MONITORING YEAR 4 ANNUAL REPORT
Final

MARTIN DAIRY BUFFER MITIGATION SITE
Orange County, NC
NCDEQ Contract No. 006831
DMS Project No. 97087
NCDWR Project No. 2016-0366

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PREPARED FOR:

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MARTIN DAIRY BUFFER MITIGATION SITE

Monitoring Year 4 Report

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Section 1: PROJECT OVERVIEW

1.1 Project Summary

Wildlands Engineering, Inc. (Wildlands) implemented a full delivery project at the Martin Dairy Mitigation Site ("Site") for the North Carolina Department of Environmental Quality Division of Mitigation Services (DMS) to restore a total of 2,135 linear feet (LF) of perennial streams in Orange County, NC. The Site included the restoration of two unnamed tributaries (Martin Dairy Creek and UT1). The project also restored 10.139 acres (441,654.84 ft^2) of riparian buffer at the Site, which will provide 379,169.330 riparian buffer credits. The project Site was planned, designed, and constructed on land surrounding Martin Dairy Creek and its tributary. The Site is located approximately eight miles northeast of Hillsborough, NC and eight miles south of Caldwell, NC (Figure 1) in the Neuse River Basin 8-Digit Hydrologic Unit Code 03020201. The project is located within the Neuse River Basin Hydrologic Unit Code 03020201030030 and NC Division of Water Resources (DWR) Subbasin 03-04-01. The Site drains to Buckwater Creek, which flows to Falls Lake, which is classified as Water Supply Waters (WS-IV) and Nutrient Sensitive Waters (NSW). The 11.155 acre Site is protected with a permanent conservation easement.

The project has been planned, designed, and constructed per the Martin Dairy Mitigation Plan (Wildlands, 2017) and the Consolidated Buffer Mitigation Rule 15A NCAC 02B .0295 (effective November 1, 2015). The purpose of the riparian buffer restoration is to provide riparian buffer credits to compensate for buffer impacts within the Hydrologic Unit Code 03020201 and the Falls Lake Watershed. The service area for the riparian buffer credits is depicted in Figure 2. The mitigation credits generated from this Site are listed in Table 1 and shown in Figure 3.

1.2 Project Goals and Objectives

Prior to construction activities, the primary degradation on the Site was the original clearing of the Site and channelization of Martin Dairy Creek and UT1. The channelization involved straightening and deepening of the stream (as indicated by the amount of dredge spoil in the floodplain). In the past livestock were grazed on the Site, which contributed to bank sloughing. Table 4 in Appendix 1 presents the pre-restoration conditions in more detail. The restored riparian buffer areas within the Site will aid in protecting water quality.

The main objective of the project was to reduce nitrogen and phosphorus loading to the Neuse River tributaries by establishing a forested riparian buffer on land previously used for agricultural purposes. The riparian buffer will immobilize nutrients, reducing quantities available to downstream aquatic ecosystems in the Neuse River Basin.

The Site is protected with a 11.155 acre conservation easement. Out of the 11.155 acres, 10.139 acres were restored for Neuse River buffer credit and 1.017 acres will not generate buffer mitigation credit. In general, riparian buffer restoration area widths on streams extend out to 200 feet from top of bank for Neuse River buffer credits. Maps detailing the credit generation are provided in Figure 3.

1.3 Monitoring Year 4 Data Assessment

The final Mitigation Plan was submitted and accepted by DMS in March 2017. Construction activities were completed by Land Mechanic Designs, Inc in July 2017. The planting was completed by Bruton Natural Systems, Inc. in December 2017. The baseline as-built survey for the stream mitigation work was completed by Turner Land Surveying in August 2017 and for the buffer mitigation component in January 2018. Monitoring Year 4 vegetation survey was completed September 2021. Refer to Appendix 1 for detailed project activity, history, contact information, and watershed/site background information.

Vegetative performance for buffer restoration areas will be in accordance with 15A NCAC 02B .0295(n)(2)(B), and (n)(4) (effective November 1, 2015). To meet success criteria, areas generating buffer mitigation credits shall include a minimum of four native hardwood tree species or four native hardwood tree and native shrub species, where no one species is greater than 50 percent of stems, and have a survival of 260 planted stems per acre at the end of the required monitoring period (MY5) (no interim success criteria required). In order for the monitoring to be terminated, DWR must provide written approval of vegetation success of the buffer restoration areas generating buffer credit. Annual monitoring was conducted to assess the condition of the vegetation in September 2021.

1.3.1 Vegetative Assessment

The quantity of monitoring vegetation plots was determined in accordance with the Carolina Vegetative Sampling Protocol (CVS Levels II) such that at least two (2) percent of the Site is encompassed in monitoring plots. A total of eight (8) vegetation plots (10 meters by 10 meters) were randomly established between the conservation easement boundaries and five feet from the top of stream banks. The plot corners have been marked and are recoverable either through field identification or with the use of a GPS unit. Reference photographs will be taken at the origin looking diagonally across the plot to the opposite corner on an annual basis. Species composition, density, and survival rates will be evaluated on an annual basis by plot and for the entire site. The extent of invasive species coverage will also be monitored and controlled as necessary.

