FINAL
Stream Mitigation Plan
Town Creek Restoration Project – Option B

Stanly County, North Carolina

NCEEP Project ID No. 95026, Contract No. 003990

Yadkin Pee-Dee River Basin: 03040105060-040

Prepared for:

NC Department of Environment and Natural Resources
Ecosystem Enhancement Program (NCEEP)
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

February 2015

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Prepared by:

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February 2015

EXECUTIVE SUMMARY

Michael Baker Engineering, Inc., (Baker) proposes to restore 2,755 linear feet (LF) and enhance approximately 940 LF of jurisdictional stream along an unnamed tributary (UT) that flows into Town Creek. The Town Creek Restoration Project site (project) is located in Stanly County, North Carolina (NC) (Figure 2.1), approximately 1.5 miles northeast of the Town of New London. The project lies in the Yadkin Pee-Dee River Basin within North Carolina Division of Water Resources (NCDWR) sub-basin 03-07-13 and the EEP Targeted Local Watershed unit 03040105060-040. The purpose of the project is to restore and/or enhance the disturbed stream, wetland and riparian buffer functions along the project corridor. A recorded conservation easement consisting of 12.0 acres (Figure 3.1) will protect all stream reaches and riparian buffers in perpetuity. In addition, Baker delineated approximately 0.44 acres of riparian wetlands that have been previously disturbed. The proposed stream mitigation activities will likely improve these wetland functions within the riparian corridor and maximize the ecological benefits of the site; however, wetland mitigation credit is not proposed as a part of this project.

Based on both the River Basin Restoration Priorities (RBRP) document for the Lower Yadkin Pee-Dee River Basin (NCEEP, 2009) and the Yadkin Pee-Dee River Basinwide Water Quality Plan (NCDENR, 2008), many streams in the Rocky River Watershed (HUC 03040105) are impaired or impacted by habitat degradation. Stressors identified in the plan include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. As stated in the Basinwide Plan, the watershed naturally consists of erodible soils; therefore, increasing the system's vulnerability to the aforementioned stressors. Activities within the Project area have further promoted erosion and habitat degradation, through the clearing of the upland areas and the riparian zone for pasture grazing, straightening of stream channels and filling in the floodplain to maximize pasture acreage. Additionally, cattle have had access to all reaches within the Project area for multiple years, and their activities have exacerbated the existing erosion and instability issues.

The project's stream components are listed and described in detail in Table ES-1. The primary goals of the project are as follows:

- Improve aquatic and terrestrial habitat through the increase of dissolved oxygen concentrations, reduction of nutrient and sediment loads, improvement of substrate and in-stream cover, reduction of stream bank erosion, and reduction of in-stream water temperature,
- Create geomorphically stable conditions along the channels,
- Enhance hydrologic connections between streams and the degraded riparian buffer and overall ecosystem functionality;
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.
- Improve terrestrial habitat and reduce sediment and nutrient loading to the project reaches and the Little Long Creek Watershed.

To accomplish these goals, the project will pursue the following objectives:

- Restore existing incised, eroding, and channelized streams by creating a stable stream channel with access to its floodplain,
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and areas of water re-aeration, and reducing bank erosion,
- Prevent cattle from accessing the project boundary by installing permanent fencing and thus reduce excessive bank erosion and undesired nutrient inputs,

- Plant native species riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, and shade the stream to decrease water temperature,
- Control invasive species vegetation within the project area and, if necessary, continue treatments during the monitoring period.

The proposed project aligns with overall NCEEP goals, which focus on restoring streams and riparian area values such as maintaining and enhancing water quality, increasing storage of floodwaters, and improving fish and wildlife habitat, as well as specific NCEEP RBRP goals including, but not limited to, nutrient and other non-point source pollutant management. The proposed natural channel design (NCD) approach will result in a stable riparian stream system that will reduce excess sediment and nutrient inputs to the Little Long Creek sub-watershed, while improving water quality conditions that support terrestrial and aquatic species, including priority species identified in the Yadkin Pee-Dee River Basin.

Table ES.1 Town Creek Restoration Project Overview (Streams)
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Reach	Design Approach	Existing Reach Length (LF)	Design Reach Length (LF)	SMU Credit Ratio	Potential SMUs	Stationing	Comment
R1	R-PI	363	316	1:1	316	10+34 to 13+50	Restoration will follow Rosgen Priority Level II transitioning to a Level I approach in order to provide an adequate floodplain and restore appropriate dimension, pattern, and profile. Existing channel pattern will be altered.
R2	EI	737	708	1.5:1	472	13+50 to 20+58	Stream Enhancement I is proposed for Reach 2. Work will include bank sloping, installation of in-stream structures, vegetation planting in the riparian zone, and permanent fencing. 20 LF of stream have been reserved for a crossing between Reach 2 and Reach 3.
R3	R-PI	1,849	1,630	1:1	1,630	20+78 to 37+08	Restoration will follow Rosgen Priority Level I approach in order to provide an adequate floodplain and restore appropriate dimension, pattern, and profile. An existing crossing will be removed.
R4	EI	234	232	1.5:1	155	37+08 to 39+40	Stream Enhancement I is proposed for Reach 4. Work will include bank sloping, installation of in-stream structures, vegetation planting in the riparian zone, and permanent fencing.
R5	R-PI	849	809	1:1	809	39+40 to 47+74	Restoration will follow Rosgen Priority Level I approach in order to provide an adequate floodplain and restore appropriate dimension, and profile. Work will include installation of in-stream structures, vegetation planting in the riparian zone,

							and permanent fencing. An existing stream crossing will be moved to a new location where 25 LF of stream has been reserved for the crossing.
Total		**4,032**	**3,695**		**3,382**		

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).
- NCDENR Ecosystem Enhancement Program In-Lieu Fee Instrument signed and dated July 28, 2010.

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

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1.0 RESTORATION PROJECT GOALS AND OBJECTIVES

The North Carolina Ecosystem Enhancement Program (NCEEP) develops River Basin Restoration Priorities (RBRPs) to guide its mitigation activities within each of the state's 17 major river basins. RBRPs designate specific watersheds that exhibit both the need and opportunity for wetland, stream and riparian buffer restoration. These watersheds, designated as Targeted Local Watersheds (TLWs), receive priority for NCEEP planning and restoration project funds. The 2009 Lower Yadkin Pee-Dee RBRP identified cataloguing unit (HUC) 03040105060-040 as a TLW.
http://www.nceep.net/services/restplans/Yadkin_Pee_Dee_RBRP_2009_Final.pdf

Based on both the RBRP document for the Lower Yadkin Pee-Dee River Basin (NCEEP, 2009) and the Yadkin Pee-Dee River Basinwide Water Quality Plan (NCDENR, 2008), many streams in the Rocky River Watershed (HUC 03040105) are impaired or impacted by habitat degradation. Stressors identified in the plan include impervious surfaces, sedimentation and erosion from construction, general agriculture, and other land disturbing activities. As stated in the Basinwide Plan, the watershed naturally consists of erodible soils; therefore, increasing the system's vulnerability to the aforementioned stressors.

The Little Long Creek sub-watershed is located in HUC 03040105060-040. The sub-watershed covers 29 square miles. Approximately 43 percent of stream reaches within the sub-watershed lack adequate riparian buffers. Land use within the project area has further promoted erosion and habitat degradation, through the clearing of upland areas and the riparian zone for pasture grazing, straightening of stream channels and filling in the floodplain to maximize pasture acreage. Additionally, cattle have had access to all reaches within the project area for multiple years, and their activities have exacerbated the existing erosion and instability issues.

The restoration strategy for the Yadkin Pee-Dee River Basin targets specific projects that will address water quality impacts from sedimentation and erosion from land disturbing activities and general agriculture. Neither the Project reaches nor Town Creek is specifically monitored for water quality impairments as a part of the Yadkin Pee-Dee Basinwide Plan (NCDENR, 2008). However, Town Creek and its tributaries discharge to Little Long Creek (NCDWR Index No. 13-17-31-1), which is listed on the North Carolina 2010 303(d) List as an impaired water for ecological/biological integrity and on the draft 2012 303(d) list as impaired for aquatic life due to copper concentrations (NCDENR, 2010, 2012). The proposed project aligns with NCEEP and NCDWR's Basinwide planning goals by focusing on restoring riparian areas and improving ecological functions by maintaining and enhancing water quality, increasing storage of floodwaters, and improving aquatic and terrestrial wildlife habitat.

The Town Creek Restoration Project was identified as an opportunity to improve water quality and ecological functions within the TLW. The proposed natural channel design approach will result in a stable riparian headwater stream and wetland system that will reduce sediment and nutrient loading to the Little Long Creek sub-watershed, while improving water quality conditions that support terrestrial and aquatic species. The primary restoration goals of the project are described below:

- Improve aquatic and terrestrial habitat through the increase of dissolved oxygen concentrations, reduction of nutrient and sediment loads, improvement of substrate and in-stream cover, reduction of stream bank erosion, and reduction of in-stream water temperature,
- Create geomorphically stable conditions along the channel,
- Enhance hydrologic connections between streams and the degraded riparian buffer and overall ecosystem functionality;

- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.
- Improve terrestrial habitat and reduce sediment and nutrient loading to the Project reaches and the Little Long Creek Watershed.

To accomplish these goals, the Project will pursue the following objectives:

- Restore existing incised, eroding, and channelized streams by creating a stable stream channel with access to its floodplain,
- Improve in-stream habitat by providing a more diverse bedform with riffles and pools, creating deeper pools and areas of water re-aeration, and reducing bank erosion,
- Establish native stream bank, riparian floodplain, and wetland vegetation protected by a permanent conservation easement to increase stormwater runoff filtering capacity, improve bank stability, shade the stream to decrease water temperature, and provide improved wildlife habitat quality.
- Prevent cattle from accessing the project boundary by installing permanent fencing and thus reduce excessive bank erosion,
- Plant native riparian buffer vegetation along stream bank and floodplain areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, improve bank stability, and shade the stream to decrease water temperature,
- Control invasive species vegetation within the project area and if necessary continue treatments during the monitoring period.

2.0 SITE SELECTION

2.1 Project Description and Directions to Project Site

The Project is located in Stanly County in the Piedmont Region of North Carolina, approximately 1.5 miles southwest of the Town of New London, as shown in Figure 2.1. To reach the site from Charlotte, take Independence Blvd (US-74) east to Albemarle Road. (NC-27 E). Travel 36 miles on Albemarle Road. (NC-27), and turn left on US-52 N. After 6.7 miles, turn left on Austin Road and continue onto Henderson Road. After 1.5 miles, turn right at Old Salisbury Road. Continue on Old Salisbury Road, for approximately 1.0 miles and turn right onto Steakhouse Road. Continue on Steakhouse Road 1.7 miles and turn right onto Blalock Road. Continue on Blalock Road for approximately 1.5 miles and the Project site is on the right accessed via a dirt farm road.

To reach the site from Raleigh, take I-40 West toward Sanford/Wake Forest. Take Exit 293 (I-440/US-64 W/US-1) toward Sanford/Wake Forest. Keep left at the fork toward US-1 S/US-64 W. Take Exit 293A for US-1 S/US-64 W toward Sanford/Asheboro. Keep left at the fork toward US-1 S/US-64 W. Continue on US-1 S/US-64 W towards Apex/Sanford/Asheboro. Take exit 98B to merge onto US-64 W towards Pittsboro/Asheboro. After 62 miles, turn left onto Connector Road. Turn right onto NC 49 S. After 25.4 miles, take a slight left onto NC-8 S. After 3.9 miles, turn right on W. Gold Street and continue Steakhouse Road. Approximately 0.5 miles after the US-52 overpass, turn left onto Blalock Road. After 1.3 miles turn left onto Old Salisbury Rd. Continue on Blalock Road for approximately 1.5 miles and the Project site is on the right accessed via a dirt farm road.

2.2 Site Selection

The site lies within cataloging unit 03040105 and NCDWR sub-basin 03-07-13 of the Yadkin River Basin. The site includes an unnamed tributary (UT) to Town Creek and areas of previously disturbed wetlands. The project reaches make up a tributary to Town Creek, which drains into Little Long Creek located in northeastern Stanly County. Soils and topographic information (Figures 2.2 and 2.3) indicate that the area likely supported a riparian stream system with wetland areas located in the adjacent floodplain. Like many riparian stream systems in the Piedmont physiographic region, the site was likely drained for agricultural production. Channel incision has occurred along the UT and the stream is largely disconnected from its historic floodplain. The valley signature for the UT is clearly visible from LiDAR imagery of the site (Figure 2.6) and verified during field investigations.

Project Reaches are shown as dashed blue-line streams on the USGS topographic quadrangle map (Figure 2.2) along their entire length within the project limits. Based on field evaluations of intermittent/ perennial status and use of NCDWR stream assessment protocols, Baker delineated 4,098 LF of the UT throughout the project area, with the use of a Trimble GeoXT GPS, as a jurisdictional stream channel. Table 1 below presents the results of the field evaluations along with the assessed status of each project reach. Copies of the NCDWR classification forms and USACE correspondence can be found in Appendix B.

Table 1. Summary Information for Field Investigations to Determine Intermittent/Perennial Status
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Project Reach Designation	Existing Project Reach Length (ft)	NCDWR Stream Classification Form Score	Watershed Drainage Area (acres) [1]	Stream Status Based on Field Analyses
Reach 3, 4, 5	3,016[2]	32.0	130.2	Perennial
Reach 2	719[2]	27.25 – 32.0	79.6	Intermittent/Perennial
Reach 1	363[2]	27.25	56.4	Intermittent

Note 1: Watershed drainage area was approximated based on USGS topographic (NC Streamstats) and LiDAR information at the downstream end of each reach.
Note 2: Delineated stream length may vary from existing conditions stream length because the jurisidictional delineation was conducted using a Trimble GeoXT GPS unit with sub-meter capabilities while the existing conditions alignment was collected using survey grade equipment.

2.2.1 Historical Land Use and Development Trends

The land cover within the project area consists primarily of pasture and the sub-watershed is characterized by forested land (40%), agricultural land (25%), and approximately 7% impervious surface cover (NCEEP 2009).

The watershed contains portions of the Town of New London and the City of Albemarle; projected population increase is estimated to be almost 1,000 residents by 2015 (NCEEP, 2009). Stanly County is within commuting distance to the Charlotte metropolitan area and may be targeted for development in the future.

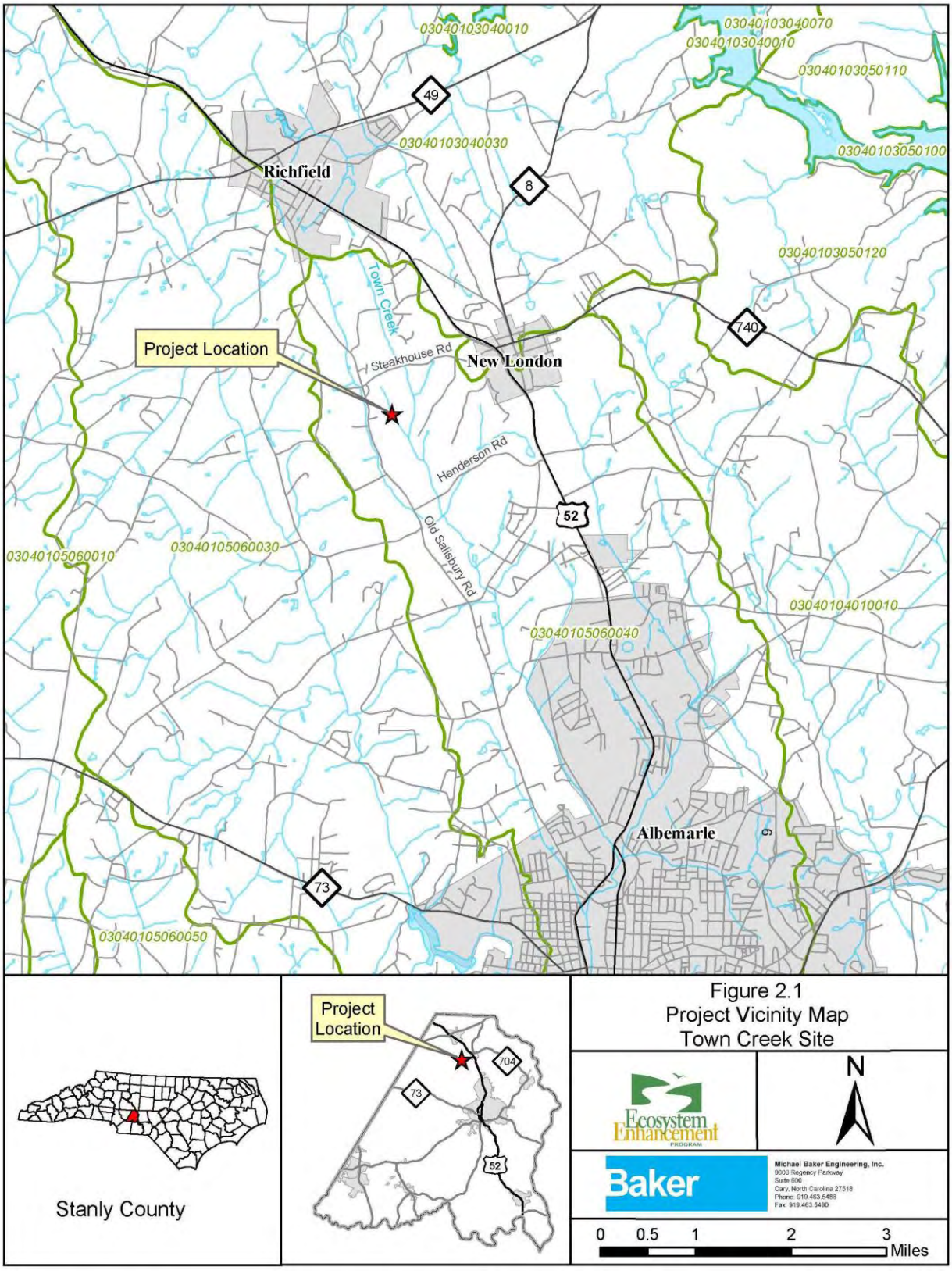
However, the 2002 Stanly County Land Use Plan, Long-Range Plan Recommendations indicate that the project area is within an agricultural conservation area. The chief purpose of the conservation area is to protect farmland from rural sprawl today and from urban sprawl in the future (Stanly County Department of Planning and Zoning, 2002). Therefore, it is anticipated that the project area will remain rural in the foreseeable future.

2.2.2 Existing Conditions and Successional Trends

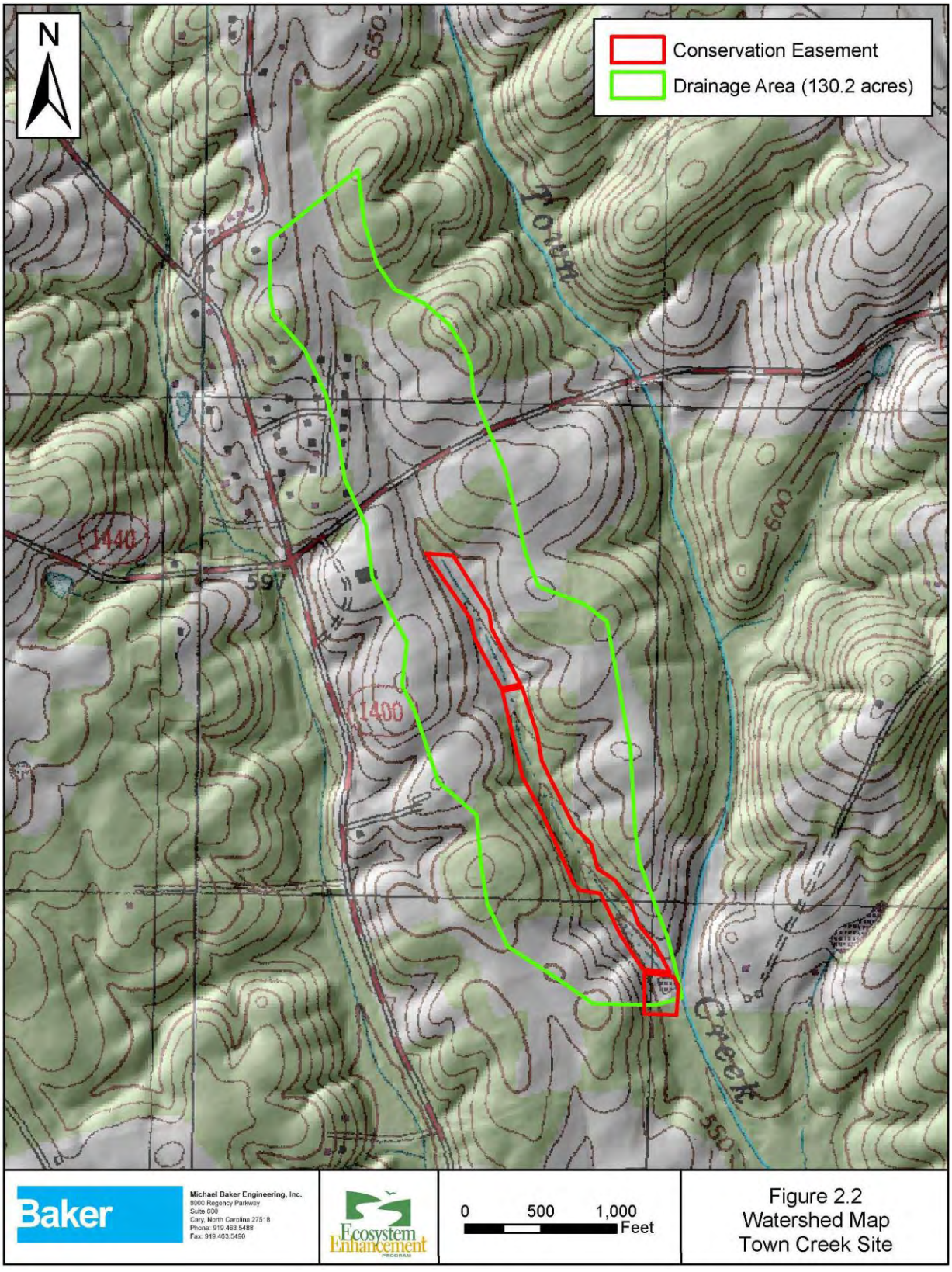
To convert the land for agricultural use, landowners historically cleared portions of the mature forest and manipulated site streams to increase land for grazing and agriculture. A historical aerial photograph from 1955 (Figure 2.5) shows both areas that have been cleared and the remaining mature riparian buffer, particularly along Reach 3, similar to what is present now (Figure 2.4). Over time, the stream channel became incised and floodplain connectivity was further reduced as result of these activities.

Baker staff conducted field assessments that included an existing conditions survey and photographic documentation to evaluate and document the impacts of past land use management practices and current site conditions for each project stream reach. Section 17.1 briefly summarizes these findings and shows the cross-sections used to describe the geomorphic (Rosgen) stream classification for the project stream reaches. Sections 7 and 17 further describe the restoration approaches proposed to achieve functional uplift and improve overall watershed health.

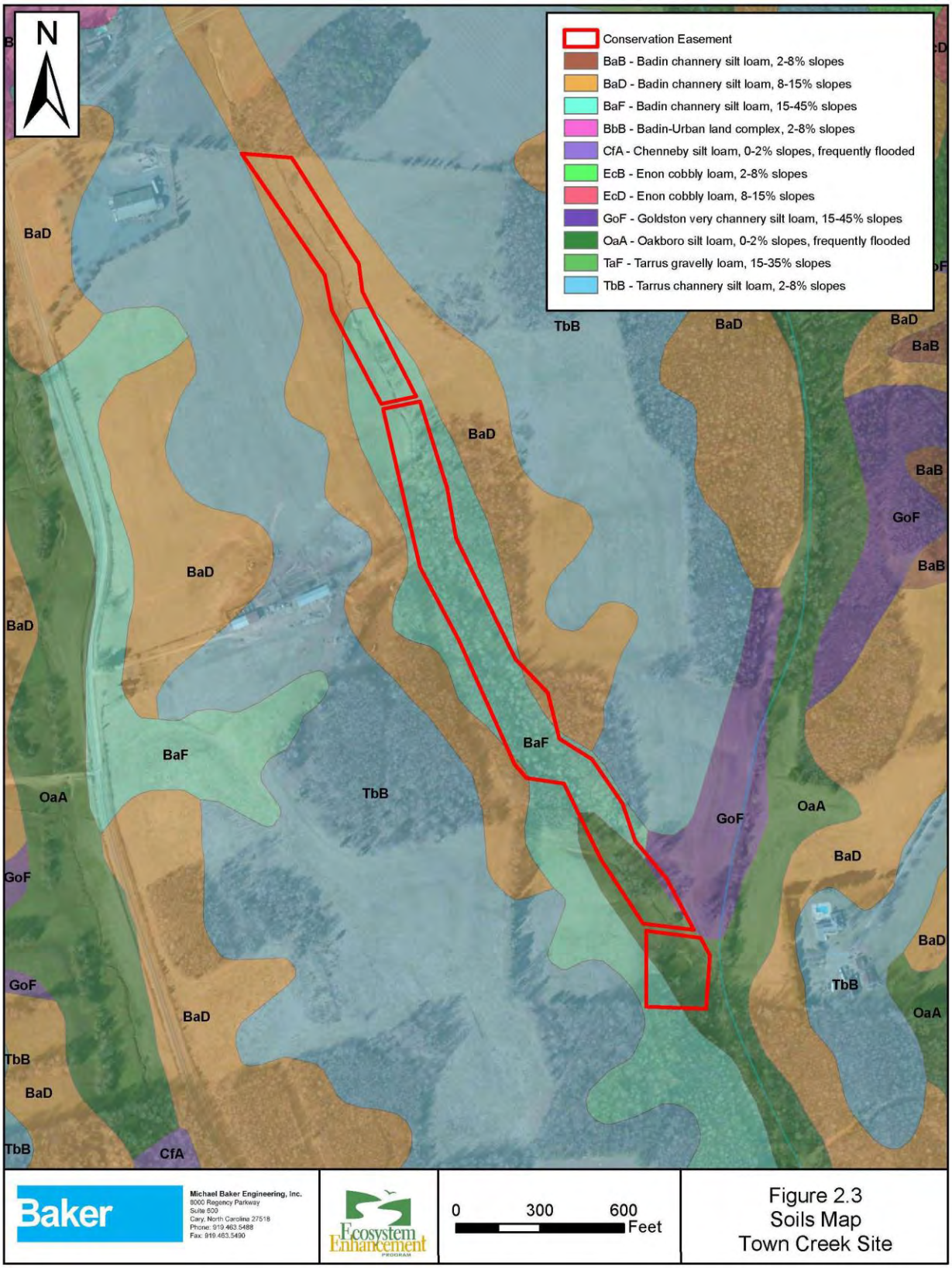
2.3 Vicinity Map



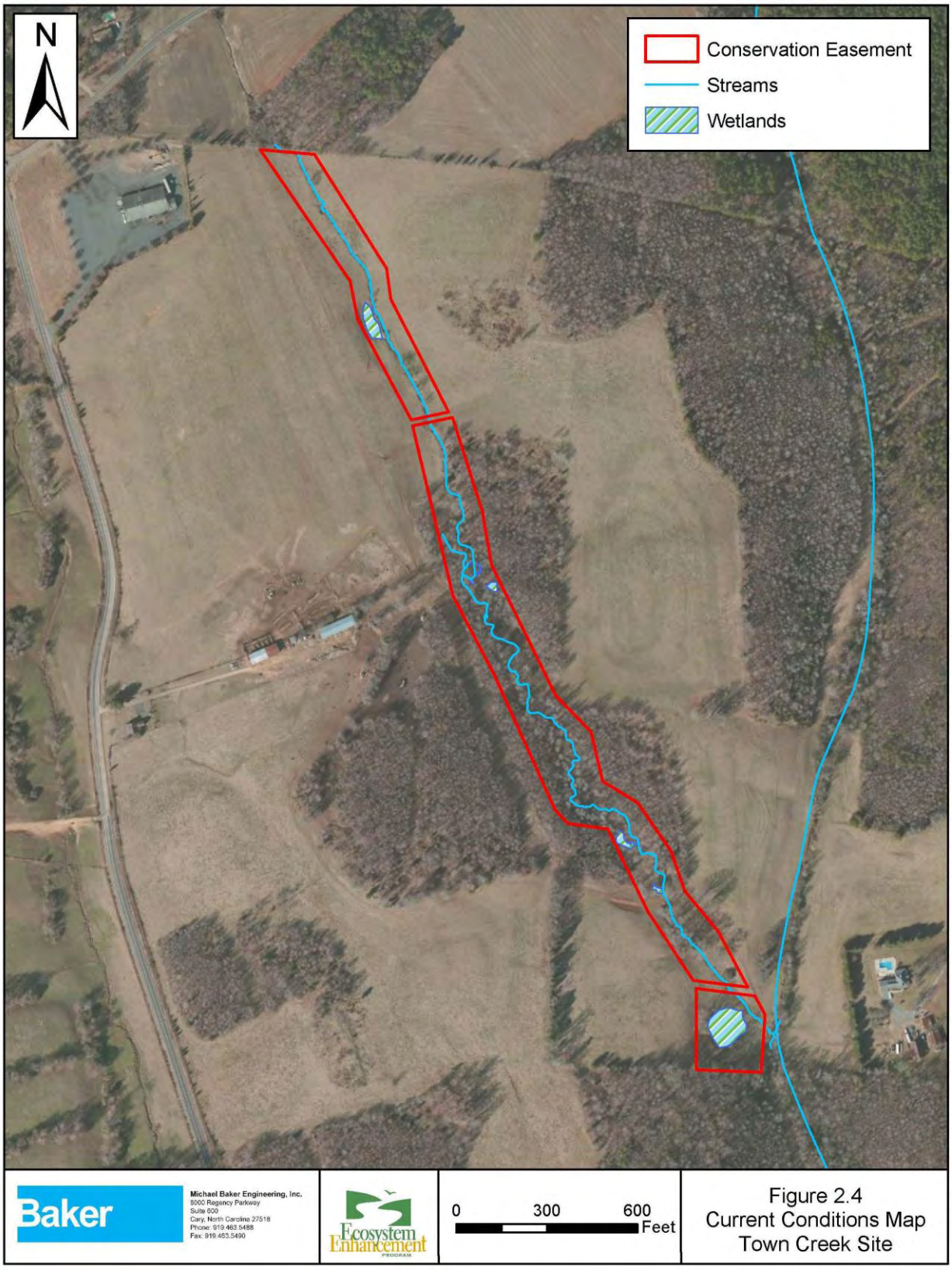
2.4 Watershed Map



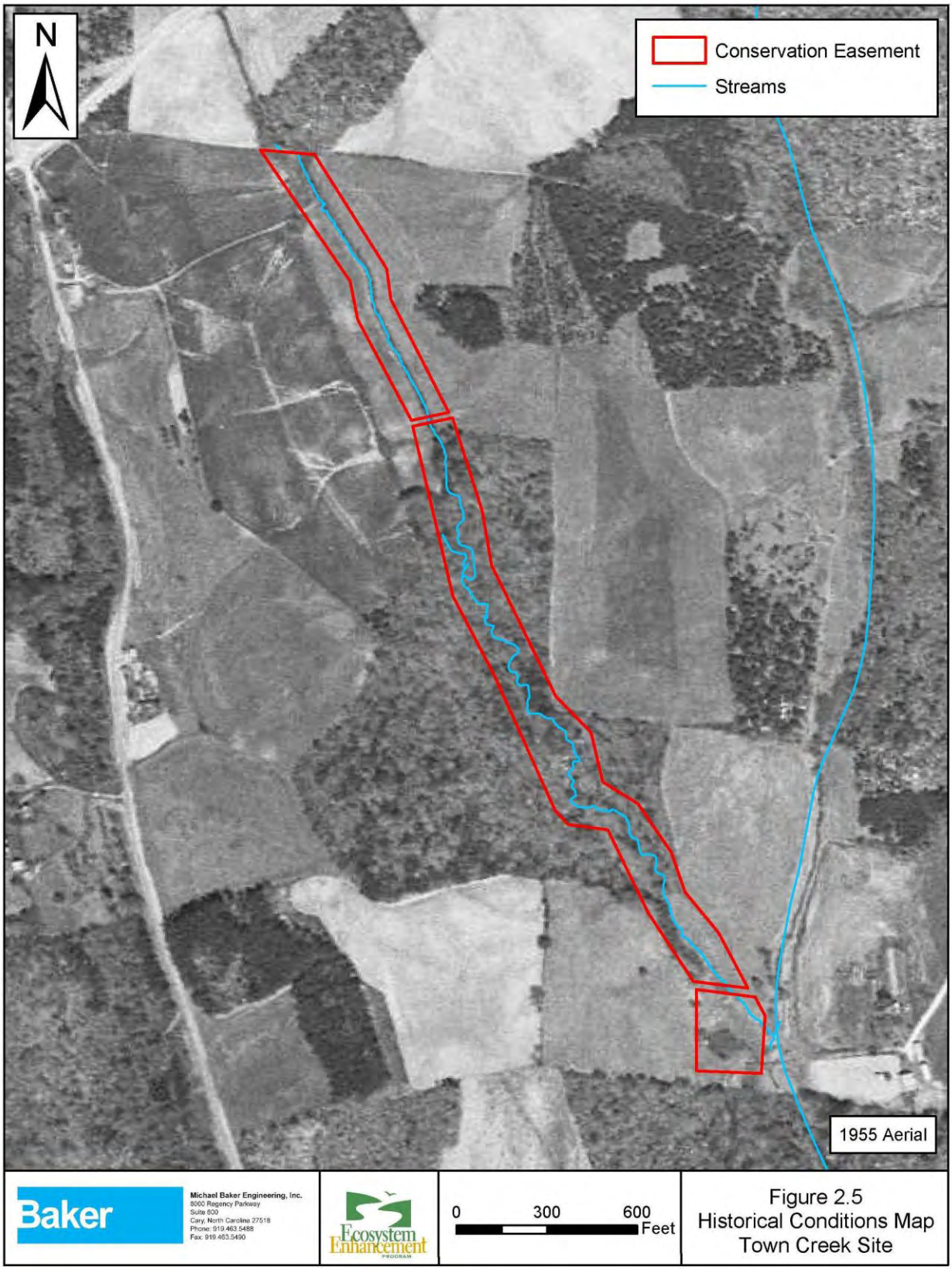
2.5 Soils Map


N
Conservation Easement
BaB - Badin channery silt loam, 2-8% slopes
BaD - Badin channery silt loam, 8-15% slopes
BaF - Badin channery silt loam, 15-45% slopes
BbB - Badin-Urban land complex, 2-8% slopes
CfA - Chenneby silt loam, 0-2% slopes, frequently flooded
EcB - Enon cobbly loam, 2-8% slopes
EcD - Enon cobbly loam, 8-15% slopes
GoF - Goldston very channery silt loam, 15-45% slopes
OaA - Oakboro silt loam, 0-2% slopes, frequently flooded
TaF - Tarrus gravelly loam, 15-35% slopes
TbB - Tarrus channery silt loam, 2-8% slopes
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
Ecosystem Enhancement Program
0 300 600 Feet
Figure 2.3
Soils Map
Town Creek Site

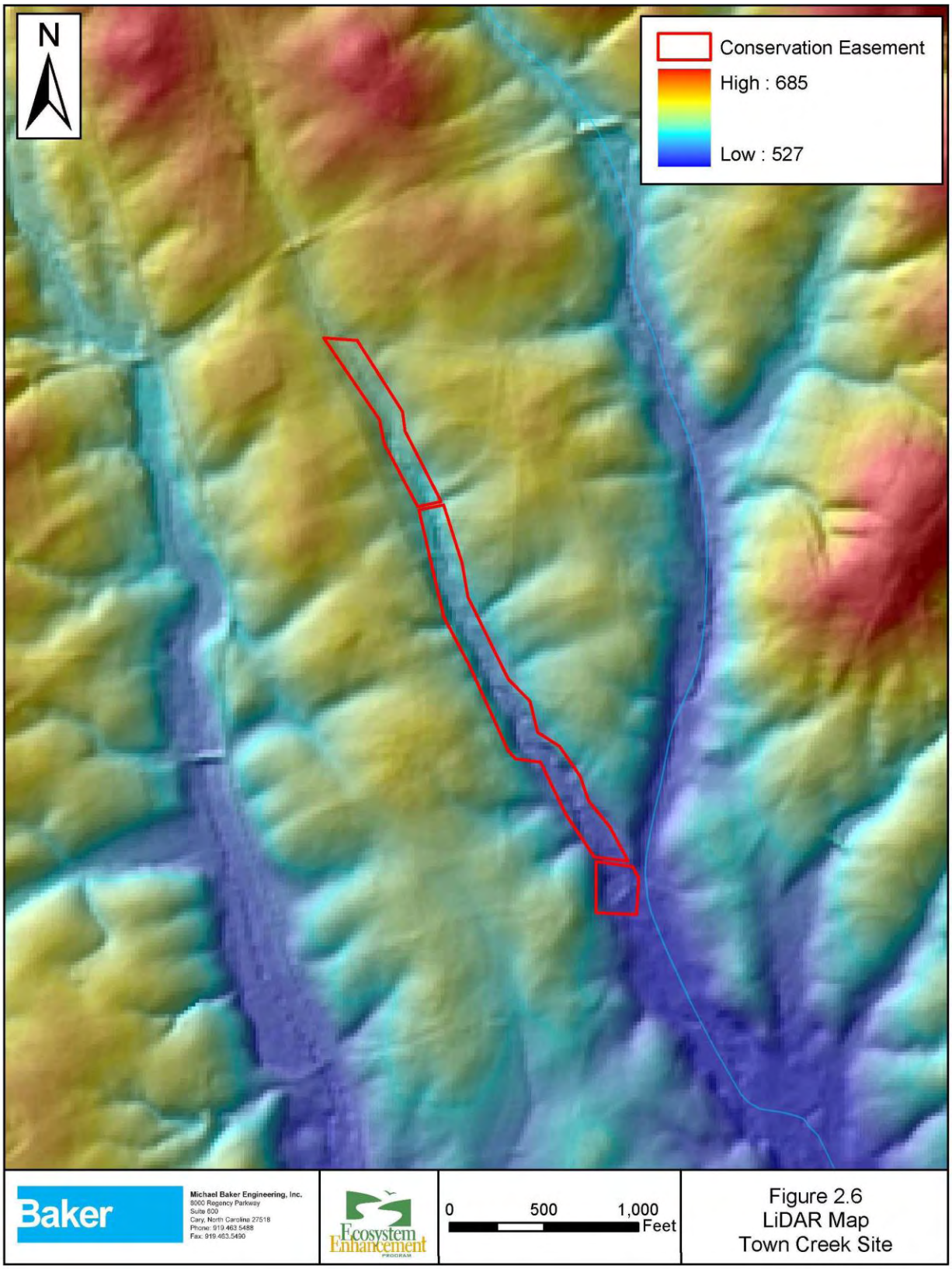
2.6 Current Conditions Map



2.7 Historical Conditions Map



2.8 LiDAR Map


N
Conservation Easement
High : 685
Low : 527
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
Ecosystem Enhancement Program
0
500
1,000
Feet
Figure 2.6
LiDAR Map
Town Creek Site

2.9 Site Photographs

2.9.1 Reach 1, Reach 2, Reach 3, Reach 4 and Reach 5

Reach 1 (1-5-11)

Reach 1 (1-5-11)

Reach 2 (1-3-11)

Reach 2 (1-5-11)

Reach 2 (1-3-11)

Reach 2 (1-5-11)

Reach 3 (7/19/11)

Reach 3 (1/3/11)

Reach 3 (1/05/11)

Reach 3 (1/05/11)

Reach 4 (1/05/11)

Reach 4 (1/05/11)

Reach 5 (1-5-11), old crossing at 41+75

Reach 5 (1-5-11)

Reach 5 (1-5-11)

Reach 5 (1-5-11)

2.9.2 Jurisdictional Wetland Areas

Wetland Pond (2/9/11)

Wetland 1 (2/9/11)

Wetland 2 (3/30/12)

Wetland 3 (3/30/12)

Wetland 4 (3/30/12)

Wetland 5 (2/9/11)

Wetland 6 (2/9/11)

Wetland 7 (2/9/11)

Upland Area (3/30/12)

3.0 SITE PROTECTION INSTRUMENT

3.1 Site Protection Instrument Summary Information

The land required for the construction, management, and stewardship of this mitigation project includes portions of the following parcels. A copy of the land protection instrument is included in Appendix A.

Table 3.1 Site Protection Instrument Summary
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Parcel Number	Landowner	PIN	County	Site Protection Instrument	Deed Book and Page Numbers	Acreage Protected
CE-1	David Lee & Kimberly Comer Harward	662102964027	Stanly	360888	1475 / 833-846	2.952
CE-2	David Lee & Kimberly Comer Harward	662102964027	Stanly	360888	1475 / 833-846	3.245
CE-3	David Lee & Kimberly Comer Harward	662104943597	Stanly	360888	1475 / 833-846	0.878
CE-4	David Lee & Kimberly Comer Harward	663101150408	Stanly	360888	1475 / 833-846	3.589
CE-5	David Lee & Kimberly Comer Harward	663101150408	Stanly	360888	1475 / 833-846	1.307

Baker has obtained a conservation easement from the current landowner for the Town Creek Restoration Project area. The deed of easement and survey plat (Map Book 23, Page Numbers 234-235) are held by the State of North Carolina and have been recorded at the Stanly County Courthouse. The secured easement allows Baker to proceed with the restoration project and restricts the land use in perpetuity.

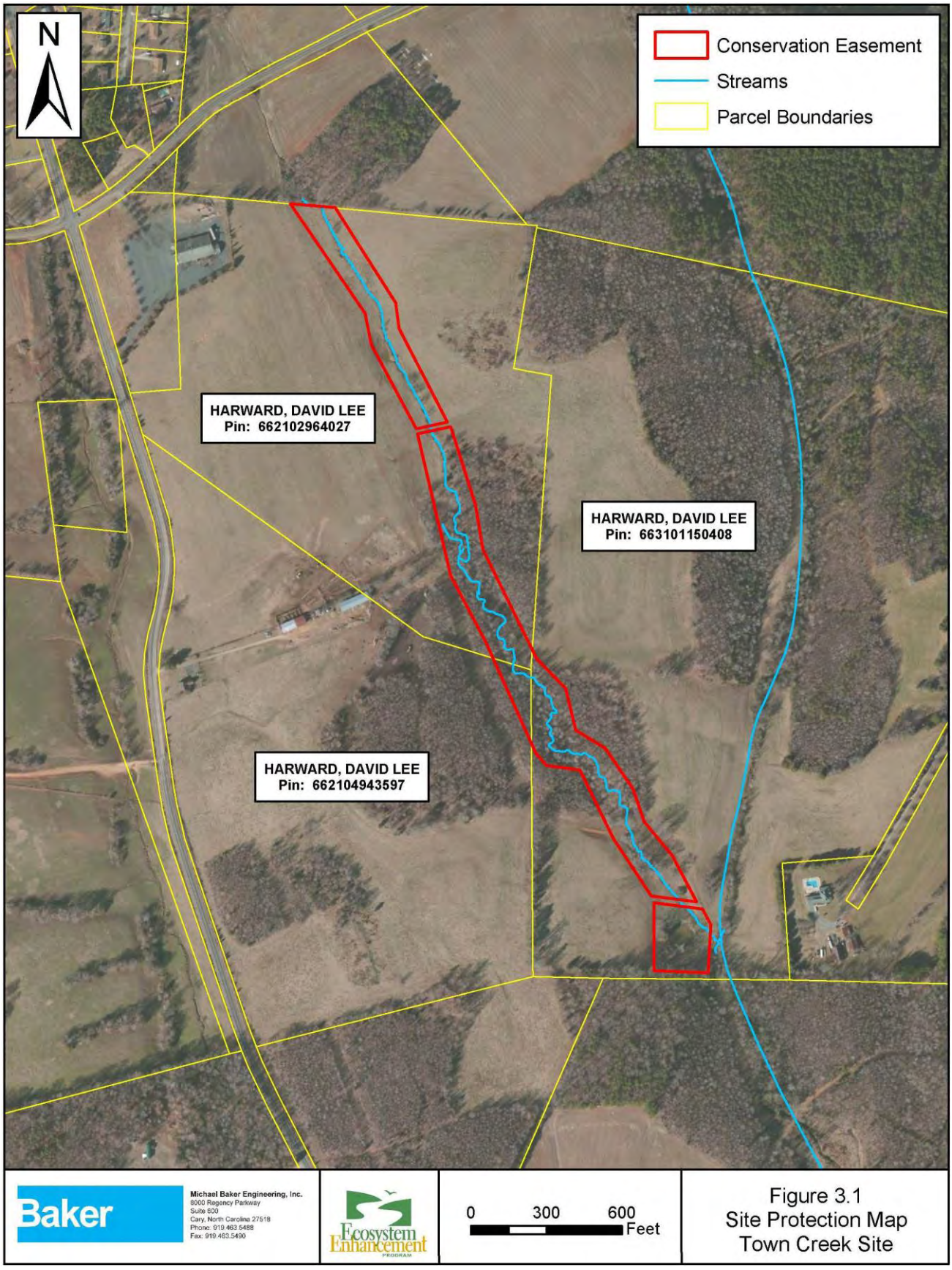
3.1.1 Potential Constraints

No fatal flaws have been identified at the time of this mitigation plan. All farm crossings have been excluded from the easement area. The existing crossing at the beginning of Reach 2 (Station 20+58 to 20+78) will be improved as part of this project. An existing crossing that is located at Station 31+50, approximately halfway through Reach 3, will be removed. An existing crossing that is located at Station 41+70 will be removed and replaced with a crossing at Station 45+57 to 45+82. An overhead power line crosses the channel in the middle of this livestock crossing. No existing or proposed easements for power and telephone utilities are located within the conservation easement. Riparian buffer widths will be at least 50 feet in width measured from the top of both banks (100 foot minimum) in total buffer width plus stream width) for all of the proposed stream reaches. The project area is not located in a special flood hazard area and hydraulic trespass would not result from the proposed project. Other regulatory factors discussed in Section 16, Appendix B were also not determined to pose potential site constraints. Construction access and staging areas have been identified and will be determined during final design.

3.2 Site Protection Instrument Figure

The conservation easement for the project area is shown in Figure 3.1 and copies of the recorded survey plat and deed of easement are included in Section 15, Appendix A.

Figure 3.1 Site Protection Instrument Map



4.0 BASELINE INFORMATION

Table 4.1 Baseline Information
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Project Information					
Project Name	Town Creek Restoration Project				
County	Stanly				
Project Area (acres)	12.0				
Project Coordinates (latitude and longitude)	35.43399 N, -80.24215 W				
Project Watershed Summary Information					
Physiographic Province	Piedmont				
River Basin	Yadkin Pee-Dee				
USGS Hydrologic Unit 8-digit and 14-digit	03040105 / 03040105060-040				
NCDWR Sub-basin	03-07-13				
Project Drainage Area (acres)	134.8				
Project Drainage Area Percent Impervious	<5%				
CGIA / NCEEP Land Use Classification	2.01, 412 / Forest (40%) Agriculture (25%) Impervious Cover (7%)				
Reach Summary Information					
Parameters	**Reach 1**	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**
Length of Reach (linear feet)	363	737	1,849	234	849
Valley Classification (Rosgen)	VII	VII	VII	VII	VII
Drainage Area (acres)	56.59	79.6	111.0	120.5	134.8
NCDWR Stream Identification Score	27.25	27.25 - 32.0	32.0	32.0	32.0
NCDWR Water Quality Classification	C, Index #: 13-17-31-1-1				
Morphological Description (Rosgen stream type)	E4b: Incised, unstable & straight	E4 : Incised, unstable & straight	C4: variable; unstable	E4: Incised & unstable	C4 and E4: Incised & straight
Evolutionary Trend	Eb→G→B	E→G→F→Bc	C→G→F→C	E→Gc→F→C	C→Gc→F→C
Underlying Mapped Soils	BaD	BaD, BaF	BaF	BaF	OaA
Drainage Class	Well drained	Well drained	Well drained	Well drained	Moderately well drained
Soil Hydric Status	Non-Hydric	Non-Hydric	Non-Hydric	Non-Hydric	Hydric
Average Channel Slope (ft/ft)	0.0212	0.0159	0.0111	0.0094	0.0133
FEMA Classification	N/A	N/A	N/A	N/A	N/A
Native Vegetation Community	Piedmont Small Stream				
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%	<5%	<5%	<5%

Table 4.1 Baseline Information
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes	Categorical Exclusion (Appendix B)
Waters of the United States – Section 401	Yes	Yes	Categorical Exclusion (Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	No	N/A	Categorical Exclusion (Appendix B)
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)

5.0 DETERMINATION OF CREDITS

Table 5.1 Project Components and Mitigation Credits
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Mitigation Credits

	Stream	Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R, E1	R	E					
Totals	3,382 SMU	0.0	0.0					

Project Components

Project Component or Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach	Restoration/ Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Reach R1	10+34 – 13+50	363 LF	Restoration	316 SMU	316 LF	1:1
Reach R2	13+50 – 20+58	737 LF	Enhancement Level I	472 SMU	708 LF	1.5:1
Reach R3	20+78 – 37+08	1,849 LF	Restoration	1,630 SMU	1,630 LF	1:1
Reach R4	37+08 – 39+40	234 LF	Enhancement Level I	155 SMU	232 LF	1.5:1
Reach R5	39+40 – 47+74	849 LF	Restoration	809 SMU	809 LF	1:1

Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
		Riverine	Non-Riverine			
Restoration	2,755					
Enhancement I	940					
Enhancement II	0					
Creation						
Preservation						
High Quality Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements: BR= Bioretention Cell; SF= Sand Filter; SW= Stormwater Wetland; WDP= Wet Detention Pond; DDP= Dry Detention Pond; FS= Filter Strip; S= Grassed Swale; LS= Level Spreader; NI=Natural Infiltration Area

6.0 CREDIT RELEASE SCHEDULE

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary 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 NC Interagency Review Team (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 6.1 as follows:

Table 6.1 Credit Release Schedule*
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Stream Credits			
Monitoring Year	**Credit Release Activity**	**Interim Release**	**Total Release**
0	Initial Allocation - see requirements above	30%	30%
1	First year monitoring report demonstrates performance standards are being met	10%	40%
2	Second year monitoring report demonstrates performance standards are being met	10%	50% (65%**)
3	Third year monitoring report demonstrates performance standards are being met	10%	60% (75%**)
4	Fourth year monitoring report demonstrates performance standards are being met	10%	70% (85%**)
5	Fifth year monitoring report demonstrates performance standards are being met and project has received closeout approval.	15%	100%

*Credit release schedule is based on a 5 –Year monitoring period for stream work as outlined in RFP # 16-003579.
** For stream projects a reserve of 15% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met.

Initial Allocation of Released Credits

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

a. Approval of the Final Mitigation Plan

b. Recordation of the preservation mechanism, as well as a title opinion acceptable to the USACE covering the property

c. Completion of project construction (the initial physical and biological improvements to the mitigation site) pursuant to the mitigation plan; Per the NCEEP Instrument, construction

means that a mitigation site has been constructed in its entirety, to include planting, and an as-built report has been produced. As-built reports must be sealed by an engineer prior to project closeout, if appropriate but not prior to the initial allocation of released credits.

d. Receipt of necessary DA permit authorization or written DA approval for projects where DA permit issuance is not required.

Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the NCIRT, based on a determination that required performance standards have been achieved. For stream projects a reserve of 15% of a site's total stream credits shall be released after two bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than two bankfull events occur during the monitoring period, release of these reserve credits shall be at the discretion of the NCIRT. As projects approach milestones associated with credit release, the NCEEP will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.

7.0 MITIGATION WORK PLAN

7.1 Target Stream Type(s), Wetland Type(s), and Plant Communities

7.1.1 Target Stream Types

The primary goal when targeting a stream type was to select a site-specific design approach that would return rural piedmont stream functions to a stable state prior to past disturbances. Current assessment methods and data analyses were utilized for identifying lost or impaired functions at the site and to determine overall mitigation potential. Among these are reviewing existing hydrogeomorphic conditions, historical aerials and LiDAR (Light Detection and Ranging) mapping, evaluating stable reference reaches, and a comparison of results from similar past projects in rural piedmont stream systems.

After examining the assessment data collected at the site and exploring the potential for restoration, an approach was developed that would address restoration of stream functions within the project area. Topography and soils on the site indicate that the project area most likely functioned in the past as small tributary stream system, eventually flowing downstream into the larger Town Creek system. Assigning an appropriate stream type for the corresponding valley that accommodates the existing and future hydrologic conditions and sediment supply was considered prior to selecting the proposed design approach. This decision was based primarily on the range of the reference reach data available and the desired performance of the site.

7.1.2 Target Wetland Types

Baker delineated approximately 0.44 acres of riparian wetlands that have been previously disturbed. The proposed stream mitigation activities will likely improve these wetland functions within the riparian corridor and maximize the ecological benefits of the site; however, wetland mitigation credit is not proposed as a part of this project.

7.1.3 Target Plant Communities

Native riparian vegetation will be established in the riparian buffer throughout the site. Schafale and Weakley's (1990) guidance on vegetation communities for Piedmont/Mountain Bottomland Forest (mixed riparian community) and Dry-Mesic Oak-Hickory Forest, as well as the USACE Wetland Research Program (WRP) Technical Note VN-RS-4.1 (1997), were referenced during the development of riparian and adjacent wetland planting lists for the site. In general, bare root vegetation will be planted at a target density of 684 stems per acre. Live stakes will be planted along the channels at a target density of 40 stakes per 1,000 square feet. Using triangular spacing along the stream banks, the live stakes will be spaced two to three feet apart in meander bends and six to eight feet apart in the riffle sections between the toe of the stream bank and bankfull elevation. Site variations may require slightly different spacing. Invasive species vegetation, such as Chinese privet (*Ligustrum sinense*), and creeping grass (*Microstegium vimineum*), will be removed to allow native plants to become established within the conservation easement. Larger native tree species will be preserved to the greatest extent possible and where trees have to be harvested, the woody material will be utilized to provide bank stabilization and aquatic habitat. Hardwood species will be planted to provide the appropriate woody vegetation for the restored riparian buffer areas. The vegetation selection will include native species found in local plant communities such as River birch (*Betula nigra*), Green ash (*Fraxinus pennsylvanica*), Tulip poplar (*Liriodendron tulipifera*), American sycamore (*Platanus occidentalis*), and White oak (*Quercus alba*).

7.2 Design Parameters

Selection of design criteria is based on a combination of approaches, including review of reference reach data, regime equations, evaluation of monitoring results from past projects, and best professional judgment. Evaluating data from reference reach surveys and monitoring results from multiple rural Piedmont stream restoration projects provided pertinent background information to determine the appropriate design parameters given the existing conditions and overall site potential. The design parameters for the site (shown in Section 17.1.2.1, Appendix C) also considered common design ratios and guidelines from the *Natural Channel Design Checklist* (Harman, Starr, 2011) and USACE 2003 *Stream Mitigation Guidelines* (USACE, 2003).

The restoration activities and structural elements are justified for the following reasons:

1. Many of the stream sections are incised (Bank Height Ratios greater than 1.5) and the cattle access has resulted in significant degradation throughout the site;
2. Past agricultural and silvicultural activities, such as timber production and channelization, have resulted in bank erosion, sedimentation and the loss of woody vegetation within the riparian zone;
3. Enhancement or preservation measures alone would not achieve the highest possible level of functional lift for many portions of the degraded headwater stream system.

For design purposes, the stream channel was divided into multiple reaches labeled Reach 1, Reach 2, Reach 3, Reach 4 and Reach 5, as shown in Table 7.1. Selection of a general restoration approach was the first step in selecting design criteria for the project reaches. The approach was based on the potential for restoration as determined during the site assessment and the specific design parameters were developed so that plan view layout, cross-section dimensions, and profile could be described for developing construction documents. The 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 long periods of time under the processes of flooding, re-colonization of vegetation, and watershed influences.

Table 7.1 Project Design Stream Types
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Reach	Proposed Stream Type	Approach/Rationale
Reach 1	B	Baker proposes to implement Priority Level I Restoration by utilizing the pasture area along the existing incised channel to restore a floodplain connection. Cattle have access to all of this reach, actively impacting the stream banks. The stream will be constructed as close to the existing channel as possible. This approach will provide the highest ecological functional uplift. (vertical transition as quickly as possible at an appropriate rate). Channel pattern will be modified at two locations to address unstable pattern issues. Riparian buffers in excess of 50 feet will be restored or protected along both sides of the entire reach.
Reach 2	B	Level I Enhancement is proposed to restore a more stable dimension and profile. Cattle have access to all of this reach, actively impacting the stream bed and bank. The stream is somewhat incised through this reach and enhancement activities will include permanent exclusion of cattle, grading of localized sections of the degraded stream banks, use of structures to promote channel stability, bedform diversity and an appropriate pool-to-pool spacing. Riparian buffers in excess of 50 feet will be restored or enhanced along both sides of Reach 2. This reach will be designed as a Rosgen B stream type. The design width/depth ratio for the channel will be 13.3, and over time, the channel will likely narrow due to deposition of sediment and stream bank vegetation growth.

Table 7.1 Project Design Stream Types
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Reach	Proposed Stream Type	Approach/Rationale
Reach 3	C	The proposed strategy for Reach 3 is to establish a stable pattern, dimension and profile, remove active headcuts, and preserve the wooded buffer and small areas of wetlands within the easement. Cattle have access to all of this reach, actively impacting the stream bed and banks. A Priority Level I restoration approach is proposed for this reach to reconnect the stream with its floodplain, as well as to re-establish a natural meander pattern and provide bedform diversity. This approach involves constructing the restored channel off-line and along the low part of the valley. The benefits of this approach are that floodplain connection is restored, limited impact to desirable native trees along the existing channel, and the ability to provide full restoration of a natural channel pattern and appropriate stream functions. Cattle will be excluded from the project area by fencing and riparian buffers in excess of 50 feet will be restored along all of Reach 3.
Reach 4	C	The proposed strategy for Reach 4 is to stabilize and enhance this moderately stable section within the wooded area. Cattle have access to all of this reach, actively impacting the stream bank. Enhancement is proposed along this section to provide a stream that is connected to its floodplain and protects a riparian buffer between the stream and adjacent farmland. Grading of banks will be done to correct existing livestock damage. Riparian buffers in excess of 50 feet will be preserved or restored along both sides of the entire reach.
Reach 5	C	Part of this reach has a minimal riparian buffer, located at the bottom of the project. The reach has most likely been historically straightened. In addition, it has been further manipulated to incorporate a culverted farm road crossing, a floodplain pond, and a sewer line. Currently cattle have access to the entire reach and have impacted both channel bed and bank. Degradation along the reach is also evident from the failed culverted crossing. A Priority Level I restoration approach is proposed for this reach to reconnect the stream with its floodplain, as well as to re-establish a natural meander pattern and provide bedform diversity. This approach involves constructing the restored channel off-line and along the low part of the valley. The benefits of this approach are that floodplain connection is restored, limited impact to desirable native trees along the existing channel, and the ability to provide full restoration of a natural channel pattern and appropriate stream functions. Cattle will be excluded from the project area by fencing and riparian buffers in excess of 50 feet will be restored along all of Reach 5.

