Little River
Stream and Wetland Enhancement Project

SCO No. 070715501
DENR Contract No. D08049S
DMS Project No. 226
Moore County, North Carolina

FINAL
Year 5 of 5 Monitoring Report
Data Collection: January through December 2015
Submission Date: January 26, 2016

Prepared for:

North Carolina Department of Environmental Quality
Division of Mitigation Services
217 West Jones Street, 3rd Floor, Suite 3000A; Raleigh, NC 27603

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Prepared by:

Land Management Group, Inc.
3805 Wrightsville Avenue; Suite 15
Wilmington, NC 28403
(910) 452-0001

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3.0 PROJECT SUMMARY

The Little River Stream and Wetland Enhancement Site is located on a 125-acre conservation easement along Little River near Vass, NC (Moore County) within the Cape Fear River Basin #03030004 Cataloging Unit (Figure 1). It is located within a larger tract owned by J.J. Barnes and his family. The larger tract is actively managed for wildlife habitat to facilitate hunting on the overall tract. This project will yield ~~1437.2~~ 1 Stream Mitigation Units (SMUs) and 32.36 Wetland Mitigation Units (WMUs). The project work includes 3,593 linear feet of stream enhancement (II), 210 linear feet of stream preservation, 54.8 acres riverine wetland enhancement, and 48.7 acres of riverine wetland preservation.

Prior to mitigation activities, the project site was a jurisdictional wetland largely planted as a loblolly pine plantation, with smaller areas containing an open field and some riparian hardwoods along the Little River. The site was clearcut and re-planted in 2001 by the landowner before the project inception. In 2003, the site was acquired by the State of NC for wetland restoration and enhancement, which included removal of all young pine trees. During the 2005 permitting phase, the Agency (Division of Mitigation Services, formerly Ecosystem Enhancement Program) and regulatory agencies expressed concern over damage that may occur during tree removal in what was described as an overall "stable system." These concerns led to a delay in permitting, and resulted in a modified project strategy that removed timbering, and replaced it with a prescribed fire to knock back pines and understory planting of climax hardwoods. This strategy was documented in a 2011 Memo "Second Follow Up on Project Strategy," attached in Appendix E.

The overall goal for the Little River Stream and Wetland Enhancement Site is to preserve and enhance a natural bottomland hardwood forest which exhibits desired functions appropriate to the existing geomorphic setting of the site.

Specific goals include:

1) Preservation of wildlife habitat; and
2) Natural community enhancement.

The project objectives include:

1) Partial removal of undesired vegetation via burning to promote desired species growth; and
2) Planting of the project site with specific native species to enhance natural habitat.

To accomplish these goals, the site was burned in December of 2010 and planted in January of 2011. The baseline field monitoring was performed by Stantec in February of 2011. Land Management Group, Inc. (LMG) performed monitoring in Years One through Five (2011-2015, Table 2).

Stream enhancement II and preservation are both components of this project (Table 1). Three stream channels traverse the project site. Small portions of the channels were altered in the past but currently appear stable. The project includes 3,593 linear feet of Stream Enhancement II on two tributaries to the Little River (Reach 1 & Reach 2) and 210 linear feet of Stream Preservation of one associated tributary (Reach 3).

Streams are visually assessed each year to monitor for stability. One crest gauge was installed on-site and is located adjacent to Vegetation Plot 7. Streams were stable during the MY5 monitoring assessment. Water was observed in the channel during the March, May, and July site visits. The approximate depth of water in the channel during the visits was between 2 and 6 inches. The crest gauge was also evaluated several times throughout 2015. Overbank flooding was not directly observed, but indicators of it, such as deposition, matted vegetation, and scouring were noted.

Wetlands were determined and confirmed by a USACE-signed jurisdictional determination (JD) conducted by Jennifer Frye (2/8/2006) and Emily Hughes (3/13/2009). This JD provided the basis for the asset crediting strategy. Wetlands within the conservation easement boundary were enhanced or preserved. Approximately 39.4 acres of wetlands in the bottomland hardwood forest adjacent to the Little River channel and 9.3 acres of successional wetlands located in the northwest portion of the project site were preserved. The wetlands within the 47.8 acre loblolly pine plantation area and 7.0 acre grassy field area were enhanced through the planting of native hardwood trees (See Table 1 for Project Components and Figure 2 for Component Location).

Because a JD was conducted, there are no hydrological success criteria. However, five continuous groundwater monitoring gauges were installed on the site to monitor and confirm hydrology. Four of the gauges are located in wetlands of the pine plantation and a fifth is a reference gauge located in a preserved wetland area on the west side of the project. During the growing season of MY5 (2015), the groundwater monitoring gauges located within the enhancement site demonstrated a water level within 12” of the soil surface for between 3% and 22% of the growing season. Rainfall totals were below average in May, July, and August, average in April and September, and above-average in June and October (Appendix D).

- Gauge #1: 8% (18 days)
- Gauge #2: 3% (7 days)
- Gauge #3: 22% (50 days)
- Gauge #4: 22% (51 days)
- Reference Gauge: 22% (51 days)

Vegetation monitoring is conducted on an annual basis using sixteen (16) permanent vegetation plots (Figure 2). The vegetation success criterion for the pine plantation area is the survival of 150 planted woody stems per acre at the end of the five-year monitoring period. The success criterion for the grassy field area is the survival of 260 planted woody stems per acre at the end of the five-year monitoring period.

Monitoring Year 5 (MY5 2015) observed a mean stem density of 252 planted stems per acre in all the plots. The plots located in the grassy field area (Plots 1-3) averaged 310 planted stems per acre. The plots located within the pine plantation area (Plots 4-16) had an average of 239 planted stems per acre. When including volunteers, the site had an overall mean stem density of 2,390 stems (excluding mature pine trees). The plots located in the grassy field area had an average of 2,158 stems per acre. The plots located within the pine plantation area had an average of 2,478 stems per acre.

Plots #2, #3, and #12 did not meet the vegetation success criterion in MY5 2015. The lack of meeting the success criterion for these plots was identified in early monitoring reports. However, project managers did not replant in these areas because the natural density was high considering volunteers. Additionally, the volunteer species in the areas where plots did not meet success were diverse, and many plots contained favorable climax hardwood species, many of which were identified in the planting plans. It should be noted that the vigor of several planted hardwood species is low, likely owed to early successional pine shading and legacy pine plantation soils which have lower pH (more acidic).

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to 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 and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices are available from EEP upon request.

4.0 METHODOLOGY

Vegetation

Sixteen (16) permanent vegetation plots are used for annual vegetation monitoring (Figure 2). All vegetation monitoring was completed in September 2015 utilizing the Carolina Vegetation Survey (CVS) – EEP protocol Level 2 (version 4.2).

Hydrology

A crest gauge was installed within a stream to monitor flow and is assessed through visual evaluation. Five groundwater monitoring gauges were installed on site (4 within the enhancement area and 1 within the reference area). All groundwater monitoring gauges were downloaded quarterly utilizing Remote Data System, Inc. data loggers and software. Data from the groundwater monitoring gauges are not used toward success criteria of the wetland.

Photo documentation was performed at prescribed locations across the site. A digital camera was used to take photos at each predetermined photo point location (Figure 2).

5.0 REFERENCES

NCEEP. 2014. Annual Monitoring and Closeout Reporting Format, Data Requirements, and Content Guidance. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. February, 2014.

NCEEP. 2014. Little River Stream and Wetland Enhancement Year 4 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. December, 2014.

NCEEP. 2014. Little River Stream and Wetland Enhancement Year 3 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. January, 2014.

NCEEP. 2013. Little River Stream and Wetland Enhancement Year 2 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. March, 2013.

NCEEP. 2012. Little River Stream and Wetland Enhancement Year 1 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. March, 2012.

NCEEP. 2011. Little River Stream and Wetland Enhancement As-Built & Baseline Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. December, 2011.

NCEEP. 2008. CVS-EEP Vegetation Sampling Protocol. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 4.2, 2008.

NCEEP. 2007. Little River Wetland Enhancement Restoration Plan. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. September 28, 2007.

US Army Corps of Engineers. 1987. U.S. Army Corps of Engineers. Tech Report Y-87-1, 1987 Wetland Delineation Manual, Washington, DC. AD/A176.

US Army Corps of Engineers. 2005. U.S. Army Corps of Engineers. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina, Wilmington Regulatory Field Office.

