BASELINE MONITORING DOCUMENT & AS-BUILT BASELINE REPORT

UT TO NEUSE RIVER (BIG DITCH)

Wayne County, North Carolina
EEP Project # 92682

Prepared for:

NCDENR-Ecosystem Enhancement Program
217 West Jones St., Suite 3000A
Raleigh, North Carolina 27603

Data Collected: September 17, 2013 – January 15, 2014
Submitted: February 28, 2014

EXECUTIVE SUMMARY

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed restoration of 2,128 linear feet of stream and installation of a stormwater wetland at the UT to Neuse (Big Ditch) site (hereafter referred to as the "Site") to assist in fulfilling stream mitigation goals in the area. The Site is located within the City of Goldsboro in Wayne County, North Carolina (Figure 1). The properties included in this project are southeast of the intersection of South John Street and East Elm Street, and is adjacent to the City of Goldsboro's Willow Dale Cemetery (Lat 35.373 Long 77.995). The Site is located in the United States Geological Survey Hydrologic Unit 03020201200040 (North Carolina Division of Water Quality Subbasin 03-04-12) of the Neuse River Basin (USGS 1974, NCEEP 2009), and will service the USGS 8-digit Cataloging Unit (CU) 03020201.

The primary goals of this stream restoration project focus on reducing sediment loading in the UT, improving water quality, providing/enhancing flood attenuation, and restoring and enhancing aquatic and riparian habitat. These goals will be accomplished through the following objectives:

- Restore a stable dimension, pattern and profile to the UT that will deter degradation of side slopes and mass wasting of banks. A newly designed channel cross-section with overbank flood relief and stream channel structures that reduce stress on channel banks and creates pools will ensure stability and reduce exiting sediment loading.
- Stabilize the UT by planting live stakes and bare roots along the channel banks to promote root growth. The proposed planting density along channel banks calls for two foot spacing, which should assist in establishing a continuous, dense root mat through the Site.
- Enhancing the capacity of the Site to mitigate flood flows by excavating a 5 foot floodplain bench off of each channel bank and sloping terrace side slopes at a 5:1 angle. Additionally, a stormwater wetland BMP will be retrofitted on a contributing conveyance which should assist in mitigating flood flows during precipitation events.
- Enhancing in stream habitat by creating an undulating bedform (shallows/deeps) by placing woody structures in the channel that provide shading, natural food sources, and protective areas for propagation. Additionally, planting vegetation along the channel banks and within the riparian buffer will enhance shading and provide much needed biomass to fauna within the UT for cover, forage and propagation.
- Reducing sedimentation and nutrients from adjacent urban areas by establishing a native riparian buffer through existing open/grassed fields that are currently regularly maintained.
- Improve terrestrial habitat by restoring a forested riparian corridor through a highly urbanized environment which has historically experienced vegetation maintenance and forest segmentation. This corridor will provide a diversity of habitats such as mature

forest, early successional forest, riparian wetlands (in the form of a stormwater wetland BMP) and uplands.
- Reduce nutrients and other pollutant inputs by retrofitting a contributing conveyance to a stormwater wetland BMP.

Prior to construction, the UT had been detrimentally impacted due to channelization and deepening. Evidence of channelization includes the fact that the channel follows the fall line of the valley through the Site with no natural meander geometry. Discussions with local landowners revealed that the channel was historically much smaller but past dredging and regular maintenance has deepened the channel over the years. The culvert at the upstream end of the Site set the channel grade to a point that bankfull flows are well below existing ground (historic floodplain). Vegetative clearing throughout the Site appeared to be a fairly routine practice. Denudation of channel banks removed and repressed the ability of root growth, which would help to stabilize Site soils. There were two sewer crossings that were aerial crossings because the channel had incised well below the hanging pipes. The UT is located within a highly urbanized watershed. The large majority of the watershed is contained within the city limits of Goldsboro. Goldsboro is highly developed, with undeveloped lands comprising relatively small portions of land in the watershed. It is not anticipated that watershed conditions will be substantially altered within the foreseeable future.

Site construction was completed on September 5, 2013 and the Site planting was completed on January 15, 2014. The construction time includes the installation of additional soil lifts to repair stream banks that were impacted by tropical storm Andrea on June 6, 2013. The Site restored 2,128 linear feet of stream using Priority II restoration by excavating a 5 foot floodplain off each channel bank, incorporating in-stream structures, and planting with native forest species. Restoration efforts slightly increased the stream length of the UT from a length of 2,113 linear feet to 2,132 linear feet. Planting occurred within approximately 9.75 acres of the 9.94-acre conservation easement including stream banks, floodplain, and stormwater wetland. Initial stem count measurements indicate an average of 423 planted stems per acre (excluding live stakes) across the Site.

Site activities provide 2,132 Stream Mitigation Credits and 1,470 pounds of Nitrogen Reduction Credits. Riparian Buffers areas may be used for stream & riparian buffer mitigation, or nutrient offset buffer restoration credit (based on DWR responses to the EEP document "Reforms needed immediately in the regulation of riparian buffer mitigation" dated August 9, 2013). Credit options for Riparian Buffers restoration areas are summarized below:

	Credit Options for Riparian Buffer Restoration Areas							
	Neuse Riparian Buffer Restoration Credits				Nutrient Offset Buffer Restoration Credits			
	50' Area (sf)	50' - 100' Area (sf)	100' - 200' Gross Area (sf)	Credit Yield**	<= 50' Nitrogen Removal (lbs)***	50' - 100' Nitrogen Removal (lbs)***	50' - 100' Nitrogen Removal (lbs)***	Credit Yield***
	157,756	107,778	78,632		0	5,624	4,103	
Credit Ratio*	1:1	1:1	4:1		1:1	1:1	1:1	
Total Credits	157,756	107,778	19,658	285,192	0	5,624	4,103	9,727

* Credit Ratios based on the memo "DWR responses to the EEP document "Reforms needed immediately in the regulation of riparian buffer mitigation" dated August 9, 2013

** - Credit Yield is the sum of 50', 50'-100' area and 100' - 200' adjusted area

*** - Nitrogen Credits were calculated based on a rate of 2,273 lbs per acre over 30 years per DWQ policy (Estimating/Calculating Riparian Buffer Credits, EEP PPPM Section 8.3.1.2)

The Site will be protected by a permanent conservation easement held by the State of North Carolina.

Monitoring Components and Duration

The first year monitoring report will be submitted in November 2014. Monitoring will continue for five years or until agreed upon success criteria are achieved, with a report submitted by the end of November for each monitoring year. Monitoring will include a survey of representative stream profiles and cross-sections, representative surveys of vegetation, and an annual monitoring report verifying that the Site has remained relatively unchanged.

Issues or Mitigating Factors

Delays in the preparation and submittal of the Baseline Monitoring Document are a result of having to wait for the Site to be planted in order to obtain the baseline vegetation data. Due to this delay, the baseline monitoring field data collection occurred at two separate times; stream morphological surveys were conducted in September 2013 and nine (9) vegetation plots were installed and surveyed in January 2014.

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APPENDICES

1.0 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

1.1 Location and Setting

The North Carolina Ecosystem Enhancement Program (NCEEP) has completed restoration of 2,128 linear feet of stream and installation of a stormwater wetland at the UT to Neuse (Big Ditch) site (hereafter referred to as the "Site") to assist in fulfilling stream mitigation goals in the area. The Site is located within the City of Goldsboro in Wayne County, North Carolina (Figure 1). The properties included in this project are southeast of the intersection of South John Street and East Elm Street, and is adjacent to the City of Goldsboro's Willow Dale Cemetery (Lat 35.373 Long 77.995). The Site is located in the United States Geological Survey Hydrologic Unit 03020201200040 (North Carolina Division of Water Quality Subbasin 03-04-12) of the Neuse River Basin (USGS 1974, NCEEP 2009), and will service the USGS 8-digit Cataloging Unit (CU) 03020201. The Site is located in the Southeastern Plains physiographic province of North Carolina.

1.2 Project Goals and Objectives

The primary goals of this stream restoration project focus on reducing sediment loading in the UT, improving water quality, providing/enhancing flood attenuation, and restoring and enhancing aquatic and riparian habitat. These goals will be accomplished through the following objectives:

1. Restore a stable dimension, pattern and profile to the UT that will deter degradation of side slopes and mass wasting of banks. A newly designed channel cross-section with overbank flood relief and stream channel structures that reduce stress on channel banks and creates pools will ensure stability and reduce exiting sediment loading.
2. Stabilize the UT by planting live stakes and bare roots along the channel banks to promote root growth. The proposed planting density along channel banks calls for two foot spacing, which should assist in establishing a continuous, dense root mat through the Site.
3. Enhancing the capacity of the Site to mitigate flood flows by excavating a 5 foot floodplain bench off of each channel bank and sloping terrace side slopes at a 5:1 angle. Additionally, a stormwater wetland BMP will be retrofitted on a contributing conveyance which should assist in mitigating flood flows during precipitation events.
4. Enhancing in stream habitat by creating an undulating bedform (shallows/deeps) by placing woody structures in the channel that provide shading, natural food sources, and protective areas for propagation. Additionally, planting vegetation along the channel banks and within the riparian buffer will enhance shading and provide much needed biomass to fauna within the UT for cover, forage and propagation.
5. Reducing sedimentation and nutrients from adjacent urban areas by establishing a native riparian buffer through existing open/grassed fields that are currently regularly maintained.

6. Improve terrestrial habitat by restoring a forested riparian corridor through a highly urbanized environment which has historically experienced vegetation maintenance and forest segmentation. This corridor will provide a diversity of habitats such as mature forest, early successional forest, riparian wetlands (in the form of a stormwater wetland BMP) and uplands.
7. Reduce nutrients and other pollutant inputs by retrofitting a contributing conveyance to a stormwater wetland BMP.

1.3 Project Structure, Restoration Type and Approach

1.3.1 Project Structure

The Project restored 2,132 linear feet of UT to Neuse southeast of the intersection of South John Street and East Elm Street in Wayne County, NC. Table 1 provides a summary of the Project components and mitigation credits (Appendix A). The location of each Site component is depicted in Figure 2 (Appendix A). See Appendix E for mitigation credit calculations and figures.

1.3.2 Restoration Type and Approach

Prior to construction, the UT had been detrimentally impacted due to channelization and deepening. The culvert at the upstream end of the Site set the channel grade to a point that bankfull flows are well below existing ground (historic floodplain). Vegetative clearing throughout the Site appeared to be a fairly routine practice. Denudation of channel banks removed and repressed the ability of root growth, which would help to stabilize Site soils. There were two sewer crossings that were aerial crossings because the channel had incised well below the hanging pipes.

After reviewing the site several times and conducting on-site and watershed surveys it was determined that the proposed plan's main focus should be to stabilize the UT through the Site to deter further mass erosion of channel and terrace banks. Natural Channel Design methodologies are incorporated into the restoration design approach; however the primary goal is not to provide the landscape with a "naturally meandering" channel. Rather, the design approach works around site constraints and concentrates on providing a system that will convey flows through the Site without degrading channel banks.

The UT is designed as B/E 5 type stream channel with a width-to-depth ratio of 12.0 and a typical entrenchment ratio of 2.6. The designed stream type combines principals of two different stream types (a B and E type channel) to accommodate site constraints. Due to vertical, horizontal and watershed constraints the proposed channel displays little meander geometry. Because of this the pool to pool spacing is relatively close (averaging close to four channel widths).

To provide some overbank relief a five foot bench has been built on each side of the channel. This provides a total of 10 feet of bankfull elevation floodplain. Five to one (5:1) side slopes

were used to transition from bankfull to top of terrace, which will substantially increase the flow area of floods when compared with 3:1 side slopes. The five foot bench and five to one side slopes allows for an average proposed entrenchment ratio of 2.6 through the Site. Another advantage of five to one side slopes in sandy soils is that rill and gully erosion should be less severe when compared with three to one side slopes.

The two existing ductile iron sewer crossings were improved by restoring the channel. The ductile iron sewer pipes were aerial crossings approximately 3 feet above existing invert. These pipes collect debris in the channel and have caused lateral expansion and mass wasting of the banks at each of their locations. The restored channel invert has been raised to the point that both pipes will be covered and situated in shallow ripple areas. This should not only stabilize the pipes, but also allow a more unobstructed flow through the Site.

A riparian buffer has been planted on two foot centers along both banks of the UT through the easement area in the restored reach of channel. To aid in quick buffer establishment, shading, habitat and roughness some containerized plants were also planted within the buffer. Additionally, ball and burlap trees were planted along the easement boundary.

1.4 Project History, Contacts and Attribute Data

The UT is located within a highly urbanized watershed. The large majority of the watershed is contained within the city limits of Goldsboro. Goldsboro is highly developed, with undeveloped lands comprising relatively small portions of land in the watershed. It is not anticipated that watershed conditions will be substantially altered within the foreseeable future.

ICA Engineering, Inc.(ICA) provided engineering, design, and construction oversight services to the EEP for the Site. Construction began in January 2013 and was completed on September 5, 2013. The construction time includes the installation of additional soil lifts to repair stream banks that were impacted by tropical storm Andrea on June 6, 2013. Site planting was completed on January 15, 2014. Delays in the preparation and submittal of the Baseline Monitoring Document are a result of having to wait for the Site to be planted in order to obtain the baseline vegetation data. Due to this delay, the baseline monitoring field data collection occurred at two separate times; stream morphological surveys were conducted in September 2013 and nine (9) vegetation plots were installed and surveyed in January 2014.

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix A).

2.0 SUCCESS CRITERIA

Monitoring of restoration efforts will be performed until success criteria are fulfilled. Monitoring is proposed for the stream channel and vegetation. In general, the restoration success criteria, and required remediation actions, are based on the *Stream Mitigation Guidelines* (USACE et al. 2003).

2.1 Streams

Success criteria for stream restoration will include 1) successful classification of the reach as a functioning stream system (Rosgen 1996) and 2) channel variables indicative of a stable stream system.

