Monitoring Report Year 3

Watts Site

DMS Project No. 413
NCDENR Contract # 6113
USACE Action ID SAW-2005-11813
NCDWR Project # 05-1354v2
State Construction Project No. 09-07804-01A-01-1
Perquimans County, NC

Prepared for the
NC Department of Environmental Quality
Division of Mitigation Services

217 West Jones St.
Raleigh, NC 27603

Environmental Quality

North Carolina Department of Environmental Quality
Submission Date: November 2017
Data Collection Date: August 2017 and November 2017

NOT AN INSTRUMENT PROJECT

Prepared by:

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This assessment and report are consistent with NCDENR Division of Mitigation Services Template Version Feb. 2014 for Baseline Monitoring Document Format, Data Requirements and Content Guidance.

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1.0 PROJECT SUMMARY

1.1 Project History and Background

The Watts Property (Site) is in eastern Perquimans County, approximately 13 miles southeast of US-17 on Norma Drive. The Site is owned in fee by the State of North Carolina. To access the Site from Hertford, drive north along US-17 and turn right onto New Hope Rd and follow for approximately 13 miles and turn left on Little River Shores Rd, turn left onto Tuscarora Trail and left on Norma Dr. The Site is on the left approximately 0.1 mile down Norma Dr. It is situated in the Coastal Plain physiographic region and the Pasquotank River Basin (Hydrologic Unit 03010205).

The Site encompasses approximately 48 acres of former agriculture land and has a direct hydrologic connection with the Little River. The Site watershed consists of agricultural land and forest. There is no impervious area within the drainage area. The drainage area for the Site is 136 acres at the lower end of the stream.

Prior to construction activities the stream was deepened and channelized and the surrounding wetland complex was drained for row crop agricultural production. These modifications resulted in significant alterations to surface and groundwater hydrology in addition to degraded aquatic and terrestrial habitats within the Site.

1.2 Project Goals and Objectives

The Site is located in the Pasquotank River Basin; eight digit CU 03010205 and the 14-digit HUC 03010205060020. The Pasquotank River Basin Restoration Priorities (EEP, 2009) restoration goals for CU 03010205 include supporting implementation of the NC Coastal Habitat Protection Plan (NCCHPP). The following are the goals of the NCCHPP:

- Improve effectiveness of existing rules and programs protecting coastal fish habitats
- Identify, designate, and protect strategic habitat areas.
- Enhance habitat and protect it from physical impacts.
- Enhance and protect water quality.

In addition to the above mentioned CU goals the following are Site specific goals established in the mitigation plan (NCDENR, 2012):

- Restore ditched wetlands to improve the habitat, fishery and flood control functions;
- Reduce sediment loading and other pollutants from the surface runoff by increasing the soils retention, filtration and nutrient uptake functions of wetland and riparian areas;
- Restore and protect wildlife corridors and other key links to high value habitat areas; and
- Restore and protect natural breeding, nesting and feeding habitat to promote species richness and diversity.

The goals established in the 2012 mitigation plan were addressed through the following project objectives:

- Promote wetland hydrology by filling drainage ditches;
- Reduce pollutant runoff by grading the headwater valley for increased residence time of stormflows;
- Promote wildlife habitat by reforestation with native hardwoods.

1.3 Project Success Criteria

The stream and wetland restoration success criteria for the Site were established in the approved mitigation plan. The success criteria were discussed with the Interagency Review Team (IRT) during the finalization of the mitigation plan. The agreed upon success criteria are a compromise between the current requirements in the Monitoring Requirements and Performance Standards for Compensatory Mitigation in North Carolina (USACE, 2013) and the success criteria found in the Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina (USACE, 2005) which was the current reference document when the Site was originally acquired for mitigation.

The stream and wetland restoration and enhancement sections of the project were assigned specific performance criteria components for hydrology, vegetation and morphology (streams only). Performance criteria will be evaluated for a minimum of five years post-construction monitoring. If all performance criteria have been met the Division of Mitigation Services (DMS) may propose the Site for closeout after five years of monitoring.

The project success criteria for stream, wetland and vegetation are as follows:

- Stream restoration success includes visual documentation of flow within the low point of the valley, during monitoring years 1-4 and visual documentation of a primary flow path, stream channel or ordinary high water mark, post monitoring year 4;
- Wetland hydrology success will include a minimum of a 8% hydroperiod in years of normal rainfall;
- Vegetation success will include stem densities of 320 stems/acre in MY3 and 260 stems/acre in MY5.

Two pressure transducers were installed but are not related to project success. The information gathered from the transducers will be included in the monitoring report as supplemental data.

1.4 Annual Monitoring Results

The headwater channel was visually assessed two times throughout MY3 for success criteria. During the winter the channel exhibited several visual indicators for the MY 1-4 success criteria. Wrack lines were observed adjacent to the channel, vegetation was laid over in the direction of stream flow, a small bank was starting to form near the upstream portion of the stream, and standing water was also observed (Appendix D). The stream restoration met the success criteria described in the mitigation plan. Additionally, the three (3) cross-sections were stable throughout MY3 and the pressure transducers demonstrated 325 consecutive days of surface water in the restored channel. There were 98 consecutive days with greater than two inches of water in the headwater channel.

Six groundwater gauges were installed to determine the wetland hydroperiod. Four of the six groundwater gauges met the minimum 8% hydroperiod; successful hydroperiods ranged from 10.6% to 52.8%. Two gauges (no. 3 and no. 5) did not meet the success criteria. The on-site rain gauge experienced above average rainfall every month this year with the exception of February. It is expected the Site will continue to recharge groundwater.

Eight CVS vegetation plots and eight random strip plots have been established to monitor vegetation success. The random strip plot totals include planted and volunteer hardwood trees. Seven of the CVS vegetation plots met success criteria of 320 planted stems/acre. Vegetation plot 7 (VP7) did not meet the success criteria with the inclusion of planted and volunteer specimens. The planted densities ranged from 283 to 931 stems per acre. Seven of the eight random plots met the MY3

success criteria; the densities ranged from 90 to 648 stems per acre. Areas with thicker herbaceous vegetation had lower stem densities across the site. A few stems of Bradford pear (*Pyrus calleryana*) were noted throughout the site but are not widespread.

2.0 METHODOLGY

Vegetation plot monitoring data were collected following the standard CVS-EEP Protocol for Recording Vegetation, Level II, Version 4.2 (Lee et al. 2008). Strip plot data was collected in 25m X 4m plots spaced at random throughout the site. The rain gauge, groundwater gauges and pressure transducers are monitored quarterly. Rain data from the CRONOS website, gauge KECG, was used for the months of June, July, and August. The on-site rain gauge was clogged during the month of June and was corrected during the August 16, 2016 site visit. The remaining months utilized the on-site rain data. Information for the CCPV was collected using a Garmin GPS.

3.0 REFERENCES

Lee, Michael T., Peet, Robert K., Steven D., Wentworth, Thomas R. 2008. CVS-EEP Protocol for Recording Vegetation Version 4.2. Available at:http://cvs.bio.unc.edu/protocol/cvs-eep-protocol-v4.2-lev1-2.pdf.

NCDENR Division of Mitigation Services, 2009. Pasquotank River Basin Restoration Priorities, September 2009. Available at http://portal.ncdenr.org/c/document_library/get_file?uuid=336f3816-416e-4ee1-854e-056021e726f8&groupId=60329.

NCDENR Division of Mitigation Services, 2012. Watts Final Mitigation Plan. Prepared by Ecological Engineering, LLP.

NCDENR Division of Mitigation Services, 2014. Annual Monitoring and Closeout Reporting Format, Data Requirements, and Content Guidance. Available at: http://portal.ncdenr.org/c/document_library/get_file?p_l_id=60409&folderId=18877169&name=DLFE-86604.pdf

NCDENR Division of Water Quality (NCDWQ), 2010. Basin Overview, Pasquotank River Subbasin 03-01-52. Available at: http://h20.enr.state.nc.us/tmdl/documents/303d_Report.pdf.

North Carolina State Climate Office, 2010. Elizabeth City Station, Available: http://www.ncclimate.ncsu.edu/cronos/normals.php?station=312719

US Army Corps of Engineers, 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. AD/A176.

US Army Corps of Engineers, 2013. Monitoring Requirements and Performance Standards for Compensatory Mitigation in North Carolina. Wilmington, NC.

US Army Corps of Engineers and NCDENR Division of Water Quality (USACE & NCDWQ), 2005. Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina. Wilmington, NC.

Appendix A

Project Information Tables

Table 1. Project Components and Mitigation Credits
Watts/ 413

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	1,003				20.4	0.04			

Project Components

Project Component	Stationing/Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
UT Little River	10+00 to 25+05	1,505	CPHSR*	Restoration	1,505	1.5:1
Non-Riparian Wetland	n/a	0 ac	n/a	Restoration	20.4	1:1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-riverine			
Restoration	1,505			20.4		26.8
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
HQ Preservation						

BMP Elements

Element	Location	Purpose/Function	Notes

BMP Elements

* CPHSR= Coastal Plain Headwater Stream Restoration (USACE et. al., 2007) BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP = Dry Dentention Pond; FS = Filter Strip; S = Grassed Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer.

