Year 2 Monitoring Report
FINAL

Rhapsody Mitigation Project

DMS Project #: 100110 | Contract #: 7864 | DWR # 2019-1405 | RFP: 16-007703

Randolph County, North Carolina
Cape Fear River Basin
Randleman Lake Watershed
HUC 03030003

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For Environmental Banc and Exchange, LLC

Prepared For:
NC Department of Environmental Quality
Division of Mitigation Services

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1 Project Summary

1.1 Project Location and Description

The Rhapsody Project is within the Randleman Lake Watershed of the Cape Fear River Basin within the 8-digit Hydrologic Unit Code (HUC) 03030003, 14-digit HUC 03030003010060 and DWR Sub Basin Number 03-06-08.

The Rhapsody Project is located in Randolph County approximately five miles east of Archdale, North Carolina (**Figure 1**). To access the Project head East on Cedar Square Road from I-74 and turn left on Muddy Creek Road, after about a one and half miles the Project will be on the right. The coordinates are 35.897336° and -79.889849°.

Environmental Banc & Exchange, LLC (EBX), a wholly owned subsidiary of Resource Environmental Solutions (RES), is pleased to provide this Monitoring Report for the Rhapsody Riparian Buffer Mitigation Project (Project) as a full-delivery buffer mitigation project for the Division of Mitigation Services (DMS) (DMS #100110). This Project provides riparian buffer mitigation credits for unavoidable impacts due to development within the Randleman Lake Watershed of the Cape Fear River Basin, United States Geological Survey (USGS) 8-digit Hydrologic Unit Code (HUC – 03030003) (**Figure 1**). The Project is in accordance with the Consolidated Buffer Mitigation Rule 15A NCAC 02B .0295 and the Randleman Lake Water Supply Watershed Buffer Rule 15A NCAC 02B .0250.

The conservation easement of the Rhapsody Project totals approximately 7.75 acres and includes two perennial unnamed tributaries (RQ1 and RQ2) that drain south through the easement into Muddy Creek approximately one mile downstream of the Project. Reach RQ1, a 1,890 linear feet reach, is the primary feature onsite and has a drainage area of 213 acres. RQ2 flows southeast into the easement for 189 linear feet and then drains directly into RQ1 just below a large bedrock outcrop. Stream determinations were verified by the DWR on June 12, 2018. There are two easement breaks in the Project: one existing culvert along RQ1 that is maintained and another break that will allow for farm access. This farm access provides a break for future, unplanned access by the landowner and includes gates on either side of the easement break in order to exclude cattle from accessing the stream. Because this access will be used for future use and no in-stream work was conducted during construction, no permits were needed. Land use within the Project was primarily actively grazed, disturbed riparian forest, non-forested pasture and a recently timbered area with the presence of invasive species. Grazing livestock have historically had access to all Project reaches causing bank instability and erosional rills within some riparian zones.

The goal of the Project is to restore and enhance ecological function to the existing stream and riparian buffer by establishing appropriate plant communities while minimizing temporal and land disturbing impacts and will assist DMS with achieving its mitigation goals in the Randleman Lake Watershed. Restoration and enhancement of the Randleman Lake riparian buffer (as defined in 15A NCAC 02B .0250) results in a reduction of the water quality stressors that affected the Project: livestock access and areas of minimal riparian buffer. Immediate water quality benefits and pollutant removal within the vicinity of the Project include the exclusion of livestock access to streams and reduction in nutrient loads from agricultural land-uses. This Project is consistent with the management strategy for maintaining and protecting riparian areas in the Randleman Lake watershed. Project attributes are summarized in **Table 1.**

1.2 Monitoring Protocol and Project Success Criteria

Annual vegetation monitoring and visual assessments will be conducted. Riparian vegetation monitoring is based on the "Carolina Vegetation Survey-Ecosystem Enhancement Program Protocol for Recording Vegetation: Level 2 Plot Sampling Only Version 4.2". 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 (4.66 acres) and are representative of the riparian restoration and enhancement areas where applicable (i.e. when enhancement credit is being generated from supplemental planting under 15A NCAC 02B .0295 (n)). As the upper section of Rhapsody was cleared after 2007, this area was planted and monitored although credit is only being generated under Enhancement for cattle exclusion. 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 CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are to be taken from the origin each monitoring year. There are four monitoring plots (two designated to restoration, two designated to enhancement via cattle exclusion with planting) (**Figure 2**).

