

**Year 1 Monitoring Report**

**FINAL**

**THUNDER SWAMP MITIGATION PROJECT**

NCDMS Project #100181 (Contract #0402-04)

RFP #16-20200402

DWR Project #2021-0306 V3

Wayne County, North Carolina

Neuse River Basin

HUC 03020201



**Provided by:**



Resource Environmental Solutions, LLC  
*for* Environmental Banc & Exchange, LLC (EBX)

**Provided for:**

NC Department of Environmental Quality  
Division of Mitigation Services

**January 2023**

ROY COOPER

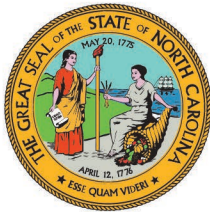
Governor

ELIZABETH S. BISER

Secretary

MARC RECKTENWALD

Director



NORTH CAROLINA  
Environmental Quality

January 12, 2023

Jamey McEachran  
Resource Environmental Solutions, LLC  
3600 Glenwood Ave., Suite 100  
Raleigh, NC 27612

Subject: Task 5 Draft Year 1 Monitoring Report Comments  
Thunder Swamp Mitigation Project (DMS #100185)  
Neuse River 03020201; Wayne County, NC  
Contract No. 0402-04

Dear Ms. McEachran:

On December 20, 2022, DMS received the Draft Year 1 Monitoring Report for the Thunder Swamp Buffer Mitigation Project from Resource Environmental Solutions, LLC (RES). DMS has completed our review of the draft report and has the following comments:

1. Section 4.3: Edit typo of baseline results to year 1 for volunteer species.
2. Table 2: Fill in cumulative results column for MY1 data.
3. Please add the invasive area(s) to the CCPV and Visual Vegetation Assessment Table if greater than 0.10 acres.
4. Please confirm with the surveyor that the easement pins were installed as shown on the survey plats with stamped corresponding numbers.

Please make the requested revisions and provide one (1) pdf copy of the revised Monitoring Report, the required digital data, and a response to comments letter for DMS review. The comment response letter should be included in the revised report and included after the report cover page.

If you have any questions, please contact me at any time. I can be reached at (919) 817-6534 or email me at [emily.dunnigan@ncdenr.gov](mailto:emily.dunnigan@ncdenr.gov).

Sincerely,

A handwritten signature in black ink that reads "Emily Dunnigan".

Emily Dunnigan  
Project Manager  
NCDEQ - Division of Mitigation Services



North Carolina Department of Environmental Quality | Division of Mitigation Services  
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**Corporate Headquarters**  
6575 W Loop S #300  
Bellaire, TX 77401  
Main: 713.520.5400

January 17, 2023

Emily Dunnigan  
NC DEQ Division of Mitigation Services  
217 West Jones Street  
Raleigh, NC 27604

RE: Thunder Swamp, Project ID #100185, DMS Contract #0402-04

Listed below are comments provided by DMS on January 12, 2023 regarding the Thunder Swamp Buffer Mitigation Project Year 1 Monitoring Report and RES' responses.

**Comments:**

1. Section 4.3: Edit typo of baseline results to year 1 for volunteer species.  
[Typo has been corrected.](#)
2. Table 2: Fill in cumulative results column for MY1 data.  
[Table updated with results.](#)
3. Please add the invasive area(s) to the CCPV and Visual Vegetation Assessment Table if greater than 0.10 acres.  
[Invasive areas have been added to the CCPV and Visual Assessment Table. Note that the overall depicted area has already been treated for Chinese privet, but some privet likely remains. Therefore, the area will be re-assessed and retreated during MY2.](#)
4. Please confirm with the surveyor that the easement pins were installed as shown on the survey plats with stamped corresponding numbers.  
[We have informed the surveyor, and it will be completed by next year's monitoring.](#)

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### **Appendix B: Vegetation Assessment Data**

Plant Species Summary
Stem Count Total and Planted by Plot Species
Vegetation Plot Mitigation Success Summary Table
Visual Vegetation Assessment Table

### **Appendix C: Photos**

Vegetation Plot Photos
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# **1 Mitigation Project Summary**

## ***1.1 Project Location and Description***

Environmental Banc & Exchange, LLC (EBX), a wholly-owned subsidiary of Resource Environmental Solutions (RES), is pleased to provide the Thunder Swamp Mitigation Project (Project), a full-delivery buffer mitigation project for the Division of Mitigation Services (DMS) (DMS Project #100181). The Thunder Swamp Project is within the Neuse River Basin within the 8-digit HUC 03020201, 030202011170030 and DWR Sub-basin Number 03-04-12. The Project easement is located in Wayne County in Mt. Olive, NC and can be accessed by NC Highway 55 just west of downtown Mt. Olive (**Figure 1**). The coordinates are 35.205212° and -78.095683°.

This buffer project provides riparian buffer mitigation credits for unavoidable impacts due to development within the Neuse River Basin, United States Geological Survey (USGS) 8-digit Cataloguing Unit 03020201 (Neuse 01), excluding Falls Lake Watershed (**Figure 1**). This Buffer Mitigation Plan is in accordance with the Consolidated Buffer Mitigation Rule 15A NCAC 02B .0295 and Nutrient Offset Credit Trading Rule 15A NCAC 02B .0703. The Thunder Swamp Project consists of a contiguous conservation easement that totals approximately 13.34 acres and includes three unnamed stream tributaries to Thunder Swamp. Thunder Swamp is a USGS-named stream that eventually drains to the Neuse River. Pre-existing land use within the Project was crop production and riparian forest. Water quality stressors previously affecting the Project included heavily manipulated/relocated and maintained stream channels, nutrient loadings from active crop production, and lack of forested riparian buffers.