Table 2. Project Activity and Reporting History
Watts/ 413

Activity or Report	Data Collection Complete	Completion or Delivery
Mitigation Plan	October-11	November-12
Final Design - Construction Plans	June-10	June-13
Construction		February-15
Temporary S&E Mix Applied to Entire Project Area		June-14
Permanent Seed Mix Applied to Streamside		June-14
Bare Root, Live Stake and Tubling Plantings Applied		December-14 & March-15
Baseline Monitoring Document	January-15 & April-15	May-15
Year 1 Monitoring	December-15	December-15
Warranty Replant	N/A	February-16 & January-17
Year 2 Monitoring	August-16 & November-16	November-16
Year 3 Monitoring	August-17 & November-17	
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contact Table
Watts/ 413

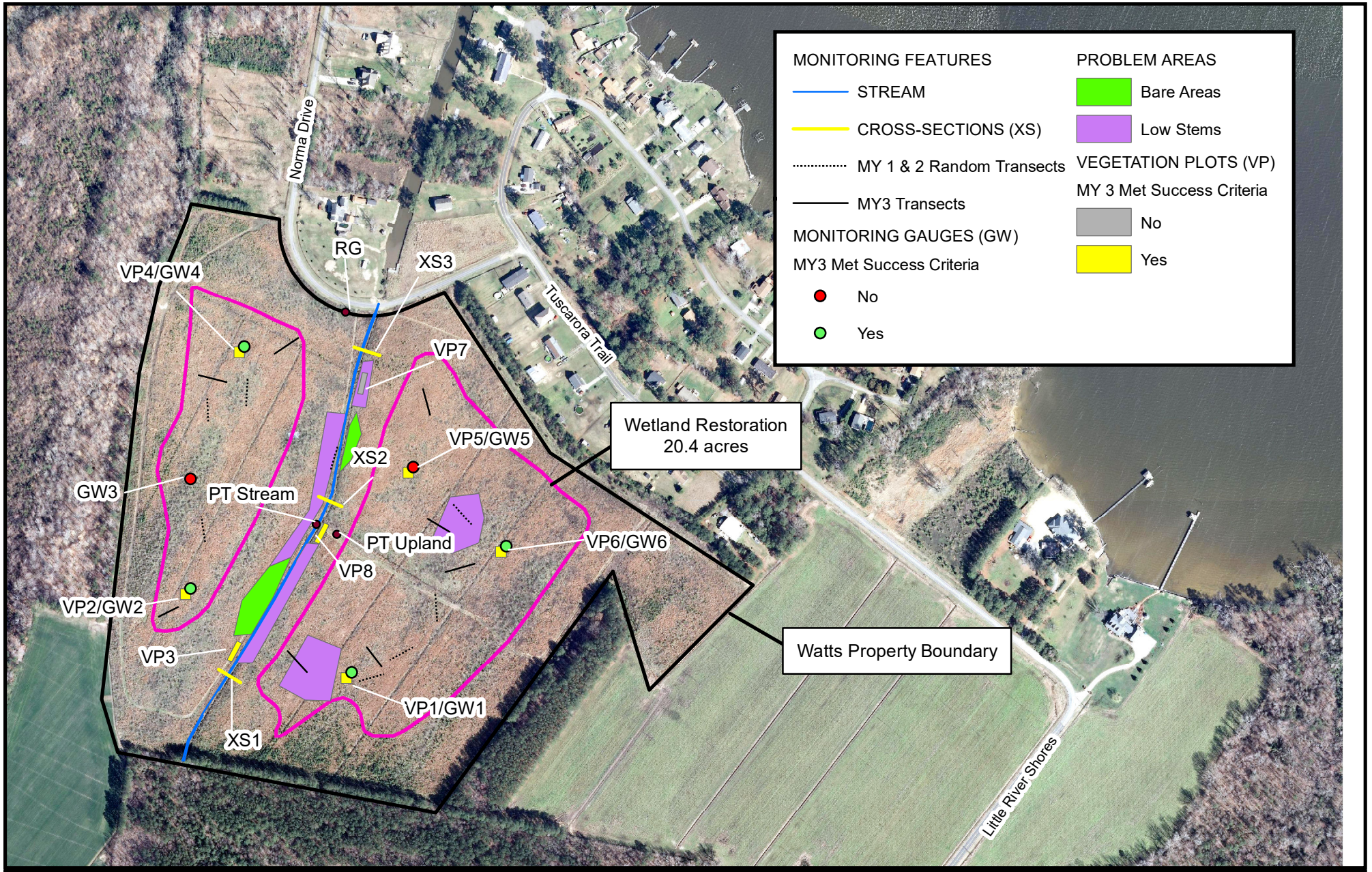
Designer Ecological Engineering, LLP Jenny S. Fleming, PE	**Firm Information/ Address** 1151 SE Cary Parkway Ste. 101, Cary, NC 27518 (919) 557-0929
Construction Contractor River Works, Inc. Bill Wright	**Firm Information/ Address** 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Planting Contractors River Works, Inc. George Morris	**Firm Information/ Address** 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Keller Environmental, LLC Jay Keller	7921 Haymarket Ln. Raleigh, NC 27615 919-749-8259
Seeding Contractor River Works, Inc. George Morris	**Firm Information/ Address** 8000 Regency Parkway, Suite 800, Cary, NC 27518 (919) 459-9001
Seed Mix Sources	Green Resource (336) 855-6363
Nursery Stock Suppliers	ArborGen (843) 851-4129 Claridge Nursery 919-857-4801 Dykes and Son Nursery 931-668-8833
Monitoring Performer Ecological Engineering, LLP G. Lane Sauls Jr. (stream, vegetation & wetland)	**Firm Information/ Address** 1151 SE Cary Parkway Ste. 101, Cary, NC 27518 (919) 557-0929

Table 4. Project Baseline Information and Attributes
Watts/ 413

Project Information			
Project Name	Watts		
County	Perquimans County		
Project Area	48.09 acres		
Project Coordinates (latitude and longitude)	36.1652791 N and 76.2676037 W		
Project Watershed Summary Information			
Physiographic Province	Coastal Plain		
River Basin	Pasquotank		
USGS Hydrologic Unit 8-digit	3010205	USGS Hydrologic Unit 14-digit	3010205060020
DWQ Subbasin	03-01-52		
Project Drainage Area	136 acres		
Project Drainage Area Percentage of Impervious Area	0 acres		
CGIA Land Use Classification	Agricultural Land		
Reach Summary Information			
Parameters	**Reach 1 (upper)**	**Reach 2**	
Length of Reach	750	755	
Valley Classification	n/a	n/a	
Drainage Area	110	136	
NCDWQ Stream ID Score	25	33.25	
NCDWQ Water Quality Classification	SC (receiving water)	SC (receiving water)	
Morphological Description (stream type)	G5 or similar	G5 or similar	
Evolutionary Trend	C to G to F	C to G to F	
Underlying Mapped Soils	Roanoke silt loam	Roanoke silt loam	
Drainage Classification	Poorly drained	Poorly drained	
Soil Hydric Status	Hydric A	Hydric A	
Slope	< 2%	< 2%	
FEMA Classification	Zone AE	Zone AE	
Native Vegetation Community	N/A	N/A	
Percent Composition of Exotic Invasive Species	< 5%	< 5%	
Wetland Summary Information			
Size of Wetland	0.06 acre		
Wetland Type	Hardwood Flat (NCWAM)		
Mapped Soil Series	Roanoke silt loam		
Drainage Classification	Poorly drained		
Soil Hydric Status	Hydric A		
Source of Hydrology	Groundwater and Surface		
Hydrologic Impairment	Clay confining layer		
Native Vegetation Community	N/A		
Percent Composition of Exotic Invasive Species	< 5%		
Regulatory Considerations			
	Applicable	**Resolved/ Supporting Documentation**	
Waters of the United States - Section 404	Yes	Resolved/ 404 Permit	
Waters of the United States - Section 401	Yes	Resolved/401 Permit	
Endangered Species Act	Yes	Resolved/Categorical Exclusion	
Historic Preservation Act	Yes	Resolved/Categorical Exclusion	
Coastal Zone/Area Management Acts (CZMA/CAMA)	Yes	Resolved/Email from CAMA	
FEMA Floodplain Compliance	Yes	Resolved/EEP Flood Checklist	
Essential Fisheries Habitat	Yes	Resolved/Categorical Exclusion	

Appendix B

Visual Assessment Data



Prepared For:

Environmental Quality

Figure 1: Current Condition Plan View (CCPV)
Watts Property
DMS Project # 413
Monitoring Year 3

Perquimans County

0 400 800

1" = 400'

N W E S

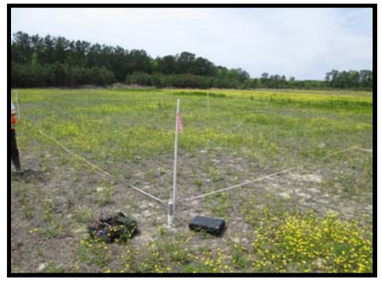
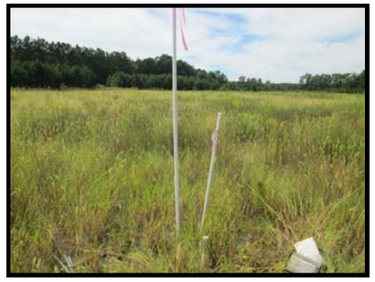
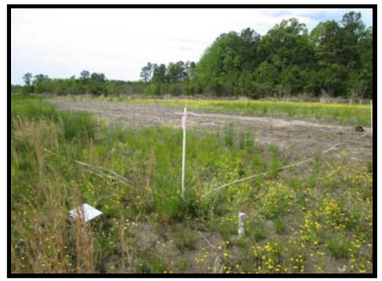
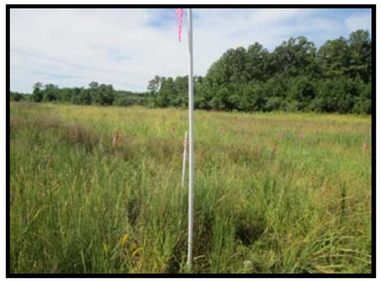
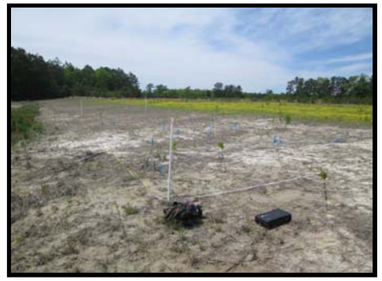
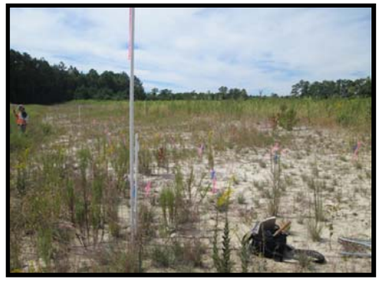
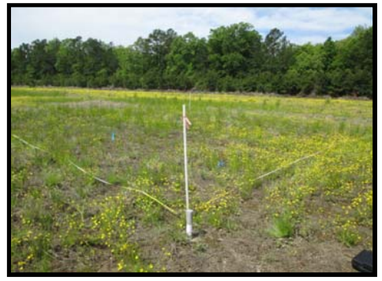
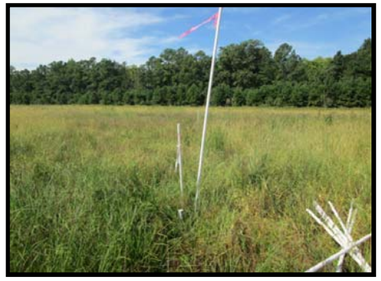
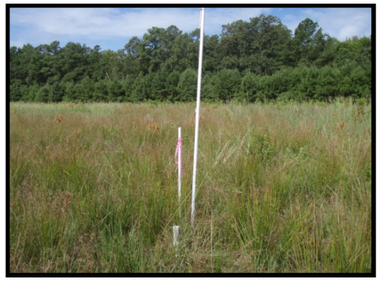
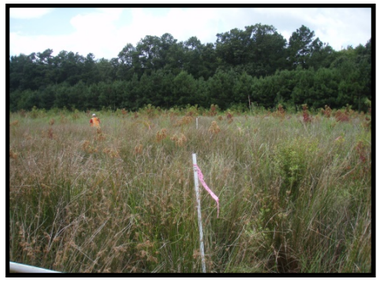
Table 5. Vegetation Condition Assessment Watts DMS # 413