7.3 Data Analyses

Baker compiled and assessed watershed information such as drainage areas, historical land use, geologic setting, soil types, and terrestrial plant communities. The results of the existing condition analyses along with reference reach data from previous projects were used to develop a proposed stream restoration design for the project reaches. Numerous sections of the existing stream channel throughout the project area have been straightened/channelized or moved in the past. This manipulation has impacted channels that are now overly sized for the given drainage areas. Within the existing forested area through the middle section of the project, the site streams are severely impacted by hoof shear and localized deep incision and likely existed prior to impacts as Rosgen "E", "B" or "C" stream types. This is evidenced by stable morphological features, the presence of knickpoints (geologic

control), valley configuration and dendritic drainage pattern. The channel slopes within the mainstem are generally consistent with the valley topography.

The design approach follows the Rosgen "step-wise" methodology in which dimensionless ratios from the reference reach and successful past project experience are used to restore stable dimension, pattern, and profile, as well as proper bankfull sediment-transport competency for the proposed reaches. The stream channel design included analysis of the hydrology, hydraulics, shear stress, sediment transport, and appropriate channel dimensions. Baker also performed representative pebble counts in order to evaluate bed material characteristics and sediment transport. The results of the substrate analyses were used to classify the stream and to complete shear stress, sediment transport, and stability analyses.

The Rosgen stream classification system (Rosgen, 1996) depends on the proper identification of "bankfull" for stream classification. Stream classifications for the project were based on multiple riffle cross-sections and indicate multiple stream classifications ranging from a G4 to a B4c to an incised E4 stream type, as determined by the calculated entrenchment ratios (based on an estimation of bankfull area from the NC Piedmont regional curve), channel slopes, and channel substrate (gravel). This diversity indicates significant departure from a stable condition. Throughout the reaches, bedform feature formation is poor with minimal habitat diversity or woody debris. Adequate riparian buffer vegetation and width are lacking throughout much the project area especially in Reaches 1, 2 and most of 5. Downstream sections of the stream channel display irregular meander geometry. The conditions are associated with either straight incised reaches or reaches where the channel has experienced significant degradation from cattle hoof shear on the stream banks and flood plain. These conditions generally lead to lateral instability over time; however, on some sections a low-flow regime and vegetation on the banks have served to maintain stability or quasi-equilibrium conditions along some wooded portions of the project reach.

The proposed design approach will restore the hydrologic conditions that were likely present prior to channelization by raising the local water table and base flow levels, as well as introducing natural flooding. The existing conditions data indicate that proposed mitigation activities will result in re-establishment of functional stream and floodplain ecosystem. The restoration and enhancement efforts, including site protection with a conservation deed of easement, will promote the greatest ecological benefit, a rapid recovery period, and a justifiable and reduced environmental impact over a natural recovery that would otherwise occur through erosional processes with associated impacts on water resources and flooding.

Additionally, by raising the stream bed and reconnecting the active floodplain, the maximum degree of potential uplift will be provided, restoring and/or enhancing stream, buffer, and wetland functions whenever possible. Functional uplift will also be provided to the system by improving and extending wildlife corridors that connect with wooded areas near the upstream and downstream extents of the project reaches. The water quality of the Town Creek tributary will be improved by providing permanent cattle exclusion fencing along the tributary, as well as reducing nutrient and sediment inputs.

8.0 MAINTENANCE PLAN

The site will be monitored on a regular basis as well as a physical inspection of the site at least once a year throughout the post-construction monitoring period. These site inspections may identify site components and features that require routine maintenance. Routine maintenance will be most likely in the first two years following site construction and may include the following components as described in Table 8.1.

Table 8.1 Routine Maintenance Components
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

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 bank 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 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 may 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 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 dewatering/dam removal. Beaver management will be implemented using accepted trapping and removal methods only within the recorded Conservation Easement.

9.0 PERFORMANCE STANDARDS

Baker has obtained regulatory approval for numerous stream mitigation plans involving NCDOT and NCEEP full-delivery projects. The success criteria for the project site will follow the mitigation plans developed for these projects, as well as the *Stream Mitigation Guidelines* (SMG) issued in April and October 2005 (USACE and NCDWR) and NCEEP's recent supplemental guidance document *Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation* dated November 7, 2011. As outlined in the RFP #16-003579, all monitoring activities will follow the NCEEP Monitoring Report Template, Version 1.3 – 1/15/10, will be conducted for a period of 5 years, and will evaluate the effectiveness of the restoration practices based on the performance success criteria outlined in the 2003 SMG. If Year 5 does not meet performance success criteria, NCEEP may require additional monitoring until the site does meet all performance success criteria.

Based on the design approaches and overall project goals, different monitoring methods are proposed for the project reaches. For reaches that involve a combination of traditional Restoration (Rosgen Priority Levels I and/or II) and Enhancement Level I (stream bed/bank stabilization) approaches, geomorphic monitoring methods will follow those recommended by the 2003 SMG. For reaches involving Enhancement Level II approaches, monitoring efforts will focus primarily on visual inspections, photo documentation, and vegetation assessments. The monitoring parameters shall be consistent with the requirements described in the Federal Rule for compensatory mitigation sites in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.5 paragraphs (a) and (b). Specific success criteria components and evaluation methods are described below and report documentation will follow the NCEEP Baseline Monitoring Document template and guidance (v 2.0, dated 10/14/10).

9.1 Stream Monitoring

Geomorphic monitoring of the proposed restoration reaches will be conducted once a year for a minimum of five years following the completion of construction. These activities will evaluate the success criteria associated with a geomorphically stable channel, hydrologic connectivity, and aquatic habitat diversity. The stream parameters to be monitored include stream dimension (cross-sections), pattern (planimetric survey), profile (longitudinal profile survey), visual observation with photographic documentation, and documentation of bank full events. The success criteria for the proposed Enhancement Level I reaches/sections will follow the methods described under Photo Reference Stations and Vegetation Monitoring. The methods used and related success criteria are described below for each parameter. Figure 9.1 shows approximate locations of the proposed monitoring devices throughout the project site.

9.1.1 Bankfull Events and Flooding Functions

The occurrence of bankfull events within the monitoring period will be documented by the use of a crest gauge and photographs. The crest gauge will be installed on the floodplain within ten feet (horizontal) of the restored channel. The crest gauge will record the highest watermark between site visits, and the gauge will be checked at each site visit to determine if a bankfull event has occurred. Photographs will be used to document the occurrence of debris lines and sediment deposition on the floodplain during monitoring site visits.

Two bankfull flow events must be documented within a five-year monitoring period. The two bankfull events must occur in separate years; otherwise, the monitoring will continue until two bankfull events have been documented in separate years to demonstrate a floodplain connection has been restored.

9.1.2 Flow Documentation

Monitoring of flow will be conducted to demonstrate that the restored stream system classified as intermittent exhibits base flow for some portion of the year during a year with normal rainfall conditions. In order to determine if rainfall amounts are normal for the given year, a rainfall gage will be installed on the site to compare precipitation amounts using tallied data obtained from the nearest Stanly County WETS Station. Data from the weather station can be obtained from the CRONOS Database located on the State Climate Office of North Carolina's website. If a normal year of precipitation does not occur during the first seven years of monitoring, flow conditions will continue to be monitored on the site until it documents that the intermittent streams have been flowing during the appropriate times of the year.

The proposed monitoring of the restored intermittent reach will include the documentation of a combination of photographic and groundwater monitoring data. A flow camera will be installed to collect a regular and continuous series of remote photos over time will be used to subjectively evaluate channel flow conditions throughout the year. More specifically, the longitudinal photos should indicate the presence of flow within the channel in order to discern water levels within the pools and riffles. The photographs will be taken from a height of approximately five to six feet to ensure that the same locations (and view directions) at the site are documented in each monitoring period and will be shown on a plan view map. The visual monitoring effort, including the photo locations with descriptions, will be included with NCEEP's annual monitoring reports. A monitoring well (pressure transducer) will be installed towards the downstream portion of restored intermittent reach. The device will be inspected on a quarterly/semi-annual basis to document surface hydrology and provide a basis for evaluating general flow response to rainfall events and surface runoff during various water tables levels throughout the monitoring period.

9.1.3 Cross-sections

Permanent cross-sections will be installed at an approximate rate of one cross-section per 500 LF of restored stream, or approximately four (4) cross-sections located at riffles, and three (3) located at pools. Each cross-section will be marked on both stream banks with permanent monuments using rebar cemented in place to establish the exact transect used. A common benchmark will be used for cross-sections and consistently used to facilitate easy comparison of year-to-year data. The cross-section surveys will occur annually 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 stream banks, 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 stream banks, or decrease in width/depth ratio). Using the Rosgen Stream Classification System, and 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 stream banks. Photographs will be taken of both stream banks at each cross-section. The survey tape will be centered in the photographs of the stream banks. The water line will be located in the lower edge of the frame, and as much of the stream bank as possible will be included in each photo. Photographers should make an effort to consistently maintain the same area in each photo over time.

9.1.4 Pattern

The plan view measurements such as sinuosity, radius of curvature, meander width ratio will be taken on newly constructed meanders during baseline (year-0) only. Subsequent visual monitoring will be conducted twice a year, at least five months apart, to document any changes or excessive lateral movement in the plan view of the restored channel.

9.1.5 Longitudinal Profile

A longitudinal profile will be surveyed for the entire length of restored channel immediately after construction to document as-built baseline conditions for the first year of monitoring only. 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 profiles will not be taken during subsequent monitoring years unless vertical channel instability has been documented or remedial actions/repairs are deemed necessary.

9.1.6 Bed Material Analyses

After construction, there should be minimal change in the pebble count data over time given the current watershed conditions and sediment supply regime. Significant changes in particle sizes or size distribution in otherwise stable riffles and pools could warrant additional sediment transport analyses and calculations. A substrate sample will be collected where constructed riffles are installed as part of the project. One constructed riffle substrate sample will be compared to existing riffle substrate data collected during the design phase and any significant changes (i.e.; aggradation, degradation) will be noted after stream bank vegetation becomes established and a minimum of two bankfull flows or greater have been documented.

9.1.7 Visual Assessment

Visual monitoring assessments of all stream sections will be conducted by qualified personnel twice per monitoring year with at least five months in between each site visit. Photographs will be used to visually document system performance and any areas of concern related to stream bank stability, condition of in-stream structures, channel migration, headcuts, live stake mortality, impacts from invasive plant species or animal species, and condition of pools and riffles. The photo locations and descriptions will be shown on a plan view map per NCEEP's monitoring report guidance (v1.5, June 2012).

The Photographs will be taken from a height of approximately five to six feet to ensure that the same locations (and view directions) at the site are documented in each monitoring period. A series of photos over time will be also be used to subjectively evaluate channel aggradation (bar formations) or degradation, stream bank erosion, successful maturation of riparian vegetation, and effectiveness of sedimentation and erosion control measures.

9.2 Vegetation Monitoring

Successful restoration of the vegetation on a site is dependent upon hydrologic restoration, planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the planting success criteria are achieved and riparian buffer establishment goals are met, vegetation monitoring will be conducted on a year for a minimum of five years following the completion of construction and one full growing season. These activities will evaluate the success criteria associated with the restoration and protection of the riparian buffer functions and corridor habitat, and reduction of sediment loading from floodplain erosion and nutrient loading through the uptake of riparian vegetation.

In order to effectively monitor the success criteria of the riparian buffer, vegetation-monitoring quadrants will be installed and monitored across the restoration site in accordance with the CVS-NCEEP Protocol for Recording Vegetation, Version 4.0 (2006). The vegetation monitoring plots shall be a minimum of 2% of the planted portion of the site with a minimum of eight (8) plots established randomly within the planted riparian buffer areas per Monitoring Levels 1 and 2. No monitoring quadrants will be established within areas where there are significant stands of undisturbed trees. The size of individual quadrants will be 100 square meters for woody tree species.

Vegetation monitoring will occur in the fall, prior to the loss of leaves. Individual quadrant data will be provided and will include species diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. 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/year 0) or after 180 days between March 1st and November 30th, species composition, stem density, and survival will be evaluated. For each subsequent year, until the final success criteria are achieved, the restored site will be evaluated March and November. The interim measure of vegetative success for the site will require the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. The final vegetative success criteria will be measured at year five and must consist of a density of no less than 260, 5-year old, planted trees per acre.

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 will incorporate the evaluation of additional plant community indices, native volunteer species, and the presence of invasive species vegetation to assess overall vegetative success.

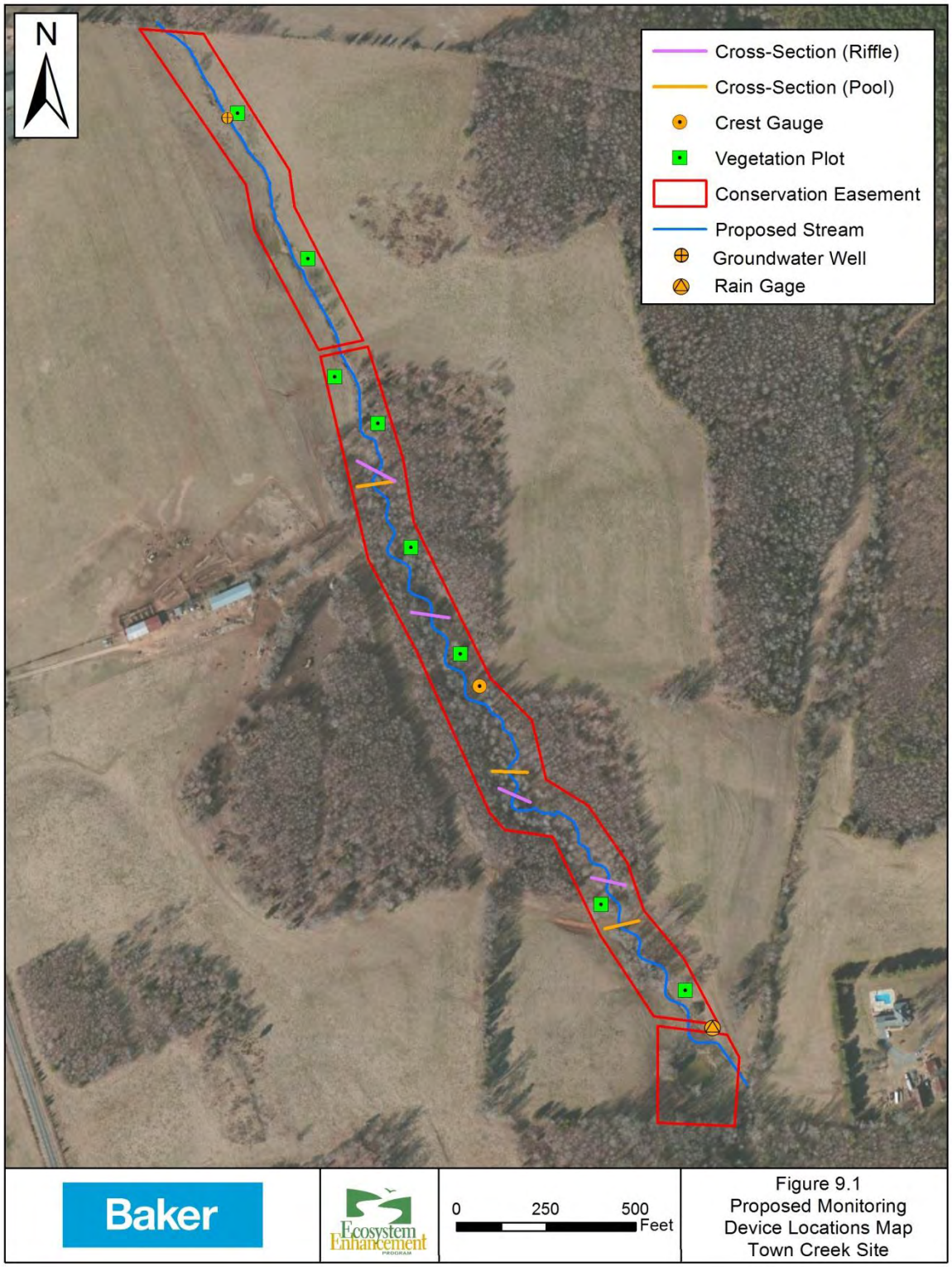
Baker will provide required remedial action on a case-by-case basis, such as: replanting more wet/drought tolerant species vegetation, conducting beaver management/dam removal, and removing undesirable/invasive species vegetation, and will continue to monitor vegetation performance until the corrective 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.

9.3 Stormwater Management Monitoring

No stormwater BMPs are proposed at the site therefore no such monitoring will be included.

Figure 9.1 Proposed Monitoring Device Locations



10.0 MONITORING REQUIREMENTS

Annual monitoring reports containing the information defined within Table 10.1 below will be submitted to NCEEP by December 31st of the each year during which the monitoring was conducted. The monitoring report shall provide a project data chronology for NCEEP to document the project status and trends, population of NCEEP databases for analysis, research purposes, and assist in decision making regarding 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.

Table 10.1 Monitoring Requirements
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Required	Parameter	Quantity	Frequency	Notes
X	Pattern	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	As-built Year and as needed	Pattern data, including bank erosion pins/arrays in pool cross-sections, will be collected only if there are indications through profile and dimensional data that significant geomorphological adjustments occurred.
X	Dimension	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines and November 2011 NCEEP Monitoring Requirements	Annually	Cross-sections to be monitored over five (5) years and shall include assessment of bank height ratio (BHR) and entrenchment ratio (ER).
X	Profile	As per November 2011 NCEEP Monitoring Requirements	As-built Year and as needed	For restoration or enhancement I components, 3,000 linear feet or less, the entire length will be surveyed. For mitigation segments in excess of this footage, 30% of the length or 3,000 feet will be surveyed, whichever is greater.
X	Substrate	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines and November 2011 NCEEP Monitoring Requirements	Annually	A substrate sample will be collected if constructed riffles are installed as part of the project. One constructed riffle substrate sample will be compared to existing riffle substrate data collected during the design phase.
X	Surface Water Hydrology	As per April 2003 USACE Wilmington District Stream Mitigation Guidelines	Annually	A Crest Gauge and/or Pressure Transducer will be installed on site; the device will be inspected on a quarterly/semi-annual basis to document the occurrence of bankfull events on the project.
X	Vegetation	NCEEP-CVS Guidance	Annually	Vegetation will be monitored using the Carolina Vegetation Survey (CVS) protocols.
X	Exotic and Nuisance Vegetation		Semi-Annually	Locations of exotic and nuisance vegetation will be visually assessed and mapped a minimum of 5 months apart.
X	Visual Assessment	As per November 2011 NCEEP Monitoring Requirements	Semi-Annually and as needed	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		Semi-Annually	Locations of fence damage, vegetation damage, boundary encroachments, etc. will be mapped

11.0 LONG-TERM MANAGEMENT PLAN

Upon approval for close-out by the NCIRT, the site will be transferred to the NCDENR. This party shall be responsible for periodic inspection of the site to ensure that restrictions required in the conservation easement or the deed restriction document(s) are upheld. Endowment funds required to uphold easement and deed restrictions shall be negotiated prior to site transfer to the responsible party.

The NCDENR Division of Natural Resource Planning and Conservation's Stewardship Program currently houses NCEEP 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 Statue 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 NCDENR Stewardship Program intends manage the account as a non-wasting endowment. Only interest generated from the endowment funds will 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.

12.0 ADAPTIVE MANAGEMENT PLAN

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

13.0 FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the Ecosystem Enhancement Program's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the USACE-Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by NCEEP. This commitment provides financial assurance for all mitigation projects implemented by the program.

14.0 OTHER INFORMATION

14.1 Definitions

This document is consistent with the requirements of the federal rule for compensatory mitigation 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). Specifically the document addresses the following requirements of the federal rule:

(2) *Objectives.* A description of the resource type(s) and amount(s) that will be provided, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project will address the needs of the watershed, ecoregion, physiographic province, or other geographic area of interest.

(3) *Site selection.* A description of the factors considered during the site selection process. This should include consideration of watershed needs, onsite alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation site. (See § 332.3(d).)

(4) *Site protection instrument.* A description of the legal arrangements and instrument, including site ownership, that will be used to ensure the long-term protection of the compensatory mitigation site (see § 332.7(a)).

(5) *Baseline information.* A description of the ecological characteristics of the proposed compensatory mitigation site and, in the case of an application for a DA permit, the impact site. This may include descriptions of historic and existing plant communities, historic and existing hydrology, soil conditions, a map showing the locations of the impact and mitigation site(s) or the geographic coordinates for those site(s), and other site characteristics appropriate to the type of resource proposed as compensation. The baseline information should also include a delineation of waters of the United States on the proposed compensatory mitigation site. A prospective permittee planning to secure credits from an approved mitigation bank or in-lieu fee program only needs to provide baseline information about the impact site, not the mitigation bank or in-lieu fee site.

(6) *Determination of credits.* A description of the number of credits to be provided, including a brief explanation of the rationale for this determination. (See § 332.3(f).)

(7) *Mitigation work plan.* Detailed written specifications and work descriptions for the compensatory mitigation project, including, but not limited to, the geographic boundaries of the project; construction methods, timing, and sequence; source(s) of water, including connections to existing waters and uplands; methods for establishing the desired plant community; plans to control invasive plant species; the proposed grading plan, including elevations and slopes of the substrate; soil management; and erosion control measures. For stream compensatory mitigation projects, the mitigation work plan may also include other relevant information, such as plan form geometry, channel form (e.g. typical channel cross-sections), watershed size, design discharge, and riparian area plantings.

(8) *Maintenance plan.* A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.

(9) *Performance standards.* Ecologically-based standards that will be used to determine whether the compensatory mitigation project is achieving its objectives. (See § 332.5.)

(10) *Monitoring requirements.* A description of parameters to be monitored in order to determine if the compensatory mitigation project is on track to meet performance standards and if adaptive management is

needed. A schedule for monitoring and reporting on monitoring results to the district engineer must be included. (See § 332.6.)

(11) *Long-term management plan.* A description of how the compensatory mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the party responsible for long-term management. (See § 332.7(d).)

(12) *Adaptive management plan.* A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. (See § 332.7(c).)

(13) *Financial assurances.* A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards (see § 332.3(n)). 2) *Objectives.* A description of the resource type(s) and amount(s) that will be provided, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and the manner in which the resource functions of the compensatory mitigation project will address the needs of the watershed, ecoregion, physiographic province, or other geographic area of interest.

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15.0 APPENDIX A - SITE PROTECTION INSTRUMENT

Filed: 12/27/2013 12:15:06 PM
Suzanne W. Lowder, Register of Deeds
Stanly County, NC
Samantha J. Biles
REAL ESTATE EXCISE TAX: $324.00

BOOK 1475 PAGE 833(14) 360888

Prepared by and return to:
Robert H. Merritt, Jr.
Bailey & Dixon, LLP
P. O. Box 1351
Raleigh, NC 27602

STATE OF NORTH CAROLINA

STANLY COUNTY

324.00
Revenue $ 324.00

SPO File Number: 84-U
EEP Project Number: 95026

DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT NO.: 003990

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this 27th day of December, 2013, by DAVID LEE HARWARD and wife, KIMBERLY COMER HARWARD, ("**Grantor**"), whose mailing address is 43204 Blalock Road, New London, North Carolina 28127, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Ecosystem Enhancement Program (formerly known as the Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between Michael Baker

Engineering, Inc., 8000 Regency Parkway, Suite 600, Cary, North Carolina 27518 and the North Carolina Department of Environment and Natural Resources, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environment and Natural Resources Purchase and Services Contract Number 003990.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Ecosystem Enhancement Program is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Ecosystem Enhancement Program with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Ecosystem Enhancement Program in the Department of Environment and Natural Resources, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple three (3) parcels of real property situated, lying, and being in Harris Township, Stanly County, North Carolina (collectively the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 101.01 acres, (Tax ID# 10117; PIN: 6631-01-15-0408) Stanly County, North Carolina, that certain parcel of land containing approximately 56.01 acres, (Tax ID# 10107; PIN: 6621-04-94-3597),

and that certain parcel of land containing approximately 47 acres, (Tax ID# 10113; PIN: 6621-02-96-4027), all of the foregoing three (3) parcels or tracts being devised to Grantor pursuant to Item III of the Last Will and Testament of Johnny B. Harward, filed with the Clerk of Superior Court of Stanly County, North Carolina as estate file number 03-E-487; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of Town Creek, Stanly County, North Carolina.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access, as follows:

The Easement Area consists of the following:

Conservation Easements identified as CE-1, CE-2, CE-3, CE-4 and CE-5 as shown on Plat entitled "Town Creek Conservation Easement Survey for State of North Carolina – Ecosystem Enhancement Program on the Property of David Lee Harward" dated November 21, 2013, certified by Marshall Wight, PLS, and recorded in Plat Book 23, Page 234 & 235, Stanly County Registry.

TOGETHER with an easement for access, ingress, egress and regress as described on the above-referenced recorded plat and this Conservation Easement Deed.

The Conservation Easements described above are hereinafter referred to as the "Easement Area" or the "Conservation Easement Area" and are further set forth in a metes and bounds description attached hereto as Exhibit 1 and incorporated herein by reference.

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat **or as specifically allowed within a fence maintenance zone as described in section D or a Road or Trail described in section H.**

The Grantor reserves the right, for himself, his successors and assigns, to operate motorized vehicles within Crossing Area(s) described on the survey recorded in Plat Book _____, Page _____, of the _____County Registry as "reserved stream crossing". Said crossing shall not exceed ____ feet in width, and must be maintained and repaired by Grantor, his successors or assigns to prevent degradation of the Conservation Easement Area.

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. Damage to Vegetation. Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited with the following exception:

Notwithstanding the foregoing, if there is a fence within the Conservation Easement Area, the Grantor reserves the right to mow and maintain vegetation within 10 feet of the Conservation Easement boundary ***as shown on the Survey Plat*** and extending along the entire length of the fence. The Grantor, his successors or assigns shall be solely responsible for maintenance of the fence for as long as there is livestock on the Grantor's property adjacent to the Conservation Easement Area.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. Roads and Trails. There shall be no construction or maintenance of roads, trails, walkways, or paving in the Conservation Easement Area with the following exception:

Only roads and trails located within the Conservation Easement Area prior to completion of the construction of the restoration project and within crossings shown on the recorded survey plat may be maintained by Grantor, successors or assigns to allow for access to the interior of the Property, and must be repaired and maintained to prevent runoff and degradation to the Conservation Easement Area. Such roads and trails shall be covered with pervious materials such as loose gravel or permanent vegetation in order to minimize runoff and prevent sedimentation.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored,

enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the N.C. Ecosystem Enhancement Program, whose mailing address is 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. The Grantee, its employees and agents, successors or assigns, shall be permitted to place fencing on the Property within the Conservation Easement Area to restrict livestock access. Although the Grantee is not responsible for fence maintenance, the Grantee reserves the right to maintain, repair or replace the fence at the sole discretion of the Grantee and at the expense of the Grantor, who agrees to indemnify the Grantee for any costs incurred as a result of maintenance, repair or replacement of the fence if such costs are required to protect the Conservation Easement Area from repeated incidents of grazing or other prohibited activities.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from

any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing

sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Ecosystem Enhancement Program Manager
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

David Lee Harward (SEAL)

Kimberly Comer Harward (SEAL)

NORTH CAROLINA
COUNTY OF WAKE

I, Robert H. Merritt, JR, a Notary Public in and for the County and State aforesaid, do hereby certify that **David Lee Harward and wife, Kimberly Comer Harward**, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the 27th day of December, 2013.

Notary Public

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

My commission expires:

5-1-2017

00361049

Exhibit 1
Legal Description
Permanent Conservation Easements
Town Creek
Stanly County, NC

1. Permanent Conservation Easement (Ref: PIN: 662102964027) (CE-1)

A permanent conservation easement over a portion of land in Harris Township, Stanly County, North Carolina, as shown on a map entitled *"Town Creek Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of David Lee Harward,"* dated November 21, 2013, and recorded in Plat Book 23, Page 234 & 235, of the Stanly County Registry, and being a portion of the parcel owned by *David Lee Harward* (PIN: 662102964027), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X=1629783.66, Y=616217.36, and identified as Control Point # 5 on the above referenced plat and running S 13°42'38" E, 333.72' to a point, which is the **POINT AND PLACE OF BEGINNING**; thence continuing the following courses and distances:

S 78°00'07"W, 126.71', thence
N 28°03'19"W, 378.01', thence
N 11°10'44"W, 127.76, thence
N 34°21'41"W, 526.39', thence
S 85°21'05"E, 179.44', thence
S 32°21'50"E, 447.69, thence
S 07°28'28" E, 102.64', thence
S 27°13'41"E, 419.11', to the **POINT AND PLACE OF BEGINNING**, said permanent conservation easement containing 2.952 acres, more or less.

2. Permanent Conservation Easement (Ref: PIN: 662102964027) (CE-2)

A permanent conservation easement over a portion of land in Harris Township, Stanly County, North Carolina, as shown on a map entitled *"Town Creek Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of David Lee Harward,"* dated November 21, 2013, and recorded in Plat Book 23, Page 234 & 235, of the Stanly County Registry, and being a portion of the parcel owned by *David Lee Harward* (PIN: 662102964027), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X=1629840.45, Y=615921.34, and identified as Conservation Easement Pin #1 on the above referenced plat and running S 35°29'09"E , 21.75' to a point, which is the **POINT AND PLACE OF BEGINNING**; thence continuing the following courses and distances:

S 17°37'38" E, 325.33', thence
S 09°37'09" E, 181.11', thence
S 26°15'05" E, 483.04', thence
S 71°21'42" E, 214.39', thence
N 27°47'46" W, 296.52', thence
N 13°15'26" W, 578.57', thence
N 78°02'55" E, 134.59', to the **POINT AND PLACE OF BEGINNING**, said permanent conservation easement containing 3.245 acres, more or less.

3. Permanent Conservation Easement (Ref: PIN: 662104943597) (CE-3)

A permanent conservation easement over a portion of land in Harris Township, Stanly County, North Carolina, as shown on a map entitled *"Town Creek Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of David Lee Harward,"* dated November 21, 2013, and recorded in Plat Book 23, Page 234 & 235, of the Stanly County Registry, and being a portion of the parcel owned by *David Lee Harward* (PIN: 662104943597), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X=1630276.26, Y=614976.29, and identified as Control Point # 3 on the above referenced plat and running S 68°46'51"W , 62.69', to a point identified as conservation easement corner #12, which is the **POINT AND PLACE OF BEGINNING**; thence continuing the following courses and distances:

L16 S 00°26'00" W, 375.52, thence
L17 N 24°16'51" W, 487.11, thence
L18 S 71°21'42" E, 214.39', to the **POINT AND PLACE OF BEGINNING**, said permanent conservation easement containing 0.878 acres, more or less.

4. Permanent Conservation Easement (Ref: PIN: 663101150408) (CE-4)

A permanent conservation easement over a portion of land in Harris Township, Stanly County, North Carolina, as shown on a map entitled *"Town Creek Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of David Lee Harward,"* dated November 21, 2013, and recorded in Plat Book 23, Page 234 & 235, of the Stanly County Registry, and being a portion of the parcel owned by *David Lee Harward* (PIN: 663101150408), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X=1630276.26, Y=614976.29, and identified as Control Point # 3 on the above referenced plat and running S 68°46'51"W , 62.69', to a point identified as conservation easement corner #12, which is the **POINT AND PLACE OF BEGINNING**; thence continuing the following courses and distances:

S 44°13'05" E, 165.38', thence
S 13°37'27" E, 168.58, thence
S 57°56'43" E, 137.70', thence
S 34°30'52" E, 193.14', thence
S 19°03'52" E, 140.21', thence
S 39°24'14" E, 174.91', thence
S 27°56'14" E, 207.42', thence
N 82°37'53" W, 181.93', thence
N 33°23'34" W, 271.38', thence
N 26°00'20" W, 304.53', thence
N 82°03'18" W, 134.18', thence
N 41°09'09" W, 63.55', thence
N 00°26'00" E, 375.52', to the **POINT AND PLACE OF BEGINNING**, said permanent conservation easement containing 3.589 acres, more or less.

5. Permanent Conservation Easement (Ref: PIN: 663101150408) (CE-5)

A permanent conservation easement over a portion of land in Harris Township, Stanly County, North Carolina, as shown on a map entitled *"Town Creek Conservation Easement Survey for State of North Carolina - Ecosystem Enhancement Program on the property of David Lee Harward,"* dated November 21, 2013, and recorded in Plat Book 23, Page 234 & 235, of the Stanly County Registry, and being a portion of the parcel owned by *David Lee Harward* (PIN: 663101150408), more particularly described as follows:

Commencing at an iron bar and cap with NC Grid coordinates of X=1630860.98, Y=613754.25, and identified as Control Point # 1 on the above referenced plat and running N 04°26'24" E, 206.11, to a point identified as conservation easement corner #28, which is the **POINT AND PLACE OF BEGINNING**; thence continuing the following courses and distances:

S 27°38'31" E, 71.09, thence
S 03°48'55" W, 190.72', thence
N 87°46'25" E, 214.90', thence
N 00°01'40" W, 270.12', thence
S 82°37'10" W, 196.20', to the **POINT AND PLACE OF BEGINNING**, said permanent conservation easement containing 1.307 acres, more or less.

6. Access to the Permanent Conservation Easements

Access to and through the permanent conservation easement described above and conveyed herein, shall be (1) as provided in this deed, (2) as provided on the Plat referenced below (see Note 8., Sheet 1 of 2); to provide ingress, egress, and regress for purposes of accessing the permanent conservation easement(s) set forth above, and as shown on the map recorded in Plat Book 23, Pages 234 & 235 of the Stanly County Registry.

00361051

OWNER(S) CERTIFICATE

PIN: 6621-04-94-3597
PIN: 6631-01-15-0408
PIN: 6621-02-96-4027

I DAVID LEE HARWARD, HEREBY CERTIFY THAT I AM THE OWNER OF THE PROPERTIES SHOWN AND DESCRIBED HEREON, WHICH WERE CONVEYED AND (DEVISED) TO ME BY THE LAST WILL AND TESTAMENT OF JOHNNY B. HARWARD, AS FILED WITH THE CLERK OF SUPERIOR COURT OF STANLY COUNTY, NORTH CAROLINA AS FILE No. 03-E-487 ON NOVEMBER 26, 2003. THE AFOREMENTIONED PROPERTIES WERE ACQUIRED BY THE DECEDENT, JOHNNY B. HARWARD, THROUGH DEEDS RECORDED IN DEED BOOK 203, PAGE 368 (PIN: 6621-04-94-3597), DEED BOOK 202, PAGE 226 (PIN: 6621-02-96-4027), AND DEED BOOK 284, PAGE 221 (PIN: 6631-01-15-0408), OF THE STANLY COUNTY REGISTRY; AND THAT I HEREBY ADOPT THIS PLAN OF SUBDIVISION AND GRANT AND CONVEY THE EASEMENTS HEREIN WITH FREE CONSENT AND HEREBY CERTIFY THAT THE LAND AS SHOWN HEREON IS WITHIN THE SUBDIVISION REGULATION JURISDICTIONS OF STANLY COUNTY, NORTH CAROLINA. KIMBERLY COMER HARWARD EXECUTES THIS CERTIFICATE AS A RESULT OF HER MARITAL RIGHTS WITH RESPECT TO THE PROPERTY.

David Lee Harward — 12-27-13
DAVID LEE HARWARD — DATE

Kimberly Comer Harward — 12-27-13
KIMBERLY COMER HARWARD — DATE

STATE OF NORTH CAROLINA
COUNTY OF WAKE

I, Robert H. Merritt, Jr. A NOTARY PUBLIC FOR THE COUNTY AND STATE AFORESAID, DO HEREBY CERTIFY THAT DAVID LEE HARWARD AND WIFE, KIMBERLY COMER HARWARD, PERSONALLY APPEARED BEFORE ME THIS DAY AND ACKNOWLEDGED THE DUE EXECUTION OF THE FOREGOING INSTRUMENT.

WITNESS MY HAND AND OFFICIAL STAMP OR SEAL THIS 27th DAY OF December, 2013.

Robert H. Merritt, Jr.

MY COMMISSION EXPIRES: 5-1-2017

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

NOTES

1. THE PURPOSE OF THIS PLAT IS TO IDENTIFY THE EXTENT AND LOCATION OF CONSERVATION EASEMENTS DEPICTED AS CE-1 THROUGH CE-5, HEREIN.

2. BOUNDARY INFORMATION IS DERIVED FROM FIELD SURVEY, DEEDS, PLATS, GIS DATA, AND TAX RECORDS OF THE STANLY COUNTY REGISTRY AS SHOWN HEREON. SURVEYED BOUNDARY LINES ARE SHOWN AS SOLID LINES.

THE NORTHERLY BOUNDARY OF CE-1 (L5) AND THEN SOUTHERLY BOUNDARY OF CE-5 (L32) ARE OFFSET FROM EXISTING FENCE LINE ~10FT FOR MAINTENANCE ACCESS.

3. NORTH CAROLINA GRID COORDINATES FOR GPS DERIVED CONTROL POINTS WERE ESTABLISHED BY MICHAEL BAKER ENGINEERING, INC. (COMBINED FACTOR=0.999853380)

4. ALL DISTANCES ARE HORIZONTAL GROUND UNLESS OTHERWISE NOTED.

5. THE BEARING BASIS FOR THIS PLAT IS NAD 83 (NC GRID).

6. ALL AREAS SHOWN WERE CALCULATED BY COORDINATE COMPUTATION.

7. ALL CONSERVATION EASEMENT POINTS ARE MONUMENTED WITH REBAR AND CAP.

8. THE RIGHT(S) OF NON-EXCLUSIVE INGRESS, EGRESS, AND REGRESS OVER AND ALONG ANY AND ALL EXISTING PATHS/ROADS (INCLUDING PUBLIC R/W), TRANSECTING SUBJECT PROPERTY ARE RESERVED BY THE GRANTOR(S) AND THE GRANTEE(S) OF THE CONSERVATION EASEMENTS FOR THE USES AND PURPOSES NOT INCONSISTENT WITH THE USES OF CE-1 THRU CE-5, DESCRIBED HEREON FOR CONSERVATION EASEMENT PURPOSES.

THE SOIL/GRAVEL PATHS/ROADS DEPICTED ON THIS PLAT WERE PLOTTED FROM GIS OR AERIAL PHOTOGRAPHY DATA AND MAY NOT INCLUDE ALL SUCH PATHS TRANSECTING SUBJECT PROPERTY.

EASEMENT CORNERS

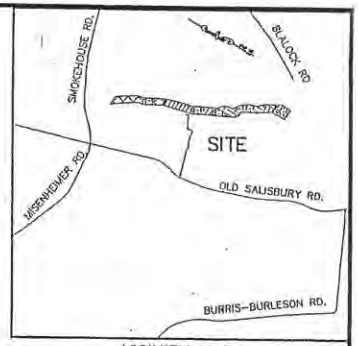
Point	Northing	Easting
1	615893.15	1629862.78
2	615966.81	1629736.82
3	616200.40	1629581.03
4	616325.74	1629538.28
5	616760.26	1629239.18
6	616745.73	1629418.01
7	616367.59	1629657.85
8	616265.82	1629671.00
9	615876.44	1629876.39
10	615565.39	1629973.90
11	615386.82	1630004.17
12	614953.60	1630217.82
13	615022.12	1630014.67
14	615284.42	1629676.40
15	615847.57	1629743.72
16	614895.06	1630333.15
17	614671.24	1630372.88
18	614508.16	1630489.570
19	614439.01	1630599.00
20	614306.49	1630644.80
21	614171.33	1630756.83
22	613988.06	1630853.01
23	614011.42	1630872.58
24	614236.00	1630523.22
25	614511.70	1630368.69
26	614530.25	1630268.80
27	614678.10	1630214.98
28	613959.74	1630876.04
29	613896.77	1630909.92
30	613708.48	1630897.23
31	613714.82	1630682.49
32	613864.85	1630682.38

REVIEW OFFICER CERTIFICATION

STATE OF NORTH CAROLINA
COUNTY OF STANLY

I Michael M. Sawby, REVIEW OFFICER OF STANLY COUNTY. CERTIFY THAT THE MAP OR PLAT TO WHICH THIS CERTIFICATE IS AFFIXED MEETS ALL STATUTORY REQUIREMENTS FOR RECORDING.

REVIEW OFFICER — 12-27-13 — DATE



VICINITY MAP
NTS

CONSERVATION EASEMENT AREA SUMMARY

CE-1 PIN: 6621-02-96-4027	2.952 Acres
CE-2 PIN: 6621-02-96-4027	3.245 Acres
CE-3 PIN: 6621-04-94-3597	0.878 Acres
CE-4 PIN: 6631-01-15-0408	3.589 Acres
CE-5 PIN: 6631-01-15-0408	1.307 Acres

PIN: 6621-02-96-4027 (6.197 ACRES)
PIN: 6621-04-94-3597 (0.878 ACRES)
PIN: 6631-01-15-0408 (4.896 ACRES)
TOTAL: 11.971 Acres

REFERENCES

STANLY COUNTY REGISTRY

ESTATE FILE 03-E-487
DB 340, PG 602
DB 978, PG 996
DB 202, PG 226
DB 242, PG 436
DB 264, PG 221
DB 709, PG 551
DB 203, PG 368
DB 201, PG 078
DB 1088, PG 054
DB 352, PG 909

THIS PLAT IS APPROVED BY THE STANLY COUNTY PLANNING DEPARTMENT.

PLANNING OFFICER — 12-27-13 — DATE

BOOK 23 PAGE 234(2) 360887
1 of 2
Filed: 12/27/2013 12:16:05 PM
Suzanne W. Lowder, Register of Deeds
Stanly County, NC

SURVEYOR'S CERTIFICATION

I, MARSHALL WIGHT, DO HEREBY CERTIFY THAT THIS SURVEY IS OF ANOTHER CATEGORY AND IS AN EXCEPTION TO THE DEFINITION OF SUBDIVISION.

MARSHALL WIGHT, RLS — L-5034

I, MARSHALL WIGHT, CERTIFY THAT THIS PLAT WAS DRAWN UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION USING REFERENCES SHOWN HEREON; THAT THE BOUNDARIES NOT SURVEYED ARE SHOWN AS BROKEN LINES PLOTTED FROM INFORMATION SHOWN HEREON; THAT THE RATIO OF PRECISION AS CALCULATED IS 1:10,000+; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH G.S. 47-30 AS AMENDED. WITNESS MY ORIGINAL SIGNATURE, REGISTRATION NUMBER, AND SEAL THIS 26 DAY OF December, 2013.

MARSHALL WIGHT, PLS — L-5034

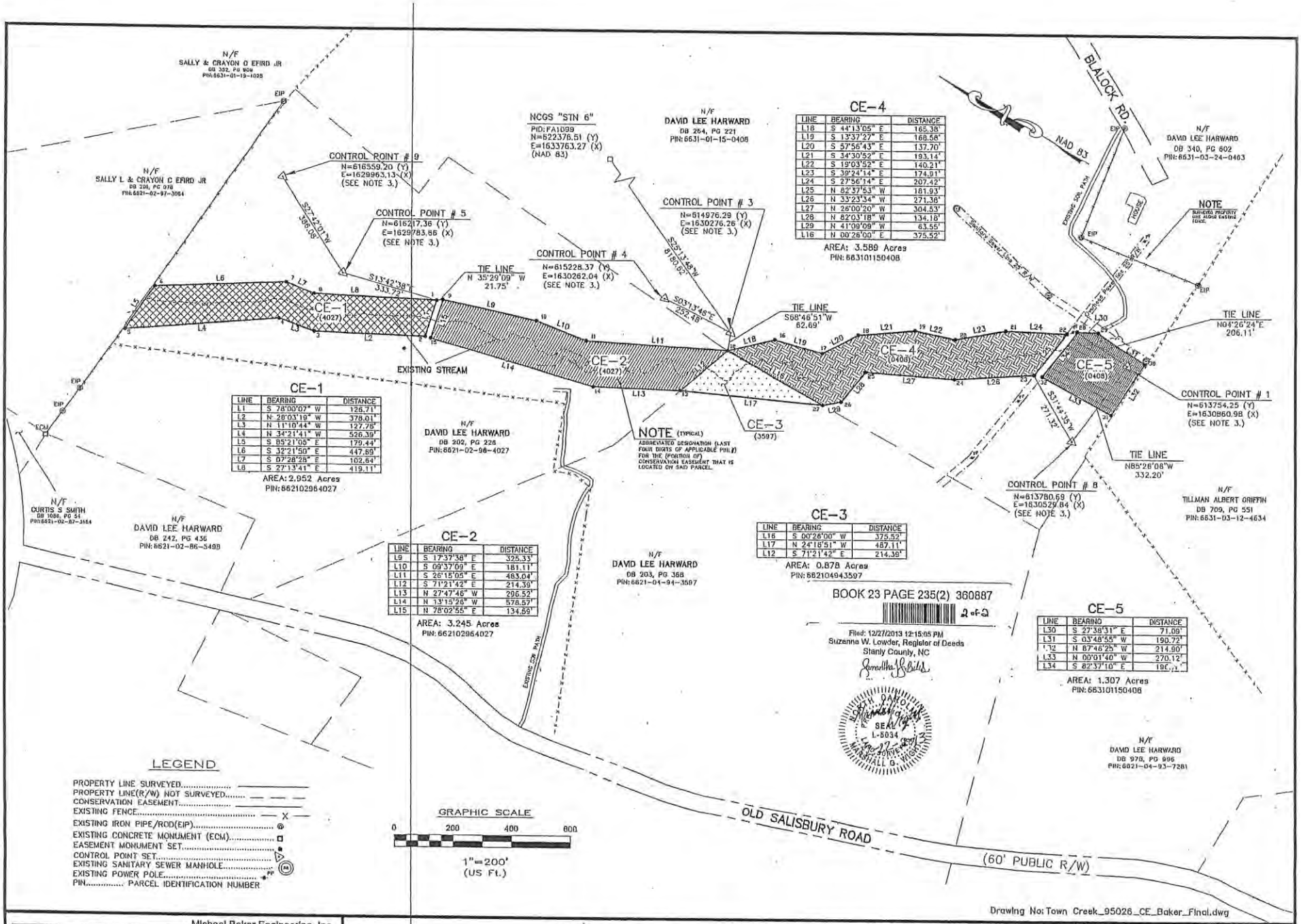
NORTH CAROLINA SEAL L-5034 MARSHALL G. WIGHT SURVEYOR 12-26-2013

Drawing No: Town Creek_95026_CE_Baker_Final.dwg

Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
License: F-1084

TOWN CREEK CONSERVATION EASEMENT SURVEY
FOR
STATE OF NORTH CAROLINA – ECOSYSTEM ENHANCEMENT PROGRAM
ON THE PROPERTY OF
DAVID LEE HARWARD
HARRIS TOWNSHIP — STANLY COUNTY — NORTH CAROLINA

BE Project No.: 124526
EEP Site ID number (95026)
Date: NOVEMBER 21, 2013
Scale: 1"=200'
Drawing: 124526PLAT.DWG
SHEET 1 of 2



Drawing No: Town Creek_95026_CE_Baker_Final.dwg

Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490
License: F-1084

TOWN CREEK CONSERVATION EASEMENT SURVEY

FOR

STATE OF NORTH CAROLINA — ECOSYSTEM ENHANCEMENT PROGRAM

ON THE PROPERTY OF

DAVID LEE HARWARD

HARRIS TOWNSHIP STANLY COUNTY NORTH CAROLINA

BE Project No.: 124526
EEP Site ID number (95026)
Date: NOVEMBER 21, 2013
Scale: 1"=200'
Drawing: 124526PLAT.DWG

16.0 APPENDIX B - BASELINE INFORMATION DATA

16.1 USACE Routine Wetland Determination Forms – per regional supplement to 1987 Manual

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Town Creek City/County: Stanly Sampling Date: 7-19-11
Applicant/Owner: Baker State: NC Sampling Point: W1 DP
Investigator(s): K. Suggs / J. Eckardt Section, Township, Range: —
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): 0 (Flat)
Subregion (LRR or MLRA): Lat: Long: Datum:
Soil Map Unit Name: NWI classification: Pond
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No (If no, explain in Remarks.)
Are Vegetation ✓, Soil ✓, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes No ✓
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks:
Wetland located in a relic farm pond located in right floodplain at toe of hillslope.

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

Wetland Hydrology Present? Yes ✓ No

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

Remarks:
- Minor amount of surface water at downstream end of polygon. Greater amounts of surface water observed in site visits in December/January prior.

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

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		
Herb Stratum (Plot size: _____)			
1. Smartweed (Polygonum spp.)	20	Y	FACW
2. Duck potato (Sagittaria spp.)	20	Y	OBL
3. Parrot feather (Myriophyllum aquaticum)	5		OBL
4. Spikerush (Eleocharis palustris)	5		OBL
5. Creeping grass (Macrostegium vimineum)	5		FAC
6. Sedges (Carex lupuline)	20	Y	OBL
7. Juncus coriaceus	5		FACW
8. Dog Fennel (Eupatorium capnifolium)	1		FACU
9. Buttercup (Ranunculus acris L.)	1		FACW
10.			
11.			
12.			
	= Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
	= Total Cover		

Dominance Test worksheet:

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

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 150 SW (A/B)

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No _____

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
0-7	5Y 5/1	50	7.5YR 4/6	20			Clayey Loam	
7-10	5Y 4/1	80	7.5YR 3/4	15			Clayey Loam	
10-12	5Y 5/2	50	7.5YR 4/6	15			Loam	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Town Crk City/County: Stanly Sampling Date: 7/21/11
Applicant/Owner: BAKER State: NC Sampling Point: WZ
Investigator(s): IE KS Section, Township, Range: New London
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): Ø
Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: _____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation ✓, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No ✓
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks: AREA IS FREQUENTLY ACCESSED BY CATTLE & HAVE CAUSED SOIL COMPACTION & RUTTED AREAS

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) (aq. worms in soil layer)
- ___ 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 _____

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

Remarks: Soil w/in 0-12 inches are damp to the touch. No significant rain event has occurred w/in past 72hrs.

W2

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

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. RED MAPLE (ACER RUBRUM)	50	Y	FAC
2. SWEET GUM (Liquidambar styraciflua)	5		FAC
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size:)			
1. Chinese privet (Ligustrum sinese)			FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size:)			
1. Smart weed (Polygonum spp)	<1%		FAC
2. False nettle (Boehmeria cylindrica)	90%	Y	FACW
3. Microstegium vimineum	4%		FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		

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

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

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
0-8	2.5Y 5/3	60%	7.5YR 4/6	20	C	PL	Silty Loam	
8-12	2.5Y 5/2	40%	7.5YR 3/4	30	RM	M	Silty Loam	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks: CONNECTS TO UT (REACH 5)

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: TOWN CRK. City/County: Stanly Sampling Date: 7/21/11
Applicant/Owner: Baker State: NC Sampling Point: W3
Investigator(s): JE + KS Section, Township, Range: NEW LONDON
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0
Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____
Soil Map Unit Name: _____ NWI classification: None
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No _____ (If no, explain in Remarks.)
Are Vegetation ✓, Soil ✓, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No ✓
Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks: AREA FREQUENTED BY CATTLE CAUSING CAVE COMPACTION + HOOF DISTURBANCE

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 _____

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

Remarks: Wetland area abuts channel

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

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Sweetgum (Liquidambar styraciflua)	70	Y	FAC
2. Shagbark Hickory (Carya ovata)	<5		FACU
3.			
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Microstegium vimineum	90	Y	FAC
2. False nettle (Boehmeria cylindrica)	<5		FACW
3. Smartweed (Polygonum sp.)	<5		FAC
4. Juncus coriaceus (Rush)	<5		FACW
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No _____

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

Vegetation is sparse in areas where water staining on leaves is present.

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
0-7	2.5Y 6/3	80	7.5YR 4/6	10			Silty Loam	
7-12	2.5Y 6/2	60	7.5YR 5/8	15			"	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

depressional area in floodplain and above channel

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: TOWN CK City/County: STANLY Sampling Date: 7/21/11

Applicant/Owner: BAKER State: NC Sampling Point: W4

Investigator(s): IE & KS Section, Township, Range: NEW LONDON

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: N/A

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

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

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

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

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

Remarks: AREA FREQUENTED BY LIVESTOCK. ACTS AS A CONVEYANCE DURING HIGH FLOW CONDITIONS. ABUTS RCH 5.

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 _____

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

Remarks: ABUTS CHANNEL

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

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Sweetgum (Liquidambar styraciflua	90	✓	FAC
2. Am. Elm (Ulmus americana	<10		FACW
3.			
4.			
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size:)			
1. Macrostegium virmineum	<5		FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		

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

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	90	x 3 =	270
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

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

Area is mostly devoid of vegetation due to being frequently inundated w/ water + accessed by cattle

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)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-2	2.5y 5/2	60	7.5yr 4/6	20			clay loam	
2-6	2.5y 5/1	60	7.5yr 4/6	20			clay loam	
6-9	2.5y 6/1	60	7.5yr 4/6	5			silt loam	
9-12	2.5y 6/2	70	10yr 10/8	20			silt loam	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Town Creek City/County: Stanly Sampling Date: 7/21/11

Applicant/Owner: Baker State: NC Sampling Point: WS

Investigator(s): IE + KS Section, Township, Range: New London

Landform (hillslope, terrace, etc.): floodplain @ toe of slope Local relief (concave, convex, none): Concave Slope (%): <1

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

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

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

Remarks: Area frequently accessed by cattle

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 _____

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

Remarks:

Located in floodplain @ toe of slope. Abuts channel. Likely acts as a conveyance during high flows. Vegetation sparse due to being freq inundated during high flows.

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

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Green Ash (Fraxinus pennsylvanica	5		FACW
2. Tulip Poplar (Liriodendron tulipifera)	5		FACU
3. Sweet Gum (Liquidambar styraciflua	15	✓	FAC
4. Red Maple (Acer rubrum)	5		FAC
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size:)			
1. Macrostegium virmeanum	40	✓	FAC
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		

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

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species	5	x 2 =	10
FAC species	65	x 3 =	195
FACU species	5	x 4 =	20
UPL species		x 5 =	
Column Totals:	75 (A)		225 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

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

Lack of vegetation in linear feature mostly likely due to freq. inundation of water in high flows.

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
0-7	2.5y 6/2	60	7.5yr 5/6	15			Clay Loam	
7-12	2.5 y 5/3	25	7.5yr 5/8	30			clay loam	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Site: Town Creek City/County: Stanly Sampling Date: 7/21/11

Applicant/Owner: BAKER State: NC Sampling Point: WG

Investigator(s): JE + KS Section, Township, Range: NEW LONDON

Landform (hillslope, terrace, etc.): floodplain toe of slope Local relief (concave, convex, none): concave Slope (%): 0

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

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

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

Remarks:

HYDROLOGY

Wetland Hydrology Indicators:

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

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1)
- ___ Sediment Deposits (B2)
- ___ Drift Deposits (B3)
- ✓ Algal Mat or Crust (B4)
- ___ Iron Deposits (B5)
- ___ Inundation Visible on Aerial Imagery (B7)
- ✓ Water-Stained Leaves (B9)
- ___ Aquatic Fauna (B13)
- ___ 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 _____

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

Remarks: depressional area lies w/in floodplain of PEE5 @ the toe of slope.

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

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Green Ash (Fraxinus pennsylvanica)	75	✓	FACW
2. Sweetgum (Liquidambar styraciflua	10		FAC
3. Am. Elm (Ulmus americana)	5		FACW
4.			
5.			
6.			
7.			
8.			
	90	= Total Cover	

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size:)			
1. Macrasteguum Virginum	75%	✓	FAC
2. False Nettle (Boehmeria cylindrica	10		FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	85	= Total Cover	

Woody Vine Stratum (Plot size:)			
1. Trumpet Vine (Campsis radicans)	<1		FAC
2.			
3.			
4.			
5.			
6.			
	<1	= Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

✓ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

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

areas that look to be frequently inundated w/ water have minimal veg present

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
0-4	2.5y 5/2	70	7.5yr 5/8	20			loam	
4-10	2.5y 6/3	70	7.5yr 6/6	15			loam	
10-12	2.5y 7/1	80	10yr 6/6	20			loam	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Town Crk City/County: Stanly Sampling Date: 7/21/11

Applicant/Owner: Baker State: NC Sampling Point: WT

Investigator(s): JE + KS Section, Township, Range: NEW LONDON

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

Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

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

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

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

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

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

Remarks: linear wetland feature (approx 1ft wide) most likely conveys water during high flow events. Area frequently accessed by cattle.

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 _____

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

Remarks: juvenile crayfish found in soil sampled by auger abuts channel (they in is in a triangular pattern)

VEGETATION (Four Strata) – Use scientific names of plants. Sampling Point: W7

Tree Stratum (Plot size:)	Absolute % Cover	Dominant Species?	Indicator Status
1. Sweet Gum (Liquidambar styraciflua)	10		FAC
2. Chinese Privet (Ligustrum sinese)	10		FAC
3. Sourwood (Oxydendrum arboreum)	10		FACU
4. Am Elm (Ulmus americana)	10		FACW
5.			
6.			
7.			
8.			
	= Total Cover		

Sapling/Shrub Stratum (Plot size:)			
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
	= Total Cover		

Herb Stratum (Plot size:)			
1. Macrostegium vimeneum	90		FAC
2. False Nettle (Boehmeria cylindrica	5		FACW
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
	= Total Cover		

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

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

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

Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation

___ 2 - Dominance Test is >50%

___ 3 - Prevalence Index is ≤3.0[1]

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

___ Problematic Hydrophytic Vegetation[1] (Explain)

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No ___

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

Vegetation is sparse in wetland area mostly likely due to conveying water during high flow events.

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
0-3	2.5y 5/3	60	10yr 5/6	10			clay silt	
3-12	2.5y 5/1	80	10yr 7/6	5			clay silt	

[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)**

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)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No _____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont

Project/Site: Town Creek City/County: Stanly Sampling Date: 7-21-11
Applicant/Owner: Baker State: NC Sampling Point: Pond
Investigator(s): J. Eckardt ; K. Suggs Section, Township, Range: New London
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Concave Slope (%): 0
Subregion (LRR or MLRA): Lat: Long: Datum:
Soil Map Unit Name: NWI classification: POND
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ✓ No (If no, explain in Remarks.)
Are Vegetation ✓, Soil ✓, or Hydrology ✓ significantly disturbed? Are "Normal Circumstances" present? Yes No ✓
Are Vegetation , Soil , or Hydrology naturally problematic? (If needed, explain any answers in Remarks.)

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

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

Remarks: man made ag pond w/ breached dam in floodplain along UT to Town

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

Wetland Hydrology Present? Yes ✓ No

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

Remarks:

Majority of farm pond has standing water. During previous site visits inundation observed to toe of berm. Currently drier climatic conditions have exposed the edge around pond. Pond created for ag. purposes.

