

MITIGATION REPORT (FINAL)

**BISHOP SITE STREAM AND WETLAND RESTORATION
ANSON COUNTY, NORTH CAROLINA
YADKIN RIVER BASIN CATALOGING UNITS 03040104 AND 03040105**

SCO ID# 040611701A



PREPARED FOR:



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EXECUTIVE SUMMARY

EcoScience Corporation (ESC) was retained by the North Carolina Ecosystem Enhancement Program (EEP) to provide stream and wetland restoration/enhancement design services for the Bishop Site Stream and Wetland Restoration (hereafter referred to as the Site). The Site, which is in the Yadkin River Basin (Cataloguing Units 03040104 and 03040105), is located north of Wadesboro in Anson County, North Carolina (Figure 1, Appendix A). Three separate construction areas, each confined within an EEP-owned conservation easement, comprise the approximate 200-acre Site: Camp Branch (Site A, 94.9 acres), Dula Thoroughfare (Site B, 70.8 acres), and the Unnamed Tributary (UT) to Dula Thoroughfare (Site C, 33.7 acres).

Pre-Construction Site Conditions

Prior to restoration activities, land use within the Site was primarily agricultural, with forested strips occupying low areas between cultivated fields. There are three major on-Site drainage features where restoration activities occurred: Camp Branch, Dula Thoroughfare, and the UT to Dula Thoroughfare (Sites A, B, and C, respectively). Each of these three watercourses was dredged and straightened to accommodate past agricultural land use, resulting in unstable F and G type channels (Rosgen 1996). In their pre-disturbance conditions, Camp Branch and the UT to Dula Thoroughfare were likely classifiable as C or E stream types (Rosgen 1996), while Dula Thoroughfare, due to its landscape position at the edge of the Rocky River floodplain, was likely a low-gradient backwater slough (an E or D stream type [Rosgen 1996]). The following table summarizes the pre-construction conditions of each stream.

Pre-Construction Site Stream Channel Conditions				
Stream	Stream Type (Rosgen 1996)	Drainage Area at Site (mi ²)	Stream Order (per USGS)	Extent within Site (linear feet)
Camp Branch	F4/5	2.9	2 nd	5,078
Dula Thoroughfare	G5	0.4	1 st	5,230
UT to Dula Thoroughfare	G4/5	0.2	1 st	4,880

Due to the presence of hydric soil inclusions, riverine wetlands were likely adjacent to Dula Thoroughfare (Site B) in its downstream portions within the Site prior to anthropogenic channel impacts. However, channel alteration resulted in hydrologic modifications that effectively drained adjacent wetlands with the exception of those within the fringe of the channel. Headwater riverine wetlands, many of which are forested, occur elsewhere along various Site drainage features.

Restoration Plan

Stream restoration and/or enhancement activities were undertaken along Camp Branch (including an adjacent UT) (Site A), Dula Thoroughfare (Site B), and the UT to Dula Thoroughfare (Site C). In order to provide Priority 1 stream restoration along the UT to Camp Branch (Site A), an appropriately sized bankfull channel was excavated on new location within the Camp Branch floodplain. Priority 2 stream restoration was achieved along Camp Branch and the UT to Camp Branch (Site A) and Dula Thoroughfare (Site B) via floodplain and stream channel excavation on new location. Level 1 stream enhancement was achieved along the UT to Dula Thoroughfare by backfilling ditched and dredged portions of the channel, thereby returning stream flow to the adjacent, stable relic portions of the stream. Boulder sill structures were also installed in downstream portions of the UT to Dula Thoroughfare to

stabilize headcut areas. Level 2 stream enhancement was achieved in upstream portions of Camp Branch (Site A) and the UT to Dula Thoroughfare (Site C) by performing supplemental riparian plantings with the appropriate indigenous suite of species adjacent to the existing channel.

