMS databases for analysis and research purposes, and will assist in decision making regarding progress towards a successful project close-out. Project success criteria must be met by the final monitoring year prior to project closeout, or monitoring will continue until unmet criteria are successfully met as directed by NCDMS and NCIRT.

Table 8.2 Monitoring Requirements and Schedule

Lochill Farm Stream Restoration Project - NCDMS Project No. 97083

Required	Parameter	Frequency	Number/Locations	Notes
X	Pattern	Baseline/As-built (MY0) and as needed	Reaches R1 and upper R3	Pattern measurements will be calculated as part of the as-built/baseline report. Additional pattern data, such as bank erosion pins/arrays, will be collected only if there are visual indications or cross section survey data that suggest significant changes have occurred.

Table 8.2 Monitoring Requirements and Schedule

Lochill Farm Stream Restoration Project - NCDMS Project No. 97083

Required	Parameter	Frequency	Number/Locations	Notes
X	Dimension	Monitoring Years 1, 2, 3, 5 and 7	10 cross sections in Reach R1, and 2 in Reach R3 (half in riffles, half in pools)	Cross sections to be monitored over seven (7) years and shall include assessment of bank height ratio (BHR) and entrenchment ratio (ER).
X	Longitudinal Profile	Baseline/As-built (Year 0) and as needed	Reaches R1 and upper R3	For the Restoration and Enhancement I components of this project where channel pattern has been significantly altered, the channel will be surveyed as part of the as-built record drawings.
X	Surface Water Hydrology	Annually	1 crest gauge and 1 flow gauge (in floodplain) on Reach R1, 1 crest gauge on Reach R3	The devices will be inspected on all site visits to document the occurrence of bankfull events on the project.
X	Vegetation	Monitoring Years 1, 2, 3, 4[1], 5 and 7	5 permanent vegetation plots will be established throughout the planted area, with 1 additional random plot to be relocated each year.	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols. Plots will be 100 m^2 in size and total 2% of the planted area.
X	Exotic and Nuisance Vegetation	Annually and as needed	Project wide	Locations of exotic and nuisance vegetation will be visually assessed, photographed, and mapped.
X	Visual Assessment	Annually and as needed	Project wide	Representative photographs will be taken to capture the state of the restored channel and vegetated buffer conditions. Stream photos will be preferably taken in the same location when the vegetation is minimal to document any areas of concern or to identify trends.
X	Project Boundary	Annually	Complete easement boundary	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be photographed and mapped.
X	Beaver Activity	Annually and as needed	Project wide	The presence of any beaver activity will be visually assessed throughout the monitoring period along all project reaches.

[1] Vegetation monitoring in Year 4 will be conducted as per the buffer mitigation credit requirements.

9.0 ADAPTIVE MANAGEMENT PLAN

Upon completion of site construction, Baker will implement the post-construction monitoring protocols previously defined in this document. Project maintenance will be performed as previously described in this document. If, during the course of annual monitoring it is determined the site's ability to achieve site performance standards are jeopardized, Baker will notify DMS and DWR of the need to develop a Plan of Corrective Action. The Plan of Corrective Action may be prepared using in-house technical staff or may require engineering and consulting services. Once the Plan of Corrective Action is prepared and finalized Baker will:

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

10.0 LONG-TERM MANAGEMENT PLAN

The NC Department of Environmental Quality's Stewardship Program currently houses DMS stewardship endowments within the non-reverting, interest-bearing Conservation Lands Stewardship Endowment Account. The use of funds from the Endowment Account is governed by North Carolina General Statute GS 113A-232(d)(3). Interest gained by the endowment fund may be used only for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable. The NCDEQ Stewardship Program intends to manage the account as a non-wasting endowment. Only interest generated from the endowment funds will be used to steward the compensatory mitigation sites. Interest funds not used for those purposes will be re-invested in the Endowment Account to offset losses due to inflation. The site-protection instrument for the site is included in Appendix B.

The project site will be protected and managed under the agreed upon terms outlined in the recorded conservation easement. The appropriate signage will be installed to mark the conservation easement boundary. The long-term manager/steward will be responsible for inspecting the site easement and signage, and for taking any corrective maintenance actions as needed. The landowner shall contact the long-term manager/steward regarding any clarification about easement restrictions, and is responsible for maintaining all livestock-excluding fencing and/or permanent crossings. Should land use change in the future, the landowner will be responsible for upholding the restrictions described in the conservation easement deed.

11.0 DETERMINATION OF CREDITS

The determination of stream and buffer credits for the Lochill Farm Stream Mitigation Project are detailed below in Tables 11.1, 11.2, and 11.3, and are shown in Figures 15A and 15B. They have been calculated according to all applicable DMS, IRT, and DEQ guidance documents. The Credit Release Table can be found in Appendix C.

Table 11.1 Project Components and Mitigation Credits

Lochill Farm Stream Restoration Project - NCDMS Project No. 97083

Project Component (reach ID, etc.)	Wetland Position and HydroType	Existing Footage or Acreage	Stationing	Restored Footage, Acreage, or SF	Creditible Footage, Acreage or SF[1]	Restoration Level	Approach Priority Level	Mitigation Ratio (X:1)	Mitigation Credits
Reach R1		2,925	10+00 - 42+19	3,219	3,105	R	PI	1	3,105
Reach R2		590	10+00 - 16+17	617	600	EII		5	120
Reach R3		1,697	10+00 - 26+17	1,617	1,602	EI		2	801
Reach T1		96	10+00 - 11+04	104	104	P		5	21
Reach T2		49	10+00 - 10+59	59	59	P		10	6
Reach T3		482	10+00 - 14+82	482	482	P		10	48
Reach T3b		34	10+00 - 10+59	34	34	P		10	3
Reach T4		89	10+00 - 10+89	89	89	P		10	9
Wetland Group 1									
Buffer Group 1 (BG1)				169,553	169,553	R		1	169,553
Buffer Group 2 (BG2)				13,067	13,067	P		5	2,613
Buffer Group 3 (BG3)				424,955	43,451	P		10	4,345

[1] Creditable Footage: The creditable amounts after exclusion and reductions are accounted for, such as utility impacts, easement breaks, and crossings.

Table 11.2 Credited Length and Area Summations by Mitigation Category

Restoration Level	Credited Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Credited Buffer (square feet)
		Riverine	Non-Riverine		
Restoration	3,105				169,553
Enhancement					
Enhancement I	1,602				
Enhancement II	600				
Creation					
Preservation	768				56,518
High Quality Pres					

Table 11.3 Overall Assets Summary

Asset Category	Overall Credits
Stream	**4,113**
RP Wetland	**-**
NR Wetland	**-**
Buffer	**176,511**

12.0 REFERENCES

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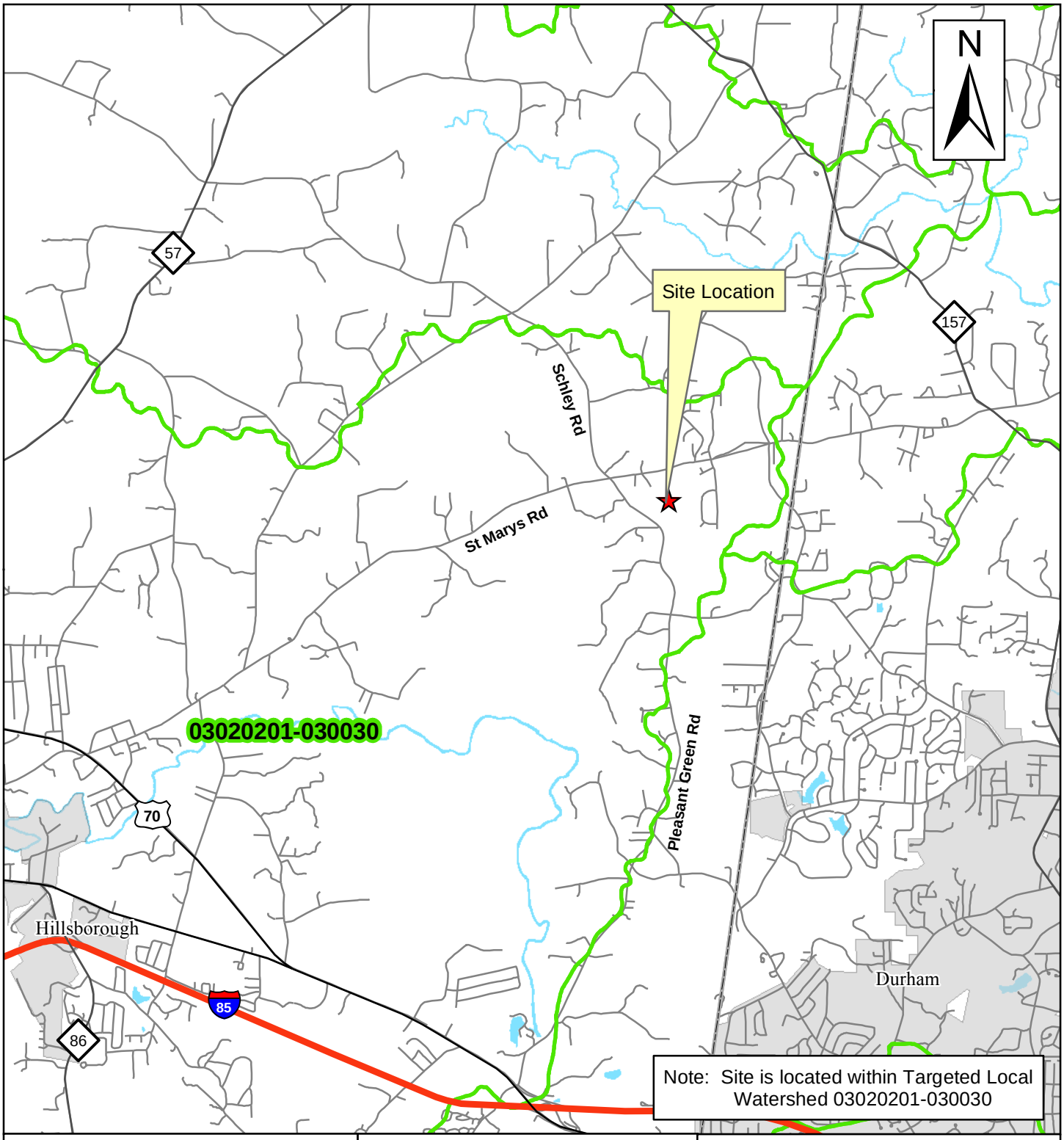
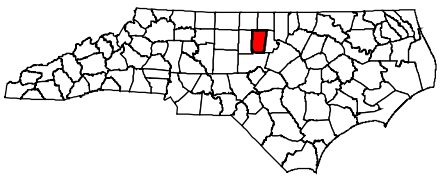
Appendix A

Figures/Maps, Cross-Sections, and Photographs





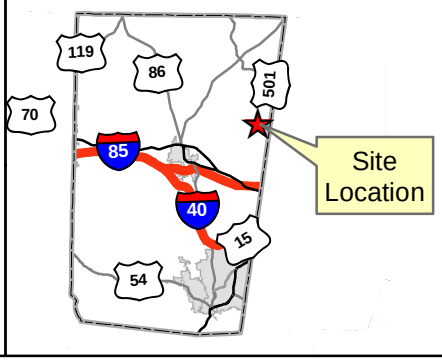
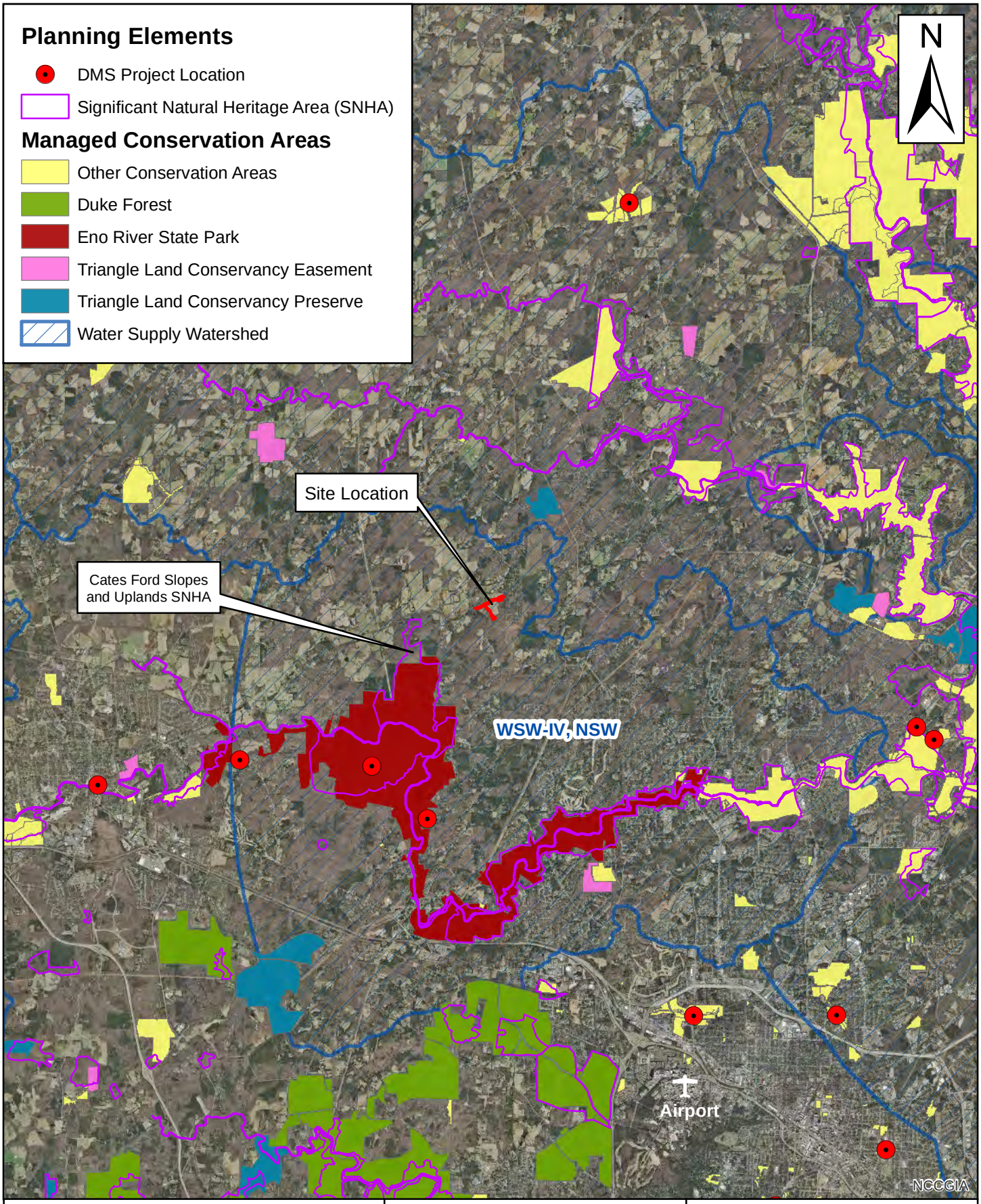


Figure 1
Project Vicinity Map
Lochill Farm Site

Michael Baker INTERNATIONAL

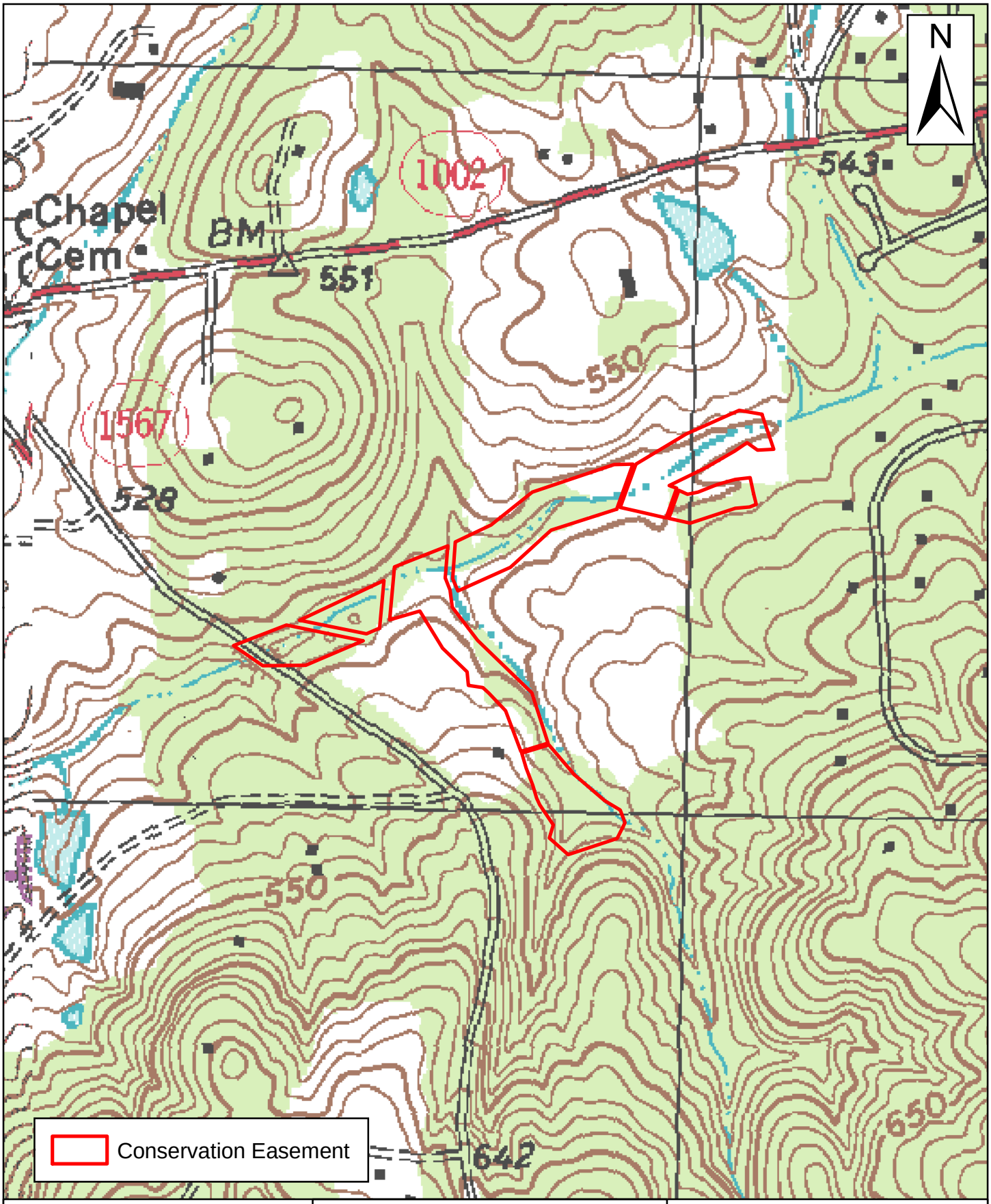
0 0.5 1 2 Miles



Michael Baker INTERNATIONAL

0 1 2 Miles

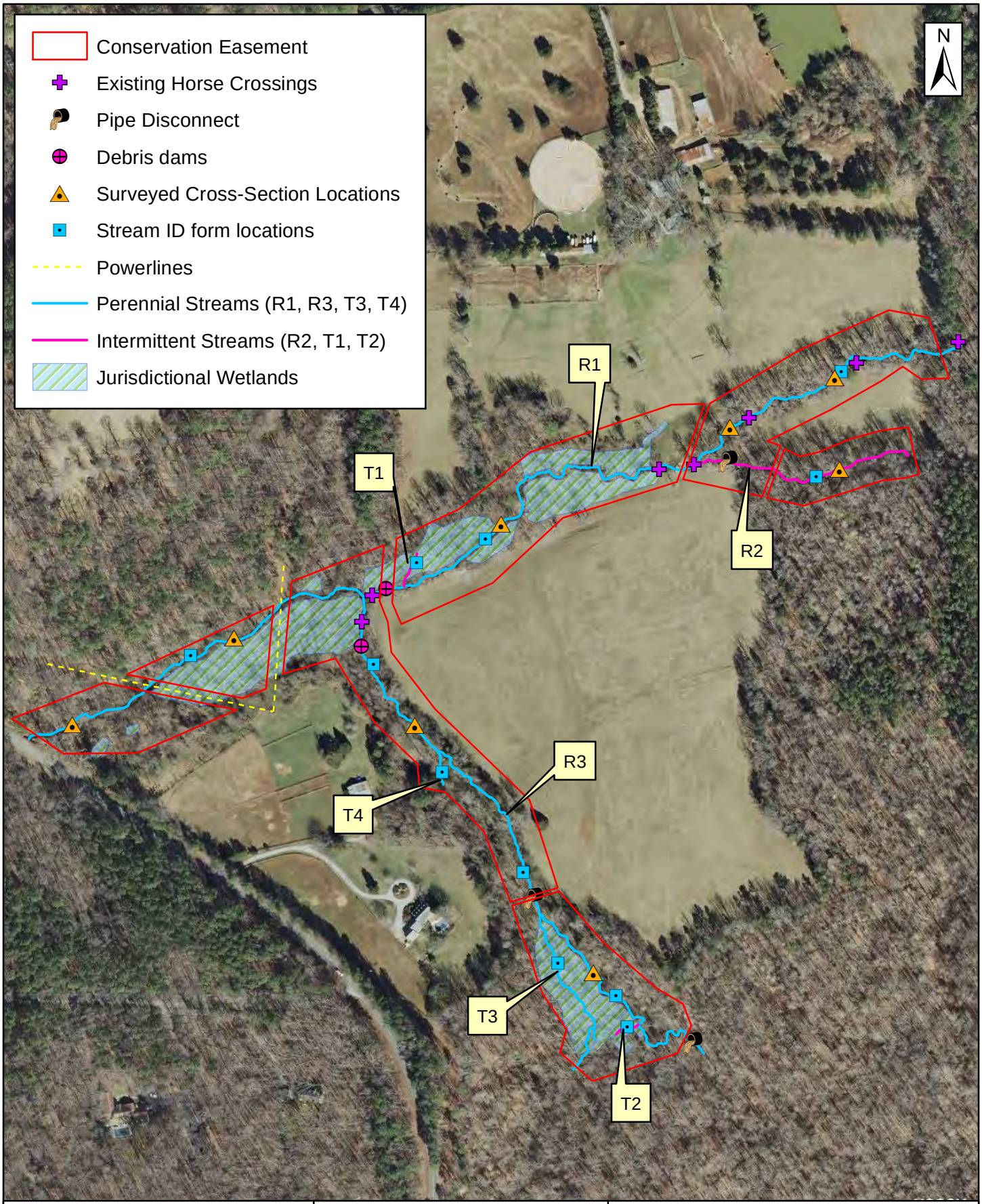
Figure 2
Planning Elements Map
Lochill Farm Site



Michael Baker INTERNATIONAL

0 500 1,000 Feet

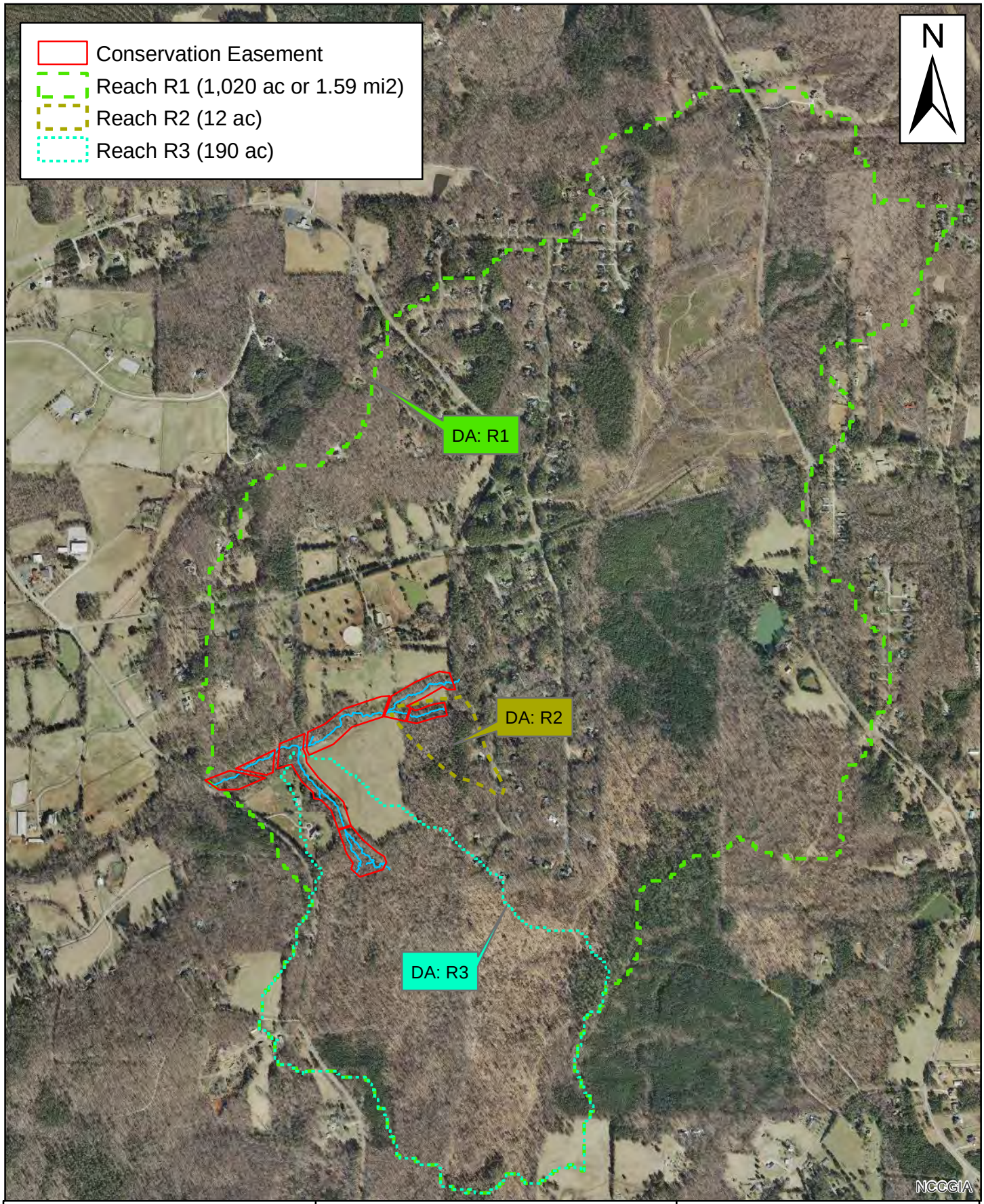
Figure 3
USGS Topographic Map
(Northwest Durham Quad)
Lochill Farm Site



Michael Baker INTERNATIONAL

0 250 500 Feet

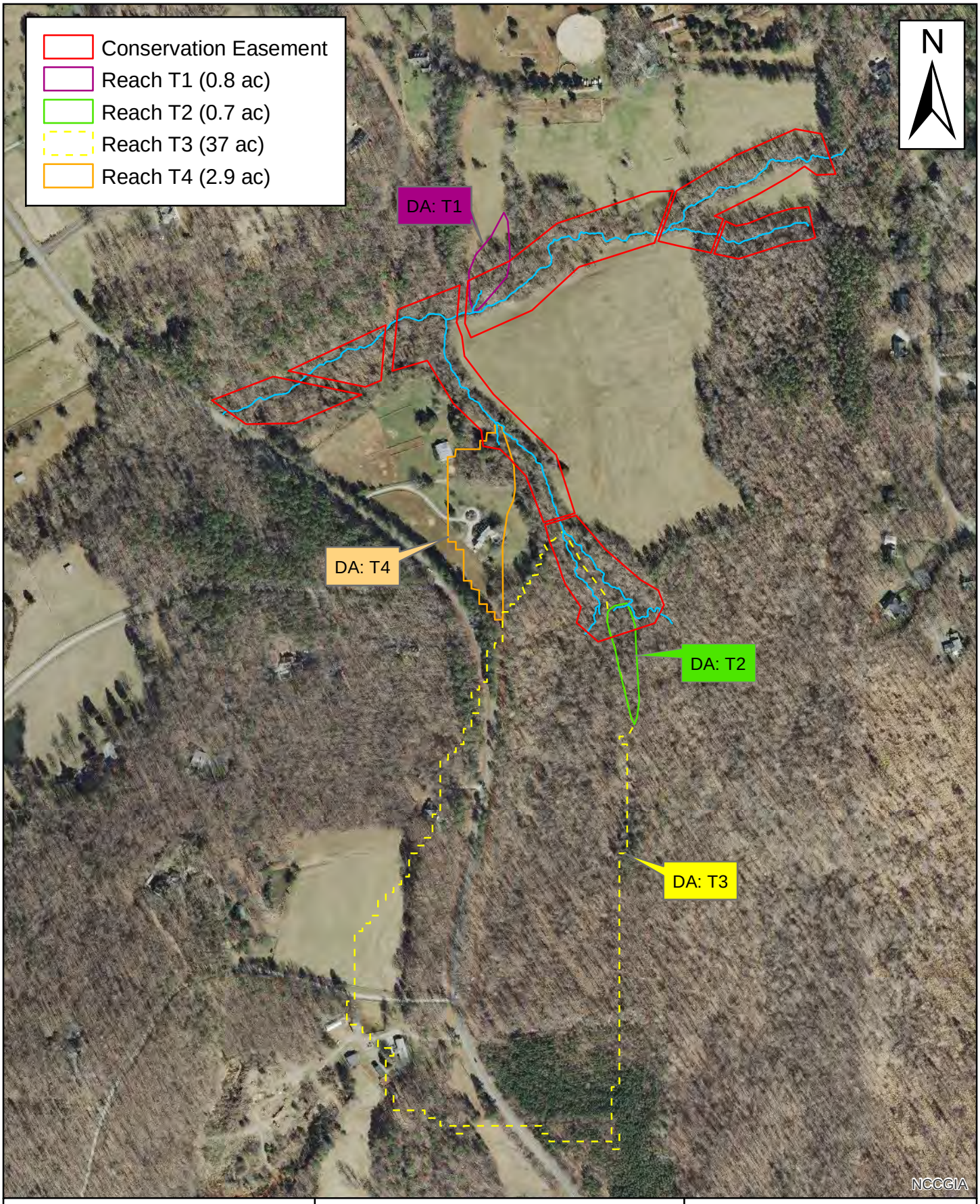
Figure 4
Existing Conditions and Features
Lochill Farm Site



Michael Baker INTERNATIONAL

0 1,000 2,000 Feet

Figure 5A
Watershed Drainage Areas
Lochill Farm Site



Michael Baker INTERNATIONAL

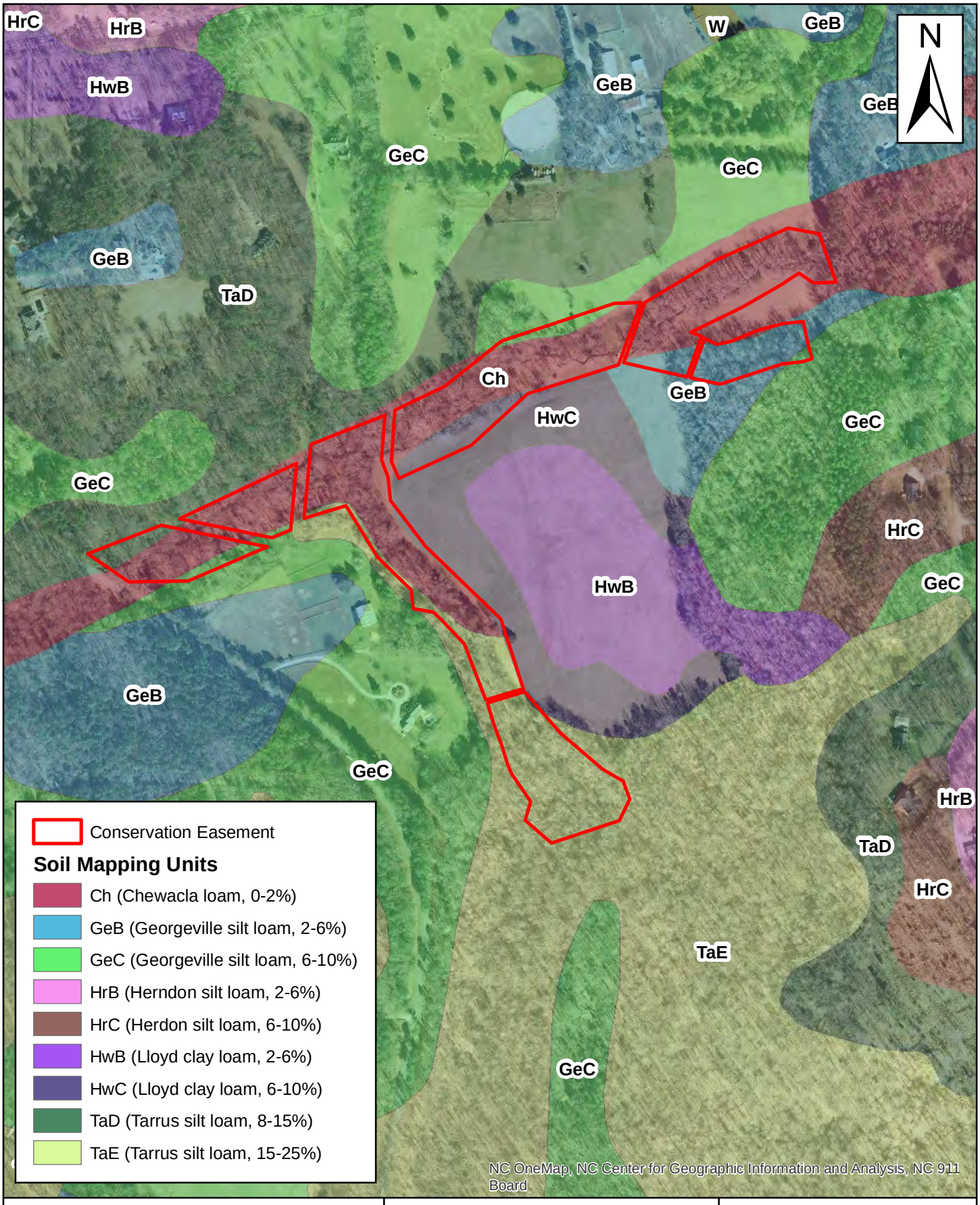
0 500 1,000 Feet

Figure 5B
Watershed Drainage Areas
Lochill Farm Site

Michael Baker INTERNATIONAL

0 1 2 Miles

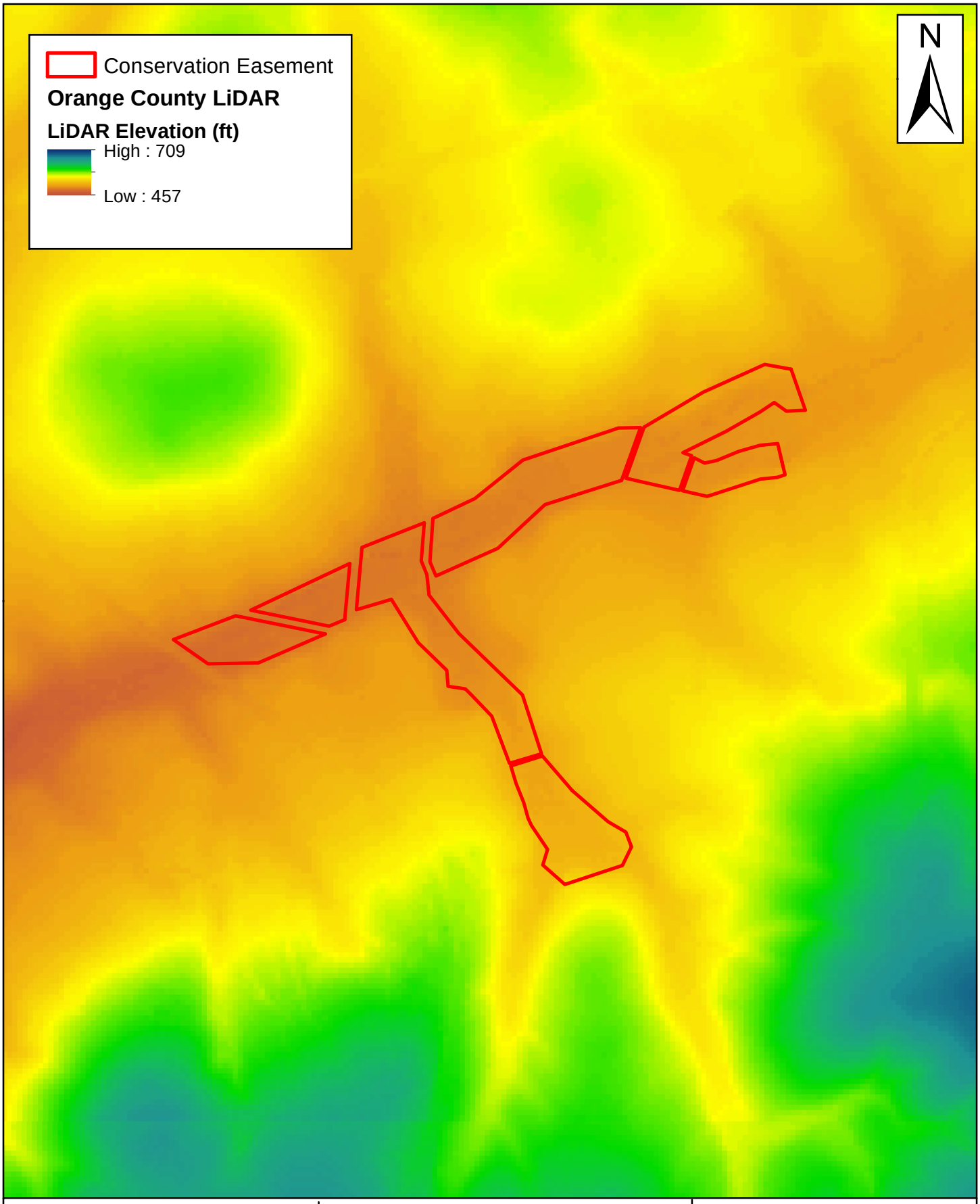
Figure 6
Geologic Map
Lochill Farm Project



Michael Baker INTERNATIONAL

0 250 500 Feet

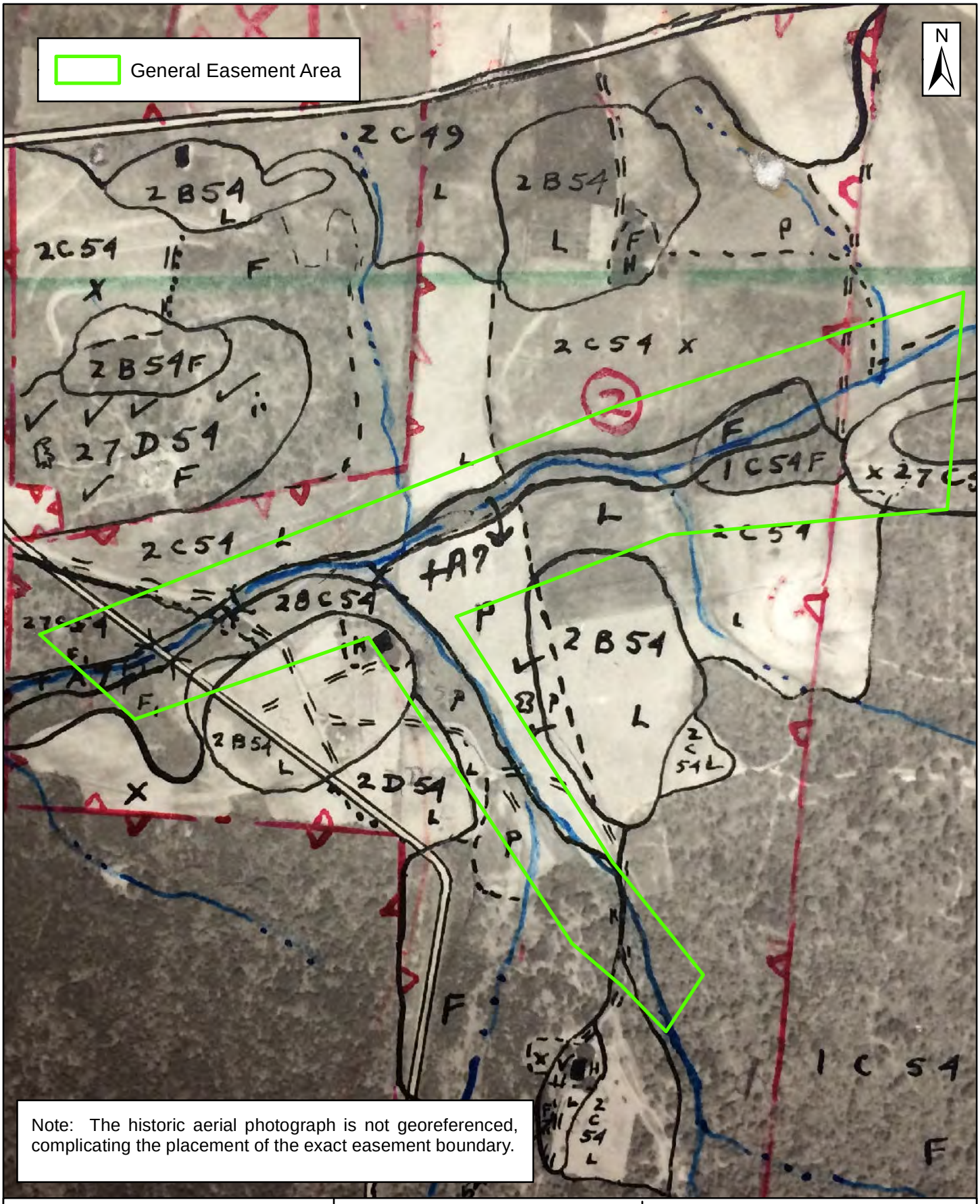
Figure 7
Soils Map
Lochill Farm Site



Michael Baker INTERNATIONAL

0 500 1,000 Feet

Figure 8
LIDAR Map
Lochill Farm Site



Michael Baker INTERNATIONAL

Not to Scale

Figure 9A
Historic Aerial 1938
Lochill Farm Site

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Not to Scale

Figure 9B
Historic Aerial 1955
Lochill Farm Site

Note: The historic aerial photograph is not georeferenced, complicating the placement of the exact easement boundary.

NCDOT GIS Unit

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Not to Scale

Figure 9C
Historic Aerial 1966
Lochill Farm Site

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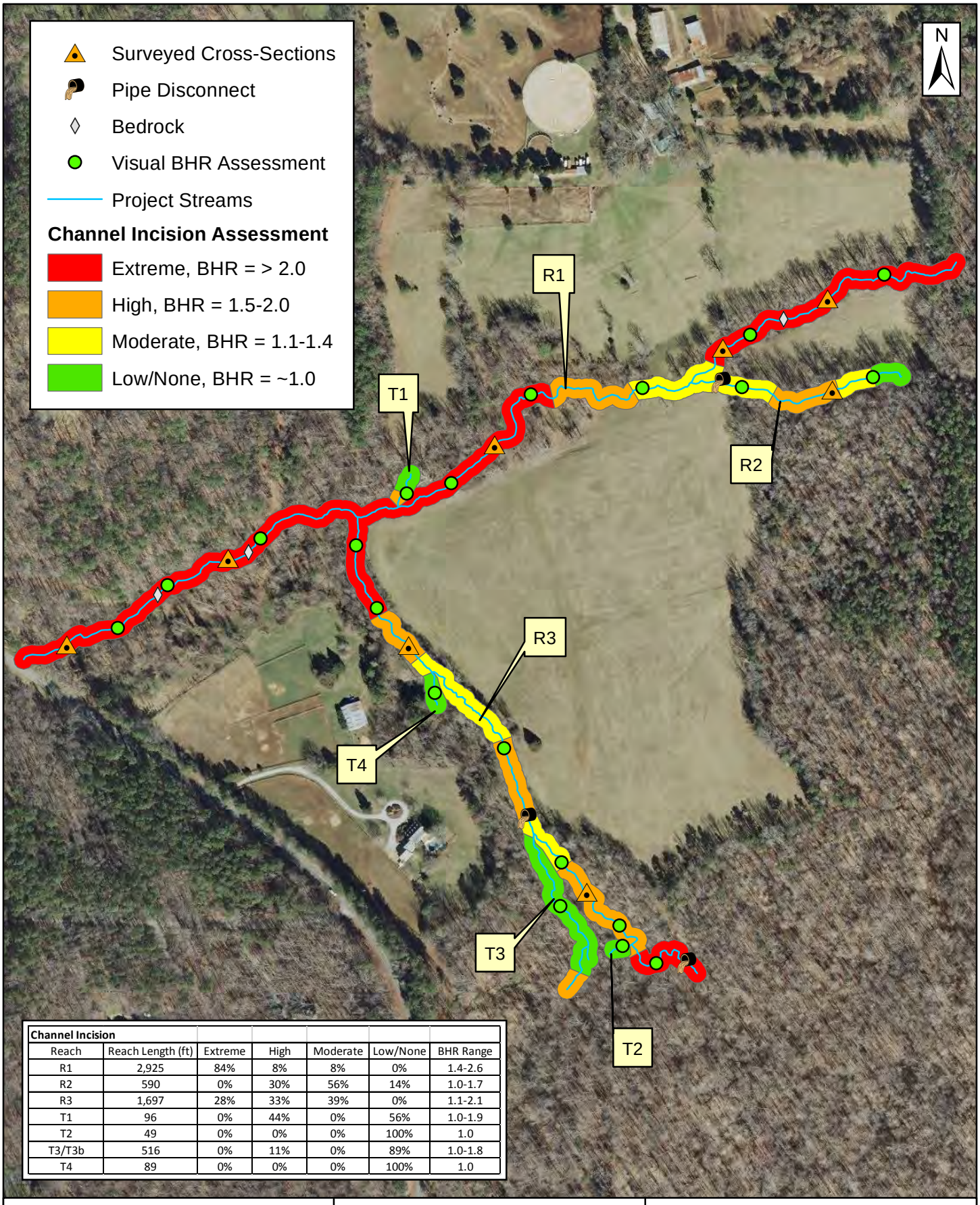
Not to Scale

Figure 9D
Historic Aerial 1987
Lochill Farm Site

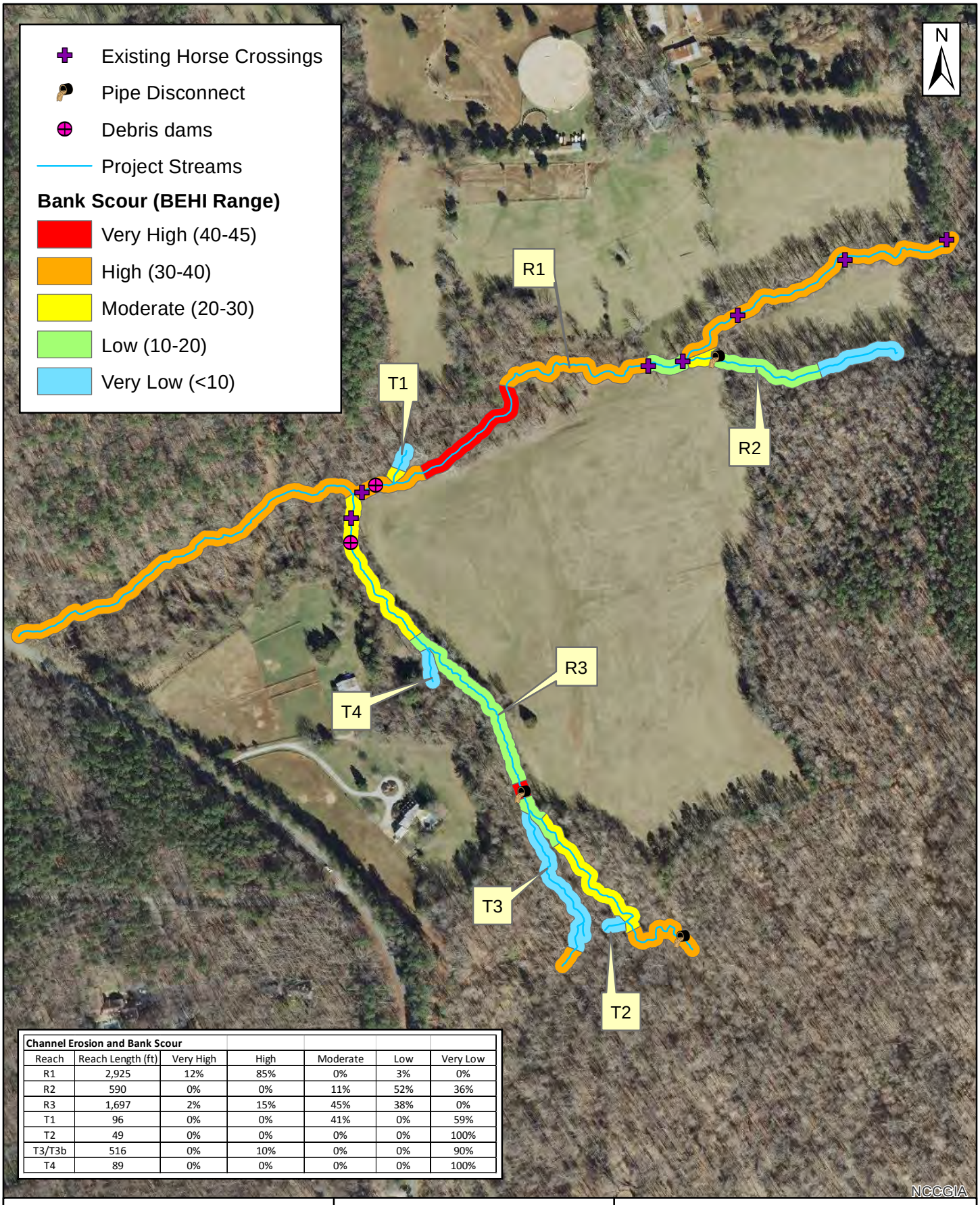


Channel Incision						
Reach	Reach Length (ft)	Extreme	High	Moderate	Low/None	BHR Range
R1	2,925	84%	8%	8%	0%	1.4-2.6
R2	590	0%	30%	56%	14%	1.0-1.7
R3	1,697	28%	33%	39%	0%	1.1-2.1
T1	96	0%	44%	0%	56%	1.0-1.9
T2	49	0%	0%	0%	100%	1.0
T3/T3b	516	0%	11%	0%	89%	1.0-1.8
T4	89	0%	0%	0%	100%	1.0

Michael Baker INTERNATIONAL

0 250 500 Feet

Figure 10
Channel Incision
Lochill Farm Site



Channel Erosion and Bank Scour						
Reach	Reach Length (ft)	Very High	High	Moderate	Low	Very Low
R1	2,925	12%	85%	0%	3%	0%
R2	590	0%	0%	11%	52%	36%
R3	1,697	2%	15%	45%	38%	0%
T1	96	0%	0%	41%	0%	59%
T2	49	0%	0%	0%	0%	100%
T3/T3b	516	0%	10%	0%	0%	90%
T4	89	0%	0%	0%	0%	100%

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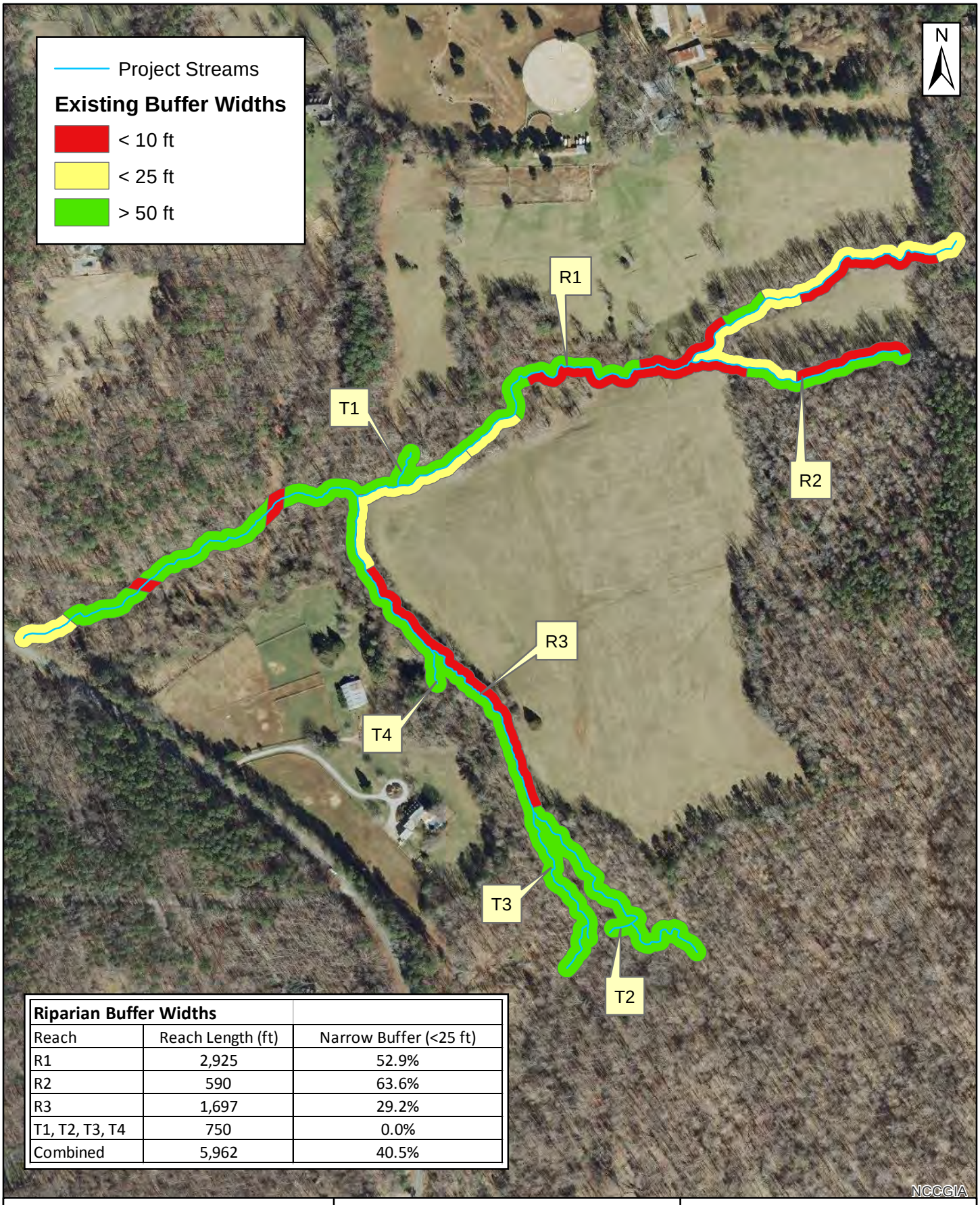
0 250 500 Feet

Figure 11
Erosion and Bank Scour
Lochill Farm Site

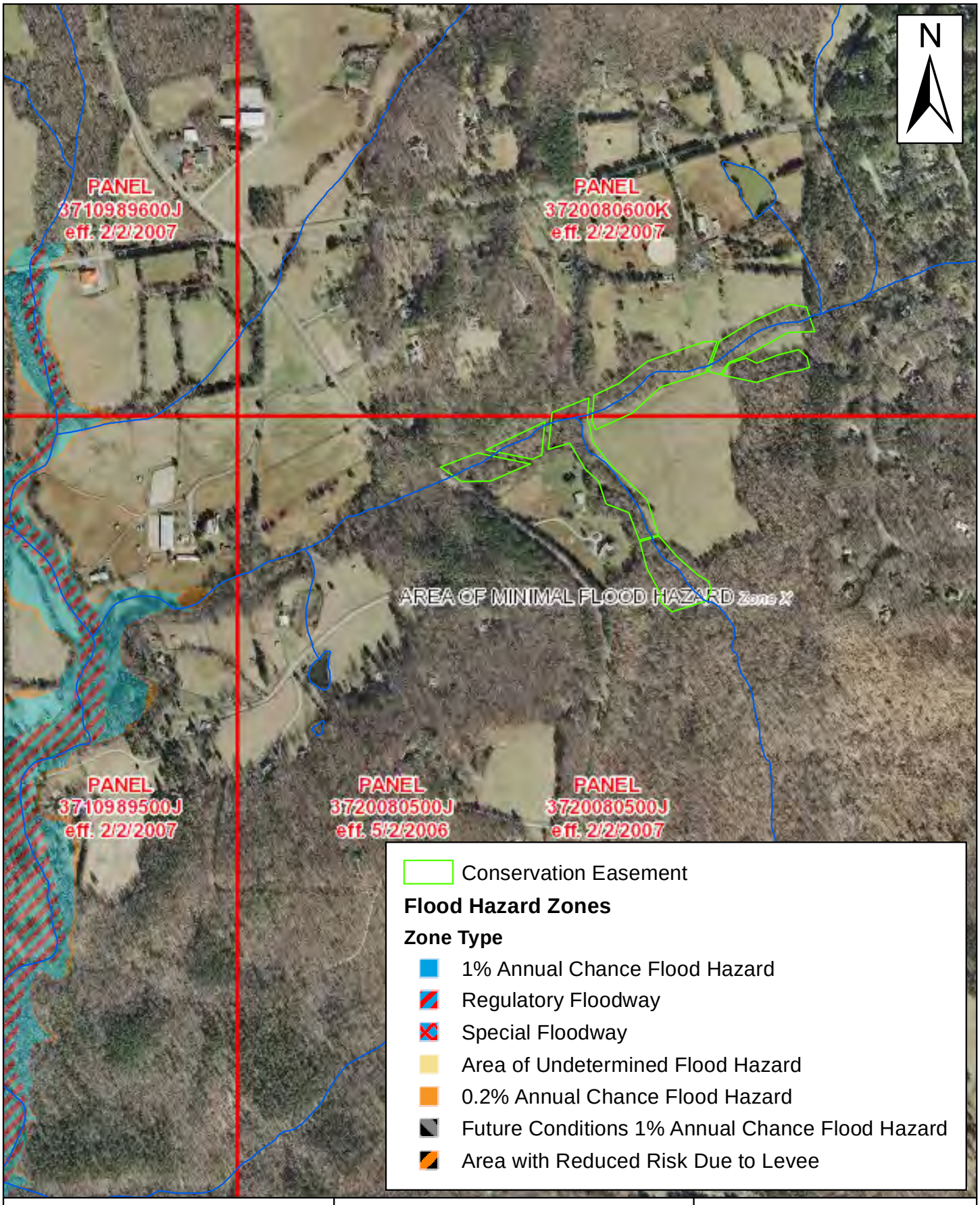


Riparian Buffer Widths		
Reach	Reach Length (ft)	Narrow Buffer (<25 ft)
R1	2,925	52.9%
R2	590	63.6%
R3	1,697	29.2%
T1, T2, T3, T4	750	0.0%
Combined	5,962	40.5%

Michael Baker INTERNATIONAL

0 250 500 Feet

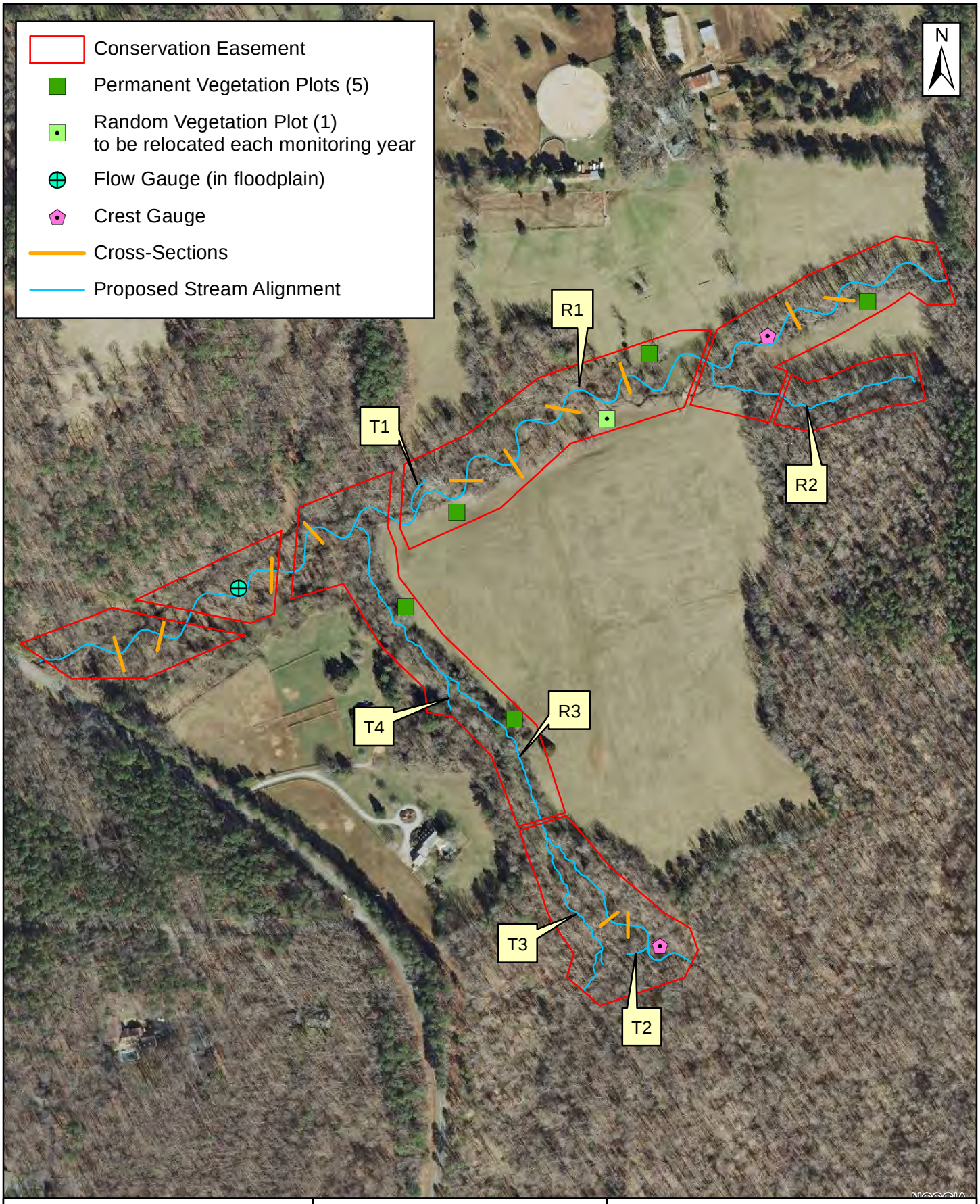
Figure 12
Existing Riparian Buffers
Lochill Farm Site



