Baseline Monitoring Report
FINAL

Bear Basin Wetland Restoration Site
Onslow County, North Carolina
DMS Contract 004741
DMS Project Number 95362

Submitted to:

NCDENR Division of Mitigation Services

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

Monitoring Data Collected: May 2015
Date Submitted: July 2015

Monitoring and Design Firm

Prepared by:

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KCI Project No: 20122265

July 2015

TABLE OF CONTENTS

Appendix A – General Tables and Figures

Appendix B – Baseline Data

Appendix C – As-Built Plan Sheets

EXECUTIVE SUMMARY

The Bear Basin Wetland Restoration Site, (BBWRS) completed in February 2015, restored 8.6 acres of non-riparian wetland along with 1.9 acre of upland preservation. The BBWRS is non-riparian wetland system in the White Oak River Basin (03030001 8-digit HUC) in northern Onslow County, North Carolina that had been substantially modified to maximize agricultural production. The completed project offers the chance to restore impacted agricultural lands to non-riparian wetland habitat. The project is located in the 14-digit HUC 03030001010010 (Upper New River), which the DMS has identified as a Targeted Local Watershed (TLW) (NCDENR, EEP 2010).

The project site is protected by an 11.9-acre permanent conservation easement held by the State of North Carolina. BBWRS is located on a single parcel located off of Jesse Williams Road approximately five miles west of Richlands, North Carolina. The site's 32.7-acre watershed is characterized by 44% agriculture, and 51% forest. The project site is bounded by Jesse Williams Road to the north, a ditch along the property line to the west and south, and agricultural land to the east. Prior to construction, the site was actively used for row-crop farming.

The White Oak River Basin Restoration Priorities identified poor riparian zones and fragmented forests as major stressors within the BBWRS's 14-digit HUC (NCDENR EEP, 2010). The project goals for BBWRS are in line with the basin priorities and include the following:

- Protect and improve water quality by reducing sediment and nutrient inputs
- Protect watersheds draining into shellfish harvesting waters
- Provide habitat for aquatic flora and fauna by improving physical structure and vegetative composition
- Increase the local hydroperiod by encouraging both surface and subsurface storage and retention
- Restore and establish a functional wetland community

The project goals will be addressed through the following objectives:

- Fill field ditches to restore surface flow retention and elevate local groundwater levels
- Redevelop longer wetland flow patterns to increase surface flow retention time
- Restore a wetland vegetation community through maintenance and germination of existing wetland seed stores, planting of wetland trees and shrubs, and incorporation of a custom wetland seed mix

Project construction was completed in February 2015. The wetland was constructed as designed with no deviation from the design plan during construction.

The monitoring components were installed in March and April 2015. Twenty groundwater monitoring gauges were installed to evaluate the attainment of jurisdictional wetland hydrology. To determine the success of the planted mitigation area, seven permanent vegetation monitoring plots were established according to the CVS-EEP Level 1 protocol. Six permanent photo points have been established to be taken annually. The site will be monitored for seven years or until the success criteria are achieved. Reports will be submitted to the DMS each year. The first year of monitoring will take place in 2015.

The planted wetland must meet the success criteria of a site average of 320 stems/acre after three years, 288 stems/acre after four years, 260 stems/acre after five years, and 210 stems/acre after seven years to be considered successful. The baseline monitoring counted an average of 763 stems/acre in the 7 vegetation monitoring plots

Wetland hydrology will be monitored with a series of automatic gauges that record water table depth. To meet the success criterion, the upper 12 inches of the soil profile must have continuously saturated or inundated conditions for at least 8% of the growing season with a 50% probability of reoccurrence during normal weather conditions. Due to the inherent variability in the site's soils and associated drainage characteristics, it is unlikely that the project will exhibit uniform hydrologic conditions across the site, making a single hydrologic performance criterion unrepresentative of the site's performance. As such, the gauge data can be evaluated and presented as a spatial average with each gauge representing the area half the distance to adjacent gauges. The spatial average will be the calculated value for comparison with the performance standard for credit validation. Gauges representing areas not achieving a minimum of 6.5% saturation will be considered non-attaining even if the spatial average exceeds the credit validation performance standard.

1.0 PROJECT GOALS, BACKGROUND, AND ATTRIBUTES

1.1 Location and Setting

The North Carolina Division of Mitigation Services (DMS) has completed restoration of 8.6 acres of non-riparian wetlands at the Bear Basin Wetland Restoration Site (BBWRS) to assist in fulfilling wetland mitigation goals in the area. The project site, which is protected by an 11.9-acre permanent conservation easement held by the State of North Carolina, is situated in Onslow County in the Carolina Flatwoods (Level IV 63h) ecoregion of the Coastal Plain physiographic province. The site is located on a single parcel located off of Jesse Williams Road, approximately five miles west of Richlands, North Carolina (Figure 1, Appendix A). The Site is within the 03030001 White Oak River Watershed Cataloging Unit (8-digit HUC) and the 03030001010010 Upper New River Local Watershed Unit (14-digit HUC) which has been identified as a Targeted Local Watershed (NCDENR, EEP 2010). The White Oak River Basin is experiencing increased habitat alteration due to population growth from Jacksonville and its surrounding metropolitan area. The BBWRS Project was identified as a wetland opportunity to improve habitat within the TLW.

