# Baseline Monitoring Report

**Buffalo Flats Restoration Site**
**Cabarrus County, North Carolina**
**EEP Contract 003273**
**EEP Project Number 94647**

Submitted to:

Ecosystem Enhancement PROGRAM

NCEEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

**Monitoring Data Collected: March 2012**
**Date Submitted: July 2012**

# Monitoring and Design Firm

Prepared by:

KCI Associates of North Carolina, PC
4601 Six Forks Rd, Suite 220
Raleigh, NC 27609
(919) 783-9214

**Project Contact: Adam Spiller**
**Email: adam.spiller@kci.com**
**KCI Project No: 20100798**

## July 2012

# TABLE OF CONTENTS



## Figures



## Tables



## Appendix A – Photos



## Appendix B – Baseline Monitoring Data



## Appendix C – As-Built Plan Sheets

## EXECUTIVE SUMMARY

The Buffalo Flats Restoration Site (BFRS) will provide mitigation for wetland impacts within Hydrologic Unit 03040105 by restoring, preserving, and creating 20.2 acres of wetland, generating 11.6 riparian wetland mitigation units (WMU's) and 3.4 non-riparian WMU's. The 2009 Lower Yadkin Pee-Dee RBRP identified HUC 03040105020050 (Upper Dutch Buffalo Creek) as a Targeted Local Watershed (NCDENR, EEP 2009).

The project goals and objectives are listed below.

*Project Goals*

- Create diverse bottomland hardwood and low elevation seep communities that are integrated into the Dutch Buffalo Creek Corridor.
- Buffer nutrient and sediment impacts to Dutch Buffalo Creek from adjacent grazing practices.

*Project Objectives*

- Fill field ditches and ponds to slow the removal of hydrology from the site.
- Redevelop wetland microtopography to capture surface hydrology and slow subsurface drainage.
- Plant the mitigation area with species native to bottomland riparian forest and low elevation seep communities.
- Install livestock exclusion fencing.

The project site, which is protected by a 20.2-acre permanent conservation easement held by the State of North Carolina, is situated in Cabarrus County in the Southern Outer Piedmont ecoregion of the Piedmont physiographic province. The site is located on a single parcel located off of Gold Hill Road approximately six miles northeast of Concord, North Carolina.

The project drainage is comprised of 0.17 square mile (106 acres) that flows through the project floodplain before reaching Dutch Buffalo Creek. The project watershed is experiencing extensive habitat alteration due to population growth from Charlotte and its surrounding metropolitan area. Currently, only 16% of the watershed is developed, but the area is expected to continue to grow. The other predominant land uses are 43% forest and 40% agriculture (NCDENR, EEP 2009).

The project site has experienced significant hydrologic and vegetative modifications to allow for cattle grazing across the property. The historic aerials indicate that the existing streams were channelized and the site has been ditched since at least 1938.

The wetland mitigation is comprised of four areas that combine preservation, creation, and restoration. The site will be monitored for at least seven years or until the success criteria are achieved. Reports will be submitted to the EEP each year. The planted wetland must meet the success criteria of a site average of 260 planted stems/acre at the end of the monitoring period based on the vegetation monitoring plots. The water table of the restored wetlands must be within 12" of the soils surface continuously for at least 5% (12 days) in the non-riparian wetland areas and 10% (23 days) in the riparian wetland area, of the 233-day growing season. Wetland hydrology will be monitored with a series of automatic gauges that record water table depth.

The monitoring components were installed in February and March 2012. Eleven permanent photo points have been established to document qualitative site conditions over the course of the monitoring period. To determine the success of the planted mitigation area, thirteen permanent vegetation monitoring plots were established according to the CVS-EEP Level 2 protocol.

# 1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

## 1.1 Location and Setting

The project site, which is protected by a 20.20-acre permanent conservation easement held by the State of North Carolina, is situated in Cabarrus County in the Southern Outer Piedmont ecoregion of the Piedmont physiographic province.

The site is located on a single parcel located off of Gold Hill Road approximately six miles northeast of Concord, North Carolina. To reach the site from Raleigh: proceed west on I-40 for approximately 80 miles. Then travel on I-85 south toward High Point. Take Exit 64 toward Kannapolis. Turn left at Lane Street and then another left onto Old Salisbury-Concord Road. Next take a slight right onto Irish Potato Road. Travel for 5 miles and then turn left onto Gold Hill Road. The site will be approximately 1.3 miles ahead on the left (shortly after crossing the bridge over Dutch Buffalo Creek). See Project Site Vicinity Map.

The site is part of the 03040105 Watershed Cataloging Unit (Rocky River). See Project Site Watershed Map. The Rocky River Watershed as a whole is experiencing a large amount of habitat alteration due to population growth from Charlotte and its surrounding metropolitan area. As a result, the focus in this watershed is on mitigating impacts from stormwater and protecting existing habitat (NCDENR, EEP 2009).

Within the Rocky River Watershed, the Upper Dutch Buffalo Creek drainage (03040105020050) remains relatively unaffected by urban development. The drainage is expected to gain an estimated 1,400 new residents over the period from 2000 to 2015 (NCDENR, EEP 2009). The drainage also contains several Natural Heritage Element Occurrences. The project site was selected due to its location along a section of Dutch Buffalo Creek (DWQ 13-17-11- (1) that is classified as Class C, Water Supply II (WS-II) and High Quality Waters (HQW) (NCDENR, DWQ 2010a). According to the most recent listing under Section 303 (d) of the Clean Water Act, no reach of Dutch Buffalo Creek is listed as an impaired water body (NCDENR, DWQ 2010b). The landscape position along the floodplain of Dutch Buffalo Creek, coupled with the impacts associated with current and past land uses and the strong evidence of hydrologic modifications indicated that the site had a high potential for wetland mitigation.

Based on these watershed and site-specific attributes, the BFRS was selected as an ideal candidate for wetland mitigation with the potential to provide an important buffer to approximately 2,200 linear feet of Dutch Buffalo Creek.

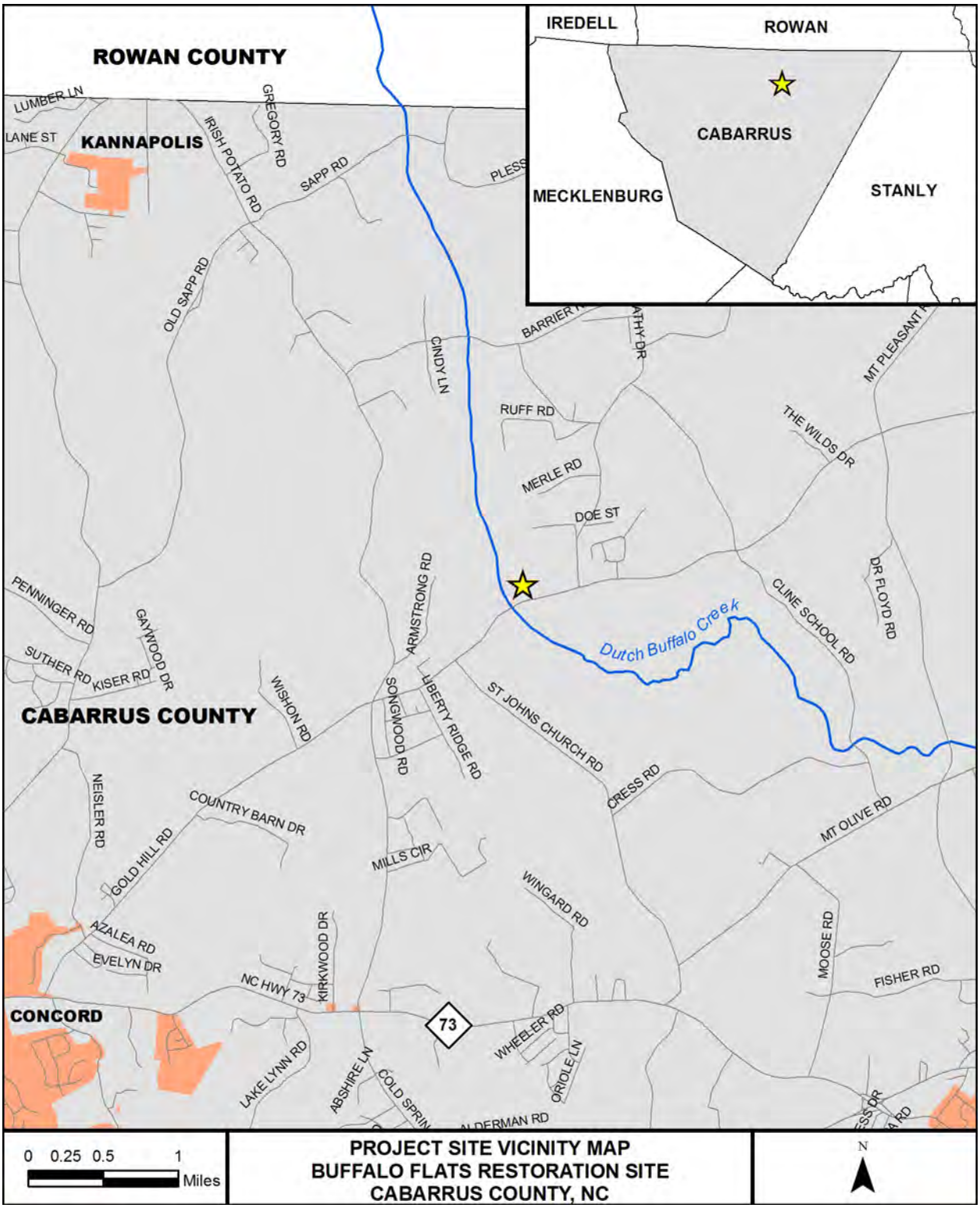
The project goals and objectives are listed below.