Photos are taken at all vegetation plot origins each monitoring year and provided in the annual reports. Visual inspections and photos are taken to ensure that enhancement 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:

- Fencing is in good condition throughout the site (if applicable);
- No cattle access within the conservation easement area;
- No encroachment has occurred;
- No invasive species in areas were 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

Component/ Feature	Monitoring	Maintenance through project close-out
		replaced on an as-needed basis. Easement monitoring and staking/ signage maintenance will continue in perpetuity as a stewardship activity.
Road Crossing	Visual Assessment	Road crossings within the Project may be maintained only as allowed by conservation easement or existing easement, deed restrictions, rights of way, or corridor agreements. Crossings in easement breaks are the responsibility of the landowner to maintain.
Livestock Fencing	Visual Assessment	Livestock fencing is to be placed outside the easement limits. Maintenance of fencing is the responsibility of the landowner.

1.3 Project Components

This Project generates approximately 66,907.251 riparian buffer restoration credits on existing non-forested pasture and 123,228.305 buffer enhancement via cattle exclusion credits. The riparian buffer mitigation credits were generated to service Randleman Lake buffer impacts within the USGS 8-digit HUC 03030003 of the Cape Fear River Basin. The total mitigation credits generated from the Rhapsody Mitigation Project are summarized below and a more detailed table is located in **Appendix A**.

Mitigation Totals	Square Feet	Credits
Restoration	68,800	66,907.251
Enhancement via Cattle Exclusion	248,174	123,228.305
Total Riparian Buffer	**316,974**	**190,135.556**

1.4 Riparian Mitigation Approach

Restoration activities included planting a composition of native bare-root tree species based on reference reach data and excluding livestock from the stream and buffer area. The restoration of plant communities within the Project not only provide stabilization and improve water quality within the easement limits, but also provide ecological benefits to the entire watershed.

Enhancement occurred in the very northern segment of the easement, along the stream in the middle segment and the complete southern segment of the easement in accordance with the Consolidated Buffer Mitigation Rule 15A NCAC 02B .0295 (o)(6) (**Figure 2**). All livestock were removed from the easement and the fence was installed to exclude access to riparian areas and their associated streams.

In the northern segment of the easement, the same activities as described in the Riparian Restoration Activities were conducted (planting a composition of native bare-root tree species). However, since this area was a riparian buffer with mature forest before and after the effective date of Rule 15A NCAC 02B .0250 and remained forested up to approximately 2007, when it was cleared, but had the presence of cattle throughout this time period, it is only viable for enhancement credit but did receive similar activities as a restoration area.

The area along the stream in the middle segment as well as the southern segment have continued to remain a fully forested area that has been grazed by cattle, therefore this area was not planted but livestock exclusion fencing was installed around these segments.

1.5 Construction and As-Built Conditions

Revegetation of the Site included treating invasive species and planting native hardwood bare root trees. Prior to planting, RES prepped the site by spraying and ripping the easement. Piedmont Alluvial Forest is the target community type for the riparian restoration areas. The community is defined by Schafale (2012). Bare root trees were planted in May 2020. Deviations from the initial planting plan were due to bare root availability. A list of the planted species can be found in **Table 5**. Additionally, a temporary and permanent seed mixture was applied where cattle caused bare areas were present. The mixture included black-eyed susan (*Rudbeckia hirta*) which is a perennial, pollinator species.

1.6 Year 2 Monitoring Performance

Monitoring of the four permanent vegetation plots was completed on November 2, 2021. Vegetation tables are in **Appendix B** and associated photos are in **Appendix C**. Year 2 monitoring data indicates that all plots are exceeding the success criteria of 320 planted stems per acre. Planted stem densities ranged from 567 to 890 planted stems per acre with a mean of 708 planted stems per acre across all plots. A total of 17 native species were documented within the plots. Volunteer species were found in two of the plots, and more are assumed to grow as monitoring continues. The average tree height observed was 2.4 feet.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project and no invasive species were observed. The fence has been installed, is in good condition, and is maintaining cattle exclusion. Additionally, there were no signs of encroachment or concentrated flow in the easement area.