Michael Baker INTERNATIONAL

0 500 1,000 Feet

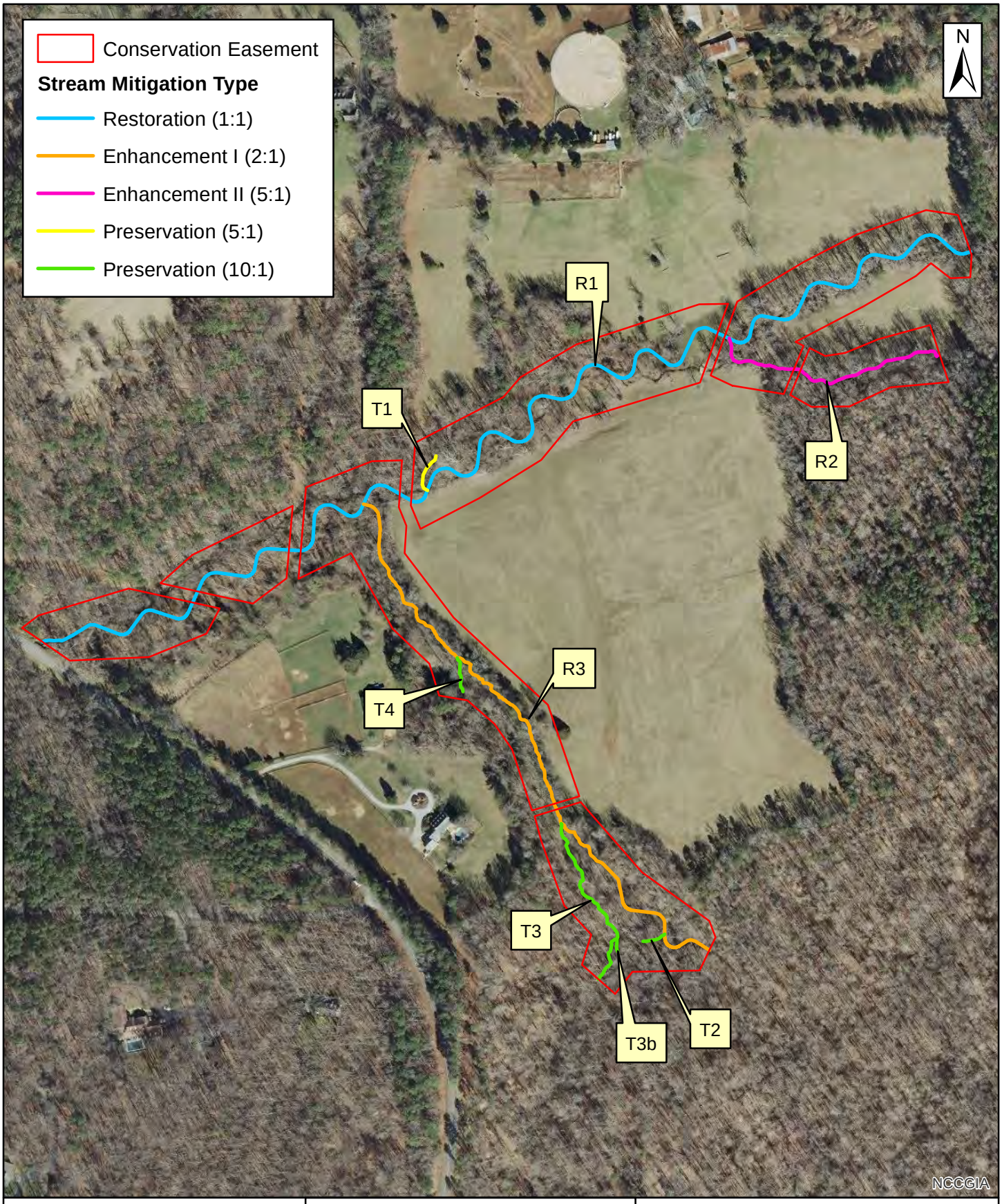
Figure 13
FEMA Floodplain Map
Lochill Farm Site



Michael Baker INTERNATIONAL

0 250 500 Feet

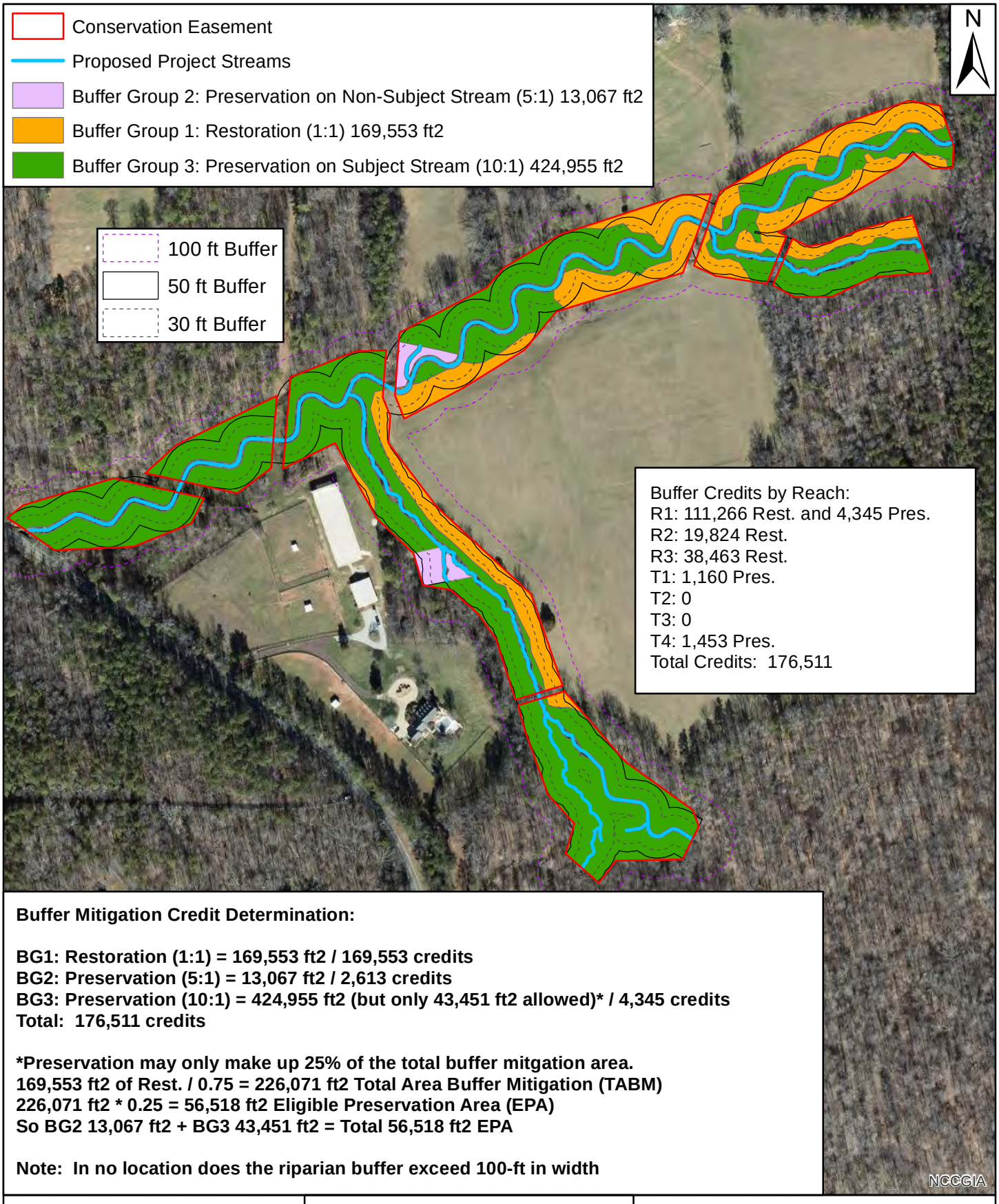
Figure 14
Proposed Monitoring Features
Lochill Farm Site



Michael Baker INTERNATIONAL

0 250 500 Feet

Figure 15A
Project Asset and Credits Map
(Stream Credits)
Lochill Farm Site



Buffer Mitigation Credit Determination:

BG1: Restoration (1:1) = 169,553 ft2 / 169,553 credits
BG2: Preservation (5:1) = 13,067 ft2 / 2,613 credits
BG3: Preservation (10:1) = 424,955 ft2 (but only 43,451 ft2 allowed)* / 4,345 credits
Total: 176,511 credits

***Preservation may only make up 25% of the total buffer mitgation area.**
169,553 ft2 of Rest. / 0.75 = 226,071 ft2 Total Area Buffer Mitigation (TABM)
226,071 ft2 * 0.25 = 56,518 ft2 Eligible Preservation Area (EPA)
So BG2 13,067 ft2 + BG3 43,451 ft2 = Total 56,518 ft2 EPA

Note: In no location does the riparian buffer exceed 100-ft in width

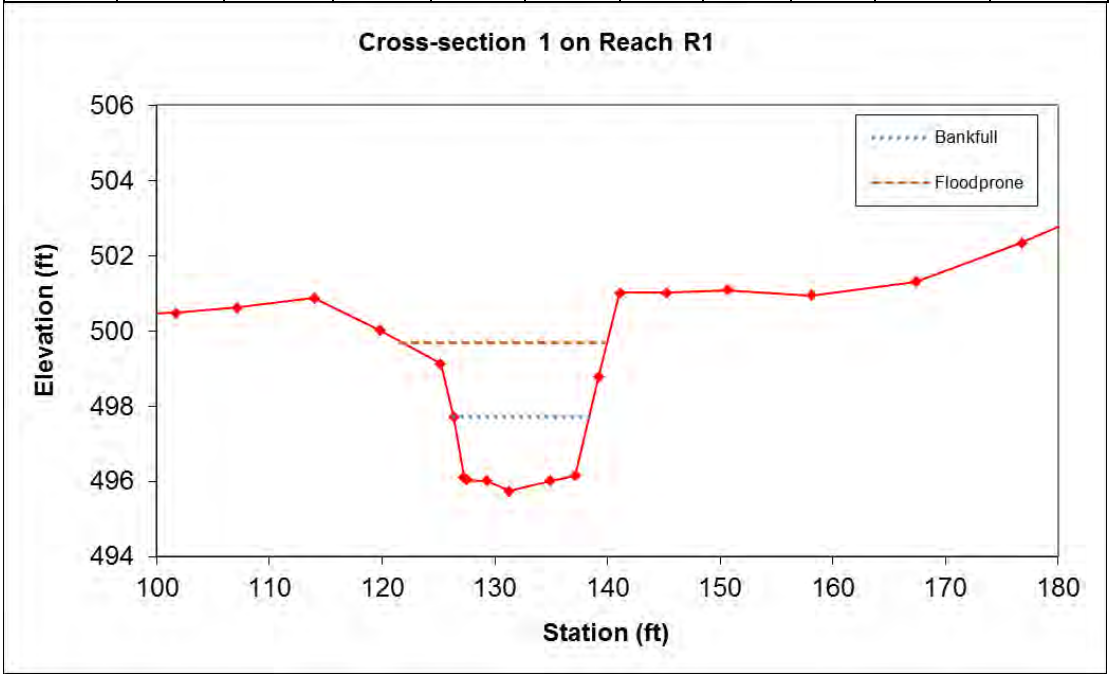
Michael Baker INTERNATIONAL

0 125 250 500 Feet

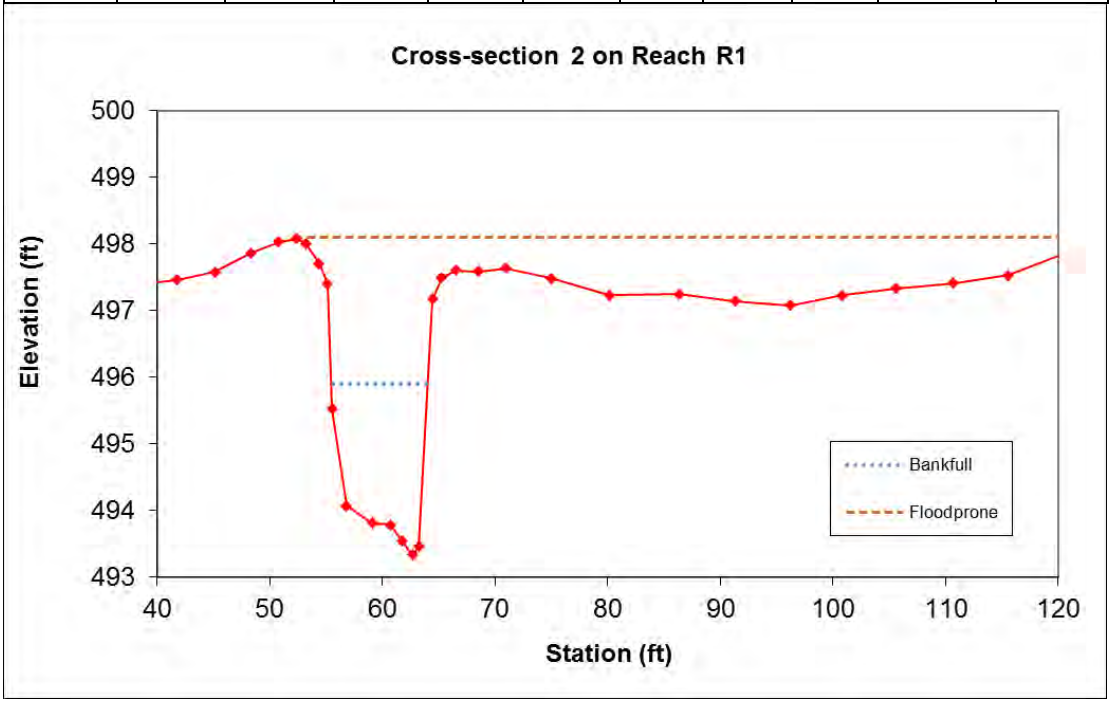
Figure 15B
Project Asset and Credits Map
(Riparian Buffers)
Lochill Farm Site

Lochill Farm Surveyed Cross-Sections:

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	19.15	12.04	1.59	1.97	7.57	2.6	1.52	497.72	501.02

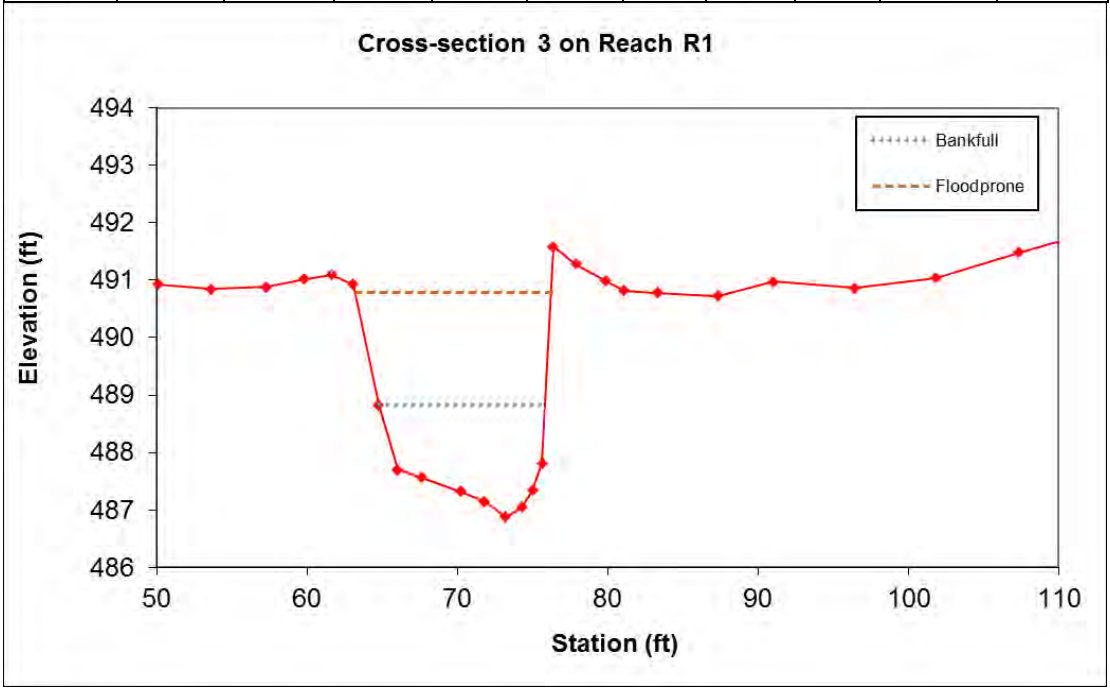


Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	19.6	10.1	1.94	2.64	5.2	1.7	8.52	495.92	497.6

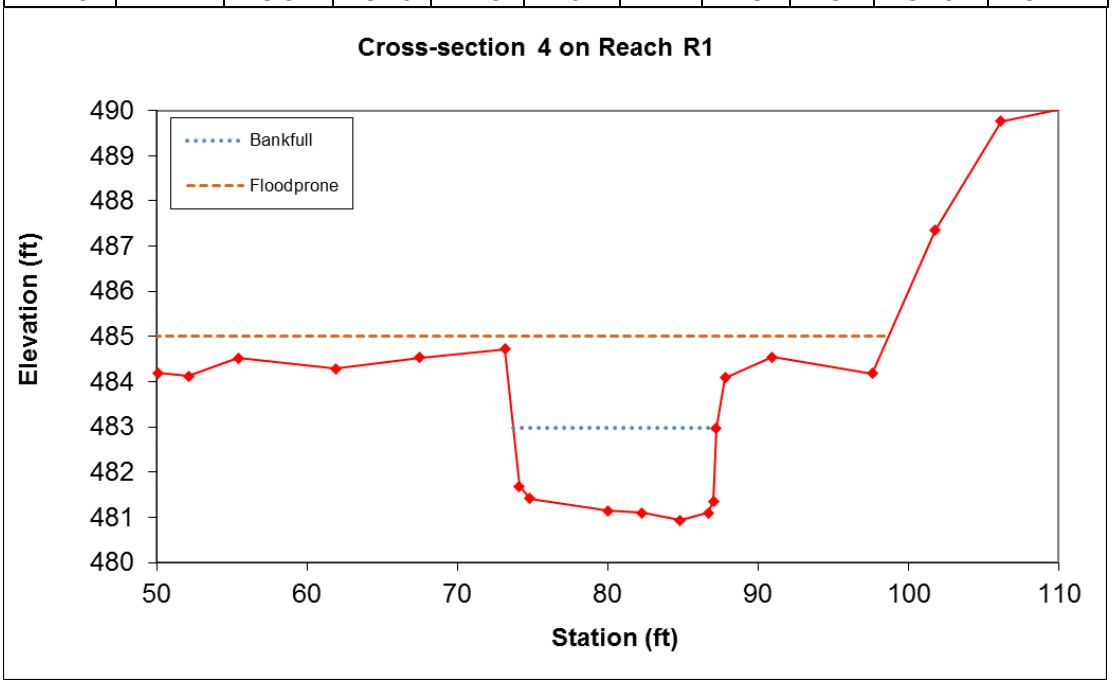


Lochill Farm Surveyed Cross-Sections:

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	15.36	11.06	1.39	1.95	7.96	2.1	2.91	488.83	491.1

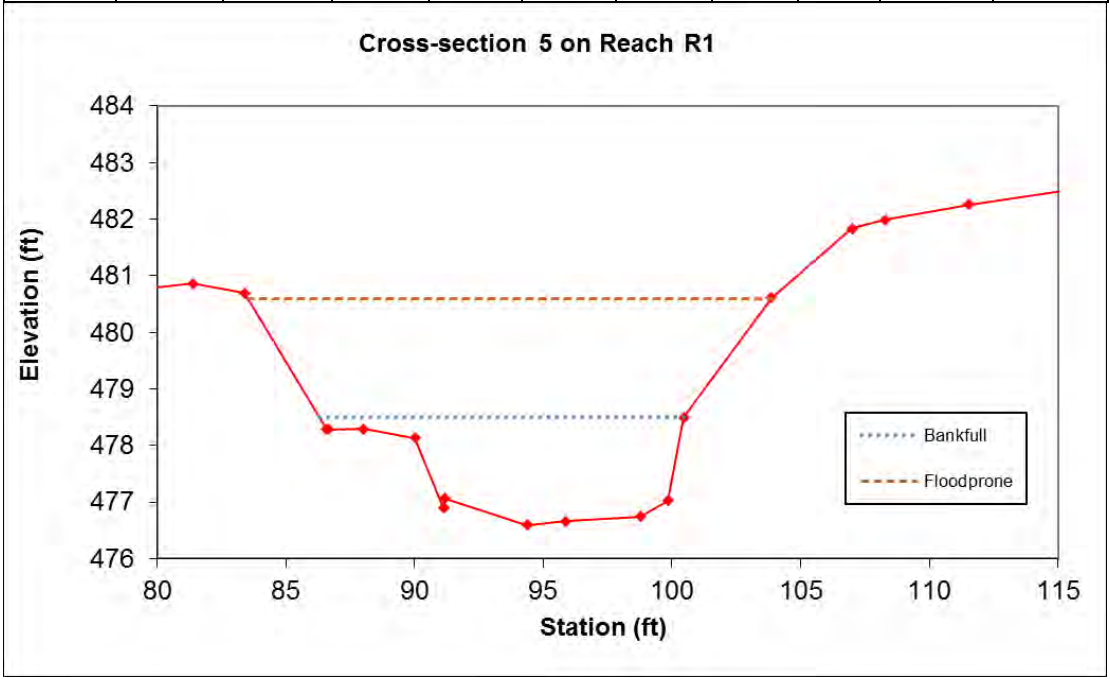


Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	23.57	13.49	1.75	2.04	7.71	1.8	7.32	482.97	484.72

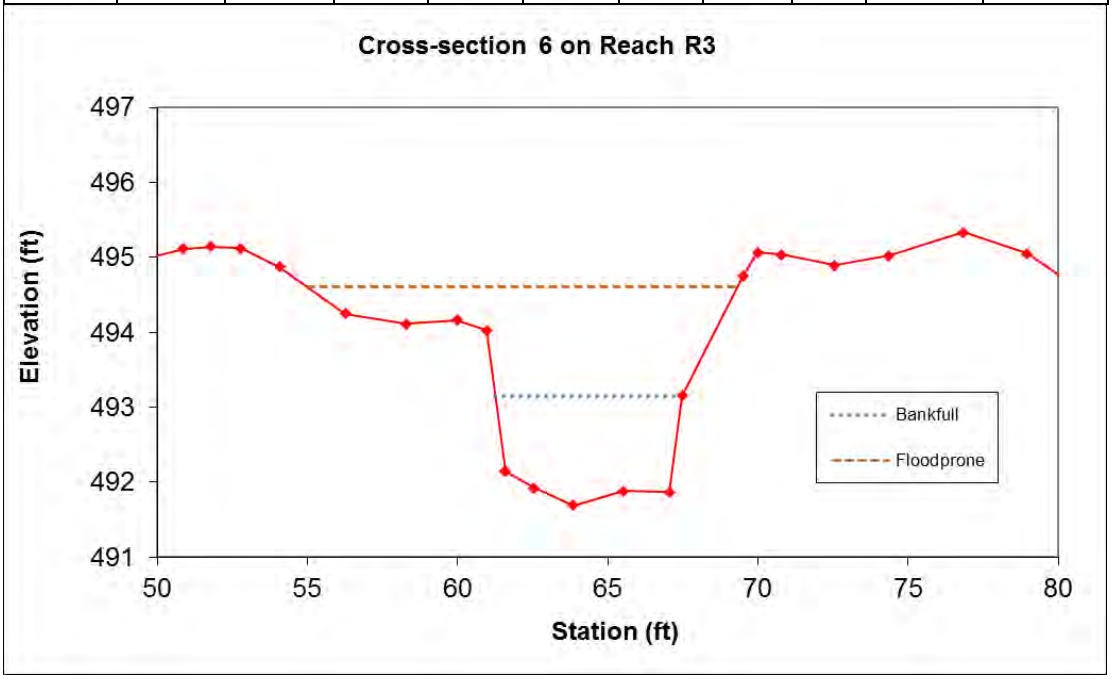


Lochill Farm Surveyed Cross-Sections:

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	20.21	14.68	1.38	2.09	10.64	2.2	5.84	478.68	480.77

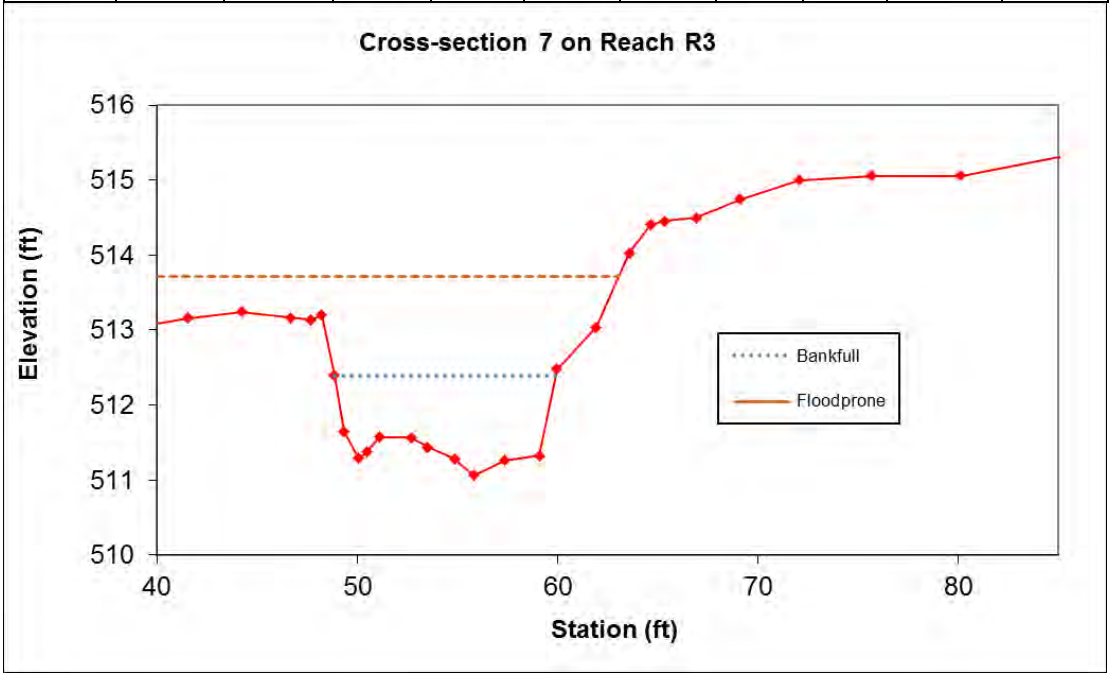


Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	7.5	6.23	1.2	1.46	5.19	1.7	2.3	493.15	494.16

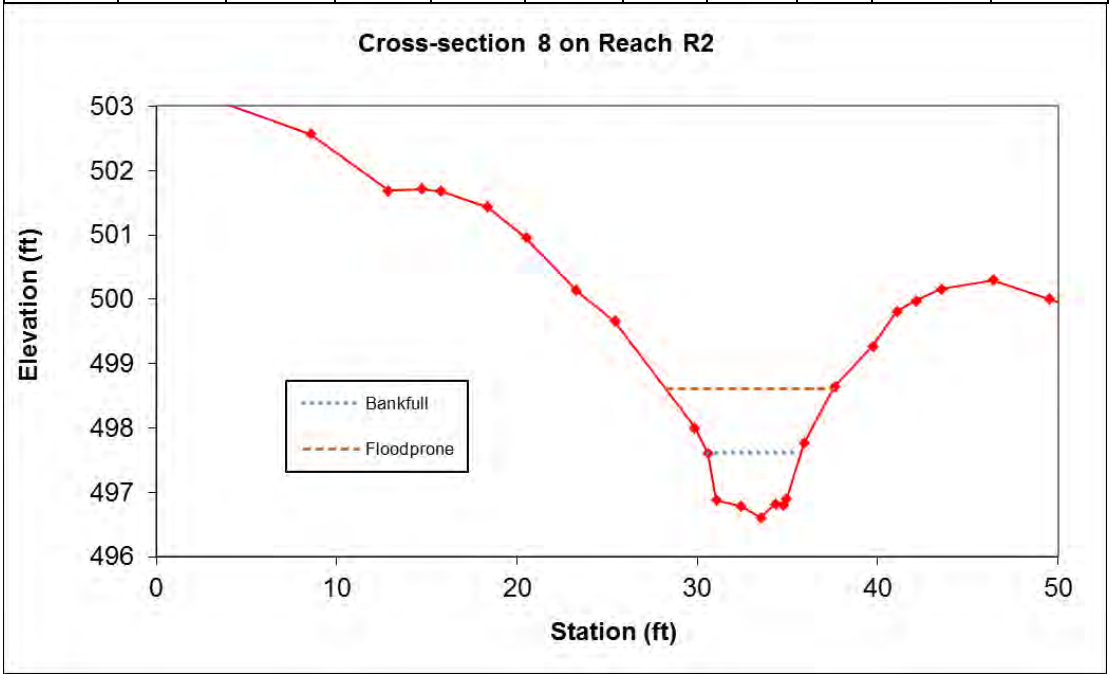


Lochill Farm Surveyed Cross-Sections:

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	10.66	11.02	0.97	1.33	11.36	1.6	5.47	512.39	513.2



Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	B	3.74	5.17	0.72	1	7.18	3.7	1.8	497.61	500.3



Reach R1, view of crossing at top of reach

Reach R1, view downstream

Reach R1, view downstream

Reach R1, view of steep bank

Reach R1, view downstream

Reach R1, view downstream

Reach R1, view downstream

Reach R1, view of vertical bank

Reach R1, view downstream

Reach R1, view downstream

Reach R1, view downstream

Reach R2, view of seep pool origin

Reach R2, view downstream

Reach R2, view upstream

Reach T3, view of eroding pipe crossing near top of reach

Reach R3, view upstream

Reach R3, view of steep bank

Reach R3, view of steep bank

Reach R3, view upstream of pipe disconnect

Reach R3, view upstream

Reach R3, view downstream

Reach R3, view downstream

Reach R3, view downstream

Reach R3, view of vertical bank

Reach T1, view of seep pool origin

Reach T1, view downstream

Reach T2, view downstream in winter

Reach T2, view upstream in summer

Reach T3, headcut at top of reach

Reach T3b, view upstream (arrow indicates seep origin)

Reach T3, view downstream

Reach T3, view downstream

Reach T3, view downstream

Reach T4, view upstream

Reach T4, view downstream from seep origin

Appendix B

Site Protection Instrument

Site Protection Instrument

The land required for the construction, management, and stewardship of this mitigation project includes portions of the parcels listed below in Table B.1. The conservation easement boundaries are shown in Figure B.1, and copies of the recorded survey plat are provided below.

Table B.1 Site Protection Instrument Summary

Lochill Farm Stream Restoration Project – NCDMS Project 97083

Parcel Number	Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Numbers	Acreage Protected
CE-A	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	1.34
CE-B	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	0.98
CE-C	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	2.48
CE-D	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	3.63
CE-E	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	2.76
CE-F	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	1.10
CE-G	Jane Kelly & David W. Gilbert	0805390700	Orange	Conservation Easement	Book 6384, Page 1	2.23
CE-H	Ralph T. & Tonya W. Bruno	0805291320	Orange	Conservation Easement	Book 6384, Page 19	0.21
CE-I	Ralph T. & Tonya W. Bruno	0805291320	Orange	Conservation Easement	Book 6384, Page 19	1.16

Baker has obtained a conservation easement from the current landowners for the entire project. The easement and survey plat was reviewed and approved by NCDMS and State Property Office (SPO) and is now held by the State of North Carolina. The easement and survey plat (Deed Book 117 / Page 189) was recorded at the Orange County Courthouse on October 30, 2017. The secured conservation easement allows Baker to proceed with the restoration project and restricts the land use in perpetuity.

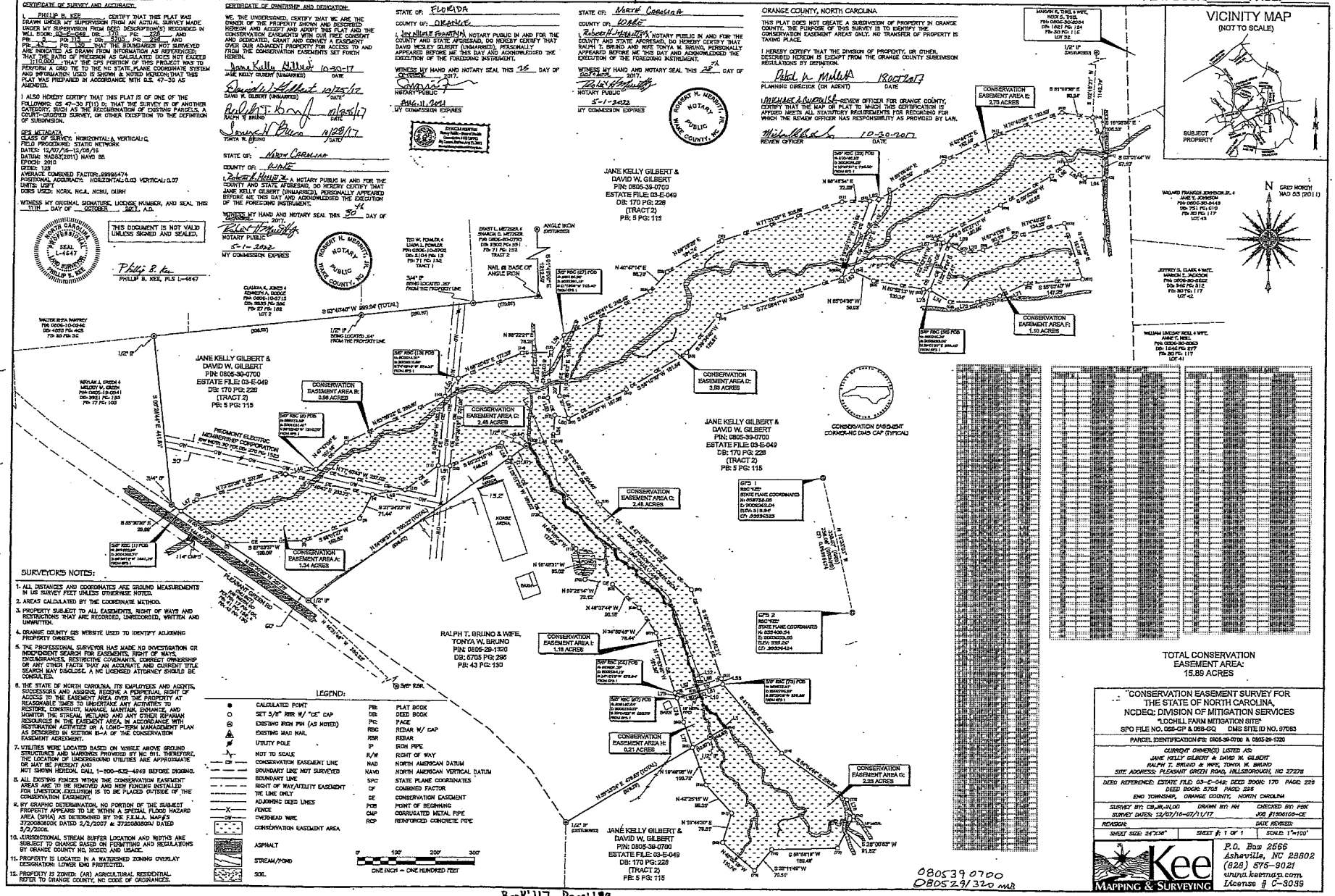
Michael Baker INTERNATIONAL

0 250 500 Feet

Figure B.1
Site Protection Instrument Map
Lochill Farm Site

BOOK: 117 Page: 189

PLAT BOOK: PAGE:



CERTIFICATE OF SURVEY AND ACCURACY:

I, PHILIP B. KEE, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION FROM DEED DESCRIPTION(S) RECORDED IN WILL BOOK: N/A PG: N/A; DB: 170 PG: 228 AND PB: 5 PG: 115; DB: 5705 PG: 296 AND PB: 43 PG: 130; THAT THE BOUNDARIES NOT SURVEYED ARE INDICATED AS DRAWN FROM INFORMATION AS REFERENCED; THAT THE RATIO OF PRECISION AS CALCULATED DOES NOT EXCEED 1:10,000; THAT THE GPS PORTION OF THIS PROJECT WAS TO PERFORM A GRID TIE TO THE NCSU STATE PLANE COORDINATE SYSTEM AND INFORMATION USED IS SHOWN & NOTED HEREON; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED.

I ALSO HEREBY CERTIFY THAT THIS PLAT IS OF ONE OF THE FOLLOWING: CS 47-30 F(11) D; THAT THE SURVEY IS OF ANOTHER CATEGORY, SUCH AS THE RECOMBINATION OF EXISTING PARCELS, A COURT-ORDERED SURVEY, OR OTHER EXCEPTION TO THE DEFINITION OF SUBDIVISION.

GPS METADATA
CLASS OF SURVEY: HORIZONTAL: A; VERTICAL: G
FIELD PROCEDURE: STATIC NETWORK
DATES: 12/07/16–12/08/16
DATUM: NAD83(2011) NAVD 88
EPOCH: 2010
GEOID: 12B
AVERAGE COMBINED FACTOR: .99986474
POSITIONAL ACCURACY: HORIZONTAL: 0.03 VERTICAL: 0.07
UNITS: USFT
CORS USED: NCRK, NCJL, NCSU, DURH

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER, AND SEAL THIS 11TH DAY OF OCTOBER, 2017, A.D.

SEAL L-4647 PROFESSIONAL LAND SURVEYOR PHILIP B. KEE

THIS DOCUMENT IS NOT VALID UNLESS SIGNED AND SEALED.

Philip B. Kee
PHILIP B. KEE, PLS L-4647

CERTIFICATE OF OWNERSHIP AND DEDICATION:

WE, THE UNDERSIGNED, CERTIFY THAT WE ARE THE OWNER OF THE PROPERTY SHOWN AND DESCRIBED HEREON AND ACCEPT AND ADOPT THIS PLAT AND THE CONSERVATION EASEMENTS WITH OUR FREE CONSENT AND DEDICATED, GRANT AND CONVEY A EASEMENT OVER OUR ADJACENT PROPERTY FOR ACCESS TO AND FROM THE CONSERVATION EASEMENTS SET FORTH HEREIN.

Jane Kelly Gilbert 10-30-17
JANE KELLY GILBERT (UNMARRIED) DATE

David W. Gilbert 10/25/17
DAVID W. GILBERT (UNMARRIED) DATE

Ralph T. Bruno 11/28/17
RALPH T. BRUNO DATE

Tonya W. Bruno 11/28/17
TONYA W. BRUNO DATE

STATE OF: North Carolina
COUNTY OF: Wake

I, Robert H. Merritt, a NOTARY PUBLIC IN AND FOR THE COUNTY AND STATE AFORESAID, DO HEREBY CERTIFY THAT JANE KELLY GILBERT (UNMARRIED), PERSONALLY APPEARED BEFORE ME THIS DAY AND ACKNOWLEDGED THE EXECUTION OF THE FOREGOING INSTRUMENT.

WITNESS MY HAND AND NOTARY SEAL THIS 30 DAY OF OCTOBER, 2017.

Robert H. Merritt
NOTARY PUBLIC

5-1-2022
MY COMMISSION EXPIRES

ROBERT H. MERRITT, JR. NOTARY PUBLIC WAKE COUNTY, NC

STATE OF: FLORIDA
COUNTY OF: ORANGE

I, Jennifer Fountain, a NOTARY PUBLIC IN AND FOR THE COUNTY AND STATE AFORESAID, DO HEREBY CERTIFY THAT DAVID WESLEY GILBERT (UNMARRIED), PERSONALLY APPEARED BEFORE ME THIS DAY AND ACKNOWLEDGED THE EXECUTION OF THE FOREGOING INSTRUMENT.

WITNESS MY HAND AND NOTARY SEAL THIS 15 DAY OF OCTOBER, 2017.

Jennifer Fountain
NOTARY PUBLIC

AUG. 11, 2021
MY COMMISSION EXPIRES

STATE OF: North Carolina
COUNTY OF: Wake

I, Robert H. Merritt, a NOTARY PUBLIC IN AND FOR THE COUNTY AND STATE AFORESAID, DO HEREBY CERTIFY THAT RALPH T. BRUNO AND WIFE TONYA W. BRUNO, PERSONALLY APPEARED BEFORE ME THIS DAY AND ACKNOWLEDGED THE EXECUTION OF THE FOREGOING INSTRUMENT.

WITNESS MY HAND AND NOTARY SEAL THIS 28 DAY OF OCTOBER, 2017.

Robert H. Merritt
NOTARY PUBLIC

5-1-2022
MY COMMISSION EXPIRES

ROBERT H. MERRITT, JR. NOTARY PUBLIC WAKE COUNTY, NC

ORANGE COUNTY, NORTH CAROLINA

THIS PLAT DOES NOT CREATE A SUBDIVISION OF PROPERTY IN ORANGE COUNTY. THE PURPOSE OF THIS SURVEY IS TO IDENTIFY THE CONSERVATION EASEMENT AREAS ONLY. NO TRANSFER OF PROPERTY IS TAKING PLACE.

I HEREBY CERTIFY THAT THE DIVISION OF PROPERTY, OR OTHER, DESCRIBED HEREON IS EXEMPT FROM THE ORANGE COUNTY SUBDIVISION REGULATIONS BY DEFINITION.

Patsy W. Mallette 10/27/2017
PLANNING DIRECTOR (OR AGENT) DATE

Michael J. Roberts 10-30-2017
REVIEW OFFICER DATE

I/MICHAEL J. ROBERTS, REVIEW OFFICER FOR ORANGE COUNTY, CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATION IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING FOR WHICH THE REVIEW OFFICER HAS RESPONSIBILITY AS PROVIDED BY LAW.

SURVEYOR'S NOTES:

1. ALL DISTANCES AND COORDINATES ARE GROUND MEASUREMENTS IN US SURVEY FEET UNLESS OTHERWISE NOTED.
2. AREAS CALCULATED BY THE COORDINATE METHOD.
3. PROPERTY SUBJECT TO ALL EASEMENTS, RIGHT OF WAYS AND RESTRICTIONS THAT ARE RECORDED, UNRECORDED, WRITTEN AND UNWRITTEN.
4. ORANGE COUNTY GIS WEBSITE USED TO IDENTIFY ADJOINING PROPERTY OWNERS.
5. THE PROFESSIONAL SURVEYOR HAS MADE NO INVESTIGATION OR INDEPENDENT SEARCH FOR EASEMENTS, RIGHT OF WAYS, ENCUMBRANCES, RESTRICTIVE COVENANTS, CORRECT OWNERSHIP OR ANY OTHER FACTS THAT AN ACCURATE AND CURRENT TITLE SEARCH MAY DISCLOSE. A NC LICENSED ATTORNEY SHOULD BE CONSULTED.
6. THE STATE OF NORTH CAROLINA, ITS EMPLOYEES AND AGENTS, SUCCESSORS AND ASSIGNS, RECEIVE A PERPETUAL RIGHT OF ACCESS TO THE EASEMENT AREA OVER THE PROPERTY AT REASONABLE TIMES TO UNDERTAKE ANY ACTIVITIES TO RESTORE, CONSTRUCT, MANAGE, MAINTAIN, ENHANCE, AND MONITOR THE STREAM, WETLAND AND ANY OTHER RIPARIAN RESOURCES IN THE EASEMENT AREA, IN ACCORDANCE WITH RESTORATION ACTIVITIES OR A LONG-TERM MANAGEMENT PLAN AS DESCRIBED IN SECTION III-A OF THE CONSERVATION EASEMENT AGREEMENT.
7. UTILITIES WERE LOCATED BASED ON VISIBLE ABOVE GROUND STRUCTURES AND MARKINGS PROVIDED BY NC 811. THEREFORE, THE LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE OR MAY BE PRESENT AND NOT SHOWN HEREON. CALL 1-800-632-4949 BEFORE DIGGING.
8. ALL EXISTING FENCES WITHIN THE CONSERVATION EASEMENT AREAS ARE TO BE REMOVED AND NEW FENCING INSTALLED FOR LIVESTOCK EXCLUSION IS TO BE PLACED OUTSIDE OF THE CONSERVATION EASEMENT.
9. BY GRAPHIC DETERMINATION, NO PORTION OF THE SUBJECT PROPERTY APPEARS TO LIE WITHIN A SPECIAL FLOOD HAZARD AREA (SFHA) AS DETERMINED BY THE FEMA, MAP #'S 3720068600K DATED 2/2/2007 & 3720068500J DATED 5/2/2006.
10. JURISDICTIONAL STREAM BUFFER LOCATION AND WIDTHS ARE SUBJECT TO CHANGE BASED ON PERMITTING AND REGULATIONS BY ORANGE COUNTY NC, NCDEQ AND USACE.
11. PROPERTY IS LOCATED IN A WATERSHED ZONING OVERLAY DESIGNATION: LOWER ENO PROTECTED.
12. PROPERTY IS ZONED: (AR) AGRICULTURAL RESIDENTIAL. REFER TO ORANGE COUNTY, NC CODE OF ORDINANCES.

LEGEND:

●	CALCULATED POINT	PB:	PLAT BOOK
○	SET 5/8" REBAR W/ "CE" CAP	DB	DEED BOOK
⊗	EXISTING IRON PIN (AS NOTED)	PG:	PAGE
▲	EXISTING MAG NAIL	RBC	REBAR W/ CAP
✗	UTILITY POLE	RBR	REBAR
⊥	NOT TO SCALE	IP	IRON PIPE
—CE—	CONSERVATION EASEMENT LINE	R/W	RIGHT OF WAY
	BOUNDARY LINE NOT SURVEYED	NAD	NORTH AMERICAN DATUM
	BOUNDARY LINE	NAVD	NORTH AMERICAN VERTICAL DATUM
	RIGHT OF WAY/UTILITY EASEMENT	SPC	STATE PLANE COORDINATES
	TIE LINE ONLY	CF	COMBINED FACTOR
	ADJOINING DEED LINES	CE	CONSERVATION EASEMENT
—X—	FENCE	POB	POINT OF BEGINNING
—OH—	OVERHEAD WIRE	CMP	CORRUGATED METAL PIPE
	CONSERVATION EASEMENT AREA	RCP	REINFORCED CONCRETE PIPE
	ASPHALT		
	STREAM/POND		
	SOIL		

0' 100' 200' 300'
ONE INCH = ONE HUNDRED FEET

"CONSERVATION EASEMENT SURVEY FOR THE STATE OF NORTH CAROLINA, NCDEQ: DIVISION OF MITIGATION SERVICES "LOCHILL FARM MITIGATION SITE"

SPO FILE NO. 058-GP & 058-GQ DMS SITE ID NO. 97083

PARCEL IDENTIFICATION #'S: 0805-39-0700 & 0805-29-1320

CURRENT OWNER(S) LISTED AS:
JANE KELLY GILBERT & DAVID W. GILBERT
RALPH T. BRUNO & WIFE, TONYA W. BRUNO
SITE ADDRESS: PLEASANT GREEN ROAD, HILLSBOROUGH, NC 27278

DEED REFERENCE: ESTATE FILE: 03-E-049; DEED BOOK: 170 PAGE: 228
DEED BOOK: 5705 PAGE: 296
END TOWNSHIP, ORANGE COUNTY, NORTH CAROLINA

SURVEY BY: CB,JR,JL,DO	DRAWN BY: MH	CHECKED BY: PBK
SURVEY DATES: 12/07/16–07/11/17		JOB #1906106–CE
REVISION:		DATE REVISED:
SHEET SIZE: 24"X36"	SHEET #: 1 OF 1	SCALE: 1"=100'

Kee MAPPING & SURVEYING
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Asheville, NC 28802
(828) 575-9021
www.keemap.com
License # C-3098

080539 0700
080529/320 MB

BOOK: 117 Page: 189

Appendix C

Credit Release Schedule

APPENDIX C: CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the NCIRT, 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 in Table C.1 as follows:

Table C.1 Stream Credit Release Schedule
Lochill Farm Stream Restoration Project - NCDMS Project No. 97083

Credit Release Milestone	Release Activity	ILF/NCDMS	
		Interim Release	Total Released
1	Site Establishment	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, and performance standards have been met and project has been approved for closeout	10%	90% (100%**)

*Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

**10% reserve of credits to be held back until the bankfull event performance standard has been met.

Appendix D

Financial Assurance

Appendix D: Financial Assurance

Pursuant to Section IV H and Appendix III of the NC Division of Mitigation Services' In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environmental Quality has provided the USACE-Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by NCDMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

Appendix E

Maintenance Plan

Appendix E: Maintenance Plan

The site will be monitored on a regular basis and a physical inspection of the site will be performed at least once a 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 is most likely to be expected in the first two years following site construction and may include the following components as described below in Table E.1:

Table E.1 Routine Maintenance Components
Lochill Farm Stream Restoration Project - NCDMS Project No. 97083

Component/Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include modifying in-stream structures to prevent piping, securing loose coir matting, and supplemental installations of live stakes and other target vegetation along the project reaches. Areas of concentrated stormwater and floodplain flows that intercept the channel may also require maintenance to prevent streambank failures and head-cutting until vegetation becomes established.
Wetland	N/A
Vegetation	Vegetation will be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, and fertilizing. Exotic invasive plant species will be controlled by mechanical and/or chemical methods. Any invasive plant species control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Site Boundary	Site boundaries will be demarcated in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries shall be identified by fence, marker, bollard, post, 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.
Farm Road Crossing	The farm road crossings within the site may be maintained only as allowed by the recorded Conservation Easement, deed restrictions, rights of way, or corridor agreements.
Beaver Management	Routine maintenance and repair activities caused by beaver activity may include supplemental planting, pruning, and dam breeching, dewatering, and/or removal. Beaver management will be performed in accordance with US Department of Agriculture (USDA) rules and regulations using accepted trapping and removal techniques only within the project boundary.

Appendix F

DWR Stream ID Forms, and DWR Site Viability for Buffer Mitigation Letter

DWR Stream Identification Form Summary						
Location	Geomorphology	Hydrology	Biology	Total	Result	Comments
R1 Upper	20.5	8	9.5	38	Perennial	
R1 Middle	18	9	12.75	39.75	Perennial	
R1 Lower	22	8	10	40	Perennial	
R2	8.5	5.5	8.75	22.75	Intermitent	Spring fed reach
R3 Upper	16	8	8.5	32.5	Perennial	
R3 Lower	15	9.5	8.5	33	Perennial	
T1	6.25	6.5	12.5	25.25	Intermitent	Spring fed reach
T2	7	9	10.5	26.5	Intermitent	Spring fed reach
T3	10.5	9.5	10	30	Perennial	Spring fed reach
T4	14.5	8.25	12	34.75	Perennial	Spring fed reach

Lochill Farm Site
Orange County, NC
03020201-030030

0 125 250 500
Feet

DWR Stream ID Form
Location Map
Lochill Farm Site

R1 (upper)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11 X1 - FINCHER BR.

Date: 7/22/15	**Project/Site:** Lochil	**Latitude:** 36.1144
Evaluator: KS/SK	**County:** Orange	**Longitude:** -78.9884
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 38	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Northwest Durham *e.g. Quad Name:* USGS

A. Geomorphology (Subtotal = 20.5)	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

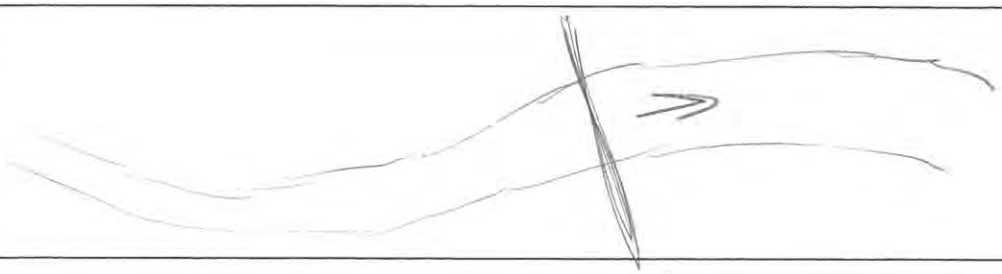
B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9.5)				
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:



X1

R1 (middle)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11 X3 FINCHER BR

Date: 7/22/15	**Project/Site:** Lochill	**Latitude:** 36.1133
Evaluator: KS	**County:** Orange	**Longitude:** -78.9915
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 39.75	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Northwest Durham *e.g. Quad Name:* USGS

A. Geomorphology (Subtotal = 18)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 12.75)				
18. Fibrous roots in streambed	(3)	2	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	(3)
22. Fish	0	0.5	(1)	1.5
23. Crayfish	(0)	0.5	(1)	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes:

Sketch:

R1 (lower)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11 X4 FINCHER BR.

Date: 7/22/15	**Project/Site:** Lochill	**Latitude:** 36.1124
Evaluator: KCS	**County:** Orange	**Longitude:** -78.9940
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 40	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** Northwest Durham *e.g. Quad Name:* USGS

A. Geomorphology (Subtotal = 22)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

B. Hydrology (Subtotal = 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 = 10)				
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:

R2

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11 X2 - UT to FINCHER BR

Date: 7/22/15	**Project/Site:** Lochill	**Latitude:** 36.1137
Evaluator: KS + SK	**County:** Orange	**Longitude:** -78.9886
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 22.75	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* Northwest Durham USGS

A. Geomorphology (Subtotal = 8.5)	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

8.5

B. Hydrology (Subtotal = 5.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 8.75)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

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

Notes:

Sketch: DAM DRAGONFLY NYMPH

R3 (upper)

NC Division of Water Quality –Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11 X5 UT to Fincher Branch

Date: 7/22/15	**Project/Site:** Lochill Farm	**Latitude:** 36.1108
Evaluator: KS	**County:** Orange	**Longitude:** -78.9910
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32.5	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Northwest Durham *e.g. Quad Name:* USGS

A. Geomorphology (Subtotal = 16)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	(3)
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	2	(3)
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	(0)	0.5	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	(0)	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 8.5)				
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: water penny, riffle beetle, mayfly, caddisfly

R3 (lower)

NC DWQ Stream Identification Form Version 4.11 at X-Section #6

Date: 8/18/15	**Project/Site:** Lochill Farm	**Latitude:** 36.1124
Evaluator: S. King	**County:** Orange	**Longitude:** -78.9924
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 33	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Northwest Durham *e.g. Quad Name:* USGS Quad

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	1	(2)	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	(0.5)	1	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

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

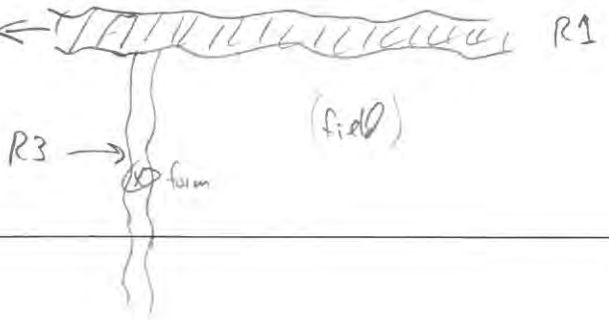
B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 8.5)				
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 spotted just above farm location	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 (none)			

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

Notes:

Sketch:



T1

NC DWQ Stream Identification Form Version 4.11

Date: 8/18/15	**Project/Site:** Ludhill Farm	**Latitude:** 36.1132
Evaluator: S. King	**County:** Orange	**Longitude:** -78.992
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 25.25	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** Northwest Durham *e.g. Quad Name:* USGS Quad

A. Geomorphology (Subtotal = 6.25)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	(1)	2	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	(1)	2	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	(No = 0)		Yes = 3	

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

18/12 = 1.5

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 = 12.5)				
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 (snails)	0	(1)	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish chimneys present	0	0.5	(1)	1.5
24. Amphibians lots of frogs	0	0.5	(1)	1.5
25. Algae	0	0.5	1	(1.5)
26. Wetland plants in streambed	FACW = 0.75; (OBL = 1.5) Other = 0			

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

Notes: * lizard tail * false nettle

Sketch:

T1 is clearly spring-fed

T2

NC DWQ Stream Identification Form Version 4.11

Date: 8/18/15	**Project/Site:** Lochill Farm	**Latitude:** 36.1098
Evaluator: S. King	**County:** Orange	**Longitude:** -78.9903
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 26.5	**Stream Determination (circle one)** * Ephemeral (Intermittent) Perennial	**Other** Northwest Durham *e.g. Quad Name:* USGS Quad

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 = 9)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	1.5	(1)	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

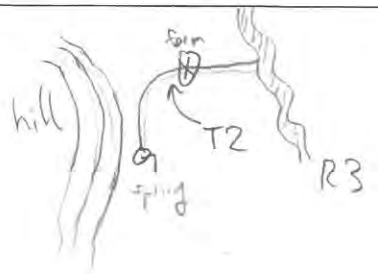
C. Biology (Subtotal = 10.5)				
18. Fibrous roots in streambed	(3)	(2)	1	0
19. Rooted upland plants in streambed	(3)	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	(2)	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	0	(0.5)	1	1.5
24. Amphibians	0	0.5	(1)	1.5
25. Algae	(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: * lizard tail + false nettle

Sketch: stream originates at a spring fed wetland complex at the base/toe of a hillside. Significant water flowing in August in a dry spell!

Note: Trib is perennial in that it clearly flows year-round but still rates as intermittent in the form for geomorphology issues.



T2 is a trib to R3 (upper)

T3

NC DWQ Stream Identification Form Version 4.11

Date: 8/18/15	**Project/Site:** Cockhill Farm	**Latitude:** 36.1103
Evaluator: S. King	**County:** Orange	**Longitude:** -78.9908
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Northwest Durham *e.g. Quad Name:* USGS Quad

A. Geomorphology (Subtotal = 10.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	(2)	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	0	(1)	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	(1)	1.5
11. Second or greater order channel	No = 0		Yes = 3	

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

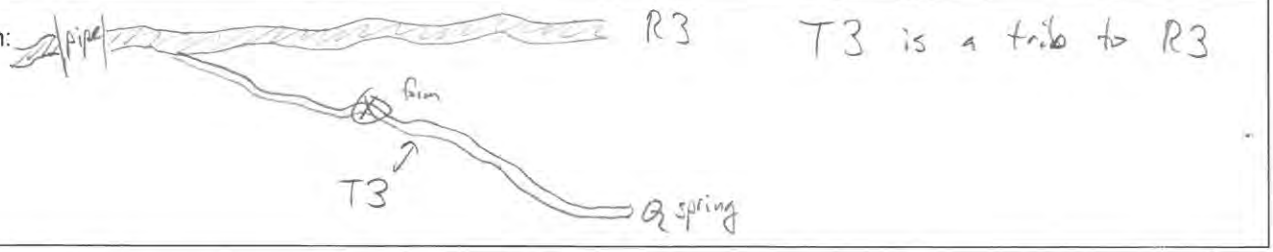
B. Hydrology (Subtotal = 9.5)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	1	(2)	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 10)				
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: * (rattail fern, false nettle, sensitive fern, green ash (on bank slopes))

Sketch:



T3 is a trib to R3

Although T3 scores close to Intermittent, it is clearly spring fed (and has good flow after long dry spell in August). It clearly appears to flow year round.