Planted Acreage 23.9 **Easement Acreage 48.1**

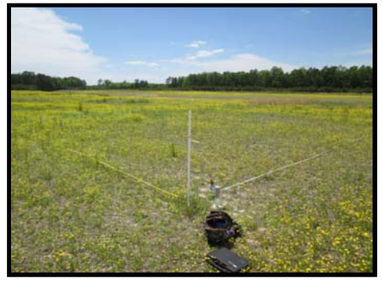
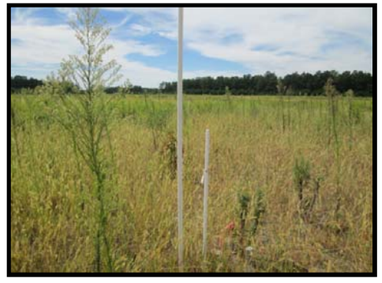
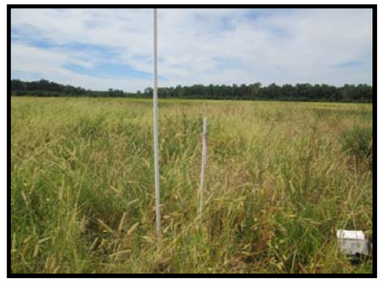
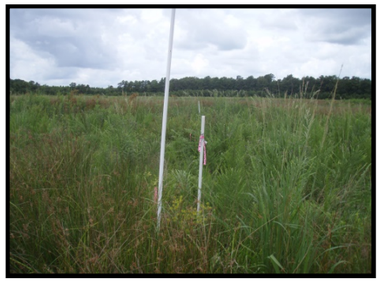
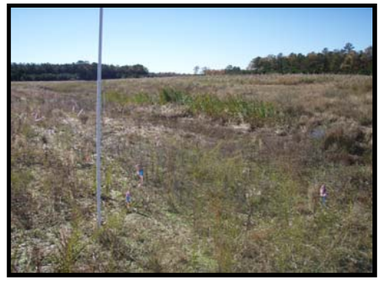
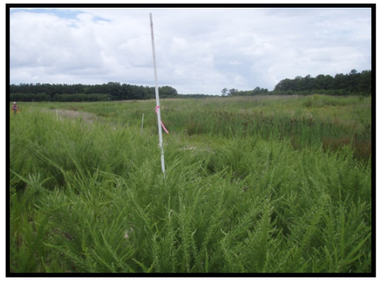
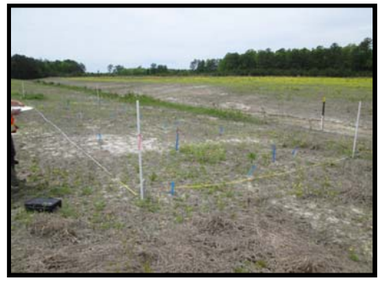
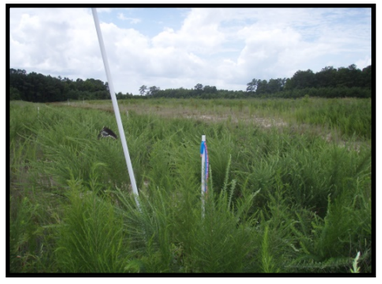
Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material	0.1 ac	Yes	2	0.47	1.97%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY 3, 4, or 5 stem count criteria	0.1 ac	Yes	4	2.01	8.41%
			Total	**6**	**2.48**	**10.38%**
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that is obviously small given the monitoring year	0.25 ac	n/a	0	0	0%
			Cumulative Total	**6**	**2.48**	**10.38%**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% Planted Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale)	0.1 ac	No	0	0	0.0%
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale)	0.1 ac	No	0	0	0.0%

Photostation Comparison
Watts- MY 3 (2017)

Photo # and Location	Baseline Condition 2015	MY 1 2015 (9/16/2015)	MY 2 2016 (8/4/2016)	MY 3 2017 (8/16/2017)
Photostation 1. Facing southwest along diagonal of Vegetation Plot 1.				
Photostation 2. Facing southwest along diagonal of Vegetation Plot 2.				
Photostation 3. Facing southwest along diagonal of Vegetation Plot 3.				
Photostation 4. Facing southwest along diagonal of Vegetation Plot 4.				

Photostation Comparison - Page 2

	Baseline Condition 2015	MY 1 2015 (9/16/2015)	MY 2 2016 (8/4/2016)	MY 2 2016 (8/16/2017)
Photostation 5. Facing southwest along diagonal of Vegetation Plot 5				
Photostation 6. Facing southwest along diagonal of Vegetation Plot 6.				
Photostation 7. Facing southwest along diagonal of Vegetation Plot 7.				
Photostation 8. Facing southwest along diagonal of Vegetation Plot 8.				

Appendix C

Vegetation Data

Table 6. Vegetation Plot Criteria Attainment
Watts DMS # 413

Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
1	Yes	88%
2	Yes	
3	Yes	
4	Yes	
5	Yes	
6	Yes	
7	No	
8	Yes	

Table 7. CVS Vegetation Plot Metadata Watts-UT Little River DMS # 413	
Report Prepared By	Heather Smith
Date Prepared	8/17/2017 13:22
database name	EcologicalEngineering-2017-WattsYear-3.mdb
database location	P:\50000 State\EEP 50512\50512-010 Watts Monitoring\Reports\MY3_2017
computer name	WKST7
file size	45608960
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
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 listed by species.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY	
Project Code	413
project Name	Watts-UT Little River
Description	Stream and Wetland
River Basin	Pasquotank
length(ft)	1,505
Required Plots (calculated)	8
Sampled Plots	8

Table 8. Planted and Total Stems

Project Name: Watts #413

			Current Plot Data (MY3 2017)																						
			413-01-0001			413-01-0002			413-01-0003			413-01-0004			413-01-0005			413-01-0006			413-01-0007			413-01-0008		
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
Acer rubrum	red maple	Tree							1	1	1	4	4	4	2	2	2				2	2	2	6	6	6
Baccharis halimifolia	eastern baccharis	Shrub																								
Betula nigra	river birch	Tree	1	1	1							1	1	1												
Carpinus caroliniana	American hornbeam	Tree							1	1	1													1	1	1
Carya	hickory	Tree																								1
Cornus florida	flowering dogwood	Tree							2	2	2															
Diospyros virginiana	common persimmon	Tree										1	1	1												
Fraxinus pennsylvanica	green ash	Tree										1	1	1												
Liquidambar styraciflua	sweetgum	Tree			2			2			1			2												
Morella cerifera	wax myrtle	shrub																								
Nyssa sylvatica	blackgum	Tree	2	2	2				1	1	1				2	2	2									
Pinus taeda	loblolly pine	Tree																								
Quercus	oak	Tree													1	1	1	3	3	3						
Quercus alba	white oak	Tree																						2	2	2
Quercus lyrata	overcup oak	Tree	6	6	6										3	3	3	3	3	3				10	10	10
Quercus michauxii	swamp chestnut oak	Tree							3	3	3										4	4	4			
Quercus nigra	water oak	Tree																3	3	3						
Quercus pagoda	cherrybark oak	Tree							1	1	1										1	1	1			
Quercus phellos	willow oak	Tree	2	2	2																			2	2	2
Quercus rubra	northern red oak	Tree							1	1	1													2	2	2
Rhus copallinum	flameleaf sumac	shrub																		2						
Taxodium distichum	bald cypress	Tree				10	10	10				1	1	1												
Unknown		Shrub or Tree													1	1	1									
Vaccinium stamineum	deerberry	Shrub																								
		Stem count	11	11	13	10	10	12	10	10	11	8	8	10	9	9	9	9	9	11	7	7	7	23	23	24
		size (ares)	1			1			1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	5	1	1	2	7	7	8	5	5	6	5	5	5	3	3	4	3	3	3	6	6	7
		Stems per ACRE	445.1542	445.1542	526.0913	404.6856	404.6856	485.6228	404.6856	404.6856	445.1542	323.7485	323.7485	404.6856	364.2171	364.2171	364.2171	364.2171	364.2171	445.1542	283.2799	283.2799	283.2799	930.777	930.777	971.2455

