

# Tar River Headwaters Wetland Restoration Site

Person County NC -- Tar-Pamlico River HUC# 03020101-0102

## MY-0 (2017) As-Built Baseline Monitoring Report

NC-DEQ Division of Mitigation Services: DMS Project # 97071

Data Collected: February 2017

Final Report: April 2017



Submitted To:  
N.C. Department of Environmental Quality  
DEQ Division of Mitigation Services  
1652 Mail Service Ctr, Raleigh, NC 27699-1652

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DMS Project Manager: Lindsay Crocker  
DEQ-DMS Contract # 006749

MOGENSEN MITIGATION, INC.  
P.O. Box 690429 Charlotte, NC 28227  
(704) 576-1111 [Rich@MogMit.com](mailto:Rich@MogMit.com)  
(919) 556-8845 [GPottern@RJGAcarolina.com](mailto:GPottern@RJGAcarolina.com)



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## **1.0. Project Summary**

### **1.1. Project Location and Setting**

The Tar River Headwaters Wetland Restoration Site (TRHWR) is a full-delivery wetland mitigation project located in eastern Person County, between Roxboro and Oxford, North Carolina, within the Piedmont Physiographic Province (Figure 1). The easement comprises 9.98 acres, most of which is drained and degraded wetlands or former wetlands with hydric soil indicators. The remaining areas include non-hydric soils, drainage ditches, and a 570-foot long riparian corridor along an intermittent stream connecting the TRHWR site to the adjacent Tar River Headwaters Riparian Buffer and Nutrient Offset Mitigation Bank project. Both projects are designed and implemented by Mogensen Mitigation, Inc. (MMI), and are located on a 228-acre farm owned by Roy and Joyce Huff, in the Tar-Pamlico River Basin 12-digit HUC # 03020101-0102. The Huff Farm property is located at 333 Bunnie Huff Road, Oxford NC 27565. The access road into the TRHWR site is at Latitude = 36.3913, Longitude = -78.8171.

### **1.2. Pre-Construction Site Conditions**

The TRHWR site was cleared and ditched for pasture use in the 1940s according to the owner, and was until recently used for grazing cattle. The project involves plugging drainage ditches to restore wetland hydrology, fencing to exclude livestock, and planting native trees and shrubs to restore a Headwater Forest wetland ecosystem similar to what occurred prior to site clearing and drainage. The remnant mature trees left for shade, hydrophytic groundcover plants mixed among the pasture grasses, and plant species recorded in adjacent forests (on the same soil mapping unit) provide data for the planting plan.

The proposed work will restore approximately 7.65 acres of headwater riparian wetland (6.53 acres reestablishment plus 1.12 acres rehabilitation) and will generate an estimated 7.28 or more riparian wetland mitigation credits (RWMC), exceeding the 5.0 RWMC requested by the NC Division of Mitigation Services (DMS) in RFP # 16-006476. Approximately 1.27 acres with non-hydric soils in the southeast corner of the mitigation site will also be reforested, and a 100-foot wide by 570-ft long riparian corridor (1.06 acre) extending southeastward along the ditch will connect the TRHWR site to MMI's adjacent stream restoration and nutrient buffer bank project to the south. Total acreage of the wetland mitigation site and riparian connector is 9.98 acres.

The proposed wetland restoration and cattle exclusion will reduce soil erosion and nutrient-enriched runoff from adjacent pasture and cropland within its watershed, and help retain agricultural chemicals used on these lands. Erosion will be significantly reduced by buffering with native tree plantings. It is expected to improve water quality and habitat in the receiving tributary and reduce fine sediment loading which will enhance the overall watershed particularly in the adjacent stream and nutrient mitigation bank.

### 1.3. Mitigation Goals and Objectives

Specific project GOALS and corresponding OBJECTIVES include:

#### GOALS:

- Restore the natural jurisdictional wetland hydro-period to five or more acres of forested wetland within a nine-acre site;
- Restore forested wetland habitat and improve habitat connectivity between Denny Store Gabbro Forest (NHP Natural Heritage Area) to the north and the Tar River tributaries;
- Buffer storm water runoff from fecal and other cattle-related pollutants and fertilizer.

#### OBJECTIVES:

- Plug existing ditches and create sheet flows throughout the site. Aerate soils to reduce compaction, improve infiltration, and create micro-topography to retain surface flows;
- Preserve the remnant mature Swamp White Oaks (a regionally rare species) for seed source. Plant appropriate native hardwood trees at a sufficient frequency to establish a diverse bottomland wetland forest. Treat and/or remove invasive species which may cause problems for site restoration, including Chinese privet and multi-flora rose;
- Install fencing to exclude cattle and establish a conservation easement to provide permanent protection on the site.

#### PERFORMANCE STANDARDS and MONITORING:

<b>GOAL</b>	<b>OBJECTIVE</b>	<b>PERFORMANCE STANDARD</b>	<b>MONITORING APPROACH</b>
Restore natural hydro-period for headwater forest wetland.	Plug existing ditches and create sheet flow throughout the site. Aerate soils to reduce compaction, improve infiltration, and create micro-topography to retain surface flows.	Water must be on or within 12 inches of the surface for 10% of the growing season* Hydrographs will indicate jurisdictional hydrology.	Use 11 shallow groundwater self-reading gauges throughout the site at a frequency of about one per acre. Visual inspection of ponding duration.
Restore forested wetland habitat and improve habitat connectivity with existing forests.	Preserve mature swamp white oak trees for seed source. Plant appropriate native hardwood trees at 10-ft average spacing (435 stems/ac) Treat invasive species.	Survival of 320 stems per acre at year 3, 260 stems per acre at year 5 and 210 stems per acre at MY 7.	Monitor vegetation plots annually and calculate densities of surviving planted stems.
Buffer storm water runoff from fecal and other cattle-related nutrient inputs.	Plant trees, fence perimeter and establish a permanent conservation easement.	Insure the integrity of the cattle exclusion fencing for the life of the contract.	Visual inspection will note fence condition through site pictures. Observations will be included in annual monitoring reports.