6.0 Project Condition and Monitoring Data Appendices

Appendix A.
Project Vicinity Map and Background Tables

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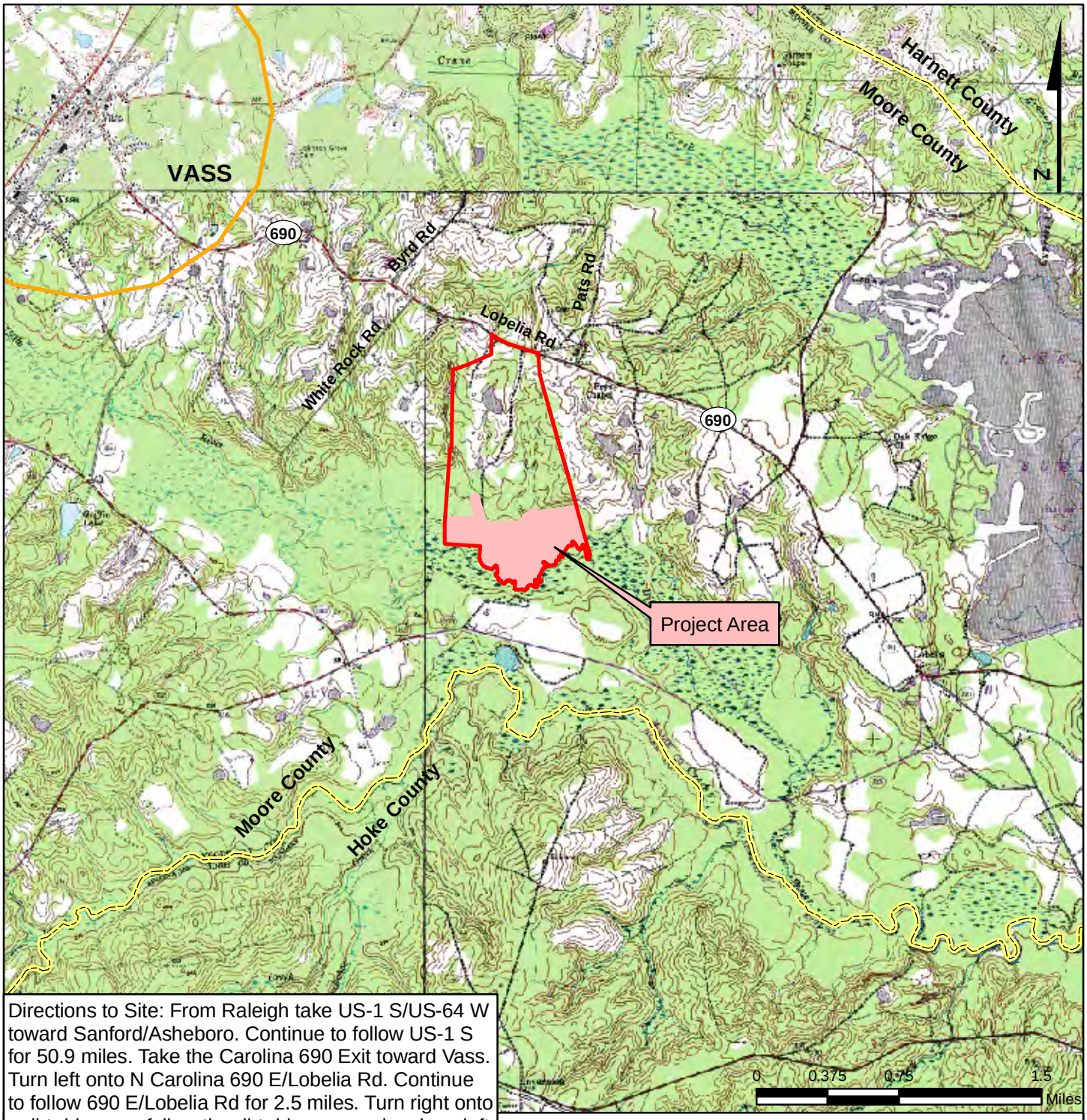

Directions to Site: From Raleigh take US-1 S/US-64 W toward Sanford/Asheboro. Continue to follow US-1 S for 50.9 miles. Take the Carolina 690 Exit toward Vass. Turn left onto N Carolina 690 E/Lobelia Rd. Continue to follow 690 E/Lobelia Rd for 2.5 miles. Turn right onto a dirt driveway, follow the dirt driveway and make a left at the fork. Continue down the dirt road to the NW corner of the site.

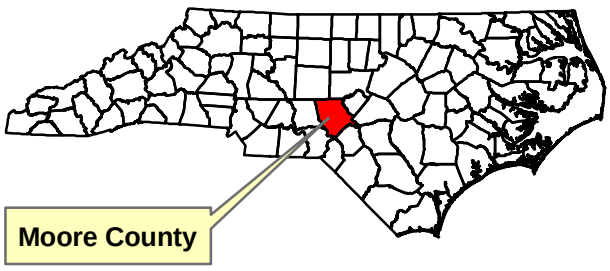

Figure 1. Vicinity Map

Little River Stream and Wetland Enhancement
DMS Project #226
Moore County, NC

7.5' USGS Topoquad Lobelia

Project boundary

J-Bar Ranch parcel boundary

Municipal boundary

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Table 1. Project Components and Mitigation Credits

Little River Stream and Wetland Enhancement Project/DMS Project No. 226

Mitigation Credits

	Stream (SMU)		Riparian Wetland (WMU)		Non-Riparian Wetland (WMU)		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	1437.2	21		32.36					

Project Components

Project Component or Reach ID	Stationing/Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio	Mitigation Units (SMU/WMU)	Comment
Reach 1	Flows NW to SE across the middle of site	1,726	E	R	1,726	2.5:1	690.4	Enhancement - planting occurred in the riparian area of both banks
Reach 2	Flows NW to SE across the middle of site	1,867	E	R	1,867	2.5:1	746.8	Enhancement - planting occurred in the riparian area of both banks
Reach 3	Enters the site on middle N boundary, tributary of Reach 2	210	P	RE	210	10:1	21	Preservation - area is protected by a conservation easement with signage around the boundary
Wetland 1	Pine Plantation	47.8	E	RE	47.8	2.5:1	19.12	Enhancement - weedy vegetation was suppressed with fire and area was planted
Wetland 2	Grassy Field	7.0	E	RE	7.0	2:1	3.5	Enhancement - EI as a result of no trees present in this area. Area was burned and planted
Wetland 3	S boundary of site	39.4	P	RE	39.4	5:1	7.88	Preservation - area is protected by a conservation easement with signage around the boundary
Wetland 4	Successional Wetlands- NW portion of the site	9.3	P	RE	9.3	5:1	1.86	Preservation - area is protected by a conservation easement with signage around the boundary

Component Summation

Restoration Level	Stream (lf)	Riparian Wetland (ac)		Non-Riparian Wetland (ac)			Buffer (sq ft)	Upland (ac)
		Riverine	Non-Riverine					
Restoration								
Enhancement		54.8						
Enhancement I								
Enhancement II	3,593							
Creation								
Preservation	210	48.7						
HQ Preservation								

BMP Elements

Element	Location	Purpose/Function	Notes
n/a	n/a	n/a	n/a

Table 2. Project Activity and Reporting History Little River Stream and Wetland Enhancement Project -DMS Project No. 226		
Elapsed Time Since Grading Complete:	**n/a**	
Elapsed Time Since Planting Complete:	**5 years**	
Number of Reporting Years[1]:	**5**	
Activity or Deliverable	**Data Collection Complete**	**Actual Completion or Delivery**
Mitigation Plan	Sep-07	Oct-07
Final Design – Construction Plans	n/a	n/a
Construction	n/a	n/a
Seeding	n/a	n/a
Prescribed Burn	n/a	Dec-10
Planting	n/a	Jan-11
As-built (Year 0 Monitoring -baseline)	Feb-11	Dec-11
Year 1 Monitoring	Dec-11	Feb-12
Year 2 Monitoring	Dec-12	Jan-13
Year 3 Monitoring	Dec-13	Jan-14
Year 4 Monitoring	Dec-14	Dec-14
Year 5 Monitoring	Dec-15	Dec-15

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

Table 3. Project Contacts Table Little River Stream and Wetland Enhancement Project -DMS Project No. 226	
Designer	Stantec Consulting Services, Inc. 801 Jones Franklin Road Suite 300; Raleigh, NC 27606
Primary project design POC	Amber Coleman (919) 865-7399
Construction Contractor	None
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Road; Edenton, NC 27932
Planting Contractor POC	Mary-Margaret McKinney (252) 482-8491
Seeding Contractor	None
Seed Mix Sources	None
Nursery Stock Suppliers	ArborGen and Superior Trees
	Arborgen - 180 Westvaco road; Summerville, SC 29483
	Superior Trees - 12493 E US Highway; Lee, FL 32059
Monitoring Performers (MY0)	Stantec Consulting Services, Inc. 801 Jones Franklin Road Suite 300; Raleigh, NC 27606
Stream Monitoring POC	Amber Coleman (919) 865-7399
Vegetation Monitoring POC	Amber Coleman (919) 865-7399
Wetland Monitoring POC	Amber Coleman (919) 865-7399
Monitoring Performers (MY1 - MY5)	Land Management Group, Inc. 3805 Wrightsville Avenue, Suite 15; Wilmington, NC 28403
Stream Monitoring POC	Kim Williams (910) 452-0001
Vegetation Monitoring POC	Kim Williams (910) 452-0001
Wetland Monitoring POC	Kim Williams (910) 452-0001

Table 4. Project Baseline Information and Attributes				
Little River Stream and Wetland Enhancement Project -DMS Project No. 226				
Project Information				
Project Name	Little River Stream and Wetland Enhancement Project			
Project County	Moore			
Project Area (ac)	125.8			
Project Coordinates (Lat and Long)	35.223562, -79.240977			
Project Watershed Summary Information				
Physiographic Region	Sandhills			
River Basin	Cape Fear			
USGS HUC for Project (14 digit)	03030004070050			
NCDWQ Subbasin	03-03-14			
Project Drainage Area (sq mi)	0.52			
Project Drainage impervious cover estimate (%)	< 1%			
CGIA Land Use Classification	Active Forest Management and Harvesting; Unused			
Reach Summary Information				
Parameters	**Reach 1**	**Reach 2**	**Reach 3**	
Length of Reach (linear feet)	1,726	1,867	210	
Valley Classification	VIII			
Drainage Area (ac)	335			
NCDWQ Stream Identification Score	30	28	28	
NCDWQ Water Quality Classification	Perennial			
Morphological Description (stream type)	C5	E5	E5	
Evolutionary Trend	C5	C5	C5	
Underlying Mapped Soils	Bibb			
Drainage Class	Poorly Drained			
Soil Hydric Status	Yes			
Slope	0-1%			
FEMA Classification	Zone X			
Native Vegetation Community	Riverine bottomland hardwood			
Percent Composition Exotic Invasive Vegetation	0%	0%	0%	
Wetland Summary Information				
Parameter	**Wetland 1**	**Wetland 2**	**Wetland 3**	
Size (ac)	47.8	7	48.7	
Wetland Type	Riparian Riverine			
Mapped Soils Series	Bibb			
Drainage Class	Poorly Drained			
Soil Hydric Status	Hydric			
Source of Hydrology	Overbank flooding and groundwater			
Hydrologic Impairment	None			
Native Vegetation Community	Riverine bottomland hardwood			
Percent of Exotic/Invasive Vegetation	0%	0%	0%	
Regulatory Considerations				
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**	
Waters of the United States - Section 404	Yes	Yes	USACE 404 Permit	
Waters of the United States - Section 401	Yes	Yes	NCDWQ 401 Permit	
Endangered Species Act	No	n/a	n/a	
Historic Preservation Act	No	n/a	n/a	
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	No	n/a	n/a	
FEMA Floodplain Compliance	No	n/a	n/a	
Essential Fisheries Habitat	No	n/a	n/a	