T4

NC DWQ Stream Identification Form Version 4.11

Date: 8/18/15	**Project/Site:** Lochill Farm	**Latitude:** 36.1116
Evaluator: S. King	**County:** Orange	**Longitude:** -78.9918
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 34.75	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** Northwest Durham *e.g. Quad Name:* USGS Quad

A. Geomorphology (Subtotal = 14.5)	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

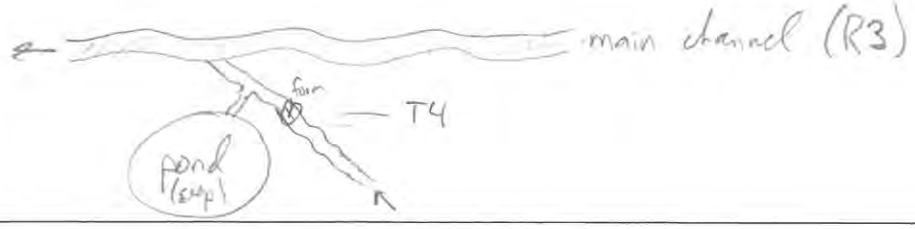
B. Hydrology (Subtotal = 8.25)				
12. Presence of Baseflow	0	1	(2)	3
13. Iron oxidizing bacteria	0	(1)	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	(0.5)	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 12)				
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: * false red

Sketch:



Note: T4 is a spring/seep fed trib to R3

Water Resources
ENVIRONMENTAL QUALITY

PAT MCCRORY
Governor
DONALD R. VAN DER VAART
Secretary
S. JAY ZIMMERMAN
Director

April 18, 2016

DWR Project #: 2016-0370

Jake Byers
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518
(via electronic mail)

Re: Site Viability for Buffer Mitigation & Nutrient Offset – Lochill Farm
Located at 6122 St. Mary's Rd, Hillsborough, NC
Orange County

Dear Mr. Byers,

On April 6, 2016, Katie Merritt, with the Division of Water Resources (DWR), assisted you and others from Michael Baker Engineering, Inc. at the proposed Lochill Farm Mitigation Site (Site) in Hillsborough, NC. The Site is located in the Upper Falls Watershed of the Neuse River Basin within the 8-digit Hydrologic Unit Code 03020201. The Site is being proposed as part of a full-delivery stream restoration project for the Division of Mitigation Services (RFP #16-006477). The Interagency Review Team (IRT) was also present onsite. At your request, Ms. Merritt performed a site assessment of features onsite to determine suitability for buffer and nutrient offset mitigation. Features are more accurately shown in the attached maps signed by Ms. Merritt on April 18, 2016. If approved, mitigating this site could provide stream mitigation credits, riparian buffer credits and/or nutrient offset credits.

Ms. Merritt's evaluation of the features for buffer and nutrient offset mitigation pursuant to Rule 15A NCAC 02B .0295 (effective November 1, 2015) and Rule 15A NCAC 02B .0240 is provided in the table below:

Feature	Classification	*Subject to Buffer Rule	Landuses	Buffer Credit Viable	**Nutrient Offset Viable at 2,273 lbs/acre	Mitigation Type
R1	Stream	Yes	Interior buffer = Native hardwood forest & Exterior buffer = fescue field (for hay?)	Yes	Yes (outside of forested areas)	Preservation per 15A NCAC 02B .0295 (o)(5) and Restoration (infield only)
R2	Stream	Yes	Native hardwood forest w/ managed lawn on North side b/w R1 and R2	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(5) & Restoration (in field only)

R3	Stream	Yes	Interior buffer = Native hardwood forest & Exterior buffer/eastern side = fescue field (for hay?)	Yes	Yes (outside of forested areas)	Preservation per 15A NCAC 02B .0295 (o)(5) and Restoration (in field only)
T1	Wetland then becomes a short stream segment	No	Native hardwood forest	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(4) adjacent to stream segment only
T2	Wetland	No		No	No	N/A
T3	Stream	Yes	Native hardwood forest	No	No	Preservation per 15A NCAC 02B .0295 (o)(5)
T4	Modified Natural Stream	No	Native hardwood forest	Yes	No	Preservation per 15A NCAC 02B .0295 (o)(4)

*Subjectivity calls were determined using the 1:24,000 scale quadrangle topographic map prepared by USGS and the most recent printed version of the soil survey map prepared by the NRCS

**For nutrient offset viability to be determined, the landowner must provide proof in writing that the land is being used for agriculture or has been used for agriculture previously. Dates, supported by photos or other written records, must be included to confirm that the uses of the open fescue fields onsite are for hay crop cultivation.

Maps showing the project site and the features are provided and signed by Ms. Merritt on April 18, 2016. This letter should be provided in all future mitigation plans for this Site. In addition, all vegetative plantings, performance criteria and other mitigation requirements for riparian restoration and preservation must follow the requirements in 15A NCAC 02B .0295 to be eligible for buffer and nutrient offset credits.

For any areas depicted as not being viable for nutrient offset credit, one could propose a different measure other than riparian restoration, along with supporting calculations and sufficient detail to support estimates of load reduction, for review by the DWR to determine viability for nutrient offset according to 15A NCAC 02B .0240.

Please contact Katie Merritt at (919)-807-6371 if you have any questions regarding this correspondence.

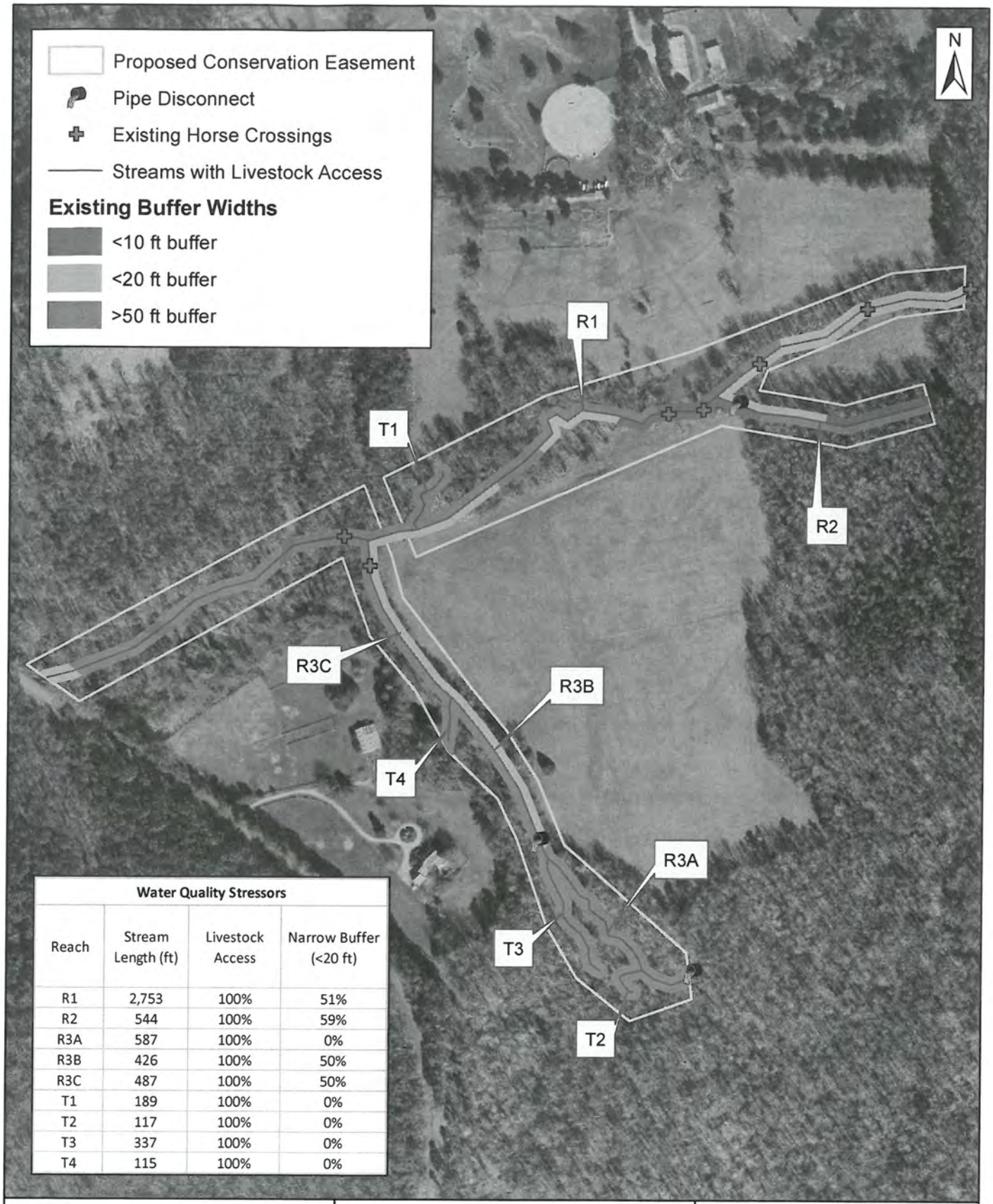
Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 and Buffer Permitting Branch

KAH/*km*
Attachments: Site Aerial Map, USGS Topographic Map, NRCS Soil Survey

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



Water Quality Stressors

Reach	Stream Length (ft)	Livestock Access	Narrow Buffer (<20 ft)
R1	2,753	100%	51%
R2	544	100%	59%
R3A	587	100%	0%
R3B	426	100%	50%
R3C	487	100%	50%
T1	189	100%	0%
T2	117	100%	0%
T3	337	100%	0%
T4	115	100%	0%

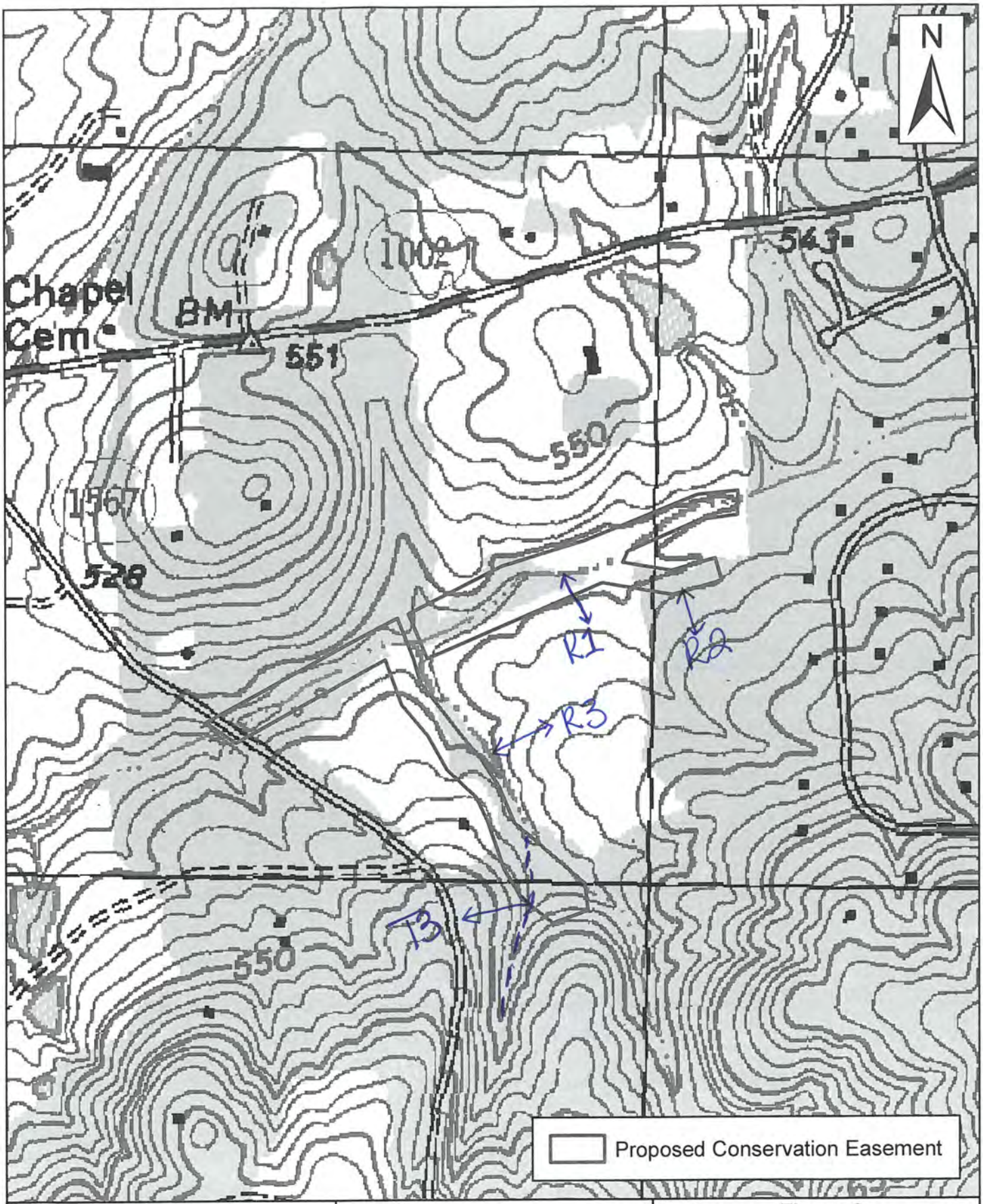
Michael Baker INTERNATIONAL

0 250 500 Feet

Figure 15
Water Quality Stressors
Lochill Farm Site

#2016-0370

4/18/16

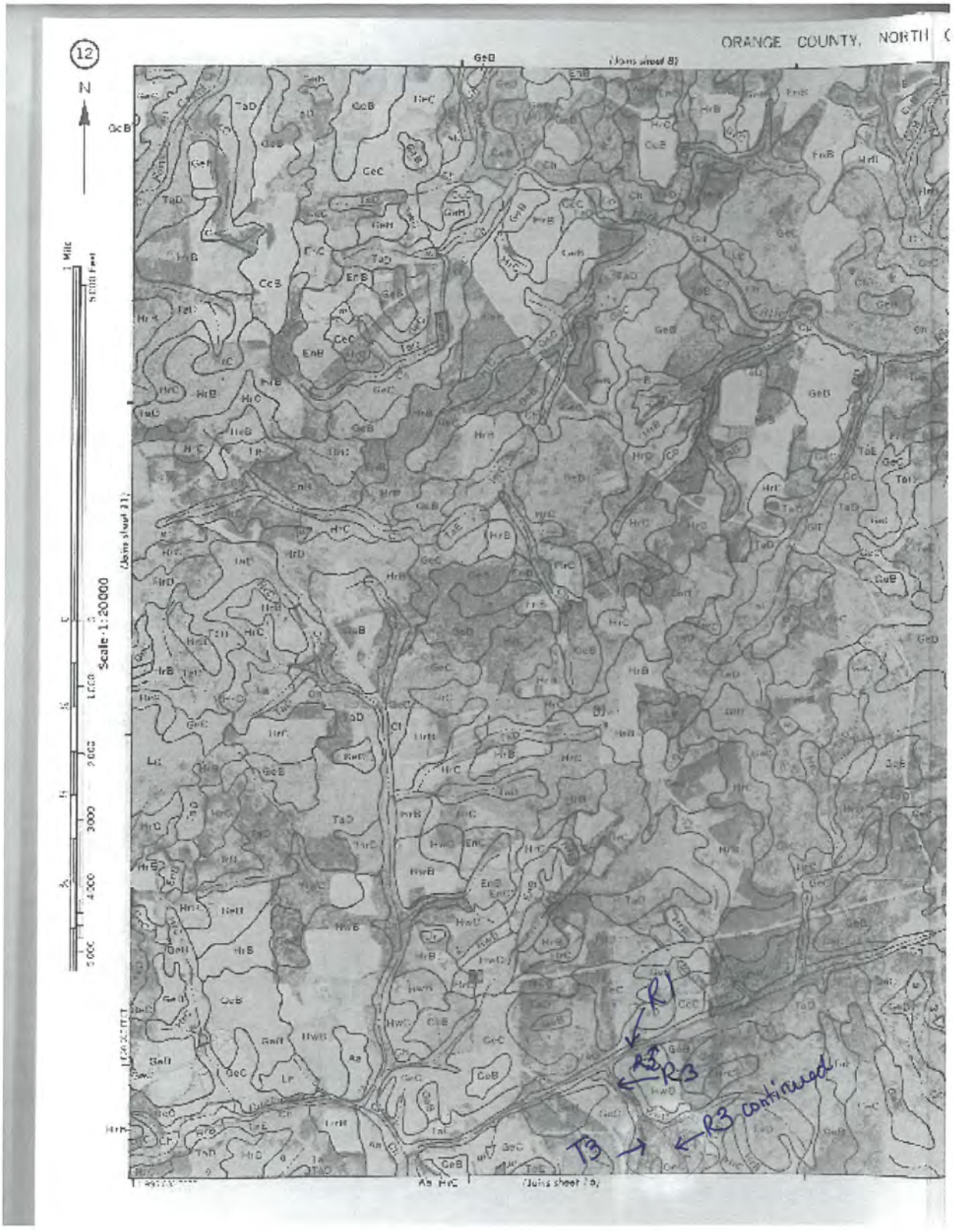


Michael Baker
INTERNATIONAL

0 500 1,000 Feet

Figure 2
USGS Topographic Map
(Northwest Durham Quad)
Lochill Farm Site

#2016-0370 RyM 4/18/16



Lochill
mitigation site
#2014-0370

Kym
4/18/14

Appendix G

USACE District Assessment Forms

Michael Baker INTERNATIONAL

0 250 500 Feet

NC-SAM and NC-WAM Site Assessment Locations Lochill Farm Site

Upper R1 (site # 1)

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.
NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:
1. Project name (if any): Cochill Farm
2. Date of evaluation: 6/22/16
3. Applicant/owner name: Baker
4. Assessor name/organization: S. King / D. Hungerford
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Buckwater Creek ~ 1/2 mile away
7. River basin: Neuse
8. Site coordinates (decimal degrees, at lower end of assessment reach): -78.9888, 36.1143

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): #1
10. Length of assessment reach evaluated (feet): ~100ft
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 5 ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 10 ft
13. Is assessment reach a swamp stream? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:
15. NC SAM Zone: ☐Mountains (M) ☒Piedmont (P) ☐Inner Coastal Plain (I) ☐Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**): ☐a (more sinuous stream, flatter valley slope) ☒b (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☒Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²) 1.0 mi²

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

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.
2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A
3. **Feature Pattern – assessment reach metric**
   - ☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
   - ☐B Not A
4. **Feature Longitudinal Profile – assessment reach metric**
   - ☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances). dams for dredging, obstacle?, significant incision!
   - ☐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 only has floodplain access around bridge downstream

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

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

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

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

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

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

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

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

Check for Tidal Marsh Streams Only

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

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

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

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

11b. Bedform evaluated. **Check the appropriate box(es).**
☒A Riffle-run section **(evaluate 11c)**
☐B Pool-glide section **(evaluate 11d)**
☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

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

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

11d. ☐Yes ☒No Are pools filled with sediment?

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

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

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

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles (including water pennies)
☐	☒	Caddisfly larvae (Trichoptera [T]) multiple
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☒	☐	Damselfly and dragonfly larvae one (found previously though)
☐	☐	Dipterans (true flies)
☒	☐	Mayfly larvae (Ephemeroptera [E]) few, maybe another big though
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*) no bivalves
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (Plecoptera [P])
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

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

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

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

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

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

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

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

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

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

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

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

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

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

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

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide narrow tree buffer, then pasture grasses
☐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. 0%
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

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

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?

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

Notes/Sketch:

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Lochill Farm (R1 Upper) | Date of Evaluation: 6/22/16

Stream Category: Pb3 | Assessor Name/Organization: S. King and D. Huneycut

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

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

Lower R1 (site #2)

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.
NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:
1. Project name (if any): Lochill Farm
2. Date of evaluation: 6/22/16
3. Applicant/owner name: Baker
4. Assessor name/organization: S King + D Harrigott
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Buckhorn Cr
7. River basin: Neuse-01
8. Site coordinates (decimal degrees, at lower end of assessment reach): -78.9937, 36.1125

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): #2
10. Length of assessment reach evaluated (feet): ~100 ft
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 5 ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 13 ft
13. Is assessment reach a swamp stream? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:
15. NC SAM Zone: ☐Mountains (M) ☒Piedmont (P) ☐Inner Coastal Plain (I) ☐Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**): ☐a (more sinuous stream, flatter valley slope) ☒b (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi²) ☐Size 2 (0.1 to < 0.5 mi²) ☒Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²) 1.6 mi²

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

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

1. **Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)**
   - ☒A Water throughout assessment reach.
   - ☐B No flow, water in pools only.
   - ☐C No water in assessment reach.
2. **Evidence of Flow Restriction – assessment reach metric**
   - ☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
   - ☒B Not A
3. **Feature Pattern – assessment reach metric**
   - ☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert). + ditching (banks)
   - ☐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). incision
   - ☐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 steep, bare sidebanks!

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 very incised, doesn't interact with floodplains on RB at all + on LB only on huge storms

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

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

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

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

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

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

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

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

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

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

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

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

11b. Bedform evaluated. **Check the appropriate box(es).**
☒A Riffle-run section **(evaluate 11c)** } section has both
☒B Pool-glide section **(evaluate 11d)**
☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

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

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

11d. ☐Yes ☒No Are pools filled with sediment?

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

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

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

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles (including water pennies)
☐	☒	Caddisfly larvae (Trichoptera [T])
☐	☐	Asian clam (*Corbicula*)
☒	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans (true flies)
☒	☐	Mayfly larvae (Ephemeroptera [E])
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*) no bivalves
☐	☒	Other fish minnows!
☐	☐	Salamanders/tadpoles
☐	☒	Snails
☐	☐	Stonefly larvae (Plecoptera [P])
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

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

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

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

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

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

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

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

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

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

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

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

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

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

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

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

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

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

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

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

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

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

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

24. Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

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

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?

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

Notes/Sketch:

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Lochill Farm (R1 Lower) | Date of Evaluation: 6/22/16

Stream Category: Pb3 | Assessor Name/Organization: S. King and D. Huneycut

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	LOW	
(2) Baseflow	HIGH	
(2) Flood Flow	LOW	
(3) Streamside Area Attenuation	LOW	
(4) Floodplain Access	LOW	
(4) Wooded Riparian Buffer	HIGH	
(4) Microtopography	NA	
(3) Stream Stability	LOW	
(4) Channel Stability	LOW	
(4) Sediment Transport	HIGH	
(4) Stream Geomorphology	LOW	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	HIGH	
(2) Baseflow	HIGH	
(2) Streamside Area Vegetation	HIGH	
(3) Upland Pollutant Filtration	HIGH	
(3) Thermoregulation	HIGH	
(2) Indicators of Stressors	NO	
(2) Aquatic Life Tolerance	HIGH	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	LOW	
(2) In-stream Habitat	LOW	
(3) Baseflow	HIGH	
(3) Substrate	HIGH	
(3) Stream Stability	LOW	
(3) In-stream Habitat	LOW	
(2) Stream-side Habitat	HIGH	
(3) Stream-side Habitat	MEDIUM	
(3) Thermoregulation	HIGH	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	LOW	

Reach R3 (Site #3)

NC SAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.
NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:
1. Project name (if any): Lochill Farm
2. Date of evaluation: 6/22/16
3. Applicant/owner name: Baker
4. Assessor name/organization: S. King / D. Hengeveld
5. County: Orange
6. Nearest named water body on USGS 7.5-minute quad: Buckhorn Creek (½ mile downstream)
7. River basin: Neuse-01
8. Site coordinates (decimal degrees, at lower end of assessment reach): -78.9921, 36.1119

STREAM INFORMATION: (depth and width can be approximations)
9. Site number (show on attached map): #3
10. Length of assessment reach evaluated (feet): ~50 ft
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 2.5 ft ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 5 ft
13. Is assessment reach a swamp stream? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:
15. NC SAM Zone: ☐Mountains (M) ☒Piedmont (P) ☐Inner Coastal Plain (I) ☐Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**): ☐a (more sinuous stream, flatter valley slope) ☒b (less sinuous stream, steeper valley slope)
17. Watershed size: (**skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi²) ☒Size 2 (0.1 to < 0.5 mi²) ☐Size 3 (0.5 to < 5 mi²) ☐Size 4 (≥ 5 mi²) 0.3 mi²

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

19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☐Yes ☒No

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

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

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

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

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

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

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

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

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.
- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

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

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

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**
- ☐A Multiple aquatic macrophytes and aquatic mosses (including liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

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

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

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

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

11b. Bedform evaluated. **Check the appropriate box(es).**
- ☒A Riffle-run section **(evaluate 11c)**
- ☐B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

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

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

11d. ☐Yes ☒No Are pools filled with sediment?

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

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

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

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

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

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

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

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

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

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

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

- ☒A Streams and/or springs (jurisdictional discharges)
- ☒B Ponds (include wet detention basins; do not include sediment basins or dry detention basins) artificial pond from seep
- ☐C Obstruction that passes some flow during low-flow periods affecting assessment reach (ex: beaver dam, bottom-release dam)
- ☐D Evidence of bank seepage or sweating (iron oxidizing bacteria in water indicates seepage)
- ☐E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

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

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

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

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

19. **Buffer Width – streamside area metric (skip for Tidal Marsh Streams)**
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

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

20. **Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

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

21. **Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)**
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

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

22. **Stem Density – streamside area metric (skip for Tidal Marsh Streams)**
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

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

23. **Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)**
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

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

24. **Vegetative Composition – First 100 feet of streamside area metric (skip for Tidal Marsh Streams)**
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

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

25. **Conductivity – assessment reach metric (skip for all Coastal Plain streams)**
25a. ☐Yes ☒No Was conductivity measurement recorded?

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

Notes/Sketch:

NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name: Lochill Farm (R3) | Date of Evaluation: 6/22/16

Stream Category: Pb2 | Assessor Name/Organization: S. King and D. Huneycut

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	LOW	
(2) Baseflow	HIGH	
(2) Flood Flow	LOW	
(3) Streamside Area Attenuation	LOW	
(4) Floodplain Access	LOW	
(4) Wooded Riparian Buffer	MEDIUM	
(4) Microtopography	NA	
(3) Stream Stability	MEDIUM	
(4) Channel Stability	MEDIUM	
(4) Sediment Transport	HIGH	
(4) Stream Geomorphology	LOW	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	HIGH	
(2) Baseflow	HIGH	
(2) Streamside Area Vegetation	MEDIUM	
(3) Upland Pollutant Filtration	LOW	
(3) Thermoregulation	HIGH	
(2) Indicators of Stressors	NO	
(2) Aquatic Life Tolerance	HIGH	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	MEDIUM	
(2) In-stream Habitat	MEDIUM	
(3) Baseflow	HIGH	
(3) Substrate	HIGH	
(3) Stream Stability	MEDIUM	
(3) In-stream Habitat	LOW	
(2) Stream-side Habitat	MEDIUM	
(3) Stream-side Habitat	LOW	
(3) Thermoregulation	HIGH	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone Habitat	NA	
Overall	MEDIUM	

WAM Site #1 (on middle R1)

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID #:		NCDWR #:	
Project Name	Lochill Farm	Date of Evaluation	6/22/16
Applicant/Owner Name	Oakley	Wetland Site Name	Site #1
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	S. King
Level III Ecoregion	Piedmont (Carolina Slate Belt)	Nearest Named Water Body	Buckhead Creek (1/2 mile downstream)
River Basin	Neuse-01	USGS 8-Digit Catalogue Unit	03020201
County	Orange	NCDWR Region	Raleigh office
☐ Yes ☒ No	Precipitation within 48 hours?	Latitude/Longitude (deci-degrees)	36.11321, -78.99187

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 of an effect.

GS	VS	
☒A	☒A	Not severely altered
☐B	☐B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, reduced 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 <u>and</u> duration are not altered.
☒B	☒B	Water storage capacity <u>or</u> duration are altered, but not substantially (typically, not sufficient to change vegetation).
☐C	☐C	Water storage capacity <u>or</u> duration is substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. **Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)**

Check a box in each column for each group below. Select for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 foot deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep
3b.	☐A		Evidence that maximum depth of inundation is greater than 2 feet
	☐B		Evidence that maximum depth of inundation is between 1 and 2 feet
	☒C		Evidence that maximum depth of inundation is less than 1 foot

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

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

4a.
- ☐A Sandy soil
- ☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres) silt loam
- ☐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 – assessment area 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, tidal marshes, and Estuarine Woody Wetland)**

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

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 the tributary or other open water sheltered or exposed?
☒Sheltered – open water width < 2500 feet and no regular boat traffic.
☐Exposed – open water width ≥ 2500 feet or regular boat traffic.

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

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

WT	WC	
N/A ☐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) Some flooding (channel lines, debris)
- ☐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)**

N/A

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

13. **Connectivity to Other Natural Areas – landscape condition metric**

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This 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

N/A

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

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/tributary 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 (3)
- ☐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)**

N/A

- ☐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 to17c for non-marsh wetlands.

N/A

☐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).

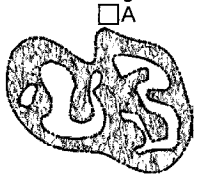
☒B Not A

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

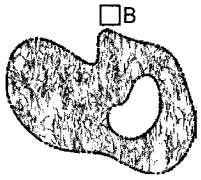
N/A

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.

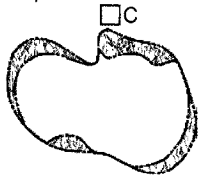
☐A



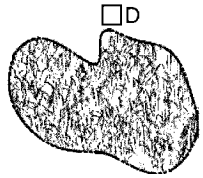
☐B



☐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. Y-Section in area indicates BHR = 2.1 (very incised!)

☐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	Site #1	Date	6/22/2016
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	S. King / D. Huneycutt

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	NO
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	**MEDIUM**
		Opportunity Presence? (Y/N)	**NO**
	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	**HIGH**
	Landscape Patch Structure	Condition	**MEDIUM**
	Vegetation Composition	Condition	**HIGH**

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

WAM Site #2 (in upper R3)

NC WAM FIELD ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID #:		NCDWR #:	
Project Name	Lochill Farm	Date of Evaluation	6/22/16
Applicant/Owner Name	Baker	Wetland Site Name	Site # 2
Wetland Type	Headwater Forest	Assessor Name/Organization	S King / D Harmon
Level III Ecoregion	Piedmont	Nearest Named Water Body	Buckhorn Creek (1/2 mile downstream)
River Basin	Neuse 01	USGS 8-Digit Catalogue Unit	03020201
County	Orange	NCDWR Region	Raleigh office
☐ Yes ☒ No	Precipitation within 48 hours?	Latitude/Longitude (deci-degrees)	

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on 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 of an effect.

GS	VS	
☒A	☒A	Not severely altered
☐B	☐B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, reduced 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 is substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column for each group below. Select for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 foot deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep
3b.	☐A		Evidence that maximum depth of inundation is greater than 2 feet
	☐B		Evidence that maximum depth of inundation is between 1 and 2 feet
	☒C		Evidence that maximum depth of inundation is less than 1 foot

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

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent guidance for National Technical Committee for Hydric Soils 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 – assessment area 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, tidal marshes, and Estuarine Woody Wetland)**

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. mostly forested

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

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

7b. How much of the first 50 feet from the bank is 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 the tributary or other open water sheltered or exposed?
☒Sheltered – open water width < 2500 feet and no regular boat traffic.
☐Exposed – open water width ≥ 2500 feet or regular boat traffic.

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

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

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

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

Answer for assessment area dominant landform.

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

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

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

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

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

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

WT	WC	FW (if applicable)	
☐A	☐A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☒G	☒G	☒G	From 1 to < 5 acres all 3 the same here
☐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)**

N/A ☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin is < 90% of the full extent of its natural landscape size.

13. **Connectivity to Other Natural Areas – landscape condition metric**

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This 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.**

N/A ☐Yes ☐No Wetland type has a surface hydrology connection to open waters/tributary 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 (1)
☐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)**

N/A ☐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 to17c for non-marsh wetlands.

N/A

☐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)

N/A

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. X-Sections in area have BHR of 1.6 - 1.9, indicating incision

☐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	Site #2	Date	6/22/2016
Wetland Type	Headwater Forest	Assessor Name/Organization	S. King / D. Huneycutt

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	NO
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	**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	**HIGH**
	Landscape Patch Structure	Condition	**MEDIUM**
	Vegetation Composition	Condition	**HIGH**

Function Rating Summary

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

Overall Wetland Rating **MEDIUM**

R1 upper

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Baker Engineering
2. Evaluator's name: Scott King, Kristi Suggs
3. Date of evaluation: 7/22/15
4. Time of evaluation: 10 AM
5. Name of stream: Finch's Branch
6. River basin: Neuse-01
7. Approximate drainage area: 1.6 sq. miles
8. Stream order: 2nd
9. Length of reach evaluated: 100 ft
10. County: Orange County
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any): –

Latitude (ex. 34.872312): 36.113419 Longitude (ex. –77.556611): –78.991165

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other ArcMap + aerials

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): see stream reach map for location at R1 upper
14. Proposed channel work (if any): priority 1 stream restoration
15. Recent weather conditions: rainfall within 48 hours, hot/humid
16. Site conditions at time of visit: warm, sunny
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters X Nutrient Sensitive Waters X Water Supply Watershed IV (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:
19. Does channel appear on USGS quad map? (YES) NO
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: 5 % Residential ___% Commercial ___% Industrial 15 % Agricultural 70 % Forested 10 % Cleared / Logged ___% Other (_____)
22. Bankfull width: 15 ft
23. Bank height (from bed to top of bank): 5.5 ft
24. Channel slope down center of stream: ___Flat (0 to 2%) X Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ___Straight X Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 50 **Comments:**_____

Evaluator's Signature Scott King **Date** 7/23/15

This channel evaluation form is intended to be used only as a guide to assist landowners and environmental professionals in gathering the data required by the United States Army Corps of Engineers to make a preliminary assessment of stream quality. The total score resulting from the completion of this form is subject to USACE approval and does not imply a particular mitigation ratio or requirement. Form subject to change – version 06/03. To Comment, please call 919-876-8441 x 26.

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	4
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	1
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	2
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	1
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	2
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	0
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	1
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	3
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	2
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	2
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	3
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	3
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	4
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	3
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	2
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	1
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	3
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	3
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						50

* These characteristics are not assessed in coastal streams.

R1 lower

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Baker Engineering **2.** Evaluator's name: Scott King, Kristi Suggs

3. Date of evaluation: 7/22/15 **4.** Time of evaluation: noon

5. Name of stream: Fincher Branch **6.** River basin: Neuse-01

7. Approximate drainage area: 1.6 sq. miles **8.** Stream order: 2nd

9. Length of reach evaluated: 100 ft **10.** County: Orange County

11. Site coordinates (if known): prefer in decimal degrees. **12.** Subdivision name (if any): —

Latitude (ex. 34.872312): 36.113419 Longitude (ex. –77.556611): -78.991165

Method location determined (circle): GPS Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): see stream reach map for location at R1 lower

14. Proposed channel work (if any): Priority 1 stream restoration

15. Recent weather conditions: hot/humid, rain within 48 hours

16. Site conditions at time of visit: Sunny, warm

17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat

___Trout Waters ___Outstanding Resource Waters _X_ Nutrient Sensitive Waters _X_ Water Supply Watershed II (I-IV)

18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:_____

19. Does channel appear on USGS quad map? (YES) NO **20.** Does channel appear on USDA Soil Survey? (YES) NO

21. Estimated watershed land use: 5 % Residential ___% Commercial ___% Industrial 15 % Agricultural

70 % Forested 10 % Cleared / Logged ___% Other (_____)

22. Bankfull width: 17 ft **23.** Bank height (from bed to top of bank): 4 ft

24. Channel slope down center of stream: ___Flat (0 to 2%) _X_ Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)

25. Channel sinuosity: ___Straight _X_ Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 56 **Comments:**_____

Evaluator's Signature Scott King **Date** 7/23/15

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	4
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	1
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	3
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	1
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	3
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	0
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	2
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	3
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	1
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	0
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	2
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	3
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	3
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	5
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	3
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	3
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	4
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						56

* These characteristics are not assessed in coastal streams.

Reach R2

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

Stream: 9 Reach R2

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Baker Engineering

2. Evaluator's name: S. King

3. Date of evaluation: 7/30/15

4. Time of evaluation: 10 AM

5. Name of stream: UT to Finche's Branch (R2)

6. River basin: ~~Cape Fear~~ Neuse - 01

7. Approximate drainage area: 20 acres

8. Stream order: 1st (seep-fed)

9. Length of reach evaluated: 25 ft

10. County: Orange

11. Site coordinates (if known): prefer in decimal degrees.

12. Subdivision name (if any): —

Latitude (ex. 34.872312): 36.1137

Longitude (ex. –77.556611): -78.9885

Method location determined (circle): GPS Topo Sheet Ortho (Aerial) Photo/GIS Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location):

small, seep-fed channel flowing at hillside toe of slope & into R2

14. Proposed channel work (if any): stream enhancement

15. Recent weather conditions: dry

16. Site conditions at time of visit: Sunny, warm

17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat

___Trout Waters ___Outstanding Resource Waters X Nutrient Sensitive Waters X Water Supply Watershed IV (I-IV)

18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:_____

19. Does channel appear on USGS quad map? YES (NO)

20. Does channel appear on USDA Soil Survey? YES (NO)

21. Estimated watershed land use: 10 % Residential ___% Commercial ___% Industrial 10 % Agricultural

80 % Forested ___% Cleared / Logged ___% Other (_____)

22. Bankfull width: 5 ft

23. Bank height (from bed to top of bank): 3 1/2 ft

24. Channel slope down center of stream: X Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)

25. Channel sinuosity: ___Straight X Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 60 **Comments:** Seep-fed channel with obvious berms on right bank

Evaluator's Signature Scott King **Date** 7/31/15

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Michael Baker INTERNATIONAL

~~TIP U-3109B~~

Stream: $ Reach R2

STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	2
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	2
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	2 ½ point
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	2
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	0
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	2
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	2
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	3
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	4
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	4
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	3
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	2
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	4
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	5
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	4
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	2
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	2
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	4
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						60

* These characteristics are not assessed in coastal streams.

R3 upper

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Baker Engineering
2. Evaluator's name: Scott King / Kristi Suggs
3. Date of evaluation: 7/22/15
4. Time of evaluation: 3 pm
5. Name of stream: UT to Finches Branch
6. River basin: Neuse-01
7. Approximate drainage area: 0.3 sq miles
8. Stream order: 1st
9. Length of reach evaluated: 50 ft
10. County: Orange County
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any): -

Latitude (ex. 34.872312): 36.113419 Longitude (ex. -77.556611): -78.991165

Method location determined (circle): GPS Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): see stream reach map for location at R3 upper
14. Proposed channel work (if any): stream enhancement work
15. Recent weather conditions: rainfall within 48 hours
16. Site conditions at time of visit: Sunny + warm
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters X Nutrient Sensitive Waters X Water Supply Watershed IV (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:_____
19. Does channel appear on USGS quad map? (YES) NO
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: 1 % Residential ___% Commercial ___% Industrial 9 % Agricultural 90 % Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 9 feet
23. Bank height (from bed to top of bank): 2.5 ft
24. Channel slope down center of stream: ___Flat (0 to 2%) X Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ___Straight X Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 61 **Comments:**_____

Evaluator's Signature Scott King **Date** 7/23/15

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	4
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	1
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	2
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	3
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	2
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	3
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	1
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	0
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	3
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	2
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	3
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	2
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	2
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	3
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	4
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	4
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	3
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	3
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	3
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	3
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	4
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						61

* These characteristics are not assessed in coastal streams.

T3

USACE AID#_____ DWQ #_____ Site #____ (indicate on attached map)

STREAM QUALITY ASSESSMENT WORKSHEET

Provide the following information for the stream reach under assessment:

1. Applicant's name: Baker Engineering
2. Evaluator's name: Scott King / Dwayne Hargett
3. Date of evaluation: 8/18/15
4. Time of evaluation: PM
5. Name of stream: UT to Finch Branch
6. River basin: Neuse - 01
7. Approximate drainage area: 37ac (.06 sq miles)
8. Stream order: 1st
9. Length of reach evaluated: 50 ft
10. County: Orange County
11. Site coordinates (if known): prefer in decimal degrees.
12. Subdivision name (if any): —

Latitude (ex. 34.872312): 36.113419 Longitude (ex. -77.556611): -78.991165

Method location determined (circle): GPS Topo Sheet (Ortho (Aerial) Photo/GIS) Other GIS Other_____

13. Location of reach under evaluation (note nearby roads and landmarks and attach map identifying stream(s) location): See reach map for location at T3
14. Proposed channel work (if any): stream preservation
15. Recent weather conditions: hot, dry past week
16. Site conditions at time of visit: warm, sunny
17. Identify any special waterway classifications known: ___Section 10 ___Tidal Waters ___Essential Fisheries Habitat ___Trout Waters ___Outstanding Resource Waters X Nutrient Sensitive Waters X Water Supply Watershed IV (I-IV)
18. Is there a pond or lake located upstream of the evaluation point? YES (NO) If yes, estimate the water surface area:_____
19. Does channel appear on USGS quad map? YES (NO)
20. Does channel appear on USDA Soil Survey? (YES) NO
21. Estimated watershed land use: 1 % Residential ___% Commercial ___% Industrial 4 % Agricultural 95 % Forested ___% Cleared / Logged ___% Other (_____)
22. Bankfull width: 2 ft
23. Bank height (from bed to top of bank): 0.5 ft
24. Channel slope down center of stream: X Flat (0 to 2%) ___Gentle (2 to 4%) ___Moderate (4 to 10%) ___Steep (>10%)
25. Channel sinuosity: ___Straight X Occasional bends ___Frequent meander ___Very sinuous ___Braided channel

Instructions for completion of worksheet (located on page 2): Begin by determining the most appropriate ecoregion based on location, terrain, vegetation, stream classification, etc. Every characteristic must be scored using the same ecoregion. Assign points to each characteristic within the range shown for the ecoregion. Page 3 provides a brief description of how to review the characteristics identified in the worksheet. Scores should reflect an overall assessment of the stream reach under evaluation. If a characteristic cannot be evaluated due to site or weather conditions, enter 0 in the scoring box and provide an explanation in the comment section. Where there are obvious changes in the character of a stream under review (e.g., the stream flows from a pasture into a forest), the stream may be divided into smaller reaches that display more continuity, and a separate form used to evaluate each reach. The total score assigned to a stream reach must range between 0 and 100, with a score of 100 representing a stream of the highest quality.

Total Score (from reverse): 64 **Comments:** This tributary is functionally and qualitatively similar to T1, T2, T4, and R2

Evaluator's Signature_____ **Date**_____

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STREAM QUALITY ASSESSMENT WORKSHEET

	#	CHARACTERISTICS	ECOREGION POINT RANGE			SCORE
			Coastal	Piedmont	Mountain	
PHYSICAL	1	**Presence of flow / persistent pools in stream** (no flow or saturation = 0; strong flow = max points)	0 – 5	0 – 4	0 – 5	3
	2	**Evidence of past human alteration** (extensive alteration = 0; no alteration = max points)	0 – 6	0 – 5	0 – 5	5
	3	**Riparian zone** (no buffer = 0; contiguous, wide buffer = max points)	0 – 6	0 – 4	0 – 5	4
	4	**Evidence of nutrient or chemical discharges** (extensive discharges = 0; no discharges = max points)	0 – 5	0 – 4	0 – 4	4
	5	**Groundwater discharge** (no discharge = 0; springs, seeps, wetlands, etc. = max points)	0 – 3	0 – 4	0 – 4	3
	6	**Presence of adjacent floodplain** (no floodplain = 0; extensive floodplain = max points)	0 – 4	0 – 4	0 – 2	4
	7	**Entrenchment / floodplain access** (deeply entrenched = 0; frequent flooding = max points)	0 – 5	0 – 4	0 – 2	2
	8	**Presence of adjacent wetlands** (no wetlands = 0; large adjacent wetlands = max points)	0 – 6	0 – 4	0 – 2	4
	9	**Channel sinuosity** (extensive channelization = 0; natural meander = max points)	0 – 5	0 – 4	0 – 3	3
	10	**Sediment input** (extensive deposition= 0; little or no sediment = max points)	0 – 5	0 – 4	0 – 4	3
	11	**Size & diversity of channel bed substrate** (fine, homogenous = 0; large, diverse sizes = max points)	NA*	0 – 4	0 – 5	1
STABILITY	12	**Evidence of channel incision or widening** (deeply incised = 0; stable bed & banks = max points)	0 – 5	0 – 4	0 – 5	3
	13	**Presence of major bank failures** (severe erosion = 0; no erosion, stable banks = max points)	0 – 5	0 – 5	0 – 5	4
	14	**Root depth and density on banks** (no visible roots = 0; dense roots throughout = max points)	0 – 3	0 – 4	0 – 5	3
	15	**Impact by agriculture, livestock, or timber production** (substantial impact =0; no evidence = max points)	0 – 5	0 – 4	0 – 5	3
HABITAT	16	**Presence of riffle-pool/ripple-pool complexes** (no riffles/ripples or pools = 0; well-developed = max points)	0 – 3	0 – 5	0 – 6	0
	17	**Habitat complexity** (little or no habitat = 0; frequent, varied habitats = max points)	0 – 6	0 – 6	0 – 6	1
	18	**Canopy coverage over streambed** (no shading vegetation = 0; continuous canopy = max points)	0 – 5	0 – 5	0 – 5	5
	19	**Substrate embeddedness** (deeply embedded = 0; loose structure = max)	NA*	0 – 4	0 – 4	2
BIOLOGY	20	**Presence of stream invertebrates** (see page 4) (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 5	0 – 5	2
	21	**Presence of amphibians** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	1
	22	**Presence of fish** (no evidence = 0; common, numerous types = max points)	0 – 4	0 – 4	0 – 4	0
	23	**Evidence of wildlife use** (no evidence = 0; abundant evidence = max points)	0 – 6	0 – 5	0 – 5	4
Total Points Possible			100	100	100	
TOTAL SCORE (also enter on first page)						64

* These characteristics are not assessed in coastal streams.

Appendix H

Approved PJD and Wetland Forms

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2016-00881** County: **Orange** U.S.G.S. Quad: **Northwest Durham**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner: **Ms. Jane Kelly Gilbert**
Address: **2801 Holt Drive**
Columbia, South Carolina 29205

Property Owner: **Mr. David W. Gilbert**
Address: **2211 Thunderbird Trail**
Maitland, Florida 32751

Property Owner: **Ralph and Tonya Bruno**
Address: **520 Pleasant Green Road**
Hillsborough, North Carolina 27278

Applicant/Agent: **Michael Baker Engineering, Inc.**
Mr. Scott King
Address: **2905 Meridian Parkway**
Durham, North Carolina 27713

Size (acres)	**15.8**	Nearest Town	**Hillsborough**
Nearest Waterway	**Buckwater Creek**	River Basin	**Upper Neuse**
USGS HUC	**03020201**	Coordinates	Latitude: **36.11408**
			Longitude: **-78.98901**

Location description: **The Lochill Farm Project area is identified as an approximate 15.8 acre tract of land, located on Orange County, North Carolina Parcels 0805390700 and 0805291320. These parcels are located at 6120 St. Mary's Road, Hillsborough, Orange County, North Carolina. Waters on-site drain into Buckwater Creek, an indirect tributary of the Upper Neuse River (8-digit HUC: 03020201)**

Indicate Which of the Following Apply:

A. Preliminary Determination

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

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

B. Approved Determination

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

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

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

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

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

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

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

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

C. Basis For Determination: **Refer to the enclosed Preliminary Jurisdictional Determination Form, Stream and Surface Water Resources Map, and Wetland Resources Map.**

D. Remarks:

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 **(This information applies only to approved jurisdictional determinations as indicated in B. above)**

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a

Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

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

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by _____.
It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: DAILEY.SAMANTHA.J.1387567948

Digitally signed by DAILEY.SAMANTHA.J.1387567948
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=DAILEY.SAMANTHA.J.1387567948
Date: 2017.07.26 13:26:01 -04'00'

Date: **July 26, 2017** Expiration Date: **N/A**

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

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: **Michael Baker Engineering, Inc.** **Attn: Mr. Scott King**	File Number: **SAW-2016-00881**	Date: **July 26, 2017**
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 district 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 **Raleigh Regulatory Field Office** **Attn: Samantha Dailey** **3331 Heritage 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 appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, **Attn: Samantha Dailey, 69 Darlington Avenue, Wilmington, North Carolina 28403**

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

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

APPENDIX 2

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): July 26, 2017

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

Property Owner: **Ms. Jane Kelly Gilbert**
Address: **2801 Holt Drive**
Columbia, South Carolina 29205

Property Owner: **Mr. David W. Gilbert**
Address: **2211 Thunderbird Trail**
Maitland, Florida 32751

Property Owner: **Ralph and Tonya Bruno**
Address: **520 Pleasant Green Road**
Hillsborough, North Carolina 27278

Applicant/Agent: **Michael Baker Engineering, Inc.**
Mr. Scott King
Address: **2905 Meridian Parkway**
Durham, North Carolina 27713

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington, Lochill Farms Project, Michael Baker Engineering, Inc., Orange County, SAW-2016-00881

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)
State: **NC** County/parish/borough: **Orange** City: **Hillsborough**
Center coordinates of site (lat/long in degree decimal format): Lat. **36.11408°N**, Long. **78.98901° W**.
Universal Transverse Mercator:
Name of nearest water body: **Buckwater Creek**

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLIES):
☒ Office (Desk) Determination. Date: **July 26, 2017**
☐ Field Determination. Date(s):

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

Site Number	Latitude (°N)	Latitude (°W)	Estimated Amount of Aquatic Resources in Review Area		Type of aquatic resource (i.e. wetland vs. non-wetland)	Geographic authority to which the aquatic resource "may be" subject (i.e. Section 404 or Section 10/404)
			Linear Feet	Acres		
R1	36.1133	-78.9915	3008		Perennial Stream	Section 404
R2	36.1137	-78.9886	590		Intermittent Stream	Section 404
R3	36.1124	-78.9924	1760		Perennial Stream	Section 404
T1	36.1132	-78.992	95		Intermittent Stream	Section 404

T2	36.1098	-78.9903	81		Intermittent Stream	Section 404
T3	36.1103	-78.9908	526		Perennial Stream	Section 404
T4	36.1116	-78.9918	116		Perennial Stream	Section 404
WL-A	36.1101	-78.9904		0.95	Riparian Wetland	Section 404
WL-B	36.1138	-78.9911		0.40	Riparian Wetland	Section 404
WL-C	36.1135	-78.9911		0.55	Riparian Wetland	Section 404
WL-D	36.1132	-78.9914		0.12	Riparian Wetland	Section 404
WL-E	36.1135	-78.9917		0.58	Riparian Wetland	Section 404
WL-F	36.1131	-78.9928		0.03	Riparian Wetland	Section 404
WL-G	36 1126	-78.9931		1.50	Riparian Wetland	Section 404
WL-H	36.1120	-78.9946		0.02	Riparian Wetland	Section 404
WL-I	36.1117	-78.9949		0.03	Riparian Wetland	Section 404
P-1	36.1115	-78.9920		0.07	Open Water	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 preliminary JD (check all that apply): Checked items should be included in subject file. Appropriately reference sources below where indicated for all checked items:

☒ Maps, plans, plots or plat submitted by or on behalf of the PJD requestor: **Michael Baker Engineering, Inc., submitted a Jurisdictional Determination Request on February 21, 2017.**
☒ Data sheets prepared/submitted by or on behalf of the PJD requestor.

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.

☒ Office concurs with data sheets/delineation report.
☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
☐ USGS NHD data.
☐ USGS 8 and 12 digit HUC maps.
☒ U.S. Geological Survey map(s). Cite scale & quad name: **1:24K, NC-Northwest Durham**
☒ USDA Natural Resources Conservation Service Soil Survey. Citation: **Web Soil Survey: July 2017**.
☒ National wetlands inventory map(s). Cite name: **Corps of Engineers SimSuite – July 2017**.
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps: .
☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
☒ Photographs: ☒ Aerial (Name & Date): .
or ☐ Other (Name & Date): .
☐ Previous determination(s). File no. and date of response letter: .
☐ Other information (please specify): .

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

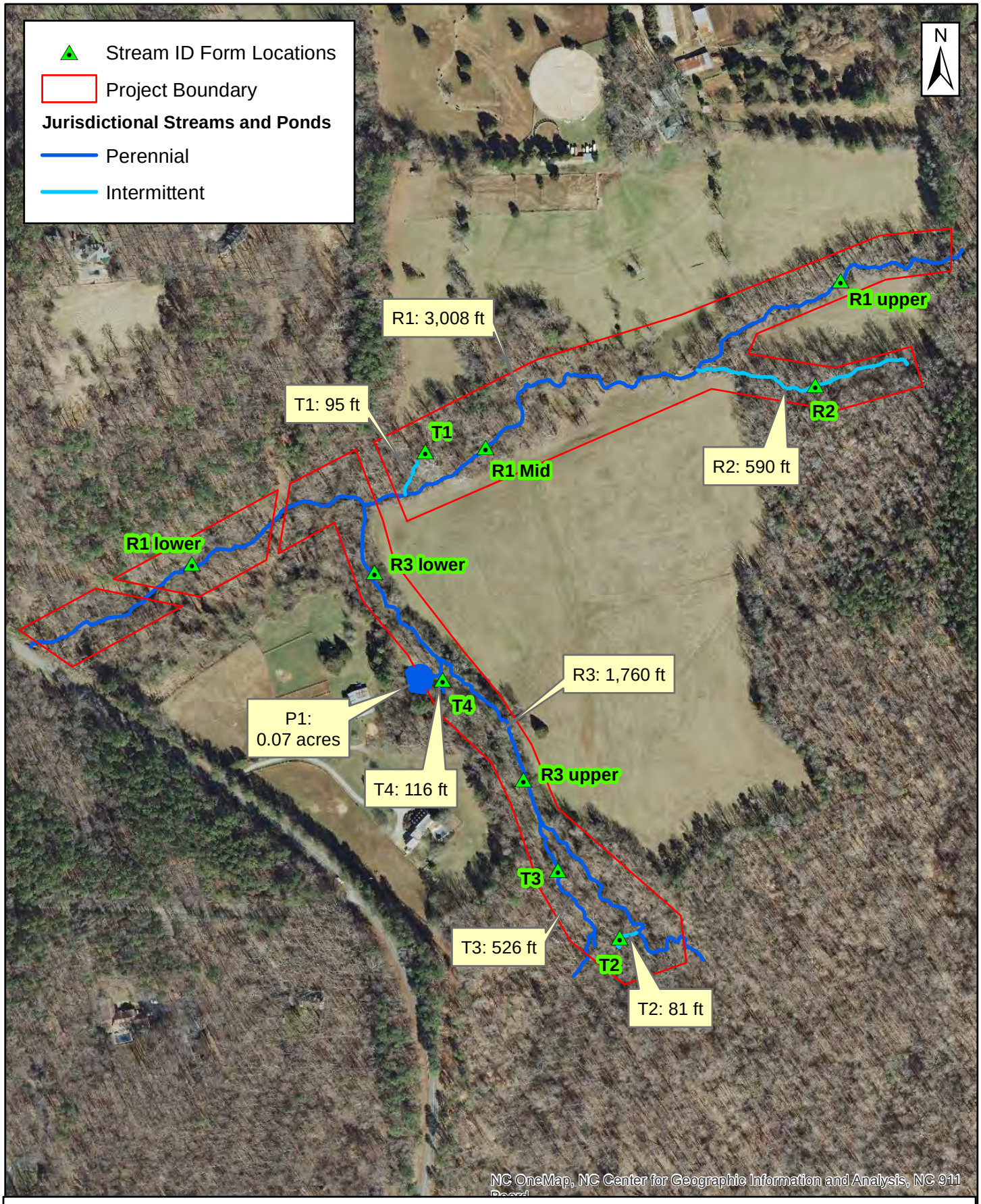
DAILEY.SAMANTHA.J.1387567948

Digitally signed by DAILEY.SAMANTHA.J.1387567948
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=DAILEY.SAMANTHA.J.1387567948
Date: 2017.07.26 13:28:23 -04'00'

Signature and date of
Regulatory Project Manager
(REQUIRED)

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

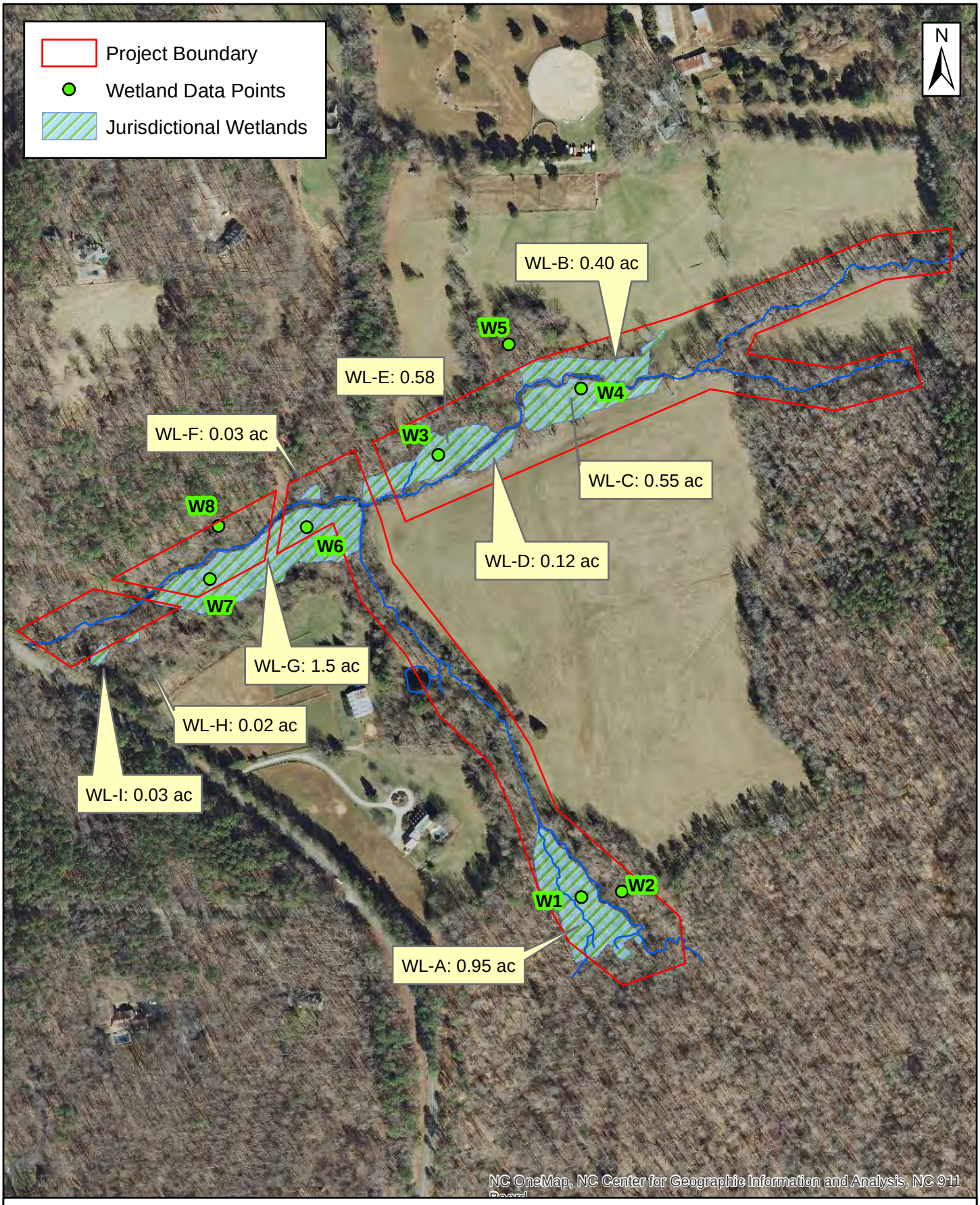
[1] Districts may establish timeframes for requestor to return signed PJD forms. If the requestor does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.



Michael Baker INTERNATIONAL

0 250 500 Feet

Stream and Surface Water Resources
Lochill Farm Site



Michael Baker INTERNATIONAL

0 250 500 Feet

Wetland Resources
Lochill Farm Site

W1

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange County Sampling Date: 6/22/16
Applicant/Owner: Balm Engineering State: NC Sampling Point: W1
Investigator(s): Scott Kirby, Daniel Hargett Section, Township, Range: —
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): flat Slope (%): 0-1%
Subregion (LRR or MLRA): 240: So. Piedmont Lat: 36.110088 Long: -78.990626 Datum: NAD83 (SP-FT)
Soil Map Unit Name: Tarvus silt loam NWI classification: none
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:
This data point is located within a wetland.

