

FINAL
MONITORING BASELINE DOCUMENT
IRWIN CREEK RESTORTION SITE
MECKLENBURG COUNTY, NORTH CAROLINA
(EEP Project No. 192)



Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina



October 2010

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Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

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October 2010

EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed level II stream enhancement and wetland creation at the Irwin Creek Restoration Site (hereafter referred to as the “Site”) to assist in fulfilling stream and wetland mitigation goals in the area. The Site is located on the western side of the City of Charlotte, approximately 2 miles southeast of the Charlotte Douglas International Airport, in Mecklenburg County. The Site is located in United States Geological Survey Hydrologic Unit 03050103020020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-34) of the Catawba River Basin and will service USGS 8-digit Cataloging Unit (CU) 03050103.

The Site is located within a NCEEP Targeted Local Watershed within the Sugar Creek watershed; this watershed in conjunction with the Little Sugar, McMullen, and McAlpine Creek watersheds in CU 03050103 drain point and nonpoint sources of pollution from the metropolitan center of Charlotte severely impacting aquatic health of the watershed. The waters are listed as impaired for elevated levels of fecal coliform bacteria and turbidity; the main goal in this CU is to provide better stormwater management (NCEEP 2007).

Prior to construction, the Site was located within a FEMA buyout area where several homes were demolished and removed. Surrounding land uses include commercial and residential areas with narrow riparian corridors adjacent to streams; greater than 85-90 percent of the contributing watershed having been cleared and developed.

The goals and objectives of this project focus on improving local water quality, habitat, and stream stability. The project approach was designed to provide restoration-oriented improvements to maximize environmental benefits while working within Site constraints, technical guidelines, and availability of funds. These goals were accomplished by the following.

1. Creating a floodplain bench including off-line wetlands to reduce the amount of sediment entering the stream by acting as a repository for soils suspended in the water column during high flow events, providing water storage to further allow sediment to settle out, and slow recharge of stormwater into the groundwater subsurface network.
2. Enhancing vegetation to provide habitat/food sources, shade the stream, filter overland runoff, and remove soil particles and other nutrients from stormwater.
3. Protecting a Site identified in a watershed that is listed as impaired for elevated levels of fecal coliform bacteria and turbidity (NCEEP 2007).

This project was constructed between the spring and early winter of 2009. The project consisted of enhancement (level II) of 980 linear feet of stream by laying back stream banks, excavating and extensive 90- to 100-foot wide floodplain bench along the entire project stream length, creating 0.5 acres of wetlands within the floodplain bench, and planting with native forest species. Several structures were left at the downstream end of the Site rather than removing them to avoid disturbance to the wetland area and stream banks. In addition, it was verified by HDR Engineering that the structures will not cause an issues with FEMA and may provide aquatic habitat and grade control. Site activities provide 653 Stream Mitigation Units and 0.17 riparian riverine Wetland Mitigation Units. The Site will be protected by a permanent conservation easement held by the State of North Carolina.

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Record Drawings March 5, 2010

1.0 INTRODUCTION

1.1 Location and Setting

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed level II stream enhancement and wetland creation at the Irwin Creek Restoration Site (hereafter referred to as the “Site”) to assist in fulfilling stream and wetland mitigation goals in the area. The Site is located on the western side of the City of Charlotte, approximately 2 miles southeast of the Charlotte Douglas International Airport, in Mecklenburg County (Figure 1, Appendix A). The Site is located in United States Geological Survey Hydrologic Unit 03050103020020 (North Carolina Division of Water Quality [NCDWQ] Subbasin 03-08-34) of the Catawba River Basin and will service USGS 8-digit Cataloging Unit (CU) 03050103.

Directions to the Site from Charlotte, North Carolina:

- Take Interstate 77 to exit 7 (Clanton Road)
- Travel northeast on Clanton Road for approximately 0.6 mile
- Take the fourth left on Fieldcrest Road
- Take the second right onto Crestridge Drive
- Take the first right onto Abeline Road
- Take the first left onto Whitehurst Road; the Site runs parallel to Whitehurst Road between Whitehurst Road and Irwin Creek
- Coordinates in center of the Site:
 - Latitude 35.199345°N, Longitude 80.900418°W (NAD83/WGS84)

1.2 Project Goals and Objectives

The goals and objectives of this project focus on improving local water quality, habitat, and stream stability. The project approach was designed to provide restoration-oriented improvements to maximize environmental benefits while working within Site constraints, technical guidelines, and availability of funds. These goals were accomplished by the following.

1. Creating a floodplain bench including off-line wetlands to reduce the amount of sediment entering the stream by acting as a repository for soils suspended in the water column during high flow events, providing water storage to further allow sediment to settle out, and slow recharge of stormwater into the groundwater subsurface network.
2. Enhancing vegetation to provide habitat/food sources, shade the stream, filter overland runoff, and remove soil particles and other nutrients from stormwater.
3. Protecting a Site identified in a watershed that is listed as impaired for elevated levels of fecal coliform bacteria and turbidity (NCEEP 2007).

1.3 Project Structure, Restoration Type, and Approach

Prior to construction, the Site was located within a FEMA buyout area where several homes were demolished and removed. Surrounding land uses include commercial and residential areas with narrow riparian corridors adjacent to streams; greater than 85-90 percent of the contributing watershed having been cleared and developed.

As constructed, Site activities enhanced (level II) 980 linear feet of stream and created 0.5 acres of riparian riverine wetlands by laying back stream banks, excavating an extensive 90- to 100-foot wide floodplain bench along the entire project stream length, creating wetlands within the floodplain bench, and planting with native forest species. Several structures were left at the downstream end of the Site rather than

removing them to avoid disturbance to the wetland area and stream banks (Photo Point 1, Appendix B and Figure 2, Appendix A). In addition, it was verified by HDR Engineering that the structures will not cause an issues with FEMA and may provide aquatic habitat and grade control. Site activities provide 653 Stream Mitigation Units and 0.17 riparian riverine Wetland Mitigation Units (Table 1 and Figure 2, Appendix A). Planting occurred within 3.2 acres of the 5.7-acre conservation easement including stream banks, floodplain, wetlands, and upland slopes on the south side of Irwin Creek. Target natural communities consisted of Piedmont/Mountain Bottomland Forest adjacent to Site streams and within floodplains grading towards a Mesic-Mixed Hardwood Forest (Piedmont subtype) on slopes (Schafale and Weakley 1990). Table 6 (Appendix C) outlines woody species planted within the Site. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix A).

2.0 MONITORING PLAN

Monitoring of Site restoration efforts will be performed for stream, vegetation, and hydrology components of the Site until success criteria are fulfilled. The establishment, collection, and summarization of monitoring data shall be conducted in accordance with the most current version of the EEP document entitled *Content, Format, and Data Requirements for EEP Monitoring Reports (version 1.2)*.

2.1 Stream

Annual stream monitoring will include vegetation survival (Section 2.2 Vegetation) and a photographic record of post construction conditions. Post construction photographs are included in Appendix B. Photographs of the enhancement (level II) reach will be taken for each year of the monitoring period. In addition, visual assessments of the stream will be conducted by walking the length of stream and bankfull flow events will be documented.

2.2 Vegetation

After planting was completed, an initial evaluation was performed to verify planting methods were successful and to determine initial species composition and density. Five sample vegetation plots (10-meter by 10-meter) were installed and measured within the Site as per guidelines established in *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006). In each sample plot, vegetation parameters to be monitored include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph. Baseline vegetation plot information can be found in Appendix C. Initial stem count measurements indicate an average of 639 stems per acre; individual plots met success criteria with the exception of plot 4, which was one stem short.

2.3 Hydrology

Two groundwater monitoring gauges were installed at the Site within off-line wetlands. Hydrological sampling will continue throughout the growing season at intervals necessary to satisfy the jurisdictional hydrology success criteria (USEPA 1990).

3.0 SUCCESS CRITERIA

3.1 Stream Success Criteria

Success criteria for stream enhancement will include 1) success of riparian vegetation and 2) documentation of two bankfull channel events. In the event that less than two bankfull events occur during the first five years, monitoring will continue until the second event is documented. In addition, bankfull events must occur during separate monitoring years.

3.2 Vegetation Success Criteria

Characteristic Tree Species include woody tree and shrub species planted at the Site, observed within the reference forest, or outlined for the appropriate plant community in Schafale and Weakley (1990). An average density of 320 stems per acre of Characteristic Tree Species must be surviving in the first three monitoring years. Subsequently, 260 Characteristic Tree Species per acre must be surviving in year 5.

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

3.3 Hydrology Success Criteria

Target hydrological characteristics include saturation or inundation for 10 percent of the growing season, during average climatic conditions. These areas are expected to support hydrophytic vegetation. If wetland parameters are marginal as indicated by vegetation and/or hydrology monitoring, a jurisdictional determination will be performed.

4.0 MAINTENANCE AND CONTINGENCY

In the event that success criteria are not fulfilled, a mechanism for contingency will be implemented.

Stream

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success include 1) riparian vegetation and/or 2) documentation of bankfull events.

Vegetation

If vegetation success criteria are not achieved based on average density calculations from combined plots over the entire restoration area, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

Hydrology

Hydrologic contingency may include floodplain surface modifications such as construction of ephemeral pools, deep ripping of the soil profile, and installation of berms to retard surface water flows. Recommendations for contingency to establish wetland hydrology may be implemented and monitored until hydrology success criteria are achieved.

5.0 REFERENCES

- Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation. Version 4.0. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.
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- 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, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.
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- United States Environmental Protection Agency (USEPA). 1990. Mitigation Site Type Classification (MiST). USEPA Workshop, August 13-15, 1989. EPA Region IV and Hardwood Research Cooperative, NCSU, Raleigh, North Carolina.
- United States Geological Survey (USGS). 1974. Hydrologic Unit Map - 1974. State of North Carolina.

**Appendix A.
General Tables and Figures**

Table 1. Site Restoration Structures and Objectives

Table 2. Project Activity and Reporting History

Table 3. Project Contacts Table

Table 4. Project Attributes Table

Figure 1. Site Location Map

Figure 2. Monitoring Plan View

Table 1. Site Restoration Structures and Objectives

Restoration Segment/ Reach ID*	Station Range	Mitigation Type	Priority Approach	Linear Footage/ Acreage	Comment
Irwin Creek	--	Enhancement	Level II	980	Laying back stream banks, excavation of a 90- to 100-foot wide floodplain bench along the entire project, creation of wetlands within the floodplain bench, and planting with native forest vegetation.
Wetland	--	Creation	--	0.5	Excavation of depressional wetlands within the floodplain bench and planting with native forest vegetation.
Component Summation					
Restoration Level	Stream (linear footage)	Riverine Riparian Wetland (acreage)		Planted Riparian Buffer (acreage)	
Enhancement (Level II)	980	--		--	
Creation	--	0.5		--	
Totals	980	0.5		3.2	
Mitigation Units	653 SMUs**	0.17 WMUs		--	

* Locations of each reach are depicted on the As-built Record Drawings in Appendix D

** A ratio of 1.5:1 was used due to the extensive excavation of a 90- to 100-foot wide floodplain bench along the entire project in addition to the incorporation of created wetlands within the floodplain bench area.

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	--	October 2003
Site Construction and 1 st Planting	--	Spring 2009
2 nd Planting	--	Late fall/early winter 2009
As-built Analysis Report	--	March 2010
As-built Record Drawings	--	March 2010
Baseline Monitoring Report	June 2010	July 2010

Table 3. Project Contacts Table

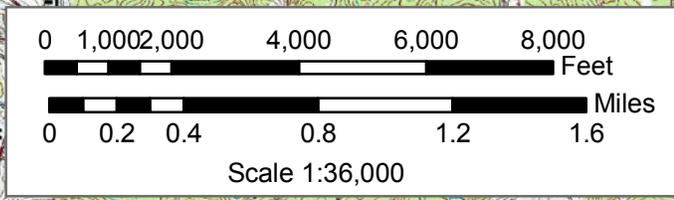
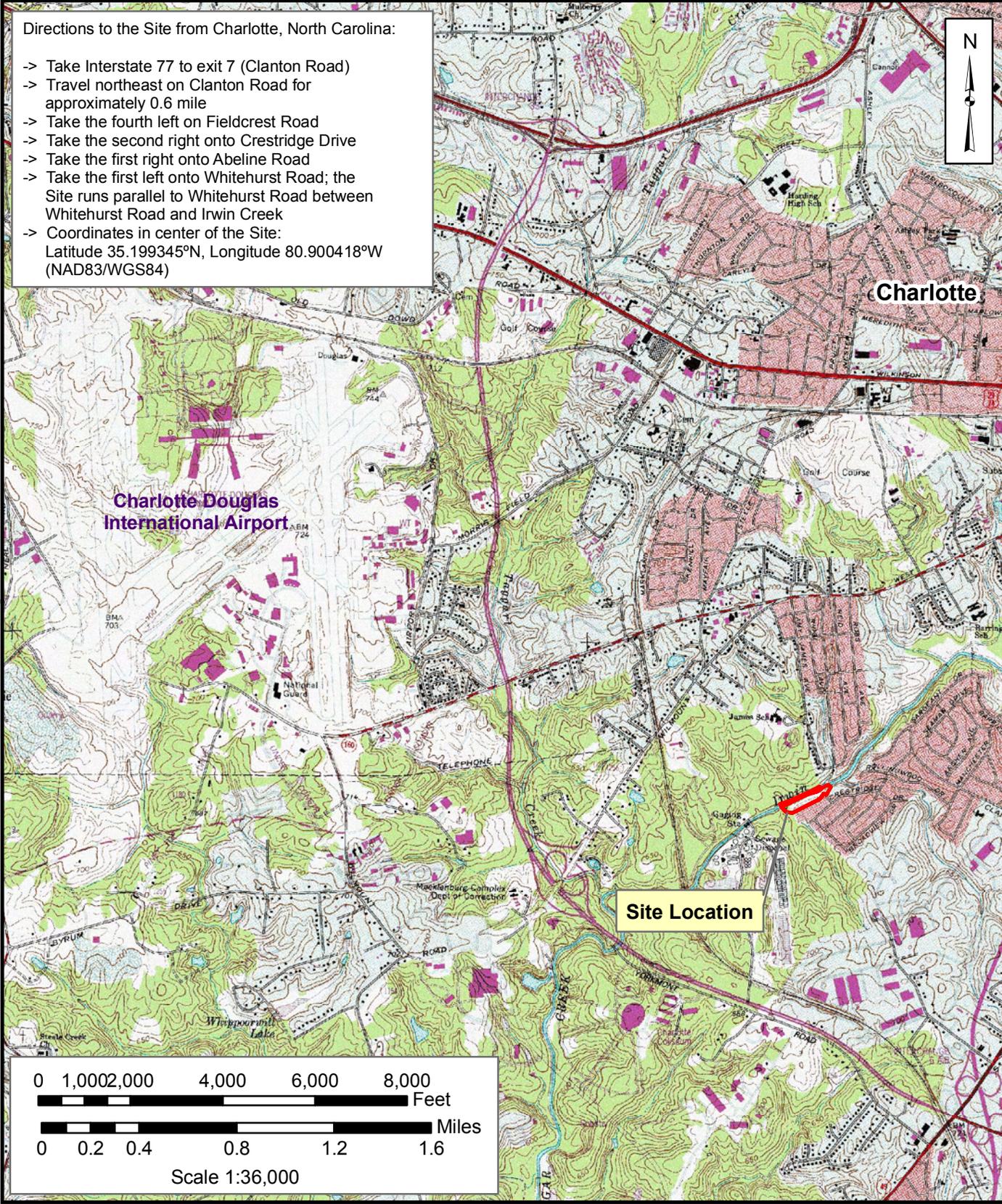
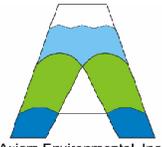
Designer	HDR Engineering of the Carolinas, Inc. 3733 National Drive Raleigh, NC 27612 919-785-1118
Construction and Seeding and Matting Contractor	Blythe Development Company 1415 E. Westinghouse Charlotte, NC 28273
Planting Contractor	North State Environmental, Inc. 2889 Lowery Street, Suite B Winston Salem, NC 27101 336-725-2010