Appendix B.
Visual Assessment Data

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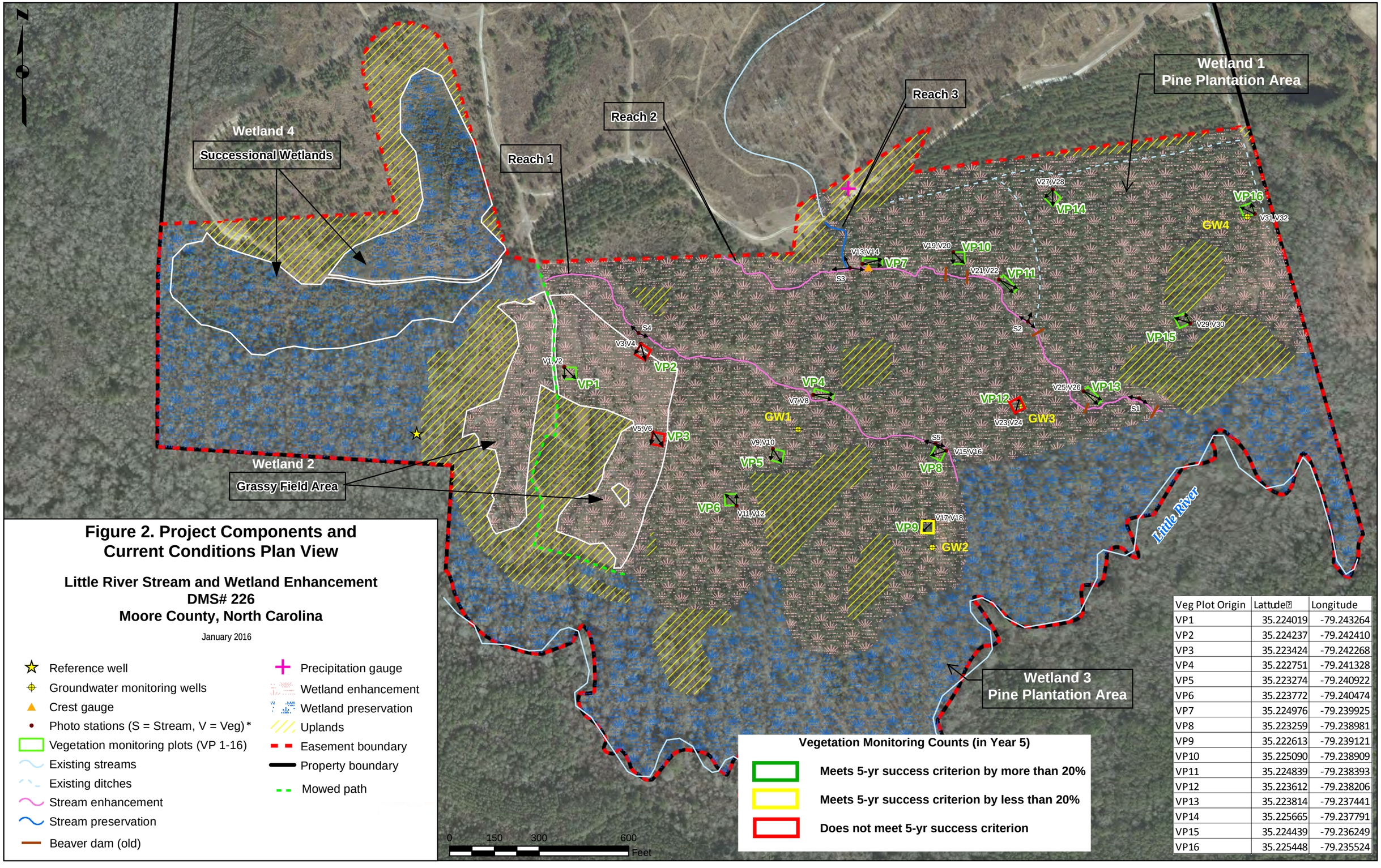

Figure 2. Project Components and Current Conditions Plan View

Little River Stream and Wetland Enhancement
DMS# 226
Moore County, North Carolina

January 2016

- Reference well
- Groundwater monitoring wells
- Crest gauge
- Photo stations (S = Stream, V = Veg) *
- Vegetation monitoring plots (VP 1-16)
- Existing streams
- Existing ditches
- Stream enhancement
- Stream preservation
- Beaver dam (old)
- Precipitation gauge
- Wetland enhancement
- Wetland preservation
- Uplands
- Easement boundary
- Property boundary
- Mowed path

Vegetation Monitoring Counts (in Year 5)

- Meets 5-yr success criterion by more than 20%
- Meets 5-yr success criterion by less than 20%
- Does not meet 5-yr success criterion

Veg Plot Origin	Latitude	Longitude
VP1	35.224019	-79.243264
VP2	35.224237	-79.242410
VP3	35.223424	-79.242268
VP4	35.222751	-79.241328
VP5	35.223274	-79.240922
VP6	35.223772	-79.240474
VP7	35.224976	-79.239925
VP8	35.223259	-79.238981
VP9	35.222613	-79.239121
VP10	35.225090	-79.238909
VP11	35.224839	-79.238393
VP12	35.223612	-79.238206
VP13	35.223814	-79.237441
VP14	35.225665	-79.237791
VP15	35.224439	-79.236249
VP16	35.225448	-79.235524

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Table 5. Vegetation Condition Assessment Table

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material	N/A	N/A	N/A	N/A	N/A
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria	N/A	N/A	N/A	N/A	N/A
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	N/A	N/A	N/A	N/A	N/A

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Stream Photo Station 1: looking upstream (northwest) (Sept. 23, 2015)

Stream Photo Station 1: looking downstream (southeast) (Sept. 23, 2015)

Stream Photo Station 2: looking upstream (northwest) (Sept. 23, 2015)

Stream Photo Station 2: looking northeast (Sept. 23, 2015)

Stream Photo Station 2: looking downstream (southeast) (Sept. 23, 2015)

Stream Photo Station 3: looking upstream along Reach 2 (west) (Sept. 23, 2015)

Stream Photo Station 3: looking upstream at Reach 3 (north) (Sept. 23, 2015)

Stream Photo Station 3: looking downstream along Reach 2 (east) (Sept. 23, 2015)

Stream Photo Station 4: looking upstream along Reach 1 (northwest) (Sept. 23, 2015)

Stream Photo Station 4: looking downstream along Reach 1 (southeast) (Sept. 22, 2015)

Stream Photo Station 5: looking upstream along Reach 1 (northwest) (Sept. 23, 2015)

Stream Photo Station 5: looking downstream along Reach 1 (southeast) (Sept. 23, 2015)

Vegetation Plot Photos (all photos recorded on 9/22/15 and 9/23/15)

Photo Station V1 - Veg Plot 1 looking along X-axis (Sept. 22, 2015)

Photo Station V2 - Veg Plot 1 looking across (Sept. 22, 2015)

Photo Station V3 - Veg Plot 2 looking along X-axis (Sept. 22, 2015)

Photo Station V4 - Veg Plot 2 looking across (Sept. 22, 2015)

Photo Station V5 - Veg Plot 3 looking along X-axis (Sept. 22, 2015)

Photo Station V6 - Veg Plot 3 looking across (Sept. 22, 2015)

Photo Station V7 - Veg Plot 4 looking along X-axis (Sept. 23, 2015)

Photo Station V8 - Veg Plot 4 looking across (Sept. 23, 2015)

Photo Station V9 - Veg Plot 5 looking along X-axis (Sept. 23, 2015)

Photo Station V10 - Veg Plot 5 looking across (Sept. 23, 2015)

Photo Station V11 - Veg Plot 6 looking along X-axis (Sept. 23, 2015)

Photo Station V12 - Veg Plot 6 looking across (Sept. 23, 2015)

Photo Station V13 - Veg Plot 7 looking along X-axis (Sept. 23, 2015)

Photo Station V14 - Veg Plot 7 looking across (Sept. 23, 2015)

Photo Station V15 - Veg Plot 8 looking along X-axis (Sept. 23, 2015)

Photo Station V16 - Veg Plot 8 looking across (Sept. 23, 2015)

Photo Station V17 - Veg Plot 9 looking along X-axis (Sept. 23, 2015)

Photo Station V18 - Veg Plot 9 looking across (Sept. 23, 2015)

Photo Station V19 - Veg Plot 10 looking along X-axis (Sept. 23, 2015)

Photo Station V20 - Veg Plot 10 looking across (Sept. 23, 2015)

Photo Station V21 - Veg Plot 11 looking along X-axis (Sept. 23, 2015)

Photo Station V22 - Veg Plot 11 looking across (Sept. 23, 2015)