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

	Absolute % Cover	Dominant Species?	Indicator Status
Tree Stratum (Plot size: _____)			
1. Sweetgum (Liquidambar styraciflua)	2	FAC	
2. Red Maple (Acer Rubrum)	1	FAC	
3.			
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
7. Sallow Sedge (*Carex lurida*)			
8.			
9. Swamp beggar's tick			
10.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Juncus coriaceus	5	FACW	
2. Spikerush	20	FACW	yes
3. Smartweed	1	FAC	
4. Unknown Sedge Carex l.	5	FAC	
5. Unknown sunflower	5		
6. Common reed	20	FACW	Yes
7. Unknown herb.	5		
8.			
9.			
10.			
11.			
12.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
6.			
	_____ = Total Cover		

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

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

Prevalence Index worksheet:

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

Prevalence Index = B/A = _____

Hydrophytic Vegetation Indicators:

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

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

Definitions of Four Vegetation Strata:

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

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

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

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

Hydrophytic Vegetation Present? Yes ✓ No _____

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

ID unknowns from pics.

SOIL Sampling Point: P1

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
0-4	2.5y 5/2	70	7.5yr 4/6	20			CLAY LOAM	
4-14	5y 5/2	80	5yr 4/6	15			"	

[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)**

Indicators for Problematic Hydric Soils[3]:

- ___ 2 cm Muck (A10) **(MLRA 147)**
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- ___ Piedmont Floodplain Soils (F19) **(MLRA 136, 147)**
- ___ Red Parent Material (TF2)
- ___ Very Shallow Dark Surface (TF12)
- ___ Other (Explain in Remarks)

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

Restrictive Layer (if observed):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes ✓ No ___

Remarks:

SAMPLE AREA IS NORMALLY INUNDATED W/ WATER (VERIFICATION FROM PREVIOUS SITE VISITS) BUT SOIL WAS VISIBLE AT THE TIME OF SAMPLING. SEE PROFILE OF SOIL CORE ABOVE

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action I.D.: SAW-2014-00016 County: Stanly U.S.G.S. Quad: New London

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Property Owner/Agent: **David Harward**
Address: **43204 Blalock Road New London, NC 28127**
Telephone No.:

Property description:
Size (acres):
Nearest Waterway: Town Creek
Coordinates: 35.430279 / -80.238945
Nearest Town: New London
River Basin: Rocky Watershed; Upper Pee Dee Basin
Hydrologic Unit Code: 03040105

Location Description: The site is located between Old Salisbury Road and Blalock Road, south of Steakhouse Road in New London, Stanly County, North Carolina.

Indicate Which of the Following Apply:

A. Preliminary Determination

_ Based on preliminary information, there may be waters and wetlands on the above described property. We strongly suggest you have this property inspected to determine the extent of Department of the Army (DA) jurisdiction. To be considered final, a jurisdictional determination must be verified by the Corps. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331).). 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.

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 and Section 404 of the Clean Water Act. 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.

X There are waters and wetlands on the above described property 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 strongly suggest you have the waters and wetlands on your property delineated. Due to the size of your property and/or our present workload, the Corps may not be able to accomplish this wetland delineation in a timely manner. For a more timely delineation, you may wish to obtain a consultant. To be considered final, any delineation must be verified by the Corps.

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

_ The waters and 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 property 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.

Placement of dredged or fill material within waters of the US and/or wetlands without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Steve Kichefski** at **828-271-7980**.

C. Basis For Determination

The site contains wetlands as determined by the *1987 Corps of Engineers Wetland Delineation Manual* and the *Interim Regional Supplement to the Corps of Engineers Wetlands Delineation Manual: Eastern Mountain and Piedmont Region.* These wetlands are adjacent to stream channels located within the project area that exhibit indicators of ordinary high water marks. The stream channel within the project area is an unnamed tributary to Town Creek which flows into the Rocky Watershed; Upper Pee Dee Basin River. UT to Town Creek flows to the Atlantic Ocean via Town Creek, Little Long Creek, Long Creek, Rocky River and the Pee Dee River. The Pee Dee River is a Section 10 navigable water at the Blewett Falls Dam.

D. Remarks: JD for portion of property associated with NCEEP restoration project.

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)

Attached to this verification is an approved jurisdictional determination. If you are not in agreement with that approved jurisdictional determination, you can make an administrative appeal under 33 CFR 331. Enclosed you will find a 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 March 3, 2014.

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: Steve Kichefski SK

Issue Date: **January 2, 2014** Expiration Date: **January 2, 2019**

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 the Customer Satisfaction Survey located at our website at http://per2.nwp.usace.army.mil/survey.html to complete the survey online.

CF: Kristi Suggs, Michael Baker Engineering, Inc., 5550 Seventy-Seven Center Drive, Ste. 320, Charlotte, NC 28217

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:
Steve Kichefski, Project Manager USACE, Asheville Regulatory Field Office 151 Patton Ave RM 208 Asheville, NC 28806 828-271-7980	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: Steve Kichefski, 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

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant: David Harward	File Number: SAW-2014-00016	Date: January 2, 2014
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
X	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/CECW/Pages/reg_materials.aspx or Corps regulations at 33 CFR Part 331.

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

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

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

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

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

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

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

16.2 NCWAM Forms – Existing Wetlands

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 1 **Date** 7/19/2011

Wetland Type Floodplain Pool **Assessor Name/Organization** K.Suggs / Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

( ) Yes (•) No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.436836 / -80.243576

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

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

Is the assessment area intensively managed? (•) Yes ( ) No

Regulatory Considerations (select all that apply to the assessment area)

- [ ] Anadromous fish
- [ ] Federally protected species or State endangered or threatened species
- [ ] NCDWQ 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
- [x] Brownwater
- [ ] Tidal (if tidal, check one of the following boxes) ( ) Lunar ( ) Wind ( ) Both

Is the assessment area on a coastal island? ( ) Yes (•) No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ( ) Yes (•) No

Does the assessment area experience overbank flooding during normal rainfall conditions? (•) Yes ( ) No

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ○ A ≥ 50 feet
- ◉ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ○ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

○ Yes ◉ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ☐ A No artificial edge within 150 feet in all directions
- ☐ B No artificial edge within 150 feet in four (4) to seven (7) directions
- ☉ C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

☉ Yes ☐ No If Yes, continue to 17b. If No, skip to Metric 18.

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

☐ A ≥ 25% coverage of vegetation
☐ B < 25% coverage of vegetation

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

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

18. Snags – wetland type condition metric

☐ 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

☐ 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

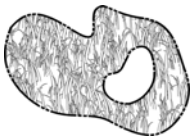
Include both natural debris and man-placed natural debris.

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

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

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

☐ A 

☐ B 

☐ C 

☐ D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 1	Date	7/19/2011
Wetland Type	Floodplain Pool	Assessor Name/Organization	K.Suggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 2 **Date** 7/21/11

Wetland Type Headwater Forest **Assessor Name/Organization** Ksuggs/Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

○ Yes ○ No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.431599 / -80.240303

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

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

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations (select all that apply to the assessment area)

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

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

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

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

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

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

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ☐ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ☐ A ≥ 50 feet
- ◉ B From 30 to < 50 feet
- ☐ C From 15 to < 30 feet
- ☐ D From 5 to < 15 feet
- ☐ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ☐ > 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

◉ Yes ☐ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ○ A No artificial edge within 150 feet in all directions
- ○ B No artificial edge within 150 feet in four (4) to seven (7) directions
- ◉ C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

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

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

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

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

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

18. Snags – wetland type condition metric

( ) 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

( ) 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.

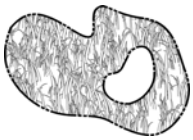
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.

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

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

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

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

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 2	Date	7/21/11
Wetland Type	Headwater Forest	Assessor Name/Organization	Ksuggs/Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 3 **Date** 7/21/11

Wetland Type Headwater Forest **Assessor Name/Organization** KSuggs / Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

○ Yes ◉ No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.431999 / -80.240601

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

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

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations (select all that apply to the assessment area)

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

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

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

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

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

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

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ○ A ≥ 50 feet
- ◉ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ○ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

○ Yes ◉ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ☐ A No artificial edge within 150 feet in all directions
- ◉ B No artificial edge within 150 feet in four (4) to seven (7) directions
- ☐ C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

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

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

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

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

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

18. Snags – wetland type condition metric

( ) 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

( ) 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.

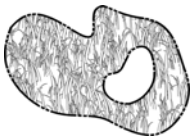
20. Large Woody Debris – wetland type condition metric

Include both natural debris and man-placed natural debris.

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

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

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

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

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 3	Date	7/21/11
Wetland Type	Headwater Forest	Assessor Name/Organization	KSuggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 4 **Date** 7/21/11

Wetland Type Headwater Forest **Assessor Name/Organization** KSuggs / Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

○ Yes ◉ No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.434399 / -80.242401

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

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

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations (select all that apply to the assessment area)

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

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

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

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

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

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

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ☐ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ☐ A ≥ 50 feet
- ☐ B From 30 to < 50 feet
- ◉ C From 15 to < 30 feet
- ☐ D From 5 to < 15 feet
- ☐ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ☐ > 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

☐ Yes ◉ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ( ) A No artificial edge within 150 feet in all directions
- (●) B No artificial edge within 150 feet in four (4) to seven (7) directions
- ( ) C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

☉ Yes ○ No If Yes, continue to 17b. If No, skip to Metric 18.

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

○ A ≥ 25% coverage of vegetation
○ B < 25% coverage of vegetation

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

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

18. Snags – wetland type condition metric

○ 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

○ 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

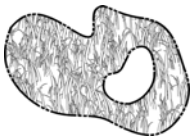
Include both natural debris and man-placed natural debris.

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

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

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

○ A 

○ B 

○ C 

○ D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 4	Date	7/21/11
Wetland Type	Headwater Forest	Assessor Name/Organization	KSuggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 5 **Date** 7/21/11

Wetland Type Headwater Forest **Assessor Name/Organization** KSuggs / Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

○ Yes ◉ No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.434502 / -80.242302

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

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

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations (select all that apply to the assessment area)

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

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

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

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

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

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

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ☐ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ☐ A ≥ 50 feet
- ☐ B From 30 to < 50 feet
- ☐ C From 15 to < 30 feet
- ◉ D From 5 to < 15 feet
- ☐ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ☐ > 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

◉ Yes ☐ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ( ) A No artificial edge within 150 feet in all directions
- (●) B No artificial edge within 150 feet in four (4) to seven (7) directions
- ( ) C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

☉ Yes ○ No If Yes, continue to 17b. If No, skip to Metric 18.

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

○ A ≥ 25% coverage of vegetation
○ B < 25% coverage of vegetation

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

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

18. Snags – wetland type condition metric

○ 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

○ 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

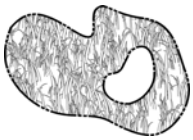
Include both natural debris and man-placed natural debris.

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

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

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

○ A 

○ B 

○ C 

○ D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 5	Date	7/21/11
Wetland Type	Headwater Forest	Assessor Name/Organization	KSuggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 6 **Date** 7/21/11

Wetland Type Headwater Forest **Assessor Name/Organization** KSuggs / Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

○ Yes ◉ No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.434299 / -80.242104

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

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

Is the assessment area intensively managed? ◉ Yes ○ No

Regulatory Considerations (select all that apply to the assessment area)

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

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

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

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

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

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

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

☐ Yes ◉ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ☐ A ≥ 50 feet
- ☐ B From 30 to < 50 feet
- ☐ C From 15 to < 30 feet
- ☐ D From 5 to < 15 feet
- ☐ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

☐ ≤ 15-feet wide ☐ > 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

☐ Yes ☐ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ( ) A No artificial edge within 150 feet in all directions
- (●) B No artificial edge within 150 feet in four (4) to seven (7) directions
- ( ) C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

☉ Yes ○ No If Yes, continue to 17b. If No, skip to Metric 18.

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

○ A ≥ 25% coverage of vegetation
○ B < 25% coverage of vegetation

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

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

18. Snags – wetland type condition metric

○ 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

○ 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

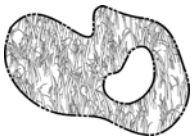
Include both natural debris and man-placed natural debris.

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

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

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

○ A 

○ B 

○ C 

○ D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 6	Date	7/21/11
Wetland Type	Headwater Forest	Assessor Name/Organization	KSuggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Wetland 7 **Date** 7/21/11

Wetland Type Headwater Forest **Assessor Name/Organization** KSuggs / Baker

Level III Ecoregion Piedmont **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee **USGS 8-Digit Catalogue Unit** 03040105

( ) Yes (•) No **Precipitation within 48 hrs?** **Latitude/Longitude (deci-degrees)** 35.434502 / -80.242401

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

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

Is the assessment area intensively managed? (•) Yes ( ) No

Regulatory Considerations (select all that apply to the assessment area)

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

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

- ( ) Blackwater
- (•) Brownwater
- [ ] Tidal (if tidal, check one of the following boxes) ( ) Lunar ( ) Wind ( ) Both

Is the assessment area on a coastal island? ( ) Yes (•) No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ( ) Yes (•) No

Does the assessment area experience overbank flooding during normal rainfall conditions? (•) Yes ( ) No

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ○ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ○ A ≥ 50 feet
- ○ B From 30 to < 50 feet
- ○ C From 15 to < 30 feet
- ○ D From 5 to < 15 feet
- ◉ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ○ > 15-feet wide ○ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

○ Yes ◉ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ( ) A No artificial edge within 150 feet in all directions
- ( ) B No artificial edge within 150 feet in four (4) to seven (7) directions
- (●) C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

☉ Yes ○ No If Yes, continue to 17b. If No, skip to Metric 18.

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

○ A ≥ 25% coverage of vegetation
○ B < 25% coverage of vegetation

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

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

18. Snags – wetland type condition metric

○ 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

○ 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

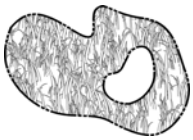
Include both natural debris and man-placed natural debris.

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

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

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

○ A 

○ B 

○ C 

○ D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Wetland 7	Date	7/21/11
Wetland Type	Headwater Forest	Assessor Name/Organization	KSuggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name Pond | **Date** 7/21/11

Wetland Type Floodplain Pool | **Assessor Name/Organization** KSuggs / Baker

Level III Ecoregion Piedmont | **Nearest Named Water Body** Tributary to Town Creek

River Basin Yadkin-PeeDee | **USGS 8-Digit Catalogue Unit** 03040105

( ) Yes (•) No **Precipitation within 48 hrs?** | **Latitude/Longitude (deci-degrees)** 35.430500 / -80.239502

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

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

Is the assessment area intensively managed? (•) Yes ( ) No

Regulatory Considerations (select all that apply to the assessment area)

- [ ] Anadromous fish
- [ ] Federally protected species or State endangered or threatened species
- [ ] NCDWQ 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
- [x] Brownwater
- [ ] Tidal (if tidal, check one of the following boxes) ( ) Lunar ( ) Wind ( ) Both

Is the assessment area on a coastal island? ( ) Yes (•) No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ( ) Yes (•) No

Does the assessment area experience overbank flooding during normal rainfall conditions? (•) Yes ( ) No

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

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

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric
Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. Refer to the current NRCS lateral effect of ditching guidance for North Carolina hydric soils (see USACE Wilmington District website) for the zone of influence of ditches in hydric soils. 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 ditch sub-surface water. Consider tidal flooding regime, if applicable.

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

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (answer for non-marsh wetlands only)
Check a box in each column for each group below. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

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

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

4. Soil Texture/Structure – assessment area condition metric

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

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

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

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

5. Discharge into Wetland – opportunity metric

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

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

6. Land Use – opportunity metric

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

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

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric

7a. Is assessment area within 50 feet of a tributary or other open water?

◉ Yes ☐ No If Yes, continue to 7b. If No, skip to Metric 8.

Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of the wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is weltand? Descriptor E should be selected if ditches effectively bypass the buffer.
- ◉ A ≥ 50 feet
- ☐ B From 30 to < 50 feet
- ☐ C From 15 to < 30 feet
- ☐ D From 5 to < 15 feet
- ☐ E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.

◉ ≤ 15-feet wide ☐ > 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?

☐ Yes ◉ No

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

8. Wetland Width at the Assessment Area – wetland type/wetland complex metric (evaluate for riparian wetlands 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 areas (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

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

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

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

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

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

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

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

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

13. Connectivity to Other Natural Areas – landscape condition metric

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

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

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

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

14. Edge Effect – wetland type condition metric (skip for all marshes)

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.

- ☐ A No artificial edge within 150 feet in all directions
- ☐ B No artificial edge within 150 feet in four (4) to seven (7) directions
- ◉ C An artificial edge occurs within 150 feet in more than four (4) directions or assessment area is clear-cut

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. Expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species). Exotic species are dominant in at least one stratum.

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

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

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

17a. Is vegetation present?

☉ Yes ☐ No If Yes, continue to 17b. If No, skip to Metric 18.

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

☐ A ≥ 25% coverage of vegetation
☐ B < 25% coverage of vegetation

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

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

18. Snags – wetland type condition metric

☐ 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

☐ 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

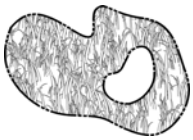
Include both natural debris and man-placed natural debris.

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

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

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

☐ A 

☐ B 

☐ C 

☐ D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands 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.

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

Notes

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 4.1
Rating Calculator Version 4.1

Wetland Site Name	Pond	Date	7/21/11
Wetland Type	Floodplain Pool	Assessor Name/Organization	KSuggs / Baker

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

Sub-function Rating Summary

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

Function Rating Summary

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

Overall Wetland Rating **HIGH**

16.3 NCDWR Stream Classification Forms

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

REACH 1 + 2 + 3 A

Date: 7/19/11	**Project/Site:** TOWN Crk	**Latitude:**
Evaluator: IE + KS	**County:** Stanly	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 32	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

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 = 7.5)				
12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	(1.5)	1	0.5	0
15. Sediment on plants or debris	0	0.5	(1)	1.5
16. Organic debris lines or piles	0	0.5	(1)	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 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: *BED + BANK CONTINUOUS & STRONG ALONG MAJORITY OF REACH. AREAS LACKING PROMINANT BED + BANK FEATURES ARE DUE TO CATTLE ACCESSING THE CHANNEL.

dragonfly nymph, water pennies, snails (left), aq. worm

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

RCH 3B

Date: 7-19-2011	**Project/Site:** Town Creek	**Latitude:**
Evaluator: KS & IE	**County:** Stanly	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 12.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	(0)	1	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	0	(1)	2	3
* 9. Grade control See below	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 6.5)				
Δ 12. Presence of Baseflow	0	(1)	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
O 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: * One large permanent bedrock outcrop but most other grade control within reach is not considered permanent

Sketch: Δ seasonal dry conditions most likely exacerbating low flow conditions.

O lack of riparian vegetation (canopy) available for litter input into the system

riffle beetle / water penny / left hand snail / damselfly / - abundance - weak diversity - mod to weak

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

Date: 1-3-11	**Project/Site:** UT2 to Town Creek Reaches 1, 2, & 3A	**Latitude:**
Evaluator: IE & KS	**County:** Stanly	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 37	**Stream Determination (circle one)** Ephemeral Intermittent (Perennial)	**Other** *e.g. Quad Name:*

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

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

B. Hydrology (Subtotal = 8.5)				
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 = 10.5)				
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 Willows in upstream/sedges	FACW = 0.75; (OBL = 1.5) Other = 0			

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

Notes: Channel has stronger definition within the wooded area (majority of reach). The very downstream section within the open pasture has less definition likely due to impairment from grazing activities and installation of culvert farm crossing.

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 1-3-11	**Project/Site:** UT2 to Town Creek Reach 3B	**Latitude:**
Evaluator: IE & KS	**County:** Stanly	**Longitude:**
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 27.25	**Stream Determination (circle one)** Ephemeral (Intermittent) Perennial	**Other** *e.g. Quad Name:*

A. Geomorphology (Subtotal = 11.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	(3)
2. Sinuosity of channel along thalweg	0	(1)	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	(2)	3
5. Active/relict floodplain	0	(1)	2	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	(0)	1	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	0.5	1	(1.5)
11. Second or greater order channel	(No = 0)		Yes = 3	

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

B. Hydrology (Subtotal = 8)				
12. Presence of Baseflow	0	1	2	(3)
13. Iron oxidizing bacteria	(0)	1	2	3
* 14. Leaf litter Lacking canopy for 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 Lacks canopy	(0)	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		(Yes = 3)	

C. Biology (Subtotal = 7.75)				
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: No canopy / Lacks organic debris

Sketch:

16.4 FHWA Categorical Exclusion Form

Appendix A

Categorical Exclusion Form for Ecosystem Enhancement Program Projects
Version 1.4

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

Part 1: General Project Information	
Project Name:	Town Creek Stream and Weltand Mitigation Project
County Name:	Stanly
EEP Number:	95026
Project Sponsor:	Michael Baker Engineering, Inc.
Project Contact Name:	Chris Yow, PE, CFM
Project Contact Address:	5550 Seventy-Seven Center Dr., Ste 320
Project Contact E-mail:	cyow@mbakercorp.com
EEP Project Manager:	Guy Pearce

Project Description

The Town Creek Stream Restoration Project will provide restore/enhance/preserve approximately 4,098 linear feet of stream and enhance approximately 0.44 acres of wetlands to mitigate for unavoidable impacts to DENR subbasin 03-07-13 and the targeted local watershed 03040105-060040 in the Yadkin River Basin. The project is located in Stanly County, approximately 1.3 miles west of the Town of New London. Proposed work will include the restoration of streams on prior converted farmland.

For Official Use Only

Reviewed By:

4/20/2012
Date

EEP Project Manager

Conditional Approved By:

Date

For Division Administrator FHWA

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

Final Approval By:

4-25-12
Date

For Division Administrator FHWA

Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☑ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☑ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☑ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☑ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☑ Yes ☐ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
4. Is the project "likely to adversely affect" the species and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☑ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☑ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A

16.5 FEMA Compliance - NCEEP Floodplain Requirements Checklist

The topography of the site supports the design without creating the potential for hydrologic trespass. The site is not located in a FEMA mapped area and therefore an extensive hydraulic analysis is not required to obtain a "No-Rise/No-Impact" certification. The project will also not require a Letter of Map Revision (LOMR) following construction in order to document changes (reductions) to Base Flood Elevations (BFEs). The NCEEP Floodplain Checklist is included.

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. Edward Curtis), NC Floodplain Mapping Unit (attn. John Gerber) and Ecosystem Enhancement Program.

Project Location

Name of project:	Town Creek Restoration Project – Option B
Name if stream or feature:	UT to Town Creek
County:	Stanly
Name of river basin:	Yadkin Pee-Dee
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Stanly County
DFIRM panel number for entire site:	6621 & 6631
Consultant name:	Kristi Suggs, Project Manager Michael Baker Engineering, Inc.
Phone number:	704-665-2206
Address:	5550 Seventy-Seven Center Drive, Suite 320 Charlotte, NC 28217

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500". The project site includes one unnamed tributary to Town Creek, approximately 1.5 miles northeast of the Town of New London (see Figure 2.1). The site lies within NC Division of Water Quality subbasin 03-07-13 and local watershed unit 03040105060-040. Currently, the project reaches (see Figure 2.2) are impacted by the historic draining of area streams for agricultural use, cattle access, and the lack of adequate riparian buffers. Project goals include approximately 2,780 linear feet (LF) of stream restoration and 960 LF of stream enhancement (Level I) to improve area water quality and the surrounding ecosystems and to obtain mitigation credit in the Yadkin Pee-Dee River Basin.

Summarize stream reaches or wetland areas according to their restoration priority.

Reach / Wetland	Linear Feet / Acreage	Priority
R1	316 LF	(Restoration)
R2	728 LF	(Enhancement I)
R3	1,630 LF	(Restoration)
R4	232 LF	(Enhancement I)
R5	834 LF	(Restoration)

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

☐ Yes ☑ No

If project is located in a SFHA, check how it was determined:

☐ Redelineation

☐ Detailed Study

☐ Limited Detail Study

☐ Approximate Study

☐ Don't know

List flood zone designation:

Check if applies:

☐ AE Zone

- ☐ Floodway
- ☐ Non-Encroachment
- ☐ None

☐ A Zone

- ☐ Local Setbacks Required
- ☐ No Local Setbacks Required

If local setbacks are required, list how many feet: No specific setbacks required for areas not requiring a CAMA permit.

FEMA Compliance_EEP Checklist_Town Creek.doc Page 2 of 4

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

☐ Yes ☑ No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, 919-807-4101)

Is community/county participating in the NFIP program?

☑ Yes ☐ No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: Edward Curtis, (919-715-8000 x369), CID 370512#

Name of Local Floodplain Administrator: Michael Sandy
Phone Number: 704-986-3665

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☑ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

☐ Other Requirements

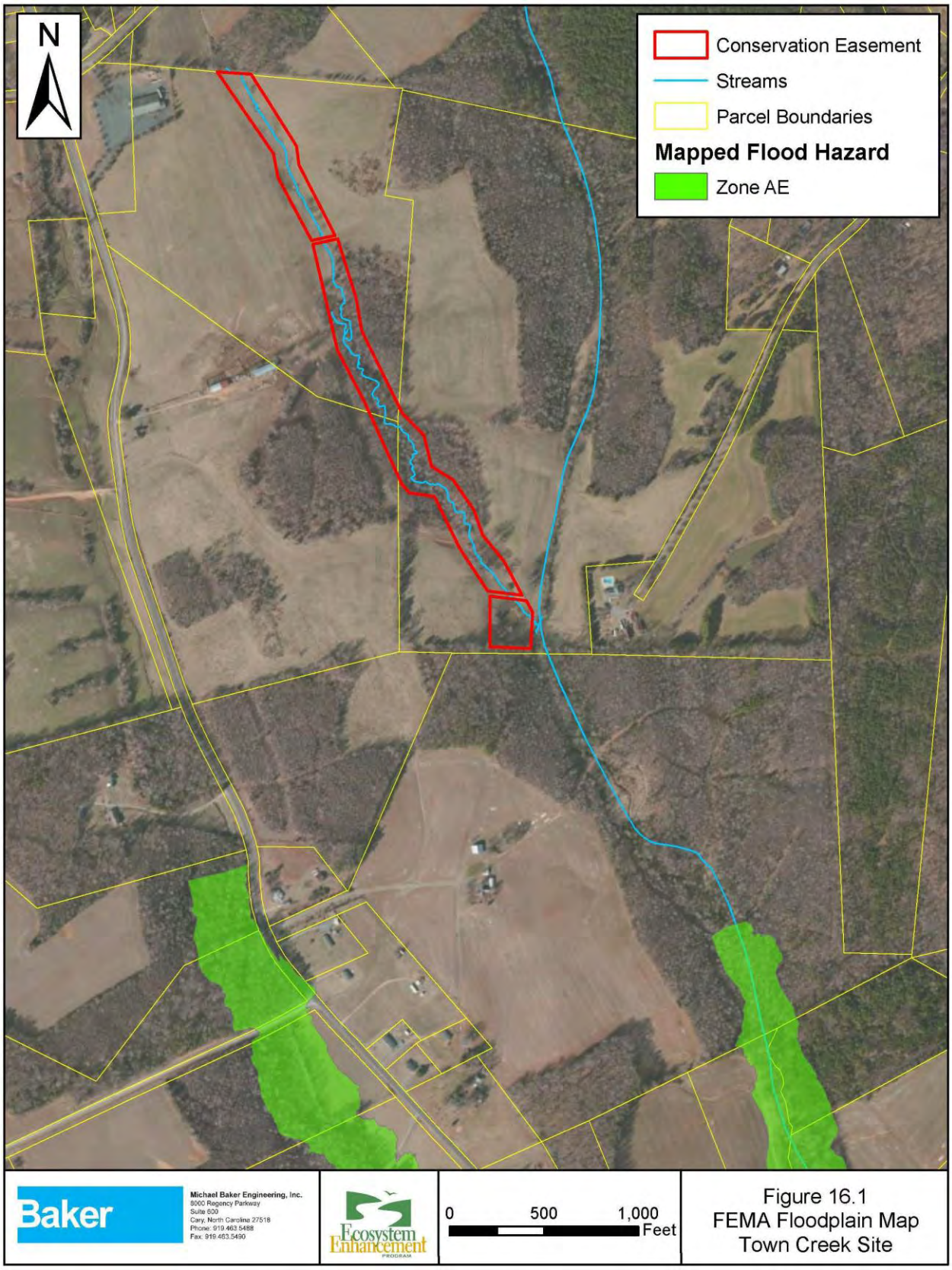
List other requirements:

Comments:

Name: Kristy Suggs Signature: Kristy Suggs

Title: Project Manager Date: 3-10-14

Figure 16.1 FEMA Floodplain Map



17.0 APPENDIX C - MITIGATION WORK PLAN DATA AND ANALYSES

17.1 Channel Morphology

17.1.1 Existing Conditions Assessment

17.1.1.1 Reach Classification Summary

The UT to Town Creek is a small, perennial stream with a total drainage area of approximately 0.20 square miles at the downstream terminus of Reach 5 (Figure 2.2). Historically, the project streams have been impacted by agricultural conversion and cattle grazing. Though the middle of the project site the reach is mostly wooded, some sections have become extremely unstable and are experiencing active widening and downcutting.

For analysis and design purposes, Baker labeled the length of stream within the project site Reach 1, 2, 3, 4 and 5. Reach 1 begins at the northernmost project boundary (upstream end of project site) and the stream flows south through an open pasture section. Reach 2 begins in this field area and continues into the beginning of the wooded area where Reach 3 begins. Reach 3 continues through much of wooded section and transitions to Reach 4, which continues through the lower part of the wooded section. Reach 4 transitions to Reach 5 upstream of the existing failing farm stream crossing. Reach 5 is the final project reach and continues to the confluence with the main stem of Town Creek.

Baker performed an existing conditions survey of the stream channels and floodplain, which included a longitudinal profile of all project reaches and eleven (11) representative cross-sections. Pebble counts, both reachwide and at riffle cross-sections, were conducted using the modified Wolman procedure (Wolman, 1954; Rosgen, 1996) to classify the streams bed material. Because reach breaks were determined after the cross-sectional data was collected, there is no cross-sectional data for Reach 4. In addition, though cross-sections X1 and X2 are physically located just downstream of the reach break for Reach 1, the cross-sectional data is indicative of Reach 1 and was therefore used for the Reach 1 existing conditions assessment. Table 17.1 represents geomorphic data compiled from the existing conditions survey. Cross-section locations and existing conditions data from the project reaches are depicted in Figure 17.1 and Figure 17.2, respectively. Pebble count distribution analyses are depicted in Figure 17.3. The total current length of the existing streams on the site is approximately 4,032 LF based on the field survey.

During field verification with the USACE of intermittent or perennial status, 654 LF of the upper section of the project reach was classified as an intermittent stream and the remaining 3,444 LF was determined to be a perennial stream. This determination was based on a minimum score of 30 for perennial streams and/or the presence of biological indicators using the NCDENR and NCDWR Determination of the Origin of Perennial Streams stream assessment protocol s and guidelines (see NCDWR stream forms and USACE JD approval in Appendix B).

Reach 1

Reach 1 begins at the north end of the project site and generally flows south 363 LF (existing channel length). Cattle currently have access to this reach and have severely

impacted the banks and channel, as evidenced by the hoof shear along the stream banks in this location. Rutted paths from livestock cross the channel in multiple locations. This reach appears to have been channelized into a straight pattern in the past; with a 90 degree bend at the property line to move the channel to a point from which is was then straightened down slope. This portion of Reach 1 is currently incised because of these modifications, and bank height ratios often exceed 1.5. At one location, a bedrock outcropping or large boulder has formed a knickpoint in the channel. However, lateral instability will likely cause further stream bank erosion, channel siltation and subsequent channel widening if left unaddressed.

The representative riffles in Reach 1 consist of fine gravel. Fine accumulations from streambank and floodplain erosion were observed in a few areas along the streambed where the channel slope flattens and allows fines to settle out of the water column. These bed material accumulations are likely due to the active stream bank erosion occurring along a majority of the reach and livestock ruts causing excess sediment into the stream.

Evidence of active stream bank erosion along Reach 1 was observed along more than 50 percent of the existing footage, predominantly in the form of surficial scour. The reach lacks woody buffer vegetation along most of the stream banks, with the buffer along the stream banks consisting of a grassed, pasture with an occasional tree. Based on existing conditions, Reach 1 is classified as an incised "Eb" Rosgen stream type, but does not have the higher sinuosity (k >1.5) typically associated with an E stream type given the narrow valley bottom and higher channel gradient.

Reach 2

Reach 2 begins at the south end of Reach 1 and flows south 737 LF (existing channel length) to a derelict ford stream crossing. Cattle currently have access to this reach and have severely impacted the channel morphology, as evidenced by the hoof shear along the stream banks in this location. Rutted paths from livestock cross the channel in multiple locations. This reach appears to have been channelized into a straight pattern in the past. On the right bank in the middle of this reach is a small wetland area that appears to have been a small livestock watering pond sometime in the past; however, now it has little depth and primarily supports wetland vegetation.

Reach 2 is incised and bank height ratios often exceed 1.5. Degradation of the reach will likely cause further channel incision, stream bank erosion, and subsequent channel widening if left unaddressed. A majority of the riffles in Reach 2 consist of medium gravel with some imbedded fine accumulations that likely originate from active stream bank erosion occurring throughout most of the reach, as well as from channel degradation caused by continuous and unimpeded livestock access to the stream.

Evidence of active stream bank erosion along Reach 2 was observed along more than 50 percent of the existing footage, predominantly in the form of surficial scour and small gullies in the banks. The reach lacks woody buffer vegetation along most of the stream banks, with the buffer along the stream banks consisting of a grassed pasture, with an occasional tree or clumps of trees, mainly black willows. Based on existing conditions, Reach 2 is classified as an incised "E" Rosgen stream type, but does not have the high sinuosity typically associated with an E stream type.

Reach 3

Reach 3 begins at the lower end of the cattle crossing, just below the end of Reach 2, and continues south into the forested middle section and has an approximate length of 1,849

LF (existing channel length). Reach 3 exhibits different geomorphic conditions than upstream Reaches 1 and 2. The initial 300 LF transitions from a straight channelized stream channel with high BHR's and a few trees in the buffer, to generally low BHRs, forested, meandering channel section. The first 300 LF is highly incised with bedrock outcroppings present through the section and large mature trees along the left bank. Below this initial section, the banks are much lower, the channel meanders across the floodplain and trees are scattered across a fairly wide flat buffer. The channel through this reach exhibits a profile that is relatively flat and then suddenly drops, over active headcuts, to the next flat "terrace" and is then relatively flat again until the next drop.

Cattle currently have access to this reach and have severely impacted the banks and channel, as evidenced by the hoof shear along the stream banks throughout this wooded section. In general, the upper section of this reach, below the first 300 LF, the BHRs are considerably lower (around 1.2). However, the channel pattern is considered slightly irregular when compared to similar reference reach streams within this geologic setting. This has likely developed as livestock have degraded banks, causing excessive sedimentation and more unnatural or lateral channel migration. These meanders are described as unstable because they run up-valley and have a radius of curvature that is much less than expected based on similar reference reach streams. Further downstream, the channel becomes more unstable and exhibits higher BHRs. This section of the Reach has significant incision, with typical BHRs of 2.0 or greater and multiple headcuts. Active stream bank erosion was observed throughout most of this section of Reach 3, predominantly in the form of surficial scour and mass wasting. Stream bank erosion here is widespread due primarily to on-going cattle access. Bed material within this reach are predominantly characteristic of fine gravel. Reach 3 is classified as an incised "C" Rosgen stream type.

Trees throughout the buffer along this reach are scattered throughout the floodplain and consist of a few mature species, but mostly younger successional trees. Chinese privet (*Ligustrum sinense*) and creeping grass (*Microstegium vimineum*) are prevalent in many locations as well. Scattered over the flood plain of this reach are small wetland areas and abandoned channels. These conditions present an exceptional opportunity for successful buffer restoration and enhancement activities.

Reach 4

Reach 4 begins at the lower end of Reach 3 and continues south to a point just north of an existing stream crossing at the lower end of the project and near where the forested section ends. This reach has an approximate channel length of 234 LF. Based on the geomorphic assessment, this reach exhibits stable conditions throughout the wooded section in the middle of the project reach. Reach 4 begins at the lower end of the deeply incised section of the previous reach. Throughout this reach, the BHRs are relatively low and average 1.0 to 1.3 based on observations within the reach. Cattle currently have access to this reach and have severely impacted the banks and channel, as evidenced by the hoof shear along the stream banks throughout this wooded section. Unlike Reach 3, the pattern has a relatively low slope and is more similar to the expected reference condition. The bed material consists of fine gravel, but excessive fine sediment accumulations were observed in some locations. Most of these fine sediments are being transported from excessive erosion upstream and from unstable stream banks within the reach.

Some sections of the riparian buffer along this reach exhibit relatively open canopy. However, there are still mature trees interspersed throughout the buffer and there are

young trees growing as well. Chinese privet (*Ligustrum sinense*) and creeping grass (*Microstegium vimineum*) are growing in many locations as well. Located on the floodplain of this reach are a couple of small wetlands with connecting high flow channels. This reach presents an exceptional opportunity for successful functional uplift through implementation of enhancement activities that will address repair of poor bank conditions and vegetation improvements.

Reach 5

Reach 5 begins at the lower end of Reach 4 at a point just north of the existing stream crossing at the lower end of the project and near where the forested section ends. This reach continues downstream through a dilapidated, culverted farm road crossing, across an existing sewer line, and to its confluence with Town Creek. The conservation easement at the lower end of this reach ends at the sewer line easement just upstream of the confluence. Much of the upper portion of Reach 5 contains a mature tree line at the top of the stream bank and is used by cattle as a loafing area. Consequently, it too is experiencing significant degradation. Within this section of the reach, the channel is cutting into the valley slope. Reach 5 is classified as an incised "E" Rosgen stream type. Cross-sectional riffle data depicts a substrate material of fine to medium gravel.

Livestock have negatively impacted the channel morphology and sediment has aggraded at the crossing due to backwater conditions from the pipe culvert being plugged in the past. The existing crossing has been degraded and sections of the concrete culvert have failed. This crossing has formed a significant drop in bed elevation between the upstream side and the downstream side. Immediately below this crossing is a stand of large, mature trees that livestock have used over the years for shade. Consequently, they have destroyed much of the natural channel morphology and understory buffer vegetation. The transition point between this stand of trees and the pasture below has a 2-3 foot headcut that has been stabilized by large roots from the mature trees. After the channel exits this stand of trees, it enters a short section of relatively open pasture that primarily has grassed banks. There are a few woody trees along the channel, but they are mostly Chinese privet (*Ligustrum sinense*) which is prevalent along much of the existing buffer.

On the right bank near the lower end of this reach is a small farm pond which has a degraded outflow control that results in minimal pond depth. The periphery of this pond has been identified as jurisdictional wetlands. This pond is included within the project conservation easement as a water quality feature, but is not being utilized to provide wetland credit. At the lower end of the reach is a sewer line easement, which has been excluded from the conservation easement.

Table 17.1 Representative Existing Conditions Geomorphic Data for Project Reaches: Stream Channel Classification Level II
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Parameter	Reach 1 & 2			
	XS1	XS2	XS3	XS4
Existing Reach Length (ft)	Reach 1 = 363		Reach 2 = 737	
Drainage Area (sq. mi.)	Reach 1 = 0.09		Reach 2 = 0.12	
Bankfull Discharge, Q_{bkf} (cfs)*	Reach 1 = 16.3		Reach 2 = 20.9	
Feature Type	Pool	Riffle	Riffle	Pool
Rosgen Stream Type	-	E4b (incised)	E4 (incised)	-
Bankfull Width (W_{bkf}) (ft)	5.53	7.16	6.55	8.83
Bankfull Mean Depth, (d_{bkf}) (ft)	1.06	0.76	1.06	1.59
Width to Depth Ratio (W_{bkf}/d_{bkf})	5.22	9.43	6.17	5.56
Cross-Sectional Area, A_{bkf} (sq ft)	5.9	5.4	6.9	14

Bankfull Max Depth (d_{mbkf}) (ft)	2.31	1.78	1.85	2.39
loodprone Width (W_{fpa}) (ft)	76.6	72.1	25.5	42.7
Entrenchment Ratio (W_{fpa}/W_{bkf}) (ft)	13.8	10.1	3.9	4.8
Bank Height Ratio**	1.3	1.5	1.6	1.5
Longitudinal Stationing of Cross-Section Along Existing Thalweg (ft)	14+06	14+73	20+28	20+57
Bankfull Mean Velocity, V_{bkf} = (Q_{bkf}/A_{bkf}) (ft/s)	---	3.02	3.03	---
Channel Materials from Riffle (Particle Size Index – d50)***				
d16 (mm)	-	0.2	<0.063	-
d35 (mm)	-	4.3	7.2	-
d50 (mm)	-	6.9	16.7	-
d84 (mm)	-	30.8	54.5	-
d95 (mm)	-	54.5	85.7	-
Average Valley Slope (ft/ft)	Reach 1 = 0.0252		Reach 2 = 0.0171	
Average Water Surface Slope (S)	Reach 1 = 0.0212		Reach 2 = 0.0159	
Average Channel Sinuosity (K)	Reach 1 = 1.17		Reach 2 = 1.06	

Parameter	**Reach 3**			
	XS5	**XS6**	**XS7**	**XS8**
Existing Reach Length (ft)	1,849			
Drainage Area (sq. mi.)	0.17			
Bankfull Discharge, Q_{bkf} (cfs)*	26.4		28.0	
Feature Type	Riffle	Pool	Riffle	Pool
Rosgen Stream Type	C4	-	E4 (incised)	-
Bankfull Width (W_{bkf}) (ft)	16.1	6.3	6.0	11.2
Bankfull Mean Depth, (d_{bkf}) (ft)	0.45	0.90	1.31	1.22
Width to Depth Ratio (W_{bkf}/d_{bkf})	35.6	7.0	4.6	9.2
Cross-Sectional Area, A_{bkf} (sq ft)	7.3	5.7	7.8	13.6
Bankfull Max Depth (d_{mbkf}) (ft)	1.6	1.3	1.9	1.9
Floodprone Width (W_{fpa}) (ft)	>81	52	32	>89
Entrenchment Ratio (W_{fpa}/W_{bkf}) (ft)	5.0	8.2	5.4	8.0
Bank Height Ratio**	1.1	1.5	1.9	1.1
Longitudinal Stationing of Cross-Section Along Existing Thalweg (ft)	25+71	28+92	33+36	37+93
Bankfull Mean Velocity, V_{bkf}= (Q_{bkf}/A_{bkf}) (ft/s)	3.62	---	3.59	---
Channel Materials from Riffle (Particle Size Index – d50)***				
d16 (mm)	<0.063	-	<0.063	-
d35 (mm)	4.6	-	3.9	-
d50 (mm)	7.3	-	6.5	-
d84 (mm)	20.4	-	19.3	-
d95 (mm)	30.8	-	32.0	-
Average Valley Slope (ft/ft)	Reach 3 = 0.0147			
Average Water Surface Slope (S)	Reach 3 = 0.0111			
Average Channel Sinuosity (K)	Reach 3 = 1.31			

Parameter	**Reach 4**	**Reach 5**		
		XS9	**XS10**	**XS11**
Existing Reach Length (ft)	234	849		
Drainage Area (sq. mi.)	0.19	0.21		
Bankfull Discharge, Q_{bkf} (cfs)*	28.0	29.6		

Feature Type	-	Riffle	Pool	Riffle
Rosgen Stream Type	-	C4		E4
Bankfull Width (W_{bkf}) (ft)	-	17.0	5.24	10.1
Bankfull Mean Depth, (d_{bkf}) (ft)	-	0.72	1.52	0.93
Width to Depth Ratio (W_{bkf}/d_{bkf})	-	23.5	3.5	10.9
Cross-Sectional Area, A_{bkf} (sq ft)	-	12.3	8.0	9.4
Bankfull Max Depth (d_{mbkf}) (ft)	-	1.6	2.1	2.0
Floodprone Width (W_{fpa}) (ft)	-	51	69	84
Entrenchment Ratio (W_{fpa}/W_{bkf}) (ft)	-	3.0	13.2	8.3
Bank Height Ratio**	-	1.3	1.3	1.3
Longitudinal Stationing of Cross-Section Along Existing Thalweg (ft)	-	45+36	45+69	47+82
Dce2w` Bankfull Mean Velocity, $V_{bkf}= (Q_{bkf}/A_{bkf})$ (ft/s)	-	2.41	-	3.15
Channel Materials from Riffle (Particle Size Index – d50)***				
d16 (mm)	-	<0.063	-	<0.063
d35 (mm)	-	4.8	-	2.0
d50 (mm)	-	8.6	-	5.6
d84 (mm)	-	28.7	-	20.4
d95 (mm)	-	87.7	-	77.0
Average Valley Slope (ft/ft)	0.0119	0.0154		
Average Water Surface Slope (S)	0.0094	0.0133		
Average Channel Sinuosity (K)	1.21	1.17		

*Bankfull discharge estimated using NC Piedmont Rural Regional Curve (Harman et al., 1999)
**Bank height ratios (values greater than 2.0 indicate system wide self-recovery is unlikely)
***Sediment samples were taken at representative riffles along mainstem

17.1.1.2 Channel Morphology and Stability Assessment

Baker performed general topographic and planimetric surveying of the project site and produced a 1-foot contour map based on survey data in order to create plan set base mapping (see Section 18.0, Appendix D). Eleven (six riffles/five pools) representative cross-sections and a longitudinal profile survey were also surveyed to assess the current condition and overall stability of the stream channels. The existing riffle cross-section data and locations are shown in Table 17.1 and Figure 17.1 for comparison with the Rosgen Channel Stability Assessment shown in Table 17.2.

Table 17.2 Rosgen Channel Stability Assessment
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No.003990

Stability Rating	Bank Height Ratio (BHR)
Stable (low risk of degradation)	1.0-1.05
Moderately unstable	1.06-1.3
Unstable (high risk of degradation)	1.3-1.5
Highly unstable	>1.5

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

Bankfull cross-sectional areas were estimated by measuring field indicators with the NC Rural Piedmont Regional Curve to compare stability ratings. The representative riffle cross-sections have Bank Height Ratios (BHR) that range from 1.1 to 1.9. Some of the cross-section data illustrate channel incision and the lack of natural floodplain deposits.

The longitudinal profiles for each reach show the existing channel slopes vary from 0.0094 to 0.0212 ft/ft and have average valley slopes of 0.0119 to 0.0252 ft/ft with several long riffle sections

and infrequently spaced pools. Channel sinuosity is approximately 1.17, a result of the valley formation, geologic control and the meander channel morphology. Large sections of the project reaches are moderately to severely entrenched and highly unstable as shown on the cross-section data. This likely indicates a movement toward a more unstable condition (e.g., downcutting, stream bank erosion), especially in portions of the reach where numerous active headcuts are present (vertical instability) or stream banks are actively eroding (lateral instability).

Figure 17.1 Existing Cross-Section Locations for Project Reaches

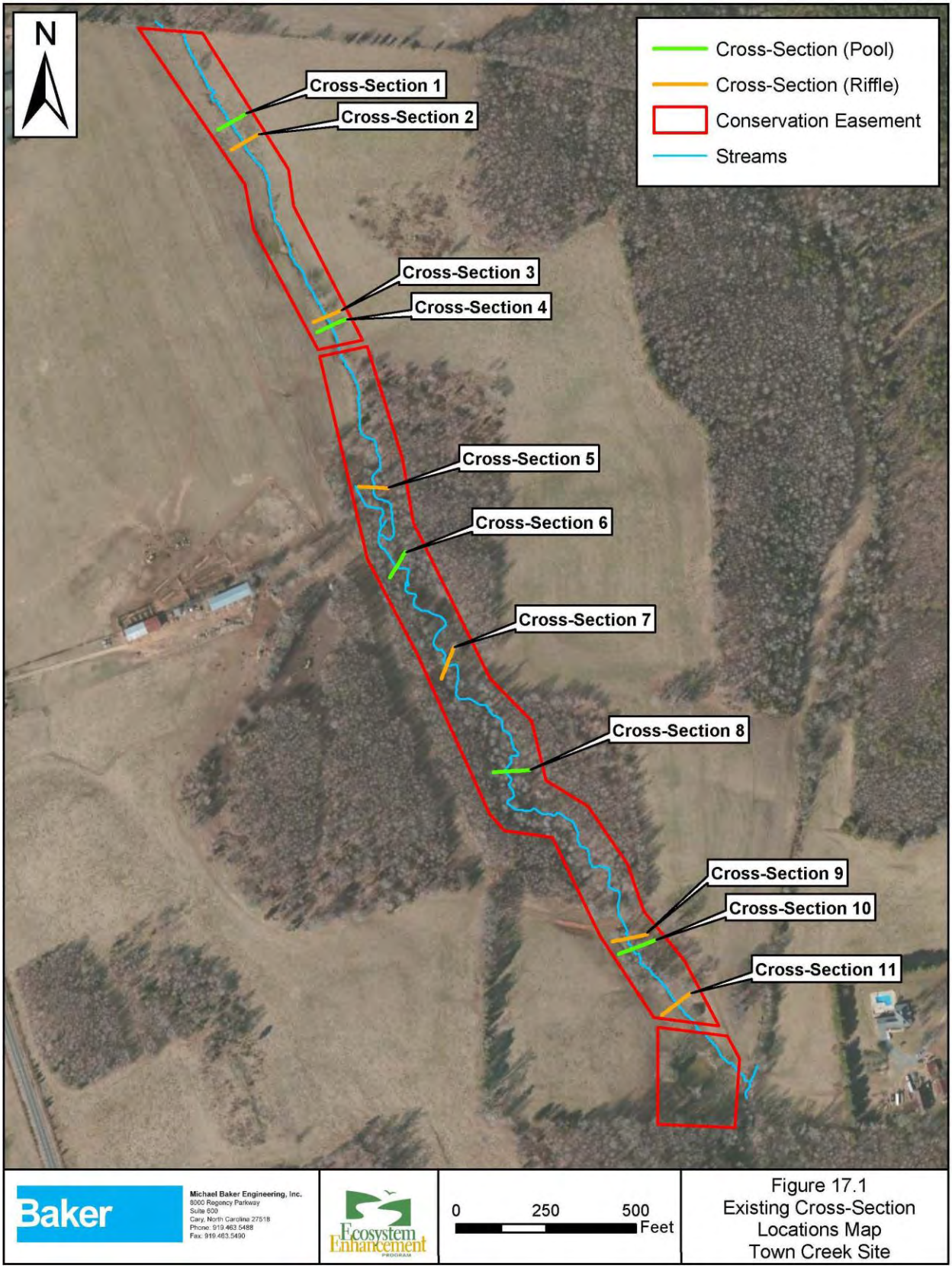
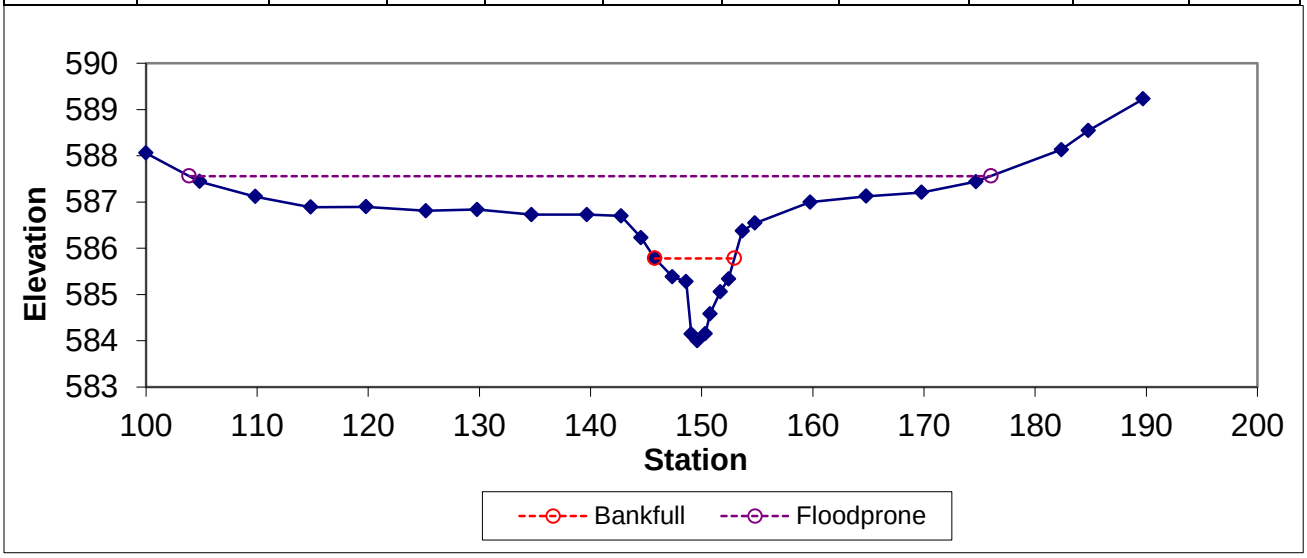


Figure 17.2 Existing Riffle Cross-Section Data for Project Reaches

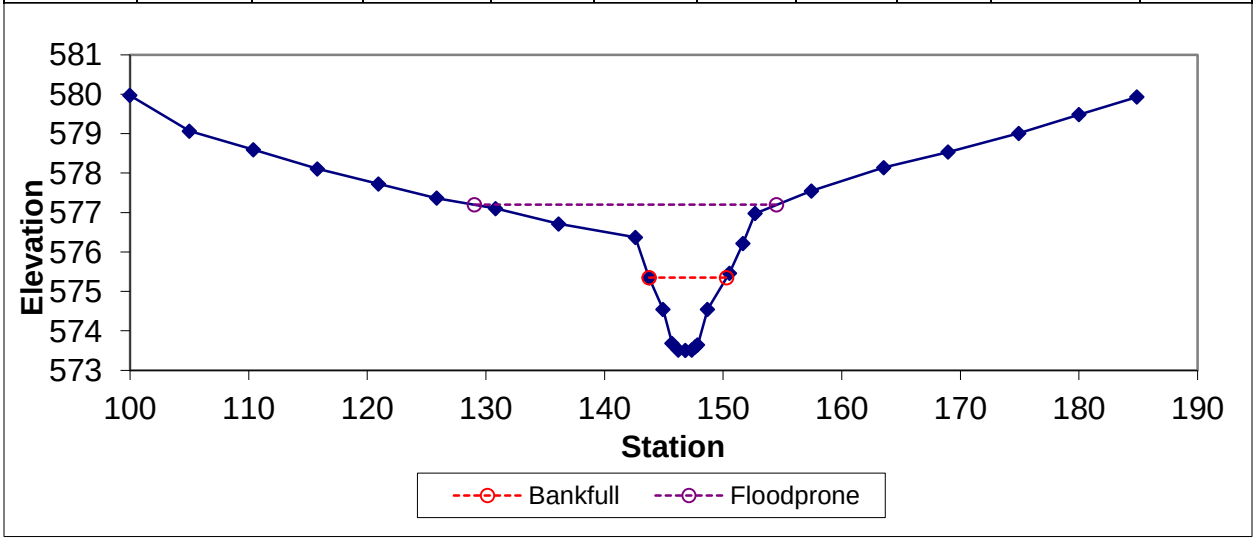
Cross-section 2, Existing Condition Profile - Station 14+73

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	5.4	7.16	0.76	1.78	9.43	1.5	10.1	585.78	586.7



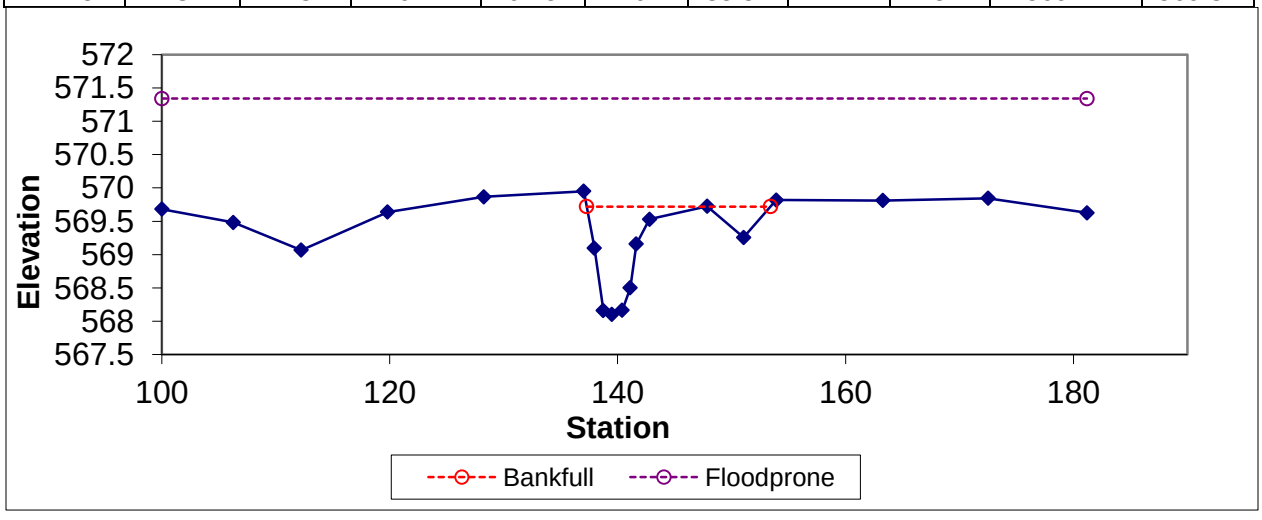
Cross-section 3, Existing Condition Profile - Station 20+28

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	6.9	6.55	1.06	1.85	6.17	1.6	3.9	575.35	576.37



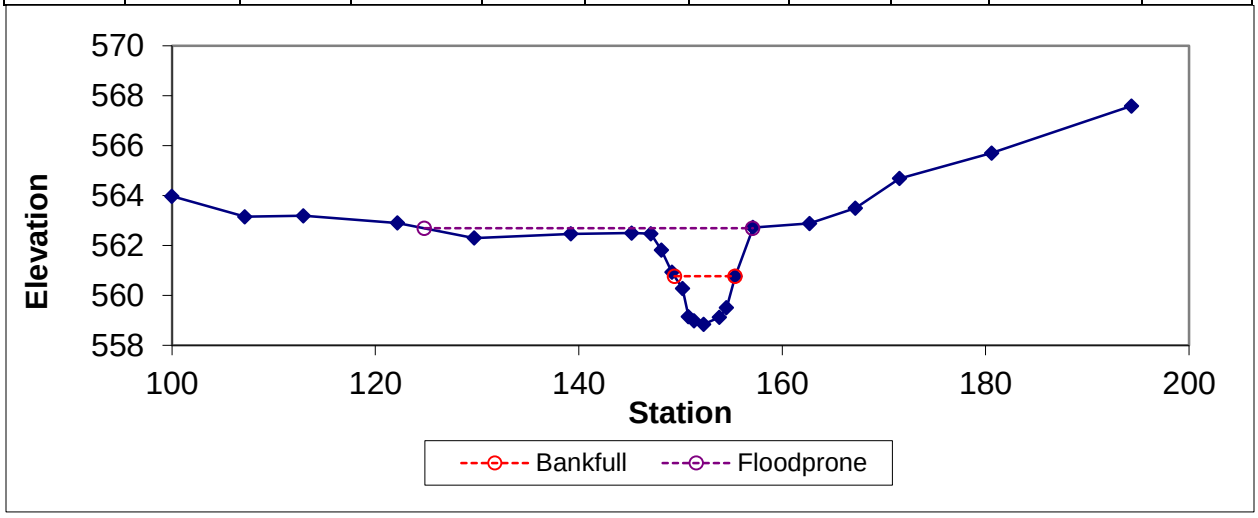
Cross-section 5, Existing Condition Profile - Station 25+71

