FINAL

Baseline Monitoring Document and As-Built Baseline Report

St. Clair Creek Restoration Project

Beaufort County, North Carolina

EEP Project ID No. 95015

Tar-Pamlico River Basin: 03020104-040040

Prepared for:

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

Data Collection Period – May-June 2014

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1.0 EXECUTIVE SUMMARY

Michael Baker Engineering, Inc. (Baker) restored 3,926 linear feet (LF) of perennial and intermittent stream, 2.8 acres (AC) of riparian wetlands, and planted 17.5 acres (AC) of native riparian vegetation within the entire conservation easement along two unnamed tributaries (UT2 and UT3) to St. Clair Creek in Beaufort County, North Carolina (NC) (Figure 1). The St. Clair Creek Restoration Project (Site) is located in in Beaufort County, approximately five miles east of the Town of Bath. The Site is located in the NC Division of Water Resources (NCDWR) subbasin 03-03-07 and the Targeted Local Watershed (TLW) 03020104-040040 of the Tar-Pamlico River Basin. The project involved the restoration of a Coastal Plain Headwater Small Stream Swamp system (NC WAM 2010, Schafale and Weakley 1990) from impairments within the project area due to past agricultural conversion and silviculture.

The primary restoration goals of the project were to improve ecological functions to the impaired areas within the Tar-Pamlico River Basin as described below:

- Create geomorphically stable conditions along the unnamed tributaries across the project,
- Implement agricultural BMPs to reduce nonpoint source inputs to the downstream estuary,
- Protect and improve water quality by reducing nutrient and sediment inputs,
- Restore stream and wetland hydrology by connecting historic flow paths and promoting natural flood processes, and
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.

To accomplish these goals, the following objectives were identified:

- Restore existing channelized streams by restoring the relic headwater valley and allowing diffuse flow, providing the streams access to their floodplains,
- Increase aquatic habitat value by allowing natural microtopography to form,
- Plant native species riparian buffer vegetation within the headwater valley and floodplain areas, and within the wetland areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, decrease erosion, and shade the stream to decrease water temperature,
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature, and
- Control invasive species vegetation within the project area and if necessary continue treatments during the monitoring period.

The project as-built condition closely mimics that proposed by the design. Differences are outlined below:

- No emergency overflow was constructed along UT3 due to the capacity of the proposed culverts.
- A ford crossing was constructed outside of the conservation easement boundary along UT2 at approximate station 35+75 at the landowner's request.
- Due to bare-root shrub availability, some species proposed in the Mitigation Plan differ from shrub species actually planted within the buffer area following construction. The understory species Titi (*Cyrilla racemiflora*), swamp doghobble (*Leucothoe racemosa*), Fetterbush (*Lyonia lucida*) and Virginia sweetspire (*Itea virginica*) were not planted on the Site. Instead, the aforementioned species were substituted with these understory species: beautyberry (*Callicarpa americana*), swamp dogwood (*Cornus foemina*), wax myrtle (*Morella cerifera*), Blueberry (*Vaccinium corymbosum*),

Arrowwood (*Viburnum dentatum*), swamp rose (*Rosa palustris*), inkberry (*Ilex glabra*) and Chokeberry (*Aronia arbutifolia*). Sixty-one percent of the riparian buffer species are overstory trees. The remaining thirty-nine percent of species are understory shrubs and twenty-one percent of these species were substituted with species of similar quantities for the riparian wetland planting areas.

This report documents the completion of the restoration construction activities and presents as-built monitoring data for the post-construction monitoring period. Table 1 summarizes project conditions before and after restoration, as well as the conditions predicted in the previously approved project Mitigation Plan. Table 1 is located in Appendix A.

2.0 PROJECT GOALS, BACKGROUND AND ATTRIBUTES

2.1 Project Location and Description

The Site is located in Beaufort County, NC, approximately five miles east of the Town of Bath, as shown on the Vicinity Map (Figure 1). The project is located in the NC Division of Water Quality (NCDWQ) sub-basin 03-03-07 of the Tar-Pamlico River Basin and hydrologic unit 03020104-040040. The project includes two unnamed headwater tributaries (UTs) to St. Clair Creek and areas of previously disturbed wetlands and is located in the Mid-Atlantic Coastal Plain physiographic region.

Reach UT2 is shown as a solid blue-line stream on the USGS topographic quadrangle map. UT2 is also shown as a perennial stream along the lower portions of the Site on the Beaufort County Soil Survey. UT3 is not shown on the USGS or County Soil Survey; however, the presence of historic valleys can be seen from LiDAR imagery for the Site and observed during field investigations.

As stated in the Site's Mitigation Plan, based on field observations and the available drainage area of UT2 (89 acres), the stream was determined to be a perennial stream channel and appropriate for use with the Coastal Plain headwater stream guidance. Reach UT3 was determined to be an intermittent stream channel, and appropriate for use with the Coastal Plain headwater stream guidance due to the defined valley signature.

2.2 Site Directions

The Site is located in Beaufort County, NC, approximately five miles east of the Town of Bath, as shown on the Project Site Vicinity Map (Figure 1). To access the site from Raleigh, follow Interstate 40 east to Interstate 440 west and take the US Highway 264 east exit. Before the City of Greenville, NC, take exit 73B to stay on US 264 east towards Washington, NC. From Washington, stay on US 264 east until NC 92/99 splits to the right from US 264 east. Take NC 92/99 for approximately 11 miles and turn left onto Peoples Road. Continue on Peoples Road for approximately 2 miles. Access to the site is via the farm road on the right.

2.3 Project Goals and Objectives

The primary restoration goals of the project were to improve ecological functions to the impaired areas within the Tar-Pamlico River Basin as described below:

- Create geomorphically stable conditions along the unnamed tributaries across the project,
- Implement agricultural BMPs to reduce nonpoint source inputs to the downstream estuary,
- Protect and improve water quality by reducing nutrient and sediment inputs,
- Restore stream and wetland hydrology by connecting historic flow paths and promoting natural flood processes, and
- Restore and protect riparian buffer functions and corridor habitat in perpetuity by establishing a permanent conservation easement.

To accomplish these goals, the following objectives were identified:

- Restore existing channelized streams by restoring the relic headwater valley and allowing diffuse flow, providing the streams access to their floodplains,
- Increase aquatic habitat value by allowing natural microtopography to form,

- Plant native species riparian buffer vegetation within the headwater valley and floodplain areas, and within the wetland areas, protected by a permanent conservation easement, to increase stormwater runoff filtering capacity, decrease erosion, and shade the stream to decrease water temperature,
- Improve aquatic and terrestrial habitat through improved substrate and in-stream cover, addition of woody debris, and reduction of water temperature, and
- Control invasive species vegetation within the project area and if necessary continue treatments during the monitoring period.

Based on the NC Ecosystem Enhancement Program's (NCEEP) 2010 Tar-Pamlico River Basin Restoration Priorities (RBRP) Plan, the St. Clair Creek Restoration Project area is located in an existing targeted local watershed (TLW) within the Tar-Pamlico River Basin. The restoration strategy for the Tar-Pamlico River Basin targeted specific projects that would promote nutrient and sediment reduction in agricultural areas by restoring and preserving wetlands, streams, and riparian buffers. The proposed project aligns with RBRP priorities, which focus on restoring ditched streams and projects that reduce sediment and nutrient impacts.

3.0 PROJECT STRUCTURE, RESTORATION TYPE AND APPROACH

3.1 Project Components

The project area consists of the restoration of two unnamed headwater tributaries (UTs) to St. Clair Creek (UT2 and UT3), and areas of previously disturbed riparian headwater wetlands. Restoration practices involved raising the existing streambed and reconnecting the stream to the historic floodplain and restoring diffuse flows to abandoned wetland floodplains and hydric soils areas previously drained by ditching activities. The existing ditches within the project area were partially to completely filled to decrease surface and subsurface drainage and raise the local water table. Native species riparian buffer vegetation was established and/or protected at least 50 feet from the valley center line along both sides of both project reaches.

3.2 Restoration Approach

Based on the post-construction as-built survey, the project consisted of 2,644 LF of restoration on UT2 and 1,282 LF of restoration on UT3. In addition, the project restored a total of 2.8 acres of riparian wetlands. A conservation easement consisting of 17.5 acres will protect and preserve all stream reaches, wetland areas, and riparian buffers in perpetuity.

The restoration design for the wetlands are based on a targeted "Coastal Plain small stream swamp" riparian wetland type, as identified by Schafale and Weakley (1990). Hydrology of this system will be palustrine, "intermittently, temporarily, or seasonally flooded". The revegetation plan for the overall riparian system is composed of native riparian communities identified by Schafale and Weakley (1990) that include "Coastal Plain Small Stream Swamp" and "Coastal Plain Bottomland Hardwood" (Appendix D).

The restoration approach consisted of grading the historic valley topography, returning the flow to the valley, and filling the channelized portions of stream and ditches. The system will be allowed to form a multi-thread channel naturally to restore historic flow patterns. Riparian buffers of at least 50 feet wide (100-foot total minimum width) were established or protected along both sides of the centerline of the restored valley and all buffer areas are protected by a perpetual conservation easement

The site was planted with native species vegetation as shown in Table 6 and Table 7 (Appendix C) and are protected through a permanent conservation easement. Table 1 and Figure 2 (Appendix A) provide a summary of the project components.

3.2.1 UT2 Restoration

The restoration of UT2 considered the USACE and NCDWQ guidance document entitled "Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina." Based on the average valley slope (0.001 foot/foot) and catchment areas (UT2 89 AC), this area most likely functioned prior to disturbance as a headwater stream and wetland system (Rosgen 'DA' stream type). Rather than the construction of a defined single thread channel, the current channelized stream was filled and graded back to topographic contours that approximate the pre-drained condition. Field surveys were conducted to determine the elevation of the stream where it comes onto the project property, and the valley topographic elevations downstream.

The restoration of UT2 ends near the culverted crossing at approximately Station 36+50. At this location, the UT2 channel will flow through the proposed culverts and connect with the existing, stable single thread channel prior to its confluence with the larger St. Clair Creek system.

3.2.2 UT3 Restoration

The restoration of UT3 considered the USACE and NCDWQ guidance document entitled "Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina." Based on the average valley slope (0.001 foot/foot) and catchment areas (UT2 30 AC), this area most likely functioned prior to disturbance as a headwater stream and wetland system (Rosgen 'DA' stream type). Rather than the construction of a defined single thread channel, the current channelized stream was filled and graded back to topographic contours that approximate the pre-drained condition. Field surveys were conducted to determine the elevation of the stream where it comes onto the project property, and the valley topographic elevations downstream.

The construction along UT3 ended near the culverted crossing at approximately Station 18+50. The restored stream downstream of the crossing flows through a previously identified jurisdictional wetland where prior disturbances to the historic flow path were located. Only minor grading was performed in this area to remove fill that was placed for a farm road. At the end of UT3, the channel was allowed to flow into the existing headwater stream and wetland system prior to the system's confluence with the larger St. Clair Creek system.

3.2.3 Wetland Restoration

The restoration design for the wetland was based on a targeted "Coastal Plain small stream swamp" riparian wetland type, as identified by Schafale and Weakley (1990). Hydrology of this system is palustrine, "intermittently, temporarily, or seasonally flooded", as the restored valley and multi-thread channel is designed to flood frequently. Hydrology has been increased by filling numerous drainage ditches that served to drain the site for agricultural use, and by returning the channelized headwater streams back to their historic flow paths.

3.3 Project History, Contacts, and Attribute Data

Baker implemented the project under a full delivery contract with NCEEP to provide stream and wetland mitigation credits in the Tar-Pamlico River Basin. The chronology of the project is presented in Table 2. The contact information for all designers, contractors, and relevant suppliers is presented in Table 3. Relevant Project background information is presented in Table 4. Tables 2, 3, and 4 are located in Appendix A of this report. As-built stationing is outlined in the Construction Summary, below, and in Table 1 in Appendix A.

3.3.1 Construction Summary

In accordance with the approved Mitigation Plan and regulatory permits, construction began with site preparation, installation of sedimentation and erosion control measures, and the establishment of staging areas, haul roads, and stockpile areas. Materials were stockpiled as needed for the initial stages of construction. Suitable fill material was harvested from a borrow area and placed on-site within the existing channel bed and drainage swale fill areas. The construction contractor was River Works, Inc. (River Works) and construction began in December 2013.

Prior to construction, the landowner harvested the pine timber within the conservation easement. Construction began on the downstream portion of UT2 at Station 36+50 with the installation of the culverts and proceeded upstream along UT2 clearing as needed. The work did not involve the construction of a defined single thread channel, but rather the current channelized stream was filled and graded back to natural topographic contours. The entire length UT2 was designed as a multi-thread system; therefore, the construction of a single channel bed was not utilized. Instead, a wider floodplain was graded as to let higher flow energies dissipate across the land surface and form a braided stream system. The as-built length (valley length) of UT2 after construction is 2,644 LF.