Photo Station V23 - Veg Plot 12 looking along X-axis (Sept. 23, 2015)

Photo Station V24 - Veg Plot 12 looking across (Sept. 23, 2015)

Photo Station V25 - Veg Plot 13 looking along X-axis (Sept. 23, 2015)

Photo Station V26 - Veg Plot 13 looking across (Sept. 23, 2015)

Photo Station V27 - Veg Plot 14 looking along X-axis (Sept. 23, 2015)

Photo Station V28 - Veg Plot 14 looking across (Sept. 23, 2015)

Photo Station V29 - Veg Plot 15 looking along X-axis (Sept. 23, 2015)

Photo Station V30 - Veg Plot 15 looking across (Sept. 23, 2015)

Photo Station V31 - Veg Plot 16 looking along X-axis (Sept. 23, 2015)

Photo Station V32 - Veg Plot 16 looking across (Sept. 23, 2015)

Appendix C.
Vegetation Plot Data

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Table 6. Vegetation Plot Criteria Attainment Little River Stream and Wetland Enhancement Project DMS No. 226		
Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
VP1	Y	81%
VP2	N	
VP3	N	
VP4	Y	
VP5	Y	
VP6	Y	
VP7	Y	
VP8	Y	
VP9	Y	
VP10	Y	
VP11	Y	
VP12	N	
VP13	Y	
VP14	Y	
VP15	Y	
VP16	Y	

Table 7. CVS Vegetation Plot Metadata Little River Stream and Wetland Enhancement Project EEP No. 226	
Report Prepared By	Kim Williams
Date Prepared	1/26/2016 10:00
Database Name	LittleRiver_226 _MY5_2015.mdb
Database Location	L:\Wetlands\2008\LittleRiver\Annual Monitoring Report\Year 5
Computer Name	KWILLIAMS
Description Worksheets in This Document	
Metadata	Description of database file, the report worksheets, and a summary of project and project data.
Proj Planted	Each project is listed with its PLANTED stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Proj 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.
Project Summary	
Project Code	226
Project Name	Little River
Description	Stream and Wetland Enhancement
River Basin	Cape Fear
Length (ft)	
Stream-to-Edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	16

Table 8. Planted and total stem counts (species by plot with annual means)
EEP Project Code 226. Project Name: Little River

			Current Plot Data (MY5 2015)																														
			E226-LMG-0001			E226-LMG-0002			E226-LMG-0003			E226-LMG-0004			E226-LMG-0005			E226-LMG-0006			E226-LMG-0007			E226-LMG-0008			E226-LMG-0009			E226-LMG-0010			E226-LMG-0011		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree						2						2			13			19						30			20			10			11
Aronia																																			
Aronia arbutifolia	Red Chokeberry	Shrub			1			3						1			2							1	1	2									6
Chamaecyparis thyoides	Atlantic white cedar	Tree																																	
Clethra alnifolia	coastal sweetpepperbush	Shrub																														8			
Cyrilla racemiflora	swamp titi	Shrub			5			6						20			14			7			8			9			7			10			8
Diospyros virginiana	common persimmon	Tree																											1						
Fraxinus pennsylvanica	green ash	Tree	1	1	1				1	1	1	2	2	5	1	1	1	1	1	2	6	6	6	6	6	6				3	3	3	2	2	2
Ilex glabra	inkberry	Shrub				1	1	1	1	1	1						4									1	2	2	49			1			
Ilex opaca	American holly	Tree			1			1															7						2			4			2
Itea virginica	Virginia sweetspire	Shrub																																	
Juniperus virginiana	eastern redcedar	Tree																																	1
Leucothoe	doghobble																																		
Ligustrum japonicum	Japanese privet	Exotic																																	
Ligustrum sinense	Chinese privet	Exotic																																	
Lindera benzoin	northern spicebush	Shrub																																	
Liquidambar styraciflua	sweetgum	Tree			54			6			41						2			2			1			8			3						1
Liriodendron tulipifera	tuliptree	Tree																																	4
Lyonia lucida	fetterbush lyonia	Shrub																																	
Magnolia virginiana	sweetbay	Tree						1																		2			1			5			2
Morella cerifera	wax myrtle	shrub			1																														
Nyssa sylvatica	blackgum	Tree	8	8	15	2	2	5	3	3	6				3	3	8	4	4	5						1							1	1	1
Ostrya virginiana	hophornbeam	Tree																																	
Persea borbonia	redbay	tree																																	
Persea palustris	swamp bay	tree																														1			1
Pinus taeda	loblolly pine	Tree			8			5			4									1			11			3			5			10			9
Prunus serotina	black cherry	Tree																																	
Quercus	oak	Tree																																	
Quercus laurifolia	laurel oak	Tree				2	2	3	1	1	1			2	1	1	1							3	3	4				1	1	1	1	1	2
Quercus lyrata	overcup oak	Tree	2	2	2							5	5	5			1						1	1	1	1	2	2	2	3	3	3	1	1	1
Quercus michauxii	swamp chestnut oak	Tree																																	
Quercus nigra	water oak	Tree			1																								5						
Quercus pagoda	cherrybark oak	Tree																																	
Quercus phellos	willow oak	Tree	1	1	1																														
Rhus copallinum	flameleaf sumac	shrub												1									19												6
Symplocos tinctoria	common sweetleaf	Shrub																																	
Vaccinium	blueberry	Shrub																																	
Vaccinium corymbosum	highbush blueberry	Shrub																																	
Viburnum	viburnum	shrub																														3			
	Stem count		12	12	90	5	5	33	6	6	54	7	7	36	5	5	46	5	5	36	6	6	53	11	11	67	4	4	95	7	7	59	5	5	57
	size (ares)		1			1			1			1			1			1			1			1			1			1			1		
	size (ACRES)		0			0			0			0			0			0			0			0			0			0			0		
	Species count		4	4	11	3	3	10	4	4	6	2	2	7	3	3	9	2	2	6	1	1	7	4	4	11	2	2	10	3	3	12	4	4	15
	Stems per ACRE		486	486	3642	202	202	1335	243	243	2185	283	283	1457	202	202	1862	202	202	1457	243	243	2145	445	445	2711	162	162	3845	283	283	2388	202	202	2307

Color for Density

Exceeds requirements by more than 20%

Exceeds requirements, but by less than 20%

Fails to meet requirements

Table 8 contd. Planted and total stem counts (species by plot with annual means)

			Current Plot Data (MY5 2015)															Annual Means											
		Species	E226-LMG-0012			E226-LMG-0013			E226-LMG-0014			E226-LMG-0015			E226-LMG-0016			MY5 (2015)			MY4 (2014)			MY3 (2013)			MY2 (2012)			MY1 (2011)		
Scientific Name	Common Name	Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			20			10						19			16			172			109			232			123			55
Aronia																										40						
Aronia arbutifolia	Red Chokeberry	Shrub												1	5	5	5	6	6	21	4	4	4	4	4	4	4	4	4	4	4	4
Chamaecyparis thyoides	Atlantic white cedar	Tree																											2			
Clethra alnifolia	coastal sweetpepperbush	Shrub									49			5			34			96			95			133						
Cyrilla racemiflora	swamp titi	Shrub			37	1	1	17			3			12			11	1	1	174	1	1	101	1	1	236	2	2	105	2	2	85
Diospyros virginiana	common persimmon	Tree																		1			1			1			3			1
Fraxinus pennsylvanica	green ash	Tree							5	5	5	3	3	3	1	1	1	32	32	36	33	33	38	32	32	38	31	31	32	32	32	37
Ilex glabra	inkberry	Shrub			4						6			12			21	4	4	100	5	5	249	7	7	169	8	8	45	10	10	45
Ilex opaca	American holly	Tree			2			1			1			2			2			25			19			27			7			6
Itea virginica	Virginia sweetspire	Shrub																								5						
Juniperus virginiana	eastern redcedar	Tree																		1			1			2						2
Leucothoe	doghobble																						5			25						
Ligustrum japonicum	Japanese privet	Exotic																											2			
Ligustrum sinense	Chinese privet	Exotic																					1			8						
Lindera benzoin	northern spicebush	Shrub																						1	1	1	1	1	1	1	1	1
Liquidambar styraciflua	sweetgum	Tree			5			5			8			6			6			148			95			114			68			54
Liriodendron tulipifera	tuliptree	Tree									1									5			4			3			5			4
Lyonia lucida	fetterbush lyonia	Shrub																								10			3			3
Magnolia virginiana	sweetbay	Tree			4			3			1			1						20			13			14			9			9
Morella cerifera	wax myrtle	shrub																		1			1			4						
Nyssa sylvatica	blackgum	Tree	1	1	1							1	1	1				23	23	43	23	23	36	30	30	55	35	35	85	41	41	91
Ostrya virginiana	hophornbeam	Tree																								12						
Persea borbonia	redbay	tree																								5						
Persea palustris	swamp bay	tree						1												3			1									
Pinus taeda	loblolly pine	Tree			8			5			4			13			15			101			112			117			108			
Prunus serotina	black cherry	Tree																											1			1
Quercus	oak	Tree																			2	2	3	3	3	4	3	3	3	3	3	3
Quercus laurifolia	laurel oak	Tree			8			6				1	1	1	2	2	2	12	12	31	8	8	23	8	8	43	9	9	15	10	10	14
Quercus lyrata	overcup oak	Tree				5	5	5	2	2	2							21	21	23	25	25	25	24	24	26	18	18	34	19	19	19
Quercus michauxii	swamp chestnut oak	Tree			1															1												
Quercus nigra	water oak	Tree																		6			9			6						
Quercus pagoda	cherrybark oak	Tree																								1						
Quercus phellos	willow oak	Tree																1	1	1												
Rhus copallinum	flameleaf sumac	shrub						9												35			15			66			12			3
Symplocos tinctoria	common sweetleaf	Shrub									9									9			16			11						
Vaccinium	blueberry	Shrub																					23									
Vaccinium corymbosum	highbush blueberry	Shrub			1															1												
Viburnum	viburnum	shrub																		3												
	Stem count		1	1	91	6	6	62	7	7	89	5	5	76	8	8	113	100	100	1057	101	101	999	110	110	1412	111	111	667	122	122	437
	size (ares)		1			1			1			1			1			16			16			16			16			16		
	size (ACRES)		0			0			0			0			0			0.40			0.40			0.40			0.40			0.40		
	Species count		1	1	11	2	2	10	2	2	11	3	3	12	3	3	10	8	8	25	8	8	25	9	9	30	9	9	21	9	9	19
	Stems per ACRE		40	40	3683	243	243	2509	283	283	3602	202	202	3076	324	324	4573	253	253	2673	255	255	2527	278	278	3571	281	281	1687	309	309	1105