A longitudinal profile will be completed on the entire restored section of the UT to collect invert, surface water and bankfull elevation data. A total of four (4) cross-sections (two riffles and two pools) have been installed. Permanent photo stations have been established at each permanent cross-section. These data will be utilized to determine the success in restoring stream channel stability. Specifically, the width-to-depth ratio and bank-height ratios should be indicative of a stable or moderately unstable channel with minimal changes in cross-sectional area, channel width, and/or bank erosion along the monitoring reach. In addition, channel abandonment and/or shoot cutoffs must not occur and sinuosity values must remain relatively constant. Visual assessment of in-stream structures will be conducted to determine if failure has occurred. Failure of a structure may be indicated by collapse of the structure, undermining of the structure, stream flow around the structure, and/or stream flow beneath the structure.

2.1.1 Stream Dimension

General maintenance of a stable cross-section and hydrologic access to the floodplain features over the course of the monitoring period will generally represent success in dimensional stability. Some changes in dimension (such as lowering of bankfull width) should be expected. Key parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modes of overall change. Riffle sections should generally maintain a Bank Height Ratio of 1.0 – 1.5, with some variation in this ratio naturally occurring. Pool sections naturally adjust based on recent flows and time between flows, therefore more variation on pool section geometry is expected.

2.1.2 Stream Pattern and Profile

The profile should not demonstrate significant trends towards degradation or aggradation over a significant portion of a reach. Additionally, bed form variables should remain noticeably intact and consistent with original design parameters that were based off of reference conditions. Pattern features should show little adjustment over the standard 5 year monitoring period.

2.1.3 Substrate

Sampling of the substrate distribution will not be completed because the restored section of the UT to Neuse is composed of a sand substrate. Coarsening of the substrate is not anticipated.

2.1.5 Sediment Transport

There should be an absence of any significant trend in the aggradational or depositional potential of the channel.

2.2 Vegetation

An average density of 320 stems per acre of Character Tree Species must be surviving after five monitoring years in accordance with North Carolina Division of Water Quality Administrative Code 15A NCAC 02B.0242 (Neuse River Basin, Mitigation Program for Protection and Maintenance of Existing Riparian Buffers) (NCDWQ 2007). Vegetation will be monitored annually for a minimum of 5 years at the site.

2.3 Hydrology

A minimum of two bankfull events must be documented within the standard 5 year monitoring period. The two bankfull events shall occur within separate years.

2.4 Scheduling and Reporting

The first year monitoring report will be submitted in November 2014. Monitoring will continue for five years or until agreed upon success criteria are achieved, with a report submitted by the end of November for each monitoring year.

3.0 MONITORING PLAN GUIDLINES

3.1 Stream Hydrology

To ensure accuracy and make note of any site changes, all data collected for monitoring purposes will be taken manually and in the field.

Verification of bankfull events and changes in stream hydrology will be recorded by a crest gauge installed in the stream as well as visual evidence of above bankfull flows. Evidence of above bankfull flows may include trash/debris lines in or above the floodplain, vegetation pushed over towards the downstream direction in the floodplain, terrace slope scour, and staining of vegetation. Early monitoring of crest gauges will allow for additional verification of bankfull design targets.

All visits to the site for purposes of data collection will be documented by the monitoring performer and will describe in detail: weather conditions; physical appearance of the site; highest stage for that monitoring interval as recorded on the crest gauge; a reset of the crest gauge; photo documentation. Data collected for the purposes of bankfull verification will be compiled and summarized in each annual version of the monitoring report.

3.2 Stream Channel Stability and Geomorphology

Assessment of the UT Neuse dimension, pattern and profile is necessary to ensure that the reach maintains reference geomorphology. Visual based assessments, photographic documentation, and surveys of profiles and representative cross-sections will be used to monitor channel stability. Vegetation will be monitored annually to document plant survival and community composition. This section serves as the general guide to the extent and type of monitoring of different stream features.

3.2.1 Dimension

Four permanent cross-sections have been established and will be used to evaluate stream dimension (2 riffles and 2 pools). Cross-sections are permanently monumented with 2-foot rebar posts at each end point. Cross-sections will be measured to provide a detailed evaluation of the stream and banks including points on the adjacent floodplain, top of bank, bankfull, breaks in slope, edge of water, and thalweg. Data will be used to calculate bankfull dimensions, width-depth ratios, entrenchment ratios, and bank height ratios for each cross-section. In addition, photographs will be taken at each permanent cross-section location annually.

3.2.2 Profile

The entire length of the restored channel will be surveyed for geomorphological changes to the profile for as-built and monitoring purposes. Stream parameters surveyed will include top of bank, thalweg, water surface, bankfull, and low flow benches, if present. The profile data will be used to calculate water surface slopes, riffle/pool lengths and depths, and pool-to-pool spacing.

3.2.3 Pattern

Stream parameters such as channel beltwidth, radius of curvature, and meander wavelength will be collected in monitoring year five if profile and dimensional data indicate that significant geo-morphological adjustments have occurred.

3.2.4 Visual Assessment

Visual stream morphology stability assessments will be completed annually in accordance with the most current version of the EEP document entitled *Monitoring Requirements and performance Standards for Stream and/or Wetland Mitigation (November 7, 2011).* The visual assessment data will be used to assess the channel bed, banks, and in-stream structures.

3.2.5 Bank Stability Assessments

Bank stability should be assessed as part of the annual visual assessment. Recording linear feet of unstable or collapsed banks will help guide repairs in the future, should they be necessary. This will be accomplished visually during all walkthroughs of the site. Near Bank Stress (NBS) and Bank Erosion Hazard Index (BEHI) assessments will be completed in year 5 of monitoring.

3.3 Vegetation

Nine sample vegetation plots (10-meter by 10-meter) were installed within the Site as per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.2 (Lee et al. 2008). Vegetation plots are permanently monumented with 4-foot metal garden posts at each corner. In each sample plot, vegetation parameters to be monitored will conform to Level 2 Standards and include species composition and species density. Visual observations of the percent cover of shrub and herbaceous species will also be documented by photograph.

3.4 Digital Photos

Permanent photo stations were established at each of the four cross-sections and at every vegetation plot. Photos of the stream will be taken annually when vegetation is minimal. Vegetation photos will be taken on the same day that vegetative cover surveys take place. All digital photo records will indicate location, date and monitoring year.

3.5 Watershed

Any changes to the project watershed will be monitored and recorded. In the event that a change to the watershed might introduce new sediment or changes in water flow to the site, such as a new development upstream, it will be closely monitored and analyzed. Any significant effects to site streams will be documented so that action can be taken, if necessary. Additionally, rare or significant hydrologic and weather events will be recorded in detail so that changes to site streams can be accounted for.

4.0 MAINTENANCE AND CONTINGENCY PLANS

The project will be monitored for 5 years or until success criteria is met. In the event that this mitigation project deviates significantly from the designed restoration intent, the EEP will evaluate the site and determine a corrective course of action.

5.0 AS-BUILT STATE

This section documents the as-built/baseline condition. Appendices B & C include Tables 5, 6, and 7 which detail specific geomorphic and vegetative data in relation to the as-built conditions. As-built/baseline drawings are included in Appendix D.

5.1 As-built/Record Drawings

The As-built/Record Drawings are attached in Appendix D.

5.2 Morphologic State of the Channel

Upon completion of grading and structure installation, a baseline survey was performed for the entire restored length of stream and included four cross-sections. Baseline morphologic data is summarized in Table 5 and Table 6 in Appendix B. Plots of the profiles are shown in Figures B.1-B.3 in Appendix B. Cross-section plots and photos can also be found in Appendix B. Cross-section photos were taken facing in the downstream direction.

5.3 Sediment Transport in the As-built State

As-built capacity (unit stream power) values are depicted in Table 5 and can be compared with design and existing values for each reach. For sand based systems, such as UT Neuse, capacity is the primary tool for assessing the channel's ability to transport sediment through the system.

5.4 Verification of Plantings

After planting was completed, an initial evaluation was performed per guidelines established in CVS-EEP Protocol for Recording Vegetation, Version 4.2 (Lee et al. 2008) to verify planting methods were successful and to determine initial species composition and density. Baseline vegetation plot data can be found in Table 7 in Appendix C. Plot photos are also located in Appendix C. Initial stem count measurements indicate an average of 423 planted stems per acre (excluding live stakes) across the Site. In addition, each individual plot met success criteria based on planted stems alone. A Final Planting List can be found in Appendix C.

5.4 Stream Gauges

One crest gauge was installed on the right bank and is being monitored regularly to track any large storm events that affect the Site. Crest gauge locations have been documented in the Monitoring Plan sheets located in Appendix A.

6.0 REFERENCES

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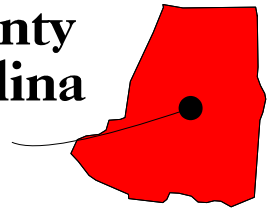
APPENDIX A
General Tables and Figures

Wayne County North Carolina

PROJECT AREA



Vicinity Map

UT to Neuse (Big Ditch)
Baseline Monitoring Document
Wayne County, North Carolina

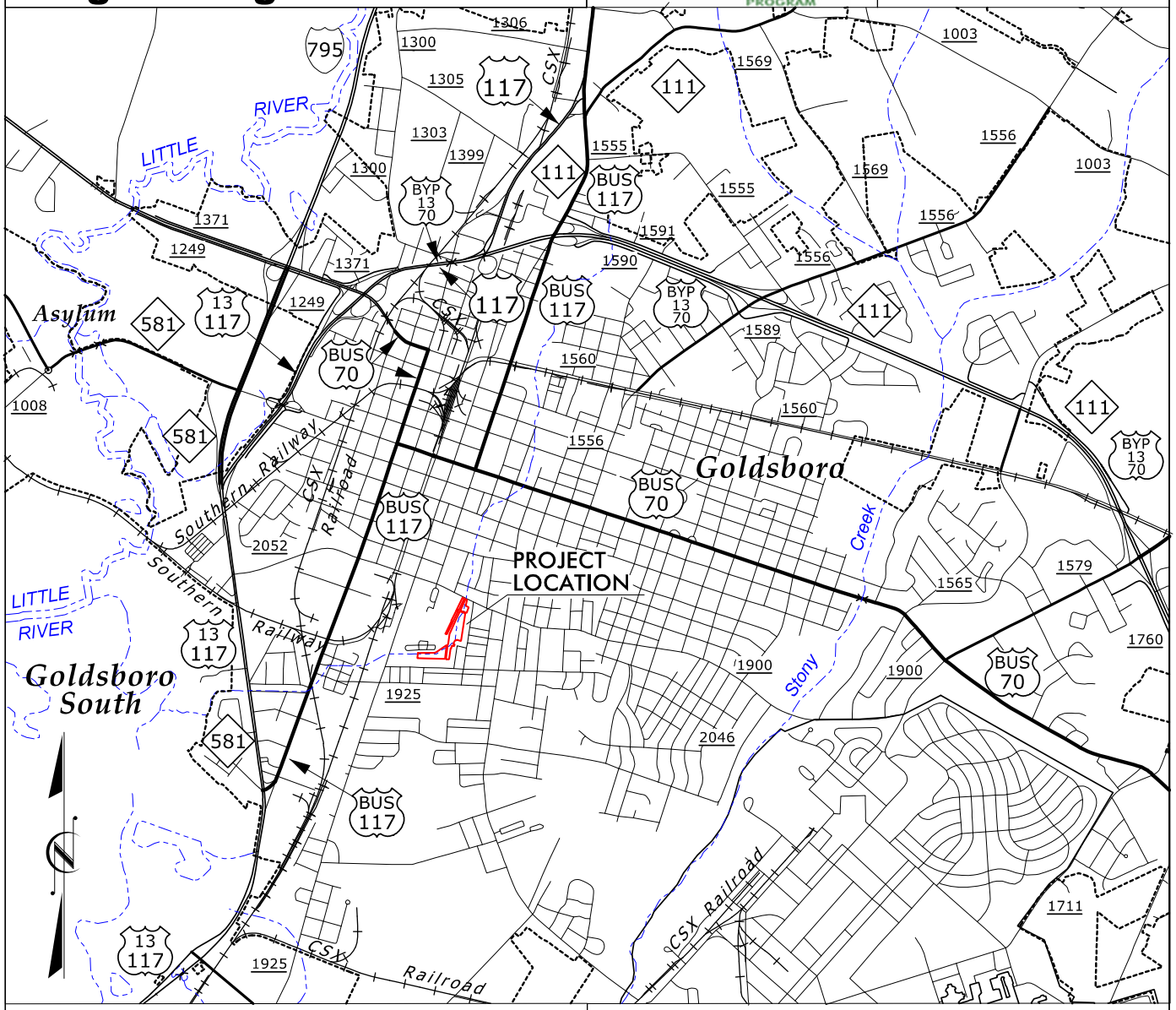
ICA Engineering
5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: F-0258

Ecosystem Enhancement Program

Date: 02/19/14

Figure: 1

0 3000 6000
FEET



Directions to the Site are as follows:

-Take I-40 East to US 70 East

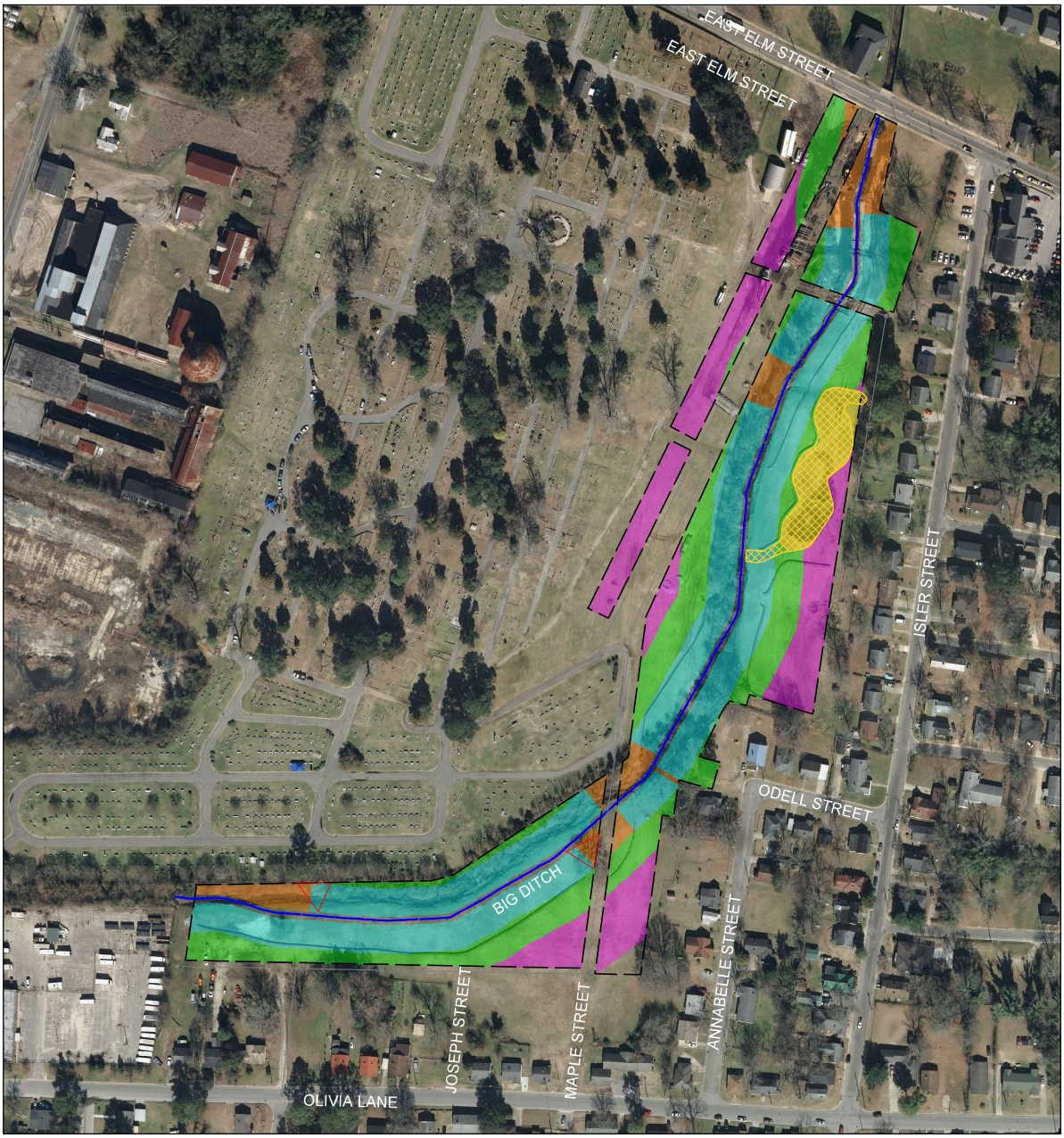
-Take US 70 East to US 117 South to Wilmington

-Turn Left onto Elm Street

-Continue East on Elm Street approximately 1.2 miles

-Project Site is East of the Willow Dale Cemetery

"The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees! contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activities requires prior coordination with EEP."



LEGEND

- Conservation Easement (9.94 Ac.)
- Restored Stream (2,132 LF)
- Stormwater BMP (0.25 Ac.)
- < 50' Buffer (28,573 SqFt)
- TOB to 50' Buffer (157,756 SqFt)
- 50' - 100' Buffer (107,778 SqFt)
- 100' - 200' Buffer (78,632 SqFt)
- Ditch Buffer Credit Reduction of 0.1 Ac.

0 300 600

FEET

Project Asset Map

UT to Neuse (Big Ditch)
Baseline Monitoring Document
Wayne County, North Carolina

Ecosystem Enhancement Program

ICA Engineering

5121 Kingdom Way,
Suite 100
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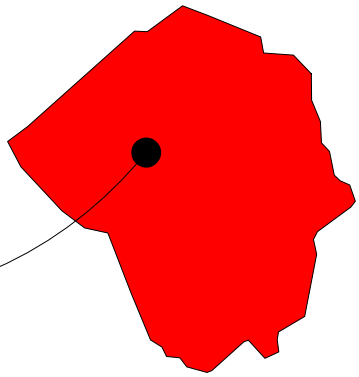
NC License No: F-0258

Date: 04/16/14

Figure: 2

Pitt County
North Carolina



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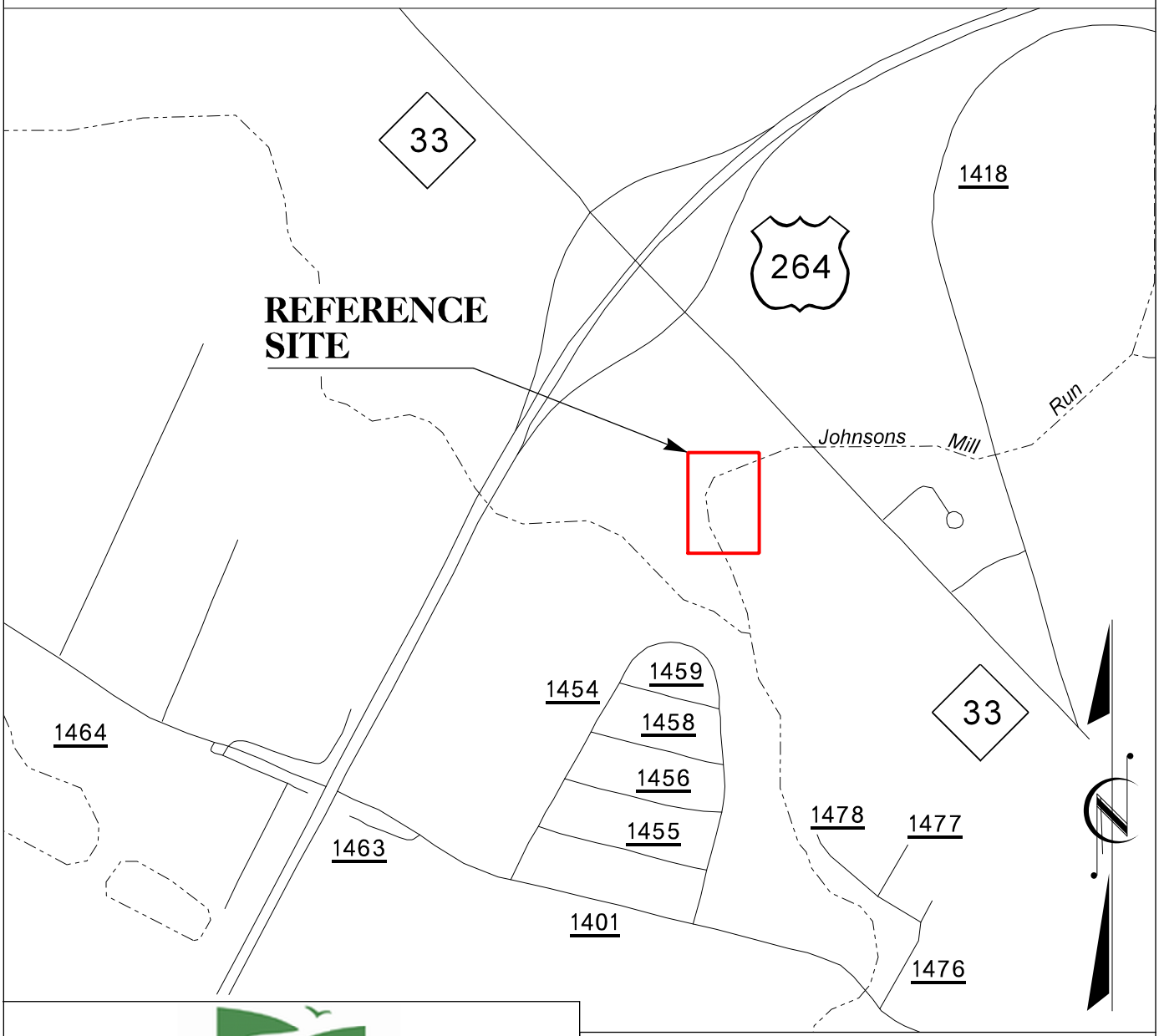

Ecosystem Enhancement Program

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Johnsons Mill Run Vicinity Map

UT to Neuse (Big Ditch)
Stream Mitigation Plan
Wayne County, North Carolina

Date: 02/19/14	Figure: 5

Table 1. Project Components and Mitigation Credits
UT Neuse (Big Ditch) (EEP Project ID No. 92682)

Mitigation Credits								
	Stream	Riparian Buffer * (square feet)			Nitrogen Nutrient Offset			
					Buffer Restoration **			
Type	R	TOB to 50'	50' - 100'	100' - 200'	Buffer Zone	<= 50'	50' - 100'	100' - 200'
Restored LF or FT^2	2,132	157,756	107,778	78,632		157,756	107,778	11,651
Credit Ratio	1:1	1:1	1:1	4:1		1:1	1:1	1:1
Totals	2,132	157,756	107,778	19,658	Pound Reduction	0	5,624	4,103

Project Components						
Project Component -or- Reach ID	Stationing/Location	Eisting Footage/ Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
UT	10+00 - 31+32	2,113	PII	R	2,132	1:1
Riparian Buffers	TOB to 50'	-	-	R	3.62	1:1
	50' - 100'	-	-	R	2.47	1:1
	100' - 200'	-	-	R	0.45	4:1

Component Summation			
Restoration Level	Stream (linear feet)	Buffer (square ft.)	Buffer Nitrogen Nutrient Offset
Restoration	2,132	285,192	9,727

BMP Elements				
Element	Size (AC)	Purpose/Function	1 yr. Total Nitrogen Reduction (lbs)	30 yr. Total Nitrogen Reduction (lbs)
Stormwater Wetland	0.253	Water Quality / Nutrient Uptake	49	1,470

* - Riparian Buffer areas may be used for stream & riparian buffer mitigation, or nutrient offset credit (*Estimating/Calculating Riparian Buffer Credits, EEP PPPM Section 8.3.1.2)* .

Table 2. Project Activity and Reporting History
UT Neuse (Big Ditch) (EEP Project ID No. 92682)

Activity or Report	Data Collection Complete	Completion or Delivery
Restoration Plan	January 2010	February 2010
Final Design – Construction Plans	January 2011	May 2012
Construction	January 23, 2013	September 5, 2013
Temporary S&E Mix Applied to Entire Project Area	January 23, 2013	September 5, 2013
Permanent Seed Mix Applied to Entire Project Area	January 23, 2013	September 5, 2013
Bare Root, Containerized, and B&B plantings for Entire Project Area	January 14, 2014	January 15, 2014
Mitigation Plan/As-built (Year 0 Monitoring-Baseline)	September 17, 2013	February 28, 2014
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts Table
UT Neuse (Big Ditch) (EEP Project ID No. 92682)

Designer Primary project design POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Kevin Williams (919) 851-6066
Construction Contractor Construction Contractor POC	Carolina Environmental Contracting, Inc. Joanne Cheatham P.O. Box 1905 Mount Airy, NC 27030 (336) 320-3849
Planting Contractor Planting Contractor POC	Carolina Sylvics, Inc. Mary-Margaret McKinney 908 Indian Trail Road Edenton, North Carolina 27932 (252) 482-8491
Seeding Contractor Seeding Contractor POC	Carolina Environmental Contracting, Inc. Joanne Cheatham P.O. Box 1905 Mount Airy, NC 27030 (336) 320-3849
Seed Mix Sources	Green Resources – Triangle Office
Nursery Stock Suppliers	1) NC Division of Forest Resources 2) Native Roots Nursery
Monitoring Performers	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Stream Monitoring POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066
Vegetation Monitoring POC	ICA Engineering 5121 Kingdom Way, Suite 100 Raleigh, North Carolina 27607 Ben Furr (919) 851-6066

Table 4. Project Information
UT Neuse (Big Ditch) (EEP Project ID No. 92682)

Project Information	
Project Name	UT Neuse (Big Ditch)
Project County	Wayne
Project Area (acres)	10
Project Coordinates	035º 22’ 24” N, 077º 59’ 40’’ W
Project Watershed Summary Information	
Physiographic Region	Southeastern Plains
Ecoregion	Southeastern Floodplains and Low Terraces
Project River Basin	Neuse
USGS 8-digit HUC	03020201
USGS 14-digit HUC	03020201200040
NCDWQ Subbasin	03-04-12
Project Drainage Area	2.27 sq. mi (at end of restoration reach)
Watershed Land Use	Forested = 20% Cultivated Cropland = 5% Urban = 74% Surface Water = 1%

Reach Summary Information	
Parameters	**UT Neuse (Big Ditch)**
Restored length	2,132
Drainage Area	2.27 sq. mi.
NCDWQ Index Number	27-(56)
NCDWQ Classification	WS-IV, NSW, C
Valley Type/Morphological Description	VIII/B/E5
Dominant Soil Series	Bibb/Norfolk loamy sand
Drainage Class	Bibb – poorly drained; Norfolk – well drained
Soil Hydric Status	Bibb – hydric; Norfolk – non-hydric
Slope	0.0017
FEMA Classification	AE & X
Native Vegetation Community	Coastal Plain Levee Forest
Percent Composition of Exotic Invasives	0%

Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**
Waters of the U.S. –Sections 404 and 401	Yes	Yes	Restoration Plan
Endangered Species Act	Yes	Yes	Restoration Plan
Historic Preservation Act	Yes	Yes	Restoration Plan
CZMA/CAMA	No	--	--
FEMA Floodplain Compliance	Yes	In Progress	LOMR
Essential Fisheries Habitat	No	--	--

APPENDIX B
Morphological Summary Data and Plots

Table 5. Baseline Stream Data Summary
UT Neuse (Big Ditch), EEP Project ID No. 92682
UT Neuse: 2,218 LF