Work along UT3 began on the upstream portion of UT3 and proceeded downstream through the wooded area taking care not to disturb mature hardwood trees within this area. The work did not involve the construction of a defined single thread channel, but rather the current channelized stream was filled and graded back to natural topographic contours. The entire length UT3 was designed as a multi-thread system; therefore, the construction of a single channel bed was not utilized. Instead, a wider floodplain was graded as to let higher flow energies dissipate across the land surface and form a braided stream system. The as-built length (valley length) of UT3 after construction is 1,282 LF.

All riparian buffer areas within the project boundaries are a minimum of fifty feet along both sides from the centerline of the constructed valley and are protected in perpetuity by a conservation easement that totals 17.5 acres. Fencing was not installed along the conservation easement boundary.

As-built plan sheets/record drawings depict actual surveyed areas with the project area and depict any changes from the construction drawings to what was implemented on-site during construction. The as-built plan sheets/record drawings are located in Appendix D. The as-built results for the project totaled 3,926 LF of stream and 2.8 AC of wetland and are outlined in Table 1.

Upon completion of stream work within the site, sedimentation and erosion control measures such as temporary stream crossings, rock check dams, and silt fence were removed and all disturbed areas were stabilized with temporary and permanent seed and mulch before leaving the site. In addition, the planting of bare-root trees and shrubs, as well as wetland plantings, were completed in April 2014. Baker and River Works met on-site April 24, 2014 and conducted a preliminary final walk through inspection, and generated a punch-list of final items to be completed. River Works completed this punch list and demobilized in May 2014 after the final walk inspection through on May 8, 2014.

4.0 PERFORMANCE STANDARDS

Baker has been involved in obtaining recent approvals from the regulatory agencies for several Coastal Plain stream and wetland mitigation plans. The success criteria for the project site will follow the mitigation plans developed for these projects, as well as the Stream Mitigation Guidelines (SMG) (USACE 2003 and NCDWQ 2003) and NCEEP's supplemental guidance document *Monitoring Requirements and Performance Standards for Stream and/or Wetland Mitigation* dated November 7, 2011. Additionally, the USACE and NCDWR Guidance Document *Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina* will be referenced for monitoring purposes. All monitoring activities will be conducted for a period of 7 years, unless the site demonstrates complete success by Year 5 and no concerns have been identified. An early closure provision may be requested by the provider for some or all of the monitoring components. Early closure may only be obtained through written approval from the USACE in consultation with the NC Interagency Review Team (NCIRT).

For Reaches UT2 and UT3, which involve the restoration of the historic flow pattern as a multi-thread headwater stream system that was constructed as a broad valley with shallow flow paths, monitoring will focus primarily on visual assessments and flow documentation. It shall be consistent with the requirements described in the Federal Rule for compensatory mitigation sites in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.5 paragraphs (a) and (b).

5.0 MONITORING PLAN AND SUCCESS CRITERIA

5.1 Stream Monitoring – Reach UT2 & UT3

Geomorphic monitoring of Reaches UT2 and UT3 will conducted once a year for seven years following the completion of construction to evaluate the effectiveness of the restoration practices. Since this approach involved the restoration of historic flow patterns and flooding functions in a multi-thread headwater stream system, monitoring efforts will focus on visual observations to document stability and the use of water level monitoring gauges to document saturation and flooding functions. The methods used and any related success criteria are described below for each parameter.

5.1.1 Bankfull Events and Flooding Functions

The occurrence of bankfull events and flooding functions within the monitoring period will be documented by the use of automated water level gauges and photographs. Groundwater levels within the restored headwater valley should approximate the wetland hydroperiods of similar reference sites. Four automated gauges on UT2 and two on UT3 were installed approximately 500 feet apart within the restored systems to document flow duration. The automated loggers were programmed to collect data at a minimum of every 6 hours to capture flow frequency and duration. Installation of monitoring stations followed the standard methods found in Stream Mitigation Guidelines (USACE and NCDWQ 2006).

A surface water flow event will be considered perennial when the flow duration occurs for a minimum of 30 days. Two surface water flow events must be documented within a five-year monitoring period; otherwise, monitoring will continue for seven years or until two flow events have been documented in separate years. The automated gauges should document the occurrence of extended periods of shallow surface ponding, indicative of flow. Additional monitoring or alternative analyses may be necessary in the event of abnormal climatic conditions.

5.1.2 Longitudinal Profile

A longitudinal profile was surveyed for the entire length of channel, along the valley centerline, immediately after construction to document as-built baseline conditions only for the purpose of determining an accurate stream length. The survey was tied to a permanent benchmark. Longitudinal profiles will not be conducted during subsequent monitoring years.

5.1.3 Photo Reference Stations

Visual monitoring of both stream reaches will be conducted twice per monitoring year with at least five months in between each site visit. Photographs will be used to visually-document system performance. Reference stations will be photographed annually for a minimum of seven years following construction. Photographs will be taken from a height of approximately five to six feet. Permanent markers will be established to ensure that the same locations (and view directions) on the site are documented in each monitoring period.

The reaches will be photographed longitudinally beginning at the downstream end of the restoration site and moving upstream to the end of the site. Photographs will be taken looking upstream at delineated locations throughout the restored stream valley. Points will be close enough together to provide an overall view of the reach lengths and valley crenulations. The angle of the shot will depend on what angle provides the best view and this angle will be noted and continued in future shots.

Lateral photographs will also be used to evaluate channel development, erosion, success of riparian vegetation, and effectiveness of erosion control measures subjectively. Photo reference stations will be marked and described for future reference to document the development of appropriate vegetation.

A series of photos over time should demonstrate successional maturation of riparian vegetation. When modifications to photo position must be made due to obstructions or other reasons, the position will be noted along with any landmarks and the same position will used in the future. Additional photographs and/or video footage may be taken to document any observed evidence of flooding patterns such as debris/leaf litter, wrack lines, water marks, diffuse flow features, sediment sorting/deposits, shelving, etc.

5.2 Wetland Monitoring

5.2.1 Groundwater Data Collection

Groundwater monitoring wells were installed in the wetland mitigation areas to document hydrologic conditions of the restored wetland area. Four groundwater monitoring wells were installed to evaluate hydrology during each growing season for seven years of hydrologic monitoring, or until success criteria have been met, whichever occurs later. To meet the hydrologic success criteria, the monitoring gauge data must show that for each normal year within the monitoring period, the site has been inundated or saturated for a certain hydroperiod. The targeted hydroperiod will be based on the range of wetness conditions for the type of wetland system to be restored and comparable hydrology of a nearby reference wetland site.

5.2.2 Hydrology

In order to determine if the hydrologic success criteria are achieved, automated groundwater-monitoring stations were installed across the restored site and monitored year-round. Groundwater monitoring stations will follow the USACE standard methods found in the WRP Technical Notes ERDC TN-WRAP-00-02, (July 2000). In the event that there are years of normal precipitation during the monitoring period, and the data for those years do not show that the site has been inundated or saturated for the appropriate hydroperiod during the normal precipitation year, the review agencies may require remedial action. Baker will provide any required remedial action and continue to monitor hydrology on the site until it displays that the site has been inundated or saturated for the appropriate hydroperiod.

The objective is for the monitoring data to show the site exhibits an increased frequency of flooding. Groundwater levels will be compared to pre-restoration conditions and reference conditions. The success criteria for wetland hydrology will be met when the site is saturated within 12 inches of the soil surface for 12% of the growing season (NCEEP, 2009b).

In order to determine if the rainfall is normal for the given year, a rainfall gage will be installed on the site to compare precipitation amounts using tallied data for the Pamlico Aquaculture Field Lab station, obtained from the CRONOS Database located on the State Climate Office of North Carolina's website. The Pamlico Aquaculture Field Lab station is approximately 6.5 miles from the project site. If a normal year of precipitation does not occur during the first seven years of monitoring, Baker will continue to monitor hydrology on the site until it documents that the site has been inundated or saturated for the appropriate hydroperiod.

If the rainfall data for any given year during the monitoring period are abnormal, it is possible that the desired hydrology for the site may not meet specific success criteria. However, reference

wetland data will be assessed to determine if there is a positive correlation between the underperformance of the project site and the natural hydrology of the reference site(s).

5.2.3 Photo Reference Stations

Visual monitoring of all wetland areas will be conducted twice per monitoring year with at least five months in between each site visit. Photographs will be used to visually document system performance and identify areas of low stem density, invasive species vegetation, beaver activity, or other areas of concern. Reference stations will be photographed twice a year for a minimum of seven years following construction. Photographs will be taken from a height of approximately five to six feet. Permanent markers will be established to ensure that the same locations (and view directions) on the site are documented in each monitoring period.

5.3 Vegetation Monitoring

Successful restoration of the vegetation on a site is dependent upon hydrologic restoration, planting of preferred canopy species, and volunteer regeneration of the native plant community. In order to determine if the criteria are achieved, vegetation-monitoring quadrants were installed and monitored across the restoration site in accordance with the CVS-NCEEP Protocol for Recording Vegetation, Version 4.1 (2007). The vegetation monitoring plots are a minimum of 2 percent of the planted portion of the site with a minimum of nine plots established randomly within the planted riparian buffer areas per Monitoring Levels 1 and 2. The size of individual quadrants are 100 square meters for woody tree species.

Vegetation monitoring will occur in the fall, prior to the loss of leaves. Individual quadrant data will be provided and will include species diameter, height, density, and coverage quantities. Relative values will be calculated, and importance values will be determined. Individual seedlings will be marked such that they can be found in succeeding monitoring years. Mortality will be determined from the difference between the previous year's living, planted seedlings and the current year's living, planted seedlings.

At the end of the first full growing season (baseline/year 0) or after 180 days between March 1st and November 30th, species composition, stem density, and survival will be evaluated. For each subsequent year, vegetation plots shall be monitored for seven years in years 1, 2, 3, 5 and 7 or until the final success criteria are achieved. The restored site will be evaluated between March and November. The interim measure of vegetative success for the site will require the survival of at least 320, 3-year old, planted trees per acre at the end of year three of the monitoring period. At Year five, density must be no less than 260, 5-year old, planted trees per acre. The final vegetative success criteria will be the survival of 210, 7-year old, planted trees per acre at the end of the seven-year monitoring period, which must average 10 feet in height (DBH). However, if the performance standard is met by Year 5 and stem densities are greater than 260, 5-year old stems/acre, vegetation monitoring may be terminated with approval by the USACE and Interagency review Team (IRT).

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

Baker will provide any required remedial action on a case-by-case basis, such as replanting more wet/drought tolerant species, beaver management/dam removal, or removing undesirable/invasive species vegetation, and continue to monitor vegetation performance until the corrective actions demonstrate that the site is trending towards or meeting the standard requirement.

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

6.0 AS-BUILT DATA DOCUMENTATION

Stream, wetland, and vegetation components will be monitored for seven years post-construction to evaluate project success, unless the site demonstrates complete success by Year 5 and no areas of concern have been identified. The specific locations of vegetation plots, flow/crest gauges, wetland groundwater wells, and photo reference stations are shown on the as-built plan sheets.

6.1 Stream Data

For monitoring stream success criteria, six flow gauges (pressure transducers) were installed along both project reaches, four in the thalweg of UT2 and two in the thalweg of UT3. These devices were installed to document flow duration and the occurrence of extended periods of shallow surface ponding, indicative of flow.

Twenty-four (24) photo reference stations were installed throughout the project area.

In addition, a longitudinal survey was completed for the restored stream channels to provide an accurate stream length for the baseline monitoring report. The longitudinal survey will not be conducted in subsequent monitoring years. As-built data will be used for comparison to post-construction monitoring data. The locations of the flow/crest gauges and photo reference stations are shown on the as-built plan sheets in Appendix D. Photographs are provided in Appendix E.

6.2 Groundwater Data

A total of four groundwater monitoring gauges were installed throughout the project site, two within the restored wetland along UT2 and two within the restored wetland along UT3. Groundwater gauges will document water table hydrology throughout the seven-year monitoring period and will be compared to pre-restoration and reference conditions. Locations of the groundwater gauges are depicted in the as-built plan sheets in Appendix D.

6.3 Vegetation Data

Bare-root trees and shrubs were planted within all restoration areas inside the conservation easement. A minimum 50-foot buffer was established and/or protected along both sides of all stream reaches. Planting of bare-root trees and shrubs, as well as wetland plantings, were completed in April 2014.

