Tar River Headwaters Wetland Restoration Site

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

MY-1 (2017) Annual Fall Monitoring Report

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

Data Collected: Oct-Nov 2017 Final Report: December 2017

	Submitted To: **N.C. Department of Environmental Quality** **DEQ Division of Mitigation Services** **1652 Mail Service Ctr, Raleigh, NC 27699-1652** --- **DMS Project Manager: Lindsay Crocker** **DEQ-DMS Contract # 006746**

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ENVIRONMENTAL CONSULTING

MOGENSEN MITIGATION, INC

20 December 2017

Lindsay Crocker
NC Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Subject: Tar Headwaters WETLAND Restoration Site #97071, MMI responses to MY1 draft comments.

Dear Lindsay,

Thank you for your prompt review comments on our MY1 Draft Monitoring Report for the Tar River Headwaters Wetland Restoration (TRHWR) site. Responses to your review comments are provided below:

- Table of Contents, Page 8, and actual table heading: update Table 4 to be titled 'Project Attributes' Response: Done
- Revise all dates in the text to include full month (Example: do not write Dec, write out December). Response: Done
- Please remove two references to the contracted area of wetland mitigation. This is not relevant to the report. Response: Done

- Section 1.1: Project Setting and Pre-Restoration Conditions- Mogensen can use previously reviewed and approved verbiage to minimize review and comment. Generally, there should not be new verbiage developed in MY1 describing pre-site conditions at this point in the project. The entire section 1 may be replaced with section 1.1, 1.2, and 1.3 from the MY0 report if the provider elects to avoid review of new information (suggestion, not requirement). Response: Text replaced with MY0 report text

- Paragraph two section 1.1, use of the word "apparently." Was the site an upland flat headwater or not? Remove word or remove sentence. Redoximorphic soil conditions are not enough to justify the assertion this classification. Response: Text replaced with MY0 report text

- Paragraph four section 1.1. There are statements in here that are not necessarily accurate. For instance, the pre-treatment gauge data did not provide any justification for the USACE wetland Pre-JD, please separate those items. Add the word 'acres' after 1.12. The last sentence of this paragraph, redox is only one hydric soil indicator. Please revise to state only that it was not hydric, rather than speculate on how redox played into the soil evaluation. Response: Text replaced with MY0 report text

- Section 1.3. Mitigation Approach and Expected Improvements. Update title to just 'Mitigation Approach.' A suggestion may be to replace entire section 1.3 with a past-tense section 1.4 of the MY0 report. The mitigation approach should not include detailed construction information as that is available in the As-Built report, this is more of an overview of the approach here, condensing is advised. Response: Text mostly replaced with MY0 report text, revised to past tense. Kept one new sentence from the draft report, explaining why effect of ditches is significant despite shallow depths.

- Current Conditions summary: Paragraph four: Mogensen doesn't have to use 'only' as an adverb to describe gauge success. In lieu of 'only four gauges,' suggest saying 'four gauges.' Response: Done

- Current Conditions Last (5th) paragraph: there is currently no adjustment for soil physical properties in the hydrology standard. This is an interesting discussion on how soil redox or other hydric soil indicators may present in soils with higher water holding capacity or clay content through capillary action, but this is not an accepted indicator for meeting hydrologic standard. DMS suggests that if Mogensen feels that current methods of measuring hydrologic saturation are inadequate, then it should be discussed at an IRT meeting rather than in a project-specific monitoring report. The hydrologic success criteria for this project was proposed and accepted at the Mitigation Plan stage. Response: Deleted 5th (last) paragraph, and moved one sentence into 4th paragraph: "The monitoring gauges measure the free water table depth and do not account for capillary fringe saturation which often extends higher in clay soils (https://www.nccedev.ces.ncsu.edu/eleventh-annual-on-site/soil-wetness/). Using the free water table depth as a conservative measure of ..."

- 3.0 Monitoring Methods: if you are going to include this in the MY1 report, please put it before the Current Conditions (2.0) section. Another idea is to remove this section, and update table in goals under the 'Monitoring Methods' column to show number of monitoring features (i.e. vegetation plots and gauges) and to include discussion of growing season dates in the Current Conditions section. Response: Moved Monitoring Methods to Section 2 and Current Conditions to Section 3.

- CCPV: Please show which gauges on the CCPV that are meeting and not meeting (could show separate as meeting, not meeting and N/A if you'd like). Response: Gauges on the CCPV figure have been color-coded to show which are meeting criteria, not meeting, or not applicable (non-credit area).

- With respect to the vegetation plot data, there are some issues with planted stems showing in MY1 that were not recorded in MY0. Review specifically the water oak, willow oak on plots 24 and 25. Is this just a case of misidentification at MY0? Please provide clarification. Response: Yes, dormant (leafless) seedlings of oaks, birch vs musclewood, and blackgum vs persimmon were in some cases misidentified during the MY0 survey, and corrected in MY1. There were also a few stems overlooked in MY0 that we found in MY1.

- Hydrology graphs, these are fine for MY1, but in the future it is beneficial to show where on the graphs (during what time of the year) that the gauges are meeting success and the number of days. This will help justify if hydrology is being attained through antecedent rain conditions or through rainfall driven events. Please consider this in the future. Response: Gauge graphs in future monitoring reports will include the start, end, and duration of the longest saturation period for each gauge.

Please provide written response to these comments. After the update is approved, please provide 3 hard copies and a digital file. Thanks for your work. Response: Upon your approval of these responses and accompanying 2nd draft report PDF, we will mail the final printed copies and support files on CD.

Sincerely,

Gerald B Pottern

Gerald Pottern, MMI Raleigh office

Table of Contents

1.0. Project Background 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 a ditch and intermittent stream connecting the TRHWR site to the adjacent Tar River Headwaters Riparian Buffer and Nutrient Offset Mitigation Bank project. Both projects are 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-Restoration Conditions

The TRHWR site was cleared and ditched for pasture use in the 1940s according to the owner, and was used for grazing cattle until January 2017 when the conservation easement fence was installed. 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. Remnant native trees left for shade, hydrophytic groundcover plants mixed among the pasture grasses, and plant species recorded in adjacent natural forests (on the same soil mapping unit) provided data for the planting plan.

The project 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. 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.

Restoration activities including tree planting, surface flow dispersal, 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. 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 Performance Criteria

The subject watershed HUC #03020101-0102 is designated by NCDEQ as a Targeted Local Watershed (TLW) for water quality improvement projects, and the Tar River reach within and downstream of this local HUC is recognized as a Significant Natural Heritage Area (SNHA) for its high diversity of aquatic life including protected species of river mussels and fishes. The TRHWR project is intended to support

these TLW and SNHA designations by improving water quality and habitat on the property and downstream. Specific project goals and objectives as identified in the TRHWR Final Mitigation Plan (December 2016) 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:

GOAL	OBJECTIVE	PERFORMANCE STANDARD	MONITORING APPROACH
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 Approach

Prior to restoration, the TRHWR project area contained 6.53 acres of former riparian wetland (ditched and drained, grazed pasture) with redoximorphic soil characteristics indicating hydric soils, but lacking adequate wetland hydrology based on groundwater gauge data and field observations during 2015-2016. Although the drainage ditches are shallow, they have effectively reduced water retention across much of the site over the past 70 years due to the slow infiltration rate, rapid runoff, and shallow hardpan in these soils. The project will re-establish jurisdictional wetlands in this area by plugging the drainage ditches to increase rainfall retention and dispersal, 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.

2.0. Monitoring Methods

Vegetation plots are monitored annually in accordance with current DMS monitoring guidance (June 2017). The nine installed CVS 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 twelve onsite groundwater monitoring gauges and one offsite reference wetland gauge are downloaded and maintained at least quarterly. Gauge data in the mitigation credit areas are plotted and evaluated for success based on the mitigation plan performance standard of continuous saturation within 12 inches of the ground surface for 10 percent of the growing season. Growing season based on air temperature at a weather station east of Roxboro is from March 28 to November 3, which is 221 days (from USDA WETS table). MMI installed a dual-probe soil temperature logger near the middle of the TRHWR site (beside GW-H) in late January 2017. Soil temperature on the site remained above 41 F at both 10-inch and 20-inch depths throughout February and March 2017. The lowest temperatures recorded were 42.7 F at 10 inches and 45.4 F at 20 inches. Based on soil temperatures remaining above the USDA-designated temperature for plant physiological activity, March 1 will be used as the start of the growing season, based on field discussions with DMS and USACE. The revised growing season length is thus 248 days, and the groundwater hydrology success criterion is 25 days

The conservation easement perimeter fence and ditch plug integrity will be monitored visually and documented with photo points.