1.2 Project Goals and Objectives

The project goals address stressors identified in the TLW and include the following:

- Protect and improve water quality by reducing sediment and nutrient inputs
- Protect watersheds draining into shellfish harvesting waters
- Provide habitat for aquatic flora and fauna by improving physical structure and vegetative composition
- Increase the local hydroperiod by encouraging both surface and subsurface storage and retention
- Restore and establish a functional wetland community

The project goals will be addressed through the following project objectives:

- Fill field ditches to restore surface flow retention and elevate local groundwater levels
- Redevelop longer wetland flow patterns to increase surface flow retention time
- Restore a wetland vegetation community through maintenance and germination of existing wetland seed stores, planting of wetland trees and shrubs, and incorporation of a custom wetland seed mix

1.3 Project Structure, Restoration Type and Approach

1.3.1 Project Structure

The mitigation work included approximately 8.6 acres of non-riparian wetland restoration and 1.9 acres of upland preservation for a total of 8.6 Wetland Mitigation Units as shown in Figure 2 and described in Table 1 in Appendix A. Planting occurred within the 11.9-acre conservation easement. The target natural community consists of Hardwood Flats Community (NCWAM, v. 4.1 2010). A portion of the site, along the boundary ditches that are to remain open is not credit bearing, but will be monitored to determine if it attains the wetland hydrology criteria. This area is described later in this document and depicted in the site maps.

1.3.2 Project Restoration Type and Approach

Prior to construction, the site had a long history of hydrologic modification in order to allow for farming to take place on the property. The site is located on a generally flat piece of land that is not within a geomorphic floodplain or topographic crenulation or contiguous to a body of water. Two interior ditches existed on the BBWRS that drained the site in a southeastern direction and discharged into a perimeter ditch that carried water in a northeasterly direction and eventually discharged into an unnamed tributary to the New River. The ditch networks were originally installed at the site to quickly remove surface inputs and to lower the water table during the growing season.

The modifications at the BBWRS focused on restoring an integrated wetland ecosystem that will buffer and support the Upper New River basin. Restoration actions focused on reestablishing an appropriate wetland hydroperiod by filling ditches, surface roughening, and planting the site with appropriate vegetation. A detailed topographic survey was used to design slight grading modifications to redirect and lengthen overland flow paths in order to retain and treat surface hydrology longer. Surface roughness variations were installed throughout the BBWRS to alleviate soil compaction and to enhance surface water storage.

A suitable reference wetland was found approximately 0.15 mile northeast of the BBWRS. The reference wetland is comprised of deciduous hardwoods over a shrub layer with broad-leaved evergreens and is consistent with the Hardwood Flats Community that will be the primary wetland type at the project site. A groundwater monitoring well has been installed to document the reference wetland hydrology during the course of monitoring.

1.4 Project History, Contacts and Attribute Data

The project was first identified for restoration by KCI Associates of NC as a full-delivery mitigation project for DMS. The planning for this project began in 2012 with the final mitigation plan completed in July 2014. Construction began in November 2014 and site construction was completed in December 2014. BBWRS was planted in late February 2015. Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 2-4 (Appendix A).

2.0 SUCCESS CRITERIA

The BBWRS will be monitored to determine if the project is on-track to meeting jurisdictional wetland status. The wetland restoration area will be deemed successful once hydrology is established and vegetation success criteria are met.

2.1 Wetland Vegetation

The site must demonstrate the re-establishment of targeted vegetative community based on the survival and growth of planted species and volunteer colonization, with an average stem density of 320 stems/acre required 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 area at a density that statistically represents the total mitigation acreage. The average density of these plots will determine whether the site meets success criterion.

2.2 Wetland Hydrology

The site must present continuous saturated or inundated hydrologic conditions for at least 8% of the growing season with a 50% probability of reoccurrence during normal weather conditions. A "normal" year is based on NRCS climatological data for Onslow County 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, April 2000." According to the Natural Resources Conservation Service, the growing season for Onslow County is considered to extend from March 18th to November 16th (243 days). The water table of the restored wetlands must be within 12" of the soils surface continuously for at least 8% (19 days) of the 243-day growing season. KCI will monitor soil temperature to verify that the local growing season is consistent with the NRCS published data and reserves the right to present this information as a modifier to the number of days of saturation that are required to achieve jurisdictional status. Wetland hydrology will be monitored with twenty automatic gauges that record water table depth.

Due to the inherent variability in the site's soils and associated drainage characteristics, it is unlikely that the project will exhibit uniform hydrologic conditions across the site, making a single hydrologic performance criterion unrepresentative of the site's performance. As such, the gauge data can be evaluated and presented as a spatial average with each gauge representing the area half the distance to adjacent gauges. The spatial average will be the calculated value for comparison with the performance standard for credit validation. Gauges representing areas not achieving a minimum of 6.5% saturation will be considered non-attaining even if the spatial average exceeds the credit validation performance standard.

3.0 MONITORING PLAN

Annual monitoring will be conducted during the first full growing season following project completion. Monitoring of BBWRS efforts will be performed for vegetation and wetland hydrology components of the site until the success criteria are fulfilled. The establishment, collection, and summarization of monitoring data shall be conducted in accordance with the DMS document entitled *Procedural Guidance and Content Requirements for EEP Monitoring Reports (version 1.5)* or a more current standard. Permanent monuments, marking monitoring feature locations, were established on-site in March/April 2015. The locations of these monitoring features are marked in Figure 3 (See Appendix A).

3.1 Wetland Hydrology

Twenty 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 Figure 4 in Appendix A).

The southern and westernmost ditches, located adjacent to project easement, were left open and not filled. It is anticipated that leaving these ditches open will have minimal impacts to the overall hydrologic performance of the site. The hydrologic influence of these ditches was modeled using Lateral Effect, a software program that determines the lateral effect of a drainage ditch or borrow pit on adjacent wetland hydrology (NCSU BAE, 2011). This analysis determined that the potential horizontal drainage influence averages 85'. Due to the fact that the southern ditch cannot be filled because of the potential for hydrologic trespass, the area immediately adjacent to the ditch will not be a credit generating part of the site. It is assumed that with the onsite modifications, such as filling ditches and surface roughening, the entire site will have more surface and groundwater, which may decrease the effect of the ditch. For this reason, the non-credit generating portion of the site is assumed to be half of the zone of influence for the ditch.

