Year 1 of 5 Monitoring Report

FINAL

Five-Mile Branch Stream and Wetland Restoration, Iredell County

NCEEP IMS ID# 92185
DENR Contract # D05013S

Prepared for:

North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program Raleigh, North Carolina

January 2014

Year 1 of 5 Monitoring Report
Five-Mile Branch Stream and Wetland Restoration

NC Engineering License # C-1869
NC Surveying License # C-1869

Prepared for:
NCDENR-EEP

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Executive Summary

Goals and Objectives

The primary goals of this restoration project focus on the following:

- Increase bank stability, nutrient filtration and aquatic habitat
- Reduce soil disturbance and nutrient inputs to stream
- Improve soil physical and chemical properties in the near term
- Improve hydrologic connectivity with floodplain
- Attenuate site impacts of storm flows
- Restore ground water hydrology to pre-agricultural levels
- Restore wetland and riparian habitat

These goals were accomplished by:

- Establishing a minimum 50-foot buffer consisting of a mix of native species representative of piedmont/mountain bottomland hardwood forest. The planted species were selected by evaluation of adjacent reference sites and reviewing species listed in Classification of Natural Communities of North Carolina: Third Approximation (Schafale and Weakley 1990). A total of 1.9 acres of bottomland hardwood forest were preserved through land ownership or conservation easements. Land preservation reduced soil disturbance and nutrient input to the streams.

- Grading stream banks, installation of in-stream structures, and removal of an adjacent berm increased bank stability, improved in-stream habitat diversity and improved the hydrologic connectivity with the adjacent floodplain. Gently sloped, vegetated, stream banks in conjunction with in-stream structures increased bank stability. The in-stream structures all increased stream habitat diversity by establishing riffle-pool sequences and establishing stable woody debris. Removal of the berm reduced the water surface elevation required to reach the floodplain.

- Fill existing drainage ditches and excavating floodplain pools restored groundwater hydrology to pre-agriculture conditions, in-turn restoring wetlands and riparian habitat.

- Ripping floodplain soil prior to planting to reduce ground compaction cause by past agricultural practice and allowing water infiltration.

The Five Mile Branch Mitigation site was selected for stream and wetland restoration originally by the North Carolina Department of Transportation (NCDOT) then transferred to the North Carolina Ecosystem Enhancement Program (NCEEP). The purpose of this restoration project was to restore, enhance and preserve streams and wetlands within the site. Beaver and Fifth creeks are the primary stream within the site. There are five unnamed tributaries that were preserved. The site's original design was developed while the project was under NCDOT auspices and was a very sinuous, priority 2 stream restoration with a great deal of structure, which presented concerns in terms of cost and stability (risk/cost-benefit). The proposed alignment also led to retrospective concerns of hydrologic trespass by NCDOT for the I-40 right of way. Collectively, this prompted an enhancement approach to the stream channel through stabilization, improvement of the profile, and the removal of berms to provide additional floodplain connection. (NCEEP 2013)

The Five Mile Branch Site (site) is east of Statesville in Iredell County, southeast of Interstate 40 (I-40) and northwest of US Route 64. The site is in the Township of Cool Springs on the Statesville East, NC, 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle map (Figure 1) and the Yadkin 02 (03040102) cataloging unit. The Site comprises 12 adjacent parcels totaling approximately 229 acres (92.67 ha). It is bordered to the north by I-40 and to the south, east, and west by various forested, pasture, and residential properties. Swann Road (SR 2167), running north and south, bisects the site. Chimney Lane dead-ends on the site west of Swann Road.

The site was broken into three stream reaches for restoration purposes. Reach 1 is Beaver Creek with a drainage area of 10.76 square miles. Reach 2, Fifth Creek upstream of Beaver Creek has a drainage area of 13.93 square miles. Reach 3, Fifth Creek downstream of Beaver Creek, has a drainage area of 26.05 square miles. The restoration strategy implemented on Beaver and Fifth creeks consisted of Enhancement Level II. Both streams were stabilized in their current locations. Their north banks were re-graded to a flatter slope and boulder grade control structures were installed. No work was performed on the unnamed tributaries. They were preserved through conservation easements or property purchase. Wetland restoration was accomplished by filling in the drainage ditches, grading floodplain pools and replanting with native vegetation. Through these practices 12,085 linear feet if stream were enhanced, 890 feet of stream preserved, 48.6 acres of wetland restored and 1.9 acres of wetlands preserved.

Vegetation monitoring was conducted on October 1 and October 3, 2013. When tallying only planted stems, two of the 23 vegetation monitoring plots are meeting the established year three success criteria of 320 stems per acre; plot 6 with 445 stems per acre and plot 9 with 324 stems per acre. Overall, there was a reduction in planted stems surviving within the monitoring plots. Baseline counts totaled 143 stems, year one totaled 90 stems.

In April 2013, it was observed that two adjacent property owners mowed a portion of the buffer area, one parcel at the western end and one parcel on the eastern end. See Figure 2 CCPV. This resulted in 100% mortality of planted stems and a significant reduction in stem count totals given that plot 1 was located in the eastern parcel. Plot 1 stem counts were reduced from 10 planted stems at baseline to zero stems during year one. No vegetation monitoring plots are located in the eastern mowed parcel. NCEEP and NCDOT have made contact with the landowners. The landowners have been notified of the property violation and have been asked to stop mowing this area. NCDOT owns the western parcel fee simple and purchased an easement on the central parcel. The areas will be replanted in the 2014/2015 dormant season once the encroachments have been rectified.

When considering volunteer stems, all but five plots (1, 13, 14, 16, and 18) of the 23 are meeting the established success criteria. Plot 17 is located in a young stand of existing sycamore and river birch. There was no grading within plot 17 and it was not planted. This plot was selected to monitoring the performance of existing, established vegetation.

Six invasive areas of concern were identified in the project area. Invasive species present are Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*) and Lespedeza (*Lespedeza cuneata*), all listed as “threat to habitat and natural areas” in NCDOT’s Invasive Plants of North Carolina. The highest density of privet is located easterly of Chimney Lane. An estimated percent coverage is 20%. This area was not impacted by construction activities. However, the contractor did conduct privet removal operations (cut and treat) in this area. Japanese honeysuckle is sparsely located throughout the site in areas that were not cleared. It highest density (10%) is easterly of Chimney Lane, the same location as privet. Thick stands of Lespedeza are located northerly of Fifth Creek upstream and downstream of Swann Road. Coverage is near 100% in these areas. It maybe outcompeting vegetation planted onsite.

Cross section surveys were conducted at 13 permanent cross sections. Most of the measured cross section parameters changed from the as built conditions. However, it is too soon in the monitoring period to identify any patterns or trends in the stream cross sections. Based on visual observations and best professional judgment, the streams appear to be stable. Several areas of bank stress were identified. See CCPV. The areas are relatively minor and not a concern at this time. Bank deposition was observed on the arms of several structures and graded banks. This is not a concern at this time either. The deposition is occurring in areas that it is expected to occur and is not threatening the integrity of the project.

When looking at the plotted cross sections, several of the year one cross sections do not align with the as-built condition and several appear to have significantly changed from the as-built condition, most notable cross section 5. These apparent changes may be the result of the lack of detail in the as-built channel survey. The as-built cross sections were generated from the surface contours created from the as-built field survey, which was not surveyed by ARCADIS staff. The year one cross sections were surveyed in the field by ARCADIS staff and are likely more accurate. These discrepancies were not noticed until the year one cross sectional survey was overlaid on the as-built drawing. Several of the cross sections do align well (3, 9, 10, 11 and 13).

Three bankfull events occurred in 2013 (7/6/2013, 7/27/2013 and 11/27/2013). These events were documented by the HOBO® pressure sensor gauges installed within the stream channels.

Wetland hydrology was monitored for the entire growing season (April 18 – October 17) in the year 1 monitoring term. Of the 30 gauges on site, all but one (gauge 17) are meeting the established groundwater success criteria of ground water within 12 inches of the ground surface for 9 consecutive days in the growing season (5% of 183 days). Gauge 17 recorded groundwater within 12 inches of the surface for a maximum of 4 consecutive days (2.2 percent) during the growing season. Wetland hydrology at gauges meeting success criteria ranged from 100 percent (183 days) of the growing season at gauges 8, 10, 21, 22 and 23 to 7.7 percent (14 days) of the growing season at gauge 28.

There was inconsistency among the gauges in their performance. For example, during one downloading event a gauge would not download. During the next event, the gauge would download properly with no data lost. This made it difficult to determine when a gauge was no longer functioning properly and when to replace it. Typically, if a

gauge failed to download on two sequential downloading events, it was replaced. Several gauges were reprogrammed during the year one monitoring term. All gauges were programmed to record once daily at 8:00 AM. Several gauges failed to accept this programming and were reprogrammed during download events. At approximately 1:30 PM, during the 5/29/2013 downloading event, ARCADIS staff members were involved in a vehicle accident and were not able to return to the site to complete downloading the remaining gauges. Only gauges west of Chimney Lane were downloaded during this event. Gauges east of Chimney Lane were downloaded on 6/4/2013. The Meazura ^{TM} handheld malfunctioned during the 8/20/2013 downloading event. Gauges 1-14 were downloaded. The remaining gauges were not downloaded due to the potential of losing all gauge data using a malfunctioning handheld. In the office, all software was reloaded onto the handheld fixing the problem.

Summary information/data related to the occurrence of such things 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 Baseline Monitoring Report (formerly Mitigation Plan) and in the Mitigation Plan (formerly the 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.

1. Methodology

1.1 Cross Section Surveys

Cross sectional surveys were conducted by ARCADIS staff on August 8, 2013 using Topcon total station.

1.2 Vegetation

Vegetation monitoring followed Carolina Vegetative Survey Level 2. All planted and volunteer stems were tallied.

1.3 Hydrology

1.3.1 Wetland Hydrology

Wetland hydrology was monitored using RDS Ecotone ® WM Water Level Instruments (gauges). The gauges were programmed to take one reading daily at 8:00 AM EST. Gauges were downloaded approximately monthly using a Meazura™ handheld device manufactured by ACEECA™. Data from the handheld device was then transferred to a Lenovo laptop computer and processed using MicroSoft Excel software.

1.3.2 Stream Hydrology

Stream flow depth was documented several ways. Originally, two stream crest gauges were installed on site, one on Beaver Creek upstream of Chimney Lane, the other on Fifth Creek downstream of Swann Road. Readings were attempted during groundwater gauge downloading events. The resulting measurements were ambiguous due to debris around the gauges, the wooded staff in the gauge rotting or the gauge being damaged.

A secondary method to identify bankfull events is visual observations. The presence of wrack/debris lines and sediment on the floodplain also indicated flows higher than bankfull. It does not provide an estimated water surface elevation, only that an overbank event occurred. Sediment within the other monitoring devises (groundwater and rain gauges) also documents an overbank event. It also gives an estimate of stage given the height of the other monitoring devises. Several rebar corners of the

vegetation monitoring plots were buried 6 inches by sand. The source of the sand was form over bank events.

The final method to document stream water depth was with the installation of HOBO ® pressure sensor gauges manufactured by onset ®. Three HOBO® devises were installed at the Five Mile Branch restoration site, one on Beaver Creek upstream of Chimney Lane, one on Fifth Creek upstream of the confluence with beaver Creek and one on Fifth Creek downstream of Swann Road. The dataloggers were downloaded during the groundwater gauges downloading events.

2. References

North Carolina Department of Environment and Natural Resources (NCDENR). 2008. Yadkin Pee-Dee River Basinwide Water Quality Plan. Prepared by the North Carolina Division of Water Quality, Water Quality Section.

North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program (NCDENR) 2010. Baseline Monitoring Document Format, Data Requirements, and Content Guidance, Version 2.0, October 14, 2010.

North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program (NCDENR) 2012. Monitoring Report Template, Version 1.5, June 8, 2012.

North Carolina Ecosystem Enhancement Program (NCEEP). 2013. Letter dated February 28, 2013.

North Carolina Department of Transportation (NCDOT). 2008. Invasive Exotic Plants of North Carolina.

Schafale, M.P., and A. S. Weakley. 1990. Classification of the Natural Communities of North Carolina, A Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, Department of Environment, Health and Natural Resources, Raleigh, NC.