3.0. Current Conditions Summary

MMI scientists made several post-construction visits to the TRHWR site between March and November 2017 to collect gauge data and evaluate the condition of the ditches, plugs, and planted trees. The CVS vegetation plot data collection was performed in early October. Eight of the nine CVS plots had 8 to 11 surviving planted stems and met success criteria. One plot (VP-21) had only five surviving planted stems and failed the criteria. Outside of the CVS plots, planted stem survival looks generally good throughout the site, with roughly ten percent apparent mortality. Leader die-back is common on many of the taller seedlings, especially on tulip poplar and river birch, but most of the trees exhibiting leader die-back also had one to several vigorous basal sprouts. Some of the trees appearing as "dead" in October may also resprout in 2018. No "low woody density" areas or "invasive exotic" areas were designated this year. Groundcover vegetation is excellent throughout, with both treated areas (non-wetland and drained wetland) and non-treated areas (existing wetland) showing dense and diverse herbaceous cover.

All ditch plugs appear to be stable and performing as designed, despite 5 to 6 inches of rainfall over a 3-day period in mid-April. Survival of planted trees, livestakes, and herbaceous cover on the plug slopes and tops appears to be providing adequate erosion protection during this first season when problems are most likely to occur. Ponding behind all of the ditch plugs was evident within a few days after construction, and dispersal of surface water from the ditches into the surrounding restoration areas was observed following large rainfall events in April and May.

Eleven groundwater gauges were installed throughout the TRHWR site during February to March 2016 to collect hydrology data for use in project design, establishing current wetland jurisdiction areas, 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. Some gauges were later relocated during project construction to provide better representation of expected hydrologic results of the project, and one additional gauge was added. The 12 current groundwater gauges (A through L) on the project site are roughly arranged in four transects perpendicular to the main ditch, as recommended by mitigation plan reviewers during field meetings (Figure 2). Three gauges (A, H and J) are within existing wetland rehabilitation areas, seven gauges (D, E, F, G, I, L, and K) are within the drained wetland reestablishment areas, and two gauges (B and C) are downslope from ditch plug #4 in areas not expected to generate wetland credits.

Wetland hydrology success for the TRHWR site is based on shallow saturation within 12 inches of the ground surface for 10% of the 248-day growing season (March 1 to November 3). The monitoring gauges measure the free water table depth and do not account for capillary fringe saturation which often extends higher in clay soils (https://www.nccedev.ces.ncsu.edu/eleventh-annual-on-site/soil-wetness/). Using the free water table depth as a conservative measure of saturation depth, four gauges in the project area (C, E, H, and L) and the off-site reference gauge met the 10% criterion. The other eight gauges had extensive periods of shallow saturation ranging from 63 to 95 ***total*** days (25% to 38% of the growing season), but they also had occasional gaps of one or more days when the water table dropped lower than 12 inches. The maximum consecutive day durations for these eight non-attaining wells ranged from 10 to 17 days (4 to 7%). This pattern of water table fluctuation may be typical for certain headwater wetlands with small watersheds, perched hydrology, and dense soils with low infiltration. Two of the three gauges within the

existing wetland (rehabilitation) areas did not meet the 10% criterion. Unusually low rainfall during February and March may also have been a factor in these results.

4.0. 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 Division of Mitigation Services. (2017). *NC-DMS Annual Monitoring Report Format, Data Requirements, and Content Guidance, June 2017*. 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/

APPENDIX A. Project Background Data

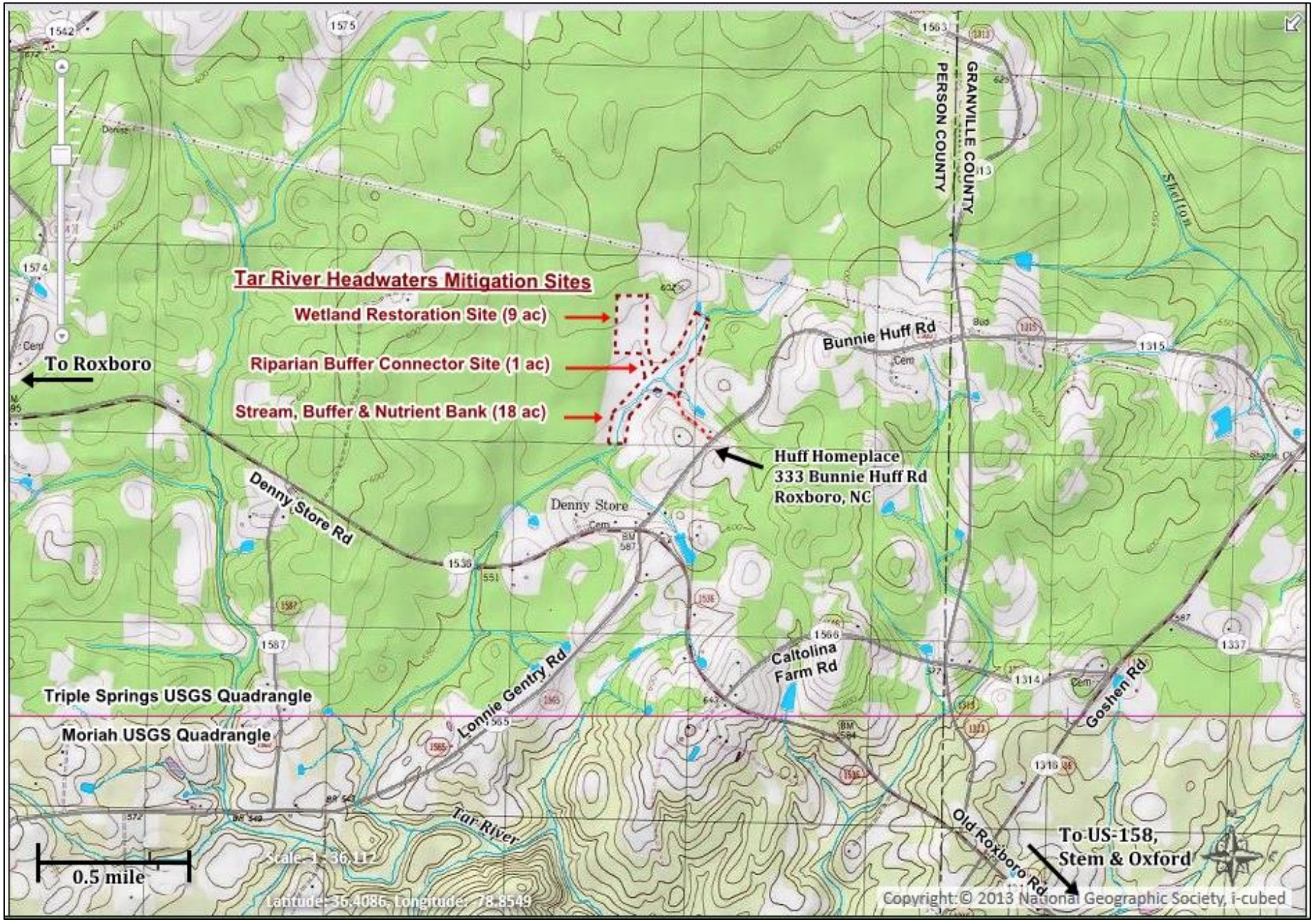


Figure 1. Project Vicinity Map: Tar River Headwaters Wetland Restoration Site and related mitigation projects on the Huff Farm property, Person County NC, Tar-Pamlico River HUC# 03020101-0102. DIRECTIONS: From US-158 in Berea, Granville County NC, turn right (northwest) on Old Roxboro Rd, which becomes 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.

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**	
Type	**R**	**RE**	**R**	**RE**	**R**	**RE**			
Acres			7.65						
Credits			7.28						
TOTAL CREDITS			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**	
Drained Wetland	--		6.53		Restore Hydrology, Fence & Plant		R (Reestablish)	6.53 ac	
Grazed Wetland	--		1.12		Fence & Plant		R (Rehabilitate)	1.12 ac	
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 Quality Preservation									
TOTAL feet or acres	-		-	**7.65 ac**					
TOTAL WMU	-		-	**7.28**					