Additionally, to monitor the effect of the unfilled ditch described above, four sets of coupled gauges were installed perpendicular to the unfilled ditch. Each set includes a well that is 50' from the open ditch and one that is 80' from the ditch. An additional 4 gauges were installed between the coupled gauges to monitor hydrology less than 42.5' from the open ditch (See GA9-GA20 on Figure 3 in Appendix A).

3.2 Wetland Vegetation

Seven vegetation plots were set up and assessed for the baseline vegetation monitoring. The plots were installed with flagged metal conduit at each corner and a flagged PVC pipe was installed at the photo corner. Vegetation data collection will follow the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2008). 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 throughout the rest of the monitoring period, the BBWRS will be monitored using the Level 2 protocol. Vegetation monitoring will occur in monitoring years 1, 2, 3, 5, and 7. Baseline vegetation plot information can be found in Appendix B.

3.3 Digital Photos

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

3.4 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.

3.5 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.

3.6 Maintenance and Contingency

KCI will monitor the BBWRS 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 repairing constructed outlets and flow dispersement from seepage areas. Any maintenance activities will be documented in the yearly monitoring reports.

4.0 BASELINE CONDITIONS

Baseline monitoring data were collected in April and May 2015. The wetland was constructed as designed with no deviation from the design plan during construction.

BBWRS was planted with a total of ten different species of bare root trees in February 2015. Baseline vegetation monitoring data were collected in May 2015. The Level 1 CVS-EEP protocol was used to collect vegetation data. Plot photos from all the vegetation plots can be found in Appendix B.

The results of the vegetation baseline monitoring show an average of 763 stems per acre in the planted restoration area (Table 5. Appendix B). Additionally, stem counts within each individual plot were well-above the required 320 stems per acre.

5.0 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)

NCDENR, Ecosystem Enhancement Program. 6/8/2012. Procedural Guidance and Content Requirements for EEP Monitoring Reports. NCEEP Monitoring Report Template, Version 1.5. http://portal.ncdenr.org/c/document_library/get_file?p_l_id=1169848&folderId=7135626&name=DLFE-53021.pdf

NCDENR, Ecosystem Enhancement Program. 2010. White Oak River Basin Restoration Priorities 2010. Raleigh, NC. Last accessed 4/2015 at: http://portal.ncdenr.org/c/document_library/get_file?uuid=1c0b7e5a-9617-4a44-a5f8-df017873496b&groupId=60329

NCSU BAE. North Carolina State University, Biological and Agricultural Engineering. 2011. Method to Determine Lateral Effect of a Drainage Ditch on Adjacent Wetland Hydrology. Last accessed 11/2012 at: http://www.bae.ncsu.edu/soil_water/projects/lateral_effect.html

NC Wetland Functional Assessment Team. 2010. NC Wetland Assessment Method (NC WAM) User Manual, version 4.1. Last accessed 11/2012 at: http://portal.ncdenr.org/c/document_library/get_file?uuid=76f3c58b-dab8-4960-ba43-45b7faf06f4c&groupId=38364