US Army Corps of Engineers (USACE) 2003. April 2003 Stream Mitigation Guidelines

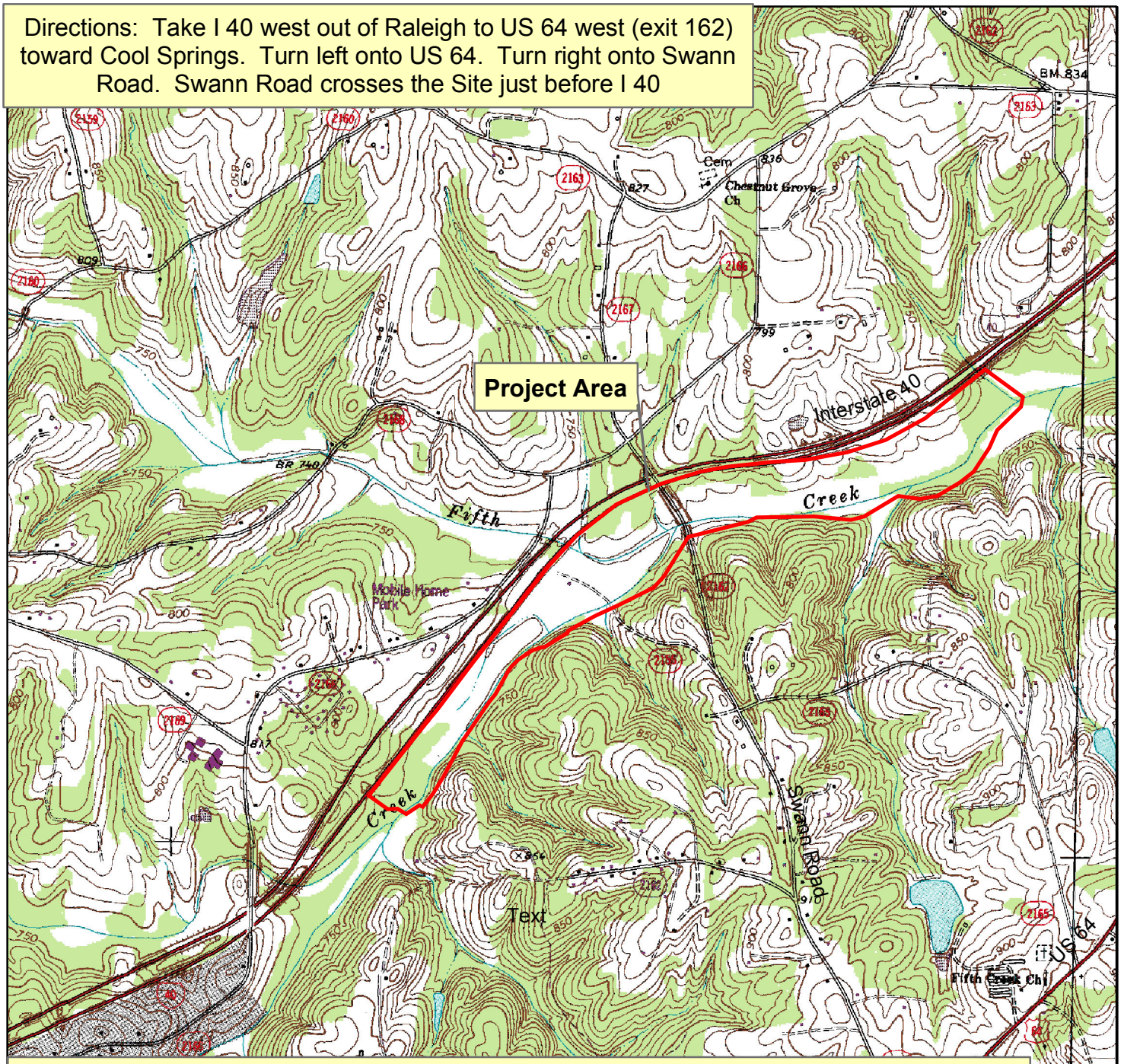
United States Department of Agriculture, Natural Resources Conservation Service, 2011 Soil Survey of Iredell County, North Carolina. (Available online at http://soils.usda.goc/survey.printed_surveys/)

U.S. Department of Agriculture, Soil Conservation Service. 1964. Soil Survey, Iredell County, North Carolina. Joel W. Cawthorn and V. S. Jenkins.

Appendix A

Project Vicinity Map and
Background Tables

Directions: Take I 40 west out of Raleigh to US 64 west (exit 162) toward Cool Springs. Turn left onto US 64. Turn right onto Swann Road. Swann Road crosses the Site just before I 40



The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is encompassed by a recorded conservation easement, but is bordered by land under private ownership. Accessing the site may require traversing areas near or along the easement boundary and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitation or activities requires prior coordination with EEP.

0 1,500 3,000 6,000 Feet

SCALE: 1:24,000

Source: USGS Quadrangle Maps Statesville East and Cool Springs, NC

N W E S

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Ecosystem Enhancement Program

VICINITY MAP

Five Mile Branch
Stream and Wetland Restoration Site
Iredell County, North Carolina

Figure No.

1

Table 1. Project Components and Mitigation Credits
Five Mile Branch Stream Restoration, EEP IMS ID# 92185

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Nutrient Offset	Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	5,924.7	142.5	48.0	0.4	-	-	-	-	-

Project Components

Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage	Approach (PI, PII etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
Reach 1 - Beaver Creek	10+87.03 PRBVR to Fifth Creek	6,133.7	E II	R	5935.38*	2:1**
Reach 2 - Fifth Creek upstream of Beaver Creek	I-40 to Beaver Creek	1,526.7	E II	R	1,526.7	2:1**
Reach 3 - Fifth Creek downstream of Beaver Creek	Beaver Creek to 78+60.00 PRFTH	5,333.3	E II	R	4387.26*	2:1**
Reach 4 - Beaver Creek (Upstream)	Property line to 10+87.03 PRBVR	193.0	Pres.	RE	193.0	10:1
Reach 5 - UT to Beaver Creek (Upstream)	Property line to Beaver Creek	180.1	Pres.	RE	180.1	10:1
Reach 6 - UT	Property line to Beaver Creek	220.4	Pres.	RE	220.4	10:1
Reach 7 - UT at Chimney Lane	Property line to Beaver Creek	139.5	Pres.	RE	139.5	10:1
Reach 8 - UT at Swann Road	Property line to Fifth Creek	520.0	Pres.	RE	520.0	10:1
Reach 9 - UT at Freeze Property	Within the Conservation Easement	172.0	Pres.	RE	172.0	10:1
Wetlands	Throughout the site	48.0	Rest.	R	48.0	1:1
Wetlands	Throughout the site	1.9	Pres.	RE	1.9	5:1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	N/A	48.0	N/A	N/A	N/A	N/A
Enhancement		N/A	N/A	N/A	N/A	N/A
Enhancement I	N/A					
Enhancement II	11,849.3					
Creation		N/A	N/A	N/A		N/A
Preservation	1,425.0	1.9	N/A	N/A		N/A
High Quality Preservation	N/A	N/A	N/A	N/A		N/A

* Difference between existing and restoration footage is due to a section of stream preservation at the the upstream limit of the project and the absence of ownership of both side of the stream at the downstream limit of the project.

**due to the near systemic nature of the improvement to the channel cross-section and the localized improvements to the profile/in-stream habitat, a credit ratio of 2.0:1 is being used.

Table 2. Project Activity and Reporting History
Five Mile Branch Stream Restoration, EEP IMS ID# 92185

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	Dec-09	Dec-09
Final Design – Construction Plans	Nov-10	Nov-10
Construction	Apr-11	Apr-12
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	Jun-12	Mar-13
Year 1 Monitoring	Dec-13	Dec-13
Year 2 Monitoring	-	-
Year 3 Monitoring	-	-
Year 4 Monitoring	-	-

Table 3. Project Contacts Table Five Mile Branch Stream Restoration, EEP IMS ID# 92185	
Designer Primary project design POC	ARCADIS G&M of NC, Inc. 801 Corporate Center Dr., Suite 300, Raleigh NC 27607 Robert Lepsic 919-854-9812
Construction Contractor Construction contractor POC	North State Environmental 2889 Lowery Street, Winston Salem, NC 27101 Michael Anderson 336-245-1253
Survey Contractor Survey contractor POC	North State Environmental 2889 Lowery Street, Winston Salem, NC 27101 David K. Alley, PLS 336-250-9225
Planting Contractor Planting contractor POC	Southern Garden, Inc. PO Box 808, Apex, NC 27502 Todd Laasko 919-362-1050
Seeding Contractor Contractor point of contact	Canady's Landscape and Erosion Control 256 Fairview Acres Road,Lexington NC 27295 336-236-1182
Seed Mix Sources	Green Resource, Colfax, NC 27235 336-855-6363
Nursery Stock Suppliers	Foggy Mountain Nursery 336-384-5323 Claridge Nursery 919-731-7988 Brook Run Plantation 434-292-1677
Monitoring Performers **Baseline and Year One**	ARCADIS G&M of NC, Inc 801 Corporate Center Dr., Suite 300, Raleigh NC 27607
Stream Monitoring POC	Robert Lepsic 919-854-9812
Vegetation Monitoring POC	Robert Lepsic 919-854-9812
Wetland Monitoring POC	Robert Lepsic 919-854-9812

Table 4. Attributes

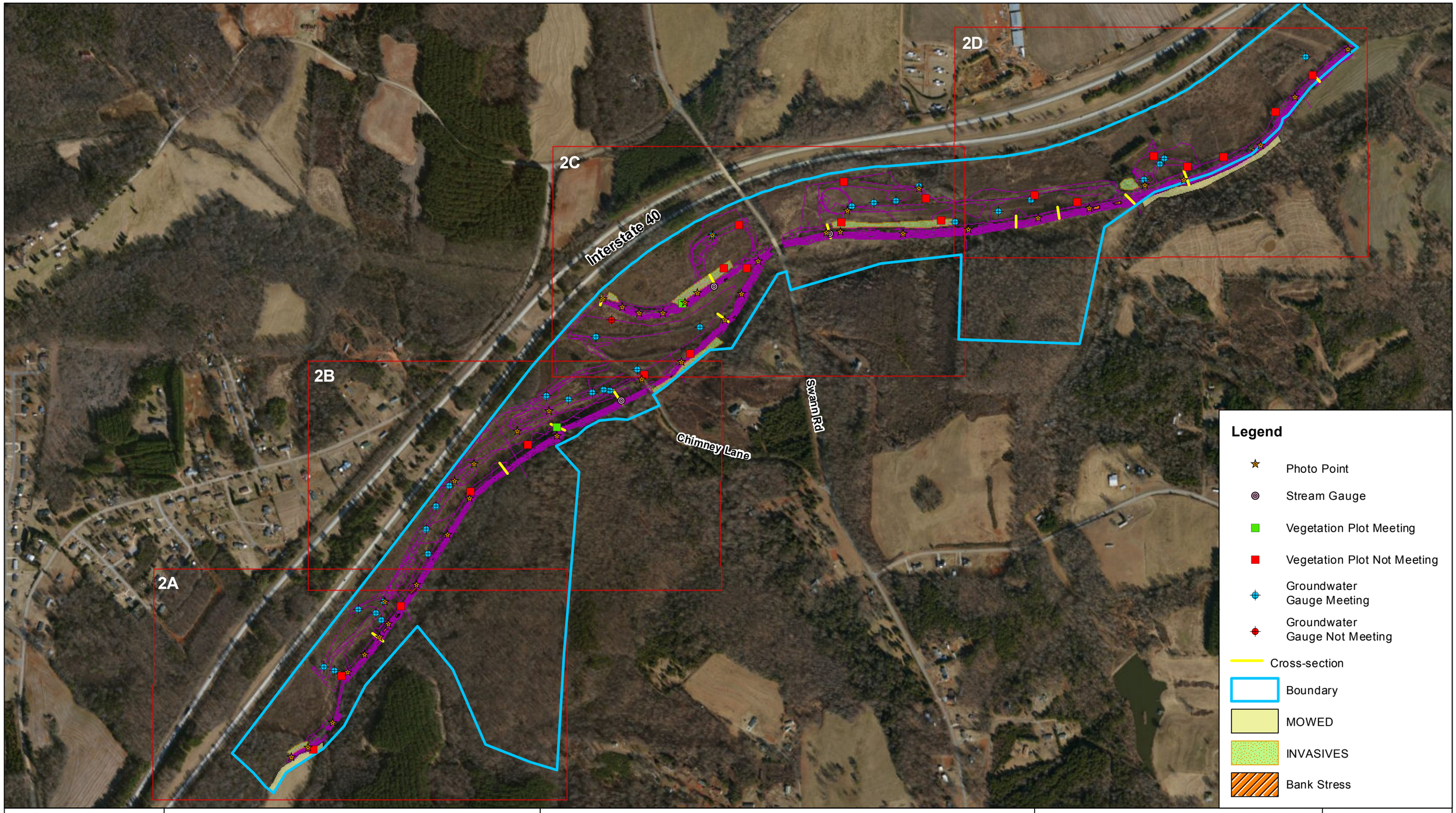
Five Mile Branch Stream Restoration, EEP IMS ID# 92185

Project Information			
Project Name		Five Mile Branch Stream and Wetland Restoration	
County		Iredell	
Project Area (acres)		229	
Project Coordinates (latitude and longitude)		035° 50' 40.18" N	080° 46' 27.37" W
Project Watershed Summary Information			
Physiographic Province		Piedmont	
River Basin		Yadkin-Pee Dee	
USGS Hydrologic Unit 8-digit		3040102	
DWQ Sub-basin		03-07-06	
Project Drainage Area (square miles)		26	
Project Drainage Area Percentage of Impervious Area		10-20	
CGIA Land Use Classification		Heavily developed, cultivated, herbaceous and shrubland, forest land, water bodies	
Reach Summary Information			
Parameters	**Reach 1**	**Reach 2**	**Reach 3**
Length of reach (linear feet)	6,134	1,527	5,333
Valley classification	VIII	VIII	VIII
Drainage area (square miles)	10.7	13.9	26
NCDWQ stream identification score	12-108-13-1	12-108-13	12-108-13
NCDWQ Water Quality Classification	Class C	Class C	Class C
Morphological Description (stream type)	E5	E5	E5
Evolutionary trend			
Underlying mapped soils	Codorus loam	Codorus loam	Codorus loam
Drainage class	somewhat poorly drained	somewhat poorly drained	somewhat poorly drained
Soil Hydric status	Yes	Yes	Yes
Slope	0-2%	0-2%	0-2%
FEMA classification	Zone AE	Zone AE	Zone AE
Native vegetation community	Bottomland hardwood	Bottomland hardwood	Bottomland hardwood

Percent composition of exotic invasive vegetation	<5	<5	<5
Wetland Summary Information			
Parameters	**Wetland 1**	**Wetland 2**	**Wetland 3**
Size of Wetland (acres)	48.0		
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)	Riparian riverine		
Mapped Soii Series	Codorus loam		
Drainage class	somewhat poorly drained		
Soil Hydric Status	Yes		
Source of Hydrology	groundwater, precipitation and overbank flooding		
Hydrologic Impairment	Ditching		
Native vegetation community	Bottomland hardwood		
Percent composition of exotic invasive vegetation	<5		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States — Section 404	Yes	Yes	Restoration Plan
Waters of the United States — Section 401	Yes	Yes	Restoration Plan
Endangered Species Act	Yes	Yes	Restoration Plan
Historic Preservation Act	Yes	Yes	Restoration Plan
Coastal Zone Management Act (CZMA)/ Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	Yes	Yes	Restoration Plan
Essential Fisheries Habitat	No	N/A	N/A

Appendix B

Visual Assessment Data



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STREAM CURRENT CONDITION PLAN VIEW

FIVE MILE BRANCH RESTORATION SITE

IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial

0 700 1,400 Feet

1 inch = 700 feet

Figure No.