Due to bare-root shrub availability, some species proposed in the Mitigation Plan differ from shrub species planted within the conservation easement following construction. The understory species Titi (*Cyrilla racemiflora*), swamp doghobble (*Leucothoe racemosa*), Fetterbush (*Lyonia lucida*) and Virginia sweetspire (*Itea virginica*) were not planted on the Site. Instead, the aforementioned species were substituted with these understory species: beautyberry (*Callicarpa americana*), swamp dogwood (*Cornus foemina*), wax myrtle (*Morella cerifera*), Blueberry (*Vaccinium corymbosum*), Arrowwood (*Viburnum dentatum*), swamp rose (*Rosa palustris*), inkberry (*Ilex glabra*) and Chokeberry (*Aronia arbutifolia*). Sixty-one percent of the buffer species are overstory trees. The remaining thirty-nine percent of species are understory shrubs and twenty-one percent of these species were substituted with species of similar quantities for the riparian wetland planting areas.

Species planted on the Site are summarized in Tables 6 and 7 in Appendix C.

The Mitigation Plan for the site specifies that the number of quadrants required shall be based on the CVS-NCEEP monitoring guidance (2007). The total number of quadrants was calculated using the CVS-NCEEP Entry Tool Database version 2.2.7 (CVS-NCEEP, 2007). The sizes of individual quadrants are 100 square meters. A total of nine vegetation plots were installed throughout the project

site. The initial planted density within each of the vegetation monitoring plots is provided in Table 7. The average density of planted bare root stems, based on the data from the nine vegetation monitoring plots, is 729 stems per acre. While the counts for the individual species for each vegetation plot are not available for the baseline monitoring report due to the timing of the planting, the individual species within each vegetation plot will be identified in Year 1 and included in the Year 1 monitoring report and all subsequent monitoring reports. The locations of the vegetation plots are shown on the as-built plan sheets in Appendix D.

6.4 Areas of Concern

No areas of concern were noted during the Baseline Monitoring field survey and data collection.

7.0 MAINTENANCE AND CONTINGENCY PLANS

Maintenance requirements vary from site to site and are generally driven by the following conditions:

- Projects without established, woody floodplain vegetation are more susceptible to erosion from floods than those with a mature, hardwood forest.
- Projects with sandy, non-cohesive soils are more prone to bank erosion than cohesive soils or soils with high gravel and cobble content.
- Alluvial valley channels with access to their floodplain are less vulnerable to erosion than channels that have been disconnected from their floodplain.
- Wet weather during construction can make accurate channel and floodplain excavations difficult.
- Extreme and/or frequent flooding can cause floodplain and channel erosion.
- Extreme hot, cold, wet, or dry weather during and after construction can limit vegetation growth, particularly temporary and permanent seed.
- The presence and aggressiveness of invasive vegetation species can affect the extent to which a native species vegetation buffer can be established.
- The presence of beaver can affect vegetation survivability and stream function.

The site will be monitored on a regular basis and as well as a physical inspection of the site at least once a year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Maintenance issues and recommended remediation measures will be detailed and documented in the post-construction monitoring reports. Factors that may have caused any maintenance needs, including any of the conditions listed above, shall be discussed. Routine maintenance will be most likely in the first two years following site construction and may include the following components as described below.

7.1 Streams

Routine stream maintenance and repair activities may include stabilizing any significant rilling or erosional areas and supplemental installations of target vegetation along the project reaches. Areas of concentrated stormwater and floodplain flows that intercept the channel may also require maintenance to prevent bank failures and head-cutting until vegetation becomes established.

7.2 Wetland

Routine wetland maintenance and repair activities may include securing of loose coir fiber matting and supplemental installations of target vegetation within the wetland. Areas of concentrated stormwater and floodplain flows that intercept the wetland may also require maintenance to prevent scour.

7.3 Vegetation

Vegetation will be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, and fertilizing. Exotic invasive plant species will controlled by mechanical and/or chemical methods. Any invasive plant species control requiring herbicide application will be performed in accordance with NC Department of Agriculture and Consumer Services (NCDA&CS) rules and regulations.

7.4 Site Boundary

Site boundaries have been demarcated in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries can be identified by marker, bollard, post, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.

7.5 Culverted Farm Road Crossing

The permanent road crossing within the site may be maintained only as allowed by the recorded Conservation Easement, deed restrictions, rights of way, or corridor agreements.

8.0 REFERENCES

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APPENDIX A

Figures 1 - 3, Tables 1 - 4

Table 1. Project Components and Mitigation Credits

St. Clair Creek Restoration Project: EEP Project No ID. 95015

Mitigation Credits

	Stream	Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	R	RE					
Totals	3,274 SMU	2.8 WMU	0					

Project Components

Project Component or Reach ID	Stationing/ Location	Existing Footage/ Acreage	Approach	Restoration/ Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
UT2	12+64 – 34+00	2,660 LF	Headwater Restoration	2,133 SMU	2,133 LF	1:1
UT3	10+66 – 22+82	1,075 LF	Headwater Restoration	1,141 SMU	1,141 LF	1:1
UT2 Wetland	See plan sheets	0.0 AC	Restoration	1.1 WMU	1.1 WMU	1:1
UT3 Wetland	See plan sheets	0.0 AC	Restoration	1.7 WMU	1.7 WMU	1:1

Component Summation

Restoration Level	Stream (LF)	Riparian Wetland (AC)		Non-riparian Wetland (AC)	Buffer (SF)	Upland (AC)
		Riverine	Non-Riverine			
Restoration	3,274	2.8				
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						

BMP Elements

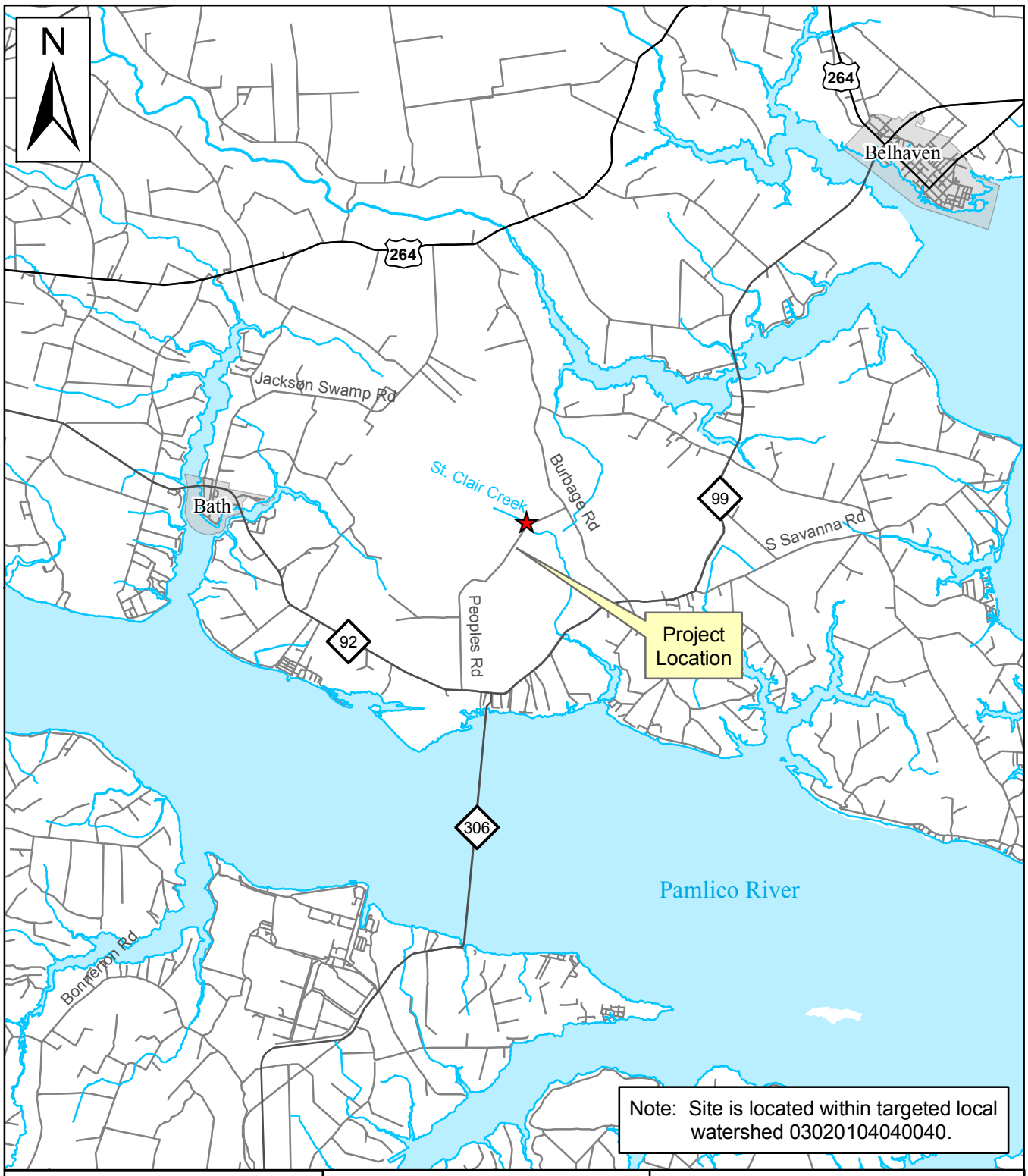
Element	Location	Purpose/Function	Notes

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

Table 2. Project Activity and Reporting History			
St. Clair Creek Restoration Project: EEP Project No ID. 95015			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan Prepared	N/A	N/A	Jul-13
Mitigation Plan Amended	N/A	N/A	Sep-13
MItigation Plan Approved	N/A	N/A	Oct-13
Final Design – (at least 90% complete)	N/A	N/A	Nov-13
Construction Begins	N/A	N/A	Dec-13
Temporary S&E mix applied to entire project area	N/A	N/A	N/A
Permanent seed mix applied to entire project area	N/A	N/A	Mar-14
Planting of live stakes	N/A	N/A	N/A
Planting of bare root trees	N/A	N/A	Apr-14
End of Construction	N/A	N/A	Apr-14
Survey of As-built conditions (Year 0 Monitoring-baseline)	N/A	May-14	Jun-14
Year 1 Monitoring	Dec-14	N/A	N/A
Year 2 Monitoring	Dec-15	N/A	N/A
Year 3 Monitoring	Dec-16	N/A	N/A
Year 4 Monitoring	Dec-17	N/A	N/A
Year 5 Monitoring	Dec-18	N/A	N/A
Year 6 Monitoring	Dec-19	N/A	N/A
Year 7 Monitoring	Dec-20	N/A	N/A

Table 3. Project Contacts Table **St. Clair Creek Restoration Project: EEP Project ID No. 95015**	
Designer	
Michael Baker Engineering, Inc.	797 Haywood Road, Suite 201 Asheville, NC 28806 Contact: Jacob Byers, Tel. 919-259-4814
Construction Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Phillip Todd, Tel. 919-582-3575
Planting Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Phillip Todd, Tel. 919-582-3575
Seeding Contractor	
River Works, Inc.	6105 Chapel Hill Road Raleigh, NC 27607 Contact: Phillip Todd, Tel. 919-582-3575
Seed Mix Sources	Green Resources, Tel. 336-855-6363
Nursery Stock Suppliers	Mellow Marsh Farm, 919-742-1200 ArborGen, 843-528-3204 Superior Tree, 850-971-5159
Monitoring Performers	
Michael Baker Engineering, Inc.	8000 Regency Parkway, Suite 600 Cary, NC 27518
Stream Monitoring Point of Contact	Contact: Dwayne Huneycutt, Tel. 919-481-5745
Vegetation Monitoring Point of Contact	Dwayne Huneycutt, Tel. 919-481-5745
Wetland Monitoring Point of Contact	Dwayne Huneycutt, Tel. 919-481-5745