## 1.4. Mitigation Components and Attributes

The TRHWR project area contains 6.53 acres of former riparian wetland (ditched and drained, grazed pasture) that has redoximorphic soil characteristics indicating hydric soils, but no longer has adequate wetland hydrology based on groundwater gauge data and field observations during 2015-2016. The drainage ditches were constructed in the 1940s, according to the owner. The project will re-establish jurisdictional wetlands in this area by plugging the drainage ditches to restore wetland hydrology, fencing out livestock, controlling invasive species, and planting suitable native tree species. These 6.53 acres of wetland restoration will generate riparian wetland credits at 1:1 ratio, yielding 6.53 WMU.

Another 1.12 acres in the TRHWR project area has been less effectively drained by the ditches, and still has sufficient hydrology to meet jurisdictional wetland criteria, based on groundwater gauge data and field observations during 2015-2016. The project will rehabilitate these areas of degraded jurisdictional wetland (grazed pasture with reduced hydrology) by plugging ditches to increase hydrology, fencing out livestock, and planting suitable native tree species. These 1.12 acres of wetland rehabilitation will generate riparian wetland credits at 1.5:1 ratio, yielding 0.75 WMU. TRHWR project components and mitigations assets are summarized in Table 1, matching the proposed assets in the Mitigation Plan.

## 1.5. Construction and As-Built Conditions

Eleven groundwater gauges were installed throughout the site in Feb-Mar 2016 to collect hydrology data for use in project design, easement boundary selection, water budgeting, and credit determination. A reference wetland gauge was installed 1,500 ft northeast of the project easement, within the same soil mapping unit on the Huff property. Some gauges were later relocated during project implementation to provide better representation of expected hydrologic impacts of the project, and one additional gauge was added. As-built gauge locations (Feb 2017) are roughly arranged in transects perpendicular to the main ditch, as recommended by mitigation plan reviewers during field meetings (Figure 2). Ten gauges are within the proposed creditable reestablishment and rehabilitation areas, and two gauges are down-gradient from ditch plug #4 in the area of non-hydric soils, not expected to generate wetland credits.

A series of six ditch plugs were constructed to retain rainfall and disperse runoff on the site. Five plugs along the main north-south ditch include four in the TRHWR area and one downstream in the connector area in the southeastern portion of the easement (Figure 2). The sixth plug is on the eastern side ditch in the TRHWR area. Ditch bed segments to be filled were excavated six inches to remove loose material and plants, to ensure good contact between the fill material and underlying clay. Clay for the plugs was excavated from the pasture area south of the easement fence, and mixed with sand to achieve liquid limit and plasticity characteristics as recommended in the mitigation plan. To further enhance ditch plug stability, the contractor increased the length of plugs on the main ditch, constructing five long plugs (each plug 65 to 118 ft long) rather than the seven short plugs shown in the mitigation plan. The proposed cluster of plugs where three ditches converge were merged into one large plug (plug #4). The centerline of each plug is approximately 2 inches below the adjacent ground surface (old ditch banks), per the mitigation plan. The elevation drop from the toe of each plug downstream to the crest of the next plug in the wetland restoration area is 1 to 2 feet (Figures 3 and 4).

In the drained areas, soil aeration and herbicide application for pasture grasses and other invasive species were conducted prior to planting. Soil amendments and seeding were applied as specified in the mitigation plan. Existing wetlands, ditch banks, and areas surrounding large native trees were not sprayed. The wetland rehabilitation and reestablishment areas were planted with eleven species of native trees selected based on nearby headwater wetland forests, published natural community descriptions (Schafale and Weakley, 1990; LeGrand, 2007), and recommendations from the plant nursery (Table 5). A few of the oak species proposed in the mitigation plan were not available; water oak, willow oak, and persimmon were substituted. Power augers and shovels were used to dig the planting holes for the gallon-size potted trees, and a tree fertilizer pellet was added to each planting hole. Live-stakes of black willow and silky dogwood were planted on the ditch plugs and adjacent ditch banks, along with rushes and other plants excavated from the ditches prior to plugging.

The easement was fenced to exclude cattle using 4-ft high woven-wire field fence supported on 6-inch diameter pressure-treated wooden posts (10-ft spacing) with single-strand barbed wire on top. Nine CVS vegetation monitoring plots, each 10 x 10 meters, were installed at representative locations to show planting densities in the mitigation areas, avoiding areas shaded by large trees (Figure 2). Plot corners were marked with steel conduit pipe, and planted trees within each plot were mapped and identified following the CVS protocol (Lee et al, 2008). A soil temperature data logger was installed near the middle of the site as a supplement to climate data for assessing growing season length.