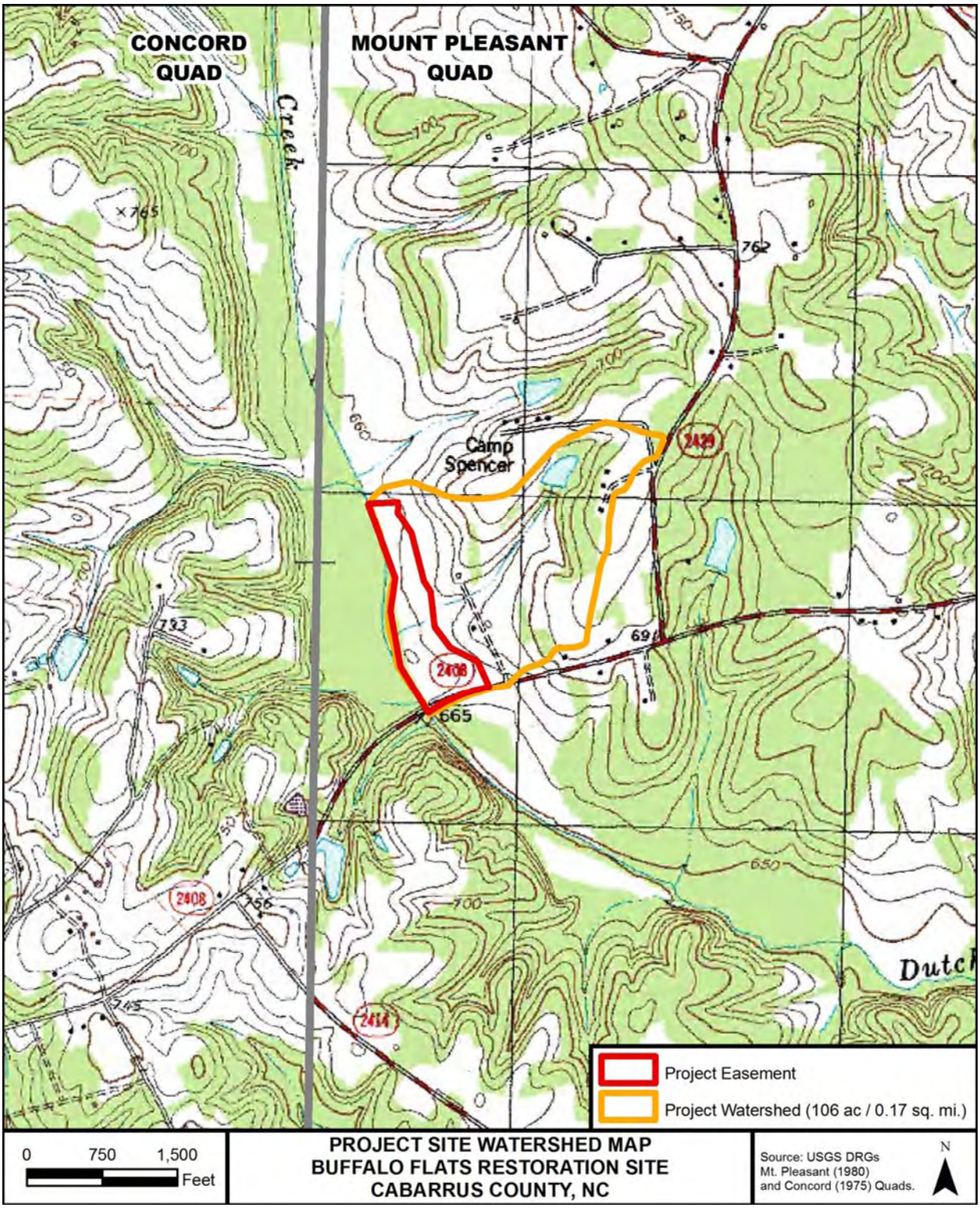
Project Goals

- Create diverse bottomland hardwood and low elevation seep communities that are integrated into the Dutch Buffalo Creek Corridor.
- Buffer nutrient and sediment impacts to Dutch Buffalo Creek from adjacent grazing practices.

Project Objectives

- Fill field ditches and ponds to slow the removal of hydrology from the site.
- Redevelop wetland mictrotography to capture surface hydrology and slow subsurface drainage.
- Plant the mitigation area with species native to bottomland riparian forest and lowland elevation seep.
- Install livestock exclusion fending.


ROWAN COUNTY
IREDELL
ROWAN
CABARRUS
MECKLENBURG
STANLY
KANNAPOLIS
CABARRUS COUNTY
CONCORD
Dutch Buffalo Creek
LUMBER LN
LANE ST
GREGORY RD
IRISH POTATO RD
SAPP RD
OLD SAPP RD
CINDY LN
RUFF RD
MERLE RD
DOE ST
THE WILDS DR
MT PLEASANT
CLINE SCHOOL RD
DR FLOYD RD
ARMSTRONG RD
PENNINGER RD
GAYWOOD DR
SUTHER RD
KISER RD
WISHON RD
SONGWOOD RD
LIBERTY RIDGE RD
ST JOHNS CHURCH RD
CRESS RD
MT OLIVE RD
NEISLER RD
COUNTRY BARN DR
GOLD HILL RD
MILLS CIR
WINGARD RD
AZALEA RD
EVELYN DR
KIRKWOOD DR
NC HWY 73
MOOSE RD
FISHER RD
WHEELER RD
ORIOLE LN
LAKE LYNN RD
ABSHIRE LN
ALDERMAN RD
73
0 0.25 0.5 1
Miles
PROJECT SITE VICINITY MAP
BUFFALO FLATS RESTORATION SITE
CABARRUS COUNTY, NC
N


CONCORD
QUAD
MOUNT PLEASANT
QUAD
Creek
Camp
Spencer
2429
2408
2408
2414
Project Easement
Project Watershed (106 ac / 0.17 sq. mi.)
0
750
1,500
Feet
PROJECT SITE WATERSHED MAP
BUFFALO FLATS RESTORATION SITE
CABARRUS COUNTY, NC
Source: USGS DRGs
Mt. Pleasant (1980)
and Concord (1975) Quads.
N

## 1.2 Project Structure, Restoration Type and Approach

The modifications at the BFRS focused on restoring hydrology to the wetland mitigation areas. This was achieved by removing the anthropogenic modifications that were previously implemented across the site. The restoration of the site will result in improved surface storage of hillside seepage for the non-riparian wetland and a lengthened or impeded flow path of surface water throughout the riparian wetland. This project involved the restoration of approximately 14.6 acres of riparian and non-riparian wetlands, and 1.2 acres of wetland creation. See Project Site Mitigation Plan View.

### *1.2.1 Project Wetlands*

Wetland Area 1 restored approximately 3.4 acres of non-riparian wetland restoration located in the southeastern portion of the site. Lateral field ditches and an existing pond were filled to restore hydrology. Surface roughening techniques were then used to encourage surface and shallow subsurface water storage. Following the completion of site grading, the non-riparian wetland was planted as a Low Elevation Seep Community.

Wetland Area 2 restored approximately 11.2 acres of riparian wetland on the floodplain of Dutch Buffalo Creek and connected the narrow riparian buffer along the creek levee. Overbank flooding from Dutch Buffalo Creek will provide occasional hydrologic inputs to the wetland, but the predominant source of hydrology will come from surface inputs that were previously being routed off the site. Modifications included the filling of shallow lateral drains, the filling of approximately 600' of deep drainage ditches, the removal of overburden from existing stream levees, the filling of two existing ponds, and the removal of several spoil piles. After this grading work was completed the surface soils were roughened to eliminate compaction and encourage surface water retention. Wetland Area 2 was then planted as a Bottomland Hardwood Forest.

Wetland Area 3 involves the creation of approximately 1.2 acres of riparian wetland located in the central portion of the site along the western easement boundary. The soils were graded to match the elevation of the adjacent Wetland Area 2, and roughened to alleviate surface compaction and keep surface water in the wetland. Spoil adjacent to Dutch Buffalo Creek was also be removed from this area. Wetland Area 3 was planted as a Bottomland Hardwood Forest.

A suitable reference wetland was found west of the BFRS and on the opposite side of Dutch Buffalo Creek. The site is consistent with the Bottomland Hardwood Community which is the primary vegetative community at the project site. A groundwater monitoring well has also been installed to document the reference wetland hydrology during the course of monitoring.

Table 1 provides a summary of the mitigation actions and units generated from this project.