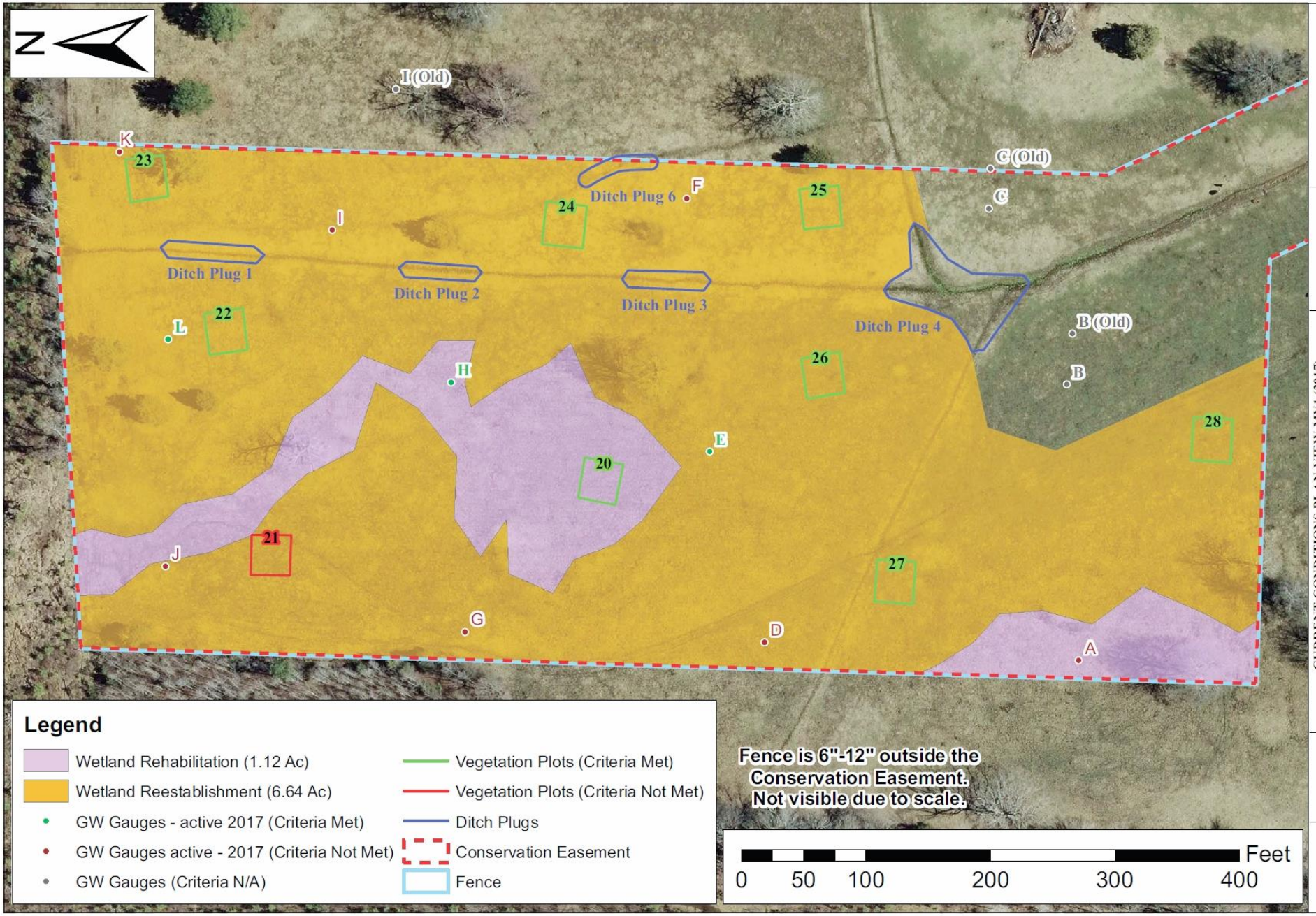
Table 2. Project Activity & Reporting History		
Tar River Headwaters Wetland Restoration Site, DMS Project# 97071		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan		Dec16
Final Construction Plans		Dec16
Construction		Jan 17
Planting		Feb 17
Baseline Monitoring/Report	Feb 17	Apr 17
Year 1 Monitoring	Nov 17	Dec17
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**	
Designer	Ecological Engineering, Raleigh NC Heather Smith: 919-557-0929
Construction Contractor	KBS Earthworks, Greensboro NC Kory Strader & Brett Strader: 336-685-4339
Survey Contractor	Michael T. Brandon, PLS, Roxboro NC Michael Brandon: 336-597-8673
Fence Contractor	Strader Fencing, Inc., Julian NC Kenneth Strader: 336-314-2935
Herbicide and Seeding	KBS Earthworks, Greensboro NC Kory Strader & Brett Strader: 336-685-4339
Planting Contractor	Mogensen Mitigation Inc, Charlotte NC Rich Mogensen: 704-576-1111; Gerald Pottern: 919-556-8845
Nursery Stock Suppliers	Mellowmarsh Farms, Siler City NC Joanie McLean: 919-742-1200
Monitoring Performers	Mogensen Mitigation Inc, Charlotte NC Rich Mogensen: 704-576-1111; Gerald Pottern: 919-556-8845

Table 4. Project Attributes				
Tar River Headwaters Wetland Restoration Site, DMS Project # 97071				
Project Name	Tar River Headwaters Wetland Restoration Site			
County	Person County			
Project Area (acres)	9.9 acres (Wetland + Buffer Easement combined)			
Project Coordinates (lat. and long.)	36.3895, -78.8153			
Project Watershed Summary Information				
Physiographic Province	Piedmont, Carolina Slate Belt			
River Basin	Tar-Pamlico River-01			
USGS Hydrologic Unit 8-digit	3020101	**USGS Hydrologic Unit 12-digit**	-0102	
DWQ Sub-basin	Tar-Pam-01			
Project Drainage Area (acres)	60			
Project Drainage Area Percentage of Impervious Area	0%			
CGIA Land Use Classification	Pasture, Crop, and Deciduous Forest			
Wetland Summary Information (Post-Restoration)				
Parameters	**Wetland Area**			
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)			
Regulatory Considerations				
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**	
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) Coastal Area Management Act (CAMA)	No	N/A	N/A	
FEMA Floodplain Compliance	No	N/A	NC Floodmaps Data	
Essential Fisheries Habitat	No	N/A	N/A	

APPENDIX B. Visual Assessment Data

Figure 2. Current Conditions Plan View
Table 5. Vegetation Conditions Assessment
Figure 3. Vegetation Plot Photos
Figure 4. Photo Point Photos



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

CURRENT CONDITIONS PLAN VIEW MY1 (2017)
TAR RIVER HEADWATERS WETLAND RESTORATION SITE
DMS PROJECT #97071

PERSON COUNTY
NORTH CAROLINA

FIGURE 2

Table 5: Vegetation Condition Assessment Table, MY-1 (2017)

Tar River Headwaters Wetland Restoration #97071. Person County HUC #03020101-0102

Planted Acreage = **7.65**

Vegetation Problem Category	Definitions	Mapping Threshold (acres)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	N/A	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	N/A	0	0	0%
			Total	**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	N/A	0	0	0%
			Cumulative Total	0	0	**0%**

Easement Acreage = **9.98**

Vegetation Problem Category	Definitions	Mapping Threshold (SF)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	1000	N/A	0	0	0%
Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	none	N/A	0	0	0%

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

CVS VegPlot-20: MY-0 Spring 2017

CVS VegPlot-20: MY-1 Fall 2017

CVS VegPlot-21: MY-0 Spring 2017

CVS VegPlot-21: MY-1 Fall 2017

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

CVS VegPlot-22: MY-0 Spring 2017

CVS VegPlot-22: MY-1 Fall 2017

CVS VegPlot-23: MY-0 Spring 2017

CVS VegPlot-23: MY-1 Fall 2017

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

CVS VegPlot-24: MY-0 Spring 2017

CVS VegPlot-24: MY-1 Fall 2017

CVS VegPlot-25: MY-0 Spring 2017

CVS VegPlot-25: MY-1 Fall 2017

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

CVS VegPlot-26: MY-0 Spring 2017

CVS VegPlot-26: MY-1 Fall 2017

CVS VegPlot-27: MY-0 Spring 2017

CVS VegPlot-27: MY-1 Fall 2017

Figure 3. Vegetation Plots: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

CVS VegPlot-28: MY-0 Spring 2017

CVS VegPlot-28: MY-1 Fall 2017

CVS VegPlot-29: MY-0 Spring 2017

CVS VegPlot-29: MY-1 Fall 2017

Figure 4. Photo Points: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

Photo Point 1: MY-0 Spring 2017

Photo Point 1: MY-1 Fall 2017

Photo Point 2: MY-0 Spring 2017

Photo Point 2: MY-1 Fall 2017

Figure 4. Photo Points: Tar River Headwaters Wetland Restoration Site #97071 MY-1 (Oct 2017)

Photo Point 3: MY-0 Spring 2017

Photo Point 3: MY-1 Fall 2017

APPENDIX C. Vegetation Plot Data

Table 6. Vegetation Plot Success Summary
Table 7. Vegetation Plot Stem Count Data

Table 6. CVS Plot Stem Density and Success Summary

CVS Plot #	Wetland Planted Stems		Planted + Volunteer Stems		Invasive Woody Stems	Success Criteria Met?
	per plot	per acre	per plot	per acre		
97071- 20	9	364	10	405	0	Yes
97071- 21	5	202	5	202	0	No
97071- 22	9	364	9	364	0	Yes
97071- 23	11	445	12	486	0	Yes
97071- 24	9	364	9	364	0	Yes
97071- 25	8	324	8	324	0	Yes
97071- 26	11	445	11	445	0	Yes
97071- 27	10	405	10	405	0	Yes
97071- 28	10	405	11	445	0	Yes
Project Avg	9.1	369	9.4	382	0	Yes

Success Criteria = 320 planted stems per acre at MY3, 260 planted stems per acre at MY5, and 210 planted stems per acre at MY7.