2

Interstate 40

Legend

- Photo Point
- Stream Gauge
- Vegetation Plot Meeting
- Vegetation Plot Not Meeting
- Groundwater Gauge Meeting
- Groundwater Gauge Not Meeting
- Root Wads
- Cross-section
- Structures
- Boundary
- Mowed
- Invasive Population
- Bank Stress

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STREAM CURRENT CONDITION PLAN VIEW

FIVE MILE BRANCH RESTORATION SITE

IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial

0 200 400 Feet

1 inch = 200 feet

Figure No.

2A

Legend

- Photo Point
- Stream Gauge
- Vegetation Plot Meeting
- Vegetation Plot Not Meeting
- Groundwater Gauge Meeting
- Groundwater Gauge Not Meeting
- Root Wads
- Cross-section
- Structures
- Boundary
- Mowed
- Invasive Population
- Bank Stress

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STREAM CURRENT CONDITION PLAN VIEW

FIVE MILE BRANCH RESTORATION SITE

IREDELL COUNTY, NORTH CAROLINA

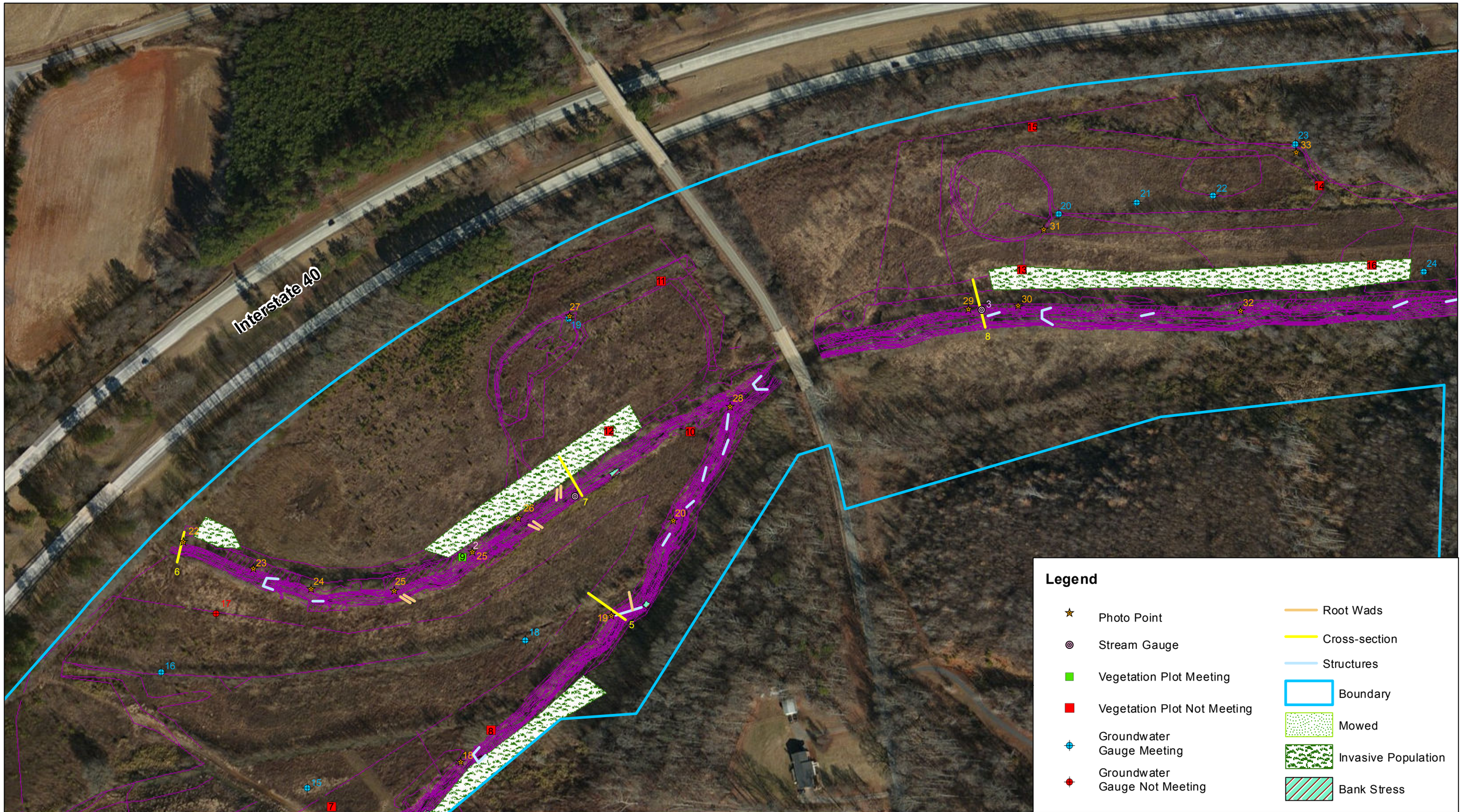
Aerial: 2011 Bing Maps Aerial

0 200 400 Feet

1 inch = 200 feet

Figure No.

2B



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STREAM CURRENT CONDITION PLAN VIEW

FIVE MILE BRANCH RESTORATION SITE

IREDELL COUNTY, NORTH CAROLINA

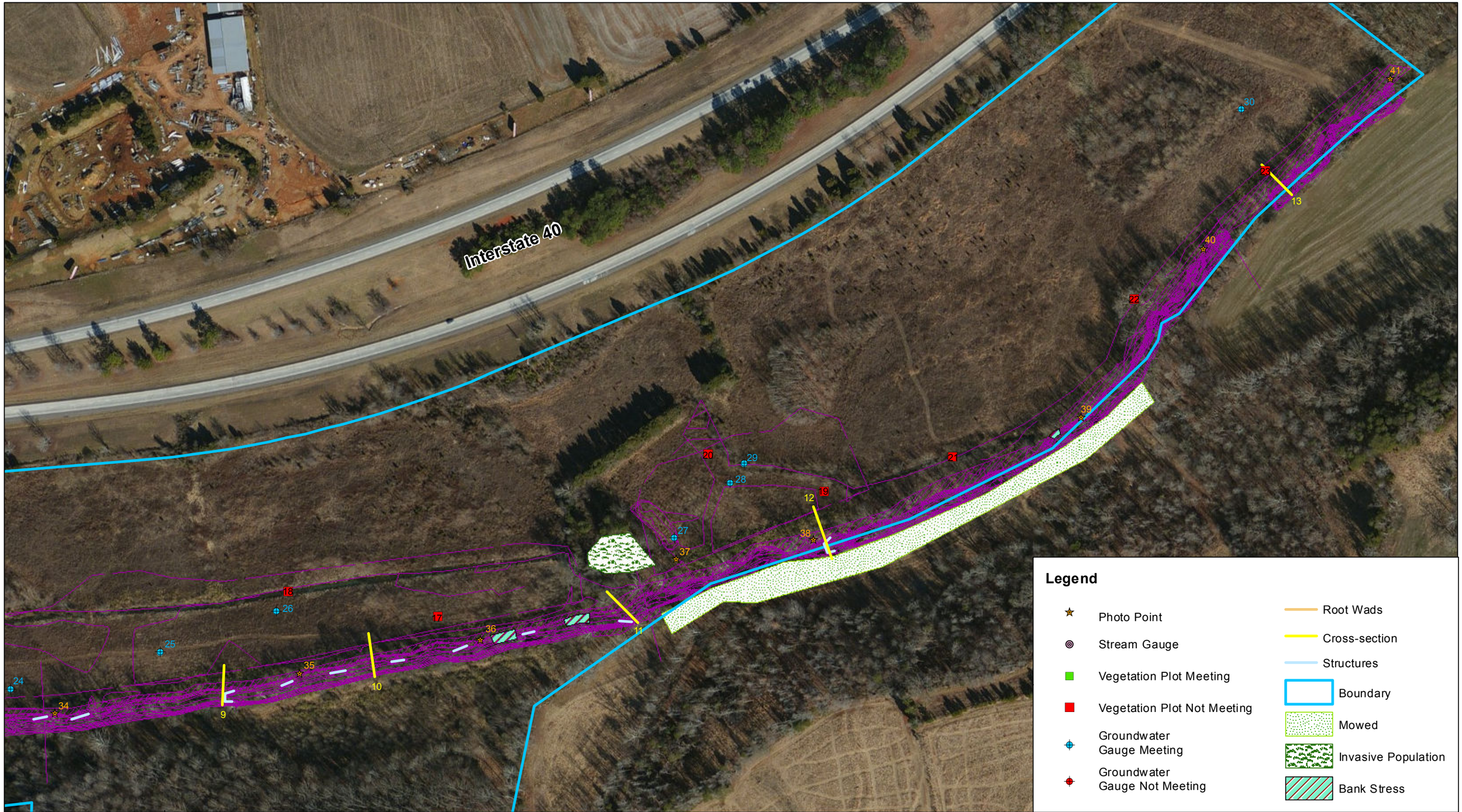
Aerial: 2011 Bing Maps Aerial

0 200 400 Feet

1 inch = 200 feet

Figure No.

2C



Legend

- Photo Point
- Stream Gauge
- Vegetation Plot Meeting
- Vegetation Plot Not Meeting
- Groundwater Gauge Meeting
- Groundwater Gauge Not Meeting
- Root Wads
- Cross-section
- Structures
- Boundary
- Mowed
- Invasive Population
- Bank Stress

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STREAM CURRENT CONDITION PLAN VIEW

FIVE MILE BRANCH RESTORATION SITE

IREDELL COUNTY, NORTH CAROLINA

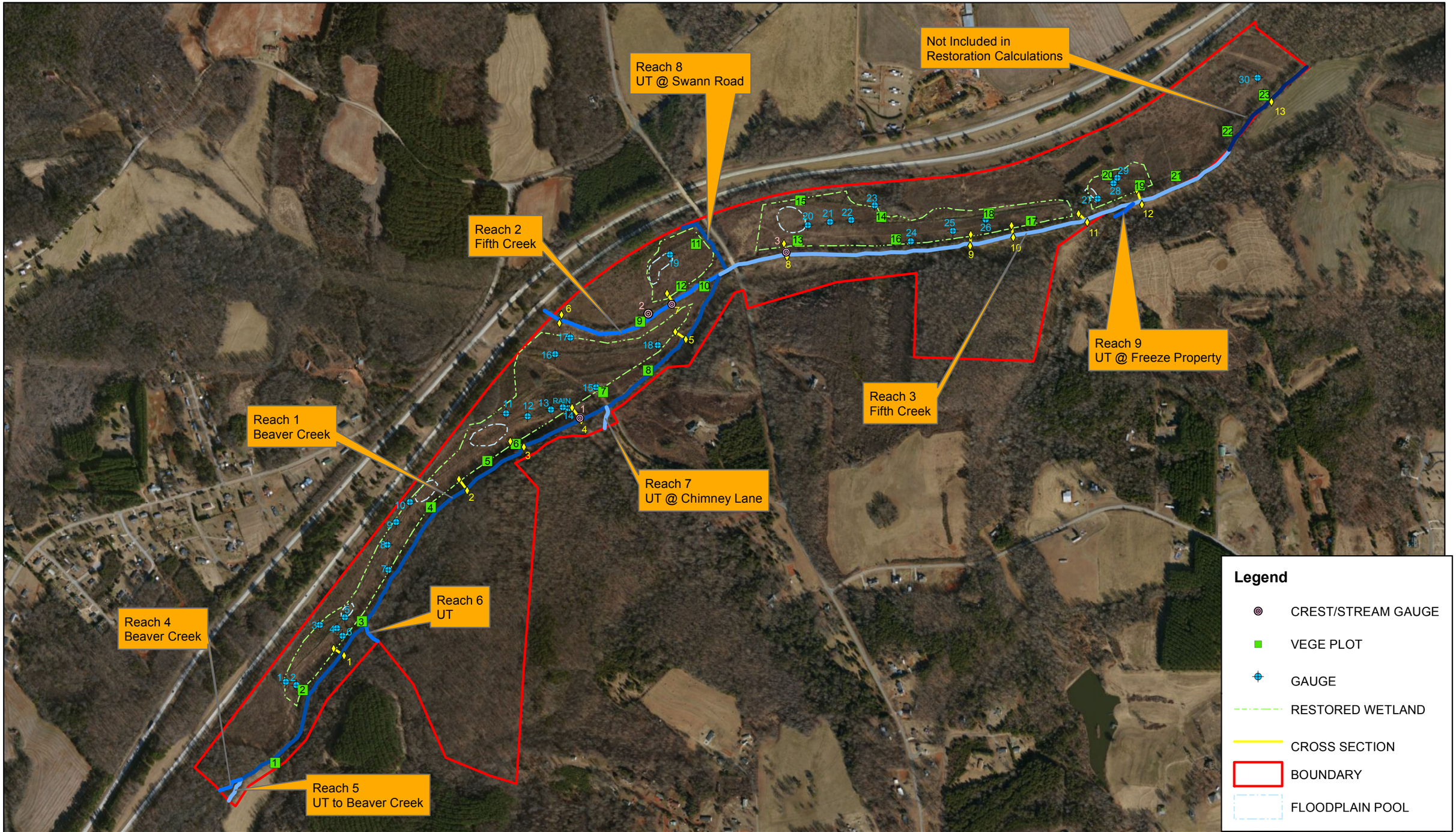
Aerial: 2011 Bing Maps Aerial

0 200 400 Feet

1 inch = 200 feet

Figure No.