The MY4 vegetative survey was completed in September 2021. All eight of the vegetation plots exceeded the MY5 success criteria with an average stem density of 435 planted stems per acre. Individual plots ranged from 364 to 486 stems per acre. All plots surpassed the density requirements for MY5 by at least 47%. Volunteer species are flourishing and have shown an overall increase in both species diversity, and density. The MY4 average stem density including volunteer species has risen to 1,108 stems per acre, which is nearly 50% higher than MY0.

Refer to Appendix 3 for vegetation plot criteria attainment data, CVS vegetation plot metadata, and vegetation summary tables and Appendix 2 for vegetation plot photographs, vegetation condition assessment table, and monitoring plan view.

Tree vigor and vegetative cover along UT1 has immensely improved from MY3. Container trees and tublings planted in MY3 have thrived and vegetative and herbaceous cover has benefited from the addition of soil amendments. The effects of the supplemental planting done during the prior year can be seen through improvements in stem density across the Site. Deer browse has limited the height of trees throughout the Site. Repellex pellets containing capsacin will be added at the base of trees in attempt to deter deer from browsing.

1.4 Monitoring Year 4 Summary

All eight vegetation plots are on track to surpass the success criteria at the end of MY5. Remedial efforts taken in the prior monitoring year have greatly benefited the Site's overall vegetative success. The density of both volunteer and planted trees have increased from MY3. The Site has shown positive trends of vegetative growth and establishment and is expected to continue these trends during the upcoming monitoring year. Herbaceous vegetation is thriving, and species diversity and abundance has increased across the site.

Summary information/data related to the performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the Mitigation Plan documents available on

DMS's website. All raw data supporting the tables and figures in the appendices is available from DMS upon request.

Section 2: METHODOLOGY

Planted woody vegetation was monitored in accordance with the guidelines and procedures developed by the Carolina Vegetation Survey-EEP Level 2 Protocol (Lee et al., 2006). A total of eight standard 10 meter by 10-meter vegetation plots were established within the project easement area.

Section 3: REFERENCES

Breeding, R. 2010. Neuse River Basin Restoration Priorities. North Carolina Ecosystem Enhancement Program.

Guidelines for Riparian Buffer Restoration. NC Department of Environment and Natural Resources, Ecosystem Enhancement Program. October 2004.

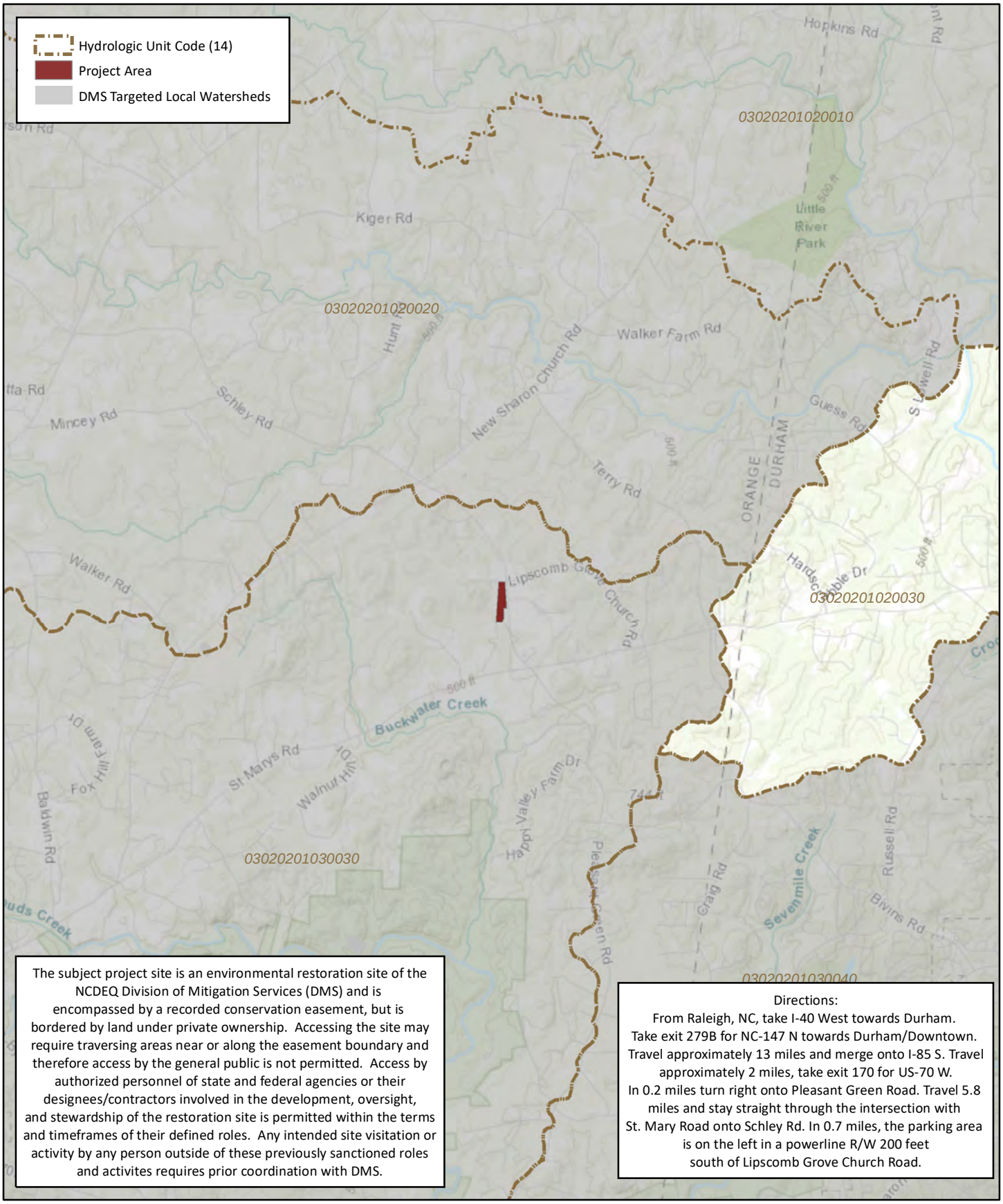
Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation Version 4.0. Retrieved from http://www.nceep.net/business/monitoring/veg/datasheets.htm.