Color for Density

Exceeds requirements by more than 20%

Exceeds requirements, but by less than 20%

Fails to meet requirements

Table 9. CVS - Damage by Plot
Little River Stream and Wetland Enhancement - EEP #226

	plot	Count of Damage Categories	(no damage)	_Enter other damage_	Deer	Diseased	Insects	Vine Strangulation
	E226-LMG-0001-year:5	3	9		1		2	
	E226-LMG-0002-year:5	3	2	2			1	
	E226-LMG-0003-year:5	4	2	1	3			
	E226-LMG-0004-year:5	4	3	1		1	1	1
	E226-LMG-0005-year:5	5		1	1		3	
	E226-LMG-0006-year:5	2	3		1		1	
	E226-LMG-0007-year:5	6			1	1	4	
	E226-LMG-0008-year:5	5	6		2		1	2
	E226-LMG-0009-year:5	2	2		1		1	
	E226-LMG-0010-year:5	6	2		1	2	2	1
	E226-LMG-0011-year:5	4	1				4	
	E226-LMG-0012-year:5	1	1		1			
	E226-LMG-0013-year:5	5	1		1		4	
	E226-LMG-0014-year:5	6	1	1	2		3	
	E226-LMG-0015-year:5	5	1		1		4	
	E226-LMG-0016-year:5	4	4		1		2	1
TOT:	**16**	**65**	**38**	**6**	**17**	**4**	**33**	**5**

Table 10. CVS - Planted Stems by Plot and Species
Little River Stream and Wetland Enhancement - EEP #226

	Comment	Species	SpType	CommonName	Total Planted Stems	# plots	avg# stems	plot E226-LMG-0001-year:5	plot E226-LMG-0002-year:5	plot E226-LMG-0003-year:5	plot E226-LMG-0004-year:5	plot E226-LMG-0005-year:5	plot E226-LMG-0006-year:5	plot E226-LMG-0007-year:5	plot E226-LMG-0008-year:5	plot E226-LMG-0009-year:5	plot E226-LMG-0010-year:5	plot E226-LMG-0011-year:5	plot E226-LMG-0012-year:5	plot E226-LMG-0013-year:5	plot E226-LMG-0014-year:5	plot E226-LMG-0015-year:5	plot E226-LMG-0016-year:5
		Aronia arbutifolia	Shrub	Red Chokeberry	6	2	3								1									5
		Cyrilla racemiflora	Shrub Tr	swamp titi	1	1	1														1			
		Fraxinus pennsylvanica	Tree	green ash	32	12	2.67	1		1	2	1	1	6	6		3	2			5	3	1
		Ilex glabra	Shrub	inkberry	4	3	1.33		1	1						2							
		Nyssa sylvatica	Tree	blackgum	23	8	2.88	8	2	3		3	4					1	1			1	
		Quercus laurifolia	Tree	laurel oak	12	8	1.5		2	1		1			3		1	1				1	2
		Quercus lyrata	Tree	overcup oak	21	8	2.62	2			5				1	2	3	1		5	2		
		Quercus phellos	Tree	willow oak	1	1	1	1															
TOT:	**0**	**8**	**8**	**8**	**100**	**8**		**12**	**5**	**6**	**7**	**5**	**5**	**6**	**11**	**4**	**7**	**5**	**1**	**6**	**7**	**5**	**8**