2D



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PROJECT COMPONENTS

FIVE MILE BRANCH RESTORATION SITE

IREDELL COUNTY, NORTH CAROLINA

Aerial: 2011 Bing Maps Aerial

670 335 0 670 Feet

1 inch = 729 feet

Figure No.

3

Appendix C

Vegetation PlotData

Five Mile Branch (#29185)

Year 1 (01-Oct-2013 to 08-Oct-2013)

Vegetation Plot Summary Information

Stream Vegetation Totals

(per acre)

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	0	0	0	No
2	202	2630	2833	No
3	283	3116	3399	No
4	283	2145	2428	No
5	202	1942	2145	No
6	445	0	445	Yes
7	283	162	445	No
8	81	2266	2347	No
9	324	445	769	Yes, barely
10	162	1983	2145	No
11	243	1821	2064	No
12	121	1659	1781	No
13	81	162	243	No
14	81	162	243	No
15	243	1821	2064	No
16	121	162	283	No
17	0	2833	2833	No
18	0	0	0	No
19	81	1740	1821	No
20	81	486	567	No
21	121	3278	3399	No
22	162	5180	5342	No
23	40	1052	1093	No
Project Avg	**158**	**1524**	**1682**	**No**

[2]Stream/ Wetland Stems — Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines

[3]Volunteers — Native woody stems. Not planted. No vines.

[4]Total — Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

EEP Project Code 29185. Project Name: Five Mile Branch

Scientific Name	Common Name	Species Type	29185-01-0001			29185-01-0002			29185-01-0003			29185-01-0004			29185-01-0005			29185-01-0006			29185-01-0007			29185-01-0008		
			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 negundo	boxelder	Tree						4						11			13						1			34
Acer rubrum	red maple	Tree															1									
Alnus serrulata	hazel alder	Shrub																								
Betula nigra	river birch	Tree							1	1	2			4	1	1	1	2	2	2				1	1	1
Carpinus caroliniana	American hornbeam	Tree				1	1	1																		
Celtis laevigata	sugarberry	Tree							2	2	2	2	2	2												
Cephalanthus occidentalis	common buttonbush	Shrub																								
Cornus amomum	silky dogwood	Shrub										3	3	3				1	1	1						
Diospyros virginiana	common persimmon	Tree																								
Fraxinus pennsylvanica	green ash	Tree																								2
Ilex decidua	possumhaw	shrub				1	1	1				1	1	1				2	2	2	4	4	4			
Juglans nigra	black walnut	Tree										1	1	1	1	1	1									1
Liquidambar styraciflua	sweetgum	Tree						34			38			37			34						2			
Morus rubra	red mulberry	Tree																1	1	1						
Nyssa sylvatica	blackgum	Tree																								
Platanus occidentalis	American sycamore	Tree				1	1	28			38			1				1	1	1			1	1	1	4
Quercus michauxii	swamp chestnut oak	Tree																			3	3	3			
Quercus pagoda	cherrybark oak	Tree				2	2	2	4	4	4				2	2	2	4	4	4						
Quercus phellos	willow oak	Tree													1	1	1									
Sambucus canadensis	Common Elderberry	Shrub																								16
		Stem count	0	0	0	5	5	70	7	7	84	7	7	60	5	5	53	11	11	11	7	7	11	2	2	58
		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	0	0	0	4	4	6	3	3	5	4	4	8	4	4	7	6	6	6	2	2	5	2	2	6
		Stems per ACRE	0	0	0	202.3	202.3	2833	283.3	283.3	3399	283.3	283.3	2428	202.3	202.3	2145	445.2	445.2	445.2	283.3	283.3	445.2	80.94	80.94	2347

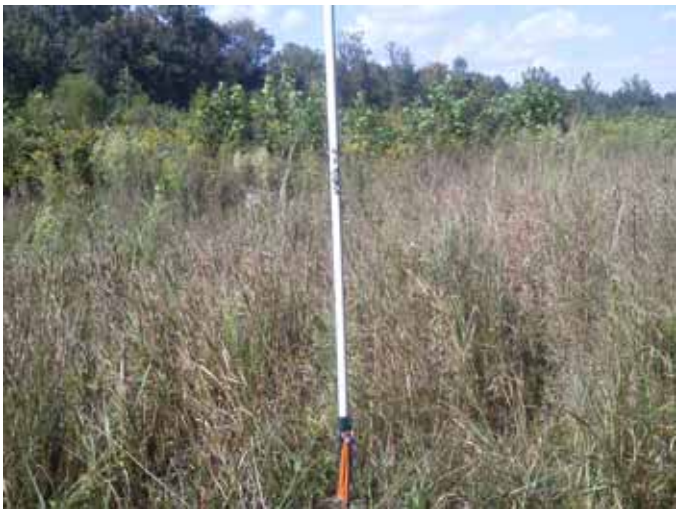
Current Plot Data (MY1 2013)

29185-01-0009			29185-01-0010			29185-01-0011			29185-01-0012			29185-01-0013			29185-01-0014			29185-01-0015			29185-01-0016			29185-01-0017			29185-01-0018			29185-01-0019			2918
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	PnoLS
		9			41			10			36			2								3			1								
								3			3									5												2	
2	2	2	1	1	1				1	1	1							3	3	5	1	1	1			31				1	1	3	1
1	1	1																														
																										2						
																				1												
			1	1	1				1	1	1																					
					6			1						1																		3	
								5						1						6	1	1	1			1				1	1	1	
						3	3	3										1	1	1													
					1				1	1	1																					2	
		1						10			2									22												31	
		1	1	1	1			16				1	1	1			2			4			1			35						3	
			1	1	1																											
5	5	5				1	1	1							2	2	4																
						2	2	2				1	1	1							1	1	1										
					1													2	2	7													1
8	8	19	4	4	53	6	6	51	3	3	44	2	2	6	2	2	6	6	6	51	3	3	7	0	0	70	0	0	0	2	2	45	2
1			1			1			1			1			1			1			1			1			1			1			
0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			
3	3	6	4	4	8	3	3	9	3	3	6	2	2	5	1	1	2	3	3	8	3	3	5	0	0	5	0	0	0	2	2	7	2
323.7	323.7	768.9	161.9	161.9	2145	242.8	242.8	2064	121.4	121.4	1781	80.94	80.94	242.8	80.94	80.94	242.8	242.8	242.8	2064	121.4	121.4	283.3	0	0	2833	0	0	0	80.94	80.94	1821	80.94

											Annual Means								
85-01-0020		29185-01-0021			29185-01-0022			29185-01-0023			MY2 (????)			MY1 (2013)			MY0 (2012)		
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
				6			3			8						182			1
							8									22			
																	2	2	2
1	3				1	1	6			4				16	16	67	19	19	50
														2	2	2	4	4	4
														4	4	6	5	5	9
	3															4			
	2	1	1	1										7	7	9	12	12	12
																11			
														2	2	17	2	2	3
														12	12	12	14	14	14
														3	3	7	15	15	15
	2			69			106			5						393			
														1	1	1	3	3	3
					2	2	2							2	2	2	2	2	2
		1	1	7			6			9				6	6	159	5	5	37
														4	4	4	15	15	15
					1	1	1	1	1	1				22	22	24	24	24	24
		1	1	1										6	6	6	10	10	10
1	4													3	3	28	5	5	5
2	14	3	3	84	4	4	132	1	1	27	0	0	0	90	90	956	137	137	206
1		1			1			1			23			23			23		
0.02		0.02			0.02			0.02			0.57			0.57			0.57		
2	5	3	3	5	3	3	7	1	1	5	0	0	0	14	14	19	15	15	16
80.94	566.6	121.4	121.4	3399	161.9	161.9	5342	40.47	40.47	1093	0	0	0	158.4	158.4	1682	241.1	241.1	362.5