Table 8. Planted and Total Stems
Project Name: Watts #413

Scientific Name	Common Name	Species Type	Annual Means											
			MY3 (2017)			MY2 (2016)			MY1 (2015)			MY0 (2015)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree	15	15	15	18	18	19	19	19	19	20	20	20
Baccharis halimifolia	eastern baccharis	Shrub						91			6			2
Betula nigra	river birch	Tree	2	2	2	4	4	4	3	3	3	3	3	3
Carpinus caroliniana	American hornbeam	Tree	2	2	2	4	4	4	5	5	5	5	5	5
Carya	hickory	Tree			1			2						
Cornus florida	flowering dogwood	Tree	2	2	2	4	4	4	5	5	5	8	8	8
Diospyros virginiana	common persimmon	Tree	1	1	1	1	1	1	2	2	2	2	2	2
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1	1	1	1	1	1	1
Liquidambar styraciflua	sweetgum	Tree			7			8			6			3
Morella cerifera	wax myrtle	shrub						1						
Nyssa sylvatica	blackgum	Tree	5	5	5	8	8	8	8	8	8	8	8	8
Pinus taeda	loblolly pine	Tree						7						
Quercus	oak	Tree	4	4	4	10	10	10	22	22	24	34	34	34
Quercus alba	white oak	Tree	2	2	2	3	3	3	3	3	3	1	1	1
Quercus lyrata	overcup oak	Tree	22	22	22	17	17	17	15	15	15	15	15	15
Quercus michauxii	swamp chestnut oak	Tree	7	7	7	10	10	10	11	11	11	11	11	11
Quercus nigra	water oak	Tree	3	3	3	3	3	3						
Quercus pagoda	cherrybark oak	Tree	2	2	2	3	3	3	3	3	3	2	2	2
Quercus phellos	willow oak	Tree	4	4	4	4	4	4	4	4	4	2	2	2
Quercus rubra	northern red oak	Tree	3	3	3	3	3	3	1	1	1	2	2	2
Rhus copallinum	flameleaf sumac	shrub			2									
Taxodium distichum	bald cypress	Tree	11	11	11	11	11	11	12	12	12	12	12	12
Unknown		Shrub or Tree	1	1	1	1	1	1	5	5	5	8	8	8
Vaccinium stamineum	deerberry	Shrub										2	2	2
		Stem count	87	87	97	105	105	215	119	119	133	136	136	141
		size (ares)	8			8			8			8		
		size (ACRES)	0.20			0.20			0.20			0.20		
		Species count	17	17	20	17	17	22	16	16	18	17	17	19
		Stems per ACRE	440.0956	440.0956	490.6813	531.1499	531.1499	1087.593	601.9699	601.9699	672.7899	687.9656	687.9656	713.2584

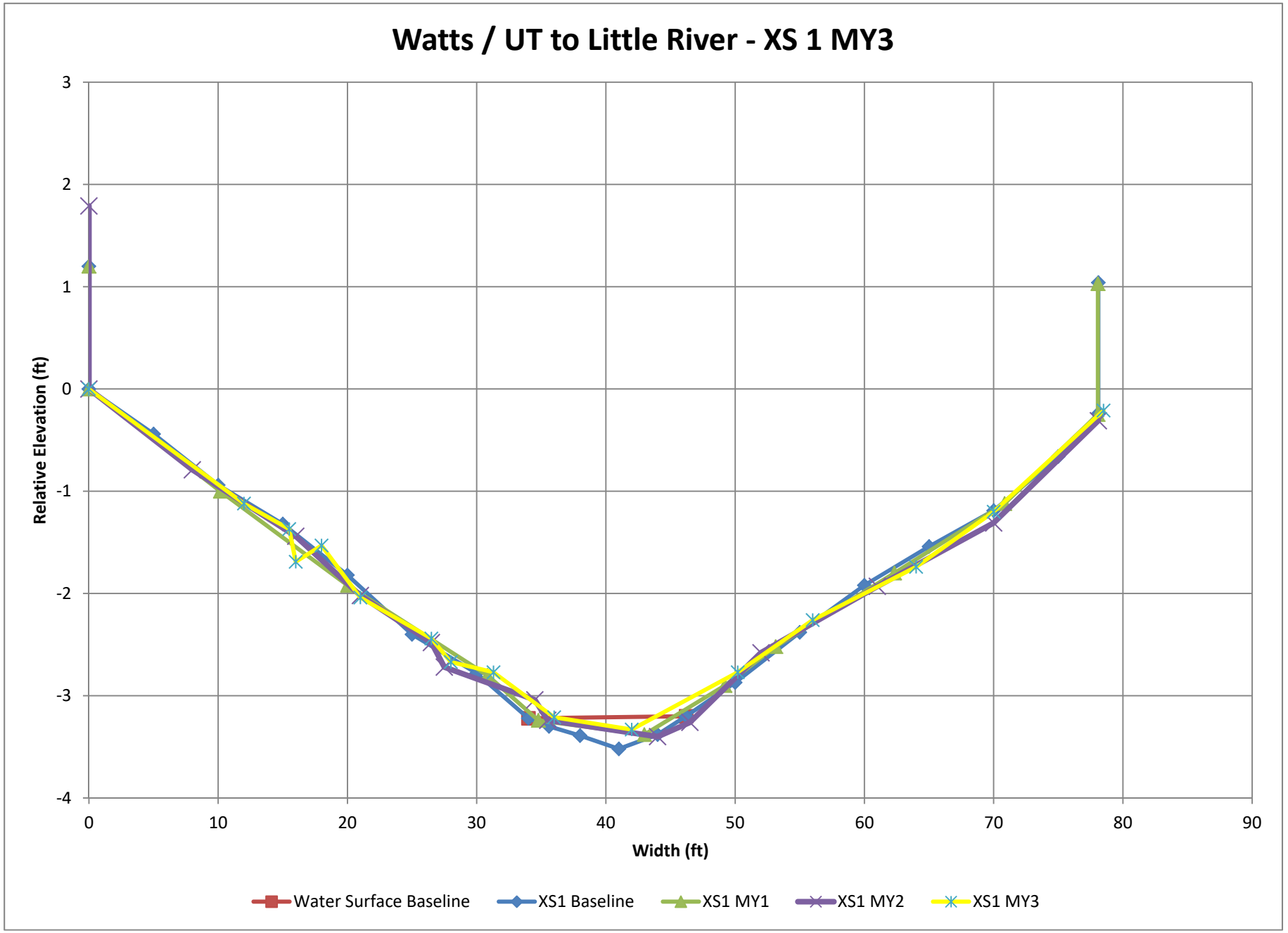
Table 9. Random Vegetation Strip Plots

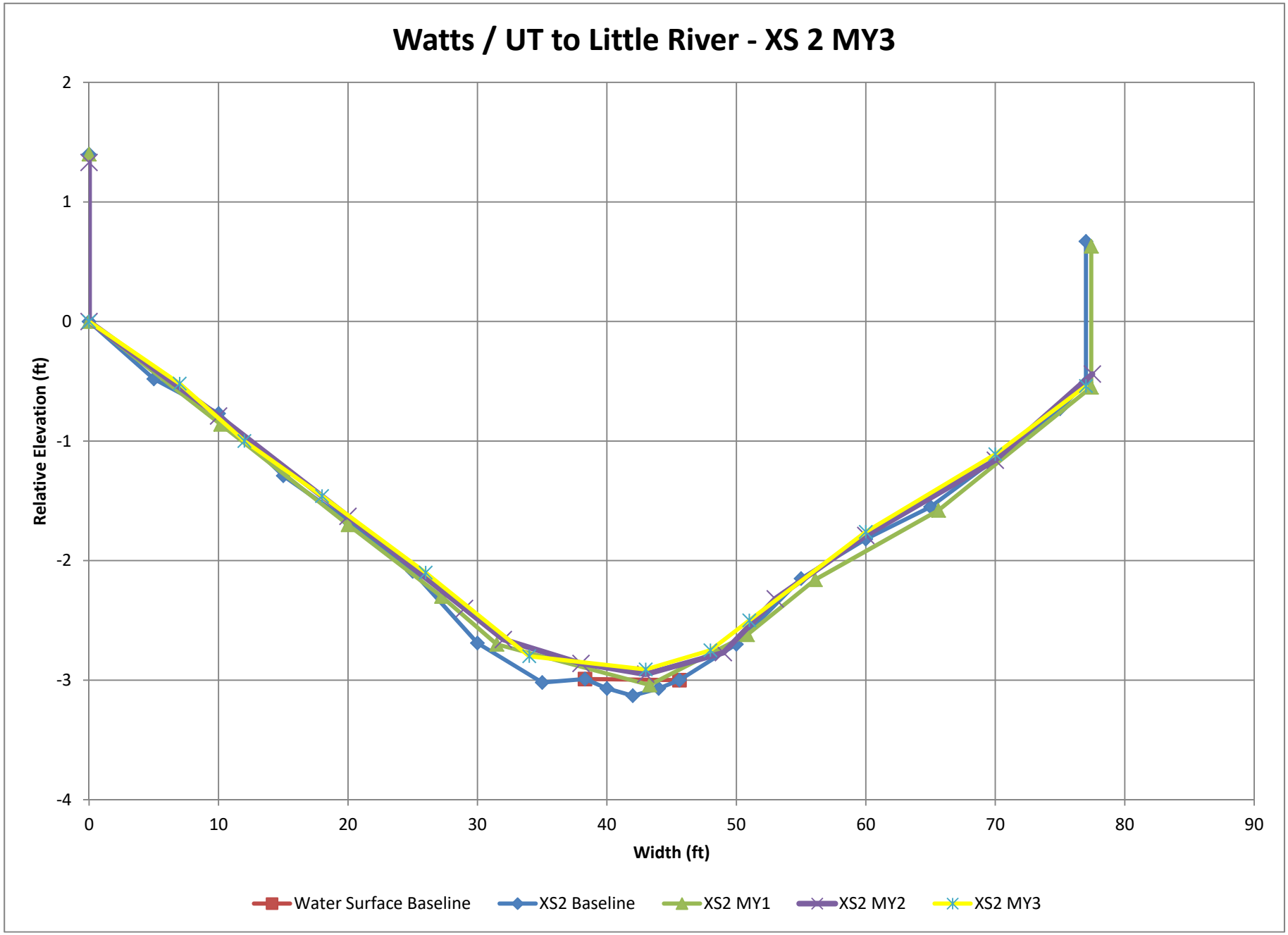
Strip Plot ID	Stems	Stem/Acre	Success Criteria Met
1	16	647.8	Yes
2	11	445.3	Yes
3	16	647.8	Yes
4	10	404.9	Yes
5	11	445.3	Yes
6	10	404.9	Yes
7	2	90.0	No
8	11	445.3	Yes