Construction, fencing, spraying and seeding were completed in January 2017. The ditch segments above the plugs filled with water within the first few days after construction. The only deviation from the mitigation plan was the contractor's decision to build the ditch plugs longer than depicted in the mitigation plan, to ensure plug stability. Tree planting and vegetation plot set-up were completed in February 2017 (Tables 5 and 6). The site was relatively wet due to recent rains during planting, and many of the planting holes had standing water. The average initial planting density based on the nine CVS plots in the wetland rehabilitation and re-establishment areas is 409 trees per acre. No invasive species problem areas were noted at this time. About a dozen mature trees remain in the restoration area; none of these are within the vegetation monitoring plots.

## **1.6. Monitoring Plan and Performance Standards**

To evaluate mitigation success on the TRHWR site, vegetation monitoring plots will be monitored annually in accordance with the "Stream and Wetland Monitoring Guidelines" (February 2014). The nine installed vegetation plots, each 10 x 10 meters, represents 2.8 percent of the planted mitigation area. Vegetation monitoring will occur between September and early November, prior to the loss of leaves. The vegetation success criteria are specified in the Performance Standards above. If success criteria are not met, site maintenance and monitoring will continue until the success criteria are met.

The groundwater monitoring gauges will be downloaded and maintained at least quarterly. Gauge data in the mitigation credit areas (2 gauges in rehabilitation areas, 8 gauges in re-establishment areas) will be plotted and evaluated for success based on the mitigation plan performance standard of saturation within the upper 12 inches for at least 10% of the growing season. The growing season will be determined either by soil temperature (41°F or greater at 20 inches below the soil surface) or from the USDA WETS Table data for Person County based on moderate-freeze air temperature data (March 28 to Nov 3 = 220 days).

## 2.0. References

- Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation version 4.2, October 2008*. Retrieved September 2011, from: <http://cvs.bio.unc.edu/methods.htm>
- LeGrand, Harry E. Jr. (2007) Natural Areas Inventory of Person County, NC. NC Natural Heritage Program, Raleigh NC.
- NC Ecosystem Enhancement Program. (2014). *NC-EEP Monitoring Report Template and Guidance version 1.0, February 2014*. <http://portal.ncdenr.org/web/eep/dbb-resources>
- Schafale, M.P., Weakley, A.S. 1990. Classification of the Natural Communities of North Carolina, Third Approximation. NC Natural Heritage Program, Raleigh, NC.
- Sink, Larry T. (1995). *Soil Survey of Person County, North Carolina*. USDA Soil Conservation Service (Natural Resources Conservation Service), Raleigh, NC.
- United States Department of Agriculture, Natural Resources Conservation Service, 2016. Web Soil Survey. Available: <http://websoilsurvey.nrcs.usda.gov/app/>