Table 4. Project Attributes			
St. Clair Creek Restoration Project: EEP Project ID No. 95015			
Project Information			
Project Name	St. Clair Creek Restoration Project		
County	Beaufort		
Project Area (acres)	17.5		
Project Coordinates (latitude and longitude)	35.452835 N, -76.76726215 W		
Watershed Summary Information			
Physiographic Province	Outer Coastal Plain		
River Basin	Tar-Pamlico		
USGS Hydrologic Unit 8-digit and 14-digit	03020104 / 03020104040040		
DWQ Sub-basin	03 03 07		
Project Drainage Area (AC)	89 (UT2), 30 (UT3)		
Project Drainage Area Percentage of Impervious Area	<1%		
CGIA Land Use Classification	3.02, Passively Managed Forest Stands, 2.01.01.07, Annual Row Crop Rotation;		
Stream Reach Summary Information			
Parameters	**Reach UT2**	**Reach UT3**	
Length of Reach (LF)	2,133 (proposed) 2,660 (existing)	1,141 (proposed) 1,075 (existing)	
Valley Classification (Rosgen)	X	X	
Drainage Area (AC)	89	30	
NCDWQ Stream Identification Score	36	20	
NCDWQ Water Quality Classification	C; Sw, NSW	C; Sw, NSW	
Morphological Description (Rosgen stream type)*	Channelized Headwater System (Perennial)	Channelized Headwater System (Intermittent)	
Evolutionary Trend **	Restored G	Restored G	
Underlying Mapped Soils	To, Hy, Ro	To, At	
Drainage Class	Very poorly drained, poorly drained	Poorly drained, somewhat poorly drained	
Soil Hydric Status	Hydric	Hydric	
Average Channel Slope (ft/ft)	0.0006	0.0009	
FEMA Classification	SFHA, AE	SFHA, AE	
Native Vegetation Community	Coastal Plain Small Stream Swamp	Coastal Plain Small Stream Swamp	
Percent Composition of Exotic/Invasive Vegetation	<5%	<5%	
Wetland Summary Information			
Parameters	**Wetland Along UT2**		
Size of Wetland (AC)	1.1		
Wetland Type	Riparian Riverine		
Mapped Soil Series	To – Tomotley fine sandy loam		
Drainage Class	Poorly drained		
Soil Hydric Status	Hydric		
Source of Hydrology	Groundwater		
Hydrologic Impairment	Disconnected floodplain from ditches, lowered water table		
Native Vegetation Community	Coastal Plain Small Stream Swamp		
Percent Composition of Exotic/Invasive Vegetation	<5%		
Parameters	**Wetland Along UT3**		
Size of Wetland (AC)	1.7		
Wetland Type	Riparian Riverine		
Mapped Soil Series	To – Tomotley fine sandy loam		
Drainage Class	Poorly drained		
Soil Hydric Status	Hydric		
Source of Hydrology	Groundwater		
Hydrologic Impairment	Disconnected floodplain from ditches, lowered water table		
Native Vegetation Community	Coastal Plain Small Stream Swamp		
Percent Composition of Exotic/Invasive Vegetation	<5%		
Regulatory Considerations			
Regulation	**Applicable**	**Resolved**	**Supporting Documentation****
Waters of the United States – Section 404	Yes	Yes	(Appendix B)
Waters of the United States – Section 401	Yes	Yes	(Appendix B)
Endangered Species Act	No	N/A	Categorical Exclusion (Appendix B)
Historic Preservation Act	No	N/A	Categorical Exclusion (Appendix B)
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	Categorical Exclusion (Appendix B)
FEMA Floodplain Compliance	Yes	Yes	(Appendix B)
Essential Fisheries Habitat	No	N/A	Categorical Exclusion (Appendix B)
Notes:			
* Due to its channelized nature, the stream would most appropriately be classified as a Rosgen G stream type but use of this classification system on this channel is questionable due to its highly altered state. ** Supporting documentation is including in the approved Final Mitigation Plan.			



Beaufort County

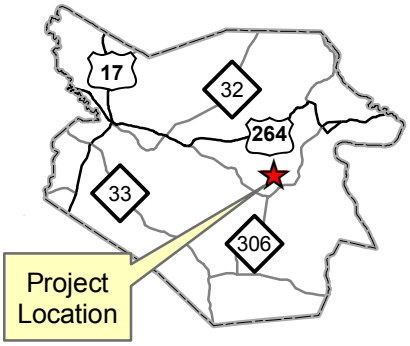
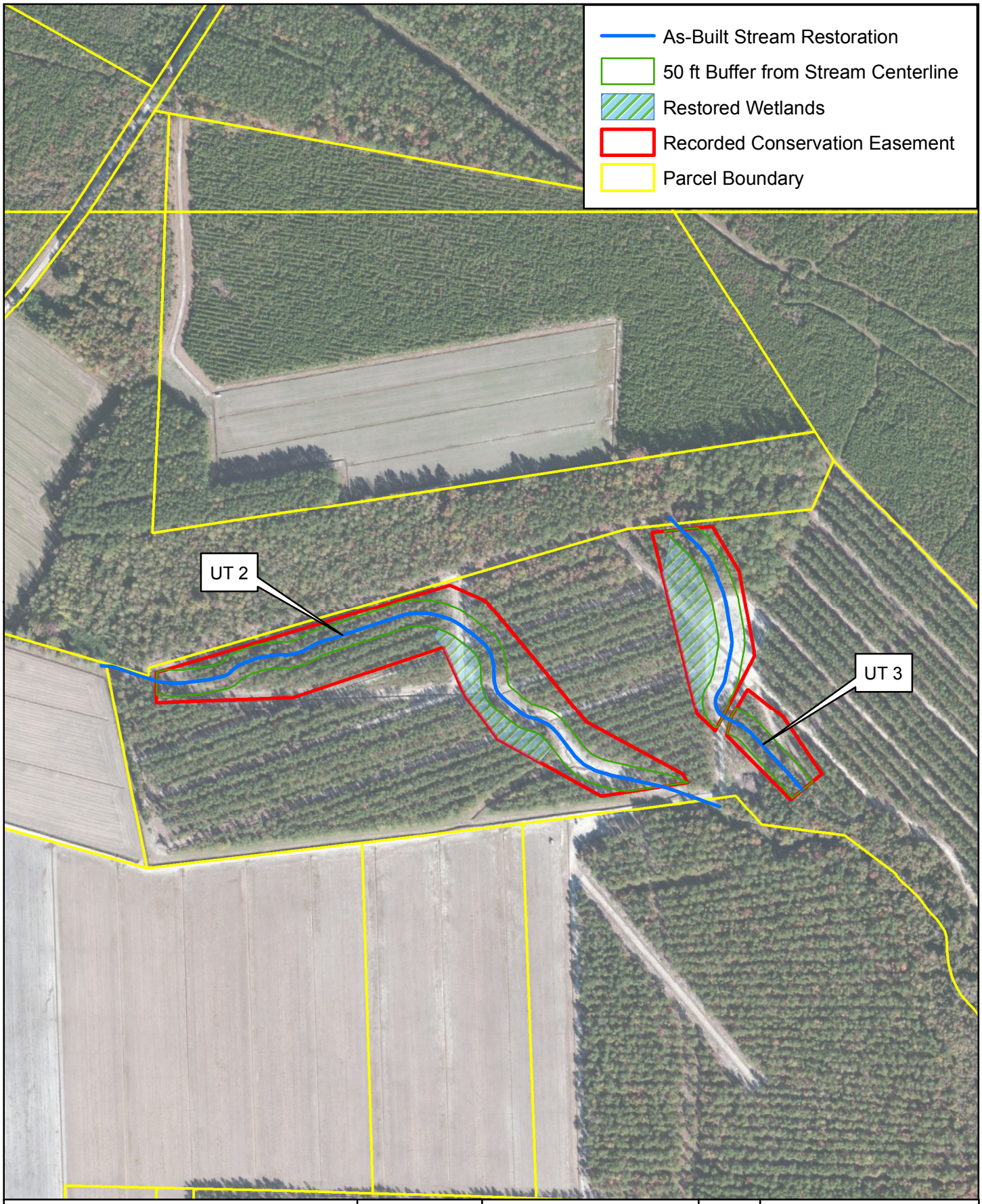


Figure 1
Project Vicinity Map
St. Clair Creek Site

Baker

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

0 0.5 1 2 3 Miles



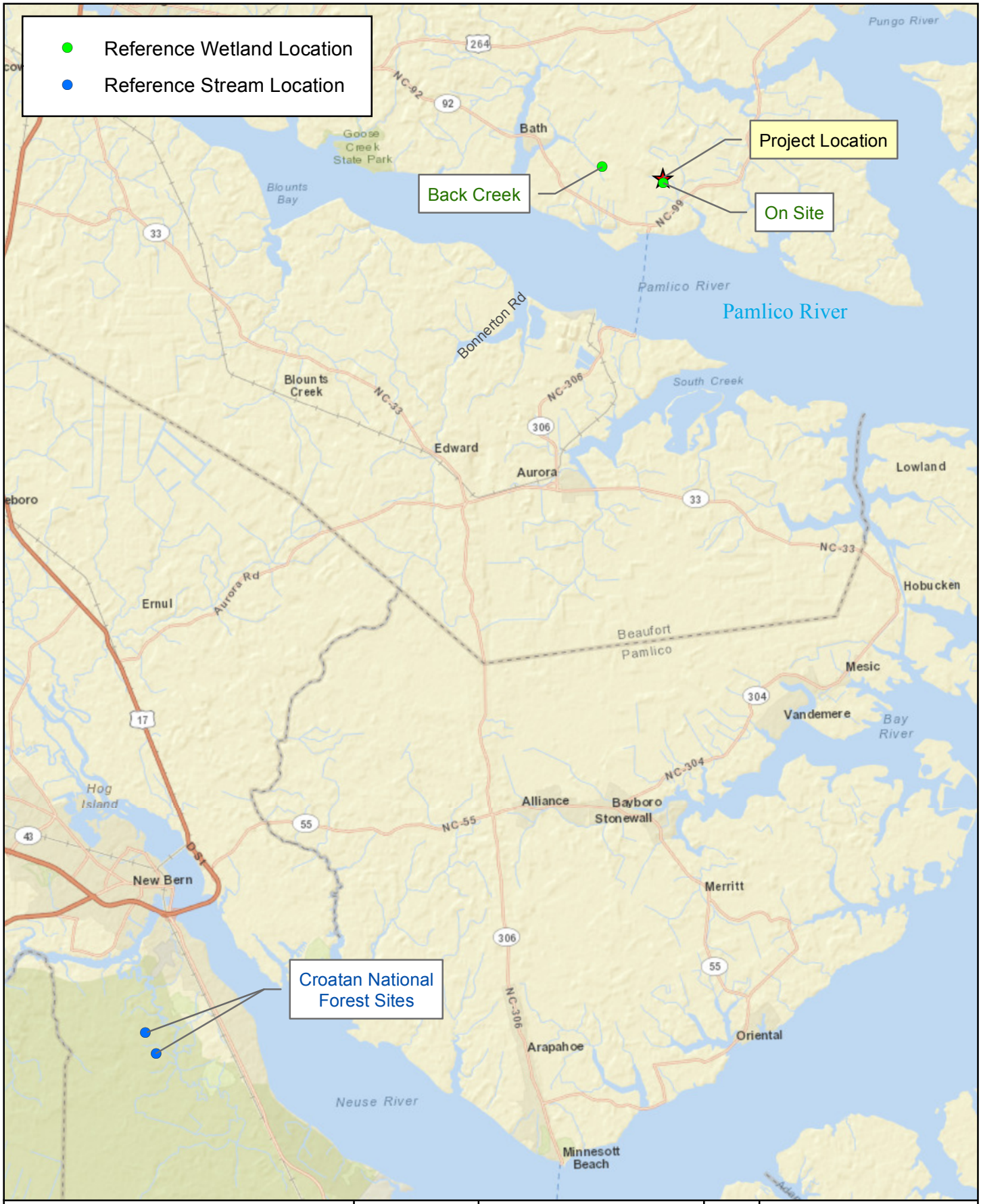
Baker
Michael Baker Engineering, Inc.
8000 Regency Parkway
Suite 600
Cary, North Carolina 27518
Phone: 919.463.5488
Fax: 919.463.5490

Ecosystem Enhancement Program

0 250 500 Feet

N

Figure 2
Restoration Summary Map
St. Clair Creek Site



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

Ecosystem Enhancement Program

Figure 3
Reference Sites
Location Map
St. Clair Creek Site

APPENDIX B

Vegetation Data (Tables 6 and 7)

Table 6. Vegetation Species Planted Across the Restoration Site
St. Clair Creek Restoration Project: EEP Project ID No. 95015

Botanical Name	Common Name	% Planted by Species	Total Number of Stems
Riparian Buffer Plantings - Overstory			
Fraxinus pennsylvanica	Green ash	6.4%	800
Nyssa sylvatica	Swamp tupelo	8.8%	1100
Quercus michauxii	Swamp chestnut oak	12.0%	1500
Quercus laurifolia	Laurel oak	8.8%	1100
Quercus lyrata	Overcup oak	6.4%	800
Quercus phellos	Willow oak	6.4%	800
Taxodium distichium	Bald cypress	6.4%	800
Ulmus americana	American elm	5.8%	725
Riparian Buffer Plantings - Understory			
Clethra alnifolia	Sweet pepperbush	5.1%	640
Carpinus caroliniana	Ironwood	4.0%	500
Magnolia virginiana	Sweetbay magnolia	6.4%	800
Persea palustris	Swamp bay	2.6%	325
Callicarpa americana	beautyberry	0.5%	65
Cornus foemina	Swamp dogwood	1.8%	220
Morella cerifera	Wax Myrtle	1.4%	175
Vaccinium corymbosum	Blueberry	4.4%	545
Viburnum dentatum	Arrowwood	4.0%	500
Rosa palustris	Swamp rose	1.5%	185
Ilex glabra	Inkberry	4.0%	500
Aronia arbutifolia	Chokeberry	3.2%	400
Riparian Live Stake Plantings			
N/A			