The Thunder Swamp Project is comprised of three intermittent stream channels: DJ1, DJ2, and DJ3 and one ephemeral stream channel, DJ7. All streams have been straightened and are incised. Furthermore, the fifty-foot riparian buffers of two stream reaches (DJ1 and DJ3) were determined to be subject to the Neuse buffer protection rules (“Subject”), whereas the other two stream reaches (DJ2 and DJ7) are not subject to the Neuse buffer protection rules (“Non-subject”). This Project was also codeveloped with a buffer mitigation and nutrient offset bank that extends riparian buffer areas associated with this Project’s streams as well as incorporate additional stream features on the property.

The goal of the Project is to restore and preserve ecological function to the existing streams and their associated riparian buffer areas by establishing appropriate plant communities while minimizing temporal and land disturbing impacts. This is being accomplished through the planting, establishment, and protection of a hardwood forest community. The result will be a riparian area that functions to mitigate nutrient and sediment inputs from the surrounding uplands. Buffer and surrounding riparian area improvements will filter runoff from agricultural fields, thereby reducing nutrient and sediment loads to Project channels and provide water quality benefit to the overall watershed. The Project will provide significant functional uplift to the watershed and will assist DMS with achieving its mitigation goals in the Neuse 01 watershed, excluding the Falls Lake Watershed.

## **2 Regulatory Considerations**

### ***2.1 Determination of Credits***

This Project has the potential to generate up to 420,320.284 ft<sup>2</sup> riparian buffer mitigation credits within a 13.34-acre conservation easement. These will be derived from buffer restoration and buffer preservation. The riparian buffer mitigation credits generated will service the Neuse 01 watershed, excluding the Falls Lake Watershed. The total potential buffer mitigation credits that the Thunder Swamp Mitigation Project will generate are detailed in **Table 1, Appendix A**. Where viable, buffer mitigation credits can be converted to nutrient offset credit in accordance with the Nutrient Offset Credit Trading Rule, 15A NCAC 02B .0703.

## **2.2 Asset Map**

See **Figure 2, Appendix A.**

## **3 Baseline**

### **3.1 Planting**

The initial planting of bare root trees occurred in Spring 2022. All riparian restoration areas are planted from top of bank back at least 50 feet from streams with bare root tree seedlings on a nine by six-foot spacing to achieve an initial density of approximately 792 trees per acre. In addition, these areas were seeded with an herbaceous seed mix to provide rapid herbaceous cover and promote immediate buffer effectiveness as well as habitat for pollinators and other wildlife. The seed blend contains both temporary and permanent seed and includes taproot species. The seed was sown utilizing a no-till drill. Planting occurred in all areas proposed for riparian buffer restoration and meets the performance standards outlined in the Rule 15A NCAC 02B .0295. This includes treating invasive species and planting of at least four species of native hardwood bare root trees. Mixed-Mesic Hardwood Forest (Coastal Plain subtype) (Schafale 2012) is the target community type and was used for all areas within the Project. This community composition is highly diverse and is suitable given the Project’s soil and landscape characteristics and will provide water quality and ecological benefits. The list of planted bare root tree species and their percentage of total species composition can be found in **Appendix B**. Wherever possible, mature vegetation has been preserved and incorporated into the buffer.

### **3.2 Other Activities**

Other activities involved with the Project included ditch plugging and bank stabilization efforts, including benching, grading, matting, tree removal, and live staking where bank stability was compromised and where erosional rills, sink holes, and gullies were identified. One agricultural ditch (Ditch A) was plugged in order to eliminate concentrated flow from entering Reach DJ2 and ensuring diffuse flow within the riparian area. The ditch footprint was then planted heavily with live stakes. Areas of actively eroding banks were stabilized by grading and/or benching banks to a stable dimension followed by matting, seeding, and planting. One such area also required the removal of two large sweetgum trees, as they were at risk of falling and collapsing the stream bank. Live stakes were be planted on stream banks where stability was compromised, such as existing areas of erosion. There were also two identified erosional rills that conveyed concentrated flow within the riparian area. These were be stabilized by installing hay bales and coir log check dams followed by live stake planting and will ensure diffuse flow within the riparian area. All construction activity information was detailed in the “Thunder Swamp As-built Baseline Monitoring Report.”

## **4 Annual Monitoring**

### **4.1 Methods**

Annual vegetation monitoring and visual assessments will be conducted. Monitoring plots were installed a minimum of 100 meters squared in size and cover at least two percent of the planted mitigation area. These plots were randomly placed throughout the planted riparian buffer mitigation area (10.58 acres) and are representative of the riparian restoration conditions. The following data is recorded for all trees in the plots: species, height, planting date (or volunteer), and grid location. All stems in plots are flagged with flagging tape. Data is processed using the “Vegetation Table Shiny Tool” made available by DMS in December

2021 and is reported in accordance with the most recent DMS requirements and templates. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. There are 9 fixed vegetation monitoring plots (**Figure 3**). These plots were planted and monitored in conjunction with plots 10-25 of the Thunder Swamp Phase II project site.

Photos are to be taken at all vegetation plot origins each monitoring year and be provided in the annual reports. Visual inspections and photos will be taken to ensure that areas are being maintained and compliant. The measures of vegetative success for the Project are the survival of at least four native hardwood tree species, where no one species is greater than 50 percent of stems, at a density of at least 260 stems per acre at the end of Year 5. Native volunteer species may be included to meet the performance standards as determined by NC Division of Water Resources (DWR).