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- X 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)
- X 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)
- X 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): ≈1"
Water Table Present? Yes X No ____ Depth (inches): 4"
Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

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

Remarks:
Clear wetland indicators found at this location

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W1

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	20	Y	FACW
2. Ulmus rubra	20	Y	FAC
3. Fraxinus pennsylvanica	15	N	FACW
4. Liquidambar styraciflua	20	Y	FAC
5. Acer rubrum	10	N	FAC
6. Liriodendron tulipifera	5	N	FACU
	90	= Total Cover	
50% of total cover: 45	20% of total cover: 18		
Sapling Stratum (Plot size:)			
1. Platanus occidentalis	20	Y	FACW
2.			
3.			
4.			
5.			
6.			
	20	= Total Cover	
50% of total cover: 10	20% of total cover: 4		
Shrub Stratum (Plot size:)			
1. Lindera benzoin	10	Y	FAC
2. Fraxinus pennsylvanica	10	Y	FACW
3. Liquidambar styraciflua	5	Y	FAC
4.			
5.			
6.			
	25	= Total Cover	
50% of total cover: 125	20% of total cover: 5		
Herb Stratum (Plot size:)			
1. Microstegium vimineum	10	N	FAC
2. Carex lurida	5	N	OBL
3. Boehmeria cylindrica	30	Y	FACW
4. Onoclea sensibilis	5	N	FACW
5. Saururus cernuus	30	Y	OBL
6.			
7.			
8.			
9.			
10.			
11.			
	80	= Total Cover	
50% of total cover: 40	20% of total cover: 16		
Woody Vine Stratum (Plot size:)			
1. Toxicodendron radicans	5	Y	FAC
2.			
3.			
4.			
5.			
	5	= Total Cover	
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 10 (A)

Total Number of Dominant Species Across All Strata: 10 (B)

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

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

SOIL

Sampling Point: W1

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
0-5	10YR 5/1	80	5YR 4/6	20	C	M	si loam	odor
5-10	10YR 6/1	75	7.5YR 5/8	25	C	M	si loam	@ 6" some gravel, @ 4" g.w., ox. rhizospheres present, @ 8" Mn, @ 8" Redox get larger
10-12"	10YR 6/2	50	10YR 5/1	25	D	M	si. loam	depleted masses
			7.5YR 5/8	25	C	M		many / dominant

[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:

Clear hydric soils found at this location

W2

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange County Sampling Date: 6/22/16
Applicant/Owner: Cole Engineering State: NC Sampling Point: W2
Investigator(s): Scott King, D. Hemmerett Section, Township, Range: —
Landform (hillslope, terrace, etc.): Terrace / slope Local relief (concave, convex, none): — Slope (%): 3%
Subregion (LRR or MLRA): MLRA: 240 Lat: 36.110129 Long: -78.990279 Datum: NAD83
Soil Map Unit Name: Tarrus silt loam 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 _____, 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 _____ No X
Hydric Soil Present?	Yes _____ No X	
Wetland Hydrology Present?	Yes _____ No X	

Remarks:
This data point is not located within a wetland

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 _____ Depth (inches): _____
Water Table Present? Yes _____ No _____ Depth (inches): _____
Saturation Present? (Includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

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

Remarks:
No evidence of hydrology present at this location

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W2

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	75	Y	FACU
2. Liquidambar styraciflua	20	Y	FAC
3. Ulmus rubra	5	N	FAC
4.			
5.			
6.			
	100	= Total Cover	

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

Sapling Stratum (Plot size:)			
1. Aesculus sylvatica	10	Y	FAC
2. Cornus florida	5	N	FACU
3. Fagus grandifolia	10	Y	FACU
4. Juniperus virginiana	10	Y	FACU
5.			
6.			
	35	= Total Cover	

50% of total cover: 17.5 20% of total cover: 7

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

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

Herb Stratum (Plot size:)			
1. Microstegium vimineum	20	Y	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	20	= Total Cover	

50% of total cover: 10 20% of total cover: 4

Woody Vine Stratum (Plot size:)			
1. Gelsemium sempervirens	1	N	FAC
2. Vitis rotundifolia	5	Y	FAC
3.			
4.			
5.			
	6	= Total Cover	

50% of total cover: 3 20% of total cover: 1.2

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 57% (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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Due to presence of FAC species, hydrophytic vegetation is present here

Hydrophytic Vegetation Present? Yes X No

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

SOIL

Sampling Point: W2

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
0-1	10YR 3/3	100					loam	soil very dry & friable
1-3	10YR 3/4	90	7.5YR 5/6	10	C	M	silt loam	diffuse boundary
3-13	5YR 4/6	80	10YR 4/4	20	D	M	si. clay loam	@ 7" mottles & less common

[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:

Clearly upland brown/red soil present here.

W3

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange County Sampling Date: 12/20/16
Applicant/Owner: Baker Engineering, Inc. State: NC Sampling Point: W3
Investigator(s): Scott King Section, Township, Range: -
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): flat Slope (%): 1%
Subregion (LRR or MLRA): LRR: P, MLRA: 240 Lat: 36.113210 Long: -78.991870 Datum: NAD83
Soil Map Unit Name: Chewacla loam 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 ____, 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:
Data Point W3 is located within a wetland.

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)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X 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)
- X 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 ____	Depth (inches): ____

Wetland Hydrology Present? Yes X No ____

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

Remarks:
Wetland hydrology present here.

note: numerous multi-stemmed trees in this area, indicating water stress

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W3

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	90	Y	FACW
2. Liriodendron tulipifera	5	N	FACU
3.			
4.			
5.			
6.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		
Sapling Stratum (Plot size:)			
1. Platanus occidentalis	20	Y	FACW
2. Lindera benzoin	10	Y	FAC
3.			
4.			
5.			
6.			
	30 = Total Cover		
50% of total cover: 15	20% of total cover: 6		
Shrub Stratum (Plot size:)			
1. Lindera benzoin	50	Y	FAC
2.			
3.			
4.			
5.			
6.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		
Herb Stratum (Plot size:)			
1. Boehmeria cylindrica	30	Y	FACW
2. Microstegium vimineum	40	Y	FAC
3. Saururus cernuus	10	N	OBL
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Woody Vine Stratum (Plot size:)			
1. Toxicodendron radicans	5	Y	FAC
2. Smilax rotundifolia	5	Y	FAC
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: 8 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

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

SOIL Sampling Point: W3

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
0-1	10YR 3/2	100					loam	soil V. moist
1-8	10YR 6/1	80	7.5YR 5/6	20	C	M	silt loam	
8-12	10YR 7/1	75	7.5YR 5/6	20	C	M	silt loam	oxidized rhizospheres present
			and 2.5YR 4/8	5	C	M		

[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:

Clear hydric soils located at this data point.

W4

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange County Sampling Date: 12/20/16
Applicant/Owner: Baker Engineering, Inc. State: NC Sampling Point: W4
Investigator(s): Scott King Section, Township, Range: -
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): flat Slope (%): 1%
Subregion (LRR or MLRA): LRR: P, MLRA: 240 Lat: 36.113644 Long: -78.990613 Datum: NAD 83
Soil Map Unit Name: Chewacla loam 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 _____, 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:
Data Point is located within a wetland

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)
- X Drift Deposits (B3)
- ___ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- X 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)
- X 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)
- ___ 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 _____	Depth (inches): _____

Wetland Hydrology Present? Yes X No _____

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

Remarks:
Wetland hydrology present at this data point.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W4

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	70	Y	FACW
2. Celtis laevigata	5	N	FACW
3.			
4.			
5.			
6.			
	75 = Total Cover		
50% of total cover: 37.5	20% of total cover: 15		
Sapling Stratum (Plot size:)			
1. Platanus occidentalis	15	Y	FACW
2. Ach negunda	5	Y	FAC
3.			
4.			
5.			
6.			
	20 = Total Cover		
50% of total cover: 10	20% of total cover: 4		
Shrub Stratum (Plot size:)			
1. Lindera benzoin	80	Y	FAC
2.			
3.			
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Herb Stratum (Plot size:)			
1. Microstegium vimineum	40	Y	FAC
2. Fescue spp.	10	Y	?
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	50 = Total Cover		
50% of total cover: 25	20% of total cover: 10		
Woody Vine Stratum (Plot size:)			
1. Smilax rotundifolia	10	Y	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: 6 (A)

Total Number of Dominant Species Across All Strata: 7 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 86 % (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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

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

SOIL

Sampling Point: W4

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	100	-				loam	
2-8	10YR 6/1	80	5YR 5/6	20	C	M	silt loam	
8-12"	10YR 7/1	80	10YR 7/6	15	C	M	silt loam	
			and 5YR 5/6	5	C	M		

[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:

Hydric soils clearly present at this data point

W5

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange County Sampling Date: 12/20/16
Applicant/Owner: Baker Engineering, Inc. State: NC Sampling Point: W5
Investigator(s): Scott King Section, Township, Range: -
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): concave Slope (%): 7%
Subregion (LRR or MLRA): LRR: P, MLRA: 240 Lat: 36.113989 Long: -78.991257 Datum: _____
Soil Map Unit Name: Georgeville silt loam 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 _____, 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 _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____ No X	
Wetland Hydrology Present?	Yes _____ No X	

Remarks:
This data point is not located within a wetland.

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 _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

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

Remarks:
No wetland indicators present at this data point.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W5

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	30	Y	FACU
2. Pinus taeda	10	N	FAC
3. Platanus occidentalis	30	Y	FACW
4.			
5.			
6.			
	70	= Total Cover	
50% of total cover: 35	20% of total cover: 14		

Sapling Stratum (Plot size:)			
1. Liriodendron tulipifera	30	Y	FACU
2. Juniperus virginiana	20	Y	FACU
3.			
4.			
5.			
6.			
	50	= Total Cover	
50% of total cover: 25	20% of total cover: 10		

Shrub Stratum (Plot size:)			
1. Lindera benzoin	25	Y	FAC
2.			
3.			
4.			
5.			
6.			
	25	= Total Cover	
50% of total cover:	20% of total cover:		

Herb Stratum (Plot size:)			
1. Polystichum acrostichoides	10	Y	FACU
2. Galium aparine	10	Y	FACU
3. Microstegium vimineum	20	Y	FAC
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:)			
1. Vitis rotundifolia	5	Y	FAC
2.			
3.			
4.			
5.			
	5	= Total Cover	
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 9 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 44% (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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes ___ No X

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

SOIL Sampling Point: W5

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
0-1	10YR 3/3	100	–				loam	moist, organic rich from leaves
1-5	10YR 4/3	100	–				silt loam	dry soil
5-12	5YR 4/6	100	–				clay	dry soil, v. friable

[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:

No hydric soil present at this location

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange Sampling Date: 2/16/17
Applicant/Owner: Baker Engineering, Inc. State: NC Sampling Point: W6
Investigator(s): Scott King, Drew Powers Section, Township, Range: -
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): flat Slope (%): 1%
Subregion (LRR or MLRA): LRR: P, MLRA: 240 Lat: 36.1127 Long: -78.993015 Datum: NAD83 (SP-FT)
Soil Map Unit Name: Chewacla loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, 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:

This data point is located within a wetland area.

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X 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)
- X 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)
- X 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 X No _____ Depth (inches): 2"
Water Table Present? Yes X No _____ Depth (inches): @3"
Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

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

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

Remarks:

Wetland hydrology clearly present with small pockets of shallow surface water all around and a water table in the soil boring hole at 3".

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W6

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	70	Y	FACW
2. Acer rubrum	10	N	FAC
3.			
4.			
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Sapling Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Shrub Stratum (Plot size:)			
1. Lindera benzoin	40	Y	FAC
2. Platanus occidentalis	10	N	FACW
3. Ligustrum sinense	5	N	FACU
4.			
5.			
6.			
	55 = Total Cover		
50% of total cover: 27.5	20% of total cover: 11		
Herb Stratum (Plot size:)			
1. Fescue spp.	15		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size:)			
1. Vitis rotundafolia	5	Y	FAC
2. Toxicodendron radicans	2	Y	FAC
3. Lonicera japonica	2	Y	FAC
4.			
5.			
	9 = Total Cover		
50% of total cover: 4.5	20% of total cover: 1.8		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

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

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No

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

SOIL Sampling Point: W6

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
0-3"	10YR 3/4	100%					loam	
3-6"	10YR 6/2	75%	5YR 4/6	25%	C	M	silty clay	Mn concretions present
6-12"	10YR 6/1	70%	5YR 4/6	15%	C	M	silty clay	Mn concretions present
			and 10YR 6/6	15%	C	M		

[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:

Hydric soils clearly present at this data point.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange Sampling Date: 2/16/17
Applicant/Owner: Baker Engineering, Inc. State: NC Sampling Point: W7
Investigator(s): Scott King, Drew Powers Section, Township, Range: -
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): flat Slope (%): 1%
Subregion (LRR or MLRA): LRR: P, MLRA: 240 Lat: 36.112333 Long: -78.993857 Datum: NAD83 (SP-FT)
Soil Map Unit Name: Chewacla loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, 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:

This data point is located within a wetland area.

HYDROLOGY

Wetland Hydrology Indicators:

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

- X Surface Water (A1)
- X 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)
- X 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 X No _____ Depth (inches): 4"
Water Table Present? Yes X No _____ Depth (inches): @9"
Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

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

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

Remarks:

Wetland hydrology clearly present with a large ephemeral pond near the data point, and a water table at 9" within the soil boring hole.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W7

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Platanus occidentalis	90	Y	FACW
2. Ulmus rubra	5	N	FAC
3.			
4.			
5.			
6.			
	95 = Total Cover		
50% of total cover: 47.5	20% of total cover: 19		
Sapling Stratum (Plot size:)			
1. Platanus occidentalis	15	Y	FACW
2.			
3.			
4.			
5.			
6.			
	15 = Total Cover		
50% of total cover: 7.5	20% of total cover: 3		
Shrub Stratum (Plot size:)			
1. Fraxinus pennsylvatica	20	Y	FACW
2. Platanus occidentalis	20	Y	FACW
3. Ligustrum sinense	5	N	FACU
4.			
5.			
6.			
	45 = Total Cover		
50% of total cover: 22.5	20% of total cover: 9		
Herb Stratum (Plot size:)			
1. Fescue spp.	10		
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	= Total Cover		
50% of total cover:	20% of total cover:		
Woody Vine Stratum (Plot size:)			
1. Lonicera japonica	5	Y	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 5 (A)

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

- ___ 1 - Rapid Test for Hydrophytic Vegetation
- X 2 - Dominance Test is >50%
- ___ 3 - Prevalence Index is ≤3.0[1]
- ___ 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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

Hydrophytic Vegetation Present? Yes X No ___

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

SOIL Sampling Point: W7

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
0-1"	10YR 3/3	100%					loam	
1-3"	10YR 4/2	70%	7.5YR 4/6	30%	C	M	clay loam	Mn concretions present
3-7"	10YR 6/1	60%	5YR 5/6	40%	C	M	silty clay	Mn concretions present
7-12"	10YR 6/1	50%	5YR 5/6	50%	C	M	clay	Mn concretions present

[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:

Hydric soils clearly present at this data point.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lochill Farm Site City/County: Orange Sampling Date: 2/16/17
Applicant/Owner: Baker Engineering, Inc. State: NC Sampling Point: W8
Investigator(s): Scott King, Drew Powers Section, Township, Range: -
Landform (hillslope, terrace, etc.): hillslope Local relief (concave, convex, none): slightly convex Slope (%): 5%
Subregion (LRR or MLRA): LRR: P, MLRA: 240 Lat: 36.112709 Long: -78.993782 Datum: NAD83 (SP-FT)
Soil Map Unit Name: Tarrus silt loam NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No _____ (If no, explain in Remarks.)
Are Vegetation _____, 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:

This data point is not located within a wetland area.

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 _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

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

Remarks:

No indicators of hydrology are present at this data point.

VEGETATION (Five Strata) – Use scientific names of plants. Sampling Point: W8

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Liriodendron tulipifera	50	Y	FACU
2. Juniperus virginiana	25	Y	FACU
3. Acer rubrum	5	N	FAC
4. Celtis laevigata	5	N	FACW
5.			
6.			
	80 = Total Cover		
50% of total cover: 40	20% of total cover: 16		
Sapling Stratum (Plot size:)			
1. Fagus grandifolia	10	Y	FACU
2. Juniperus virginiana	10	Y	FACU
3. Cornus florida	5	N	FACU
4. Prunus serotina	10	Y	FACU
5. Carya glabra	5	N	FACU
6.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		
Shrub Stratum (Plot size:)			
1. Lindera benzoin	20	Y	FAC
2. Quercus falcata	20	Y	FACU
3.			
4.			
5.			
6.			
	40 = Total Cover		
50% of total cover: 20	20% of total cover: 8		
Herb Stratum (Plot size:)			
1. Polystichum acrostichoides	5	Y	FACU
2. Allium vineale	5	Y	FACU
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	10 = Total Cover		
50% of total cover: 5	20% of total cover: 2		
Woody Vine Stratum (Plot size:)			
1. Vitis rotundifolia	5	Y	FAC
2.			
3.			
4.			
5.			
	5 = Total Cover		
50% of total cover: 2.5	20% of total cover: 1		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 10 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 20% (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 Five Vegetation Strata:

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

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

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

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

Woody vine – All woody vines, regardless of height.

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

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

SOIL Sampling Point: W8

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
0-1"	10YR 3/3	100%					loam	
1-6"	5YR 4/3	100%					silty clay	soil is very dry
6-9"	5YR 4/6	100%					silty clay	some gravel
9-12"	2.5YR 4/4	100%					silty clay	

[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:

Hydric soils are clearly not present at this data point.

Appendix I

Approved FHWA Categorical Exclusion Forms

Appendix A

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:	Lochill Farm Stream Mitigation Project
County Name:	Orange
EEP Number:	97083
Project Sponsor:	FHWA
Project Contact Name:	Scott King, Michael Baker Engineering
Project Contact Address:	8000 Regency Parkway, Suite 600, Cary, NC 27518
Project Contact E-mail:	Scott.king@mbakerintl.com
DMS Project Manager:	Lindsay Crocker (lindsay.crocker@ncdenr.gov)

Project Description

The Lochill Farm Stream Mitigation Project area is located in Orange County, NC, approximately five miles northeast of Hillsborough and four miles northwest of Durham. The project is located in the Neuse River Basin, DEQ subbasin 03020201 (previously categorized as subbasin 03-04-01), Targeted Local Watershed (TLW) 03020201-030030. The site is located off St. Mary's Road near its intersection with Pleasant Green Road.

The project will involve the restoration, enhancement, or preservation of stream, wetland, and riparian buffer functions along Finches Branch and unnamed tributaries (UTs) to Finches Branch. Segments of these reaches have been identified as incised, eroding, and no longer connected to their floodplains. In total, 5,500 linear feet of stream have been identified for preservation, enhancement, or restoration. The conservation easement and proposed disturbance limits extend at least 50 feet from the existing top of bank and include several riparian wetland areas.

For Official Use Only

Reviewed By: LINDSAY CROCKER

9-21-2016
Date

LCrocker
DMS Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

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

Final Approval By:

9-21-16
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? No Designated Critical Habitat is present for any of the federally listed Threatened and Endangered species. Potential habitat for Michaux's sumac is present in the vicinity of the site and at the edge of the easement boundary; however, the site does not contain the soils typically found for the species. A site survey was conducted on June 22, 2016. No individuals were observed. The biological conclusion is No Effect.	☒ 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?	☐ Yes ☐ No ☒ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☒ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☒ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☒ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☒ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☒ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☒ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☒ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☒ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☒ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☒ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☒ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☒ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☒ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☒ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☒ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☒ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☒ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☒ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☒ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☒ N/A

Michael Baker
INTERNATIONAL

Innovation Done Right...We Make a Difference

September 16, 2016

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

Subject: NCDMS stream mitigation project in Orange County DMS# 97083.

Dear Ms. Crocker,

Please find enclosed two hard copies of the Categorical Exclusion (CE) for the Lochill Farm Stream Mitigation Project in Orange County, North Carolina. The project site is located approximately five miles northeast of Hillsborough and four miles northwest of Durham, within North Carolina Department of Environmental Quality (NCDEQ) subbasin 03020201 (previously categorized as subbasin 03-04-01) and the targeted local watershed 03020201-030030 of the Neuse River Basin.

The proposed project is a full-delivery effort for the NCDEQ Division of Mitigation Services (DMS) in response to RFP#: 16-006477. Project goals include the restoration, enhancement, and preservation of approximately 5,450 linear feet of stream for the purpose of obtaining stream mitigation credit in the Neuse River Basin. Based on preliminary mitigation plans and the interagency review team (IRT) review meeting, it is anticipated to include approximately 2,750 feet of Restoration, 1,075 feet of Enhancement I, 970 feet of Enhancement II, and 660 feet of Preservation.

Based on information from the US Fish and Wildlife Service (USFWS) and the North Carolina Wildlife Resources Commission (NCWRC), the following federally listed species have been found in Orange County (see Table 1). As shown in the enclosed copies of letters to these agencies, the proposed project has been found to have no effect on any federally listed species. The USFWS raised concerns regarding the project's possible sedimentation impacts to aquatic species. The USFWS recommended that:

- All practicable measures be taken to avoid adverse impacts to aquatic species, including implementing directional boring methods and stringent sediment and erosion control measures
- An erosion and sedimentation control plan be submitted to and approved by the North Carolina Division of Land Resources, Land Quality Section prior to construction.
- Erosion and sedimentation controls be installed and maintained between the construction site and any nearby down-gradient surface waters.
- Natural, vegetated buffers be maintained on all streams and creeks adjacent to the project site.

- The NCWRC Guidance Memorandum to Address and Mitigate Secondary and Cumulative Impacts to Aquatic and Terrestrial Wildlife Resources and Water Quality (http://www.ncwildlife.org/portals/0/Conserving/documents/2002_GuidanceMemorandumforSecondaryandCumulativeImpacts.pdf) will be considered in project development.

NCWRC did not identify any specific concerns with the project area, but noted that several sensitive species exist downstream near the confluence of Buckwater Creek and the Eno River. None of these species is covered by the Endangered Species Act of 1973.

Table 1. Federally Protected Species for Orange County.

Scientific Name	Common Name	Federal Status	Habitat Present	Biological Conclusion
Haliaeetus leucocephalus	Bald Eagle	BGPA	No	No Effect
Alasmidonta heterodon	Dwarf Wedgemussel	Endangered	No	No Effect
Rhus michauxii	Michaux's Sumac	Endangered	Yes	No Effect
Echinacea laevigata	Smooth Coneflower	Endangered	No	No Effect

E – Endangered; BGPA = Bald and Gold Eagle Protection Act

Based on our review and field surveys, we have developed the following conclusions on the potential effects of this project on federally listed species:

Haliaeetus leucocephalus (Bald eagle)
Federal Status: Protected by the Bald and Golden Eagle Protection Act
Animal Family: Accipitridae

Adult bald eagles can be identified by their large white head and short white tail. The body plumage is dark-brown to chocolate-brown in color. In flight, bald eagles can be identified by their flat wing soar. Eagle nests are found in close proximity to water (within 0.5 mile) with a clear flight path to the water, in the largest living tree in an area, and having an open view of the surrounding land.

Human disturbance can cause an eagle to abandon otherwise suitable habitat. The breeding season for the bald eagle begins in December or January. Fish are the major food source for bald eagles. Other sources include coots, herons, and wounded ducks. Food may be live or carrion.

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. A desktop-GIS assessment of the project study area on June 20, 2016 using Google Earth color aerials. No large water bodies were found within four miles of the project. Due to the distance to the nearest large body of water and minimal impact anticipated for this project, it has been determined that this project will not affect this species. Further, no large nests have been observed in the forest canopy during site walkovers conducted during the winter months.

***Alasmidonta heterodon* (Dwarf wedgemussel)**
Federal Status: Endangered
Animal Family: Unionidae

The dwarf wedgemussel is a small freshwater mussel with a trapezoidal-shaped shell that is usually less than 1.7 inches in length and is brown to yellowish brown in color. It is historically known to exist from New Brunswick, Canada to North Carolina. Documented populations in North Carolina have occurred in Johnston, Wake, Orange, Nash, Wilson, Granville, Person, Vance, Franklin, and Warren counties.

The dwarf wedgemussel inhabits creeks and rivers close to the banks, under overhangs, and around submerged logs. It is also known to live on firm substrate of sand, gravel, and muddy sand with a slow to moderate current and requires clean water that is well oxygenated and nearly silt free. Hosts for the dwarf wedgemussel larvae (glochidia) that have been identified include the tessellated darter (*Etheostoma olmstedi*), Johnny darter (*E. nigrum*), and mottled sculpin (*Cottus bairdi*).

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. The dwarf wedgemussel requires nearly silt-free waters. The existing mainstem of Finches Branch is deeply incised and has active streambank erosion, as do substantial portions of the other reaches at this site. Large portions of the project site lack adequate riparian buffers and are impacted by livestock intrusion. Off-site downstream conditions are similar, if not worse, with continued livestock access to a degraded channel. A field survey conducted on June 22, 2016 did not observe the presence of any mussels, nor evidence of mussels such as shells on stream banks, along either of the two primary intermittent streams, nor in any of their smaller spring-fed tributaries that make up the proposed project. Currently, the project reaches act as sources of sediment and nutrient water quality impairment to Buckwater Creek, the Eno River, and ultimately the Neuse River. As the project currently lacks the mussel's preferred habitat, the construction of this project is anticipated to have no effect on the species. Post-construction, the restored stream will be stable and will exclude livestock from the channel. The resulting water quality improvements should actually serve to increase dwarf wedgemussel habitat.

Rhus michauxii (Michaux's sumac)
Federal Status: Endangered
Plant Family: Anacardiaceae

Michaux's sumac is a rhizomatous, densely hairy shrub, with erect stems from 1-3 feet in height. The compound leaves contain evenly serrated, oblong to lanceolate, acuminate leaflets. Most plants are unisexual; however, more recent observations have revealed plants with both male and female flowers on one plant. The flowers are small, borne in a terminal, erect, dense cluster, and colored greenish yellow to white in color. Flowering usually occurs from June to July; and the fruit, a red drupe, is produced through the months of August to October.

Michaux's sumac grows in sandy or rocky open woods in association with basic soils. Apparently, this plant survives best in areas where some form of disturbance has provided an open area. Several populations in North Carolina are on highway rights-of way, roadsides, or on the edges of artificially maintained clearings. The plant is also threatened by fire suppression activities, habitat destruction due to residential and industrial development and construction, and herbicides used for power line maintenance.

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. A geospatial analysis of habitat near the site was conducted on June 28, 2016, using the NC Gap Analysis Project (GAP) online tool. Potential Michaux's sumac habitat is located within the vicinity of the site and at the edge of the easement boundary, though the site does not contain the soils typically found for the species. Based on a site survey conducted on June 22, 2016, potential habitat for Michaux's sumac is present in open areas at the edges of the trees; however, no individuals were observed. The construction of this project is anticipated to have no effect on the species.

Echinacea laevigata **(**Smooth Coneflower**)**
Federal Status: Endangered
Plant Family: Asteraceae

Smooth coneflower is a perennial herb in the Aster family (Asteraceae) that grows up to 3.3 feet (ft) tall from a vertical root stock. The large elliptical to broadly lanceolate basal leaves may reach 8 inches (in) in length and 3.0 in in width and taper into long petioles toward the base. They are smooth to slightly rough in texture. The stems are smooth, with few leaves. The mid-stem leaves are smaller than the basal leaves and have shorter petioles. Flower heads are usually solitary. The rays of the flowers (petal-like structures) are light pink to purplish in color, usually drooping, and 2 – 3.2 in long. Flowering occurs from late May through mid July and fruits develop from late June to September. The fruiting structures often persist through the fall.

Smooth coneflower is typically found in open woods, glades, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium and calcium rich soils associated with amphibolite, dolomite or limestone (in Virginia), gabbro (in North Carolina and Virginia), diabase (in North Carolina and South Carolina), and marble (in South Carolina and Georgia). Smooth coneflower occurs in plant communities that have been described as xeric hardpan forests, diabase glades, or dolomite woodlands. Optimal sites are characterized by abundant sunlight and little competition in the herbaceous layer. Many of the herbs associated with smooth coneflower are also sun-loving species that depend on periodic disturbances to reduce the shade and competition of woody plants.

Biological Conclusion: No Effect

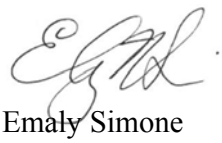
Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. The species was historically found in Orange County, but there are no known current occurrences. A survey of potential habitat for the species was conducted on June 22, 2016 during the blooming window for the

species. Neither individuals nor the appropriate habitat were encountered during the survey. The site does not contain the typical soils or underlying geology commonly associated with the species, nor were the dominant site conditions conducive to its occurrence with a dense vegetative understory on wet floodplains beneath a heavily shaded canopy. The open areas beside the horse pasture along the forest edge were especially closely inspected for the species but none were discovered. The construction of this project is anticipated to have no effect on the species.

The enclosed documentation also covers correspondence with the North Carolina Historic Preservation Office (NC-HPO) and the Natural Resources Conservation Service (NRCS).

This project would be considered a "Ground-Disturbing Activity" and the entire CE "checklist" has been completed. Please note that only one set of figures is included in the submittal; identical figures were sent to: USFWS, NCWRC, NC-HPO, and NRCS. The actions associated with the construction of the referenced project have been determined not to individually or cumulatively have a significant effect on the environment. Submission of this CE document fulfills the environmental documentation requirements mandated under the National Environmental Policy Act (NEPA; 40 CFR Parts 1500-1508). If you have any questions, please feel free to contact me at 919-481-5721 or via email at emaly.simone@mbakerintl.com.

Sincerely,



Emaly Simone
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 200
Cary, NC 27518
Phone: (919) 481-5721
Email: emaly.simone@mbakerintl.com

Michael Baker
INTERNATIONAL

Gary Jordan
US Fish and Wildlife Service
Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636

June 29, 2016

Subject: NC Division of Mitigation Services (DMS) stream and wetland mitigation project in Orange County

Dear Mr. Jordan,

The purpose of this letter is to request review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with a potential wetland and stream restoration project on the attached site (USGS site maps with approximate property lines and areas of potential ground disturbance are enclosed).

The Lochill Farm site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and/or wetland impacts. The existing stream reaches (Finches Branch and UTs to Finches Branch) and riparian wetlands at the site have been significantly impacted by past and present use as a horse farm, historic logging activity, and agricultural use for both row-crops and pasture for cattle and sheep.

We have already obtained an updated species list for Orange County from your web site (http://www.fws.gov/raleigh/species/cntylist/orange.html). The listed species are shown below.

Scientific Name	Common Name	Federal Status
Haliaeetus leucocephalus	Bald Eagle	Bald and Gold Eagle Protection Act (BGPA)
Alasmidonta heterodon	Dwarf Wedgemussel	Endangered
Rhus michauxii	Michaux's Sumac	Endangered
Echinacea laevigata	Smooth Coneflower	Endangered

Based on our review and field surveys, we have developed the following conclusions on the potential effects of this project on federally listed species:

Haliaeetus leucocephalus (Bald eagle)
Federal Status: Protected by the Bald and Golden Eagle Protection Act
Animal Family: Accipitridae

Adult bald eagles can be identified by their large white head and short white tail. The body plumage is dark-brown to chocolate-brown in color. In flight, bald eagles can be identified by their flat wing soar. Eagle nests are found in close proximity to water (within 0.5 mile) with a clear flight path to the water, in the largest living tree in an area, and having an open view of the surrounding land.

Human disturbance can cause an eagle to abandon otherwise suitable habitat. The breeding season for the bald eagle begins in December or January. Fish are the major food source for bald eagles. Other sources include coots, herons, and wounded ducks. Food may be live or carrion.

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. A desktop-GIS assessment of the project study area on June 20, 2016 using Google Earth color aerials. No large water bodies were found within four miles of the project. Due to the distance to the nearest large body of water and minimal impact anticipated for this project, it has been determined that this project will not affect this species. Further, no large nests have been observed in the forest canopy during site walkovers conducted during the winter months.

***Alasmidonta heterodon* (Dwarf wedgemussel)**
Federal Status: Endangered
Animal Family: Unionidae

The dwarf wedgemussel is a small freshwater mussel with a trapezoidal-shaped shell that is usually less than 1.7 inches in length and is brown to yellowish brown in color. It is historically known to exist from New Brunswick, Canada to North Carolina. Documented populations in N.C. have occurred in Johnston, Wake, Orange, Nash, Wilson, Granville, Person, Vance, Franklin, and Warren counties.

The dwarf wedgemussel inhabits creeks and rivers close to the banks, under overhangs, and around submerged logs. It is also known to live on firm substrate of sand, gravel, and muddy sand with a slow to moderate current and requires clean water that is well oxygenated and nearly silt free. Hosts for the dwarf wedgemussel larvae (glochidia) that have been identified include the tessellated darter (*Etheostoma olmstedi*), Johnny darter (*E. nigrum*), and mottled sculpin (*Cottus bairdi*).

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. The dwarf wedgemussel requires nearly silt-free waters. The existing mainstem of Finches Branch is deeply incised and has active streambank erosion, as do substantial portions of the other reaches at this site. Large portions of the project site lack adequate riparian buffers and are impacted by livestock intrusion. Off-site downstream conditions are similar, if not worse, with continued livestock access to a degraded channel. A field survey conducted on June 22, 2016 did not observe any mussels, nor evidence of mussels such as shells on stream banks, present along either of the two primary intermittent streams, nor in any of their smaller spring-fed tributaries that make up the proposed project. Currently, the project reaches act as sources of sediment and nutrient water quality impairment to Buckwater Creek, the Eno River, and ultimately the Neuse River. As the project currently lacks the mussel's preferred habitat, the construction of this project is anticipated to have no effect on the species. Post-construction, the restored stream will be stable and will exclude livestock from the channel. The resulting water quality improvements should actually serve to increase dwarf wedgemussel habitat.

Rhus michauxii (Michaux's sumac)
Federal Status: Endangered
Plant Family: Anacardiaceae

Michaux's sumac is a rhizomatous, densely hairy shrub, with erect stems from 1-3 feet in height. The compound leaves contain evenly serrated, oblong to lanceolate, acuminate leaflets. Most plants are unisexual; however, more recent observations have revealed plants with both male and female flowers on one plant. The flowers are small, borne in a terminal, erect, dense cluster, and colored greenish yellow to white in color. Flowering usually occurs from June to July; and the fruit, a red drupe, is produced through the months of August to October.

Michaux's sumac grows in sandy or rocky open woods in association with basic soils. Apparently, this plant survives best in areas where some form of disturbance has provided an open area. Several populations in North Carolina are on highway rights-of way, roadsides, or on the edges of artificially maintained clearings. The plant is also threatened by fire suppression activities, habitat destruction due to residential and industrial development and construction, and herbicides used for power line maintenance.

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. A geospatial analysis of habitat near the site was conducted on June 28, 2016, using the NCGAP online tool. Potential Michaux's sumac habitat is located within the vicinity of the site and at the edge of the easement boundary, though the site does not contain the soils typically found for the species. Based on a site survey conducted on June 22, 2016, potential habitat for Michaux's sumac is present in open areas at the edges of the trees; however, no individuals were observed. The construction of this project is anticipated to have no effect on the species.

Echinacea laevigata **(**Smooth Coneflower**)**
Federal Status: Endangered
Plant Family: Asteraceae

Smooth coneflower is a perennial herb in the Aster family (Asteraceae) that grows up to 3.3 feet (ft) tall from a vertical root stock. The large elliptical to broadly lanceolate basal leaves may reach 8 inches (in) in length and 3.0 in in width and taper into long petioles toward the base. They are smooth to slightly rough in texture. The stems are smooth, with few leaves. The mid-stem leaves are smaller than the basal leaves and have shorter petioles. Flower heads are usually solitary. The rays of the flowers (petal-like structures) are light pink to purplish in color, usually drooping, and 2 – 3.2 in long. Flowering occurs from late May through mid July and fruits develop from late June to September. The fruiting structures often persist through the fall.

Smooth coneflower is typically found in open woods, glades, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium and calcium rich soils associated with amphibolite, dolomite or limestone (in Virginia), gabbro (in North Carolina and Virginia), diabase (in North Carolina and South Carolina), and marble (in South Carolina and Georgia). Smooth coneflower occurs in plant communities that have been described as xeric hardpan forests, diabase glades, or dolomite woodlands. Optimal sites are characterized by abundant sunlight and little competition in the herbaceous layer. Many of the herbs associated with smooth coneflower are also sun-loving species that depend on periodic disturbances to reduce the shade and competition of woody plants.

Biological Conclusion: No Effect

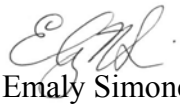
Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. The species was historically found in Orange County, but there are no known current occurrences. A survey of potential habitat for the species was conducted on June 22, 2016 during the blooming window for the species. Neither individuals nor the appropriate habitat were encountered during the survey. The site does not contain the typical soils or underlying geology commonly associated with the species, nor were the dominant site conditions conducive to its occurrence with a dense vegetative understory on wet floodplains beneath a heavily shaded canopy. The open areas beside horse pasture along the forest edge were especially closely inspected for the species but none were discovered. The construction of this project is anticipated to have no effect on the species.

Please provide comments on any possible issues that might emerge with respect to endangered species, migratory birds or other trust resources from the construction of a wetland and/or stream restoration project on the subject property. A USGS map showing the approximate property lines and areas of potential ground disturbance is enclosed.

If we have not heard from you in 30 days we will assume that our species list and conclusions are correct, that you do not have any comments regarding associated laws, and that you do not have any information relevant to this project at the current time.

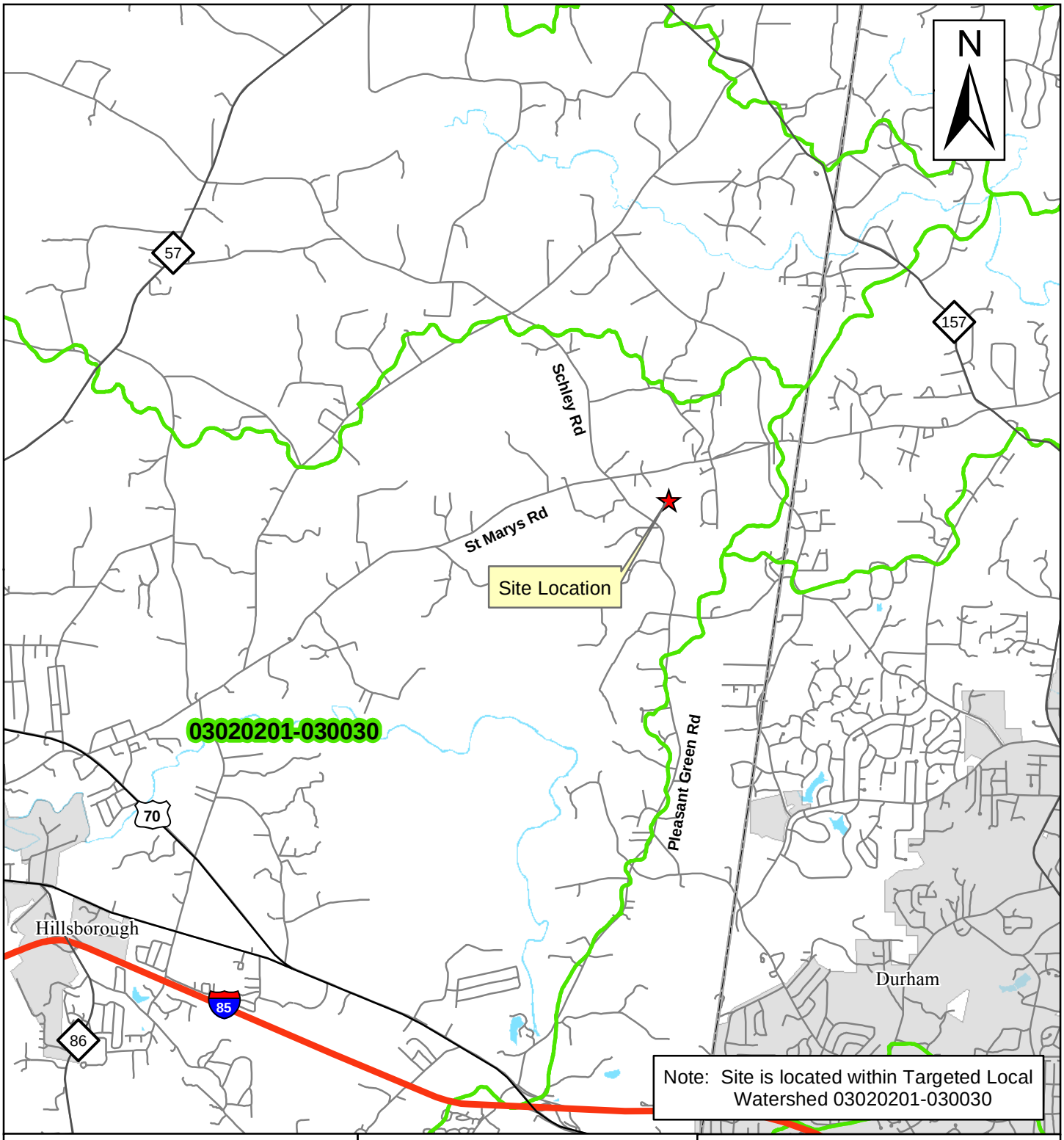
We thank you in advance for your timely response and cooperation. Please feel free to contact us with any questions that you may have concerning the extent of site disturbance associated with this project.

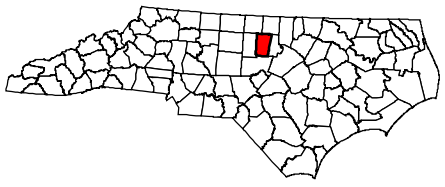
Sincerely,



Emaly Simone
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518

Phone: (919) 481-5721
Email: emaly.simone@mbakerintl.com





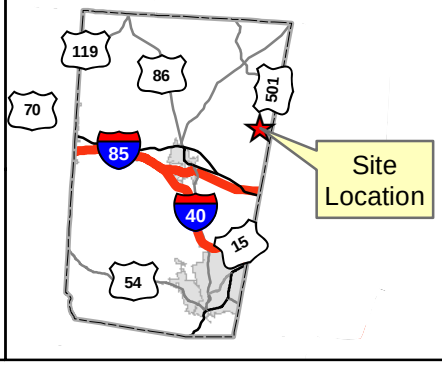
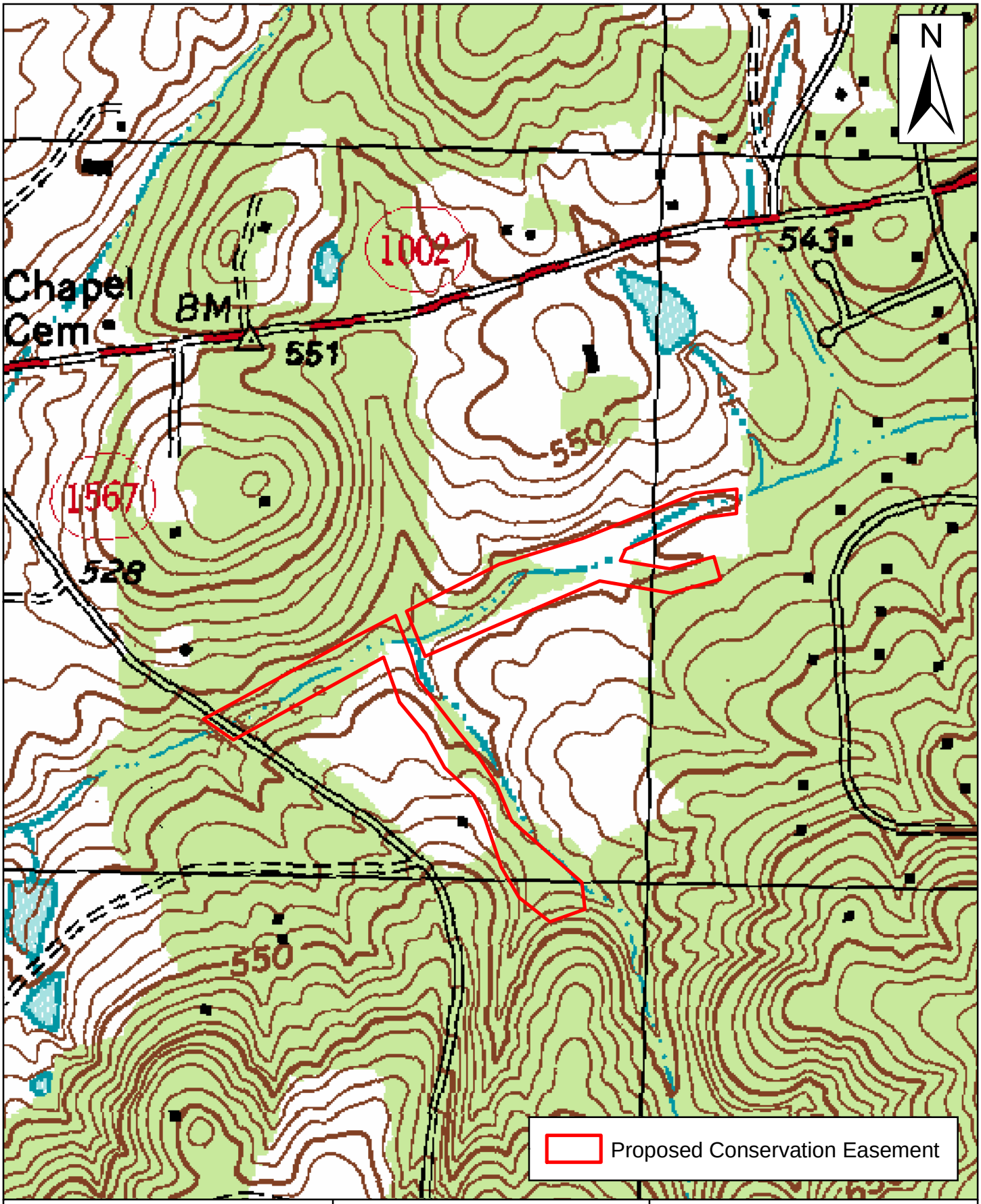


Figure 1
Project Vicinity Map
Lochill Farm Site

Michael Baker INTERNATIONAL

0 0.5 1 2 Miles



Michael Baker INTERNATIONAL

0 500 1,000 Feet

Figure 2
USGS Topographic Map
(Northwest Durham Quad)
Lochill Farm Site

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Raleigh ES Field Office
Post Office Box 33726
Raleigh, North Carolina 27636-3726

July 28, 2016

Emaly Simone
Michael Baker International
8000 Regency Parkway, Suite 600
Cary, NC 27518

Re: Lochill Farm Stream & Wetland Mitigation – Orange County, NC

Dear Mrs. Simone:

This letter is to inform you that a list of all federally-protected endangered and threatened species with known occurrences in North Carolina is now available on the U.S. Fish and Wildlife Service's (Service) web page at http://www.fws.gov/raleigh. Therefore, if you have projects that occur within the Raleigh Field Office's area of responsibility (see attached county list), you no longer need to contact the Raleigh Field Office for a list of federally-protected species.

Our web page contains a complete and frequently updated list of all endangered and threatened species protected by the provisions of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), and a list of federal species of concern[1] that are known to occur in each county in North Carolina.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes.

[1] The term "federal species of concern" refers to those species which the Service believes might be in need of concentrated conservation actions. Federal species of concern receive no legal protection and their designation does not necessarily imply that the species will eventually be proposed for listing as a federally endangered or threatened species. However, we recommend that all practicable measures be taken to avoid or minimize adverse impacts to federal species of concern.

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

With regard to the above-referenced project, we offer the following remarks. Our comments are submitted pursuant to, and in accordance with, provisions of the Endangered Species Act.

Based on the information provided and other information available, it appears that the proposed action is not likely to adversely affect any federally-listed endangered or threatened species, their formally designated critical habitat, or species currently proposed for listing under the Act at these sites. We believe that the requirements of section 7(a)(2) of the Act have been satisfied for your project. Please remember that obligations under section 7 consultation must be reconsidered if: (1) new information reveals impacts of this identified action that may affect listed species or critical habitat in a manner not previously considered; (2) this action is subsequently modified in a manner that was not considered in this review; or, (3) a new species is listed or critical habitat determined that may be affected by the identified action.

However, the Service is concerned about the potential impacts the proposed action might have on aquatic species. Aquatic resources are highly susceptible to sedimentation. Therefore, we recommend that all practicable measures be taken to avoid adverse impacts to aquatic species, including implementing directional boring methods and stringent sediment and erosion control measures. An erosion and sedimentation control plan should be submitted to and approved by the North Carolina Division of Land Resources, Land Quality Section prior to construction. Erosion and sedimentation controls should be installed and maintained between the construction site and any nearby down-gradient surface waters. In addition, we recommend maintaining natural, vegetated buffers on all streams and creeks adjacent to the project site.

The North Carolina Wildlife Resources Commission has developed a Guidance Memorandum (a copy can be found on our website at (http://www.fws.gov/raleigh) to address and mitigate secondary and cumulative impacts to aquatic and terrestrial wildlife resources and water quality. We recommend that you consider this document in the development of your projects and in completing an initiation package for consultation (if necessary).

We hope you find our web page useful and informative and that following the process described above will reduce the time required, and eliminate the need, for general correspondence for species' lists. If you have any questions or comments, please contact Kathy Matthews of this office at (919) 856-4520 ext. 27.

Sincerely,

for Kathy H. Matthews

Pete Benjamin
Field Supervisor

List of Counties in the Service's Raleigh Field Office Area of Responsibility

Alamance
Beaufort
Bertie
Bladen
Brunswick
Camden
Carteret
Caswell
Chatham
Chowan
Columbus
Craven
Cumberland
Currituck
Dare
Duplin
Durham
Edgecombe
Franklin
Gates
Granville
Greene
Guilford
Halifax
Harnett
Hertford
Hoke
Hyde
Johnston
Jones
Lee
Lenoir
Martin
Montgomery
Moore
Nash
New Hanover
Northampton
Onslow
Orange
Pamlico
Pasquotank
Pender
Perquimans
Person
Pitt
Randolph
Richmond
Robeson
Rockingham
Sampson
Scotland
Tyrrell
Vance
Wake
Warren
Washington
Wayne
Wilson

Michael Baker
INTERNATIONAL

Travis Wilson
NC Wildlife Resources Commission
1718 Hwy 56 West
Creedmoor, NC 27522

June 29, 2016

Subject: NC Division of Mitigation Services (DMS) stream and wetland mitigation project in Orange County

Dear Mr. Wilson,

The purpose of this letter is to request review and comment on any possible issues that might emerge with respect to fish and wildlife issues associated with a potential wetland and stream restoration project on the attached site (USGS site maps with approximate property lines and areas of potential ground disturbance are enclosed).

The Lochill Farm site has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and/or wetland impacts. The existing stream reaches (Finches Branch and UTs to Finches Branch) and riparian wetlands at the site have been significantly impacted by past and present use as a horse farm, historic logging activity, and agricultural use for both row-crops and pasture for cattle and sheep.

We have already obtained an updated species list for Orange County from your web site (http://www.fws.gov/raleigh/species/cntylist/orange.html). The listed species are shown below.

Scientific Name	Common Name	Federal Status
Haliaeetus leucocephalus	Bald Eagle	Bald and Gold Eagle Protection Act (BGPA)
Alasmidonta heterodon	Dwarf Wedgemussel	Endangered
Rhus michauxii	Michaux's Sumac	Endangered
Echinacea laevigata	Smooth Coneflower	Endangered

Based on our review and field surveys, we have developed the following conclusions on the potential effects of this project on federally listed species:

Haliaeetus leucocephalus (Bald eagle)
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Animal Family: Accipitridae

Adult bald eagles can be identified by their large white head and short white tail. The body plumage is dark-brown to chocolate-brown in color. In flight, bald eagles can be identified by their flat wing soar. Eagle nests are found in close proximity to water (within 0.5 mile) with a clear flight path to the water, in the largest living tree in an area, and having an open view of the surrounding land.

Human disturbance can cause an eagle to abandon otherwise suitable habitat. The breeding season for the bald eagle begins in December or January. Fish are the major food source for bald eagles. Other sources include coots, herons, and wounded ducks. Food may be live or carrion.

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. A desktop-GIS assessment of the project study area on June 20, 2016 using Google Earth color aerials. No large water bodies were found within four miles of the project. Due to the distance to the nearest large body of water and minimal impact anticipated for this project, it has been determined that this project will not affect this species. Further, no large nests have been observed in the forest canopy during site walkovers conducted during the winter months.

***Alasmidonta heterodon* (Dwarf wedgemussel)**
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Animal Family: Unionidae

The dwarf wedgemussel is a small freshwater mussel with a trapezoidal-shaped shell that is usually less than 1.7 inches in length and is brown to yellowish brown in color. It is historically known to exist from New Brunswick, Canada to North Carolina. Documented populations in N.C. have occurred in Johnston, Wake, Orange, Nash, Wilson, Granville, Person, Vance, Franklin, and Warren counties.

The dwarf wedgemussel inhabits creeks and rivers close to the banks, under overhangs, and around submerged logs. It is also known to live on firm substrate of sand, gravel, and muddy sand with a slow to moderate current and requires clean water that is well oxygenated and nearly silt free. Hosts for the dwarf wedgemussel larvae (glochidia) that have been identified include the tessellated darter (*Etheostoma olmstedi*), Johnny darter (*E. nigrum*), and mottled sculpin (*Cottus bairdi*).

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. The dwarf wedgemussel requires nearly silt-free waters. The existing mainstem of Finches Branch is deeply incised and has active streambank erosion, as do substantial portions of the other reaches at this site. Large portions of the project site lack adequate riparian buffers and are impacted by livestock intrusion. Off-site downstream conditions are similar, if not worse, with continued livestock access to a degraded channel. A field survey conducted on June 22, 2016 did not observe any mussels, nor evidence of mussels such as shells on stream banks, present along either of the two primary intermittent streams, nor in any of their smaller spring-fed tributaries that make up the proposed project. Currently, the project reaches act as sources of sediment and nutrient water quality impairment to Buckwater Creek, the Eno River, and ultimately the Neuse River. As the project currently lacks the mussel's preferred habitat, the construction of this project is anticipated to have no effect on the species. Post-construction, the restored stream will be stable and will exclude livestock from the channel. The resulting water quality improvements should actually serve to increase dwarf wedgemussel habitat.

Rhus michauxii (Michaux's sumac)
Federal Status: Endangered
Plant Family: Anacardiaceae

Michaux's sumac is a rhizomatous, densely hairy shrub, with erect stems from 1-3 feet in height. The compound leaves contain evenly serrated, oblong to lanceolate, acuminate

leaflets. Most plants are unisexual; however, more recent observations have revealed plants with both male and female flowers on one plant. The flowers are small, borne in a terminal, erect, dense cluster, and colored greenish yellow to white in color. Flowering usually occurs from June to July; and the fruit, a red drupe, is produced through the months of August to October.

Michaux's sumac grows in sandy or rocky open woods in association with basic soils. Apparently, this plant survives best in areas where some form of disturbance has provided an open area. Several populations in North Carolina are on highway rights-of way, roadsides, or on the edges of artificially maintained clearings. The plant is also threatened by fire suppression activities, habitat destruction due to residential and industrial development and construction, and herbicides used for power line maintenance.

Biological Conclusion: No Effect

Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. A geospatial analysis of habitat near the site was conducted on June 28, 2016, using the NCGAP online tool. Potential Michaux's sumac habitat is located within the vicinity of the site and at the edge of the easement boundary, though the site does not contain the soils typically found for the species. Based on a site survey conducted on June 22, 2016, potential habitat for Michaux's sumac is present in open areas at the edges of the trees; however, no individuals were observed. The construction of this project is anticipated to have no effect on the species.

Echinacea laevigata **(**Smooth Coneflower**)**
Federal Status: Endangered
Plant Family: Asteraceae

Smooth coneflower is a perennial herb in the Aster family (Asteraceae) that grows up to 3.3 feet (ft) tall from a vertical root stock. The large elliptical to broadly lanceolate basal leaves may reach 8 inches (in) in length and 3.0 in in width and taper into long petioles toward the base. They are smooth to slightly rough in texture. The stems are smooth, with few leaves. The mid-stem leaves are smaller than the basal leaves and have shorter petioles. Flower heads are usually solitary. The rays of the flowers (petal-like structures) are light pink to purplish in color, usually drooping, and 2 – 3.2 in long. Flowering occurs from late May through mid July and fruits develop from late June to September. The fruiting structures often persist through the fall.

Smooth coneflower is typically found in open woods, glades, cedar barrens, roadsides, clearcuts, dry limestone bluffs, and power line rights-of-way, usually on magnesium and calcium rich soils associated with amphibolite, dolomite or limestone (in Virginia), gabbro (in North Carolina and Virginia), diabase (in North Carolina and South Carolina), and marble (in South Carolina and Georgia). Smooth coneflower occurs in plant communities that have been described as xeric hardpan forests, diabase glades, or dolomite woodlands. Optimal sites are characterized by abundant sunlight and little competition in the herbaceous layer. Many of the herbs associated with smooth coneflower are also sun-loving species that depend on periodic disturbances to reduce the shade and competition of woody plants.

Biological Conclusion: No Effect

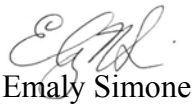
Based on a search of the Natural Heritage database (June 20, 2016), no populations of the species are listed within 2 miles of the project study area. The species was historically found in Orange County, but there are no known current occurrences. A survey of potential habitat for the species was conducted on June 22, 2016 during the blooming window for the species. Neither individuals nor the appropriate habitat were encountered during the survey. The site does not contain the typical soils or underlying geology commonly associated with the species, nor were the dominant site conditions conducive to its occurrence with a dense vegetative understory on wet floodplains beneath a heavily shaded canopy. The open areas beside horse pasture along the forest edge were especially closely inspected for the species but none were discovered. The construction of this project is anticipated to have no effect on the species.

Please provide comments on any possible issues that might emerge with respect to endangered species, migratory birds or other trust resources from the construction of a wetland and/or stream restoration project on the subject property. A USGS map showing the approximate property lines and areas of potential ground disturbance is enclosed.

If we have not heard from you in 30 days we will assume that our species list and conclusions are correct, that you do not have any comments regarding associated laws, and that you do not have any information relevant to this project at the current time.

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

Sincerely,



Emaly Simone
Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518

Phone: (919) 481-5721
Email: emaly.simone@mbakerintl.com

Simone, Emaly

From: Wilson, Travis W. <travis.wilson@ncwildlife.org>
Sent: Wednesday, June 29, 2016 2:45 PM
To: Simone, Emaly
Cc: King, Scott
Subject: RE: NC DMS Stream and Wetland Mitigation Project in Orange County - Lochill Farm

I have reviewed the project area. Finches Branch and UT Finches Branch are tributaries of Buckwater Creek that is a tributary of the Eno River. Our records do not identify any specific concerns within the project area. There are sensitive aquatic species in the Eno River at the confluence with Buckwater and it is feasible for those species to be present in the lower reaches of Buckwater Creek. Those species include:

Triangle floater (*Alasmidonta undulata*: state T)
Atlantic pigtoe (*Fusconaia masoni*: state E, FSC)
Eastern lampmussel (*Lampsilis radiata*: state T)
Creeper (*Strophitus undulatus*: state T)
Notched rainbow (*Villosa constricta*: state SC)
Roanoke bass (*Ambloplites cavifrons*: state SR, FSC)
Yellow lampmussel (*Lampsilis cariosa*: state E, FSC)

From: Simone, Emaly [mailto:Emaly.Simone@mbakerintl.com]
Sent: Wednesday, June 29, 2016 12:55 PM
To: Wilson, Travis W. <travis.wilson@ncwildlife.org>
Cc: King, Scott <Scott.King@mbakerintl.com>
Subject: NC DMS Stream and Wetland Mitigation Project in Orange County - Lochill Farm

Hi, Travis,

Attached please find a request to review fish and wildlife impacts associated with a stream and wetland mitigation project in Orange County.

Thanks,

Emaly

Emaly Simone | Environmental Specialist | Michael Baker International
8000 Regency Parkway, Suite 600 | Cary, NC | [O] 919-481-5721
emaly.simone@mbakerintl.com | www.mbakerintl.com

Michael Baker
INTERNATIONAL

Innovation Done Right...We Make a Difference

May 11, 2016

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

RE: Coordination Request
North Carolina Division of Mitigation Services
Lochill Farm Stream Mitigation Project
Orange County, North Carolina
Catalogue Unit No. 03020201

Dear Ms. Gledhill-Earley,

Michael Baker Engineering, Inc., (Michael Baker) has been contracted by the North Carolina Division of Mitigation Services (NCDMS) to conduct stream and wetland restoration/enhancement activities for the above-referenced project. We request that your office review the attached documentation and comment on any possible issues with respect to archaeological or cultural resources associated the proposed stream and wetland restoration/enhancement project.

The project area is located in Orange County, NC, approximately five miles northeast of Hillsborough and four miles northwest of Durham (see enclosed vicinity map). The project is located on the Northwest Durham, North Carolina 7.5-minute topographic map from the United States Geological Survey (USGS). The northern terminus of the project site is located at latitude 36º 52' 92"N and longitude 78º 59' 16"W and the southern terminus is located at latitude 36º 06' 44"N and longitude 78º 59' 48"W. Enclosed please find a map showing the project location on a USGS quadrangle map. The site is located off St. Mary's Road near its intersection with Pleasant Green Road.