APPENDIX A

General Tables and Figures

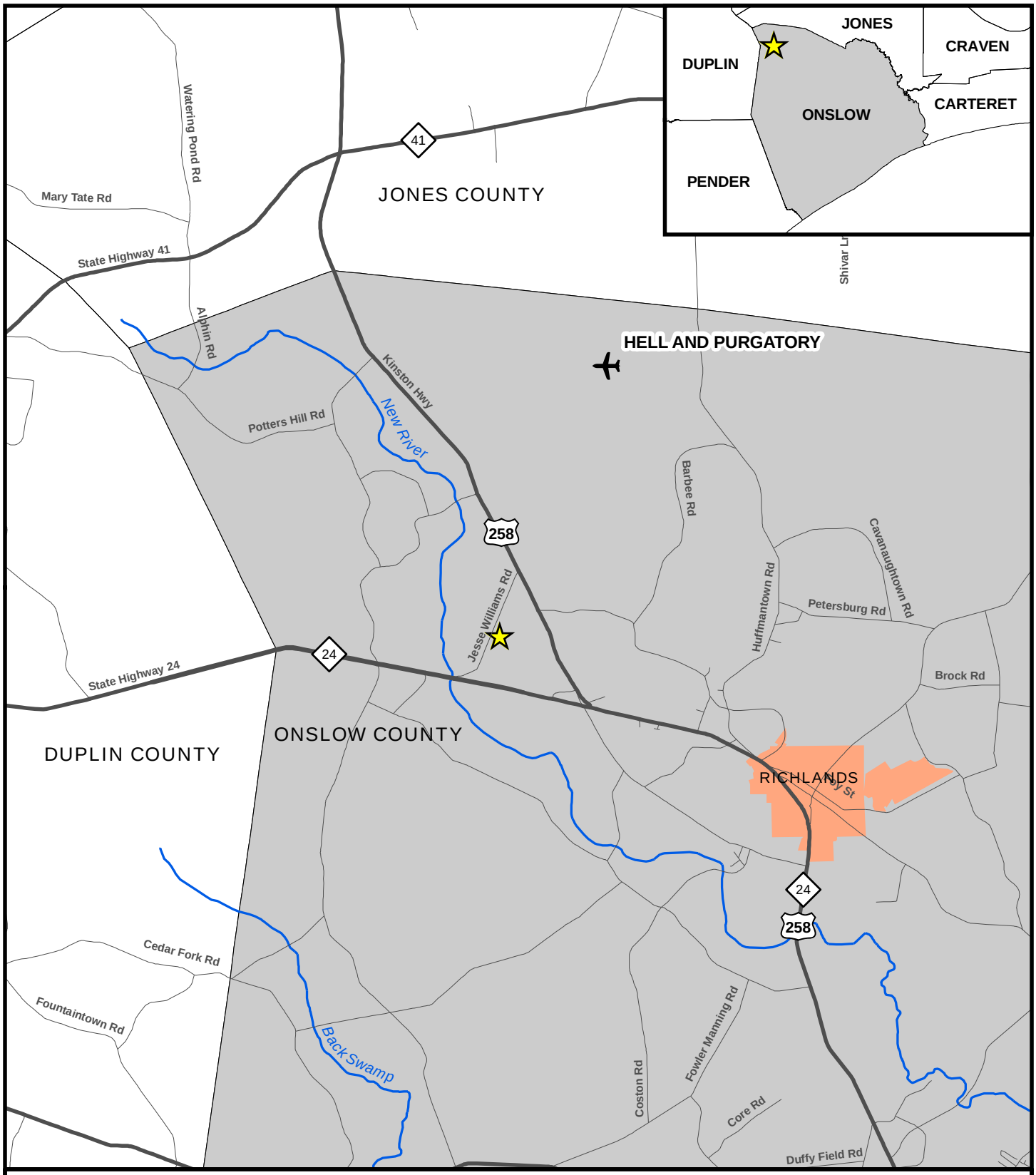


Figure 1. Vicinity Map

Project Site Location

Major Rivers and Streams

Cities and Towns

Airports within 5 miles

Major Roads

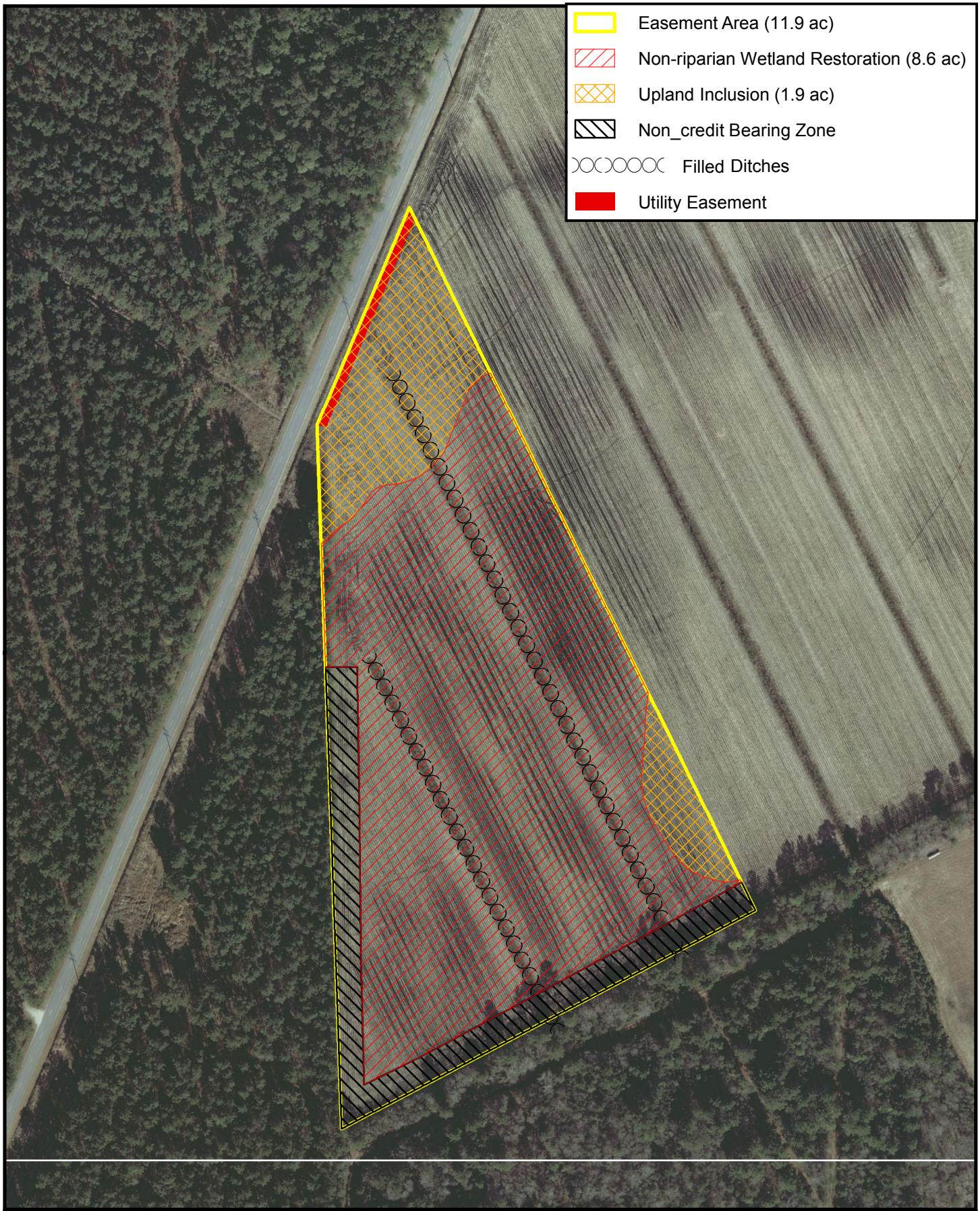
Other Roads

N

1:96,000

1 inch = 8,000 feet

8,000 4,000 0 8,000 Feet



160 80 0 160
Feet

FIGURE 2: PROJECT SITE PROPOSED MITIGATION PLAN VIEW
BEAR BASIN RESTORATION SITE
ONSLOW COUNTY, NC

Image Source: North Carolina Statewide Orthoimagery, 2010.