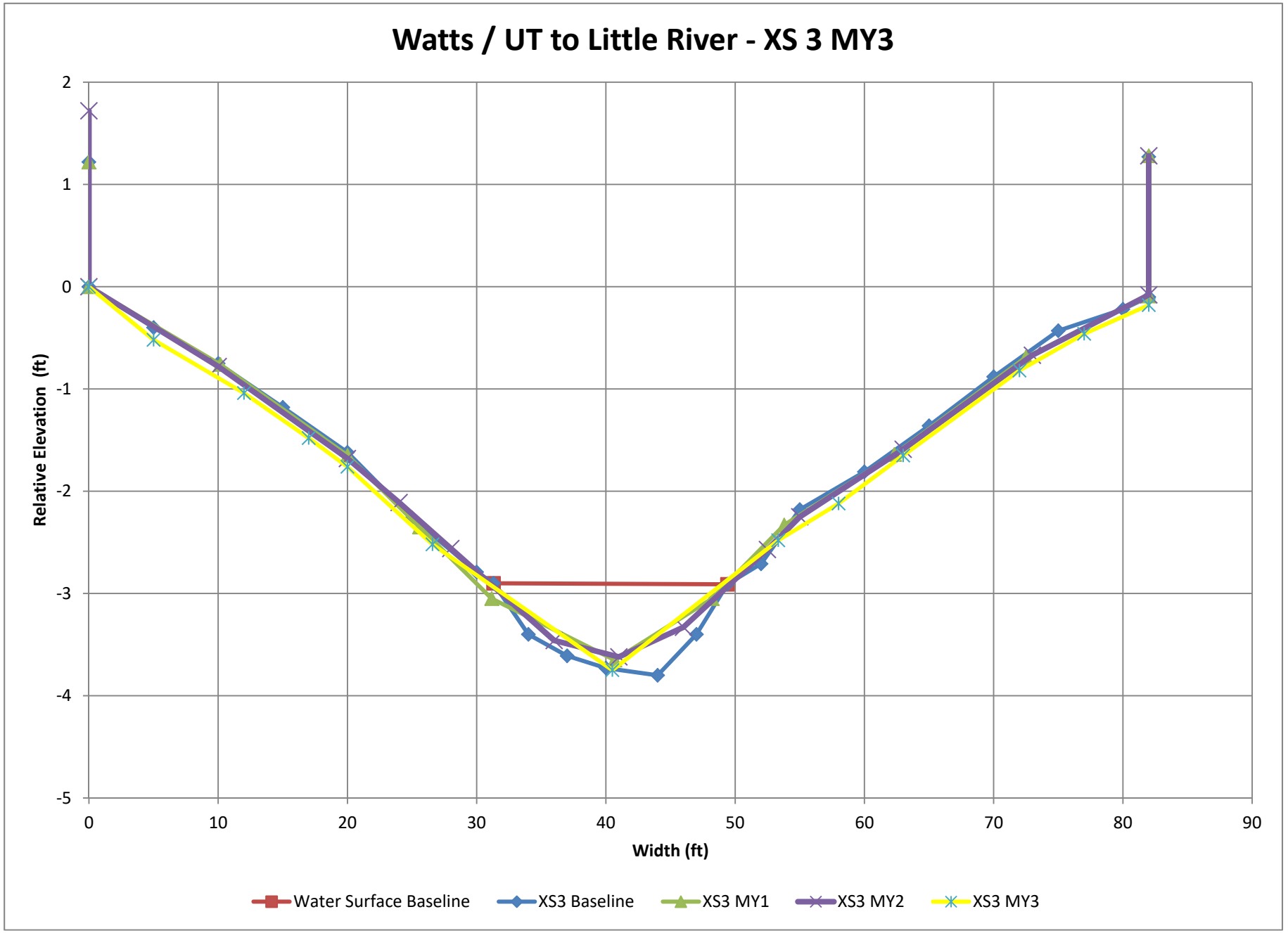
Note: Plot size is 0.0247 acres ($100m^2$)

Appendix D

Stream Geomorphology


Watts / UT to Little River - XS 1 MY3
Relative Elevation (ft)
3
2
1
0
-1
-2
-3
-4
0
10
20
30
40
50
60
70
80
90
Width (ft)
Water Surface Baseline
XS1 Baseline
XS1 MY1
XS1 MY2
XS1 MY3


Watts / UT to Little River - XS 2 MY3
Relative Elevation (ft)
2
1
0
-1
-2
-3
-4
0
10
20
30
40
50
60
70
80
90
Width (ft)
Water Surface Baseline
XS2 Baseline
XS2 MY1
XS2 MY2
XS2 MY3


Watts / UT to Little River - XS 3 MY3
Relative Elevation (ft)
2
1
0
-1
-2
-3
-4
-5
0
10
20
30
40
50
60
70
80
90
Width (ft)
Water Surface Baseline
XS3 Baseline
XS3 MY1
XS3 MY2
XS3 MY3