Tar River Headwaters Wetland Restoration (TRHWR) Project, DMS # 97071.
Monitoring Year 1 (Oct 2017) -- Person County NC. Tar-Pamlico HUC# 03020101-0102.

Table 7. CVS Plot Stem Counts and Density by Species.

			Current Plot Data (MY1 - Oct 2017)											
			97071-20		97071-21		97071-22		97071-23		97071-24		97071-25	
Scientific Name	Common Name	Growth Type	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total
Betula nigra	River Birch	Tree (P)	4	4	3	3	3	3	4	4				
Carpinus caroliniana	Musclewood	Tree (P)												
Diospyros virginiana	Persimmon	Tree (P)												
Fraxinus pennsylvanica	Green Ash	Tree (P)			1	1	3	3	2	2	1	1		
Liriodendron tulipifera	Tulip Poplar	Tree (P)	3	3	1	1								
Nyssa biflora	Swamp Blackgum	Tree (P)												
Platanus occidentalis	Sycamore	Tree (P)	2	2			2	2						
Quercus bicolor	Swamp White Oak	Tree (P)							1	1	1	1	1	1
Quercus phellos	Willow Oak	Tree (P)							1	1				
Quercus nigra	Water Oak	Tree (P)					1	1	3	3	2	2	7	7
Ulmus americana	American Elm	Tree (P)		1						1	5	5		
		Stem count	9	10	5	5	9	9	11	12	9	9	8	8
		ares	1	1	1	1	1	1	1	1	1	1	1	1
(P) = planted species		acres	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
		Species count	3	4	3	3	4	4	5	6	4	4	2	2
		Stems per ACRE	364	405	202	202	364	364	445	486	364	364	324	324

			Current Plot Data (MY1 - Oct 2017)						Annual Means					
			97071-26		97071-27		97071-28		MY2 (2018)		MY1 (2017)		MY0 (2017)	
Scientific Name	Common Name	Growth Type	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total	Plant	Total
Betula nigra	River Birch	Tree (P)	7	7			2	2			23	23	23	23
Carpinus caroliniana	Musclewood	Tree (P)			2	2	4	4			6	6	6	6
Diospyros virginiana	Persimmon	Tree (P)									0	0	2	2
Fraxinus pennsylvanica	Green Ash	Tree (P)			1	1	2	2			10	10	9	9
Liriodendron tulipifera	Tulip Poplar	Tree (P)	2	2							6	6	12	12
Nyssa biflora	Swamp Blackgum	Tree (P)									0	0	1	1
Platanus occidentalis	Sycamore	Tree (P)			1	1					5	5	5	5
Quercus bicolor	Swamp White Oak	Tree (P)									3	3	3	3
Quercus phellos	Willow Oak	Tree (P)									1	1	14	14
Quercus nigra	Water Oak	Tree (P)	2	2			2	2			17	17	6	6
Ulmus americana	American Elm	Tree (P)			6	6		1			11	14	10	10
		Stem count	11	11	10	10	10	11			82	85	91	91
		ares	1	1	1	1	1	1			9	9	9	9
(P) = planted species		acres	0.025	0.025	0.025	0.025	0.025	0.025			0.22	0.22	0.222	0.222
		Species count	3	3	4	4	4	5			11	11	11	11
		Stems per ACRE	445	445	405	405	405	445			369	382	409	409

Plant = Planted Stems; Total = Planted + Volunteer Stems

Color codes for Plot Density & Success

Exceeds criteria by 10% or more	(352 or more)
Exceeds criteria by less than 10%	(320 - 351)
Fails criteria by less than 10%	(289 - 319)
Fails criteria by more than 10%	(288 or less)

APPENDIX D. Hydrologic Data

Figure 5. Monthly Rainfall Plot with Percentiles
Figure 6. Groundwater Gauge and Rainfall Data
Table 8. Hydrologic Success Attainment

Figure 5. Monthly Rainfall Totals (2017) with 30th and 70th Percentiles.
From USDA WETS table, 30-year historical data (1981-2010) at ROXBORO 7 ESE, NC

Month	Monthly Total	30th P*	70th P*
Jan-17	4.54	2.45	4.46
Feb-17	0.39	2.58	3.82
Mar-17	1.67	2.99	5.32
Apr-17	8.24	2.18	4.21
May-17	7.21	2.51	4.04
Jun-17	6.59	2.15	4.45
Jul-17	3.62	3.38	5.44
Aug-17	4.5	2.57	4.9
Sep-17	2.17	1.94	4.85
Oct-17	2.4	2.65	4.72
Nov-17	1.71	1.89	4.42
Dec-17		2.56	4.52