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	7.3	16.14	0.45	1.62	35.57	1.1	5	569.72	569.82



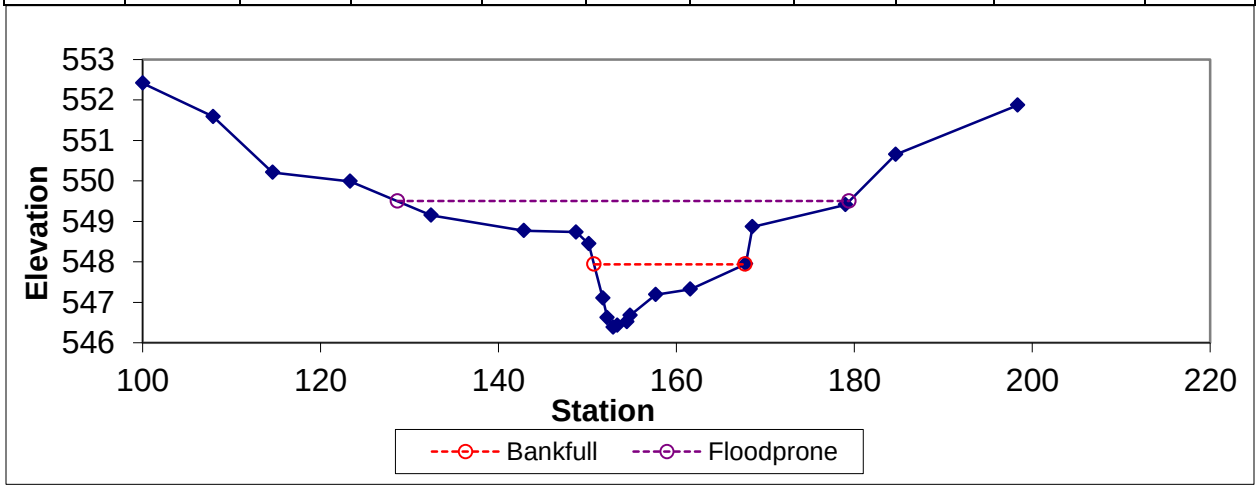
Cross-section 7, Existing Condition Profile - Station 33+36

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	7.8	5.97	1.31	1.92	4.57	1.9	5.4	560.77	562.47



Cross-section 9, Existing Condition Profile - Station 45+36

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	12.3	16.98	0.72	1.56	23.47	1.3	3	547.94	548.45



Cross-section 11, Existing Condition Profile - Station 47+82

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	E	9.4	10.1	0.93	2.02	10.9	1.3	8.3	544.96	545.55

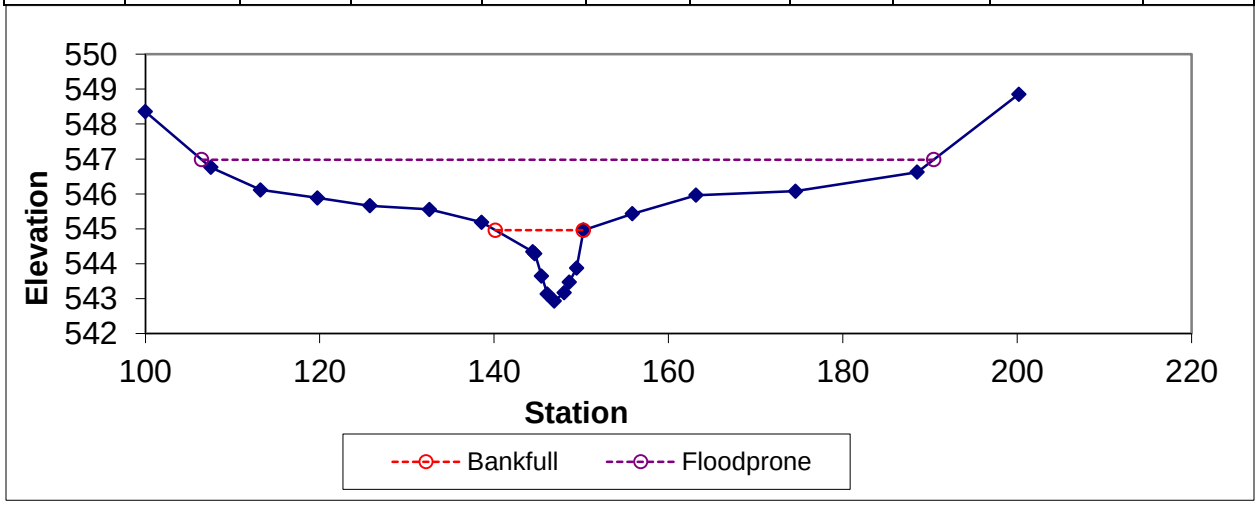
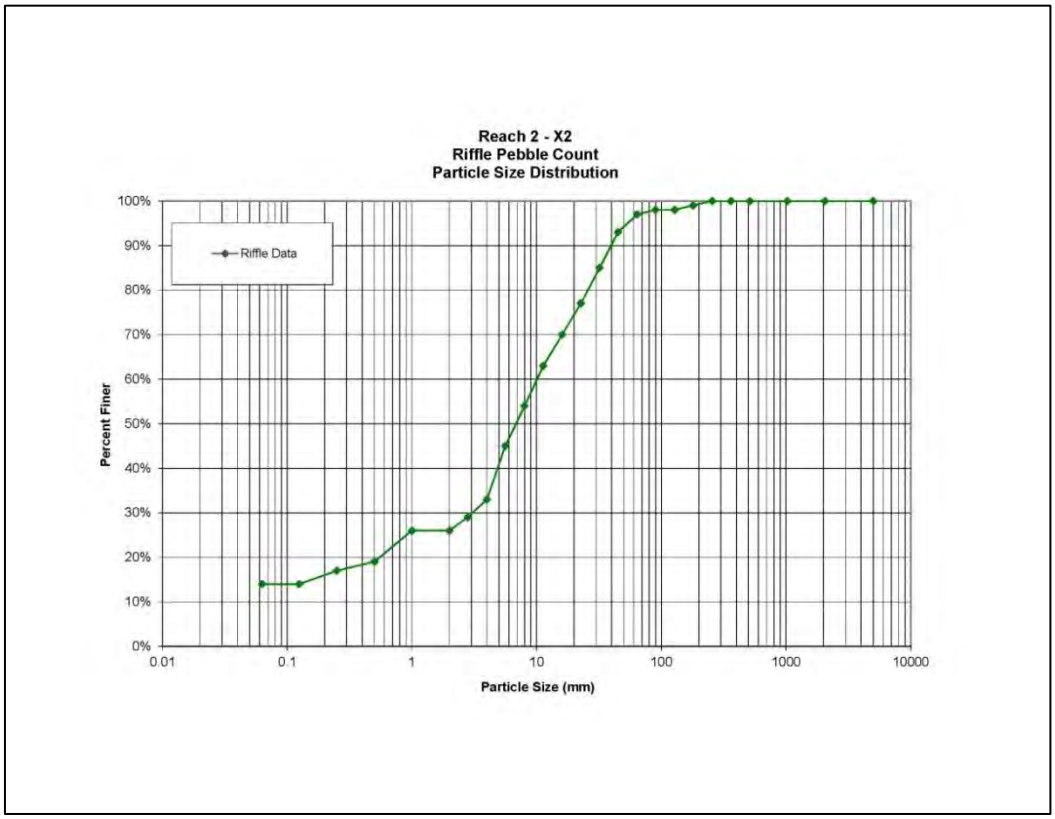
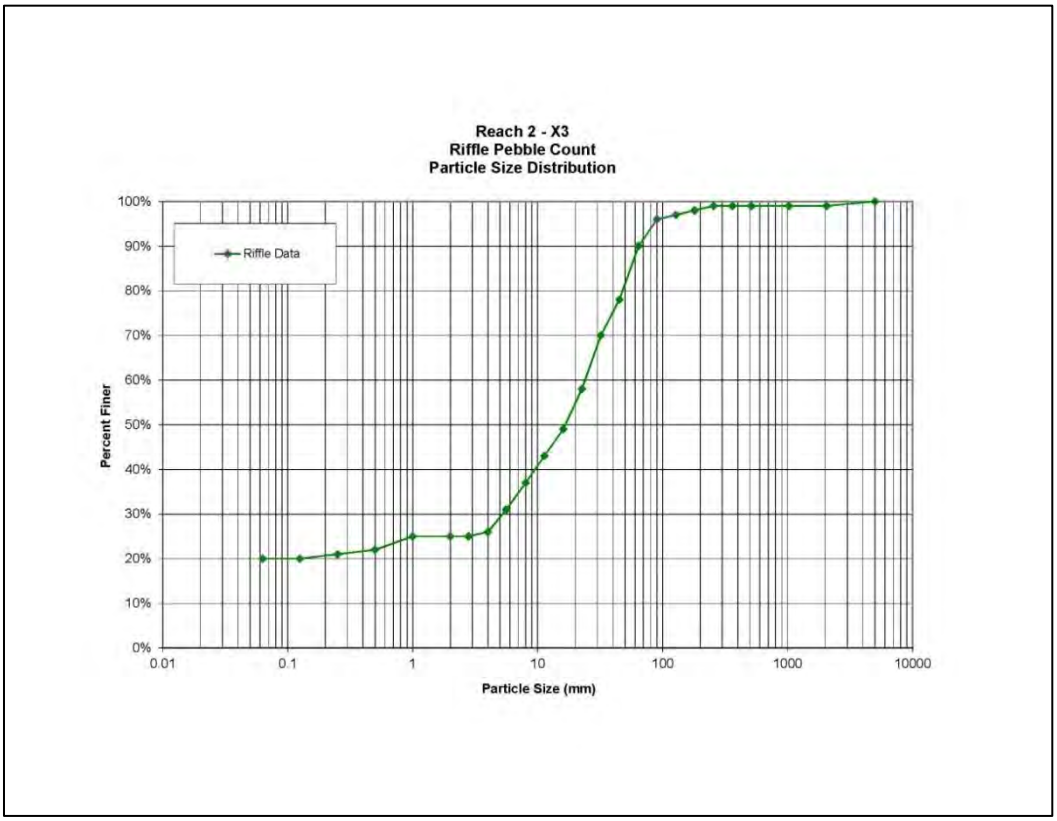
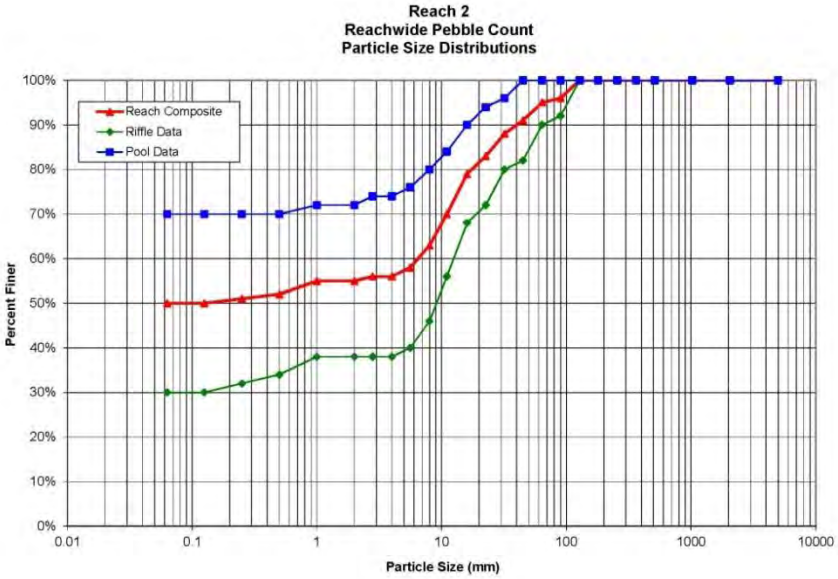
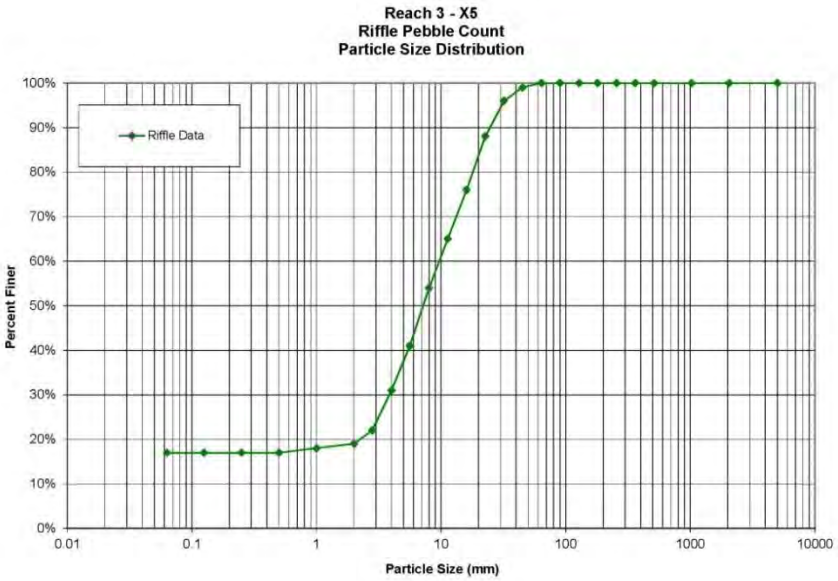


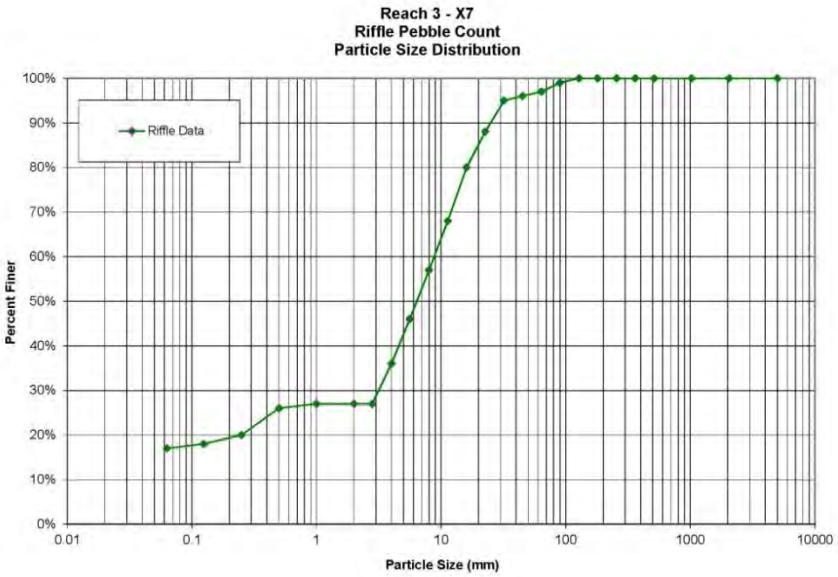
Figure 17.3 Reachwide and Cross-section Pebble Counts for Project Reaches

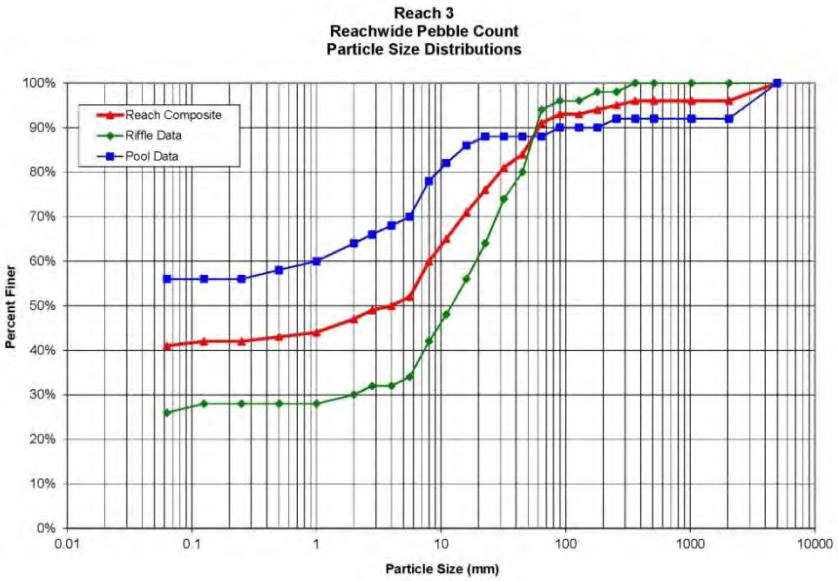


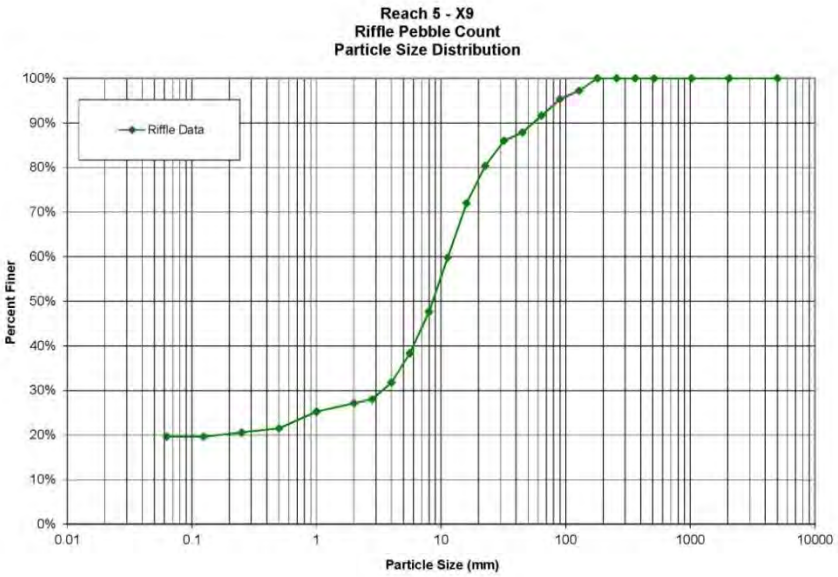


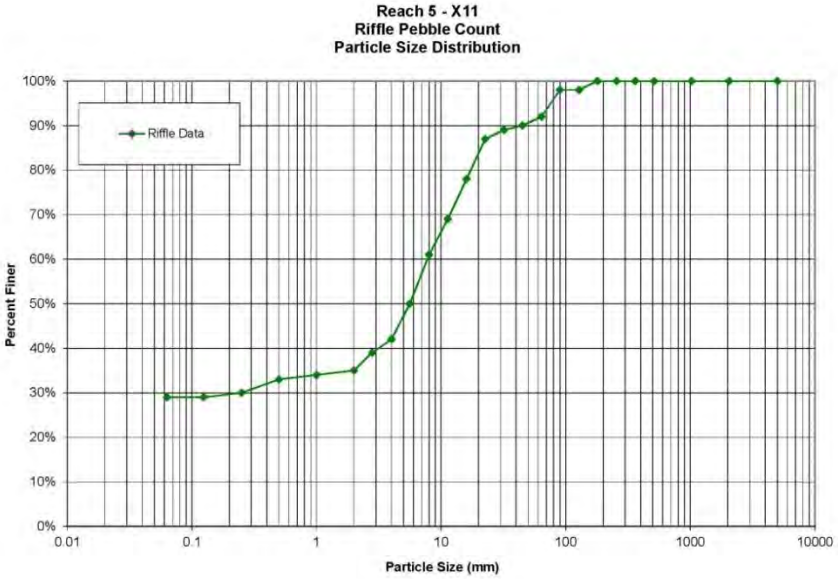

Reach 2
Reachwide Pebble Count
Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
Percent Finer
Particle Size (mm)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000

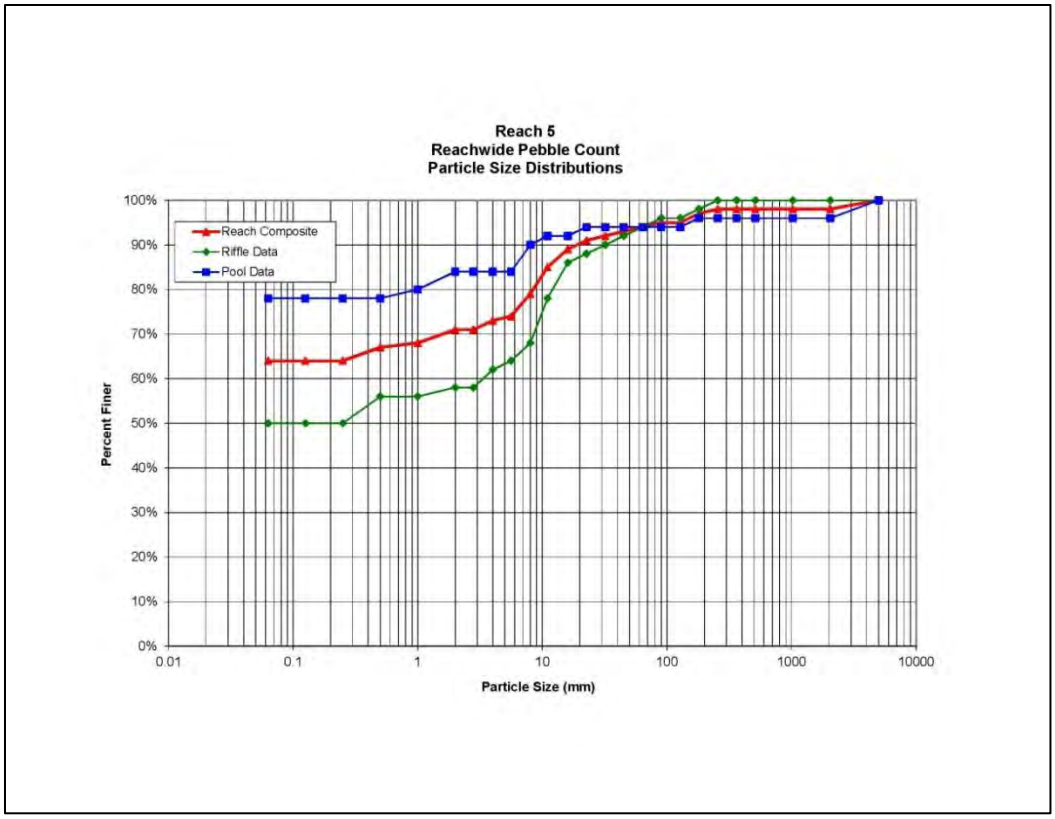

Reach 3 - X5
Riffle Pebble Count
Particle Size Distribution
Riffle Data
Percent Finer
Particle Size (mm)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000


Reach 3 - X7
Riffle Pebble Count
Particle Size Distribution
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


Reach 3
Reachwide Pebble Count
Particle Size Distributions
Reach Composite
Riffle Data
Pool Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


Reach 5 - X9
Riffle Pebble Count
Particle Size Distribution
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


Reach 5 - X11
Riffle Pebble Count
Particle Size Distribution
Riffle Data
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)



17.1.1.3 Valley Classification and Geology

The project site is located in northern Stanly County in the Piedmont physiographic region of North Carolina. Undisturbed Piedmont valleys in this region are generally classified as Valley Type 'VII' or 'IV' if the valley is steeper, confined, and controlled by bedrock features (Rosgen, 2006), although it is understood this classification does not describe specific landforms within the provinces throughout the Mid-Atlantic/Southeast region. The underlying geology of the project area is within the Yadkin formation of the Carolina Slate Belt geologic region and Level III Ecoregion. This geology consists of mafic metavolvanic rock (CZmv,) metasedimentary (CZy), volcanic sandstone, and siltstone (Geologic Map of North Carolina, NC Geological Survey, 1998). The hydrophysiographic region is characterized by broad, rolling, interstream divides across variable slopes along well-defined drainage ways and receives moderately high rainfall with precipitation averaging 46.6 inches per year (NRCS, 1989).

17.1.1.4 Channel Evolution

Channel stability is defined as the stream's ability to transport incoming flows and sediment loads supplied by the watershed without undergoing significant changes over a geologically short time-scale. A generalized relationship of stream stability was proposed by Lane (1955); it states that the product of sediment load and sediment size is in balance with the product of stream slope and discharge, or stream power. A change in any one of these variables induces physical adjustment of one or more of the other variables to compensate and maintain the proportionality.

Longitudinally, the water and sediment flows delivered to each subsequent section are the result of the watershed and upstream or backwater (downstream) conditions. Water and sediment pass through the channel, which is defined by its shape, material, and vegetative condition. Flow and sediment are either stored or passed through at each section along the reach. The resulting physical

changes are a balancing act between gravity, friction, and the sediment and water being delivered into the system (Leopold et al., 1964).

Observed stream response to induced instability, as described by Simon's (1989) Channel Evolution Model, involve extensive modifications to channel form resulting in profile, cross-sectional, and plan form changes, which often take decades or longer to achieve resolution. The Simon (1989) Channel Evolution Model characterizes typical evolution in six steps:

1. Pre-modified
2. Channelized
3. Degradation
4. Degradation and widening
5. Aggradation and widening
6. Quasi-equilibrium.

The channel evolution process is initiated once a stable, well-vegetated stream that interacts frequently with its floodplain is disturbed. Channelization, dredging, changing land use, removal of streamside vegetation, upstream or downstream channel modifications, and/or change in other hydrologic variables result in adjustments in channel morphology to compensate for the new condition(s). Disturbance commonly results in an increase in stream power that can cause degradation, often referred to as channel incision (Lane, 1955). Incision eventually leads to over-steepening of the banks and, when critical bank heights are exceeded, the banks begin to fail and mass wasting of soil and rock leads to channel widening. Incision and widening continue moving upstream in the form of a head-cut. Eventually the mass wasting slows, and the stream begins to aggrade. A new, low-flow channel begins to form in the sediment deposits. By the end of the evolutionary process, a stable stream with dimension, pattern, and profile similar to those of undisturbed channels forms in the deposited alluvium. The new channel is at a lower elevation than its original form, with a new floodplain constructed of alluvial material (FISRWG, 1998).

The majority of the assessed reaches within the Project are perennial with a small section of intermittent channel in the upstream extent. The channel originates from a watershed that has mixed land use, but is predominantly forested with low-density housing and agricultural land, where historical and current rural land management practices include timber harvesting, pasture conversion, channelization, and livestock grazing. The channel within the Project area has experienced prior channelization and/or additional watershed disturbances. Currently, livestock have access to the channel and impacts from this access are further exacerbating channel stability.

Channel stability and evolution was assessed with the following methods: qualitative and quantitative site observations, detailed topographic data collection of site-specific geomorphic facets, and sediment analyses. Due to active degradation, the UT is moderately to severely incised in many sections as evidenced by bank height ratios (BHRs) greater than 1.5.

The majority of the Project area consists of reaches that vary between Stage III and IV of channel evolution. Thus, the system overall is in a degradational phase of channel evolutionary sequence and, if left unrestored, would continue to degrade and widen further in order to reach Stage 6 (quasi-equilibrium). Additional reachwide evolutionary analyses are outlined below. As a result, these streams are contributing excess sediment from bank erosion and are prime candidates for restoration and enhancement.

Reach 1 & 2

Reach 1 begins at the upstream extent of the Project as an intermittent channel and continues downstream for approximately 363 LF. Reach 2 begins at the terminus of Reach 1 and continues downstream as an intermittent channel for approximately another 291 LF where a headcut marks the jurisdictional call of a perennial channel on Reach 2. Currently, both Reach 1 and Reach 2 are

downcutting, with vertical incision becoming more evident in the downstream extents of Reach 2 where several headcuts are present. Areas of lateral erosion are also present. The riparian buffer is mostly void of any adequate vegetation and is open to cattle access throughout entire reach. The majority of Reach 1 is in stage III of the Simon Evolutionary Model (Simon, 1989). Portions of Reach 2 are in the late phase of stage III, while the majority of the reach is in stage IV. Without restoration efforts, the channel will continue to laterally and vertically erode.

Reach 3 & 4

Reach 3 begins at the terminus of Reach 2 and progresses downstream for approximately 1,849 LF from an open pasture area through an open wooded section. Reach 4 begins at the terminus of Reach 3 and terminates at an existing stream crossing. Cattle access has impacted the channel through hoof shear and limiting vegetation growth along the top of banks preventing natural stream progression and causing erosion and channel instability. A majority of Reach 3 is situated at the toe of the right valley wall, while Reach 4 is situated at the toe of the left valley wall. Vertical erosion or "head-cutting" is present in the upstream portion of Reach 3. Vertical erosion is less common along Reach 4 because a large root mass is currently providing grade control. The majority of Reach 3 is in stage IV of the Simon Evolutionary Model (Simon, 1989) and in a Rosgen Channel Evolution Scenario 5 (Rosgen 2001b), while Reach 4 is currently in the late phases of stage II. Without restoration efforts, Reach 3 will continue to erode laterally and Reach 4 may begin to experience vertical degradation.

Reach 5

Reach 5 is the downstream extent of the Project. This reach appears to have been historically straightened and a majority of the riparian buffer has been cleared for agricultural purposes. Currently, this reach has pockets of erosion, excess siltation from upstream erosion, and a degraded streambed due to frequent access by cattle. Available habitat is mostly in the form of backwater pools caused by multiple debris jams and scour pools associated with an upstream culvert. Reach 5 is currently late in the phase of stage III of the Simon Evolutionary Model (Simon, 1989) and in a Rosgen Channel Evolution Scenario 5 (Rosgen 2001b). The channel is currently incising vertically. Without restoration efforts, the channel will continue to incise and then begin lateral erosion.

17.1.2 Proposed Morphological Conditions

After examining the assessment data collected at the site and exploring the potential for restoration, an approach was developed that would address restoration of stream functions within the project area while minimizing disturbance to existing wooded areas. Prior to impacts from past channelization, topography and soils on the site indicate that the project area most likely functioned in the past as a small tributary stream system, eventually flowing into the larger Town Creek system.

Therefore, Baker formulated a design approach to restore and/or enhance the project reach to this type of system. First, an appropriate stream type for the valley type, slope, and desired stream functions was selected and designed to restore and/or enhance historic flow patterns throughout the project area. Then a design plan was developed in order to improve the channel hydrology and base flow interaction impaired by current cattle impacts, active degradation, and other agricultural land manipulations.

17.1.2.1 Proposed Design Approach and Criteria Selection

For design purposes, the mainstem was divided into five reaches identified as Reach 1, Reach 2, Reach 3, Reach 4 and Reach 5 beginning at the top, respectively (Figure 17.4). Selection of a general restoration approach was the first step in selecting design criteria for the proposed reaches. The approach was based on the potential for restoration as determined during the site assessment. Next, the specific design parameters were developed so that plan view layout, cross-section dimensions, and a longitudinal profile could be described for developing construction documents.

The 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 long periods-of-time under the processes of flooding, re-colonization of vegetation, and watershed influences.

After selecting an appropriate design approach for the site based on field assessments and functional lift potential, proposed stream design values and design criteria were selected using common reference reach ratios and guidelines (Harman, Starr, 2011). Table 17.3 presents the design parameters used for the proposed reaches. Following initial application of the design criteria, detailed refinements were made to accommodate the existing valley type and channel morphology. This was done to minimize unnecessary disturbance of the riparian area, and to allow for some natural channel adjustment following construction. The design plans have been tailored to produce a cost and resource efficient design that is constructible, using a level of detail that corresponds to the tools of construction.

Reach 1 Restoration

A Priority Level II transitioning to a Priority Level I restoration approach is proposed for the reach to fully restore stream functions and a floodplain connection. For most of its length, the existing degraded stream channel follows the lowest part of the valley. However, the stream initially takes a 90 degree turn across the valley, following the property line and was likely moved to this location at some time in the past. This unnatural turn in the channel will be removed and the channel will be aligned to flow down valley converging with the existing channel at Station 11+38, removing approximately 28 feet from the existing channel length. Starting at the northern project boundary, the bed elevation will be raised to provide a reconnection to the geomorphic floodplain. The restored channel will be constructed mostly in-line along the existing valley bottom, and will be designed as a Rosgen B stream type.

The design width/depth ratio for the channel will be 13.3 and over time, the channel will narrow slightly from deposition of sediment and stream bank vegetation growth. In-stream structures will include constructed riffles for grade control and aquatic habitat improvement, grade control j-hook vanes, rock step structures for stream bed/bank stability, and habitat diversity.

The existing, unstable channel will be partially to completely filled along its length using material excavated during construction for the restored channel. A second modification to the existing channel pattern will be made near the end of the reach where a large bedrock outcrop is present in the middle of the present channel alignment. Because its current position within the channel is promoting lateral instability by diverting flows around the feature, the channel will be realigned so that the outcrop is no longer in the center of the channel and promoting instability, but instead will be situated to function as a habitat feature.

Riparian buffers in excess of 50 feet will be restored along all of Reach 1 and permanent fencing will be installed to exclude livestock from entering the restored stream or buffer area. This buffer will be planted with a diverse assemblage of woody and herbaceous vegetation to reestablish a native plant community.

Reach 2 Enhancement

Work on Reach 2 will be similar to that proposed for Reach 1; however, unlike Reach 1, this reach does not require a change to the channel alignment, therefore enhancement activities are proposed. These activities will primarily involve a Level I Enhancement approach for the entire reach. Channel bank stabilization and in-stream structures are proposed to enhance bedform morphology, provide improved connection to the floodplain and stabilize the reach profile. In-stream structures will include constructed riffles for grade control and aquatic habitat improvement, grade control j-hook vanes, rock step structures for stream bed/bank stability, and habitat diversity.

Riparian buffers in excess of 50 feet will be restored along all of Reach 2 and permanent fencing will be installed to exclude livestock from entering the restored stream or buffer area. This buffer will be planted with a diverse assemblage of woody and herbaceous vegetation to reestablish a native plant community. Within this reach is an abandoned livestock-watering pond that has filled and become over grown with wetland vegetation. This wetland was considered jurisdictional and is being preserved within the buffer. To enhance the hydrology of this wetland, the existing berm between the wetland and the channel will be lowered so that during high flows water can flow into the wetland. This reach will end at station 20+58 where a 20 LF width has been left outside of the easement area. An improved stream crossing will be constructed in this area for moving livestock and farm vehicles across the channel.

Reach 3 Restoration

Reach 3 begins immediately downstream of the easement crossing. As noted within the existing conditions description above, the channel BHRs throughout this reach alternate between 1 to greater than 2. Because of this varying stability, the proposed restoration will follow a Rosgen Priority I approach within those areas where the bank heights are low, but restoration will follow a Rosgen Priority II approach where the banks are high and the channel is incised. This approach is necessary to fully restore stream functions and a floodplain connection. The degraded channel banks will be graded to a more stable slope, a width/depth ratio of 14.3 will be established through this reach, and bankfull benches will be incorporated where needed to further promote stability and re-establish a connection to the floodplain. The pattern through this reach will be meandering while incorporating geolifts, toewood and rootwads to provide bank stabilization and high quality habitat. In-stream structures such as rock and log step pools, vanes, and constructed riffle structures will be installed to control grade, dissipate energies, and eliminate the potential for upstream channel incision or headcutting.

The restored channel will be designed and constructed as a Rosgen C stream type. The existing, unstable channel will be partially to completely filled along its length using material excavated for construction of the restored channel. The existing stream crossing within this reach will be removed. Riparian buffers in excess of 50 feet will be restored along all of Reach 3 and permanent fencing will be installed to exclude livestock from entering the restored stream or buffer area. The existing vegetation through this reach will be preserved to the greatest extent possible. This buffer will be planted with a diverse assemblage of woody and herbaceous vegetation to supplement the existing vegetation to establish a native plant community. In addition to these plantings, existing nonnative, invasive vegetation will be treated to eliminate nonnatives from the easement.

Reach 4 Enhancement

Work on Reach 4 will primarily involve Level I Enhancement approaches on a majority of the reach. Due to the presence of mature trees along much of this reach, the stream shows minimal channel incision or downcutting. Level I Enhancement is proposed to restore a more stable dimension and profile. Minor channel bank stabilization and in-stream structures are proposed to enhance bedform morphology for the portions of the reach where the riparian buffer and/or channel have been impacted.

Riparian buffers in excess of 50 feet will be restored along all of Reach 3 and permanent fencing will be installed to exclude livestock from entering the restored stream or buffer area. The existing vegetation through this reach will be preserved to the greatest extent possible. This buffer will be planted with a diverse assemblage of woody and herbaceous vegetation to supplement the existing vegetation to establish a native plant community. In addition to these plantings, existing exotic invasive species vegetation will be treated to eliminate them to the extent possible.

Reach 5 Restoration

Downstream of the Reach 4, the proposed restoration will follow a Rosgen Priority Level I approach to fully restore stream functions and a floodplain connection. The degraded channel banks will be graded to a stable slope to promote channel stability and re-establishment of riparian vegetation. The existing channel crossing located at the upper end of this reach will be moved to a 25 LF section that has been removed from the easement and lies under an existing powerline. The restoration through this crossing will follow a Rosgen Priority II approach. This approach is warranted because sediment has aggraded upstream of the crossing and the channel will likely remain incised unless the floodplain is lowered to meet existing ground below the crossing. This approach will also be necessary at the bottom of the project as the restored channel connects at the existing confluence with Town Creek. These approaches are necessary to fully restore stream functions and a floodplain connection. In-stream structures such as log vanes, rock vanes, cross vanes and constructed riffle structures will be installed to control grade, dissipate energies, and eliminate the potential for upstream channel incision.

The restored channel will be designed and constructed as a Rosgen C stream type. The existing, unstable channel will be partially to completely filled along its length using material excavated for construction of the restored channel.

Riparian buffers in excess of 50 feet will be restored along all of Reach 5 and permanent fencing will be installed to exclude livestock from entering the restored stream or buffer area. The existing vegetation through this reach will be preserved to the greatest extent possible. This buffer will be planted with a diverse assemblage of woody and herbaceous vegetation to supplement the existing vegetation and to establish a native plant community. In addition to these plantings, existing nonnative, invasive vegetation will be treated to eliminate nonnatives from the easement.

Table 17.3 Natural Channel Design Parameters for Project Reaches
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Parameter	Design Values					Rationale
	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	
Stream Type (Rosgen)	B4	B4	C4	C4	C4	Note 1
Bankfull Discharge, Qbkf (cfs)	16.3	20.9	26.4	28.0	29.6	Note 2
Bankfull Mean Velocity, Vbkf (ft/s)	2.72	3.48	3.77	3.22	3.40	V=Q/A
Bankfull Riffle XSEC Area, Abkf (sq ft)	6.1	6.1	7.0	8.7	8.7	Note 7
Bankfull Riffle Width, Wbkf (ft)	9.0	9.0	10.0	10.5	10.5	$\sqrt{Abkf * W / D}$
Bankfull Riffle Mean Depth, Dbkf (ft)	0.68	0.68	0.70	0.84	0.84	d=A/W
Width to Depth Ratio, W/D (ft/ft)	13.3	13.3	14.3	12.5	12.5	Note 3
Width Floodprone Area, Wfpa (ft)	20 - 50	20 - 50	2 - 80	25 – 110	25 - 110	
Entrenchment Ratio, Wfpa/Wbkf (ft/ft)	>2.2	>2.2	>2.2	>2.2	>2.2	Note 4
Riffle Max Depth @ bkf, Dmax (ft)	1.0	1.0	1.0	1.2	1.2	
Riffle Max Depth Ratio, Dmax/Dbkf	1.48	1.48	1.43	1.43	1.43	Note 5
Bank Height Ratio, Dtob/Dmax (ft/ft)	1.0	1.0	1.0	1.0	1.0	Note 6

Meander Length, Lm (ft)	NA	NA	70.0 – 120.0	Existing	73.5-126.0	Note 7
Meander Length Ratio, Lm/Wbkf	NA	NA	7.0 – 12.0	Existing	7.0 – 12.0	Note 7
Radius of Curvature, Rc (ft)	NA	NA	20 - 30	Existing	21 – 31.5	Note 7
Rc Ratio, Rc/Wbkf *	NA	NA	2.0 – 3.0	Existing	2.0 – 3.0	Note 7
Belt Width, Wblt (ft)	NA	NA	35 - 80	Existing	37 - 84	Note 7
Meander Width Ratio, Wblt/Wbkf	NA	NA	3.5 – 8.0	Existing	3.5 – 8.0	Note 7
Sinuosity, K (TW length/ Valley length)	1.02	1.02	1.17	1.20	1.17	Note 7
Valley Slope, Sval (ft/ft)	0.0222	0.0180	0.0144	0.0135	0.0124	
Channel Slope, Schan (ft/ft)	0.0217	0.0177	0.0122	0.0113	0.0106	Sval / K
Average Slope Riffle, Srif (ft/ft)	0.0220	0.0175	0.0160	Existing	0.0200	
Riffle Slope Ratio, Srif/Schan	0.88 – 1.15	0.56 – 1.41	0.82 – 1.80	Existing	1.5 - 2.0	Note 8
Slope Pool, Spool (ft/ft)	0.0000 - 0.0043	0.0000 - 0.0035	0.0000 - 0.0049	Existing	0.000 - 0.0021	
Pool Slope Ratio, Spool/Schan	0.0 - 0.2	0.0 - 0.2	0.0 - 0.40	Existing	0.0 - 0.2	Note 8
Pool Max Depth, Dmaxpool (ft)	1.4 – 2.4	1.4 – 2.4	1.4 – 2.4	Existing	1.7 – 2.9	
Pool Max Depth Ratio, Dmaxpool/Dbkf	2.00 – 3.50	2.00 – 3.50	2.00 – 3.50	Existing	2.0 -3.5	Note 7
Pool Width, Wpool (ft)	9.9 – 13.5	9.9 – 13.5	9.9 - 13.5	Existing	13.7 – 17.9	
Pool Width Ratio, Wpool/Wbkf	1.1 – 1.5	1.1 – 1.5	1.1 - 1.5	Existing	1.3 – 1.7	Note 9
Pool-Pool Spacing, Lps (ft)	14 - 45	14 - 45	36 - 63	Existing	42 - 74	
Pool-Pool Spacing Ratio, Lps/Wbkf	1.5 – 5.0	1.5 – 5.0	4.0 – 7.0	Existing	4.0 – 7.0	Note 7

Notes:

1 A ‘C’ stream type is appropriate for a lower slopes (generally less than 0.015 ft/ft), wider alluvial valleys (generally greater than 100 ft). A ‘B’ stream type is appropriate for higher slopes (generally greater than 0.015 ft/ft), in more confined valleys. The channel dimensions were based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, as well as sediment transport analyses and past project evaluation.

2 Bankfull discharge analysis was estimated by comparing regional curves and using Manning’s equation (n = ~0.04) to represent post-construction conditions.

3 The W/D ratio was selected based on relationships of W/D ratio to slope in NC Piedmont reference reach streams, as well as sediment transport analyses and past project evaluation.

4 Required for Rosgen stream classification.

5 Ratio was based on past project evaluation of similar design channels as well NC Piedmont reference reach streams.

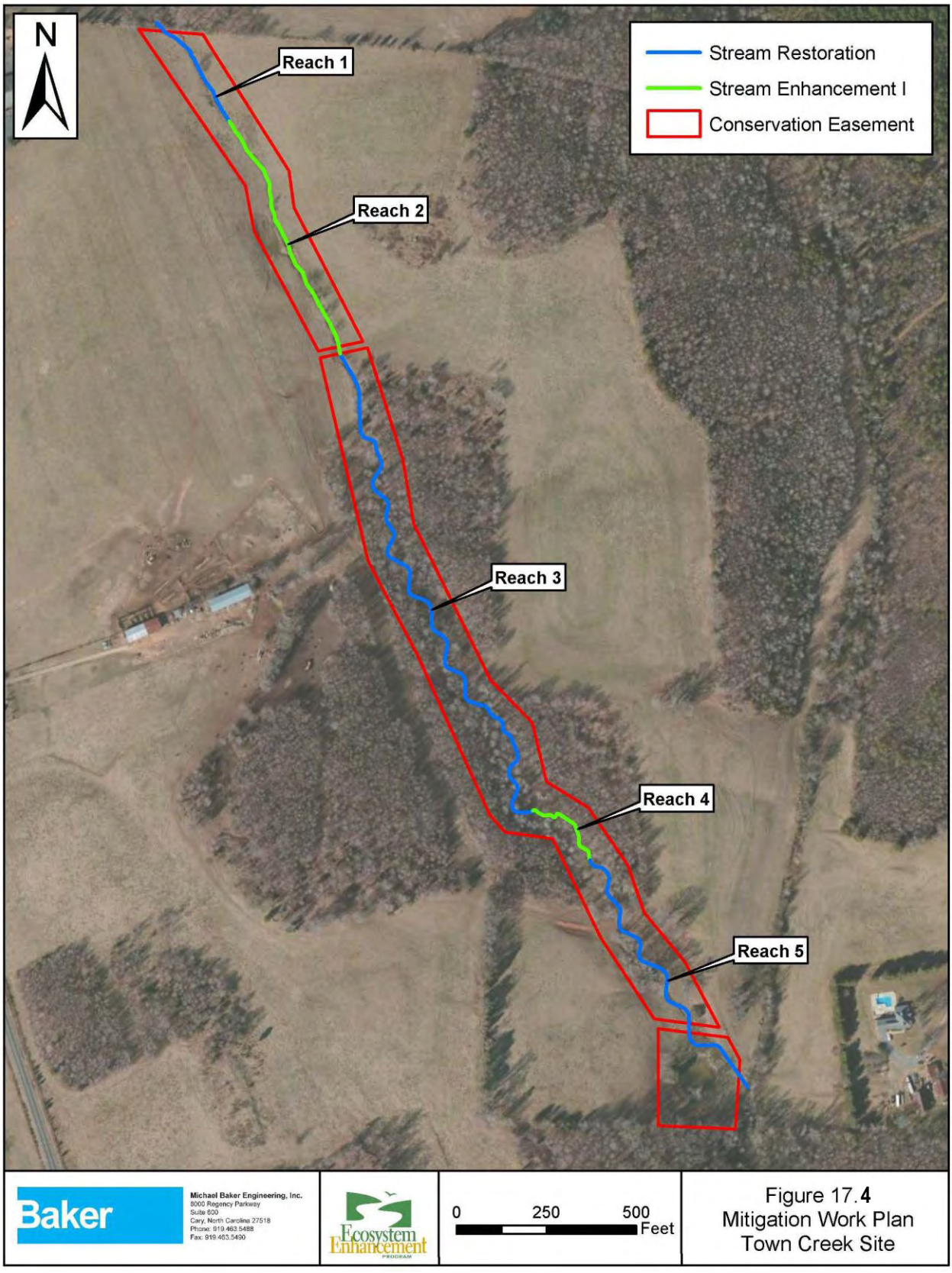
6 A bank height ratio near 1.0 ensures that all flows greater than bankfull will spread onto a floodplain. This minimizes shear stress in the channel and maximizes floodplain functionality, resulting in lower risk of channel instability.

7 Design Values were chosen based on small piedmont stream reference reach data and past project evaluation.

8 Due to the small channel sizes, facet slopes were not calculated for the proposed design. Past project experience has shown that these minor changes in slope between bedform features form naturally within the constructed channel, provided that the overall design channel slope is maintained after construction.

9 Design Values were chosen based on reference reach comparison and past project evaluation. It is more conservative to design a pool wider than the riffle. Over time, the pool width may narrow from sediment deposits and vegetation growth, which is considered to be a positive evolutionary step towards stability.

Figure 17.4 Mitigation Work Plan



17.1.3 Reference Reach Data Indicators

Reference reach surveys are valuable tools for comparison. The morphologic data obtained such as dimension, pattern, and profile can be used as a template for design of a stable stream in a similar valley type with similar bed material. In order to extract the morphological relationships observed in a stable system, dimensionless ratios are developed from the surveyed reference reach. These ratios can be applied to a stream design to allow the designer to 'mimic' the natural, stable form of the target channel type.

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. Often the best reference data is from adjacent stable stream reaches, or reaches within the same watershed.

For comparison purposes, Baker selected local reference reaches from both the NCDOT database and internal reference data, in the locations shown on Figure 17.5. The data shown on Table 17.4 helped to provide a basis for evaluating the valley slope and topography of 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 Town Creek site. The site is located in Carolina Slate Belt geologic region, west of the Carolina Sand hills/Outer Coastal Plain region. These systems exist as the floodplains of smaller intermittent/perennial streams in which flows tend to be relatively steady, with floods of short duration, and seasonal periods of low flow.

The undisturbed native plant communities within these areas primarily consist of Piedmont Bottomland Hardwood Forest (mixed riparian community) and Dry-Mesic Oak-Hickory Forest (mixed hardwoods and pine) as described by Schafale and Weakely (1990). The dominant canopy species of a Piedmont/Mountain bottomland forest area included Yellow poplar (*Liriodendron tulipifera*), American sycamore (*Platanus occidentalis*), Sweetgum (*Liquidambar styraciflua*), Green ash (*Fraxinus pennsylvanica*), Red maple (*Acer rubrum*), Black gum (*Nyssa sylvatica*), and Black willow (*Salix nigra*). Understory species included box elder (*Acer negundo*), Flowering dogwood (*Cornus florida*), Ironwood (*Carpinus caroliniana*), Black cherry (*Prunus serotina*), alder (*Alnus serrulata*), Elderberry (*Sambucus canadensis*), Red bud (*Cercis canadensis*), and Persimmon (*Diospyros virginiana*). Woody vine and herbaceous species consisted of poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), trumpet creeper (*Campsis radicans*), pokeweed (*Phytolacca americana*), dog fennel (*Eupatorium capillifolium*), shallow sedge (*Carex lurida*), flat sedge (*Cyperus strigosus*), fescue (*fescue* spp.), and little bluestem (*Schizachyrium scoparium*).

The Dry-Mesic Oak-Hickory Forest ecological community is typically located on hillsides in an upland transition from the Piedmont/Mountain Bottomland Forest. The dominant overstory species of these upslope areas include Sweetgum (*Liquidambar styraciflua*), Tulip poplar (*Liriodendron tulipifera*), Red maple (*Acer rubrum*), Loblolly pine (*Pinus taeda*), Northern red oak (*Quercus rubra*), White oak (*Quercus alba*), Shag-bark hickory (*Carya ovata*), Mockernut hickory (*Carya tomentosa*), Green ash (*Fraxinus pennsylvanica*), and Hackberry (*Celtis occidentalis*). Mid-canopy species include Red bud (*Cercis canadensis*), Red mulberry (*Morus rubra*), green ash, Red cedar (*Juniperus virginiana*), Service berry (*Amelanchier arborea*), and buckeye (*Aesculus sylvatica*). Herbaceous and vine species consisted of Poison ivy (*Toxicodendron radicans),* grape (*Vitis* spp.), Virginia creeper (*Parthenocissus*

quinquefolia), trumpet creeper (*Campsis radicans*), Christmas fern (*Polystichum acrostichoides*), yellow root (*Xanthorhiza simplicissima*), Nepal grass (*Microstegium vimineum*), and Japanese honeysuckle (*Lonicera japonica*).

The primary soils series at the stream reference sites include Shellbluff (ShA), Chenneby (CnA), Congaree (Co) and can be generally be described as silty loam alluvium/medium sand found on flatter slopes typically ranging from 0-2-4 percent (NRCS Soil Survey). These series are frequently flooded and consist of deep, somewhat poorly to well drained, moderately permeable soils. These soils are commonly found throughout the floodplain and lower valley areas (base of slopes) of the reference sites. The series descriptions are similar to the soils evaluated on the project site.

Figure 17.5 Reference Streams Location Map

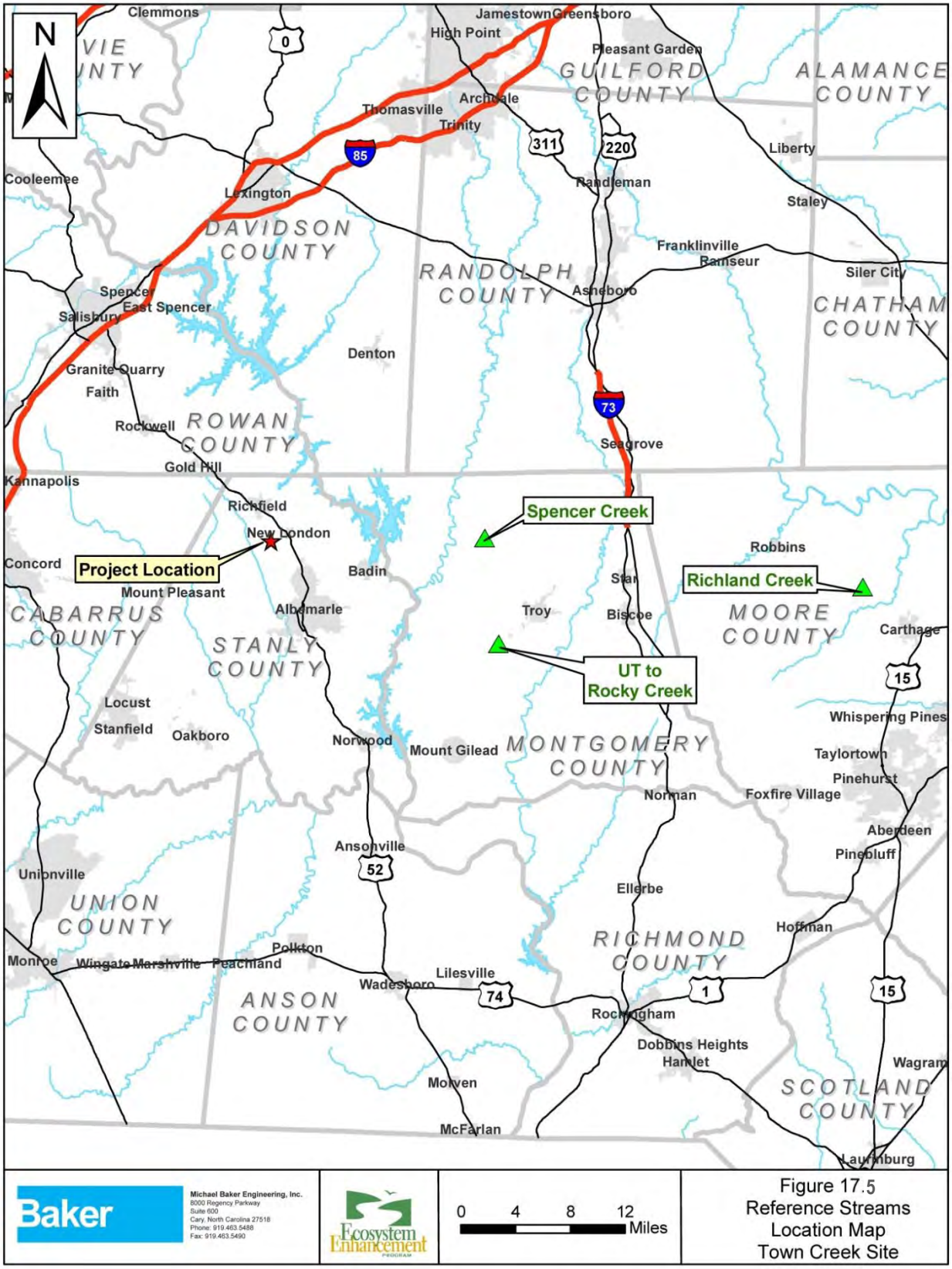


Table 17.4 Reference Reach Parameters Used to Determine Design Ratios
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Parameter	UT to Rocky Creek		Spencer Creek Upstream		Richland Creek	
	Min	Max	Min	Max	Min	Max
Stream Type (Rosgen)	E4b		E4/C4		C4	
Drainage Area – square miles	1.05		0.50		1.00	
Bankfull Width (w_{bkf}) – feet	12.2		8.7		16.2	16.7
Bankfull Mean Depth (d_{bkf}) – feet	1.3		1.2		0.9	0.9
Width/Depth Ratio (w/d ratio)	9.1		7.3		18.0	18.6
Cross sectional Area (A_{bkf}) – SF	16.3		10.6		15.0	15.5
Bankfull Mean Velocity (v_{bkf}) - fps	5.5		N/P		N/P	
Bankfull Discharge (Q_{bkf}) – cfs	85		N/P		N/P	
Bankfull Max Depth (d_{mbkf}) - feet	1.8		1.9		1.4	1.5
d_{mbkf} / d_{bkf} ratio	1.3		1.6		1.6	1.7
Low Bank Height to d_{mbkf} Ratio	1.0		1.0		1.0	
Floodprone Area Width (w_{fpa}) – feet	72.4		228.5		50	53
Entrenchment Ratio (ER)	6.0		26.3		3.0	3.3
Meander length (L_m) – feet	N/A		54.0	196.0	90	94
Ratio of meander length to bankfull width (L_m/w_{bkf})	N/A		6.2	22.5	5.5	5.7
Radius of curvature (R_c) – feet	N/A		5.4	22.1	14.3	26.1
Ratio of radius of curvature to bankfull width (R_c / w_{bkf})	N/A		0.6	2.5	0.9	1.6
Belt width (w_{blt}) – feet	N/A		24.0	52	25	40
Meander Width Ratio (w_{blt}/W_{bkf})	N/A		2.8	6.0	1.5	2.4
Sinuosity (K) Stream Length/ Valley Distance	1.1		1.1		1.2	
Valley Slope – feet per foot	0.0261		0.0139		0.0136	
Channel Slope ($s_{channel}$) – feet per foot	0.0235		0.0132		0.0133	
Pool Slope (s_{pool}) – feet per foot	0.0	0.0037	0.0001		0.00	0.0014
Ratio of Pool Slope to Average Slope (s_{pool} / $s_{channel}$)	0.0	0.15	0.01		0.00	0.11
Maximum Pool Depth (d_{pool}) – feet	2.2		2.5		2.5	
Ratio of Pool Depth to Average Bankfull Depth (d_{pool}/d_{bkf})	1.6		2.1		2.8	
Pool Width (w_{pool}) – feet	10.9		8.4		11.1	
Ratio of Pool Width to Bankfull Width (w_{pool} / w_{bkf})	0.9		1.0		0.7	
Pool Area (A_{pool}) – square feet	19.3		12.8		20.1	
Ratio of Pool Area to Bankfull Area (A_{pool}/A_{bkf})	1.2		1.2		1.3	
Pool-to-Pool Spacing – feet	26.3	81.3	13.0	46.5	37.3	95.8
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
Riffle Slope (s_{riffle}) – feet per foot	0.0606	0.089	0.010	0.067	0.013	0.0413
Ratio of Riffle Slope to Average Slope (s_{riffle}/ s_{bkf})	2.6	3.8	0.8	5.1	1.0	3.1
Material (d_{50})	Coarse Gravel		Medium Gravel		Very Coarse Gravel	
d_{16} – mm	<0.063		0.06		6.0	
d_{35} – mm	2.4		3		N/P	
d_{50} – mm	22.6		8.6		45.0	
d_{84} – mm	120		77		125.0	
d_{95} – mm	256		180		N/P	

17.2 Bankfull Verification Analysis

17.2.1 Bankfull Stage and Discharge

Bankfull stage and its corresponding discharge are the primary variables used to develop a natural channel design. However, the correct identification of the bankfull stage in the field can be difficult and subjective (Williams, 1978; Knighton, 1984; and Johnson and Heil, 1996). Numerous definitions exist of bankfull stage and methods for its identification in the field (Wolman and Leopold, 1957; Nixon, 1959; Schumm, 1960; Kilpatrick and Barnes, 1964; and Williams, 1978). The identification of bankfull stage in the humid Southeast can be especially difficult because of dense understory vegetation and a long history of channel modification and subsequent adjustment in channel morphology.