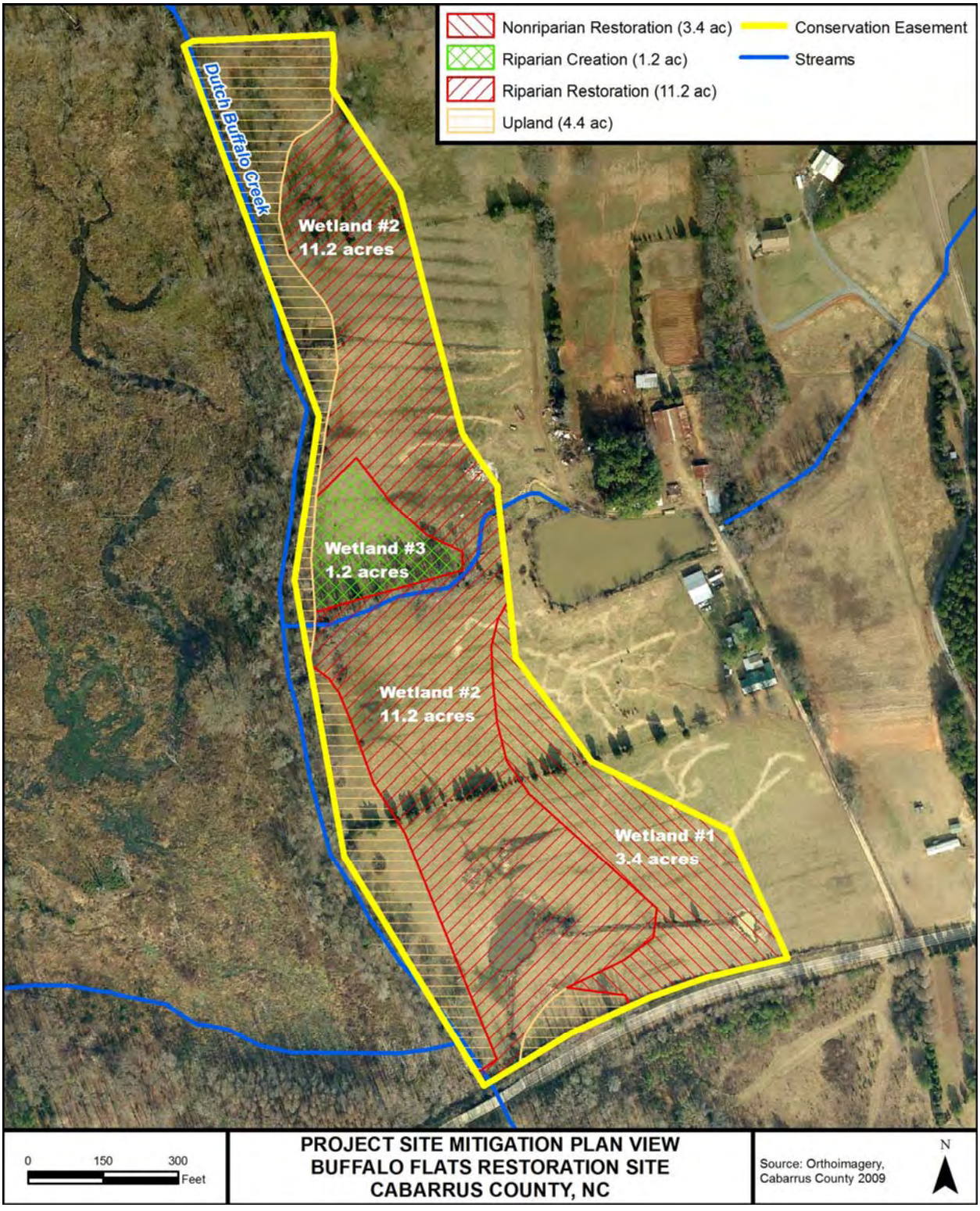

Nonriparian Restoration (3.4 ac)
Riparian Creation (1.2 ac)
Riparian Restoration (11.2 ac)
Upland (4.4 ac)
Conservation Easement
Streams
Dutch Buffalo Creek
Wetland #2
11.2 acres
Wetland #3
1.2 acres
Wetland #2
11.2 acres
Wetland #1
3.4 acres
0
150
300
Feet
PROJECT SITE MITIGATION PLAN VIEW
BUFFALO FLATS RESTORATION SITE
CABARRUS COUNTY, NC
Source: Orthoimagery,
Cabarrus County 2009
N

**Table 1. Project Components**
**Buffalo Flats Restoration Site**

**Mitigation Credits**

| | Stream | | Riparian Wetland | | Non-riparian Wetland | | Buffer | Nitrogen Nutrient Offset | Phosphorous Nutrient Offset |
|---|---|---|---|---|---|---|---|---|---|
| **Type** | R | RE | R | RE | R | RE | | | |
| **Acres** | - | - | 11.2 | 1.2 | 3.4 | - | | | |
| **Credits** | - | - | 11.2 | 0.4 | 3.4 | - | - | - | - |
| **TOTAL CREDITS** | | | 11.6 | | 3.4 | | | | |

**Project Components**

| Project Component -or- Reach ID | Stationing/ Location | Existing Footage/ Acreage | Approach (PI, PII etc.) | Restoration -or- Restoration Equivalent | Restoration Footage or Acreage | Mitigation Ratio |
|---|---|---|---|---|---|---|
| Wetland Area 1 | Southeastern corner of project | 3.4 acres | - | Restoration | 3.4 acres | 1:1 |
| Wetland Area 2 | North to south throughout the center of project | 11.2 acres | - | Restoration | 11.2 acres | 1:1 |
| Wetland Area 3 | West-central portion of the project | 1.2 acres | - | Creation | 1.2 acres | 3:1 |

**Component Summation**

| Restoration Level | Stream (linear feet) | Riparian Wetland (acres) | | Non-riparian Wetland (acres) | Buffer (square feet) | Upland (acres) |
|---|---|---|---|---|---|---|
| | | Riverine | Non-Riverine | | | |
| Restoration | - | 11.2 acres | - | 3.4 acres | - | - |
| Enhancement | | - | - | | - | - |
| Enhancement I | - | | | | | |
| Enhancement II | - | | | | | |
| Creation | | 1.2 acres | - | - | | - |
| Preservation | - | - | - | - | | 4.4 acres |
| High Quality Preservation | - | - | - | - | | - |
| **TOTAL** | | 12.4 acres | - | 3.4 acres | | 4.4 acres |

### *1.2.2 Project Community Types*

Planting consists of native species commonly found in the Piedmont Bottomland Forest Community and Low Elevation Seep Community as described by Schafale and Weakley (1990). Trees were planted at a density of 605 trees per acre (12 feet by 6 feet spacing). Woody vegetation planting was conducted during dormancy. The following tree species were planted within the wetland site:

| **Common Name** | **Scientific Name** | **Indicator Status (Region 2)** |
|---|---|---|
| Water tupelo | *Nyssa aquatica* | OBL |
| Overcup oak | *Quercus lyrata* | OBL |
| Tulip poplar* | *Liriodendron tulipifera* | FAC |
| Laurel oak | *Quercus laurifolia* | FACW |
| Cherrybark oak | *Quercus pagoda* | FAC+ |
| Willow oak* | *Quercus phellos* | FACW- |
| American sycamore* | *Platanus occidentalis* | FACW- |

***Trees observed on-site or in adjacent floodplain***

## 1.3 Project History, Contacts and Attribute Data

| Table 2. Project Activity & Reporting History<br>Buffalo Flats Restoration Site | | |
|---|---|---|
| **Activity or Report** | **Data Collection Complete** | **Actual Completion or Delivery** |
| Mitigation Plan | | Dec 10 |
| Final Design - Construction Plans | | Dec 10 |
| Construction | | Oct 11 |
| Planting | | Feb 12 |
| Baseline Monitoring/Report | Feb/March 12 | July 12 |

| Table 3. Project Contacts<br>Buffalo Flats Restoration Site | |
|---|---|
| **Design Firm** | KCI Associates of North Carolina, PC<br>Landmark Center II, Suite 220<br>4601 Six Forks Rd.<br>Raleigh, NC 27609<br>Contact: Mr. Tim Morris<br>Phone: (919) 278-2512<br>Fax: (919) 783-9266 |
| **Construction Contractor** | KCI Environmental Technologies and Construction, Inc.<br>Landmark Center II, Suite 220<br>4601 Six Forks Rd.<br>Raleigh, NC 27609<br>Contact: Mr. Tim Morris<br>Phone: (919) 278-2512<br>Fax: (919) 783-9266 |
| **Planting Contractor** | Bruton Nurseries and Landscapes<br>PO Box 1197<br>Freemont, NC 27830<br>Contact: Mr. Charlie Bruton<br>Phone: (919) 242-6555 |
| **Monitoring Performers** | |
| **MY-00** | KCI Associates of North Carolina, PC<br>Landmark Center II, Suite 220<br>4601 Six Forks Rd.<br>Raleigh, NC 27609<br>Contact: Mr. Adam Spiller<br>Phone: (919) 278-2514<br>Fax: (919) 783-9266 |

| Table 4. Project Information<br>Buffalo Flats Restoration Site | | | |
|---|---|---|---|
| **Project Name** | Buffalo Flats Restoration Site | | |
| **County** | Cabarrus County | | |
| **Project Area (acres)** | 20.20 acres | | |
| **Project Coordinates (lat. and long.)** | 35.456988 N , -80.496325 W | | |
| **Project Watershed Summary Information** | | | |
| **Physiographic Province** | Piedmont | | |
| **River Basin** | Yadkin-Pee Dee | | |
| **USGS Hydrologic Unit 8-digit** | 03040105 | **USGS Hydrologic Unit 14-digit** | 03040105020050 |
| **DWQ Sub-basin** | 03-07-12 | | |
| **Project Drainage Area (acres)** | 106 acres | | |
| **Project Drainage Area Percentage of Impervious Area** | 1% | | |
| **CGIA Land Use Classification** | 3.6% Cultivated, 54.1% Managed Herbaceous Cover, 32.5% Mixed Upland Hardwoods, 5.2% Southern Yellow Pine, and 4.6% Water Bodies | | |
| **Wetland Summary Information** | | | |
| **Parameters** | **Wetland Area 1** | **Wetland Area 2** | **Wetland Area 3** |
| Size of Wetland (acres) | 3.4 acres | 11.2 acres | 1.2 acres |
| Wetland Type (non-riparian, riparian riverine or riparian non-riverine) | Non-riparian | Riparian non-riverine | Riparian non-riverine |
| Mapped Soil Series | Chewacla (Wehadkee and Armenia by detailed soil investigation) | Chewacla (Wehadkee and Armenia by detailed soil investigation) | Chewacla |
| Drainage class | Poorly drained | Poorly drained | Somewhat poorly drained |
| Soil Hydric Status | Drained Hydric | Drained Hydric | Non hydric |
| Source of Hydrology | Hillside seepage | Surface/Overbank Flow | Surface/Overbank Flow |
| Hydrologic Impairment | Ditching and Pasture | Ditching and Pasture | Ditching and Pasture |
| Native vegetation community | Pasture | Pasture | Pasture |
| Percent composition of exotic invasive vegetation | 0% | 0% | 2% |
| **Regulatory Considerations** | | | |
| **Regulation** | **Applicable?** | **Resolved?** | **Supporting Documentation** |
| Waters of the United States – Section 404 | Yes | Received NWP 27 | Jurisdictional Determination |
| Waters of the United States – Section 401 | Yes | Received NWP 27 | Jurisdictional Determination |
| Endangered Species Act | No | N/A | N/A |
| Historic Preservation Act | No | N/A | N/A |
| Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA) | No | N/A | N/A |
| FEMA Floodplain Compliance | Yes | No-Rise Certification with Cabarrus County | FEMA Model |
| Essential Fisheries Habitat | No | N/A | N/A |

## 2.0 SUCCESS CRITERIA

The BFRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. In the restoration area, the wetland site will be deemed successful once hydrology is established and vegetation success criteria are met. In the creation area, success will be achieved if wetland hydrology and vegetation are present along with indicators of hydric soils.