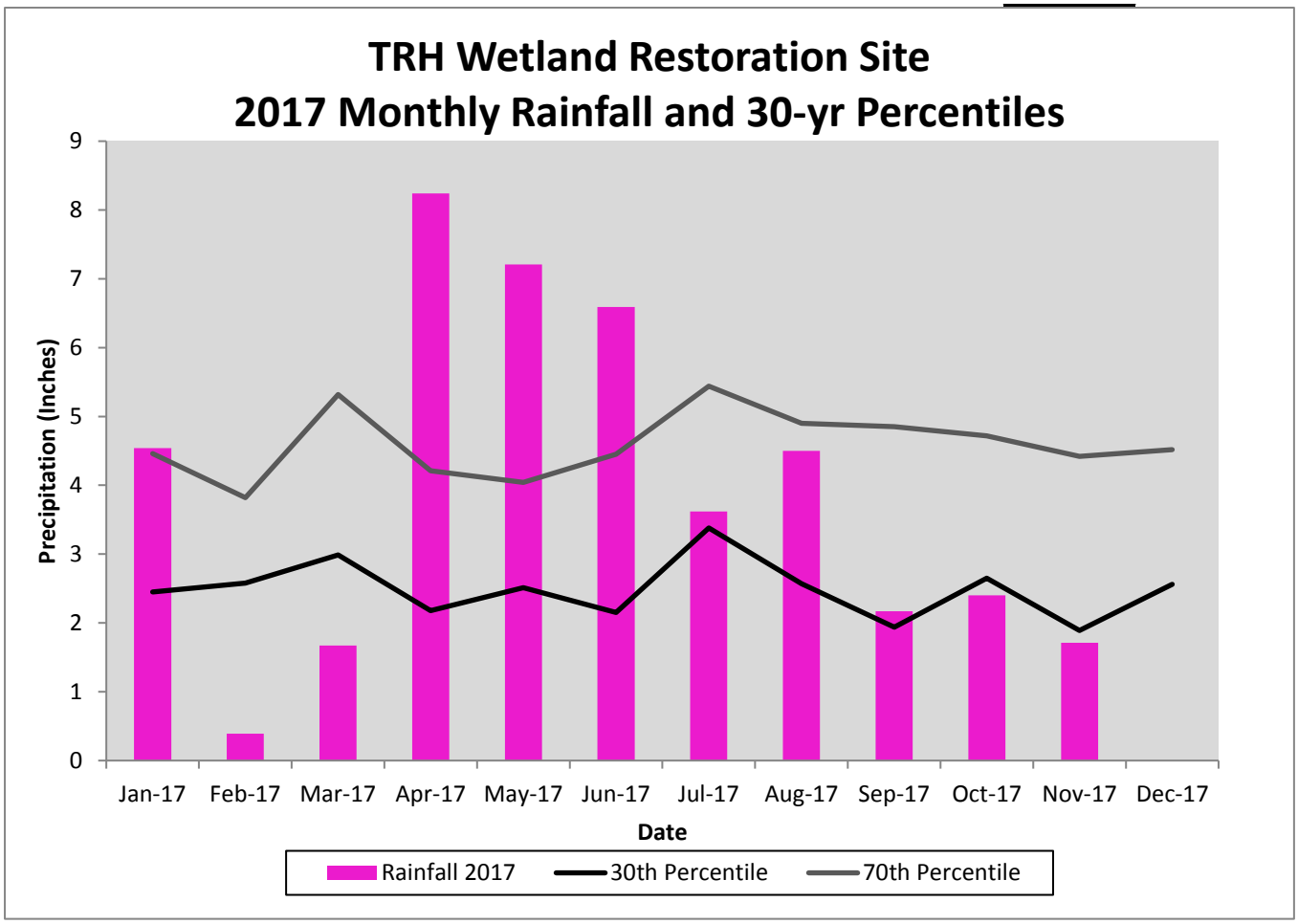
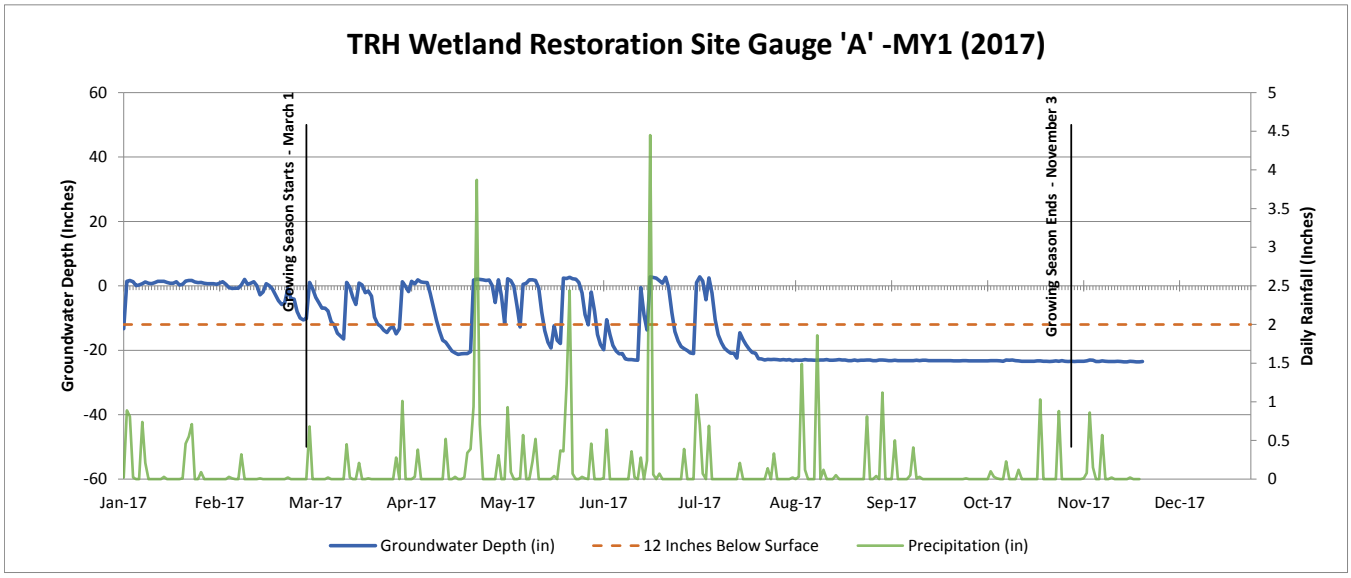
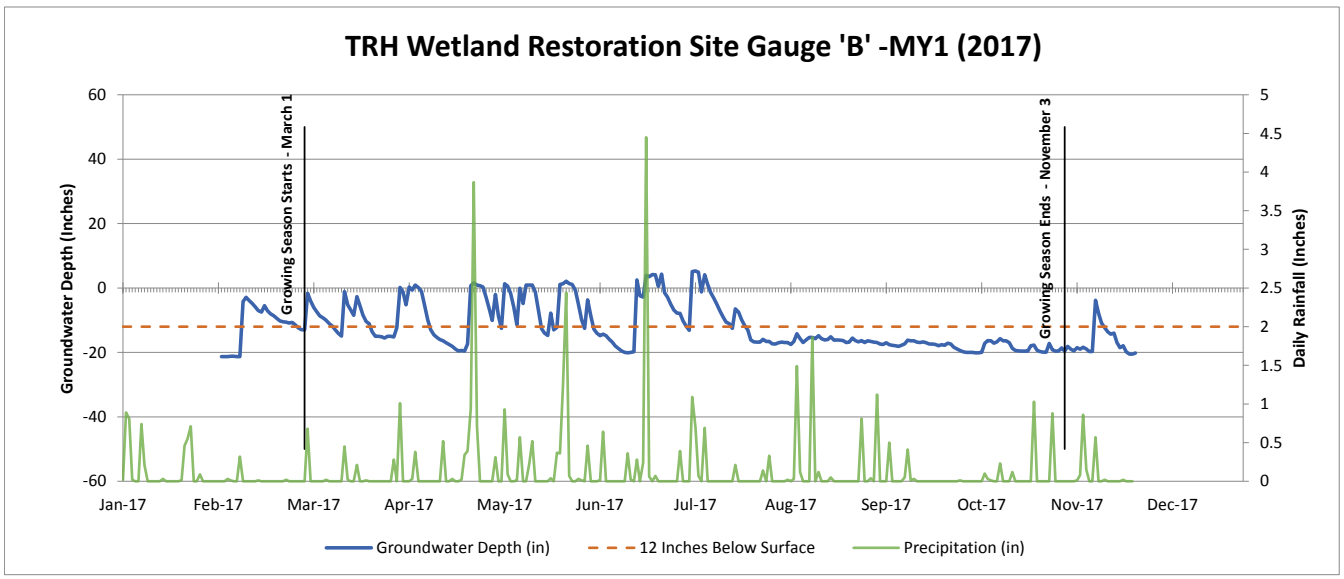


Figure 6A. Groundwater Gauges and Rainfall Data Plots 2017 -- Tar River Headwaters Wetland Restoration # 97071