Vegetation Monitoring Plot #1 5/29/2012

Vegetation Monitoring Plot #4 5/29/2012



Vegetation Monitoring Plot #2 5/29/2012

Vegetation Monitoring Plot #5 5/30/2012

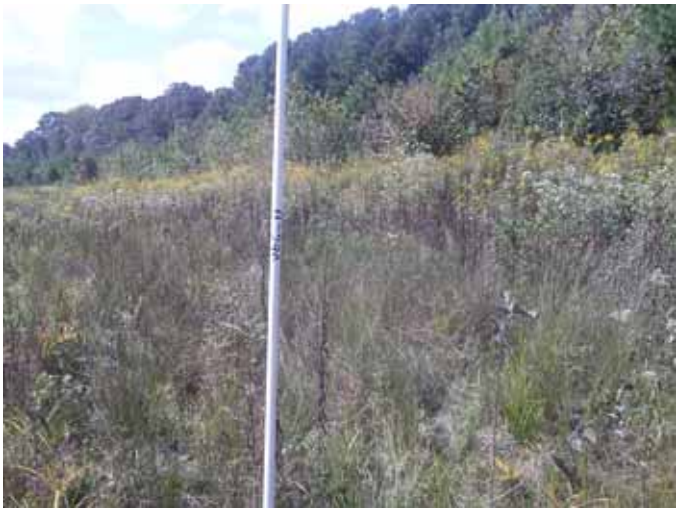
Vegetation Monitoring Plot #3 5/29/2012

Vegetation Monitoring Plot #6 5/30/2012

Vegetation Monitoring Plot #7 5/30/2012

Vegetation Monitoring Plot #10 5/30/2012

Vegetation Monitoring Plot #8 5/30/2012



Vegetation Monitoring Plot #11 5/30/2012

Vegetation Monitoring Plot #9 5/30/2012

Vegetation Monitoring Plot #12 5/30/2012

Vegetation Monitoring Plot #13 5/30/2012

Vegetation Monitoring Plot #16 5/31/2012

Vegetation Monitoring Plot #14 5/31/2012

Vegetation Monitoring Plot #18 6/1/2012

Vegetation Monitoring Plot #15 6/1/2012

Vegetation Monitoring Plot #19 6/1/2012

Vegetation Monitoring Plot #20 6/1/2012

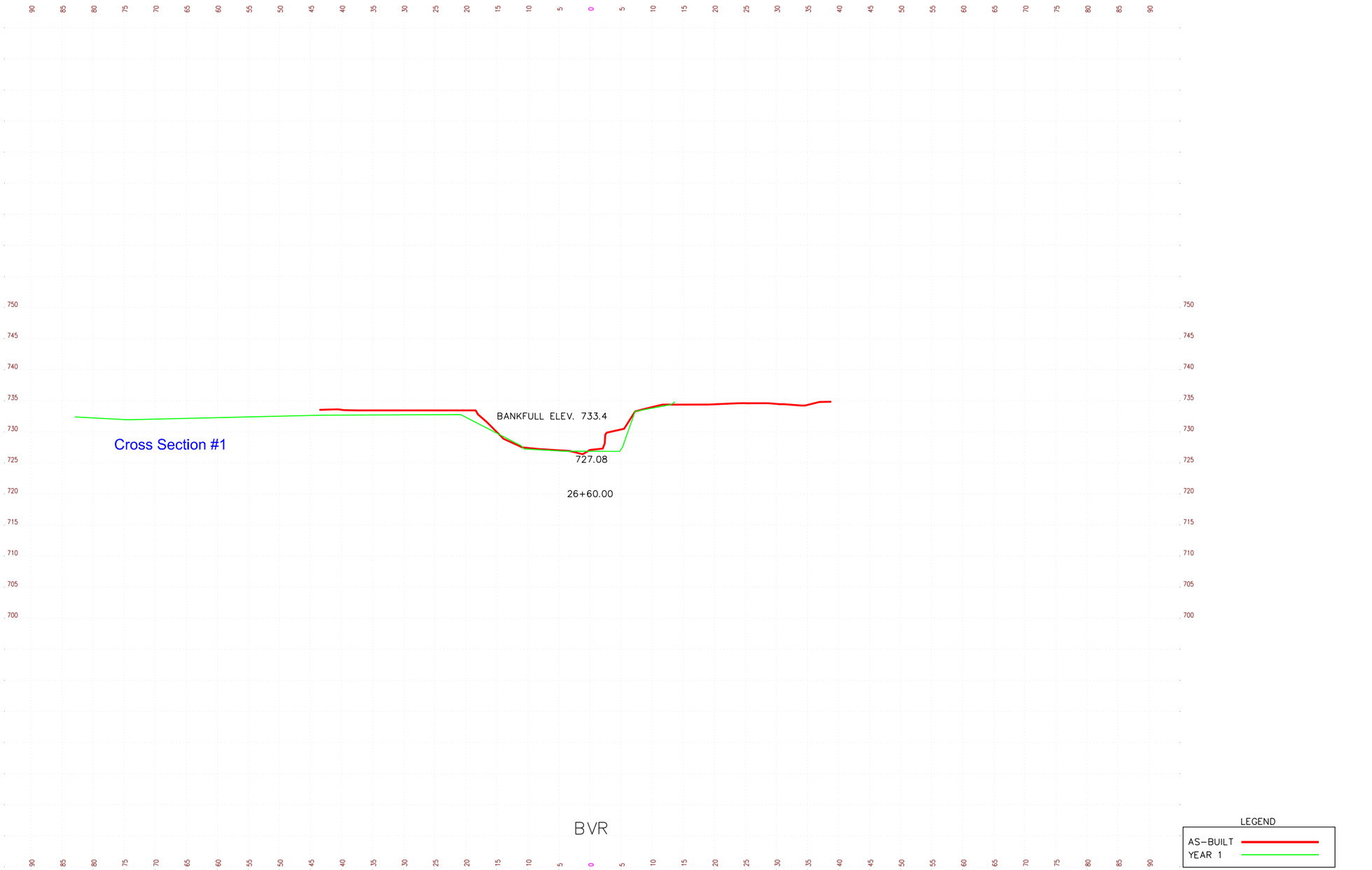
Vegetation Monitoring Plot #23 6/1/2012

Vegetation Monitoring Plot #21 6/1/2012

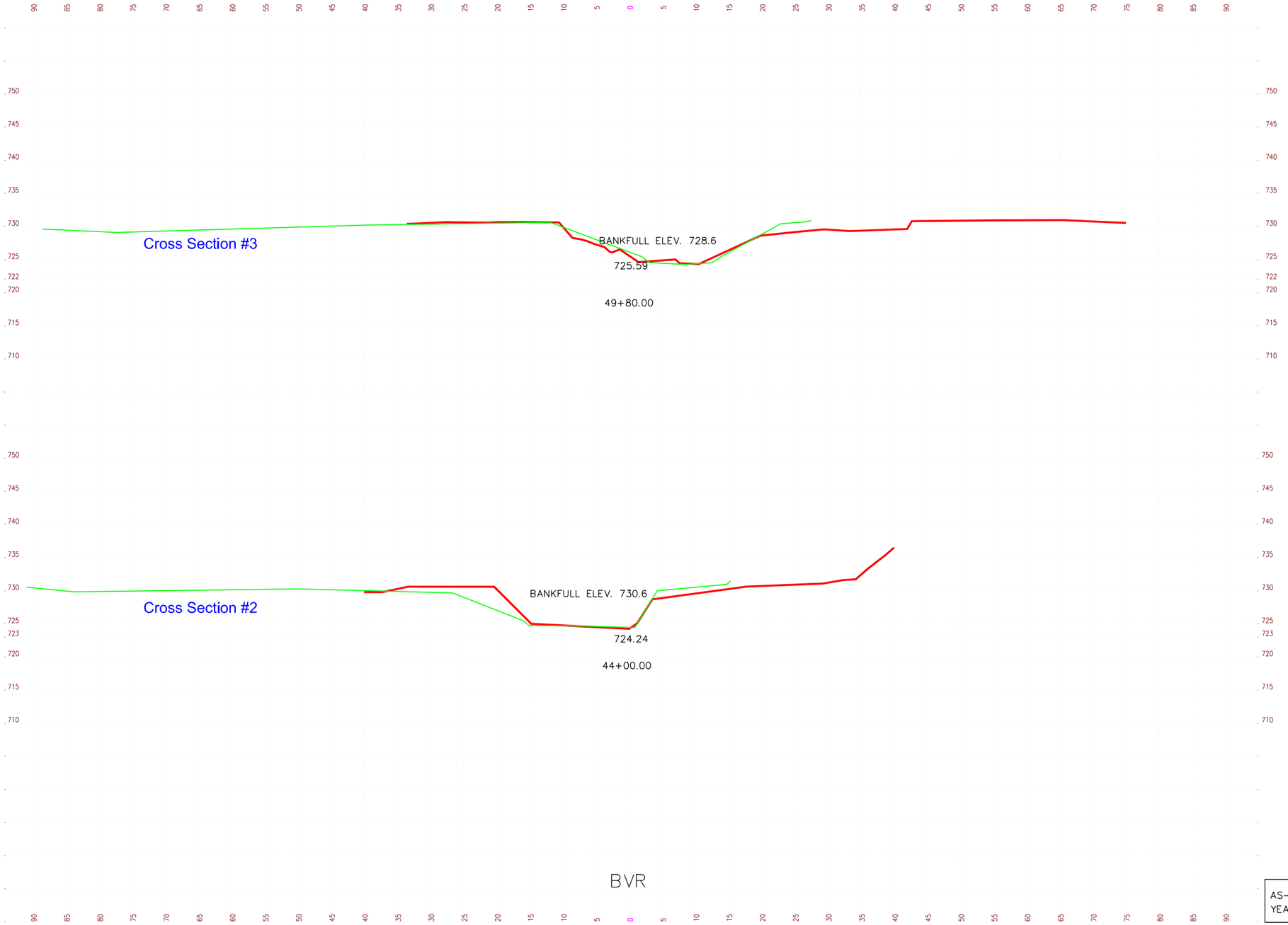
Vegetation Monitoring Plot #22 6/1/2012

Appendix D

Stream Survey Data



		KEYPLAN	ARCADIS	Five Mile Branch Stream and Wetland Restoration Iredell County, NC NCEEP IMS ID# 92185	PROJECT MANAGER	DEPARTMENT MANAGER	LEAD DESIGN PROF. / CHECKED
	REV.ISSUED DATE DESCRIPTION		ARCADIS G&M of North Carolina, Inc. 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607 Tel: 919-854-1282 Fax: 919-854-5448 www.arcadis-us.com		SHEET TITLE		TASK/PHASE NUMBER / DRAWN BY
							PROJECT NUMBER / DRAWING NUMBER



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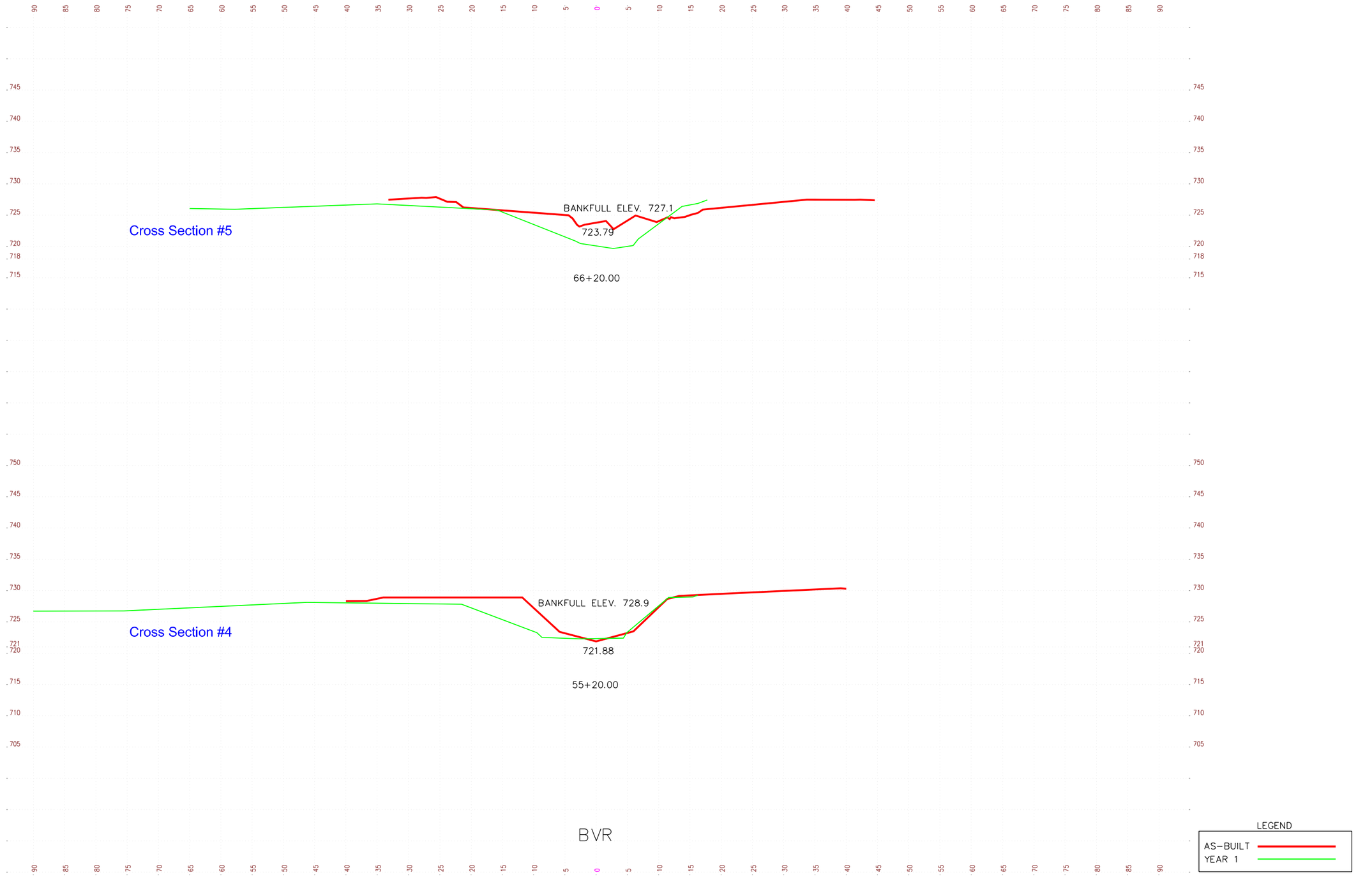
801 Corporate Center Drive, Suite 300
Raleigh, NC 27607
Tel: 919-854-1282 Fax: 919-854-5448
www.arcadis-us.com

Five Mile Branch Stream and Wetland Restoration
Iredell County, NC
NCEEP IMS ID# 92185

PROJECT MANAGER	DEPARTMENT MANAGER	LEAD DESIGN PROF.	CHECKED
SHEET TITLE		TASK/PHASE NUMBER	DRAWN BY
		PROJECT NUMBER	DRAWING NUMBER