Peet, R.K., T.R. Wentworth and P.S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea 63:262-274. http://cvs.bio.unc.edu/methods.htm

Schafale, M.P. and Weakley, A.S. 1990. A Classification of the Natural Communities of North Carolina, Third Approximation.

Wildlands Engineering (2017). Martin Dairy Mitigation Site. NCDWR, Raleigh NC. http://portal.ncdenr.org/web/wq/nutrientbufferbanks

APPENDIX 1. General Figures and Tables



The subject project site is an environmental restoration site of the NCDEQ Division of Mitigation Services (DMS) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight, and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activity by any person outside of these previously sanctioned roles and activites requires prior coordination with DMS.

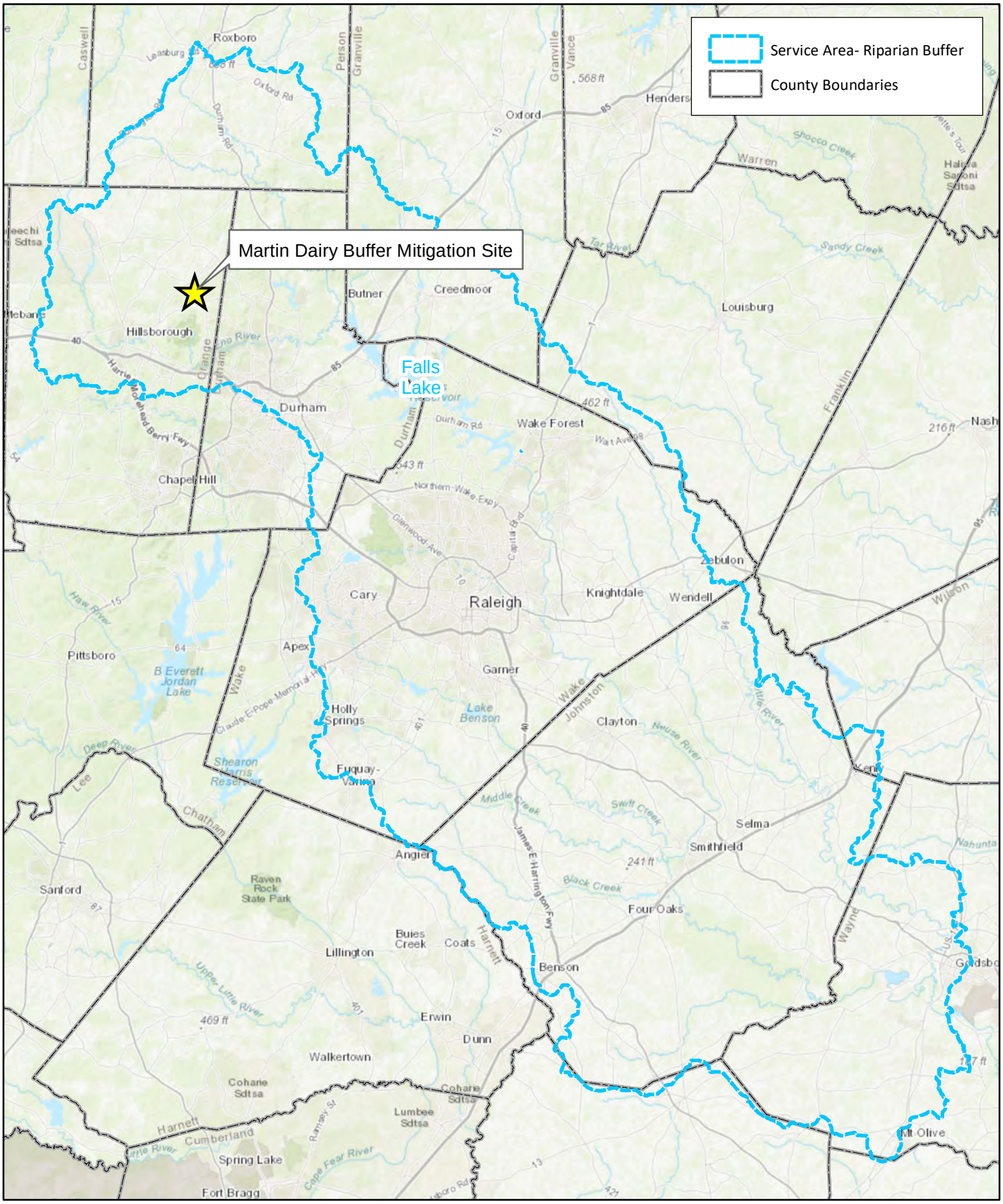
Directions:
From Raleigh, NC, take I-40 West towards Durham. Take exit 279B for NC-147 N towards Durham/Downtown. Travel approximately 13 miles and merge onto I-85 S. Travel approximately 2 miles, take exit 170 for US-70 W. In 0.2 miles turn right onto Pleasant Green Road. Travel 5.8 miles and stay straight through the intersection with St. Mary Road onto Schley Rd. In 0.7 miles, the parking area is on the left in a powerline R/W 200 feet south of Lipscomb Grove Church Road.