Table 4. Project Attribute Table

Project County	Mecklenburg County, North Carolina
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont
Project River Basin	Catawba
USGS 14-digit HUC	03050103020020
NCDWQ Subbasin	03-08-34
Within EEP Watershed Plan Extent?	Yes-Targeted Local Watershed
WRC Class	Warm
% of project easement fenced	NA
Beaver activity observed during design phase	No
Drainage Area	31 square miles
Stream Order	4 th or greater
Enhanced length	980 linear feet
Perennial or Intermittent	Perennial
Watershed Type	Highly Developed
Watershed Land Use	>85-90 percent commercial/residential development
Impervious Surface	>30 percent
NCDWQ Index Number	11-137-1
NCDWQ Classification	C
303d listed?	Yes
Upstream of a 303d listed segment?	Yes
Reasons for 303d listing	Increased levels of copper, lead, and zinc affecting aquatic communities; downstream watershed is characterized by elevated levels of fecal coliform and turbidity.
Total easement	5.7 acres
Total planted within easement	3.2 acres
Trout Waters Designation	No
Species of concern	No
Dominant Soil Series	Monacan

Directions to the Site from Charlotte, North Carolina:

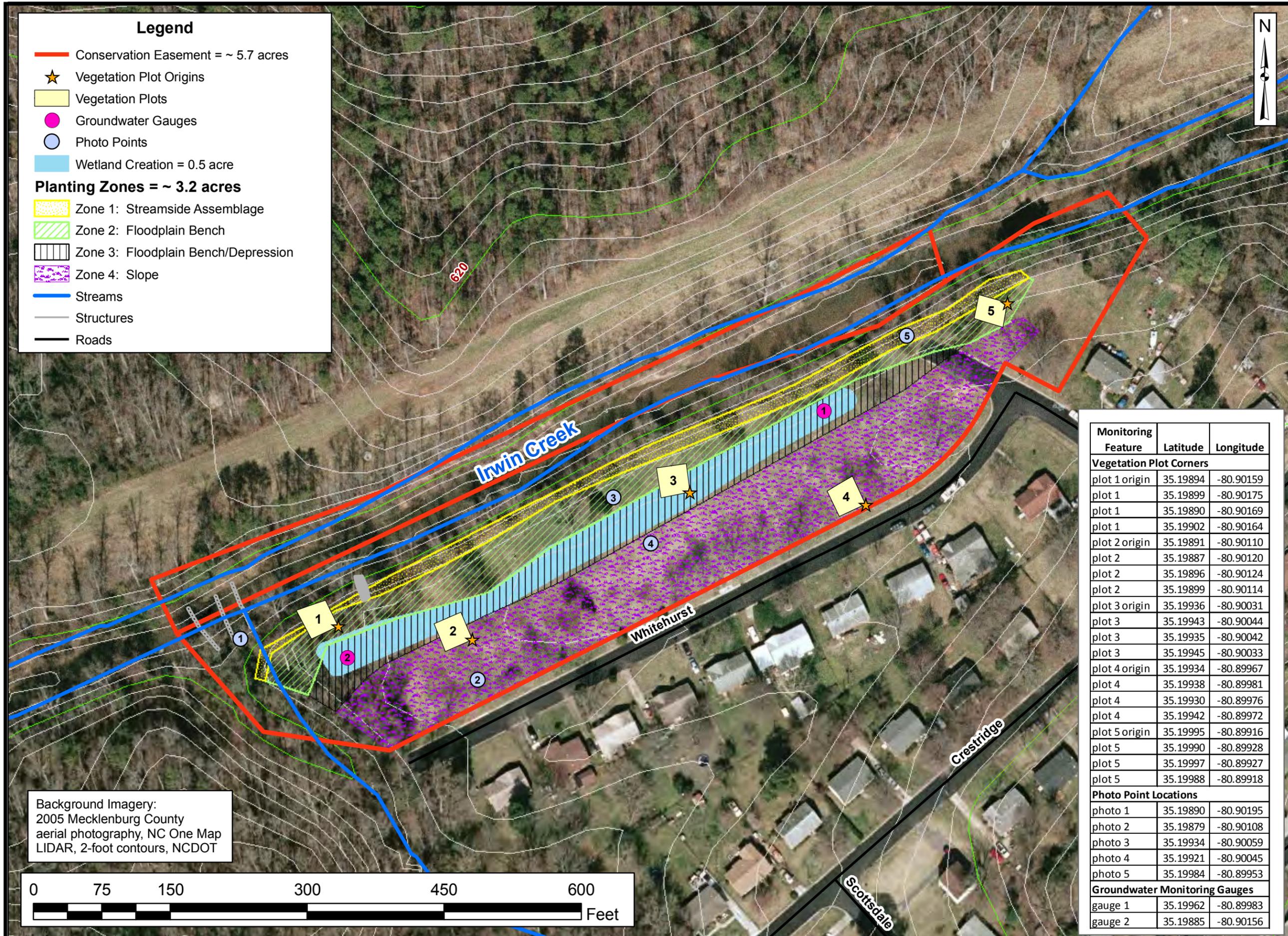
- > Take Interstate 77 to exit 7 (Clanton Road)
- > Travel northeast on Clanton Road for approximately 0.6 mile
- > Take the fourth left on Fieldcrest Road
- > Take the second right onto Crestridge Drive
- > Take the first right onto Abeline Road
- > Take the first left onto Whitehurst Road; the Site runs parallel to Whitehurst Road between Whitehurst Road and Irwin Creek
- > Coordinates in center of the Site:
Latitude 35.199345°N, Longitude 80.900418°W
(NAD83/WGS84)

20 Enterprise Street
Suite 7
Raleigh, NC 27607
(919) 215-1693

SITE LOCATION MAP
IRWIN CREEK STREAM RESTORATION SITE
Mecklenburg County, North Carolina

Dwn. by:	CLF	FIGURE 1
Date:	June 2010	
Project:	10-009	



Legend

- Conservation Easement = ~ 5.7 acres
- ★ Vegetation Plot Origins
- Vegetation Plots
- Groundwater Gauges
- Photo Points
- Wetland Creation = 0.5 acre

Planting Zones = ~ 3.2 acres

- Zone 1: Streamside Assemblage
- Zone 2: Floodplain Bench
- Zone 3: Floodplain Bench/Depression
- Zone 4: Slope
- Streams
- Structures
- Roads



Project:

IRWIN CREEK RESTORATION SITE

Avery County, NC

Title:

MONITORING PLAN VIEW

Drawn by: CLF

Date: JUNE 2010

Scale: 1:1200

Project No.: 10-009

Monitoring Feature	Latitude	Longitude
Vegetation Plot Corners		
plot 1 origin	35.19894	-80.90159
plot 1	35.19899	-80.90175
plot 1	35.19890	-80.90169
plot 1	35.19902	-80.90164
plot 2 origin	35.19891	-80.90110
plot 2	35.19887	-80.90120
plot 2	35.19896	-80.90124
plot 2	35.19899	-80.90114
plot 3 origin	35.19936	-80.90031
plot 3	35.19943	-80.90044
plot 3	35.19935	-80.90042
plot 3	35.19945	-80.90033
plot 4 origin	35.19934	-80.89967
plot 4	35.19938	-80.89981
plot 4	35.19930	-80.89976
plot 4	35.19942	-80.89972
plot 5 origin	35.19995	-80.89916
plot 5	35.19990	-80.89928
plot 5	35.19997	-80.89927
plot 5	35.19988	-80.89918
Photo Point Locations		
photo 1	35.19890	-80.90195
photo 2	35.19879	-80.90108
photo 3	35.19934	-80.90059
photo 4	35.19921	-80.90045
photo 5	35.19984	-80.89953
Groundwater Monitoring Gauges		
gauge 1	35.19962	-80.89983
gauge 2	35.19885	-80.90156

Background Imagery:
2005 Mecklenburg County
aerial photography, NC One Map
LIDAR, 2-foot contours, NCDOT

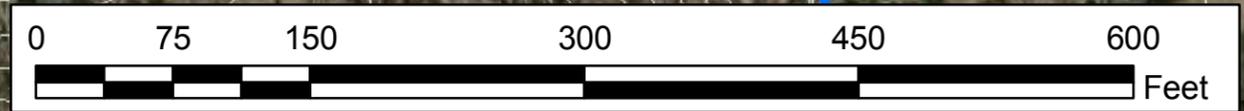


FIGURE 2

**Appendix B.
Stream Data**

**Post
Construction Photographs**

**Irwin Creek
Post Construction Pictures
Taken July 2010**



Photo Point 1: Downstream Structure left in place to avoid disturbance to wetlands and stream banks in addition to provide potential aquatic habitat and channel grade control



Photo Point 2:
Levee Area



Photo Point 3:
Excavated bench area

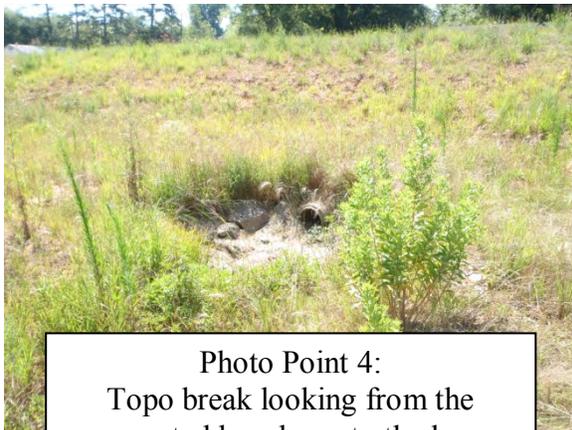


Photo Point 4:
Topo break looking from the excavated bench up to the levee



Photo Point 5:
Stream-side assemblage

**Appendix C.
Vegetation Data**

Table 5. Vegetation Plot Attribute Table

Table 6. Planted Woody Species

Table 5. Vegetation Plot Attributes Data

Plot ID	Community Type	Planting Zone ID*	Reach ID	Associated Gauge	Method	CVS Level
1	Bottomland Hardwoods	Zones 1/2	Irwin Creek	NA	Vegetation plots will be monitored using the CVS-EEP Protocol for Recording Vegetation Level 1-2 Plot Sampling Only (Version 4.0) (Lee et al. 2006).	
2	Bottomland Hardwoods/Mixed-Mesic Hardwoods	Zones 3/4				
3	Bottomland Hardwoods	Zones 2/3				
4	Mixed-Mesic Hardwoods	Zone 4				
5	Bottomland Hardwoods	Zones 1/2				

*Zone 1 = streamside assemblage, Zone 2 = floodplain bench, Zone 3 = floodplain bench/depression, Zone 4 = slope

Table 6. Planted Woody Vegetation

ZONE 1: STREAMSIDE ASSEMBLAGE		ZONE 2: FLOOPLAIN BENCH	
Livestakes		Containerized/Plugs	
Silky dogwood (<i>Cornus amomum</i>)		Tag alder (<i>Alnus serrulata</i>)	
Black willow (<i>Salix nigra</i>)		Chokeberry (<i>Aronia arbutifolia</i>)	
Silky willow (<i>Salix sericea</i>)		American beautyberry (<i>Callicarpa americana</i>)	
Elderberry (<i>Sambucus canadensis</i>)		Buttonbush (<i>Cephalanthus occidentalis</i>)	
		Winterberry (<i>Ilex verticulata</i>)	
		Virginia willow (<i>Itea virginica</i>)	
		Possumhaw (<i>Viburnum nudum</i>)	
		Bare Root	
		Red maple (<i>Acer rubrum</i>)	
		River birch (<i>Betula nigra</i>)	
		Green ash (<i>Fraxinus pennsylvanica</i>)	
		Sycamore (<i>Platanus occidentalis</i>)	
		Water oak (<i>Quercus nigra</i>)	
		Willow oak (<i>Quercus phellos</i>)	
ZONE 3: FLOOPLAIN BENCH/DEPRESSION		ZONE 4: SLOPE	
Bare Root		Bare Root	
River birch (<i>Betula nigra</i>)		Red maple (<i>Acer rubrum</i>)	
Silky dogwood (<i>Cornus amomum</i>)		Green ash (<i>Fraxinus pennsylvanica</i>)	
Buttonbush (<i>Cephalanthus occidentalis</i>)		Sweetgum (<i>Liquidambar styraciflua</i>)	
Green ash (<i>Fraxinus pennsylvanica</i>)		Tulip poplar (<i>Liriodendron tulipifera</i>)	
Winterberry (<i>Ilex verticulata</i>)			
Black willow (<i>Salix nigra</i>)			
Elderberry (<i>Sambucus canadensis</i>)			
Yellowroot (<i>Xanthorhiza simplicissima</i>)			

Appendix D.
As-built Analysis Report and Record Drawings

As-built Analysis Report
Record Drawings March 5, 2010



Summer 2009



Winter 2009

Irwin Creek Stream Restoration

As-Built Analysis Report

NCDENR Contract #: EW03004S

SCO ID # 010548701A

Mecklenburg County, North Carolina

Submitted to:



North Carolina Ecosystem Enhancement Program
Department of Environmental and Natural Resources
2728 Capital Blvd, Suite 1H 103
Raleigh, NC 27604

Prepared by:



HDR Engineering of the Carolinas, Inc.
3733 National Drive
Raleigh, NC 27612

March 5, 2010

Executive Summary

The Irwin Creek Stream Restoration Project is located on Irwin Creek within the City of Charlotte, Mecklenburg County, NC. Surrounding land use includes residential areas and a narrow riparian corridor adjacent to the stream. Irwin Creek is in the Catawba River Basin (USGS HUC no. 03050103). The NCDWQ lists this tributary in Subbasin No. 03-08-34 and classifies the best usage of the waters as Class C. Irwin Creek is listed as a 303(d) Impaired Water from its source to Sugar Creek. The impairment is a result of fecal coliform contamination from industrial and municipal sources as well as urban runoff.