The project will involve the restoration, enhancement, or preservation of stream, wetland, and riparian buffer functions along Finches Branch and unnamed tributaries (UTs) to Finches Branch. Segments of these reaches have been identified as incised, eroding, and no longer connected to their floodplains. In total, 5,500 linear feet of stream have been identified for preservation, enhancement, or restoration. The conservation easement and proposed disturbance limits extends at least 50 feet from the existing top of bank, and includes several riparian wetland areas. The enclosed proposed mitigation features map displays the areas proposed for restoration/enhancement.

The area surrounding the project includes the Gosling House (OR0652), which is on the Study List for the National Register of Historic Places (NRHP). The boundary for the Saint Mary's Road Rural Historical District (OR1456) is located across Schley Road from the southern terminus of the project (see enclosed map generated using the

Michael Baker Engineering, Inc.
8000 Regency Parkway, Suite 600, Cary, NC
Office 919.463.5488, Fax 919.463.5490

HPOWEB GIS Service). On-site investigations and discussions with landowners have not revealed any potential cultural resources within the proposed easement areas. The project is consistent with maintaining the rural, agricultural feel of the site. No existing structures are located with the areas proposed for restoration or enhancement. Furthermore, no architectural structures or archeological artifacts have been observed or noted during preliminary surveys of the site for restoration purposes. In addition, the majority of the site has historically been disturbed due to past and current management for horse grazing and rearing.

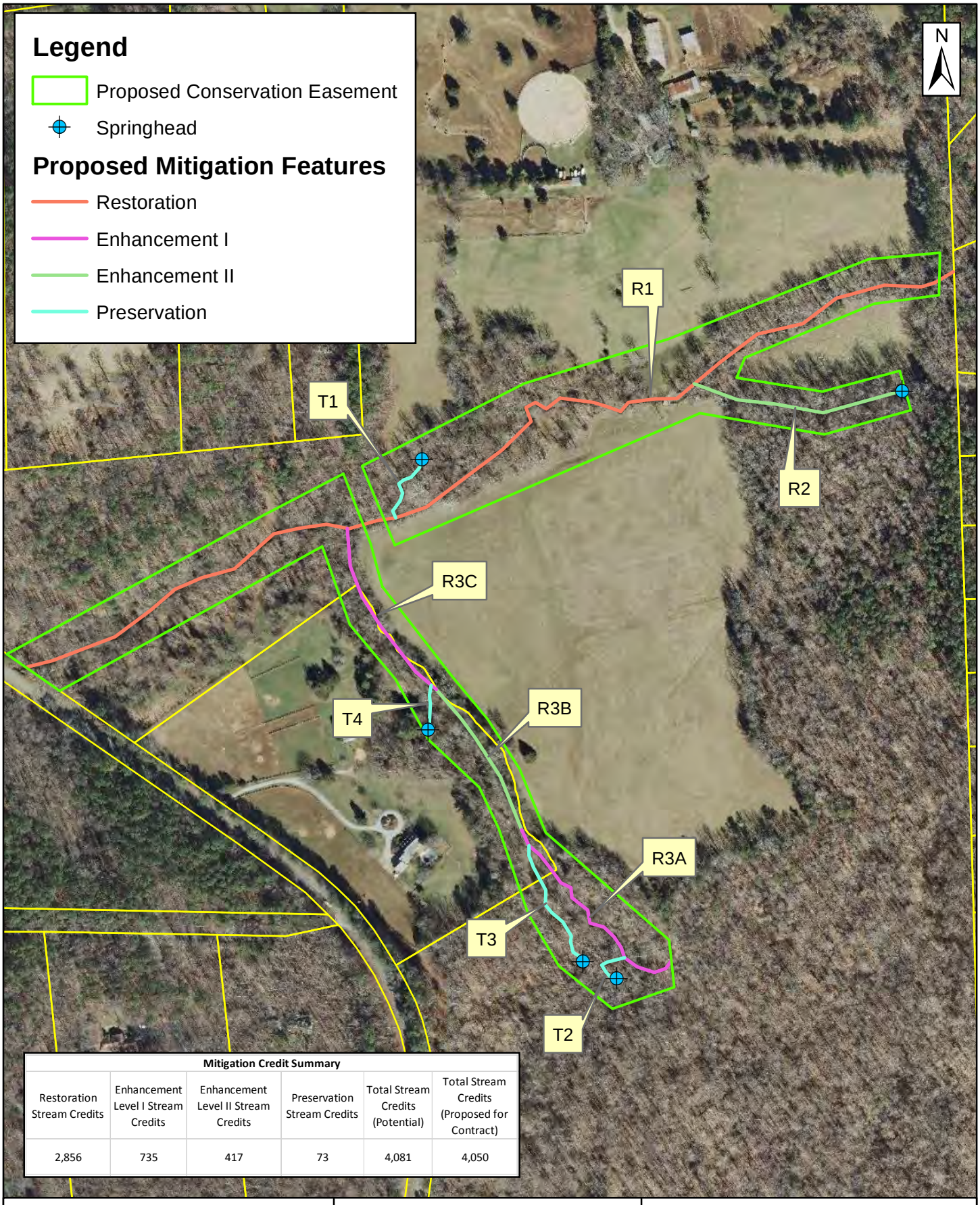
We ask that you review this site based on the attached information to determine the presence of any historic properties. Please feel free to contact us if you have any questions regarding this project or the extent of proposed disturbance. I can be reached at 919-481-5721.

Sincerely,

Emaly Simone

cc: Lindsay Crocker, NCDMS
Scott King, Michael Baker

Enclosures



Mitigation Credit Summary					
Restoration Stream Credits	Enhancement Level I Stream Credits	Enhancement Level II Stream Credits	Preservation Stream Credits	Total Stream Credits (Potential)	Total Stream Credits (Proposed for Contract)
2,856	735	417	73	4,081	4,050

Michael Baker INTERNATIONAL

0 250 500 Feet

Figure 9
Proposed Mitigation Features
Lochill Farm Site


OR1454 Dodson House
OR0718 Walker Farm
OR0018 St. Marys Chapel
1978
OR0657 St. Mary's School
Fairhaven
St Marys Rd
OR1455 Walker House
OR0652 Gosling House
1993
Martin Ct
Malvern Ln
Hepowil Trce N
St Marys Rd
OR1002 G. Washington
Walker, Jr. Farm
ORANGE
Pleasant Green Rd
860 ft
332 ft
283 ft
336 ft
440 ft
420 ft
313 ft
438 ft
412 ft
307 ft
259 ft
165 ft
241 ft
254 ft
510 ft
130 ft
405 ft
Area: 0.05 sq mi
Perimeter: 9,851 ft
461 ft
342 ft
340 ft
180 ft
369 ft
543 ft
Buck Quarter Rd
Gentry Ln
Linden Ct
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Pat McCrory
Secretary Susan Kluttz

Office of Archives and History
Deputy Secretary Kevin Cherry

July 8, 2016

Emaly Simone
Michael Baker International
8000 Regency Parkway, Suite 600
Cary, NC 27518

Re: Lochill Farm Stream Mitigation Project, Catalogue Unit 03020201, Orange County, ER 16-0829

Dear Ms. Simone:

Thank you for your letter of May 11, 2016, concerning the above project. We apologize for the delay in our response.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

Michael Baker
INTERNATIONAL

Innovation Done Right...We Make a Difference

Mr. Richard Brooks
Resource Soil Scientist
2736 NC Hwy 210
Smithfield, NC 27577

June 14, 2016

Subject: Prime and Important Farmland Soils RE: NCDMS Project, Lochill Farm Stream Restoration Site, Orange County, NC

Dear Mr. Brooks:

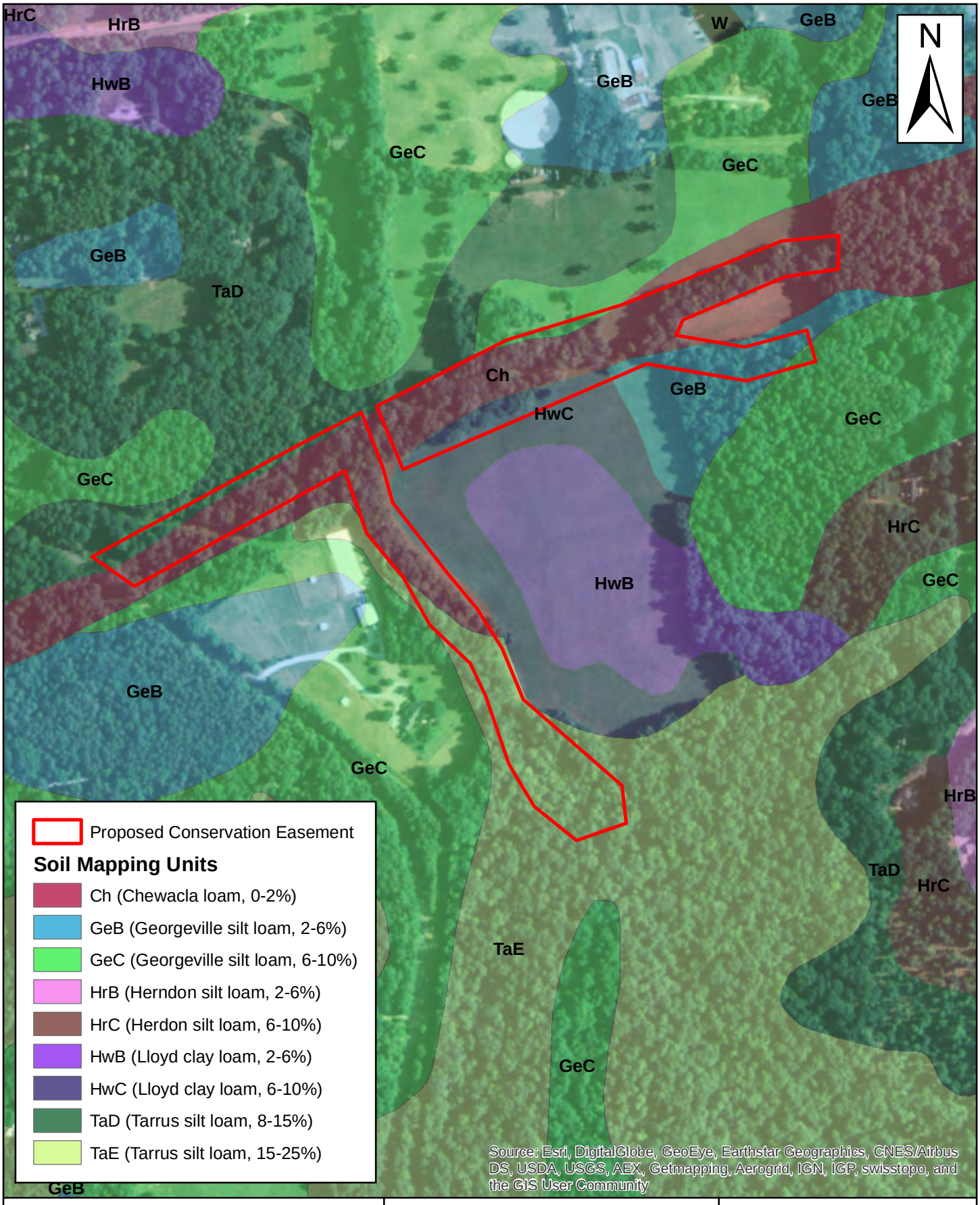
Enclosed please find a draft copy of the Farmland Conversion Impact Rating form (AD-1006) and associated mapping for the subject site. The site is located on Pleasant Green Rd. near St. Mary's St. in Orange County, northeast of the Hillsborough, as shown in Figures 1 and 2. This stream restoration site proposes to restore Finches Branch and unnamed tributaries (UTs) to Finches Branch. Figure 3 is a map of the soils encountered at the project site. Additional information about these soils is provided in the table below.

Soil Code	Soil Description	Acres	Soil Designation
Ch	Chewacla loam, 0 to 2 percent slopes, frequently flooded	9.2	Prime
GeB	Georgeville silt loam, 2 to 6 percent slopes	1.2	Prime
GeC	Georgeville silt loam, 6 to 10 percent slopes	0.3	Farmland of statewide importance
HwC	Lloyd clay loam, 6 to 10 percent slopes	1.3	Farmland of statewide importance
TaD	Tarrus silt loam, 8 to 15 percent slopes	0.7	Farmland of statewide importance
TaE	Tarrus silt loam, 15 to 25 percent slopes	3.3	
Total Acreage		15.8	
Total Prime Farmland Acreage		10.4	Prime
Total Acreage of Farmland of Statewide Importance		2.3	Farmland of statewide importance

We appreciate your assistance with the project. I would be glad to provide a hard copy of the final information if it would be better for you. If you have any questions, please feel free to contact me at emaly.simone@mbakerintl.com or by phone at (919) 481-5721. Thank you again for your assistance in this matter.

Sincerely,

Emaly N. Simone
Baker Engineering, NY, Inc.
8000 Regency Parkway, Suite 600
Cary, NC 27518



Michael Baker INTERNATIONAL

0 250 500 Feet

Figure 3
Soils Map
Lochill Farm Site

Natural Resources
Conservation Service

North Carolina
State Office

4407 Bland Road
Suite 117
Raleigh, NC 27609
Voice 919-873-2171
Fax 844-325-6833

August 18, 2016

Emaly Simone
Environmental Specialist
Michael Baker International
8000 Regency Parkway, Suite 600
Cary, NC

Dear Ms Simone:

Thank you for your letter dated on August 3, 2016, Subject: Request for Comments – NCDMS Project, Lochill Farm Stream Restoration Site; Orange County, NC. The following guidance is provided for your information.

Projects are subject to the Farmland Protection Policy Act (FPPA) requirements if they may irreversibly convert farmland (directly or indirectly) to non-agricultural use and are completed by a federal agency or with assistance from a federal agency. Farmland means prime or unique farmlands as defined in section 1540(c)(1) of the FPPA or farmland that is determined by the appropriate state or unit of local government agency or agencies with concurrence of the Secretary of Agriculture to be farmland of statewide local importance.

For the purpose of FPPA, farmland includes prime farmland, unique farmland, and land of statewide or local importance. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forestland, pastureland, cropland, or other land, but not water or urban built-up land.

Farmland does not include land already in or committed to urban development or water storage. Farmland *already in* urban development or water storage includes all such land with a density of 30 structures per 40-acre area. Farmland already in urban development also includes lands identified as *urbanized area* (UA) on the Census Bureau Map, or as urban area mapped with a *tint overprint* on the United States Geological Survey (USGS) topographical maps, or as *urban-built-up* on the United States Department of Agriculture (USDA) Important Farmland Maps.

The area in question meets one or more of the above criteria for Farmland. Farmland area will be affected or converted. Enclosed is the Farmland Conversion Impact Rating form AD1006 with PARTS II, IV and V completed by NRCS. The corresponding agency will need to complete the evaluation, according to the Code of Federal Regulation 7CFR 658, Farmland Protection Policy Act.

If you have any questions, please contact Milton Cortes, Assistant State Soil Scientist at 919-873-2171 or by email: milton.cortes@nc.usda.gov.

Again, thank you for inquiry. If we can be of further assistance, please do not hesitate to contact us.

Sincerely,

MILTON CORTES

Digitally signed by MILTON CORTES
DN: c=US, o=U.S. Government, ou=Department of Agriculture, cn=MILTON CORTES, 0.9.2342.19200300.100.1.1=12001000080173
Date: 2016.08.18 10:38:59 -04'00'

Milton Cortes
Assistant State Soil Scientist

cc:
Kent Clary, State Soil Scientist, NRCS, Raleigh, NC
Scott King, LSS, PWS, Environmental Specialist, Michael Baker International, Cary NC

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*		Date Of Land Evaluation Request 6/14/16	
Name of Project Lochill Farm Stream Restoration Project		Federal Agency Involved FHWA	
Proposed Land Use Stream Restoration		County and State Orange County, NC	
PART II *(To be completed by NRCS)*		Date Request Received By NRCS 8/8/16	Person Completing Form: Milton Cortes NRCS NC
Does the site contain Prime, Unique, Statewide or Local Important Farmland? *(If no, the FPPA does not apply - do not complete additional parts of this form)*	YES ☑ NO ☐	Acres Irrigated none	Average Farm Size 88 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 97% % 245, 406 acres	Amount of Farmland As Defined in FPPA Acres: 90% % 203, 636 acres	
Name of Land Evaluation System Used Orange Co, Lesa	Name of State or Local Site Assessment System none	Date Land Evaluation Returned by NRCS August 18, 2016 by email	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	15.8			
B. Total Acres To Be Converted Indirectly	0			
C. Total Acres In Site	15.8			
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	10.4			
B. Total Acres Statewide Important or Local Important Farmland	2.3			
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted	0.0062			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value	93			
PART V (To be completed by NRCS) Land Evaluation Criterion Relative Value of Farmland To Be Converted (Scale of 0 to 100 Points)	68			

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(Criteria are explained in 7 CFR 658.5 b. For Corridor project use form NRCS-CPA-106)*	**Maximum Points**	Site A	Site B	Site C	Site D
1. Area In Non-urban Use	(15)	12			
2. Perimeter In Non-urban Use	(10)	10			
3. Percent Of Site Being Farmed	(20)	0			
4. Protection Provided By State and Local Government	(20)	20			
5. Distance From Urban Built-up Area	(15)	14			
6. Distance To Urban Support Services	(15)	10			
7. Size Of Present Farm Unit Compared To Average	(10)	10			
8. Creation Of Non-farmable Farmland	(10)	0			
9. Availability Of Farm Support Services	(5)	5			
10. On-Farm Investments	(20)	1			
11. Effects Of Conversion On Farm Support Services	(10)	0			
12. Compatibility With Existing Agricultural Use	(10)	0			
TOTAL SITE ASSESSMENT POINTS	160	82	0	0	0
PART VII ***(To be completed by Federal Agency)***					
Relative Value Of Farmland *(From Part V)*	100	68	0	0	0
Total Site Assessment *(From Part VI above or local site assessment)*	160	82	0	0	0
TOTAL POINTS ***(Total of above 2 lines)***	260	150	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? YES ☐ NO ☐

Reason For Selection:

Name of Federal agency representative completing this form:	Date:

(See Instructions on reverse side) **Form AD-1006 (03-02)**

Lochill Farm Stream Restoration
316 Pleasant Green Rd.
Hillsborough, NC 27278

Inquiry Number: 4641954.2s
June 08, 2016

The EDR Radius Map™ Report

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

316 PLEASANT GREEN RD.
HILLSBOROUGH, NC 27278

COORDINATES

Latitude (North):	36.1114920 - 36° 6' 41.37''
Longitude (West):	78.9899840 - 78° 59' 23.94''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	680918.4
UTM Y (Meters):	3997984.5
Elevation:	531 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5945261 NORTHWEST DURHAM, NC
Version Date:	2013
Northeast Map:	5945265 ROUGEMONT, NC
Version Date:	2013
Southwest Map:	5947925 HILLSBOROUGH, NC
Version Date:	2013
Northwest Map:	5947438 CALDWELL, NC
Version Date:	2013

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140619
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
316 PLEASANT GREEN RD.
HILLSBOROUGH, NC 27278

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
A1	ST MARY'S SCHOOL	7500 SCHLEY ROAD	LUST, UST	Lower	2332, 0.442, WNW
A2	KANTNER SCHOOL (FORM	7500 SCHLEY ROAD	LUST TRUST, IMD	Lower	2332, 0.442, WNW
A3	ST. MARY'S SCHOOL	7500 SCHLEY ROAD	IMD	Lower	2332, 0.442, WNW
4	JOHN E BYRD JR TRUCK	1200 BYRDS VIEW LANE	SWF/LF	Higher	2393, 0.453, SSE

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL ---------- National Priority List
Proposed NPL ---------- Proposed National Priority List Sites
NPL LIENS ---------- Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL ---------- National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY ---------- Federal Facility Site Information listing
SEMS ---------- Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE ---------- Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS ---------- Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF ---------- RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG ---------- RCRA - Large Quantity Generators
RCRA-SQG ---------- RCRA - Small Quantity Generators
RCRA-CESQG ---------- RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS ---------- Land Use Control Information System
US ENG CONTROLS ---------- Engineering Controls Sites List

US INST CONTROL ---------- Sites with Institutional Controls

Federal ERNS list

ERNS ---------- Emergency Response Notification System

State- and tribal - equivalent NPL

NC HSDS ---------- Hazardous Substance Disposal Site

State- and tribal - equivalent CERCLIS

SHWS ---------- Inactive Hazardous Sites Inventory

State and tribal landfill and/or solid waste disposal site lists

OLI ---------- Old Landfill Inventory

State and tribal leaking storage tank lists

LAST ---------- Leaking Aboveground Storage Tanks
INDIAN LUST ---------- Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST ---------- Underground Storage Tank Listing
UST ---------- Petroleum Underground Storage Tank Database
AST ---------- AST Database
INDIAN UST ---------- Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

INST CONTROL ---------- No Further Action Sites With Land Use Restrictions Monitoring

State and tribal voluntary cleanup sites

INDIAN VCP ---------- Voluntary Cleanup Priority Listing
VCP ---------- Responsible Party Voluntary Action Sites

State and tribal Brownfields sites

BROWNFIELDS ---------- Brownfields Projects Inventory

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS ---------- A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

HIST LF ---------- Solid Waste Facility Listing
SWRCY ---------- Recycling Center Listing
INDIAN ODI ---------- Report on the Status of Open Dumps on Indian Lands

ODI	Open Dump Inventory
DEBRIS REGION 9	Torres Martinez Reservation Illegal Dump Site Locations

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL	Delisted National Clandestine Laboratory Register
US CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
SPILLS	Spills Incident Listing
SPILLS 90	SPILLS 90 data from FirstSearch
SPILLS 80	SPILLS 80 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated
FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
FINDS	Facility Index System/Facility Registry System
UXO	Unexploded Ordnance Sites

DOCKET HWC ---------- Hazardous Waste Compliance Docket Listing
COAL ASH ---------- Coal Ash Disposal Sites
DRYCLEANERS ---------- Drycleaning Sites
Financial Assurance ---------- Financial Assurance Information Listing
NPDES ---------- NPDES Facility Location Listing
UIC ---------- Underground Injection Wells Listing
FUELS PROGRAM ---------- EPA Fuels Program Registered Listing
ECHO ---------- Enforcement & Compliance History Information

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP ---------- EDR Proprietary Manufactured Gas Plants
EDR Hist Auto ---------- EDR Exclusive Historic Gas Stations
EDR Hist Cleaner ---------- EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS ---------- Recovered Government Archive State Hazardous Waste Facilities List
RGA LF ---------- Recovered Government Archive Solid Waste Facilities List
RGA LUST ---------- Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: The Solid Waste Facilities/Landfill Sites records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. The data come from the Department of Environment & Natural Resources' List of Solid Waste Facility Contacts in Alpha Order.

A review of the SWF/LF list, as provided by EDR, and dated 03/17/2016 has revealed that there is 1 SWF/LF site within approximately 0.5 miles of the target property.

Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
JOHN E BYRD JR TRUCK	1200 BYRDS VIEW LANE	SSE 1/4 - 1/2 (0.453 mi.)	4	17

Facility Status: Open
Permit Num: NCS-00429

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incidents Management Database contains an inventory of reported leaking underground storage tank incidents. The data come from the Department of Environment, & Natural Resources' Incidents by Address.

A review of the LUST list, as provided by EDR, and dated 02/05/2016 has revealed that there is 1 LUST site within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
ST MARY'S SCHOOL	***7500 SCHLEY ROAD***	***WNW 1/4 - 1/2 (0.442 mi.)***	***A1***	***8***
Incident Phase: Response Incident Phase: Closed Out Incident Number: 23192 Incident Number: 23504 Current Status: File Located in Archives Current Status: File Located in House				

LUST TRUST: This database contains information about claims against the State Trust Funds for reimbursements for expenses incurred while remediating Leaking USTs.

A review of the LUST TRUST list, as provided by EDR, and dated 04/11/2016 has revealed that there is 1 LUST TRUST site within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
KANTNER SCHOOL (FORM	***7500 SCHLEY ROAD***	***WNW 1/4 - 1/2 (0.442 mi.)***	***A2***	***15***
Facility Id: 0-002591 Site ID: 23192				

ADDITIONAL ENVIRONMENTAL RECORDS

Records of Emergency Release Reports

IMD: Incident Management Database.

A review of the IMD list, as provided by EDR, and dated 07/21/2006 has revealed that there are 2 IMD sites within approximately 0.5 miles of the target property.

Lower Elevation	Address	Direction / Distance	Map ID	Page
KANTNER SCHOOL (FORM Facility Id: 23192	***7500 SCHLEY ROAD***	***WNW 1/4 - 1/2 (0.442 mi.)***	***A2***	***15***
ST. MARY'S SCHOOL	7500 SCHLEY ROAD	WNW 1/4 - 1/2 (0.442 mi.)	A3	16

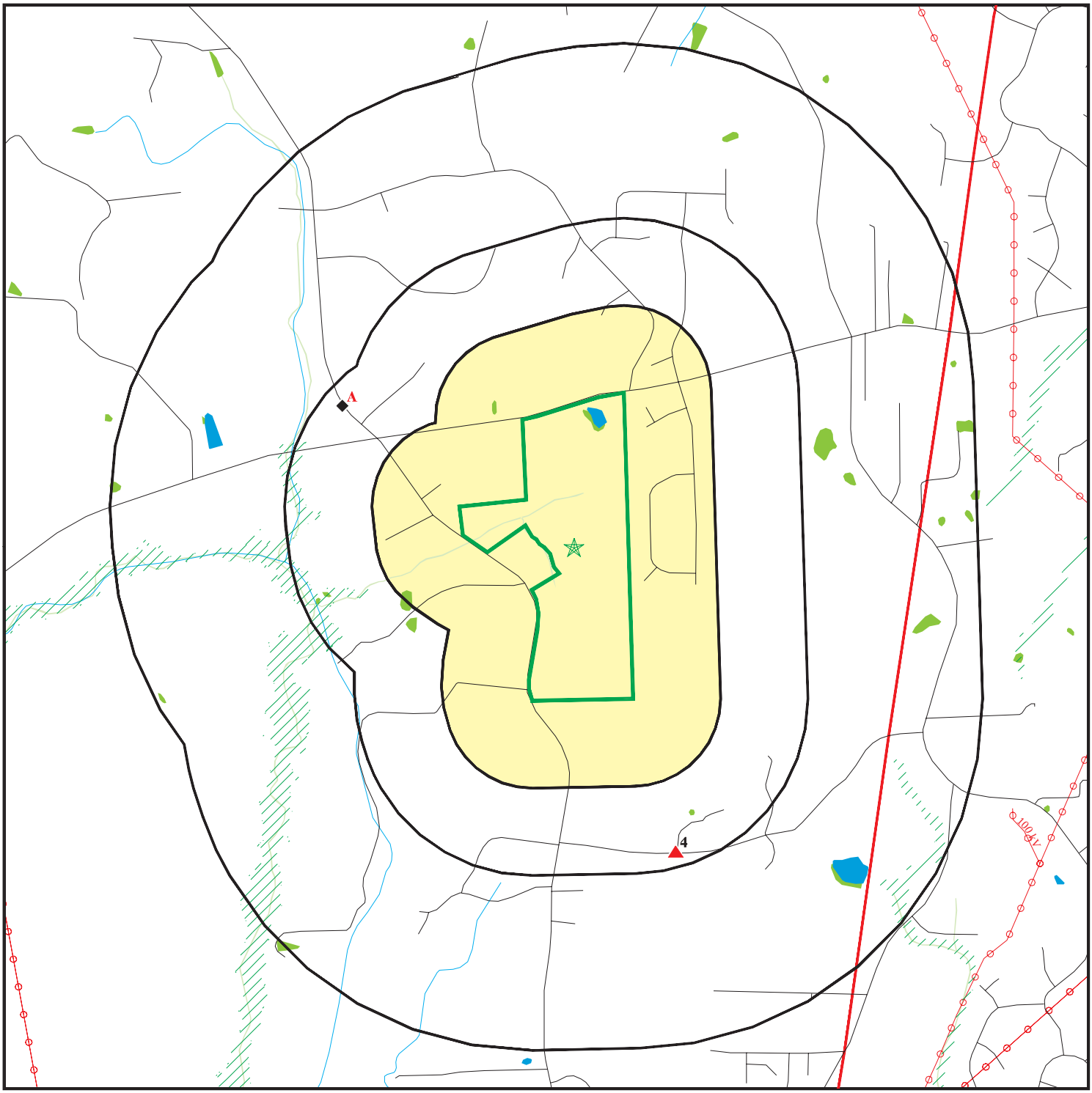
EXECUTIVE SUMMARY

Facility Id: 23504

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 4641954.2S



0 1/4 1/2 1 Miles

- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites
- Indian Reservations BIA
- County Boundary
- Power transmission lines
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Lochill Farm Stream Restoration	CLIENT:	Michael Baker Engineering, Inc.
ADDRESS:	316 Pleasant Green Rd. Hillsborough NC 27278	CONTACT:	Emaly Simone
LAT/LONG:	36.111492 / 78.989984	INQUIRY #:	4641954.2s
		DATE:	June 08, 2016 3:29 pm

ICE OF AN OPPORTUNITY FOR AN INFORMATIONAL LIC MEETING ON THE USE OF PROPERTY FOR THE RESTORATION OF STREAMS

a County

l Baker Engineering, Inc., proposes to acquire a pres- n easement on a 15.5-acre tract of land in Orange , NC, northeast of Hillsborough off St. Marys Road. urpose of using this property is to provide mitigation avoidable impacts to streams that will result from exist- future development in this area. The project will re- sections of Finches Branch and unnamed tributaries

s desiring that an informational public meeting be held proposed action may make such a request by regis- etter to Michael Baker Engineering, Inc., at 8000 Re- Parkway, Suite 600 Cary, NC 27518. Requests must de by August 29, 2016. If additional information is re- please contact Emaly Simone at 919-481-5721.

lorth Carolina Division of Mitigation Services re- the right to determine if a public meeting will be held.

June 22, 29, 1016

NORTH CAROLINA
ORANGE COUNTY

AFFIDAVIT OF PUBLICATION

Before the undersigned, a Notary Public of said County and State, duly commissioned, qualified, and authorized by law to administer oaths, affirmations, personally appeared Kimberly Cates, who, being duly sworn or affirmed, according to law, doth depose and say that she is an authorized employee of The News of Orange County Newspaper, engaged in the publication of a newspaper known as The News of Orange County published, issued and entered as second class mail in the City of Hillsborough, in said County and State; that she is authorized to make this affidavit and sworn statement; that the notice or other legal advertisement, a true copy of which is attached hereto, was published in The News of Orange County on the following date(s): June 22, 29, 2016 and that the said newspapers in which such notice, paper, document, or legal advertisement was published at the time of each and every such publication, a newspaper meeting all of the requirements and qualifications of Section I-597 of the General Statues of North Carolina and was qualified newspaper within the meaning of Section I-597 of the General Statutes of North Carolina.

This 3 day of August, 2016.

Kimberly Cates

Sworn to and subscribed before me, this 3 day of August, 2016.

Notary Public

My Commission Expires: Feb-10, 2021

SEAL

HAYDEN SMITH
Notary Public
Orange Co., North Carolina
My Commission Expires Feb. 10, 2021

Appendix J

IRT Communications

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

November 21, 2017

Regulatory Division

Re: NCIRT Review and USACE Approval of the Lochill Farm Stream Mitigation Site Draft Mitigation Plan; SAW-2016-00881; DMS Project #97083

Mr. Tim Baumgartner
North Carolina Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day review for the Lochill Farm Stream Mitigation Site Draft Mitigation Plan, which closed on October 29, 2017. These comments are attached for your review.

Based on our review of these comments and the provider's response, we have determined that no significant concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several issues were identified, as described in the attached revised comment memo, which must be appropriately addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) application for Nationwide permit (NWP) approval of the project along with a copy of this letter. Issues identified in the attached memos must be appropriately addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the appropriate USACE field office at least 30 days in advance of beginning construction of the project. **Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed.** Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please contact Kim Browning at (919) 554-4884 extension 60.

Sincerely,

HUGHES.ANDREA.WADE.1258339165

Digitally signed by HUGHES.ANDREA.WADE.1258339165
DN: c=US, o=U.S. Government, ou=DoD, ou=PKI, ou=USA, cn=HUGHES.ANDREA.WADE.1258339165
Date: 2017.11.21 09:26:18 -05'00'

for
Henry M. Wicker, Jr.
Deputy Chief, Regulatory

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Lindsay Crocker, NCDMS

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

CESAW-RG/Browning November 2, 2017

MEMORANDUM FOR RECORD

SUBJECT: Lochill Farm Stream Mitigation Project - NCIRT Comments during 30-day Mitigation Plan Review

PURPOSE: The comments listed below were posted to the NCDMS Mitigation Plan Review Portal during the 30-day comment period in accordance with Section 332.8(g) of the 2008 Mitigation Rule.

NCDMS Project Name: Lochill Farm Stream Mitigation Project, Orange County, NC

USACE AID#: SAW-2016-00881

NCDMS #: 97083

30-Day Comment Deadline: October 29, 2017

Kathy Matthews, USFWS, October 6, 2017:

1. The consultant requested the Service's review of the project for ESA impacts (only) on June 29, 2016. I provided a letter to the consultant on July 28, 2016, indicating no significant impact to threatened and endangered species. I was unable to participate in the field meeting for this site, so I will defer to the members of the IRT who have seen it.

2. I am concerned that the small preservation tributaries (T1 and T2, portions of T3 and T4) adjacent to the larger restored reaches may be impacted by the work which is going to be conducted on the larger reach. It looks like it may be difficult to have equipment in those areas without impacting the buffer and therefore impacting the mitigation ratio. The mitigation plan does not address this issue or how the buffers of these tributaries will be protected. At a minimum, I would think some of the trees will have roots affected by earthmoving activities. T1 is adjacent to R1, which is slated for full restoration activities, and it seems impossible to accomplish this without removing the entire buffer on one side of T1. Therefore, the mitigation ratio should be higher than 5:1. I also have concerns with the tree removal along R1 associated with full restoration of that stream, but again defer to the members of the IRT who have been to the site.

Mac Haupt, NCDWR, October 27, 2017:

1. R3- DWR stressed (during October 12, 2017 site visit) to leave as many trees as possible, not only for this section, but other areas along R3. During the initial IRT visit (May 2017), it was suggested that all the reach needed was some bedform enhancement and some bank sloping, and it looks like they are following that recommendation. I told them I was ok with their approach here. The reach is not incised and has a decent buffer, they will be adding buffer on stream right.

2. R2- This reach looked more channel like, and we (IRT) did tell them this would be at most 5:1, however, there is likely a very minimal uplift for this reach.

3. R1- DWR would like some gauges installed to assess the effect on the adjacent wetlands. Baker said they would install some gauges (while on the site visit, October 12, 2017). Baker spoke of their having to build a lot of benching because of DMS's standards but they have scaled back some (with DMS's approval) on the extent of benching. While typically wider benches are better, in this case, it means taking down more trees. DWR would like an assessment of the extent of the benching and the effect on the wetlands. Baker shows bench limits demarcated on most of the R1 plans but the bench limits are not shown from sta 19+00 to 37+00 (where most of the wetlands are). This has now become DWR's biggest concern for this site, the loss of trees and effect of wetlands on R1.

4. Baker talked about, qualitatively, the functional uplift using Harmon's terms (pyramid) but they did not actually run (measure, quantitatively) the tool. DWR recommends Baker run the quantification tool on R1 and R3 prior to beginning construction.

Kim Browning, USACE, October 25, 2017:

1. Table 4.1, page 4-5: The functional pyramid is cited to show existing conditions for each category, but the measurements and score sheets are not included. The functional pyramid was used to describe the benefits of the project, and discussed in the Functional Uplift Potential narratives in section 4.0. Please note that the functional pyramid and QT tool have not been approved for use in determining success for mitigation projects and should not be tied directly to project performance. No standards for collection protocol are addressed in the plan, nor are sampling location and number of samples discussed.

2. Section 7.2, Vegetation Monitoring, Page 7-3: The plan states “The final vegetative success criteria will be the survival of 210 stems per acre at the end of the year 7 monitoring period. However, if the performance standards are met by year 5 and stem densities are greater than 260 stem/acre, then the vegetation monitoring may be terminated with approval by the USACE and the NCIRT.” The plan should state the project will be monitored for 7 years. Please remove the following sentence, which is not consistent with current guidance - "If the performance standard is met by Year 5 and stem densities are greater than 260, 5-year old stems/acre, vegetation monitoring may be terminated with approval by the USACE and the IRT."

3. Appendix J, Plan sheet 11: The Plan View shows a pond within the easement, NE of reach T4, and "Remove accumulated sediment from pond littoral. Shelf as directed by the engineer." There is no discussion of this pond in the narrative on page 6-10. Please provide additional information regarding the purpose and plan for this feature.

Todd Bowers, USEPA, October 27, 2017:

1. Section 2.1/Page 2-1: The fifth paragraph eludes to wetland restoration, enhancement and preservation when the mitigation plan clearly is not going to restore or directly enhance the approximately 5 acres of on-site wetlands.

2. Section 3.1.2/Page 3-6: The second paragraph mentions development pressure from the surrounding towns in and adjacent counties. I recommend that this claim be clarified or refined to provide additional justification for "preservation" of streams on-site. Preservation as a method of proving mitigation credit assumes that some demonstrable threat to aquatic resources is evident. I would also recommend, especially with the claim of recent development doubling in two decades that the stream designs take into account the result of a significant increases in the watershed impervious surfaces if they have not done so already.

3. Section 3.2.3/Page 3-8: Since Baker is proposing to enhance jurisdictional wetlands via stream function correction, there is the likelihood of on-site wetlands to either expand or contract in area based on water table manipulation. I recommend establishing some sort of threshold by which the IRT can determine if the wetlands did in fact undergo enhancement and are similar in size and quality of the baseline condition. This approach will allow for an accurate assessment of jurisdictional wetlands during the site closeout period at the end of monitoring. Without some sort of metric to compare the wetlands at Year 7 to the current condition, conflict pertaining to loss of wetlands at closeout may result.

4. Section 4.5/Page 4-4: While it is "anticipated" that biology will be improved through improvement of lower level function, it really remains an "assumption" that the project reaches currently rated as FAR "will" be improved to Functioning without evidence. Until data is supplied to confirm an improvement, using "will" instead of "may" to evaluate the functional improvement remains a dubious position. Recommend establishing some sort of baseline data of organisms (aquatic fauna), and not habitat (a level III function), to illustrate a functional lift in biology during and at the completion of the monitoring period.

5. Section 4.6/Page 4-4: Recommend adding information about the on-site canopy tress as a constraint to Priority One restoration of Reach 1 as some trees will necessarily need to be removed.

6. Section 5.0 and Table 5.1/Page 5-1: Recommend adding programmatic goals (ex: providing SMUs for NCDMS In-Lieu Fee Program in HUC 03020201) to the opening paragraph and in the subsequent table of goals and objectives. I also recommend modifying Table 5.1 goal of "Improve stream habitat" to include a particular organism or suite of species being considered. In this case "fish and macroinvertebrates" would be sufficient since it appears that mussel and/or amphibian habitat are not being considered.

7. Table 6.1/Page 6-1: Recommend addition of Large Woody Debris as parameter to consider when gathering data from reference sites to inform proper amounts of LWD to design within the restored and enhanced stream reaches (Tables 6.2 and 6.3)

8. Section 6.5 and Table 6.8: Excellent suite of canopy and understory species presented in the riparian floodplain and wetland buffer plantings. Great diversity of appropriate trees and shrubs to occupy the site and provide a good long-term forest structure. I really appreciate the attention given to the understory species.

9. Section 7.2/Page 7-3: I concur with the evaluation and exclusion of certain native species from the Year 7 height requirement.

10. Section 7.3/Page 7-3: Recommend monitoring of the water table within the jurisdictional wetlands on-site in order to facilitate a controversy-free closeout period. See comment above.

11. Section 8.0 and Table 8.1: See comment above for Table 5.1. A similar situation is presented here. Is there a way to accurately quantify an increase in quality and quantity of habitat? I suppose that would depend on the species being considered. A direct measurement of macroinvertebrate quantity and diversity may indicate such an improvement and I recommend its use as a surrogate for "habitat".

12. Table 8.2: Recommend addition of "Exotic and Nuisance Fauna" or just "beavers" as a parameter to monitor. They may show up on-site as soon as the as-built report is ready for development and will need constant vigilance. Also recommend monitoring the sub-surface hydrology at a suitable frequency to avoid a potential loss of wetlands due to site hydrology manipulation.

Kim Browning
Mitigation Specialist
Regulatory Division

Michael Baker
INTERNATIONAL

Michael Baker Engineering, Inc.
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November 13, 2017

Kim Browning, Mitigation Specialist
US Army Corps of Engineers – Wilmington District
Regulatory Division
Wilmington, NC 28403-1343

Subject: Response Letter to NCIRT Memorandum of Mitigation Plan Review Comments
Lochill Farm Stream Mitigation Project, Orange County
DMS Project# 97083, DEQ Contract# 6828, RFP# 16-006477, USACE AID# SAW-2016-00881

Ms. Browning:

Please find below our responses to the NCIRT review comments dated November 2, 2017 in reference to the Lochill Farm Stream Mitigation Project – Draft Mitigation Plan. We have revised the Final document in response to the referenced review comments. Each comment and its corresponding response is outlined below.

Kathy Matthews, USFWS, October 6, 2017:

1. The consultant requested the Service's review of the project for ESA impacts (only) on June 29, 2016. I provided a letter to the consultant on July 28, 2016, indicating no significant impact to threatened and endangered species. I was unable to participate in the field meeting for this site, so I will defer to the members of the IRT who have seen it.

   Response: Acknowledged.

2. I am concerned that the small preservation tributaries (T1 and T2, portions of T3 and T4) adjacent to the larger restored reaches may be impacted by the work which is going to be conducted on the larger reach. It looks like it may be difficult to have equipment in those areas without impacting the buffer and therefore impacting the mitigation ratio. The mitigation plan does not address this issue or how the buffers of these tributaries will be protected. At a minimum, I would think some of the trees will have roots affected by earthmoving activities. T1 is adjacent to R1, which is slated for full restoration activities, and it seems impossible to accomplish this without removing the entire buffer on one side of T1. Therefore, the mitigation ratio should be higher than 5:1. I also have concerns with the tree removal along R1 associated with full restoration of that stream, but again defer to the members of the IRT who have been to the site.

   Response: The approach, work plan, and credit ratios have been discussed in detail in the field with various IRT members during multiple field meetings and documented with memos and emails of concurrence. The small preservation tributaries will be protected to the extent possible during construction. Some disturbance to the buffer will be required in order to complete restoration and enhancement work.

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Mac Haupt, NCDWR, October 27, 2017:

1. R3- DWR stressed (during October 12, 2017 site visit) to leave as many trees as possible, not only for this section, but other areas along R3. During the initial IRT visit (May 2017), it was suggested that all the reach needed was some bedform enhancement and some bank sloping, and it looks like they are following that recommendation. I told them I was ok with their approach here. The reach is not incised and has a decent buffer, they will be adding buffer on stream right.

   Response: Baker agrees with this assessment of the Reach R3 work. Construction impacts to the upper portion of R3 will be minimized by restricting vehicle operation to the right bank to the extent possible, avoiding wetlands and the more mature vegetation found along the left bank. The remaining work on R3 is enhancement-level, primarily bank sloping. While this will necessitate the removal of some trees, the sections of steep bank selected for grading contain relatively few mature trees.

2. R2- This reach looked more channel like, and we (IRT) did tell them this would be at most 5:1, however, there is likely a very minimal uplift for this reach.

   Response: Along Reach R2, Baker proposes to replace the undersized, clogged culvert along Reach R2 to restore hydrologic connection to the stream, and to plant the buffer on the right bank (consisting of ~0.4 planted acres or ~60% of the full buffer for that bank). Reach R2 will also be extended by 27 feet to connect it back into the restored and relocated Reach R1 channel.

3. R1- DWR would like some gauges installed to assess the effect on the adjacent wetlands. Baker said they would install some gauges (while on the site visit, October 12, 2017). Baker spoke of their having to build a lot of benching because of DMS's standards but they have scaled back some (with DMS's approval) on the extent of benching. While typically wider benches are better, in this case, it means taking down more trees. DWR would like an assessment of the extent of the benching and the effect on the wetlands. Baker shows bench limits demarcated on most of the R1 plans but the bench limits are not shown from station 19+00 to 37+00 (where most of the wetlands are). This has now become DWR's biggest concern for this site, the loss of trees and effect of wetlands on R1.

   Response: Baker understands the concern over the potential impacts to existing wetlands from construction activities, however the vast majority of wetlands are located outside areas of any proposed stream benching. Benching is only being proposed in the upstream and downstream most sections of Reach R1 where a tie to the existing bed elevation is necessary. Benching is the only way to provide floodplain access until the bed elevation can be raised to the point to connect the stream to the historic floodplain as part of the priority 1 restoration efforts. The middle section of Reach R1 (roughly between Stations 19+00 to 37+00) is where the bulk of the wetland areas are located. This section has no benching as the bed elevation has been elevated to connect the stream to its historic floodplain. This restored section of R1 will have its stream bed raised by ~2.4 feet from the currently incised channel. This will increase the frequency of overbank events flooding the wetlands and help raise their water table elevations, improving wetland hydrology. There are only a couple of locations in the lowermost section of Reach R1 where benching is actually located adjacent to wetlands. The first is from Station 37+20 to 37+80 where the benching is only just beginning and is at its shallowest and most narrow, only directly impacting ~0.04 acres of wetland area, and potentially indirectly affecting (through the adjacent benching) an additional ~0.09 acres. The second location is around Station 40+00, where two small wetland pockets totaling 0.05 acres are located adjacent to proposed benching, of which <0.01 acres are directly impacted. Please keep in mind that even in these two locations, the adjacent restored stream bed is also still being raised

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from its existing elevation. All of the direct impacts cited here are being reported as part of the permitting process. The total wetland area either directly or potentially impacted by the proposed benching totals ~0.18 acres, or roughly 4% of the total existing wetland areas found on the project. The proposed benching in this section of R1 cannot be removed as it is necessary to maintain a floodplain as the stream drops in elevation to connect back into the existing stream where it crosses under Pleasant Green Rd. The work done in the upper section of Reach R3 that is adjacent to existing wetlands does not involve any benching and the construction will be conducted with equipment operating along the right bank to the extent possible to avoid interfering with the wetlands found along much of the left bank and floodplain.

It should also be noted that while the project will restore, enhance, and preserve wetlands found on the project site, DMS did not request wetland mitigation credits. As such, no full hydric soil delineation was performed for the project. Based on field evaluation of hand augured soils, there are areas along the floodplain within the conservation easement where hydric soil is present outside of jurisdictional wetlands and where hydrologic restoration would be expected, but are not demarcated on the plans or being requested for credit. The majority of the wetland areas should ultimately be enhanced through increased overbank events, raised water table elevations that will result from raising the adjacent stream bed, and the planting of a native riparian buffer where needed. Some of the wetlands will likely be unaffected and will simply be preserved and protected within the conservation easement.

As described above, the wetlands will overall experience a net improvement in their condition. The relatively small areas that could potentially be affected by benching activities represent a small fraction of the total wetlands on site. Baker proposes that visual monitoring of the existing wetlands be conducted to document the post-construction condition. Baker anticipates these wetland areas being significantly improved hydrologically for the reasons stated above, and do not warrant the installation of groundwater monitoring devices. The lack of background water table data for the existing wetlands is also a concern, as post-construction data would have no basis for comparison.

4. Baker talked about, qualitatively, the functional uplift using Harmon's terms (pyramid) but they did not actually run (measure, quantitatively) the tool. DWR recommends Baker run the quantification tool on R1 and R3 prior to beginning construction.

   Response: This evaluation is intended to be qualitative only and only uses the functional pyramid framework as a guide for well-established uplift parameters and their uplift potential. For mitigation plan purposes, a qualitative assessment using the input from a range of experienced professionals having spent extensive time on the site would be more appropriate than using the quantification tool with missing parameter indices that would only be collected as part of a much more detailed site assessment that goes beyond the range of data collected typically to provide mitigation credits through DMS.

Kim Browning, USACE, October 25, 2017:

1. Table 4.1, page 4-5: The functional pyramid is cited to show existing conditions for each category, but the measurements and score sheets are not included. The functional pyramid was used to describe the benefits of the project, and discussed in the Functional Uplift Potential narratives in section 4.0. Please note that the functional pyramid and QT tool have not been approved for use in determining success for mitigation

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projects and should not be tied directly to project performance. No standards for collection protocol are addressed in the plan, nor are sampling location and number of samples discussed.

Response: See response to comment #4 (Mac Haupt) above. Section 4.0 was not intended to describe the project monitoring efforts and their associated performance standards or success criteria. Sections 7.0 and 8.0 address performance standards and the site-specific monitoring plan and follows the recent NCIRT guidance document *Wilmington District Stream and Wetland Compensatory Mitigation Update* dated October 24, 2016. Annual stream, vegetation, hydrology, survey, and visual assessment monitoring methodologies/protocols are all detailed in this section and the approximate locations of proposed monitoring features are shown in Figure 14.

2. Section 7.2, Vegetation Monitoring, Page 7-3: The plan states "The final vegetative success criteria will be the survival of 210 stems per acre at the end of the year 7 monitoring period. However, if the performance standards are met by year 5 and stem densities are greater than 260 stem/acre, then the vegetation monitoring may be terminated with approval by the USACE and the NCIRT." The plan should state the project will be monitored for 7 years. Please remove the following sentence, which is not consistent with current guidance - "If the performance standard is met by Year 5 and stem densities are greater than 260, 5-year old stems/acre, vegetation monitoring may be terminated with approval by the USACE and the IRT."

   Response: The mitigation plan has been revised as recommended.

3. Appendix J, Plan sheet 11: The Plan View shows a pond within the easement, NE of reach T4, and "Remove accumulated sediment from pond littoral. Shelf as directed by the engineer." There is no discussion of this pond in the narrative on page 6-10. Please provide additional information regarding the purpose and plan for this feature.

   Response: The small, spring-fed pond near Reach T4 is a feature simply used for landowner aesthetic enjoyment and is not used for any farm operations. It has a small drainage area (~3 acres) and is not strongly affected by stormwater runoff. Its small (~2 feet tall) berm is stable and vegetated. Over time it has slowly filled with sediment, which the landowners wish to have removed as much as is practicable. As such, Baker has proposed to remove sediment from around the edge of the pond wherever access allows. This additional information has been added to the narrative in the mitigation plan as recommended.

Todd Bowers, USEPA, October 27, 2017:

1. Section 2.1/Page 2-1: The fifth paragraph eludes to wetland restoration, enhancement and preservation when the mitigation plan clearly is not going to restore or directly enhance the approximately 5 acres of on-site wetlands.

   Response: The DMS contract has no credits for wetland restoration, enhancement, or preservation associated with it. However, through Priority 1 stream restoration efforts, riparian buffer planting, and the establishment of a permanent conservation easement, wetlands on site will be restored, enhanced and/or preserved. Since no wetland credit is associated with this contract, no wetland specific monitoring or a detailed hydric soils evaluation is proposed. See the response to DWR/Mac Haupt's Comment #3 above.

2. Section 3.1.2/Page 3-6: The second paragraph mentions development pressure from the surrounding towns in and adjacent counties. I recommend that this claim be clarified or refined to provide additional

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justification for "preservation" of streams on-site. Preservation as a method of proving mitigation credit assumes that some demonstrable threat to aquatic resources is evident. I would also recommend, especially with the claim of recent development doubling in two decades that the stream designs take into account the result of a significant increases in the watershed impervious surfaces if they have not done so already.

Response: The preservation of the four spring-fed tributaries is part of a holistic approach to protect more of the project stream system's headwater drainage/watershed to the extent possible. Three of the tributaries (T1, T2, and T4) are captured in their entirety, with their springhead origins and associated wetlands. Reach T3 contains at least one spring itself, and the entire area between T3 and the main reach R3 is an existing wetland that contains ephemeral pools and drainages. The addition of these tributaries and their associated springs, wetlands, and ephemeral pools and drainages improves the overall quality of the project. The preservation areas increase the size and diversity of the types of resource features and habitats found within its widened riparian corridor, all of which are permanently protected within the conservation easement. During the field walkovers with the IRT, members also seemed to appreciate the addition of these tributaries and the functions they provide to the ecosystem as a whole. Providers have often been encouraged to capture as much of the contributing headwater system as possible for projects.

The population of Orange County, and the nearby cities of Hillsborough and Durham (to the west and east of the project respectively) have experienced significant growth over the past few decades and are expected to continue growing in the decades to come. The stream design for the project has accordingly taken into account potential watershed changes such as with the heavy use of bio-engineering to provide the accelerated establishment or bank root mass to provide bank stability.

3. Section 3.2.3/Page 3-8: Since Baker is proposing to enhance jurisdictional wetlands via stream function correction, there is the likelihood of on-site wetlands to either expand or contract in area based on water table manipulation. I recommend establishing some sort of threshold by which the IRT can determine if the wetlands did in fact undergo enhancement and are similar in size and quality of the baseline condition. This approach will allow for an accurate assessment of jurisdictional wetlands during the site closeout period at the end of monitoring. Without some sort of metric to compare the wetlands at Year 7 to the current condition, conflict pertaining to loss of wetlands at closeout may result.

   Response: See response to DWR/Mac Haupt's Comment #3 above.

4. Section 4.5/Page 4-4: While it is "anticipated" that biology will be improved through improvement of lower level function, it really remains an "assumption" that the project reaches currently rated as FAR "will" be improved to Functioning without evidence. Until data is supplied to confirm an improvement, using "will" instead of "may" to evaluate the functional improvement remains a dubious position. Recommend establishing some sort of baseline data of organisms (aquatic fauna), and not habitat (a level III function), to illustrate a functional lift in biology during and at the completion of the monitoring period.

   Response: Section 4.5 was revised to better indicate that the biology is anticipated/assumed to be improved based on the stated improvements to habitat.

5. Section 4.6/Page 4-4: Recommend adding information about the on-site canopy trees as a constraint to Priority One restoration of Reach 1 as some trees will necessarily need to be removed.

   Response: That section was modified as recommended.

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6. Section 5.0 and Table 5.1/Page 5-1: Recommend adding programmatic goals (ex: providing SMUs for NCDMS In-Lieu Fee Program in HUC 03020201) to the opening paragraph and in the subsequent table of goals and objectives. I also recommend modifying Table 5.1 goal of "Improve stream habitat" to include a particular organism or suite of species being considered. In this case "fish and macroinvertebrates" would be sufficient since it appears that mussel and/or amphibian habitat are not being considered.

   Response: The text in the project introduction page was revised slightly to clarify that the project is part of the ILF program for DMS. The project outcomes as well as the goals and objectives listed in Table 5.1 were created, as required by contract, with recent DMS mitigation plan guidance, which requires ecological function improvements as goals and not programmatic goals. The predicted outcomes as listed in Table 5.1 associated with the goal of improving in-stream habitat list habitat improvements for "a diverse range of aquatic organisms". This diverse range would likely include fish, macroinvertebrates, amphibians, and mussel species though no target species have been identified or listed.

7. Table 6.1/Page 6-1: Recommend addition of Large Woody Debris as parameter to consider when gathering data from reference sites to inform proper amounts of LWD to design within the restored and enhanced stream reaches (Tables 6.2 and 6.3).

   Response: Baker will consider adding a Large Woody Debris (LWD) parameter to its evaluation when collecting data from reference sites in the future.

8. Section 6.5 and Table 6.8: Excellent suite of canopy and understory species presented in the riparian floodplain and wetland buffer plantings. Great diversity of appropriate trees and shrubs to occupy the site and provide a good long-term forest structure. I really appreciate the attention given to the understory species.

   Response: Thank you.

9. Section 7.2/Page 7-3: I concur with the evaluation and exclusion of certain native species from the Year 7 height requirement.

   Response: Thank you.

10. Section 7.3/Page 7-3: Recommend monitoring of the water table within the jurisdictional wetlands on-site in order to facilitate a controversy-free closeout period. See comment above.

    Response: Please see the response to Mac Haupt's comment #3 above

11. Section 8.0 and Table 8.1: See comment above for Table 5.1. A similar situation is presented here. Is there a way to accurately quantify an increase in quality and quantity of habitat? I suppose that would depend on the species being considered. A direct measurement of macroinvertebrate quantity and diversity may indicate such an improvement and I recommend its use as a surrogate for "habitat".

    Response: As shown in Table 8.1, the improvement of in-stream habitat will be demonstrated through an increase in the number of pools and woody structures as compared to the existing conditions, and through the reduction of stream disconnects from clogged culverts. These features can be quantified and serve as a useful measure for the listed "likely functional uplift" features.

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12. Table 8.2: Recommend addition of "Exotic and Nuisance Fauna" or just "beavers" as a parameter to monitor. They may show up on-site as soon as the as-built report is ready for development and will need constant vigilance. Also recommend monitoring the sub-surface hydrology at a suitable frequency to avoid a potential loss of wetlands due to site hydrology manipulation.

    Response: Beaver activity was added as a parameter to monitor in Table 8.2 as recommended. The sub-surface hydrology concern has been addressed in previous responses.

This letter serves as the formal response to the NCIRT comments and shall be submitted in conjunction with the Final Mitigation Plan and the Pre-Construction Notification (PCN) for Nationwide Permit (NWP) 27 application approval. If you have any additional questions concerning the Final Mitigation Plan, please do not hesitate to contact me at 919-481-5731 or Scott.King@mbakerintl.com. With this submittal, we have included eight (8) hardcopies of the revised Final Mitigation Plan with IRT comments, four (4) copies with a completed PCN, and three (3) CDs with electronic copies of the documents.

Sincerely,

Scott King, LSS, PWS
Project Manager

Enclosures

Mitigation Plan Checklist for Riparian Buffer Restoration Mitigation Sites –created 7/15/13

Lochill Farm
Project Name
Katie Merritt
Reviewed By
11/22/17 - 11/27/17
Date

☑ DWR Stream Determination

☑ DWR Site Viability Letter

☑ Site Location

- ☑ Directions including Lat & Long
- ☑ 8-digit HUC &/or 14 digit (if applicable)
- ☑ County
- ☑ EMC approved Soil map, Topo and Aerial Maps
- ☑ Sub-watershed where applicable Upper Falls WS

☑ Existing Site Conditions w/ photos (no field photos, included aerials) ✓

☑ All proposed mitigation activities, including a brief summary of stream and/or wetland mitigation w/ a detailed planting plan – all buffer credits depend on TOB measurements upon stream channel construction (As-Built)

☑ Monitoring & Maintenance Plan proposed plot placement (Fig14) ✓ =#5

☐ Financial Assurance (if applicable)

☑ Associated buffer and/or nutrient offset credit calcs, which shall include credit generation, service area, etc. Buffer credit Service area – 03020201 including Falls WS (site is in Upper Falls WS)

☑ Credit Determination Table/Map Total- 176,511 ft² Buffer credits

☐ Verification that the site does not have an impact on threatened or endangered species

☐ Verification that the site is not affected by on-site or nearby sources of contamination as provided by Environmental Data Resources, Inc.

☐ Verification that the site can be constructed on land if it is an archaeological site;

☐ A list of all permits that will be required and obtained prior to constructing the mitigation site for nutrient offset and/or buffer mitigation (*e.g. Sediment and Erosion Control Plan from Division of Land Resources, NCG010000 Stormwater Permit from NCDWQ, 404 permit from the Army Corps of Engineers and corresponding 401 Water Quality Certification from NCDWQ*).

Margin notes:

Reveg. Plan (#15-20) need to show 0-50 ft, 0-100.

- Fencing will be installed. Remove Tag Alder since in NSW WS

<100' implied in figure but not stated in text - verify not >100' to rity not 33%.

7.2 performance std out need to be noted including the rule referenc. Currently as stated.