It is generally accepted that bankfull stage corresponds with the discharge that fills a channel to the elevation of the active floodplain and represents a breakpoint between processes of channel formation and floodplain development. The bankfull discharge, which also corresponds with the dominant discharge or effective discharge, is thought to be the flow that moves the most sediment over time in stable alluvial channels.

Field indicators include the back of point bars, significant breaks in slope, changes in vegetation, the highest scour line, or the top of the stream bank (Leopold, 1994). 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 stream banks (Harman et al., 1999).

Upon completion of the field survey, accurate identification of bankfull stage could not be made in all reach sections throughout the site due to incised/impaired channel conditions. Although some indicators were apparent in portions with lower stream bank heights and discernible scour features, the reliability of the indicators was inconsistent due to the altered condition of the stream channels. For this reason, bankfull stage was estimated using regional curve information.

17.2.2 Bankfull Hydraulic Geometry Relationships (Regional Curves)

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 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 un-gaged 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 exceedence probability on the maximum annual series (Dunne and Leopold, 1978; Leopold, 1994).

Publicly available and in-house bankfull 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 an unpublished NC Piedmont Regional Curve being developed by the Natural Resources Conservation Service (A. Walker private communication, 2012) were used for comparison to other more site-specific means of estimating bankfull discharge. The tributaries on the site are small streams; small streams are poorly represented on the regional curves.

It has been found that the NC Piedmont Regional Curve Equations may overestimate discharge and channel dimension for smaller streams, such as those present at this site. The unpublished NC Piedmont Regional Curve corresponds closer to the discharge and channel dimension that were compared with the WARSSS (2006) worksheets. Based on these data, Baker estimated bankfull flows using these comparisons shown in Table 17.5.

Additionally, Baker has conducted numerous projects in small drainages in North Carolina, and has produced "mini-curves" specific to these projects. The growing number of data points on these small streams curves provides supporting evidence for the selection of bankfull indicators that produce smaller dimensions and flow rates than the published regional data.

Table 17.5 NC Rural Piedmont Regional Curve Equations
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

NC Piedmont Rural Regional Curve Equations (Harman et al., 1999)		NC Piedmont Rural Regional Curve Equations (Unpublished Revised NC Rural Piedmont Regional Curve (NRCS, 2008)	
$Q_{bkf} = 66.57\ A_w^{0.89}$	$R^2=0.97$	$Q_{bkf} = 58.26\ A_w^{0.78}$	$R^2=0.99$
$A_{bkf} = 21.43\ A_w^{0.68}$	$R^2=0.95$	$A_{bkf} = 15.65 A_w^{0.69}$	$R^2=0.99$
$W_{bkf} = 11.89\ A_w^{0.43}$	$R^2=0.81$	$W_{bkf} = 11.64\ A_w^{0.46}$	$R^2=0.98$
$D_{bkf} = 1.50\ A_w^{0.32}$	$R^2=0.88$	$D_{bkf} = 1.15\ A_w^{0.28}$	$R^2=0.96$

17.2.3 Conclusions for Channel Forming Discharge

As described above in Section 17.1 and 17.2, 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 not possible in the field for all reaches under current conditions, the cross-section data used for the above regional curve comparison are within an acceptable range of values.

Baker estimated the bankfull discharge by comparing unpublished NRCS NC Piedmont Rural Regional Curve and the published NC Piedmont Rural Regional Curve with cross-sectional data. As a comparison, the Friction Factor to Relative Roughness Ratio (method relates hydraulic radius, d84, and shear velocity to flow velocity), Manning Equation with the Manning's n from the friction factor and relative roughness were also considered since some channel sections contain a coarser gravel substrate. Table 17.6 provides a bankfull discharge analyses and comparisons 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 calculated based on the proposed design cross-sections for all project reaches.

Table 17.6 Bankfull Discharge Analysis
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Estimating Method	Bankfull Velocity (ft/sec)	Bankfull Discharge (cfs)
	(Reaches 1, 2, 3, 4, 5)	
NC Rural Piedmont Regional Curve[1] $Q = 89.039*DA^{0.72}$	2.7, 3.5, 3.8, 3.2, 3.4	16.3, 20.9, 26.4, 28.0, 29.6
NRCS NC Rural Piedmont Regional Curve[2] $Q = 56.136*DA^{0.8041}$	1.7, 1.6, 2.0, 2.1, 1.8	9.0, 11.2, 14.7, 16.0, 17.3
Friction Factor to Relative Roughness Ratio method[3] v=[2.83+5.66*log{R/D84}]*v*	4.7, 4.2, 2.8, 3.6, 4.3	25.6, 29.1, 20.4, 28.2, 53.5
Manning's "n" from friction factor and relative roughness[3]	3.5, 4.3, 2.5, 3.3, 3.7	21.3, 29.7, 17.9, 25.9, 46.4

Table 17.6 Bankfull Discharge Analysis
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Estimating Method	Bankfull Velocity (ft/sec)	Bankfull Discharge (cfs)
$v=(1.4895*R^{2/3}*S^{1/2})/n$		
Manning's "n" from stream type[3] $v=(1.4895*R^{2/3}*S^{1/2})/n$	3.4, 3.5, 1.8, 2.5, 3.4	15.6, 24.1, 13.4, 19.4, 41.9
Baker Design Estimate	2.7, 3.5, 3.8, 3.2, 3.4	16.3, 20.9, 26.4, 28.0, 29.6

Notes:
[1] NC Piedmont Regional Curve (Harman et al., 1999). [2] Unpublished Revised NC Rural Piedmont Regional Curve developed by NRCS (A. Walker personal communication, 2008).
[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 0.033 to 0.055 based on channel slopes, depth, bed material size, and vegetation influence.

17.3 Sediment Transport Analysis

17.3.1 Background and Methodology

The purpose of a sediment transport analysis is to ensure that the stream restoration design creates a stable channel that does not aggrade or degrade over time. The overriding assumption is that the site should be transporting the total sediment load delivered from upstream sources. The total volume of sediment transported through a cross-section consists of bedload plus suspended load fractions. Suspended load is normally composed of fine sand, silt, and clay particles transported in the water column. Bedload is generally composed of larger particles, such as course sand, gravels, and cobbles, which are transported by rolling, sliding, or hopping (saltating) along the bed. The ability of the stream to transport its total sediment load can be quantified through two measures: sediment transport competency (force) and sediment transport capacity (power).

Sediment transport competency is a stream's ability to move particles of a given size and is a measurement of force, often expressed as units of pounds per square foot (lbs/ft^2). A streams competency is estimated in terms of the relationship between critical and actual depth, at a given slope, and occurs when the critical depth produces enough shear stress to move the largest (d100) sub pavement particle. Median substrate size has an important influence on the mobility of particles in stream beds. Critical dimensionless shear stress (τ_{ci}) is the measure of force required to initiate general movement of particles in a bed of a given composition. At shear stresses exceeding this critical value, essentially all grain sizes are transported at rates in proportion to their presence in the bed (Wohl, 2000). Critical dimensionless shear stress can be calculated for gravel-bed stream reaches using surface and subsurface particle samples from a stable, representative riffle in the reach (Andrews, 1983). The following equations was used to determine the critical dimensionless shear stress required to mobilize and transport the largest particle from the bar sample (or subpavement sample).

Calculate the ratio d_{50}/ds_{50}

where: d_{50}/ds_{50} median diameter of the riffle bed (from 100 count in riffle or pavement sample)
d_{50}/ds_{50} = median diameter of the bar sample (or subpavement)

$$\tau_{ci} = 0.0834(d_{50}/ds_{50})^{-0.872}$$

The prediction calculations shown on Table 17.7 include shear stress, tractive force, and critical dimensionless shear stress, which help to determine a particle size class (e.g., sand, gravel, cobble) that is mobile, or entrained, under various flow conditions (WARSS, 2006). The aggradation analysis is based on calculations of the required depth and slope needed to transport large sediment particles, in this case defined as the largest particle of the riffle subpavement sample. Required depth can be

compared with the existing/design mean riffle depth, and required slope can be compared to the existing and design slopes to verify that the stream has sufficient competency to move large particles (and thus prevent thalweg aggradation). The required depth and slope are calculated by:

$$d_r = \frac{1.65\tau_{ci}D_i}{S_e} \qquad s_r = \frac{1.65\tau_{ci}D_i}{d_e}$$

where: d_r = required bankfull mean depth (ft)
d_e= design bankfull mean depth (ft)
1.65 = sediment density (submerged specific weight)
= density of sediment (2.65) – density of water (1.0)
τ_{ci} = critical dimensionless shear stress
D_i = largest particle from bar sample (or subpavement) (ft)
s_r = required bankfull water surface slope (ft/ft)
S_e = design bankfull water surface slope (ft/ft)

As a complement to the required depth and slope calculations, boundary shear stresses for a design riffle cross-section can be compared with a modified Shields Curve to predict sediment transport competency. The shear stress placed on the sediment particles is the force that entrains and moves the particles and is given by:

$$\tau = \gamma Rs$$

where: τ = shear stress (lb/ft^2)
γ = specific gravity of water (62.4 lb/ft^3)
R = hydraulic radius (ft)
s = average channel slope (ft/ft)

Additionally, a degradation analysis was conducted in order to assess whether the design cross-sections will result in scour and bed downcutting. The potential for degradation may be evaluated by examining the upper competency limits for design cross-sections and by reviewing existing and design grade control at the site. The calculated shear stress is compared to the Modified Shields Curve determine the largest particle size that stress value will move. This value is comparable to the D_{84} to D_{95} values from the reach-wide pebble count and considered for sizing the design substrate material.

Sediment transport capacity is a stream's ability to move a mass of sediment through a cross-section dimension, and is a measurement of stream power, often expressed in units of watts/square meter (Watts/meter^2). Sediment transport capacity can also be calculated as a sediment transport rating curve, which provides an estimate of the quantity of total sediment load transported through a cross-section per unit of time. For sand bed streams, sediment transport capacity is more critical than competency, but is most directly assessed using actual monitored data from storm events to develop a sediment transport rating curve the project site. Since this curve development is often difficult and was not performed for this project, stream power was calculated and values were compared to reference stream values to confirm that sediment should be adequately transported through the system without containing excess energy in the channel.

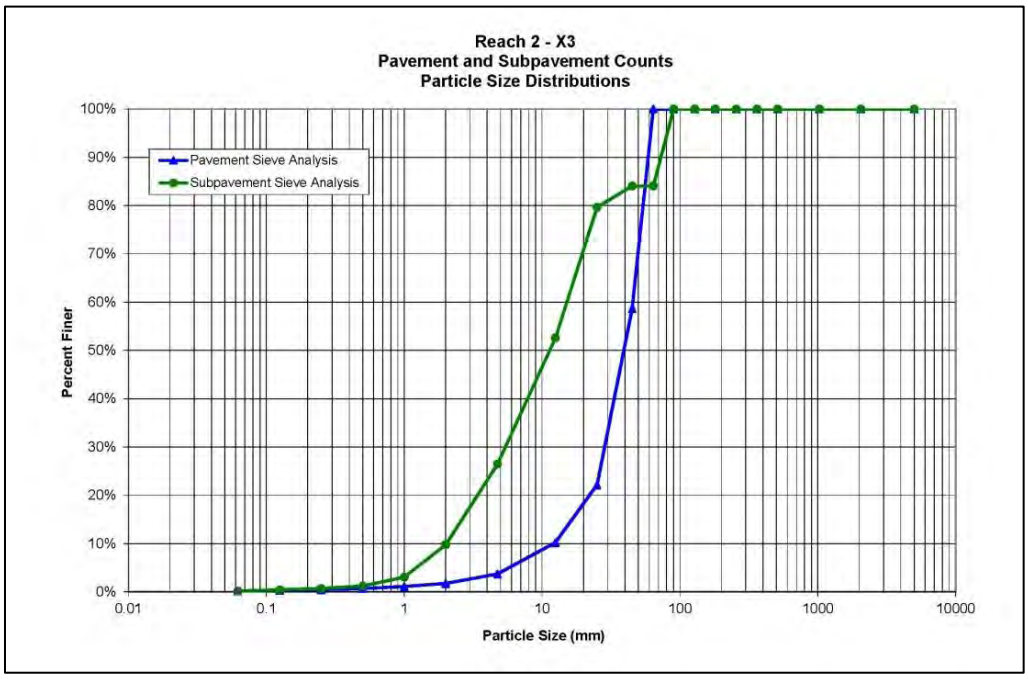
$$w = \gamma QS/W_{bkf}$$

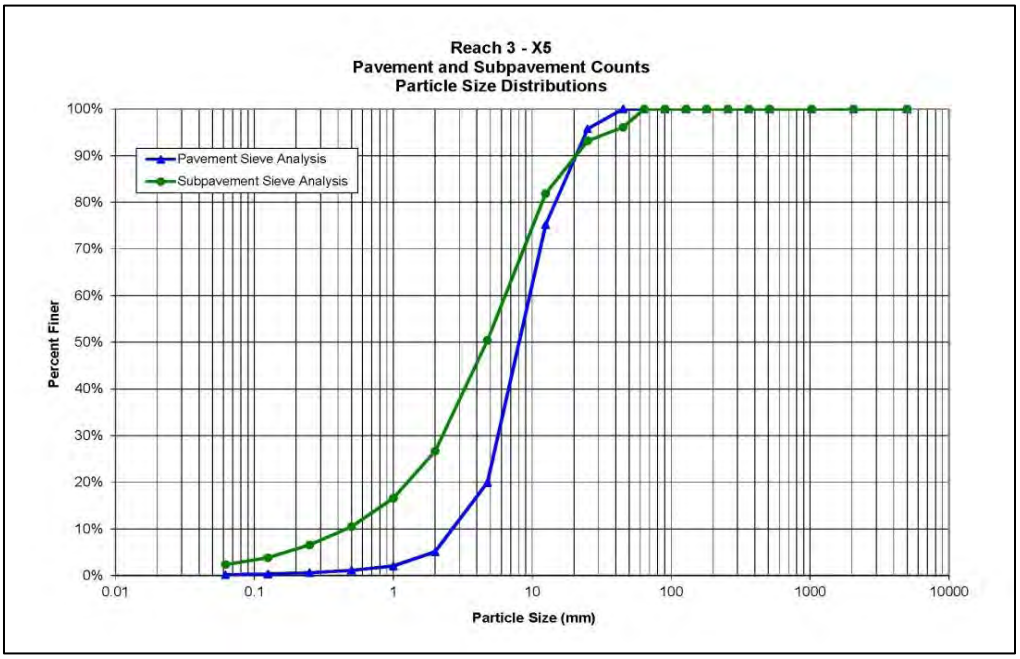
where: w = mean stream power (W/m^2)
γ = specific weight of water 9,810 N/m^3); $\gamma = \rho g$, where ρ is the density of the water-sediment mixture (1,000 kg/m^3) and g is the acceleration due to gravity 9.81 m/s^2)
Q = bankfull discharge (m^3/s)
S = design channel slope (m/m)
Wbkf = bankfull channel width (m)
Note: 1 ft-lb/sec/ft^2 = 14.56 W/m^2

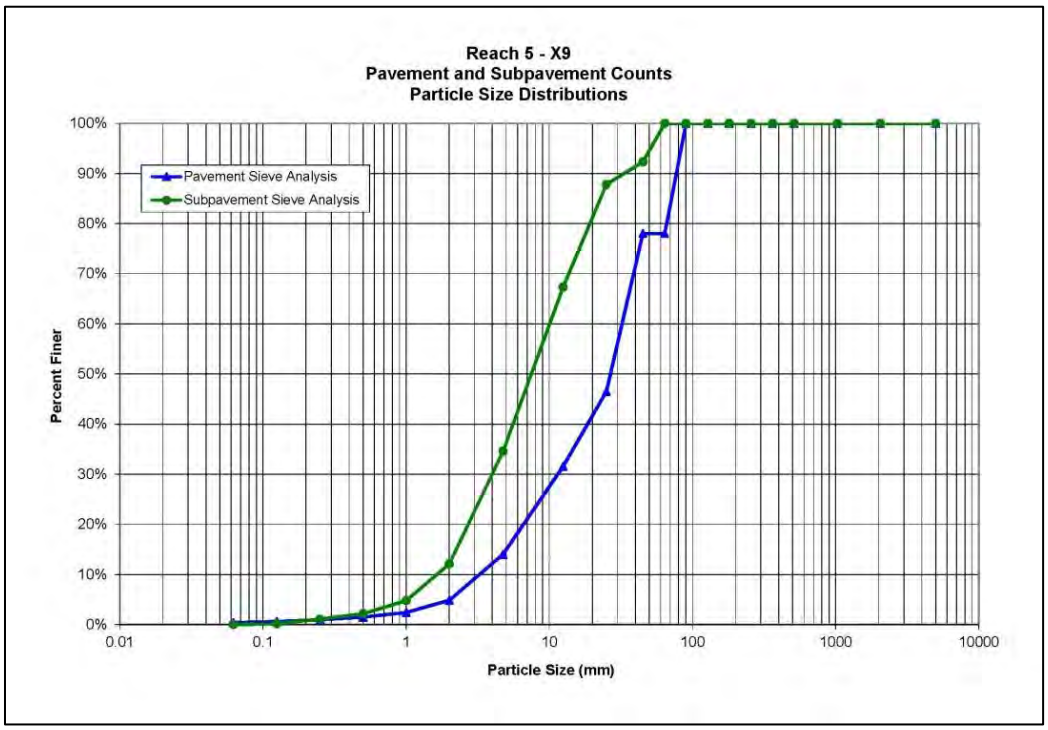
17.3.2 Sampling Data Results

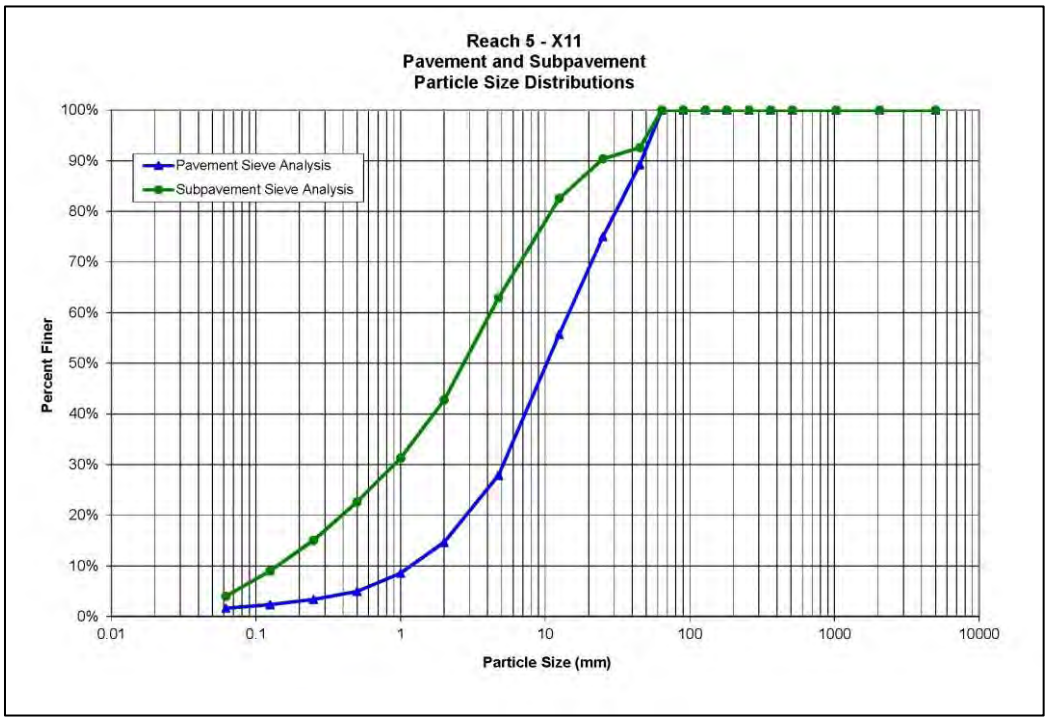
Pavement and subpavement sediment samples were collected along the unnamed tributary and then dry sieved in a lab to obtain a sediment size distribution, determine dimensionless critical shear stress, and calculate/predict corresponding slope and depth required to move the d100 largest particle class size. The sieve data shown in Figure 17.6 indicate that the dominant bed material in the stream channel is coarse sand to medium gravel under current conditions. A majority of the site reaches contain a combination of sand, silt, and gravel bed material due to the parent soil material and cattle impacts. The sediment samples collected helped to confirm these initial observations.

Figure 17.6 Sediment Particle Size Distribution






Reach 5 - X9
Pavement and Subpavement Counts
Particle Size Distributions
Pavement Sieve Analysis
Subpavement Sieve Analysis
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)


Reach 5 - X11
Pavement and Subpavement
Particle Size Distributions
Pavement Sieve Analysis
Subpavement Sieve Analysis
Percent Finer
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.01
0.1
1
10
100
1000
10000
Particle Size (mm)

17.3.3 Predicted Channel Response

The existing channel substrate is predominantly gravel, with a few localized sections of coarser material that control grade, as well as a sandier substrate in some flatter channel sections. Based on field observations from the project area and upper watershed, the streams receive mostly fine materials from stream bank erosion with minimal sediment contributions from the upstream drainage. Further site investigations and visual assessments confirmed that the sediment supply from upstream sources is somewhat limited during larger storm events due to smaller undeveloped headwater drainages, stable streams with floodplain access, and mature stream and riparian buffer vegetation. While it is predicted that the restoration and enhancement efforts will reduce localized stream bed/bank erosion, the channels should still be able to transport smaller bedload and suspended sediment material from upstream sources while maintaining stream bed/bank stability.

Enhancement Reach 4 is relatively stable and will not involve system-wide channel modifications to dimension, pattern and profile; therefore, it was not included in this comparison. Generally, the stream system is in the process of degrading, which means that the channel has abandoned its active floodplain and started deepening/widening to form a new channel at a lower elevation.

As a design consideration, the proposed substrate material mix (riffle armor) will contain particle sizes larger than the d100 to prevent bed scour and achieve vertical stability immediately after construction. In general, the proposed riffles will be constructed using a mix of larger colluvial-size particles ranging from approximately 140mm to 200mm. This approach will mimic the natural armoring present in stable channel sections; however, the material is not intended to mobilize during a bankfull storm event. Any concerns regarding further channel degradation, substrate embeddness, and vertical stability will be addressed by allowing flows greater than bankfull to spread across the geomorphic floodplain (decreasing in-channel shear stress) and by installing a combination of grade control structures such as log/rock step pools and constructed riffles in straighter channel segments.

Table 17.7 Boundary Shear Stress and Stream Power for Existing and Proposed Conditions
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Parameter	Reach 2 Existing Conditions	Reach 2 Proposed Conditions	Reach 3 Existing Conditions	Reach 3 Proposed Conditions	Reach 5 Existing Conditions	Reach 5 Proposed Conditions
Bankfull Discharge Estimate, Q (cfs)	20.9	20.9	26.4	26.4	29.6	29.6
Bankfull XSC Area (square feet)	6.9	6.1	7.3	7.0	12.3	8.7
Mean Bankfull Velocity (cfs)	3.0	3.4	3.6	3.7	2.4	3.4
Bankfull Width, W (feet)	6.6	9.0	16.1	10.0	16.9	10.5
Bankfull Mean Depth, D (feet)	1.0	0.7	0.5	0.7	0.7	0.8
Width to Depth Ratio, w/d (feet/foot)	6.2	13.3	35.6	14.3	23.5	12.5
Wetted Perimeter (feet)	8.7	10.4	17.0	11.4	18.4	12.2
Hydraulic Radius, R (feet)	0.80	0.59	0.43	0.61	0.67	0.71
Channel Slope (feet/ foot)	0.0159	0.0177	0.0111	0.0122	0.0133	0.0106
Boundary Shear Stress, τ (lbs/ft^2)	0.79	0.65	0.30	0.47	0.55	0.47
Subpavement d_{100} (mm)	80	80	60	60	60	60

Table 17.7 Boundary Shear Stress and Stream Power for Existing and Proposed Conditions
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Parameter	Reach 2 Existing Conditions	Reach 2 Proposed Conditions	Reach 3 Existing Conditions	Reach 3 Proposed Conditions	Reach 5 Existing Conditions	Reach 5 Proposed Conditions
Largest Moveable Particle (mm) per Modified Shield's Curve	128	111	62	87	98	88
Predicted Critical Depth (feet)	0.42	0.38	0.41	0.37	0.34	0.43
Predicted Critical Slope (feet/ foot)	0.0064	0.0099	0.0100	0.0065	0.0063	0.0054
Unit Stream Power (W/m^2)	34.9	32.9	15.7	25.6	19.4	23.4

17.4 Existing Vegetation Assessment

The riparian areas within and adjacent to the proposed project area consists of successional forest, pasture, agricultural fields, and disturbed hardwood forest, as described by Schafale and Weakley (1990). Historic land management surrounding the project area has been primarily for agricultural and silvicultural purposes through the alteration of drainage patterns and the significant removal of native species vegetation in the riparian zone. The wooded portions located within the middle of the site consist of basic Mesic Forest in the uplands with Piedmont/Mountain Alluvial Forests and Bottomland Forest in the lower areas and floodplains (Schafale and Weakley, 1990). Some of these areas lack understory vegetation due to extensive livestock use and grazing. The riparian buffer areas overall ranged from somewhat disturbed to very disturbed and a general description of each community follows.

17.4.1 Successional Deciduous Forest

This community is primarily located along the wooded sections located near the middle of the project area. Species include Sweetgum (*Liquidambar styraciflua*), Green ash (*Fraxinus pennsylvanica*) and American elm (*Ulnus Americana*), Tulip poplar (*Liriodendron tulipifera*) and Red maple (*Acer rubrum)*, making up the majority of the canopy throughout the middle reaches.

17.4.2 Agricultural Fields and Pasture Areas

This community covers approximately 45-50 percent of the project area. Currently, pasture areas are used for cattle grazing and fields have been used for cultivated crop production in the recent past. Vegetation within open fields and pasture areas is primarily comprised of fescues, clovers, and Dog fennel (*Eupatorium capillifolium*). In narrow wooded riparian areas within the pastures and fields, the canopy is dominated by Green ash (*Fraxinus pennsylvanica*), American elm (*Ulnus Americana*), Tulip poplar (*Liriodendron tulipifera*) and Red maple (*Acer rubrum*). Understory species consist of Black willow (*Salix negra*), Sweetgum (*Liquidambar styraciflua*), and American holly (*Ilex opaca*). Woody shrub and vine species include Chinese privet (*Ligustrum sinense*), Poison ivy (*Toxicodendron radicans*) and Greenbrier (*Smilax rotundifolia*). Herbaceous species consist of creeping grass (*Microstegium vimineum*), false nettle (*Boehmeria cylindrical*), Dog fennel (*Eupatorium capillifolium*), Sedges (*Carex spp.)* and rushes (*Juncus spp.*).

17.4.3 Invasive Species Vegetation

The invasive species vegetation present on the project site are primarily Chinese privet (*Ligustrum sinense*) and creeping grass (*Microstegium vimineum*) which were found interspersed throughout the riparian buffer and wetland areas.

17.5 Site Wetlands

17.5.1 Jurisdictional Wetland Assessment

The proposed project area was reviewed for the presence of wetlands and waters of the United States in accordance with the provisions on Executive Order 11990, the Clean Water Act, and subsequent federal regulations. 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 included:

1. Prevalence of hydrophytic vegetation.
2. Permanent or periodic inundation or saturation.
3. Hydric soils.

On June 5, 2007, the USACE and US Environmental Protection Agency (USEPA) issued joint guidance for their field offices for Clean Water Act jurisdictional determinations in response to the Supreme Court's decision in the consolidated cases of Rapanos v. United States and Carabell v. United States (USEPA and USACE, 2007). Based on this guidance, the agencies assert jurisdiction over the following waters:

- Traditional navigable waters (TNWs)
- Wetlands adjacent to TNWs
- Non-navigable tributaries of TNWs that are considered relatively permanent waters (RPWs). Such tributaries flow year-round or exhibit continuous flow for at least 3 months.
- Wetlands that directly abut RPWs.

The agencies decided to assert jurisdiction over the following waters based on a standardized analysis to determine whether they have a significant nexus with a traditional navigable water:

- Non-navigable tributaries that are not relatively permanent waters (non-RPWs)
- Wetlands adjacent to non-RPWs
- Wetlands that are adjacent to but do not directly abut an RPW.

The significant nexus analysis is fact-specific and assesses the flow characteristics of a tributary and the functions performed by all its adjacent wetlands to determine if they significantly affect the physical, chemical, and biological integrity of downstream TNWs. A significant nexus exists when a tributary, in combination with its adjacent wetlands, has more than a speculative or insubstantial effect on the physical, chemical, or biological integrity of a TNW.

The USACE and USEPA apply the significant nexus standard within the limits of jurisdiction specified by the Supreme Court decision in the case of Solid Waste Agency of Northern Cook County (SWANCC) v. US Army Corps of Engineers. Under the SWANCC decision, the USACE and USEPA cannot regulate isolated wetlands and waters that lack links to interstate commerce sufficient to serve as a basis for jurisdiction under the Clean Water Act. Though isolated wetlands and waters are not regulated by the USACE, within the state of North Carolina isolated wetlands and waters are considered "waters of the state" and are regulated by the NCDWR under the isolated wetlands rules (15A NCAC 2H .1300).

Following a desktop review of the National Wetland Inventory (NWI), NRCS soil survey and USGS quadrangle maps, the project area was evaluated for potential impacts to jurisdictional wetlands. Baker wetland scientists conducted a field survey of the project area in July 2011 to investigate potential wetlands within hydric soils areas and confirm perennial and intermittent streams in the project area. In

total, the field survey identified eight (8) separate wetland areas containing hydric soil indicators and a predominance of hydrophytic vegetation and wetland hydrology. These areas were identified, flagged, and mapped, as shown in the current conditions map, Figure 2.4. Wetland data forms are provided in Section 16.1, Appendix B. Most of the identified areas along the UT exhibited marginal hydrologic indicators, dominated by herbaceous species currently subject to cattle grazing or pasture management practices. All identified areas are located along the floodplain within depressional areas and/or in headwater forested areas adjacent to the stream channels. These wetland areas have been verified by the USACE and the proposed mitigation plan for the site will seek to enhance wetland functions or avoid impacts to these areas, if possible, in order to restore a stable stream system.

17.5.2 Wetland Impacts and Considerations

It is likely that wetland pockets and floodplain pools were historically present in some of these locations after evaluating existing topography, soils, hydrology and hydrophytic vegetation within the project reaches. The original plant community located in these wetlands was most likely indicative of other wetlands in the region, but past agricultural land use practices have altered the composition of the plant community currently present. Wetland stressors, such as man-made dams, ponds and ditching, have altered the hydrological connections within the project area. The main tributaries were likely deepened to capture various sources of seepage to increase land available for agricultural use, which exacerbated channel incision and exerts a drainage effect on the adjacent fields.

After completing the proposed stream restoration practices, these areas will likely experience a more natural hydrology and flooding regime, and the riparian buffer area will be planted with native woody vegetation that is tolerant of wetter conditions. The design approach will also enhance any potential areas of adjacent fringe or marginal wetlands through higher water table conditions (elevated stream profile) and a more frequent over-bank flooding regime. Stream profiles will be raised along various reaches, which will lead to higher water table conditions adjacent to the channels and more frequent out-of-bank flooding of adjacent wetland areas.

17.5.3 Climatic Conditions

The average growing season (defined as the period in which air temperatures are maintained above 28° Fahrenheit at a frequency of 5 years in 10) for the project locale is 224 days, beginning on March 27th and ending in November 7th (NRCS Stanly County WETS Station: Albemarle, NC, 1998). The area experiences an average annual rainfall of 46.61 inches (Albemarle, NC NRCS Stanly County Soil Survey 1998) as shown on Table 17.8. During 2013, the New London – North Stanly Middle School weather station (NEWL, ECONET) recorded 36.30 inches of rain. In much of the southeastern US, average rainfall exceeds average evapotranspiration losses and these areas experience a moisture excess during most years. Excess water leaves a site by groundwater flow, surface runoff, channelized surface flow, or deep seepage. Annual losses due to deep seepage, or percolation of water to confined aquifer systems, are usually small and are not considered a significant loss pathway for excess water. Although groundwater flow can be significant in some systems, most excess water is lost via surface and shallow subsurface flow.

Table 17.8 Comparison of Monthly Rainfall Amounts for Project Site vs. Long-term Averages
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Month-Year	Observed Monthly Precipitation (in)	WETS Table Average Monthly Precipitation (in)	Deviation of Observed from Average (in)
Jan-2013	3.81	3.52	-0.29
Feb-2013	3.86	4.13	0.27
Mar-2013	3.94	4.24	0.3
Apr-2013	4.66	3.46	-1.2

Table 17.8 Comparison of Monthly Rainfall Amounts for Project Site vs. Long-term Averages Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990			
Month-Year	**Observed Monthly Precipitation (in)**	**WETS Table Average Monthly Precipitation (in)**	**Deviation of Observed from Average (in)**
May-2013	3.04	3.81	0.77
Jun-2013	4.51	4.05	-0.46
Jul-2013	0.88	5.00	4.12
Aug-2013	0.28	5.42	5.14
Sept-2013	2.13	3.92	1.79
Oct-2013	0.05	3.02	2.97
Nov-2013	2.70	2.07	-0.63
Dec-2013	6.44	3.97	-2.47
Sum	**36.30**	**46.61**	**-10.31**

17.5.4 Hydrological Characterization

The presence of buried and surface hydric soils over the portions of the project site is evidence that the site historically supported a stream and wetland system. Like many other rural areas in this region, drainage patterns on-site were historically altered to maximize the availability of arable lands or lands to support livestock. Man-made drainage patterns were added to further drain stream and wetland complexes on-site. Evidence of these swales and ponds still exist today and exert varying degrees of influence on water table hydrology. Wetland hydrology indicators included saturated soils, algal mats, water-stained leaves, drainage patterns, sparsely vegetated concave surfaces, and hydrogen sulfide odors.

17.5.5 Soil Characterization

Soils at the project site were initially determined using NRCS soil survey data for Stanly County. The areas proposed for stream restoration and enhancement are mapped as both non-hydric and hydric soils. The non-hydric soils are mainly the Badin series and the Goldston series. The hydric soils found on the downstream portion of the site is underlain by the Oakboro series, which are classified as nearly level, moderately drained soils that are found on floodplains. Soil texture varied among the wetlands and ranged from clay loam to clay silt to silt loam to loam. Soil color ranged from light grey brown to medium grey (2.5YR 7/1 2.5YR 5/1) with mottles ranging from orange to dark reddish brown, and to orange yellow to yellow brown (7.5YR 6/6 to 10YR 5/6). Hydric soil indicators included depleted matrix and redox depressions. Figure 2.3 shows soil conditions throughout the project area and the Soil Series are shown on Table 17.9.

Table 17.9 NRCS Soil Series (Stanly County Soil Survey, USDA-SCS, 1989)
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Soil Name	Landform	Hydric Soil	Description
Badin	Upland Ridges	No	Well drained soils on narrow, undulating upland ridges that are highly dissected by intermittent drainageways. This soil is found mainly on slate formations. Slope ranges from 2 to 8 percent and permeability is moderate.
Badin	Hilly to Steep	No	Well drained soils on the upland side slopes adjacent to major drainageways. This soil is found mainly on slate formations and sandstone formations from Locust to New London. Slope ranges from 15 to 45 percent and permeability is moderate.
Goldston	Side Slopes	No	Well drained soils on the upland side slopes adjacent to major drainageways throughout the slate belt area of the county. Slope ranges from 15 to 45 percent and permeability is moderate.
Oakboro	Floodplains	Yes	Nearly level and moderately well drained. On long, narrow flood plains typically at the headwater of creeks and the lower reaches of larger streams where floodplains are narrow. Slope ranges from 0 to 2 percent and permeability is moderate.

17.5.6 Plant Community Characterization

Based on historical aerials, site reconnaissance and the landowner's verification, the proposed stream restoration area is comprised of pasture land, narrow tree canopy, headwater forest, and successional vegetation. Historically, the surrounding pasture areas have been used for cattle production. The vegetation diversity present has been impacted due to agriculture management and cattle activities. Current canopy vegetation within the existing delineated wetlands includes hardwood species such as Sweetgum (*Liquidambar styraciflua*), Green ash (*Fraxinus pennsylvanica*), American elm (*Ulnus Americana*) and Chinese privet (*Ligustrum sinese*). Herbaceous vegetation is the dominant stratum in the wetland areas. Common species found include creeping grass (*Microstegium vimineum*), smartweed (*Polygonum spp.)*, spikerush (*Eleocharis spp.*), duck potato (Saggittaria spp.), Sedges (*Carex spp.),* and rushes (*Juncus coriaceus, uncus effusus*).

17.5.7 Proposed Riparian Vegetation Plantings

The vegetative restoration component for this project will include stream bank, floodplain, and transitional upland plantings and in combination, these areas are described as the riparian buffer zone. The planting boundaries are shown on the revegetation plan sheets in Section 18, Appendix D. In addition to the riparian buffer zone, any areas of the site that are disturbed or adversely impacted by the construction process, will be planted.

Bare-root trees, live stakes, and permanent seedlings will be planted within designated areas of the conservation easement. A minimum 50-foot buffer will be established along both stream banks (100-foot minimum width) for all of the proposed stream reaches within the project boundary. In some areas, the buffer width will be in excess of 50 feet along one or both stream banks and will encompass an adjacent pond and/or wooded areas. In general, bare-root vegetation (trees and shrubs) will be planted at a total target density of 680 stems per acre. Planting will be conducted during the dormant season, with all trees being installed between November and March.

Selected species for hardwood revegetation planting are presented in Table 17.10. Tree species selected for restoration and enhancement areas will be weak to tolerant of flooding. Weakly tolerant species are able to survive and grow in areas where the soil is saturated or flooded for relatively short periods of time. Moderately tolerant species are able to survive in soils that are saturated or flooded for several months during the growing season. Flood tolerant species are able to survive on sites in which the soil is saturated or flooded for extended periods during the growing season (WRP, 1997).

Observations will be made during construction of the site regarding the relative wetness of areas to be planted as compared to the revegetation plan. The planting zone will be determined based on these comparisons, and planted species will be matched according to their wetness tolerance and the anticipated wetness of the planting area.

Once trees are transported to the site, they will be planted within two days. Soils across the site will be prepared by sufficiently loosening prior to planting. 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.

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 stream banks between the toe of the stream bank and bankfull elevation. Site variations may require slightly different spacing.

A permanent seed mixture will be applied to all disturbed areas of the project site. Table 17.11 lists the species, mixtures, and application rates that will be used. A mixture is provided that is suitable for stream bank, floodplain, and adjacent wetland areas. The seed mix 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 stream banks of the restored stream channel. The species provided are deep-rooted and have been shown to proliferate along restored stream channels, providing beneficial shade during the hot summer months for newly planted and young woody species and floodplain stability until the woody vegetation matures.

Temporary seeding will be applied to all disturbed areas of the site that are susceptible to erosion. These areas include constructed stream banks, access roads, side slopes, and spoil piles. If temporary seeding is applied from November through April, rye grain will be used and applied at a rate of 130 pounds per acre. If applied from May through October, temporary seeding will consist of browntop millet, applied at a rate of 40 pounds per acre.

Table 17.10 Proposed Bare-Root and Live Stake Species
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Riparian Buffer Bare-Root Plantings (Overstory and Understory Species) - 8' x 8' spacing - 680 stems/Acre			
Bare-Root Overstory Species			
Botanical Name	**Common Name**	**% Planted by Species**	**Wetland Tolerance**
Fraxinus pennsylvanica	Green Ash	8%	FACW
Betula nigra	River Birch	8%	FACW
Liriodendron tulipifera	Tulip Poplar	6%	FACU
Quercus phellos	Willow Oak	5%	FAC
Quercus michauxii	Swamp Chestnut Oak	5%	FACW
Carpinus caroliniana	Ironwood	6%	FAC
Platanus occidentalis	American Sycamore	8%	FACW
Quercus alba	White Oak	3%	FACU

Quercus pagoda Raf.	Cherrybark Oak	5%	FACW
Quercus falcata Michx.	Southern Red Oak	6%	FACU
Bare-Root Understory Species			
Botanical Name	**Common Name**	**% Planted by Species**	**Wetland Tolerance**
Diospyros virginiana	Persimmon	6%	FAC
Lindera benzoin	Spicebush	8%	FAC
Hamamelis virginiana	Witch hazel	6%	FACU
Viburnum dentatum	Arrowwood Viburnum	6%	FAC
Cornus amomum	Silky Dogwood	8%	FACW
Asimina triloba	Paw paw	6%	FAC
Riparian Live Stake Plantings			
Botanical Name	**Common Name**	**% Planted by Species**	**Wetland Tolerance**
Cornus amomum	Silky Dogwood	10%	FACW
Salix nigra	Black Willow	10%	OBL
Salix sericea	Silky Willow	40%	OBL
Sambucus canadensis	Elderberry	40%	FAC

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 17.11 Proposed Permanent Seed Mixture
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

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%	1.50	FAC
Carex crinita	Fringed sedge	10%	2.25	OBL
Chasmanthium latifolium	River oats	5%	1.50	FACU
Elymus virginicus	Virginia wild rye	15%	1.50	FACW
Juncus effusus	Soft rush	5%	2.25	FACW
Panicum virgatum	Switchgrass	10%	1.50	FAC
Polygonum pensylvanicum	Pennsylvania Smartweed	5%	0.75	FACW
Schizachyrium scoparium	Little blue stem	10%	0.75	FACU
Tripsacum dactyloides	Eastern gamagrass	5%	0.75	FACW
Sorghastrum nutans	Indiangrass	10%	0.75	FACU
	Total	100%	15	

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.

17.6 Site Construction

17.6.1 Site Grading, Structure Installation, and Other Project Related Construction

A general construction sequence is provided below and included on the plan set for the Town Creek Restoration 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 fencing 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 Sedimentation and Erosion 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 the new channels. The Contractor may fill ditches, which do not contain any water during the grading operations. 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 stockpiled and placed back over these areas to a depth of eight inches to achieve design grades and create a soil base for vegetation.
12. Contractor shall begin construction on Reach 1 at Station 10+34 and proceed in a downstream direction. Some sections of design channel will be constructed offline and in the dry, since it will be excavated through the field areas. The Contractor shall excavate the channel to design grades in all areas except within 10 feet of the top of existing stream banks.
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. Grading activities shall not be performed within 10 feet of the new stream channel banks. 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 mulch to any areas disturbed during construction. Apply permanent seeding mixtures, as shown on the vegetation plan. Temporary seeding shall be applied in all areas susceptible to erosion (i.e. disturbed ditch banks, steep slopes, and spoil 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 (Reach 2 between Station 20+58 and 20+78 and Reach 5 between Station 45+47 and 45+72) by installing permanent ford crossings, culverts, stabilizing side slopes, and raising 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.

17.6.2 In-stream Structures and Other Construction Elements

A variety of in-stream structures are proposed for the project site. Structures such as log vanes, log and rock step-pools, constructed riffles, root wads, log weirs, and cover logs will be used to stabilize the newly-restored stream and improve habitat functions. Woody debris will be harvested through the construction of this project and incorporated whenever possible. Table 17.12 summarizes the use of in-stream structures at the site.

Table 17.12 Proposed In-Stream Structure Types and Locations
Town Creek Restoration Project Stream Mitigation Plan - NCEEP Project No. 95026; Contract No. 003990

Structure Type	Location
Root Wads	In locations along outside of meander bends or against one stream bank in straight reaches to increase pool diversity and provide refugium for fish.
Grade Control J-Hook Vanes	In locations where grade control is necessary to prevent possible downcutting or headcut migration, and stream bed/bank erosion.
Log Vanes	Located throughout various meander bends to prevent possible stream bank erosion.
Log Weirs / Step Pools	In locations where grade control is necessary to prevent possible downcutting or headcut migration, and bed erosion.

Toe Wood w/ Cover Logs	Located along outside bends to prevent stream bank erosion, increase pool diversity and provide refugium for fish.
Constructed Riffles	In locations where grade control is necessary to prevent possible downcutting or headcut migration, and bed erosion.
Ditch Plug / Channel Block	Installed along some or all of remnant channel segments to prevent subsurface flow.
Vegetation Transplants	In locations outside of meander bends to increase stream bank stability and cover.
Vegetated Geolift	In locations outside of meander bends to create and/or increase stream bank stability and reduce near bank stress.

Root Wads

Root wads are placed at the toe of the stream bank along the outside of meander bends for the creation of habitat and for stream bank protection. Root wads include the root mass or root ball of a tree plus a portion of the trunk. They are used to armor a stream bank and reduce near bank stress by deflecting stream flows away from the stream bank. In addition to stream bank protection, they provide structural support to the stream bank and habitat for fish and other aquatic animals. They also serve as a food source for aquatic insects. Root wads will be placed throughout the project reaches primarily to improve aquatic habitat and provide cover.

Grade Control J-Hook Vanes

Grade control j-hook vanes are utilized to provide grade control and protect the stream banks. These vanes may be constructed out of logs and/or rock boulders. The structure arms turn water away from the stream banks and re-direct flow energies toward the center of the channel. In addition to providing stability to stream banks, grade control j-hook vanes also promote pool scour and provide structure within the pool habitat. Grade control j-hooks have two to three boulders placed in a hook shape at the upstream end of the vane. The primary difference between regular j-hooks and grade control j-hooks is the way that the "hook" part of the structure is constructed. Regular j-hooks are constructed to have gaps between the header boulders in the hook to promote flow convergence. Grade control j-hooks do not have gaps between the header boulders in the hook and also have a boulder sill built from the outside of the hook over to the opposite stream bank such that the structure can serve as a grade control feature. Grade control j-hooks still promote scour in the downstream pool, thus providing habitat benefit.

Log Vanes

A log vane is used to provide cover for aquatic organisms in the downstream scour pool and with a potential secondary benefit of protecting stream banks by reducing near-bank stress and redirecting flow away from the stream bank. The length of a single vane structure can span one-half to two-thirds the bankfull channel width. Vanes are located just downstream of the point where the stream flow intersects the stream bank at an acute angle in a meander bend.

Log Weirs / Step Pools

Log weirs and step pools are used to provide grade control as well as provide a secondary pool habitat benefit for aquatic organisms. A log weir consists of two logs stacked (a header log and a footer log) and installed perpendicular to the direction of flow. This center structure sets the invert elevation of the streambed. A step pool sequence or log/rock "rollers" are also commonly used in confined settings where sinuosity is less than 1.2 and in drainage areas less than 3 square miles, and located based on pool-to-pool spacing ratios. They can be used as floodplain interceptors to intercept concentrated floodplain flows from swales, ditches, low points, oxbow pond or vernal pool drains, etc. and to drain such flow to the restored channel in a stable and natural manner.

Toe Wood with Cover Logs

Toe wood structures are typically constructed in meandering streams using a combination of native materials such as logs, branches, brush, live cuttings, sods mats, transplants, and soil. The structure helps ensure long-term stability against eroding banks and can enhance aquatic and terrestrial habitat within the pool area by establishing a source of detritus and large woody debris. The structures are located along the outer meander bends and should cover at least the lower half of the bank such that the toe wood is submerged and saturated to avoid premature deterioration. The upper bank contains live cuttings in combination with sod mats, live stakes, transplants, or geolifts to cover the toe wood up to the bankfull stage.

A cover log is placed along the outside of a meander bend to provide habitat in the pool area. It is most often installed in conjunction with root wads. The log is buried into the outside stream bank of the meander bend; the opposite end extends through the deepest part of the pool and may be buried in the inside of the meander bend, in the bottom of the point bar. The placement of the cover log near the bottom of the stream bank slope on the outside of the bend encourages scour in the pool. This increased scour provides a deeper pool for bedform variability.

Constructed Riffles

A constructed riffle is installed by placing coarse bed material (gravel, cobble, and small boulders) in the stream at specific riffle locations along the profile. The purpose of this structure is to provide initial grade control and establish riffle habitat within the restored channel, prior to the natural establishment of an armored streambed. Wood material can also be incorporated with rock for these structures, and function in a similar way as natural riffles; the surfaces and interstitial spaces are crucial to the life cycles of many aquatic macroinvertebrate species.

Ditch Plug / Channel Block

A compacted earth plug will be installed by filling the existing ditch to prevent subsurface flows and improve site hydrology. The fill material used for ditch plugs shall come from a nearby borrow area and be free of debris, rocks, trash, etc. and shall consist of compactable soil material.

Vegetation Transplants

Vegetation transplants will be identified before starting construction as viable candidates (species and size) for uprooting and relocation. Areas that must be cleared will maximize the harvesting of transplants; transplants will be taken from other areas as suitable to enhance the rapid development of vegetative growth along the constructed channel.

Vegetated Geolift

Geolifts are a bioengineering measure used to stabilize stream banks. Geolifts are most commonly used along the outside of stream meander bends. They are essentially a series of large overlapping soil "burritos," or "lifts", constructed using coir fiber erosion control matting and native soils. Live cutting materials, or whips, from specific woody native species plants are planted in the layers between the lifts. A stone or woody brush toe base is typically installed to provide protection at the toe of the stream bank and to provide a foundation for the geolifts. The geolifts are installed on top of the base material to comprise the entire restored stream bank up to the bankfull channel elevation. Geolifts can be used to effectively stabilize restored stream banks for all sizes of streams simply by varying the number of lifts required to form the stream bank.

18.0 APPENDIX D - PROJECT PLAN SHEETS

PROJECT: 124526 TOWN CREEK RESTORATION PROJECT–OPTION B

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	124526	C1	35

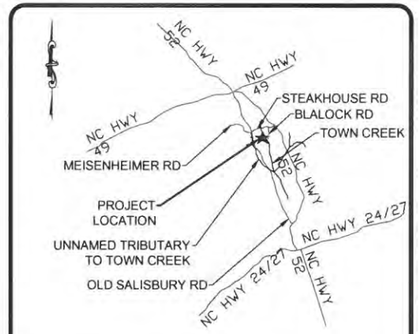
NC ECOSYSTEM ENHANCEMENT PROGRAM

STANLY COUNTY

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

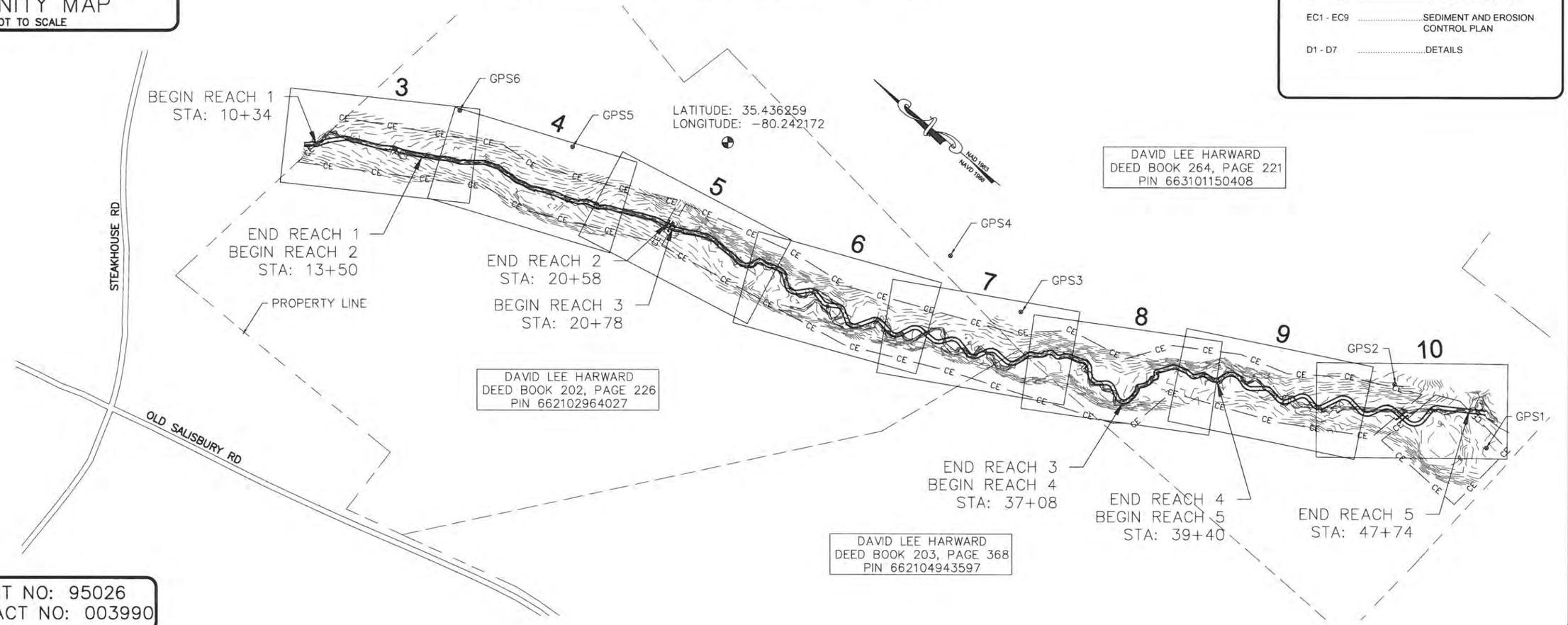
LOCATION:
APPROXIMATELY 9 MILES NORTHWEST OF ALBEMARLE, NC NEAR THE INTERSECTION OF STEAKHOUSE ROAD AND OLD SALISBURY ROAD

TYPE OF WORK:
STREAM RESTORATION & STREAM ENHANCEMENT



VICINITY MAP
NOT TO SCALE

SHEET INDEX



DAVID LEE HARWARD
DEED BOOK 264, PAGE 221
PIN 663101150408

DAVID LEE HARWARD
DEED BOOK 202, PAGE 226
PIN 662102964027

DAVID LEE HARWARD
DEED BOOK 203, PAGE 368
PIN 662104943597

EEP PROJECT NO: 95026
EEP CONTRACT NO: 003990

GRAPHIC SCALES

PLANS
20 0 20 40

PROFILE (HORIZONTAL)
20 0 20 40

PROFILE (VERTICAL)
4 0 4 8

CONTROL POINTS			
POINT	NORTHING	EASTING	ELEVATION
GPS1	613754.25	1630860.98	541.40
GPS2	614063.02	1630823.49	553.43
GPS3	614976.29	1630276.26	573.19
GPS4	615228.37	1630262.04	585.99
GPS5	616217.36	1629783.66	600.72
GPS6	616519.86	1629648.52	601.23

DESIGN SUMMARY

REACH NAME	METHOD	PROPOSED LENGTH (FT)
1	RESTORATION	316
2	ENHANCEMENT I	708
3	RESTORATION	1630
4	ENHANCEMENT I	232
5	RESTORATION	809

PREPARED FOR THE OFFICE OF:
Ecosystem Enhancement Program
NCDENR – ECOSYSTEM ENHANCEMENT PROGRAM
2728 CAPITAL BLVD., SUITE 1H 103
RALEIGH, NC 27604

NCEEP CONTACT: HARRY TSOMIDES, REVIEW COORDINATOR
NCEEP CONTACT: HARRY TSOMIDES, PROJECT MANAGER

PREPARED IN THE OFFICE OF:
Baker
Michael Baker Engineering, Inc.
797 HAYWOOD ROAD
Suite 200
ASHEVILLE, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409
PROFESSIONAL CORPORATION LICENSE NUMBER: F-1084

WILLIAM S. HUNT III, P.E.
PROJECT ENGINEER
MICKY CLEMMONS
PROJECT DESIGNER

PROJECT ENGINEER
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III P.E.
08.14.14
SIGNATURE:

CONSTRUCTION SEQUENCE

Construction shall be performed in general accordance with the following sequence:

Construction Sequence

1. Preparation for site access.
   a. Utility locations shown on these plans are approximate. The Contractor shall have all underground utilities within the project limits located and marked prior to beginning construction. Contractor must call 1-800-632-4949 to locate all underground utilities before mobilizing to the site.
   b. Contractor must schedule and attend a pre-construction conference with the NCDENR Dept. of Land Quality Sediment and Erosion Control Inspector, engineer, and appropriate utility companies.
   c. Contractor is to not disturb more than can be stabilized within the same day.
   d. Contractor is not to disturb any areas outside the limits of disturbance and shall pay close attention to areas in and around the existing wetlands.
   e. Clearing and Grubbing is minimal and can be accomplished with an excavator and track truck; therefore, additional equipment, such as a pan or off-road dump trucks, are not required. Waste material is to be disposed within the project limits as depicted on the plan set.
   f. Where feasible, the channel construction should always begin at the upstream extents and work downstream.
   g. When access to a construction area requires crossing a delineated jurisdictional feature, impacts shall be minimized by placing a temporary stream/wetland crossing (as outlined on D6 of the plan set) across the feature prior to accessing the area with heavy equipment.
   h. Erosion control measures shall be installed by the contractor to protect jurisdictional waters from significant runoff prior to permanent stabilization. Measures to be used shall include measures shown on the plan (e.g. silt fence, check dams, temporary construction entrances, temporary stream crossings, haul road, etc.).
2. Access to the project site shall be from State Road 1400, Old Salisbury Road, .35 miles south of its intersection with SR 1440, Misenheimer Road. Access paths are shown on the plan sheets. Upon mobilization of equipment and materials to the site, access to work areas shall be along paths designated by the landowner and shown on the plan sheets. Trucks and equipment shall use the farm roads to access the project reach. Where roads are not adjacent to the stream, centralized stream accesses shall be used as shown in the plans.
3. Equipment and materials shall be mobilized to the site.
4. A gravel, Class A Stone "construction entrance" at least 50 feet in length, shall be incorporated into access points that connect to any public road. See plan set for construction entrance locations and installation details.
5. Construction access and staging areas will be established near stations 13+00 (left), 19+00 (left), 23+50 (right), 27+50 (left), 28+50 (left), 33+00 (right), 37+00 (left), 38+00 (right), and 44+00 (right). Equipment and materials will be mobilized to these locations and as shown in these plans.
6. Install sediment and erosion control measures, temporary stream crossings, and silt fence. Clear and install silt fence around stockpile areas.
7. Temporary check dams shall be installed as shown in the plans. Temporary check dams shall be removed when grading work upstream has been completed.
   a. The contractor shall be responsible for inspecting the temporary rock check dams on a daily basis and cleaning or repairing them as needed. The contractor shall be required to remove sediment from the check dams once the depth of sediment reaches 12 inches.
8. Contractor is required to remove existing topsoil layer and stockpile in designated areas separate from other stockpiled soil for later reapplication to the excavated floodplain and constructed wetlands.
9. Construction will proceed upstream to downstream.
10. Temporary stream crossings may be installed at locations shown on the plans.
11. Contractor to construct stream off-line where feasible. In-line construction will be necessary in areas where the proposed channel crosses the existing channel. Temporary sand bag coffer dams will be installed upstream of each work area and flow in the work reach will be diverted with a pump and piping. The length of each diversion will be approximately 200 to 400 linear feet.
12. The clearing and grubbing required within the grading limits shall be performed so as to limit sediment migration off-site. Logs and root wads from trees larger than 10 inches in diameter shall be stockpiled for use as in-stream structures. In areas where new channel will be constructed salvageable native vegetation, mats or individual plants will be harvested for transplanting. These mats will be excavated and moved to the banks of the new channel sections.
13. The new channel sections shall be stabilized with in-stream structures, erosion control matting, seed, mulch, and transplants before turning water into these sections. Compacted soil channel plugs (clay if available) shall be installed in areas where the new channel diverges from the original channel, and the original, abandoned channel sections will be backfilled.
14. Earthwork shall be staged such that no more channel will be disturbed than can be stabilized by the end of the work day or before flow is diverted into a new channel segment.
15. Dewatering of off-line channel sections is expected to be minor. Any water pumped during dewatering operations in the off-line sections will be diverted through a sediment filter before being discharged into the downstream reach.
16. Excess soil materials will be stockpiled outside the floodplain in the staging areas, with silt fence installed on the stream side(s) of the base of the stockpiles and maintained when sediment has accumulated above one third of the height of the silt fence and/or the silt fence has failed. This excess material will be hauled outside the conservation easement to identified waste areas or used to backfill abandoned channel before demobilization.
17. The flow diversions and stream crossings will be removed when no longer needed and the banks in these areas stabilized with seeding and matting.
18. Bank and floodplain vegetation, including brush materials and live stakes, will be installed during dormant season, November to April.
19. Construction entrances, staging areas and silt fences will be removed once planting is complete or once they are no longer needed.
20. After construction on the reach is complete, stabilize with erosion control matting and permanent vegetation before proceeding to the next reach. No more area is to be disturbed than can be stabilized within the work day. All disturbed areas are to be stabilized at the end of each work day.
21. Demobilize from site after site has been approved by designer.