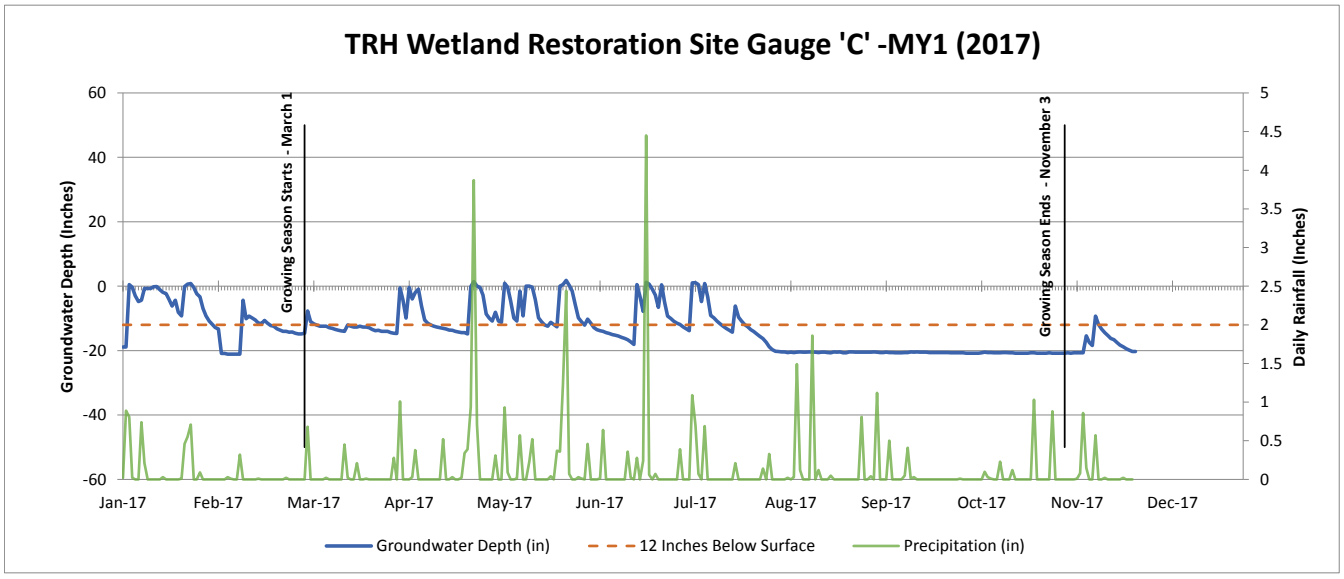
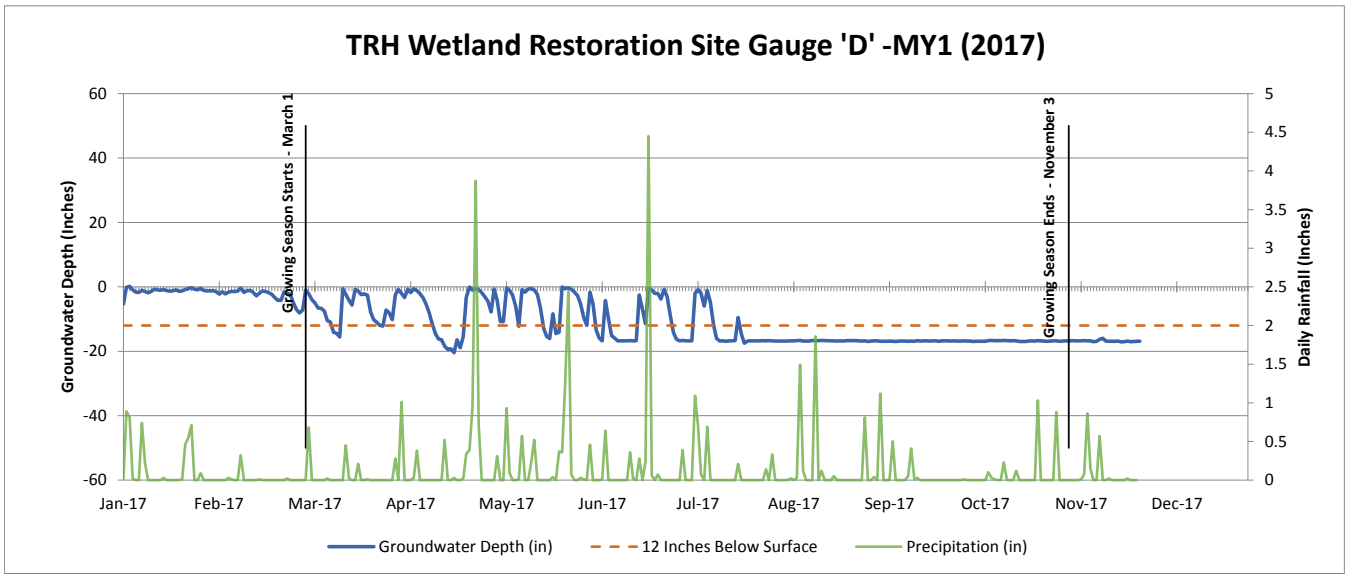
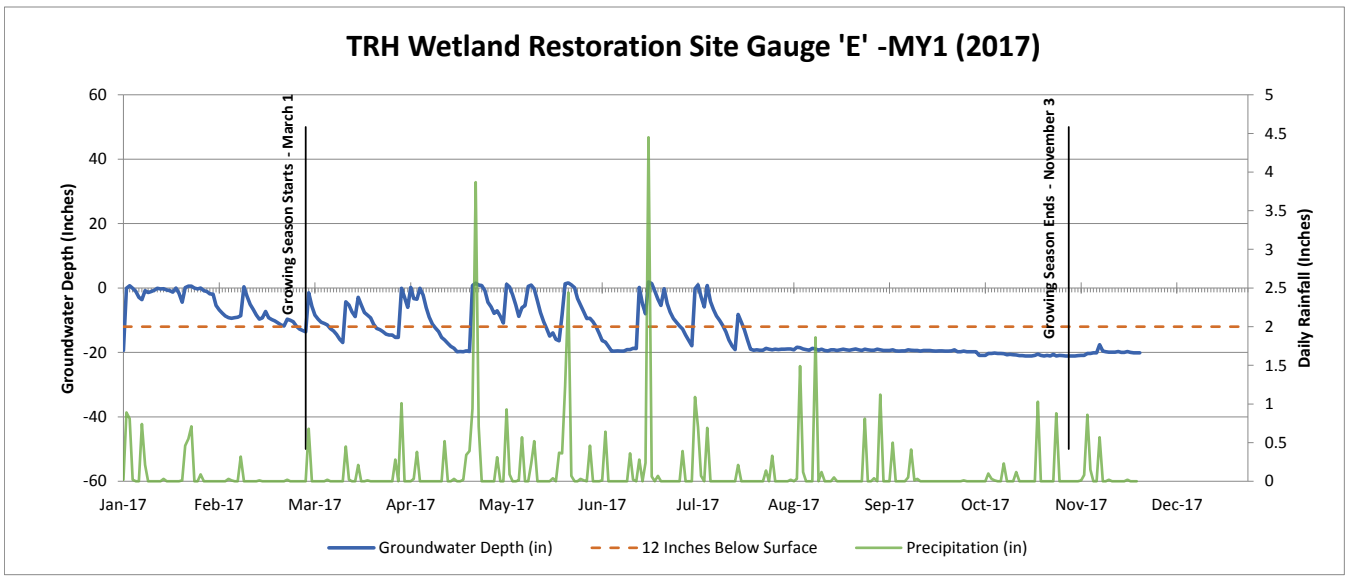


Figure 6B. Groundwater Gauges and Rainfall Data Plots 2017 -- Tar River Headwaters Wetland Restoration # 97071





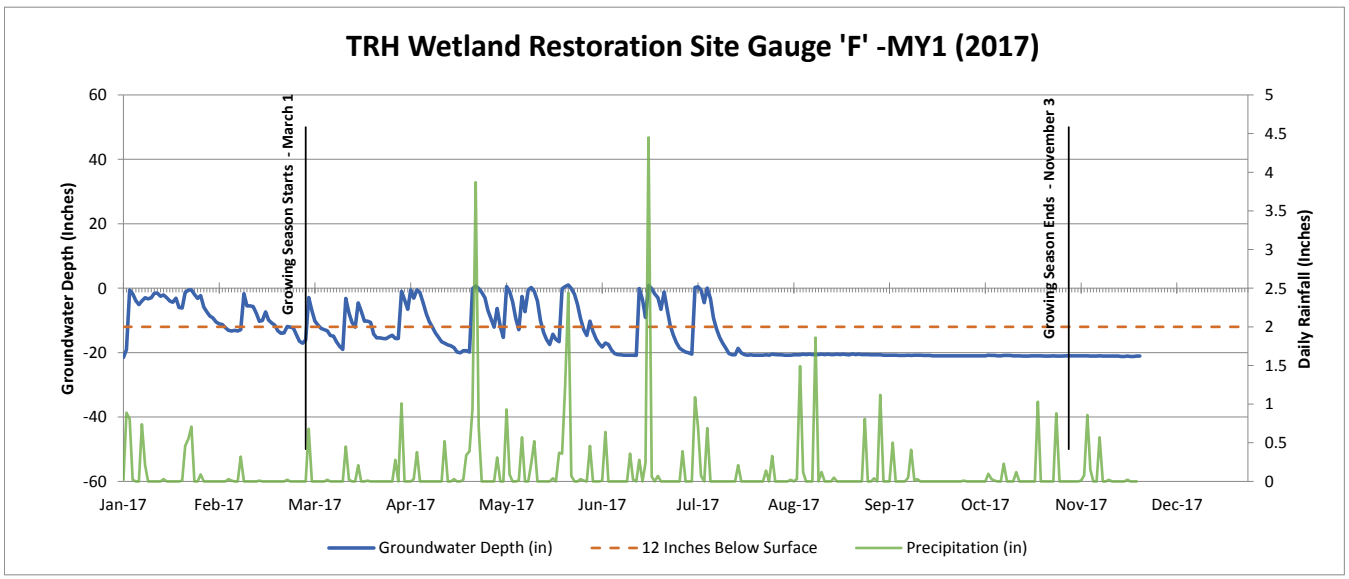
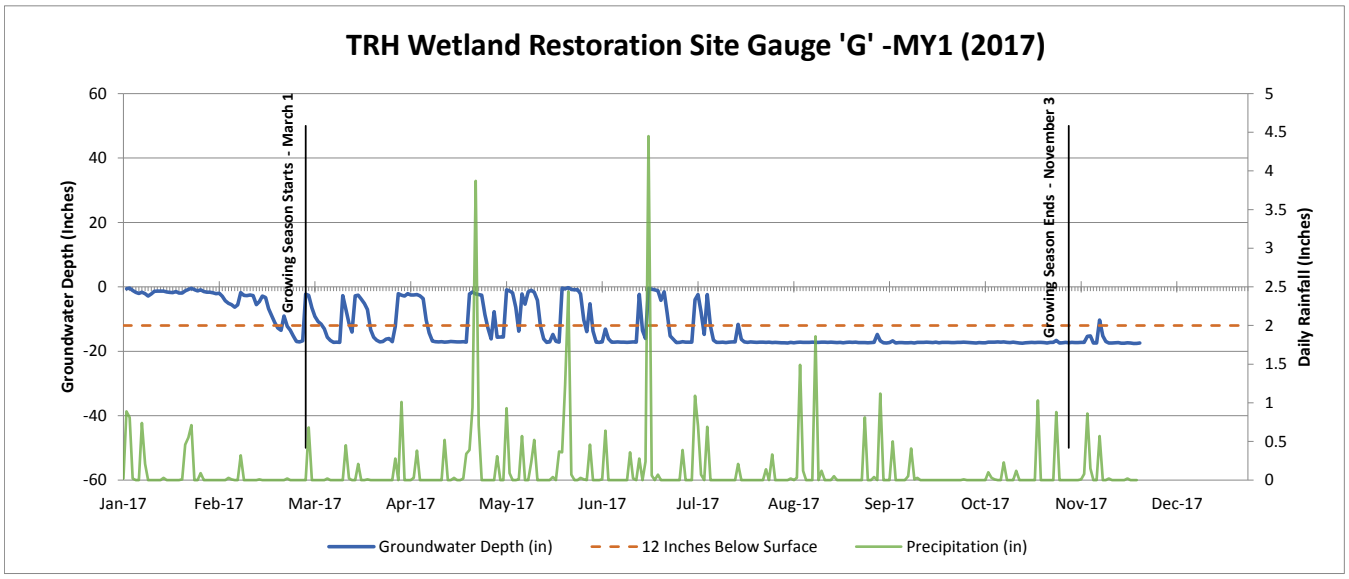
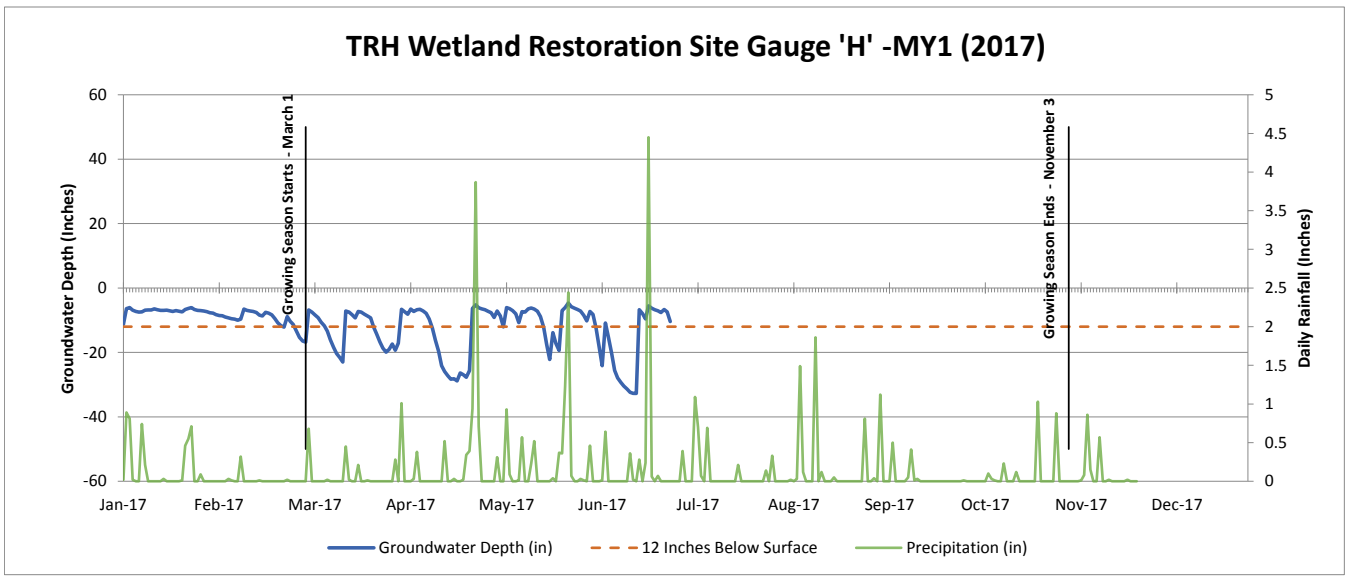