Wetland restoration adjacent to Dula Thoroughfare (Site B) were achieved by floodplain excavation and Site planting to mimic the Piedmont Bottomland Forest community described by Schafale and Weakley (1990). Wetland enhancement was also achieved in the headwaters of the UT to Dula Thoroughfare (Site C) via site planting. Exotic species removal (Chinese privet, *Ligustrum sinense*) was undertaken within forested portions of the active restoration areas at each of the three sites.

Post-Construction Site Conditions

On-Site restoration activities provided the following project totals (see Tables 1 and 2 and Figures 2 and 2A-C [Appendix A] for additional details):

- Priority 1 Stream Restoration: 403 linear feet
- Priority 2 Stream Restoration: 4,640 linear feet
- Level 1 Stream Enhancement: 1,871 linear feet
- Level 2 Stream Enhancement: 1,425 linear feet
- Stream Preservation: 12,918 linear feet
- Riverine Wetland Restoration: 3.1 acres
- Riverine Wetland Enhancement: 1.0 acres
- Riverine Wetland Preservation: 7.5 acres

Numerous ecological benefits are anticipated as a result of on-Site restoration activities. Stream channel restoration will reintroduce stable bankfull dimension, pattern, and profile along restored stream reaches, which is expected to greatly enhance lotic habitat quality and stream function. Floodplain excavation adjacent to restored streams will restore the characteristic flood regime to the stream as well as provide a lateral hydrologic input to restored wetland areas along the Dula Thoroughfare (Site B) floodplain. Restored and enhanced wetland areas will help to improve water quality via nutrient removal, increase local vegetative biodiversity, provide wildlife habitat, and serve as a forested corridor, linking the Site with adjacent forested areas.

Monitoring Plan

In order to ensure the Site meets regulatory stream and wetland restoration/enhancement monitoring criteria, each parameter on-Site will be monitored annually for five (5) years or until success criteria has been achieved. Refer to Figures 3A-C (Appendix A) and Section 3.0 (Monitoring Plan) of this Mitigation Report for details.

Along Camp Branch (Site A), the UT to Camp Branch (Site A), and Dula Thoroughfare (Site B), permanent cross-sections have been established to monitor stream restoration and level 1 enhancement reaches. Longitudinal profiles have been established along the entire restored Camp Branch and UT to Camp Branch reaches. Success criteria for stream restoration will include 1) successful classification of enhanced reaches as functioning systems (Rosgen 1996), and 2) channel stability indicative of a stable stream system. In addition, stream crest gauges have been installed to verify the required occurrence of at least two bankfull events over the course of the five year monitoring period in these locations. Permanent

channel cross-sections and photo points have been established along the UT to Dula Thoroughfare to monitor channel stability within Level 1 stream enhancement reaches.

Site groundwater hydrology within wetland restoration areas adjacent to Dula Thoroughfare (Site B) will be monitored by three (3) auto-logging monitoring gauges. Gauges will be downloaded monthly throughout the growing season. Hydrologic success criteria will be achieved by gauges registering groundwater levels within the upper 12 inches of the soil surface for a minimum number of consecutive days corresponding to at least 12.5 percent of the growing season in Anson County under normal annual precipitation. Exceptions will be made if monitoring gauges do not achieve success criteria during documented Site drought conditions.

In order to monitor planted vegetation (i.e., bare root seedlings), 10 X 10m² vegetation monitoring plots have been established within planted portions of Site restoration and enhancement areas. Site vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey (CVS) (CVS-EEP Protocol for Recording Vegetation, Level 1-2 Plot Sampling Only, Version 4.0, 2006). Stem counts of planted and volunteer species as well as an assessment of planted stem survivability will be performed annually. Vegetative monitoring success criteria will be achieved by plot data indicating an average number of planted stems per acre exceeding 320 stems/acre after the third year of monitoring and 260 stems/acre after the fifth and final year of project monitoring.

If vegetative success criteria are not achieved, supplemental plantings will be performed with native species approved by the appropriate regulatory agencies. Supplemental plantings will be performed as needed until success criteria are achieved.