Stream Formation Photos MY 3

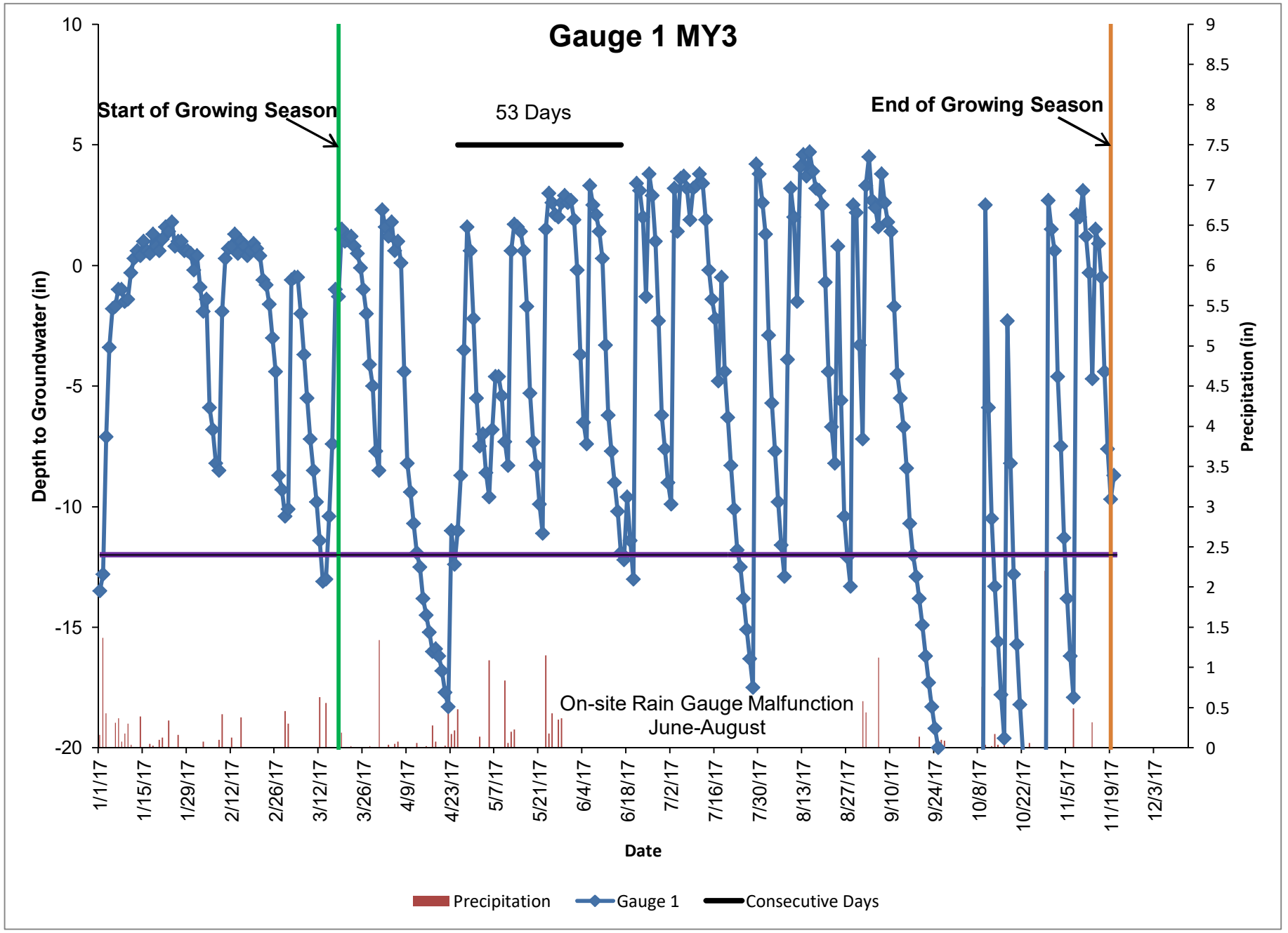
Bank formation near VP 3 3-15-2017

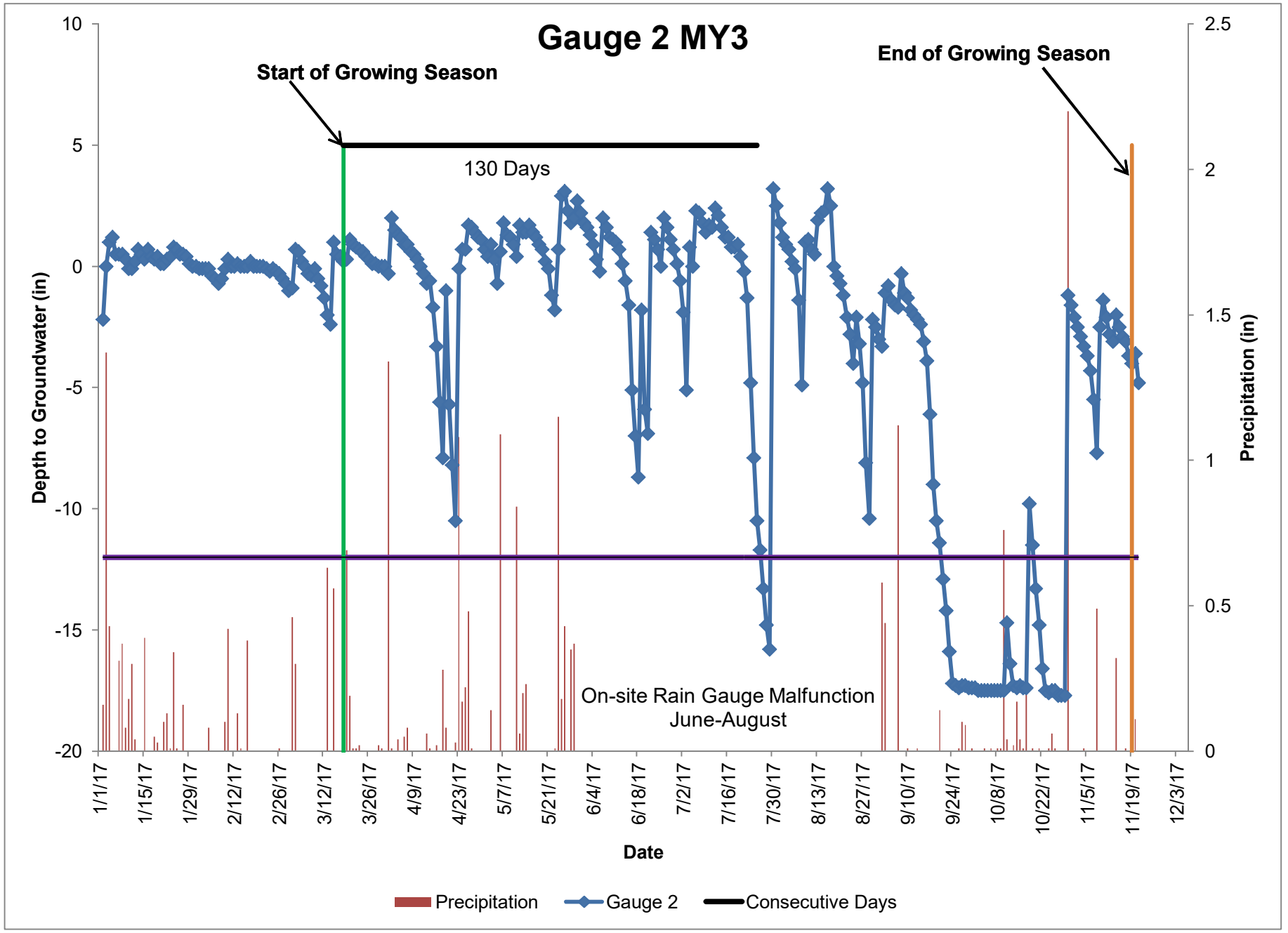
Flow Path 3-15-2017

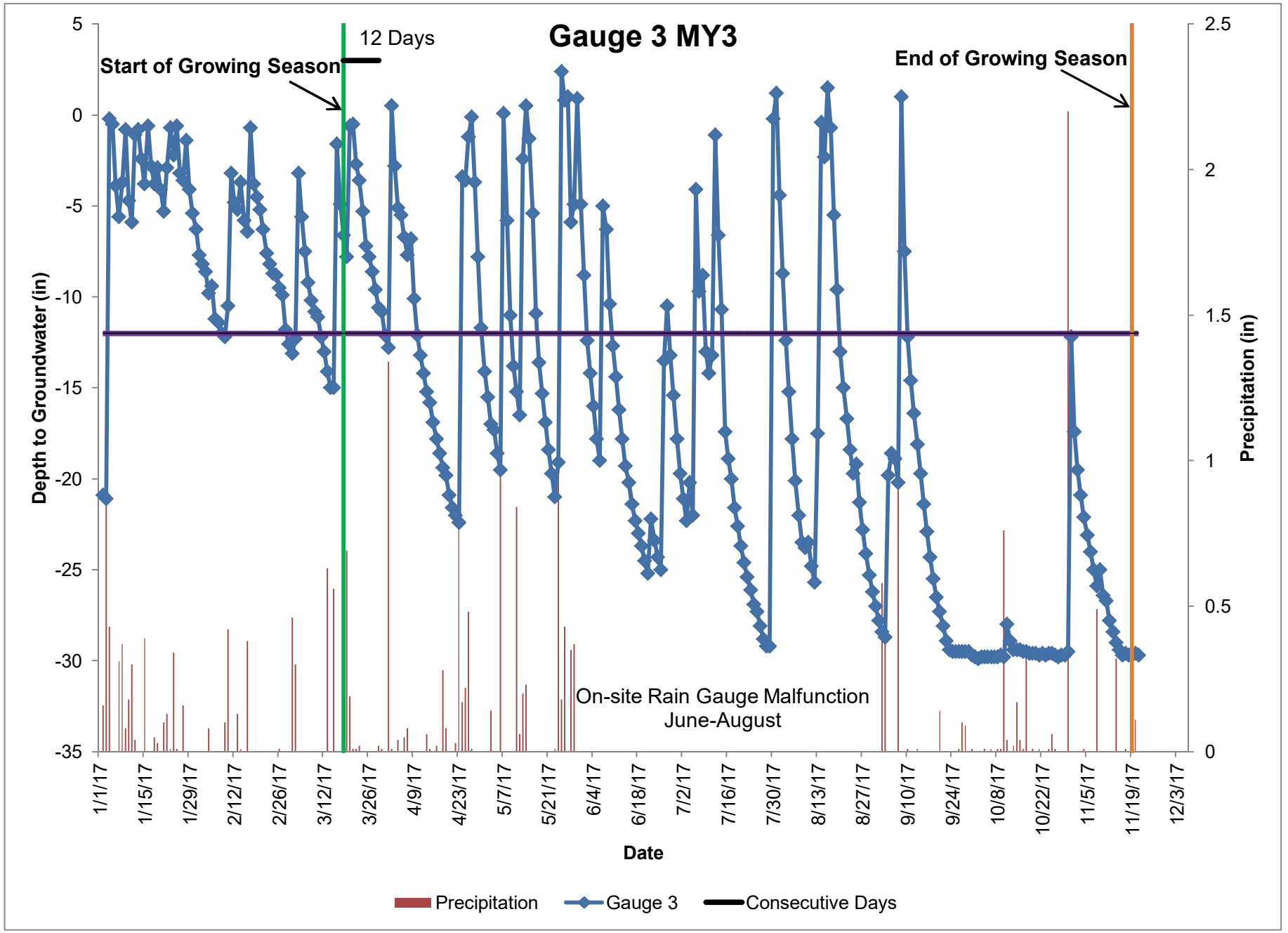
Upstream portion: Evidence of flow 3-15-2017