The Irwin Creek Stream Restoration Project was originally scoped to study restoration and enhancement opportunities for a 5,000-6,000-foot long reach of Irwin Creek. The reach was studied as four discrete zones with different strategies suggested for each. The project was scaled back in subsequent revisions of the plans due to constraints associated with the other zone options. In the end, the project area included an 980 linear-foot restoration reach in what was described as Zone 1 of the 60% Restoration Plan (October 2003).

This project reach is located in a FEMA buyout area where several homes were demolished and removed. The restoration includes grading the banks back, building a bench, and replanting. The bench area also has a wetland designed with storage capacity and to assist with pollutant removal of stormwater before reaching Irwin Creek.

The Irwin Creek Stream Restoration project objectives were to enhance water quality and habitat through bank stabilization utilizing the following mechanisms:

- Creation of a floodplain bench (including off-line wetlands) to reduce the amount of sediment entering the stream by acting as a repository for soils suspended in the water column during high flow events, providing water storage to further allow sediment to settle out, and slower recharge of storm water into the groundwater subsurface network.
- Enhance vegetation to provide habitat/food sources, shade the stream, filter overland runoff, and remove soil particles and other nutrients present in storm water.

The Irwin Creek Stream Restoration is best described as a Priority Level 3 restoration with laying back the banks and creating wetlands in the bench. Construction involved approximately 980 linear feet of floodplain grading and improvements including erosion control and planting completed in the spring of 2009. The restoration does not include any in-stream channel work. The excavation and planting occurs on the left bank of the stream. The final planting of the bench was completed late fall/early winter of 2009.

Project Contacts	
Designer	HDR Engineering of the Carolinas, Inc. 3733 National Drive Raleigh, NC 27612 919.785.1118
Construction Contractor	Blythe Development Company 1415 E. Westinghouse Charlotte, NC 28273
Planting Contractor	North State Environmental, Inc 2889 Lowery Street, Suite B Winston-Salem, NC 27101 336.725.2010
Seeding and Matting Contractor	Blythe Development Company 1415 E. Westinghouse Charlotte, NC 28273

Cut/Fill Table

Cross Section	Design		As-Built		Difference	
	Cut	Fill	Cut	Fill	Cut	Fill
5+78	2321	1492	2292	1492	-29	0
6+68	1658	877	1617	877	-41	0
8+42	3493	1901	3390	1901	-103	0
9+28	1679	1024	1631	1024	-48	0
10+43	2200	1504	2162	1504	-38	0
11+07	1209	895	1068	887	-141	-8

*All Cut and Fill Volumes are reported in Cubic Yards (CY)

The differences in excavation from the proposed design to the as-built condition are mainly seen at the immediate stream bank location (See Record Drawing Set). Due to the significant amount of time between initial surveys/design to the beginning of stream construction, there have been major alterations to the southern bank of Irwin Creek. These were caused by numerous bankfull and larger storm events. Another significant difference from design to as-built earthwork is evident at Station 11+07. As shown on the Record Drawing Set, this cross section represents an area that was graded in such a way that stormwater would be directed to the step-down channel outfall. All other areas, especially those shown as Fill sections were within acceptable tolerance and resulted in little variation from proposed to as-built excavation.

NC Ecosystem Enhancement Program Irwin Creek Stream Restoration

SCO# -01-05487-01

Mecklenburg County, North Carolina
MARCH 2010



DRAWING INDEX

SHEET NO.	TITLE				
	- Title Sheet	XS-1	Cross Sections	D-1	Standard Details
G-1	Plan Sheet Index	XS-2	Cross Sections	D-2	Standard Details
C-1	Sediment and Erosion Control Plan	XS-3	Cross Sections	D-3	Standard Details
C-2	Overall Site Plan			L-1	Planting Plan
C-3	Plan Sta. 0+00 to Sta. 7+50	PF-1	Longitudinal Profile Section	L-2	Planting Plan Details
C-4	Plan Sta. 7+50 to Sta. 12+30			L-3	Planting Plan Details

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email: wcdsb@mail.charmeck.nc.us
- Crescent EMC
Mr. Dennis Goodrum
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Cornelius, NC 28031
- ICG Telcom
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- MCI Telecommunications
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email: phillip.r.strickland@mci.com
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Ph: #704-525-5585
- Sprint
Mr. Neal Gilman
12502 Sennott Valley Drive
Reston, VA 20196
703-689-5962
- Time Warner Cable
Mr. David Winkler
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Matthews, NC 28105
Ph: #704-378-2500

UTILITIES / AGENCIES HAVE RECEIVED A COPY OF THESE PLANS. THIS LIST DOES NOT INDICATE UTILITY / AGENCY REVIEW OR APPROVAL OF THIS PROJECT

**RECORD DRAWINGS
3-5-10**

PROJECT PERMITS

AGENCY	PERMIT	PERMIT NO.	DATE	EXPIRATION
US ARMY CORPS OF ENGINEERS	SECTION 404 NATIONWIDE 13	HELD BY EEP		
NCDENR - DIV OF WATER QUALITY	SECTION 401	HELD BY EEP	-	
NCDENR - LAND QUALITY SECTION	NPDES - EROSION & SEDIMENT CONTROL			
MECK. COUNTY FLOODWAY ENCROACHMENT			-	

REVIEWED FOR CONSTRUCTION

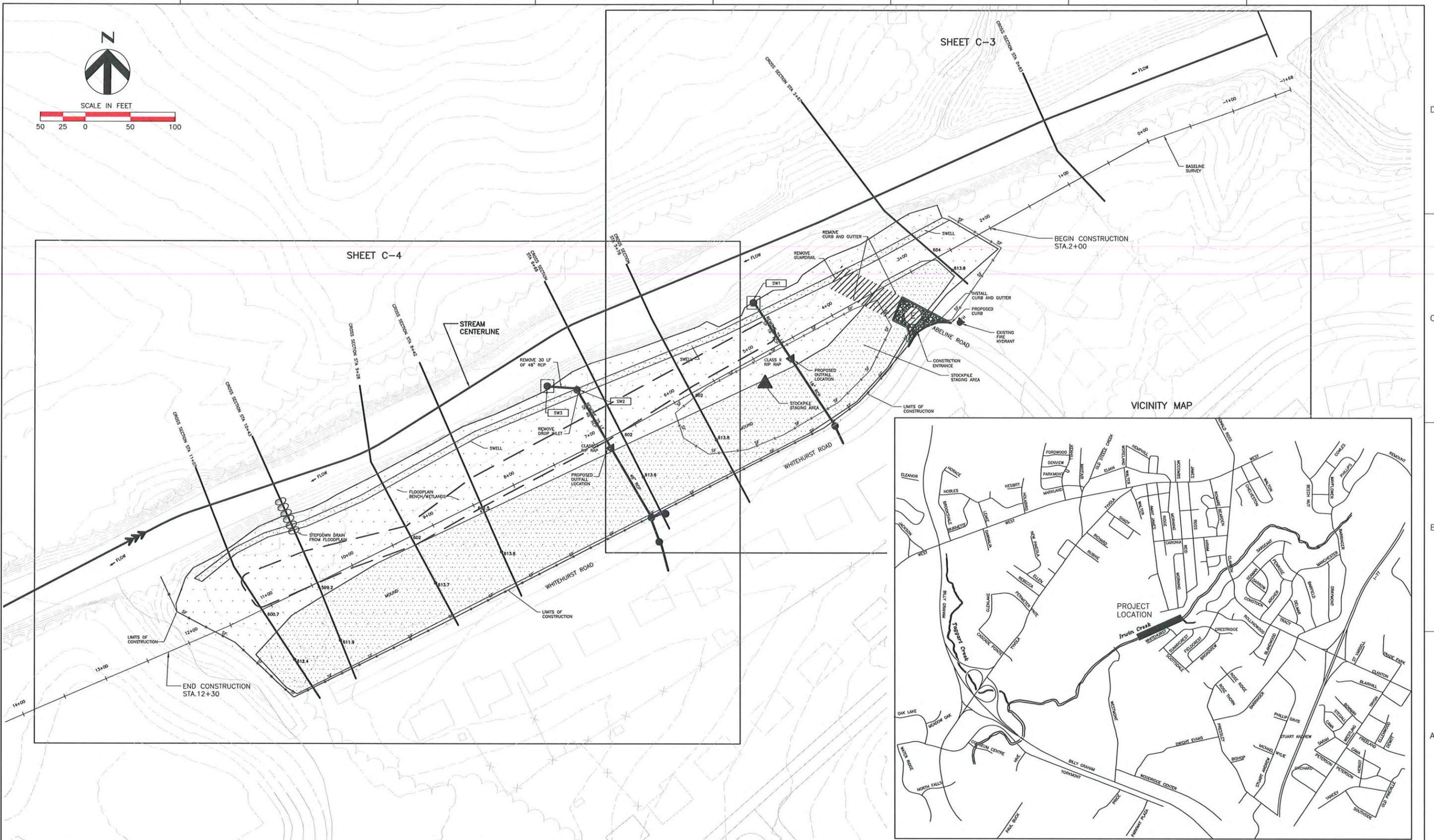


HDR Engineering, Inc.
of the Carolinas

128 S. Tryon Street, Suite 1400 | Charlotte, NC 28202



NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM
DEPT. OF ENVIRONMENTAL AND NATURAL RESOURCES
2728 CAPITAL BLVD, SUITE 1H 103
RALEIGH, NC 27612



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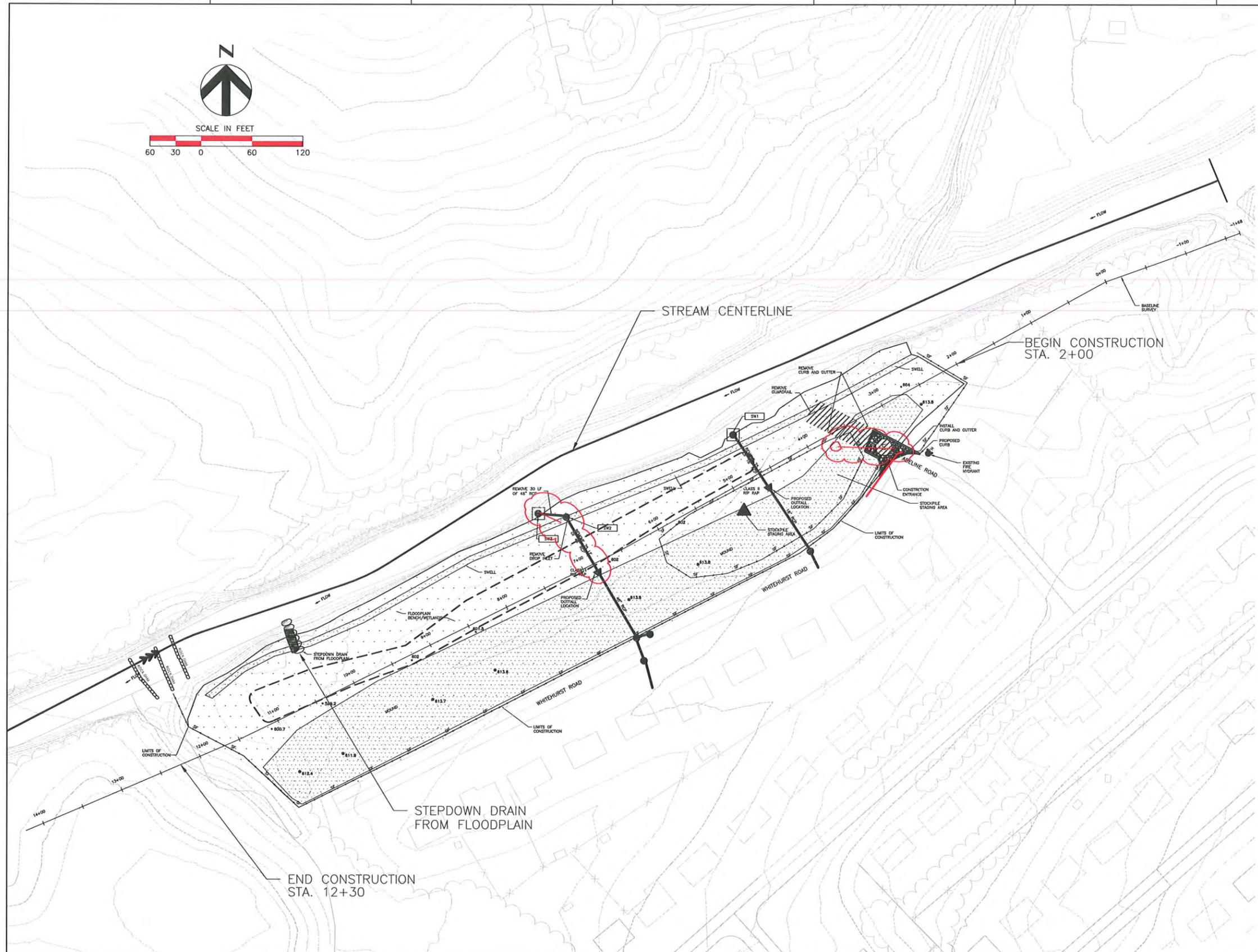
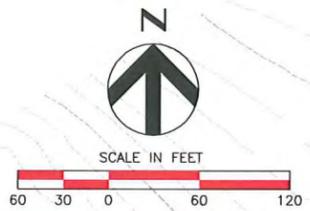
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	05/2005	PRELIMINARY (MAU)
	04/2004	PRELIMINARY (JMP)

PROJECT MANAGER	CHRIS MATTHEWS DASA CROWELL, PE
PROJECT NUMBER	0977021-018



NC Wetlands Restoration Program
SCO# - 01-05487-01
Irwin Creek
Stream Restoration
 Charlotte North Carolina

PLAN SHEET INDEX AND VICINITY MAP	
	FILENAME 00G-01.dwg SCALE AS NOTED
SHEET	G-1



Irwin Creek Construction Schedule:

Mobilize equipment to stream access location. Install stream access and construct three check dams at downstream construction limit according to check dam detail.