Table 7. Stem Count for Each Species Arranged by Plot
St. Clair Creek Restoration Project: EEP Project ID No. 95015

Botanical Name	Common Name	Plots								
		1	2	3	4	5	6	7	8	9
Tree Species										
Fraxinus pennsylvanica	*Green ash*									
Nyssa sylvatica	*Swamp tupelo*									
Quercus michauxii	*Swamp chestnut oak*									
Quercus laurifolia	*Laurel oak*									
Quercus lyrata	*Overcup oak*									
Quercus phellos	*Willow oak*									
Taxodium distichium	*Bald cypress*									
Ulmus americana	*American elm*									
Shrub Species										
Clethra alnifolia	*Sweet pepperbush*									
Carpinus caroliniana	*Ironwood*									
Magnolia virginiana	*Sweetbay magnolia*									
Persea palustris	*Swamp bay*									
Callicarpa americana	*Beautyberry*									
Cornus foemina	*Swamp dogwood*									
Morella cerifera	*Wax Myrtle*									
Vaccinium corymbosum	*Blueberry*									
Viburnum dentatum	*Arrowwood*									
Rosa palustris	*Swamp rose*									
Ilex glabra	*Inkberry*									
Aronia arbutifolia	*Chokeberry*									
Unknown		18	16	17	18	17	12	29	18	19
Stems/plot		18	16	17	18	17	12	29	18	19
Stems/acre		720	640	680	720	680	480	1160	720	760
Total Stems/ Acre for Year 0 As-Built (Baseline Data)		**729**								

APPENDIX C

As-Built Plan Sheets

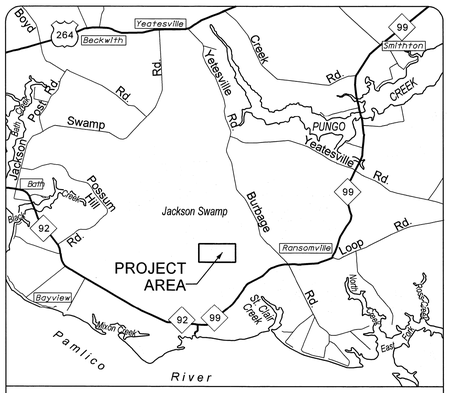
STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
NC	125116	1	11

NORTH CAROLINA ECOSYSTEM ENHANCEMENT PROGRAM

ST. CLAIR CREEK RESTORATION PROJECT

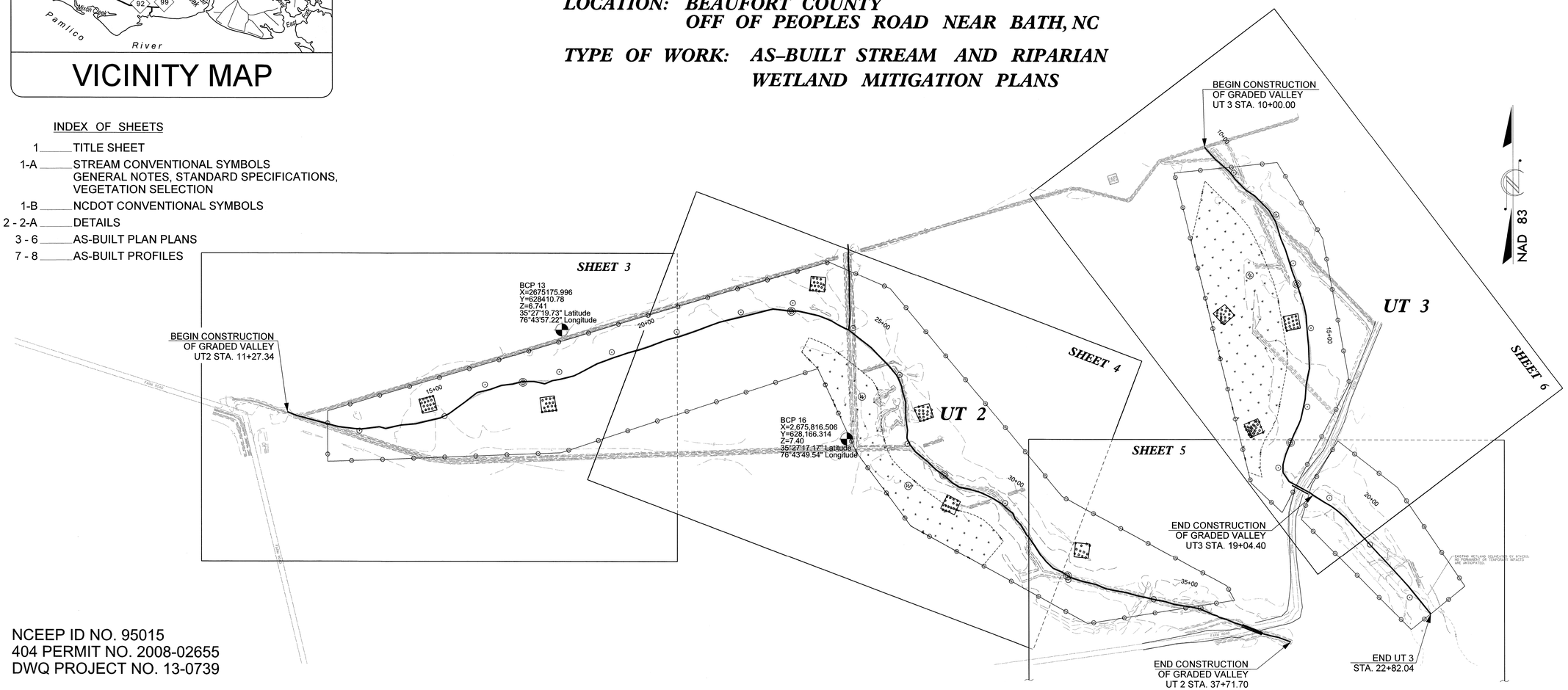
LOCATION: BEAUFORT COUNTY
OFF OF PEOPLES ROAD NEAR BATH, NC

TYPE OF WORK: AS–BUILT STREAM AND RIPARIAN WETLAND MITIGATION PLANS



VICINITY MAP

INDEX OF SHEETS



NCEEP ID NO. 95015
404 PERMIT NO. 2008-02655
DWQ PROJECT NO. 13-0739

PROJECT: 125116

GRAPHIC SCALES

PLANS: 40 20 0 40 80
PROFILE (HORIZONTAL): 40 20 0 40 80
PROFILE (VERTICAL): 4 2 0 4 8

PROJECT DATA

	UT2	UT3	
DESIGN REACH LENGTH =	2,494	1,278	FEET
AS–BUILT STREAM CREDITS =	2,133	1,141	SMU
AS–BUILT RIPARIAN WETLAND AREA =	1.1	1.7	ACRES
CONSERVATION EASEMENT AREA =	11.6	5.9	ACRES
AS–BUILT STREAM LENGTH =	2,644	1,282	FEET

PREPARED FOR THE OFFICE OF:

Ecosystem Enhancement PROGRAM

ECOSYSTEM ENHANCEMENT PROGRAM
217 WEST JONES STREET
RALEIGH, NC 27603

CONTACT: HEATHER SMITH, PROJECT MANAGER

PREPARED IN THE OFFICE OF:

Baker

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

FALL 2013
LETTING DATE:

JACOB BYERS, PE
PROJECT ENGINEER

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

SIGNATURE: P.E.

PROJECT REFERENCE NO.	SHEET NO.
125116	1-B

2/26/03

*S.U.E = SUBSURFACE UTILITY ENGINEER

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

CONVENTIONAL SYMBOLS

ROADS & RELATED ITEMS

Edge of Pavement
Curb
Prop. Slope Stakes Cut — C
Prop. Slope Stakes Fill — F
Prop. Woven Wire Fence
Prop. Chain Link Fence
Prop. Barbed Wire Fence
Prop. Wheelchair Ramp — WCR
Curb Cut for Future Wheelchair Ramp — CCFR
Exist. Guardrail
Prop. Guardrail
Equality Symbol
Pavement Removal

RIGHT OF WAY

Baseline Control Point
Existing Right of Way Marker
Exist. Right of Way Line w/Marker
Prop. Right of Way Line with Proposed R/W Marker
Prop. Right of Way Line with Proposed (Concrete or Granite) R/W Marker
Exist. Control of Access Line — CA
Prop. Control of Access Line — CA
Exist. Easement Line — E
Prop. Temp. Construction Easement Line — E
Prop. Temp. Drainage Easement Line — TDE
Prop. Perm. Drainage Easement Line — PDE

HYDROLOGY

Stream or Body of Water
River Basin Buffer — RBB
Flow Arrow
Disappearing Stream
Spring
Swamp Marsh
Shoreline
Falls, Rapids
Prop Lateral, Tail, Head Ditches — FLOW

STRUCTURES

MAJOR
Bridge, Tunnel, or Box Culvert — CONC
Bridge Wing Wall, Head Wall and End Wall — CONC WW

MINOR
Head & End Wall — CONC HW
Pipe Culvert
Footbridge
Drainage Boxes — CB
Paved Ditch Gutter

UTILITIES

Exist. Pole
Exist. Power Pole
Prop. Power Pole
Exist. Telephone Pole
Prop. Telephone Pole
Exist. Joint Use Pole
Prop. Joint Use Pole
Telephone Pedestal — T
U/G Telephone Cable Hand Hold — HH
Cable TV Pedestal — C
U/G TV Cable Hand Hold — HH
U/G Power Cable Hand Hold — HH
Hydrant
Satellite Dish
Exist. Water Valve
Sewer Clean Out
Power Manhole
Telephone Booth — 3
Cellular Telephone Tower
Water Manhole — W
Light Pole
H–Frame Pole
Power Line Tower
Pole with Base
Gas Valve
Gas Meter
Telephone Manhole — T
Power Transformer
Sanitary Sewer Manhole
Storm Sewer Manhole — S
Tank; Water, Gas, Oil
Water Tank With Legs
Traffic Signal Junction Box — S
Fiber Optic Splice Box — F
Television or Radio Tower
Utility Power Line Connects to Traffic Signal Lines Cut Into the Pavement — TS TS

Recorded Water Line — W W
Designated Water Line (S.U.E.*) — W W
Sanitary Sewer — SS SS
Recorded Sanitary Sewer Force Main — FSS FSS
Designated Sanitary Sewer Force Main(S.U.E.*) — FSS FSS
Recorded Gas Line — G G
Designated Gas Line (S.U.E.*) — G G
Storm Sewer — S S
Recorded Power Line — P P
Designated Power Line (S.U.E.*) — P P
Recorded Telephone Cable — T T
Designated Telephone Cable (S.U.E.*) — T T
Recorded U/G Telephone Conduit — TC TC
Designated U/G Telephone Conduit (S.U.E.*) — TC TC
Unknown Utility (S.U.E.*) — ?UTL ?UTL
Recorded Television Cable — TV TV
Designated Television Cable (S.U.E.*) — TV TV
Recorded Fiber Optics Cable — FO FO
Designated Fiber Optics Cable (S.U.E.*) — FO FO
Exist. Water Meter
U/G Test Hole (S.U.E.*)
Abandoned According to U/G Record — ATTUR
End of Information — E.O.I.

BOUNDARIES & PROPERTIES

State Line
County Line
Township Line
City Line
Reservation Line
Property Line
Property Line Symbol — PL
Exist. Iron Pin — EIP
Property Corner
Property Monument — ECM
Property Number — 123
Parcel Number — 6
Fence Line — WW & ISBW
Existing Wetland Boundaries — WLB
High Quality Wetland Boundary — HQ WLB
Medium Quality Wetland Boundaries — MQ WLB
Low Quality Wetland Boundaries — LQ WLB
Proposed Wetland Boundaries — WLB
Existing Endangered Animal Boundaries — EAB
Existing Endangered Plant Boundaries — EPB

BUILDINGS & OTHER CULTURE

Buildings
Foundations
Area Outline
Gate
Gas Pump Vent or U/G Tank Cap
Church
School
Park
Cemetery — t
Dam
Sign — S
Well — W
Small Mine
Swimming Pool

TOPOGRAPHY

Loose Surface
Hard Surface
Change in Road Surface
Curb
Right of Way Symbol — R/W
Guard Post — GP
Paved Walk
Bridge
Box Culvert or Tunnel
Ferry
Culvert
Footbridge
Trail, Footpath
Light House

VEGETATION

Single Tree
Single Shrub
Hedge
Woods Line
Orchard
Vineyard — VINEYARD

RAILROADS

Standard Gauge — CSX TRANSPORTATION
RR Signal Milepost — MILEPOST 35
Switch — SWITCH

6/5/2014
R:\125116\Design\Plans\As-Built\125116_AB-PSH-01B.dgn

2/26/03

STREAM CONVENTIONAL SYMBOLS
SUPERCEDES SHEET 1B

- ROOT WAD
- LOG J-HOOK
- LOG VANE
- LOG WEIR
- LOG CROSS VANE
- FOOT BRIDGE
- TEMPORARY STREAM CROSSING
- PERMANENT STREAM CROSSING
- LOG STEP POOL
- SAFETY FENCE
- TAPE FENCE
- 100 YEAR FLOOD PLAIN
- CONSERVATION EASEMENT
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- TRANSPLANTED VEGETATION
- TREE REMOVAL
- TREE PROTECTION
- CHANNEL BLOCK
- TRANSPLANTS
- CHANNEL FILL

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

GENERAL NOTES

1. CONSTRUCTION BEGAN IN JANUARY, 2014 AND WAS COMPLETED IN APRIL, 2014.
2. VEGETATION PLANTING WAS COMPLETED IN APRIL, 2014.