A visual assessment of the conservation easement is also performed each year to confirm:

- Easement boundary markers/signage are in good condition throughout the site;
- No encroachment has occurred;
- No invasive species in areas where invasive species were treated;
- Diffuse flow is being maintained in the conservation easement areas; and
- There has not been any cutting, clearing, filling, grading, or similar activities that would negatively affect the functioning of the buffer.

Component/ Feature	Monitoring	Maintenance through project close-out
Vegetation	Annual vegetation monitoring	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 treated by mechanical and/or chemical methods. Any vegetation requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations. Vegetation maintenance activities will be documented and reported in annual monitoring reports. Vegetation maintenance will continue through the monitoring period.
Invasive and Nuisance Vegetation	Visual Assessment	Invasive and noxious species will be monitored and treated so that none become dominant or alter the desired community structure of the Project. Locations of invasive and nuisance vegetation will be mapped.
Project Boundary	Visual Assessment	Project boundaries shall be identified in the field to ensure clear distinction between the mitigation project and adjacent properties. Boundaries are marked with signs identifying the property as a mitigation project and will include the name of the long-term steward and a contact number. Boundaries may be identified by fence, marker, bollard, post, tree-blazing, or other means as allowed by Project conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as-needed basis. Easement monitoring and staking/ signage maintenance will continue in perpetuity as a stewardship activity.

#### ***4.2 Vegetation Assessment Tables***

See **Appendix B**.

#### ***4.3 Results and Discussion***

Monitoring of 9 fixed vegetation plots was completed on November 29<sup>th</sup>, 2022. Vegetation tables are in **Appendix B** and associated photos are in **Appendix C**. MY1 monitoring data indicates that all plots are exceeding the success criteria of 260 planted stems per acre. Planted stem densities ranged from 526 to 891 planted stems per acre with a mean of 737 planted stems per acre across all plots. A total of 12 species were



documented within the plots. Volunteer species were not noted at MY1 monitoring but are expected to establish in upcoming years. The average tree height observed was 1.7 feet.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. Chinese privet, an invasive species located in forested preservation areas, was initially treated in May 2022, and the kill appears effective. Easement boundary markers and signs are clearly visible and in good condition. Additionally, there were no signs of encroachment or undocumented concentrated flow in the easement area.

#### ***4.4 Maintenance and Management***

Chinese Privet will continue to be monitored and treated in the preservation areas as needed in the following monitoring year.

### **5 References**

NC Environmental Management Commission. 2014. Rule 15A NCAC 02B.0295 - Mitigation Program Requirements for the Protection and Maintenance of Riparian Buffers.

NC Environmental Management Commission. 2020. Rule 15A NCAC 02B.0714 – Neuse River Basin: Nutrient Sensitive Waters Management Strategy: Protection and Maintenance of Existing Riparian Buffers.

NC Department of Environmental Quality, Division of Mitigation Services. 2021. Vegetation Table Shiny Tool. [https://ncdms.shinyapps.io/Veg\\_Table\\_Tool/](https://ncdms.shinyapps.io/Veg_Table_Tool/).

Resource Environmental Solutions, LLC (2022). Thunder Swamp Mitigation Project. Final Mitigation Plan.

Resource Environmental Solutions, LLC (2022). Thunder Swamp Mitigation Project. As-built Baseline Monitoring Report.

Schafale, M.P. 2012. Classification of the Natural Communities of North Carolina, Fourth Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDENR, Raleigh, NC.

# **Appendix A**

## **Background Tables & Site Maps**



**Table 2: Summary: Goals, Performance and Results**

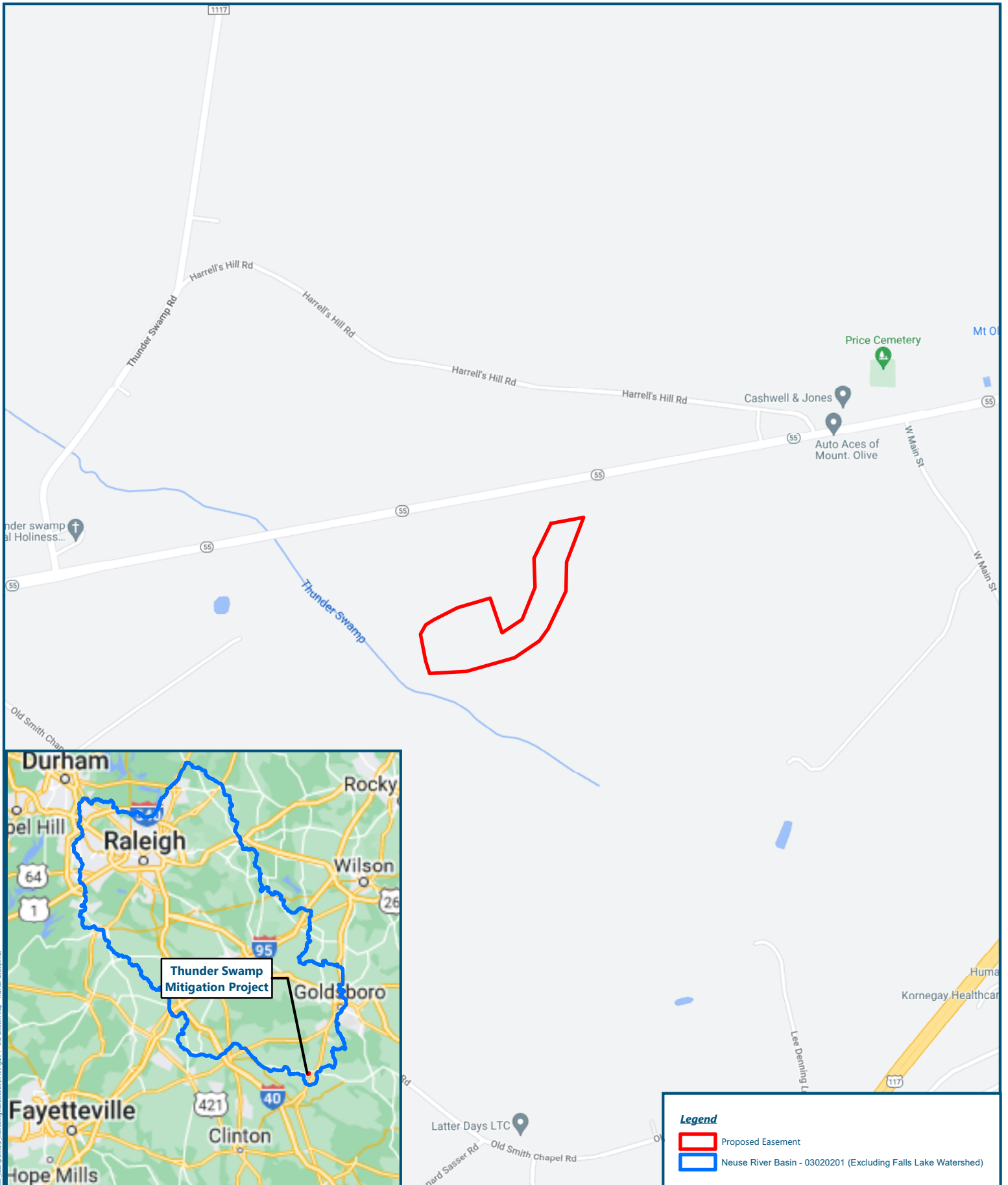
Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Restore and preserve native vegetation.	Established and increased forested riparian buffers to 50 feet and greater along both sides of the channel along the project reaches with a hardwood riparian plant community;	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD, and increased organic material in streams	Survival of at least four native hardwood tree species, where no one species is greater than 50 percent of stems, at a density of at least 260 stems per acre at the end of MY5	Nine fixed vegetation plots	9/9 Veg Plots met - MY1