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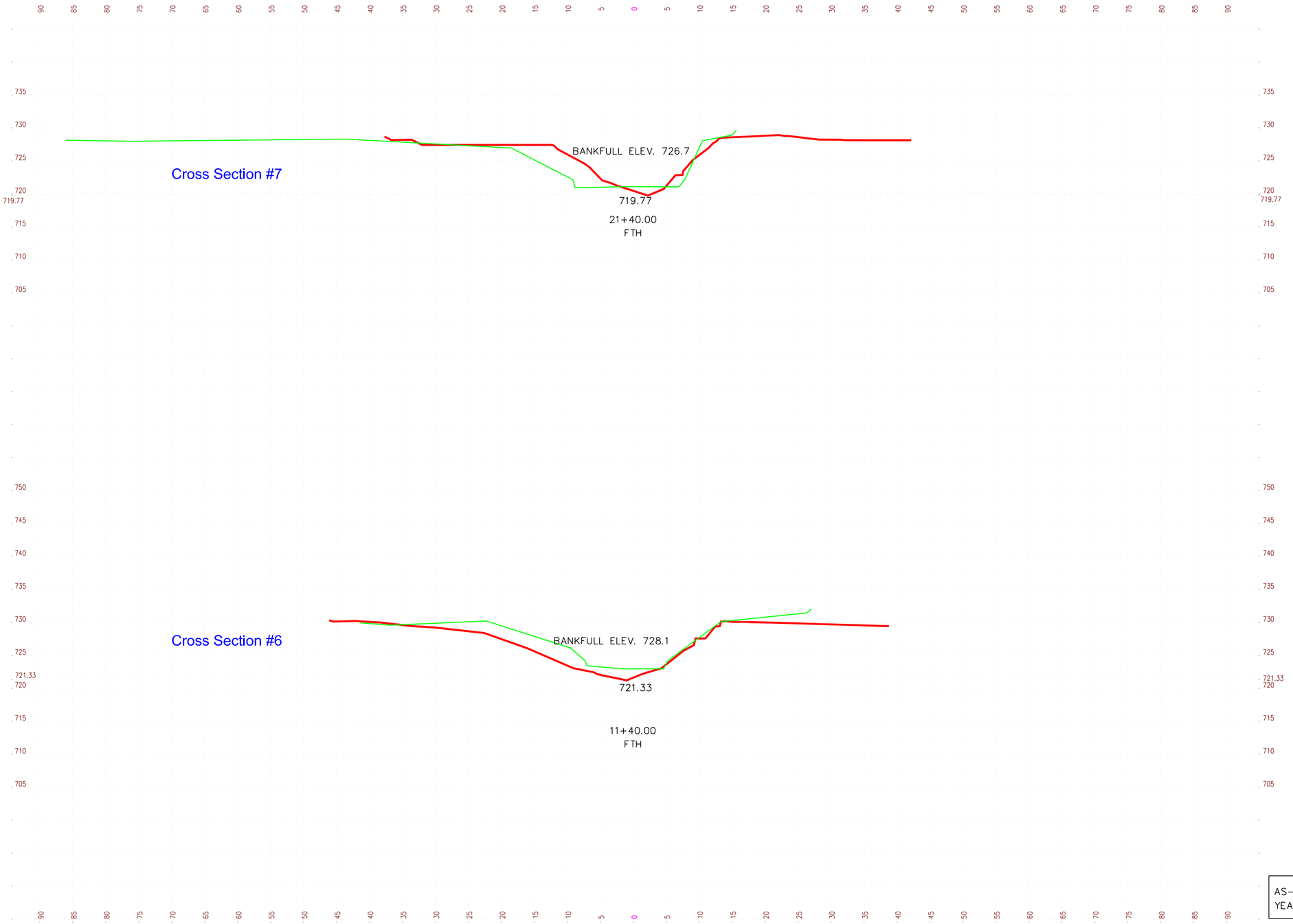
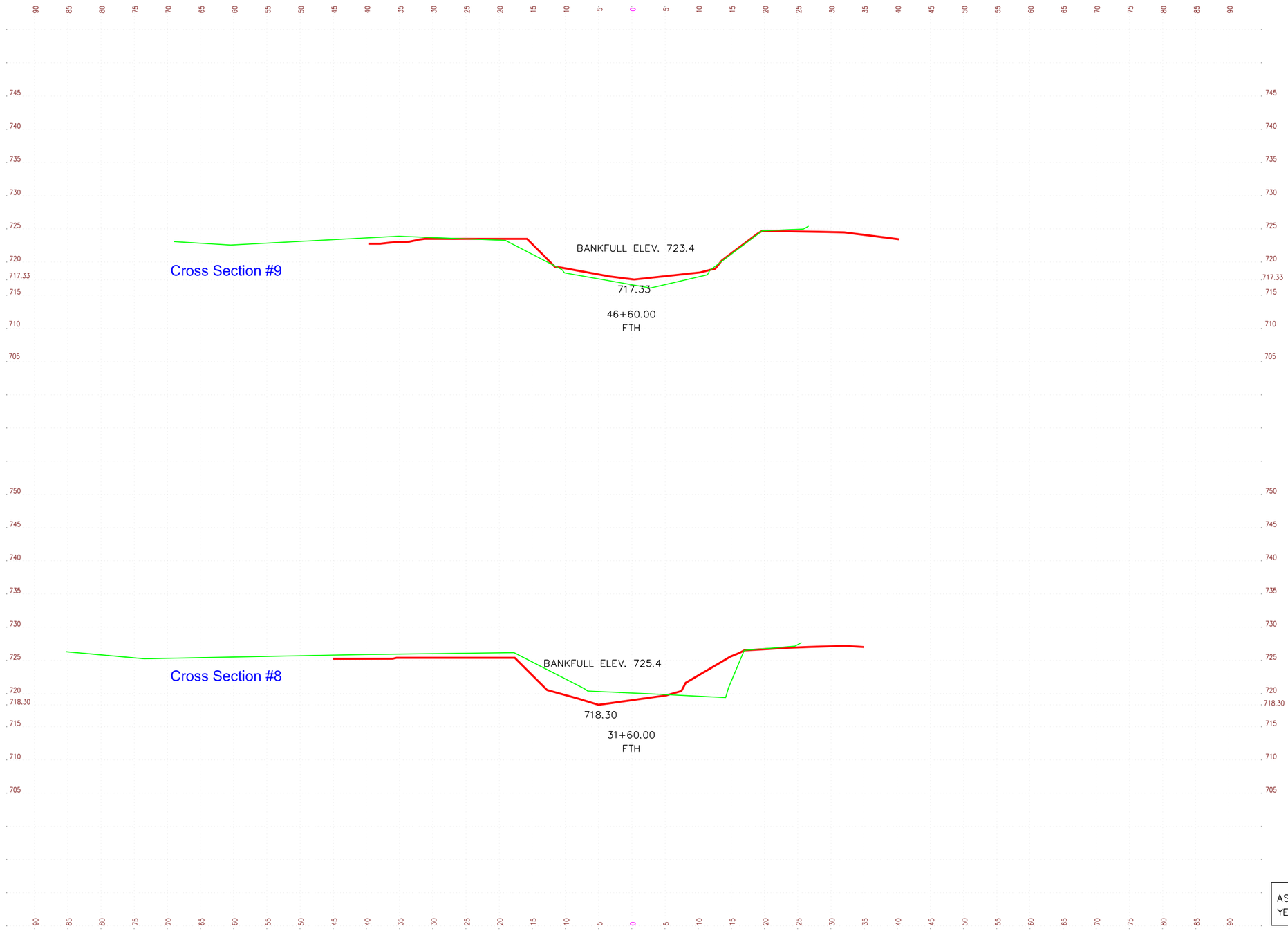
REV.	ISSUED DATE DESCRIPTION			SHEET TITLE	TASK/PHASE NUMBER	DRAWN BY
					PROJECT NUMBER	DRAWING NUMBER



	KEYPLAN	ARCADIS	Five Mile Branch Stream and Wetland Restoration Iredell County, NC NCEEP IMS ID# 92185	PROJECT MANAGER	DEPARTMENT MANAGER	LEAD DESIGN PROF. / CHECKED
REV. ISSUED DATE DESCRIPTION		ARCADIS G&M of North Carolina, Inc. 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607 Tel: 919-854-1282 Fax: 919-854-5448 www.arcadis-us.com		SHEET TITLE		TASK/PHASE NUMBER / DRAWN BY
						PROJECT NUMBER / DRAWING NUMBER



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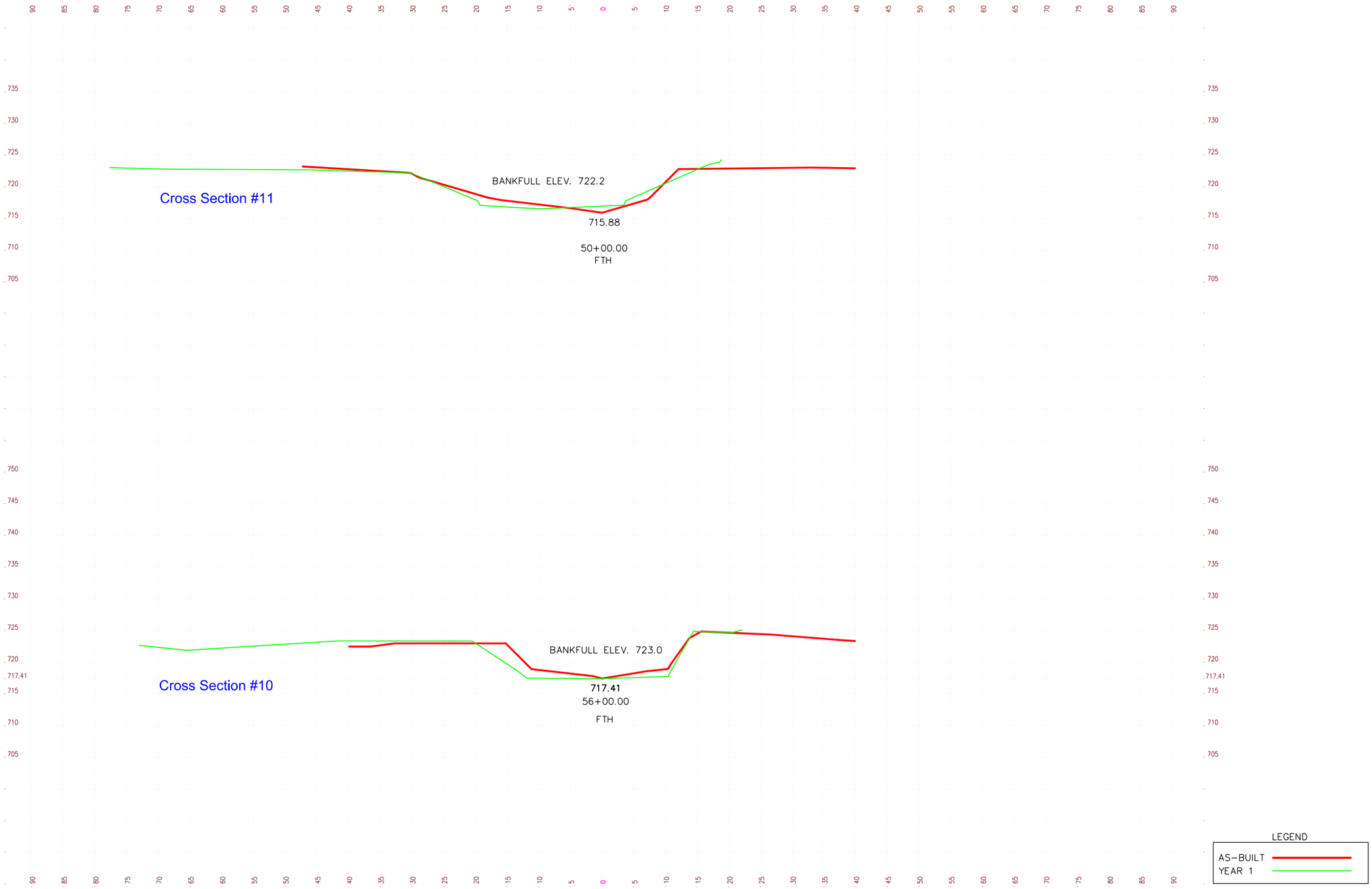
SHEET TITLE		TASK/PHASE NUMBER	DRAWN BY
		PROJECT NUMBER	DRAWING NUMBER



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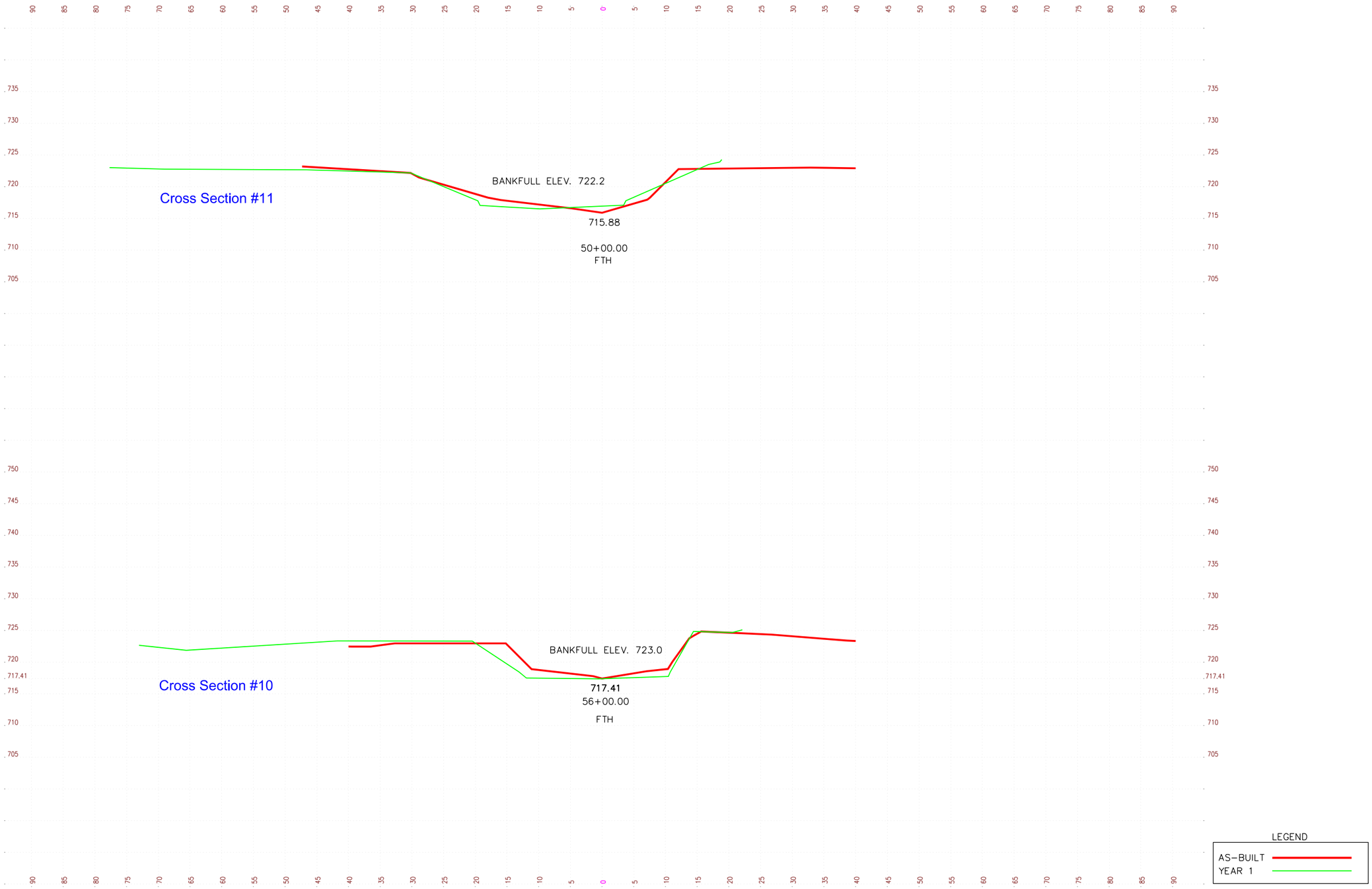
PROJECT MANAGER	DEPARTMENT MANAGER	LEAD DESIGN PROF.	CHECKED
SHEET TITLE		TASK/PHASE NUMBER	DRAWN BY
		PROJECT NUMBER	DRAWING NUMBER