8.0 - not in line w/ 0295 (table 8.1) Where is the Appendix?

categorical exclusion form was approved by DMS

Lochill Farm Mitigation Plan (DWR# 2016-0370v2) DWR staff Comments to Buffer Mitigation Proposal
November 27, 2017

- Section 1.0:
  - Please add the following statement: *"This mitigation plan does not include a proposal for generating nutrient offset credits. Therefore, this mitigation site cannot be used to generate nutrient offset credits.*
    (I know the RFP did not request Nutrient Offsets and Michael Baker Engineering, Inc didn't provide it in the proposal –Unless DMS provides a supplemental Credit Asset Summary Map with this mitigation plan review, DWR will not accept conversion requests from Buffer Credits to Nutrient Offset credits at closeout. Please note, that not all buffer creditable areas are viable for nutrient offsets. It's best to iron this out in the beginning stages of the project than at Closeout.
- Section 5.0 (and other parts of plan)
  - Table 5.1 and other parts of the plan, included plan sheets, do not indicate the approximate max width where riparian buffer mitigation credits are being generated. To verify that the ratio doesn't change from 1:1 to 3:1, please add clarification to the plan where applicable.
- Section 6.0 of where applicable
  - Add the following, "*All riparian planting activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where buffer mitigation credits are being generated may be altered slightly depending on the final stream bank design. The planted areas will be surveyed and information provided in the As-Built report*."
- Section 6.5
  - Text implies that areas generating buffer mitigation credit are going to be a minimum of 50' with areas in excess of 50' present as well. Please see comments below on Figure 15B. Statement stating buffer widths will not exceed 100', if this applies, is acceptable.
- Section 6.8
  - Tag Alder is not a recommended species for this vegetation plan and is not vital for this project's vegetation success.
  - Excellent diversity of canopy and sub-canopy species and greatly appreciate herbaceous species will be selected and applied as part of the planting plan.
- Section 7.2 & Table 8.1
  - Performance standards for vegetation are different for generating buffer mitigation and are referenced within 15A NCAC 02B .0295 (n)(2). To rectify any confusion, please reference a Supplement Document here (see last comment) or include details of what those performance standards are.
  - Monitoring of vegetation data for Years 1, 2, 3, 4 & 5 need to be all the same. The statement provided in this section reads, *"…buffer monitoring will only report density and health of stems within vegetation plots"*. Please note, that species composition must also be included, as well as indication of Planted vs Volunteer, Tree or Shrub, etc.

- Section 9.0
    - Notification to DWR of any adaptive management necessary on the Site is a necessary addition to this section.
- Section 11.0
    - Rule .0295 has been accurately applied to the total creditable footage for buffer mitigation credits. This project is anticipated to yield 176,511 ft2 of buffer mitigation credits to use in the Neuse 03020201 Service Area.
- Figure 15B & Plan Sheets
    - Clarify widths to justify the 1:1 & 3:1 (aka. 33%) ratios by having them drawn out by computer. 1:1 applies for all widths that are a minimum of 30-100'. Anything greater than 100' gets only 33%. Currently, the Figure shows 30' and 50' widths from top of bank and text throughout the Plan state that widths will be "in excess of 50'. While this is a great addition to the Figure and the Plan overall, and greatly appreciated, it still remains difficult to confirm that the 100' max for 1:1 is met throughout the site. The plan sheets also do not provide the widths.
- Addition of a Supplement document: In previous plans submitted by DMS for this round of Full-Delivery proposals, there has been an Appendix titled *"Riparian Buffer Mitigation Plan Supplement"* that includes a breakdown specifically for the buffer mitigation component. This would be an acceptable addition to this Mitigation Plan to address many of the comments and edits listed above where clarity and details are requested.
- Overall, this Plan indicates that this site will be a good candidate for providing buffer mitigation credits for the Neuse 03020201. The site is located in the Upper Fall WS of the Neuse River Basin.

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January 16, 2018

Ms. Katie Merritt
NC Division of Water Resources
512 N. Salisbury St.
Raleigh, NC 27604

Subject: Response Letter to 'Lochill Farm Mitigation Plan (DWR# 2016-0370v2) DWR staff Comments to Buffer Mitigation Proposal' dated November 27, 2017
Lochill Farm Stream Mitigation Project, Orange County
DMS Project# 97083, DEQ Contract# 6828, RFP# 16-006477, USACE AID# SAW-2016-00881

Ms. Merritt:

Please find below our responses to the DWR review comments dated November 27, 2017 in reference to the Lochill Farm Stream Mitigation Project – Draft Mitigation Plan. We have revised the Final document in response to the review comments as outlined below.

Section 1.0:

o Please add the following statement: *"This mitigation plan does not include a proposal for generating nutrient offset credits. Therefore, this mitigation site cannot be used to generate nutrient offset credits.*

(I know the RFP did not request Nutrient Offsets and Michael Baker Engineering, Inc didn't provide it in the proposal –Unless DMS provides a supplemental Credit Asset Summary Map with this mitigation plan review, DWR will not accept conversion requests from Buffer Credits to Nutrient Offset credits at closeout. Please note, that not all buffer creditable areas are viable for nutrient offsets. It's best to iron this out in the beginning stages of the project than at Closeout.)

Response: There are no nutrient offset credits proposed at this time. Per DMS request Baker will not add the recommended text to avoid any involvement in programmatic policy differences between DWR and DMS.

• Section 5.0 (and other parts of plan)

o Table 5.1 and other parts of the plan, included plan sheets, do not indicate the approximate max width where riparian buffer mitigation credits are being generated. To verify that the ratio doesn't change from 1:1 to 3:1, please add clarification to the plan where applicable.

Response: As discussed in more detail below, in no locations do the riparian buffers exceed 100-feet in width. Language has been added to the appropriate sections stating that fact, and Figure 15B has been modified to show the 100-ft buffer width indicating that fact as well.

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• Section 6.0 of where applicable

o Add the following, "*All riparian planting activities will commence in concurrence with the stream mitigation activities and not before. Therefore, the mitigation area where buffer mitigation credits are being generated may be altered slightly depending on the final stream bank design. The planted areas will be surveyed and information provided in the As-Built report*."

Response: This statement has been added to the buffer credit discussion in Section 6.

• Section 6.5

o Text implies that areas generating buffer mitigation credit are going to be a minimum of 50' with areas in excess of 50' present as well. Please see comments below on Figure 15B. Statement stating buffer widths will not exceed 100', if this applies, is acceptable.

Response: In no location on the project will the riparian buffer width even remotely approach 100-feet. Language has been added to the text in Section 6 directly stating this fact, and Figure 15B has been modified to include a 100-foot buffer line clearly showing the buffers are not 100-foot wide, along with a note stating that fact.

• Section 6.8

o Tag Alder is not a recommended species for this vegetation plan and is not vital for this project's vegetation success.

o Excellent diversity of canopy and sub-canopy species and greatly appreciate herbaceous species will be selected and applied as part of the planting plan.

Response: Baker is pleased that DWR appreciates the planting species diversity, but wishes to retain Tag Alder as it has been a part of our successful planting plans for this vegetative community type in the past.

• Section 7.2 & Table 8.1

o Performance standards for vegetation are different for generating buffer mitigation and are referenced within 15A NCAC 02B .0295 (n)(2). To rectify any confusion, please reference a Supplement Document here (see last comment) or include details of what those performance standards are.

Response: At the end of Section 7.2, a discussion of riparian buffer credit monitoring does specifically state that performance standards for buffer vegetation associated with Riparian Buffer Credits will be in accordance with 15A NCAC 02B.0295(n)(2)(B) and 15A NCAC 02B.0295(n)(4). Additionally, the text has been revised as described below.

o Monitoring of vegetation data for Years 1, 2, 3, 4 & 5 need to be all the same. The statement provided in this section reads, *"…buffer monitoring will only report density and health of stems within vegetation plots"*. Please note, that species composition must also be included, as well as indication of Planted vs Volunteer, Tree or Shrub, etc.

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Response: The buffer discussion in Section 7.2 has been revised as recommended and now states that vegetation monitoring for buffer credits will be the same for all monitored years and will include all the required components discussed previously in this section (plant species, heights, planted vs. volunteer, tree vs. shrub, and age).

• Section 9.0

o Notification to DWR of any adaptive management necessary on the Site is a necessary addition to this section.

Response: Section 9 has been revised to state that DWR will also be notified of any project need for an adaptive management plan.

• Section 11.0

o Rule .0295 has been accurately applied to the total creditable footage for buffer mitigation credits. This project is anticipated to yield 176,511 ft2 of buffer mitigation credits to use in the Neuse 03020201 Service Area.

Response: Baker appreciates the direct acknowledgement of buffer mitigation credits.

• Figure 15B & Plan Sheets

o Clarify widths to justify the 1:1 & 3:1 (aka. 33%) ratios by having them drawn out by computer. 1:1 applies for all widths that are a minimum of 30-100'. Anything greater than 100' gets only 33%. Currently, the Figure shows 30' and 50' widths from top of bank and text throughout the Plan state that widths will be "in excess of 50'. While this is a great addition to the Figure and the Plan overall, and greatly appreciated, it still remains difficult to confirm that the 100' max for 1:1 is met throughout the site. The plan sheets also do not provide the widths.

Response: Figure 15B has been modified to show a 100-foot buffer line in addition to the 30 and 50-foot buffer lines. This clearly shows that no portion of the riparian buffer exceeds the 100-feet width. A statement to this effect has also been added to the Figure.

• Addition of a Supplement document: In previous plans submitted by DMS for this round of Full-Delivery proposals, there has been an Appendix titled *"Riparian Buffer Mitigation Plan Supplement"* that includes a breakdown specifically for the buffer mitigation component. This would be an acceptable addition to this Mitigation Plan to address many of the comments and edits listed above where clarity and details are requested.

Response: With the changes made to the mitigation plan as described above, all requested and required aspects of the riparian buffer crediting, monitoring, and performance standards have been addressed and that there is no need for the addition of a specialized Appendix.

• Overall, this Plan indicates that this site will be a good candidate for providing buffer mitigation credits for the Neuse 03020201. The site is located in the Upper Fall WS of the Neuse River Basin.

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Response: Baker appreciates this acknowledgement.

This letter serves as the formal response to the NC-DWR comments and shall be submitted in conjunction with the Final Mitigation Plan and Pre-Construction Notification (PCN) for Nationwide Permit (NWP) 27 application approval. If you have any additional questions concerning the Final Mitigation Plan, please do not hesitate to contact me at 919-481-5731 or Scott.King@mbakerintl.com.

Sincerely,

Scott King, LSS, PWS
Project Manager

Enclosures

IRT Site Walkover
Meeting Minutes

Michael Baker
INTERNATIONAL

Meeting Minutes

LOCHILL FARM RESTORATION PROJECT

DMS Contract No. 6828

Date Prepared:	April 8, 2016
Meeting Date, Time, Location:	April 6, 2016, 12:30 pm On-site (Orange County, NC)
Attendees:	USACE – Todd Tugwell DMS – Jeff Schaffer, Lindsay Crocker DEQ – Katie Merritt, Ginny Baker WRC – Travis Wilson Baker – Jake Byers, Scott King
Subject:	Post-contract site walkover with IRT
Recorded By:	Scott King

An on-site meeting was held on April 6th, 2016 at 12:30 PM to discuss the recently contracted Lochill Farm Restoration Project (Full Delivery) in Orange County, NC. The purposes of this meeting were to:

1. Familiarize the IRT with the stream restoration project and discuss basic concepts for the proposed restoration;
2. Discuss mitigation approaches and credit ratios for each project reach;

After brief introductions, Scott King passed around a site map from the proposal showing the reach designations and restoration approaches. Essentially, Baker is proposing a watershed-based approach that includes virtually all of the intermittent and perennial reaches located within the proposed easement boundary, along with a significant amount of existing wetland acreage. These wetlands are present as both high-quality and degraded areas (though no wetland credits are being requested here). For stream credit as initially proposed, a Restoration approach at a 1:1 ratio is proposed for the main Reach (R1), while Enhancement I at a 1.5:1 ratio is proposed for Reaches R3A and R3C, and Enhancement II at a 2.5:1 ratio for both Reaches R2 and R3B. Additionally, Preservation is proposed for four of the small spring-fed tributaries (T1, T2, T3, and T4) found within the easement boundary. The site visit began at the upper section of Reach R1 and proceeded downstream through the project area. All of the project stream reaches were observed and discussed. Comments made for each reach are detailed below.

Note: A revised site map showing the changes made during the walkover is included with this memo.

Reach R1 (upper)

The group started at the muddy, degraded animal and vehicle crossing located at the uppermost portion of R1 and proceeded to walk downstream. Scott noted that the crossing will be replaced with a stable rock crossing. Continuing along the left bank, the deeply incised, eroding, vertical sidewalls in the uppermost section were noted. Todd commented that the right floodplain was fairly narrow and

expressed concern about an ability to relocate the stream so close to valley wall there. Jake and Scott noted that the restored stream will be expanded and *centered* more into the right floodplain, but that it wasn't entirely being relocated there. The left floodplain has a horse riding area that the landowner would like to maintain. Jake also noted that this was only for the upper ~300 ft or so, and that once the valley flattened out on both banks we have a much wider area to work with (as reflected in the wider easement boundary). Most of the group began walking down the channel itself, entering at one of the several existing horse crossing that will be eliminated with the project. At the confluence of Reach R2 into the main channel, the group walked out of the stream and switched to an inspection of R2 (as described below). Once that was completed, we continued downstream along R1. The valley begins to flatten out above the confluence with R2 and the group paused at an open section of stream with a wooden bridge crossing. Baker proposes to replace this bridge with a pipe crossing with adjacent floodplain pipes. Travis recommended using a box culvert in place of a round pipe in the channel, citing problems with stability in the round pipes for larger drainage areas. He also mentioned that the box culverts were better for bedform diversity and for mimicking stream dimension. If a round pipe was to be used, Travis suggested installing sills both immediately above and below the pipe, and/or installing some type of baffling in the crossing area. Baker will take this comment into consideration during design. The group continued walking downstream along R1, noting the mix of existing and degraded wetlands present throughout the floodplain in this section (including Reach T1 as discussed below). Todd commented that this will require a JD to establish the extent of existing wetlands on site and Baker concurred. All stream sections will also require a JD to confirm perennial/intermittent/ephemeral status. The stream channel here becomes more deeply incised the farther downstream we went, with long sections of eroding, vertical sidewalls. Travis commented on their severity, and other members of the group voiced agreement. The IRT generally appeared satisfied with the proposed approach and crediting, with no one voicing any substantial criticisms, and so Baker takes this as acceptance of the general design approach and credit ratio (**Restoration at a 1:1 ratio**).

Reach R2

The group walked up Reach R2 to its spring-fed pool origin, inspecting the channel itself at various points along the way. Todd (along with other members of the IRT) commented that they felt the condition of the stream wasn't that bad, and that it appeared stable with no apparent damage from horses. Todd also noted that the amount of buffer being restored was less than 50%. Jake noted the spoil piles built up along the right bank and commented that Baker proposes to remove portions of those piles and lay back a few of the steeper sections of banks. The lowermost portion of the reach will also likely require more work to re-connect back into the restored main channel of R1. There is also a pipe crossing in the lower portion of R2 that will be replaced. The current pipe appears undersized and is partially clogged with some obvious storm overflow scouring present along with upstream aggradation. Travis commented that he believes replacing the pipe would be of significant benefit with regards to biological connectivity. After discussion, Todd stated that he didn't think the functional uplift potential warranted a ratio of 2.5:1, but no other ratio was suggested at that time. **Baker would like to propose a ratio of 3:1 for this section as a more appropriate mitigation ratio**. This takes into account the added buffer, connecting R2 to the new raised bed elevation of R1 which will improve ground water hydrology, culvert replacement and crossing improvement, and selective spoil removal in areas where it can be accomplished without detrimental effects to existing trees.

Reach T1

At Reach T1, located in the right floodplain of R1, the group observed the spring pool origin and flow path into R1. Todd and Ginny stated that T1 would be considered a linear wetland in the uppermost portion, only becoming a stream at a pinch-point by a tree (subsequently flagged) where a distinct,

narrow channel begins and flows into the main stem of R1. The functional benefit of including the associated upper spring and wetlands were discussed and it was suggested that the lower stream section be allowed at a **Preservation ratio of 5:1** (in place of the proposed 10:1) provided that the easement include those spring and wetlands features as well. All parties agreed to this proposal.

Reach R3A

The group eventually reached the downstream confluence of Reach R3 where it flows into R1. The group then crossed over R1 and headed up an open field to the pipe crossing at the very bottom of Reach R3A, just below where T3 flows in. The pipe crossing is partly clogged and clearly gets backed-up during storm events, resulting in overflows and scouring immediately downstream. This pipe will be replaced with one that is appropriately sized. We then began walking upstream in the right floodplain along T3 and then to T2 (see below for discussions on those). The group began its evaluation of the stream channel for R3A in earnest at the pipe crossing at the uppermost portion of the reach. The pipe is almost completely clogged with obvious signs of storm overflow resulting in significant bank and channel scour in the immediate downstream portion. It will be replaced with a pipe that is appropriately sized. For the remainder of the Reach, Baker is proposing an Enhancement Level I approach for this section at a ratio of 1.5:1, to include laying back steeper sections of eroding banks, stabilizing undercut banks, excavating bankfull benches in select areas, and installing a few in-stream structures where needed. As the group walked downstream, Todd expressed reluctance at the proposed approach. He noted the established vegetation in the buffer on both banks and was concerned about construction damage to the existing wetlands on the left floodplain. Scott noted that the right floodplain is higher and does not contain wetlands, so construction equipment and paths could be focused on that side to minimize any impacts. Jake noted the many sections of eroding vertical or undercut banks we would be addressing. Travis stated that he walked farther upstream of the easement boundary to a less disturbed portion of the stream, and noted how surprisingly incised R3A is by comparison. No agreement was reached regarding the approach or crediting during the walkover itself, but was made at the end of the visit back in the parking area. Scott proposed that taking into account the functional benefit of including all the numerous springs, small tribs, and wetlands associated with this Reach, an **Enhancement I approach at a 1.5:1 ratio** could be justified if we included the additional small trib near T3 with the headcut (which will be fixed) into the easement boundary, and if these **small tribs were to remain at a 10:1 Preservation ratio** (and not at the potential 5:1 ratio discussed in the field). Todd agreed that this sounded fair and other members of the IRT also appeared satisfied with that proposal.

Reach T3

Walking up Reach T3 to its spring-fed origin the group noted the presence of significant existing wetland areas between T3 and R3A, along with several smaller tributaries flowing into T3. At the top of T3, Travis and Lindsay continued walking up one of those tribs (identified as T3B in the map) for a short distance (apx. 50 ft), noting a significant head-cut likely responsible for downstream sedimentation. A discussion ensued about how best to capture this section of stream and head-cut (so it could be repaired and stabilized). Jake commented that at a 10:1 ratio, Baker cannot purchase additional easement area without taking a financial loss. The idea of potentially setting this trib at a 5:1 ratio was therefore proposed, but nothing firm was decided. The group thought it best to continue the inspection of the rest of Reach R3A first. **Ultimately a 10:1 Preservation ratio was agreed upon** (as explained above in the Reach R3A section).

Reach T2
The group continued walking along the left floodplain of R3A to Reach T2 and its spring-fed origin. After discussion, Todd decided that he believes the upper portion is actually a wetland (from the spring to the abrupt 90° right turn towards R3A), and should not receive stream credits. The overall high-quality of the wetland was noted. The group then hiked to the pipe crossing at the upper part of Reach R3A. **Ultimately a 10:1 Preservation ratio was agreed upon** (as explained above in the Reach R3A section).

Reach R3B
The group then headed back down Reach R3, starting our inspection of R3B by walking downstream along its left bank. Enhancement II was proposed for this section as the stream incision wasn't as severe as in R3A or R3C, and had fewer sections of actively eroding banks, thus requiring less work to restore. Ginny noted the lack of woody vegetation in several large grassy areas and asked if trees would be planted there. Scott stated that all such sparse areas found along the left bank would be planted, along with virtually the entire right bank, which has just one row of trees throughout. A few steeper sections of stream bank will also be laid back, and a few sections of undercut banks will be stabilized as needed. Few overall comments were made by the IRT for this Reach. Baker takes that as general acceptance of the proposed approach and credit determination of **Enhancement II at a 2.5:1 ratio**.

Reach T4
The group then Reach T4, another spring-fed tributary flowing into R3. It's also located next to a small, man-made, spring-fed pond whose overflow also contributes to T4. In walking over the area, Todd commented that the water source for T4 likely originated with an adjacent series of springs but was diverted to help fill the pond. No direct comment was made as to any credit impact that might present and Baker takes that as a general acceptance of the proposed credit determination for T4 of **Preservation at a 10:1 ratio**.

Reach R3C
Reach R3B transitions to Reach R3C just prior to its confluence with Reach T4. Enhancement I is proposed for this Reach as it is more deeply incised than R3B (especially towards the bottom) with more frequent sections of eroding, undercut banks found throughout. It also lacks a buffer on the right bank throughout the section, and lacks buffer on its left bank in the lower half. This Reach will also likely require more work towards the bottom as it re-connects back into the restored channel of Reach R1. No specific comments made by the IRT for this section were noted and Baker takes that as a general acceptance of the proposed approach and credit determination of **Enhancement I at a 1.5:1 ratio**.

Reach R1 (lower)
The group then returned to the main stem of R1, walking both in the stream channel itself at various points and along its right bank. Group consensus was that this section was certainly appropriate for the **Restoration at a 1:1 ratio** as proposed. However, Todd raised the issue that the IRT will allow *no* credits within the two existing powerline right-of-ways located on this section of R1. DMS and Baker expressed surprise at this announcement, believing that 50% credit was generally given to sections of projects under powerlines. Todd explained that was an agreement made earlier in the program's history as a way to resolve older project crediting concerns, but that it was no longer applicable. Scott asked about the potential use of an Overlay Agreement with the power company, giving the stream special protections, but Todd stated that such an agreement could not (or would not) be made by the power company. He said they would always have the potential ability to impact the restored stream and buffer. Todd stated that he would double check on the potential of mitigation credits inside of the power easements but felt it was unlikely. No other issues of concern were raised for this stream

section. After reaching the bottom of R1 at its intersection with Pleasant Green Road, the group hiked back to the parking area, briefly summarized the points made during the walkover, established a credit determination for Reach R3A (as discussed above), and departed at about 3:30.

This represents Baker Engineering's best interpretation of the meeting discussions. If anyone should find any information contained in these meeting notes to be in error and/or incomplete based on individual comments or conversations, please notify me with corrections/additions as soon as possible.

Most sincerely,

Scott King
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Cary, NC 27518
Phone: 919-481-5731
Email: scott.king@mbakerintl.com

Michael Baker INTERNATIONAL

0 250 500 Feet

Proposed Mitigation Features
Post IRT Visit
Lochill Farm Site

Michael Baker
INTERNATIONAL

Meeting Minutes

LOCHILL FARM RESTORATION PROJECT

DMS Contract No. 6828

Date Prepared:	August 17, 2016
Meeting Date, Time, Location:	August 12, 2016, 1:00 pm On-site (Orange County, NC)
Attendees:	USACE – Todd Tugwell, Andrea Hughes DMS – Jeff Schaffer, Lindsay Crocker, Periann Russell DEQ – Mac Haupt Baker – Jake Byers, Scott King, Russell Myers
Subject:	Follow-up site visit to the April post-contract site walkover with IRT
Recorded By:	Scott King

An on-site meeting was held on August 12th at 1:00 PM with DMS and the IRT to review the contracted Lochill Farm Restoration Project (Full Delivery) in Orange County, NC. The purpose of the meeting was to more closely inspect Reaches R2, R3A, R3B, and R3C to discuss the proposed mitigation approaches and establish credit ratios for each reach.

Note: A revised site map showing the changes made during the walkover is included with this memo.

Reach R3

The group started at the top of the project at the uppermost portion of Reach R3A and walked downstream to the trib's confluence with Reach R1. Baker commented that while most of this reach wasn't particularly incised, it does get slightly more incised downstream as the stream cut down to meet the significantly incised Reach R1. It is also laterally instable with numerous stretches of exposed, eroding banks throughout. Periann noted that the channel lacks good pool formation and could be improved with addition of wood for habitat diversity. Baker reminded the group that the easement in the uppermost section R3A includes numerous small seeps/springs and tribs within a large wetland complex, and had been expanded to the west to include the spring-fed trib T-3B up to a headcut (which will be stabilized). Todd commented during the walkover that the level of incision appeared quite minor and that the areas of lateral instability did not appear too frequent and weren't strongly eroding. He observed the presence of macroinvertebrates in the stream bed. He also noted the established trees in the buffer of R3A. Andrea noted that she did identify a few pools present in the stream.

Later that day, Mac summarized his views on R3 as follows: He did not feel that Reach R3 as a whole was in particularly bad shape. Reach R3A could benefit from the addition of some wood in the channel, some spot pool additions, the culvert replacement at the top, and some spot bank stabilization, but did not believe that there were many widespread areas of lateral instability, and noted the presence of established hardwoods in the buffer. He thought that Reach R3B and R3C could benefit from some isolated bank work where the streams aren't connecting to the floodplain as well as they could be, there

is some significant planting required throughout the right buffer, and that the culvert replacement would be beneficial. Mac suggested the three sections of the reach just be merged for crediting purposes as an E2 approach at a 2.5:1 ratio. Todd generally agreed with Mac's assessment but offered a 2:1 ratio for all three sections. Baker contended that the level of lateral instability is more widespread and active than the group believes, but accepted an E2 approach for the entire reach at a 2:1 ratio.

Reach R2

The group next inspected the lower half of Reach R2, where the channel and buffer were evaluated. Todd commented that he believed the functional uplift potential resulting from the culvert replacement and the additional planting in the right buffer easement were very low. He suggested that any spot bank work (pulling back slopes and/or removing spoil piles) was unnecessary and might do more harm than good. As such he believed an E2 approach at a 5:1 ratio was warranted here. Mac was agreeable to this assessment as well. Baker accepted the ratio.

This represents Baker Engineering's best interpretation of the meeting discussions. If anyone should find any information contained in these meeting notes to be in error and/or incomplete based on individual comments or conversations, please notify me with corrections/additions as soon as possible.

Most sincerely,

Scott King
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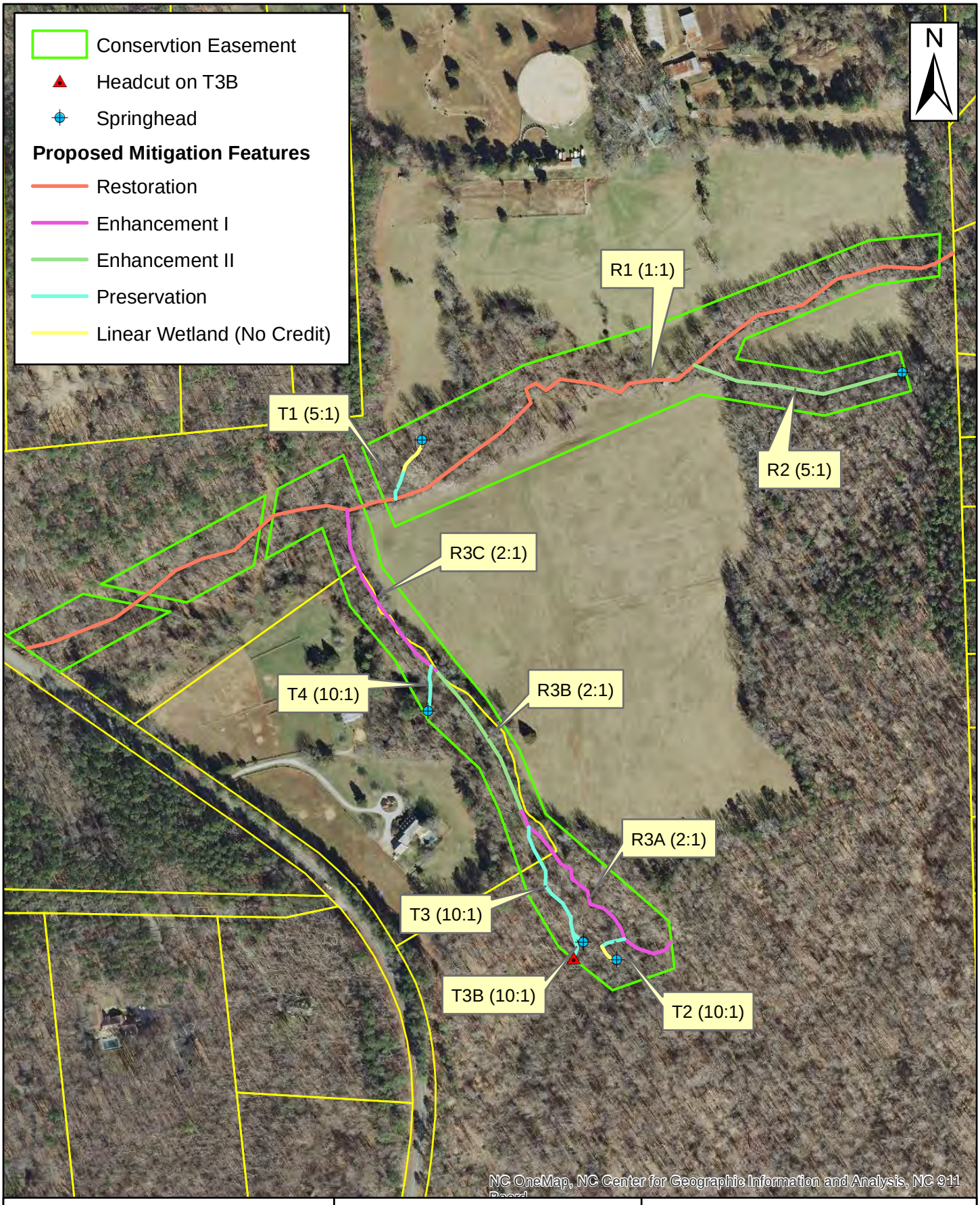


Michael Baker INTERNATIONAL

0 250 500 Feet

Proposed Mitigation Features
Post IRT Visit
Lochill Farm Site

rev. 17Aug2016

Appendix K

Plan Sheets

LOCHILL FARM

PROJECT: 153145

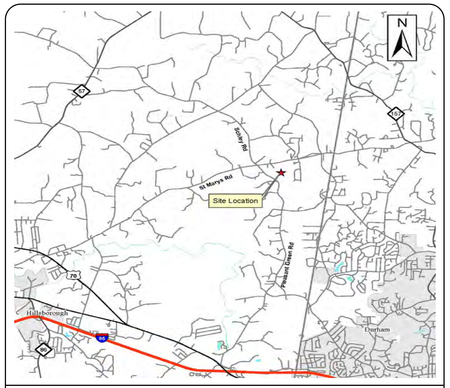
STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	153145	1	33

NORTH CAROLINA
DIVISION OF MITIGATION SERVICES

ORANGE COUNTY

LOCATION: OFF ST. MARY'S ROAD NEAR ITS INTERSECTION WITH PLEASANT GREEN ROAD

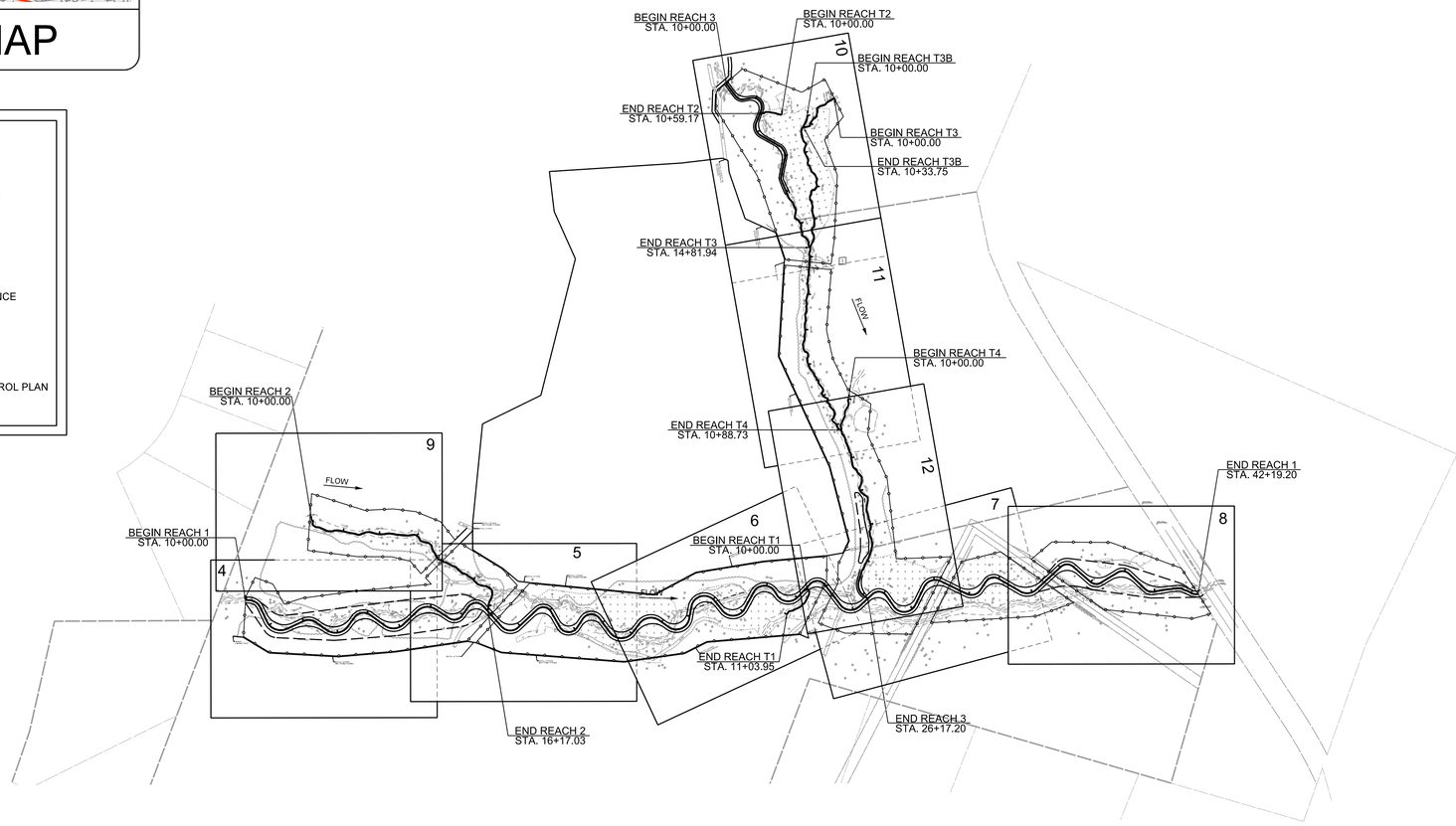
TYPE OF WORK: RESTORATION, ENHANCEMENT, AND PRESERVATION OF STREAM, WETLAND, AND RIPARIAN BUFFERS ALONG FINCHES BRANCH



VICINITY MAP

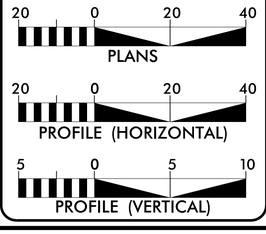
NAD 83

INDEX OF SHEETS



NCDMS ID NO. 97083

GRAPHIC SCALES



SUMMARY

REACH	DESIGN LENGTH*
R1	3,105.04 LF
R2	600.22 LF
R3	1,602.12 LF
T1	103.95 LF
T2	59.17 LF
T3	481.94 LF
T3B	33.75 LF
T4	88.73 LF

* EXCLUDES EASEMENT BREAKS

PREPARED FOR THE OFFICE OF:

NCDEQ
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NC 27699-1652

CONTACT: LINDSAY CROCKER
PROJECT MANAGER

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

FALL 2017
LETTING DATE:

JACOB M. BYERS, PE
PROJECT ENGINEER

SCOTT E. KING, LSS
PROJECT MANAGER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

DocuSigned by: Jacob Byers 07CF47BBE19D462...
11/15/2017
SIGNATURE: *P.E.*

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
153145	1-B
NCDMS ID No. 97083	

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

DocuSigned by: Jacob Byers 07CF478BE160462...
APPROVED BY:
11/15/2017
DATE:

BOUNDARIES AND PROPERTY:

- State Line
- County Line
- Township Line
- City Line
- Reservation Line
- Property Line
- Existing Iron Pin — EIP
- Property Corner
- Property Monument — ECM
- Parcel/Sequence Number — 123
- Existing Fence Line
- Proposed Woven Wire Fence
- Proposed Chain Link Fence
- Proposed Barbed Wire Fence
- Existing Wetland Boundary — WLB
- Proposed Wetland Boundary — WLB
- Existing Endangered Animal Boundary — EAB
- Existing Endangered Plant Boundary — EPB

BUILDINGS AND OTHER CULTURE:

- Gas Pump Vent or U/G Tank Cap
- Sign — S
- Well — W
- Small Mine
- Foundation
- Area Outline
- Cemetery
- Building
- School
- Church
- Dam

HYDROLOGY:

- Stream or Body of Water
- Hydro, Pool or Reservoir
- Jurisdictional Stream — JS
- Buffer Zone 1 — BZ 1
- Buffer Zone 2 — BZ 2
- Flow Arrow
- Disappearing Stream
- Spring
- Wetland
- Proposed Lateral, Tail, Head Ditch — FLOW
- False Sump

RAILROADS:

- Standard Gauge — CSX TRANSPORTATION
- RR Signal Milepost — MILEPOST 35
- Switch — SWITCH
- RR Abandoned
- RR Dismantled

RIGHT OF WAY:

- Baseline Control Point
- Existing Right of Way Marker
- Existing Right of Way Line
- Proposed Right of Way Line — RW
- Proposed Right of Way Line with Iron Pin and Cap Marker — RW
- Proposed Right of Way Line with Concrete or Granite Marker — RW
- Existing Control of Access — CA
- Proposed Control of Access — CA
- Existing Easement Line — E
- Proposed Temporary Construction Easement — E
- Proposed Temporary Drainage Easement — TDE
- Proposed Permanent Drainage Easement — PDE
- Proposed Permanent Utility Easement — PUE
- Proposed Temporary Utility Easement — TUE
- Proposed Permanent Easement with Iron Pin and Cap Marker

ROADS AND RELATED FEATURES:

- Existing Edge of Pavement
- Existing Curb
- Proposed Slope Stakes Cut — C
- Proposed Slope Stakes Fill — F
- Proposed Wheel Chair Ramp — WCR
- Existing Metal Guardrail
- Proposed Guardrail
- Existing Cable Guiderail
- Proposed Cable Guiderail
- Equality Symbol
- Pavement Removal

VEGETATION:

- Single Tree
- Single Shrub
- Hedge
- Woods Line
- Orchard
- Vineyard — Vineyard

EXISTING STRUCTURES:

MAJOR:

- Bridge, Tunnel or Box Culvert — CONC
- Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR:

- Head and End Wall — CONC HW
- Pipe Culvert
- Footbridge
- Drainage Box: Catch Basin, DI or JB — CB
- Paved Ditch Gutter
- Storm Sewer Manhole — S
- Storm Sewer — S

UTILITIES:

POWER:

- Existing Power Pole
- Proposed Power Pole
- Existing Joint Use Pole
- Proposed Joint Use Pole
- Power Manhole — P
- Power Line Tower
- Power Transformer
- U/G Power Cable Hand Hole — HH
- H-Frame Pole
- Recorded U/G Power Line — P
- Designated U/G Power Line (S.U.E.*) — P

TELEPHONE:

- Existing Telephone Pole
- Proposed Telephone Pole
- Telephone Manhole — T
- Telephone Booth
- Telephone Pedestal — T
- Telephone Cell Tower
- U/G Telephone Cable Hand Hole — HH
- Recorded U/G Telephone Cable — T
- Designated U/G Telephone Cable (S.U.E.*) — T
- Recorded U/G Telephone Conduit — TC
- Designated U/G Telephone Conduit (S.U.E.*) — TC
- Recorded U/G Fiber Optics Cable — T FO
- Designated U/G Fiber Optics Cable (S.U.E.*) — T FO

WATER:

- Water Manhole — W
- Water Meter
- Water Valve
- Water Hydrant
- Recorded U/G Water Line — W
- Designated U/G Water Line (S.U.E.*) — W
- Above Ground Water Line — A/G Water

TV:

- TV Satellite Dish
- TV Pedestal — C
- TV Tower
- U/G TV Cable Hand Hole — HH
- Recorded U/G TV Cable — TV
- Designated U/G TV Cable (S.U.E.*) — TV
- Recorded U/G Fiber Optic Cable — TV FO
- Designated U/G Fiber Optic Cable (S.U.E.*) — TV FO

GAS:

- Gas Valve
- Gas Meter
- Recorded U/G Gas Line — G
- Designated U/G Gas Line (S.U.E.*) — G
- Above Ground Gas Line — A/G Gas

SANITARY SEWER:

- Sanitary Sewer Manhole
- Sanitary Sewer Cleanout
- U/G Sanitary Sewer Line — SS
- Above Ground Sanitary Sewer — A/G Sanitary Sewer
- Recorded SS Forced Main Line — FSS
- Designated SS Forced Main Line (S.U.E.*) — FSS

MISCELLANEOUS:

- Utility Pole
- Utility Pole with Base
- Utility Located Object
- Utility Traffic Signal Box — S
- Utility Unknown U/G Line — ?UTL
- U/G Tank; Water, Gas, Oil
- A/G Tank; Water, Gas, Oil
- U/G Test Hole (S.U.E.*)
- Abandoned According to Utility Records — AATUR
- End of Information — E.O.I.

11/3/2017
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mpeters

revised 02/02/00

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
153145	1-A

PROJECT ENGINEER

SEAL 039201 NORTH CAROLINA PROFESSIONAL ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers

APPROVED BY:

11/15/2017

DATE:

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Michael Baker Engineering Inc.
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Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID No. 97083

STREAM CONVENTIONAL SYMBOLS

SUPERCEDES SHEET 1-B

- ROCK J-HOOK
- BOULDER STEP
- OUTLET PROTECTION
- ROCK CROSS VANE
- DOUBLE DROP ROCK CROSS VANE
- SINGLE WING DEFLECTOR
- DOUBLE WING DEFLECTOR
- TEMPORARY SILT CHECK
- ROOT WAD
- GRADE CONTROL LOG J-HOOK
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- LOG ROLLER
- GRADE CONTROL LOG JAM
- CONSTRUCTED RIFFLE
- BOULDER CLUSTER
- ROCK STEP POOL
- BOULDER BANK PROTECTION
- SAFETY FENCE
- TF — TAPE FENCE
- FP — 100 YEAR FLOOD PLAIN
- CE — CONSERVATION EASEMENT
- 435 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- LIMITS OF DISTURBANCE
- PROPERTY LINE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- DITCH PLUG
- CHANNEL FILL
- TOE WOOD
- GEOLIFT WITH BRUSH TOE
- BANK GRADING

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL IN-STREAM STRUCTURES USING A TRACK HOE WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS (3'x2'x2'), LOGS AND ROOTWADS.
2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.
3. CONSTRUCTION IS SCHEDULED TO BEGIN FALL/WINTER 2017.
4. CONTRACTOR SHOULD CALL NORTH CAROLINA "ONE-CALL" BEFORE EXCAVATION STARTS. (1-800-632-4949)
5. ENGINEER WILL FLAG TREES TO BE SAVED PRIOR TO CONSTRUCTION.
6. FENCING MUST BE INSTALLED IN LOCATIONS SHOWN AND COMPLETELY OUTSIDE OF THE CONSERVATION EASEMENT.

STANDARD SPECIFICATIONS

NORTH CAROLINA
EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009 (REV 2013)

- 6.05 TREE PROTECTION
- 6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
- 6.24 RIPARIAN AREA SEEDING
- 6.60 TEMPORARY SEDIMENT TRAP
- 6.62 TEMPORARY SILT FENCE
- 6.63 TEMPORARY ROCK DAM
- 6.70 TEMPORARY STREAM CROSSING

VEGETATION SELECTION

Proposed Bare-Root and Live Stake Species
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Botanical Name	Common Name	% Planted by Species	Wetland Tolerance
All Buffer Plantings at 8' x 8' spacing for 680 stems/acre Riparian Floodplain – Overstory Species			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Liriodendron tulipifera	Tulip Poplar	10%	FACU
Quercus phellos	Willow Oak	5%	FAC
Acer negundo	Box Elder	5%	FACW
Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	10%	FACW
Riparian Floodplain – Understory Species			
Carpinus caroliniana	American Hornbeam	10%	FAC
Asimina triloba	Pawpaw	10%	FAC
Viburnum dentatum	Arrowwood Viburnum	10%	FAC
Aesculus sylvatica	Painted Buckeye	10%	FAC

Wetland Buffer Plantings – Overstory			
Fraxinus pennsylvanica	Green Ash	10%	FACW
Betula nigra	River Birch	10%	FACW
Quercus michauxii	Swamp Chestnut Oak	10%	FACW
Acer negundo	Box Elder	10%	FACW
Platanus occidentalis	American Sycamore	10%	FACW
Celtis laevigata	Sugarberry	5%	FACW
Nyssa sylvatica	Black gum	5%	FAC
Wetland Buffer Plantings – Understory			
Lindera benzoin	Spicebush	10%	FAC
Alnus serrulata	Tag Alder	10%	OBL
Ilex verticillata	Winterberry	10%	FACW
Viburnum nudum	Possumhaw	10%	OBL
Streambank Live Stake Plantings			
Salix sericea	Silky Willow	25%	OBL
Sambucus nigra canadensis	Elderberry	25%	FAC
Cephalanthus occidentalis	Buttonbush	15%	OBL
Cornus amomum	Silky Dogwood	25%	FACW
Salix nigra	Black Willow	10%	OBL

Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Proposed Permanent Seed Mixture
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

Botanical Name	Common Name	% Planted by Species	Density (lbs/ac)	Wetland Tolerance
Andropogon gerardii	Big blue stem	10%	1.50	FAC
Dichanthelium clandestinum	Deer tongue	15%	2.25	FAC
Carex crinita	Fringed sedge	10%	1.50	OBL
Elymus virginicus	Virginia wild rye	10%	1.50	FACW
Juncus effusus	Soft rush	10%	1.50	FACW
Panicum virgatum	Switchgrass	15%	2.25	FAC
Schizachyrium scoparium	Little blue stem	10%	1.50	FACU
Sorghastrum nutans	Indiangrass	10%	1.50	FACU
Impatiens capensis	Jewelweed	10%	1.50	FACW
	Total	100%	15.00	

Note: Final species selection may change due to refinement or availability at the time of planting. If species substitution is required, the planting Contractor will submit a revised planting list to Baker for approval prior to the procurement of plant stock.

Proposed Temporary Seed Mixture
Lochill Farm Stream Mitigation Project – NCDMS Project No. 97083

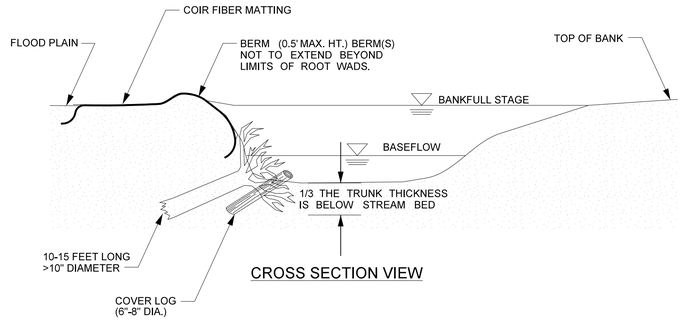
Planting Dates	Species	Rate (lbs/ac)
September to March	Rye Grain (cool season)	130
April to August	Browntop millet (warm season)	40

Note: All disturbed areas will be stabilized using mulch and temporary seed as defined in the construction specifications.

2/26/03

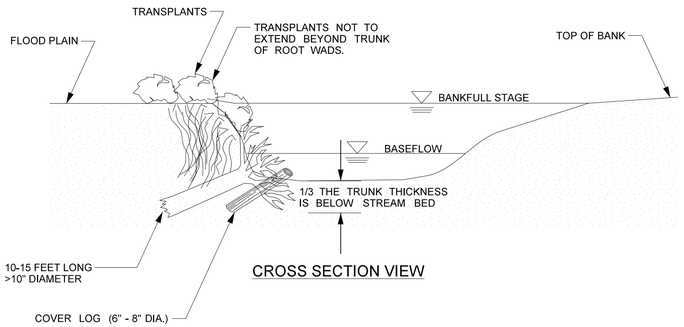
ROOT WADS

ROOT WADS WITHOUT TRANSPLANTS
USE IF TRANSPLANTS ARE NOT AVAILABLE ON-SITE



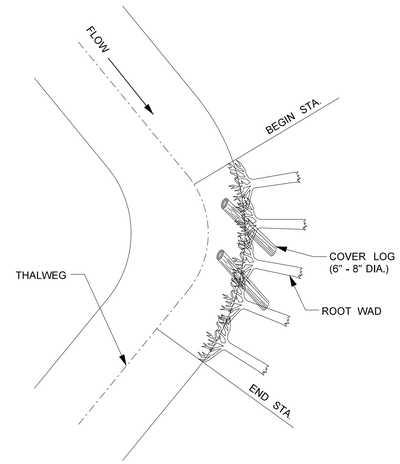
CROSS SECTION VIEW

ROOT WADS WITH TRANSPLANTS
USE IF TRANSPLANTS ARE AVAILABLE ON-SITE



CROSS SECTION VIEW

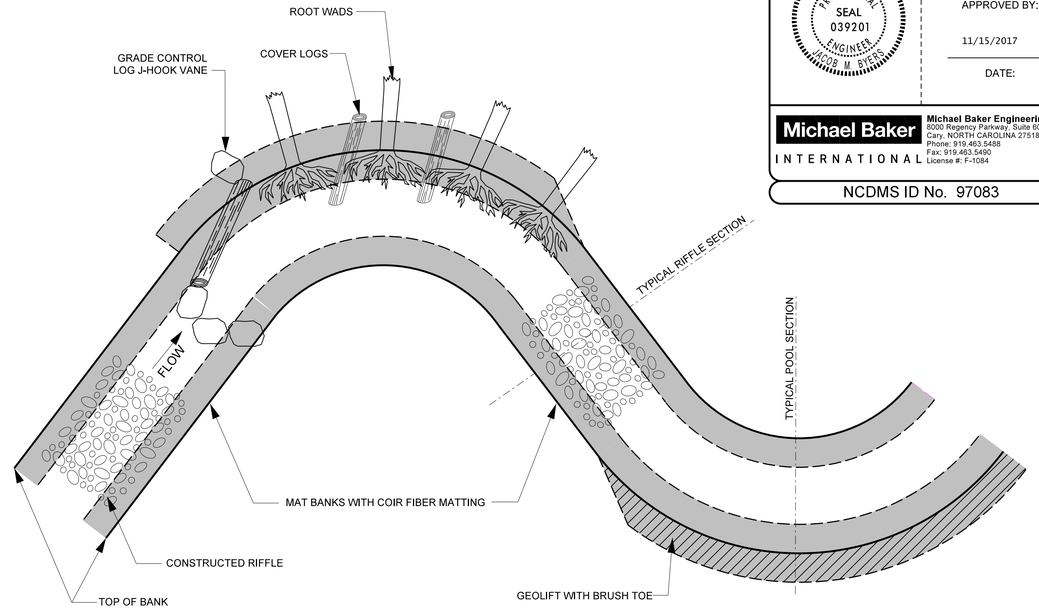
PLAN VIEW



NOTES:

1. INSTALLATION USING THE TRENCHING METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS OR CHANNEL BOTTOM.
2. THE NUMBER OF ROOTWADS ESTIMATED MAY VARY DEPENDING ON THE ROOTMASS SIZE. IN GENERAL, ROOTWADS SHOULD PROTECT THE OUTER MEANDER BEND AS SHOWN. SEE STRUCTURE TABLE FOR APPROXIMATE STATION AND LOCATION.
3. INSTALL COVER LOGS BETWEEN ROOTWADS TO PROVIDE HABITAT ONLY WHEN AVAILABLE FROM ON-SITE HARVESTING.

TYPICAL STRUCTURE PLACEMENT



STRUCTURE NOTES:

1. GENERALLY CONSTRUCTED RIFFLES, ROOT WADS, LOG VANES AND COIR FIBER MATTING WILL BE INSTALLED IN THE LOCATION AND SEQUENCE AS SHOWN.
2. ANY CHANGES TO NUMBER OR LOCATION OF STRUCTURES DURING CONSTRUCTION MUST BE APPROVED BY THE DESIGN ENGINEER.
3. COIR FIBER MATTING TO BE INSTALLED ON ALL RESTORED STREAMBANKS, FLOODPLAIN BENCHING, AND TERRACE SLOPES AS DESCRIBED IN THE TECHNICAL SPECIFICATIONS.
4. ROOTWADS MAY BE REPLACED WITH GEOLIFT.

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 97CF478BE1E0402...

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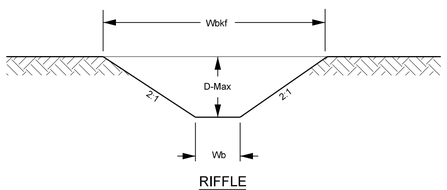
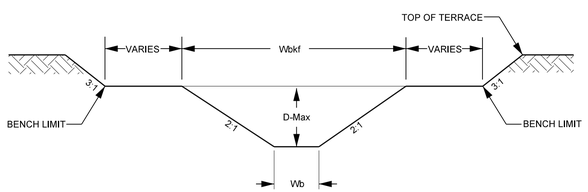
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS-SECTIONS

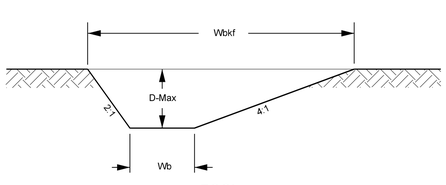
R1		R2		R3		
RIFFLE	POOL	RIFFLE	POOL	RIFFLE	POOL	
15.7	24.0	6.7	8.0	11.0	15.0	WIDTH OF BANKFULL (Wbkf)
1.5	3.5	0.6	1.0	1.2	2.5	MAXIMUM DEPTH (D-Max)
13.0	-	12.0	-	12.2	-	WIDTH TO DEPTH RATIO (Wbkf / D)
19.0	-	3.8	-	10.3	-	BANKFULL AREA (Abkf)
9.7	4.8	3.9	-	6.4	-	BOTTOM WIDTH (Wb)



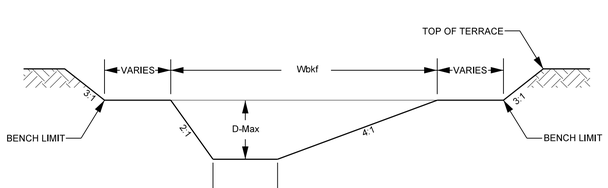
RIFFLE



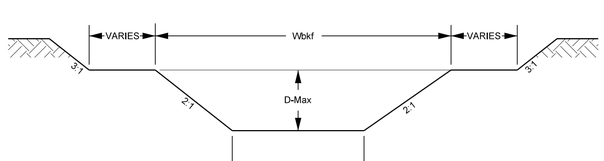
RIFFLE WITH BANKFULL BENCH



POOL



POOL WITH BANKFULL BENCH



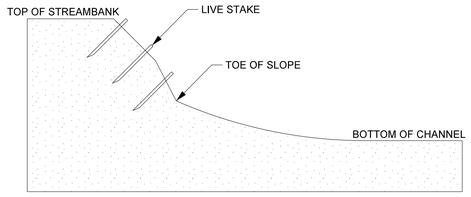
STEP - POOL

NOTES:

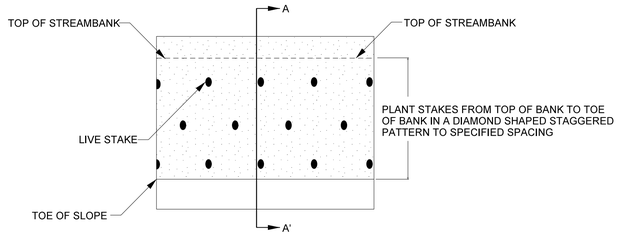
1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
2. POOLS SHOWN ABOVE ARE LEFT POOLS FOR MEANDER CHANNELS.

2/26/03

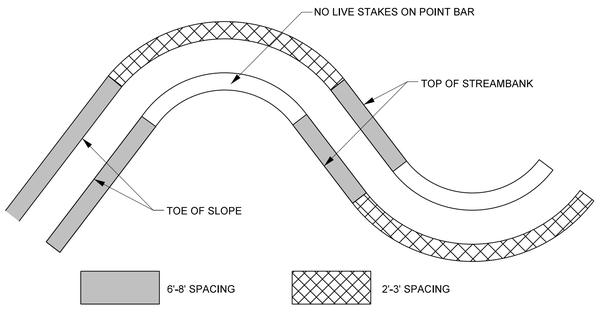
LIVE STAKING



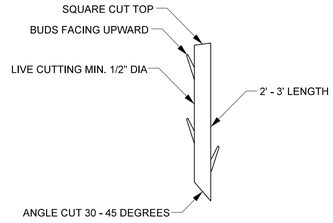
SECTION A - A'



PLAN VIEW



LIVE STAKE SPACING PLAN VIEW

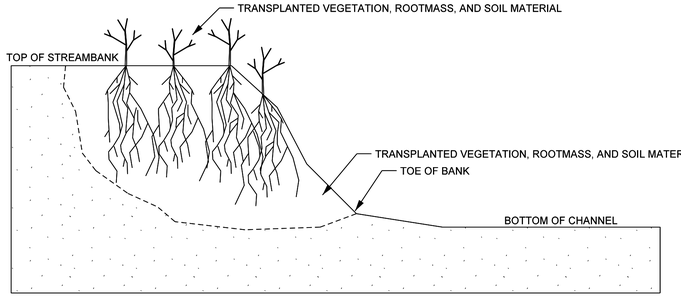


LIVE STAKE DETAIL

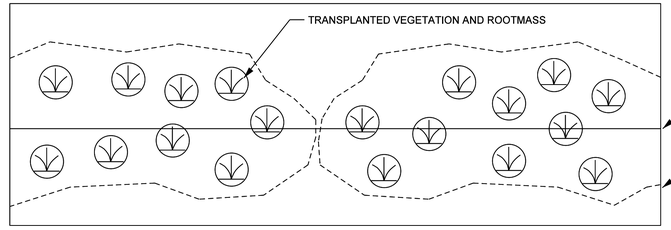
NOTES:

1. STAKES SHOULD BE CUT AND INSTALLED ON THE SAME DAY.
2. DO NOT INSTALL STAKES THAT HAVE BEEN SPLIT.
3. STAKES MUST BE INSTALLED WITH BUDS POINTING UPWARDS.
4. STAKES SHOULD BE INSTALLED PERPENDICULAR TO BANK.
5. STAKES SHOULD BE 1/2 TO 2 INCHES IN DIAMETER AND 2 TO 3 FT LONG.
6. STAKES SHOULD BE INSTALLED LEAVING 1/5 OF STAKE ABOVE GROUND.

TRANSPLANTED VEGETATION



CROSS SECTION VIEW



PLAN VIEW

NOTES:

1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATED AT ONCE, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. WHEN POSSIBLE, PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

DocuSigned by: Jacob Byers 07CF478BE10D462...

APPROVED BY:

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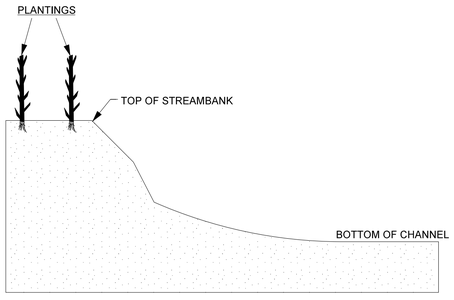
PLANTING SPECIFICATIONS

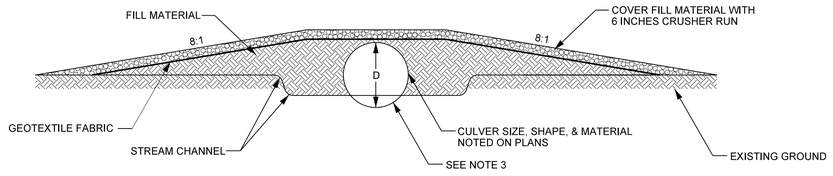


CROSS SECTION VIEW OF BARE ROOT PLANTING

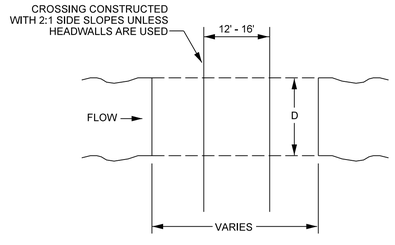
NOTES:

1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER/PLANTING ZONE AS SHOWN ON THE PLANS.
2. ALLOW FOR 6-10 FEET BETWEEN PLANTINGS, DEPENDING ON SIZE.
3. LOOSEN COMPACTED SOIL.
4. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
5. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
6. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
7. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.

PERMANENT STREAM CROSSING



PROFILE VIEW ALONG ROAD

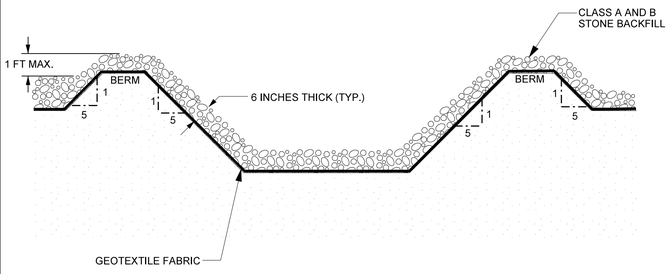


PLAN VIEW

NOTES:

1. INSTALL FLOODPLAIN CULVERTS AS SHOWN ON THE PLANS.
2. UPSTREAM AND DOWNSTREAM ROAD SLOPES SHALL BE PROTECTED WITH CLASS B STONE UNDERLAIN BY FILTER FABRIC OR STACKED BOULDER HEADWALLS AS SHOWN ON THE PLANS.
3. CULVERTS WILL BE BURIED AT LEAST 6" BELOW THE BED OF THE STREAM.
4. CULVERTS SHALL HAVE A MINIMUM OF 1' OF COVER.