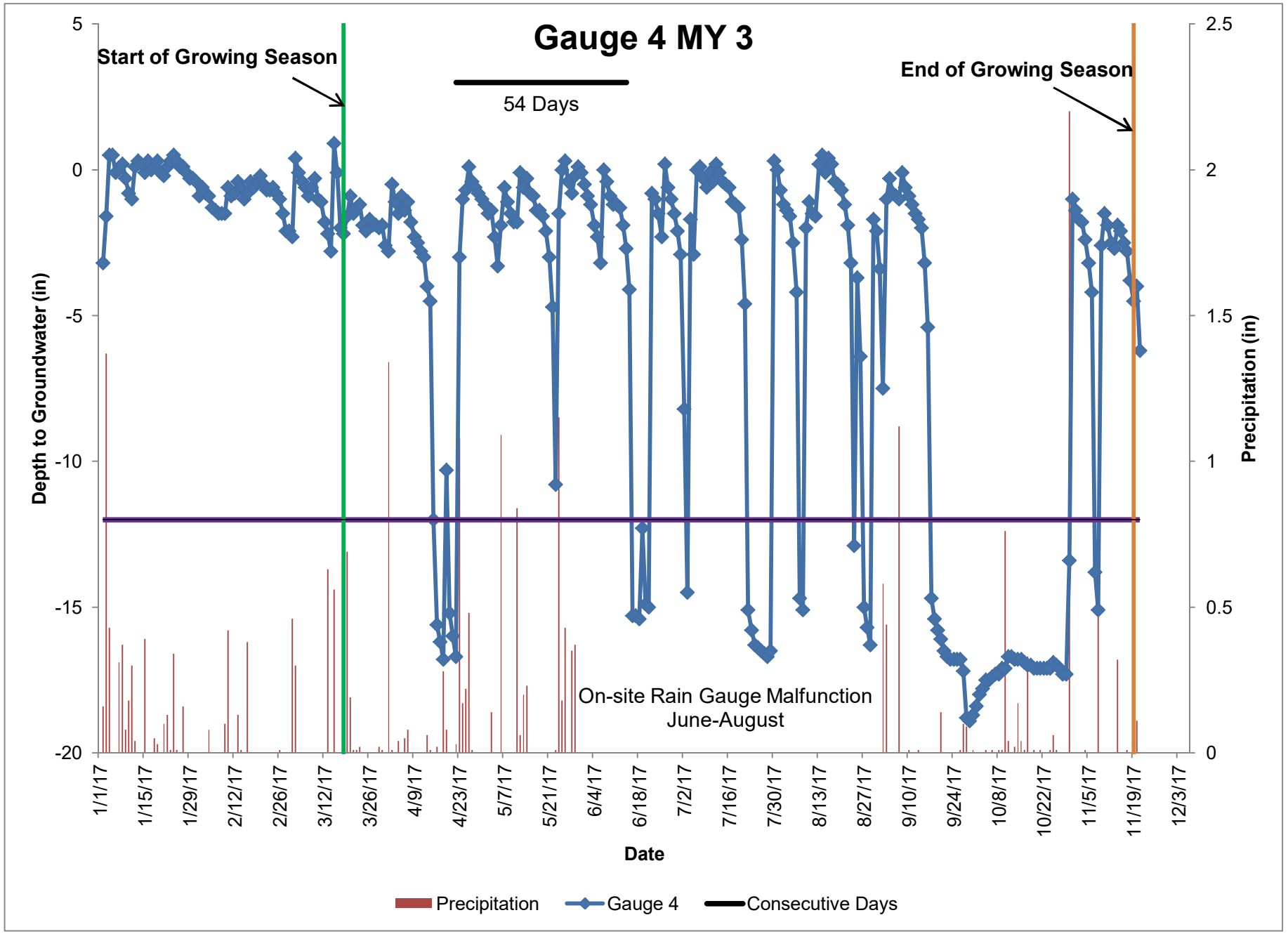
Appendix E

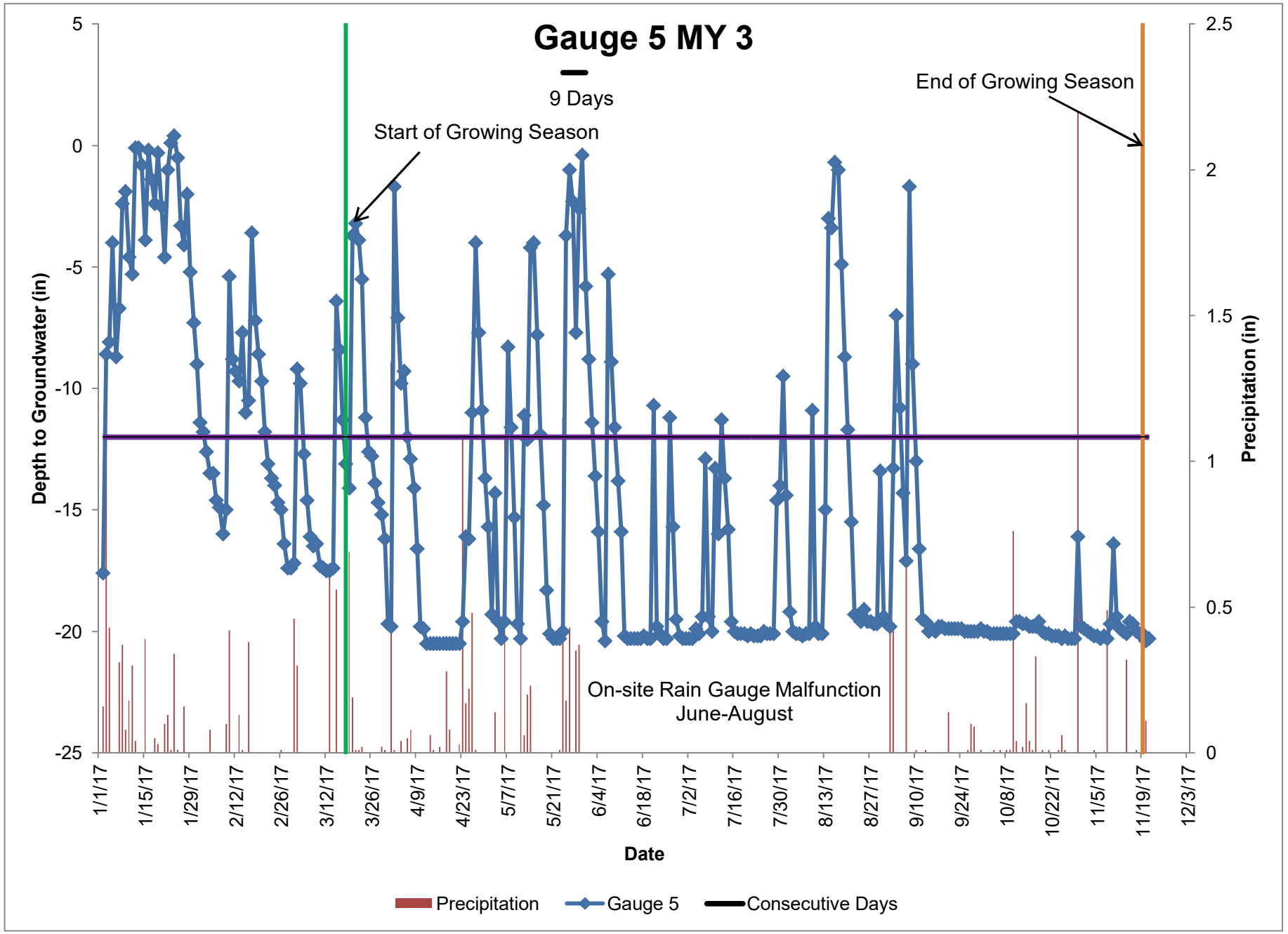
Hydrology Data


Gauge 1 MY3
Start of Growing Season
53 Days
End of Growing Season
On-site Rain Gauge Malfunction
June-August
Depth to Groundwater (in)
Precipitation (in)
Date
10
5
0
-5
-10
-15
-20
9
8.5
8
7.5
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
1/1/17
1/15/17
1/29/17
2/12/17
2/26/17
3/12/17
3/26/17
4/9/17
4/23/17
5/7/17
5/21/17
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
Precipitation
Gauge 1
Consecutive Days


Gauge 2 MY3
Start of Growing Season
End of Growing Season
130 Days
On-site Rain Gauge Malfunction
June-August
Depth to Groundwater (in)
Precipitation (in)
Date
10
5
0
-5
-10
-15
-20
2.5
2
1.5
1
0.5
0
1/1/17
1/15/17
1/29/17
2/12/17
2/26/17
3/12/17
3/26/17
4/9/17
4/23/17
5/7/17
5/21/17
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
Precipitation
Gauge 2
Consecutive Days


Gauge 3 MY3
12 Days
Start of Growing Season
End of Growing Season
On-site Rain Gauge Malfunction
June-August
Depth to Groundwater (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
-30
-35
2.5
2
1.5
1
0.5
0
1/1/17
1/15/17
1/29/17
2/12/17
2/26/17
3/12/17
3/26/17
4/9/17
4/23/17
5/7/17
5/21/17
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
Precipitation
Gauge 3
Consecutive Days


Gauge 4 MY 3
Start of Growing Season
54 Days
End of Growing Season
On-site Rain Gauge Malfunction
June-August
Depth to Groundwater (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
2.5
2
1.5
1
0.5
0
1/1/17
1/15/17
1/29/17
2/12/17
2/26/17
3/12/17
3/26/17
4/9/17
4/23/17
5/7/17
5/21/17
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
Precipitation
Gauge 4
Consecutive Days


Gauge 5 MY 3
9 Days
Start of Growing Season
End of Growing Season
On-site Rain Gauge Malfunction
June-August
Depth to Groundwater (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
-25
2.5
2
1.5
1
0.5
0
1/1/17
1/15/17
1/29/17
2/12/17
2/26/17
3/12/17
3/26/17
4/9/17
4/23/17
5/7/17
5/21/17
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
Precipitation
Gauge 5
Consecutive Days