Appendix D.
Hydrologic Data

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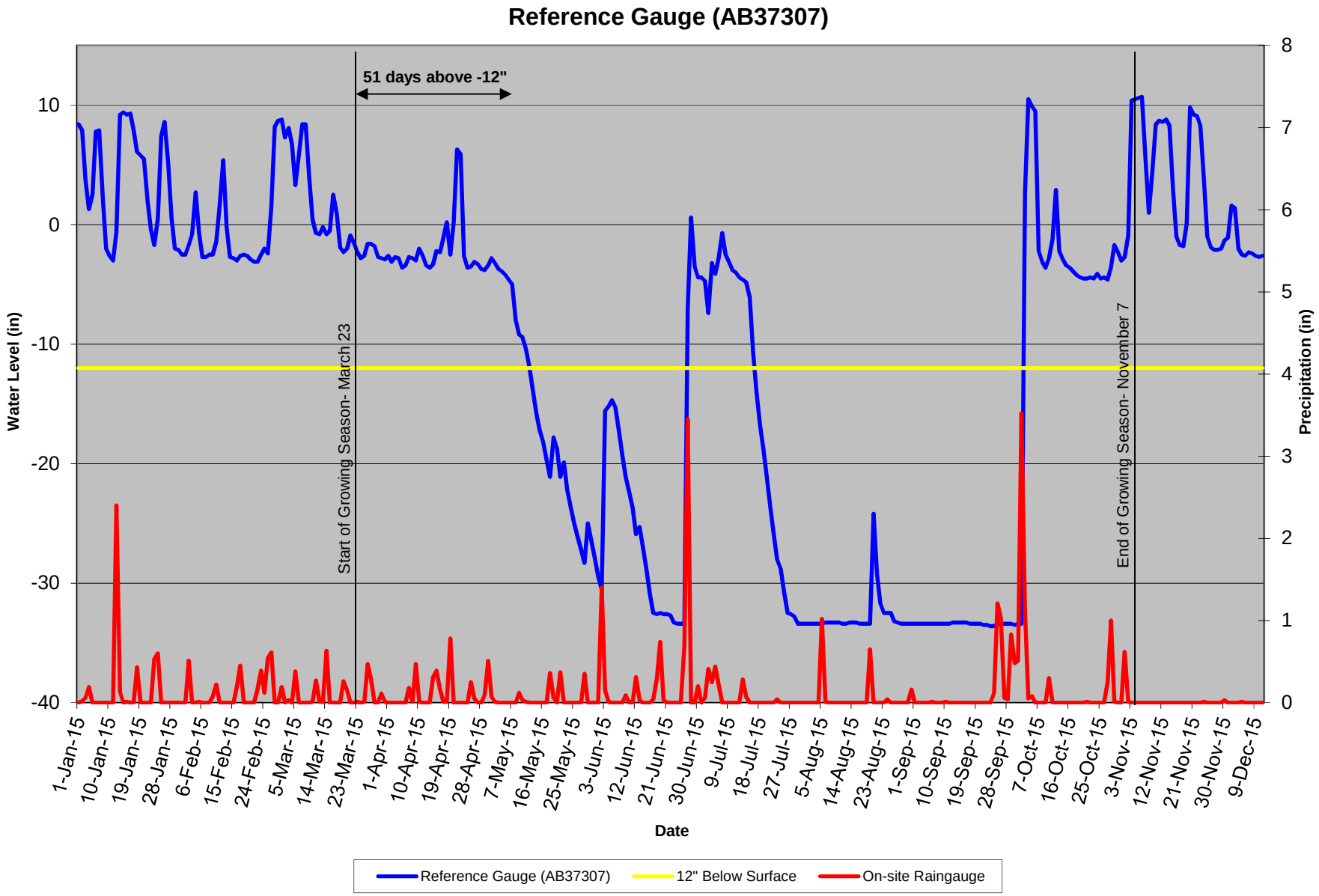
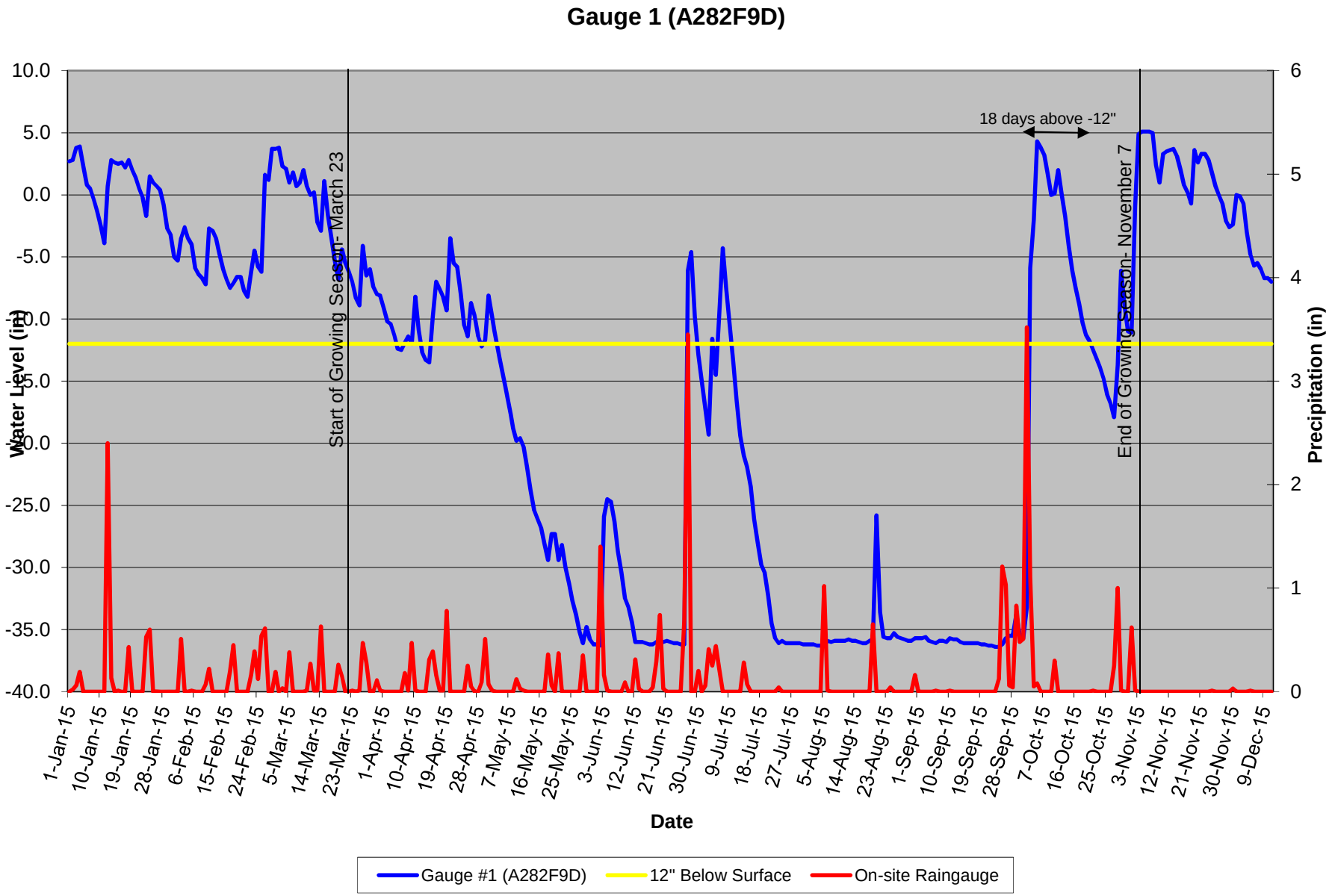
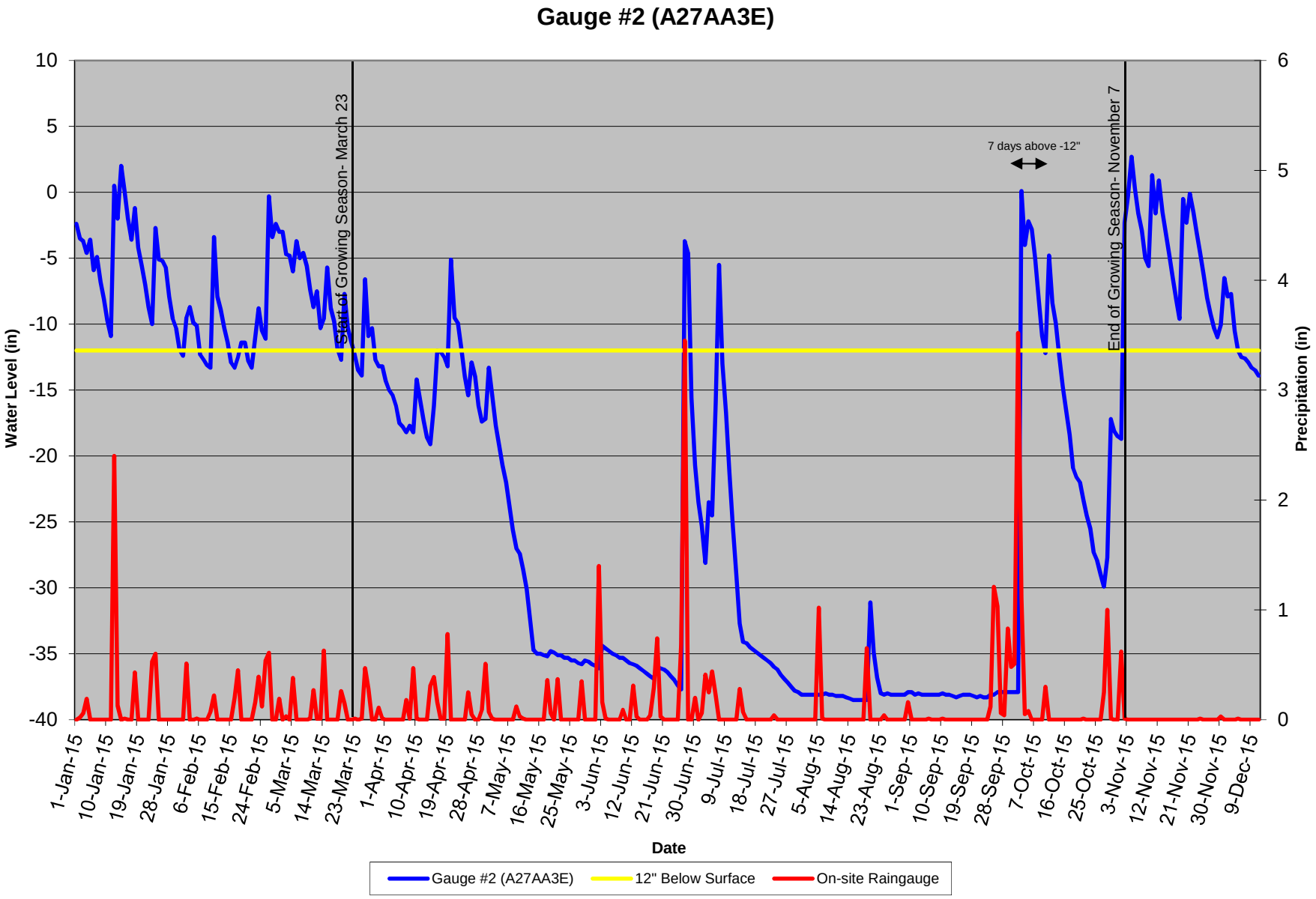
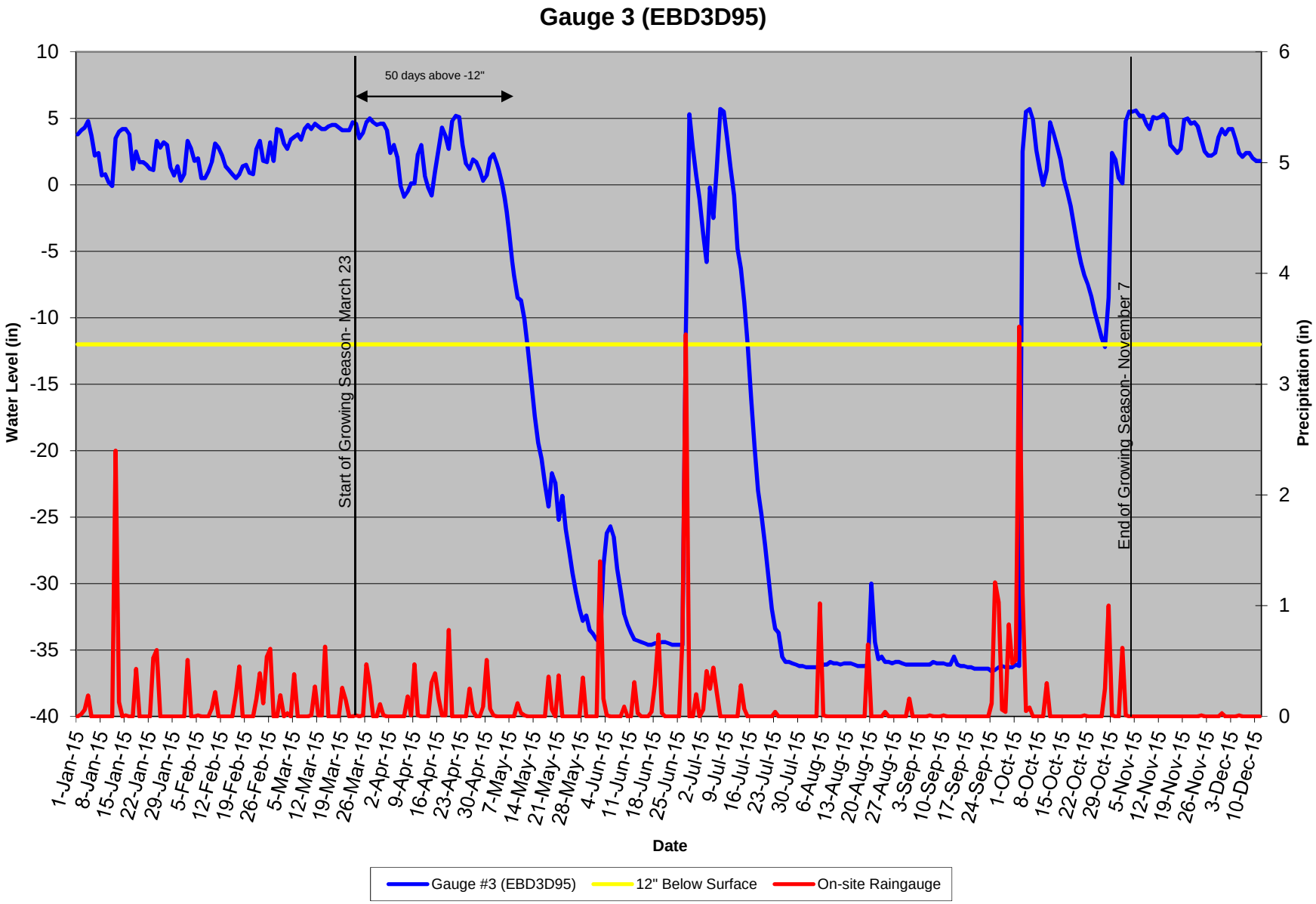
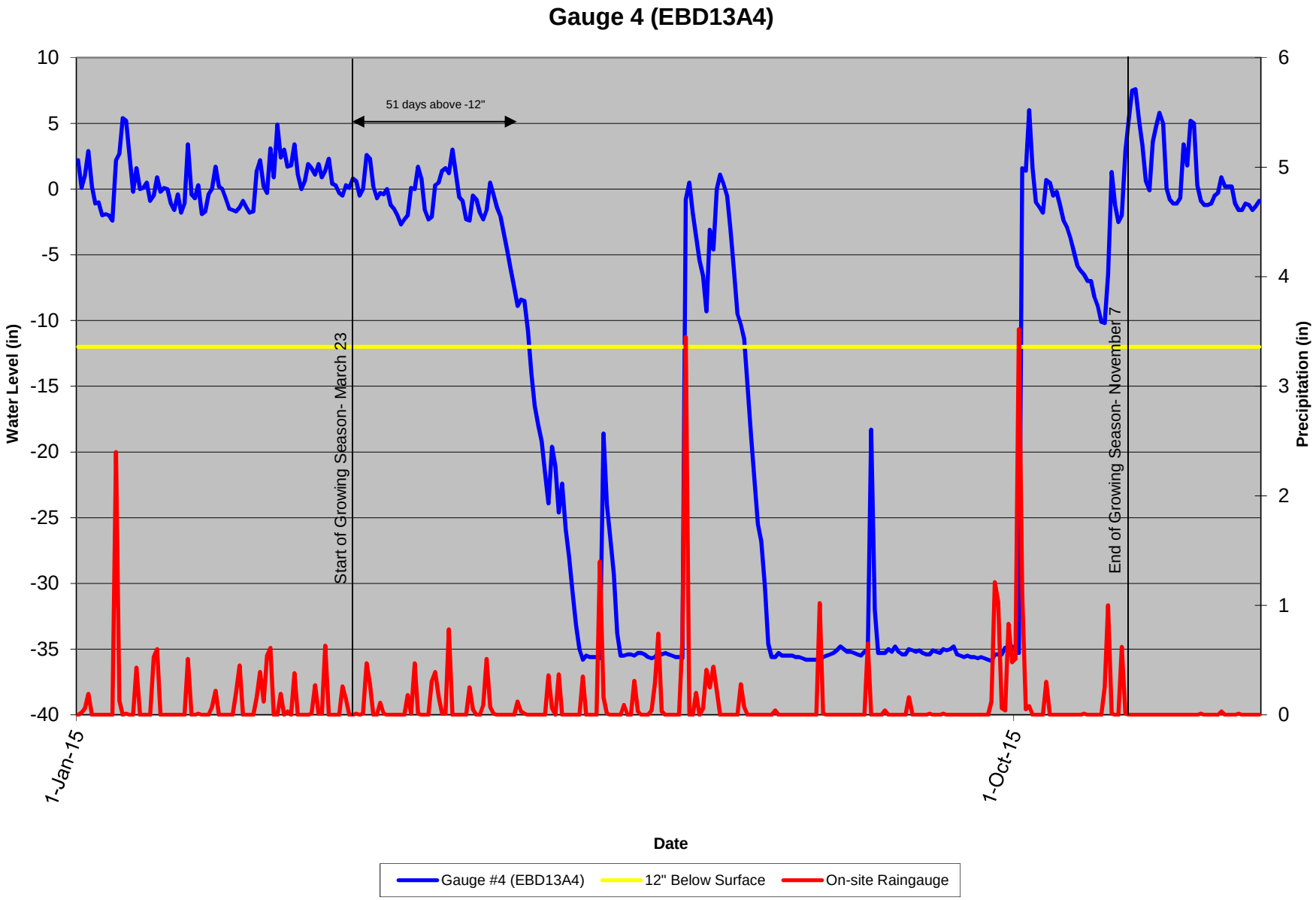