FORD STREAM CROSSING

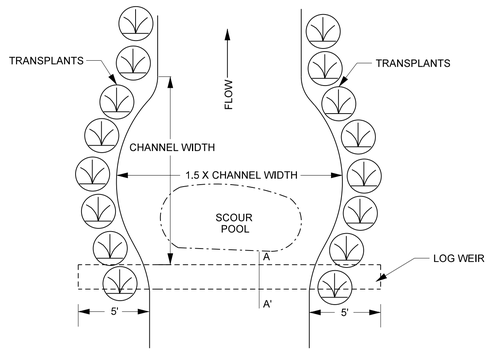


NOTES:

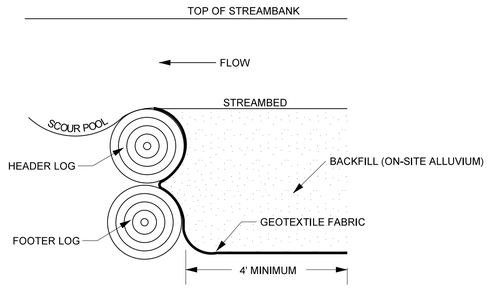
1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM. COMPLETE ONE SIDE BEFORE STARTING ON THE OTHER SIDE.
4. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
5. GRADE SLOPES TO A 5:1 SLOPE. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. A STABILIZED PAD OF STONE BACKFILL, 6 INCHES THICK, LINED WITH GEOTEXTILE FABRIC, SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
8. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.

2/26/03

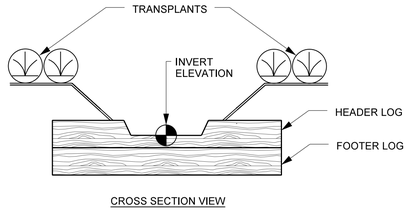
LOG WEIR



PLAN VIEW



SECTION A-A'

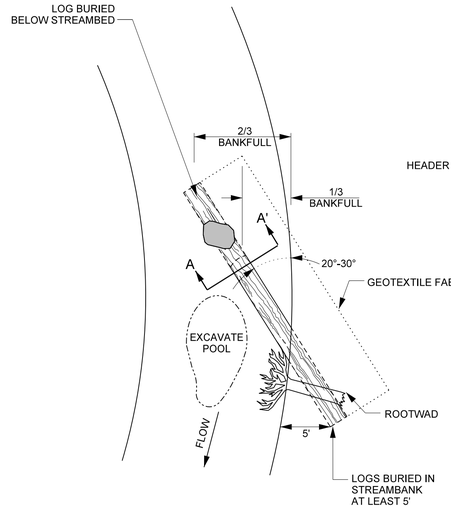


CROSS SECTION VIEW

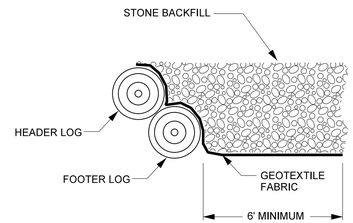
NOTES:

1. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. LOGS >24 INCHES IN DIAMETER MAY BE USED ALONE WITHOUT AN ADDITIONAL LOG. GEOTEXTILE FABRIC SHOULD STILL BE USED TO SEAL AROUND LOG
3. PLACE FOOTER LOGS FIRST AND THEN HEADER (TOP) LOG. SET HEADER LOG APPROXIMATLEY 3 INCHES ABOVE THE INVERT ELEVATION.
4. CUT A NOTCH IN THE HEADER LOG APPROXIMATLEY 50 PERCENT OF THE CHANNEL BOTTOM WIDTH AND EXTENDING DOWN TO THE INVERT ELEVATION.
5. USE GEOTEXTILE FABRIC TO SEAL GAPS BETWEEN LOGS.
6. PLACE TRANSPLANTS FROM TOE OF STREAMBANK TO TOP OF STREAMBANK.

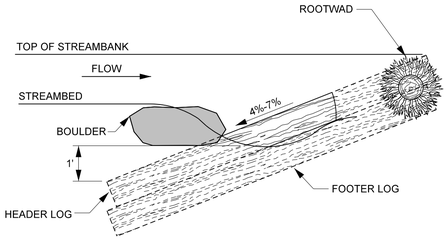
LOG VANE



PLAN VIEW



SECTION A - A'



PROFILE VIEW

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE OF SUFFICIENT SIZE TO ANCHOR LOGS.
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOGS.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
5. BOULDER SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING.
6. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL.
7. TRANSPLANTS CAN BE USED INSTEAD OF ROOTWADS, PER DIRECTION OF ENGINEER.
6. STONE BACKFILL SHALL CONSIST OF A WELL GRADED MIX OF CLASS A, CLASS B, #57 STONE, AND ON-SITE ALLUVIUM WHERE AVAILABLE.

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-B

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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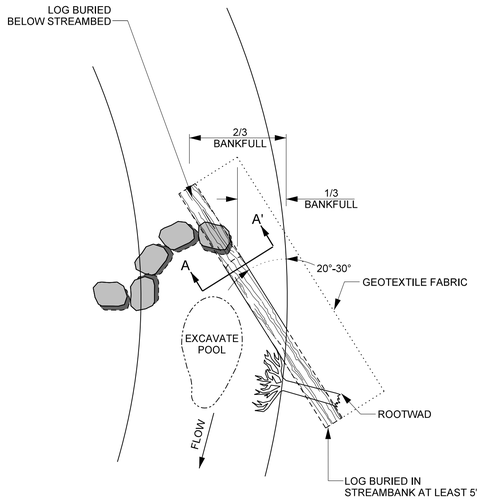
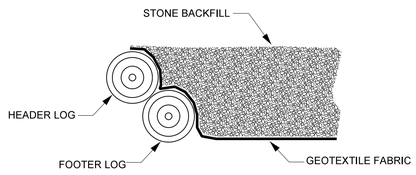
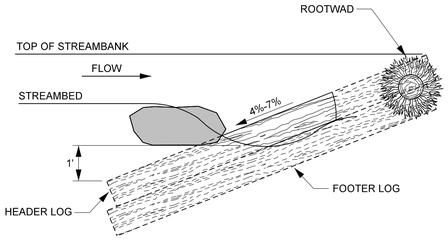
GRADE CONTROL LOG J-HOOK VANE



PLAN VIEW



SECTION A - A'

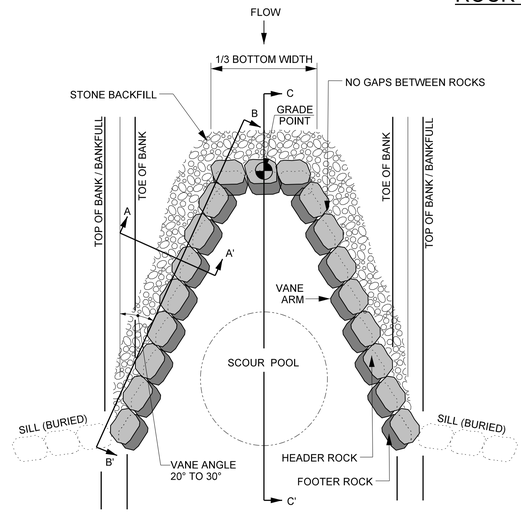


PROFILE VIEW

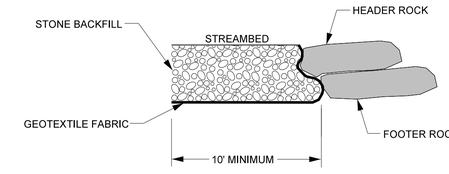
NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. BOULDERS MUST BE AT LEAST 3' x 2' x 2',
3. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
4. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
5. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ACHORING.
6. STONE BACKFILL SHALL CONSIST OF A WELL GRADED MIX OF CLASS A, CLASS B, #57 STONE, AND ON-SITE ALLUVIUM WHERE AVAILABLE.
7. GEOTEXTILE FABRIC SHOULD BE NAILED TO THE LOG.
8. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.

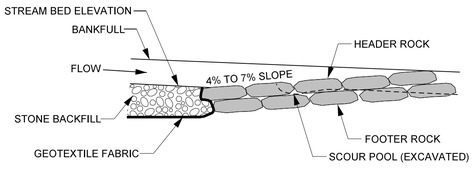
ROCK CROSS VANE



PLAN VIEW



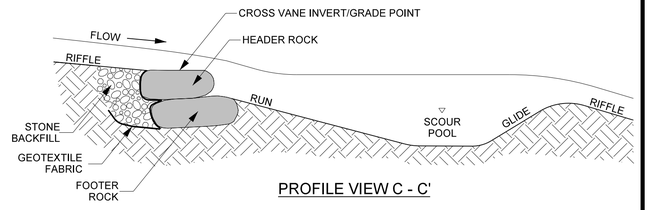
SECTION A - A'



PROFILE VIEW B - B'
VANE ARM

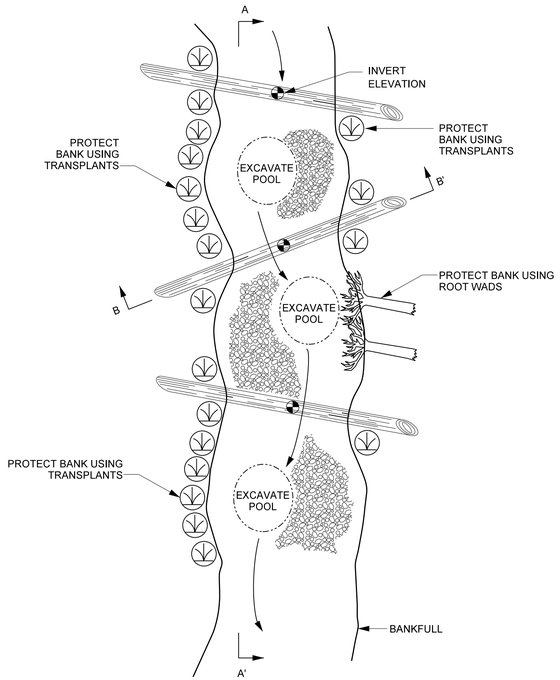
NOTES FOR ALL VANE STRUCTURES:

1. INSTALL BEGINNING AT THE TOP OF THE HEADER ROCKS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
2. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
3. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
4. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
5. AN EXTRA ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
6. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER ROCKS.
7. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.
8. STONE BACKFILL SHALL CONSIST OF A WELL GRADED MIX OF CLASS A, CLASS B, #57 STONE, AND ON-SITE ALLUVIUM WHERE AVAILABLE.

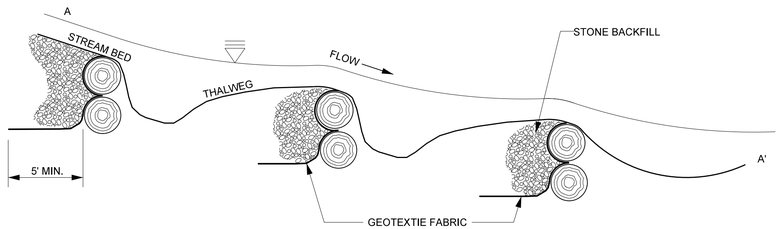


PROFILE VIEW C - C'

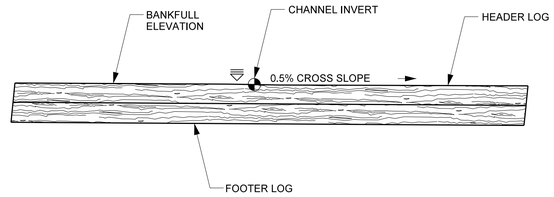
LOG ROLLER



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTES:

1. LOGS SHOULD BE AT LEAST 10" OR MORE IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, RECENTLY HARVESTED AND EXTENDING INTO THE BANK 5' ON EACH SIDE.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. FILTER FABRIC SHOULD BE NAILED (1' ON CENTER) TO THE LOG BELOW THE BACKFILL.
4. TRANSPLANTS, GEOLIFTS, OR ROOT WADS CAN BE USED INSTEAD OF ROOT WADS, PER DIRECTION OF ENGINEER.

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-C

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers DFCF47B8E19D462...

APPROVED BY:

11/15/2017

DATE:

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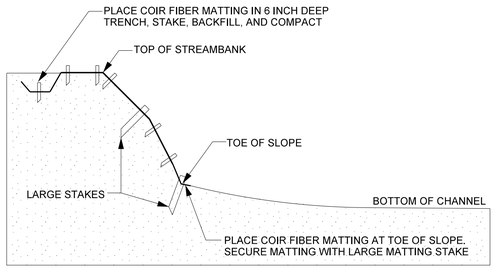
License #: F-1084

NCDMS ID No. 97083

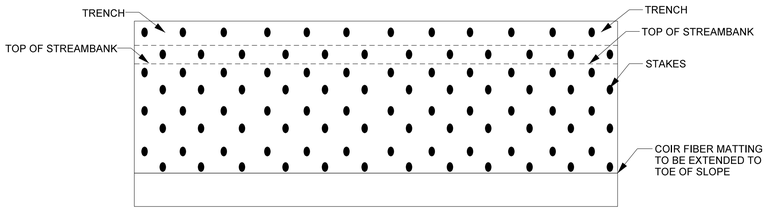
COIR FIBER MATTING



CROSS SECTION VIEW

NOTES:

1. BANKS SHOULD BE SEEDED PRIOR TO PLACEMENT OF MATTING.
2. USE C-7 MATTING.

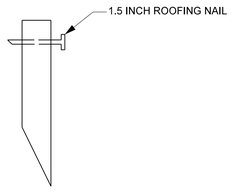


PLAN VIEW

TYPICAL SMALL MATTING STAKE

THE WOOD STAKE SHALL BE THE NORTH AMERICAN GREEN ECO-STAKE OR APPROVED EQUAL WITH THE FOLLOWING DIMENSIONS:

LEG LENGTH	11.00 IN (27.94 CM)
HEAD WIDTH	1.25 IN (3.18 CM)
HEAD THICKNESS	0.40 IN (1.02 CM)
LEG WIDTH	0.60 IN (1.52 CM) (TAPERED TO POINT)
LEG THICKNESS	0.40 IN (1.02 CM)
TOTAL LENGTH	12.00 IN (30.48 CM)

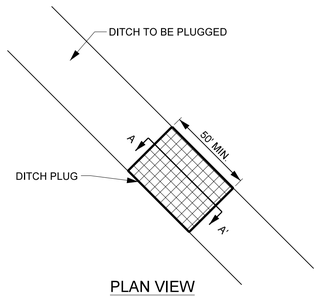


TYPICAL LARGE MATTING STAKE

THE WOOD STAKE SHALL BE THE NORTH AMERICAN GREEN ECO-STAKE OR APPROVED EQUAL WITH THE FOLLOWING DIMENSIONS:

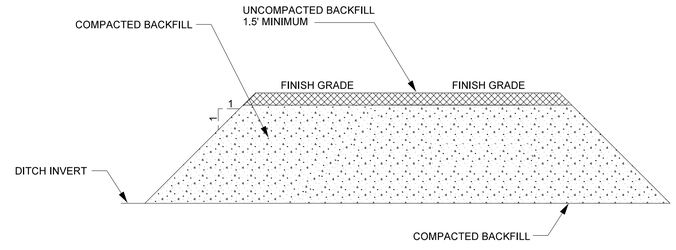
LEG LENGTH	17.00 IN (43.18 CM) (TAPERED TO POINT)
WIDTH	1.00 IN (2.54 CM)
THICKNESS	1.00 IN (2.54 CM)

DITCH PLUG



PLAN VIEW

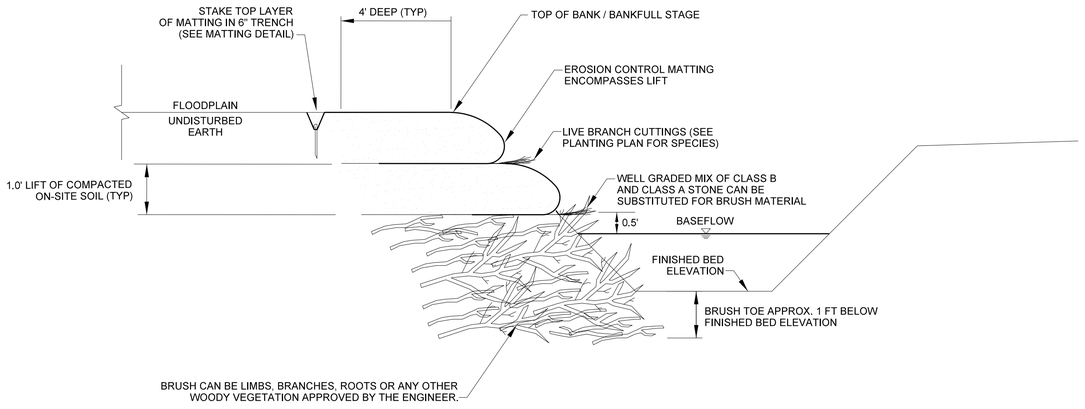
NOTE:
COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.



SECTION A - A'

2/26/03

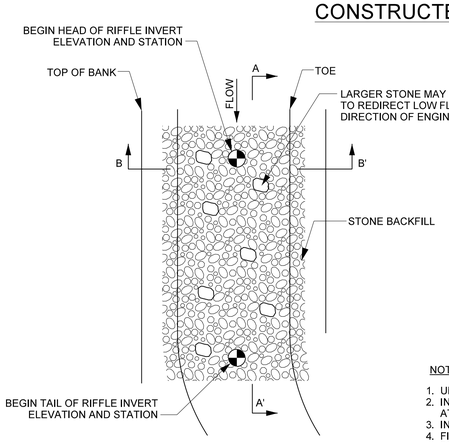
GEOLIFT WITH BRUSH TOE



NOTES:

1. LIVE BRANCH CUTTINGS SHALL BE THE SAME SPECIES AS THE LIVE STAKES AND SHALL BE INSTALLED DURING VEGETATION DORMANCY.
2. LIVE BRANCH CUTTINGS SHALL BE INSTALLED AT A DENSITY OF 20-30 CUTTINGS PER LINEAR FOOT AND A MAXIMUM DIAMETER OF 2.5 INCHES.
3. NUMBER OF SOIL LIFTS MAY VARY, IN GENERAL LIFTS SHALL EXTEND TO THE TOP OF BANK OR BANKFULL STAGE.
4. WHEN GEOLIFTS ARE BUILT ABOVE ROOTWAD CLUSTER, USE LARGE STONE BACKFILL BEHIND ROOT MASS TO BUILT FOUNDATION.

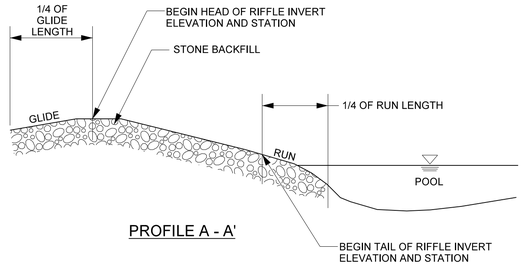
CONSTRUCTED RIFFLE



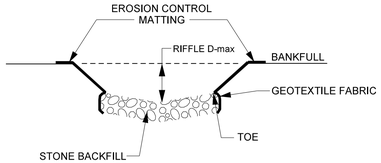
PLAN VIEW

NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
2. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
3. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
4. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, SMOOTH, AND CONCAVE, WITH THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.
5. STONE SHALL BE WELL GRADED MIX OF CLASS II, CLASS A, AND CLASS B STONE AND A MINIMUM OF 18 INCHES DEEP. ON-SITE ALLUVIUM SHALL BE INCORPORATED WHERE AVAILABLE.



PROFILE A - A'



SECTION B - B'

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-D

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47BBE195462...

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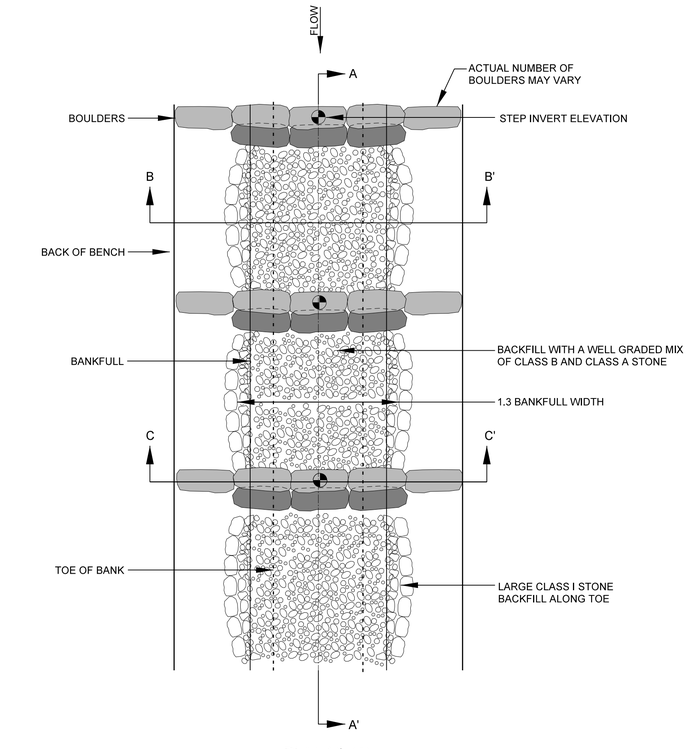
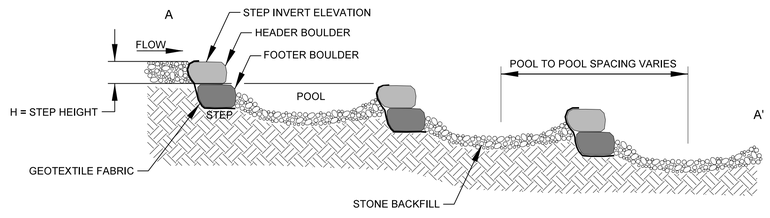
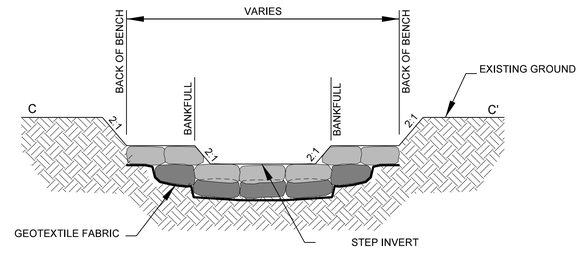
ROCK STEP POOL CHANNEL



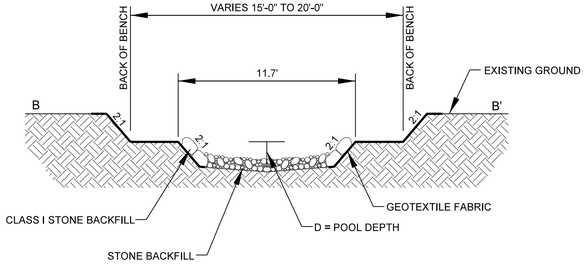
PLAN VIEW



PROFILE VIEW A-A'



POOL CROSS SECTION C-C'



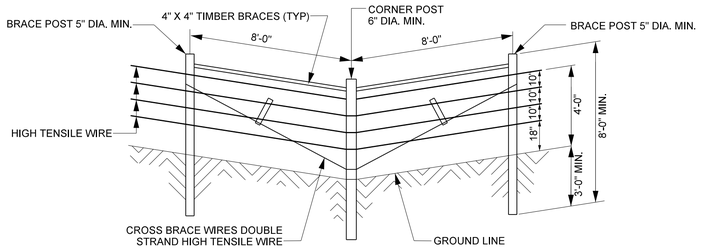
POOL CROSS SECTION B-B'

NOTES:

1. BOULDERS MUST BE AT LEAST 2' X 2' X 3' AND NOT EXCEED 4' X 3' X 2'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH BUCKET OF TRACK HOE.
4. INSTALL GEOTEXTIEL FABRIC UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT POOL BED ELEVATION 8 INCHES TO ALLOW FOR LAYER OF STONE.
6. INSTALL COIR FIBER MATTING ALONG COMPLETED BANKS SUCH THAT THE GEOTEXTILE FABRIC AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. INSTALL LARGE STONE BACKFILL ALONG SIDE SLOPES.
8. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, COMPACTED, AND CONCAVE, WITH THE ELEVATION OF THE BED APPROXIMATELY 0.5 FT DEEPER IN THE CENTER THAN AT THE EDGES.
9. STEP HEIGHT (H) SHALL NOT EXCEED 0.8 FT.

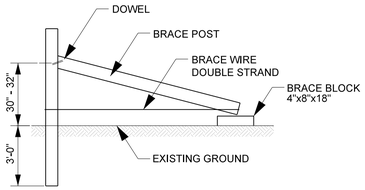
2/26/03

4 STRAND - HIGH TENSILE FENCING



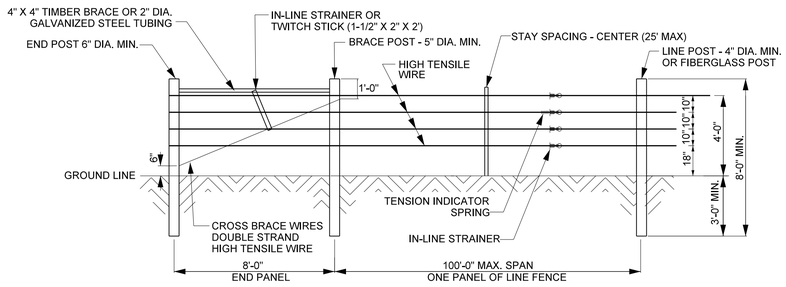
CORNER AND VERICAL CHANGE BRACING

INSTALL AT ALL POINTS WHERE FENCE ALIGNMENT CHANGES 15 DEGREES OR MORE

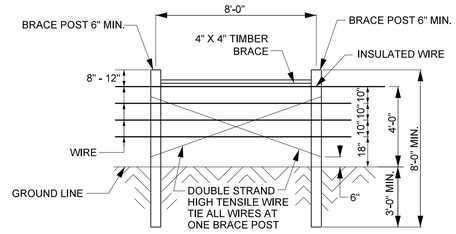


CORNER OR END BRACE ASSEMBLY

OPTIONAL FIGURE 4



END ASSEMBLY AND LINE FENCE SECTION



PULL POST ASSEMBLY

PLACE IN FENCE LINE SO THAT MAXIMUM DISTANCE BETWEEN BRACED POSTS DOES NOT EXCEED 1320 FEET

NOTES:

1. NOTCH POSTS 3/4" FOR 4" X 4" TIMBER BRACES.
2. DOWELS TO BE 1/2" DIA. X 5" PLAIN STEEL RODS. DRIVE DOWELS IN 7/16" DIA. HOLES, 2-1/2" INTO EACH POST AND TIMBER BRACE.
3. STAPLE CROSS-BRACE WIRES TO BRACE AND CORNER POSTS AT QUARTER POINTS OF THE POSTS.
4. HIGH TENSILE WIRE WILL BE NEW AND SMOOTH AND WILL MEET THE FOLLOWING 1) TENSILE STRENGTH - 110,000 PSI 2) GALVANIZING - TYPE III 3) GAGE - 12-1/2.
5. ALL CORNER POSTS, BRACE POSTS, BRACES, AND STAY SPACERS, SHALL BE PRESSURE TREATED. PRESSURE TREATMENT SHALL CONFORM TO FEDERAL SPECIFICATION TT-W-571. (1-1/4" LONG FOR HARD WOODS).
6. AT CORNER POSTS, STAPLE EACH WIRE AT QUARTER POINTS OF POSTS. AT BRACE POSTS, DOUBLE STAPLE EACH WIRE. AT LINE POSTS, SECURE EACH WIRE WITH STANDARD CLAMPS.
7. FIBERGLASS MAY BE USED FOR LINE POSTS. THESE WILL CONSIST OF MARBLE, FIBERGLASS, AND POLYMER RESINS WHICH HAVE BEEN TREATED BY THERMOSETTINGS (HEAT TREATMENT). POSTS MUST BE DRIVEN IN THE SOIL AT LEAST 18 INCHES.
8. 2" DIAMETER PIPE DIAGONAL BRACE MAY BE USED IN PLACE OF HORIZONTAL TIMBER BRACE AND DIAGONAL WIRES.
9. MINIMUM NET RETENTION OF CHROMATED COPPER ARSENATE (CCA) FOR WOOD FENCE POSTS SHALL BE 0.40 POUNDS PER CUBIC FOOT.
10. A SINGLE 12 FOOT LONG, 6 INCH MINIMUM DIAMETER POST MAY BE SUBSTITUTED FOR END PANEL, CORNER AND VERTICAL CHANGE BRACING, AND PULL POST ASSEMBLY. THE 12 FOOT LONG POSTS SHALL EXTEND A MINIMUM OF 7.5 FEET INTO THE GROUND AND BE BACKFILLED WITH GRAVEL.
11. FOR FURTHER DETAILS ON APPROVED METHODS OF FENCE INSTALLATION, SEE NATURAL RESOURCE SERVICE'S CONSERVATION PRACTICE MATERIALS AND CONSTRUCTION SPECIFICATIONS FOR FENCING (CODE 382) BY NRCS NORTH CAROLINA (FEBRUARY 2008).

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	2-E

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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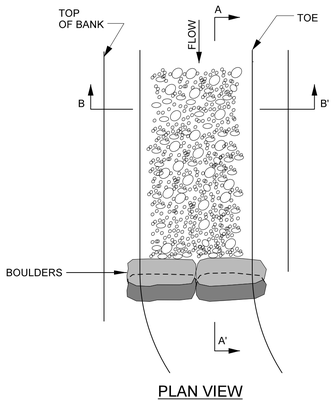
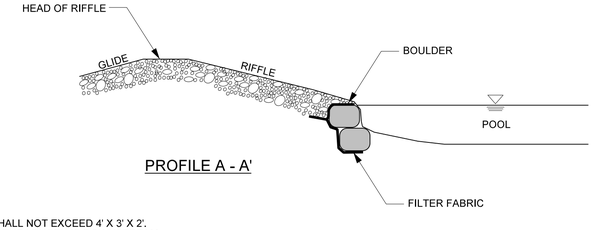
NCDMS ID No. 97083

BOULDER STEP



PLAN VIEW



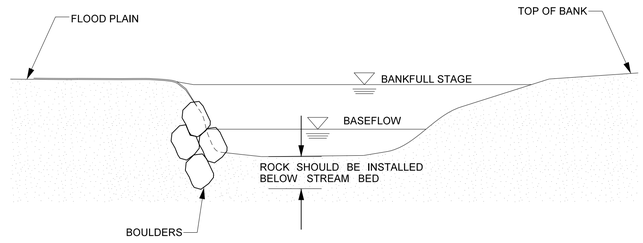
PROFILE A - A'

NOTES;

1. HEADER BOULDERS MUST BE 3' X 2' X 2' AND FOOTERS SHALL NOT EXCEED 4' X 3' X 2'.
2. FOOTERS SHALL BE INSTALLED SUCH THAT 1/4 TO 1/3 OF THE LENGTH IS DOWNSTREAM OF THE HEADER.
3. SOIL SHALL BE WELL COMPACTED AROUND BURIED PORTION OF FOOTERS WITH THE BUCKET OF EXCAVATOR.
4. INSTALL NON-WOVEN FILTER FABRIC UNDERNEATH FOOTER BOULDERS.
5. UNDERCUT THE RIFFLE ELEVATION 16 INCHES TO ALLOW FOR A LAYER OF STONE.
6. INSTALL EROSION CONTROL MATTING ALONG COMPLETED BANKS SUCH THAT THE EROSION CONTROL MATTING AT THE TOE OF THE BANK EXTENDS DOWN TO THE UNDERCUT ELEVATION.
7. FILL TRENCH WITH GRADED MIX OF CLASS A, CLASS B, AND #57 STONE TO THE BED ELEVATION OF THE CHANNEL.
8. BOULDER STEPS MUST BE EXTENDED TO A MINIMUM OF 2' INTO THE BANK. USE SILL BOULDERS IF NECESSARY.
9. THALWEG WILL BE CONCAVE AND SHAPED PER DIRECTION OF THE DESIGNER.

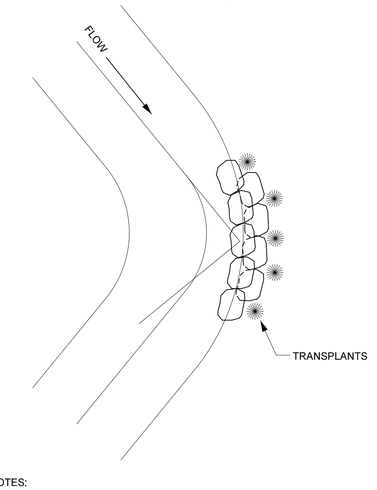
BOUDER TOE PROTECTION

CROSS SECTION VIEW
NTS



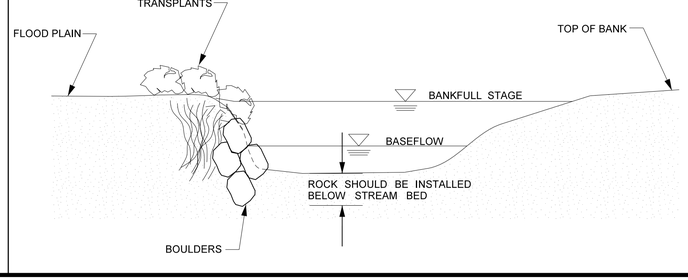
BOULDER TOE PROTECTION

PLAN VIEW
NTS



BOULDER TOE PROTECTION WITH TRANSPLANTS

CROSS SECTION VIEW
NTS



NOTES:

TRENCHING METHOD:
IF THE BOULDERS CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE BOULDERS, ONE-THIRD OF THE BOULDERS SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

NOTES:

DRIVEN METHOD:
BOULDERS SHOULD BE LAIN IN THE STREAMBED AND THEN DRIVEN INTO THE BANK WITH A HORIZONTAL AND DOWNWARD FORCE.

GENERAL CONSTRUCTION SEQUENCE

BAKER PROJECT REFERENCE NO. 153145 | SHEET NO. 3

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

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APPROVED BY:

11/15/2017

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License #: F-1084

NCDMS ID No. 97083

General Construction Sequence

A general construction sequence is provided below and is included on the plan set for the Lochill Farm Stream Mitigation Project. The site construction, including grading and planting activities, will be conducted using common machinery, tools, equipment and techniques for successfully implementing the project

1. Contractor shall contact North Carolina “One Call” Center (1.800.632.4949) before any excavation.
2. Contractor shall prepare stabilized construction entrances and haul roads as indicated on the plans.
3. The Contractor shall mobilize equipment, materials, prepare staging area(s) and stockpile area(s) as shown on the plans.
4. Construction traffic shall be restricted to the area denoted as “Limits of Disturbance” or “Haul Roads” on the plans.
5. The Contractor shall install temporary rock dams at locations indicated on the plans.
6. The Contractor shall install temporary silt fence around the staging area(s). Temporary silt fencing will also be placed around the temporary stockpile areas as material is stockpiled throughout the construction period.
7. The Contractor shall install all temporary and permanent stream crossings as shown on the plans in accordance with the NC Erosion and Sediment Control Planning and Design Manual. The existing channel and ditches on site will remain open during the initial stages of construction to allow for drainage and to maintain site accessibility.
8. The Contractor shall construct only the portion of channel that can be completed and stabilized within the same day.
9. The Contractor shall apply temporary seed and mulch to all disturbed areas at the end of each work day.
10. The Contractor shall clear and grub an area adequate to construct the stream channel and grading operations after all Sedimentation and Erosion Control practices have been installed and approved. In general, the Contractor shall work from upstream to downstream and in-stream structures and channel fill material shall be installed using a pump-around or flow diversion measure as shown on the plans.
11. The Contractor will begin construction by excavating channel fill material in areas for Reach R1. Along ditches with water or stream reaches, excavated material should be stockpiled in areas shown on the plans. In any areas where excavation depths will exceed 10 inches, topsoil shall be separated, stockpiled and placed back over these areas to a depth of eight inches to achieve design grades and create a soil base for vegetation according to the plans and specifications.
12. Contractor shall begin construction on stream Reach R1 at Station 10+00 and proceed in a downstream direction until the reach is completed at Station 42+30 at Pleasant Green Road. Concurrently, construction along Reach R3 will begin at the upstream section at Station 10+00 and continue downstream until its confluence with Reach R1 at Station 26+10.
13. After excavating the channel to design grades, install in-stream structures, grassing, matting, and transplants in this section, and ready the channel to accept flow per approval by the Engineer.
14. Water will be turned into the constructed channel once the area in and around the new channel has been stabilized. Immediately begin plugging, filling, and grading the abandoned channel, as indicated on plans, moving in a downstream direction to allow for drainage of the old channels. No water shall be turned into any section of channel prior to the channel being completely stabilized with all structures installed.
15. The new channel sections shall remain open on the downstream end to allow for drainage during rain events.
16. Any grading activities adjacent to the stream channel shall be completed prior to turning water into the new stream channel segments. The Contractor shall not grade or roughen any areas where excavation activities have not been completed.
17. Once a stream work phase is complete, apply temporary seeding, permanent seeding, and mulching to any areas disturbed during construction. Apply permanent seeding mixtures, as shown on the vegetation plan. Temporary seeding shall be applied in all disturbed areas such that ground cover is established within 15 working days following completion of any phase of grading. Permanent ground cover shall be established for all disturbed areas within 15 working days or 90 calendar days (whichever is shorter) following completion of construction.
18. Contractor shall improve and construct the existing farm road crossings by installing ford and culvert crossings, stabilizing side slopes, and modifying the farm road bed elevations according to the plans and specifications.
19. All disturbed areas should be seeded and mulched before leaving the project. Remove temporary stream crossings and any in-stream temporary rock dams. All waste material must be removed from the project site.
20. The Contractor shall treat areas of invasive species vegetation throughout the project area according to the plans and specifications prior to demobilization.
21. The Contractor shall plant woody vegetation and live stakes, according to planting details and specifications. The Contractor shall complete the reforestation (bare-root planting) phase of the project and apply permanent seeding at the appropriate time of the year.
22. The Contractor shall ensure that the site is free of trash and leftover materials prior to demobilization of equipment from the site.

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	4

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47BBE19D462...

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License #: F-1084

NCDMS ID NO. 97083

NAD 83

BEGIN REACH 1
STA. 10+00.00

INSTALL ROCK CROSS VANE (TYP.)

INSTALL PERMANENT FORD STREAM CROSSING

INSTALL TOE WOOD (TYP.)

INSTALL CONSTRUCTED RIFFLE (TYP.)

INSTALL LOG VANE (TYP.)

BENCH LIMITS

TIE INTO EXISTING FENCE

INSTALL GEOLIFT WITH BRUSH TOE (TYP.)

INSTALL GRADE CONTROL J-HOOK VANE (TYP.)

INSTALL 4 STRAND HIGH TENSILE FENCING

GILBERT, JANE KELLY & GILBERT, DAVID W.
PIN: 0805390700

MATCHLINE SHEET 5 STA. 16+00.00

NOTES:

1. ANY HARDWOOD TREES REMOVED MUST BE INCORPORATED WITHIN THE STRUCTURES BEING INSTALLED.
2. EXCAVATE STREAMBED MATERIAL BEFORE FILLING IN THE OLD CHANNEL AND USE STREAMBED MATERIAL WITHIN THE NEWLY CONSTRUCTED CHANNEL.
3. CONTRACTOR CAN USE BRUSH MATERIAL TO INCORPORATE WITHIN THE CONSTRUCTED RIFFLES AND BRUSH TOES ALONG MEANDER BENDS.
4. FENCING INSIDE EASEMENT WILL BE REMOVED AND HAULED OFF-SITE BY THE CONTRACTOR.
5. ANY AREA THAT HAS BEEN GRADED MUST HAVE POSITIVE DRAINAGE, UNLESS OTHERWISE DIRECTED BY ENGINEER.
6. AREAS OF BENCHING: CONTRACTOR WILL EXCAVATE THE TOPSOIL, STOCKPILE IT, AND THEN ADD THE TOPSOIL AS TOP LAYER OF BENCH AND TERRACE SLOPES TO A DEPTH OF AT LEAST 8 INCHES.
7. CONTRACTOR WILL CONTROL ANY INVASIVE SPECIES WITHIN EASEMENT.
8. LOCATIONS OF GRADE CONTROL STRUCTURES ARE SUBJECT TO CHANGE BASED ON FIELD CONDITIONS AND BY THE DIRECTION OF THE ENGINEER.
9. POOLS MY BE OVER EXCAVATED AT THE DIRECTION OF THE ENGINEER.
10. ANY EXISTING ROADS OR PATHS WITHIN THE CONSERVATION EASEMENT SHALL BE REMOVED AND GRADED TO MATCH THE SURROUNDING TOPOGRAPHY. SOIL SHALL ALSO BE RIPPED TO REDUCE COMPACTION.

FILL EXISTING CHANNEL

DITCH PLUG

LOCHILL FARM
REACH 1
PLAN VIEW

20 0 20 40
SCALE (FT)

K:\3153145_LochillFarm\Design\Plans\153145_PSH-04.dgn
2/13/2017
jmorel

2/26/03

NAD 83

NOTES:

1. ANY HARDWOOD TREES REMOVED MUST BE INCORPORATED WITHIN THE STRUCTURES BEING INSTALLED.
2. EXCAVATE STREAMBED MATERIAL BEFORE FILLING IN THE OLD CHANNEL AND USE STREAMBED MATERIAL WITHIN THE NEWLY CONSTRUCTED CHANNEL.
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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47BBE19D462...

APPROVED BY:

11/15/2017

DATE:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
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Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 97083

MATCHLINE SHEET 9 STA. 14+50.00

MATCHLINE SHEET 4 STA. 16+00.00

MATCHLINE SHEET 6 STA. 23+00.00

BANK GRADING ALONG REACH 2 FROM STA. 10+00 TO STA. 15+00 WILL BE ON-SITE AT THE DIRECTION OF THE ENGINEER.

REMOVE EXIST. 18" RCP

INSTALL BOULDER STEP (TYP.)

END REACH 2
STA. 16+17.03

INSTALL 20' GATE

INSTALL 4 STRAND HIGH TENSILE FENCING

INSTALL CONSTRUCTED RIFFLE (TYP.)

INSTALL GEOLIFT WITH BRUSH TOE (TYP.)

BENCH LIMITS

INSTALL APRON LINED WITH CLASS B STONE (TYP.)

EXCAVATE PLUNGE POOL AND LINE WITH CLASS I RIP RAP

INSTALL 24" RCP FLOODPLAIN PIPE

INSTALL LOG VANE (TYP.)

INSTALL GRADE CONTROL J-HOOK VANE (TYP.)

INSTALL 24" RCP FLOODPLAIN PIPE

INSTALL 20' GATE

INSTALL 4 STRAND HIGH TENSILE FENCING

INSTALL 48"x76" ELLIPTICAL CONCRETE CULVERT WITH BOULDER HEADWALLS
INV. IN 494.04'
INV. OUT 493.90'

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

FILL EXISTING CHANNEL

DITCH PLUG

LOCHILL FARM
REACH 1
PLAN VIEW

20 0 20 40
SCALE (FT)

K:\13\2317\153145_Lochill Farm\Design\Plans\153145_PSH-05.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	6

PROJECT ENGINEER

SEAL 039201 NORTH CAROLINA PROFESSIONAL ENGINEER JACOB M. BYERS

APPROVED BY:

11/15/2017

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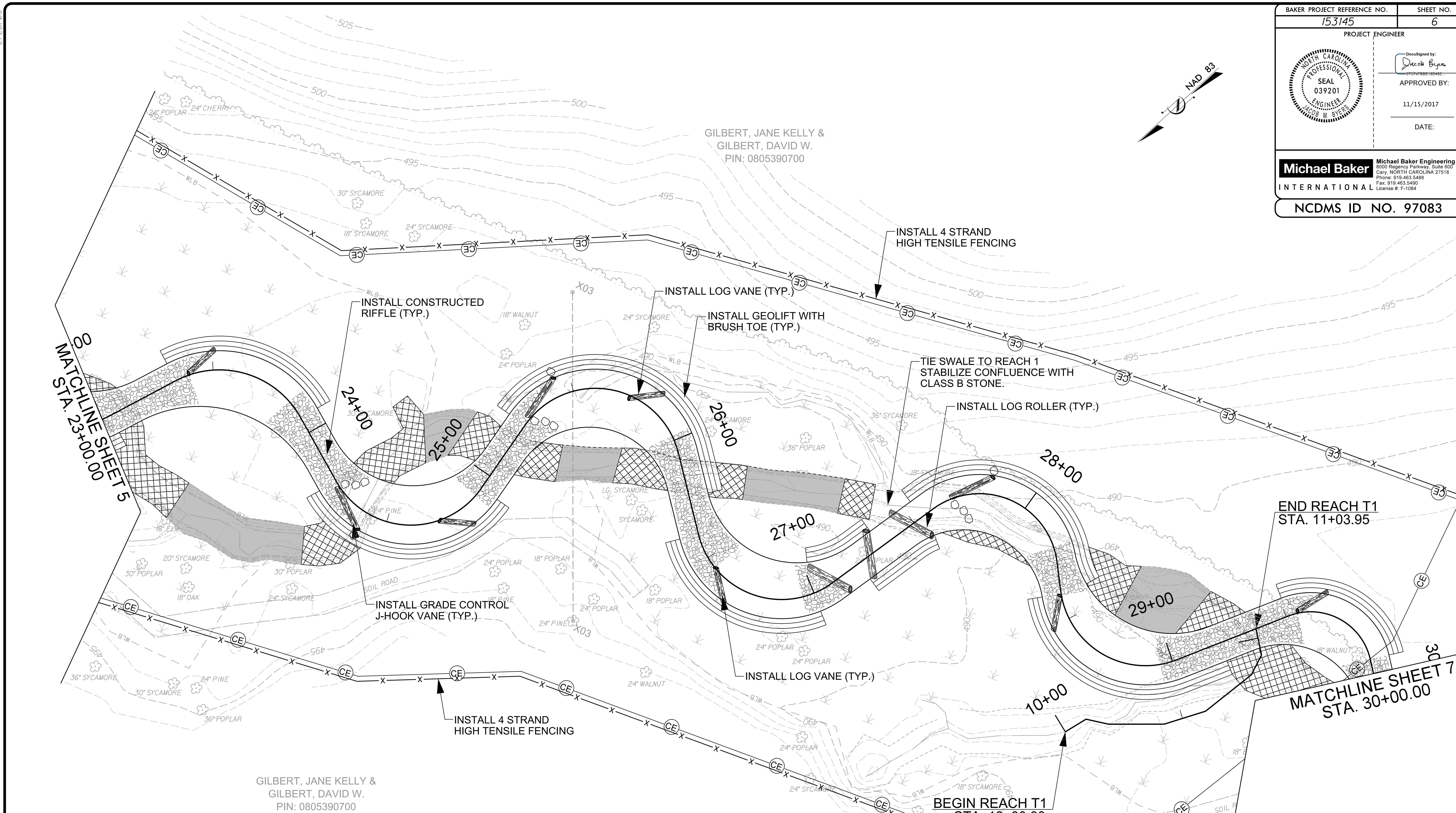
NCDMS ID NO. 97083



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FILL EXISTING CHANNEL

DITCH PLUG

LOCHILL FARM
REACH 1
PLAN VIEW

20 0 20 40
SCALE (FT)

2/26/03

NAD 83

NOTES:

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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF471B8E19D482...

APPROVED BY:

11/15/2017

DATE:

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Phone: 919.463.5488
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License #: F-1084

NCDMS ID NO. 97083

MATCHLINE SHEET 12
STA. 24+50.00

INSTALL 4 STRAND HIGH TENSILE FENCING

INSTALL ROCK CROSS VANE (TYP.)

25+00

REMOVE BERM TO THE DEGREE POSSIBLE WITHOUT DAMAGING ROOTS OF THE LARGER TREES.

MATCHLINE SHEET 6
STA. 30+00.00

30+00

31+00

INSTALL BOULDER STEP (TYP.)

INSTALL GEOLIFT WITH BRUSH TOE (TYP.)

26+00

32+00

33+00

END REACH 3
STA. 26+17.20

INSTALL LOG VANE (TYP.)

34+00

INSTALL CONSTRUCTED RIFFLE (TYP.)

35+00

36+00

INSTALL LOG ROLLER (TYP.)

MATCHLINE SHEET 8
STA. 37+00.00

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

GILBERT, JANE KELLY &
GILBERT, DAVID W
PIN: 0806

PIEDMONT ELECTRIC MEMBERSHIP CORPORATION
R/W WIDTH 30' PER DB878 PG325

OVERHEAD POWER

FILL EXISTING CHANNEL

DITCH PLUG

LOCHILL FARM
REACH 1
PLAN VIEW

20 0 20 40
SCALE (FT)

K:\13\153145_Lochill\Farm\Design\Plans\153145_PSH-07.dgn
2/13/2017
jmcdaniel

2/26/03

NOTES:

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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	8

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 076F47FBBE19D4C...

APPROVED BY:

11/15/2017

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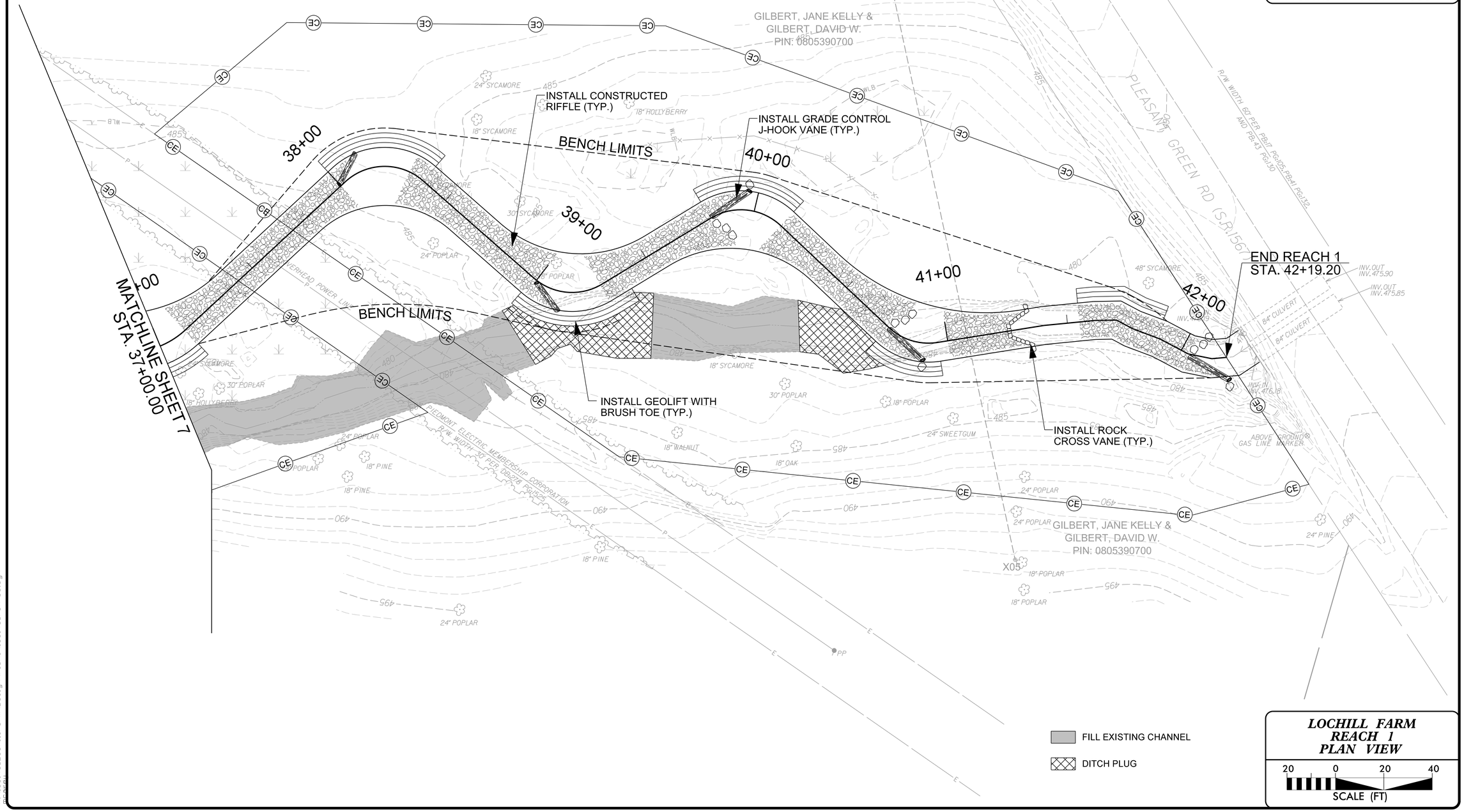
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 97083

NAD 83



LOCHILL FARM
REACH 1
PLAN VIEW

20 0 20 40
SCALE (FT)

11/3/2017
K:\153145_Lochill Farm\Design\Plans\153145_PSH-08.dgn
mpeal

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	9

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

DocuSigned by: Jacob Byers 07CF4TBBE19D452...

APPROVED BY:

11/15/2017

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Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 97083

FILL EXISTING CHANNEL

DITCH PLUG

NAD 83

BEGIN REACH 2
STA. 10+00.00

10+00

11+00

12+00

13+00

14+00

BANK GRADING ALONG REACH 2 FROM STA. 10+00 TO STA. 15+00 WILL BE ON-SITE AT THE DIRECTION OF THE ENGINEER.

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

EXTEND CLEARING AND GRUBBING OF CROSSING TO THE EXISTING SOIL ROAD

SOIL ROAD

INSTALL 4 STRAND HIGH TENSILE FENCING

INSTALL 10' GATE

INSTALL 12' OF 30" RCP

MATCHLINE SHEET 4

MATCHLINE SHEET 5
STA. 14+50.00

NOTES:

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LOCHILL FARM
REACH 2
PLAN VIEW

20 0 20 40
SCALE (FT)

K:\3153\153145_LochillFarm\Design\Plans\153145_PSH-09.dgn
11/3/2017
153145_PSH-09

2/26/03

NOTES:

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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	10

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47EBE15D422...

APPROVED BY:

11/15/2017

DATE:

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
8000 Regency Parkway, Suite 600
Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 97083

NAD 83

BEGIN REACH T3
STA. 10+00.00

BEGIN REACH T3B
STA. 10+00.00

BEGIN REACH T2
STA. 10+00.00

BEGIN REACH 3
STA. 10+00.00

END REACH T3B
STA. 10+33.75

END REACH T2
STA. 10+59.17

END REACH T3
STA. 14+81.94

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

BRUNO, RALPH T. &
BRUNO, TONYA W.
PIN: 0805291320

INSTALL GEOLIFT WITH BRUSH TOE (TYP.)

INSTALL CONSTRUCTED RIFFLE (TYP.)

INSTALL GRADE CONTROL J-HOOK VANE (TYP.)

INSTALL ROCK CROSS VANE (TYP.)

INSTALL LOG WEIR (TYP.)

INSTALL LOG ROLLER (TYP.)

INSTALL APRON LINED WITH CLASS B STONE (TYP.)

INSTALL 12' OF 24" RCP FLOODPLAIN PIPE

INSTALL ROCK STEP POOL (TYP.)

RE-GRADE SOIL ROAD TO ENSURE 1' MINIMUM COVER OVER PIPE

INSTALL 48" RCP
INV IN 519.65'
INV OUT 519.50'

INV. OUT INV.519.20

INV. IN INV.519.32

INSTALL 4 STRAND HIGH TENSILE FENCING ALONG WOODLINE

INSTALL 10' GATE AT THE SOIL ROAD ENTRANCE AT THE WOODLINE

INV. IN INV.505.86

MATCHLINE SHEET 11 STA. 16+00.00

FILL EXISTING CHANNEL

DITCH PLUG

LOCHILL FARM
REACH 3
PLAN VIEW

20 0 20 40
SCALE (FT)

K:\13\2017\153145_Lochill\Farm\Design\Plans\153145_PSH-10.dgn
11/13/2017

2/26/03

NOTES:

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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	11

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47B8E19D462

APPROVED BY:

11/15/2017

DATE:

Michael Baker INTERNATIONAL

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Fax: 919.463.5490
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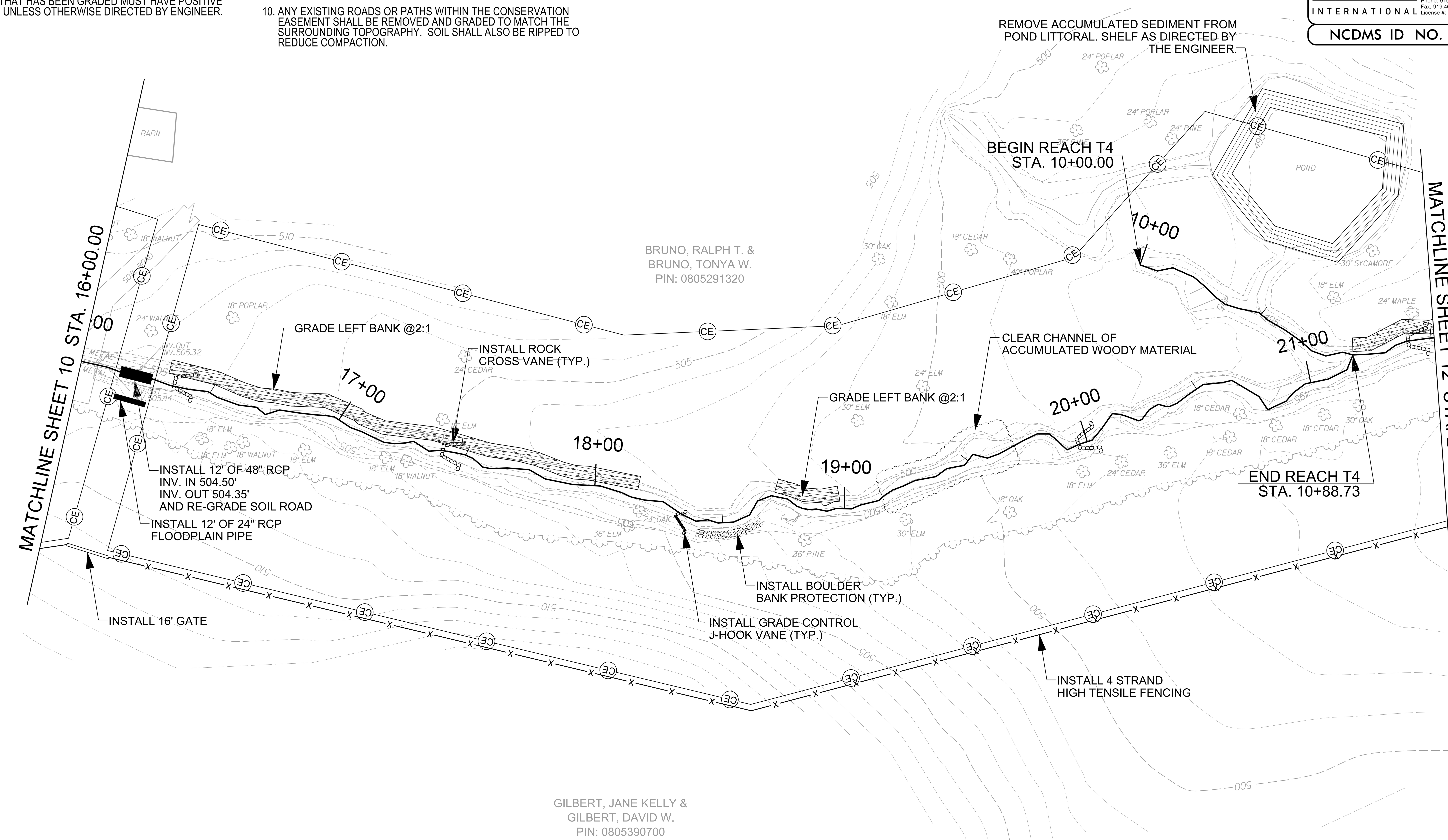
NCDMS ID NO. 97083



FILL EXISTING CHANNEL

DITCH PLUG

LOCHILL FARM
REACH 3
PLAN VIEW

20 0 20 40

SCALE (FT)

11/13/2017
R:\153145_Lochill Farm\Design\Plans\153145_PSH-11.dgn

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	12

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47BBE19D462...