<b>Table 3. Project Attribute Table</b>			
Project Name	Thunder Swamp Mitigation Project		
County	Wayne		
Project Area (acres)	13.34		
Planted Area (acres)	10.58		
Project Coordinates (latitude and longitude decimal degrees)	35.205212, -78.095683		
<b>Project Watershed Summary Information</b>			
Physiographic Province	Rolling Coastal Plain		
River Basin	Neuse		
USGS Hydrologic Unit 8-digit	3020201		
DWR Sub-basin	03-04-12		
<b>Regulatory Considerations</b>			
<b>Parameters</b>	<b>Applicable?</b>	<b>Resolved?</b>	<b>Supporting Docs?</b>
Water of the United States - Section 404	No	N/A	N/A
Water of the United States - Section 401	No	N/A	N/A
Buffer Authorization - Neuse Riparian Buffer Protection Rules	Yes	Yes	Appendix A
Endangered Species Act	Yes	Yes	Categorical Exclusion
Historic Preservation Act	Yes	Yes	Categorical Exclusion
Coastal Zone Management Act (CZMA or CAMA)	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

**Table 4. Project Timeline and Contacts**

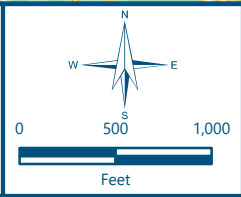
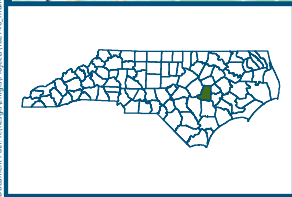
<b>Activity or Deliverable</b>	<b>Data Collection Complete</b>	<b>Task Completion or Deliverable Submission</b>
Project Instituted	NA	Dec-20
Mitigation Plan Approved	NA	Feb-22
Construction (Grading) Completed	NA	Apr-22
Planting Completed	NA	04-May-22
As-built Survey Completed	NA	Jul-22
MY-0 Baseline Report	May-22	Jul-22
MY1 Monitoring Reports	Nov-22	Dec-22

<b>Thunder Swamp #100181</b>	
<b>Provider</b>	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Mitigation Provider POC	Jamey Mceachran (919) 623-9889
<b>Designer</b>	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Primary project design POC	Ben Carroll, PE (336) 514-0927
<b>Construction Contractor</b>	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Construction contractor POC	Paul Dunn



**Legend**

- Proposed Easement
- Neuse River Basin - 03020201 (Excluding Falls Lake Watershed)



**Figure 1 - Site Location Map**

**Thunder Swamp Mitigation Project**

**Wayne County, North Carolina**

Date: 7/7/2022

Drawn by: MDD

Checked by: JRM

1 inch = 1,000 feet



Document Path: R:\Resilient\Projects\03020201\_Thunder\_Swamp\Maintenance\Map\03020201\_Site\_Location\_Map\_Thunder\_Swamp.mxd

CERTIFICATE OF SURVEY AND ACCURACY

I, CHRISTOPHER L. COLE, CERTIFY THAT THE AS-BUILT INFORMATION SHOWN IS BASED UPON A SURVEY PERFORMED UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER MY SUPERVISION;  
 THAT THE ELATIVE POSITIONAL ACCURACY DOES NOT EXCEED 0.10 FEET + 50 PPM;  
 THAT A GLOBAL POSITIONING SYSTEM (GPS) SURVEY WAS PERFORMED UNDER MY DIRECT SUPERVISION AND THE FOLLOWING INFORMATION WAS USED TO PERFORM THE GPS SURVEY:

1. CLASS OF SURVEY: A
2. RELATIVE POSITIONAL ACCURACY: DOES NOT EXCEED 0.10 FEET + 50 PPM
3. TYPE OF GPS SURVEY PROCEDURE: RTK SURVEY USING A JAVAD L3 PLUS IN CONJUNCTION WITH A T3 BASE STATION
4. DATE OF SURVEY: MARCH 23RD, 2021
5. DATUM/EPOCH: NAD 83 (2011)(EPOCH 2010)
6. PUBLISHED/FIXED-CONTROL: CORS NETWORK
7. GEOID MODEL: GEOID12B
8. COMBINED GRID FACTOR: 0.99987066
9. UNITS: U.S. SURVEY FEET

THIS MAP MEETS THE REQUIREMENTS OF THE STANDARDS OF PRACTICE FOR LAND SURVEYING IN NORTH CAROLINA (21 NCAC 56. 1600).

WITNESS MY ORIGINAL SIGNATURE, LICENSE NUMBER AND SEAL THIS 17TH DAY OF AUGUST, A.D., 2022.

Christopher L. Cole  
 Digitally signed by Christopher L. Cole  
 Date: 2022.08.16 18:32:01 -04'00'  
 PROFESSIONAL LAND SURVEYOR  
 LICENSE NUMBER L-5008

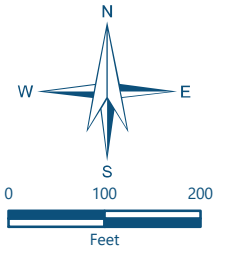
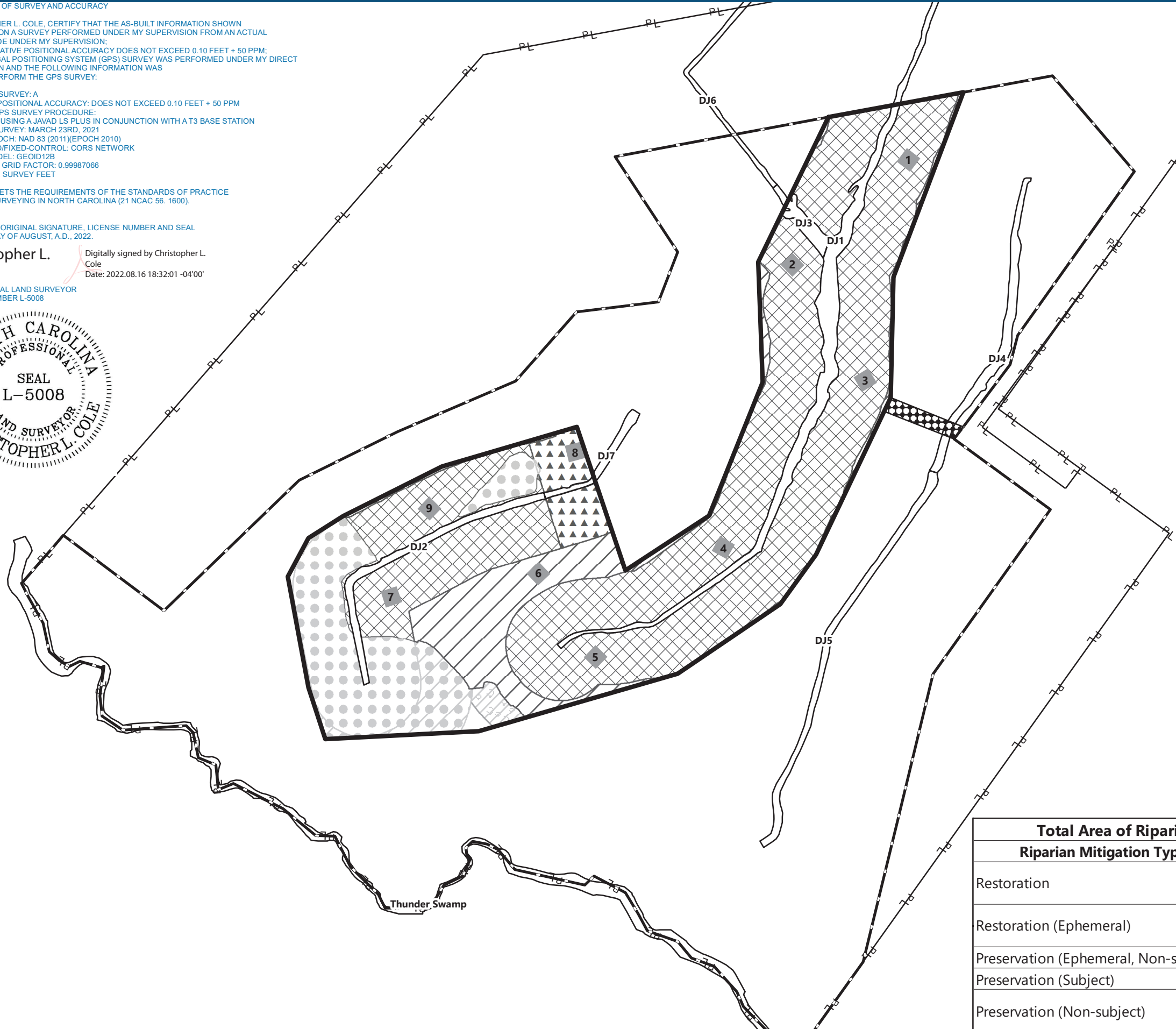