WILDLANDS ENGINEERING

0 0.5 1 Miles

N

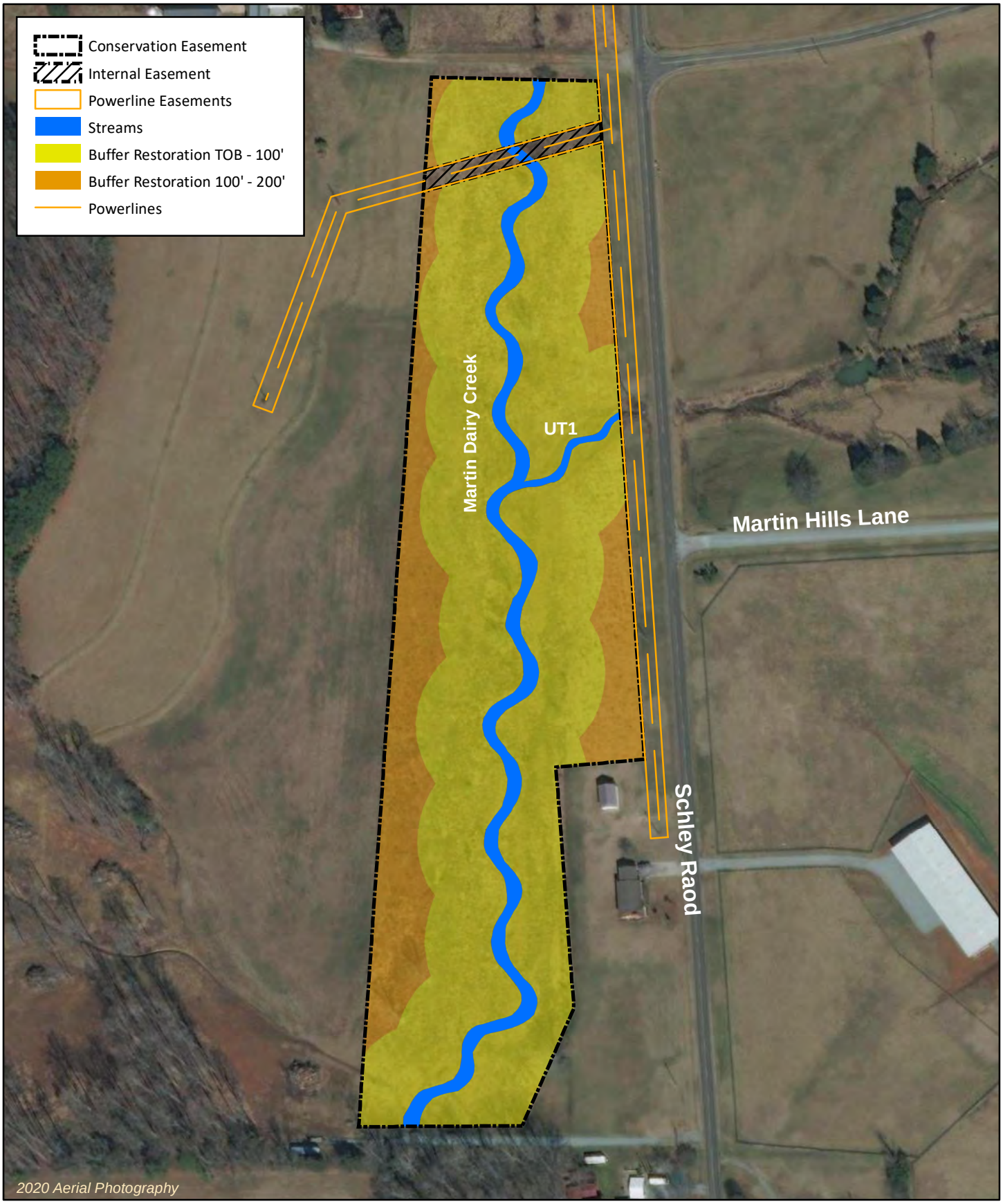
Figure 1. Project Vicinity Map
Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021
Orange County, NC



WILDLANDS ENGINEERING

Figure 2. Service Area
Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Orange County, NC



WILDLANDS ENGINEERING

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Figure 3. Project Component / Asset Map
Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021
Orange County, NC