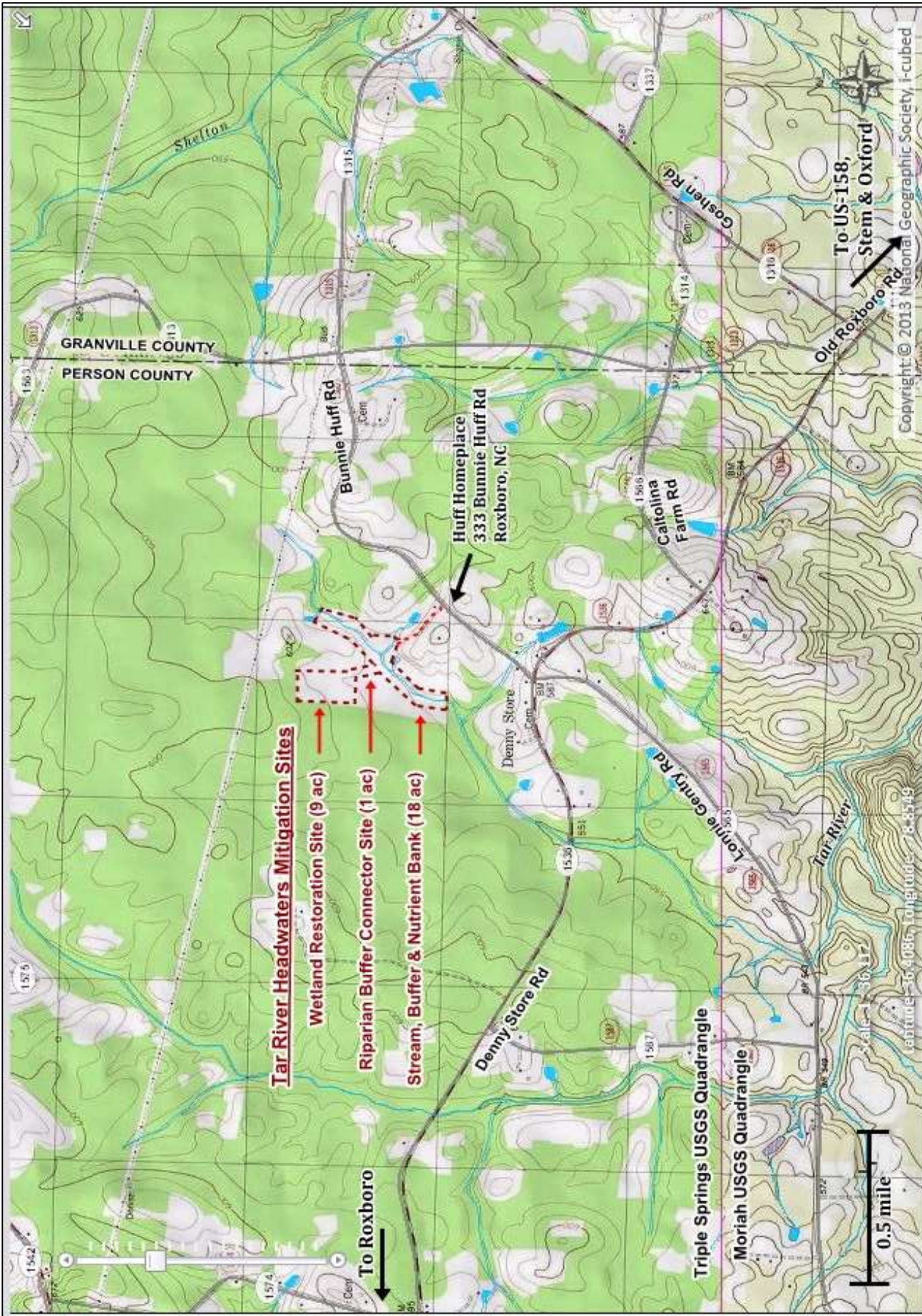


Figure 1. Project Vicinity Map: Tar River Headwaters Wetland Restoration Site and related mitigation projects on the Huff Farm property, Person County NC, Tar-Pamlico River HUC# 03020101-0102. DIRECTIONS: From US-158 in Berea, Granville County NC, turn right (northwest) on Old Roxboro Rd, which becomes Denny Store Rd where it crosses into Person County. Turn right (north) on Bunnie Huff Rd, go 0.4 mile, and turn left into the driveway just past the Huff Homeplace sign. Proceed through the gate at end of driveway to the project sites.



## APPENDIX A. Background Tables and Figures

Table 1. Project Components and Mitigation Credits									
Tar River Headwaters Wetland Restoration Site, DMS Project # 97071									
Mitigation Credits									
	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Acres			7.65						
Credits			7.28						
<b>TOTAL CREDITS</b>			7.28						
Project Components									
Project Component or Reach ID	Stationing / Location		Existing Footage or Acreage	Approach (PI, PII etc.)	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio		
Drained Wetland	--		6.53		R (Reestablish)	6.53 ac	1 : 1		
Grazed Wetland	--		1.12		R (Rehabilitate)	1.12 ac	1.5 : 1		
Component Summation									
Restoration Level	Stream (lin. feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (sq. feet)	Upland (acres)			
		Riverine	Non-Riverine						
Restoration				6.53 ac					
Enhancement				1.12 ac					
Enhancement I									
Enhancement II									
Creation									
Preservation									
High Qual Preservation									
<b>TOTAL feet or acres</b>	-		-	<b>7.65 ac</b>					
<b>TOTAL WMU</b>	-		-	<b>7.28</b>					

<b>Table 2. Project Activity &amp; Reporting History</b>		
<b>Tar River Headwaters Wetland Restoration Site, DMS Project# 97071</b>		
<b>Activity or Report</b>	<b>Data Collection Complete</b>	<b>Actual Completion or Delivery</b>
Mitigation Plan		Dec16
Final Design – Construction Plans		Dec16
Construction		Jan 17
Planting		Feb 17
Baseline Monitoring/Report	Feb 17	Apr 17
Year 1 Monitoring		
Year 2 Monitoring		
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

**Table 3. Project Contacts Table**  
**Tar River Headwaters Wetland Restoration Site, DMS Project # 97071**

<b>Designer</b>	Ecological Engineering, Raleigh NC Heather Smith: 919-557-0929
<b>Construction Contractor</b>	KBS Earthworks, Greensboro NC Kory Strader & Brett Strader: 336-685-4339
<b>Survey Contractor</b>	Michael T. Brandon, PLS, Roxboro NC Michael Brandon: 336-597-8673
<b>Fence Contractor</b>	Strader Fencing, Inc., Julian NC Kenneth Strader: 336-314-2935
<b>Herbicide and Seeding</b>	KBS Earthworks, Greensboro NC Kory Strader & Brett Strader: 336-685-4339
<b>Planting Contractor</b>	Mogensen Mitigation Inc, Charlotte NC Rich Mogensen: 704-576-1111; Gerald Pottern: 919-556-8845
<b>Nursery Stock Suppliers</b>	Mellowmarsh Farms, Siler City NC Joanie McLean: 919-742-1200
<b>Monitoring Performers</b>	Mogensen Mitigation Inc, Charlotte NC Rich Mogensen: 704-576-1111; Gerald Pottern: 919-556-8845