CONVENTIONAL SYMBOLS

EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
EXISTING STREAM ALIGNMENT
EXISTING SANITARY SEWER
EXISTING OVERHEAD ELECTRIC
EXISTING FENCE
PROPOSED STREAM ALIGNMENT
PROPOSED TOP OF BANK
PROPOSED TEMPORARY SILT FENCE
PROPOSED LIMIT OF DISTURBANCE
PROPOSED CONSERVATION EASEMENT
PROPOSED TEMPORARY HI-VIZ SAFETY FENCE
PROPOSED FENCE

FLOW DIRECTION
EXISTING TREE
EXISTING WETLAND
PROPOSED ROCK CROSS VANE
PROPOSED LOG J-HOOK
PROPOSED BOULDER STEP
PROPOSED LOG VANE
PROPOSED ROOTWADS
PROPOSED CONSTRUCTED RIFFLE
PROPOSED VEGETATED GEOLIFT
PROPOSED TOE WOOD
PROPOSED ROCK VANE
PROPOSED BOULDER TOE
PROPOSED TEMPORARY STREAM/WETLAND CROSSING
PROPOSED TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
PROPOSED TEMPORARY ROCK CHECK DAM
EXISTING FARM ROAD
PROPOSED TEMPORARY HAUL ROAD
EXISTING FARM ROAD TO REMOVE/RELOCATE

PROPOSED TRANSPLANT
PROPOSED CHANNEL PLUG
PROPOSED CHANNEL FILL
PROPOSED ANGLED LOG STEP
PROPOSED PERMANENT STREAM CROSSING
PROPOSED PUMP AROUND

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	1
NCEEP PROJECT NO. 95028	DATE: 8/15/2014
PROJECT ENGINEER	

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Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III 08.14.14

TOWN CREEK RESTORATION PROJECT–OPTION B

CONSTRUCTION SEQUENCE AND SYMBOLS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	2
EEP PROJECT NO. 95028	DATE: 3/6/2014

PROJECT ENGINEER

PROGRESS
DRAWINGS
NOT FOR
CONSTRUCTION

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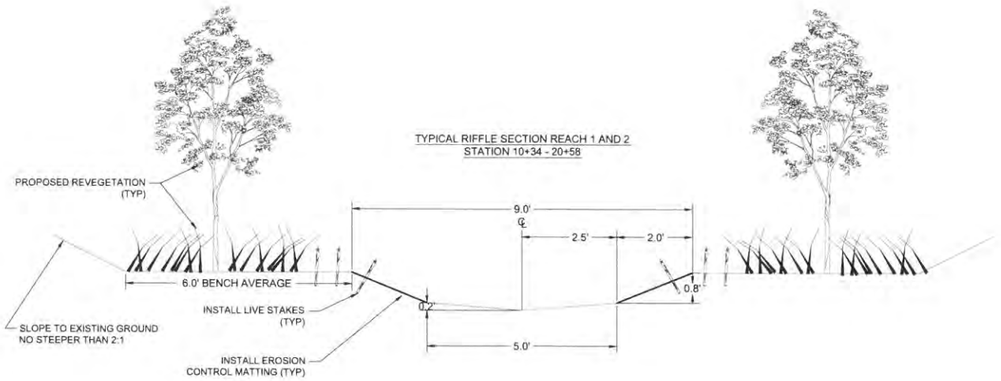
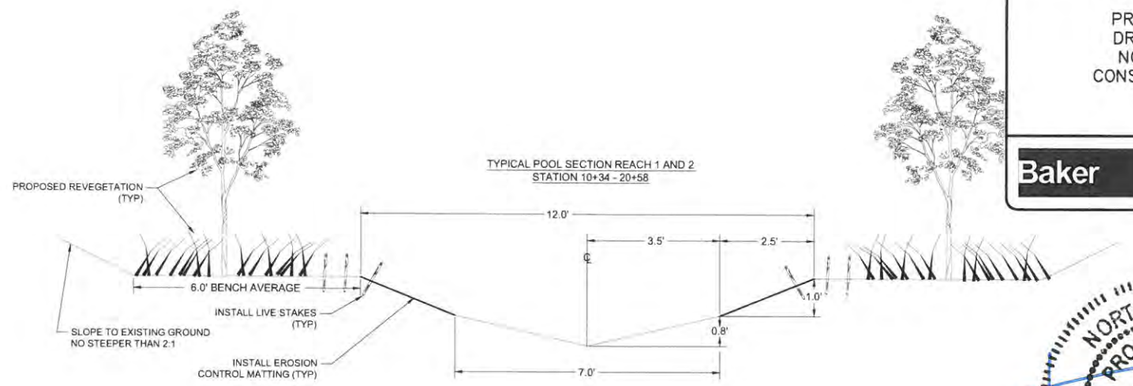
TYPICAL RIFFLE SECTION REACH 1 AND 2
STATION 10+34 - 20+58

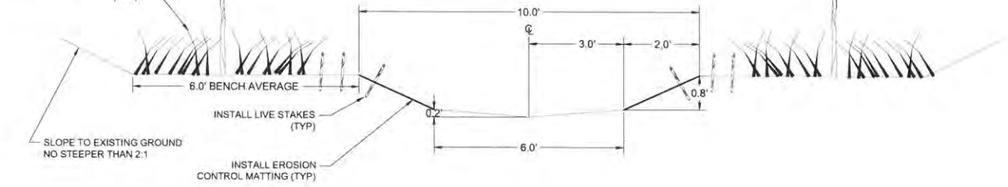


TYPICAL POOL SECTION REACH 1 AND 2
STATION 10+34 - 20+58

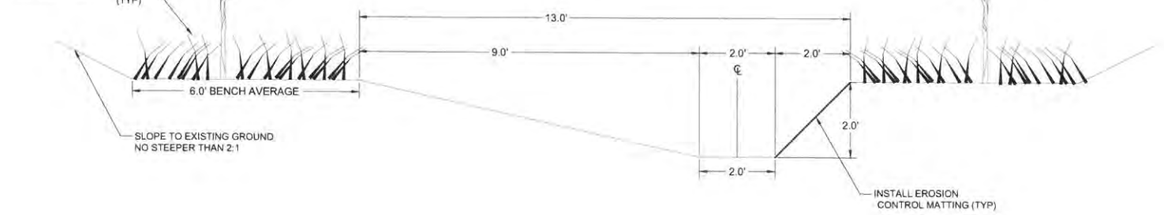


NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
10.29.2014

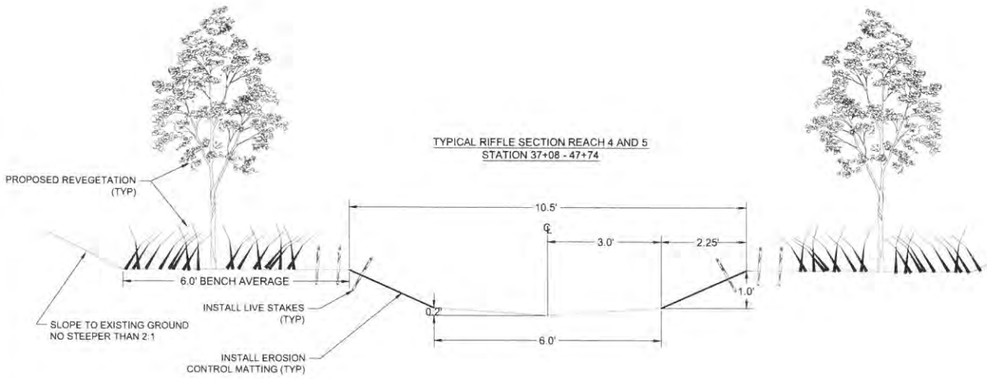
TYPICAL RIFFLE SECTION REACH 3
STATION 20+78 - 37+08



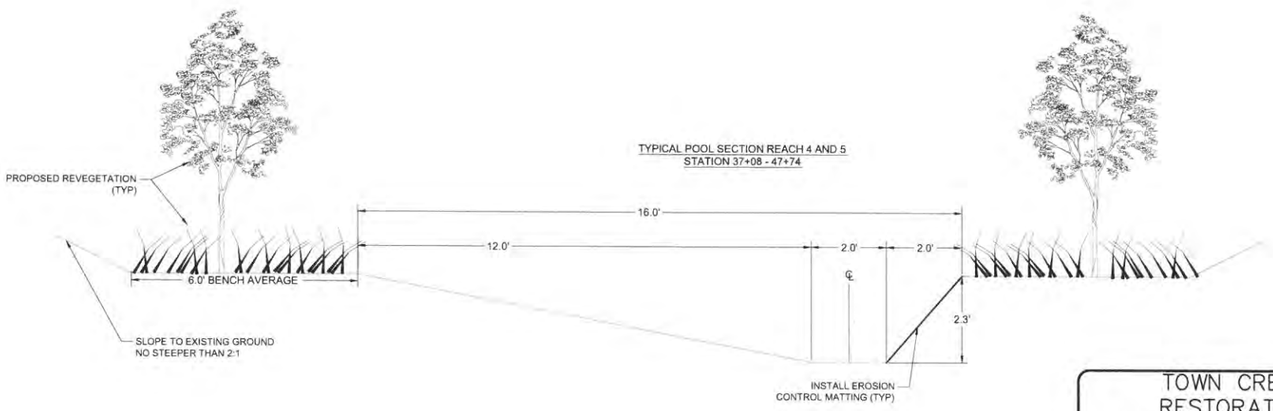
TYPICAL POOL SECTION REACH 3
STATION 20+78 - 37+08



TYPICAL RIFFLE SECTION REACH 4 AND 5
STATION 37+08 - 47+74



TYPICAL POOL SECTION REACH 4 AND 5
STATION 37+08 - 47+74



TOWN CREEK
RESTORATION
PROJECT–OPTION B

TYPICAL
CROSS SECTIONS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	3
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

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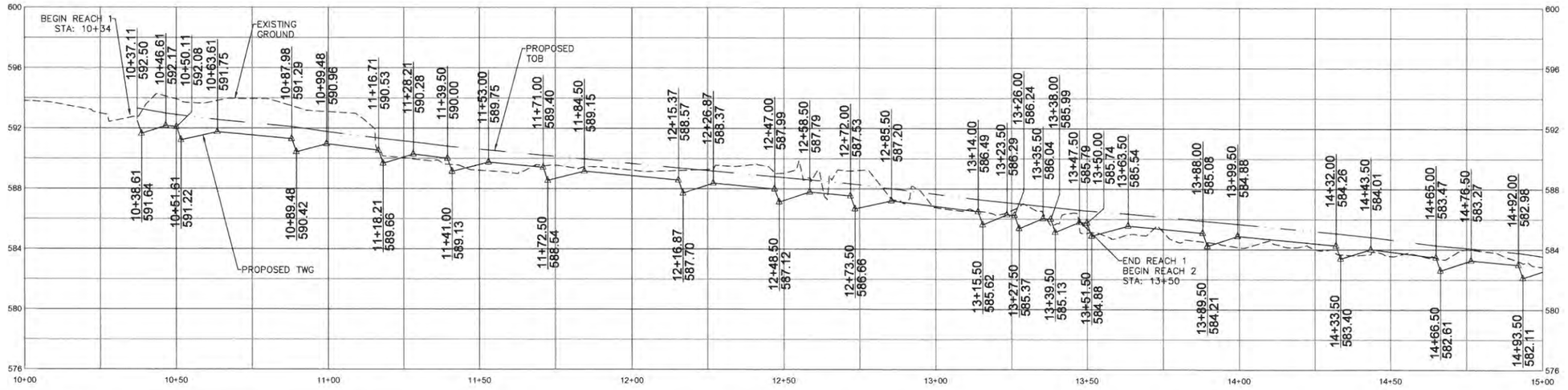
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

NAD 1983
NAVD 1988

GPS6
N: 616519.86
E: 1629648.52
ELEV: 601.23'

TIE PROPOSED FENCE INTO EXISTING FENCE
PROPOSED FENCE
CONSERVATION EASEMENT
CHANNEL PLUG
BEGIN REACH 1
STA: 10+34
FLOW
INSTALL GEOLIFT (TYP)
INSTALL J-HOOK LOG VANE (TYP)
INSTALL ANGLED LOG STEP (TYP)
END REACH 1
BEGIN REACH 2
STA: 13+50
INSTALL LOG VANE (TYP)
INSTALL CONSTRUCTED RIFFLE (TYP)
INCORPORATE BEDROCK PER DIRECTION OF ENGINEER
INSTALL BOULDER STEP (TYP)
10+00
10+50
11+00
11+50
12+00
12+50
13+00
13+50
14+00
14+50
15+00

MATCHLINE SHEET 4 STA. 15+00



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

4 0 4 8
VERTICAL SCALE (FT)
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	4
NCEEP PROJECT NO 95026	DATE: 8/15/2014

PROJECT ENGINEER

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797 Haywood Road
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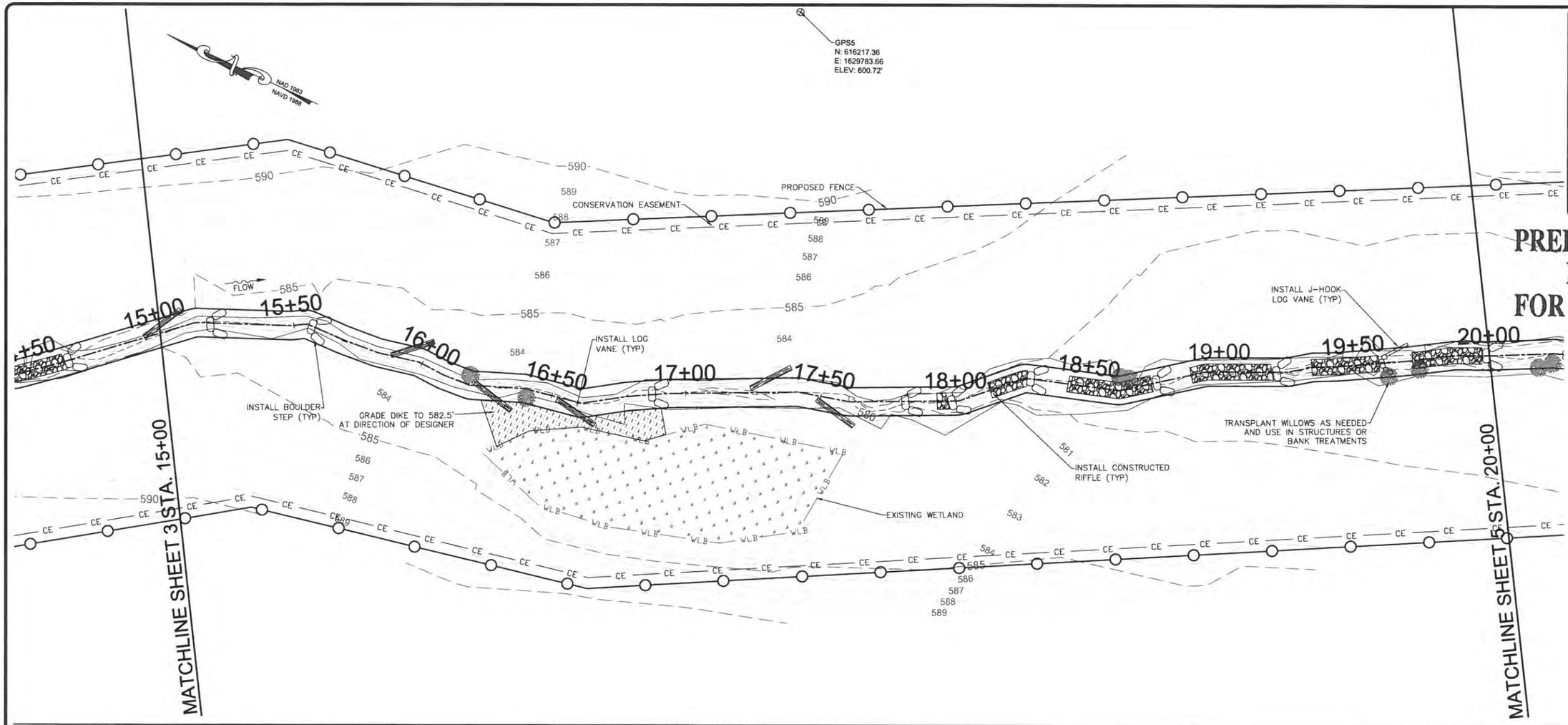
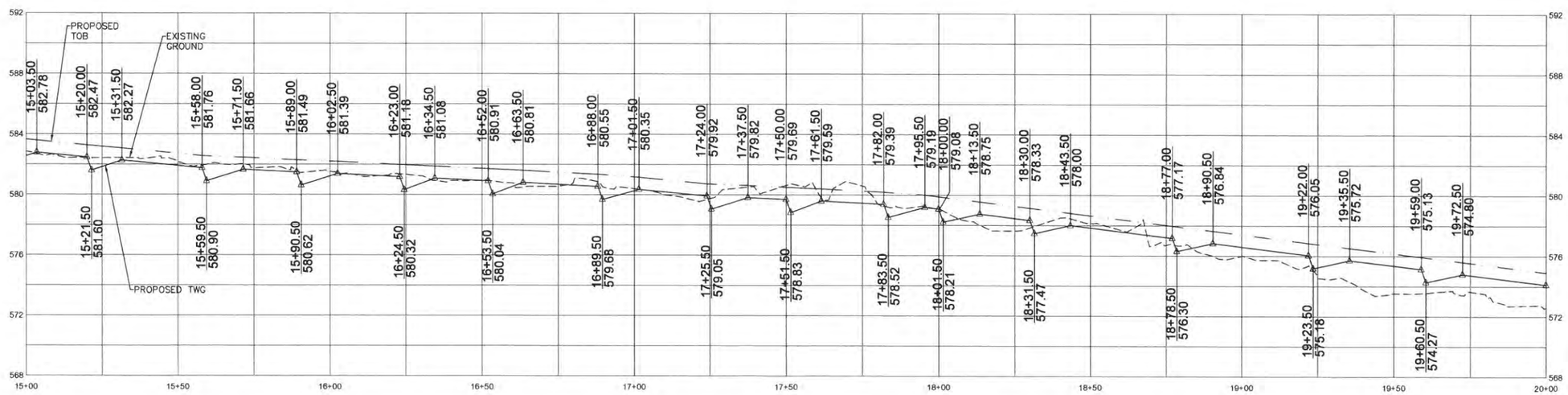
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION





NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	5
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

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Michael Baker Engineering, Inc.
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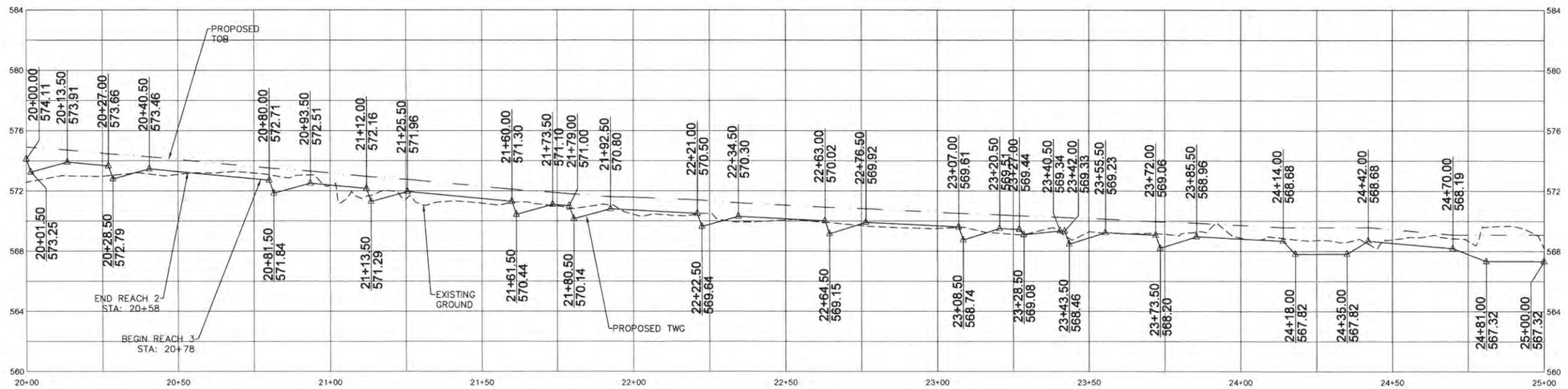
Phone: 828.350.1408
Fax: 828.350.1409

NAD 1983
NAVD 1988

PERMANENT STREAM CROSSING (TYP)
CONSERVATION EASEMENT
PROPOSED FENCE
BEGIN REACH 3 STA: 20+78
END REACH 2 STA: 20+58
INSTALL BOULDER TOE (TYP)
INSTALL ROCK VANE (TYP)
INSTALL TOE WOOD (TYP)
INSTALL BOULDER STEP (TYP)
INSTALL LOG VANE (TYP)
INSTALL CONSTRUCTED RIFFLE (TYP)
INSTALL TRANSPLANTS (TYP)
INSTALL ROOT WADS (TYP)
INSTALL J-HOOK LOG VANE (TYP)
CHANNEL PLUG (TYP)
FLOW
STRUCTURES SHOULD INCORPORATE EXISTING BEDROCK WHERE POSSIBLE IN THIS AREA PER DIRECTION OF ENGINEER
INSTALL GATES AT PERMANENT STREAM CROSSING
MATCHLINE SHEET 4 STA. 20+00
MATCHLINE SHEET 6 STA 25+00

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
03.14.14

4 0 4 8
VERTICAL SCALE (FT)
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	6
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

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Michael Baker Engineering, Inc.
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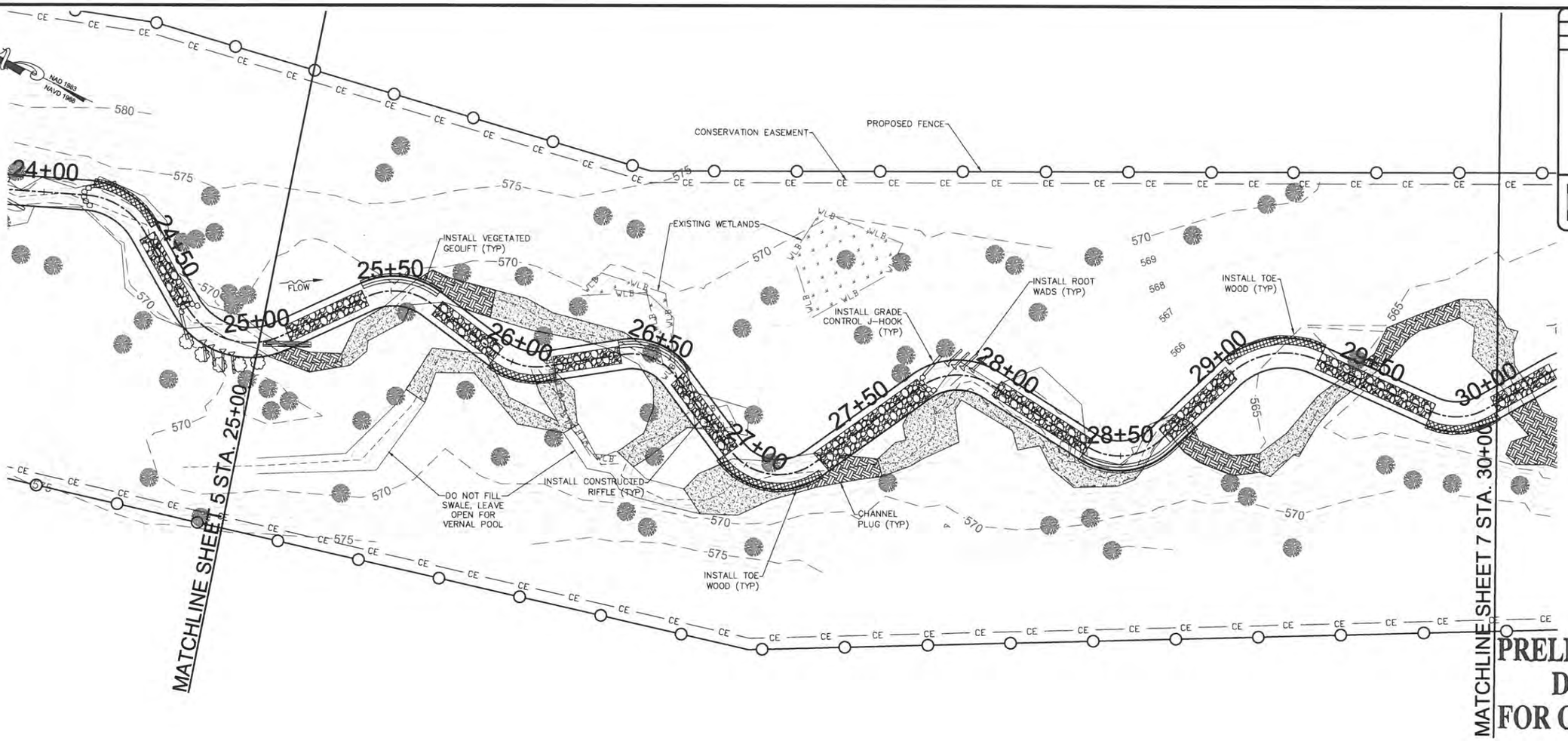
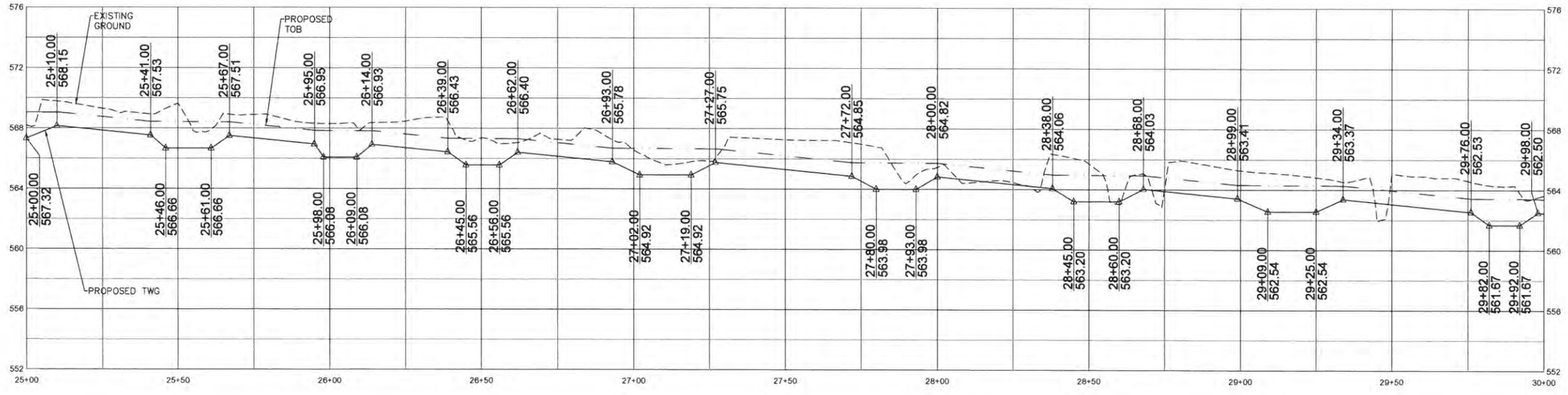
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.4.4

4 0 4 8
VERTICAL SCALE (FT)
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	7
NCEEP PROJECT NO. 95026	DATE: 8/15/2014

PROJECT ENGINEER

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Michael Baker Engineering, Inc.
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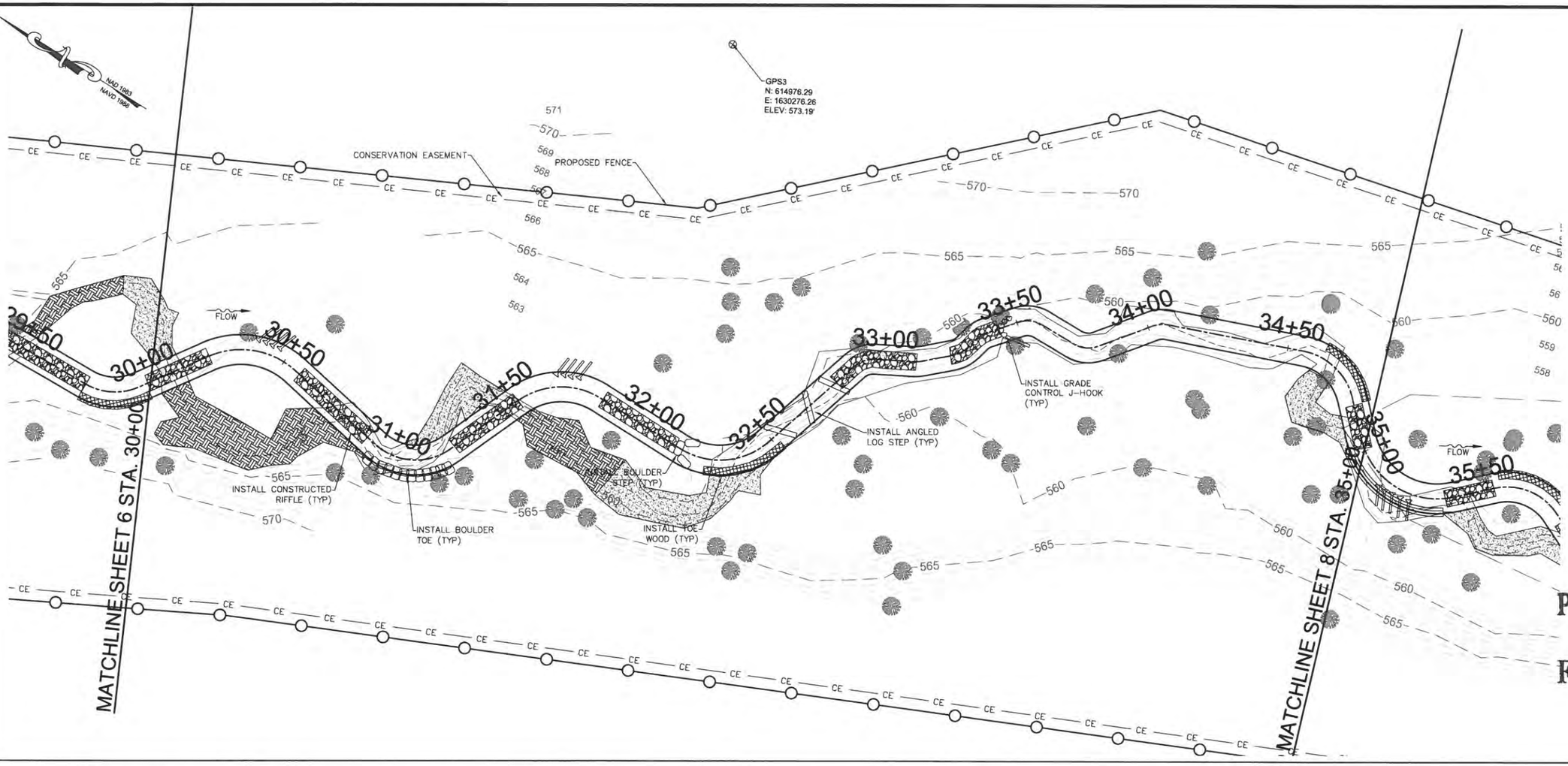
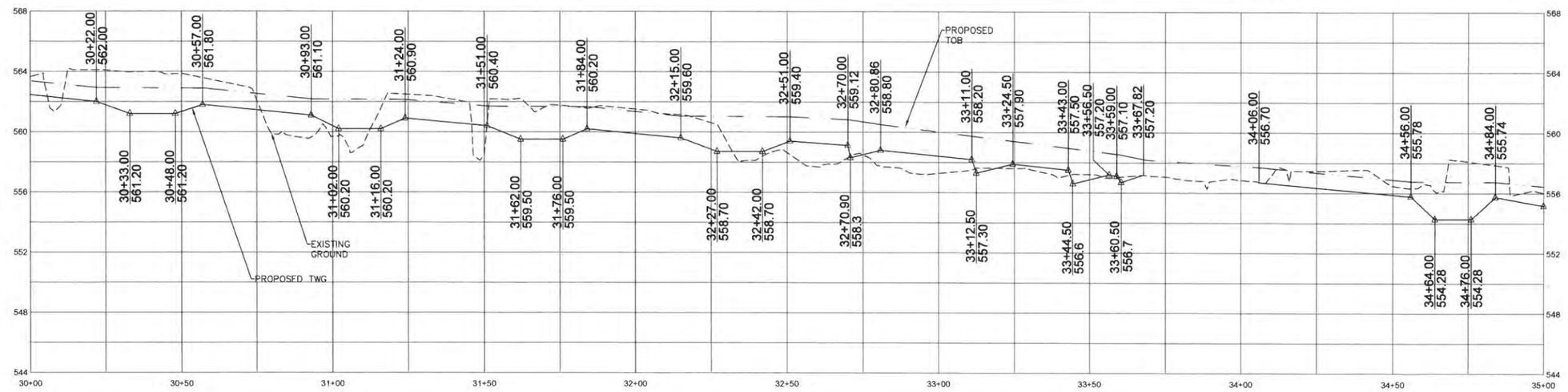
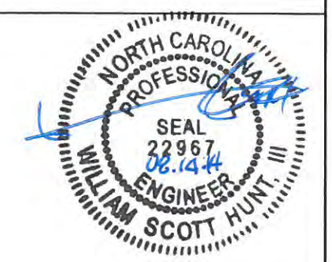
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION





4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	8
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
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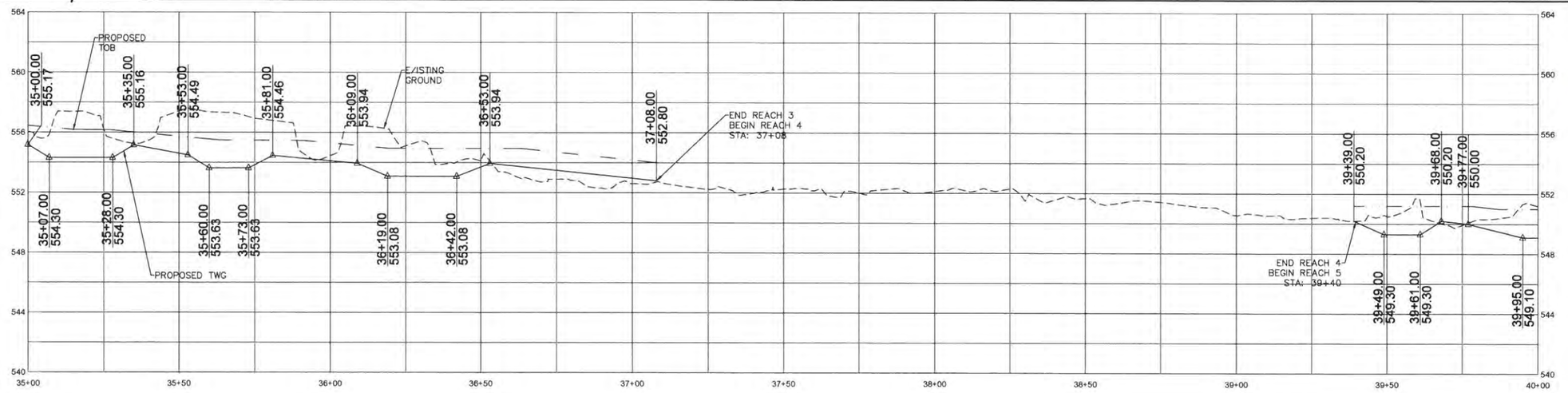
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

NAD 1983
NAVD 1988

CONSERVATION EASEMENT
PROPOSED FENCE
SLOPE BANKS 2.5:1
STA: 37+08–39+40
END REACH 4
BEGIN REACH 5
STA: 39+40
END REACH 3
BEGIN REACH 4
STA: 37+08
INSTALL TOE WOOD (TYP)
INSTALL GEOLIFT AND ROOT WADS (TYP)
INSTALL CONSTRUCTED RIFFLE (TYP)
INSTALL LOG VANE (TYP)
INSTALL TRANSPLANTS (TYP)
INSTALL VEGETATED GEOLIFT (TYP)
EXISTING WETLAND
FLOW
MATCHLINE SHEET 7 STA. 35+00
MATCHLINE SHEET 9 STA. 40+00

PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.14.14

4 0 4 8
VERTICAL SCALE (FT)
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	9
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

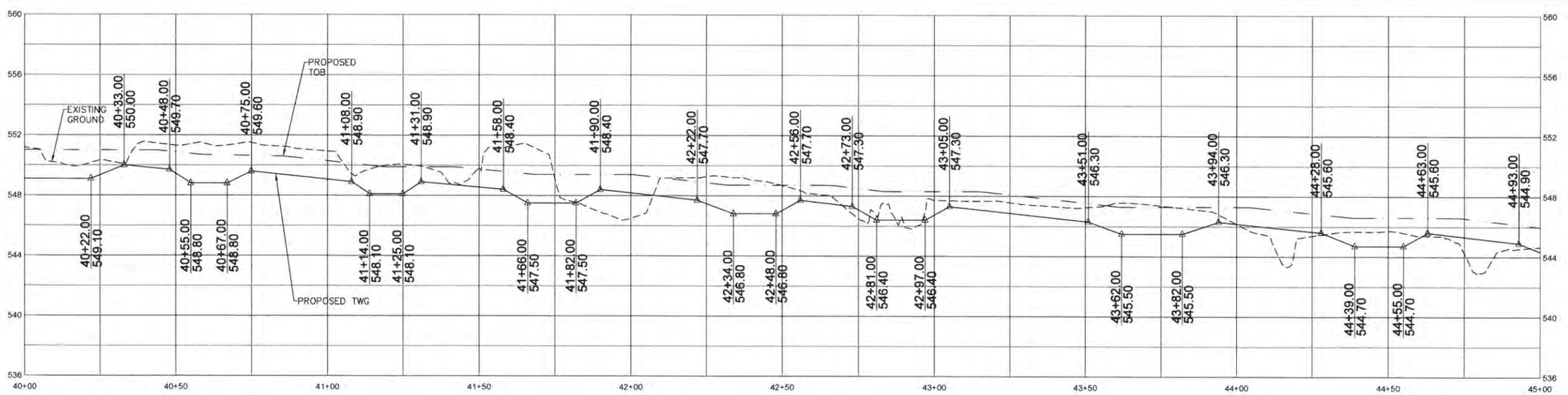
Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

NAD 1983
NAVD 1988

GPS2
N: 614063.02
E: 1630823.49
ELEV: 553.43'

PROPOSED FENCE
CONSERVATION EASEMENT
FLOW
INSTALL ROOT WADS (TYP)
INSTALL TOE WOOD (TYP)
INSTALL CONSTRUCTED RIFFLE (TYP)
INSTALL VEGETATED GEOLIFT (TYP)
CHANNEL PLUG (TYP)
MATCHLINE SHEET 8 STA. 40+00
MATCHLINE SHEET 10 STA. 45+00

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

4 0 4 8
VERTICAL SCALE (FT)

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	10
NCEEP PROJECT NO. 95028	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

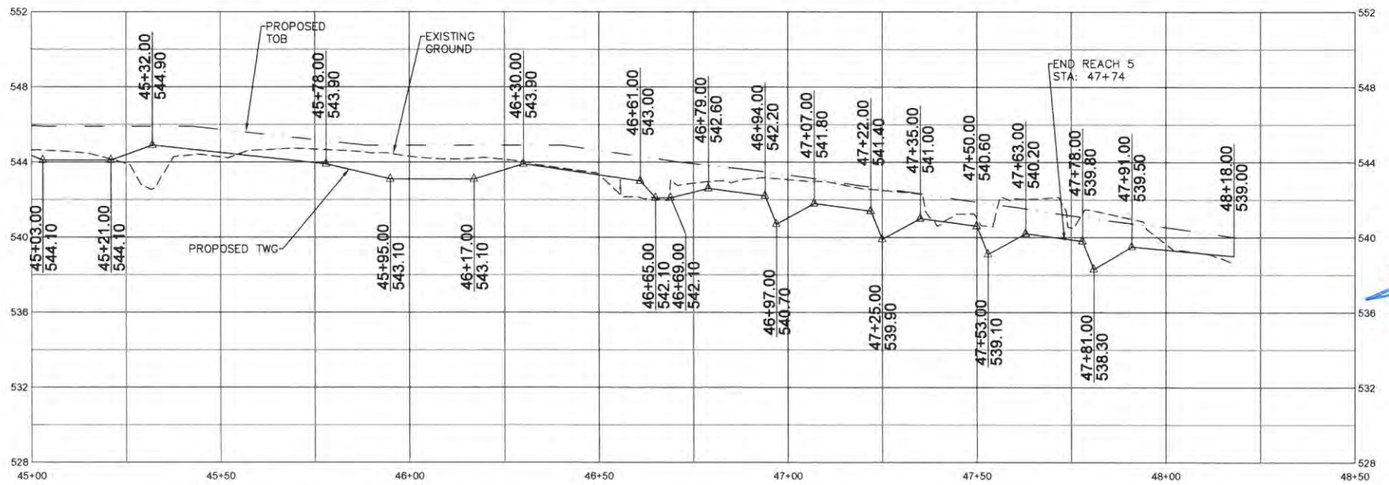
NAD 1983
NAVD 1988

45 MATCHLINE SHEET 9 STA. 45+00

GPS2
N: 614063.02
E: 1630823.49
ELEV: 553.43'

EXISTING SANITARY SEWER
EXISTING OVERHEAD ELECTRIC
CONSERVATION EASEMENT
PROPOSED FENCE
EXISTING RCP TO REMAIN
INSTALL ROOT WADS (TYP)
END REACH 5 STA: 47+74
FLOW
44+50
45+00
45+50
46+00
46+50
47+00
47+50
48+00
48+17.07
INSTALL CONSTRUCTED RIFFLE (TYP)
INSTALL ROCK CROSS VANE (TYP)
INSTALL GRADE CONTROL J-HOOK (TYP)
INSTALL TOE WOOD (TYP)
PERMANENT STREAM CROSSING (TYP)
INSTALL GATES AT PERMANENT STREAM CROSSING
EXISTING WETLAND
GPS1
N: 613754.25
E: 1630860.98
ELEV: 541.40'

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

4 0 4 8
VERTICAL SCALE (FT)
20 0 20 40
HORIZONTAL SCALE (FT)

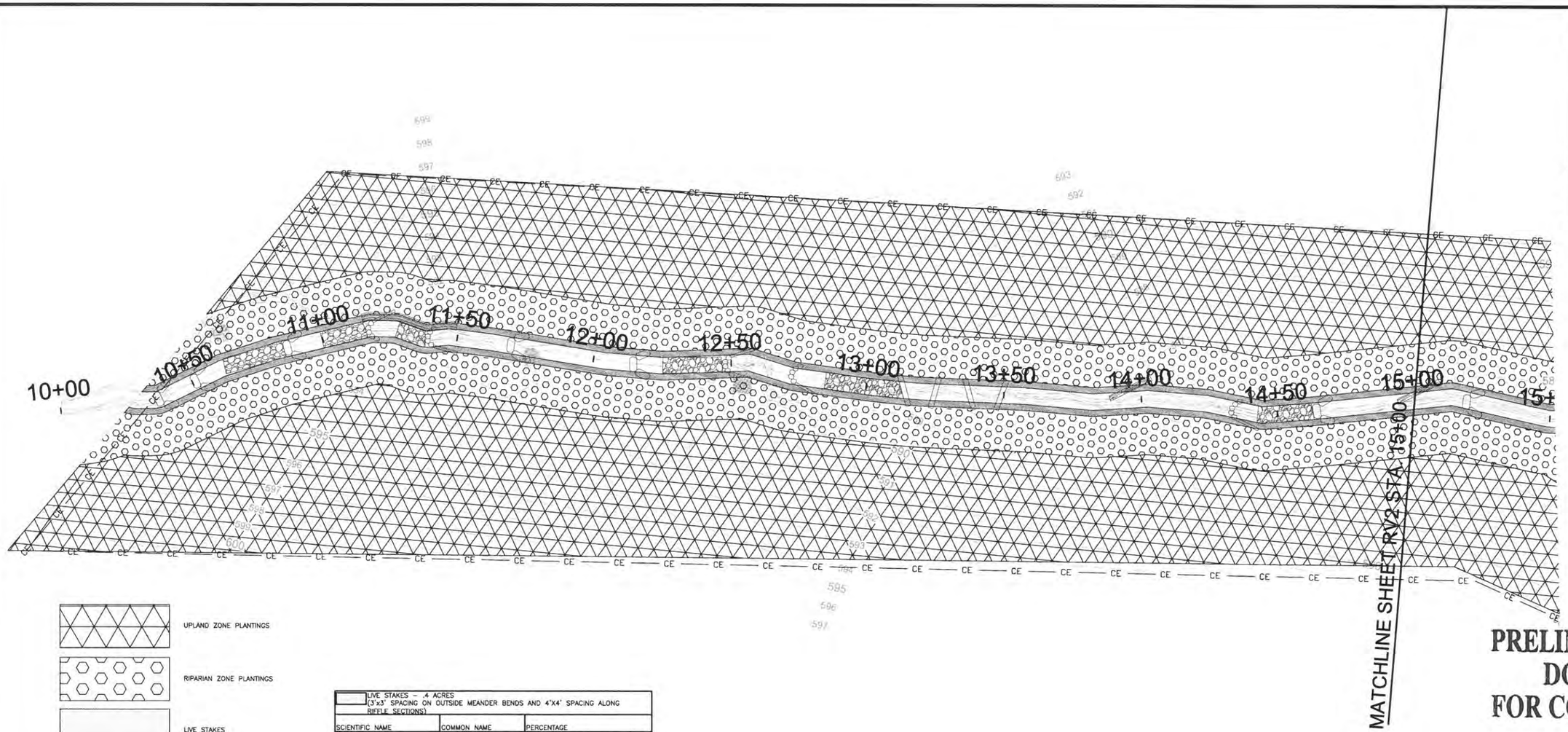
TOWN CREEK RESTORATION PROJECT–OPTION B

PLAN & PROFILE

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV1
NCEEP PROJECT NO. 95026	DATE: 8/15/2014

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

LIVE STAKES – .4 ACRES (3'x3' SPACING ON OUTSIDE MEANDER BENDS AND 4'X4' SPACING ALONG RIFFLE SECTIONS)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE
Cornus amomum	Silky dogwood	35%
Salix nigra	Black Willow	10%
Salix sericea	Silky willow	35%
Sambucus canadensis	Elderberry	20%

RIPARIAN ZONE PLANTINGS – 3.6 ACRES (8'X8' SPACING–APPLICATION RATE 680 TREES & SHRUBS/ACRE)

TREE SPECIES			
SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
Betula nigra	River Birch	5%	FACW
Celtis laevigata	Sugarberry	8%	FACW
Diospyros virginiana	Persimmon	3%	FAC
Fraxinus pennsylvanica	Green Ash	12%	FACW
Liriodendron tulipfera	Tulip Poplar	7%	FAC
Platanus occidentalis	Sycamore	15%	FACW–
Quercus lyrata	Overcup Oak	5%	OBL
Quercus michauxii	Swamp Chestnut Oak	3%	FACW–
Quercus phellos	Willow Oak	2%	FACW
SHRUB SPECIES			
Alnus serrulata	Tag Alder	10%	FACW+
Asimina triloba	Paw paw	5%	FAC
Carpinus caroliniana	Ironwood	5%	FAC
Cornus amomum	Silky dogwood	10%	FACW+
Sambucus canadensis	Elderberry	10%	FACW–

UPLAND ZONE PLANTINGS – 7.0 ACRES (8'X8' SPACING–APPLICATION RATE 680 TREES & SHRUBS/ACRE)

TREE SPECIES			
SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
Liriodendron tulipfera	Tulip Poplar	15%	FAC
Diospyros virginiana	Persimmon	10%	FAC
Quercus michauxii	Swamp Chestnut Oak	8%	FACW–
Nyssa sylvatica	Black Gum	10%	FAC
Juglans nigra	Black Walnut	5%	FACU
Quercus falcata	Southern red Oak	12%	FACU–
Quercus alba	White Oak	10%	FACU
SHRUB SPECIES			
Carpinus caroliniana	Ironwood	5%	FAC
Asimina triloba	Paw paw	5%	FAC
Cercis canadensis	Redbud	5%	FACU
Cornus florida	Flowering dogwood	10%	FACU
Corylus americana	Hazelnut	5%	FACU

NOTE: SPECIES SELECTIONS MAY BE SUBSTITUTED BY ENGINEER DUE TO REFINEMENT OR AVAILABILITY AT THE TIME OF PLANTING

TEMPORARY SEEDING – PLANTED WITH PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
Summer Seeding (May 1 – August 15)	Application Rate
Browntop Millet– Panicum ramosum	13 lbs/acre
Winter Seeding (August 15 – May 1)	Application Rate
Rye Grain– Secale cereale	44 lbs/acre
TEMPORARY SEEDING – PLANTED WITHOUT PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
Summer Seeding (May 1 – August 15)	Application Rate
Browntop Millet– Panicum ramosum	44 lbs/acre
Winter Seeding (August 15 – May 1)	Application Rate
Rye Grain– Secale cereale	130 lbs/acre

PERMANENT RIPARIAN SEEDING (TO BE PLANTED AT 15 LB/AC IN ALL PLANTING AREAS DENOTED IN PLANTING PLAN)

SCIENTIFIC NAME	COMMON NAME	PERCENTAGE	WETLAND INDICATOR
Agrostis alba	Red Top	10%	FACW
Elymus virginicus	Virginia Wild Rye	15%	FAC
Panicum virgatum	Switchgrass	15%	FAC+
Tripsicum dactyloides	Gamma grass	5%	FAC+
Polygonum pennsylvanicum	Pennsylvania smartweed	5%	FACW
Schizachyrium scoparium	Little bluestem	5%	FACU
Juncus effusus	Soft rush	5%	FACW+
Bidens aristosa	Tickseed	10%	FACW
Coreopsis lanceolata	Lance–leaved coreopsis	10%	FAC
Dichanthelium clandestinum	Deer tongue	10%	FACW
Andropogon gerardii	Big bluestem	5%	FAC
Sorgastrum nutans	Indiangrass	5%	FACU

PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.16

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

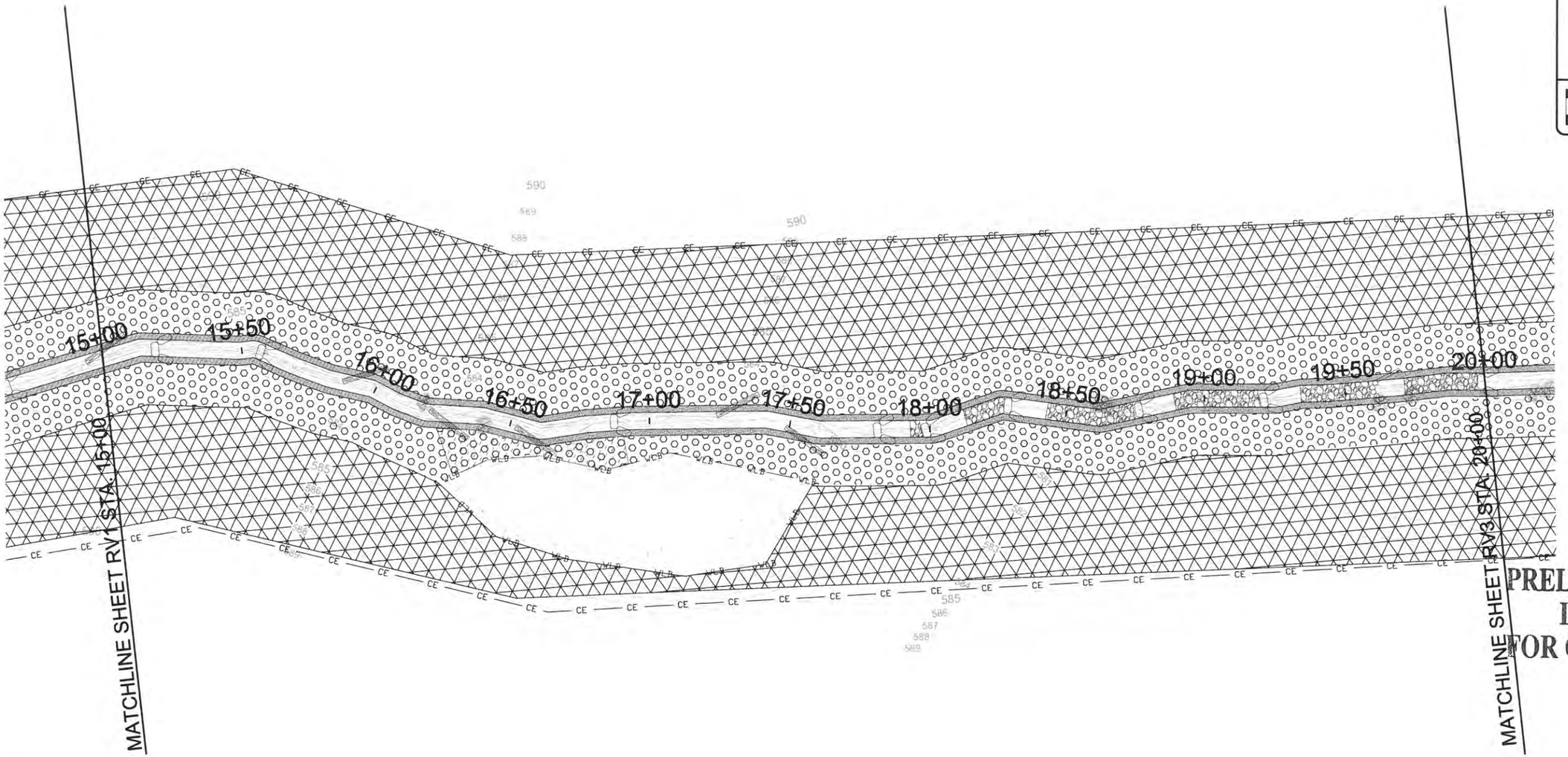
TOWN CREEK RESTORATION PROJECT–OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV2
NCEEP PROJECT NO. 95026	DATE: 8/15/2014

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 22967 WILLIAM SCOTT HUNT, III 08.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

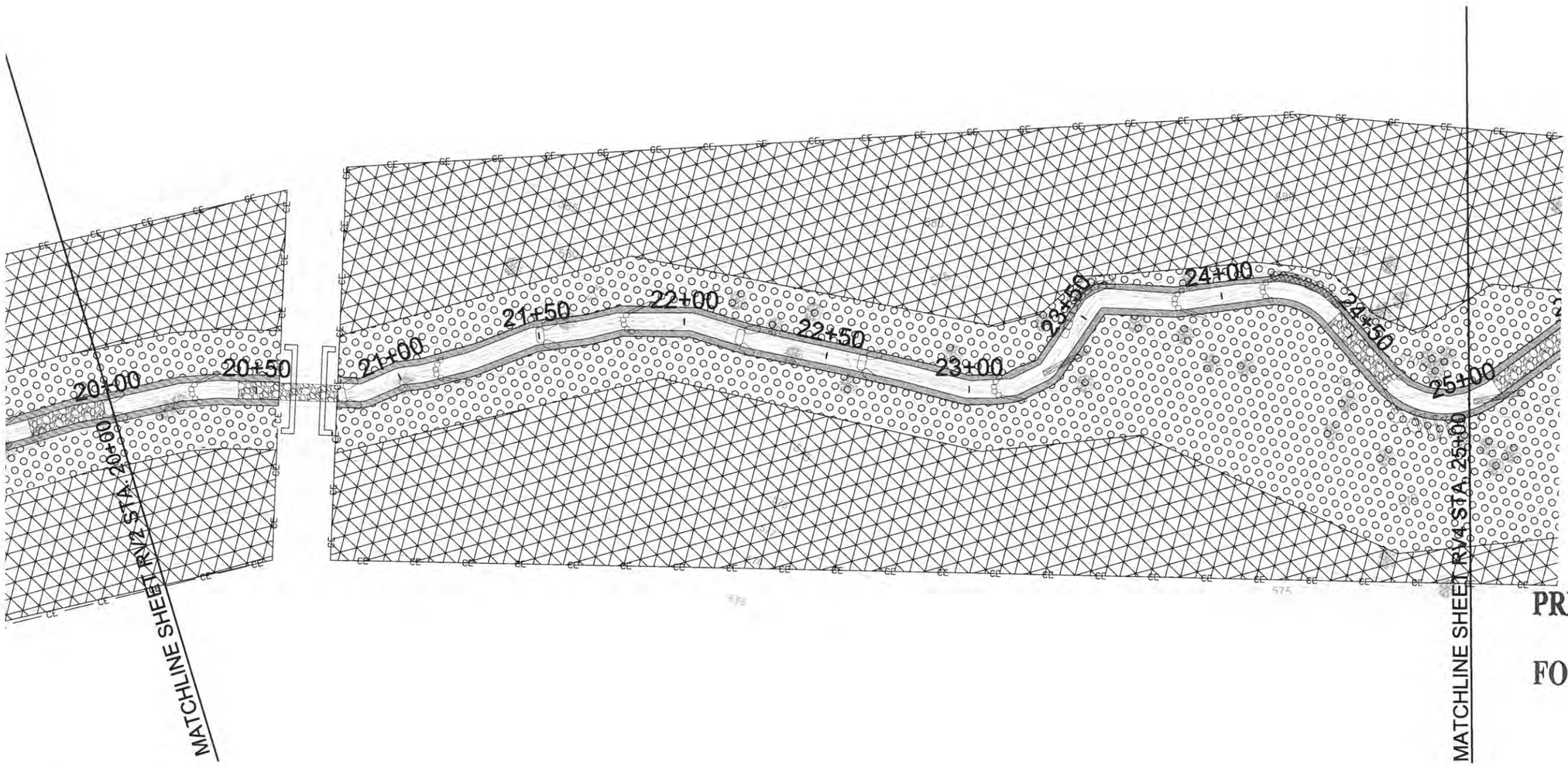
TOWN CREEK RESTORATION PROJECT–OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV3
NCEEP PROJECT NO. 95026	DATE: 8/15/2014