Parameter	Regional Curve			Pre-Existing Condition	Reference - Johnson Mill	Design	As-built/Baseline					
Dimension and Substrate - Riffle	Eq.			Mean	Mean	Mean	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	14.20			8.90	21.20	14.00	13.00	13.30	13.30	13.60	0.42	2
Floodprone Width (ft)				16.60	34.90	36.00	46.70	49.85	49.85	53.00	4.45	2
Bankfull Mean Depth (ft)	1.60			1.01	2.25	1.17	1.00	1.10	1.10	1.20	0.14	2
Bankfull Max Depth (ft)				1.43	2.42	1.75	2.20	2.25	2.25	2.30	0.07	2
Bankfull Cross Sectional Area (ft^2)	23.30			9.02	47.59	16.30	13.00	14.30	14.30	15.60	1.84	2
Width/Depth Ratio				8.90	9.40	12.00	11.80	12.40	12.40	13.00	0.85	2
Entrenchment Ratio				1.85	1.65	2.60	3.40	3.75	3.75	4.10	0.49	2
Bank Height Ratio				5.80	1.00	1.00	1.00	1.00	1.00	1.00	0.00	2
d50 (mm)				sand	sand	sand						
Profile												
Riffle Length (ft)							38.64	59.42	60.26	82.92	16.99	8
Riffle Slope (ft/ft)				0.0100	0.0010	0.0021	0.0014	0.0021	0.0020	0.0034	0.0007	8
Pool Length (ft)							28.34	48.34	52.08	73.96	12.02	25
Pool Max depth (ft)				1.50	3.56	2.33	2.78	3.86	3.79	5.14	0.64	25
Pool Spacing (ft)				23.14-86.74	91.07-129.97	56.0-84.0	22.39	79.14	73.37	155.21	29.55	24
Pool Cross Sectional Area (ft^2)							31.10	31.15	31.15	31.20	0.07	2
Pattern												
Channel Beltwidth (ft)				Channelized	50-1500	28-980						
Radius of Curvature (ft)				Channelized	43-235	42-70						
Rc: Bankfull Width (ft/ft)				Channelized	2.0-11.1	3.0-5.0						
Meander Wavelength (ft)				Channelized	250-400	140-280						
Meander Width Ratio				Channelized	2.36-70.85	2.0-70.0						
Substrate, bed and transport parameters												
Ri% / P%							30% / 70%					
SC% / Sa% / G% / C% / B% / Be%												
d16 / d35 / d50 / d84 / d95/ d^p / di^{sp} (mm)												
Reach Shear Stress (competency) lb/ft^2				0.282	0.116	0.113						
Max part size (mm) mobilized at bankfull												
Unit Stream Power (transport capacity) lbs/ft.s				0.964	0.200	0.193	0.223					
Additional Reach Parameters												
Drainage Area (SM)				2.05	13.50	2.05						
Impervious cover estimate (%)												
Rosgen Classification				G/B 5	B5	B/E 5	E5					
Bankfull Velocity (fps)					1.50	1.70	1.75					
Bankfull Discharge (cfs)				25.00	80.90	25.00	25.00					
Valley length (ft)				2106		2106.00	2106.00					
Channel Thalweg length (ft)				2113		2128.00	2161.00					
Sinuosity (ft)				1.00	1.10	1.01	1.03					
Water Surface Slope (Channel) (ft/ft)				0.0055	0.0010	0.0017	0.0019					
BF slope (ft/ft)						0.0017	0.0019					
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Entrenchment Class (ER Range)												
Incision Class (BHR Range)												
BEHI VL% / L% / M% / H% / VH% / E%												
Channel Stability or Habitat Metric												
Biological or Other												

Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters - Cross Section)
UT Neuse (Big Ditch) (EEP Project No. 92682)
UT Neuse: 2,128 LF

	Cross Section 1 (Riffle)							Cross Section 2 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	13.6							13.4						
Floodprone Width (ft)	46.7							45.5						
Bankfull Mean Depth (ft)	1.2							2.3						
Bankfull Max Depth (ft)	2.3							3.2						
Bankfull Cross Sectional Area (ft^2)	15.6							31.1						
Bankfull Width/Depth Ratio	11.8							5.8						
Bankfull Entrenchment Ratio	3.4							3.4						
Bankfull Bank Height Ratio	1							1						
	Cross Section 3 (Pool)							**Cross Section 4 (Riffle)**						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation[1]														
Bankfull Width (ft)	14.4							13						
Floodprone Width (ft)	53.1							53						
Bankfull Mean Depth (ft)	2.2							1						
Bankfull Max Depth (ft)	3							2.2						
Bankfull Cross Sectional Area (ft^2)	31.2							13						
Bankfull Width/Depth Ratio	6.6							13						
Bankfull Entrenchment Ratio	3.7							4.1						
Bankfull Bank Height Ratio	1							1						

1 = Widths and depths for each resurvey will be based on the baseline bankfull datum regardless of dimensional/depositional development.

Figure B.1 UT Neuse - Longitudinal Profile

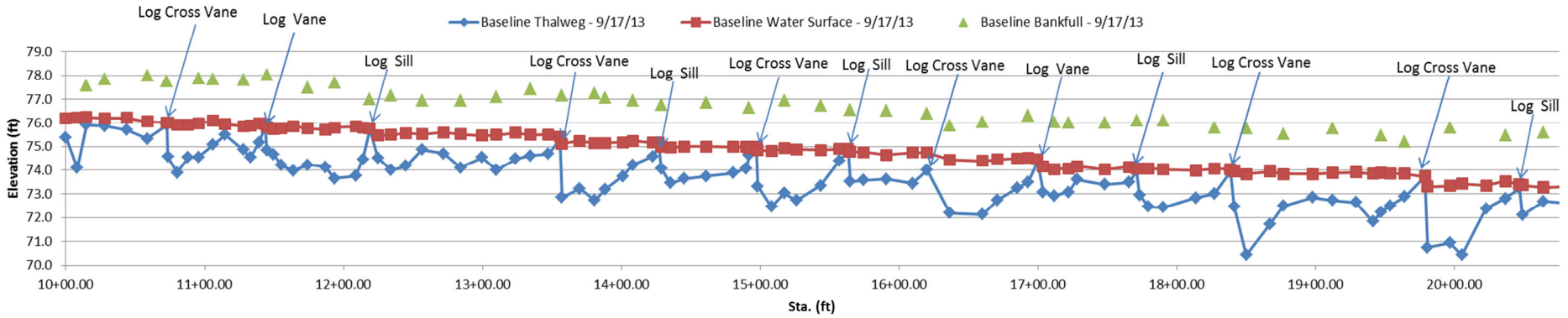
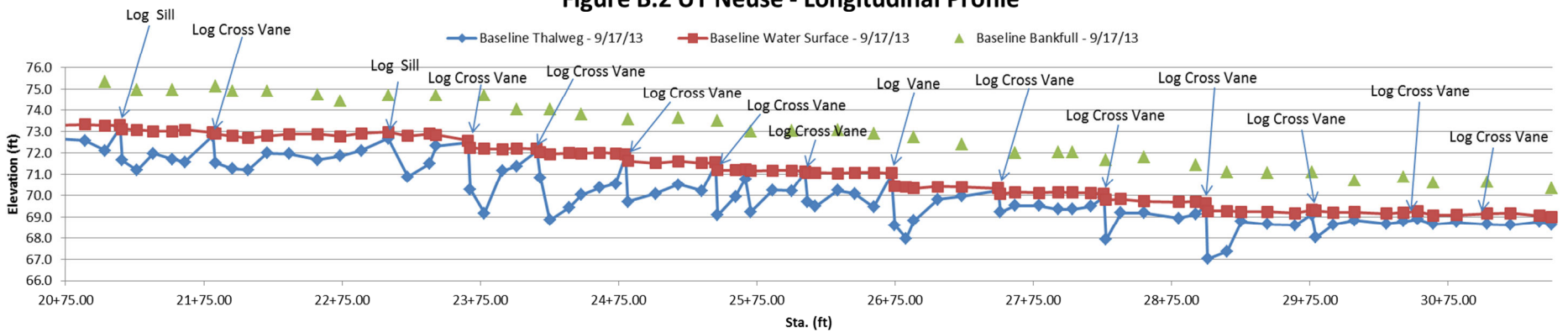
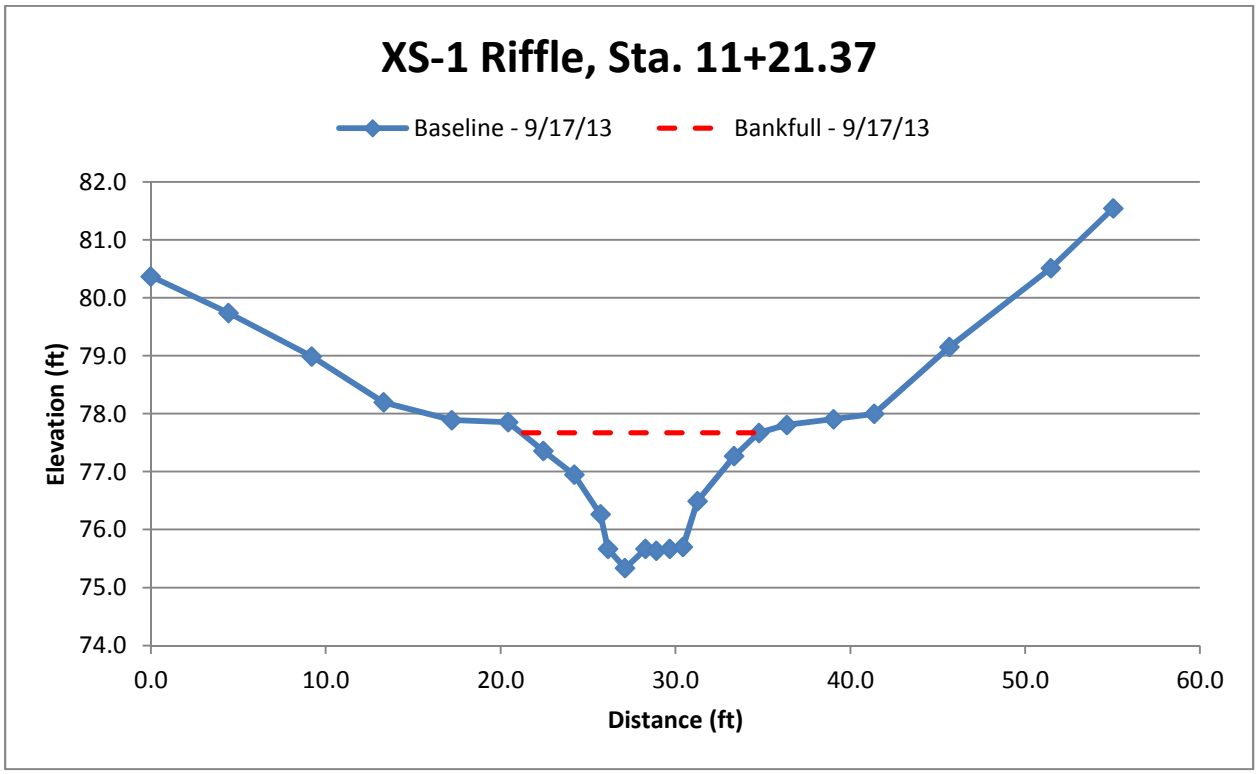
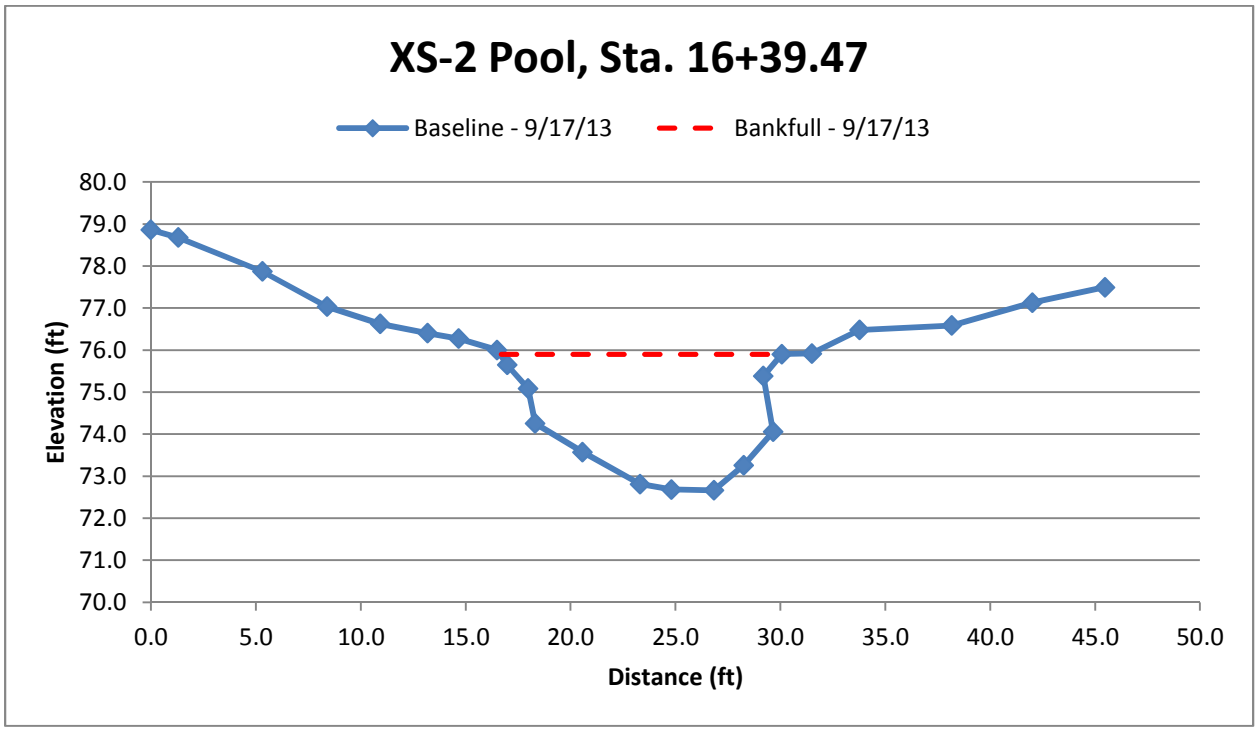