Table 1. Project Components and Mitigation Credits

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

MITIGATION CREDITS												
Riparian Buffer (15A NCAC 02B.0295)											**If Converted to Nutrient Offset**	
Location	**Jurisdictional Streams**	**Restoration Type**	**Reach ID /Component**	**Buffer Width (ft)**	**Creditable Area (square feet)**	**Initial Credit Ratio (x:1)**	**% Full Credit**	**Final Credit Ratio (x:1)**	**Riparian Buffer Credits (BMU)**	**Convertible to Nutrient Offset (Yes or No*)**	**Nutrient Offset: N (lbs)**	**Nutrient Offset: P (lbs)**
Rural	Subject	Restoration	Martin Dairy	0-100	348,392.88	1	100%	1.00000	348,392.88	No	0.000	0.000
			Martin Dairy	101-200	93,261.96		33%	3.00000	30,776.45	No	0.000	0.000
			SUBTOTALS		**441,654.84**				**379,169.33**		**0.000**	**0.000**

*Riparian buffer credits are not convertible to nutrient offset because the site was used for hay production and livestock have been removed.

Table 2. Project Activity and Reporting History

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Activity or Report	Date Collection Complete	Completion or Scheduled Delivery
Conservation Easement	N/A	November 2016
Mitigation Plan	March 2017	March 2017
Bare Root Planting	N/A	December 2017
As-Built & Baseline Monitoring Document	January 2018	January 2018
Year 1 Monitoring	September 2018	December 2018
Year 2 Monitoring	September 2019	December 2019
Supplemental Planting		January 2020
Year 3 Monitoring	September 2020	December 2020
Year 4 Monitoring	September 2021	December 2021
Year 5 Monitoring	2022	December 2022

Table 3. Project Contact Table

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Designer Angela Allen, PE	**Wildlands Engineering, Inc.** 312 West Millbrook Road, Suite 225 Raleigh, NC 27609 919.851.9986
Planting Contractor	**Bruton Natural Systems, Inc** P.O. Box 1197 Fremont, NC 27830
Nursery Stock Suppliers	**Dykes and Son Nursery**
Monitoring Performers Monitoring, POC	**Wildlands Engineering, Inc.** Jason Lorch 919.851.9986, ext. 107

Table 4. Project Information and Attributes

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

PROJECT INFORMATION	
Project Name	Martin Dairy Buffer Mitigation Site
County	Orange County
Project Area (acres)	11.155
Planted Area (acres)	10.139
Project Coordinates (latitude and longitude)	36° 7' 25.76"N 79° 0' 14.26"W
PROJECT WATERSHED SUMMARY INFORMATION	
Physiographic Province	Carolina Slate Belt of the Piedmont Physiographic Province
River Basin	Neuse
USGS Hydrologic Unit 8-digit	03020201
USGS Hydrologic Unit 14-digit	03020201030030
DWR Sub-basin	03-04-01
Project Drainage Area (acres)	526.0
Project Drainage Area Percentage of Impervious	0.4%
CGIA Land Use Classification	59.0% forested, 40.6% cultivated, 0.40% impervious

Table 5. Adjacent Forested Areas Existing Tree and Shrub Species

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Common Name	Scientific Name	Wetland Indicator Status
Red Maple	*Acer rubrum*	FAC
Water Hickory	*Carya aquatica*	OBL
Sugarberry	*Celtis laevigata*	FACW
Sweet Pepperbush	*Clethra alnifolia*	FACW
Swamp Titi	*Cyrilla racemiflora*	FACW
Persimmon	*Diospyros virginiana*	FAC
Water Ash	*Fraxinus caroliniana*	OBL
Deciduous Holly	*Ilex decidua*	FACW-
Virginia Sweetspire	*Itea virginica*	FACW+
Eastern Red Cedar	*Juniperus virginiana*	FACU-
Sweetgum	*Liquidambar styraciflua*	FAC+
Yellow Poplar	*Liriodendron tulipifera*	FAC
Water Tupelo	*Nyssa aquatica*	OBL
Blackgum	*Nyssa sylvatica*	FAC
Loblolly Pine	*Pinus taeda*	FAC
American Sycamore	*Platanus occidentalis*	FACW-
Willow Oak	*Quercus phellos*	FACW-
Red Oak	*Quercus rubra*	FACU
Shumard Oak	*Quercus shumardii*	FACW-
Black Willow	*Salix nigra*	OBL