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1409
Fax: 828.350.1409



UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

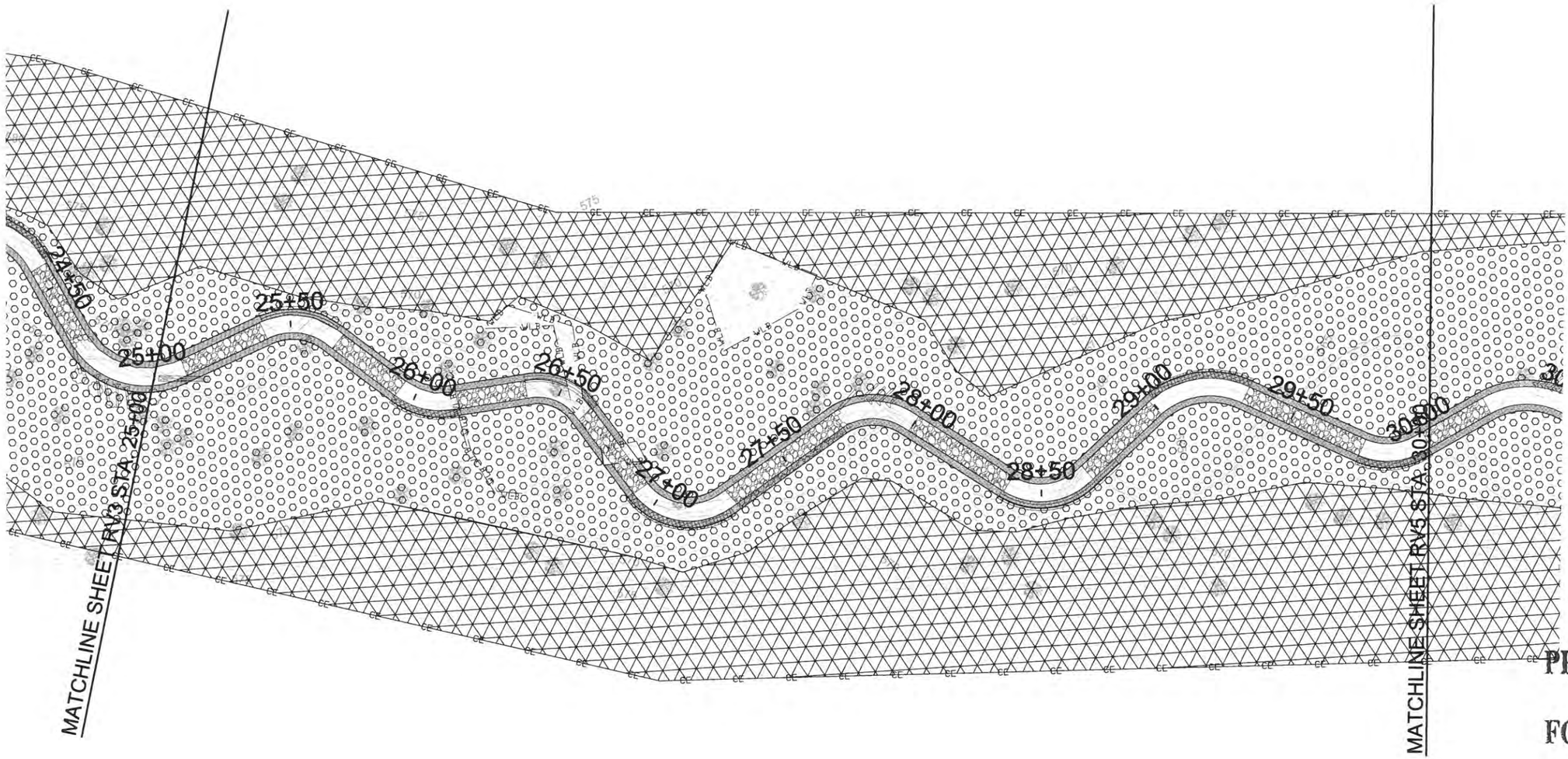
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT—OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV4
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1406
Fax: 828.350.1409



PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.16.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

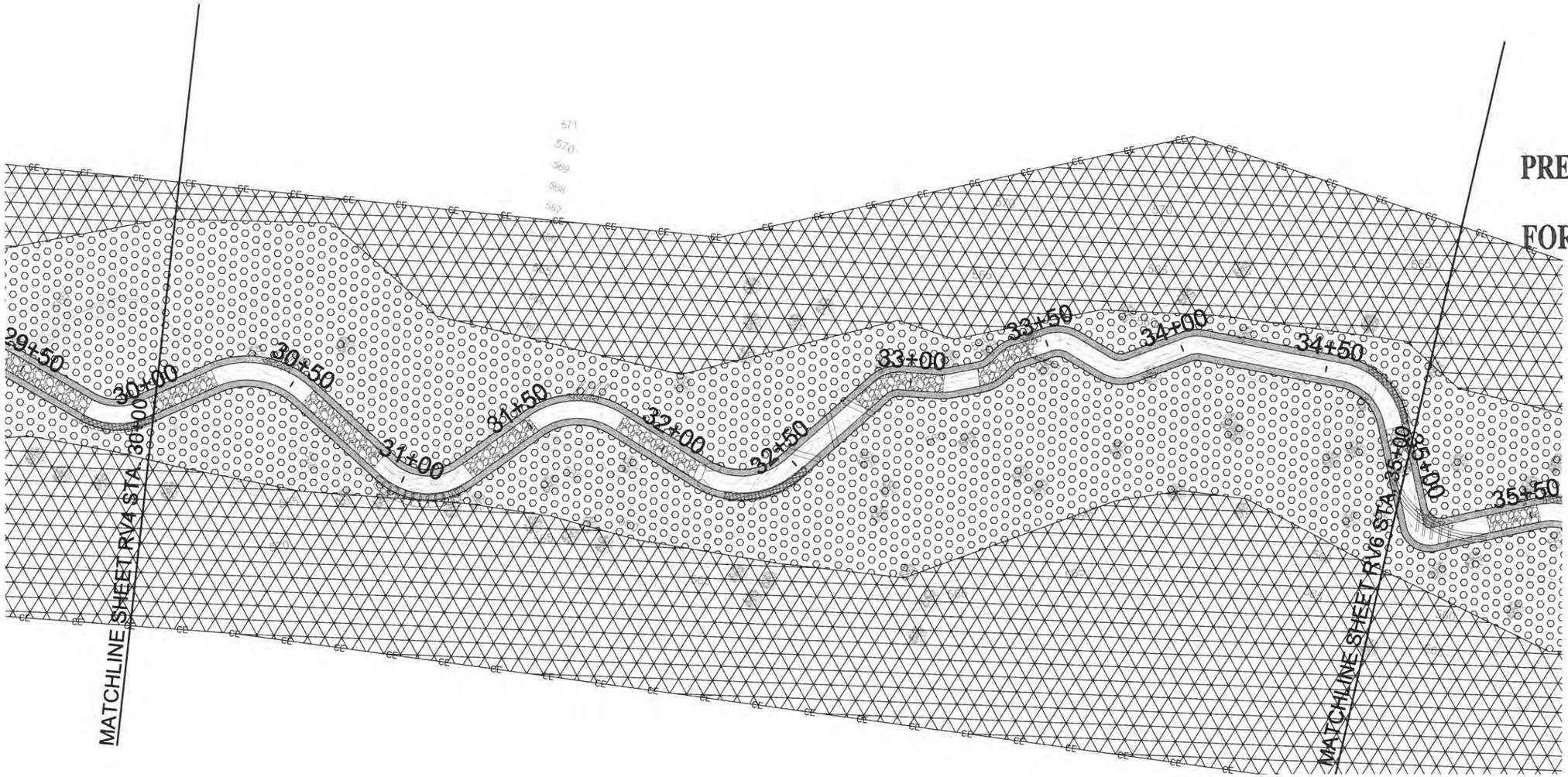
TOWN CREEK
RESTORATION
PROJECT–OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV5
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

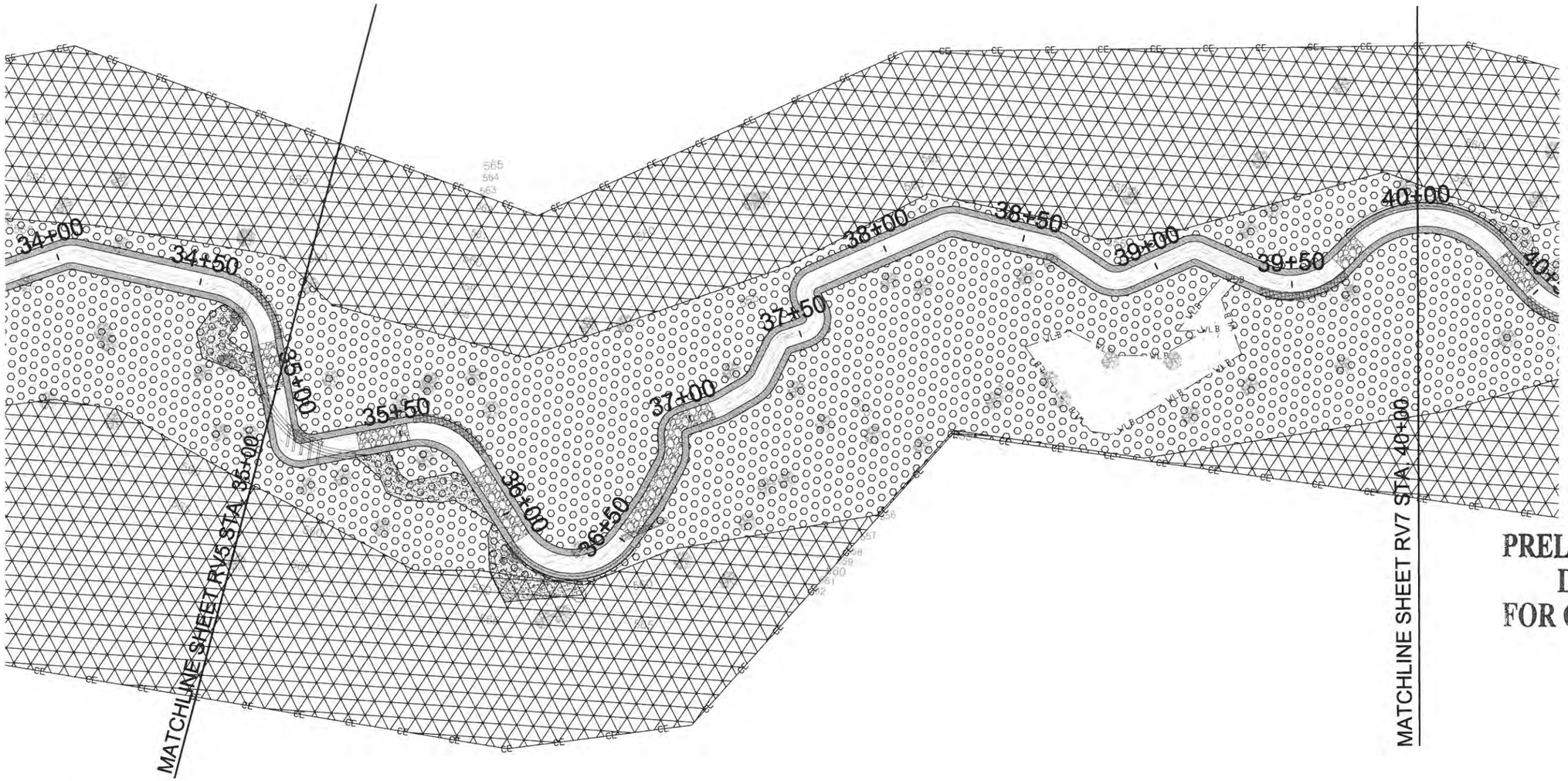
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV6
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

NORTH CAROLINA
PROFESSIONAL
SEAL
22967
08.14.14
ENGINEER
WILLIAM SCOTT HUNT, III

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

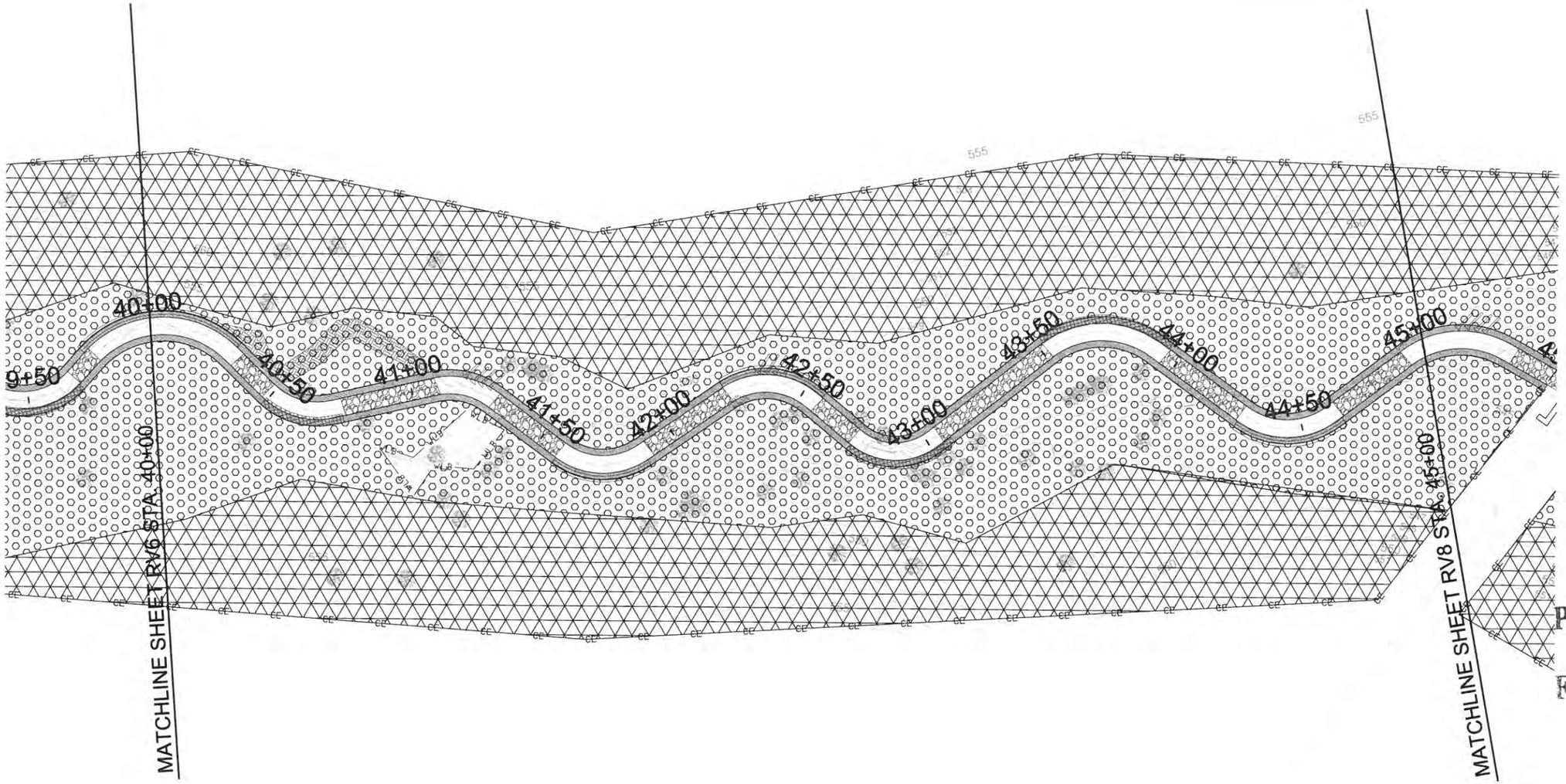
TOWN CREEK
RESTORATION
PROJECT–OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV7
NCEEP PROJECT NO. 95026	DATE: 8/15/2014

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

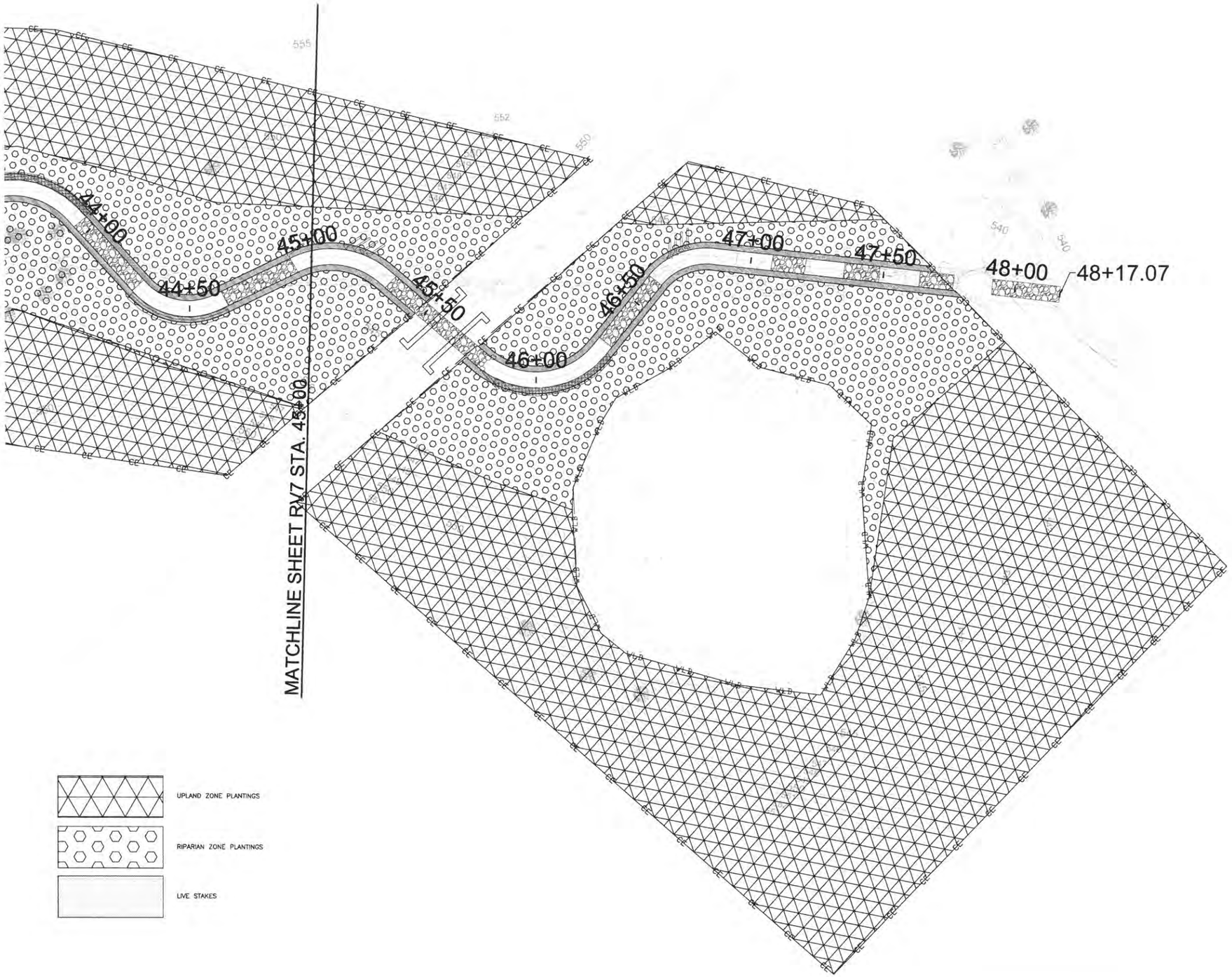
20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK
RESTORATION
PROJECT–OPTION B

REVEGETATION PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	RV8
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409



UPLAND ZONE PLANTINGS

RIPARIAN ZONE PLANTINGS

LIVE STAKES

PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

REVEGETATION PLAN

PROJECT: 124526 TOWN CREEK RESTORATION PROJECT–OPTION B

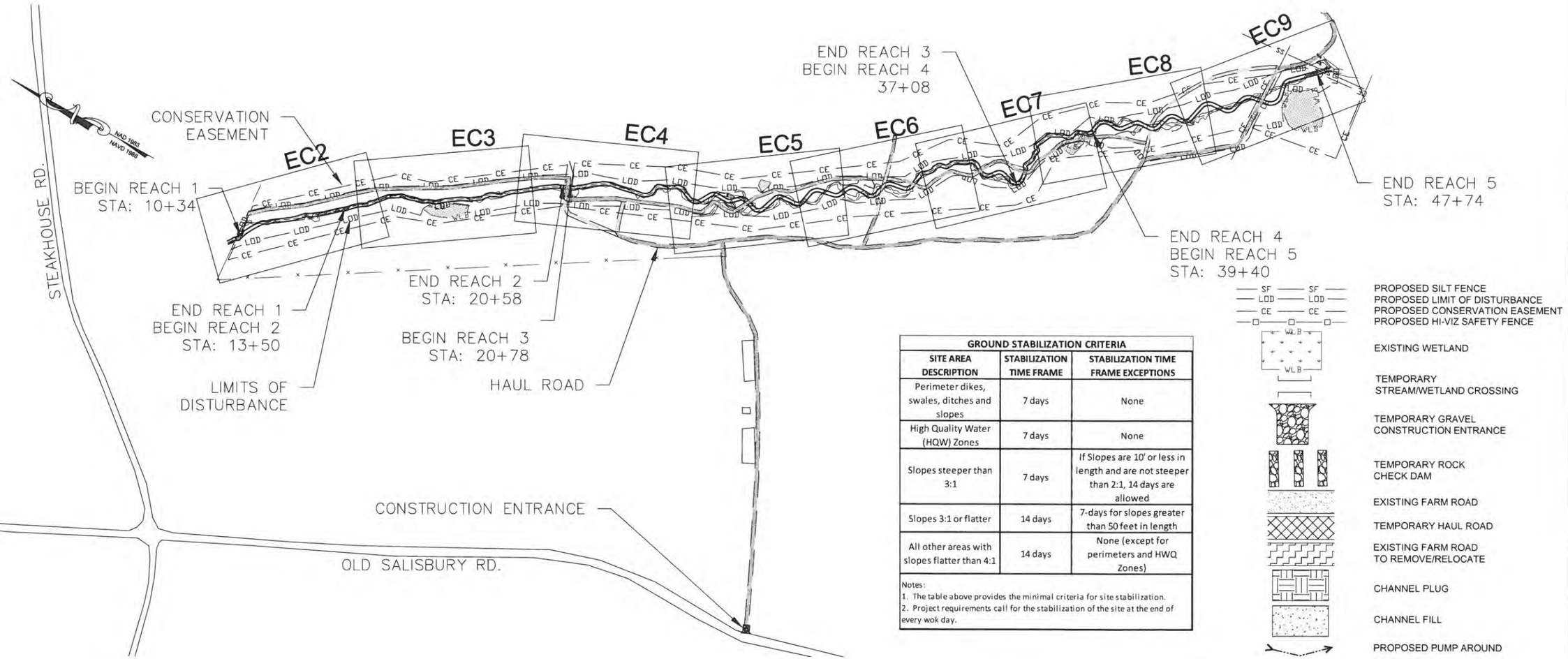
NC ECOSYSTEM ENHANCEMENT PROGRAM

SEDIMENT AND EROSION CONTROL PLAN

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	124526	EC1	9

SHEET INDEX



GROUND STABILIZATION CRITERIA

SITE AREA DESCRIPTION	STABILIZATION TIME FRAME	STABILIZATION TIME FRAME EXCEPTIONS
Perimeter dikes, swales, ditches and slopes	7 days	None
High Quality Water (HQW) Zones	7 days	None
Slopes steeper than 3:1	7 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 feet in length
All other areas with slopes flatter than 4:1	14 days	None (except for perimeters and HWQ Zones)

Notes:
1. The table above provides the minimal criteria for site stabilization.
2. Project requirements call for the stabilization of the site at the end of every wok day.

PROPOSED SILT FENCE
PROPOSED LIMIT OF DISTURBANCE
PROPOSED CONSERVATION EASEMENT
PROPOSED HI-VIZ SAFETY FENCE
EXISTING WETLAND
TEMPORARY STREAM/WETLAND CROSSING
TEMPORARY GRAVEL CONSTRUCTION ENTRANCE
TEMPORARY ROCK CHECK DAM
EXISTING FARM ROAD
TEMPORARY HAUL ROAD
EXISTING FARM ROAD TO REMOVE/RELOCATE
CHANNEL PLUG
CHANNEL FILL
PROPOSED PUMP AROUND

GRAPHIC SCALE

20 0 20 40

PLANS

THIS PROJECT CONTAINS SEDIMENT AND EROSION CONTROL PLANS FOR ALL PHASES OF CONSTRUCTION

TOTAL DISTURBED AREA = 6.96 AC

PREPARED FOR THE OFFICE OF:

Ecosystem Enhancement

NCDENR – ECOSYSTEM ENHANCEMENT PROGRAM
2728 CAPITAL BLVD., SUITE 1H 103
RALEIGH, NC 27604

NCEEP CONTACT: HARRY TSOMIDES — REVIEW COORDINATOR

NCEEP CONTACT: HARRY TSOMIDES — PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Baker

Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

PROFESSIONAL CORPORATION LICENSE NUMBER: F-1084

SCOTT HUNT III, P.E. — PROJECT ENGINEER

MICKY CLEMMONS — PROJECT DESIGNER

PROJECT ENGINEER

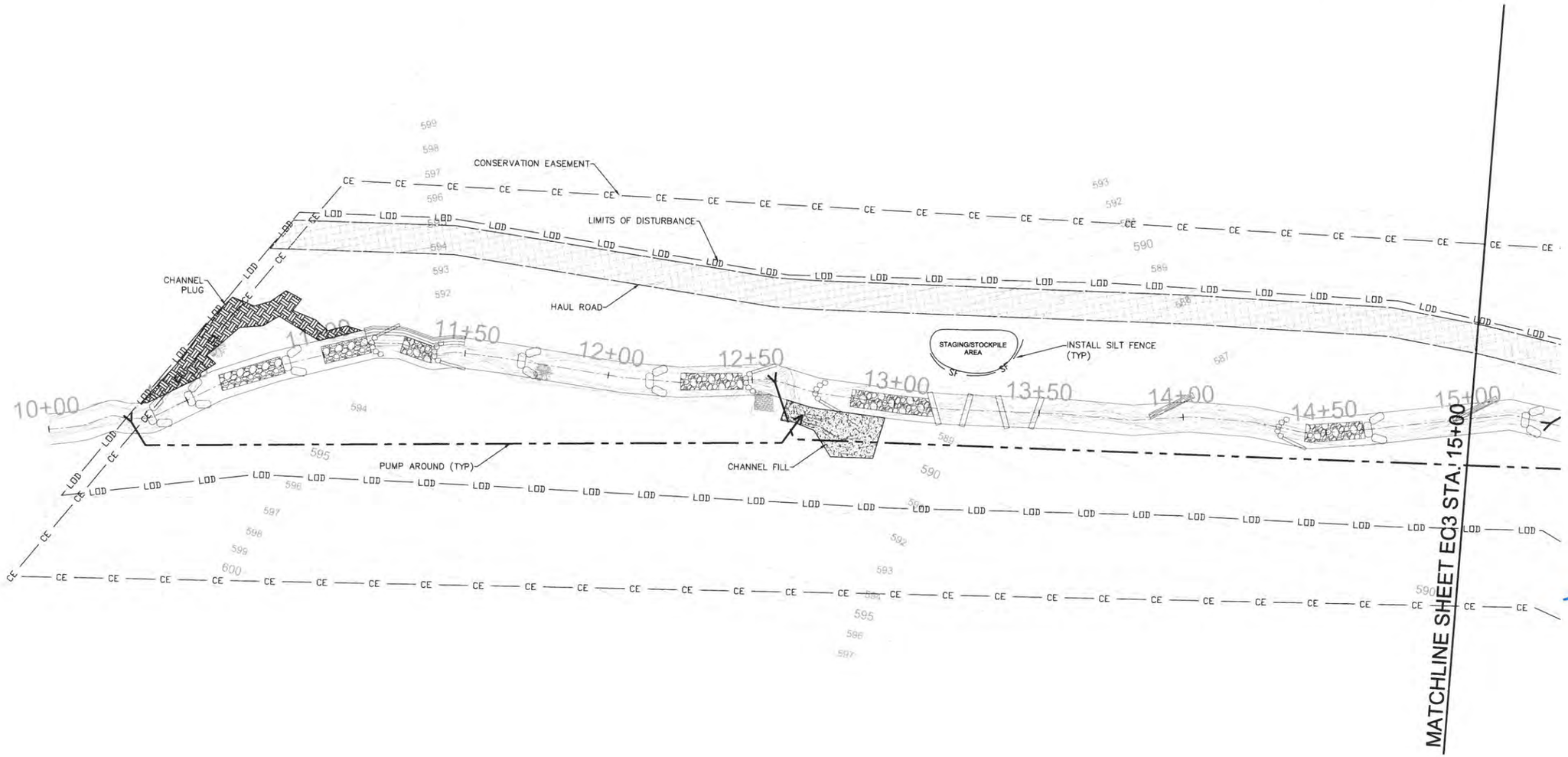
NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III

SIGNATURE:

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC2
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



TEMPORARY SEEDING – PLANTED WITH PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
Summer Seeding (May 1 – August 15)	Application Rate
Browntop Millet– Panicum ramosum	13 lbs/acre
Winter Seeding (August 15 – May 1)	Application Rate
Rye Grain– Secale cereale	44 lbs/acre
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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC3
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville NC 28806
Phone: 828.350.1408
Fax: 828.350.1405

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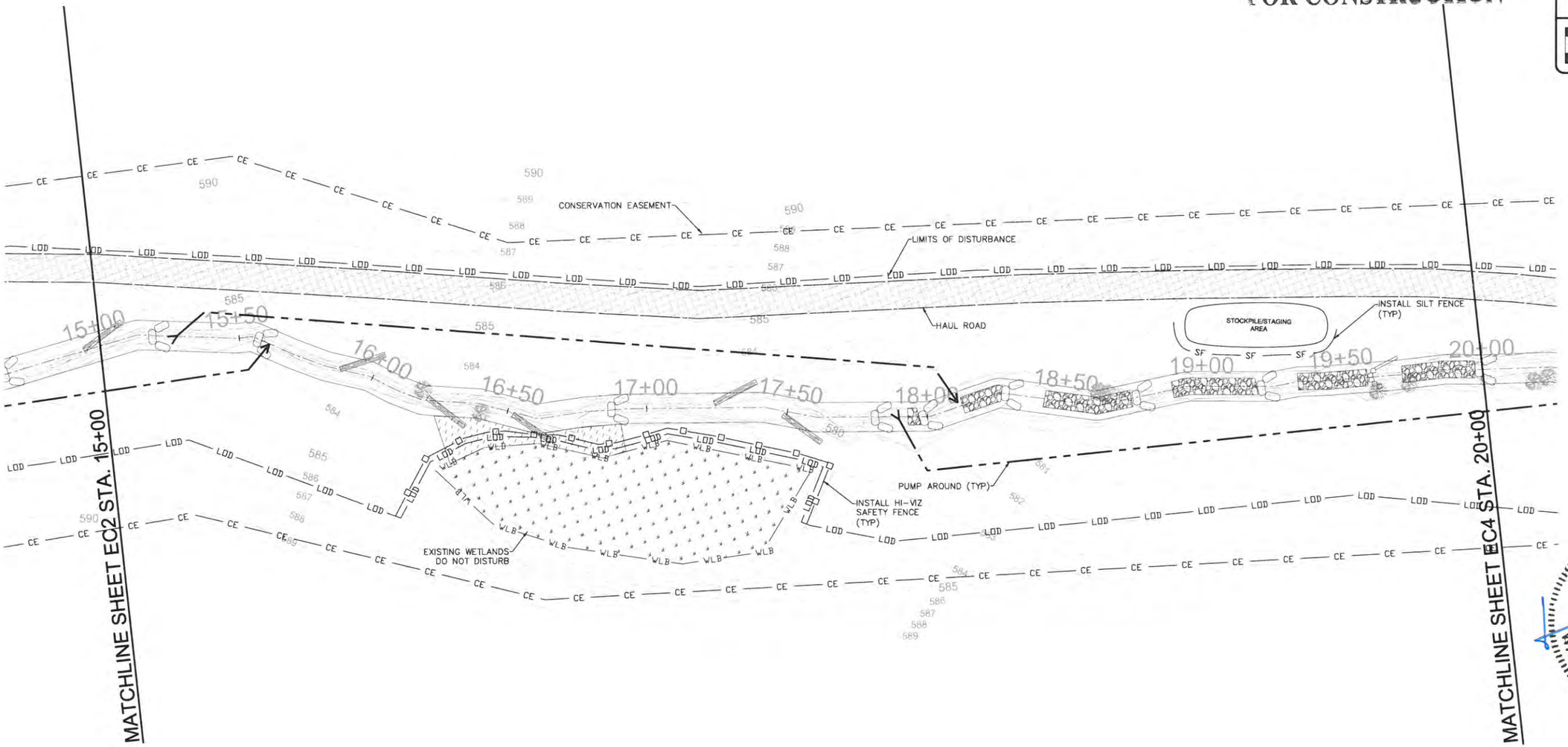

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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC4
NCEEP PROJECT NO. 95028	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
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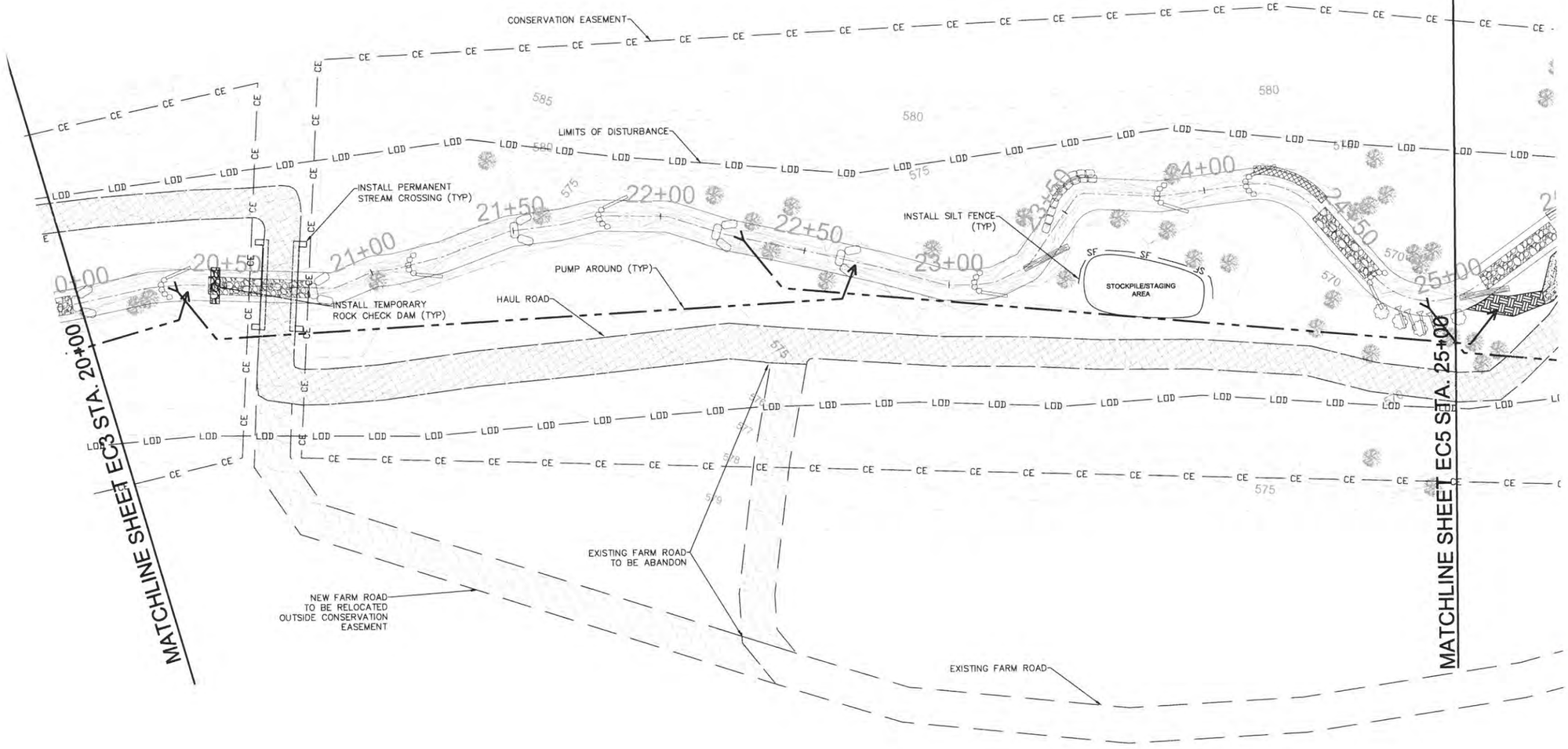

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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

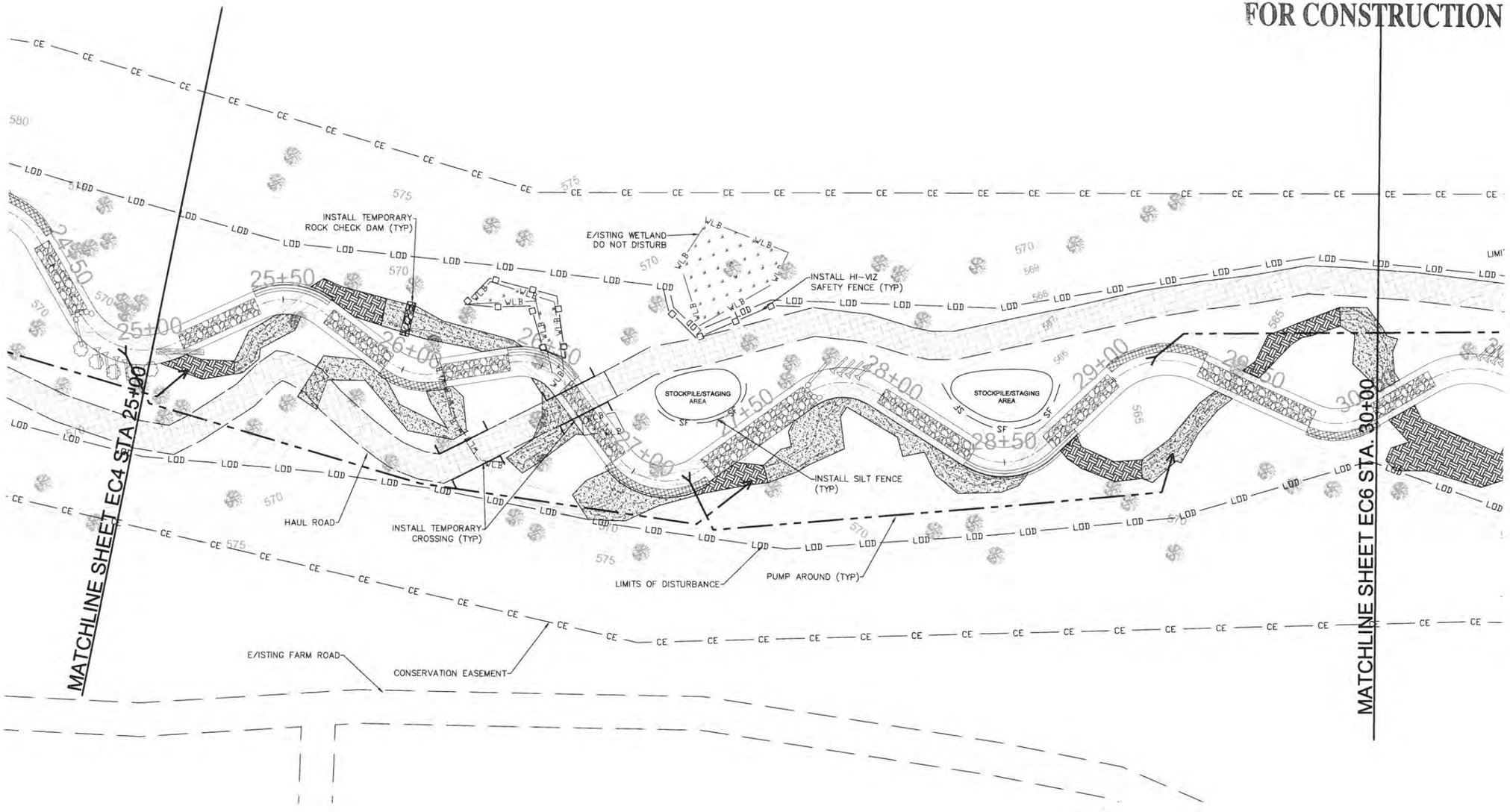
TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC5
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



TEMPORARY SEEDING – PLANTED WITH PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
Summer Seeding (May 1 – August 15)	Application Rate
Browntop Millet– Panicum ramosum	13 lbs/acre
Winter Seeding (August 15 – May 1)	Application Rate
Rye Grain– Secale cereale	44 lbs/acre
TEMPORARY SEEDING – PLANTED WITHOUT PERMANENT RIPARIAN SEED MIX (TO BE PLANTED IN ALL DISTURBED AREAS AND PLANTING ZONES)	
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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

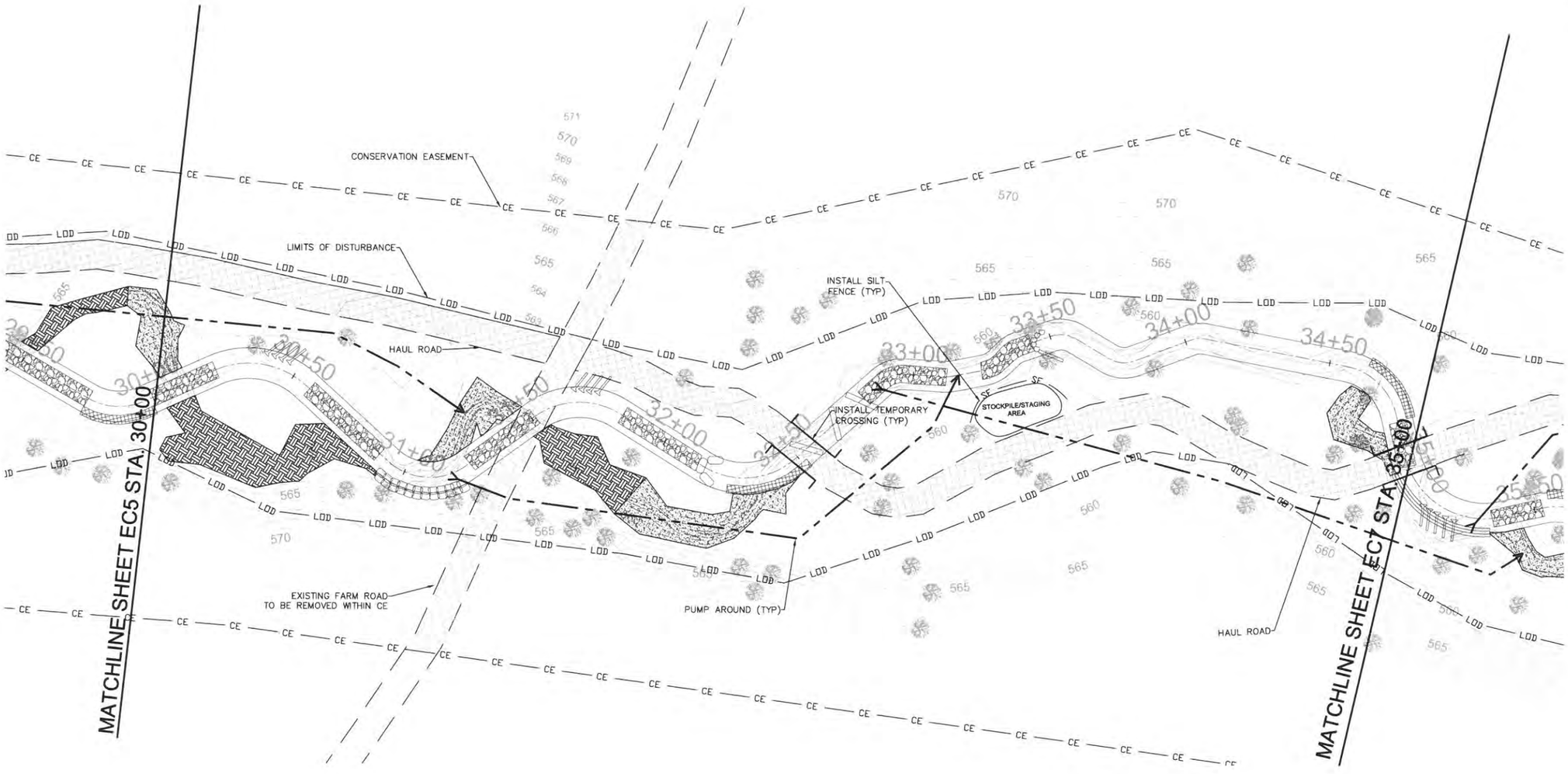
TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC6
NCEEP PROJECT NO. 95028	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 202
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
06.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC7
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
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Suite 201
Asheville, NC 28806
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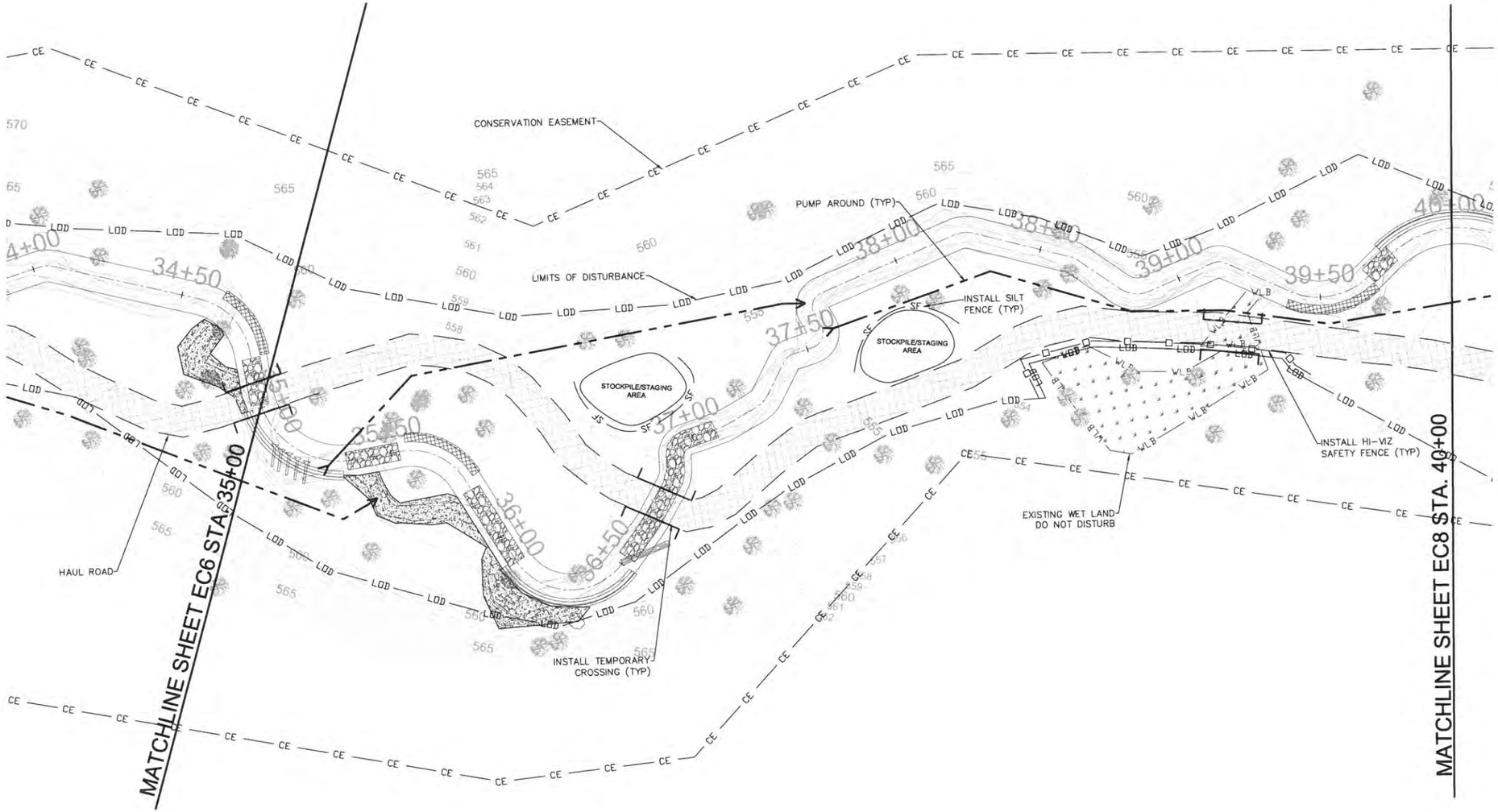
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION



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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
8.14.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC8
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

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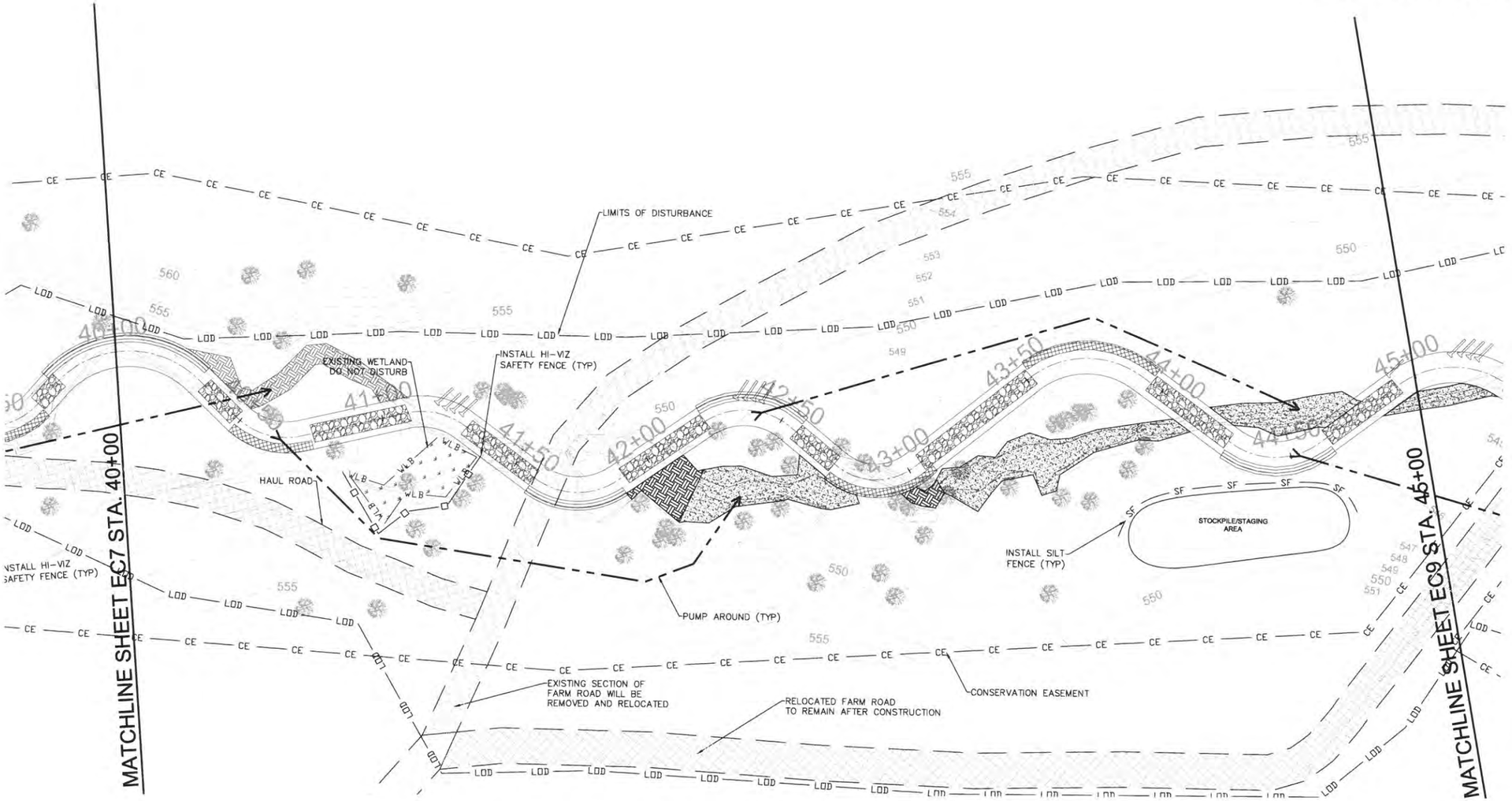
**PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION**



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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.4.14

NAD 1983
NAVD 1988

20 0 20 40
HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	EC9
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
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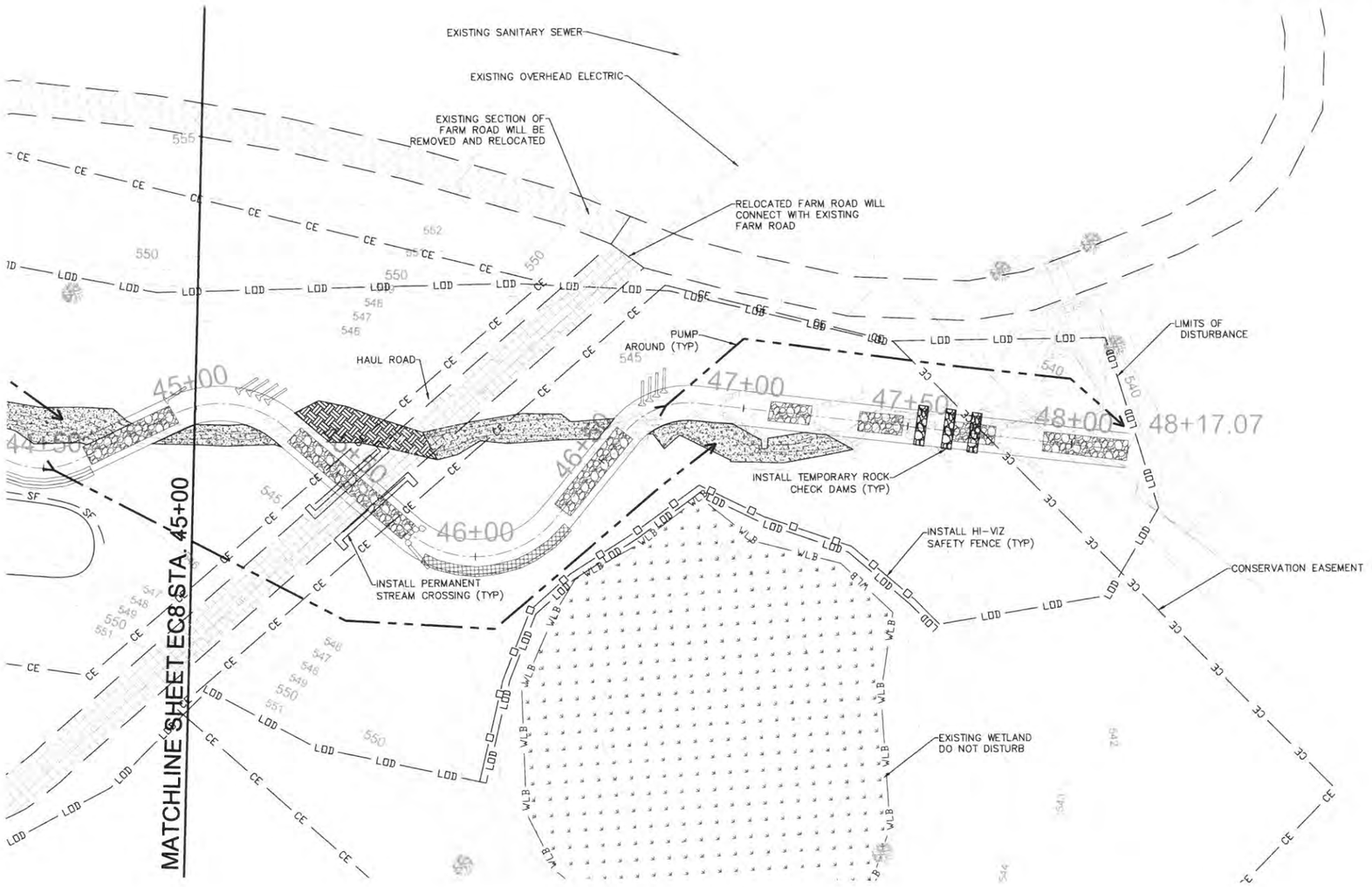
Asheville, NC 28806
Phone: 828.350.1406
Fax: 828.350.1409

**PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION**



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NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

NAD 1983
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HORIZONTAL SCALE (FT)

TOWN CREEK RESTORATION PROJECT–OPTION B

SEDIMENT AND EROSION CONTROL PLAN

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D1
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

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Michael Baker Engineering, Inc.
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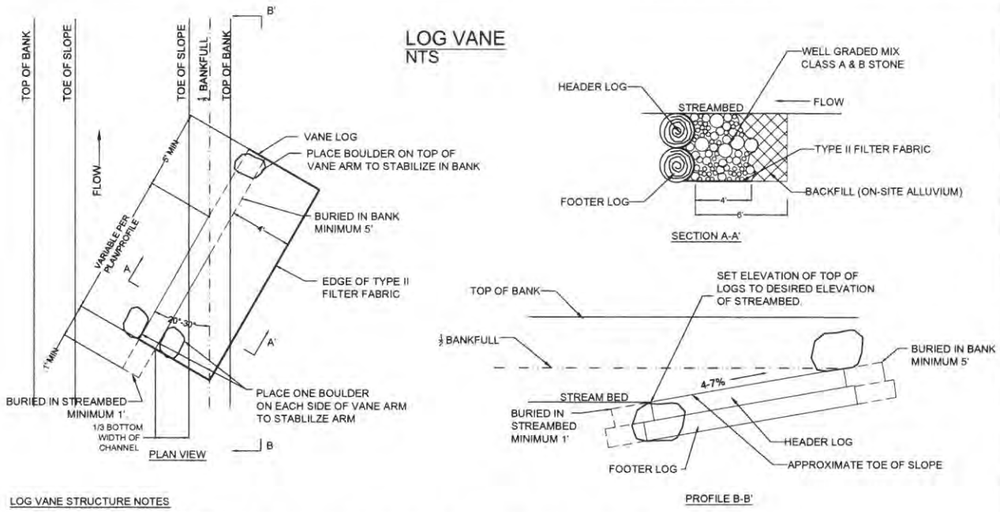
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

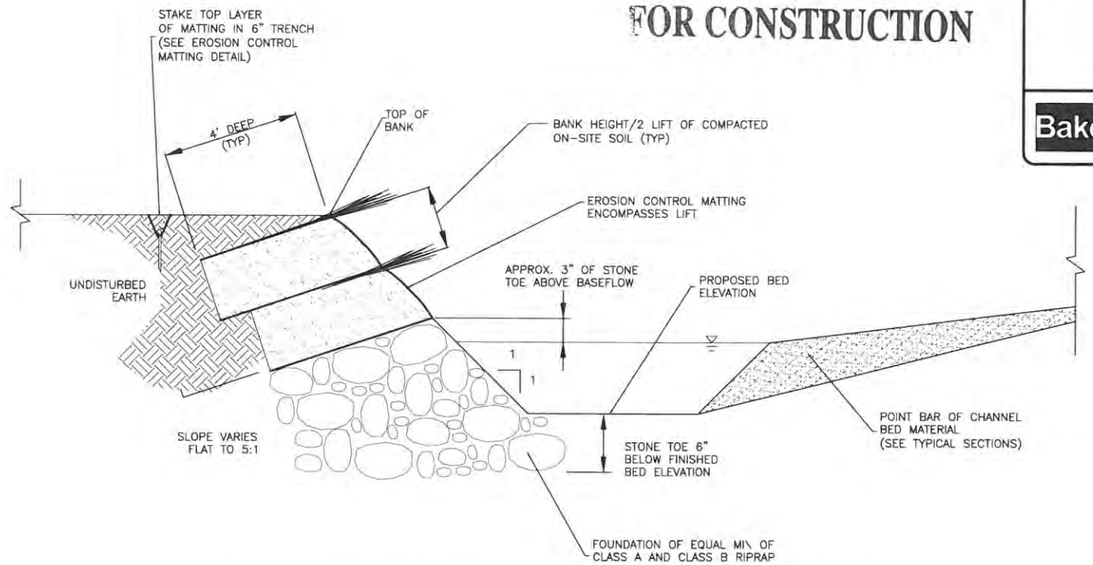
LOG VANE
NTS



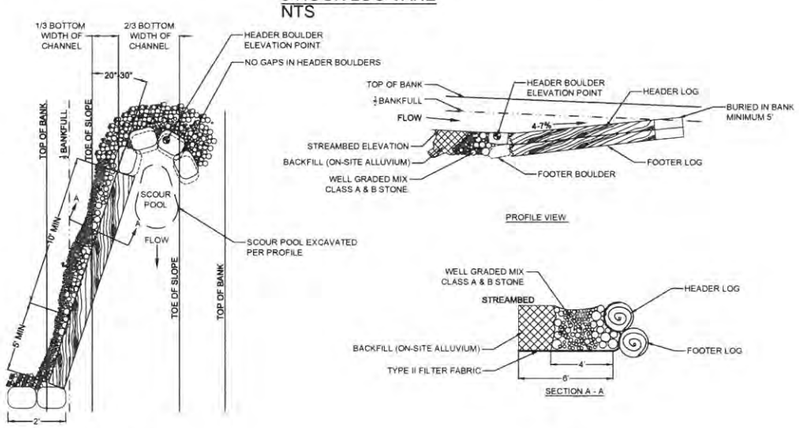
LOG VANE STRUCTURE NOTES

1. BOULDERS SHALL BE AT LEAST 3'X2'X1'.
2. LOGS SHALL BE AT LEAST 12" IN DIAMETER WITH A MAXIMUM DIAMETER OF 24", RELATIVELY STRAIGHT, AND HARDWOOD.
3. A SINGLE LOG WITH A MINIMUM DIAMETER OF 36 INCHES MAY BE USED IN PLACE OF TWO LOGS (A HEADER AND FOOTER) PER ON-SITE ENGINEER APPROVAL.
4. LOGS FOR LOG VANES SHALL BE A MININUM OF 30' IN LENGTH.
5. VANE ARM LOG SHALL BE BURIED INTO THE BANK A MINIMUM OF 5'.
6. DIG A TRENCH BELOW THE BED FOR FOOTER LOG. START AT BANK AND PLACE FOOTER LOG FIRST AND THE HEADER LOGS. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
7. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS.
8. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER LOG AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER LOG, AND THEN UPSTREAM FOR A MINIMUM OF SIX FEET.
9. NAIL FILTER FABRIC TO TOP OF HEADER LOG USING 3" 10d GALVANIZED COMMON NAIL ON 1' SPACING ALONG LOG.
10. USE WELL GRADED MIX OF CLASS A AND B STONE ON UPSTREAM SIDE OF STRUCTURE
11. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER LOG.
12. FILTER FABRIC SHALL BE TRIMMED ALONG THE TRANSITION BETWEEN THE STONE BACKFILL AND THE HEADER LOG SO THAT THE FILTER FABRIC DOES NOT OVERLAP THE HEADER LOG.