Secure stockpile locations. Install silt fence according to Silt Fence Detail, install safety fence.

The reshaping and grading of channel banks and flood plain bench shall be limited in extent each day to the length that can be stabilized by the end of that same workday.

Install stream access located at Abeline Road according to detail. Reshape banks, excavate a floodplain bench according to plans and stockpile the existing topsoil in screening location at Whitehurst Road. Remove pavement at Abeline Road according to plans. Construct wetland and screening mound. according to plans and detail.

Construct step-down structure through levee to Irwin Creek.

Plant bank, floodplain bench and wetland with vegetative materials (live stakes, containerized materials, bare-root seedlings) according to planting detail.

Apply erosion control matting and seed according to specifications.

Remove stream access.

Re-vegetate stream access location.

Reconstruct curb at Abeline and Whitehurst Roads intersection/curve according to plans.

Plant buffer areas.

Remove silt and safety fence.

Remove excess construction materials and debris.

Demobilize equipment.

Anticipated Irwin Creek construction duration: 5 weeks.

Record Note: Construction Sequence was modified so that the step-down channel was installed prior to the completion of major grading of channel banks, floodplain bench construction, and wetland grading. This allowed the contractor to keep access to the downstream check dams opens so that adjustments could be made if necessary. This change was discussed at the weekly meeting on April 14, 2009 Confirmation letter sent to EEP on April, 16 2009

- LEGEND**
- RIP RAP APRON
 - CONSTRUCTION ENTRANCE
 - STORMWATER OUTFALL
 - SILTFENCE
 - STOCKPILE/STAGING AREA
 - ASPHALT REMOVAL
 - MOUND
 - LOCATION OF FLOODPLAIN BENCH/WETLAND
 - CHECK DAM
 - LIMITS OF WETLAND BOWL

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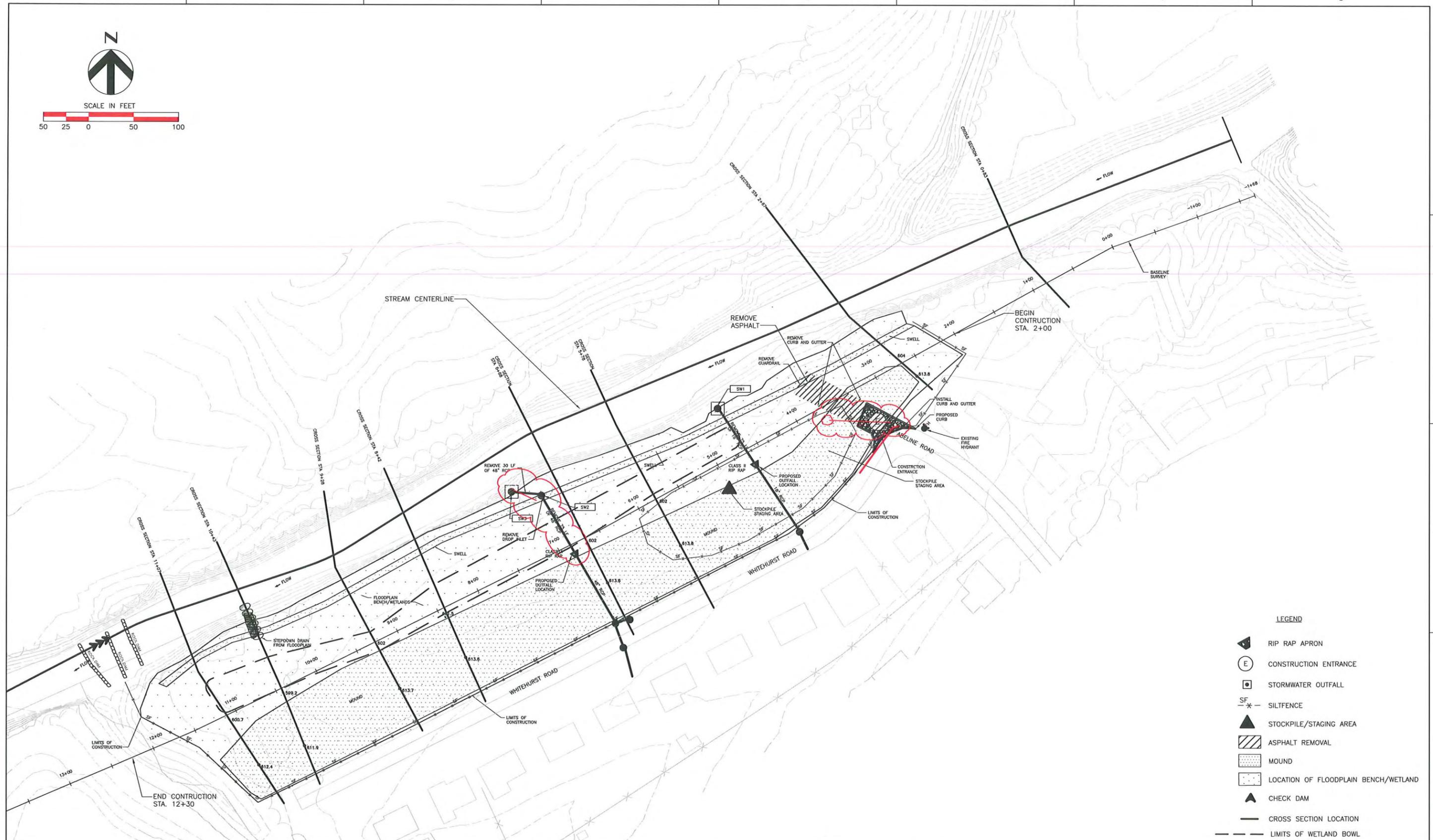
PROJECT MANAGER	CHRIS MATTHEWS DASA CROWELL, PE
PROJECT NUMBER	0977021-018

NC Wetlands Restoration Program
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SEDIMENT AND EROSION CONTROL PLAN

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SCALE	AS NOTED		



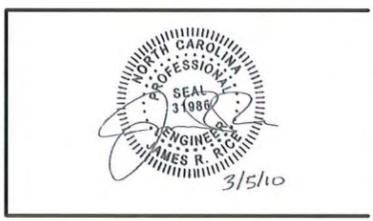
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- RIP RAP APRON
 - CONSTRUCTION ENTRANCE
 - STORMWATER OUTFALL
 - SILTFENCE
 - STOCKPILE/STAGING AREA
 - ASPHALT REMOVAL
 - MOUND
 - LOCATION OF FLOODPLAIN BENCH/WETLAND
 - CHECK DAM
 - CROSS SECTION LOCATION
 - LIMITS OF WETLAND BOWL

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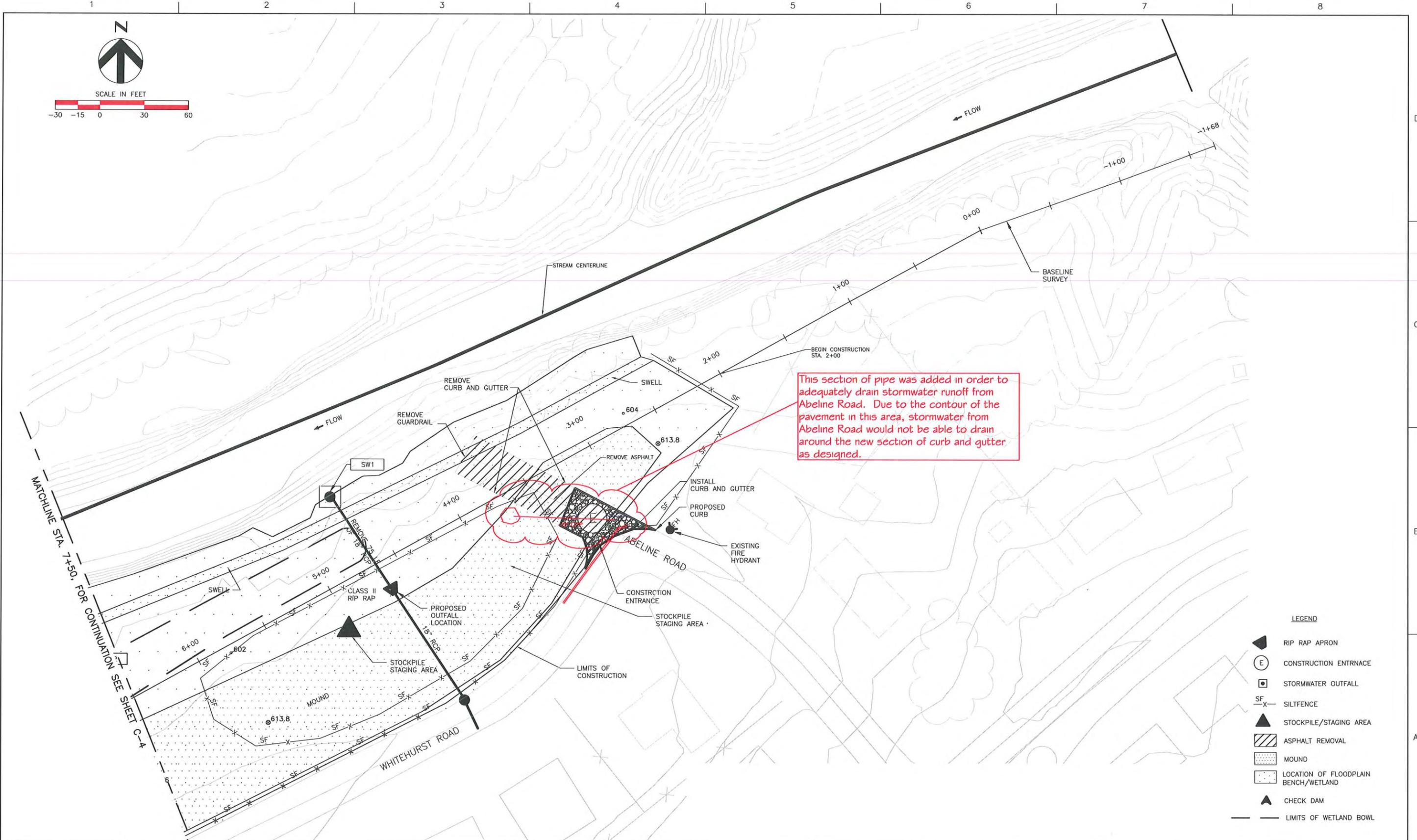
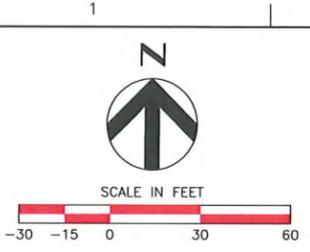


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OVERALL SITE PLAN

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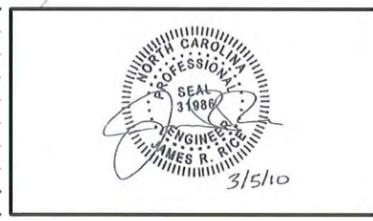
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- STORMWATER OUTFALL
- SILTFENCE
- STOCKPILE/STAGING AREA
- ASPHALT REMOVAL
- MOUND
- LOCATION OF FLOODPLAIN BENCH/WETLAND
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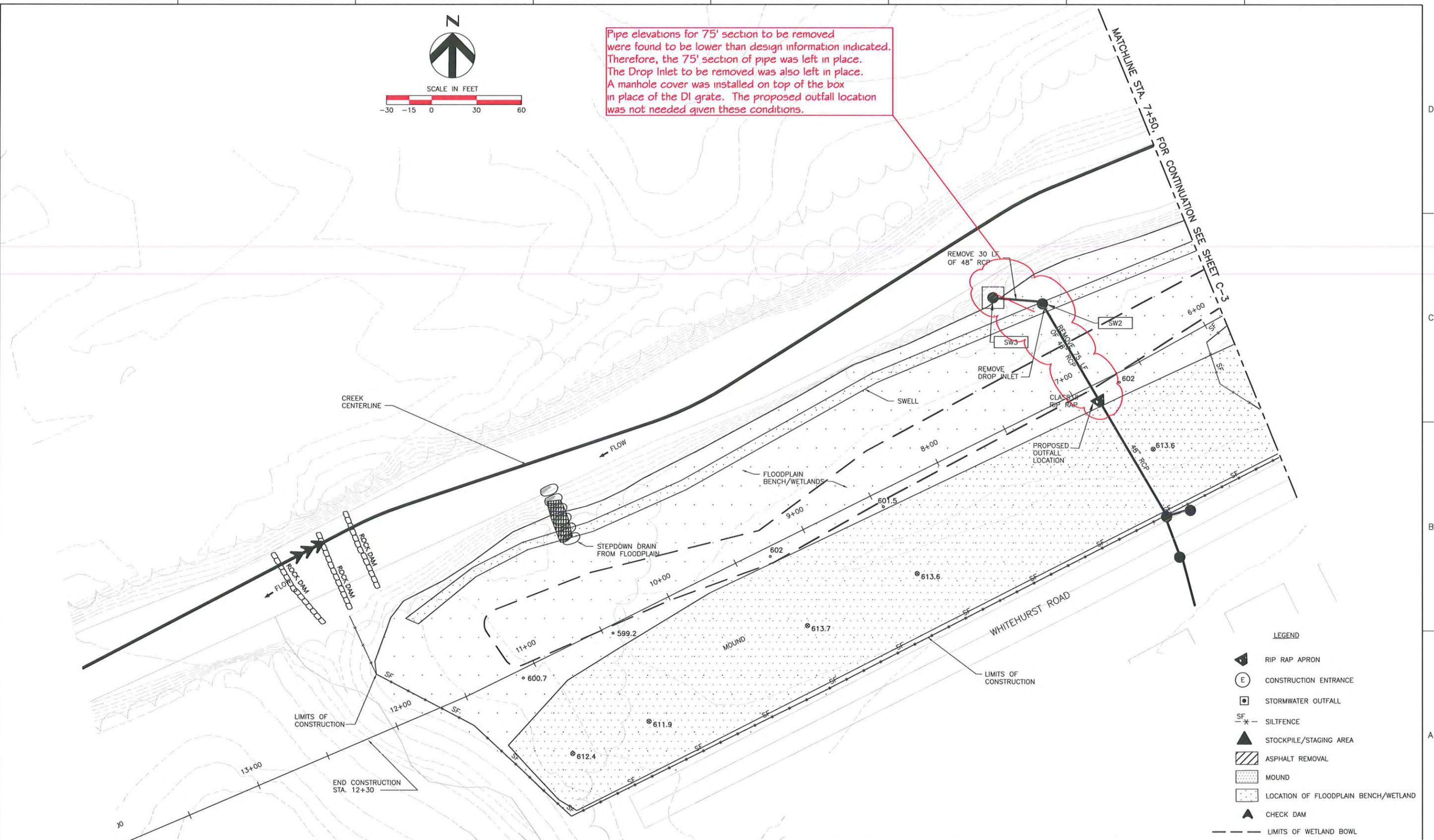
STA. 0+00 TO STA. 7+50

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SCALE	AS NOTED		



Pipe elevations for 75' section to be removed were found to be lower than design information indicated. Therefore, the 75' section of pipe was left in place. The Drop Inlet to be removed was also left in place. A manhole cover was installed on top of the box in place of the DI grate. The proposed outfall location was not needed given these conditions.