**Table 4. Project Baseline Information****Tar River Headwaters Wetland Restoration Site, DMS Project # 97071**

<b>Project Name</b>	Tar River Headwaters Wetland Restoration Site		
<b>County</b>	Person County		
<b>Project Area (acres)</b>	9.9 acres (Wetland + Buffer Easement combined)		
<b>Project Coordinates (lat. and long.)</b>	36.3895, -78.8153		
<b>Project Watershed Summary Information</b>			
<b>Physiographic Province</b>	Piedmont, Carolina Slate Belt		
<b>River Basin</b>	Tar-Pamlico River-01		
<b>USGS Hydrologic Unit 8-digit</b>	3020101	<b>USGS Hydrologic Unit 12-digit</b>	-0102
<b>DWQ Sub-basin</b>	Tar-Pam-01		
<b>Project Drainage Area (acres)</b>	60		
<b>Project Drainage Area Percentage of Impervious Area</b>	0%		
<b>CGIA Land Use Classification</b>	Pasture, Crop, and Deciduous Forest		
<b>Wetland Summary Information (Post-Restoration)</b>			
<b>Parameters</b>	<b>Wetland Area</b>		
Size of Wetland (acres)	1.12 ac existing + 6.53 ac drained = 7.65 ac		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian non-riverine (Headwater)		
Mapped Soil Series	Iredell Loam (IrB)		
Drainage class	Iredell = moderately well; Hydric inclusions = poorly		
Soil Hydric Status	Drained Hydric		
Source of Hydrology	Shallow ponding; perched on shallow aquitard		
Hydrologic Impairment	Drainage ditches (1940s)		
Native vegetation community	Headwater depression wetland forest (prior to pasture conversion)		
Percent composition of exotic invasive vegetation	20% Fescue (sprayed)		
<b>Regulatory Considerations</b>			
<b>Regulation</b>	<b>Applicable?</b>	<b>Resolved?</b>	<b>Supporting Documentation</b>
Waters of the United States – Section 404	Yes	Yes	Prelim JD
Waters of the United States – Section 401	Yes	Yes	Prelim JD
Endangered Species Act	No	N/A	US FWS Letter
Historic Preservation Act	No	N/A	NC SHPO Letter
Coastal Zone Management Act (CZMA)	No	N/A	N/A
Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	NC Floodmaps
Essential Fisheries Habitat	No	N/A	N/A

# APPENDIX B. Visual Assessment Data -- Current Conditions Plan View (MY0 Baseline)

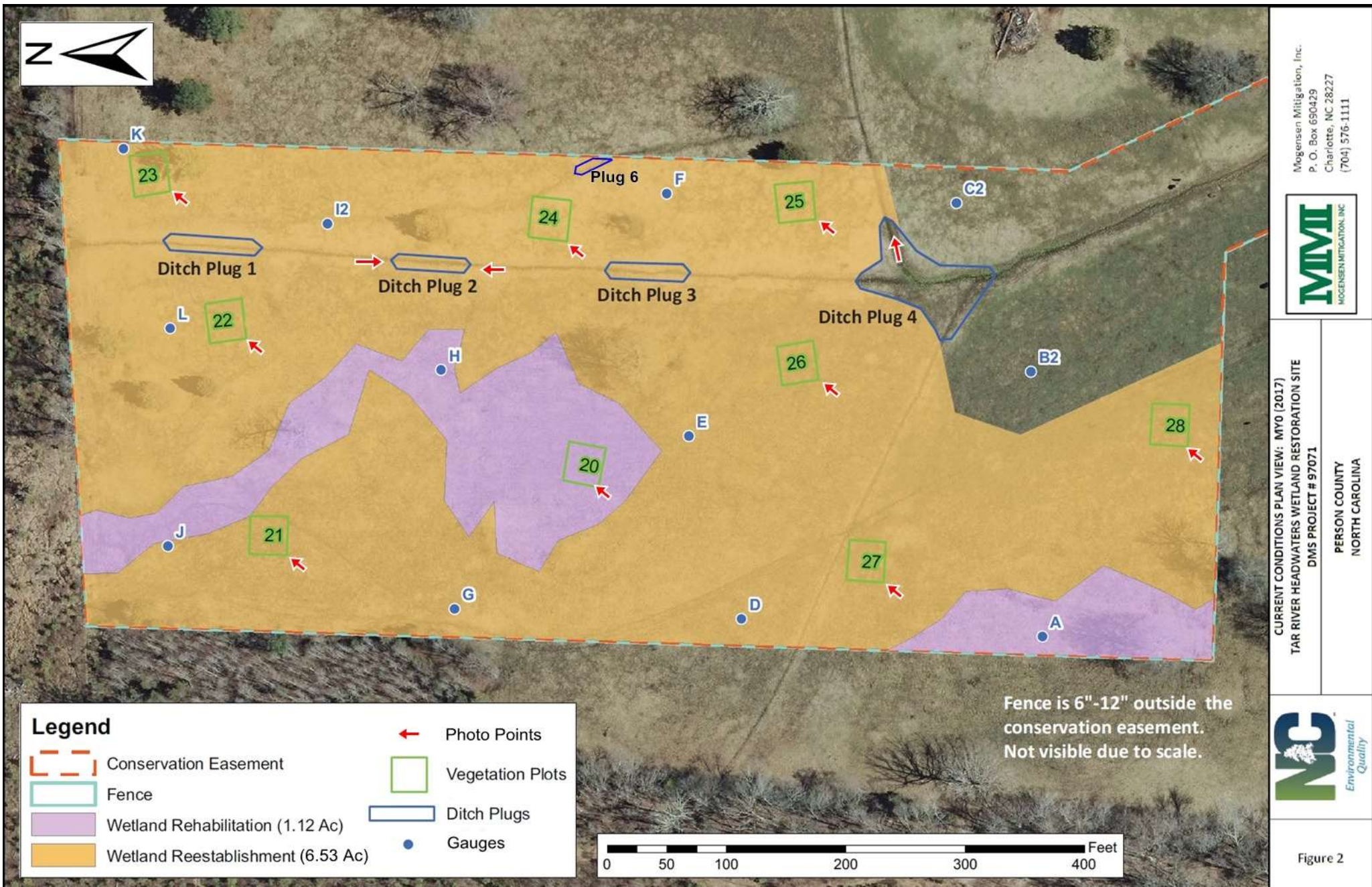


Figure 2

**Appendix B. PHOTOS: CVS Vegetation Plots 20 to 23, MY0 Baseline, February 2017. Tar Headwaters Wetland Restoration #97071**