Table 1: Project Mitigation Structure and Objectives

Project Segment or Reach ID	Mitigation Type	Approach	Restored Linear Footage (LF) or Acreage (AC)	Stationing	Comment
Reach 1 (Camp Branch)	R	P2	1,767 LF	0+00 – 17+94	Total includes 27 LF gap in easement at channel ford
Reach 2 (Camp Branch)	E2	NA	945 LF	NA	Enhancement reaches not stationed
Reach 3 (UT to Camp Branch)	R	P1	403 LF	0+00 – 4+33	Total includes 30 LF gap in easement at channel ford
Reach 4 (UT to Camp Branch)	R	P2	143 LF	4+33 – 5+76	
Reach 5 (Dula Thoroughfare -T- Channel)	R	P2	2,025 LF	0+00 – 20+25	
Reach 6 (Dula Thoroughfare-D- Channel)	R	P2	705 LF	0+00 – 7+05	
Reach 7 (UT to Dula Thoroughfare)	E1	NA	1,871 LF	NA	Enhancement reaches not stationed
Reach 8 (UT to Dula Thoroughfare)	E2	NA	480 LF	NA	Enhancement reaches not stationed
Stream Preservation	P	NA	12,918 LF	NA	
Riverine Wetland Restoration	R	NA	3.1 AC	NA	
Riverine Wetland Enhancement	WE	NA	1.0 AC	NA	
Riverine Wetland Preservation	P	NA	7.5 AC	NA	
<i>R = Restoration</i> <i>E1 = Level 1 Stream Enhancement</i> <i>E2 = Level 2 Stream Enhancement</i> <i>WE = Wetland Enhancement</i> <i>P = Preservation</i>			<i>P1 = Priority 1</i> <i>P2 = Priority 2</i> <i>NA = Not applicable</i>		

Table 2. Project Mitigation Totals by USGS 8-Digit Cataloguing Unit

Mitigation Type	USGS Cataloguing Unit	
	03040104	03040105
Priority 1 Stream Restoration	--	403 LF
Priority 2 Stream Restoration	2,730 LF	1,910 LF
Level 1 Stream Enhancement	1,871 LF	--
Level 2 Stream Enhancement	480 LF	945 LF
Stream Preservation	6,355 LF	6,563 LF
Wetland Restoration	3.1 AC	--
Wetland Enhancement	1.0 AC	--
Wetland Preservation	2.3 AC	5.2 AC

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MITIGATION REPORT

BISHOP SITE STREAM AND WETLAND RESTORATION ANSON COUNTY, NORTH CAROLINA YADKIN RIVER BASIN CATALOGING UNITS 03040104 AND 03040105

SCO ID# 040611701A

1.0 INTRODUCTION

EcoScience Corporation (ESC) was retained by the North Carolina Ecosystem Enhancement Program (EEP) to provide stream and wetland restoration/enhancement design services for the Bishop Site Stream and Wetland Restoration (hereafter referred to as the Site). The Site, which is in the Yadkin River Basin (Cataloging Units 03040104 and 03040105), is located north of Wadesboro in Anson County, North Carolina (Figure 1, Appendix A). It is just northwest (upstream) of the Rocky River's confluence with the Pee Dee River. Three separate construction areas, each confined within an EEP-owned conservation easement, comprise the approximate 200-acre Site: Camp Branch (Site A, 94.9 acres), Dula Thoroughfare (Site B, 70.8 acres), and the Unnamed Tributary (UT) to Dula Thoroughfare (Site C, 33.7 acres).

The table below provides summary information of the three major drainage features present within the Site prior to restoration activities. Camp Branch is a second-order stream (per United States Geological Survey [USGS] mapping) that flows approximately 5,078 linear feet through the Site before its confluence with the Rocky River. Dula Thoroughfare is a first-order stream that flows approximately 5,230 linear feet through the Site before its eventual confluence with the Pee Dee River. Its setting at the western edge of the Rocky River floodplain it was previously part of a backwater slough wetland/stream system. The Unnamed Tributary (UT) to Dula Thoroughfare is also a first-order stream that flows approximately 4,880 linear feet within the Site before its confluence with Dula Thoroughfare.