PROJECT REFERENCE NO.	SHEET NO.
125116	1-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

APPROVED BY:

6/5/14
DATE:

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

STANDARD SPECIFICATIONS

EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL
MARCH 2009

6.06 TEMPORARY GRAVEL CONSTRUCTION ENTRANCE

6.62 SILT FENCE

6.70 TEMPORARY STREAM CROSSING

VEGETATION SELECTION

The following table lists the vegetation selection for the project site. Total planting area is approximately 17.5 acres. Exact placement of species was determined in the field and based on apparent wetness of planting locations and per the vegetation specialist. The entire easement area was planted. Based on vegetation plot data all bare-root species were planted at a density of approximately 729 stems per acre.

Riparian Buffer Plantings - Overstory

Botanical Name	Common Name	Percent Planted by Species	Total Number of Stems
Fraxinus pennsylvanica	Green ash	6.4%	800
Nyssa sylvatica var. biflora	Swamp tupelo	8.8%	1,100
Quercus michauxii	Swamp chestnut oak	12.0%	1,500
Quercus laurifolia	laurel oak	8.8%	1,100
Quercus lyrata	Overcup oak	6.4%	800
Quercus Phellos	Willow oak	6.4%	800
Taxodium distichum	Bald cypress	6.4%	800
Ulmus americana	American elm	5.8%	725
	Total	**61.0%**	7,625

Riparian Buffer Plantings - Overstory

Botanical Name	Common Name	Percent Planted by Species	Total Number of Stems
Clethra alnifolia	Sweet pepperbush	5.1%	640
Carpinus caroliniana	Ironwood	4.0%	500
Magnolia virginiana	Sweetbay magnolia	6.4%	800
Persea palustris	Swamp bay	2.6%	325
Callicarpa americana	Beautyberry	0.5%	65
Cornus foemina	Swamp dogwood	1.8%	220
Morella cerifera	Wax myrtle	1.4%	175
Vaccinium corymbosum	Blueberry	4.4%	545
Viburnum dentatum	Arrowwood	4.0%	500
Rosa palustris	Swamp rose	1.5%	185
Ilex glabra	Inkberry	4.0%	500
Aronia arbutifolia	Chokeberry	3.2%	400
	Total	**38.9%**	4,855

Permanent herbaceous seed mixtures for the restoration site were planted throughout the floodplain, the graded valley and buffer areas. Permanent herbaceous seed mixtures were applied with temporary seed, as defined in the construction specifications. Permanent seed was applied at a rate of 1.5 lbs/acre.

Permanent Seed

Botanical Name	Common Name	Percent Planted by Species	Wetland Tolerance
Andropogon gerardii	Big blue stem	10.0%	FAC
Andropogon glomeratus	Bushy blue stem	10.0%	FACW+
Carex lupulina	Hop sedge	10.0%	OBL
Carex vulpinoidea	Fox sedge	10.0%	OBL
Elymus virginicus	Virginia wild rye	10.0%	FAC
Juncus effusus	Soft rush	15.0%	FACW+
Panicum virgatum	Switchgrass	10.0%	FAC+
Polygonum pensylvanicum	Smartweed	5.0%	FACW
Schizachyrium scoparium	Little blue stem	10.0%	FACU
Sorghastrum nutans	Indiangrass	10.0%	FACU
	Total	**100.0%**	

The following table lists temporary seed species for the project site.

Botanical Name	Common Name	Rate	Dates
Secale cereal	Cereal Rye	130 lbs/acre	eptember to March
Panicum ramosum	Browntop Millet	40 lbs/acre	April to August

6/5/2014
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mpeel

2/26/03

PROJECT REFERENCE NO.	SHEET NO.
125116	2

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

APPROVED BY:

6/5/14

DATE:

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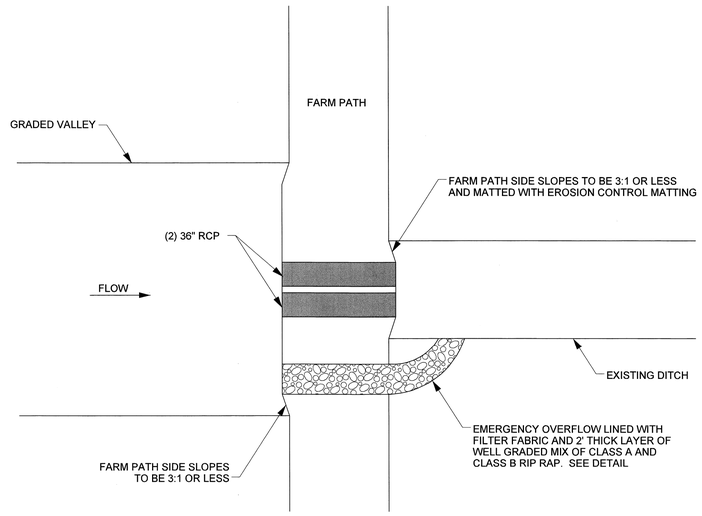
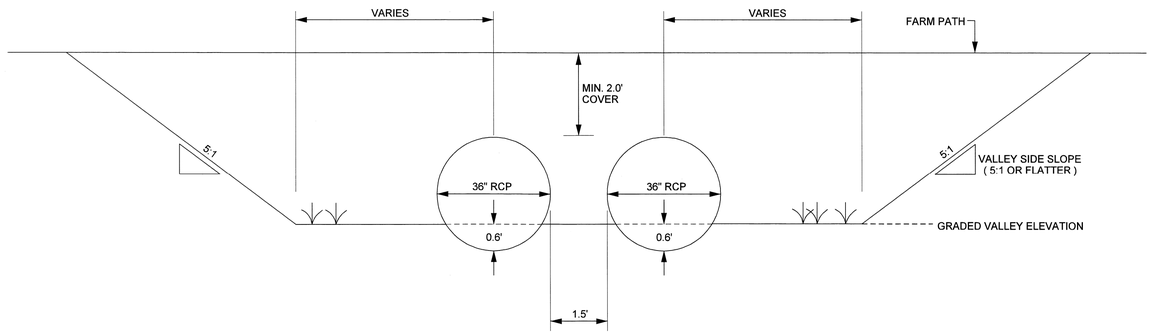
PERMANENT ROAD CULVERT CROSSING



PLAN VIEW

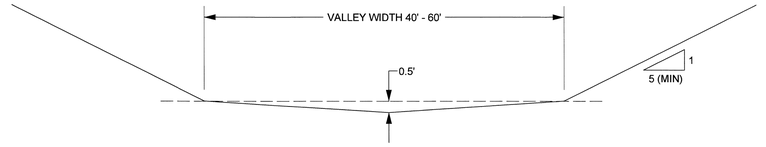


SECTION VIEW

NOTES:

1. CULVERTS TO BE SET TO THE ELEVATIONS SHOWN ON THE PLAN & PROFILE.
2. CULVERTS MUST HAVE A MINIMUM OF 2' OF COVER. ADJUST ROAD GRADE TO ENSURE THE COVER REQUIREMENT IS MET.

TYPICAL GRADED VALLEY

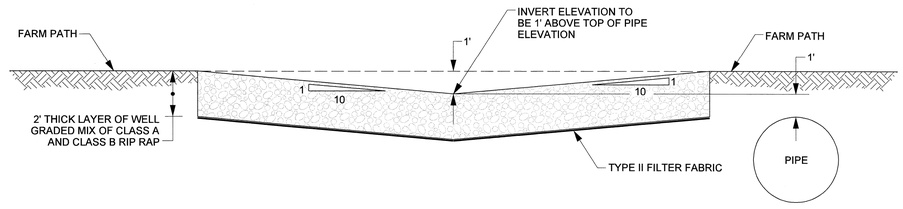


SECTION VIEW

NOTES:

1. GRADE VALLEY TO DESIGN GRADES SHOWN ON PROFILE.
2. MICROTOPOGRAPGHY IS ALLOWED TO FORM NATURALLY.

EMERGENCY OVERFLOW



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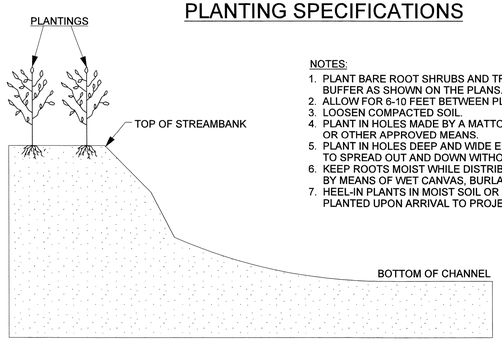
2/26/03

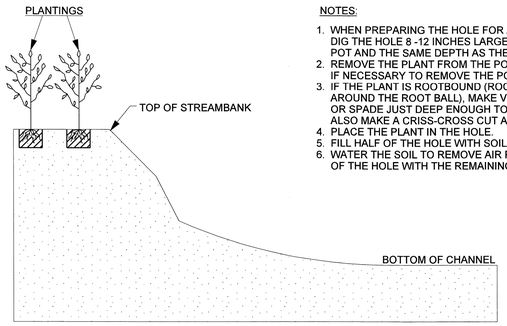
PLANTING SPECIFICATIONS



CROSS SECTION VIEW OF BARE ROOT PLANTING

NOTES:

1. PLANT BARE ROOT SHRUBS AND TREES TO THE WIDTH OF THE BUFFER AS SHOWN ON THE PLANS.
2. ALLOW FOR 6-10 FEET BETWEEN PLANTINGS, DEPENDING ON SIZE.
3. LOOSEN COMPACTED SOIL.
4. PLANT IN HOLES MADE BY A MATTOCK, DIBBLE, PLANTING BAR, OR OTHER APPROVED MEANS.
5. PLANT IN HOLES DEEP AND WIDE ENOUGH TO ALLOW THE ROOTS TO SPREAD OUT AND DOWN WITHOUT J-ROOTING.
6. KEEP ROOTS MOIST WHILE DISTRIBUTING OR WAITING TO PLANT BY MEANS OF WET CANVAS, BURLAP, OR STRAW.
7. HEEL-IN PLANTS IN MOIST SOIL OR SAWDUST IF NOT PROMPTLY PLANTED UPON ARRIVAL TO PROJECT SITE.

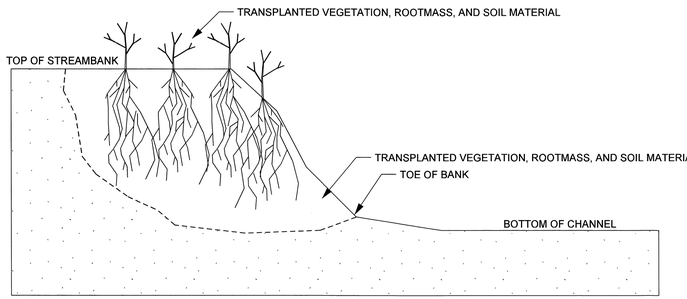


CROSS SECTION VIEW OF CONTAINER PLANTING

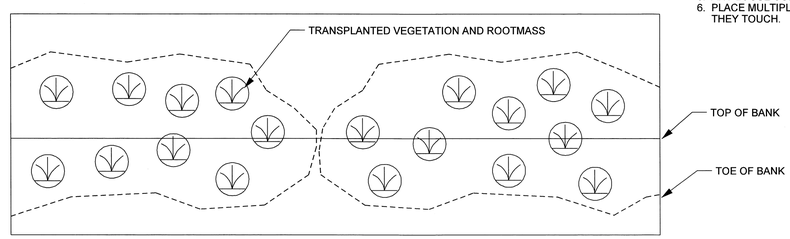
NOTES:

1. WHEN PREPARING THE HOLE FOR A POTTED PLANT OR SHRUB DIG THE HOLE 8 -12 INCHES LARGER THAN THE DIAMETER OF THE POT AND THE SAME DEPTH AS THE POT.
2. REMOVE THE PLANT FROM THE POT. LAY THE PLANT ON ITS SIDE IF NECESSARY TO REMOVE THE POT.
3. IF THE PLANT IS ROOTBOUND (ROOTS GROWING IN A SPIRAL AROUND THE ROOT BALL), MAKE VERTICAL CUTS WITH A KNIFE OR SPADE JUST DEEP ENOUGH TO CUT THE NET OF ROOTS. ALSO MAKE A CRISS-CROSS CUT ACROSS THE BOTTOM OF THE BALL.
4. PLACE THE PLANT IN THE HOLE.
5. FILL HALF OF THE HOLE WITH SOIL (SAME SOIL REMOVED FOR BACKFILL).
6. WATER THE SOIL TO REMOVE AIR POCKETS AND FILL THE REST OF THE HOLE WITH THE REMAINING SOIL.