N

Table 1. Project Components and Mitigation Credits									
Bear Basin Wetland Restoration Site, DMS Project # 95362									
Mitigation Credits									
	Stream		**Riparian Wetland**		**Non-riparian Wetland**		**Buffer**	**Nitrogen Nutrient Offset**	**Phosphorous Nutrient Offset**
Type	R	RE	R	RE	R	RE			
Acres					8.6				
Credits					8.6				
TOTAL CREDITS					8.6				

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	-	8.6 acres	-	Restoration	8.6 acres	1:1

Component Summation						
Restoration Level	**Stream (linear feet)**	**Riparian Wetland (acres)**		**Non-riparian Wetland (acres)**	**Buffer (square feet)**	**Upland (acres)**
		Riverine	Non-Riverine			
Restoration				8.6 acres		
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						1.9 acre
High Quality Preservation						
TOTAL	**-**	**-**	**-**	**8.6 acres**	**-**	**1.9 acre**
TOTAL WMU	**-**	**-**	**-**	**8.6**	**-**	**-**

There were no BMP elements included in this project.

SYM.	DESCRIPTION	DATE
	REVISIONS	

NCDENR DIVISION OF MITIGATION SERVICES

KCI ASSOCIATES
ENGINEERS • PLANNERS • SCIENTISTS
460 SIX FORKS ROAD
RALEIGH, NORTH CAROLINA 27609

BEAR BASIN RESTORATION SITE

RICHLANDS, ONSLOW COUNTY, NORTH CAROLINA

DATE: JULY 2015
SCALE: GRAPHIC

MONITORING PLAN VIEW

SHEET 1 OF 1

FIGURE 3

200 100 0 200
Feet

FIGURE 4: PROJECT SITE REFERENCE WETLAND
BEAR BASIN RESTORATION SITE
ONSLOW COUNTY, NC

Image Source: North Carolina Statewide Orthoimagery, 2010.

N

Table 2. Project Activity & Reporting History		
Bear Basin Wetland Restoration Site, DMS Project# 95362		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		July 14
Final Design – Construction Plans		July 14
Construction		Dec 14
Planting		March 15
Baseline Monitoring/Report	April/May 15	June 15

Table 3. Project Contacts	
Bear Basin Wetland Restoration Site, DMS Project # 95362	
Design Firm	KCI Associates of North Carolina, PC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Construction Contractor	KCI Environmental Technologies and Construction, Inc. Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Tim Morris Phone: (919) 278-2512 Fax: (919) 783-9266
Planting Contractor	Forestree Management Co. 1280 Maudis Road Bailey, NC 27807 Contact: Mr. Tony Cortez Phone: (252) 243-2513
Monitoring Performers	
MY-00	KCI Associates of North Carolina, PC Landmark Center II, Suite 220 4601 Six Forks Rd. Raleigh, NC 27609 Contact: Mr. Adam Spiller Phone: (919) 278-2514 Fax: (919) 783-9266

Table 4. Project Information			
Bear Basin Wetland Restoration Site, DMS Project # 95362			
Project Name	Bear Basin Wetland Restoration Site		
County	Onslow County		
Project Area (acres)	11.9 acres		
Project Coordinates (lat. and long.)	34.925365 N , -77.607461 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	White Oak		
USGS Hydrologic Unit 8-digit	03030001	**USGS Hydrologic Unit 14-digit**	03030001010010
DWQ Sub-basin	03-05-02b		
Project Drainage Area (acres)	32.7 acres		
Project Drainage Area Percentage of Impervious Area	2%		
CGIA Land Use Classification	44% Cultivated, 4% Managed Herbaceous Cover, 50% Southern Yellow Pine and 2% High-Intensity Development		
Wetland Summary Information (Post-Restoration)			
Parameters	**Wetland Area**		
Size of Wetland (acres)	8.6 acres		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Non-riparian		
Mapped Soil Series	Rains and Stallings (Pantego and Lynchburg by detailed soil investigation)		
Drainage class	Poorly drained		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Precipitation		
Hydrologic Impairment	Ditching and Crops		
Native vegetation community	Crops		
Percent composition of exotic invasive vegetation	0%		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States – Section 404	Yes	Yes, received 404 permit	Jurisdictional Determination
Waters of the United States – Section 401	Yes	Yes, received 401 permit	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	No	N/A	FEMA Floodplain Checklist
Essential Fisheries Habitat	No	N/A	N/A

APPENDIX B

Baseline Data

Table 5. CVS Stem Count Total and Planted by Plot and Species

Bear Basin Wetland Restoration Site (DMS Project Code 95362)			Current Plot Data (MY0 2015)																			Annual Means		
			95362-01-0001			95362-01-0002			95362-01-0003			95362-01-0004			95362-01-0005			95362-01-0006			95362-01-0007			MY0 (2015)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Aronia arbutifolia	Red Chokeberry	Shrub							2	2	2							2	2	2				4	4	4
Betula nigra	River birch	Tree	1	1	1				4	4	4							1	1	1				6	6	6
Cephalanthus occidentalis	Common buttonbush	Shrub							1	1	1													1	1	1
Diospyros virginiana	Common persimmon	Tree	3	3	3	3	3	3													1	1	1	7	7	7
Fraxinus pennsylvanica	Green ash	Tree	5	5	5				3	3	3													8	8	8
Liriodendron tulipifera	Tuliptree	Tree							5	5	5	7	7	7	3	3	3							15	15	15
Magnolia virginiana	Sweetbay	Tree	2	2	2				3	3	3													5	5	5
Quercus	Oak	Tree				1	1	1	1	1	1													2	2	2
Quercus nigra	Water oak	Tree				1	1	1																1	1	1
Quercus pagoda	Cherrybark oak	Tree	6	6	6	13	13	13	8	8	8	21	21	21	1	1	1	6	6	6	10	10	10	65	65	65
Quercus phellos	Willow oak	Tree	2	2	2				3	3	3				7	7	7	4	4	4				16	16	16
Vaccinium corymbosum	Highbush blueberry	Shrub							1	1	1							1	1	1				2	2	2
		Stem count	19	19	19	18	18	18	31	31	31	28	28	28	11	11	11	14	14	14	11	11	11	132	132	132
		size (ares)	1			1			1			1			1			1			1			7		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.17		
		Species count	6	6	6	4	4	4	10	10	10	2	2	2	3	3	3	5	5	5	2	2	2	12	12	12
		Stems per ACRE	769	769	769	728	728	728	1255	1255	1255	1133	1133	1133	445	445	445	567	567	567	445	445	445	763	763	763