Table 6. Planted Tree Species

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

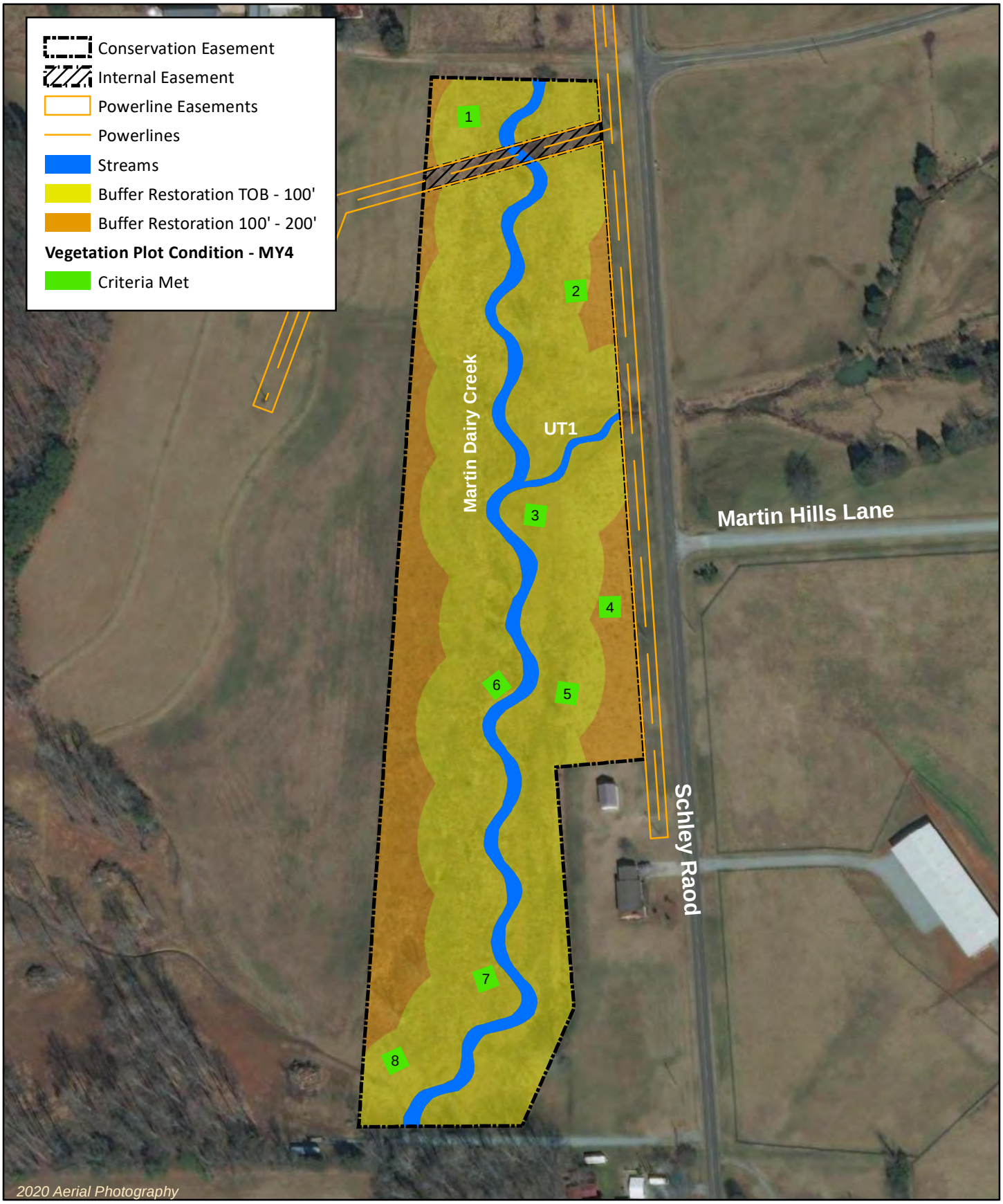
Common Name	Scientific Name	Number Planted	% of Total
River Birch	*Betula nigra*	926	16%
Eastern Redbud	*Cercis canadensis*	58	1%
Flowering Dogwood	*Comus florida*	58	1%
Green Ash	*Fraxinus pennsylvanica*	1,042	18%
Tulip Poplar	*Liriodendron tulipifera*	926	16%
Sycamore	*Platanus occidentalis*	1,274	22%
Pin Oak	*Quercus palustris*	811	14%
Willow Oak	*Quercus phellos*	695	12%
Total		**5,790**	**100%**

Table 6a. Supplemental Planting Tree Species (Planted MY3 - January 2020)

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Common Name	Scientific Name	Number Planted
Tag Alder	*Alnus serrulata*	15
Pawpaw	*Asimina triloba*	15
River birch	*Betula nigra*	100
Silky dogwood	*Cornus amomum*	15
Sourwood	*Oxydendrum arboreum*	10
Sycamore	*Platanus occidentalis*	100
Black Cherry	*Prunus Serotina*	35
White Oak	*Quercus alba*	10
Overcup Oak	*Quercus lyrata*	15
Willow Oak	*Quercus phellos*	75
Northern red oak	*Quercus rubra*	45
Shumard's oak	*Quercus shumardii*	30
American elm	*Ulmus americana*	25
Total		**490**

APPENDIX 2. Visual Assessment Data



WILDLANDS ENGINEERING

0 100 200 Feet

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Figure 4. Monitoring Plan View
Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021
Orange County, NC

Table 7. Vegetation Condition Assessment Table

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Planted Acreage **10.139**

Vegetation Category	Definitions	Mapping Threshold (Ac)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0	0%
		Total	**0**	**0**	**0%**
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 Ac	0	0	0%
		Cumulative Total	**0**	**0.00**	**0%**

Easement Acreage **11.155**

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas of points (if too small to render as polygons at map scale).	1,000	0	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