MATCHLINE STA. 7+50 FOR CONTINUATION SEE SHEET C-3



LEGEND

- RIP RAP APRON
- CONSTRUCTION ENTRANCE
- STORMWATER OUTFALL
- SILTFENCE
- STOCKPILE/STAGING AREA
- ASPHALT REMOVAL
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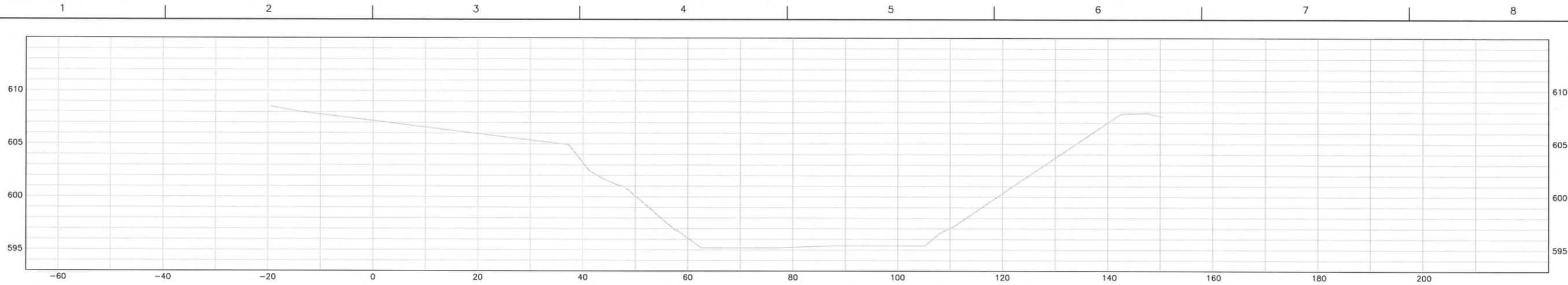
NC Wetlands Restoration Program
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Stream Restoration

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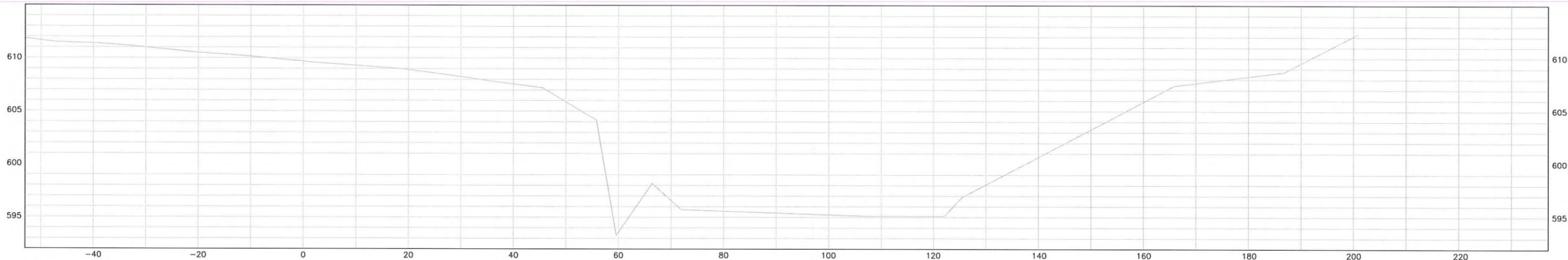
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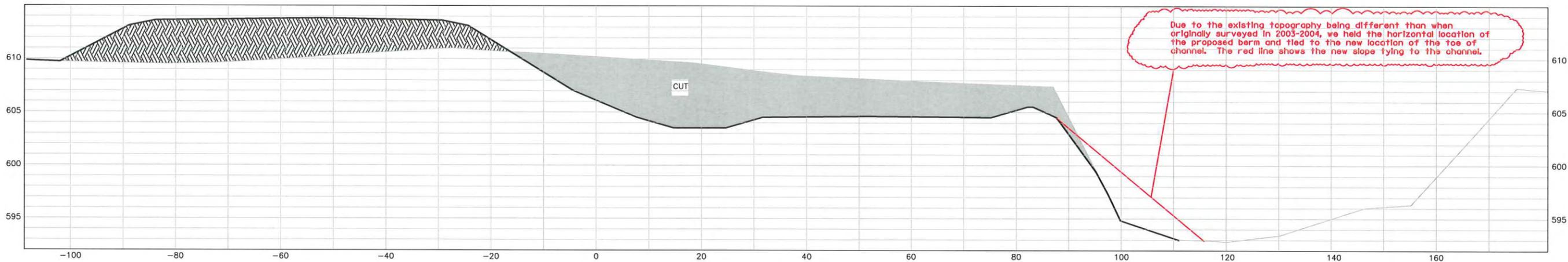
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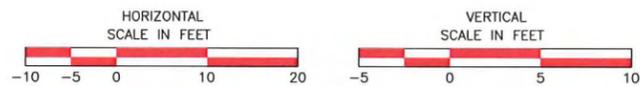
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STA 2+67

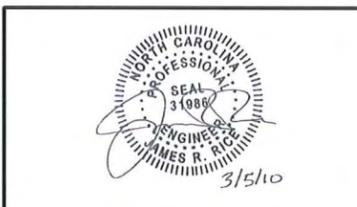


STA 5+78



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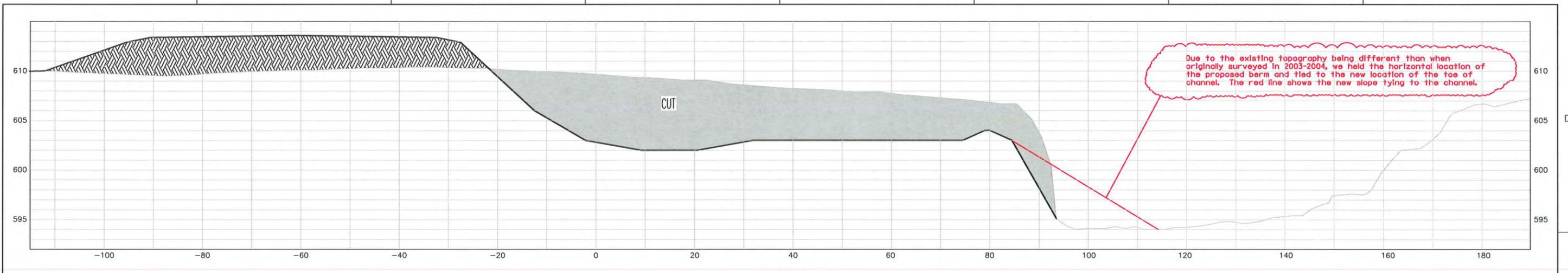
PROJECT MANAGER	CHRIS MATTHEWS
	DASA CROWELL, PE
PROJECT NUMBER	0977021-018



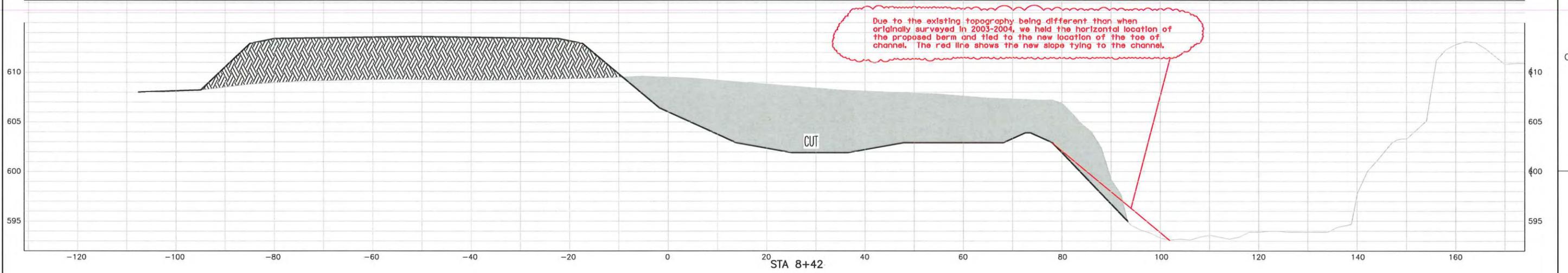
NC Wetlands Restoration Program
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Stream Restoration

Charlotte North Carolina

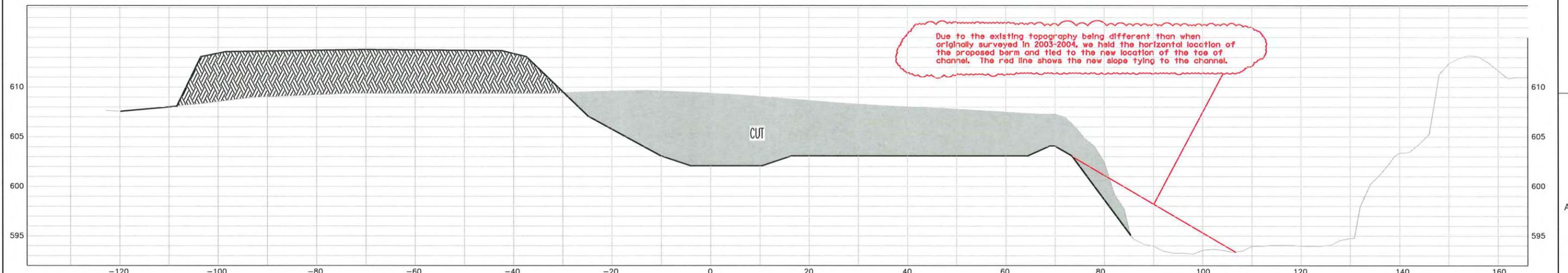
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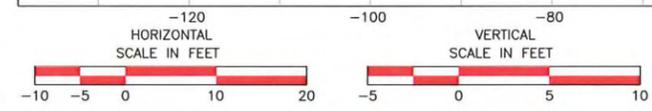
STA 6+68



STA 8+42



STA 9+28

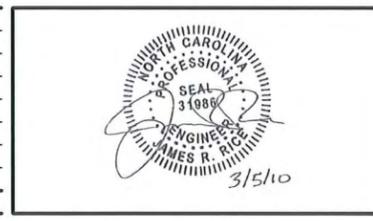


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PROJECT MANAGER	CHRIS MATTHEWS DASA CROWELL, PE
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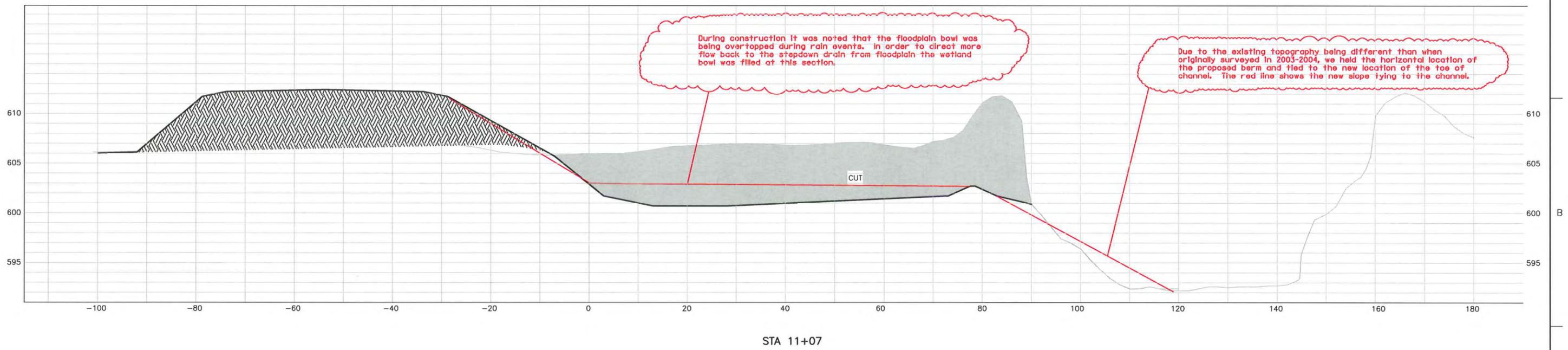
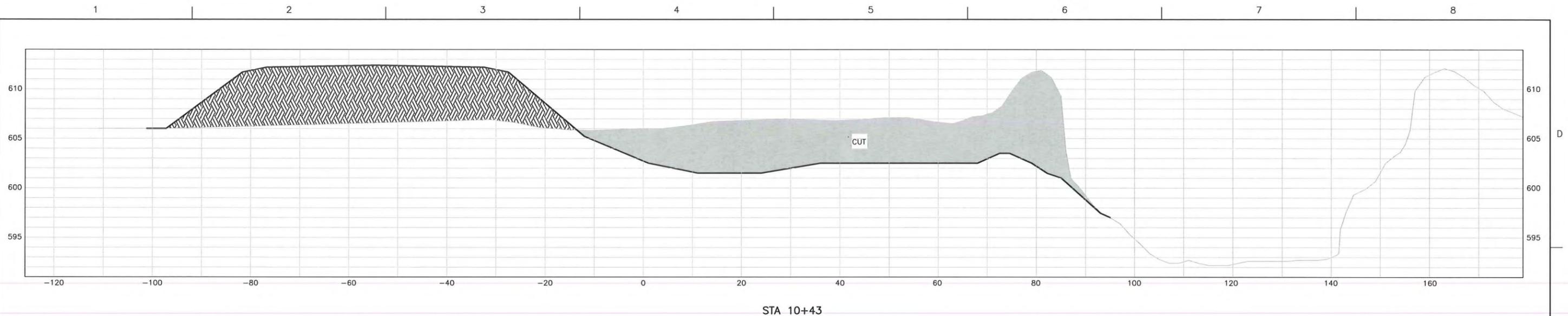