Reference Gauge (AB37307)
51 days above -12"
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
10
0
-10
-20
-30
-40
8
7
6
5
4
3
2
1
0
1-Jan-15
10-Jan-15
19-Jan-15
28-Jan-15
6-Feb-15
15-Feb-15
24-Feb-15
5-Mar-15
14-Mar-15
23-Mar-15
1-Apr-15
10-Apr-15
19-Apr-15
28-Apr-15
7-May-15
16-May-15
25-May-15
3-Jun-15
12-Jun-15
21-Jun-15
30-Jun-15
9-Jul-15
18-Jul-15
27-Jul-15
5-Aug-15
14-Aug-15
23-Aug-15
1-Sep-15
10-Sep-15
19-Sep-15
28-Sep-15
7-Oct-15
16-Oct-15
25-Oct-15
3-Nov-15
12-Nov-15
21-Nov-15
30-Nov-15
9-Dec-15
Date
Reference Gauge (AB37307)
12" Below Surface
On-site Raingauge

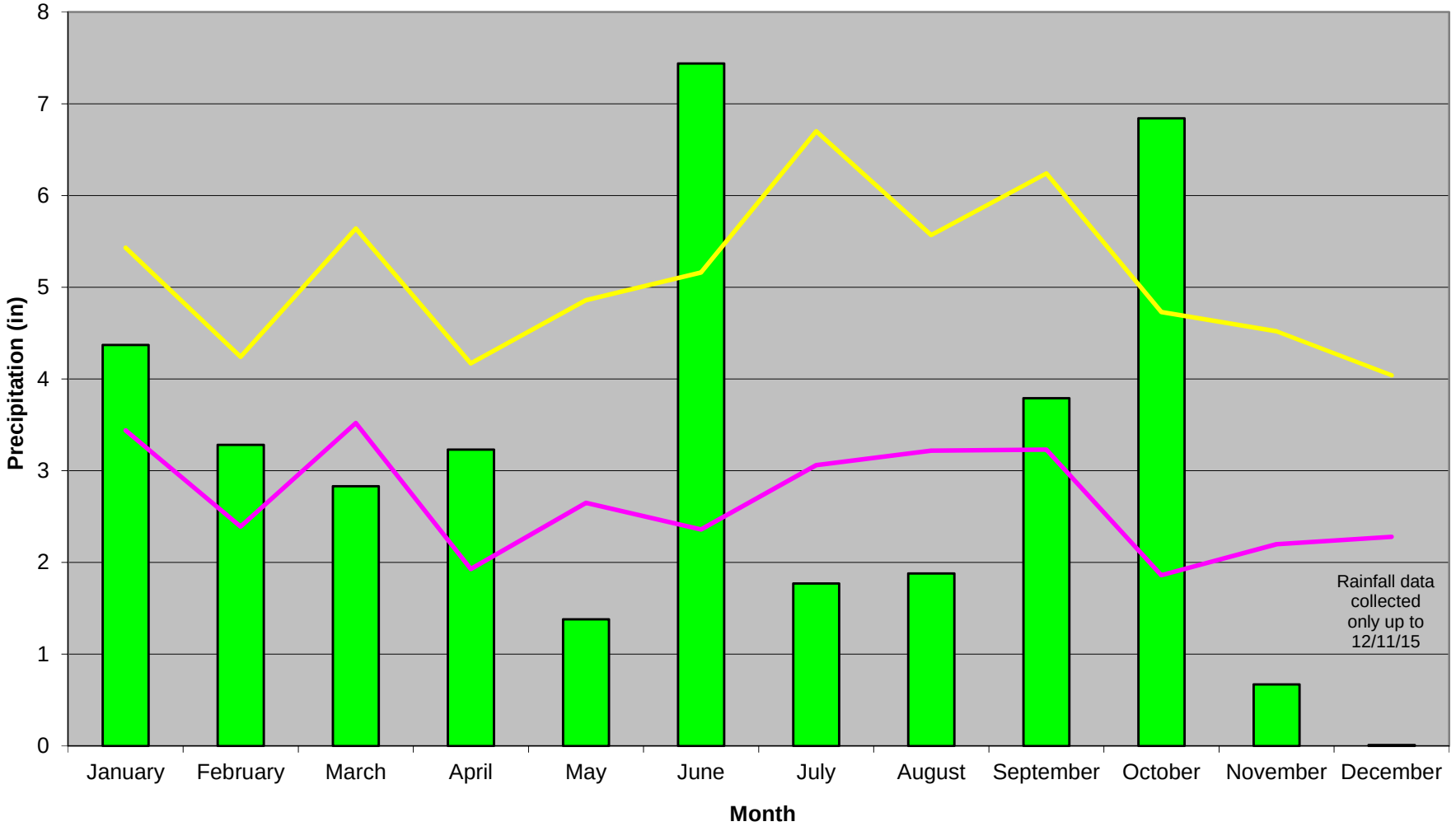

Gauge 1 (A282F9D)
Water Level (in)
Precipitation (in)
Date
Start of Growing Season- March 23
End of Growing Season- November 7
18 days above -12"
10.0
5.0
0.0
-5.0
-10.0
-15.0
-20.0
-25.0
-30.0
-35.0
-40.0
6
5
4
3
2
1
0
1-Jan-15
10-Jan-15
19-Jan-15
28-Jan-15
6-Feb-15
15-Feb-15
24-Feb-15
5-Mar-15
14-Mar-15
23-Mar-15
1-Apr-15
10-Apr-15
19-Apr-15
28-Apr-15
7-May-15
16-May-15
25-May-15
3-Jun-15
12-Jun-15
21-Jun-15
30-Jun-15
9-Jul-15
18-Jul-15
27-Jul-15
5-Aug-15
14-Aug-15
23-Aug-15
1-Sep-15
10-Sep-15
19-Sep-15
28-Sep-15
7-Oct-15
16-Oct-15
25-Oct-15
3-Nov-15
12-Nov-15
21-Nov-15
30-Nov-15
9-Dec-15
Gauge #1 (A282F9D)
12" Below Surface
On-site Raingauge