2 Reference

Lee Michael T., Peet Robert K., Roberts Steven D., and Wentworth Thomas R., 2008. *CVS-EEP Protocol for Recording Vegetation Level*. Version 4.2

NC Environmental Management Commission. 2010. Rule 15 A NCAC 02B .0250 – Randleman Lake Water Supply Watershed: Protection and Maintenance of Riparian Buffers.

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

Resource Environmental Solutions, LLC (2020). Rhapsody Mitigation Project – Final Mitigation Plan.

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

Project Background Tables and Site Maps

Table 1. Buffer Project Areas and Assets

Credit Type	Location	Subject? (enter NO if ephemeral or ditch [1])	Feature Type	Mitigation Activity	Min-Max Buffer Width (ft)	Feature Name	Total Area (sf)	Creditable Area (sf)	Initial Credit Ratio (x:1)	% Full Credit	Final Credit Ratio (x:1)	Riparian Buffer Credits
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	20-30	RQ1	258	258	2	75%	2.66667	96.750
Buffer	Rural	Yes	I / P	Restoration	0-100	RQ1	65,975	65,975	1	100%	1	65,975.000
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	0-100	RQ1, RQ2	245,449	245,449	2	100%	2	122,724.500
Buffer	Rural	Yes	I / P	Restoration	101-200	RQ1	2,825	2,825	1	33%	3.0303	932.251
Buffer	Rural	Yes	I / P	Enhancement via Cattle Exclusion	101-200	RQ1	2,467	2,467	2	33%	6.06061	407.055
							TOTAL	**316,974**				**190,135.556**

Table 2. Project Activity and Reporting History
Rhapsody Site

Elapsed Time Since planting complete: 1 year 7 months
Number of reporting Years[1]: 2

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	NA	Jan-20
Final Design – Construction Plans	NA	NA
Stream Construction	NA	NA
Site Planting	NA	May-20
As-built (Year 0 Monitoring – baseline)	May-20	May-20
Year 1 Monitoring	Nov-20	Dec-20
Year 2 Monitoring	Nov-21	Nov-21
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

1 = The number of reports or data points produced excluding the baseline

Table 3. Project Contacts Table Rhapsody Site	
Planting Contractor	H&J Forestry
Planting contractor POC	Matt Hitch
Nursery Stock Suppliers	Arborgen
Monitoring Performers	RES / 3300 Glenwood Ave, Suite 100, Raleigh, NC 27612
Monitoring POC	Ryan Medric (919) 741-6268

Table 4. Project Background Information			
Project Name	Rhapsody		
County	Randolph		
Project Area (acres)	7.75		
Project Coordinates (latitude and longitude)	Latitude: 35.897336 N Longitude: -79.889849 W		
Planted Acreage (Acres of Woody Stems Planted)	4.66		
Project Watershed Summary Information			
Physiographic Province	Southern Outer Piedmont		
River Basin	Cape Fear		
USGS Hydrologic Unit 8-digit	03030003	USGS Hydrologic Unit 14-digit	03030003010060
DWR Sub-basin	03-06-08		