TRANSPLANTED VEGETATION



CROSS SECTION VIEW



PLAN VIEW

NOTES:

1. EXCAVATE A HOLE IN THE BANK TO BE STABILIZED THAT WILL ACCOMMODATE THE SIZE OF TRANSPLANT TO BE PLACED. BEGIN EXCAVATION AT THE TOE OF THE BANK.
2. EXCAVATE TRANSPLANT USING A FRONT END LOADER. EXCAVATE THE ENTIRE ROOT MASS AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE. IF ENTIRE ROOT MASS CAN NOT BE EXCAVATE IN ONE BUCKET LOAD, THE TRANSPLANT IS TOO LARGE AND ANOTHER SHOULD BE SELECTED.
3. PLACE TRANSPLANT IN THE BANK TO BE STABILIZED SO THAT VEGETATION IS ORIENTATED VERTICALLY.
4. FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
5. ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
6. PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.

PROJECT REFERENCE NO.	SHEET NO.
125116	2-A

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M BYERS

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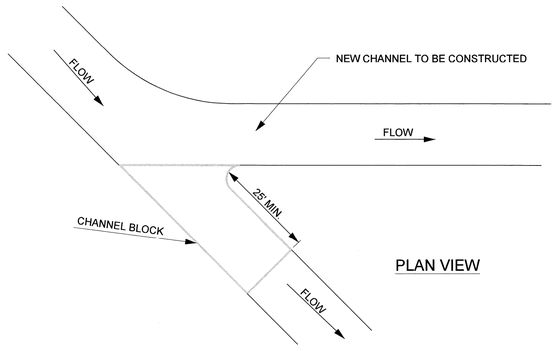
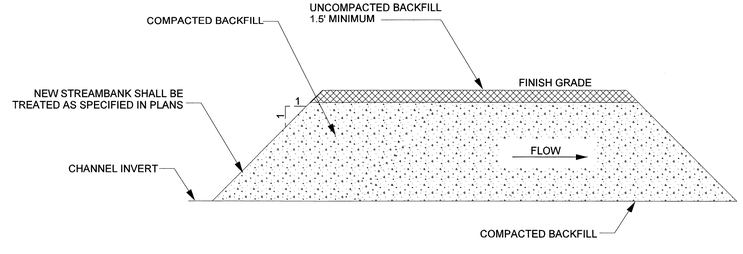
CHANNEL BLOCK

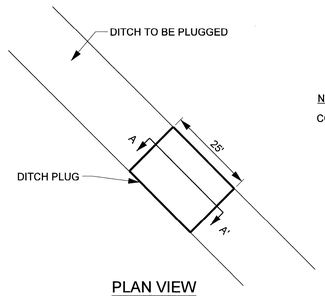


PLAN VIEW



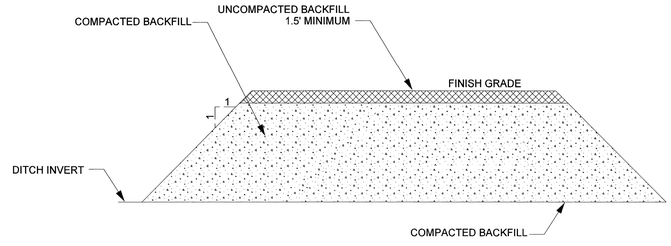
PROFILE VIEW

DITCH PLUG



PLAN VIEW

NOTE:
COMPACT BACKFILL USING ON-SITE HEAVY EQUIPMENT IN 10 INCH LIFTS.



SECTION A - A'

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BAKER PROJECT REFERENCE NO.	SHEET NO.
125116	3

PROJECT ENGINEER

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6/5/14

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NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WIGHT

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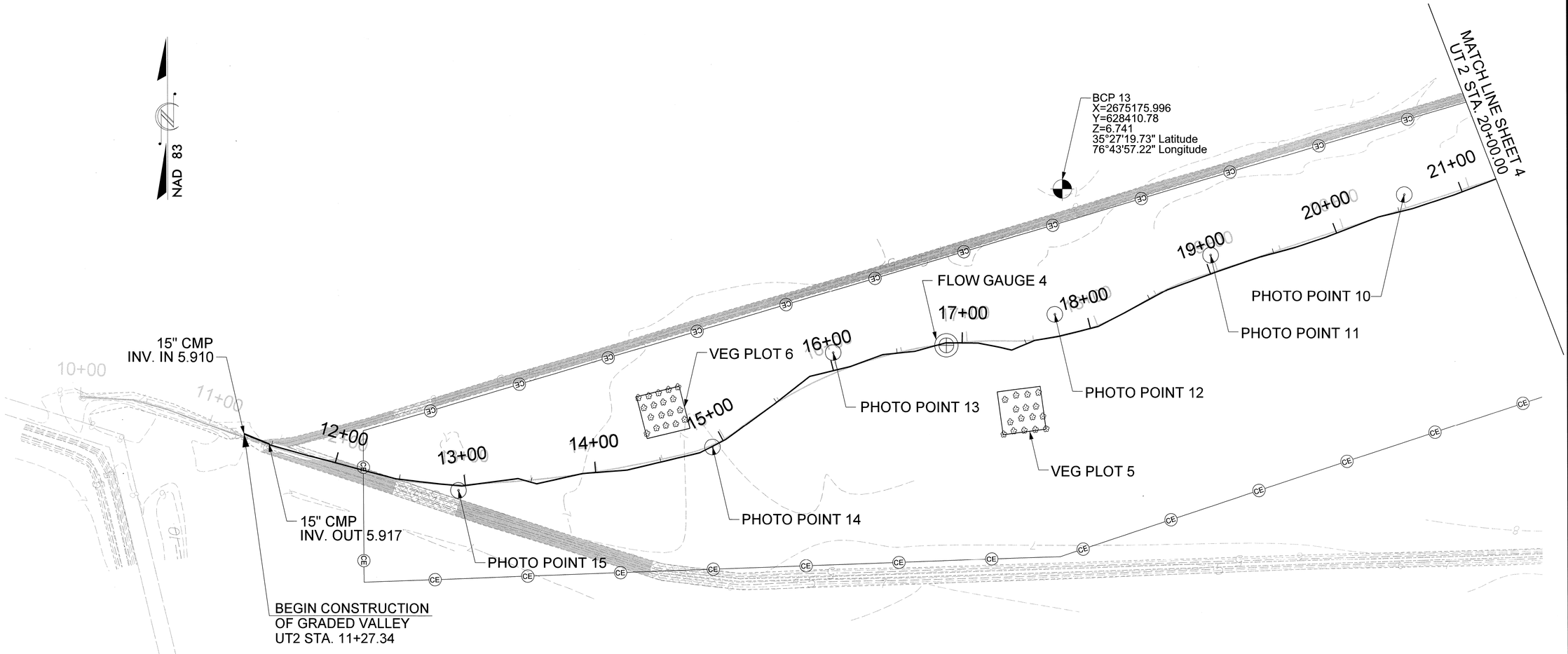
NAD 83



NOTES:

1. UT2 & UT3 WERE RESTORED TO A COASTAL PLAIN HEADWATER STREAM AND WETLAND SYSTEM BY RESTORING THE HEADWATER VALLEYS AND PROMOTING DIFFUSE FLOW.
2. TO THE EXTENT POSSIBLE, CONTRACTOR AVOIDED COMPACTION WITHIN THE RESTORED VALLEY.
3. EXCAVATED MATERIALS WERE USED TO FILL EXISTING DITCHES AND TO ELEVATE EXISTING FARM ROADS AS DIRECTED BY THE ENGINEER.
4. CONTRACTOR ENSURED A MINIMUM OF 2' OF COVER OVER ALL PROPOSED CULVERTS UNDER FARM ROADS.

FILLED EXISTING DITCH

PLUGGED EXISTING DITCH

WETLAND RESTORATION

ST. CLAIR
AS–BUILT PLAN

40 20 0 40 80
SCALE (FT)

6/5/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
125116	4

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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6/5/14

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NAD 83

24" PLASTIC PIPE
INV. IN 3.208

24" PLASTIC PIPE
INV. OUT 3.546

VEG PLOT 4

PHOTO POINT 8

PHOTO POINT 7

22+00

23+00

24+00

25+00

26+00

27+00

28+00

29+00

30+00

31+00

32+00

33+00

FLOW GAUGE 3

FLOW GAUGE 2

FLOW GAUGE 1

VEG PLOT 3

VEG PLOT 1

VEG PLOT 2

PHOTO POINT 9

PHOTO POINT 6

PHOTO POINT 5

PHOTO POINT 4

PHOTO POINT 3

AUTO WELL 2

AUTO WELL 1

BCP 16
X=2,675,816.506
Y=628,166.314
Z=7.40
35°27'17.17" Latitude
76°43'49.54" Longitude

MATCH LINE SHEET 3
UT 2 STA. 20+00.00

MATCH LINE SHEET 5
UT 2 STA. 32+00.00

NOTES:

1. UT2 & UT3 WERE RESTORED TO A COASTAL PLAIN HEADWATER STREAM AND WETLAND SYSTEM BY RESTORING THE HEADWATER VALLEYS AND PROMOTING DIFFUSE FLOW.
2. TO THE EXTENT POSSIBLE, CONTRACTOR AVOIDED COMPACTION WITHIN THE RESTORED VALLEY.
3. EXCAVATED MATERIALS WERE USED TO FILL EXISTING DITCHES AND TO ELEVATE EXISTING FARM ROADS AS DIRECTED BY THE ENGINEER.
4. CONTRACTOR ENSURED A MINIMUM OF 2' OF COVER OVER ALL PROPOSED CULVERTS UNDER FARM ROADS.

FILLED EXISTING DITCH

PLUGGED EXISTING DITCH

WETLAND RESTORATION

ST. CLAIR AS-BUILT PLAN

40 20 0 40 80

SCALE (FT)

6/5/2014
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mcahill

2/26/03

BAKER PROJECT REFERENCE NO.	SHEET NO.
125116	5

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 039201 JACOB M. BYERS

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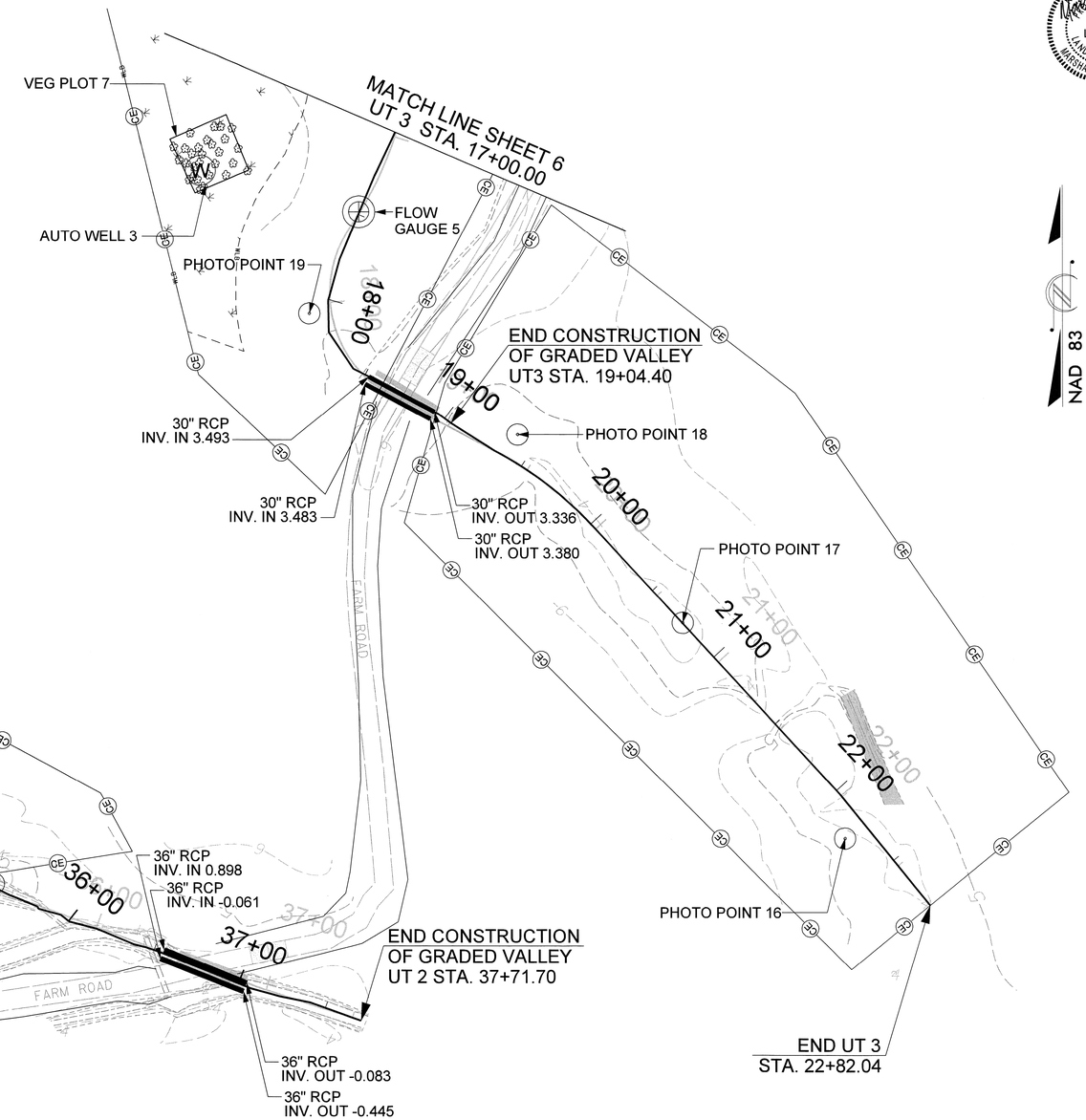
NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT SEAL L-5034 LANDSCAPE ARCHITECT MARSHALL G. WICKER