Figure 2 - As-built Map

**Thunder Swamp Mitigation Project**

Wayne County, North Carolina

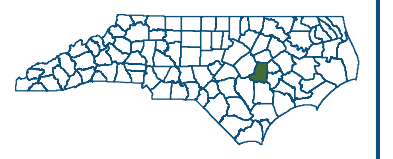
Date: 8/16/2022 Drawn by: MDD  
 Checked by: JRM 1 inch = 200 feet

- Legend**
- Recorded Easement (13.34 ac)
  - Thunder Swamp Phase II Bank Easement
  - Internal Crossing
  - Project Parcel Boundary
  - Surveyed Top of Bank
  - Vegetation Plot
- Riparian Buffer Mitigation Approach**
- Riparian Restoration (0-100')
  - Riparian Restoration (101-200')
  - Riparian Restoration (0-100'), Ephemeral
  - Riparian Restoration (101-200'), Ephemeral
  - Riparian Preservation (0-100'), Subject
  - Riparian Preservation (101-200'), Subject
  - Riparian Preservation (0-100'), Non-subject
  - Riparian Preservation (101-200'), Non-subject

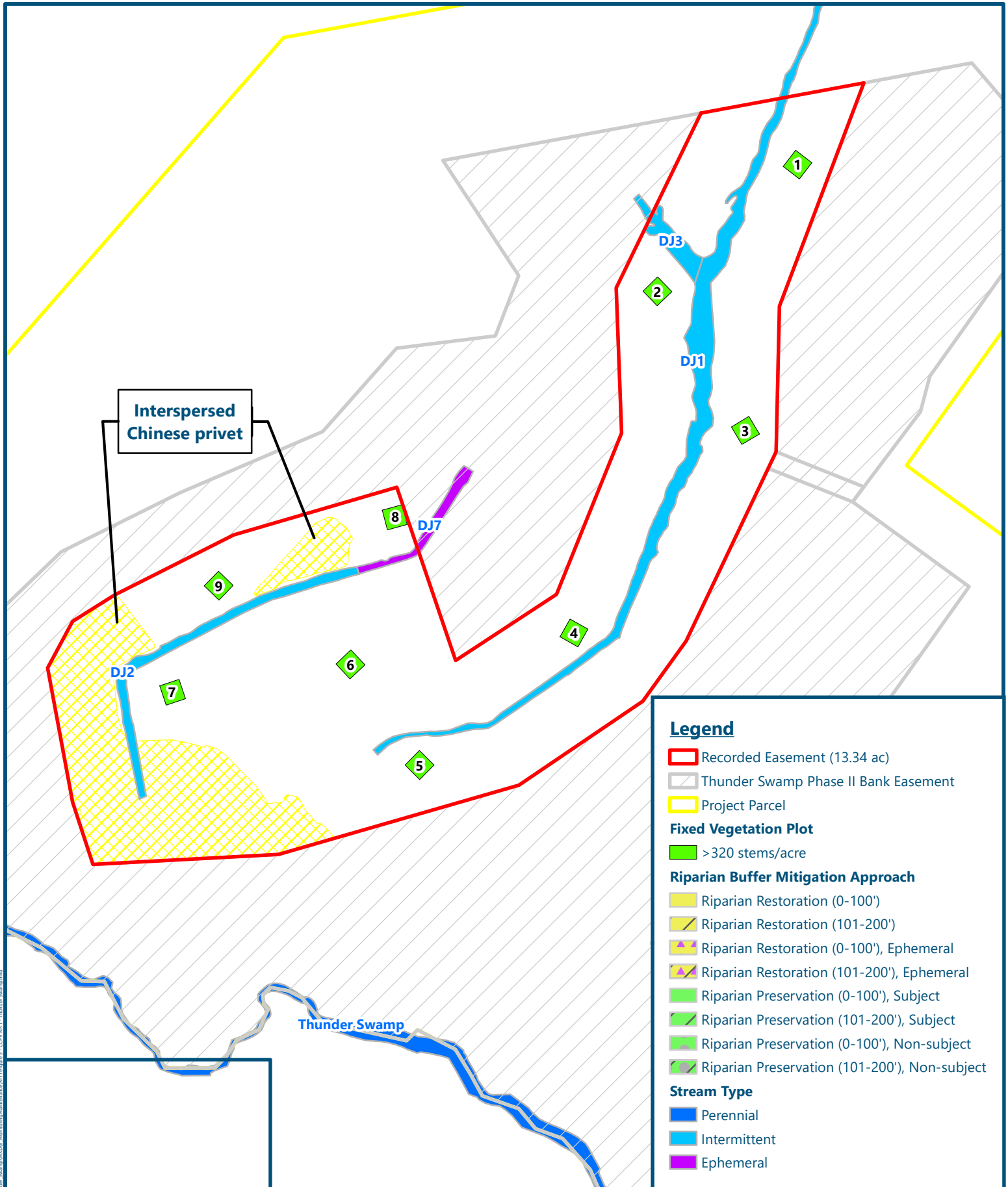
Total Area of Riparian Buffer Mitigation		
Riparian Mitigation Type	Zone	Square Feet
Restoration	0-100	362,948
	101-200	67,467
Restoration (Ephemeral)	0-100	20,363
	101-200	286
Preservation (Ephemeral, Non-subject)	0-100	97
	101-200	4,932
Preservation (Non-subject)	0-100	66,114
	101-200	18,876

**REFERENCE**

- 1) Horizontal Datum is NAD83 UTM Zone 17N
- 2) Map Projection is NAD\_1983\_StatePlane\_North\_Carolina\_FIPS\_3200\_Feet