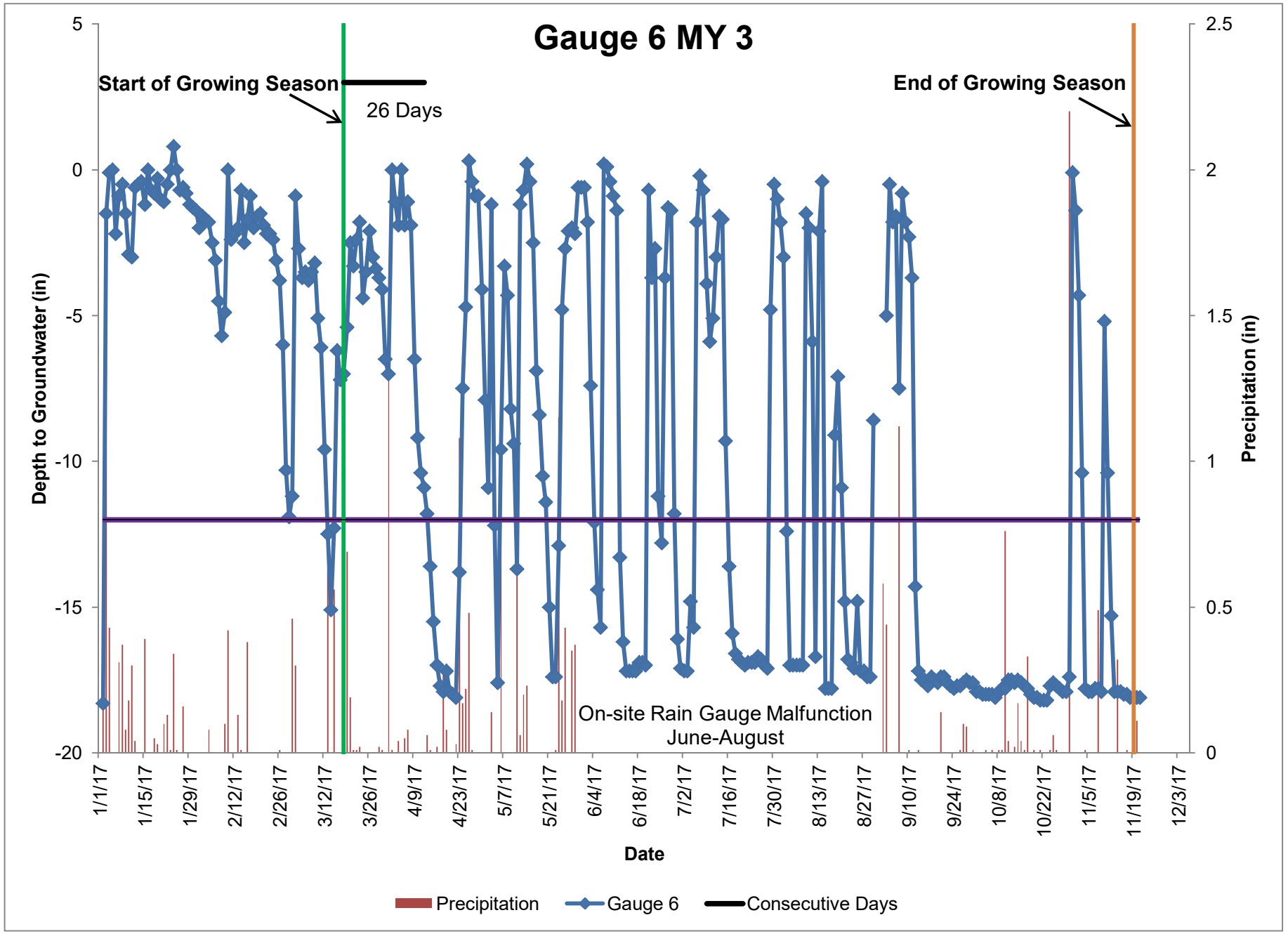
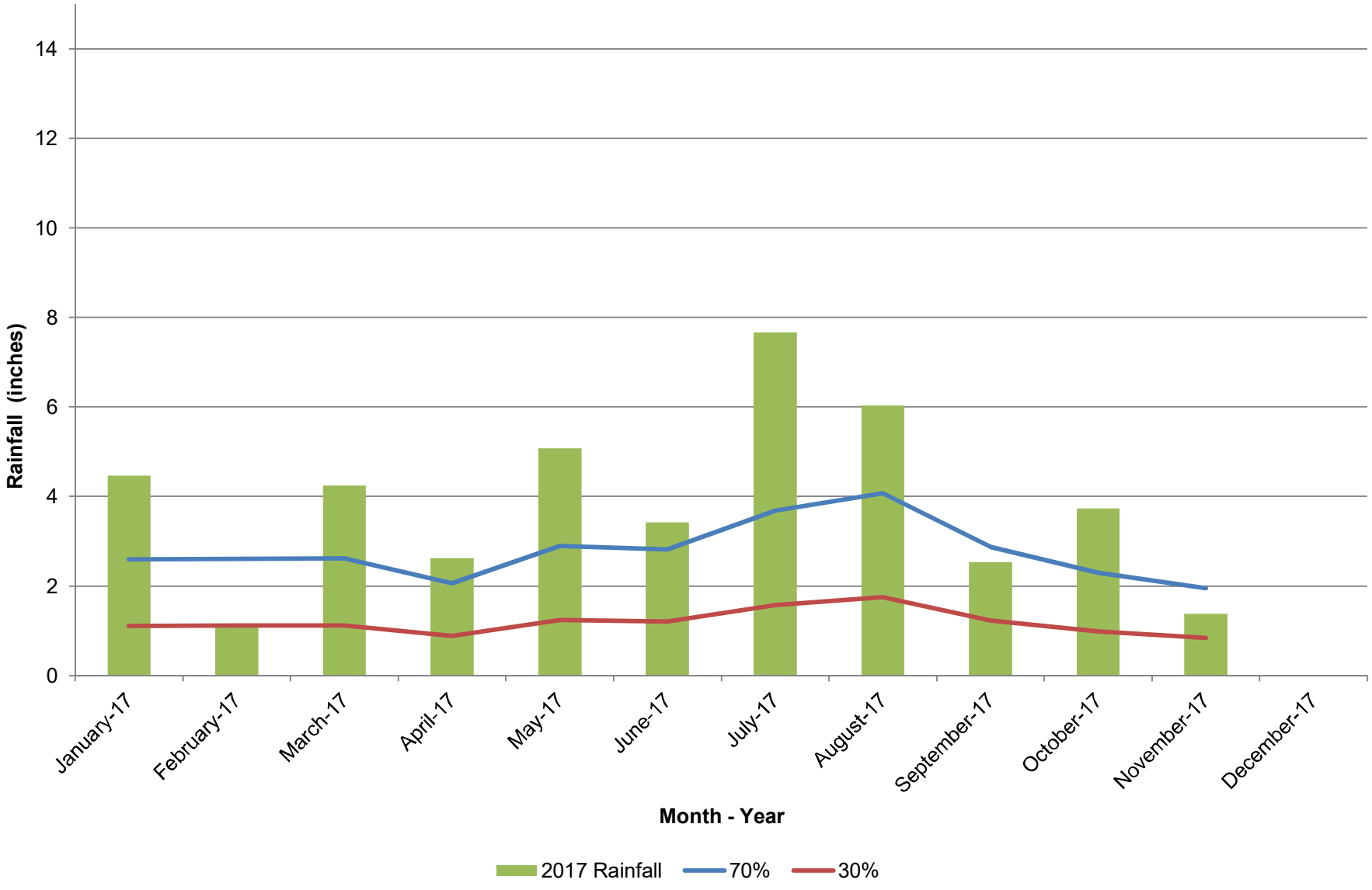
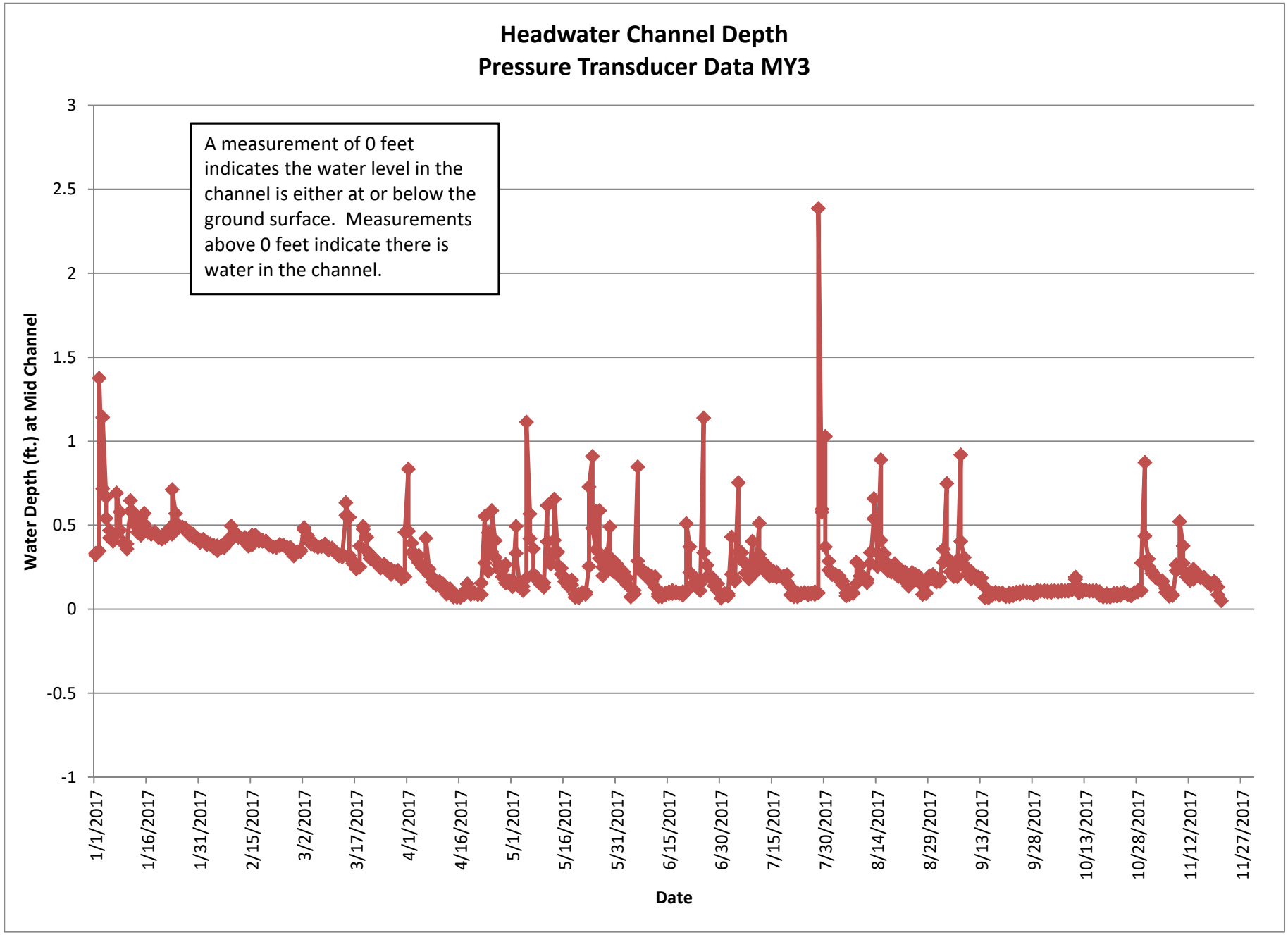

Gauge 6 MY 3
Start of Growing Season
26 Days
End of Growing Season
On-site Rain Gauge Malfunction
June-August
Depth to Groundwater (in)
Precipitation (in)
Date
5
0
-5
-10
-15
-20
2.5
2
1.5
1
0.5
0
1/1/17
1/15/17
1/29/17
2/12/17
2/26/17
3/12/17
3/26/17
4/9/17
4/23/17
5/7/17
5/21/17
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
Precipitation
Gauge 6
Consecutive Days

Table 10.	Wetland Hydrology Attainment Table Watts Stream and Wetland Restoration DMS #413				
	Greater than 8% Continuous Saturation				
Gauge #	MY- 1 2015	MY- 2 2016	MY- 3 2017	MY- 4 2018	MY- 5 2019
1	Yes/25 10.2%	Yes/54 22.0%	Yes/53 21.5%		
2	Yes/63 25.6%	Yes/65 26.4%	Yes/130 52.8%		
3	No/7 2.8%	No/12 4.9%	No/12 4.9%		
4	Yes/71 28.9%	Yes/46 18.7%	Yes/54 22.0%		
5	No/8 3.3%	No/10 4.1%	No/9 3.7%		
6	Yes/25 10.2%	Yes/61 24.8%	Yes/26 10.6%		

Growing season is assumed to be 246 days

Watts Property Monitoring Year 3
2017 Monthly Precipitation Data 30/70 Graph




Headwater Channel Depth
Pressure Transducer Data MY3
A measurement of 0 feet indicates the water level in the channel is either at or below the ground surface. Measurements above 0 feet indicate there is water in the channel.
Water Depth (ft.) at Mid Channel
3
2.5
2
1.5
1
0.5
0
-0.5
-1
1/1/2017
1/16/2017
1/31/2017
2/15/2017
3/2/2017
3/17/2017
4/1/2017
4/16/2017
5/1/2017
5/16/2017
5/31/2017
6/15/2017
6/30/2017
7/15/2017
7/30/2017
8/14/2017
8/29/2017
9/13/2017
9/28/2017
10/13/2017
10/28/2017
11/12/2017
11/27/2017
Date