Vegetation Monitoring Plot Photos

Vegetation Plot 1 – MY-00 – 5/19/15

Vegetation Plot 2 – MY-00 – 5/19/15

Vegetation Plot 3 – MY-00 – 5/19/15

Vegetation Plot 4 – MY-00 – 5/19/15

Vegetation Plot 5 – MY-00 – 5/19/15

Vegetation Plot 6 – MY-00 – 5/19/15

Vegetation Plot 7 – MY-00 – 5/19/15

Photo Reference Points

PP1 – MY-00 – 5/26/15

PP2– MY-00 – 5/26/15

PP3 – MY-00 – 5/26/15

PP4 – MY-00 – 5/26/15

PP5 – MY-00 – 5/26/15

PP6 – MY-00 – 5/26/15

APPENDIX C

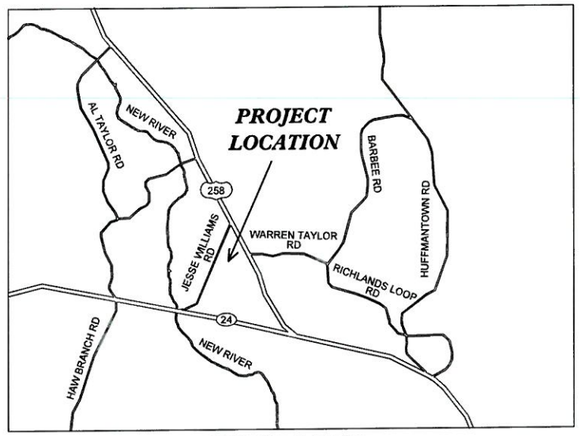
As-Built Plan Sheet

STATE	FED PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
N.C.	95362	1	3

AS-BUILT PLAN

KCI JOB# : 20122266

CONTRACT #: 004741



VICINITY MAP
NOT TO SCALE

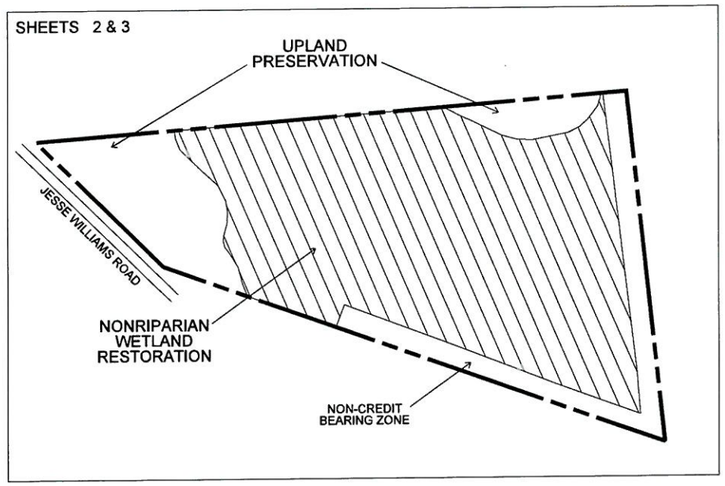
DIRECTIONS FROM RALEIGH:
PROCEED EAST ON I-40 FOR APPROXIMATELY 74 MILES. THEN TAKE EXIT 373 FOR NC-24 E/ NC-903 TOWARDS KENANSVILLE. TAKE A LEFT OFF I-40 ONTO NC-24 E/ NC-903. AFTER 6 MILES TAKE A RIGHT TO STAY ONTO NC-24 E. IN 19 MILES TAKE A LEFT ONTO JESSE WILLIAMS RD. THE SITE WILL BE ON THE RIGHT APPROXIMATELY 0.8 MILES UP THE ROAD.

NCDENR DIVISION OF MITIGATION SERVICES

BEAR BASIN RESTORATION SITE

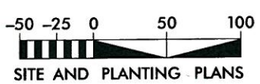
ONSLOW COUNTY, NORTH CAROLINA
WHITE OAK RIVER BASIN

UPPER NEW RIVER WATERSHED
03030001010010



INDEX OF SHEETS

GRAPHIC SCALES



SITE AND PLANTING PLANS

PROJECT DATA

NONRIPARIAN WETLAND RESTORATION = 8.6 ACRES

Prepared in the Office of:

KCI Associates of North Carolina, P.A.
SUITE 220 LANDMARK CENTER II, 4601 SIX FORKS RD., RALEIGH, NC 27609
ENGINEERS • PLANNERS • ECOLOGISTS

GARY M. MRYNCZA, P.E.
PROJECT ENGINEER

TIM MORRIS
WETLAND DESIGN

PROJECT ENGINEER

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

07.12.15

SIGNATURE *P.E.*

Prepared for:

NCDENR DIVISION OF MITIGATION SERVICES

JEFF JUREK
CONTRACT ADMINISTRATOR

SITE PLAN LEGEND

- EASEMENT LINE
- PRE-RESTORATION CONTOUR LINES
- DESIGNED CONTOUR LINES
- OHW — EXISTING OVERHEAD WIRE
- ROCK STABILIZED OUTLET
- FILLED DITCH