Pre-Construction Site Stream Channel Conditions				
Stream	Stream Type (Rosgen 1996)	Drainage Area at Site (mi ²)	Stream Order (per USGS)	Extent within Site (linear feet)
Camp Branch	F4/5	2.9	2 nd	5,078
Dula Thoroughfare	G5	0.4	1 st	5,230
UT to Dula Thoroughfare	G4/5	0.2	1 st	4,880

The goals of the Site restoration effort included stream channel restoration, enhancement, and preservation, and riverine wetland restoration, enhancement, and preservation. Priority 1 and Priority 2 stream restoration were achieved by excavating an appropriately sized (using reference reach data as guidance) bankfull channel on new location. In the Priority 1 stream restoration approach (performed along the UT to Camp Branch), a bankfull channel was excavated along the existing floodplain such that the stream's bankfull elevation corresponded to the existing floodplain grade. A bankfull channel was constructed within a new floodplain excavated at an elevation lower than the existing floodplain grade using the Priority 2 stream restoration approach (Camp Branch and Dula Thoroughfare). Level 1 stream

enhancement was performed along the UT to Dula Thoroughfare by backfilling previously ditched and dredged portions of the channel, thereby reintroducing flow into the appropriately sized adjacent relic streambed. Level 2 stream enhancement was achieved by performing supplemental riparian plantings along Camp Branch (upstream of the Priority 2 restoration reach) and UT to Dula Thoroughfare (upstream of the Level 1 enhancement reach). Stream preservation will be applied to all stream reaches within the Site where no restoration or enhancement activities occurred.

On-Site wetland restoration was achieved by excavating a floodplain adjacent to Dula Thoroughfare, thereby intercepting the local water table to saturate floodplain soils for sufficient periods of time to achieved jurisdictional wetland hydrology. Restored wetland areas were also planted with the appropriate suite of native hardwood species to emulate the Piedmont Bottomland Forest community described by Schafale and Weakley (1990). Wetland enhancement was achieved by performing plantings within deforested (or sparsely forested) jurisdictional wetland areas. Wetland preservation will be applied to all wetland areas within the Site identified during the project's jurisdictional delineation where no restoration or enhancement activities occurred.

On-Site restoration activities provided the following project totals (see Tables 1 and 2 and Figures 2 and 2A-C [Appendix A] for additional details):

- Priority 1 Stream Restoration: 403 linear feet
- Priority 2 Stream Restoration: 4,640 linear feet
- Level 1 Stream Enhancement: 1,871 linear feet
- Level 2 Stream Enhancement: 1,425 linear feet
- Stream Preservation: 12,918 linear feet
- Riverine Wetland Restoration: 3.1 acres
- Riverine Wetland Enhancement: 1.0 acres
- Riverine Wetland Preservation: 7.5 acres

2.0 RESTORATION SUMMARY

2.1 Project Mitigation Goals

The primary Site restoration goals included the restoration of stable dimension, pattern, and profile for impacted on-Site stream reaches including Camp Branch, the UT to Camp Branch, Dula Thoroughfare, and the UT to Dula Thoroughfare. A second primary project goal was the restoration of riverine wetlands adjacent to Dula Thoroughfare.

Secondary Site restoration goals included stream channel enhancement and preservation as well as wetland enhancement and preservation. These goals were achieved via site planting with bare root seedlings to recreate pre-disturbance vegetative communities within their appropriate landscape contexts. See Section 2.1 (Site Restoration Approaches) for details.