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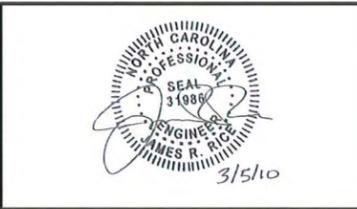
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STA. 6+68 STA. 8+42 STA. 9+28		
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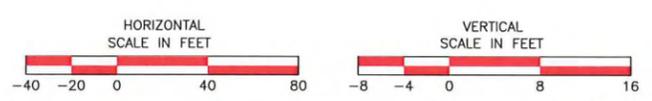
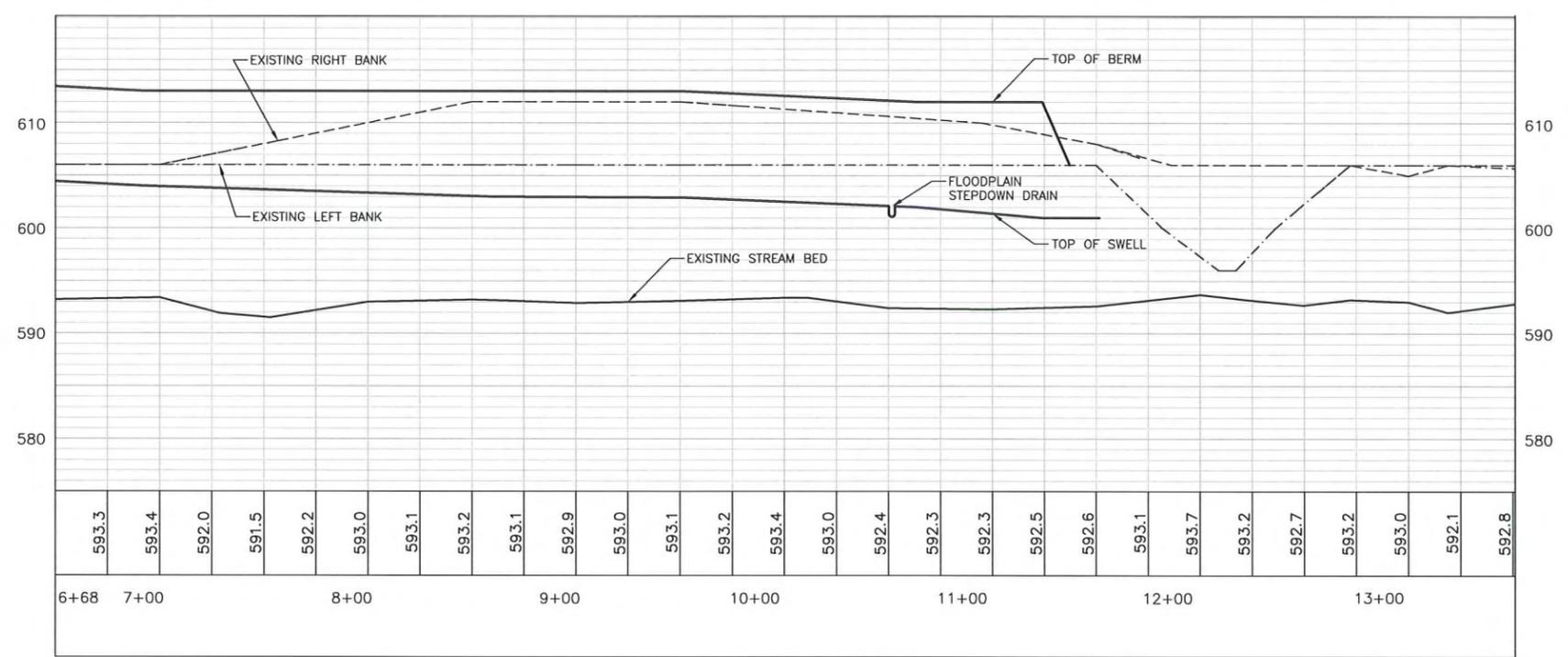
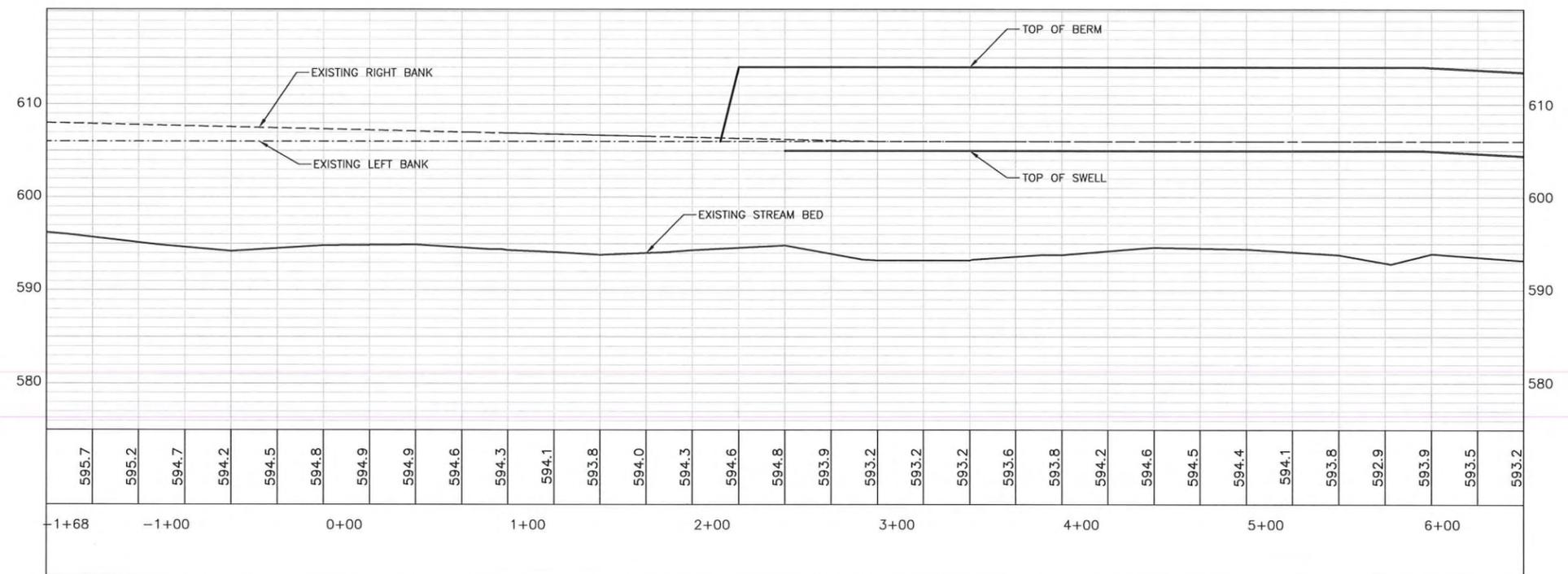
Charlotte North Carolina

CROSS SECTIONS
STA. 10+43
STA. 11+07

0 1" 2"

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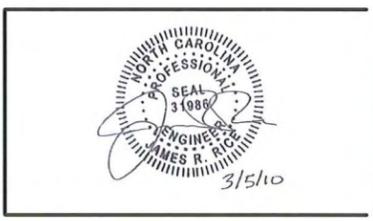


All profile elevations are within allowable tolerance



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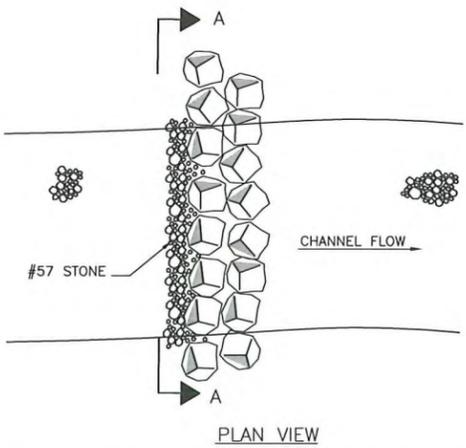


NC Wetlands Restoration Program
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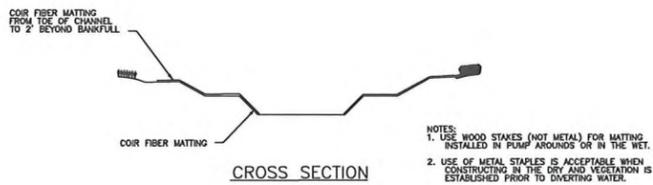
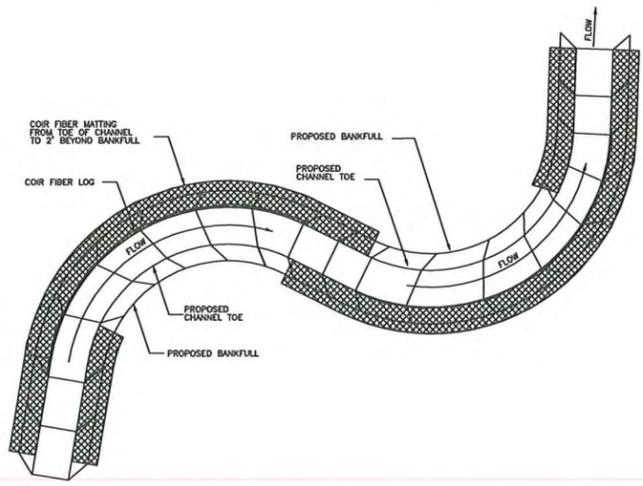
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0 1" 2"

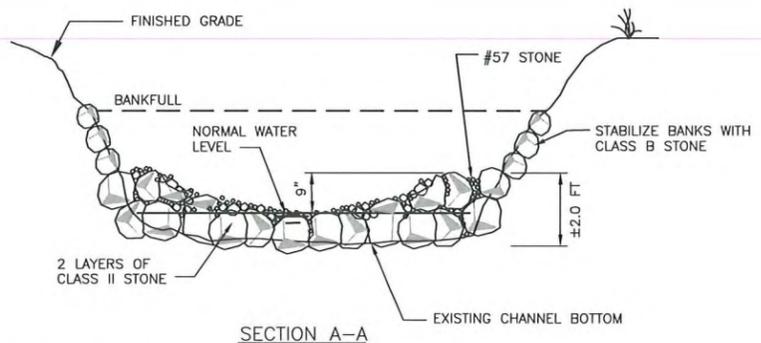
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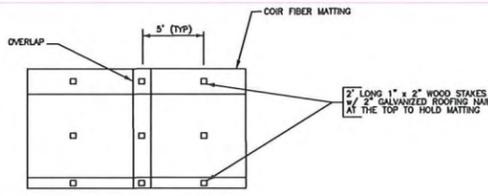
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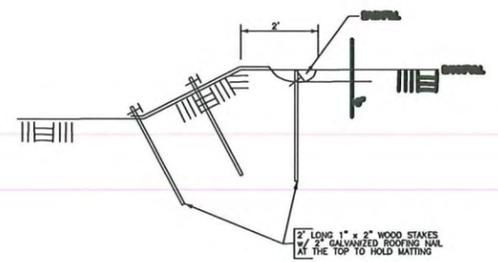
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SECTION A-A



MATTING STAKING VIEW



SECTION A-A

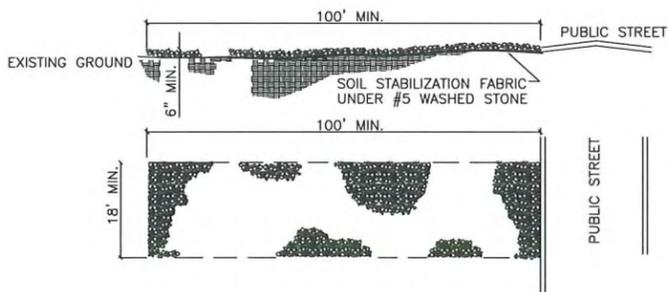
TYPICAL MATTING LOCATION
NTS

TEMPORARY ROCK SILT CHECK

NOT TO SCALE

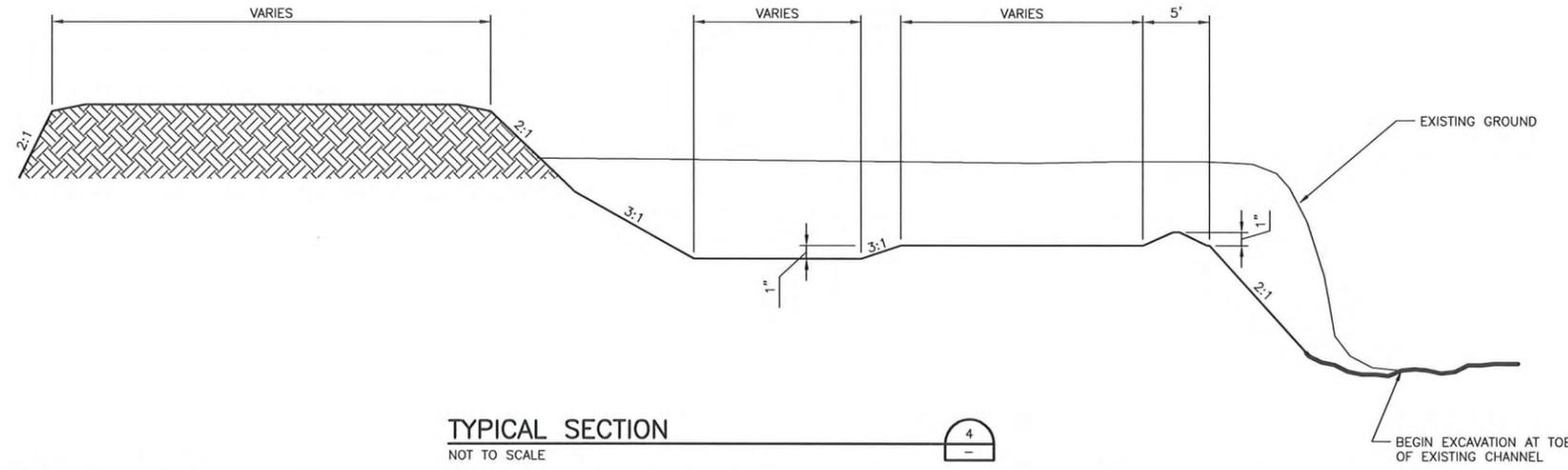


- NOTES:
1. A STABILIZED ENTRANCE PAD OF #5 WASHED STONE OR RAIL ROAD BALLAST SHALL BE LOCATED WHERE TRAFFIC WILL ENTER OR LEAVE THE CONSTRUCTION SITE ONTO A PUBLIC STREET.
 2. FILTER FABRIC OR COMPACTED CRUSHER RUN STONE SHALL BE USED AS A BASE FOR THE CONSTRUCTION ENTRANCE.
 3. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC STREETS OR EXISTING PAVEMENT. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS WARRANT AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT.
 4. ANY SEDIMENT SPILLED, DROPPED, WASHED, OR TRACKED ONTO PUBLIC STREETS MUST BE REMOVED IMMEDIATELY.
 5. WHEN APPROPRIATE, WHEELS MUST BE CLEANED TO REMOVE SEDIMENT PRIOR TO ENTERING A PUBLIC STREET. WHEN WASHING IS REQUIRED, IT SHALL BE DONE IN AN AREA STABILIZED WITH CRUSHED STONE WHICH DRAINS INTO AN APPROVED SEDIMENT BASIN SEE STD. NO. 30.11B.