Figure B.2 UT Neuse - Longitudinal Profile

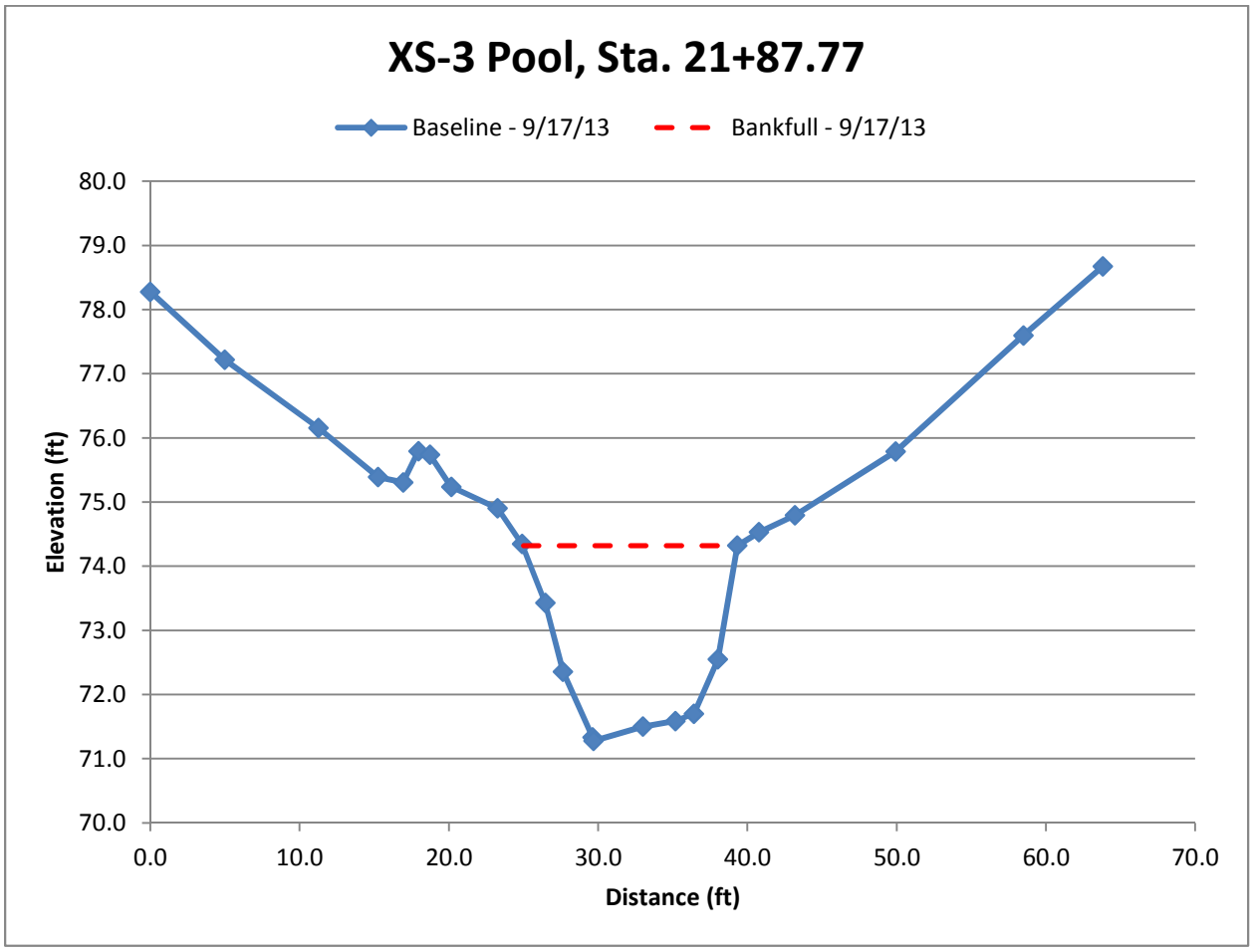




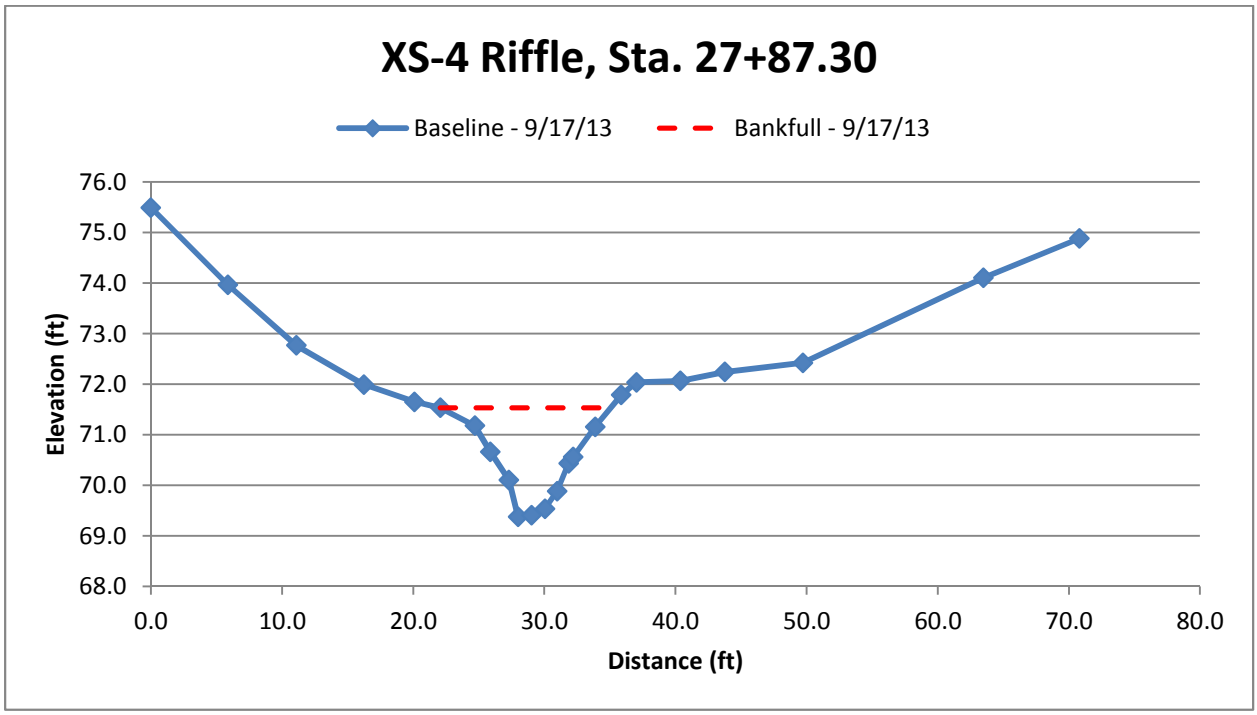
Bankfull Width (ft)	13.6
Floodprone Width (ft)	46.7
Bankfull Mean Depth (ft)	1.2
Bankfull Max Depth (ft)	2.3
Bankfull Cross Sectional Area (ft2)	15.6
Bankfull Width/Depth Ratio	11.8
Bankfull Entrenchment Ratio	3.4
Bankfull Bank Height Ratio	1.0



Bankfull Width (ft)	13.4
Floodprone Width (ft)	45.5
Bankfull Mean Depth (ft)	2.3
Bankfull Max Depth (ft)	3.2
Bankfull Cross Sectional Area (ft2)	31.1
Bankfull Width/Depth Ratio	5.8
Bankfull Entrenchment Ratio	3.4
Bankfull Bank Height Ratio	1.0



Bankfull Width (ft)	14.4
Floodprone Width (ft)	53.1
Bankfull Mean Depth (ft)	2.2
Bankfull Max Depth (ft)	3.0
Bankfull Cross Sectional Area (ft2)	31.2
Bankfull Width/Depth Ratio	6.6
Bankfull Entrenchment Ratio	3.7
Bankfull Bank Height Ratio	1.0



Bankfull Width (ft)	13.0
Floodprone Width (ft)	53.0
Bankfull Mean Depth (ft)	1.0
Bankfull Max Depth (ft)	2.2
Bankfull Cross Sectional Area (ft2)	13.0
Bankfull Width/Depth Ratio	13.0
Bankfull Entrenchment Ratio	4.1
Bankfull Bank Height Ratio	1.0

APPENDIX C
Vegetation Data

Table 7. Planted and Total Stem Counts (Species by Plot with Annual Means)

UT Neuse River (Big Ditch) (EEP Project ID No. 92682) (As-Built Baseline 2014)																			Annual Means	
			Plot 1		Plot 2		Plot 3		Plot 4		Plot 5		Plot 6		Plot 7		Plot 8		Plot 9		AB (2014)	
Scientific Name	Common Name	Type	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Amelanchier arborea	serviceberry	Tree	1	1																	1.0	1.0
Betula nigra	river birch	Tree	1	1			1	1	3	3			3	3							8.0	8.0
Carya alba	mockernut hickory	Tree													1	1			1	1	2.0	2.0
Carya glabra	pignut hickory	Tree			1	1	1	1			3	3	1	1	2	2	3	3			11.0	11.0
Chionanthus virginicus	white fringetree	Shrub Tree	1	1																	1.0	1.0
Diospyros virginiana	common persimmon	Tree			1	1	3	3	1	1							2	2			7.0	7.0
Fraxinus pennsylvanica	green ash	Tree			1	1	1	1			1	1									3.0	3.0
Liriodendron tulipifera	tuliptree	Tree	2	2	2	2	2	2	2	2	3	3	4	4	2	2					17.0	17.0
Ostrya virginiana	hophornbean		1	1																	1.0	1.0
Platanus occidentalis	American sycamore	Tree							1	1					2	2	2	2			5.0	5.0
Quercus nigra	water oak	Tree													2	2			6	6	8.0	8.0
Quercus pagoda	cherrybark oak	Tree			1	1			2	2	1	1	1	1	1	1	1	1	2	2	9.0	9.0
Quercus rubra	northern red oak	Tree	4	4	4	4	2	2	2	2	3	3	3	3			2	2	1	1	21.0	21.0
Plot Area (acres)			0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247		0.0247			
Species Count			6	6	6	6	6	6	6	6	5	5	5	5	6	6	5	5	4	4	5.4	5.4
Stem Count			10	10	10	10	10	10	11	11	11	11	12	12	10	10	10	10	10	10	10.4	10.4
Stems per Acre			405	405	405	405	405	405	445	445	445	445	486	486	405	405	405	405	405	405	10	423

UT Neuse (Big Ditch)
EEP Project # 92682

Final Planting List

Species	Number of Stems Planted
River Birch	400
Mockernut Hickory	200
Pignut Hickory	200
Green Ash	300
Yellow Poplar	600
Sycamore	400
Cherrybark Oak	400
White Oak	300
Northern Red Oak	300
Persimmon	200

Vegetation Plot #1 (15 January 2014, Baseline)

Vegetation Plot #2 (15 January 2014, Baseline)

Vegetation Plot #3 (15 January 2014, Baseline)

Vegetation Plot #4 (15 January 2014, Baseline)

Vegetation Plot #5 (15 January 2014, Baseline)

Vegetation Plot #6 (15 January 2014, Baseline)

Vegetation Plot #7 (15 January 2014, Baseline)

Vegetation Plot #8 (15 January 2014, Baseline)

Vegetation Plot #9 (15 January 2014, Baseline)

APPENDIX D
As-Built Plan Sheets

09/09/99

CONTRACT: UT TO NEUSE (BIG DITCH) SCO# 090776201

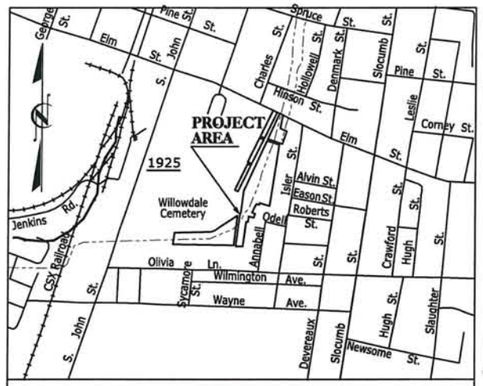
STATE		SHEET NO.	TOTAL SHEETS
N.C.	UT TO NEUSE (BIG DITCH)	1	5

RECORD DRAWINGS
UT TO NEUSE (BIG DITCH)

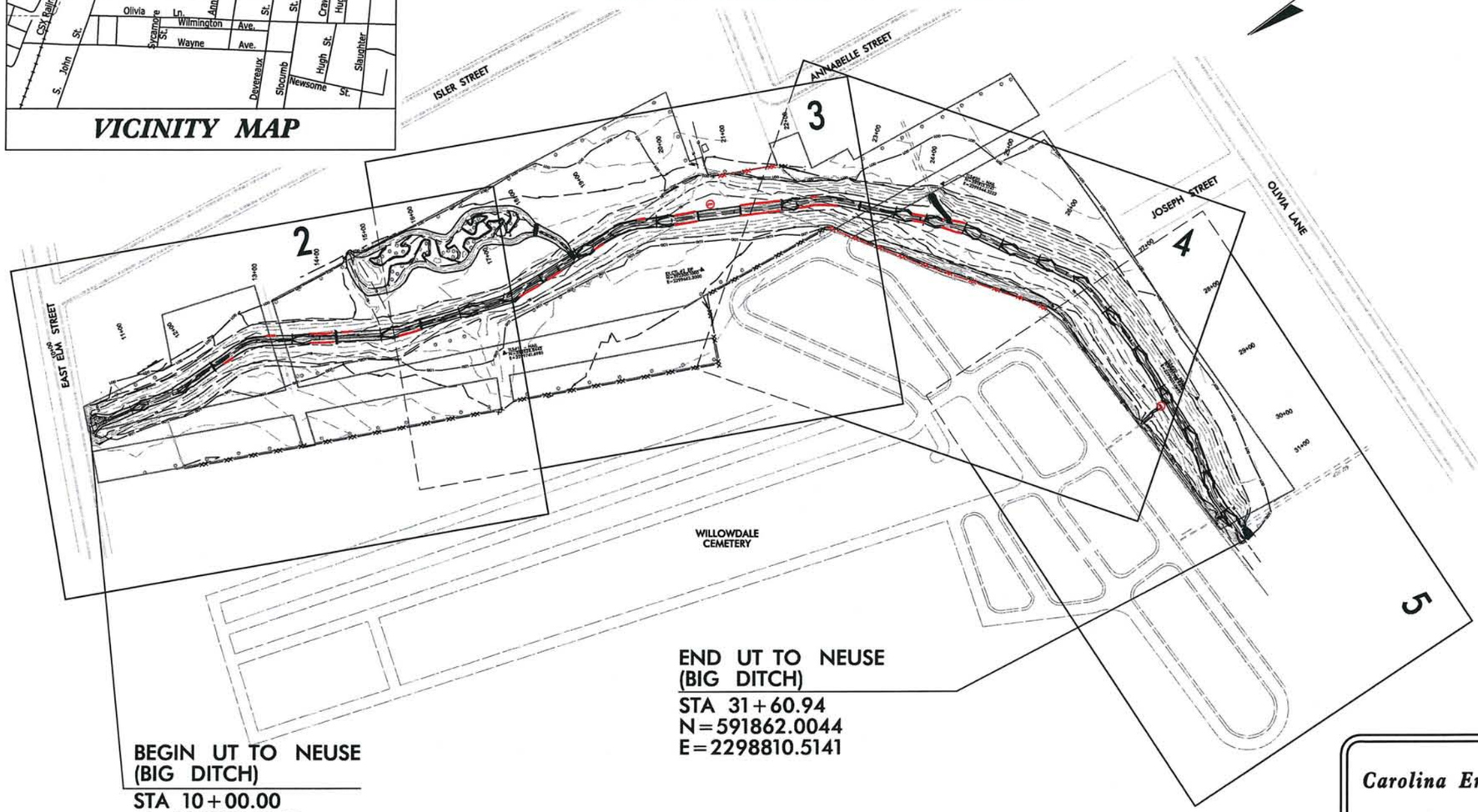
LOCATION: WAYNE COUNTY, NORTH CAROLINA

LAT: 35°22'24" N **LONG: 77°59'40" W**

TYPE OF WORK: RECORD DRAWINGS



VICINITY MAP



BEGIN UT TO NEUSE (BIG DITCH)
STA 10+00.00
N=593228.3048
E=2300042.9512

END UT TO NEUSE (BIG DITCH)
STA 31+60.94
N=591862.0044
E=2298810.5141

DISTURBED AREA = 11.13 AC.