At Camp Branch (Site A), specific Site restoration goals included:

- Priority II stream restoration (including all attendant benefits outlined in Rosgen 1996) via excavation of approximately 1,767 linear feet of a designed E/C-type stream of the main Camp Branch channel on new location, including adjacent floodplain excavation to achieve an entrenchment ratio characteristic of E/C-type streams;
- Priority I stream restoration (including all attendant benefits outlined in Rosgen 1996) of approximately 403 linear feet and Priority II restoration of approximately 143 linear feet of a designed E/C-type stream of a UT to Camp Branch, including floodplain excavation along the UT upstream of Camp Branch to achieve a stable confluence;
- Level II stream enhancement of approximately 945 linear feet of Camp Branch upstream of its confluence with the UT via riparian plantings adjacent to the Camp Branch stream banks; and
- Re-establishment of the characteristic, pre-disturbance Piedmont Bottomland Forest (Schafale and Weakley 1990) community adjacent to restoration reaches using bare root seedling plantings.

At Dula Thoroughfare (Site B), specific Site restoration goals included:

- Priority II stream restoration via excavation of approximately 2,730 linear feet of a designed E-type stream of Dula Thoroughfare (including an associated tributary), including adjacent floodplain excavation to achieve an entrenchment ratio characteristic of E-type streams;
- Restoration of approximately 3.1 acres of riverine wetlands adjacent to Dula Thoroughfare via floodplain excavation in previously identified hydric soil areas, thereby re-establishing jurisdictional wetland hydrology;
- Aquatic habitat creation via excavation of vernal pools within floodplain cut areas; and
- Re-establishment of the characteristic, pre-disturbance Piedmont Bottomland Forest (Schafale and Weakley 1990) community adjacent to restoration reaches using bare root seedling plantings.

At UT to Dula Thoroughfare (Site C), specific Site restoration goals included:

- Level I enhancement of approximately 1,871 linear feet of stream via backfill of straightened and ditched portions of the existing watercourse, thereby re-establishing characteristic stream dimension and pattern by reintroducing flow into adjacent relic channel areas;
- Level II enhancement of approximately 480 linear feet of stream via riparian plantings adjacent to the UT to Dula Thoroughfare stream banks; and
- Re-vegetation of open areas adjacent to the UT to Dula Thoroughfare via plantings of characteristic, pre-disturbance community types described by Schafale and Weakley (1990) using bare root seedling plantings.

Prior to restoration activities, each of the on-Site drainage features listed above had been impacted to accommodate agricultural land usage (primarily row crop cultivation). In the classic scenario, stream channels are traditionally relocated to the toe of the adjacent valley slope, straightened, and dredged in an attempt to decrease flooding and increase the size of the cultivatable areas within the floodplain. Field evidence suggests this was the case with Camp Branch, while Dula Thoroughfare and the UT to Dula Thoroughfare were straightened and ditched along their existing locations. The straightening and ditching of Dula Thoroughfare likely drained adjacent riverine wetlands with the exception of those along the fringe of the channel.

2.1 Site Restoration Approaches

Site restoration approaches are discussed below. Site restoration activities consisted of stream restoration, enhancement, and preservation, and wetland restoration, enhancement, and preservation. Stream and wetland preservation do not involve active restoration activities and thus are not detailed below; however, Site preservation totals are summarized in Tables 1 and 2 and depicted on Figures 2 and 2A-C (Appendix A).

2.1.1 Stream Channel Restoration

Priority 2 stream restoration (Reaches 1, 4, 5, and 6, Table 1) was achieved by restoring Camp Branch, UT to Camp Branch, and Dula Thoroughfare's bankfull dimensions to reflect those exhibited by reference streams in similar geographic contexts within the Piedmont physiographic province. This was accomplished by the construction of a new bankfull channel within an excavated floodplain, thereby re-establishing the stream's appropriate bankfull dimensions and geometry to enable bankfull and higher-volume flows to exit the channel. Although riffle and pool depths were specified along Camp Branch and the UT to Camp Branch, they were not along Dula Thoroughfare because the intent of restoration efforts was to recreate a low-gradient backwater slough system. Priority 2 stream restoration reaches are displayed on Figures 2 and 2A-B (Appendix A). The total stream channel length improved by Priority 2 restoration is 4,640 linear feet.