APPROVED BY:

11/15/2017

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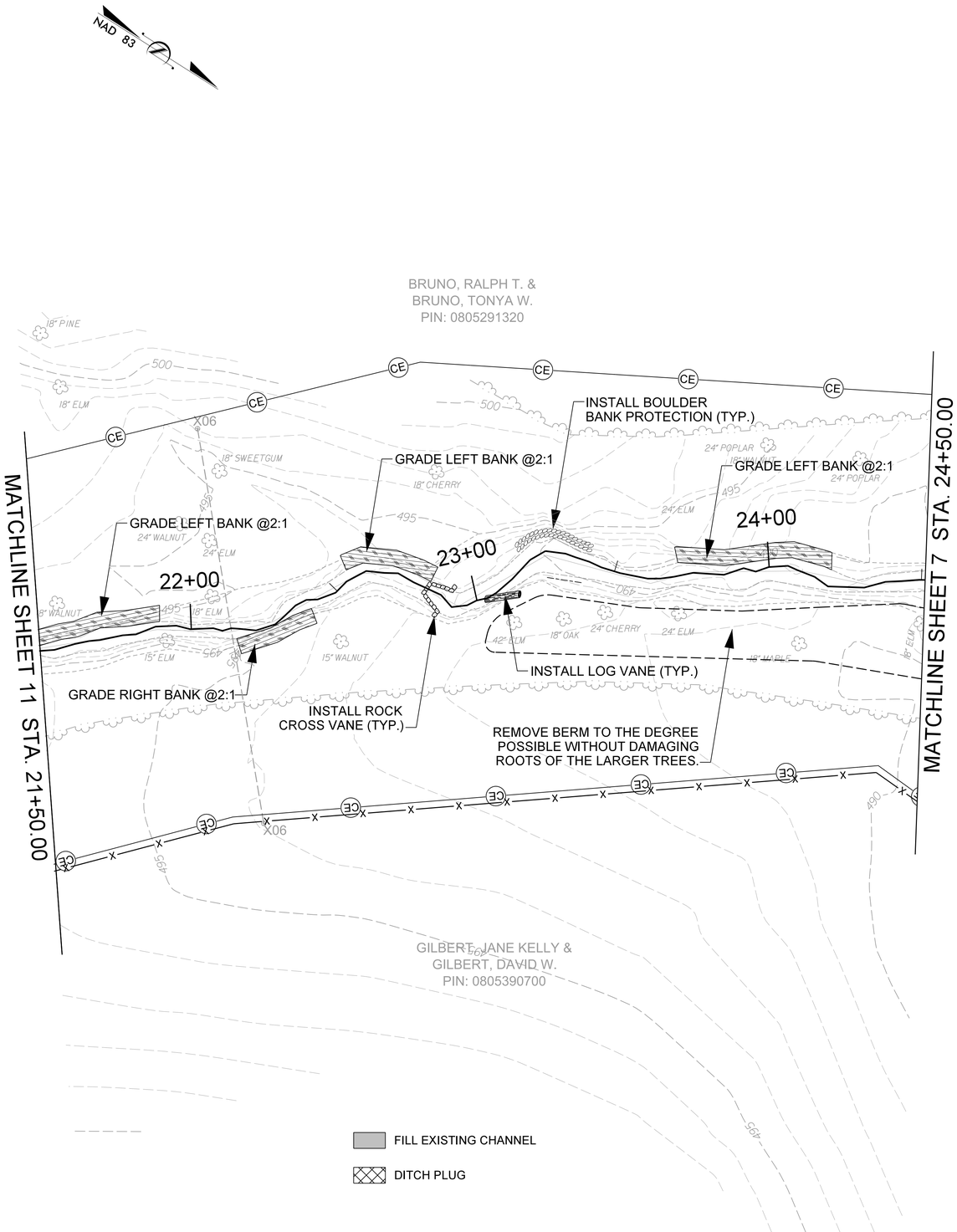
NCDMS ID NO. 97083



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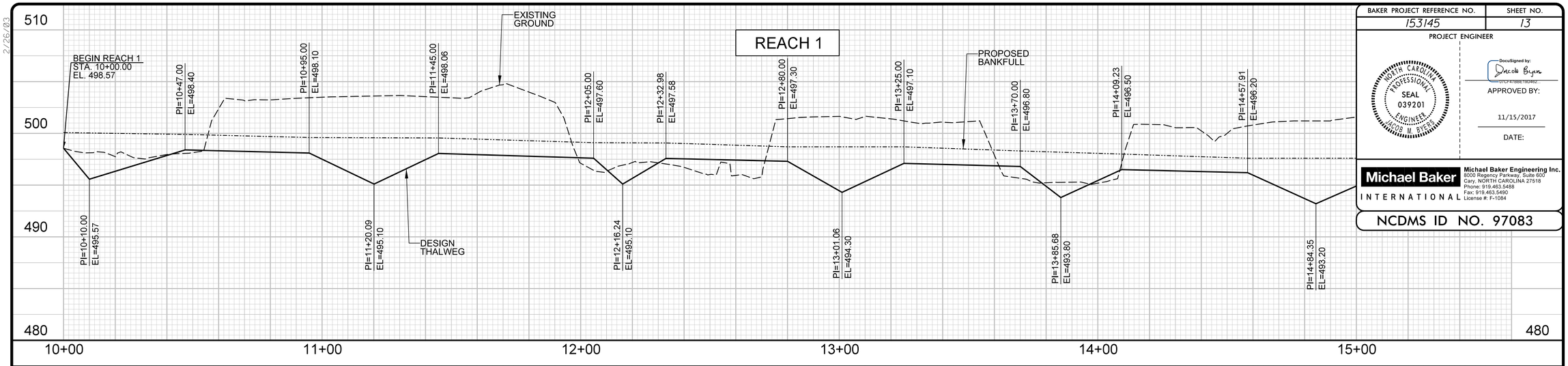
LOCHILL FARM
REACH 3
PLAN VIEW

20 0 20 40
SCALE (FT)

K:\13\2017\153145_Lochill Farm\Design\Plans\153145_PSH-12.dgn
mgeal

2/26/03



BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	13

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB H. BYERS

DocuSigned by: Jacob Byers 37CF4788E190492...

APPROVED BY:

11/15/2017

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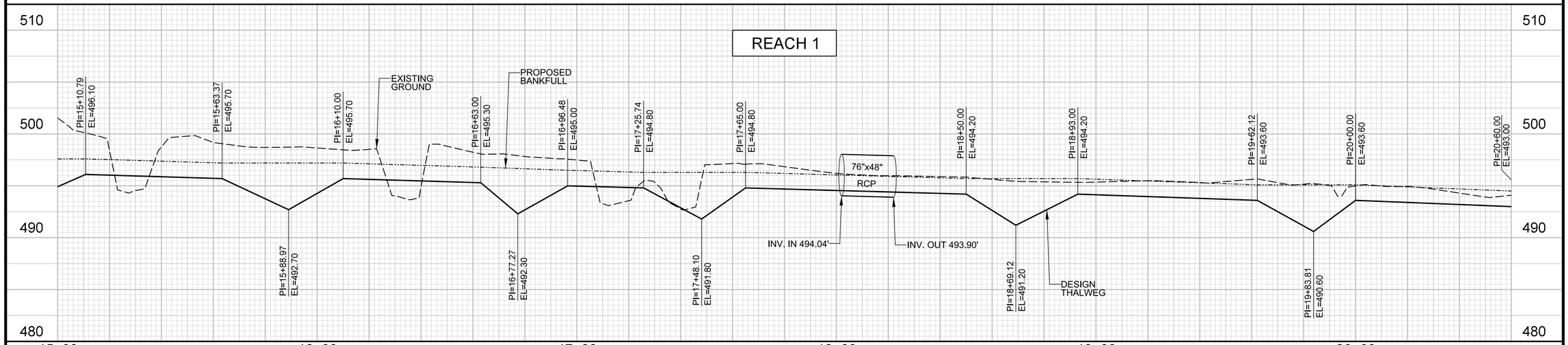
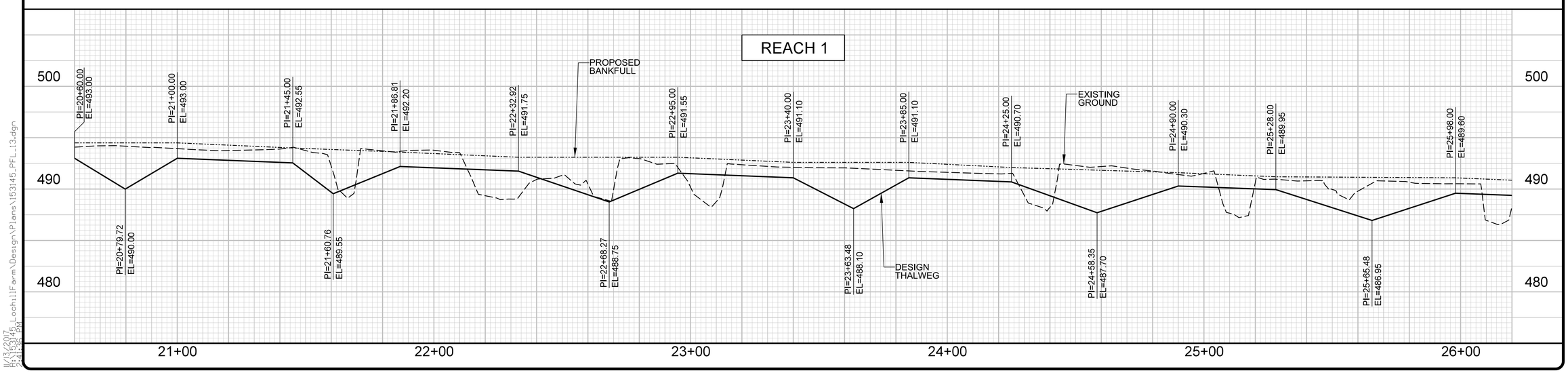
License #: F-1084

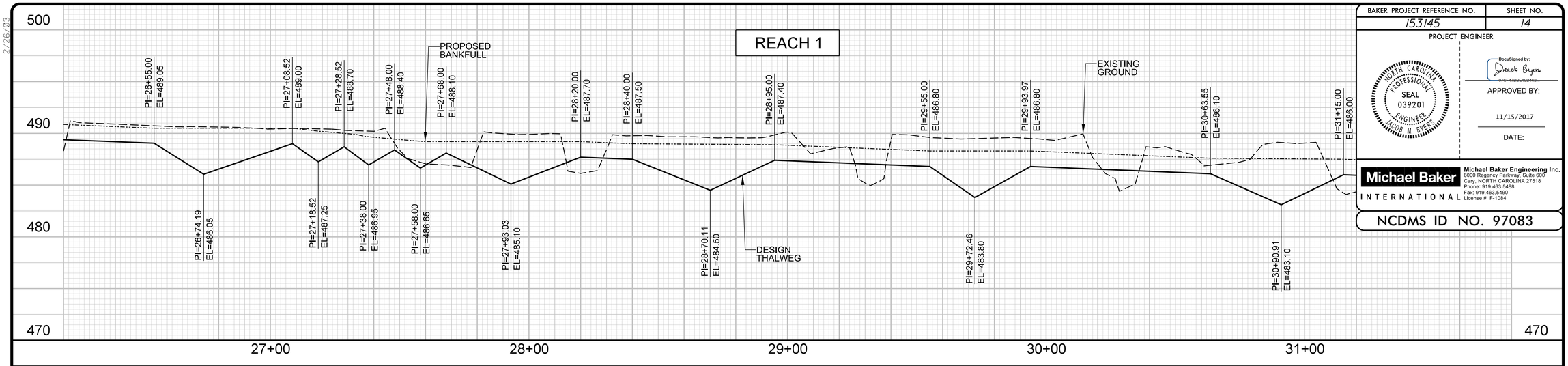
NCDMS ID NO. 97083





470

2/26/03



BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	14

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07DF47B8C19D462...

APPROVED BY:

11/15/2017

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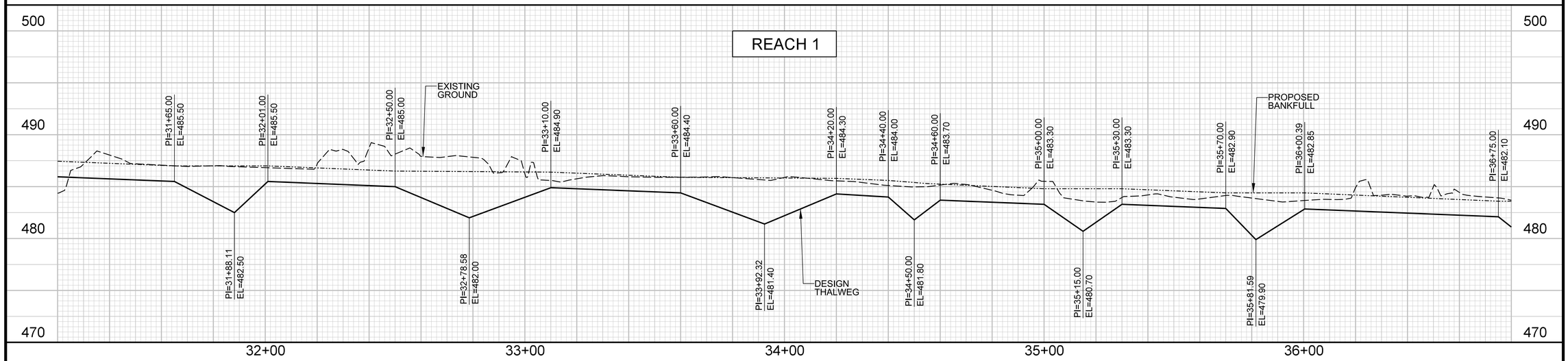
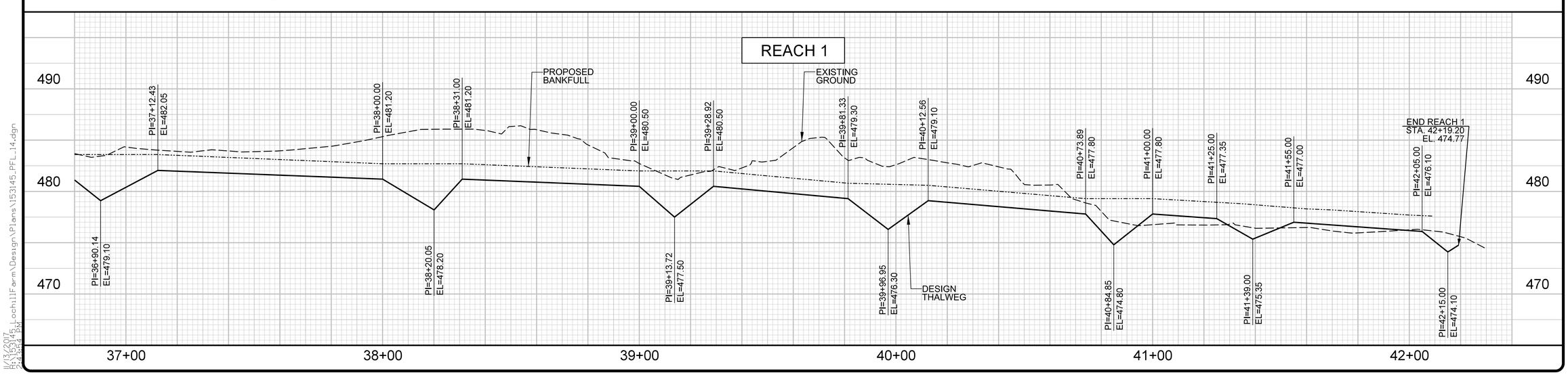
NCDMS ID NO. 97083





2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	15

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB H BYERS

DocuSigned by: Jacob Byers 07CF47BBE19D462...

APPROVED BY:

11/15/2017

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NCDMS ID NO. 97083

REACH 2

BEGIN REACH 2
STA. 10+00.00
EL. 498.92

EXISTING GROUND

500
490
480

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

REACH 2

BEGIN REACH 2
STA. 10+00.00
EL. 498.92

EXISTING GROUND

500
490
480

15+00 16+00

REACH 3

BEGIN REACH 3
STA. 10+00.00
EL. 519.50

PI=10+01.00
EL=519.50

PI=10+04.00
EL=518.00

PI=10+15.00
EL=519.00

PI=10+19.00
EL=517.40

PI=10+27.00
EL=518.50

PI=10+42.00
EL=518.10

48" RCP
INV. IN 519.65'
INV. OUT 519.50'

PI=10+55.00
EL=516.60

PI=10+67.00
EL=518.00

PI=10+90.00
EL=517.40

PI=11+12.00
EL=515.90

PI=11+34.00
EL=517.10

PI=11+44.00
EL=516.70

PI=11+48.00
EL=515.20

PI=11+55.00
EL=516.20

PI=11+60.00
EL=515.90

PI=11+64.00
EL=514.50

PI=11+70.00
EL=515.40

PI=11+76.00
EL=515.10

EXISTING GROUND

PI=11+94.00
EL=513.40

PI=12+14.00
EL=514.80

PI=12+29.00
EL=514.40

PI=12+33.00
EL=512.80

PI=12+40.00
EL=514.20

PI=12+74.00
EL=513.30

PI=12+88.00
EL=511.80

PI=13+05.00
EL=513.20

DESIGN THALWEG

PI=13+44.00
EL=511.90

PI=13+48.00
EL=510.40

PI=13+58.00
EL=511.40

PI=13+94.00
EL=510.40

PI=13+98.00
EL=508.90

530
520
510
500
490

480 500 10+00 11+00 12+00 13+00 14+00

REACH 3

PI=14+08.00
EL=509.90

TIE TO EXISTING
STA. 14+41.00
EL. 509.10

PI=16+42.00
EL=504.60

PI=16+57.00
EL=504.30

48" RCP

INV. IN .504.50'

INV. IN .504.35'

PI=16+45.00
EL=503.10

DESIGN THALWEG

EXISTING GROUND

PI=17+40.00
EL=502.50

PI=17+44.00
EL=501.00

PI=17+55.00
EL=502.40

PI=18+35.00
EL=500.90

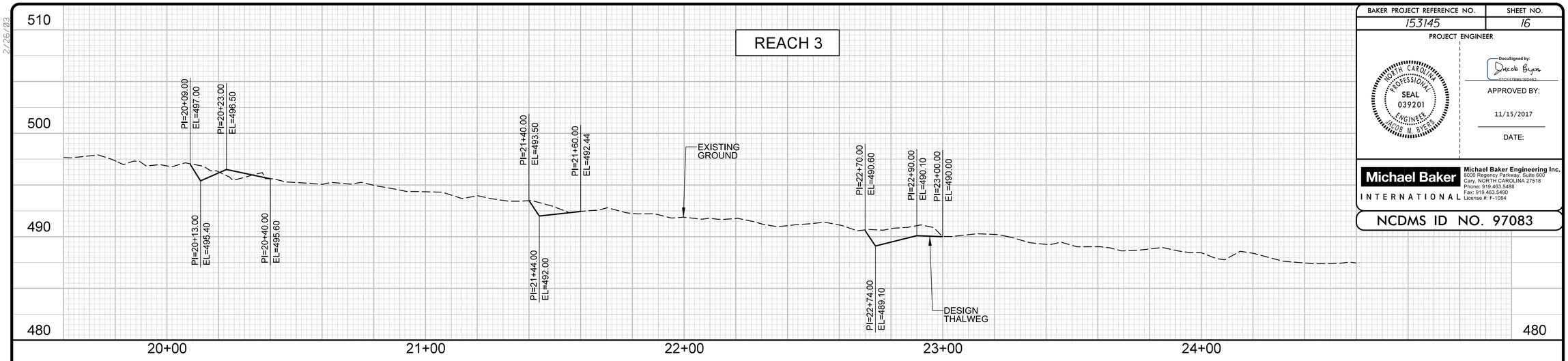
PI=18+39.00
EL=499.40

PI=18+50.00
EL=500.20

520
510
500
490

14+00 15+00 16+00 17+00 18+00 19+00

2/26/03



BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	16

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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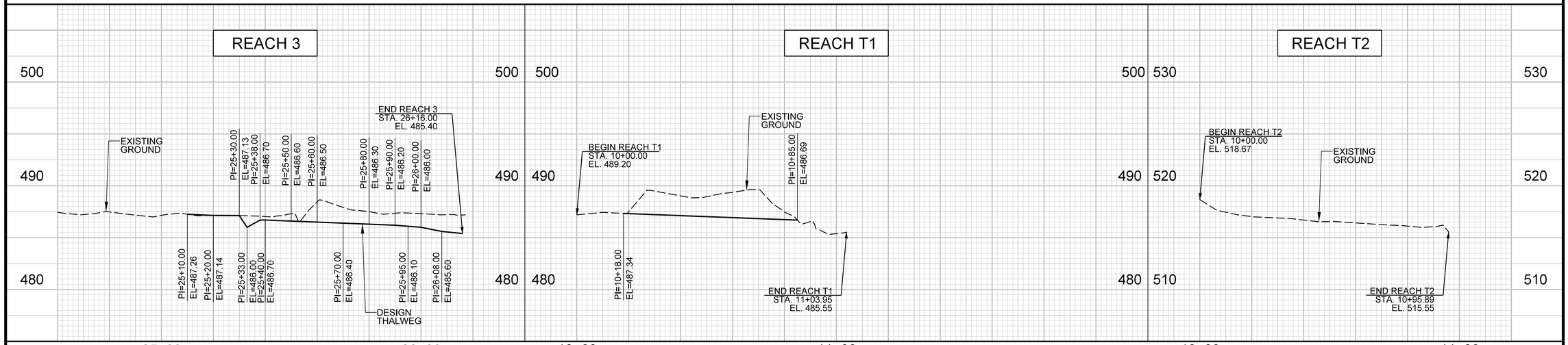

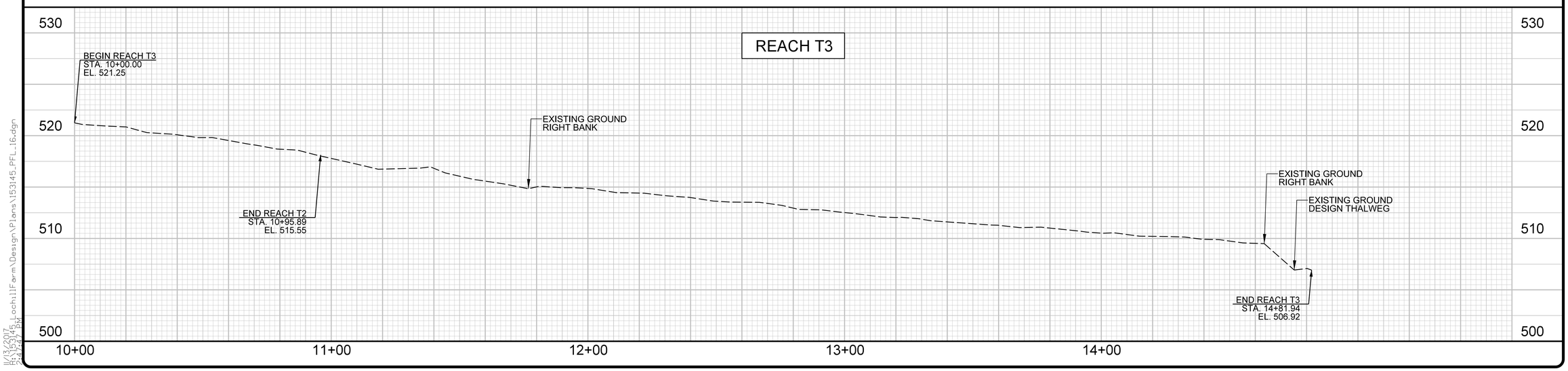

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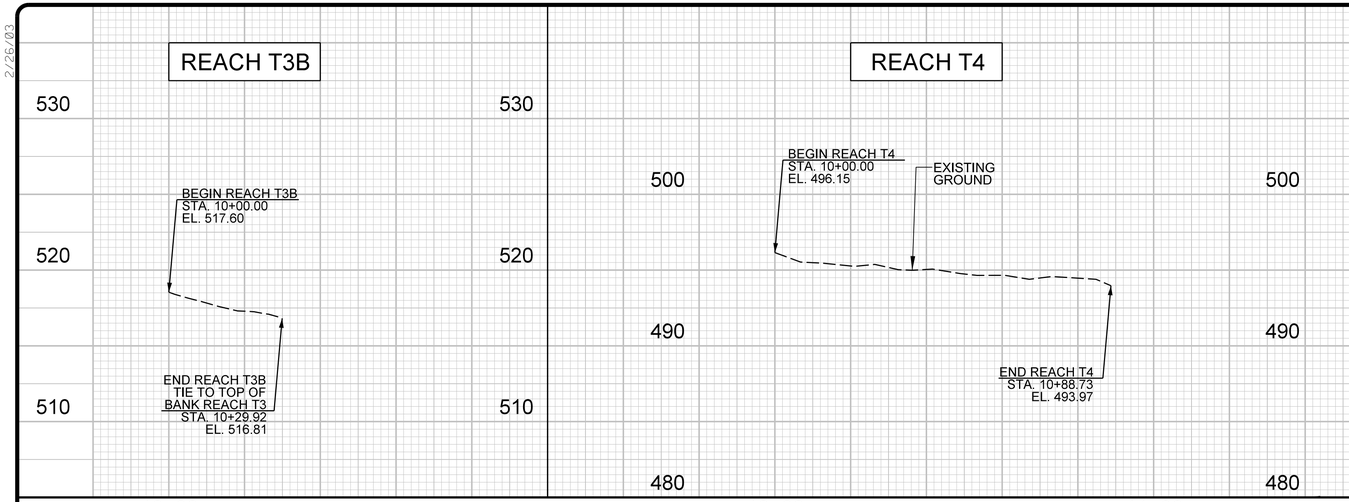

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	17

PROJECT ENGINEER

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BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	18

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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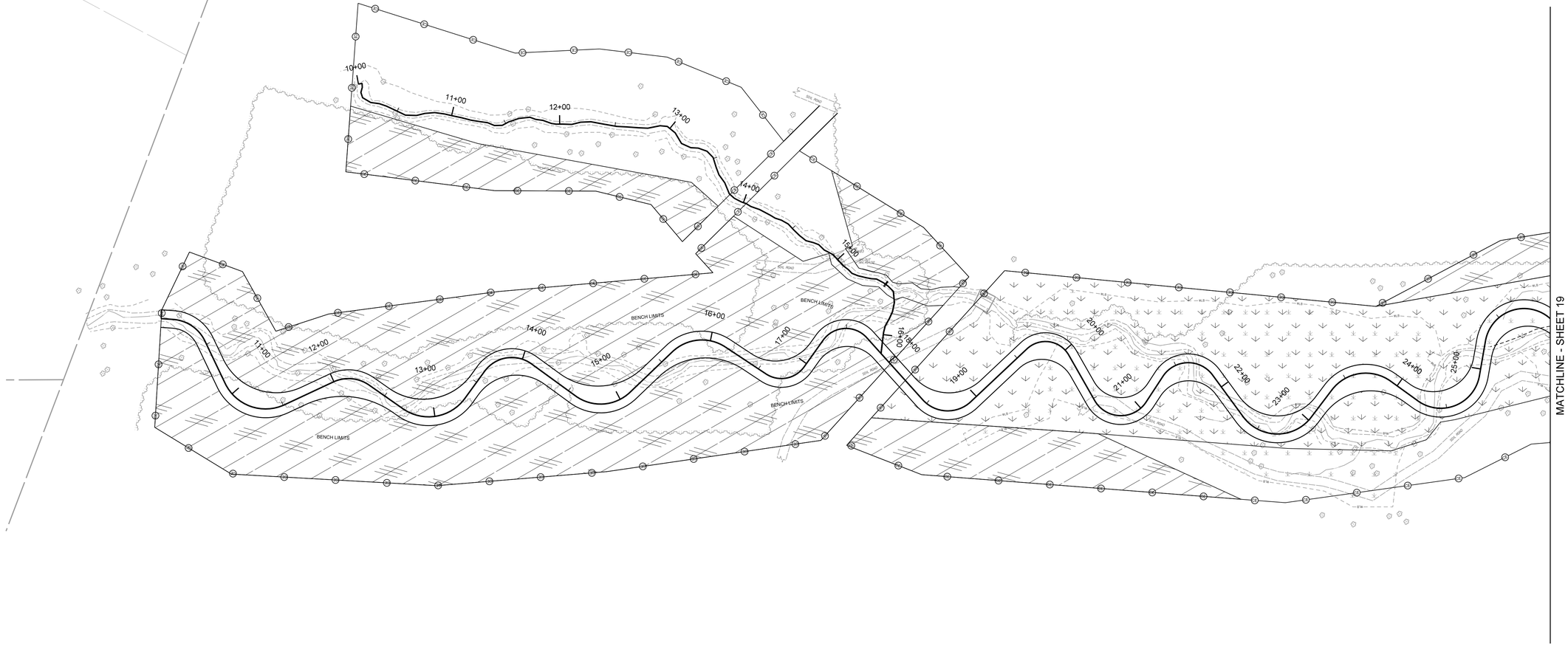
NCDMS ID NO. 97083

NAD 83



WETLAND
RIPARIAN
HERB/SHRUB ONLY

LOCHILL FARM
REVEGETATION PLAN

50 0 50 100
SCALE (FT)

11/3/2017
K:\153145_Lochill\Farm\Design\Plans\153145_PSH-VEG-18.dgn
jbyers

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	19

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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NCDMS ID NO. 97083

NAD 83

MATCHLINE - SHEET 20

MATCHLINE - SHEET 18

22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00 40+00 41+00 42+00

ABOVE GROUND GAS LINE MARKER

PLEASANT GREEN RD (SR 1567)

WETLAND
RIPARIAN
HERB/SHRUB ONLY

LOCHILL FARM
REVEGETATION PLAN

50 0 50 100
SCALE (FT)

11/3/2017
K:\153145_LochillFarm\Design\Plans\153145_PSH-VEG-19.dgn

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	20

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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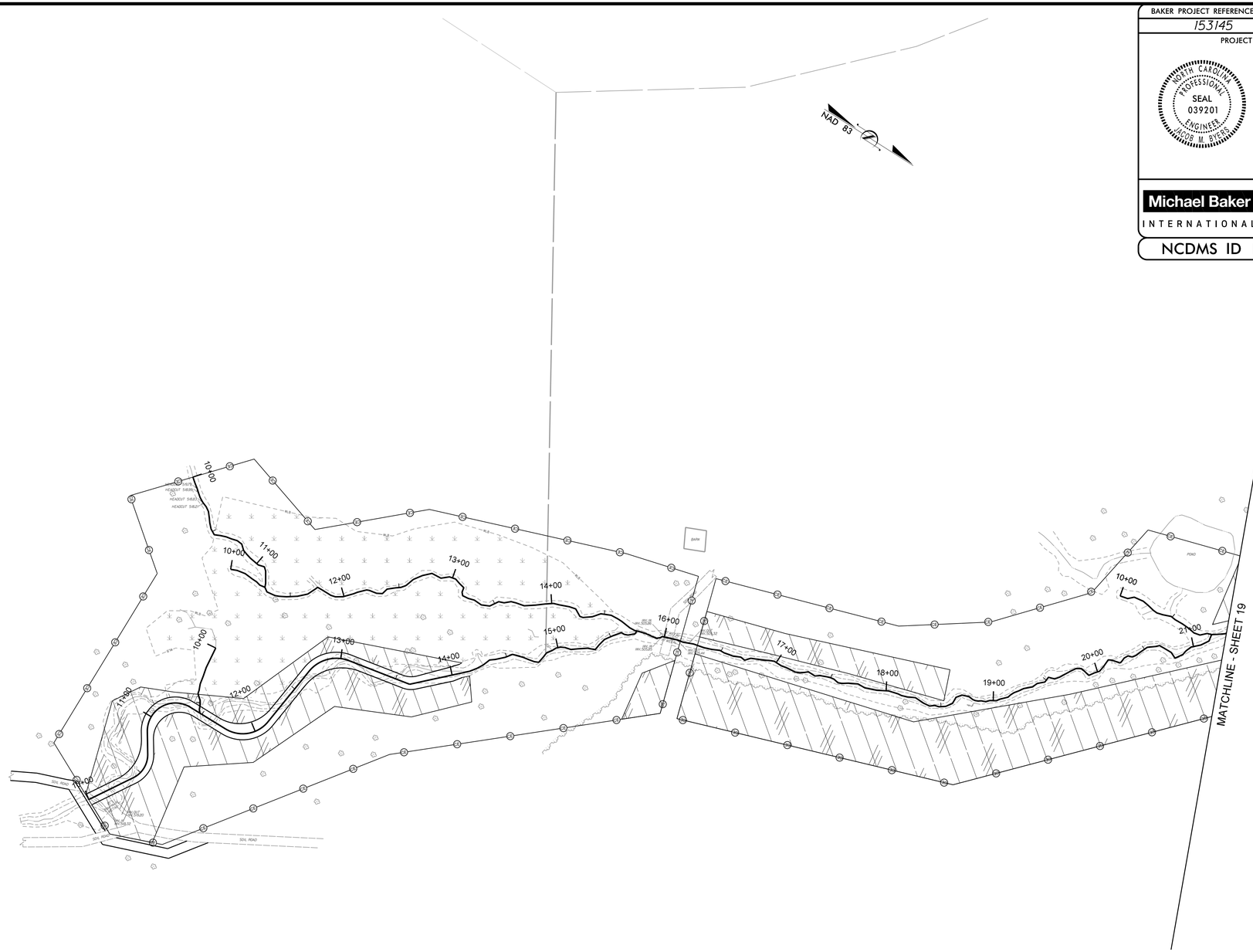


WETLAND
RIPARIAN
HERB/SHRUB ONLY

LOCHILL FARM REVEGETATION PLAN

50 0 50 100
SCALE (FT)

11/13/2017
153145_Lochill Farm\Design\Plans\153145_PSH-VEG-20.dgn
mbyers

LOCHILL FARM

PROJECT: 153145

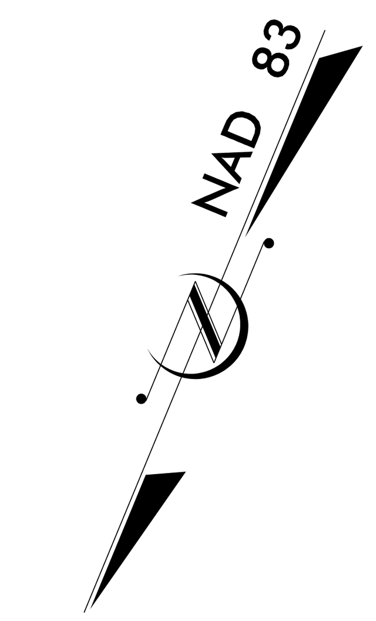
STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	153145	EC-1	6

NORTH CAROLINA
DIVISION OF MITIGATION SERVICES

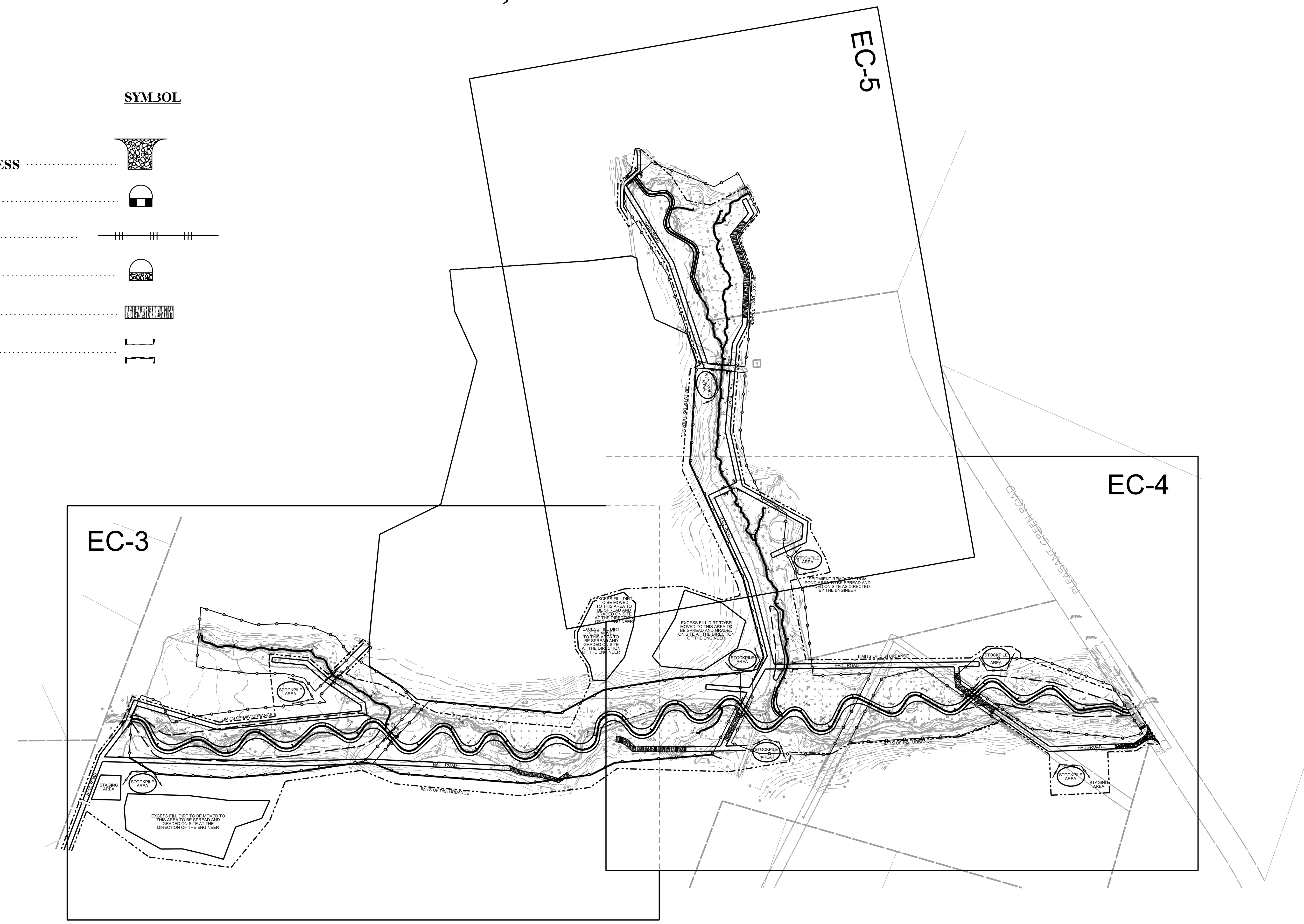
EROSION & SEDIMENTATION CONTROL PLAN

LOCATION: OFF ST. MARY'S ROAD NEAR ITS INTERSECTION WITH PLEASANT GREEN ROAD

TYPE OF WORK: RESTORATION, ENHANCEMENT, AND PRESERVATION OF STREAM, WETLAND, AND RIPARIAN BUFFERS ALONG FINCHES BRANCH



STD. NO.	DESCRIPTION	SYMBOL
6.06	TEMPORARY GRAVEL CONSTRUCTION ACCESS	
6.60	TEMPORARY SEDIMENT TRAP	
6.62	SILT FENCE	
6.63	TEMPORARY ROCK DAM	
	TEMPORARY WETLAND MAT	
	TEMPORARY STREAM CROSSING	



NCDMS ID NO. 97083

GRAPHIC SCALES

50 0 50 100
PLANS

THIS PROJECT CONTAINS EROSION CONTROL PLANS FOR ALL PHASES OF CONSTRUCTION.

TOTAL DISTURBED AREA = 23 Acres

APPROXIMATE PROJECT CENTER
LATITUDE 36.1134
LONGITUDE -78.9911

PROJECT STANDARDS

THE FOLLOWING STANDARDS AS THEY APPEAR IN THE "NC EROSION CONTROL PLANNING AND DESIGN MANUAL" AND ARE APPLICABLE TO THIS PROJECT AND BY REFERENCE HEREBY ARE CONSIDERED PART OF THE PLANS.

6.06	TEMPORARY GRAVEL CONSTRUCTION ACCESS
6.60	TEMPORARY SEDIMENT TRAP
6.62	SILT FENCE
6.63	TEMPORARY ROCK DAM

PREPARED IN THE OFFICE OF:
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License #: F-1084

FALL 2017
LETTING DATE:

JACOB M. BYERS, PE
PROJECT ENGINEER

SCOTT E. KING, LSS
PROJECT MANAGER

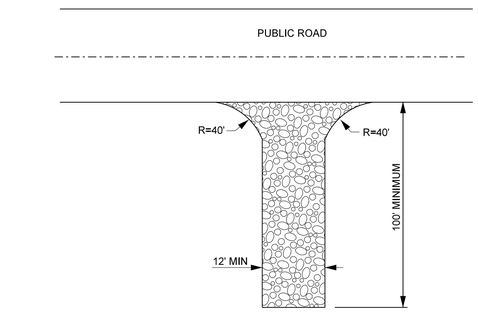
PROJECT ENGINEER

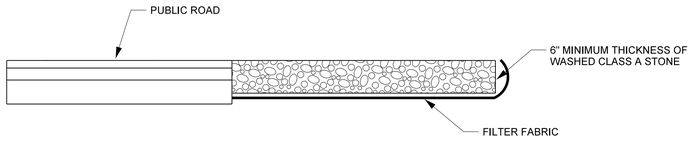
NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers
07CF47BBE19D462
11/15/2017
P.E.
SIGNATURE:

2/26/03

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE /EXIT

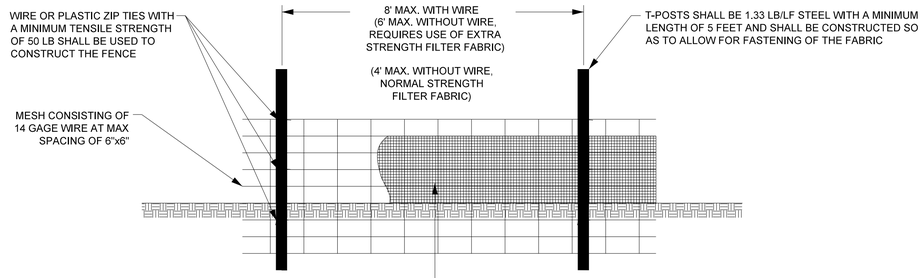


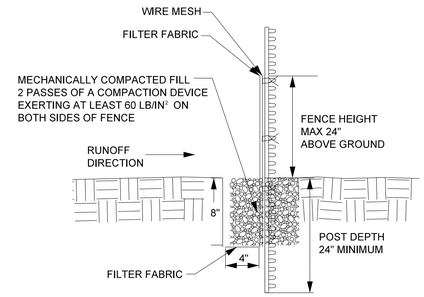


NOTES:

SPECIFICATION NO. 6.06 - CONSTRUCTION ACCESS "N.C. EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL MARCH 2009"

TEMPORARY SILT FENCE





NOTES:

1. AVOID JOINTS, UNAVOIDABLE JOINTS MUST HAVE 4' OF CLOTH OVERLAP AND SHOULD TIE INTO THE NEXT ADJACENT POST.
2. PLACE ON CONTOUR EXCEPT ENDS WHICH SHOULD BE 1' ABOVE GRADE TO PREVENT CUT AROUND.
3. WRAP APPROX. 6" OF FABRIC AROUND END POSTS AND SECURE WITH TIES.
4. REMOVE ONCE AREA IS STABLE.
5. CONTRACTOR SHALL SIDE CAST SPOIL MATERIAL FROM TRENCHING FOR SILT FENCE ONTO HIGH GROUND OR ONTO THE PERMITTED WETLAND IMPACT SIDE TO AVOID UNPERMITTED WETLAND IMPACTS.

PROJECT REFERENCE NO.	SHEET NO.
153145	EC-2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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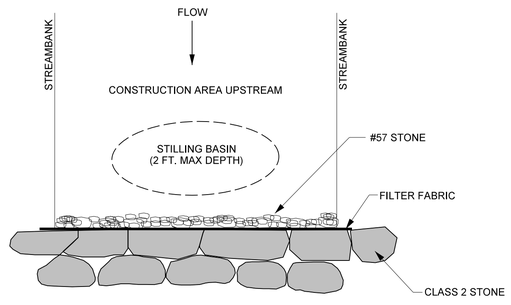
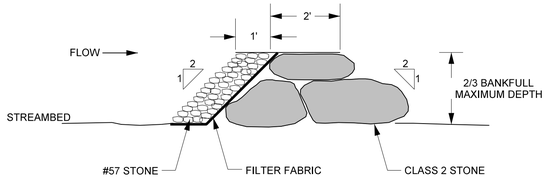
NCDMS ID No. 97083

TEMPORARY ROCK DAM



PLAN VIEW

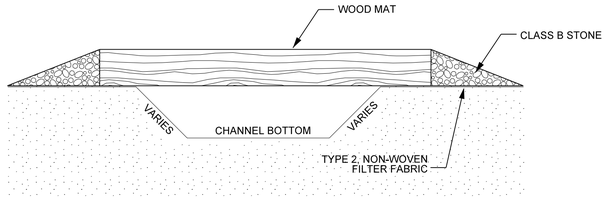


CROSS SECTION

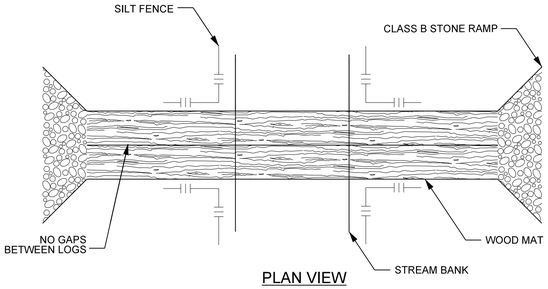
NOTES:

CLEAN OUT STILLING BASIN OF TRAPPED SEDIMENT PRIOR TO REMOVAL.

TEMPORARY STREAM / WETLAND CROSSING - WOOD MAT



CROSS SECTION



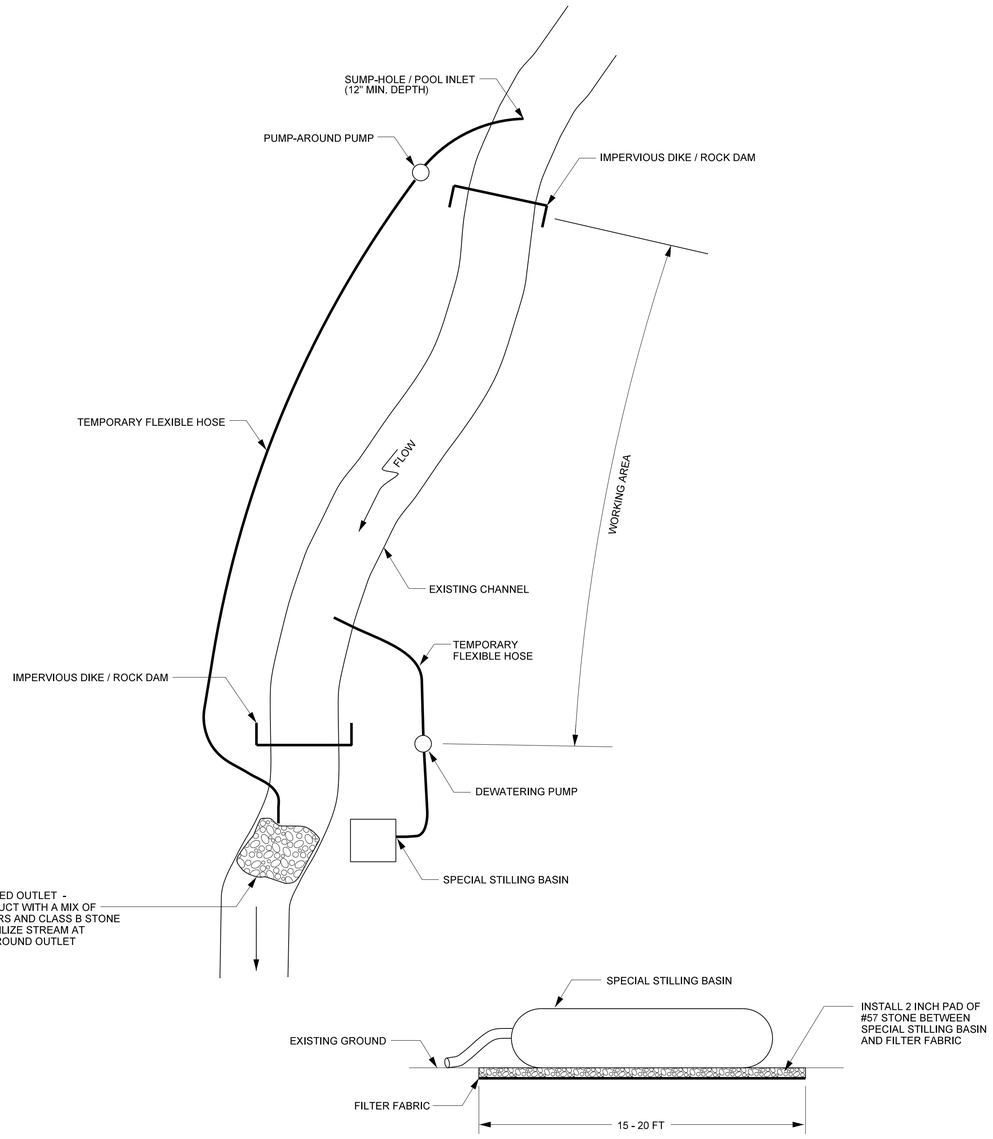
PLAN VIEW

NOTES:

1. CONSTRUCT STREAM CROSSING WHEN FLOW IS LOW.
2. HAVE ALL NECESSARY MATERIALS AND EQUIPMENT ON-SITE BEFORE WORK BEGINS.
3. MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
4. LINE STREAMBANK AND ACCESS RAMP AREA WITH NON-WOVEN FILTER FABRIC.
5. INSTALL STREAM CROSSING AT RIGHT ANGLE TO THE FLOW.
6. TRANSPLANT SOD FROM ORIGINAL STREAMBANK ONTO SIDE SLOPES FOR LATER USE.
7. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL BY INSTALLING SILT FENCE ON ALL FOUR CORNERS ADJACENT TO THE STREAM. SEE SILT FENCE DETAIL.
8. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
9. THE WOOD MAT SHALL BE OF SUFFICIENT SIZE AND WIDTH TO SUPPORT THE LARGEST VEHICLE CROSSING THE CHANNEL.
10. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED. RECOMMENDED AT A 5:1 SLOPE.

2/26/03

TYPICAL PUMP-AROUND OPERATION



SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP-AROUND

1. INSTALL STABILIZED OUTLET AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP-AROUND PUMP AND THE TEMPORARY FLEXIBLE HOSE THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE TO THE SPECIAL STILLING BASIN OR STABILIZED OUTLET.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL FLOW INTO A SPECIAL STILLING BASIN.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. THE CONTRACTOR WILL COMPLETE ALL GRADING AND STABILIZATION IN ONE DAY WITHIN THE PUMP-AROUND AREA BETWEEN THE IMPERVIOUS DIKES.
8. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE SPECIAL STILLING BASIN AND STABILIZED OUTLET AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.

NOTES:

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. THE PUMP-AROUND PUMP SHOULD ADEQUATELY CONVEY BASEFLOW CONDITIONS OF THE STREAM.

PROJECT REFERENCE NO.	SHEET NO.
153145	EC-2A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47BBE15D462...

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NCDMS ID No. 97083

STABILIZATION TIMEFRAMES		
SITE AREA DESCRIPTION	STABILIZATION	TIME FRAME EXCEPTIONS
PERIMITER DIKES, SWALE, DITCHES AND SLOPES	7 DAYS	NONE
HIGH QUALITY WATER (HQW) ZONES	7 DAYS	NONE
SLOPES STEEPER THAN 3:1	14 DAYS	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
SLOPES 3:1 OR FLATTER	14 DAYS	7 days for slopes greater than 50' in length
ALL OTHER AREAS WITH SLOPES FLATTER THAN 4:1	14 DAYS	None, except for perimeters and HQW Zones
* ALL CHANNEL WORK MUST BE STABILIZED DAILY		

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	EC-3

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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NCDMS ID NO. 97083

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

INSTALL PERMANENT STREAM CROSSING (TYP.)

INSTALL PERMANENT STREAM CROSSING (TYP.)

INSTALL PERMANENT STREAM CROSSING (TYP.)

EXCESS FILL DIRT TO BE MOVED TO THIS AREA TO BE SPREAD AND GRADED ON SITE AT THE DIRECTION OF THE ENGINEER

STOCKPILE AREA

LIMITS OF DISTURBANCE

HAUL ROAD

STAGING AREA

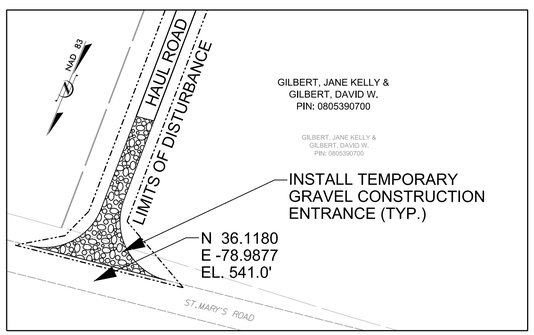
STOCKPILE AREA

EXCESS FILL DIRT TO BE MOVED TO THIS AREA TO BE SPREAD AND GRADED ON SITE AT THE DIRECTION OF THE ENGINEER

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE LOCATED AT ST. MARY'S ROAD. APPROXIMATELY 1,100 FT. NORTH OF REACH 1 CONSERVATION EASEMENT. SEE DETAIL THIS SHEET.

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

USE EXISTING SOIL ROAD AS HAUL ROAD
INSTALL WETLAND MATS AS NEEDED



EROSION & SEDIMENTATION CONTROL NOTES:

1. THE CONTRACTOR SHALL INSTALL THE EROSION AND SEDIMENTATION CONTROL MEASURES AS SHOWN ON THE PLANS PRIOR TO ANY GRADING ACTIVITIES. SEE SHEET 3 FOR GENERAL CONSTRUCTION SEQUENCE.
2. ALL DISTURBED AREAS SHALL BE SEEDED AND MULCHED PER THE PLANS AND TECHNICAL SPECIFICATIONS. TEMPORARY AND PERMANENT SEEDING SHALL BE PLACED ON ALL DISTURBED AREAS BY THE END OF EACH WORK DAY. SLOPES FLATTER THAN 3H:1V SHALL BE STABILIZED WITH GROUND COVER WITHIN FOURTEEN (14) CALENDAR DAYS FROM THE LAST LAND-DISTURBING ACTIVITY. ALL SLOPES STEEPER THAN 3H:1V SHALL BE STABILIZED AS SOON AS PRACTICABLE WITHIN SEVEN (7) CALENDAR DAYS. SEE SHEET 1-A FOR VEGETATION SELECTION.
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7. THE CONTRACTOR SHALL WORK IN THE DRY AND UTILIZE A PUMP-AROUND OPERATION OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLAN SHEETS.
8. THE ENGINEER MUST APPROVE ALL GRADING ACTIVITIES AND GROUNDCOVER STABILIZATION PRIOR TO RIPARIAN VEGETATION PLANTING.
9. ROCK DAMS SHALL BE INSTALLED BELOW ACTIVE WORK AS NEEDED.

MATCHLINE - SHEET EC-4

LOCHILL FARM
EROSION & SEDIMENTATION CONTROL PLAN

50 0 50 100
SCALE (FT)

11/3/2017
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mcoffey

2/26/03

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NAD 83

MATCHLINE - SHEET EC-5

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

STOCKPILE AREA

SEIDMENT REMOVED FROM POND AREA TO BE SPREAD AND GRADED ON SITE AS DIRECTED BY THE ENGINEER

BRUNO, RALPH T. &
BRUNO, TONYA W.
PIN: 0805291320

EXCESS FILL DIRT TO BE MOVED TO THIS AREA TO BE SPREAD AND GRADED ON SITE AT THE DIRECTION OF THE ENGINEER

INSTALL TEMPORARY STREAM CROSSING (TYP.)

STOCKPILE AREA

LIMITS OF DISTURBANCE

HAUL ROAD

22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00 38+00 39+00 40+00 41+00 42+00 10+00

MATCHLINE - SHEET EC-3

INSTALL TEMPORARY STREAM CROSSING (TYP.)

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

GILBERT, JANE KELLY &
GILBERT, DAVID W.
PIN: 0805390700

INSTALL WETLAND MATS (TYP.)

STOCKPILE AREA

LIMITS OF DISTURBANCE

HAUL ROAD

USE EXISTING PATH AS HAUL ROAD WITHIN THE POWER LINE EASEMENT. INSTALL WETLAND MATS AND TEMPORARY STREAM CROSSING AS NEEDED

ABOVE GROUND GAS LINE MARKER

PLEASANT GREEN RD (SR 1567)

INSTALL ROCK CHECK DAM (TYP.)

STOCKPILE AREA

STAGING AREA

N 36.1120
E -78.9957
EL. 490.0'

INSTALL TEMPORARY GRAVEL CONSTRUCTION ENTRANCE (TYP.)

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	EC-4

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47BBE1604B2...

APPROVED BY:

11/15/2017

DATE:

Michael Baker INTERNATIONAL
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Cary, NORTH CAROLINA 27518
Phone: 919.463.5488
Fax: 919.463.5490
License #: F-1084

NCDMS ID NO. 97083

LOCHILL FARM EROSION & SEDIMENTATION CONTROL PLAN

50 0 50 100
SCALE (FT)

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2/26/03

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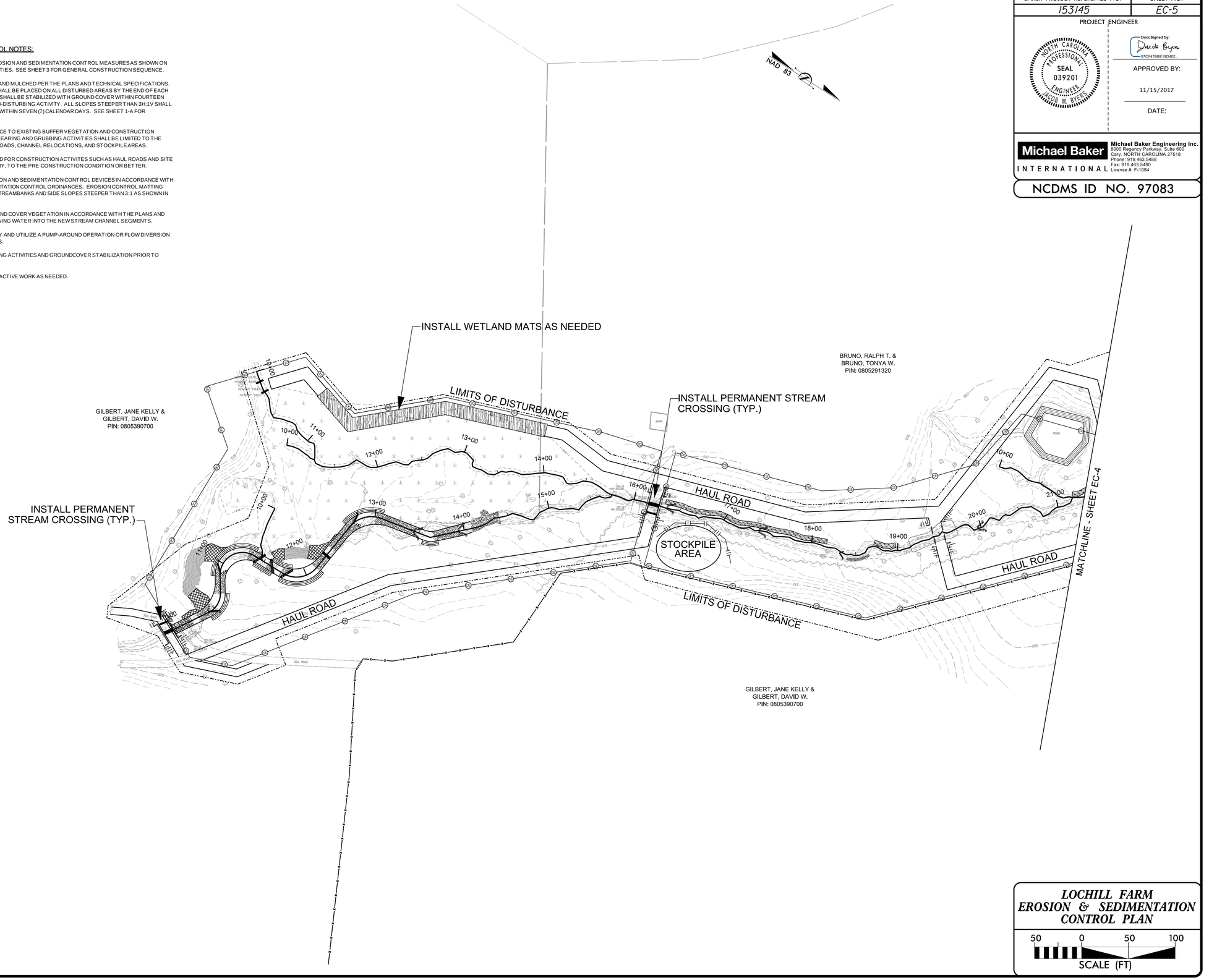

BAKER PROJECT REFERENCE NO.	SHEET NO.
153145	EC-5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

DocuSigned by: Jacob Byers 07CF47B8E190462...

APPROVED BY:

11/15/2017

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LOCHILL FARM
EROSION & SEDIMENTATION CONTROL PLAN

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