Interspersed Chinese privet

**Legend**

- Recorded Easement (13.34 ac)
- Thunder Swamp Phase II Bank Easement
- Project Parcel
- Fixed Vegetation Plot**
- > 320 stems/acre
- Riparian Buffer Mitigation Approach**
- Riparian Restoration (0-100')
- Riparian Restoration (101-200')
- Riparian Restoration (0-100'), Ephemeral
- Riparian Restoration (101-200'), Ephemeral
- Riparian Preservation (0-100'), Subject
- Riparian Preservation (101-200'), Subject
- Riparian Preservation (0-100'), Non-subject
- Riparian Preservation (101-200'), Non-subject
- Stream Type**
- Perennial
- Intermittent
- Ephemeral

Thunder Swamp

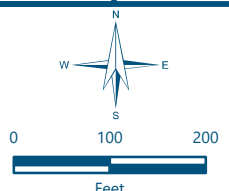
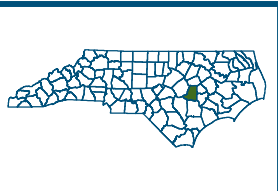
DJ2

DJ3

DJ1

DJ7

Interspersed Chinese privet



**Figure 3 - CCPV MY1 2022**  
**Thunder Swamp Mitigation Project**  
 Wayne County, North Carolina

Date: 1/17/2023  
 Drawn by: GDS  
 Checked by: MDD  
 1 inch = 200 feet



Document Path: R:\Projects\GIS\Projects\102746\_Thunder\_Swamp\MXD\Thunder\_Swamp\MXD\Thunder\_Swamp\_Mitigation\_MY1\_Easement\_3\_CCPV\_MY1\_Thunder\_Swamp.mxd

# **Appendix B**

## Vegetation Assessment Data

**Bare Root Tree Species Planted at Thunder Swamp DMS**

<b>Common Name</b>	<b>Species</b>	<b>% of Total Species</b>	<b>Planted Amount</b>
<b>River Birch</b>	Betula nigra	10%	854
<b>Buttonbush</b>	Cephalanthus occidentalis	5%	427
<b>Persimmon</b>	Diospyros virginiana	10%	854
<b>Green Ash</b>	Fraxinus pennsylvanica	5%	427
<b>Overcup Oak</b>	Quercus lyrata	10%	854
<b>American Sycamore</b>	Platanus occidentalis	10%	854
<b>Northern Red Oak</b>	Quercus rubra	10%	854
<b>Swamp Chestnut Oak</b>	Quercus michauxii	10%	854
<b>Water Oak</b>	Quercus nigra	10%	854
<b>Willow Oak</b>	Quercus phellos	10%	854
<b>Shumard's Oak</b>	Quercus shumardii	10%	854

**TOTAL 8,540 Trees**

Planted Acreage	10.58
Date of Initial Plant	2022-05-04
Date(s) of Supplemental Plant(s)	NA
Date(s) Mowing	2022-05-12
Date of Current Survey	11/29/2022
Plot size (ACRES)	0.0247

	Scientific Name	Common Name	Tree/Shrub	Indicator Status	Veg Plot 1 F		Veg Plot 2 F		Veg Plot 3 F		Veg Plot 4 F		Veg Plot 5 F		Veg Plot 6 F		Veg Plot 7 F		Veg Plot 8 F		Veg Plot 9 F			
					Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total	Planted	Total
Species Included in Approved Mitigation Plan	<i>Betula nigra</i>	river birch	Tree	FACW			2	2				3	3	4	4	3	3					4	4	
	<i>Cephalanthus occidentalis</i>	common buttonbush	Shrub	OBL	2	2										1	1	6	6					
	<i>Diospyros virginiana</i>	common persimmon	Tree	FAC					3	3	1	1							1	1		5	5	
	<i>Fraxinus pennsylvanica</i>	green ash	Tree	FACW					1	1	6	6	1	1					2	2	1	1	1	1
	<i>Nyssa biflora</i>	swamp tupelo	Tree	OBL					1	1														
	<i>Platanus occidentalis</i>	American sycamore	Tree	FACW			2	2			1	1	3	3	2	2				2	2		3	3
	<i>Quercus lyrata</i>	overcup oak	Tree	OBL	2	2	1	1					1	1	2	2				4	4	1	1	1
	<i>Quercus michauxii</i>	swamp chestnut oak	Tree	FACW	3	3	3	3	3	3	2	2									1	1	1	1
	<i>Quercus nigra</i>	water oak	Tree	FAC	1	1	5	5			1	1	1	1										
	<i>Quercus phellos</i>	willow oak	Tree	FACW	10	10	6	6	2	2	2	2	5	5	4	4	9	9	3	3	3	3	3	3
	<i>Quercus rubra</i>	northern red oak	Tree	FACU	2	2	2	2	3	3	2	2	1	1	2	2	2	2	2	2	2	2	2	2
	<i>Quercus shumardii</i>	Shumard's oak	Tree	FAC							1	1					2	2	3	3	1	1	2	2
	Sum	Performance Standard				20	20	21	21	13	13	19	19	16	16	18	18	22	22	15	15	20	20	
Mitigation Plan Performance Standard	Current Year Stem Count				20	20	21	21	13	13	19	19	16	16	18	18	22	22	15	15	20	20		
	Stems/Acre				810	810	850	850	526	526	769	769	648	648	729	729	891	891	607	607	810	810		
	Species Count				6	6	7	7	6	6	9	9	7	7	8	8	5	5	8	8	8	8		
	Dominant Species Composition (%)				50	50	29	29	23	23	32	32	31	31	22	22	41	41	27	27	25	25		
	Average Plot Height (ft.)				1	1	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	
% Invasives				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Post Mitigation Plan Performance Standard	Current Year Stem Count				20	20	21	21	13	13	19	19	16	16	18	18	22	22	15	15	20	20		
	Stems/Acre				810	810	850	850	526	526	769	769	648	648	729	729	891	891	607	607	810	810		
	Species Count				6	6	7	7	6	6	9	9	7	7	8	8	5	5	8	8	8	8		
	Dominant Species Composition (%)				50	50	29	29	23	23	32	32	31	31	22	22	41	41	27	27	25	25		
	Average Plot Height (ft.)				1	1	2	2	2	2	2	2	1	1	2	2	2	2	2	2	2	2	2	
% Invasives				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