Priority 1 stream restoration (Reach 3, Table 1) was achieved by excavating a new bankfull channel within the existing UT to Camp Branch floodplain such that the channel bankfull elevation corresponded with the existing floodplain grade. Priority 1 stream restoration provides the same fluvial hydrologic benefits as those offered by Priority 2 restoration (discussed above), but is preferable since less land disturbance is required. Also, the natural soil profile is preserved using this approach. The Site's Priority 1 stream restoration reach is displayed on Figure 2A (Appendix A). The total stream channel length improved by Priority 1 restoration is 403 linear feet.

2.1.2 Stream Channel Enhancement

Level 1 stream channel enhancement was undertaken along the UT to Dula Thoroughfare (Reach 7, Table 1). Prior to restoration activities, the stream had been diverted into an adjacent ditched and straightened channel, while soil material leftover from the excavation was left adjacent to the relic stream. In order to provide Level 1 stream enhancement along this reach, the previously ditched and straightened portions of the channel were backfilled with the leftover excavated material and flow was reintroduced into the adjacent relic channel. The Site's Level 1 stream enhancement reach is displayed on Figure 2C (Appendix A). The total stream channel length improved by Level 1 stream enhancement is 1,871 linear feet.

Level 2 stream channel enhancement was performed along reaches of Camp Branch and the UT to Dula Thoroughfare upstream of restoration and Level 1 enhancement reaches. (Reaches 2 and 8, Table 1). Riparian bare root seedling plantings were performed adjacent to the stream banks in these areas, thereby increasing canopy shading, floral diversity, and contributing to floodplain roughness to dissipate higher-energy flood flows upon tree maturity. The suite of species used to plant riparian areas mimicked the Piedmont Bottomland Forest described by Schafale and Weakley (1990). Level 2 stream enhancement

reaches are displayed on Figures 2A and 2C (Appendix A). The total stream channel length improved by Level 2 stream enhancement is 1,425 linear feet.

2.1.3 Riverine Wetland Restoration

Riverine wetland restoration was performed by excavating downstream floodplain areas adjacent to Dula Thoroughfare that contained hydric soil inclusions. Floodplain excavation effectively lowered the ground surface elevation in excavated areas closer to the seasonal high water table. In addition, floodplain excavation restored Dula Thoroughfare's natural flood regime, enabling bankfull and higher flows to spread out over the floodplain, providing an additional hydrologic input. In order to diversify floodplain habitat and increase local microtopographical complexity, floodplain pools were constructed within the excavated floodplain. In essence, grading activities along Dula Thoroughfare resulted in the restoration of a backwater slough ESC believes the watercourse mimicked in its pre-disturbance condition. Riverine wetland restoration areas are displayed on Figure 2B (Appendix A). The total area of riverine wetland restoration is 3.1 acres (Table 1).

2.1.4 Riverine Wetland Enhancement

Riverine wetland enhancement was accomplished by restoring the characteristic, native plant communities within deforested (or sparsely forested) jurisdictional wetland areas. Aside from incidental grading within a small seep wetland adjacent to the UT to Dula Thoroughfare (Figure 2C, Appendix A), grading activities were not performed in wetland enhancement areas. The total area of riverine wetland enhancement is 1.0 acre (Table 1).

3.0 MONITORING PLAN

In order to ensure the Site meets regulatory stream and wetland restoration monitoring criteria, each parameter on-Site will be monitored annually for five (5) years or until success criteria has been achieved. Refer to Figures 3A-C (Appendix A) for monitoring plan details.