VEGETATED GEOLIFT
NTS



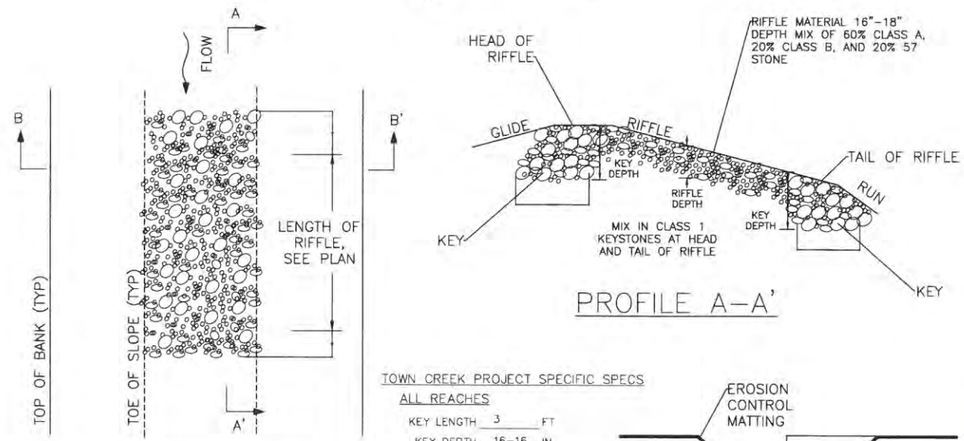
J-HOOK LOG VANE
NTS



J-HOOK LOG VANE STRUCTURE NOTES:

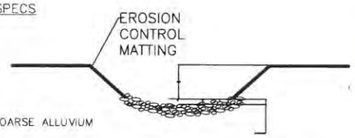
1. BOULDERS MUST BE AT LEAST 2'x2'x2'.
2. LOGS SHOULD BE AT LEAST 12 INCHES IN DIAMETER WITH A MAXIMUM DIAMETER OF 24 INCHES, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
3. A SINGLE LOG WITH A MINIMUM DIAMETER OF 36 INCHES MAY BE USED IN PLACE OF TWO LOGS (A HEADER AND FOOTER) PER ON-SITE ENGINEER APPROVAL.
4. USE FILTER FABRIC TO SEAL GAPS BETWEEN LOGS/BOULDERS.
5. DIG A TRENCH BELOW THE BED FOR FOOTER LOGS/BOULDERS. START AT BANK AND PLACE FOOTER LOG/BOULDERS FIRST AND THE HEADER LOG/BOULDERS. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER LOG/BOULDERS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER LOG/BOULDERS, AND THEN UPSTREAM FOR A MINIMUM OF SIX FEET.
7. NAIL FILTER FABRIC TO TOP OF HEADER LOG USING 3" 10d GALVANIZED COMMON NAIL ON 1' SPACING ALONG LOG.
8. USE WELL GRADED MIX OF CLASS A AND B STONE ON UPSTREAM SIDE OF STRUCTURE.
9. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER LOG/ROCK.
10. FILTER FABRIC SHALL BE TRIMMED ALONG THE TRANSITION BETWEEN THE STONE BACKFILL AND THE HEADER LOG/BOULDERS SO THAT THE FILTER FABRIC DOES NOT OVERLAP THE HEADER LOG/BOULDERS.

CONSTRUCTED RIFFLE
NTS



TOWN CREEK PROJECT SPECIFIC SPECS
ALL REACHES

KEY LENGTH	3	FT
KEY DEPTH	16-16	IN
RIFFLE DEPTH	16-18	IN
RIFFLE COMPOSTION	0-10	% ONSITE COARSE ALLUVIUM
	60	% CLASS A
	20	% CLASS B
	20	% 57 STONE
	0	OTHER



SECTION B-B'

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

TOWN CREEK RESTORATION PROJECT-OPTION B

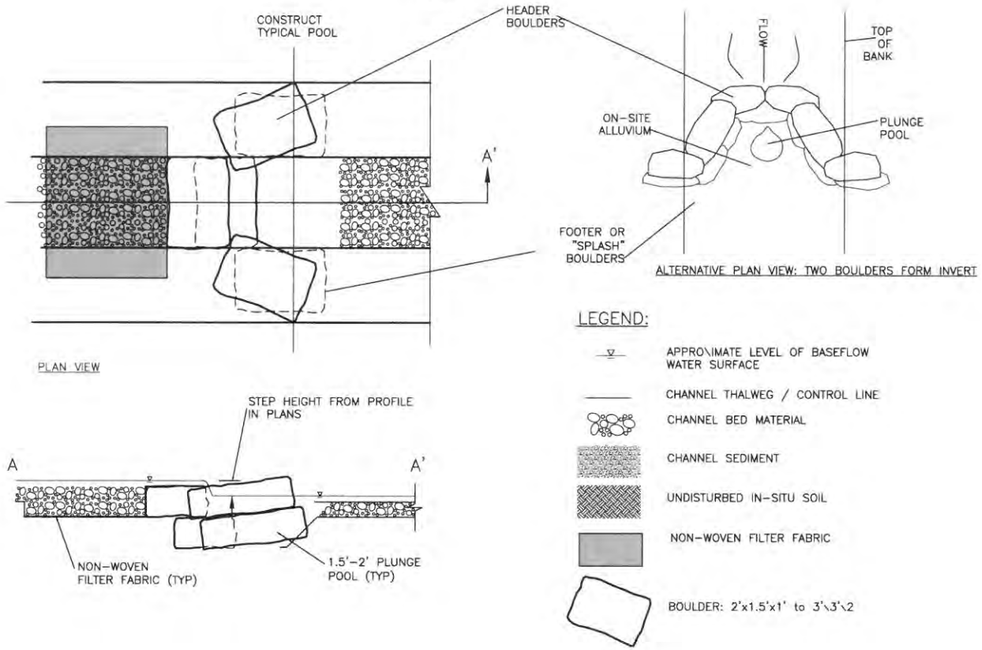
DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D2
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

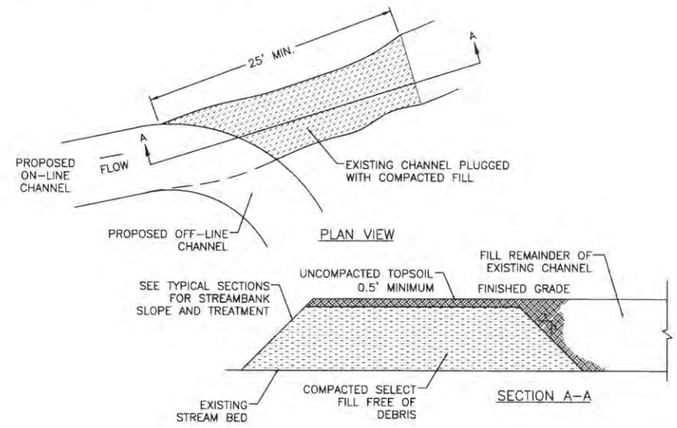
Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 201
Asheville, NC 28806
Phone 828.350.1408
Fax 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

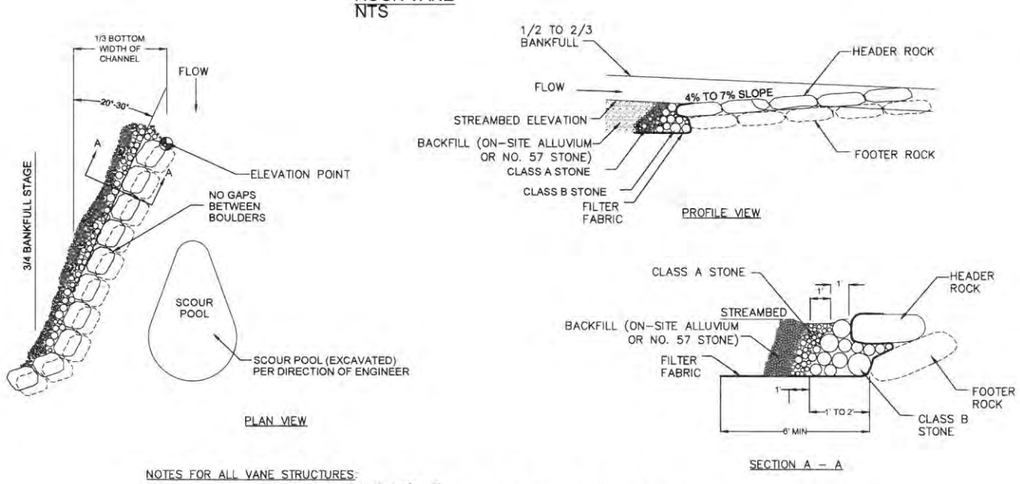
BOULDER STEP
NTS



CHANNEL PLUG
NTS



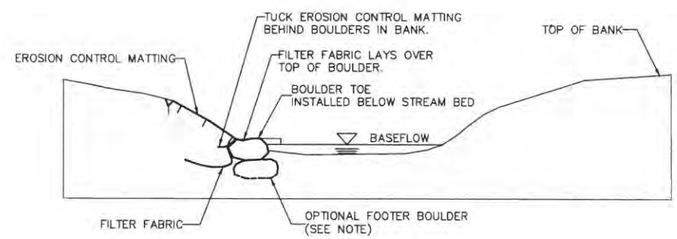
ROCK VANE
NTS



NOTES FOR ALL VANE STRUCTURES:

1. BOULDERS MUST BE AT LEAST 3' x 2' x 1'.
2. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER ROCKS AND E/TEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER ROCK, AND THEN UPSTREAM TO A MINIMUM OF TEN FEET.
3. DIG A TRENCH BELOW THE BED FOR FOOTER ROCKS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
4. START AT BANK AND PLACE FOOTER ROCKS FIRST AND THEN HEADER (TOP) ROCK.
5. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
6. A SMALL BOULDER OR LARGE ROCK CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
7. USE CLASS B STONE TO FILL GAPS ON UPSTREAM SIDE OF BOULDERS, AND CLASS A STONE TO FILL GAPS ON UPSTREAM SIDE OF CLASS 1 STONE.
8. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM OR #57 STONE TO THE ELEVATION OF THE TOP OF THE HEADER ROCK.

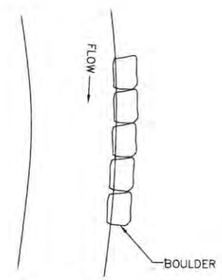
BOULDER TOE
NTS



CROSS SECTION VIEW

NOTE:

1. BOULDERS SHOULD E/TEND BELOW SCOUR DEPTH AND ABOVE BASE FLOW WATER LEVELS. FOOTER BOULDERS MAY BE REQUIRED, DEPENDING ON E/ISTING BED MATERIAL.
2. TOE BOULDERS SHALL BE TOUCHING SO THAT VOID SPACE IS MINIMIZED.
3. THE MAJORITY OF THE BOULDER SHOULD BE BURIED IN THE STREAM BANK, LEAVING FACE OF BOULDER E/POSED TO FLOW.
4. FILTER FABRIC SHOULD BE PLACED BEHIND BOULDER TOE, BURIED BELOW BOULDER DEPTH, AND E/TEND INTO THE BANK.
5. EROSION CONTROL MATTING SHOULD BE PLACED AGAINST BOULDER BEFORE BACKFILL, THEN FOLDED BACK OVER SEEDED BANK SLOPE.
6. BOULDER TOE SHOULD BE BACKFILLED AND COMPACTED, VOID SPACE BETWEEN FABRIC AND BOULDER TOE SHOULD BE MINIMIZED.
7. BOULDER TOE SHOULD NOT EXCEED MAXIMUM BANKFULL ELEVATION.



PLAN VIEW

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

TOWN CREEK RESTORATION PROJECT–OPTION B

DETAILS

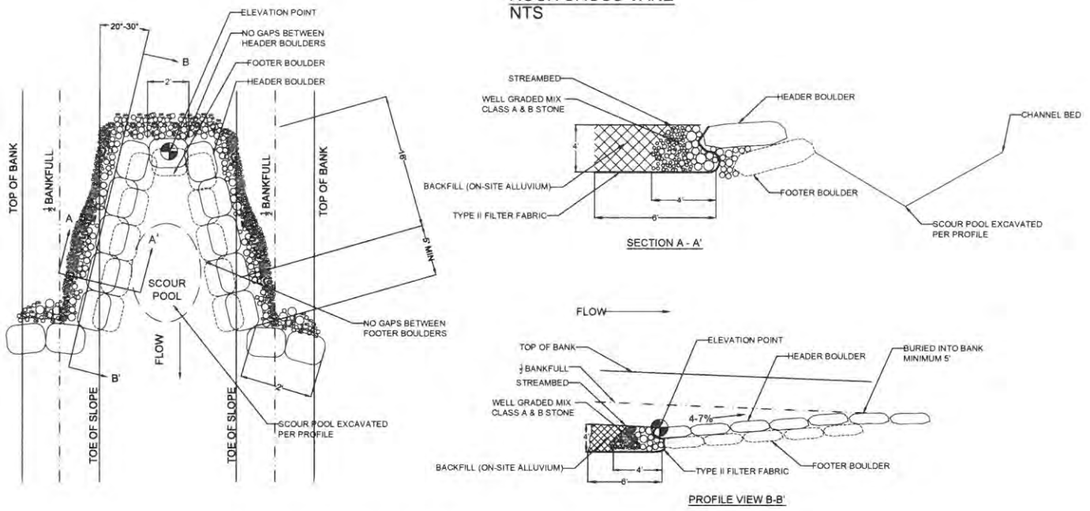
BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D3
NCEEP PROJECT NO. 95026	DATE: 8/15/2014

PROJECT ENGINEER

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
Suite 200
Asheville, NC 28806
Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

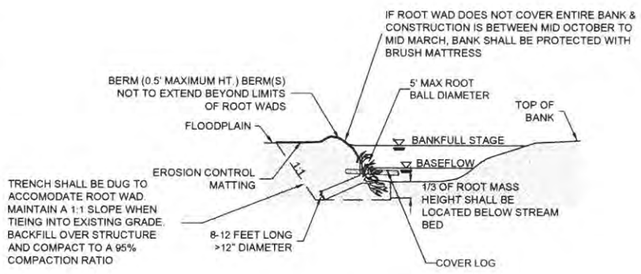
ROCK CROSS VANE
NTS



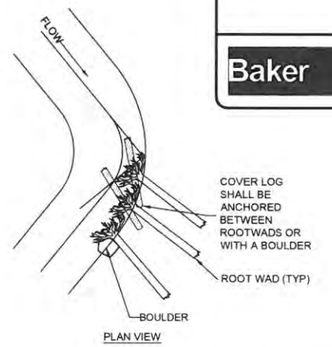
ROCK CROSS VANE STRUCTURE NOTES:

1. BOULDERS MUST BE AT LEAST 3'x2'x1'.
2. USE FILTER FABRIC TO SEAL GAPS BETWEEN BOULDERS.
3. DIG A TRENCH BELOW THE BED FOR FOOTER BOULDERS. START AT BANK AND PLACE FOOTER BOULDERS FIRST AND THE HEADER BOULDERS. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. INSTALL FILTER FABRIC FOR DRAINAGE BEGINNING AT THE MIDDLE OF THE HEADER BOULDERS AND EXTEND DOWNWARD TO THE DEPTH OF THE BOTTOM FOOTER BOULDERS, AND THEN UPSTREAM FOR A MINIMUM OF SIX FEET.
5. USE WELL GRADED MIX OF CLASS A AND B STONE ON UPSTREAM SIDE OF STRUCTURE.
6. AFTER ALL STONE HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER BOULDER.
7. FILTER FABRIC SHALL BE TRIMMED ALONG THE TRANSITION BETWEEN THE STONE BACKFILL AND THE HEADER BOULDERS SO THAT THE FILTER FABRIC DOES NOT OVERLAP THE HEADER BOULDERS.

ROOT WAD
NTS



CROSS-SECTION VIEW



PLAN VIEW

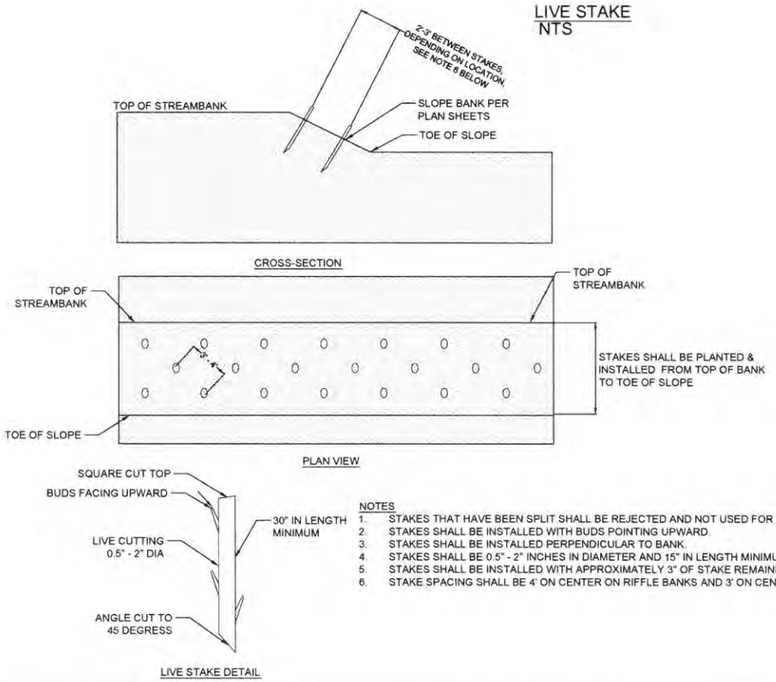
NOTE
1. ROOTWADS SHALL BE A HARDWOOD SPECIES WITH A 12" MINIMUM DIAMETER
2. THE CHANNEL BASEFLOW ELEVATION WILL VARY SEASONALLY AND MAY BE VERY LOW DURING TIMES OF DROUGHT. FOR CONSTRUCTION PURPOSES, THE BASEFLOW ELEVATION WILL BE CONSIDERED TO BE EQUAL TO THE DOWNSTREAM RIFFLE ELEVATION.
3. ELEVATION OF THE ROOTWADS WILL BE BASED ON THE DOWNSTREAM RIFFLE ELEVATION. ROOTWADS SHOULD BE CONSTRUCTED SUCH THAT HALF OF THE ROOTWAD MASS IS BELOW THE BASEFLOW WATER SURFACE.
4. THE CONTRACTOR WILL BE RESPONSIBLE FOR CHANGES TO THE ROOTWADS ELEVATION AND PLACEMENT IF IT IS DETERMINED BY THE ENGINEER THAT THE ROOTWADS WERE NOT INSTALLED PROPERLY ACCORDING TO THIS DETAIL.

NOTE
TRENCHING METHOD:
IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK REQUIRES RECONSTRUCTION, THE TRENCHING METHOD SHALL BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. ONE-THIRD OF THE ROOT WAD SHALL REMAIN BELOW NORMAL BASE FLOW CONDITIONS.

NOTE
DRIVE POINT METHOD.
THE TRUNK END OF THE LOG SHALL BE SHARPENED WITH A CHAINSAW BEFORE "DRIVING" IT INTO THE BANK. ROOT WADS SHALL BE ORIENTED UPSTREAM SO THAT THE STREAM FLOW MEETS THE ROOT WAD AT A 90-DEGREE ANGLE, DEFLECTING THE WATER AWAY FROM THE BANK. A TRANSPLANT OR BOULDER SHALL BE PLACED ON THE DOWNSTREAM SIDE OF THE ROOT WAD IF A BACK EDDY IS FORMED BY THE ROOT WAD. THE BOULDER SHALL BE APPROXIMATELY 4' X 3' X 2'.

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

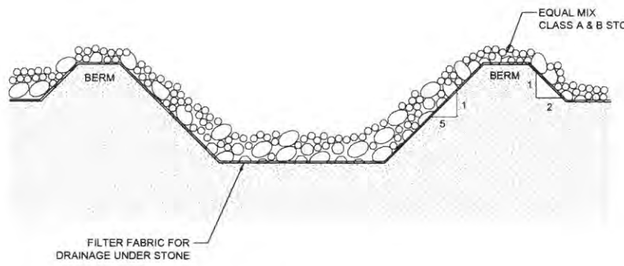
LIVE STAKE
NTS



LIVE STAKE DETAIL

NOTES
1. STAKES THAT HAVE BEEN SPLIT SHALL BE REJECTED AND NOT USED FOR CONSTRUCTION.
2. STAKES SHALL BE INSTALLED WITH BUDS POINTING UPWARD.
3. STAKES SHALL BE INSTALLED PERPENDICULAR TO BANK.
4. STAKES SHALL BE 0.5" - 2" INCHES IN DIAMETER AND 15" IN LENGTH MINIMUM.
5. STAKES SHALL BE INSTALLED WITH APPROXIMATELY 3" OF STAKE REMAINING ABOVE GROUND.
6. STAKE SPACING SHALL BE 4' ON CENTER ON RIFFLE BANKS AND 3' ON CENTER ON OUTSIDE BANK BENDS.

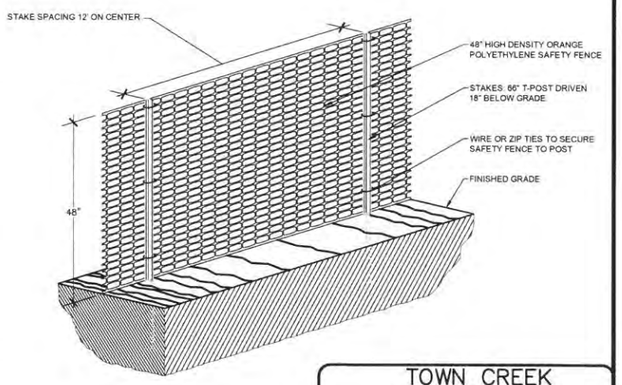
PERMANENT STREAM CROSSING
NTS



FORD 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 PERPENDICULAR TO THE FLOW.
5. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
6. A STABILIZED PAD OF CLASS A STONE (75%) AND #57 STONE (25%), 6 INCHES THICK, LINED WITH FILTER FABRIC FOR DRAINAGE SHALL BE USED OVER THE BERM AND ACCESS SLOPES.
7. WIDTH OF THE CROSSING SHALL BE SUFFICIENT TO ACCOMMODATE A 10' WIDE FARM VEHICLE CROSSING THE CHANNEL.
8. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED.

HI-VIZ SAFETY FENCE
NTS



TOWN CREEK RESTORATION PROJECT—OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D4
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
797 Haywood Road
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Asheville, NC 28806
Phone: 828.350.1408
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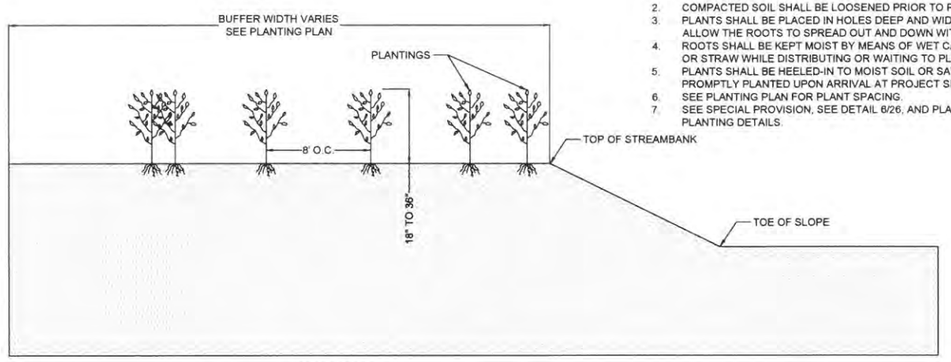
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

BARE ROOT PLANTING
NTS

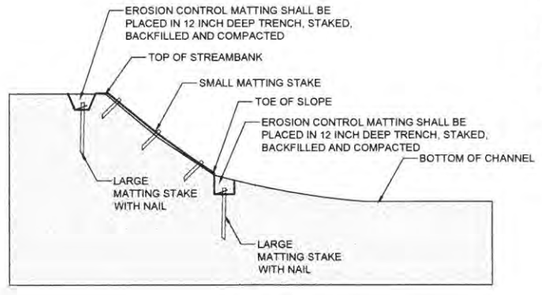


CROSS-SECTION

BARE ROOT PLATING NOTES:

1. BARE ROOT SHRUBS AND TREES SHALL BE PLANTED AS SHOWN ON THE PLANS.
2. COMPACTED SOIL SHALL BE LOOSENED PRIOR TO PLANTING.
3. PLANTS SHALL BE PLACED IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
4. ROOTS SHALL BE KEPT MOIST BY MEANS OF WET CANVAS, BURLAP, OR STRAW WHILE DISTRIBUTING OR WAITING TO PLANT.
5. PLANTS SHALL BE HEELED-IN TO MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL AT PROJECT SITE.
6. SEE PLANTING PLAN FOR PLANT SPACING.
7. SEE SPECIAL PROVISION, SEE DETAIL 8/26, AND PLANTING PLAN FOR PLANTING DETAILS.

EROSION CONTROL MATTING
NTS



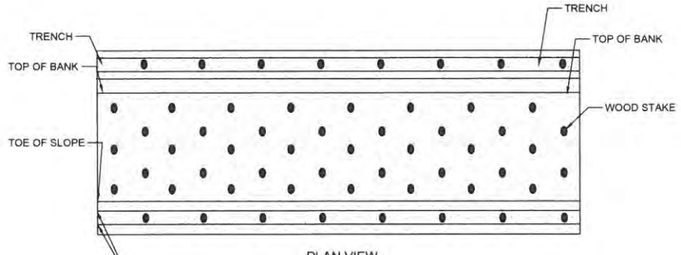
CROSS-SECTION

EROSION CONTROL MATTING NOTES

1. BANKS SHALL BE SEEDED (PERMANENT & TEMPORARY) PRIOR TO PLACEMENT OF MATTING.
2. WOODEN STAKES SHALL BE PLACED IN A DIAMOND SHAPE PATTERN PER THE PLAN VIEW.
3. TRENCH STAKES AND WOOD STAKES SHALL BE PLACED A MAXIMUM DISTANCE APART OF 3'.
4. EROSION CONTROL MATTING (RCM) SHOULD BE USED TO AID PERMANENT VEGETATED STABILIZATION OF SLOPES 2:1 OR GREATER AND WITH MORE THAN 10 FEET OF VERTICAL RELIEF.
5. RCM SHOULD BE USED WHEN MULCH CANNOT BE ADEQUATELY TACKED AND WHERE IMMEDIATE GROUND COVER IS REQUIRED TO PREVENT EROSION DAMAGE.
6. **6" MINIMUM OVERLAP IN THE HORIZONTAL**

EROSION CONTROL MATTING MAINTENANCE NOTES

1. INSPECT ECM AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENT. REPAIR IMMEDIATELY.
2. GOOD CONTACT WITH THE GROUND MUST BE MAINTAINED, AND EROSION MUST NOT OCCUR BENEATH THE ECM.
3. ANY AREAS OF THE ECM THAT ARE DAMAGED OR NOT IN CLOSE CONTACT WITH THE GROUND SHALL BE REPAIRED AND STAPLED.
4. IF EROSION OCCURS DUE TO POORLY CONTROLLED DRAINAGE, THE PROBLEM SHALL BE FIXED AND THE ERODED AREA PROTECTED.
5. MONITOR AND REPAIR THE ECM AS NECESSARY UNTIL GROUND COVER IS ESTABLISHED.



PLAN VIEW

TYPICAL LARGE MATTING STAKE

THE WOOD STAKE SHALL HAVE THE FOLLOWING DIMENSIONS:

LEG LENGTH	17.00 IN (43.18 CM) (TAPERED TO POINT)
WIDTH	1.5 IN (3.81 CM)
THICKNESS	1.5 IN (3.81 CM)

TYPICAL SMALL MATTING STAKE

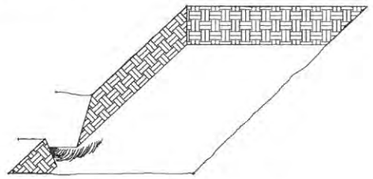
THE WOOD STAKE SHALL HAVE THE FOLLOWING DIMENSIONS:

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)

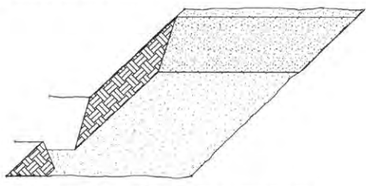
BARE ROOT INSTALLATION PLANTING DETAIL
NTS

HEELING IN

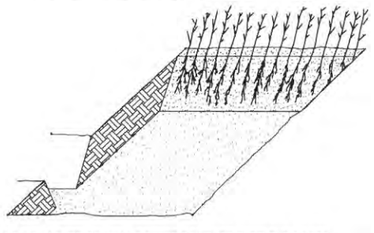
1. LOCATE A HEELING-IN SITE IN A SHADY, WELL PROTECTED AREA.
2. EXCAVATED A FLAT BOTTOM TRENCH 12 INCHES DEEP AND PROVIDE DRAINAGE.



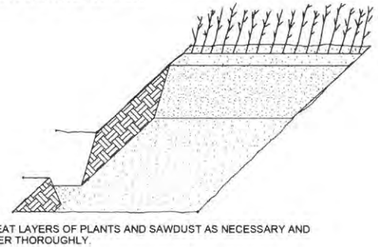
3. BACKFILL THE TRENCH WITH 2 INCHES OF WELL ROTTED SAWDUST. PLACE A 2 INCH LAYER OF WELL ROTTED SAWDUST AT A SLOPING ANGLE AT ONE END OF THE TRENCH.



4. PLACE A SINGLE LAYER OF PLANTS AGAINST THE SLOPING END SO THAT THE ROOT COLLAR IS AT GROUND LEVEL.



5. PLACE A 2 INCH LAYER OF WELL ROTTED SAWDUST OVER THE ROOTS MAINTAINING A SLOPING ANGLE.



6. REPEAT LAYERS OF PLANTS AND SAWDUST AS NECESSARY AND WATER THOROUGHLY.

DIBBLE PLANTING METHOD USING THE KBC PLANTING BAR

1. INSERT PLANTING BAR 12" INTO THE GROUND AS SHOWN AND PULL HANDLE TOWARD PLANTER.
2. REMOVE PLANTING BAR AND PLACE SEEDING AT CORRECT DEPTH.
3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDING.

4. PULL HANDLE OF BAR TOWARD PLANTER, FIRMING SOIL AT BOTTOM.
5. PUSH HANDLE FORWARD FIRMING SOIL AT TOP.
6. LEAVE COMPATION HOLE OPEN WATER THOROUGHLY.

PLANTING NOTES:

PLANTING BAG

DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT THE ROOT SYSTEMS FROM DRYING.

KBC PLANTING BAR

PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.

ROOT PRUNING

ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.

TOWN CREEK RESTORATION PROJECT–OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D5
NCEEP PROJECT NO. 95028	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
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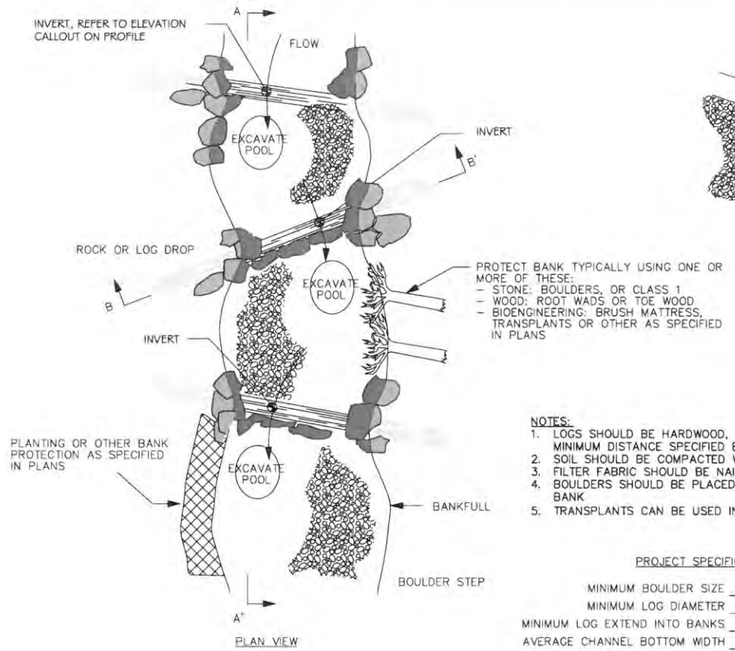
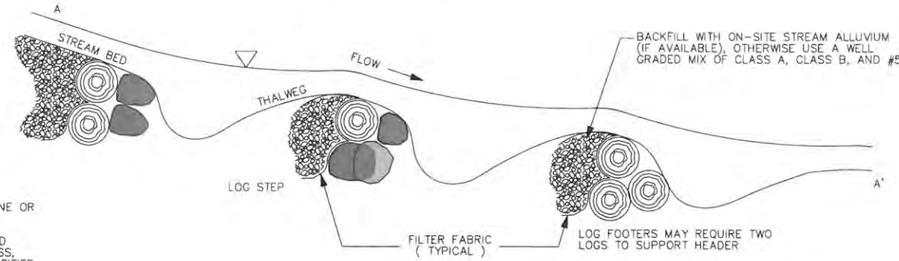
PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

ANGLED LOG STEP
NTS



PLAN VIEW

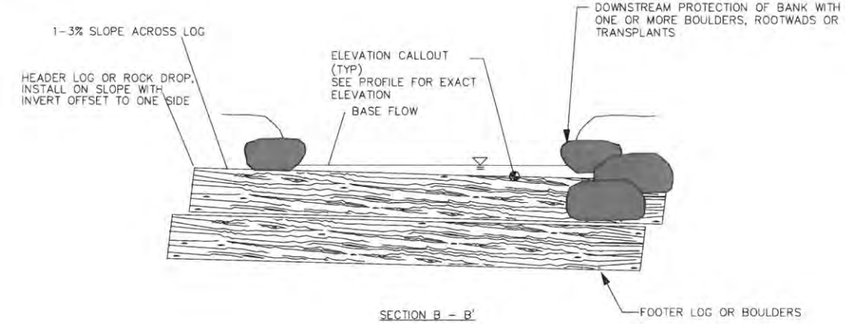


SECTION A – A'

NOTES:
1. LOGS SHOULD BE HARDWOOD, RECENTLY HARVESTED AND EXTENDING INTO THE BANK ON EACH SIDE AT MINIMUM DISTANCE SPECIFIED BELOW.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG
3. FILTER FABRIC SHOULD BE NAILED TO THE LOG BELOW THE BACKFILL
4. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ANCHORING AND INCORPORATED INTO BANK
5. TRANSPLANTS CAN BE USED INSTEAD OF BOULDERS WITH ENGINEER'S APPROVAL

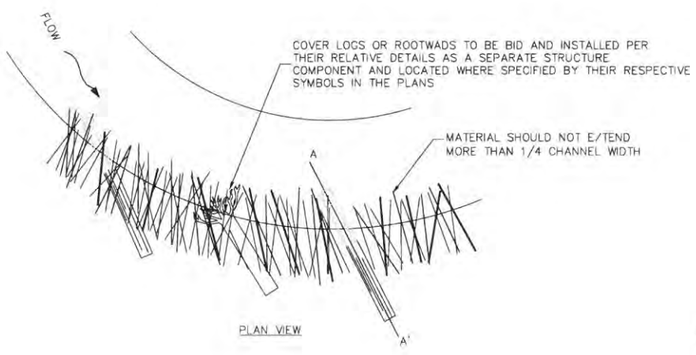
PROJECT SPECIFIC SPECS

MINIMUM BOULDER SIZE	2.5x1.5x1	FT
MINIMUM LOG DIAMETER	10	IN
MINIMUM LOG EXTEND INTO BANKS	3	FT
AVERAGE CHANNEL BOTTOM WIDTH	5	FT
APPROXIMATE LOG LENGTHS	11+	FT

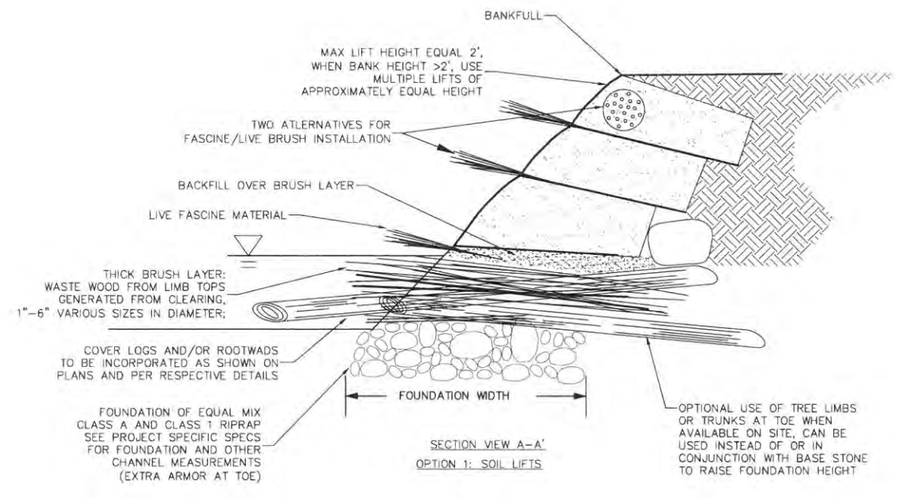


SECTION B – B'

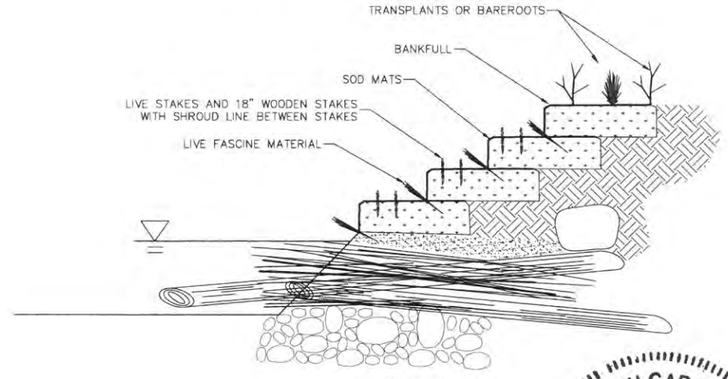
TOE WOOD
NTS



PLAN VIEW



SECTION VIEW A–A'
OPTION 1: SOIL LIFTS



SECTION VIEW A–A'
OPTION 2: SOD MATS

PROJECT SPECIFIC SPECS

POOL WATER DEPTH	2.0	FT
FOUNDATION HEIGHT	12	IN
FOUNDATION WIDTH	2	FT
BRUSH THICKNESS	~8	IN

NORTH CAROLINA PROFESSIONAL SEAL 22967 ENGINEER WILLIAM SCOTT HUNT, III
08.14.14

TOWN CREEK RESTORATION PROJECT–OPTION B

DETAILS

PRELIMINARY PLANS
DO NOT USE
FOR CONSTRUCTION

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D6
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

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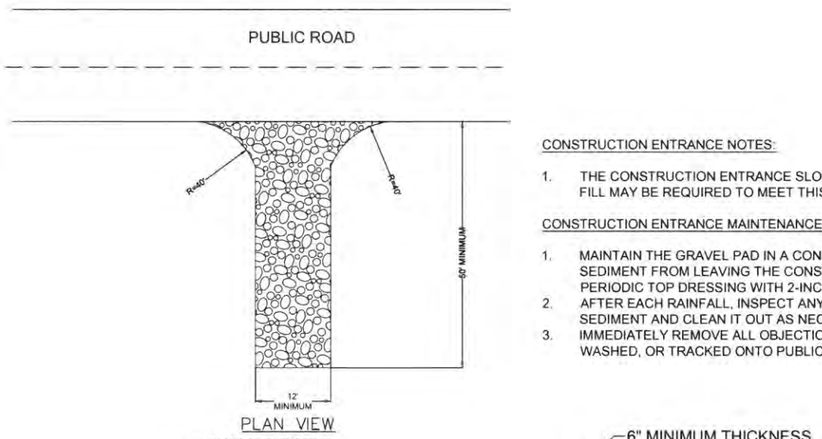
TEMPORARY CONSTRUCTION ENTRANCE
NTS



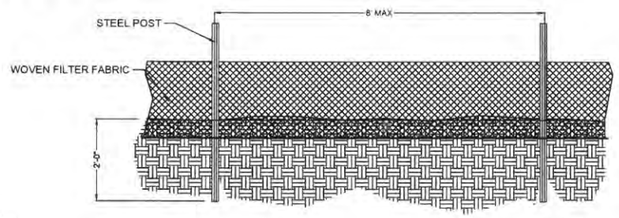
CONSTRUCTION ENTRANCE NOTES:

1. THE CONSTRUCTION ENTRANCE SLOPE SHALL NOT EXCEED A 3:1 RATIO. FILL MAY BE REQUIRED TO MEET THIS DESIGN RATIO.

CONSTRUCTION ENTRANCE MAINTENANCE NOTES:

1. MAINTAIN THE GRAVEL PAD IN A CONDITION TO PREVENT MUD OR SEDIMENT FROM LEAVING THE CONSTRUCTION SITE. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH 2-INCH STONE.
2. AFTER EACH RAINFALL, INSPECT ANY STRUCTURE USED TO TRAP SEDIMENT AND CLEAN IT OUT AS NECESSARY.
3. IMMEDIATELY REMOVE ALL OBJECTIONABLE MATERIALS SPILLED, WASHED, OR TRACKED ONTO PUBLIC ROADWAYS.

TEMPORARY SILT FENCE
NTS

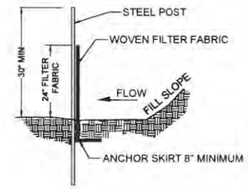


TEMPORARY SILT FENCE NOTES:

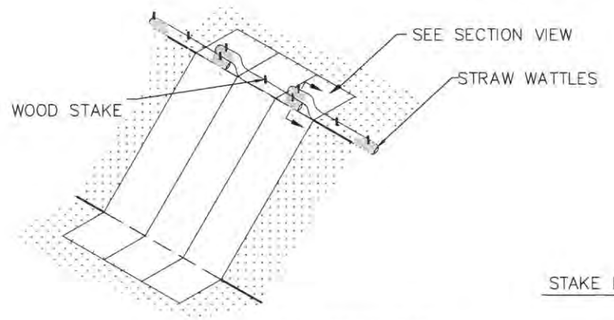
1. FILTER FABRIC FENCE SHALL BE A MINIMUM OF 32" IN WIDTH AND SHALL HAVE A MINIMUM OF 6 LINE WIRES WITH 12" STAY SPACING.
2. WOVEN FILTER FABRIC TO BE USED WHERE SILT FENCE IS TO REMAIN FOR A PERIOD OF MORE THAN 30 DAYS.
3. STEEL POSTS SHALL BE 5'-0" IN HEIGHT AND BE OF THE SELF-FASTENER ANGLE STEEL TYPE.
4. TURN SILT FENCE UP SLOPE AT ENDS.
5. DRAINAGE AREA CAN NOT BE GREATER THAN 1/4 ACRE PER 100 FT OF FENCE.
6. SLOPE LENGTHS CAN NOT EXCEED CRITERIA SHOWN IN TABLE 6.62A NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
7. DO NOT INSTALL SEDIMENT FENCE ACROSS STREAMS, WETLANDS, DITCHES, WATERWAYS OR OTHER AREAS OF CONCENTRATED FLOW.
8. INSTALL POSTS WITH THE NIPPLES FACING AWAY FROM THE SILT FENCE.
9. ATTACH THE FABRIC TO EACH POST WITH THREE TIES WITH THE TOP TIE WITHIN 8" OF THE TOP OF THE FABRIC.
10. WRAP APPROXIMATELY 6 INCHES OF FABRIC AROUND THE END POSTS AND SECURE WITH 3 TIES.
11. CONSTRUCT THE FILTER FABRIC FROM A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID JOINTS. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FILTER CLOTH ONLY AT A SUPPORT POST WITH 4 FEET MINIMUM OVERLAP TO THE NEXT POST.

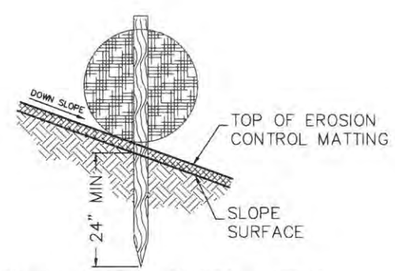
TEMPORARY SILT FENCE MAINTENANCE NOTES:

1. INSPECT SEDIMENT FENCES AT LEAST ONCE A WEEK AND AFTER EACH RAINFALL. MAKE ANY REQUIRED REPAIRS IMMEDIATELY.
2. SHOULD THE FABRIC OF THE SEDIMENT FENCE COLLAPSE, TEAR, DECOMPOSE OR BECOME INEFFECTIVE, REPLACE IT PROMPTLY.
3. REMOVE SEDIMENT DEPOSITS AS NECESSARY TO PROVIDE ADEQUATE STORAGE VOLUME FOR THE NEXT RAIN AND TO REDUCE PRESSURE ON THE FENCE. TAKE CARE TO AVOID UNDERMINING THE FENCE DURING CLEANOUT.
4. REMOVE ALL FENCING MATERIALS AND UNSTABLE SEDIMENT DEPOSITS AND BRING THE AREA TO GRADE AND STABILIZE IT AFTER THE CONTRIBUTING DRAINAGE AREA HAS BEEN PROPERLY STABILIZED.

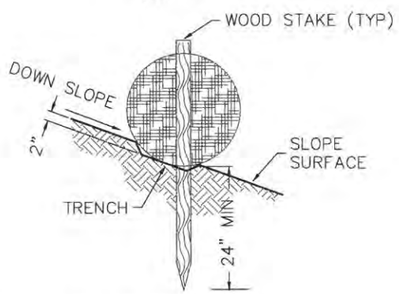


STRAW WATTLE
NTS

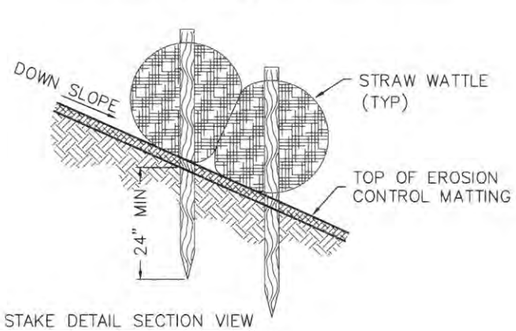




STAKE DETAIL ON EROSION CONTROL MATTING
NOT TO SCALE

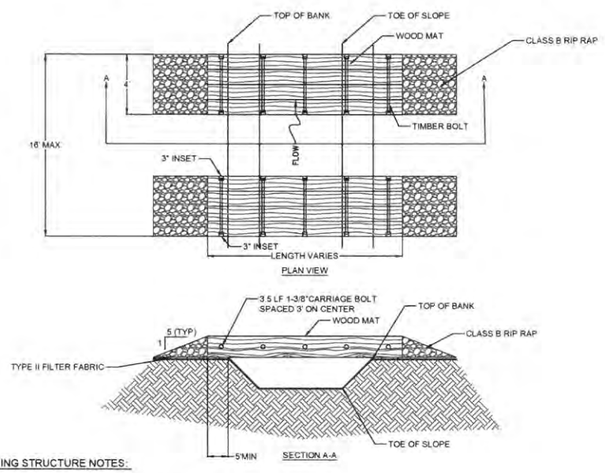


STAKE DETAIL ON BARE SOIL
NOT TO SCALE



STAKE DETAIL SECTION VIEW
NOT TO SCALE

TEMPORARY STREAM/WETLAND CROSSING
NTS



TEMPORARY STREAM/WETLAND CROSSING STRUCTURE 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 PERPENDICULAR TO THE FLOW.
6. MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER EXISTING CHANNEL.
7. STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUDMAT.
8. THE MUD MAT SHALL BE OF SUFFICIENT SIZE AND WIDTH TO SUPPORT THE LARGEST VEHICLE CROSSING THE CHANNEL.
9. CONTRACTOR SHALL DETERMINE AN APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT UTILIZED. RECOMMENDED AT A 5:1 SLOPE.

TEMPORARY STREAM CROSSING MAINTENANCE NOTES:

1. INSPECT TEMPORARY STREAM/WETLAND CROSSINGS AFTER RUN-OFF PRODUCING RAINS TO CHECK FOR BLOCKAGE IN CHANNEL, EROSION OF ABUTMENTS, CHANNEL SCOUR, RIPRAP DISPLACEMENT, OR PIPING. MAKE ALL REPAIRS IMMEDIATELY TO PREVENT FURTHER DAMAGE TO THE INSTALLATION.

TOWN CREEK RESTORATION PROJECT–OPTION B

DETAILS

BAKER PROJECT REFERENCE NO.	SHEET NO.
124526	D7
NCEEP PROJECT NO. 95026	DATE: 8/15/2014
PROJECT ENGINEER	

Baker
Michael Baker Engineering, Inc.
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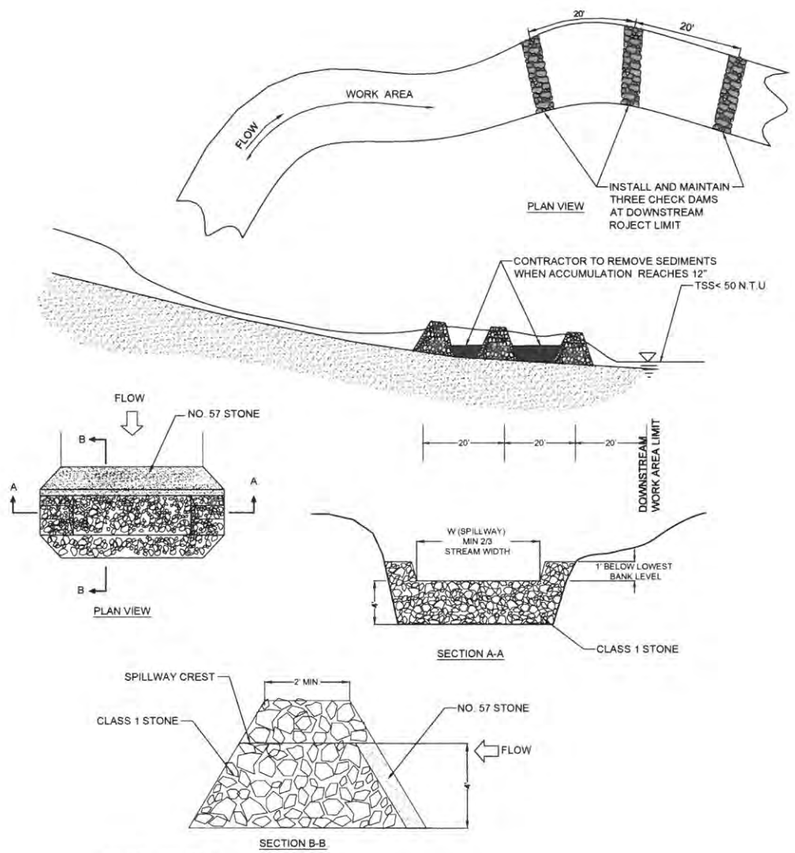
Phone: 828.350.1408
Fax: 828.350.1409

PRELIMINARY PLANS DO NOT USE FOR CONSTRUCTION

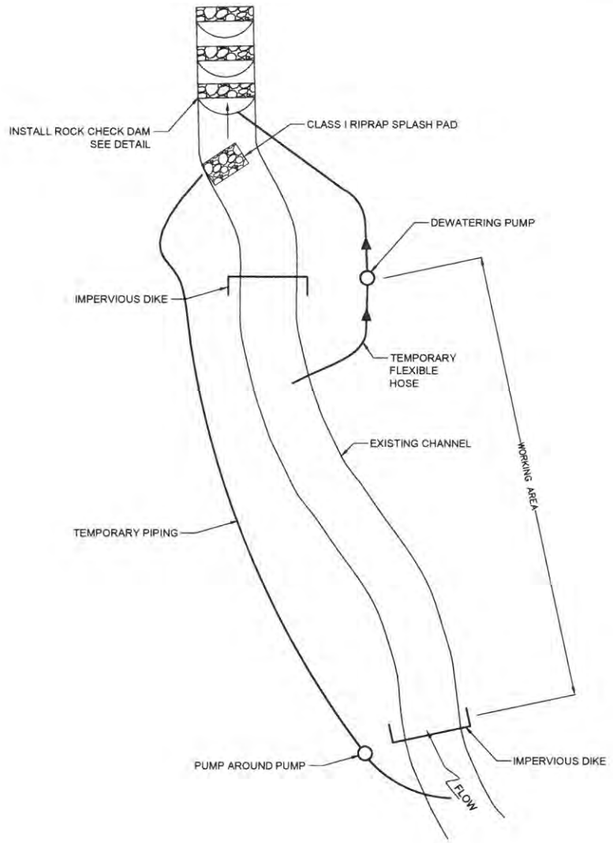
TEMPORARY ROCK CHECK DAM
NTS



MAINTENANCE NOTES

1. INSPECT CHECK DAMS AT LEAST WEEKLY AND AFTER EACH SIGNIFICANT (1/2 INCH OR GREATER) RAINFALL EVENT AND REPAIR IMMEDIATELY.
2. ANTICIPATE EROSION AROUND THE EDGED OF THE DAM, CORRECT ALL DAMAGE IMMEDIATELY.
3. REMOVE SEDIMENTS BEHIND DAMS WHEN ACCUMULATION REACHES 12 INCHES.

TYPICAL PUMP AROUND OPERATION
NTS

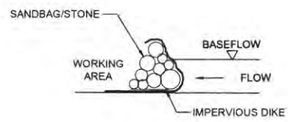


SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL ROCK CHECK DAMS AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE.
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/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE STILLING BASINS AND STABILIZE DISTURBED AREAS WITH SEED AND MULCH.

PUMP AROUND 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 1.0 CFS.
5. PROVIDE STABILZED OUTLET TO STREAM BANK.



IMPERVIOUS DIKE

TOWN CREEK RESTORATION PROJECT–OPTION B

DETAILS