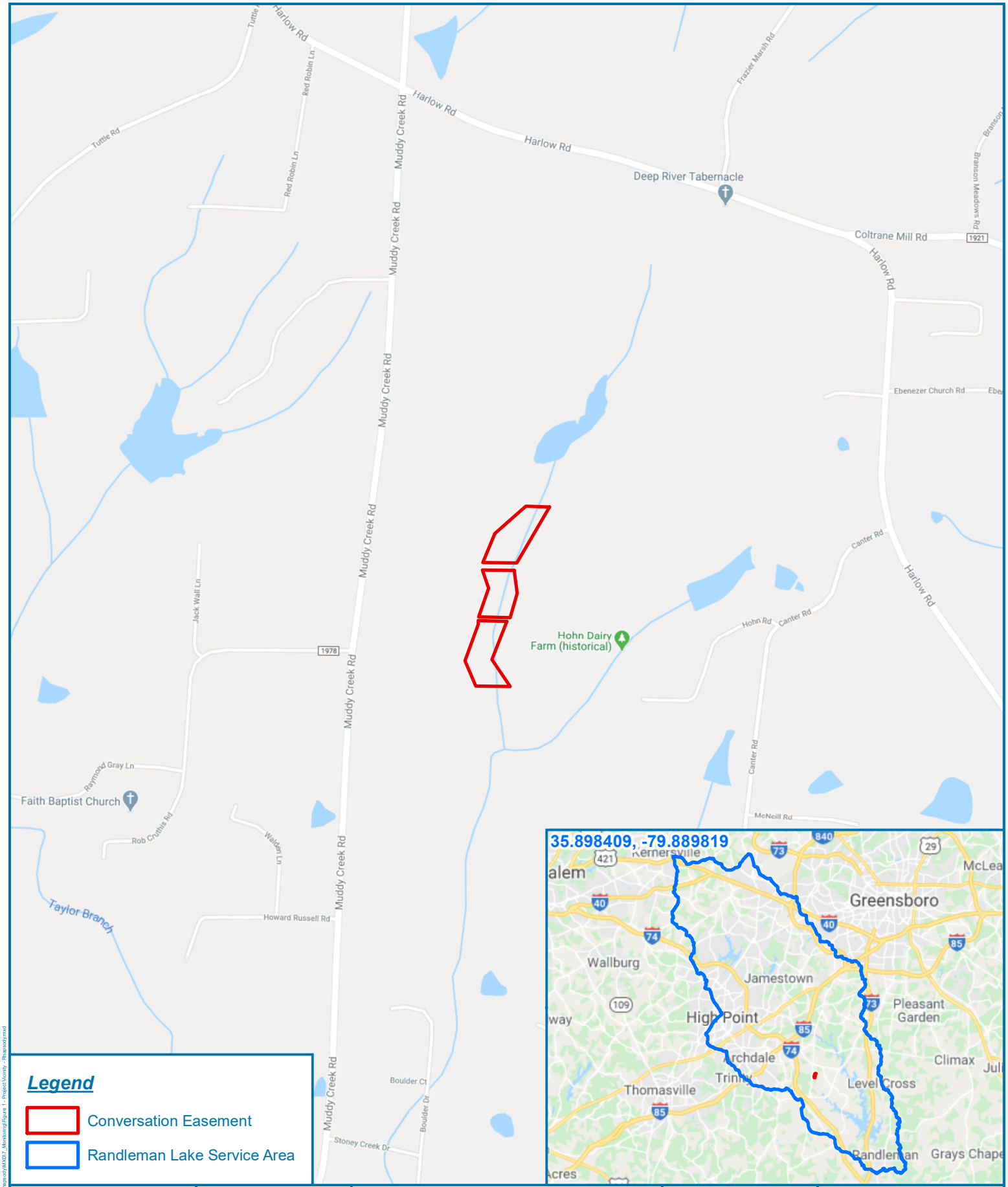


Figure 1 - Site Location Map

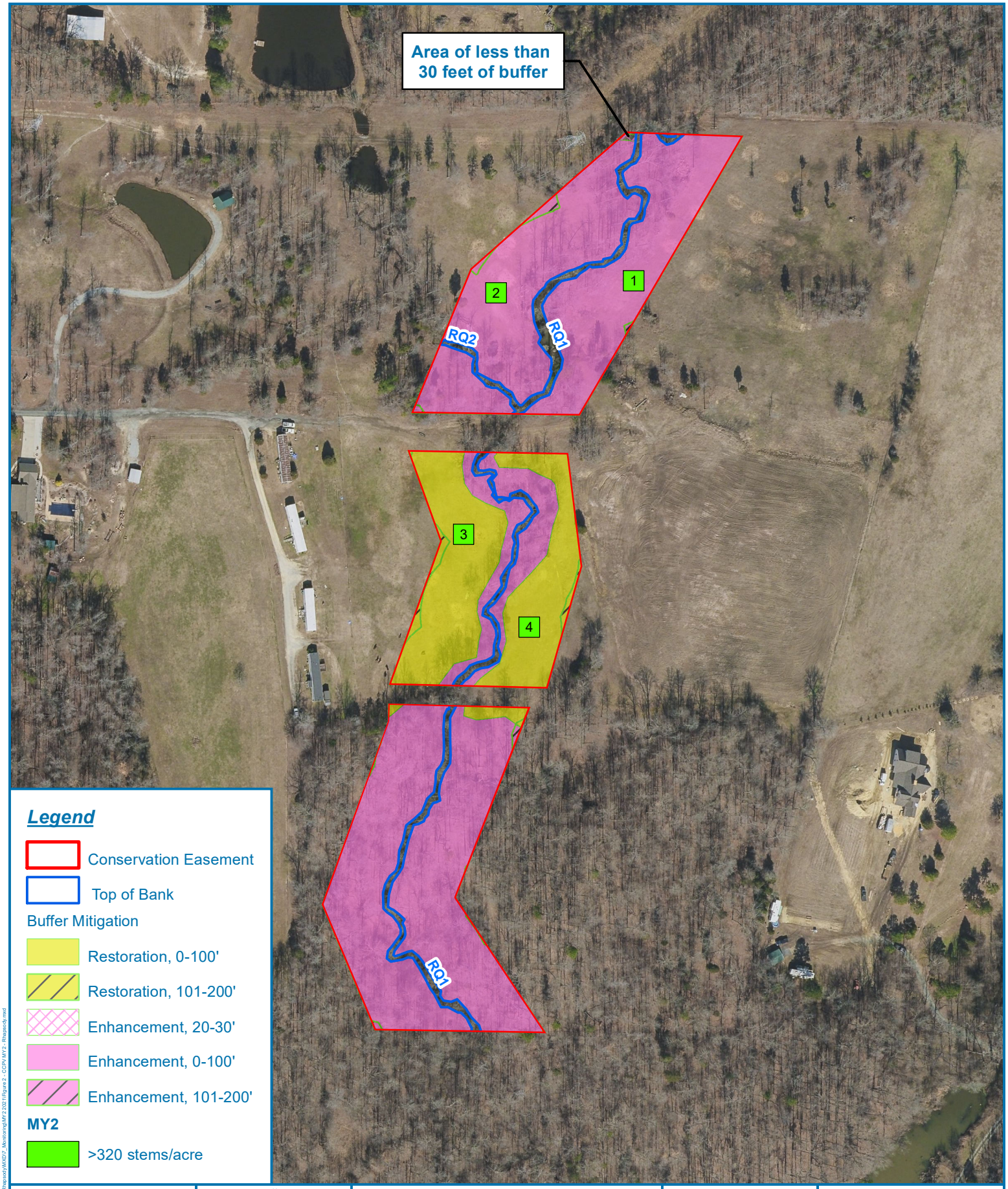
Rhapsody Mitigation Project

Randolph County, North Carolina

Date:	5/20/2020
Drawn by:	HKH
Checked by:	RTM
	1 inch = 1,000 feet

res

Document Path: R:\Regional\Projects\NC\Rhapsody\MXD\7_Monitoring\Figure 1 - Project Vicinity - Rhapsody.mxd



Legend

- Conservation Easement
- Top of Bank

Buffer Mitigation

- Restoration, 0-100'
- Restoration, 101-200'
- Enhancement, 20-30'
- Enhancement, 0-100'
- Enhancement, 101-200'

MY2

- >320 stems/acre

N W E S

0 100 200

Feet

Figure 2 - Current Conditions Plan View

Rhapsody Mitigation Project

Randolph County, North Carolina

Date: 11/3/2021

Drawn by: GDS

Checked by: RTM

1 inch = 200 feet

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Document Path: R:\Respiratory\Projects\101739_Rhapsody\MY0\7_Monitoring\MY2 2021\Figure 2 - CCPV MY2 - Rhapsody.mxd