CONVENTIONAL SYMBOLS

- Conservation Easement — E —
- Pipe Culvert
- Conc Headwall
- Sanitary Sewer — SS — SS —
- Fence Line — x — x — x —
- Single Tree
- Woods Line
- Thalweg
- Bankfull
- Limits Of Disturbance — LOD —
- Pre-Construction Top Of Bank — TB —
- Pre-Construction Thalweg
- Rip Rap
- Soil Lift
- Log Cross Vane
- Log Vane w/Sill
- Construction Revisions
- Log Sill
- Construction Revisions
- Floodplain Interceptor — FPI

NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH
10/22/13

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.

Constructed By:

Carolina Environmental Contracting, INC.
P.O. Box 1905
Mount Airy N.C. 27030
(336) 320-3849

GRAPHIC SCALES

50 25 0 50 100
PLANS

DESIGN DATA

DESIGN STREAM TYPE	=	B/E 6
BANKFULL AREA (FT^2) CROSS-SECTIONED	=	16.3
BANKFULL WIDTH (FT)	=	14.0
MAX DEPTH (FT)	=	1.75
WIDTH /DEPTH RATIO	=	12
DRAINAGE AREA (MI^2)	=	2.05
BANKFULL SLOPE(FT/FT)	=	0.0017

PROJECT LENGTH

EXISTING STREAM LENGTH	=	2,113.9 FT
PROPOSED DESIGN STREAM LENGTH	=	2,127.8 FT

R. KEVIN WILLIAMS
PROJECT ENGINEER

CHRISTOPHER L. SMITH
PROJECT DESIGNER

RYAN V. SMITH
PROJECT MANAGER

Prepared In the Office of:

ICA Engineering
f/k/a Florence & Hutcheson, Inc.

5121 Kingdom Way,
Suite 100
Raleigh, NC 27607
NC License No: F-0258

10/22/2013
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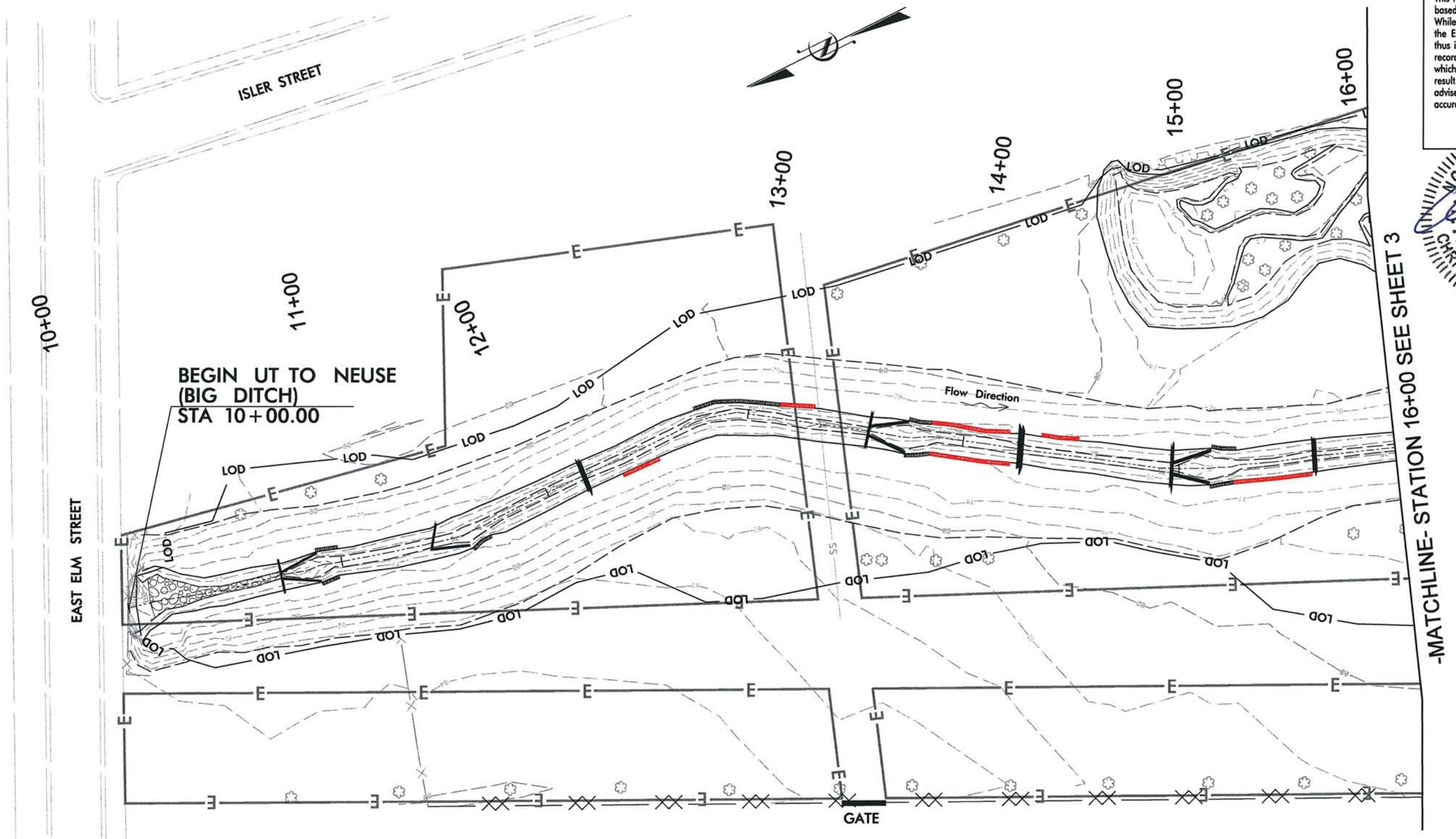
Florence & Hutcheson, Inc.

RECORD DRAWINGS



LEGEND

- CONSERVATION EASEMENT
- THALWEG
- BANKFULL
- LOD — LIMITS OF DISTURBANCE
- CONSTRUCTION REVISIONS
- FENCE
- RIP RAP
- SOIL LIFT
- BALL & BURLAP TREES
- LOG CROSS VANE
- LOG SILL
- LOG VANE W/SILL

NOTE:
SOIL LIFTS SHOWN AS CONSTRUCTION REVISIONS INSTALLED AFTER TROPICAL STORM ANDREA AS BANK STABILIZATION.

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.

NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH 10/22/13

ICA Engineering
(f/k/a Ferguson & Hutcheson, Inc.)
5121 Kingdom Way, Suite 100
Raleigh, NC 27607
NC License No: P-0258

UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 10+00 - STA 16+00

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 09-30-13

RECORD DRAWINGS

SHEET
2
OF 5

10/22/2013
H:\Construction\As_Built\UTNeuse_AsBuilts_psh_02.dgn

RECORD DRAWINGS

LEGEND

- CONSERVATION EASEMENT
- THALWEG
- BANKFULL
- LOD — LIMITS OF DISTURBANCE
- FENCE
- CONSTRUCTION REVISIONS
- FPI — FLOODPLAIN INTERCEPTOR
- BALL & BURLAP TREES
- RIP RAP
- SOIL LIFT
- LOG CROSS VANE
- LOG SILL
- LOG VANE W/SILL

NOTES:
1. SOIL LIFTS SHOWN AS CONSTRUCTION REVISIONS INSTALLED AFTER TROPICAL STORM ANDREA AS BANK STABILIZATION.
2. FENCE SHOWN AS CONSTRUCTION REVISIONS ADDED DURING CONSTRUCTION

TWO ADDITIONAL 1.5" DIAMETER HOLES INSTALLED IN OUTLET DEVICE TO DECREASE DRAW-DOWN TIME.

FPI Flow Direction

17+00 18+00 19+00 20+00 21+00 22+00

-MATCHLINE- STATION 16+00 SEE SHEET 2

-MATCHLINE- STATION 22+00 SEE SHEET 4

GATE

WILLOWDALE CEMETERY

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.

NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH 10/23/13

ICA Engineering (f/k/a Florence & Hutcheson, Inc.)
5121 Kingdom Way, Suite 100
Raleigh, NC 27607
NC License No: P1868

UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 16+00 – STA 22+00

GRAPHIC SCALE 50 25 0 25 PLANS

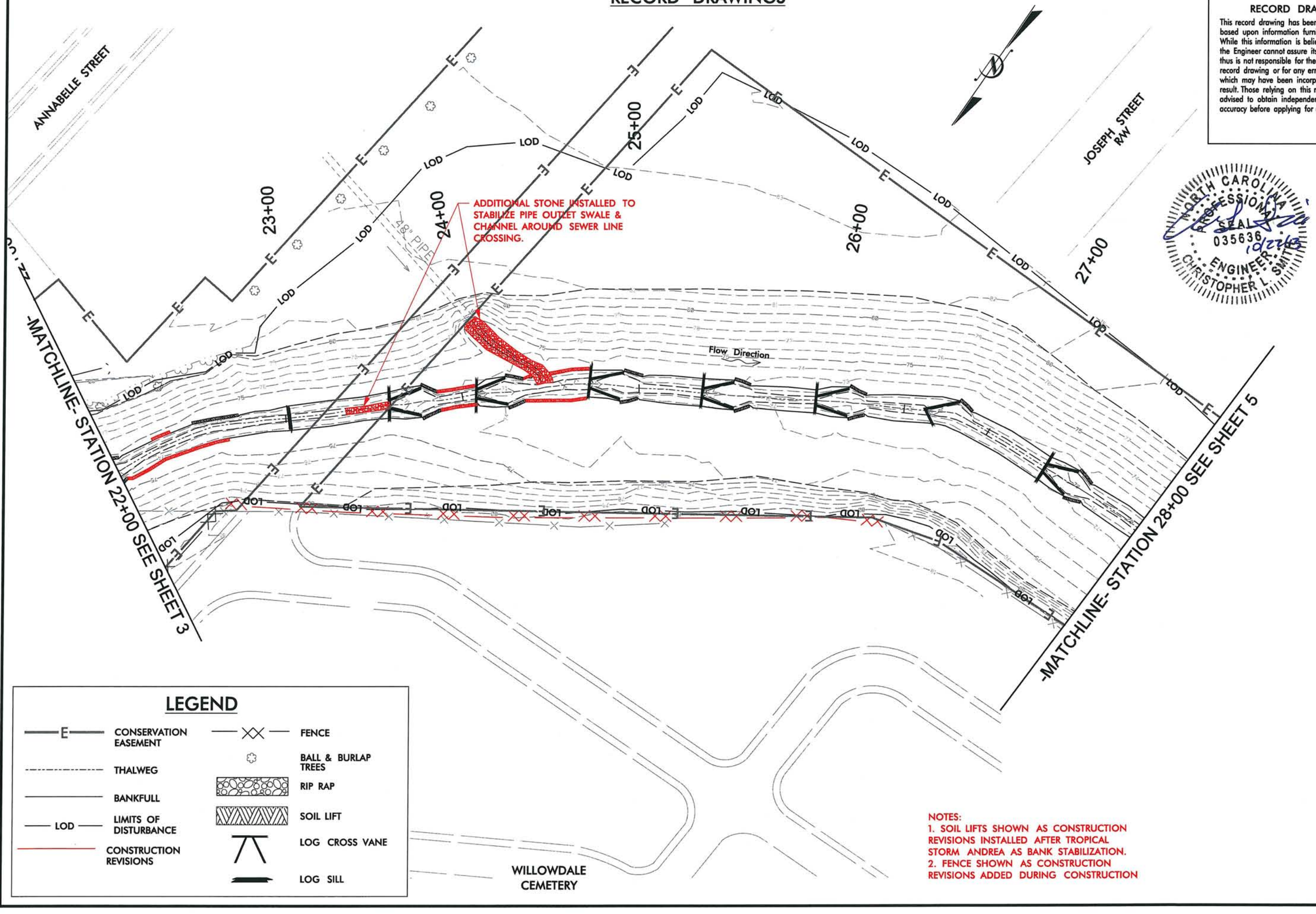
DATE: 09-30-13

RECORD DRAWINGS

SHEET 3 OF 5

10/23/2013
H:\Construction\As_Built\UTNeuse_AsBuilts_psh_03.dgn

RECORD DRAWINGS



LEGEND

- E — CONSERVATION EASEMENT
- THALWEG
- BANKFULL
- LOD — LIMITS OF DISTURBANCE
- CONSTRUCTION REVISIONS
- FENCE
- BALL & BURLAP TREES
- RIP RAP
- SOIL LIFT
- LOG CROSS VANE
- LOG SILL

NOTES:
1. SOIL LIFTS SHOWN AS CONSTRUCTION REVISIONS INSTALLED AFTER TROPICAL STORM ANDREA AS BANK STABILIZATION.
2. FENCE SHOWN AS CONSTRUCTION REVISIONS ADDED DURING CONSTRUCTION

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.

NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH

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(f/k/a Florence & Hutcheson, Inc.)

UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 22+00 - STA 28+00

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 09-30-13

RECORD DRAWINGS

SHEET 4 OF 5

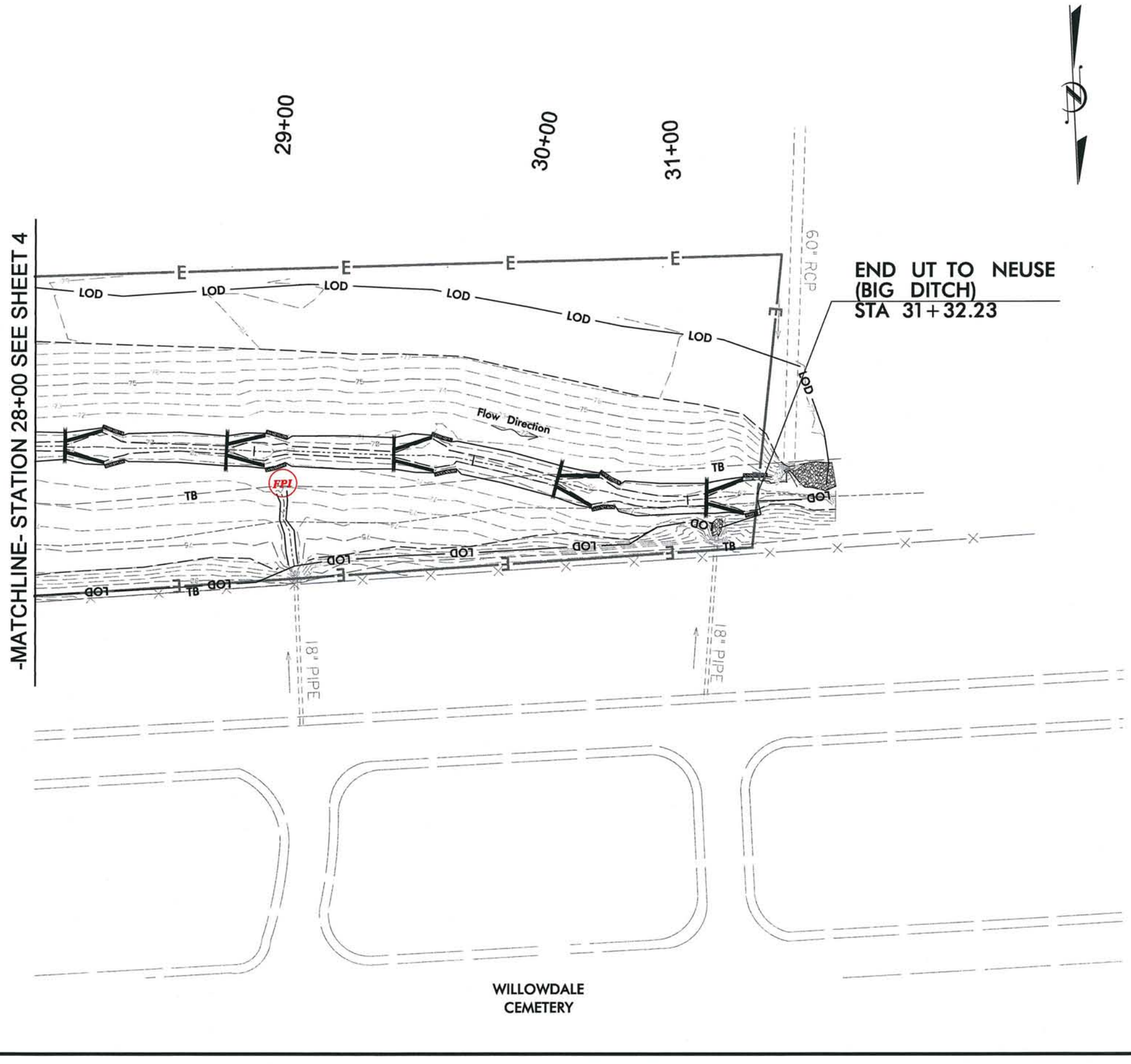
10/23/2013
R:\Construction\As_Built\UTNeuse_AsBuilts_psh_04.dgn

RECORD DRAWINGS

RECORD DRAWINGS

RECORD DRAWINGS

This record drawing has been prepared in part, based upon information furnished by others. While this information is believed to be reliable, the Engineer cannot assure its accuracy, and thus is not responsible for the accuracy of this record drawing or for any errors or omissions which may have been incorporated into it as a result. Those relying on this record document are advised to obtain independent verification of its accuracy before applying for any purpose.



LEGEND

- E — CONSERVATION EASEMENT
- THALWEG
- BANKFULL
- LOD — LIMITS OF DISTURBANCE
- FENCE
- CONSTRUCTION REVISIONS
- RIP RAP
- SOIL LIFT
- LOG CROSS VANE
- FPI — FLOODPLAIN INTERCEPTOR

NORTH CAROLINA PROFESSIONAL SEAL 035636 ENGINEER CHRISTOPHER L. SMITH 10/22/13

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UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 28+00 – STA 31+32.23

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 09-30-13

RECORD DRAWINGS

SHEET 5 OF 5

10/22/2013
R:\Construction\As Built\UTNeuse_AsBuilts_psh_05.dgn
Florence & Hutcheson, Inc.

APPENDIX E
Credit Calculation Documentation and Figures

Appendix E: Credit Calculation Documentation and Figures

The following tables and figures were prepared to document the methods used in determining stream restoration (SR), riparian buffer restoration (RBR), nutrient offset pound reduction (NO lb.), and nutrient offset buffer restoration (NOBR) credits for the Project.

Stream Restoration credit was based on a one to one ratio.

Riparian buffer areas were measured for four different categories: areas with less than 50' buffer, areas with a 50' buffer, areas with a buffer greater than 50' and up to 100' and areas with a buffer greater than 100' and up to 200'. Stream and Riparian Buffer restoration credits were calculated based a memo dated August 9, 2013 titled *DWR responses to the EEP document "Reforms needed immediately in the regulation of riparian buffer mitigation"* which is attached to this appendix. Per the memo, the buffer zones of 50' and 50' – 100' were given a one to one mitigation ratio. The buffer zone of 100' – 200' was given a four to one mitigation ratio. Riparian Buffer restoration areas may be used for stream & wetland mitigation, stream & riparian buffer mitigation, or nutrient offset buffer restoration credit (Estimating/Calculating Riparian Buffer Credits, EEP PPPM Section 8.3.1.2).

Stream lengths and buffer areas were outlined and measured in MicroStation. For each buffered ditch entering the project area, 0.10 acres was deducted from the corresponding buffer area (DWQ Memo #2008-019, dated August 19, 2008).

The stormwater wetland BMP footprint within the conservation easement were not included in riparian buffer acreage calculations.

Neuse Riparian Buffer Restoration Credits (RBR)

Riparian Buffer Restoration Credit Summary					
	50' Gross Area	50' - 100' Gross Area	100' - 200' Gross Area	50' - 200' Adjusted Area*	Credit Yield**
UT Neuse (SF)	157,756	107,778	78,632	19,658	285,192
UT Neuse (AC)	**3.62**	**2.47**	**1.81**	**0.45**	**6.55**

* Areas adjusted by 25% based on the memo "DWR responses to the EEP document "Reforms needed immediately in the regulation of riparian buffer mitigation" dated August 9, 2013

** - Credit Yield is the sum of 50', 50'-100' area and 100' - 200' adjusted area

Neuse Nutrient Offset Pound Reduction Credits (NO lb.)

Nutrient Offset Pound Reduction Credit Summary				
BMP	Pre-Existing Annual Total Nitrogen Load (lb/yr)	Annual Total Nitrogen Load w/ BMP (lb/yr)	Annual Total Nitrogen Load Reduction (lb/yr)	30 yr. Total Nitrogen Reduction (lbs)
Stormwater Wetland	121	72	49	1470

Neuse Nutrient Offset Buffer Restoration Credits (NOBR)

Nutrient Offset Buffer Restoration Credit Summary								
	<= 50'		50' - 100'		100' - 200'		Total	
	Area (ac)	Nitrogen Credits*	Area (AC)	Nitrogen Credits**	Area (AC)	Nitrogen Credits**	Area (ac)	Nitrogen Credits**
UT Neuse	4.28	0	2.47	5,624	1.81	4,103	8.56	9,727

* - In accordance with EEP PPPM Section 8.3.1.2, *Estimating/Calculating Riparian Buffer Credits* , no Nitrogen Credits were calculated for 0-50' buffer area.

** - Nitrogen Credits were calculated based on a rate of 2,273 lbs per acre over 30 years per DWQ policy (*Estimating/Calculating Riparian Buffer Credits, EEP PPPM Section 8.3.1.2*)

UT Neuse - Riparian Buffer Restoration Area Calculations																			
	Left Bank																		
	< 50'						50'						50' - 100'				100' - 200'			
	Beg Sta.	End Sta.	Area (sf)	# Ditches	Deduct (sf)*	Net Area (sf)	Beg Sta.	End Sta.	Area (sf)	# Ditches	Deduct (sf)*	Net Area (sf)	Beg Sta.	End Sta.	Area (sf)	Net Area (sf)	Beg Sta.	End Sta.	Area (sf)	Net Area (sf)
	10+00	11+74	5019			5019	11+74	13+21	7884			7884	11+74	13+07	6036	6036	11+96	12+19	73	73
	22+28	22+35	409			409	13+42	22+28	44554			44554	13+27	22+28	26286	26286	14+18	14+49	165	165
	23+30	23+19	1477			1477	22+35	23+30	5138			5138	22+37	24+47	7069	7069	14+73	20+41	22545	22545
	23+70	24+28	1600			1600	24+28	31+33	36908	1	4356	32552	24+22	31+38	27189	27189	22+16	22+23	15	15
																	23+30	24+47	11754	11754
																	24+71	26+62	8341	8341
																	30+60	31+43	59	59
Total						8,505						90,128				66,579				42,952
	Right Bank																		
	< 50'						50'						50' - 100'				100' - 200'			
	Beg Sta.	End Sta.	Area (sf)	# Ditches	Deduct (sf)*	Net Area (sf)	Beg Sta.	End Sta.	Area (sf)	# Ditches	Deduct (sf)*	Net Area (sf)	Beg Sta.	End Sta.	Area (sf)	Net Area (sf)	Beg Sta.	End Sta.	Area (sf)	Net Area (sf)
	09+82	10+84	1132			1132	11+99	13+37	5644			5644	09+78	12+20	8519	8519	10+81	13+72	6645	6645
	10+00	11+99	4072			4072	13+62	14+80	6327			6327	11+99	13+44	1788	1788	13+74	16+42	14389	14389
	14+80	15+56	4186			4186	15+56	22+03	32295			32295	13+67	14+80	6327	6327	16+76	20+36	10141	10141
	22+03	22+66	3015			3015	23+49	29+28	27718	1	4356	23362	14+44	15+81	804	804	17+97	20+84	4506	4506
	23+01	23+49	1198			1198							15+56	22+03	19525	19525				
	29+28	31+29	6464			6464							23+48	29+28	4237	4237				
Total						20,068						67,628				41,199				35,680
* - For each buffered ditch entering the project area, 0.10 acres was deducted from the corresponding buffer area per Scenario 1 in the *DWQ Memo #2008-019, dated August 19, 2008.*																				

09/08/99

CONTRACT: UT TO NEUSE (BIG DITCH) DENR# D090525

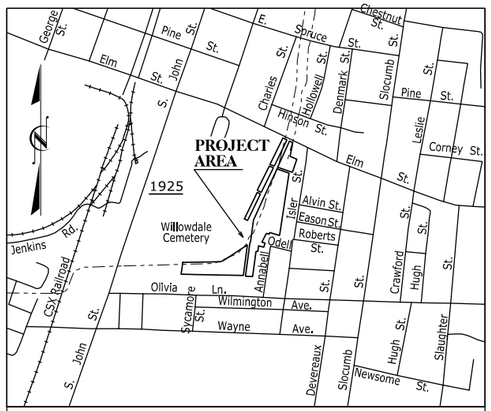
STATE		SHEET NO.	TOTAL SHEETS
N.C.	UT TO NEUSE (BIG DITCH)	1	5

CREDIT CALCULATION FIGURES
UT TO NEUSE (BIG DITCH)