ALL VEGETATION PLOT PHOTOS ARE TAKEN FROM SOUTHWEST CORNER OF PLOT (0,0 ORIGIN) FACING NORTHEAST



**Appendix B. PHOTOS: CVS Vegetation Plots 24 to 27, MY0 Baseline, February 2017. Tar Headwaters Wetland Restoration #97071.**



ALL VEGETATION PLOT PHOTOS ARE TAKEN FROM SOUTHWEST CORNER OF PLOT (0,0 ORIGIN) FACING NORTHEAST



**Appendix B. PHOTOS: CVS Vegetation Plot 28 and Other Photos, MY0 - Feb 2017. Tar Headwaters Wetland Restoration #97071.**



ALL VEGETATION PLOT PHOTOS ARE TAKEN FROM SOUTHWEST CORNER OF PLOT (0,0 ORIGIN) FACING NORTHEAST



## APPENDIX C. Vegetation Plot Data

Tar River Headwaters Wetland Restoration Site, DMS # 97071.

Monitoring Year 0 (Feb 2017) -- Person County NC. Tar-Pamlico HUC# 03020101-0102.

Table 5. Tree Species and Approximate Numbers Planted. Feb 2017.

Scientific Name	Common Name	approx # planted
<i>Betula nigra</i>	River Birch	1200
<i>Carpinus caroliniana</i>	Musclewood	280
<i>Diospyros virginiana</i>	Persimmon	20
<i>Fraxinus pennsylvanica</i>	Green Ash	318
<i>Liriodendron tulipifera</i>	Tulip Poplar	560
<i>Nyssa biflora</i>	Swamp Blackgum	31
<i>Platanus occidentalis</i>	Sycamore	222
<i>Quercus bicolor</i>	Swamp White Oak	173
<i>Quercus phellos</i>	Willow Oak	454
<i>Quercus nigra</i>	Water Oak	164
<i>Ulmus americana</i>	American Elm	378
Total Planted Stems	All Species	3800

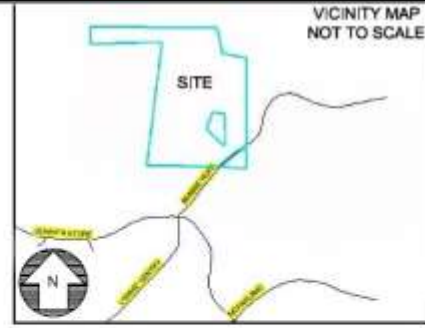






# APPENDIX D. As-Built Survey Data

NC Division of Mitigation Service Project ID # 97071  
 Tar River Headwaters Wetland Restoration Site: DMS Contract Number #6749  
 Tar River Headwaters Stream Mitigation Site: DMS Contract Number #7016

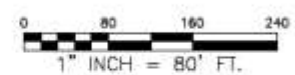


I HEREBY CERTIFY THAT THIS PLAT IS OF THE FOLLOWING TYPE:  
 G.S. 47-30 (F)(1)(C)(2). THIS SURVEY IS OF AN EXISTING BUILDING OR  
 OTHER STRUCTURE, OR NATURAL FEATURE, SUCH AS A  
 WATERCOURSE.

AND  
 I, MICHAEL T. BRANDON, CERTIFY THAT THIS PLAT WAS DRAWN  
 UNDER MY SUPERVISION FROM AN ACTUAL SURVEY MADE UNDER  
 MY SUPERVISION (DEED DESCRIPTION RECORDED IN BOOK 302,  
 PAGE 41, ETC.) THAT THE BOUNDARIES NOT SURVEYED ARE  
 CLEARLY INDICATED AS DRAWN FROM INFORMATION FOUND IN  
 (SEE "REFERENCES"); THAT THE RATIO OF PRECISION AS CALCULATED  
 IS 1:10,000; THAT THIS PLAT WAS PREPARED IN ACCORDANCE WITH  
 G.S. 47-30 AS AMENDED, WITNESS MY ORIGINAL SIGNATURE,  
 REGISTRATION NUMBER AND SEAL THIS  
 6TH DAY OF MARCH, A.D., 2017



*Michael T. Brandon*  
 PROFESSIONAL LAND SURVEYOR REG. NUMBER L-4922



LINE	BEARING	DISTANCE
L1	S 29°41'10" E	84.84'
L2	N 44°47'05" W	57.76'
L3	N 62°19'56" W	41.47'
L4	N 62°19'56" W	31.60'
L5	S 25°14'40" E	279.05'
L6	S 25°13'23" E	43.08'
L7	S 25°13'23" E	176.98'
L8	N 76°34'55" E	46.29'
L9	N 42°58'24" E	76.74'
L10	S 42°58'24" W	103.69'

\*\*NOTES:  
 COORDINATE DATA IS TAKEN FROM A RAPID STATIC GPS  
 OBSERVATION PERFORMED ON 4/4/2016, AND DOWNLOADED  
 TO THE NGS OPLS SITE. THE DATUM IS NAD 83/2011. THE  
 COMBINED GRID FACTOR IS 1.00004546.