NOTES:

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4. CONTRACTOR ENSURED A MINIMUM OF 2' OF COVER OVER ALL PROPOSED CULVERTS UNDER FARM ROADS.
5. UT3 FROM APPROXIMATELY STA. 19+50 TO STA. 22+78 WAS NOT BE DISTURBED EXCEPT TO GRADE THE HIGH AREA AT APPROXIMATE STA. 21+40 TO FILL THE EXISTING DITCH.

FILLED EXISTING DITCH

PLUGGED EXISTING DITCH

WETLAND RESTORATION

ST. CLAIR AS–BUILT PLAN

40 20 0 40 80

SCALE (FT)

6/5/2014
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2/26/13

BAKER PROJECT REFERENCE NO.	SHEET NO.
125116	6

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. RIVERS

NORTH CAROLINA REGISTERED PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL C. WICKER

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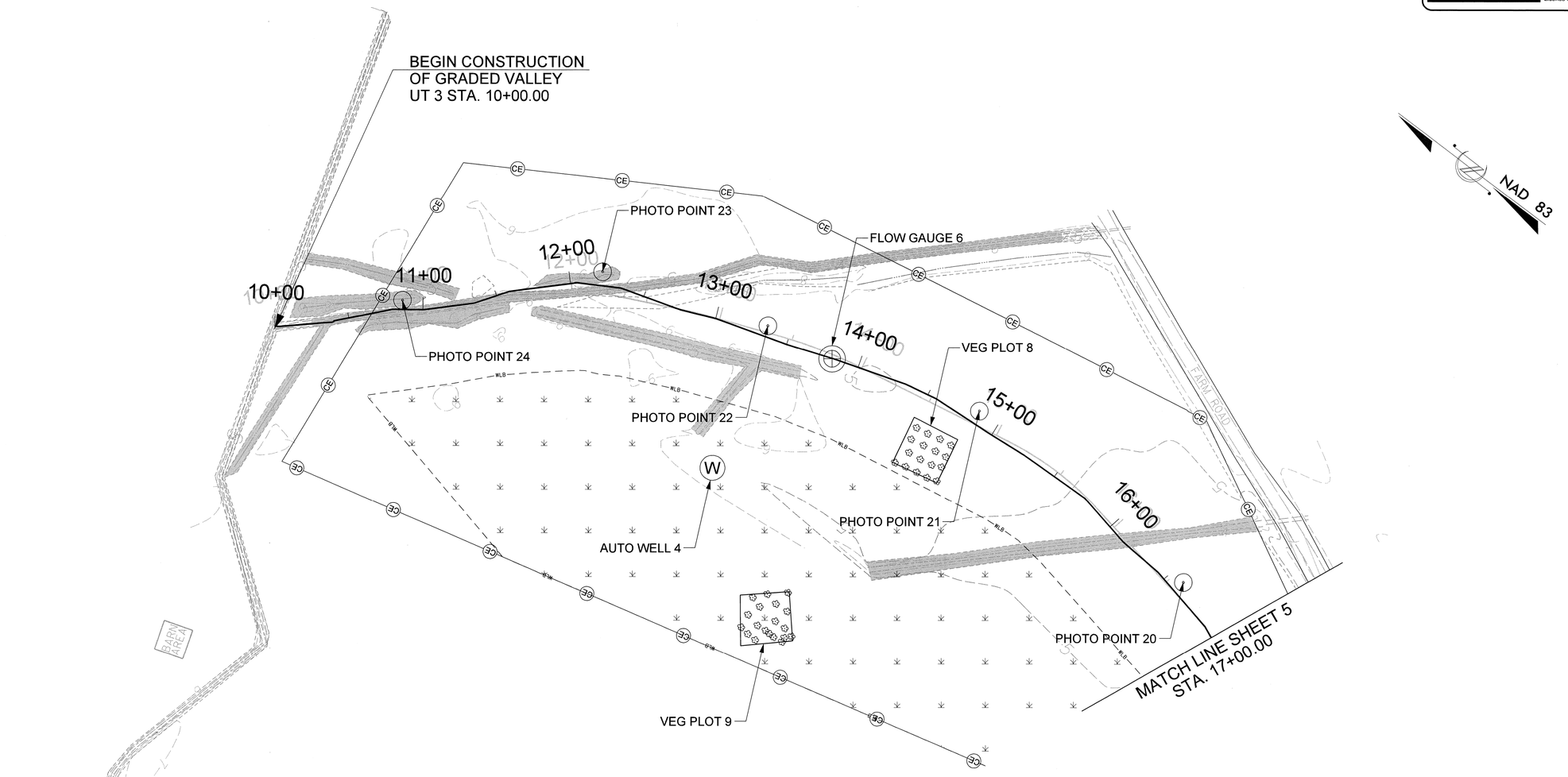

NOTES:

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FILLED EXISTING DITCH

PLUGGED EXISTING DITCH

WETLAND RESTORATION

ST. CLAIR
AS–BUILT PLAN

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SCALE (FT)

6/5/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
125116	7

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 039201 ENGINEER JACOB M. BYERS

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NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MITCHELL G. WILDER

UT2

BEGIN CONSTRUCTION OF GRADED VALLEY
UT2 STA. 11+27.34
ELEV. 5.91

INV. 5.910'
15" CMP
INV. 5.917'

EXISTING GROUND

DESIGN VALLEY BOTTOM

AS-BUILT PROFILE

12 8 4 0 -4 -8

10+00 11+00 12+00 13+00 14+00 15+00 16+00 17+00 18+00 19+00

UT2

EXISTING GROUND

AS-BUILT PROFILE

DESIGN VALLEY BOTTOM

12 8 4 0 -4 -8

19+00 20+00 21+00 22+00 23+00 24+00 25+00 26+00 27+00 28+00 29+00 30+00

UT2

EXISTING GROUND

DESIGN VALLEY BOTTOM

AS-BUILT PROFILE

INV. 0.898'

INV. 0-.0445'

2 - 36" RCP

END CONSTRUCTION
OF GRADED VALLEY
UT 2 STA. 37+71.70
ELEV. 0.80

12 8 4 0 -4 -8

30+00 31+00 32+00 33+00 34+00 35+00 36+00 37+00

6/4/2014
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BAKER PROJECT REFERENCE NO.	SHEET NO.
125116	8

PROJECT ENGINEER

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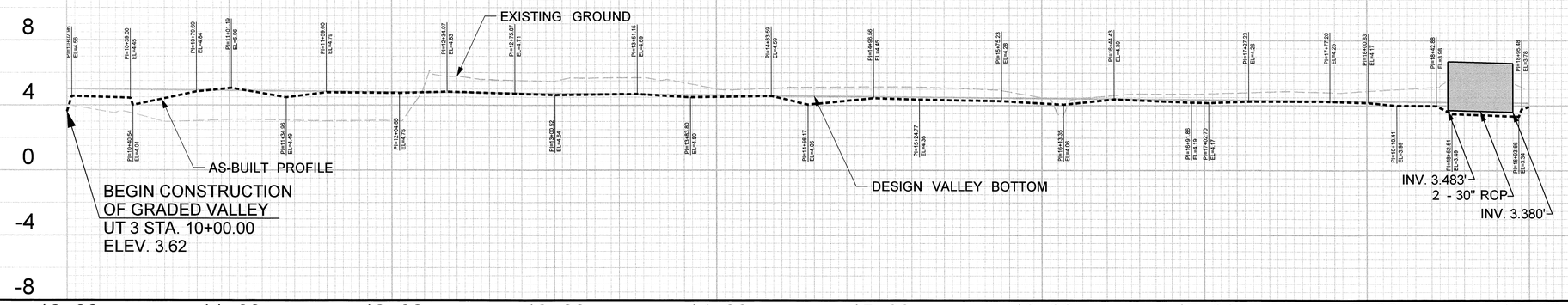
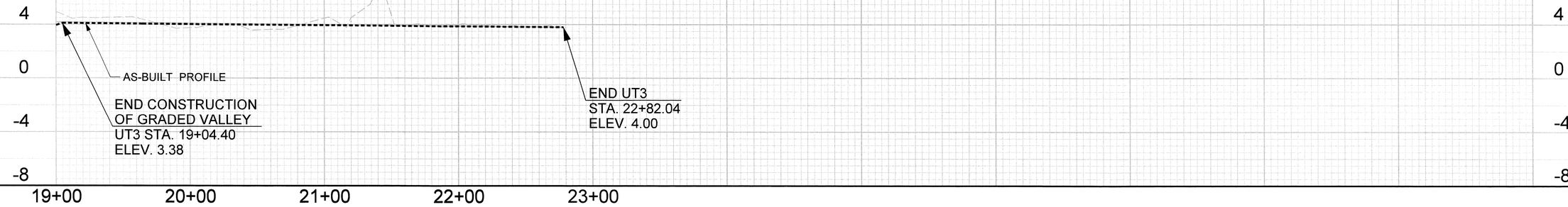
NORTH CAROLINA PROFESSIONAL SEAL L-5034 LAND SURVEYOR MARSHALL G. WILKINS

UT3



UT3



PROP. STA.
PROP. ELEV.

6/5/2014
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APPENDIX D

Photo Log

Photo Point 1, UT2 – Station 35+54 (June 4, 2014)

Photo Point 2, UT2 – Station 34+45 (June 4, 2014)

Photo Point 3, UT2 – Station 32+49 (June 4, 2014)

Photo Point 4, UT2 – Station 30+25 (June 4, 2014)

Photo Point 5, UT2 – Station 27+65 (June 4, 2014)

Photo Point 6, UT2 – Station 26+11 (June 4, 2014)

Photo Point 7, UT2 – Station 24+65 (August 13, 2013)

Photo Point 8, UT2 – Station 23+24 (June 4, 2014)

Photo Point 9, UT2 – Station 22+08 (June 4, 2014)

Photo Point 10, UT2 – Station 20+57 (June 4, 2014)

Photo Point 11, UT2 – Station 19+05 (June 4, 2014)

Photo Point 12, UT2 – Station 17+76 (June 4, 2014)

Photo Point 13, UT2 – Station 16+04 (June 4, 2014)

Photo Point 14, UT2 – Station 14+91 (June 4, 2014)

Photo Point 15, UT2 – Station 12+94 (June 4, 2014)

Photo Point 16, UT3 – Station 22+16 (June 4, 2014)

Photo Point 17, UT3 – Station 20+73 (June 4, 2014)

Photo Point 18, UT3 – Station 19+38 (June 4, 2014)

Photo Point 19, UT3 – Station 18+10 (June 4, 2014)

Photo Point 20, UT3 – Station 16+61 (June 4, 2014)

Photo Point 21, UT3 – Station 14+85 (June 4, 2014)

Photo Point 22, UT3 – Station 13+35 (June 4, 2014)

Photo Point 23, UT3 – Station 12+19 (June 4, 2014)

Photo Point 24, UT3 – Station 10+87 (June 4, 2014)

As-built Wetland Photo Point – SCAW1

As-built Wetland Photo Point – SCAW2

As-built Wetland Photo Point – SCAW3

As-built Wetland Photo Point – SCAW4