TEMPORARY GRAVEL CONSTRUCTION ENTRANCE DETAIL

NOT TO SCALE



TYPICAL SECTION

NOT TO SCALE



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SCO# - 01-05487-01
Irwin Creek
Stream Restoration

Charlotte North Carolina

STANDARD DETAILS

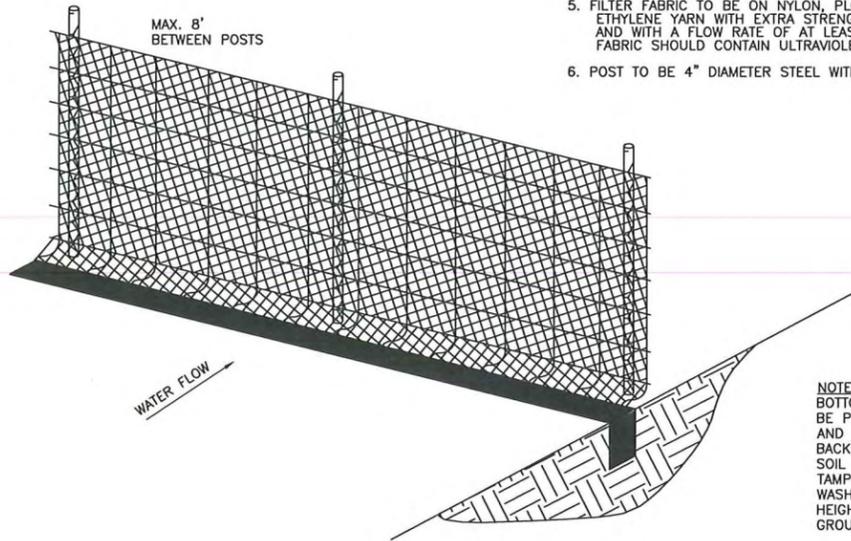
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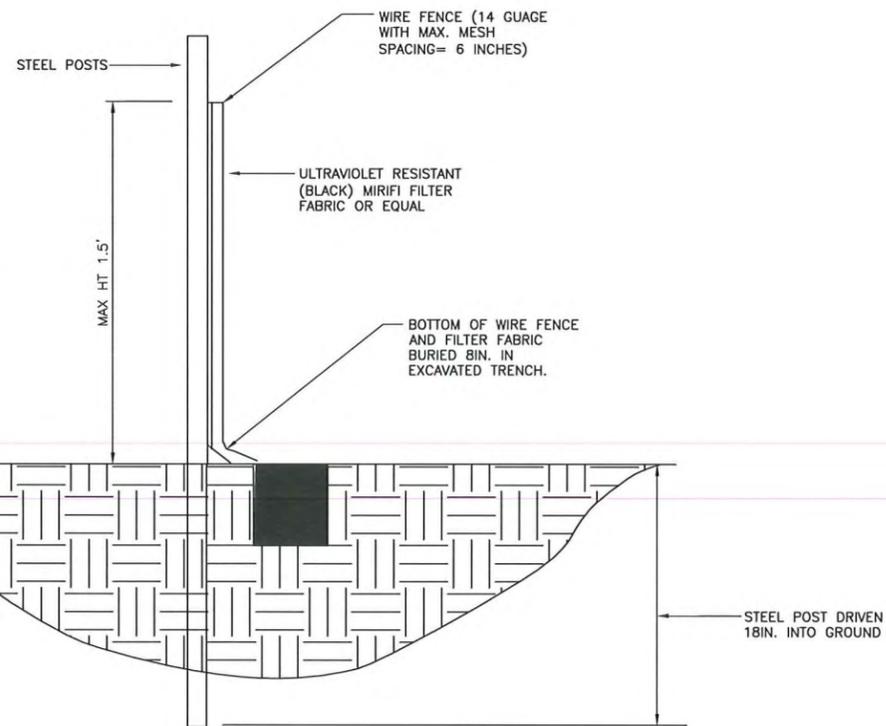
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CONSTRUCTION SPECIFICATIONS

1. CONSTRUCT SEDIMENT FENCE ON LOW SIDE OF TOPSOIL STOCKPILE TO PREVENT SEDIMENT FROM BEING WASHED INTO THE DRAINAGE SYSTEM. FENCE TO EXTEND AROUND APPROXIMATELY 70% OF THE PERIMETER OF THE STOCKPILE.
2. LOCATE POSTS DOWNSLOPE OF FABRIC TO HELP SUPPORT FENCING.
3. BURY TOE OF FENCE APPROXIMATELY 8" DEEP TO PREVENT UNDERCUTTING.
4. WHEN JOINTS ARE NECESSARY, SECURELY FASTEN THE FABRIC AT A SUPPORT POST WITH OVERLAP TO THE NEXT POST.
5. FILTER FABRIC TO BE ON NYLON, PLOYESTER, PROPYLENE OR ETHYLENE YARN WITH EXTRA STRENGTH-50LB/ LIN. IN. (MINIMUM) AND WITH A FLOW RATE OF AT LEAST 0.3 GAL./SOFT / MINUTE. FABRIC SHOULD CONTAIN ULTRAVIOLET RAY INHIBITORS AND STABILIZERS.
6. POST TO BE 4" DIAMETER STEEL WITH A MINIMUM LENGTH OF 4'.

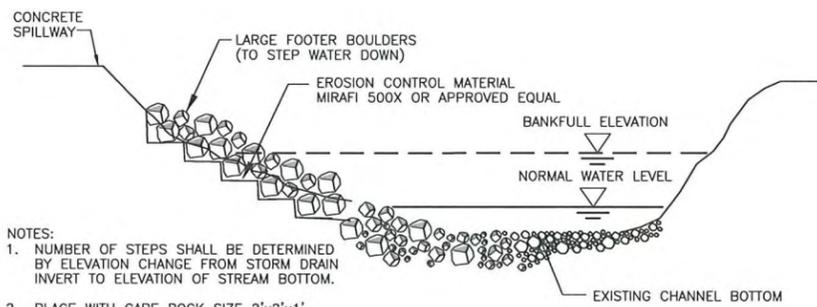


NOTE:
BOTTOM OF FILTER MUST BE PLACED IN TRENCH AND SECURED BY EITHER BACK-FILLING WITH SOIL MATERIAL AND TAMPING OR BY PLACING WASHED STONE TO A HEIGHT OF 6IN. ABOVE GROUND LEVEL.



SILT FENCE DETAIL

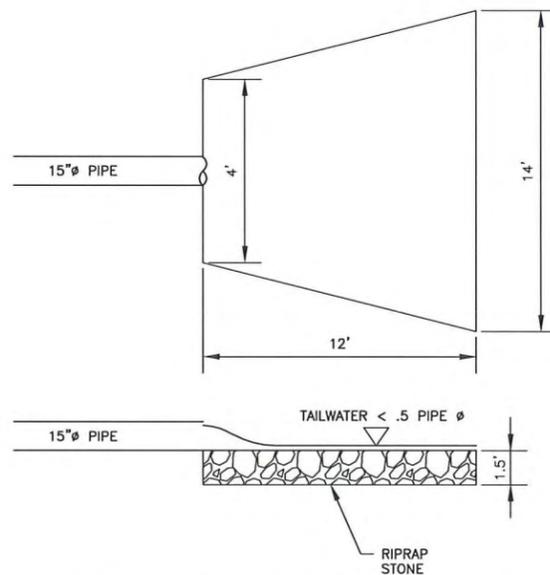
NOT TO SCALE



- NOTES:
1. NUMBER OF STEPS SHALL BE DETERMINED BY ELEVATION CHANGE FROM STORM DRAIN INVERT TO ELEVATION OF STREAM BOTTOM.
 2. PLACE WITH CARE ROCK SIZE 2'x2'x1'

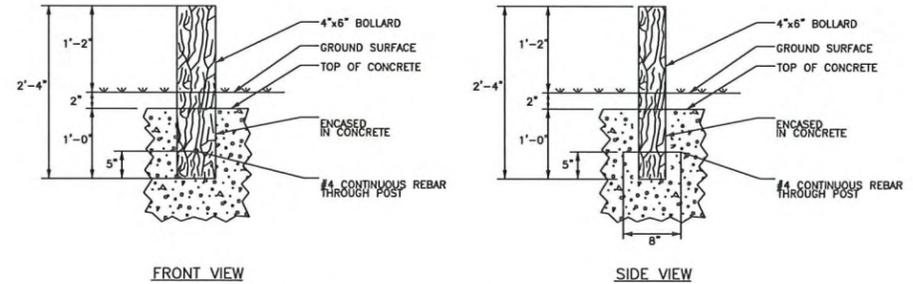
STEP-DOWN CHANNEL

NOT TO SCALE



STORM DRAIN OUTFALL PROTECTION

NOT TO SCALE



- NOTES:
1. BASE DIMENSIONS: STANDARD 4"x6" POST
 2. SIZE FOOTER HOLE TO ACCOMMODATE 1 CUBIC FOOT OF CONCRETE AND WOODEN POST.

BOLLARD DETAIL

NOT TO SCALE



TOP VIEW

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HDR Engineering, Inc.
of the Carolinas
128 S Tryon Street, Suite 1400 | Charlotte, NC 28202

ISSUE	DATE	DESCRIPTION
05/2008		PRELIMINARY
05/2005		PRELIMINARY (MAU)
04/2004		PRELIMINARY (JMP)

PROJECT MANAGER	CHRIS MATTHEWS
	DASA CROWELL, PE
PROJECT NUMBER	0977021-018

NC Wetlands Restoration Program
SCO# - 01-05487-01
Irwin Creek
Stream Restoration

Charlotte North Carolina

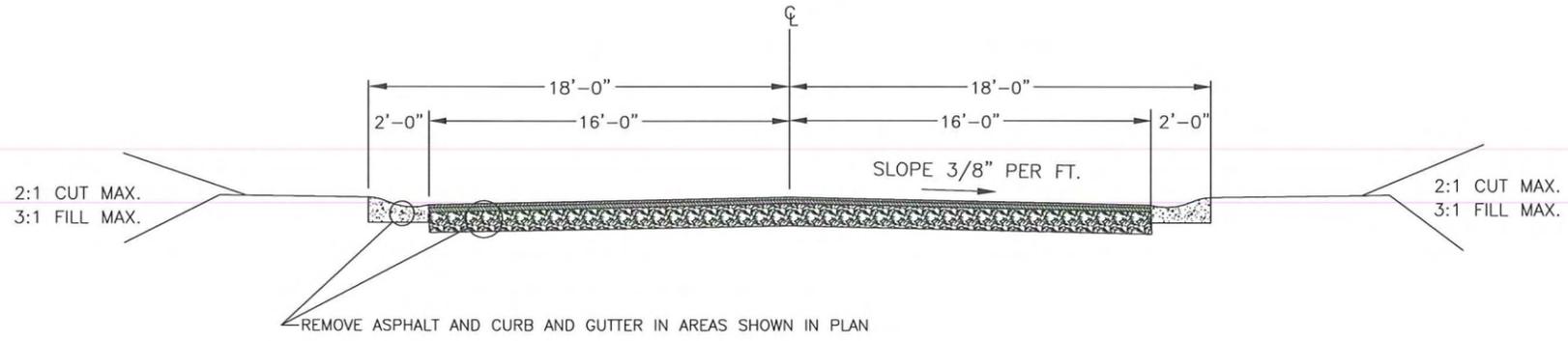
STANDARD DETAILS

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SCALE	AS NOTED		

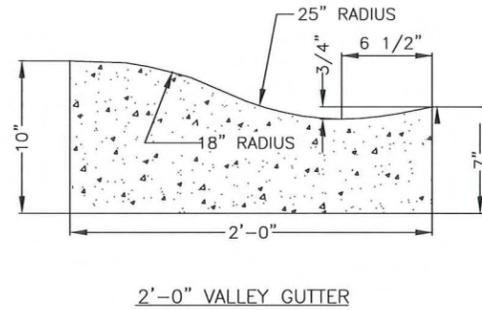
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1 2 3 4 5 6 7 8