### 2.1 Wetland Hydrology

The site will present continuous saturated or inundated hydrologic conditions for at least 10% of the growing season for riparian mitigation areas (11.6 acres) and 5% for non-riparian mitigation areas (3.4 acres) (50% probability of reoccurrence) during normal weather conditions. A "normal" year is based on NRCS climatological data for Cabarrus County, and using the 30th to 70th percentile thresholds as the range of normal, as documented in the USACE Technical Report "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology" (Sprecher, 2000). According to the Cabarrus County Soil Survey, the growing season is considered to extend from March 23rd to November 11th, comprising 233 days.

Due to the inherent variability in the sites features and its geomorphic position, it is unlikely that the project will homogeneously exhibit common hydrologic conditions across the site, making a single hydrologic performance criterion unrepresentative of the sites performance. As such, the gauge data will be evaluated as a spatial average with each gauge representing the area half the distance to adjacent gauges or wetland type boundaries. The spatial average by wetland type will be the calculated value for comparison with the performance standard for credit validation. Gauges not achieving a minimum of 5% saturation will be considered non-attaining even if the spatial average exceeds the credit validation performance standard (5% for non-riparian and 10% for riparian). The water table of the restored wetlands must be within 12" of the soils surface continuously for at least 5% (12 days) in the non-riparian wetland area and 10% (23 days) in the riparian wetland area, of the 233-day growing season. Wetland hydrology will be monitored with ten automatic gauges that record water table depth. Two of these gauges are located in Wetland Area 1, six of these gauges are located in Wetland Area 2, and the remaining two gauges are located in Wetland 3.

Hydrologic performance will be determined through evaluation of automatic recording gauge data supplemented by documentation of wetland hydrology indicators as defined in the 1987 US ACOE Wetland Delineation Manual (Manual).

### 2.2 Vegetation

The site will demonstrate the re-establishment of targeted vegetative communities based on survival and growth of planted species and volunteer colonization, with an average stem density of 320 stems/acre after three years, 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after 7 years. Permanent monitoring plots (10 by 10 meters) have been established in the wetland restoration and creation areas at a density that statistically represents the total mitigation acreage. Three of these plots are located in Wetland Area 1, nine of these plots are located in Wetland Area 2, and one plot is located in Wetland Area 3. The average density of these plots will determine whether the site meets success criterion. Non-target species must not constitute more than 20% of the woody vegetation based on permanent monitoring plots.

### 2.3 Soils

The 1.2 acre wetland creation area will be monitored to document the development of redoximorphic features in the soil by evidence of two or more indicators i.e. changes in chroma, organic matter content, oxidized root channels, concretions, mottles and other indications that the soil is subject to low oxygen conditions etc. within the seven-year monitoring period. Two permanent monitoring plots will be

established and soil profiles will be monitored yearly for development of redoximorphic conditions by a licensed soil scientist. Profiles will be compared from year to year and changes will be documented in the yearly monitoring reports.

# 3.0 PROJECT MONITORING

## 3.1 Monitoring Features

Permanent monuments, marking monitoring feature locations, were established on-site in February 2012. Thirteen (10 meter x 10 meter) vegetation plots were installed with flagged metal conduit at each corner and a flagged PVC pipe was installed at the photo corner. Ten automatic recording gauges were installed in the site's wetlands, eight in the wetland restoration areas and two in the creation wetland, to record hydrology data throughout the growing season. One gauge was installed at the reference wetland. Two permanent plots were set up in the wetland creation area for yearly soil profile monitoring. Eleven photograph reference points (PRPs) have been established as part of the baseline monitoring with flagged PVC pipe. The locations of these monitoring features are marked in As-Built Plan Sheet 9 (Appendix C).

## 3.2 Monitoring Guidelines

The first scheduled monitoring will be conducted during the first full growing season following project completion. Monitoring shall subsequently be conducted annually for a total period of seven years or until the project meets its success criteria. Annual monitoring reports will be prepared and submitted after all monitoring tasks for each year are completed. The report will document the monitored components and include all collected data, analyses, and photographs. Each report will provide the new monitoring data and compare the most recent results against previous findings. The monitoring report format will be similar to that set out in the most recent EEP monitoring protocol.

### *3.2.1 Wetland Vegetation*

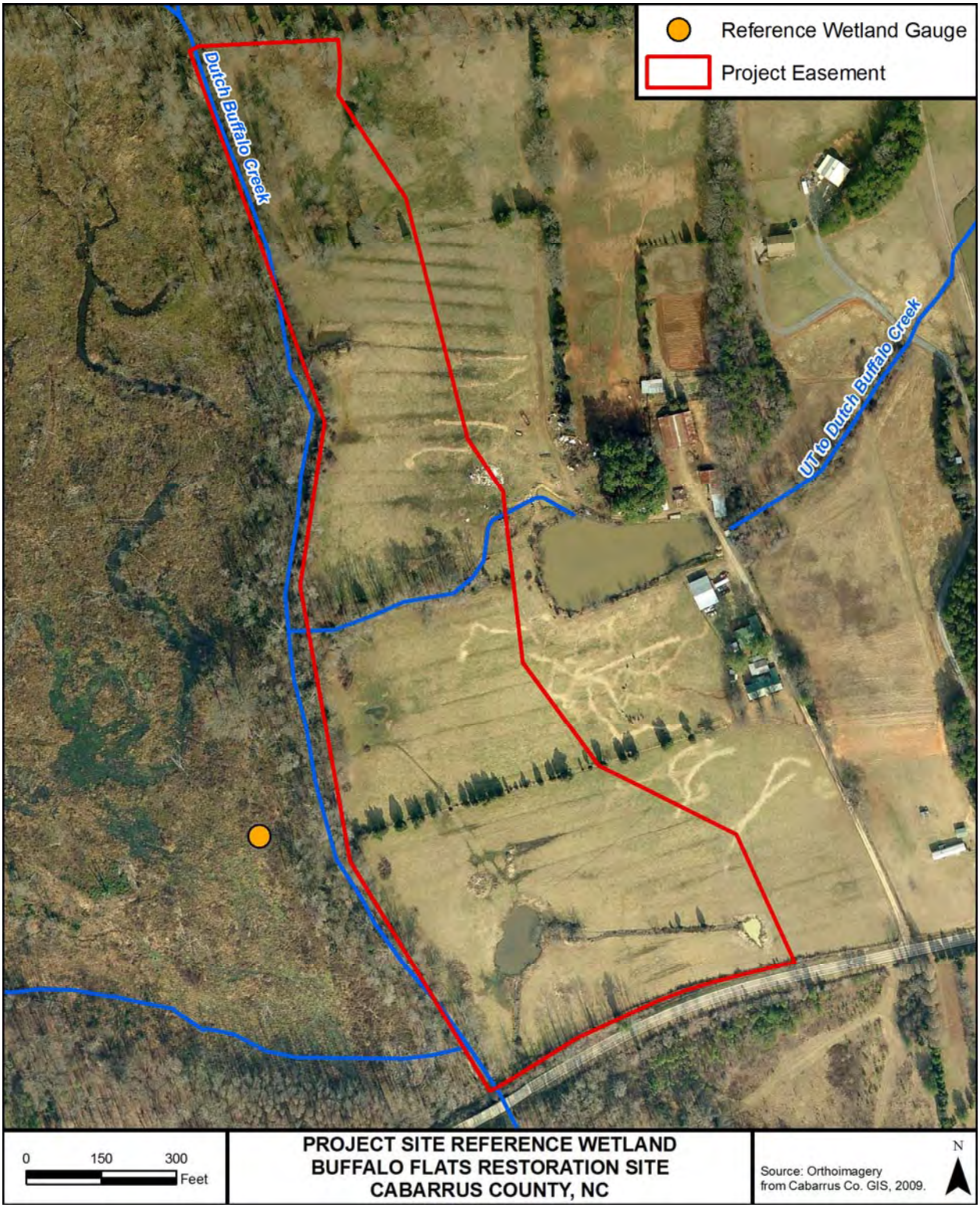
Thirteen vegetation plots were set up and assessed for the baseline vegetation monitoring. Vegetation data collection must follow the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2008, http://cvs.bio.unc.edu/methods.htm). The baseline vegetation monitoring was conducted as Level 1: Inventory of Planted Stems, as will the first year monitoring. Beginning in year two and continuing in years three, five, and seven, the site will be monitored using the Level 2 protocol. Additionally, a photograph will be taken of each monitoring plot, allowing yearly qualitative comparison of vegetation conditions.

### *3.2.2 Wetland Hydrology*

Ten groundwater monitoring gauges were set up and assessed for the baseline monitoring to evaluate the attainment of jurisdictional wetland hydrology. Verification of wetland hydrology will be determined by automatic recording well data collected within the project area and reference wetland. The wetland gauges will be checked and/or downloaded every other month. Daily data will be collected from the automatic gauges over the 7-year monitoring period following wetland construction. The nearby reference wetland will also be monitored using the same procedures for comparative analysis. See Project Site Reference Wetland.

### *3.2.3 Soil Profile*

Two permanent plots were set up for soil profiles to determine jurisdictional wetland status within the 1.2 acre creation area. These soil profiles will be evaluated the same years the vegetation is monitored. Profiles will be compared from year to year and changes will be documented in the yearly monitoring reports.


Reference Wetland Gauge
Project Easement
Dutch Buffalo Creek
UT to Dutch Buffalo Creek
0
150
300
Feet
PROJECT SITE REFERENCE WETLAND
BUFFALO FLATS RESTORATION SITE
CABARRUS COUNTY, NC
Source: Orthoimagery
from Cabarrus Co. GIS, 2009.
N

### *3.2.4 Digital Photos*

Eleven photograph reference points (PRPs) have been established as part of the baseline monitoring to assist in characterizing the site and to allow qualitative evaluation of the site conditions. Starting in the first monitoring year, these photos will be taken in late summer, so that vegetative conditions are similar at the site between monitoring years.

### *3.2.5 Watershed Conditions*

Yearly monitoring will document any evident changes in the watershed. Any large hydrologic events in the watershed, such as tropical storms or hurricanes, will also be documented in the yearly monitoring reports.