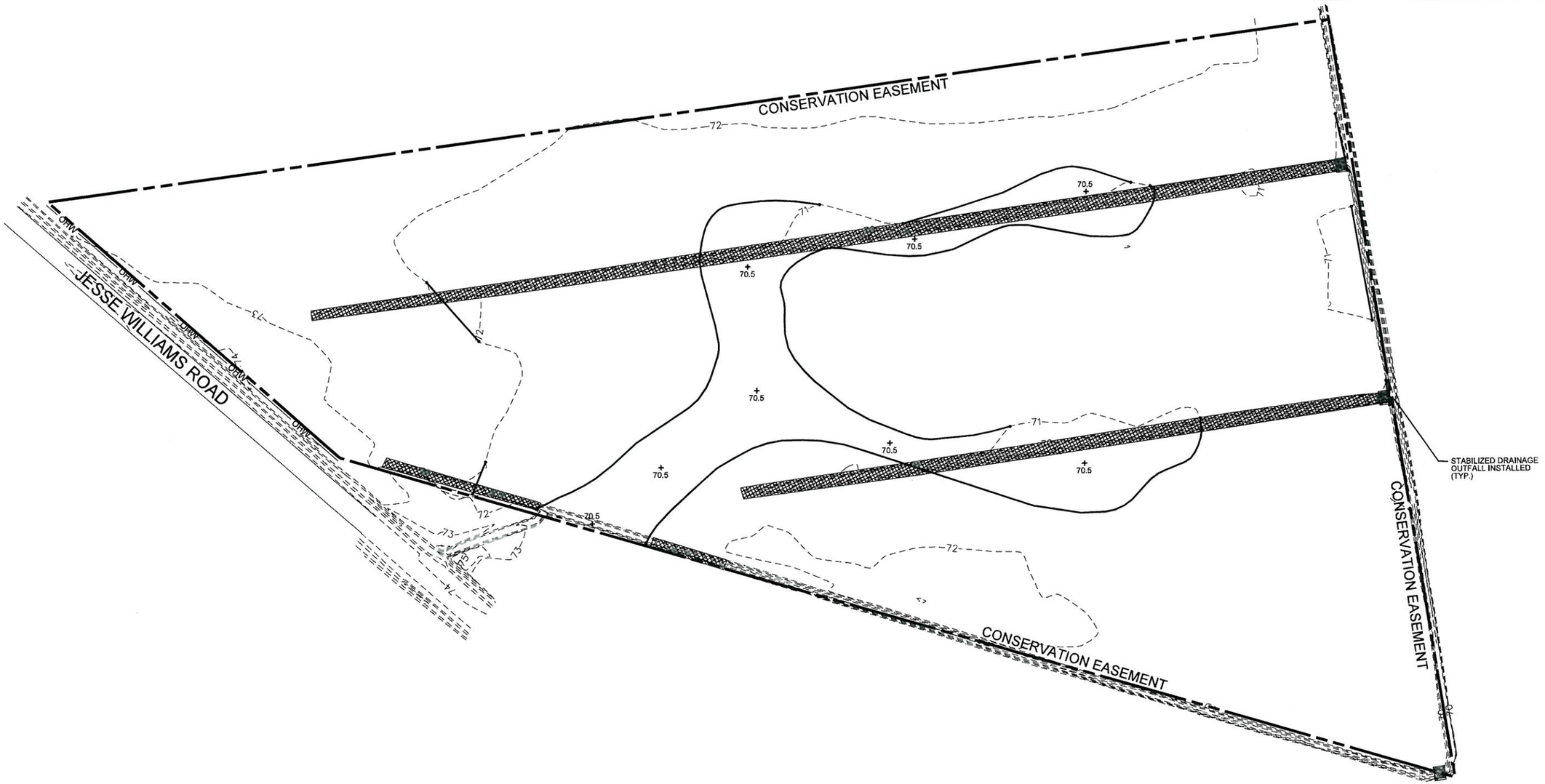
NC GRID NAD 83

-50 -25 0 50 100

GRAPHIC SCALE

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MRYNCZA

07.17.15



NOTE: SURFACE ROUGHENING WAS INSTALLED THROUGHOUT THE EASEMENT TO ALLEVIATE SOIL COMPACTION AND TO ENHANCE SURFACE WATER STORAGE.