Gauge #2 (A27AA3E)
Water Level (in)
Precipitation (in)
Date
Start of Growing Season- March 23
End of Growing Season- November 7
7 days above -12"
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
6
5
4
3
2
1
0
1-Jan-15
10-Jan-15
19-Jan-15
28-Jan-15
6-Feb-15
15-Feb-15
24-Feb-15
5-Mar-15
14-Mar-15
23-Mar-15
1-Apr-15
10-Apr-15
19-Apr-15
28-Apr-15
7-May-15
16-May-15
25-May-15
3-Jun-15
12-Jun-15
21-Jun-15
30-Jun-15
9-Jul-15
18-Jul-15
27-Jul-15
5-Aug-15
14-Aug-15
23-Aug-15
1-Sep-15
10-Sep-15
19-Sep-15
28-Sep-15
7-Oct-15
16-Oct-15
25-Oct-15
3-Nov-15
12-Nov-15
21-Nov-15
30-Nov-15
9-Dec-15
Gauge #2 (A27AA3E)
12" Below Surface
On-site Raingauge


Gauge 3 (EBD3D95)
50 days above -12"
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
Date
Gauge #3 (EBD3D95)
12" Below Surface
On-site Raingauge


Gauge 4 (EBD13A4)
51 days above -12"
Start of Growing Season- March 23
End of Growing Season- November 7
Water Level (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
6
5
4
3
2
1
0
1-Jan-15
1-Oct-15
Date
Gauge #4 (EBD13A4)
12" Below Surface
On-site Raingauge

Little River Site
Rainfall 2015



Precipitation data obtained from:
On-site rain gauge & Fayetteville Airport (KFAY) www.nc-climate.ncsu.edu

30% & 70% precipitation data obtained from Moore County WETS Station: Carthage 8 SE, NC1515 1971-2000 (wcc.nrcs.usda.gov)

Appendix E.
2011 Agency Memo
“Second Follow Up on Project Strategy”

MEMORANDUM

TO: Todd Tugwell, Chair
Interagency Review Team

FROM: Tracy Stapleton, Project Manager

THROUGH: Jeff Schaffer, Eastern WPPI Supervisor and Marc Recktenwald, WPPI Manager

RE: Second Follow Up on Project Strategy
Little River (IMS #226)
Cape Fear 03030004

DATE: 19 January 2011

This memo serves as an update of the restoration approach for the subject project, and to seek approval of the monitoring and credit strategy for this project.

As you may recall, the Little River project is located near Vass in Moore County, in CF 04 (Figure 1). It is a WRP-originated project that originally proposed a large amount of stream restoration. In 2001 the site was timbered, streams channelized, soil bedded and loblolly pines planted in much of the floodplain wetlands by the owners for silviculture. The conservation easement was purchased by EEP in 2003. During design development visits to the site with agency staff and a change in design firm delayed and changed the restoration strategy at the site. In 2009, Stantec finalized plans to enhance the bedded pine plantation wetlands by removing pines and re-planting. Concerns at EEP continued, though, including bringing large equipment into the site, and disturbing the recovering soils. After another site visit with agencies, and internal discussion, EEP decided to plant a small portion of the site, below existing pines, for enhancement of the stream and wetlands and comparison of bottomland hardwood community development in planted and unplanted portions of the pine plantation.

Wetland Community type	***Acres***
Wetland pine plantation	48
Wetland grassy fields	7
BLH preservation	49
Total	**104**
Warm Stream	***Linear ft***
Channel A	1726
Channel B	1867
Total	**3593**

As discussed in the June 2010 IRT meeting, an approach being considered for restoration was to contract for burning of the site to clear the existing underbrush for bareroot planting. EEP contracted with ASIS to burn the site in December 2010. The burning was successful in opening up the understory at the site. Therefore EEP is changing its restoration approach and the resulting credits from the approach's implemententation. EEP will now plant all 55 acres of wetland and stream buffer (pine plantation and grassy fields) with bare roots of climax community species. The pine plantation, including stream buffer, will be planted at a rate of 300 stems per acre, with a target of 150 planted stems per acre at Year 5. These bare roots will mimic the understory development of these species, at a lower density than other wetland enhancement projects because of the high density of pines forming a canopy above them. We anticipate more closely mimicking a jump-started successional community by bringing in climax species to the nine year old loblolly stand. The grassy fields will be planted at a rate of 600 stems per acre

Most of EEP's wetland enhancement projects invovle planting bare roots in a jurisdictional wetland barren of woody stems. For these projects, the ratio of 2:1 has been set by agreements that establish EEP policy. For this project, we propose 2.5: 1 credit in pine plantation areas because of the lower density of planted woody stems. In the grassy fields, we anticipate 2:1 credit. This would result in approximately 19.2 credits from the pine plantation, 3.5 credits from the grassy field area, and 9.8 credits from the preservation area. The total anticipated wetland credits from this site are 32.5 riparian wetland mitigation units, all of which are restoration equivalent credits. Stream credits total 1437 credits, attributed to Enhancement II of 3593 linear feet of stream through planting.

Summary Table of Little River Proposed Mitigation

Type	Acres/lf	Ratio	Total Credits
Riparian Wetland Enh (pine plantation)	48	2.5:1	19.2
Riparian Wetland Enh (grassy field)	7	2:1	3.5
Riparian Wetland Pres	49	5:1	9.8
Stream Enh 2	3593	2.5:1	1,437.2

Monitoring

In the pine plantation wetlands, monitoring will include 8 CVS monitoring plots. Success will be met if 150 planted woody stems per acre are surviving in year 5 of monitoring in the pine plantation area, while 260 planted woody stems per acre must be surviving after 5 years of monitoring in the grassy field area. This lower density in the plantation area is a result of the loblolly pine presence and abundance. The grassy field area will have 2 CVS vegetation plots. In addition, five monitoring wells will be re-installed to collect hydrology data about the site.

The stream portion of the site will be equipped with a crest gage, photo points, and 6 CVS vegetation plots. Stream buffer plots, because they are within the planted pine plantation, will also have a stem density requirement of 150 planted woody stems per acre surviving in year 5 of monitoring to meet success.

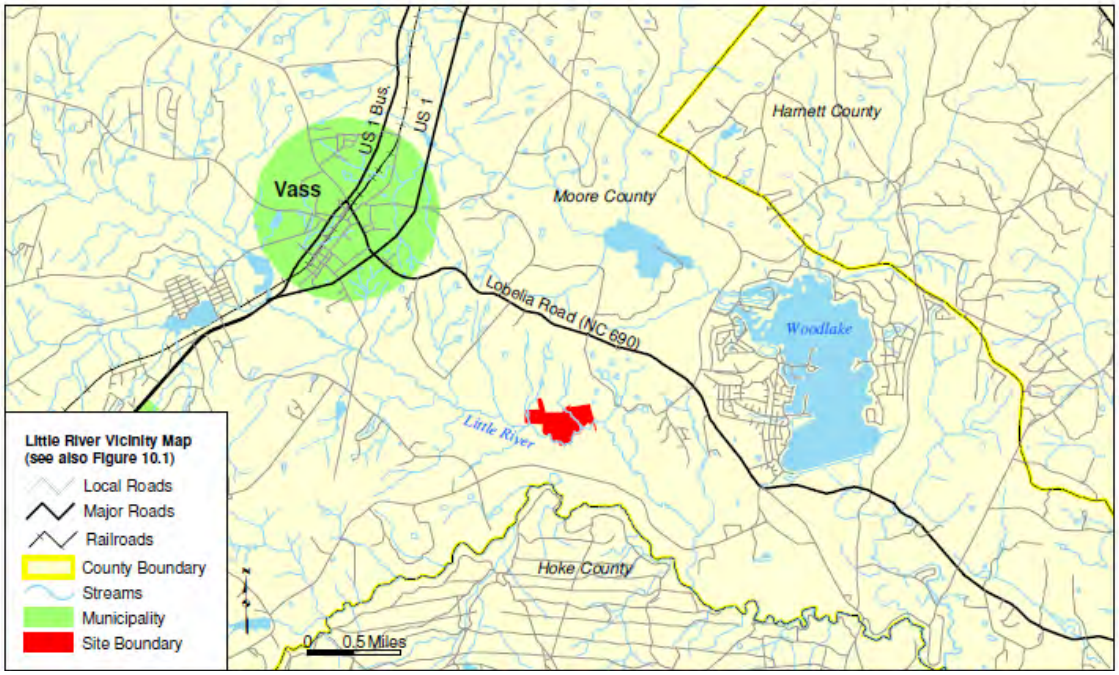
If you have any questions, please feel free to call me at 715-1658.

References

Parker, G.R. and W. T. Swank. *Tree Species Response to Clear-cutting a Southern Appalachian Watershed*, 1982: Coweeta Hydrologic Laboratory, US Forest Service. North Carolina, USA.

Cain, Michael D. and Michael G. Shelton. *Secondary forest succession following reproduction cutting on the Upper Coastal Plain of southeastern Arkansas, USA*, 2000: USDA Forest Service, Southern Research Station, Monticello, Arkansas.

Figure 1.0 Project Vicinity Map and Directions



Directions to Little River project site: *From Raleigh follow US 1 South approximately 50 miles to Vass. Take the NC 690 exit and follow NC 690 east for approximately 2.3 miles. Turn right into project site.*

Figure 2.0 Project Vegetative Communities