## 4.0 BASELINE CONDITIONS

The wetlands were built as designed without any significant changes from the design plans and documented in the As-Built Plan Sheets in Appendix C. The site was planted with a total of nine different species of bare root trees in February 2012. Baseline monitoring data were collected in February and March 2012. The Level 1 CVS-EEP protocol (http://cvs.bio.unc.edu/methods.htm) was used to collect vegetation data. Plot photos from all the vegetation plots can be found in Appendix A.

The results of the baseline monitoring show an average of 729 stems per acre in the planted wetland (Table 5). Additionally, stem counts within each individual plot were well-above the required 320 stems per acre. An attempt to identify all trees was made, but since monitoring was conducted while the trees were dormant, many were unidentifiable. All trees will be positively identified during the first year of monitoring.

**Table 5. Planted Stem Density by Plot**
**Buffalo Flats Restoration Site**
**Wetland Plots**

| Common Name | Species | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| River Birch | *Betula nigra* | | 1 | 4 | | 1 | | 3 | 10 | 1 | 4 | 6 | 13 | 4 |
| Water Tupelo | *Nyssa aquatica* | | | | | 2 | | | | 1 | | | 3 | |
| Oak sp. | *Quercus sp.* | | 1 | 1 | | | | 1 | | | | | | |
| Laurel Oak | *Quercus laurifolia* | 8 | 5 | | 2 | | 4 | | | | | | | |
| Cherrybark Oak | *Quercus pagoda* | | 5 | 3 | 2 | 1 | | 1 | 2 | 4 | | 4 | 2 | |
| Willow Oak | *Quercus phellos* | 4 | 1 | | | 1 | | | | 1 | 3 | 1 | | 3 |
| Unknown sp. | | 9 | 10 | 8 | 11 | 14 | 11 | 9 | 12 | 13 | 8 | 10 | | 9 |
| **Total (Baseline)** | | 21 | 23 | 16 | 15 | 19 | 15 | 14 | 24 | 20 | 15 | 21 | 18 | 16 |
| **Density (Baseline)** | | 840 | 920 | 640 | 600 | 760 | 600 | 560 | 960 | 800 | 600 | 840 | 720 | 640 |
| **Total Average Density (Stems/Acre)** | | | | | | | | | | | | | | 729 |

The two permanent soil data plots were assessed in May 2012 for the baseline monitoring year. The results are included in Appendix B Baseline Monitoring Data.

## 5.0 MAINTENANCE AND CONTINGENCY PLANS

KCI will monitor the site on a regular basis and conduct a physical inspection of the site a minimum of once per 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. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

| Component/Feature | Maintenance Through Project Close-Out |
|---|---|
| Wetland | Routine wetland maintenance and repair activities may include evaluating and repairing floodplain scour areas, constructed outlets and flow dispersement from seepage areas. Areas where stormwater and floodplain flows intercept the wetland may also require maintenance to prevent scour. |
| Vegetation | Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations. |
| Site Boundary | Site boundaries have been marked with signage every 150' along the site boundary. Most of the signage occurs on the existing fence line which is consistent with the easement boundary. Additional steel t-posts with signage have been installed to denote areas that are not fenced, such as the area directly adjacent to Dutch Buffalo Creek. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis. |

## 6.0 REFERENCES

Lee, Michael T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation, Version 4.2 (http://cvs.bio.unc.edu/methods.htm)

USACE. 2003. Stream Mitigation Guidelines. USACE, NCDENR-DWQ, USEPA, NCWRC.

Sprecher, S. W. and Warne, A. G. 2000. "Accessing and Using Meteorological Data to Evaluate Wetland Hydrology," ERDC/EL TR-WRAP-00-01, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

# APPENDIX A

Photos

## Photograph Reference Point Photos

Photo Point 1: View looking west, from the southeastern corner of the project site. 3/1/2012 – Baseline

Photo Point 2: View looking north, from the southeastern corner of the project site. 3/1/2012 – Baseline

Photo Point 3: View looking south, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 4: View looking west, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 5: View looking north, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 6: View looking southwest, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 7: View looking northwest, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 8: View looking southwest, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 9: View looking west, from the eastern easement boundary. 3/1/2012 – Baseline

Photo Point 10: View looking north, from the eastern easement boundary. 3/1/2012 – Baseline

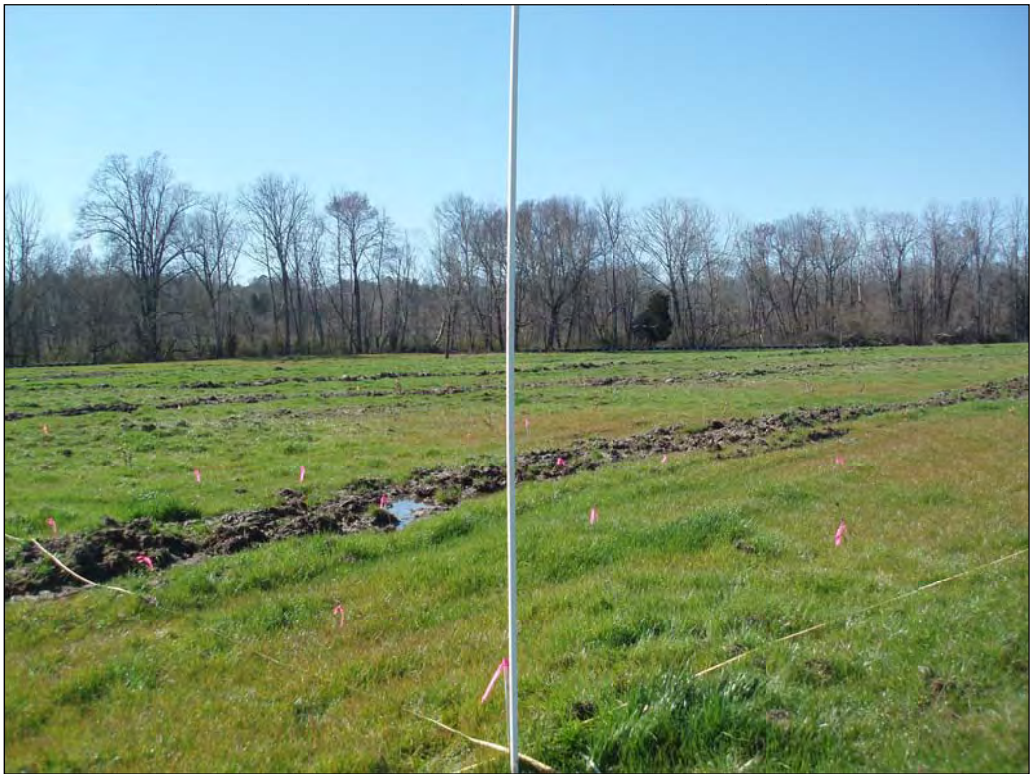
Photo Point 11: View looking south, from the northeastern corner of the project site. 3/1/2012 – Baseline