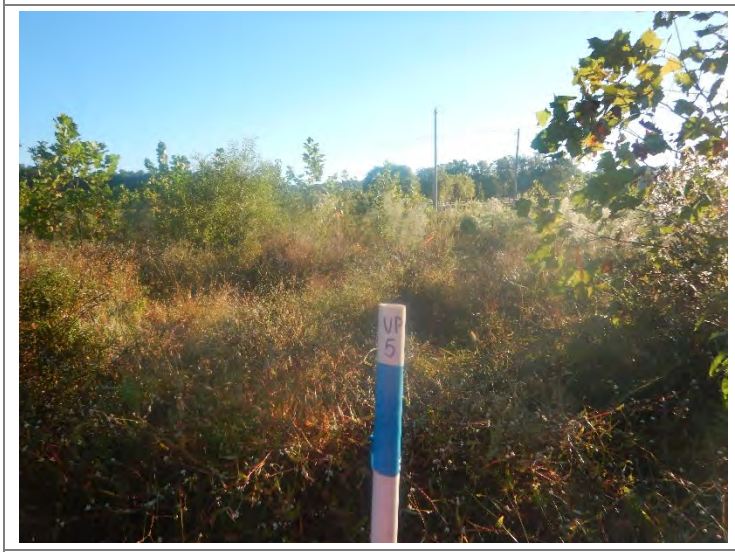
VEGETATION PLOT PHOTOGRAPHS

VEG PLOT 1 *(09/24/2021)*

VEG PLOT 2 *(09/24/2021)*

VEG PLOT 3 *(09/24/2021)*

VEG PLOT 4 *(09/24/2021)*



VEG PLOT 5 *(09/24/2021)*

VEG PLOT 6 *(09/24/2021)*

	
VEG PLOT 7 *(09/24/2021)*	**VEG PLOT 8** *(09/24/2021)*

APPENDIX 3. Vegetation Plot Data

Table 8. Vegetation Plot Criteria Attainment Table

Martin Dairy Buffer Mitigation Site
DMS Project No. 97087
Monitoring Year 4 - 2021

Plot	Met Success Criteria	Tract Mean
1	Yes	100%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	Yes	
8	Yes	

Table 9 CVS Vegetation Tables - Metadata
Martin Dairy Buffer Mitigation Project
DMS Project No.97087
Monitoring Year 4 - 2021

Report Prepared By	Jason Lorch
Date Prepared	10/1/2021 13:28
Database Name	Martin Dairy- cvs-v2.5.0.- MY4.mdb
Database Location	F:\Projects\005-02158 Martin Dairy\Monitoring\Monitoring Year 4 - 2021\Vegetation Assessment
Computer Name	CARLYNN-PC
File Size	51679232
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Project Planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Project Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	97087
Project Name	Martin Dairy
Description	Stream Restoration Project
Sampled Plots	8

Table 10. Planted and Total Stem Counts

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021)											
			VP 1			VP 2			VP 3			VP 4		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Baccharis halimifolia	Groundsel Tree	Shrub Tree									3			
Betula nigra	River Birch	Tree	2	2	2	2	2	2	3	3	3	1	1	2
Carya	Hickory	Tree												
Cephalanthus occidentalis	Buttonbush	Shrub Tree												
Cercis canadensis	Eastern Redbud	Shrub Tree												
Cornus amomum	Silky Dogwood	Shrub Tree												
Cornus florida	Flowering Dogwood	Shrub Tree												
Fraxinus pennsylvanica	Green Ash	Tree	1	1	1	3	3	3	2	2	3	3	3	3
Juglans nigra	Black Walnut	Tree												1
Ligustrum sinense	Chinese Privet	Exotic									1			
Liquidambar styraciflua	Sweet Gum	Tree			2			7			9			3
Liriodendron tulipifera	Tulip Poplar	Tree	2	2	2							1	1	1
Nyssa sylvatica	Black Gum	Tree												
Pinus taeda	Loblolly Pine	Tree									4			
Platanus occidentalis	Sycamore	Tree	2	2	2	2	2	2	3	3	4	2	2	3
Prunus serotina	Black Cherry	Tree				1	1	1						
Pyrus calleryana	Bradford Pear	Exotic												
Quercus lyrata	Overcup Oak	Tree	1	1	1									
Quercus palustris	Pin Oak	Tree										1	1	1
Quercus phellos	Willow Oak	Tree	3	3	3	4	4	4	4	4	4	3	3	3
Quercus rubra	Northern Red Oak	Tree												
Salix nigra	Black Willow	Tree												
Ulmus	Elm	Tree												
Ulmus alata	Winged Elm	Tree												1
Ulmus americana	American Elm	Tree												1
Ulmus rubra	Slippery Elm	Tree			1			4						
		Stem count	11	11	14	12	12	23	12	12	23	11	11	19
		size (ares)		1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02	
		Species count	6	6	8	5	5	7	4	4	8	6	6	10
		Stems per ACRE	445	445	567	486	486	931	486	486	931	445	445	769