- 1). Bolded species are proposed for the current monitoring year, italicized species are not approved, and a regular font indicates that the species has been approved.
- 2). The "Species Included in Approved Mitigation Plan" section contains only those species that were included in the original approved mitigation plan. The "Post Mitigation Plan Species" section includes species that are being proposed through a mitigation plan addendum for the current monitoring year (bolded), species that have been approved in prior monitoring years through a mitigation plan addendum (regular font), and species that are not approved (italicized).
- 3). The "Mitigation Plan Performance Standard" section is derived only from stems included in the original mitigation plan, whereas the "Post Mitigation Plan Performance Standard" includes data from mitigation plan approved, post mitigation plan approved, and proposed stems.

Vegetation Performance Standards Summary Table												
	Veg Plot 1 F				Veg Plot 2 F				Veg Plot 3 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	810	1	6	0	850	2	7	0	526	2	6	0
Monitoring Year 0	850	0	6	0	931	0	7	0	648	0	7	0
	Veg Plot 4 F				Veg Plot 5 F				Veg Plot 6 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	769	2	9	0	648	1	7	0	729	2	8	0
Monitoring Year 0	850	0	9	0	648	0	7	0	729	0	8	0
	Veg Plot 7 F				Veg Plot 8 F				Veg Plot 9 F			
	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives	Stems/Ac.	Av. Ht. (ft)	# Species	% Invasives
Monitoring Year 7												
Monitoring Year 5												
Monitoring Year 3												
Monitoring Year 2												
Monitoring Year 1	891	2	5	0	607	2	8	0	810	2	8	0
Monitoring Year 0	891	0	5	0	769	0	8	0	810	0	8	0

\*Each monitoring year represents a different plot for the random vegetation plot "groups". Random plots are denoted with an R, and fixed plots with an F.

**Visual Vegetation Assessment****Planted acreage****10.58**

<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>Combined Acreage</b>	<b>% of Planted Acreage</b>
Bare Areas	Very limited cover of both woody and herbaceous material.	0.10 acres	0.00	0.0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on current MY stem count criteria.	0.10acres	0.00	0.0%
<b>Total</b>			<b>0.00</b>	<b>0.0%</b>
Areas of Poor Growth Rates	Planted areas where average height is not meeting current MY Performance Standard.	0.10 acres	0.00	0.0%
<b>Cumulative Total</b>			<b>0.00</b>	<b>0.0%</b>

**Easement Acreage****13.34**

<b>Vegetation Category</b>	<b>Definitions</b>	<b>Mapping Threshold</b>	<b>Combined Acreage</b>	<b>% of Easement Acreage</b>
Invasive Areas of Concern	Invasives may occur outside of planted areas and within the easement and will therefore be calculated against the total easement acreage- Include species with the potential to directly outcompete native, young, woody stems in the short-term or community structure for existing communities. Species included in summation above should be identified in report summary.	0.10 acres	2.11	15.8%
Easement Encroachment Areas	Encroachment may be point, line, or polygon. Encroachment to be mapped consists of any violation of restrictions specified in the conservation easement. Common encroachments are mowing, cattle access, vehicular access. Encroachment has no threshold value as will need to be addressed regardless of impact area.	none	# Encroachments noted	

# **Appendix C**

## **Photos**

**Thunder Swamp MY1 Vegetation Monitoring Plot Photos**



Vegetation Plot 1 (11/29/2022)



Vegetation Plot 2 (11/29/2022)



Vegetation Plot 3 (11/29/2022)

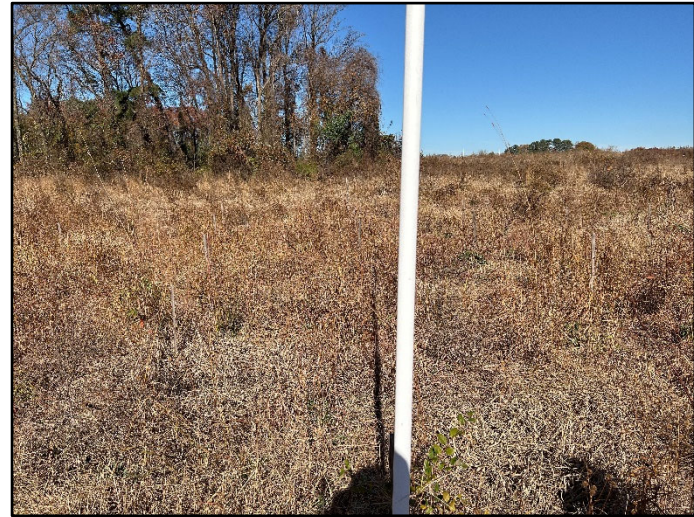


Vegetation Plot 4 (11/29/2022)





Vegetation Plot 5 (11/29/2022)



Vegetation Plot 6 (11/29/2022)



Vegetation Plot 7 (11/29/2022)



Vegetation Plot 8 (11/29/2022)



Vegetation Plot 9 (11/29/2022)