## Vegetation Plot Photos

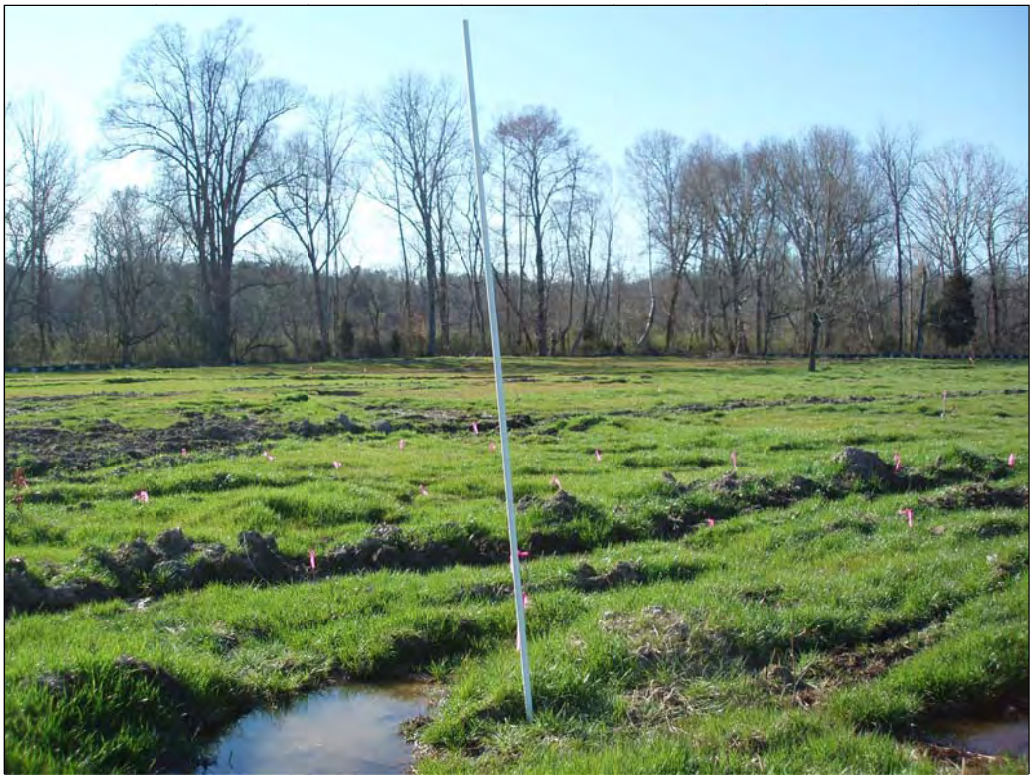
Vegetation Plot 1: 2/28/2012 – Baseline

Vegetation Plot 2: 2/28/2012 – Baseline

Vegetation Plot 3: 2/28/2012 – Baseline



Vegetation Plot 4: 2/28/2012 – Baseline

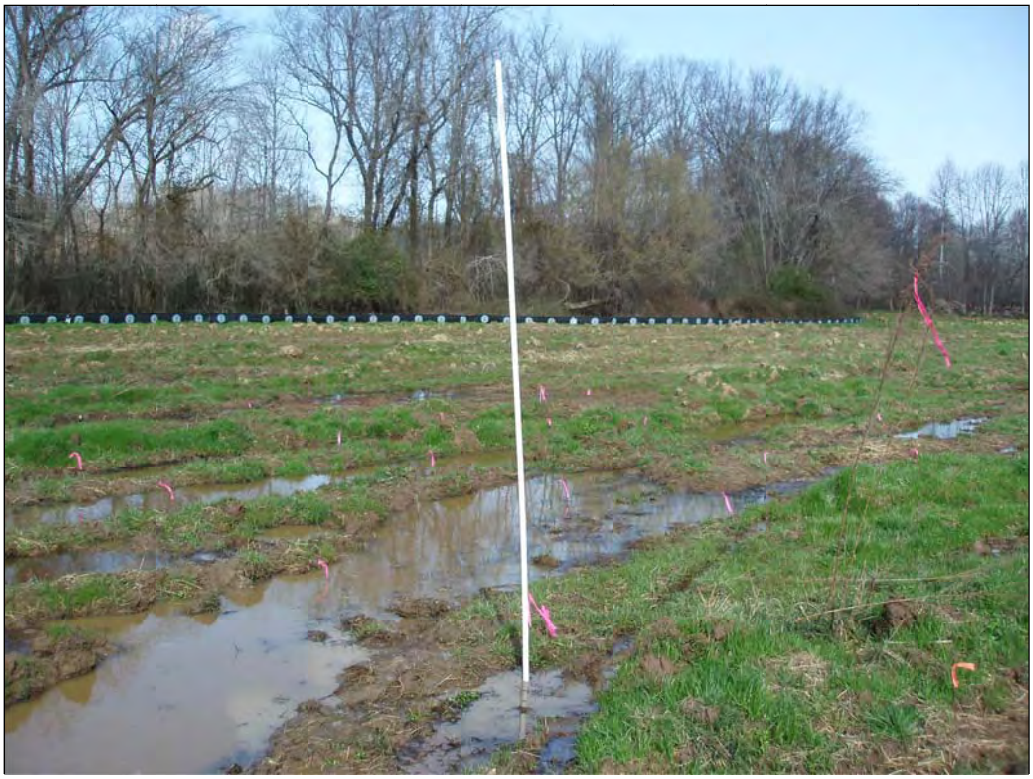


Vegetation Plot 5: 2/28/2012 – Baseline

Vegetation Plot 6: 2/28/2012 – Baseline

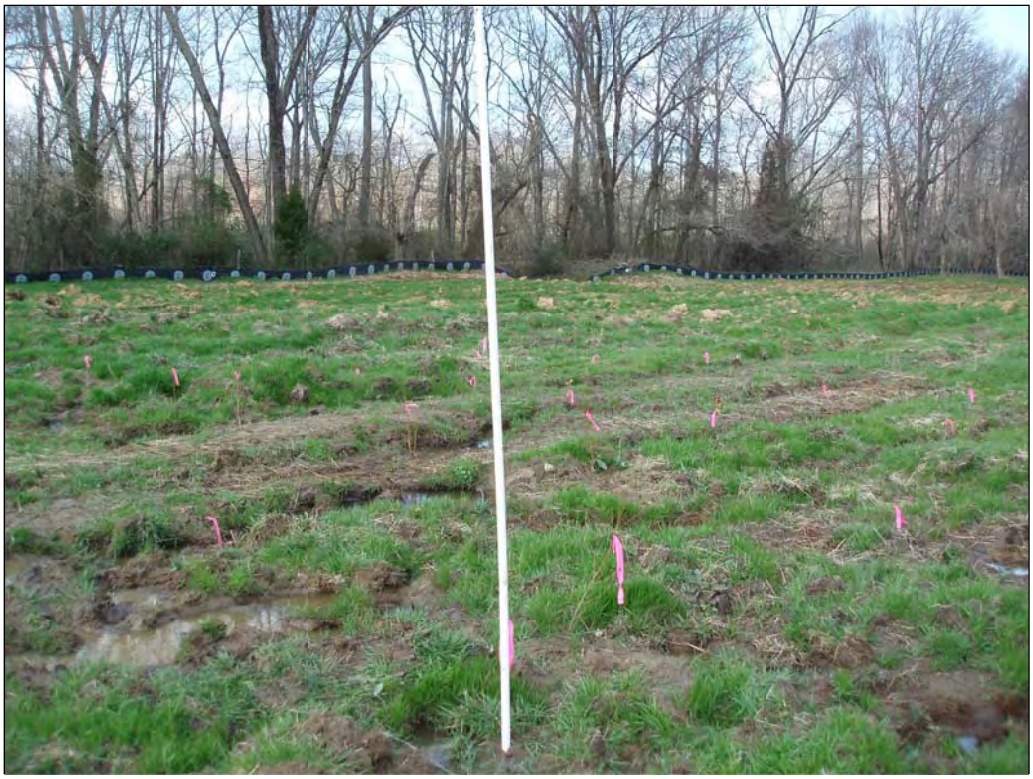
Vegetation Plot 7: 2/28/2012 – Baseline

Vegetation Plot 8: 2/28/2012 – Baseline



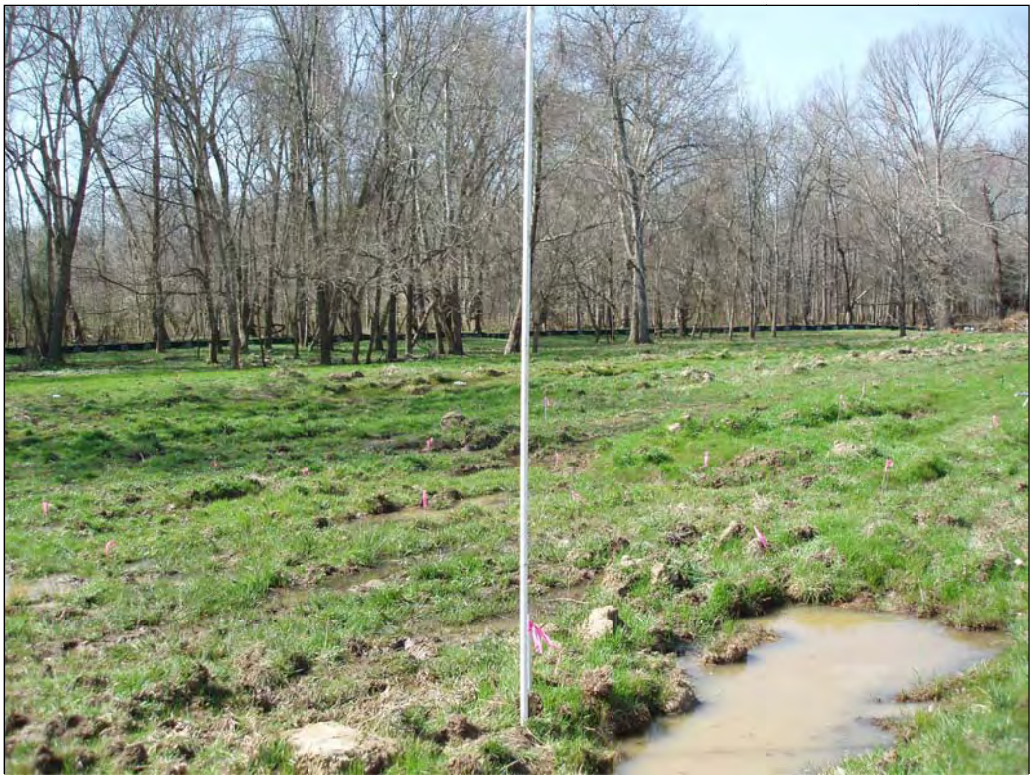
Vegetation Plot 9: 2/28/2012 – Baseline

Vegetation Plot 10: 2/28/2012 – Baseline



Vegetation Plot 11: 2/28/2012 – Baseline

Vegetation Plot 12: 2/28/2012 – Baseline



Vegetation Plot 13: 2/28/2012 – Baseline

# APPENDIX B

Baseline Monitoring Data

KCI ASSOCIATES OF NORTH CAROLINA, PA

# SOIL PROFILE DESCRIPTION

**Client:** KCI Associates of North Carolina, P.A.
**Date:** May 23, 2012
**Project:** Buffalo Flats Wetland Restoration Site
**Project #:** 20100798
**County:** Cabarrus
**State:** NC
**Location:** 4939 Gold Hill Road
**Site/Lot:** MW#Buff 7
**Soil Series:** Chewacla
**Soil Classification:** Fine-loamy, mixed, active, thermic Fluvaquentic Dystrochrepts
**AWT:** 18" **SHWT:** 13-18" **Slope:** 0-1% **Aspect:**
**Elevation:** ~657 **Drainage:** Somewhat Poorly Drained **Permeability:** slow
**Vegetation:** Virginia Wildrye
**Borings terminated at** 45 **Inches**

| HORIZON | DEPTH (IN) | MATRIX | MOTTLES | TEXTURE | STRUCTURE | CONSISTENCE | BOUNDARY | NOTES |
|---|---|---|---|---|---|---|---|---|
| Ap | 0-3 | 10YR 5/2 | 10YR 4/4f1f | l | massive | mfr | as | slight Percent O.M. |
| Bw1 | 3-7 | 10YR 4/4 | | l | 1fgr | mfr | cs | No visible O.M. |
| Bw2 | 7-11 | 10YR 5/3 | | sl | 1fsbk | mfr | cs | |
| Bw3 | 11-13 | 10YR 5/3 | 10YR 4/4c2d | sl | 2msbk | mfr | cs | few <5mm concretions |
| Bw4 | 13-18 | 7.5YR 4/6 | 10YR 6/1c2d | scl | 2msbk | mfr | gw | |
| Cg1 | 18-42 | 10YR 4/2 | 10YR 4/8c2d | sc | massive | mfi | cw | common 5-8mm concretions |
| | | | 10YR 5/4c2f | | | | | 10YR 2/2_Mn masses |
| | | | 10YR 2/2c2d | | | | | |
| Cg2 | 42-45 | 5/5GY | 5YR 4/6c2p | sc | massive | mfi | | |

COMMENTS:

Surface ponding from 1 to 3 inches was observed around the monitoring well where the soil description was written.