REVISIONS

SYM	DESCRIPTION

NCDENR DIVISION OF MITIGATION SERVICES

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

BEAR BASIN
RESTORATION SITE
RICHLANDS, ONSLOW COUNTY, NORTH CAROLINA

DATE: JUNE 2015
SCALE: GRAPHIC

AS-BUILT:
SITE
PLAN

SHEET 2 OF 3

WETLAND PLANTING ZONE

NON-RIPARIAN WETLAND RESTORATION
HARDWOOD FLATS VEGETATIVE COMMUNITY
10.4 AC

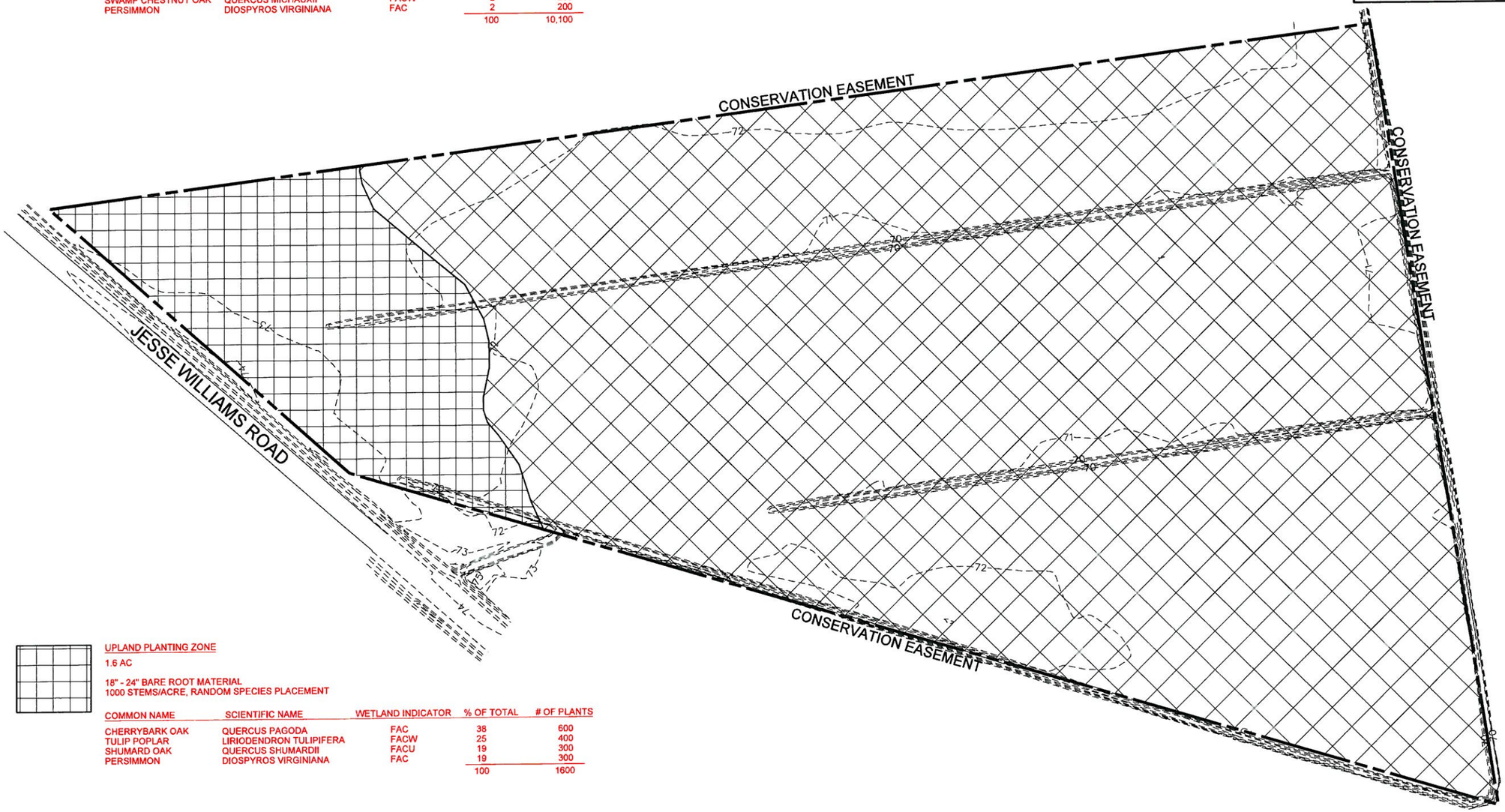
18" - 24" BARE ROOT MATERIAL
971 STEMS/ACRE, RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	WETLAND INDICATOR	% OF TOTAL	# OF PLANTS
CHERRYBARK OAK	QUERCUS PAGODA	FAC	22	2200
BALD CYPRESS	TAXODIUM DISTICHUM	OBL	15	1500
RIVER BIRCH	BETULA NIGRA	FACW	11	1100
TULIP POPLAR	LIRIODENDRON TULIPIFERA	FACW	11	1100
WATER OAK	QUERCUS NIGRA	FAC	10	1000
WILLOW OAK	QUERCUS PHELLOS	FACW-	7	700
GREEN ASH	FRAXINUS PENNSYLVANICA	FACW	6	600
BUTTON BUSH	CEPHALANTHUS OCCIDENTALIS	OBL	5	500
SWEETBAY MAGNOLIA	MAGNOLIA VIRGINIANA	FACW	5	500
RED CHOKEBERRY	ARONIA ARBUTIFOLIA	FACW	2	250
HIGHBUSH BLUEBERRY	VACCINIUM CORYMBOSUM	FACW	2	250
SWAMP CHESTNUT OAK	QUERCUS MICHAUXII	FACW-	2	200
PERSIMMON	DIOSPYROS VIRGINIANA	FAC	2	200
			100	10,100

NC GRID NAD 83

-50 -25 0 50 100

GRAPHIC SCALE



UPLAND PLANTING ZONE

1.6 AC

18" - 24" BARE ROOT MATERIAL
1000 STEMS/ACRE, RANDOM SPECIES PLACEMENT

COMMON NAME	SCIENTIFIC NAME	WETLAND INDICATOR	% OF TOTAL	# OF PLANTS
CHERRYBARK OAK	QUERCUS PAGODA	FAC	38	600
TULIP POPLAR	LIRIODENDRON TULIPIFERA	FACW	25	400
SHUMARD OAK	QUERCUS SHUMARDII	FACU	19	300
PERSIMMON	DIOSPYROS VIRGINIANA	FAC	19	300
			100	1600

NORTH CAROLINA PROFESSIONAL SEAL 32733 ENGINEER GARY MICHAEL MAYNOR

07.12.15

SYM	DESCRIPTION	REVISIONS

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BEAR BASIN
RESTORATION SITE
RICHLANDS, ONSLOW COUNTY, NORTH CAROLINA

DATE: JUNE 2015
SCALE: GRAPHIC

AS-BUILT:
PLANTING
PLAN

SHEET 3 OF 3