Appendix B

Vegetation Assessment Data

Table 5. Rhapsody Planted Species Summary

Common Name	Scientific Name	Total Stems Planted
American Sycamore	*Platanus occidentalis*	2,000
Water Oak	*Quercus nigra*	1,400
Tuliptree	*Liriodendron tulipifera*	1,400
Northern Red Oak	*Quercus rubra*	1,300
River Birch	*Betula nigra*	1,200
Silky Dogwood	*Cornus amomum*	1,000
Willow Oak	*Quercus phellos*	800
Black Walnut	*Juglans nigra*	700
Eastern Red Bud	*Cercis canadensis*	600
Pin Oak	*Quercus palustris*	500
Southern Crab Apple	*Malus angustifolia*	500
White Oak	*Quercus alba*	300
American Plum	*Prunus americana*	200
Southern Red Oak	*Quercus falcata*	200
Common Persimmon	*Diospyros virginiana*	200
Blackgum	*Nyssa sylvatica*	100
Common Elderberry	*Sambucus canadensis*	100
Total		12,500

Table 6. Rhapsody Vegetation Plot Mitigation Success Summary

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Average Planted Stem Height (ft)
1	890	526	1416	Yes	2.5
2	647	0	647	Yes	3.4
3	567	0	567	Yes	1.9
4	728	81	809	Yes	1.9
Project Avg	**708**	**152**	**860**	**Yes**	**2.4**

Table 7. Rhapsody Stem Count Total and Planted by Plot Species

Rhapsody			Current Plot Data (MY2 2021)												Annual Means								
			100110-01-0001			100110-01-0002			100110-01-0003			100110-01-0004			MY2 (2021)			MY1 (2020)			MY0 (2020)		
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
Betula nigra	river birch	Tree	2	2	2	4	4	4	1	1	1	2	2	2	9	9	9	11	11	11	18	18	18
Cercis canadensis	eastern redbud	Tree	1	1	1	2	2	2	3	3	3	2	2	2	8	8	8	6	6	6	11	11	11
Cornus amomum	silky dogwood	Shrub	6	6	6				7	7	7				13	13	13	15	15	15	18	18	18
Diospyros virginiana	common persimmon	Tree	4	4	4	1	1	1				1	1	1	6	6	6	7	7	7	8	8	8
Juglans nigra	black walnut	Tree	5	5	5	1	1	1				2	2	2	8	8	8	10	10	10	11	11	11
Liriodendron tulipifera	tuliptree	Tree	1	1	2	1	1	1				2	2	4	4	4	7	4	4	4	2	2	2
Malus angustifolia	southern crabapple	Tree	1	1	1										1	1	1	1	1	1	3	3	3
Pinus taeda	loblolly pine	Tree			10												10						
Platanus occidentalis	American sycamore	Tree	1	1	3	1	1	1				3	3	3	5	5	7	5	5	5	6	6	6
Prunus americana	American plum	Tree										1	1	1	1	1	1	1	1	1	4	4	4
Quercus alba	white oak	Tree							1	1	1				1	1	1				3	3	3
Quercus falcata	southern red oak	Tree				1	1	1				1	1	1	2	2	2	1	1	1	5	5	5
Quercus nigra	water oak	Tree				1	1	1	1	1	1	2	2	2	4	4	4	3	3	3	5	5	5
Quercus palustris	pin oak	Tree				2	2	2							2	2	2	2	2	2	4	4	4
Quercus phellos	willow oak	Tree							1	1	1				1	1	1	2	2	2	7	7	7
Quercus rubra	northern red oak	Tree	1	1	1	2	2	2				2	2	2	5	5	5	6	6	6	6	6	6
Sambucus canadensis	Common Elderberry	Shrub																1	1	1	1	1	1
Stem count			22	22	35	16	16	16	14	14	14	18	18	20	70	70	85	75	75	75	112	112	112
size (ares)			1			1			1			1			4			4			4		
size (ACRES)			0.02			0.02			0.02			0.02			0.10			0.10			0.10		
Species count			9	9	10	10	10	10	6	6	6	10	10	10	15	15	16	15	15	15	16	16	16
Stems per ACRE			890	890	1416	647	647	647	567	567	567	728	728	809	708	708	860	759	759	759	1133	1133	1133

Appendix C

Vegetation Monitoring Plot Photos

Rhapsody Vegetation Monitoring Plot Photos

Vegetation Plot 1 (11/2/2021)

Vegetation Plot 2 (11/2/2021)

Vegetation Plot 3 (11/2/2021)

Vegetation Plot 4 (11/2/2021)