3.1 Stream Channel

In order to ensure stable channel bankfull dimension, pattern, and profile along stream restoration reaches, stream channel assessment surveys will be undertaken. Longitudinal profiles along the entirety of the Camp Branch and UT to Camp Branch restoration reaches (Reaches 1, 3, and 4) are proposed to verify stream profile stability (see Figures 3A-B [Appendix A] for longitudinal profile locations). Longitudinal profiles are not proposed along Dula Thoroughfare because riffles and pool depths (i.e., variations in bedform) were not specified (see Section 2.1.1). Within each longitudinal profile monitoring reach and along Dula Thoroughfare (Reaches 5 and 6) and the UT to Dula Thoroughfare (Reach 7), stream channel cross-sections are proposed (approximately one cross-section for every 500 linear feet of stream) to monitor any potential instability and adverse changes in channel geometry (see Figures 3A-B [Appendix A] for cross-section locations). Measured parameters will include cross-sectional area, bankfull width, average and maximum bankfull depth, width-to-depth ratio, and substrate size class distribution. Stream channel photographs will also be taken at each cross-section location looking upstream and downstream at the channel at the cross-section midpoint. Longitudinal profiles and cross-sections will be surveyed annually throughout the 5-year project monitoring period. Channel geomorphic data will be analyzed and presented in the Site's Annual Monitoring Reports. Success criteria for stream

restoration and Level 1 enhancement will include 1) successful classification of the reach as a functioning system (Rosgen 1996), and 2) channel stability indicative of a stable stream system.

Photo points are proposed along the UT to Dula Thoroughfare (Reach 7) in conjunction with channel cross-sections to monitor Level 1 stream enhancement activities. Photo points are proposed at strategic locations within the reach so that any potential areas of instability will be documented and addressed with remedial maintenance measures.

Stream crest gauges have been installed adjacent to stream restoration reaches at Camp Branch, the UT to Camp Branch, and Dula Thoroughfare to monitor for the occurrence of bankfull events (see Figures 3A-B [Appendix A] for crest gauge locations). In order to achieve success criteria, at least two bankfull events must occur over the course of the five year monitoring period. It should be noted that at least two bankfull events were observed on Camp Branch, the UT to Camp Branch, and Dula Thoroughfare following the completion of Site grading activities before the project's final walkthrough.

3.2 Groundwater Hydrology

Three (3) auto-logging groundwater monitoring gauges have been installed in wetland restoration areas adjacent to Dula Thoroughfare (see Figure 3B [Appendix A] for monitoring gauge locations). Gauges will be downloaded monthly throughout the growing season. Hydrologic success criteria will be achieved by registering groundwater levels within the upper 12 inches of the soil surface for a minimum number of consecutive days corresponding to at least 12.5 percent of the growing season in Anson County under normal annual precipitation. Exceptions will be made if monitoring gauges do not achieve success criteria during documented Site drought conditions.

3.3 Vegetation

Vegetation monitoring (10 X 10m²) plots will be installed to monitor planted vegetation within Site restoration and enhancement areas. Site vegetation will be monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey (CVS) (CVS-EEP Protocol for Recording Vegetation, Level 1-2 Plot Sampling Only, Version 4.0, 2006). Proposed vegetation monitoring plot locations are displayed on Figures 3A-C (Appendix A). Plots will be monitored annually, and a stem count of planted and volunteer species as well as an assessment of survivability of planted stems will be performed. Vegetative monitoring success will be achieved by plot data indicating an average number of planted stems per acre exceeding 320 stems/acre after the third year of monitoring and 260 stems/acre after the fifth and final year of project monitoring.

4.0 MAINTENANCE AND CONTINGENCY PLANS

Graded areas within the Site will be inspected throughout the five year monitoring period. Areas of erosion will be noted, photographed, and discussed with EEP staff to determine if remedial maintenance measures should be undertaken.

If vegetation success criteria are not achieved by on average planted stem/acre density calculations from combined sample plot data, supplemental plantings will be performed with native tree species approved by the appropriate regulatory agencies (i.e., the EEP, USACE, and DWQ). Supplemental plantings will be performed as needed until vegetative success criteria are achieved.

Beaver activity has been observed within the UT to Camp Branch (Site A) just upstream of the access road ford. Throughout the five-year monitoring period, the Site will be periodically monitored for beaver activity encroachment into the conservation easement. If beaver activity is observed on-Site, EEP will be notified to pursue remedial measures.

5.0 REFERENCES

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology. Pagosa Springs, Colorado

Schafale, M. P. and A. S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, N.C. Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

Click on the Desired Link Below

Appendix A

Appendix B