Figure 6C. Groundwater Gauges and Rainfall Data Plots 2017 -- Tar River Headwaters Wetland Restoration # 97071





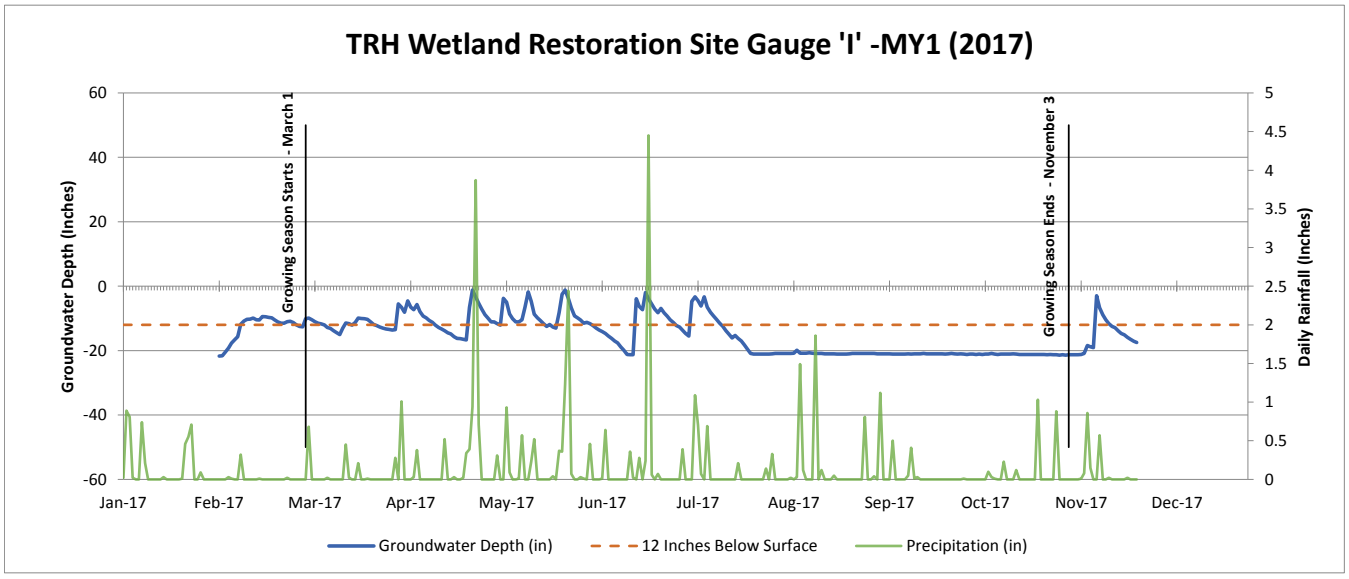
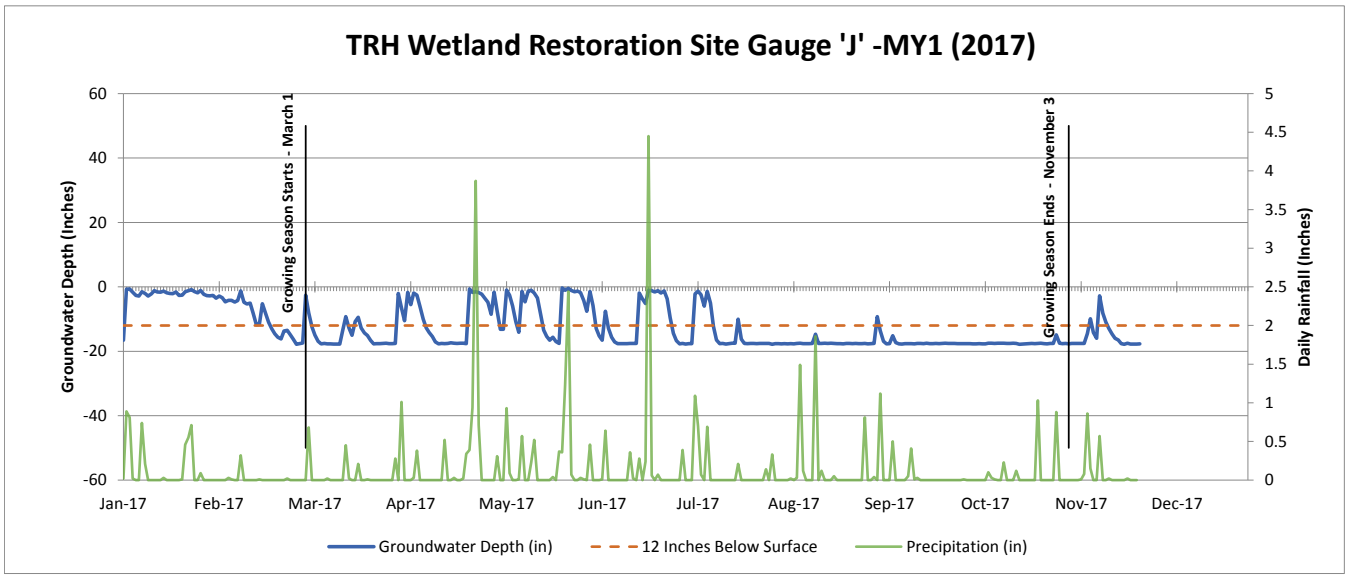
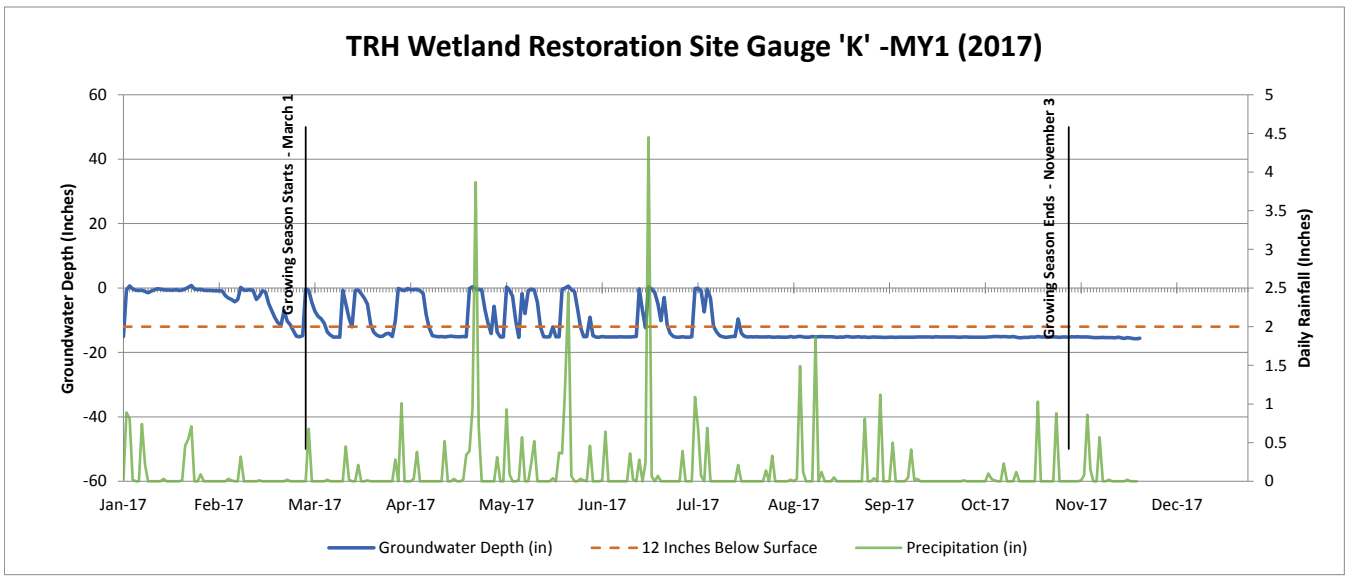