**LEGEND**

- Vegetation Plot
- Gauge
- New Fence
- Existing Fence
- Ditch Centerline

AS-BUILT SURVEY FOR  
**MOGENSEN MITIGATION, INC.**  
 ALLENVILLE TWP., PERSON CO., NORTH CAROLINA  
 FIELD WORK PERFORMED MARCH 2017  
 PROPERTY AS DESCRIBED IN DB 302-41  
 OWNED BY ROY HUFF

LEGEND

□	IRON ROD OR PIPE SET
○	EXISTING MONUMENT FOUND
⊙	MATHEMATICAL POINT
—	PROPERTY LINE
---	TE LINE
---	EASEMENT LINE
---	RIGHT OF WAY
---	LINE FROM REFERENCE MATERIAL NOT SURVEYED

OWNER ADDRESS:  
 ROY HUFF  
 P.O. BOX 679  
 ROXBORO, N.C. 27574  
 TRACT DATA:  
 DB 302-41  
 PAGE 41  
 PROJECT: 2016020303A  
 DRAWN BY: MTS  
 DEVELOPED BY: MTS  
 REVISIONS:

**MICHAEL T. BRANDON**  
 PROFESSIONAL LAND SURVEYOR L-4922  
 1437 BROOKS DAIRY RD.  
 ROXBORO, N.C. 27574  
 PHONE: 919-368-4432  
 www.mtbrandon.com

Mogensen Mitigation, Inc.  
 P.O. Box 690429, Charlotte NC 28227  
 Phone: 704-576-1111

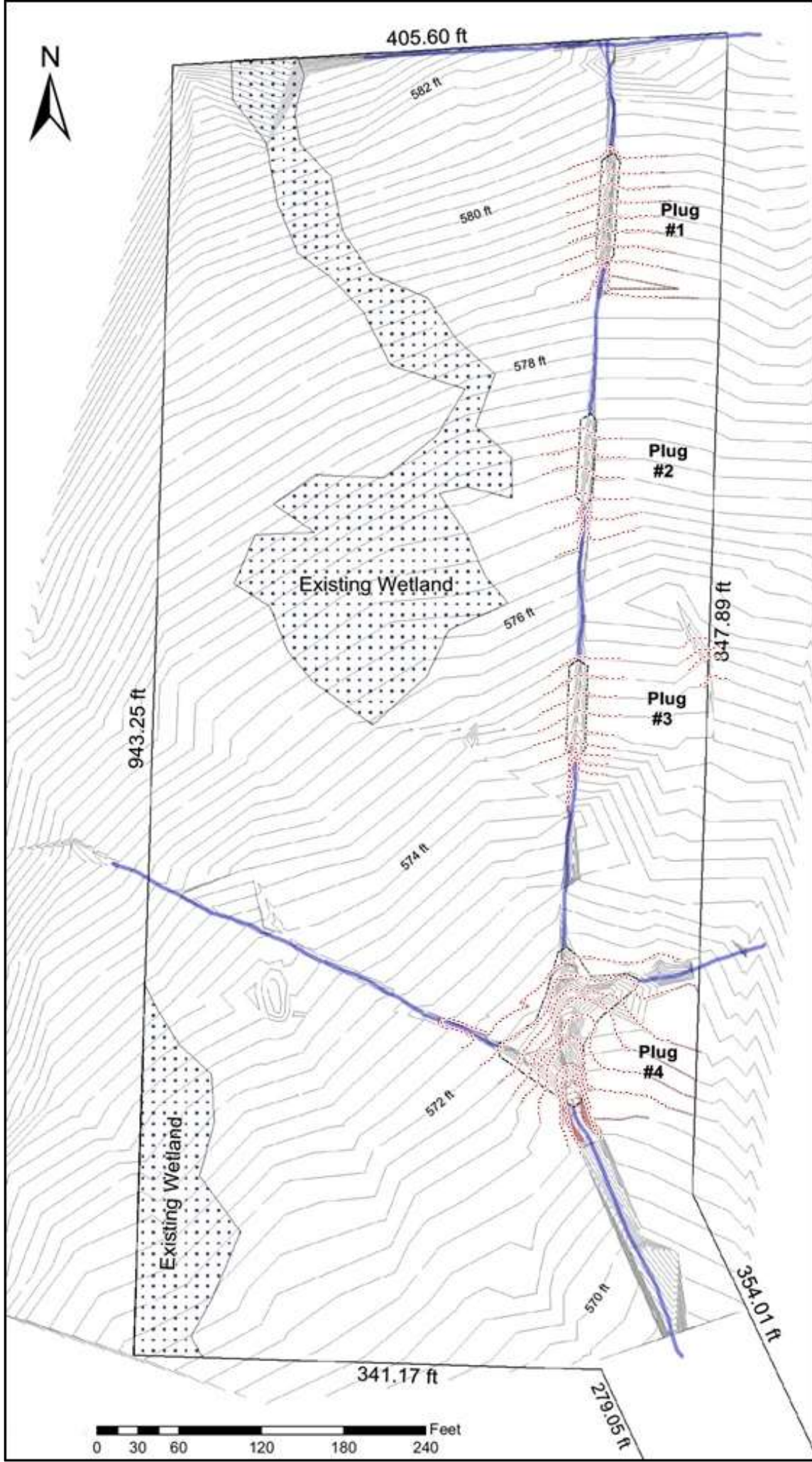
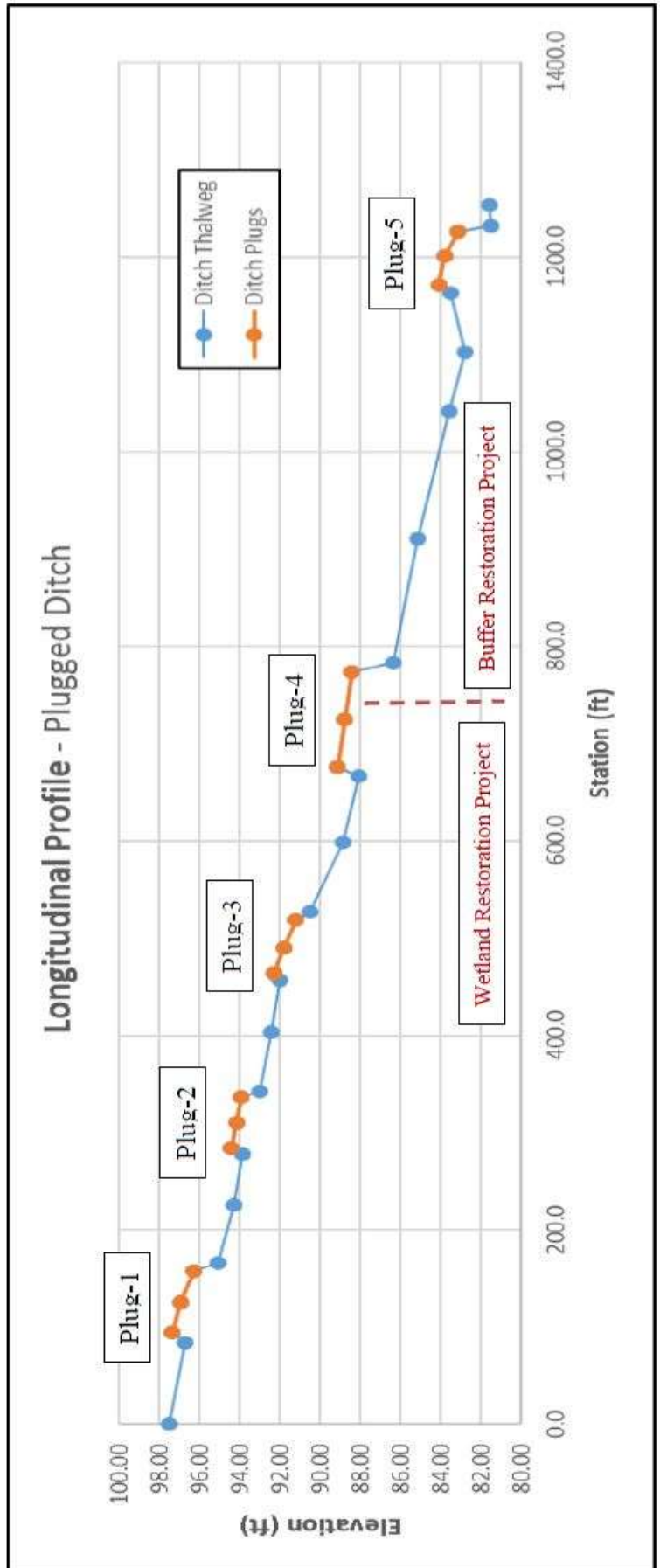