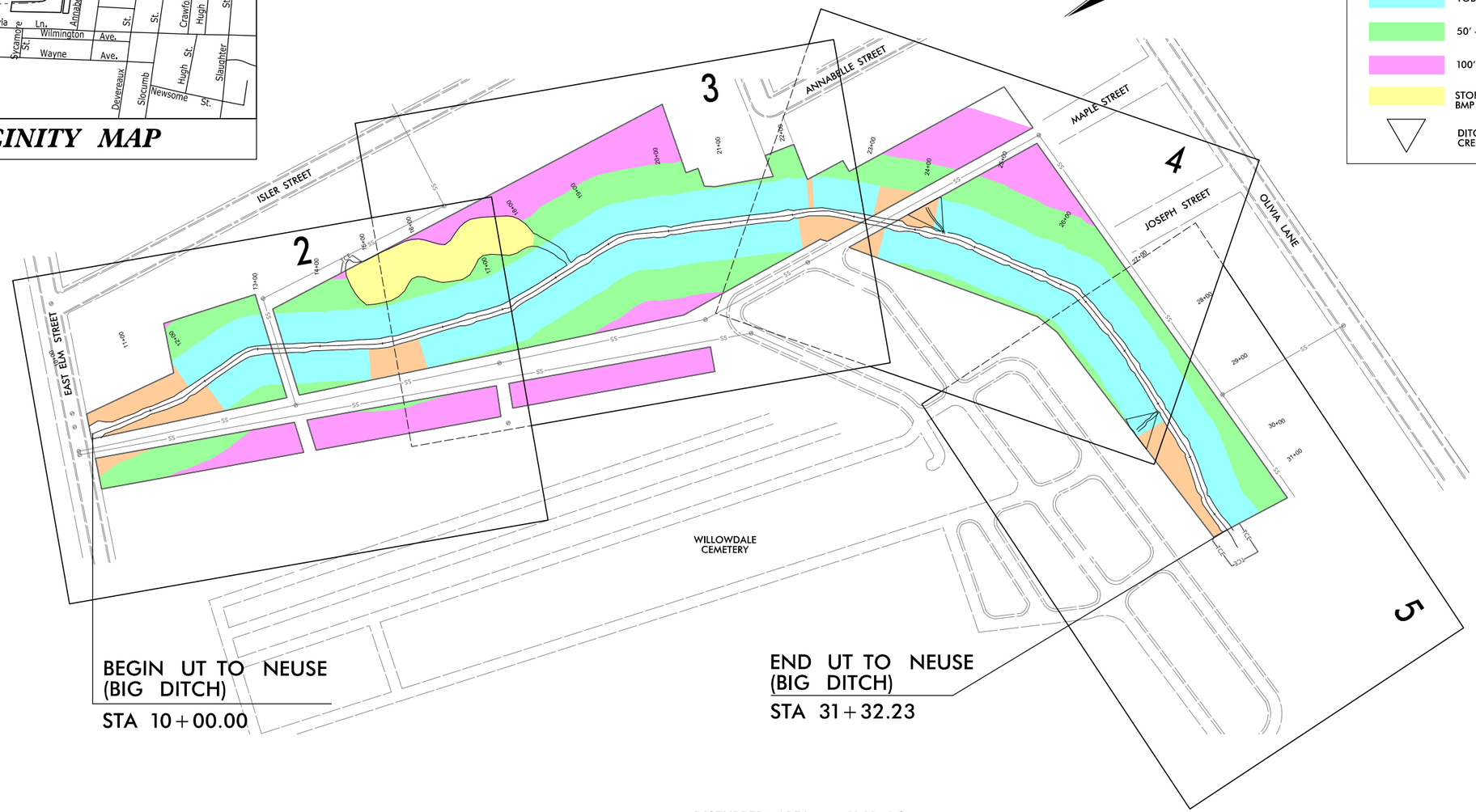
LOCATION: WAYNE COUNTY, NORTH CAROLINA

LAT: 35°22'24" N ***LONG: 77°59'40" W***

TYPE OF WORK: MONITORING PLANS



VICINITY MAP



DISTURBED AREA = 11.13 AC.

GRAPHIC SCALES

50 25 0 50 100
PLANS

DESIGN DATA

DESIGN STREAM TYPE	=	B/E 6
BANKFULL AREA (FT^2) CROSS-SECTIONED	=	16.3
BANKFULL WIDTH (FT)	=	14.0
MAX DEPTH (FT)	=	1.75
WIDTH /DEPTH RATIO	=	12
DRAINAGE AREA (MI^2)	=	2.05
BANKFULL SLOPE(FT/FT)	=	0.0017

PROJECT LENGTH

EXISTING STREAM LENGTH	=	2,113.9 FT
PROPOSED DESIGN STREAM LENGTH	=	2,127.8 FT

R. KEVIN WILLIAMS
PROJECT ENGINEER

CHRISTOPHER L. SMITH
PROJECT DESIGNER

RYAN V. SMITH
PROJECT MANAGER

Prepared In the Office of:

ICA Engineering
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Raleigh, NC 27607
NC License No: F-0258

4/17/2014
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Florence & Hutcheson, Inc.

INCOMPLETE PLANS

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

ISLER STREET

EAST ELM STREET

10+00

11+00

12+00

13+00

14+00

15+00

16+00

BEGIN UT TO NEUSE
(BIG DITCH)
STA 10+00.00

-MATCHLINE- STATION 16+00 SEE SHEET 3

Flow Direction

E

SS

LEGEND

- CONSERVATION EASEMENT
- THALWEG
- ASBUILT BANKFULL
- < 50' BUFFER
- TOB to 50' BUFFER
- 50' – 100' BUFFER
- 100' – 200' BUFFER
- STORMWATER BMP
- DITCH BUFFER CREDIT REDUCTION

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UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 10+00 – STA 16+00

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 02-25-14

CREDIT CALCULATION FIGURE

SHEET
2
OF 5

4/17/2014
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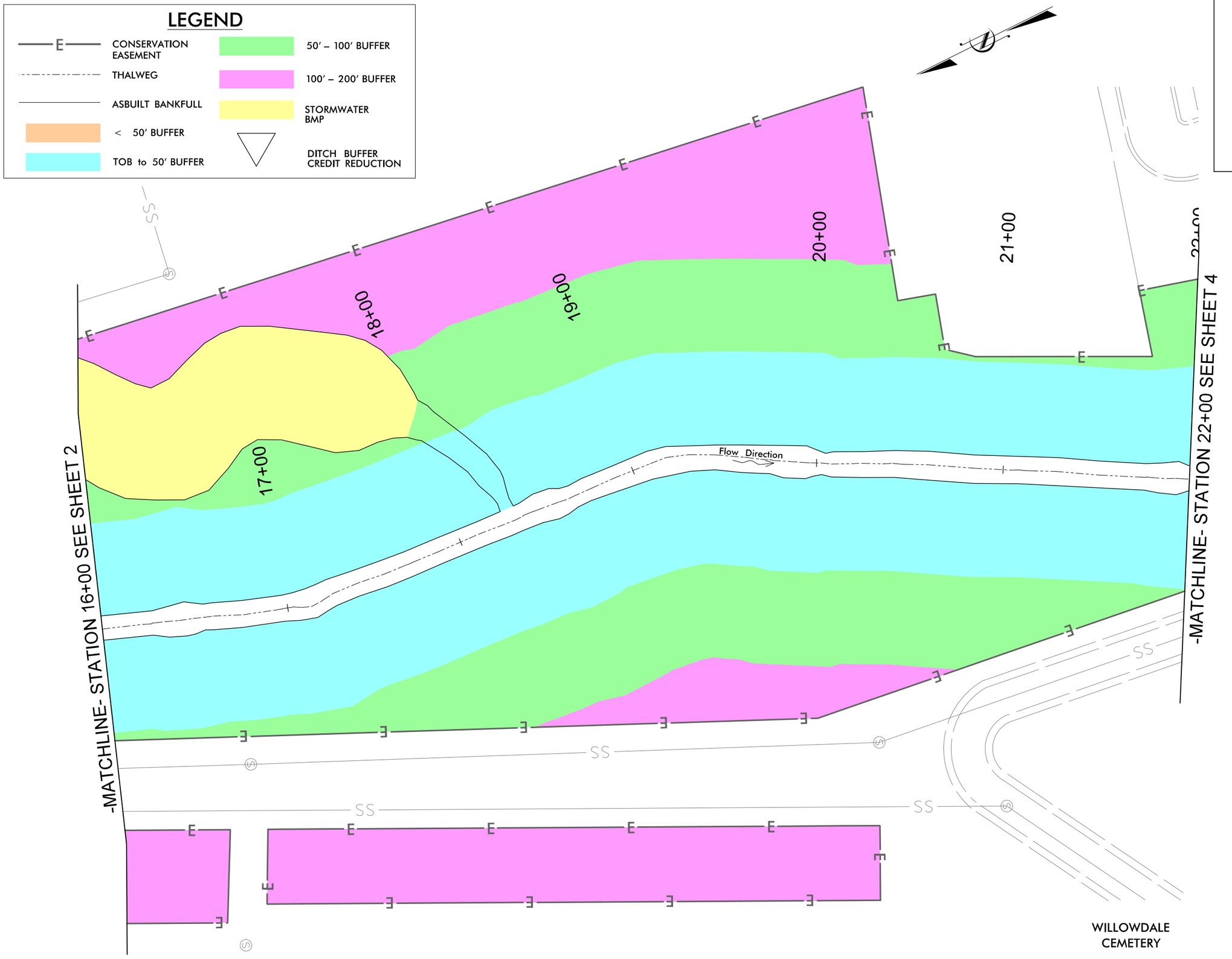
Engineering Licensee No. P0265

LEGEND

- E — CONSERVATION EASEMENT
- THALWEG
- ASBUILT BANKFULL
- < 50′ BUFFER
- TOB to 50′ BUFFER
- 50′ – 100′ BUFFER
- 100′ – 200′ BUFFER
- STORMWATER BMP
- DITCH BUFFER CREDIT REDUCTION



INCOMPLETE PLANS

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

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Raleigh, NC 27607
NC License No: F-0258

UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 16+00 – STA 22+00

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 02-25-14

CREDIT CALCULATION FIGURE

SHEET
3
OF 5

4/17/2014
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Preferred by Intergraph Corporation

INCOMPLETE PLANS

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

ANNABELLE STREET

JOSEPH STREET
R/W

23+00

24+00

25+00

26+00

27+00

-MATCHLINE- STATION 22+00 SEE SHEET 3

-MATCHLINE- STATION 28+00 SEE SHEET 5

Flow Direction

WILLOWDALE
CEMETERY

LEGEND

- CONSERVATION EASEMENT
- THALWEG
- ASBUILT BANKFULL
- < 50' BUFFER
- TOB to 50' BUFFER
- 50' – 100' BUFFER
- 100' – 200' BUFFER
- STORMWATER BMP
- DITCH BUFFER CREDIT REDUCTION

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UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 22+00 – STA 28+00

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 02-25-14

CREDIT CALCULATION FIGURE

SHEET
4
OF 5

4/17/2014
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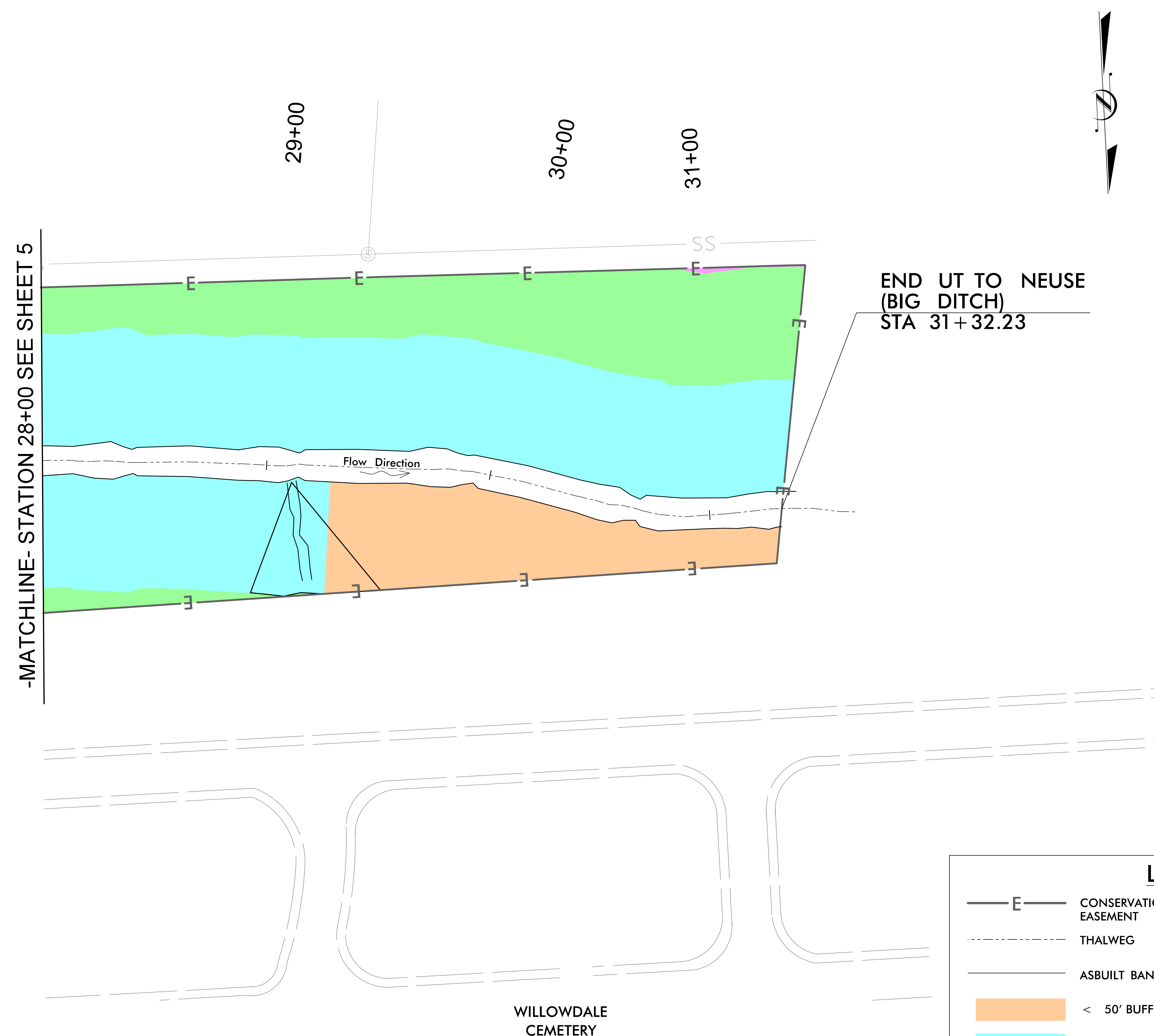
Environmental Resource Solutions



INCOMPLETE PLANS

PRELIMINARY PLANS
DO NOT USE FOR CONSTRUCTION

LEGEND

—E—	CONSERVATION EASEMENT	(green)	50' – 100' BUFFER
- - -	THALWEG	(pink)	100' – 200' BUFFER
——	ASBUILT BANKFULL	(yellow)	STORMWATER BMP
(orange)	< 50' BUFFER	▽	DITCH BUFFER CREDIT REDUCTION
(cyan)	TOB to 50' BUFFER		

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UT TO NEUSE (BIG DITCH)
STREAM RESTORATION PROJECT
WAYNE COUNTY, NORTH CAROLINA
STA 28+00 – STA 31+32.23

GRAPHIC SCALE
50 25 0 25
PLANS

DATE: 02-25-14

CREDIT CALCULATION FIGURE

SHEET
5
OF 5

4/17/2014
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