Figure 6D. Groundwater Gauges and Rainfall Data Plots 2017 -- Tar River Headwaters Wetland Restoration # 97071





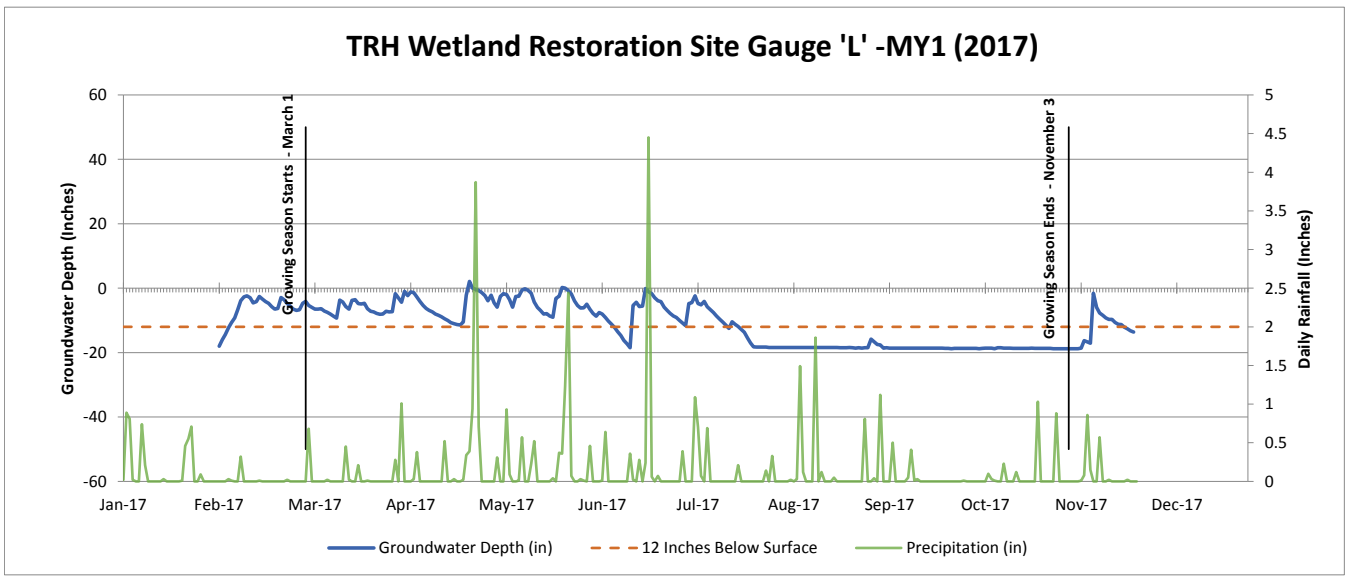


Figure 6E. Groundwater Gauges and Rainfall Data Plots 2017 -- Tar River Headwaters Wetland Restoration # 97071

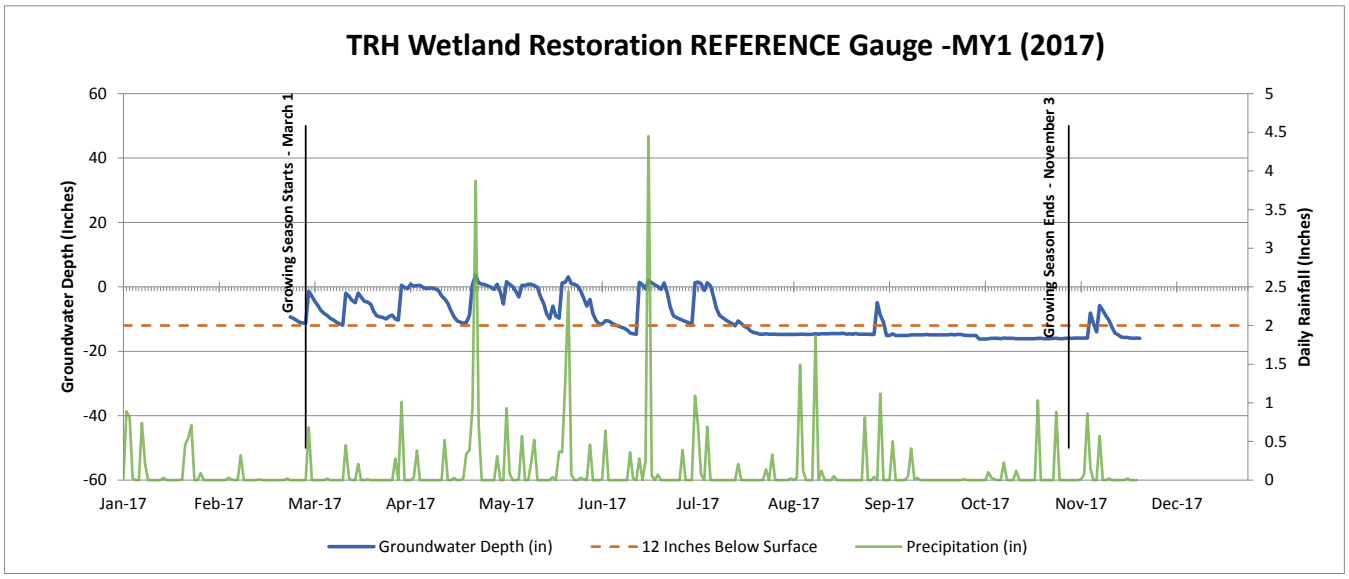


Table 8. Hydrologic Success Attainment, Groundwater Wells

Tar River Headwaters Wetland Mitigation Site # 97071.

	MY1 2017			
Gage #	% Growing Season Monitored	Total # Days WT < 12" from surface	Max Consec Days <12" from surface	Success Critera Attained?
A	100%	82 (33%)	15 (6%)	**No**
D	100%	95 (38%)	17 (7%)	**No**
E	100%	89 (36%)	24 (10%)	**Yes**
F	100%	68 (27%)	11 (4%)	**No**
G	100%	63 (25%)	10 (4%)	**No**
H	48%	73 (29%)	24 (10%)	**Yes**
I	100%	87 (35%)	14 (6%)	**No**
J	100%	66 (27%)	11 (4%)	**No**
K	100%	71 (29%)	11 (4%)	**No**
L	100%	134 (54%)	100 (40%)	**Yes**
B	100%	95 (38%)	17 (7%)	**NA**
C	100%	81 (33%)	25 (10%)	**NA**
REF	100%	137 (55%)	101 (41%)	**Yes**

Mitigation Plan success criterion is 10% of growing season (consecutive days < 12" below surface).

Growing Season based on USDA air temp data at Roxboso ESE gauge is Mar 28 to Nov 3 (221 Days).

Growing Season used here, based on on-site soil temperature > 41° F is Mar 1 to Nov 3 (248 Days).

10% of 248-day growing season is 25 consecutive days.