DESCRIBED BY: SFS DATE: 5/23/2012

KCI ASSOCIATES OF NORTH CAROLINA, PA

# SOIL PROFILE DESCRIPTION

**Client:** KCI Associates of North Carolina, P.A. **Date:** May 23, 2012
**Project:** Buffalo Flats Wetland Restoration Site **Project #:** 20100798
**County:** Cabarrus **State:** NC
**Location:** 4939 Gold Hill Road **Site/Lot:** MW#Buff 6
**Soil Series:** Chewacla
**Soil Classification:** Fine-loamy, mixed, active, thermic Fluvaquentic Dystrochrepts
**AWT:** 12" **SHWT:** 21 **Slope:** 0-1% **Aspect:**
**Elevation:** ~655 **Drainage:** Somewhat Poorly Drained **Permeability:** Moderate to Moderately slow
**Vegetation:** Virginia Wildrye
**Borings terminated at** 60 **Inches**

| HORIZON | DEPTH (IN) | MATRIX | MOTTLES | TEXTURE | STRUCTURE | CONSISTENCE | BOUNDARY | NOTES |
|---|---|---|---|---|---|---|---|---|
| Ap | 0-9 | 7.5YR 4/4 | 10YR 4/2f1f | l | 1mgr | mfr | as | |
| AB | 9-14 | 7.5YR 4/4 | | l | 1fsbk | mfr | cs | |
| Bw1 | 14-17 | 7.5YR 4/2 | 10YR 5/2f1f | l | 1fsbk | mfr | cs | |
| | | | 5YR 3/4f1p | | | | | |
| Bw2 | 17-21 | 10YR 4/3 | 7.5YR 4/6f1d | l | 1fsbk | mfr | gw | |
| Bg1 | 21-30 | 10YR 4/2 | | l | 1fsbk | mfr | gw | |
| Bg2 | 30-41 | 10YR 4/1 | 7.5YR 2.5/3c2d | sl | 1fsbk | mfr | gw | |
| Cg1 | 41-50 | 10YR 5/1 | 7.5YR 4/6c2d | sc | massive | mfi | gw | |
| Cg2 | 50-60 | 4/10Y | 7.5YR 4/6c2d | sc | massive | mfi | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

COMMENTS:

DESCRIBED BY: SFS DATE: 5/23/2012

LICENSED SOIL SCIENTIST
STEVEN F. STOKES
THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
1087
STATE OF NORTH CAROLINA

# APPENDIX C

As-Built Plan Sheet

KCI JOB# : 20100798

CONTRACT #: 003273

# STATE OF NORTH CAROLINA
# ECOSYSTEM ENHANCEMENT PROGRAM

| STATE | CONTRACT NUMBER | SHEET NO. | TOTAL SHEETS |
|---|---|---|---|
| N.C. | 003273 | 1 | 9 |

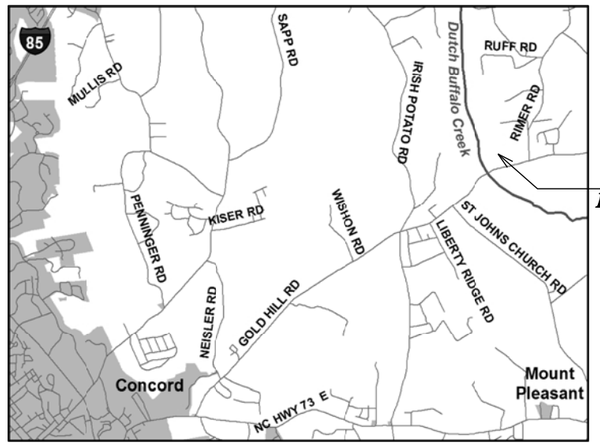
| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

REVISIONS

# *BUFFALO FLATS RESTORATION SITE*

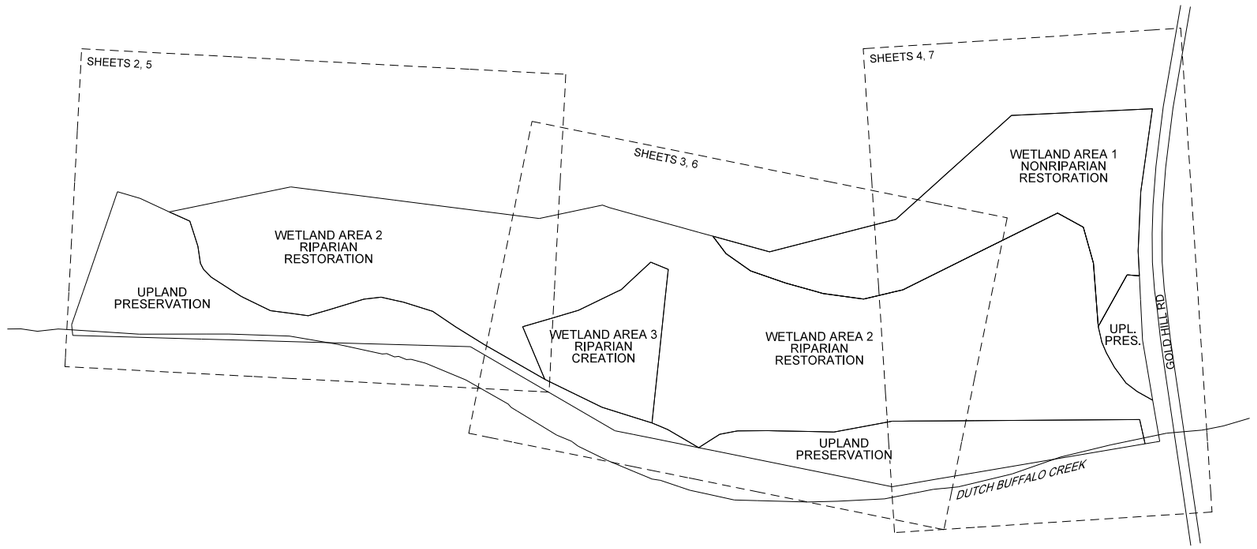
## *CABARRUS COUNTY, NORTH CAROLINA*
## *YADKIN RIVER BASIN*

*ROCKY RIVER WATERSHED*
*UPPER DUTCH BUFFALO CREEK DRAINAGE*
*03040105020050*




*VICINITY MAP*
*NOT TO SCALE*

DIRECTIONS FROM RALEIGH:
PROCEED WEST ON I-40 FOR APPROXIMATELY 80 MILES. THEN TRAVEL ON I-85 SOUTH TOWARD HIGH POINT. TAKE EXIT 63 TOWARD KANNAPOLIS. TURN LEFT AT LANE STREET AND ANOTHER LEFT ONTO OLD SALISBURY-CONCORD RD. THEN TAKE A SLIGHT RIGHT ONTO IRISH POTATO RD. TRAVEL FOR 5 MILES AND THEN TURN LEFT AT GOLD HILL RD. THE SITE WILL BE APPROXIMATELY 1.3 MILES AHEAD ON THE LEFT (SHORTLY AFTER CROSSING THE BRIDGE OVER DUTCH BUFFALO CREEK).




*INDEX OF SHEETS*



# *AS–BUILT PLAN*

*GRAPHIC SCALES*

–30 –15 0 30 60
GRADING AND PLANTING PLANS

*PROJECT DATA*

WETLAND AREA 1
NONRIPARIAN WETLAND RESTORATION = 3.4 ACRES

WETLAND AREA 2
RIPARIAN WETLAND RESTORATION = 11.2 ACRES

WETLAND AREA 3
RIPARIAN WETLAND CREATION = 1.2 ACRES

Prepared in the Office of:


KCI Associates of North Carolina, P.A.
SUITE 220 LANDMARK CENTER II, 4601 SIX FORKS RD., RALEIGH, NC
ENGINEERS • PLANNERS • ECOLOGISTS

GARY M. MRYNCZA, P.E.
*PROJECT ENGINEER*

TIM MORRIS & KRISTIN KNIGHT-MENG
*WETLAND DESIGN*


*PROJECT ENGINEER*

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

*SIGNATURE:* *P.E.*

Prepared for:

Ecosystem Enhancement PROGRAM

GUY PEARCE
*CONTRACT ADMINISTRATOR*

SITE PLAN LEGEND

- EASEMENT LINE
- PRE-RESTORATION CONTOUR LINES
- DESIGNED CONTOUR LINES
- TREE LINE
- ROCK STABILIZED OUTLET
- FILLED DITCH
- 656.5 APPROX. FINISHED GRADING ELEV.

NC GRID NAD '83

−30 −15 0 30 60

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MARTINCA

CONSERVATION EASEMENT

EXISTING FENCE REMOVED

STABILIZED DRAINAGE OUTLET TIED INTO DUTCH BUFFALO CREEK

EXPANDED DITCH FILLED WITH ADJACENT SPOIL

DUTCH BUFFALO CREEK

MATCHLINE - SEE SHEET 3

REVISIONS

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

# BUFFALO FLATS RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012

SCALE: GRAPHIC

## AS-BUILT SITE PLAN

SITE PLAN LEGEND

- EASEMENT LINE
- PRE-RESTORATION CONTOUR LINES
- DESIGNED CONTOUR LINES
- TREE LINE
- ROCK STABILIZED OUTLET
- FILLED DITCH
- 656.5 APPROX. FINISHED GRADING ELEV.

*UT TO DUTCH BUFFALO CREEK*
BANKS STABILIZED AND MATTED
UP TO TREELINE

CONSERVATION EASEMENT

CONSERVATION EASEMENT

MATCHLINE - SEE SHEET 2

MATCHLINE - SEE SHEET 4

EXISTING FENCE
REMOVED

SPOIL PILE
REMOVED AND
USED TO FILL POND

CONSERVATION EASEMENT

*DUTCH BUFFALO CREEK*

ROCK
STABILIZED
OUTLET

DITCH FILLED WITH
ADJACENT SPOIL

–30 –15 0 30 60
GRAPHIC SCALE

NC GRID
NAD 83

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MARTINCA

REVISIONS

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

# BUFFALO FLATS RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: GRAPHIC

## AS-BUILT SITE PLAN

SITE PLAN LEGEND

- EASEMENT LINE
- PRE-RESTORATION CONTOUR LINES
- DESIGNED CONTOUR LINES
- TREE LINE
- ROCK STABILIZED OUTLET
- FILLED DITCH
- 656.5 APPROX. FINISHED GRADING ELEV.