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteers

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

Table 10. Planted and Total Stem Counts

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 4 - 2021

			Current Plot Data (MY4 2021)											
			VP 5			VP 6			VP 7			VP 8		
Scientific Name	**Common Name**	**Species Type**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**	**PnoLS**	**P-all**	**T**
Baccharis halimifolia	Groundsel Tree	Shrub Tree												
Betula nigra	River Birch	Tree	3	3	3	2	2	2	3	3	3	3	3	3
Carya	Hickory	Tree												
Cephalanthus occidentalis	Buttonbush	Shrub Tree												
Cercis canadensis	Eastern Redbud	Shrub Tree												
Cornus amomum	Silky Dogwood	Shrub Tree							1	1	6			
Cornus florida	Flowering Dogwood	Shrub Tree												
Fraxinus pennsylvanica	Green Ash	Tree	1	1	2	1	1	1	1	1	10	2	2	48
Juglans nigra	Black Walnut	Tree												
Ligustrum sinense	Chinese Privet	Exotic												
Liquidambar styraciflua	Sweet Gum	Tree												5
Liriodendron tulipifera	Tulip Poplar	Tree										1	1	1
Nyssa sylvatica	Black Gum	Tree						18						
Pinus taeda	Loblolly Pine	Tree												
Platanus occidentalis	Sycamore	Tree	4	4	5	4	4	4	5	5	5	2	2	13
Prunus serotina	Black Cherry	Tree												
Pyrus calleryana	Bradford Pear	Exotic			3									
Quercus lyrata	Overcup Oak	Tree												
Quercus palustris	Pin Oak	Tree												
Quercus phellos	Willow Oak	Tree	2	2	2	3	3	3	1	1	1	1	1	1
Quercus rubra	Northern Red Oak	Tree												
Salix nigra	Black Willow	Tree			2									
Ulmus	Elm	Tree												
Ulmus alata	Winged Elm	Tree												
Ulmus americana	American Elm	Tree												
Ulmus rubra	Slippery Elm	Tree												2
		Stem count	10	10	14	10	10	28	11	11	25	9	9	73
		size (ares)		1			1			1			1	
		size (ACRES)		0.02			0.02			0.02			0.02	
		Species count	4	4	6	4	4	5	5	5	5	5	5	7
		Stems per ACRE	405	405	567	405	405	1,133	445	445	1,012	364	364	2,954

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteers

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

Table 10. Planted and Total Stem Counts

Martin Dairy Buffer Mitigation Site

DMS Project No. 97087

Monitoring Year 4 - 2021

			Annual Means														
			MY4 (2021)			MY3 (2020)			MY2 (2019)			MY1 (2018)			MY0 (2018)		
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**
Baccharis halimifolia	Groundsel Tree	Shrub Tree			3												
Betula nigra	River Birch	Tree	19	19	20	12	12	18	14	14	14	16	16	16	17	17	17
Carya	Hickory	Tree						1									
Cephalanthus occidentalis	Buttonbush	Shrub Tree									12			8			
Cercis canadensis	Eastern Redbud	Shrub Tree										1	1	1	3	3	3
Cornus amomum	Silky Dogwood	Shrub Tree	1	1	6												
Cornus florida	Flowering Dogwood	Shrub Tree						4				2	2	2	2	2	2
Fraxinus pennsylvanica	Green Ash	Tree	14	14	71	15	15	83	15	15	45	17	17	29	18	18	18
Juglans nigra	Black Walnut	Tree			1												
Ligustrum sinense	Chinese Privet	Exotic			1			1									
Liquidambar styraciflua	Sweet Gum	Tree			26			9			9			2			
Liriodendron tulipifera	Tulip Poplar	Tree	4	4	4	4	4	4	5	5	7	7	7	7	19	19	19
Nyssa sylvatica	Black Gum	Tree			18			24									
Pinus taeda	Loblolly Pine	Tree			4												
Platanus occidentalis	Sycamore	Tree	24	24	38	22	22	29	22	22	27	24	24	25	25	25	25
Prunus serotina	Black Cherry	Tree	1	1	1												
Pyrus calleryana	Bradford Pear	Exotic			3			2			3						
Quercus lyrata	Overcup Oak	Tree	1	1	1												
Quercus palustris	Pin Oak	Tree	1	1	1	3	3	3	12	12	12	16	16	16	20	20	20
Quercus phellos	Willow Oak	Tree	21	21	21	15	15	15	12	12	12	14	14	14	14	14	14
Quercus rubra	Northern Red Oak	Tree						1									
Salix nigra	Black Willow	Tree			2			2									
Ulmus	Elm	Tree									2			1			
Ulmus alata	Winged Elm	Tree			1												
Ulmus americana	American Elm	Tree			1												
Ulmus rubra	Slippery Elm	Tree			7			6									
		Stem count	86	86	219	71	71	202	80	80	143	97	97	121	118	118	118
		size (ares)		8			8			8			8			8	
		size (ACRES)		0.20			0.20			0.20			0.20			0.20	
		Species count	9	9	20	6	6	15	6	6	10	8	8	11	8	8	8
		Stems per ACRE	435	435	1,108	359	359	1,022	405	405	723	491	491	612	597	597	597

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements, by less than 10%

Fails to meet requirements by more than 10%

Volunteers

PnoLS: Number of Planted stems excluding live stakes

P-all: Number of planted stems including live stakes

T: Total Stems

APPENDIX 4. Overview Photos