Figure 3. Tar River Headwaters Wetland Restoration Site, DMS # 97071. Topographic survey of project area; 1-ft contour survey prepared by Michael Brandon, PLS, and 0.2 ft contours interpolated. **Red-line contours show the filled ditch plug areas.**

Figure 4. Longitudinal Profile of Plugged Ditch with Relative Elevation Data.  
 Tar River Headwaters Wetland Restoration Site, DMS # 97071

	Longit Sta, ft	Elevation feet
ditch upper end @ fence	0.0	97.51
ditch @ upst toe Plug-1	84.3	96.73
Plug-1 top upper	94.0	97.34
Plug-1 top middle	125.2	96.95
Plug-1 top lower	157.6	96.26
ditch @ dnst toe Plug-1	166.4	95.07
ditch midway P1-P2	225.5	94.29
ditch @ upst toe Plug-2	278.0	93.83
Plug-2 top upper	283.8	94.41
Plug-2 top middle	310.2	94.16
Plug-2 top lower	336.8	93.91
ditch @ dnst toe Plug-2	341.8	92.98
ditch midway P2-P3	402.6	92.45
ditch @ upst toe Plug-3	456.3	92.01
Plug-3 top upper	463.6	92.30
Plug-3 top middle	489.4	91.80
Plug-3 top lower	518.3	91.19
ditch @ dnst toe Plug-3	526.7	90.51
ditch midway P3-P4	598.5	88.86
ditch @ upst toe Plug-4	666.1	88.11
Plug-4 top upper	675.4	89.12
Plug-4 top middle	725.2	88.77
Plug-4 top lower	773.6	88.41
ditch @ dnst toe Plug-4	783.3	86.34
ditch 1/3 way P4-P5	910.8	85.17
ditch 2/3 way P4-P5	1041.4	83.58
ditch 3/4 way P4-P5	1102.2	82.78
ditch @ upst toe Plug-5	1163.0	83.49
Plug-5 top upper	1171.8	84.11
Plug-5 top middle	1200.6	83.81
Plug-5 top lower	1225.9	83.14
ditch @ dnst toe Plug-5	1232.2	81.53
ditch @ fence crossing	1253.8	81.55



Station 0.0 = North boundary (easement) fence  
 Station 1253.8 = Fence above road crossing