MATCHLINE - SEE SHEET 3

CONSERVATION EASEMENT

DUTCH BUFFALO CREEK

SPOIL PILES REMOVED AND USED TO FILL POND

POND (FILLED)

SPOIL PILE REMOVED AND USED TO FILL POND

STABILIZED DRAINAGE OUTLET

GOLD HILL RD

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

NO. 0810 NAD 83

–30 –15 0 30 60
GRAPHIC SCALE

REVISIONS

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | | | |

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

# BUFFALO FLATS RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: GRAPHIC

## AS-BUILT SITE PLAN

ZONE A

ZONE B

NC GRID
NAD '83

–30 –15 0 30 60

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

REVISIONS

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | | | |

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

# BUFFALO FLATS RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012

SCALE: GRAPHIC

## PLANTING PLAN

SHEET 5 OF 9

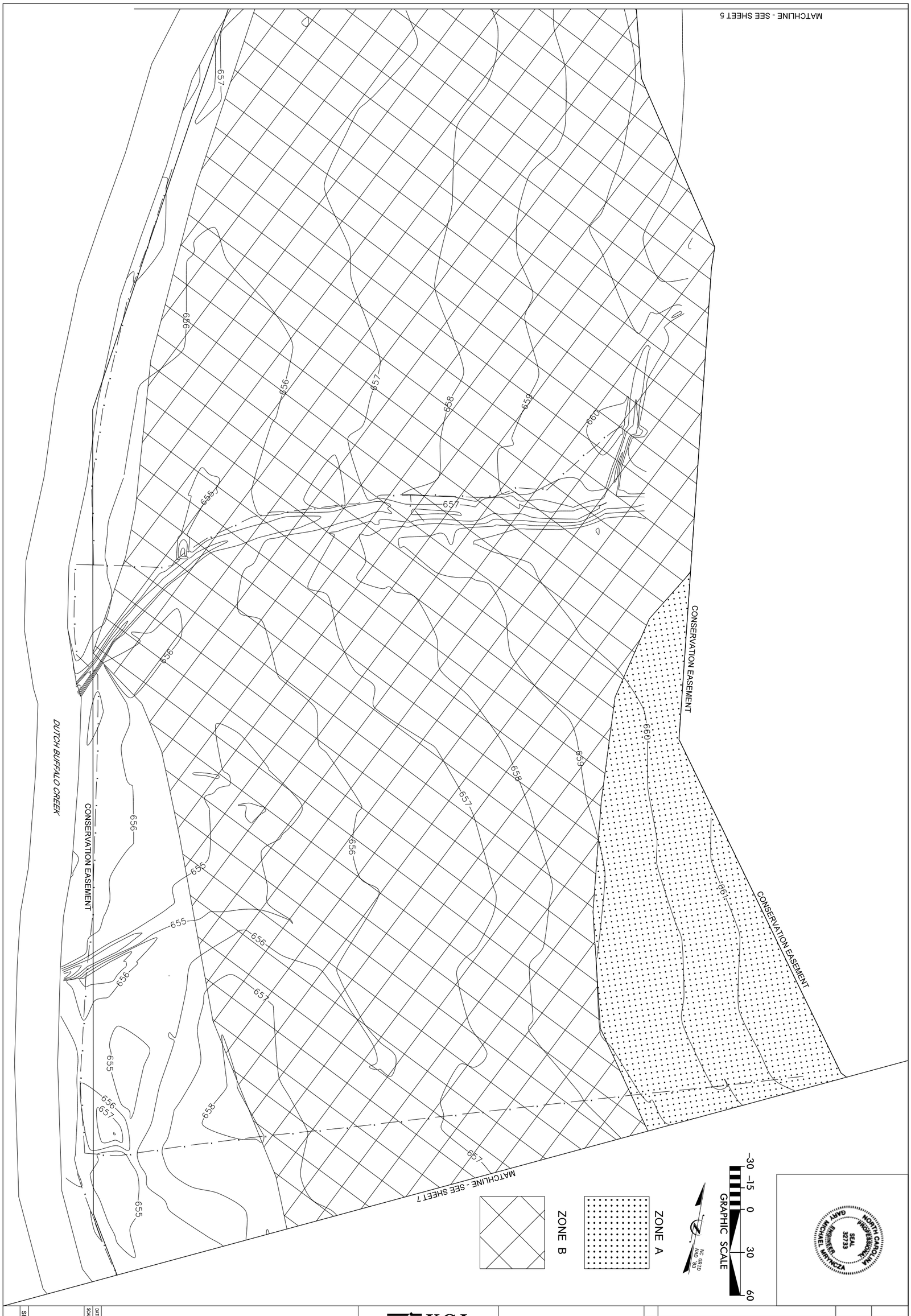
CONSERVATION EASEMENT

CONSERVATION EASEMENT

CONSERVATION EASEMENT

MATCHLINE - SEE SHEET 6

DUTCH BUFFALO CREEK




PLANTING PLAN

SHEET 6 OF 9

DATE: JUNE 2012
SCALE: GRAPHIC

# BUFFALO FLATS RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

Ecosystem Enhancement Program

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | REVISIONS | | |

ZONE A

ZONE B

MATCHLINE - SEE SHEET 6

CONSERVATION EASEMENT

DUTCH BUFFALO CREEK

GOLD HILL RD

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

NO. DATE DESCRIPTION SYM.

REVISIONS

APPROVED

DATE

–30 –15 0 30 60

GRAPHIC SCALE

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC

ENGINEERS • PLANNERS • SCIENTISTS

4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

BUFFALO FLATS
RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012

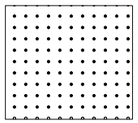
SCALE: GRAPHIC

PLANTING PLAN

SHEET 7 OF 9

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

ZONE A



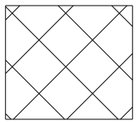
LOW ELEVATION SEEP ZONE

WETLAND AREA 1
NONRIPARIAN WETLAND RESTORATION
3.4 AC

18" - 24" BARE ROOT MATERIAL
436 STEMS/ACRE (10' X 10' SPACING), RANDOM SPECIES PLACEMENT

| COMMON NAME | SCIENTIFIC NAME | WETLAND INDICATOR | % OF TOTAL | # OF PLANTS |
|---|---|---|---|---|
| TULIP POPLAR | LIRIODENDRON TULIPIFERA | FAC | 16 | 237 |
| AMERICAN SYCAMORE | PLATANUS OCCIDENTALIS | FACW- | 16 | 237 |
| LAUREL OAK | QUERCUS LAURIFOLIA | FACW | 13 | 193 |
| SWAMP CHESTNUT OAK | QUERCUS MICHAUXII | FACW- | 13 | 193 |
| CHERRYBARK OAK | QUERCUS PAGODA | FAC+ | 13 | 193 |
| WILLOW OAK | QUERCUS PHELLOS | FACW- | 13 | 193 |
| AMERICAN ELM | ULMUS AMERICANA | FACW | 16 | 237 |
| | | | 100 | 1,483 |

ZONE B



BOTTOMLAND HARDWOOD FOREST ZONE

WETLAND AREAS 2 AND 3
RIPARIAN WETLAND RESTORATION AND CREATION
12.4 AC

18" - 24" BARE ROOT MATERIAL
436 STEMS/ACRE (10' X 10' SPACING), RANDOM SPECIES PLACEMENT

| COMMON NAME | SCIENTIFIC NAME | WETLAND INDICATOR | % OF TOTAL | # OF PLANTS |
|---|---|---|---|---|
| SUGARBERRY | CELTIS LAEVIGATA | FACW | 10 | 541 |
| BUTTONBUSH | CEPHALANTHUS OCCIDENTALIS | OBL | 10 | 541 |
| GREEN ASH | FRAXINUS PENNSYLVANICA | FACW | 10 | 541 |
| TULIP POPLAR | LIRIODENDRON TULIPIFERA | FAC | 10 | 541 |
| WATER TUPELO | NYSSA AQUATICA | OBL | 10 | 541 |
| OVERCUP OAK | QUERCUS LYRATA | OBL | 10 | 541 |
| SWAMP CHESTNUT OAK | QUERCUS MICHAUXII | FACW- | 10 | 541 |
| CHERRYBARK OAK | QUERCUS PAGODA | FAC+ | 10 | 541 |
| WILLOW OAK | QUERCUS PHELLOS | FACW- | 10 | 541 |
| AMERICAN ELM | ULMUS AMERICANA | FACW | 10 | 541 |
| | | | 100 | 5,410 |

REVISIONS

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | | | |

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

BUFFALO FLATS
RESTORATION SITE
CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: N.T.S.

PLANTING PLAN

MONITORING LEGEND

- GROUNDWATER WELL
- RAIN GAUGE / BARROLOGGER
- PHOTO POINT
- VEGETATION PLOT
- EXISTING EASEMENT LINE
- TREE LINE

PHOTO POINT 11
PHOTO POINTS 10 9 8
PHOTO POINTS 7 6
PHOTO POINTS 5 4 3
PHOTO POINTS 2 1
RAIN GAUGE
GAUGE 1
GAUGE 2
GAUGE 3
GAUGE 4
GAUGE 5
GAUGE 6
GAUGE 7
GAUGE 8
GAUGE 9
GAUGE 10
VEG PLOT 1
VEG PLOT 2
VEG PLOT 3
VEG PLOT 4
VEG PLOT 5
VEG PLOT 6
VEG PLOT 7
VEG PLOT 8
VEG PLOT 9
VEG PLOT 10
VEG PLOT 11
VEG PLOT 12
VEG PLOT 13
GOLD HILL RD
DUTCH BUFFALO CREEK

NC GRID NAD 83

–80 –40 0 80 160

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

REVISIONS

| SYM. | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| | | | |

Ecosystem Enhancement Program

KCI ASSOCIATES OF NC
ENGINEERS • PLANNERS • SCIENTISTS
4601 SIX FORKS ROAD, SUITE 220
RALEIGH, NORTH CAROLINA 27609

# BUFFALO FLATS RESTORATION SITE

CONCORD, CABARRUS COUNTY, NORTH CAROLINA

DATE: JUNE 2012
SCALE: GRAPHIC

MONITORING LOCATIONS

SHEET 9 OF 9