ABELINE ROAD ASPHALT PAVEMENT REMOVAL

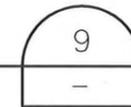


ABELINE ROAD CURB AND GUTTER INSTALLATION



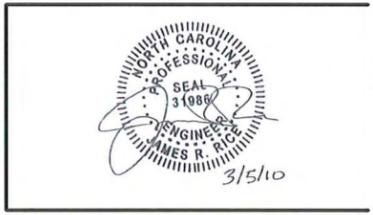
ABELINE ROAD ALTERATIONS DETAIL

NTS



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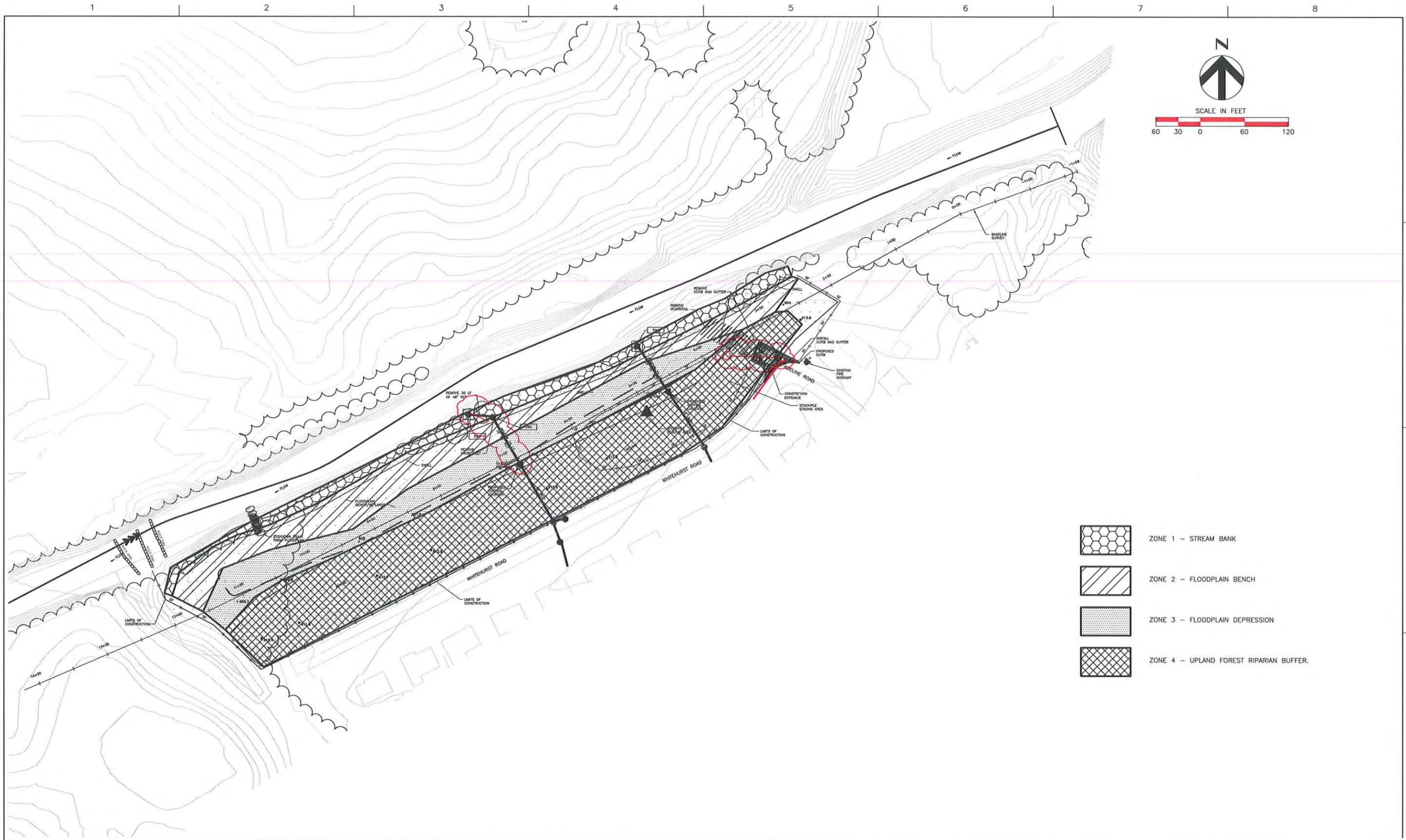
Charlotte North Carolina

STANDARD DETAILS

0 1" 2"

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SCALE	AS NOTED		

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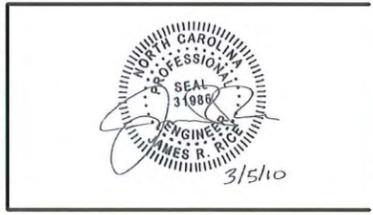


-  ZONE 1 - STREAM BANK
-  ZONE 2 - FLOODPLAIN BENCH
-  ZONE 3 - FLOODPLAIN DEPRESSION
-  ZONE 4 - UPLAND FOREST RIPARIAN BUFFER.



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PROJECT NUMBER	0977021-018

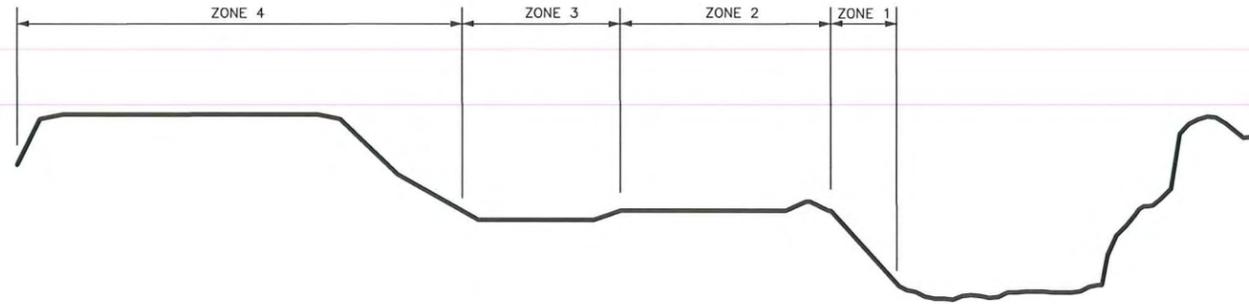


NC Wetlands Restoration Program
SCO# - 01-05487-01
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Charlotte North Carolina

PLANTING PLAN		
FILENAME	01L-01.dwg	SHEET
SCALE	AS NOTED	L-1

PLANTING DETAILS



ZONE 1

Live Stakes

Species Name	Common Name
Cornus amomum	Silky dogwood
Salix nigra	Black willow
Salix sericea	Silky willow
Sambucus canadensis	Elderberry

To be installed approx. 3' on center (4840 stakes/acre)

ZONE 2

Containerized /Plugs

Species Name	Common Name
Alnus serrulata	Tag alder
Aronia arbutifolia	Chokeberry
Callicarpa americana	Beautyberry
Cephalanthus occidentalis	Button bush
Ilex verticillata	Winterberry
Itea virginica	Virginia willow
Viburnum nudum	Possumhaw

A minimum of 5 out of the 7 species to be installed approx. 15' on center. 30-40% container, the remainder to be plugs.

ZONE 3

Bare Root

Species Name	Common Name
Betula nigra	River birch
Fraxinus pennsylvanica	Green Ash
Itea virginica	Virginia willow
Xanthoxhiza simplicissima	Yellowroot
Cornus amomum	Silky dogwood
Cephalanthus occidentalis	Buttonbush
Salix nigra	Black willow
Sambucus canadensis	Elderberry

A minimum of 5 out of the 8 species to be installed approx. 8' on center (680 bare roots/acre)

ZONE 4

Bare Root

Species Name	Common Name
Liquidambar styraciflua	Sweet gum
Liriodendron tulipifera	Yellow poplar
Acer rubrum	Red maple
Fraxinus pennsylvanica	White ash

To be installed approx. 10' on center. (680 bare roots/acre)

TEMPORARY SEEDING

Species Name	Common Name
Secale cereale	Rye grain (for cool season)
Pennisetum glaucum	Pearl millet (for warm season)

Applied at a rate of 50lbs per acre

Bare Root

Species Name	Common Name
Acer rubrum	Red maple
Betula nigra	River birch
Fraxinus pennsylvanica	Green Ash
Platanus occidentalis	Sycamore
Quercus nigra	Water oak
Quercus phellos	Willow oak

SEE SPECIAL PROVISIONS FOR SPECIFICATIONS

Permanent Seed Mix (Zones 1,2,3)

Species Name	Common Name
Andropogon gerardii	Big bluestem
Panicum clandestinum	Deertongue
Chasmanthium latifolium	River oats
Elymus virginicus	Virginia wildrye
Tripsacum dactyloides	Eastern gamma grass
Eragrostis spectabilis	Purple love grass
Juncus effusus	Soft rush

A minimum of 4 out of the 7 species applied at 40 lbs/acre

Permanent Seed Mix (Zones 4)

Species Name	Common Name
Tridens flavus	Purpletop tridens
Panicum virgatum	Switchgrass
Andropogon virginicus	Broomsedge bluestem
Sorghastrum nutans	Indian grass
Elymus virginicus	Virginia wildrye

A minimum of 4 out of the 5 species applied at 40 lbs/acre

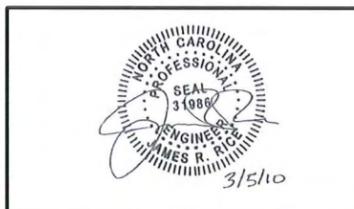
A minimum of 4 out of the 6 species to be installed approx. 8' on center (680 bare roots/acre)

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ISSUE	DATE	DESCRIPTION
	5/2008	PRELIMINARY
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PROJECT MANAGER	CHRIS MATTHEWS
	DASA CROWELL, PE
PROJECT NUMBER	0977021-018



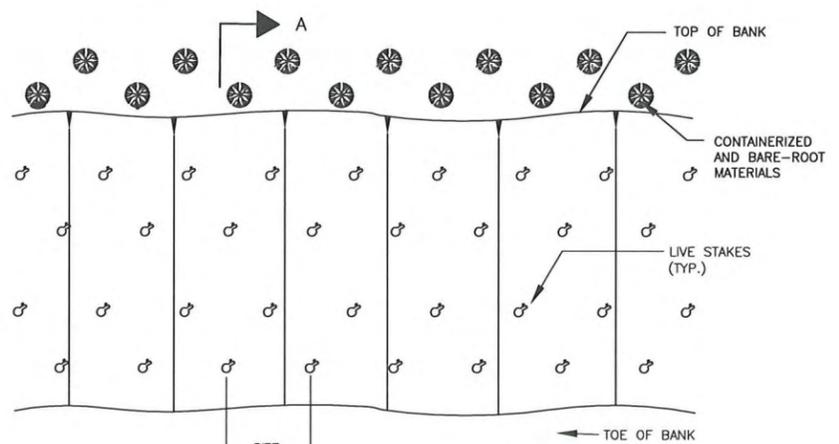
NC Wetlands Restoration Program
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Irwin Creek
Stream Restoration

Charlotte North Carolina

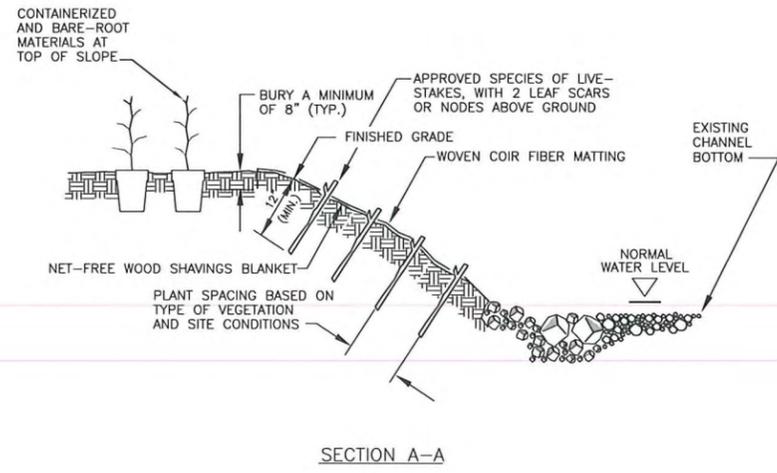
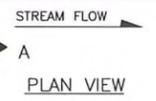
PLANTING PLAN DETAILS

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SCALE	AS SHOWN		

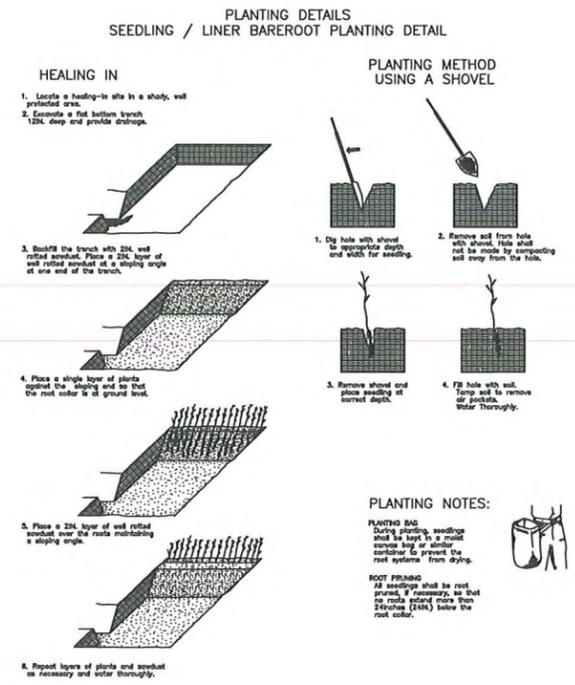
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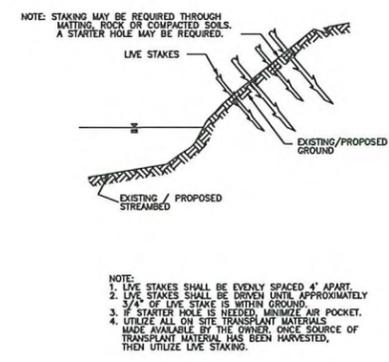
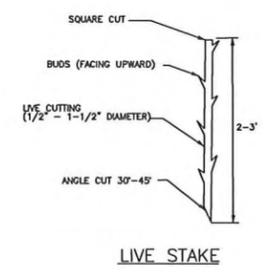
- PLANTING SCHEDULE**
1. STREAMBANK GRADING
 2. SOIL SURFACE ROUGHENING
 3. SEEDING OF GRASS COVER CROP WITH SPECIFIED SEED MIX
 4. INSTALLATION OF EROSION CONTROL BLANKET ACCORDING TO MANUFACTURER'S SPECIFICATIONS
 5. TOP PROTECTION INSTALLATION
 6. LIVE-STAKING
 7. CONTAINERIZED AND BARE-ROOT SEEDLING INSTALLATION



PLANTING DETAIL
NOT TO SCALE



PLANTING DETAIL
NTS

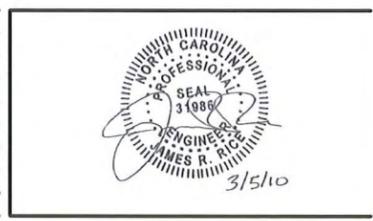


LIVE STAKE DETAIL
NTS



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Irwin Creek
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Charlotte North Carolina

STANDARD DETAILS

0 1" 2"

FILENAME: 01D-002.dwg
SCALE: AS NOTED

SHEET: **L-3**