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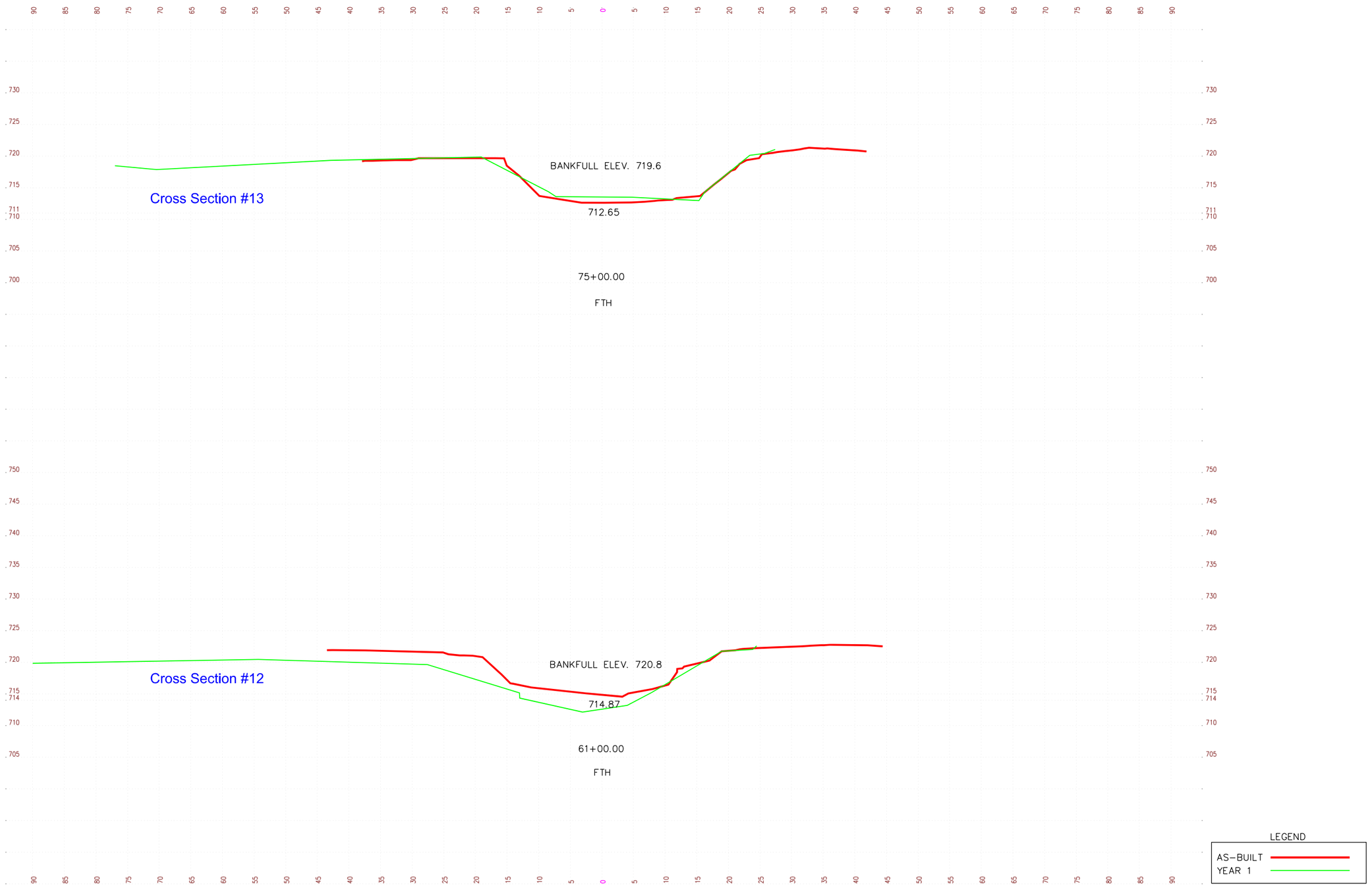


	KEYPLAN	ARCADIS G&M of North Carolina, Inc. 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607 Tel: 919-854-1282 Fax: 919-854-5448 www.arcadis-us.com	Five Mile Branch Stream and Wetland Restoration Iredell County, NC NCEEP IMS ID# 92185	PROJECT MANAGER / DEPARTMENT MANAGER	LEAD DESIGN PROF.	CHECKED
REV.	ISSUED DATE DESCRIPTION			SHEET TITLE	TASK/PHASE NUMBER	DRAWN BY
					PROJECT NUMBER	DRAWING NUMBER

Exhibit Table 5a. Baseline Stream Data Summary
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 1 Beaver Creek 5,622 feet

Parameter	Gauge[3]	Regional Curve	Pre-Existing Condition						References Reach(es) Data[1]						Design			As-Built / Baseline[2]					
Dimension and Substrate - Riffle		**Equation**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	51.0	41.9*	20.2	26.7	26.3	35.2	4.3	48	N/A	N/A	N/A	N/A	N/A		20.7	27.6	38.8	24.1	29.5	26.3	38.1	7.5	3
Floodprone Width (ft)			100.0	180.0	-	250.0	-	-	N/A	N/A	N/A	N/A	N/A		100.0	180.0	250.0	-	>200	-	-	0.0	3
Bankfull Mean Depth (ft)	2.7	2.2*	3.3	4.5	4.5	5.9	0.5	48	N/A	N/A	N/A	N/A	N/A		3.3	4.2	5.0	3.5	4.2	4.4	4.7	0.6	3
Bankfull Max Depth (ft)	3.3		5.0	6.9	6.9	8.1	0.7	48	N/A	N/A	N/A	N/A	N/A		4.6	5.9	7.2	6.4	6.8	7.0	7.1	4.0	3
Bankfull Cross Sectional Area (ft^2)	139.3	92.9**	79.7	119.4	116.9	176.0	22.9	48	N/A	N/A	N/A	N/A	N/A		75.0	115.5	163.2	105.4	121.1	124.5	133.4	14.3	3
Width/Depth Ratio	18.8		4.4	6.0	5.9	9.1	1.2	48	N/A	N/A	N/A	N/A	N/A		5.1	6.6	9.5	5.5	7.3	5.6	10.9	3.1	3
Entrenchment Ratio	1.4		4.6	8.2	-	10.9	-	-	N/A	N/A	N/A	N/A	N/A		3.6	6.4	9.0	5.2	7.0	7.6	8.3	1.6	3
Bank Height Ratio	1.4		1.0	1.2	-	1.5	-	-	N/A	N/A	N/A	N/A	N/A		-	1.0	-	-	1.0	-	-	0.0	3
d50 (mm)			-	0.2	-	-	-	-	N/A	N/A	N/A	N/A	N/A										
Profile																							
Riffle Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A		-	-	-	-	-	-	-	-	-
Riffle Slope (ft)			0.0	0.0020	0.0014	0.0094	0.003	26	N/A	N/A	N/A	N/A	N/A		0.0	0.0020	0.0094	-	-	-	-	-	-
Pool Length (ft)			5.5	25.7	19.1	161.9	27.5	34	N/A	N/A	N/A	N/A	N/A		5.5	25.7	161.9	-	-	-	-	-	-
Pool Max Depth (ft)			4.7	6.7	6.6	7.8	0.9	13	N/A	N/A	N/A	N/A	N/A		4.7	6.7	7.8	4.3	4.3	4.3	4.3	0	2
Pool Spacing (ft)			20.6	176.7	19.1	748.9	27.5	34	N/A	N/A	N/A	N/A	N/A		20.6	176.7	748.9	-	-	-	-	-	-
Pool Cross Sectional Area (ft2)			80.9	100.6	-	119.8	-	-	N/A	N/A	N/A	N/A	N/A		80.9	100.6	119.8	74.4	40.4	40.4	52.1	16.5	2
Pattern																							
Channel Beltwidth (ft)			47.0	235.0	-	443.0	-	-	N/A	N/A	N/A	N/A	N/A		47.0	235.0	443.0	47.0	235.0	-	443.0	-	-
Radius of Curvature (ft)			60.0	3527.0	-	14000.0	-	-	N/A	N/A	N/A	N/A	N/A		60.0	3527.0	14000.0	60.0	3527.0	-	14000.0	-	-
Rc: Bankfull Width (ft/ft)			2.7	161.8	-	642.2	-	-	N/A	N/A	N/A	N/A	N/A		2.2	127.8	507.2	2.2	127.8	-	507.2	-	-
Meander Wavelength (ft)			575.0	1380.0	-	2132.0	-	-	N/A	N/A	N/A	N/A	N/A		575.0	1380.0	2132.0	575.0	1380.0	-	2132.0	-	-
Meander Width Ratio			26.3	63.3	-	97.8	-	-	N/A	N/A	N/A	N/A	N/A		20.8	50.0	77.2	20.8	50.0	-	77.2	-	-
Substrate, bed and transport parameters																							
Ri% / Ru% / P% / G% / S%			-						N/A									-	-	-	-	-	-
SC% / Sa% /G.% / C% / B% / Be%			-						N/A														
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)			> 2.0 mm						N/A														
Reach Shear Stress (competency) lb/f^2			0.43												0.35			0.31					
Max part size (mm) mobilized at bankfull			33.0												24.0			22.7					
Stream power (transport capacity) W/m^2			1.58												1.3			1.29					
Additional Reach Parameters																							
Drainage Area (SM)			10.76						N/A														
Impervious cover estimate (%)			10-20						N/A														
Rosgen Classification	B		E5						N/A						E5			E5					
Bankfull Velocity (fps)	3.9	4.1***	3.8												3.7			3.6					
Bankfull Discharge (cfs)	539.9	379.2**	453.7																				
Valley length (ft)			-						N/A														
Channel Thalweg length (ft)			-						N/A						-			-					
Sinuosity (ft)			1.07						N/A						1.07			1.07					
Water Surface Slope (Channel) (ft/ft)	0.0032		0.0016						N/A						0.0016			0.0014					
BF slope (ft/ft)	-		-						N/A						-			-					
Bankfull Floodplane Area (acres)			-						N/A						-			-					
Additional Reach Parameters																							
Proportion over wide (%)			-						N/A														
Entrenchment Class (ER Range)			-						N/A														
Incision Class (BHR Range)			-						N/A														
BEHI VL% / L% / M% / H% / VH% / E%			-						N/A														
Channel Stability or Habitat Metric			-						N/A														
Biological or Other			-						N/A														

* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 1/27/2010

** NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 3/16/2006

***Bankfull Discharge/Bankfull Cross Sectional Area

1 A singulare reference stream was not used to design the Enhancement Level II project.

2 As built profile parameters not calculated for Enhancement Level II

Exhibit Table 5b. Baseline Stream Data Summary
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 2 Fifth Creek upstream of Beaver Creek 1,251 feet

Parameter	Gauge[3]	Regional Curve	Pre-Existing Condition						References Reach(es) Data[1]						Design			As-Built / Baseline[2]					
Dimension and Substrate - Riffle		**Equation**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Max**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	51.0	46.0*	23.9	30.7	30.3	40.3	4.8	11	N/A	N/A	N/A	N/A	N/A	N/A	25.1	29.0	33.0	-	24.2	-	-	-	1
Floodprone Width (ft)			-	>200.0	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	>200.0	-	-	>200.0	-	-	-	1
Bankfull Mean Depth (ft)	2.7	2.3*	3.8	4.2	4.2	5.0	0.4	11	N/A	N/A	N/A	N/A	N/A	N/A	3.8	4.1	4.6	-	4.3	-	-	-	1
Bankfull Max Depth (ft)	3.3		6.7	7.8	7.9	9.1	0.6	11	N/A	N/A	N/A	N/A	N/A	N/A	6.4	7.4	8.3	-	7.7	-	-	-	1
Bankfull Cross Sectional Area (ft^2)	139.3	112.5**	94.0	130.1	128.2	176.4	4.8	11	N/A	N/A	N/A	N/A	N/A	N/A	104.5	119.7	144.7	-	104.2	-	-	-	1
Width/Depth Ratio	18.8		5.3	7.0	7.1	8.4	1.0	11	N/A	N/A	N/A	N/A	N/A	N/A	5.5	7.0	8.6	-	5.6	-	-	-	1
Entrenchment Ratio	1.4		-	6.5	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	6.5	-	-	8.3	-	-	-	1
Bank Height Ratio	1.4		1.1	1.1	-	1.2	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1.0	1.0	1.0	-	1.0	-	-	-	1
d50 (mm)			-	0.2	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A									
Profile																							
Riffle Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-
Riffle Slope (ft)			0.0009	0.0010	0.0010	0.0011	0.0001	2	N/A	N/A	N/A	N/A	N/A	N/A	0.0009	0.0010	0.0011	-	-	-	-	-	-
Pool Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	81.2	112.8	144.3	-	-	-	-	-	-
Pool Max Depth (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	7.5	7.8	8.0	-	7.2	-	-	-	1
Pool Spacing (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	272.0	297.0	322.0	-	-	-	-	-	-
Pool Cross Sectional Area (ft2)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	104.5	119.7	144.7	-	136.3	-	-	-	1
Pattern																							
Channel Beltwidth (ft)			48.0	639.0	-	1566.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	48.0	639.0	1566.0	48.0	639.0	-	1566.0	-	-
Radius of Curvature (ft)			1275.0	2693.0	-	3800.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1275.0	2693.0	3800.0	1275.0	2693.0	-	3800.0	-	-
Rc: Bankfull Width (ft/ft)			49.6	104.8	-	147.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	49.6	104.8	147.8	49.6	104.8	-	147.8	-	-
Meander Wavelength (ft)			4464.0	4618.0	-	4771.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	4464.0	4618.0	4771.0	4464.0	4618.0	-	4771.0	-	-
Meander Width Ratio			173.7	179.7	-	185.6	-	-	N/A	N/A	N/A	N/A	N/A	N/A	173.7	179.7	185.6	173.7	179.7	-	185.6	-	-
Substrate, bed and transport parameters																							
Ri% / Ru% / P% / G% / S%			-						N/A									-	-	-	-	-	-
SC% / Sa% /G.% / C% / B% / Be%			-						N/A														
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)			> 2.0 mm						N/A														
Reach Shear Stress (competency) lb/ft^2			0.38												0.3			0.37					
Max part size (mm) mobilized at bankfull			28.0												17.0			27.9					
Stream power (transport capacity) W/m^2			1.36												1.46			1.79					
Additional Reach Parameters																							
Drainage Area (SM)			13.93						N/A														
Impervious cover estimate (%)			10-20						N/A														
Rosgen Classification	B		E5						N/A						E5			E5					
Bankfull Velocity (fps)	3.9	4.1***	3.4												3.4			3.9					
Bankfull Discharge (cfs)	539.9	466.8**	442.3																				
Valley length (ft)			-						N/A														
Channel Thalweg length (ft)			-						N/A						-			-					
Sinuosity (ft)			1.04						N/A						1.04			1.04					
Water Surface Slope (Channel) (ft/ft)	0.0032		0.0013						N/A						0.0013			0.00171					
BF slope (ft/ft)	-		-						N/A						-			-					
Bankfull Floodplain Area (acres)			-						N/A						-			-					
Additional Reach Parameters																							
Proportion over wide (%)			-						N/A														
Entrenchment Class (ER Range)			-						N/A														
Incision Class (BHR Range)			-						N/A														
BEHI VL% / L% / M% / H% / VH% / E%			-						N/A														
Channel Stability or Habitat Metric			-						N/A														
Biological or Other			-						N/A														

* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 1/27/2010

** NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 3/16/2006

***Bankfull Discharge/Bankfull Cross Sectional Area

1 A singulare reference stream was not used to design the Enhancement Level II project.

2 As built profile parameters not calculated for Enhancement Level II

Exhibit Table 5c. Baseline Stream Data Summary
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 3 Fifth Creek downstream of Beaver Creek 4.377 feet

Parameter	Gauge[3]	Regional Curve	Pre-Existing Condition						References Reach(es) Data[1]						Design			As-Built / Baseline[2]					
Dimension and Substrate - Riffle		**Equation**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**	**Min**	**Mean**	**Med**	**Min**	**Mean**	**Med**	**Max**	**SD**	**n**
Bankfull Width (ft)	51	58*	27.9	35.6	34.7	44.1	3.9	27	N/A	N/A	N/A	N/A	N/A	N/A	26.3	33.4	40.8	28.4	34.1	32.2	41.7	6.9	3
Floodprone Width (ft)			250	316.7	-	400.0	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	>200.0	-	-	>200.0	-	-	-	-
Bankfull Mean Depth (ft)	2.7	2.8*	4.5	5.3	5.1	6.8	0.5	27	N/A	N/A	N/A	N/A	N/A	N/A	4.0	4.7	5.7	4.0	4.3	4.1	4.7	0.4	3
Bankfull Max Depth (ft)	3.3		5.8	7.6	7.2	9.3	0.7	27	N/A	N/A	N/A	N/A	N/A	N/A	5.1	6.5	7.8	5.6	6.3	6.3	7.1	0.8	3
Bankfull Cross Sectional Area (ft^2)	139.3	179.2**	192.6	202.5	175.5	222.2	22	27	N/A	N/A	N/A	N/A	N/A	N/A	120.3	157.8	202.7	115.3	143.5	150.2	165.2	25.6	3
Width/Depth Ratio	18.8		4.7	6.6	6.8	8.2	1.0	25	N/A	N/A	N/A	N/A	N/A	N/A	5.2	7.1	8.8	6.9	8.1	6.9	10.4	2	3
Entrenchment Ratio	1.4		7.1	8.6	-	10.8	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	>6.5	-	4.8	6.0	6.2	7.0	1.1	3
Bank Height Ratio	1.4		1.3	1.5	-	1.7	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	1.0	-	1.0	1.0	1.0	1.0	0	3
d50 (mm)			-	0.2	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A									
Profile																							
Riffle Length (ft)			-	-	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-	-	-	-
Riffle Slope (ft)			0.0	0.0017	0.002	0.004	0	18	N/A	N/A	N/A	N/A	N/A	N/A	0.0022	0.0026	0.003	-	-	-	-	-	-
Pool Length (ft)			15.2	30	27.5	69.8	15	19	N/A	N/A	N/A	N/A	N/A	N/A	81.2	112.8	144.3	-	-	-	-	-	-
Pool Max Depth (ft)			8	9.4	9.5	11.4	1.1	15	N/A	N/A	N/A	N/A	N/A	N/A	7.5	7.8	8.0	6.1	6.4	6.2	7.0	0.5	3
Pool Spacing (ft)			62.3	256.3	150.6	1206	298	18	N/A	N/A	N/A	N/A	N/A	N/A	272.0	297.0	322.0	-	-	-	-	-	-
Pool Cross Sectional Area (ft2)			-	199.0	-	-	-	-	N/A	N/A	N/A	N/A	N/A	N/A	120.3	157.8	202.7	148.3	169.9	152.2	209.2	34.1	3
Pattern																							
Channel Beltwidth (ft)			48	639	-	1556	-	-	N/A	N/A	N/A	N/A	N/A	N/A	48	639	1556	48	639	-	1556	-	-
Radius of Curvature (ft)			1275	2693	-	3800	-	-	N/A	N/A	N/A	N/A	N/A	N/A	1275	2693	3800	1275	2693	-	3800	-	-
Rc: Bankfull Width (ft/ft)			34.7	73.4	-	103.5	-	-	N/A	N/A	N/A	N/A	N/A	N/A	49.6	73.4	113.8	38.2	80.6	-	113.8	-	-
Meander Wavelength (ft)			4464	4618	-	4771	-	-	N/A	N/A	N/A	N/A	N/A	N/A	4464	4618	4771	4464	4618	-	4771	-	-
Meander Width Ratio			121.6	125.8	-	130	-	-	N/A	N/A	N/A	N/A	N/A	N/A	173.7	125.8	46.9	1.4	19.1	-	46.9	-	-
Substrate, bed and transport parameters																							
Ri% / Ru% / P% / G% / S%			-						N/A									-	-	-	-	-	-
SC% / Sa% /G.% / C% / B% / Be%			-						N/A														
d16 / d35 / d50 / d84 / d95 / di^p / di^{sp} (mm)			> 2.0 mm						N/A														
Reach Shear Stress (competency) lb/ft^2			0.46												0.35			0.36					
Max part size (mm) mobilized at bankfull			35												20			27.1					
Stream power (transport capacity) W/m^2			2.76												1.06			1.49					
Additional Reach Parameters																							
Drainage Area (SM)			26.05						N/A														
Impervious cover estimate (%)			10-20						N/A														
Rosgen Classification	B		E5						N/A						E5			E5					
Bankfull Velocity (fps)	3.9	4.3***	5.2												3.9			3.7					
Bankfull Discharge (cfs)	539.9	772.1**	1166.3																				
Valley length (ft)			-						N/A														
Channel Thalweg length (ft)			-						N/A						-			-					
Sinuosity (ft)			1.04						N/A						1.04			1.04					
Additional Reach Parameters																							
BF slope (ft/ft)	-		-						N/A						-			-					
Bankfull Floodplane Area (acres)			-						N/A						-			-					
Proportion over wide (%)			-						N/A														
Entrenchment Class (ER Range)			-						N/A														
Incision Class (BHR Range)			-						N/A														
BEHI VL% / L% / M% / H% / VH% / E%			-						N/A														
Channel Stability or Habitat Metric			-						N/A														
Biological or Other			-						N/A														

* NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 1/27/2010

** NC Rural Mountain and Piedmont Regional Curve, Surry County NRCS, Draft 3/16/2006

***Bankfull Discharge/Bankfull Cross Sectional Area

1 A singulare reference stream was not used to design the Enhancement Level II project.

2 As built profile parameters not calculated for Enhancement Level II

Exhibit Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters -- Cross Section)
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 1 Beaver Creek 5,622 feet

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																																			
Bankfull Width (ft)	26.3	27.9						38.1	30.7						28.7	34.2						24.1	31.8						52.1	28.8					
Floodprone Width (ft)	200.0	200.0						200.0	200.0						200.0	200.0						200.0	200.0						200.0	200.0					
Bankfull Mean Depth (ft)	4.7	4.4						3.5	3.7						2.6	3.7						4.4	3.7						1.8	3.6					
Bankfull Max Depth (ft)	7.1	5.9						6.4	5.2						4.3	6.1						7.0	5.5						4.3	6.1					
Bankfull Cross Sectional Area (ft^2)	124.5	123.7						133.4	115.0						74.4	125.8						105.4	117.4						95.3	102.6					
Bankfull Width/Depth Ratio	5.6	6.3						10.9	8.3						11.0	9.2						5.5	8.6						28.9	10.8					
Bankfull Entrenchment Ratio	7.6	7.2						5.2	6.5						7.0	5.8						8.3	6.3						3.8	6.9					
Bankfull Bank Height Ratio	1.0	1.0						1.0	1.0						1.0	1.0						1.0	1.0						1.0	1.0					
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)		219							226							235.0							213							156					
d50 (mm)	0.2							0.2							0.2							0.2							0.2						
	Cross Section # (##)							**Cross Section # (##)**							**Cross Section # (##)**							**Cross Section # (##)**							**Cross Section # (##)**						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)																																			

Exhibit Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters -- Cross Section)
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 2 Fifth Creek upstream of Beaver Creek 1,251

	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																																				
Bankfull Width (ft)	34.2	32.3						24.2	28.5																											
Floodprone Width (ft)	200.0	200.0						200.0	200.0																											
Bankfull Mean Depth (ft)	4.0	4.6						4.3	4.5																											
Bankfull Max Depth (ft)	7.2	7.2						7.7	6.0																											
Bankfull Cross Sectional Area (ft²)	136.3	147.6						104.2	127.2																											
Bankfull Width/Depth Ratio	8.6	7.0						5.6	6.3																											
Bankfull Entrenchment Ratio	5.8	6.2						8.3	7.0																											
Bankfull Bank Height Ratio	1.0	1.0						1.0	1.0																											
Based on current/developing bankfull feature																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft²)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft²)		203							247																											
d50 (mm)	0.2							0.2																												

	Cross Section # (##)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft²)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Based on current/developing bankfull feature																																				
Bankfull Width (ft)																																				
Floodprone Width (ft)																																				
Bankfull Mean Depth (ft)																																				
Bankfull Max Depth (ft)																																				
Bankfull Cross Sectional Area (ft²)																																				
Bankfull Width/Depth Ratio																																				
Bankfull Entrenchment Ratio																																				
Bankfull Bank Height Ratio																																				
Cross Sectional Area between end pins (ft²)																																				
d50 (mm)																																				

Exhibit Table 6. Morphology and Hydraulic Monitoring Summary (Dimensional Parameters -- Cross Section)
Five Mile Branch Stream Restoration, EEP IMS ID# 92185 Segment/Reach: Reach 3 Fifth Creek downstream of Beaver Creek

	Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)							Cross Section 11 (Riffle)							Cross Section 12 (Pool)						
Dimension and substrate	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Based on fixed baseline bankfull elevation																																			
Bankfull Width (ft)	32.2	34.5						33.7	36.8						28.4	34.0						41.7	34.9						36.6	43.0					
Floodprone Width (ft)	200.0	200.0						200.0	200.0						200.0	200.0						200.0	200.0						200.0	200.0					
Bankfull Mean Depth (ft)	4.7	4.9						4.4	4.5						4.1	4.8						4.0	4.9						4.2	4.3					
Bankfull Max Depth (ft)	7.1	6.8						6.1	7.2						5.6	5.9						6.3	5.7						6.2	7.5					
Bankfull Cross Sectional Area (ft^2)	150.2	170.2						148.3	166.8						115.3	162.8						165.1	170.7						152.2	183.2					
Bankfull Width/Depth Ratio	6.9	7.0						7.7	8.2						6.9	7.1						10.4	7.1						8.8	10.0					
Bankfull Entrenchment Ratio	6.2	5.8						5.9	5.4						7.0	5.9						4.8	5.7						5.5	4.7					
Bankfull Bank Height Ratio	1.0	1.0						1.0	1.0						1.0	1.0						1.0	1.0						1.0	1.0					
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)		284							248							229							285							376					
d50 (mm)	0.2							0.2							0.2							0.2							0.2						

	Cross Section 13 (Pool)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)							Cross Section # (##)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	40.1	42.1																																	
Floodprone Width (ft)	200.0	200.0																																	
Bankfull Mean Depth (ft)	5.2	4.9																																	
Bankfull Max Depth (ft)	7.0	6.7																																	
Bankfull Cross Sectional Area (ft^2)	209.2	206.4																																	
Bankfull Width/Depth Ratio	7.7	8.6																																	
Bankfull Entrenchment Ratio	5.0	4.8																																	
Bankfull Bank Height Ratio	1.0	1.0																																	
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)		246																																	
d50 (mm)	0.2																																		

Cross Section 1 12/5/13

Cross Section 2 12/5/13

Cross Section 1 12/5/13

Cross Section 3 12/5/13

Cross Section 2 12/5/13

Cross Section 3 12/5/13

Cross Section 4 12/5/13

Cross Section 5 12/5/13

Cross Section 4 12/5/13

Cross Section 6 12/5/13

Cross Section 5 12/5/13

Cross Section 6 12/5/13

Cross Section 7 12/5/13

Cross Section 8 12/15/13

Cross Section 7 12/5/13

Cross Section 9 12/15/13

Cross Section 8 12/15/13

Cross Section 9 12/15/13

Cross Section 10 12/15/13

Cross Section 11 12/15/13

Cross Section 10 12/15/13

Cross Section 12 12/15/13

Cross Section 11 12/15/13

Cross Section 12 12/15/13

Cross Section 13 12/15/13

Cross Section 13 12/15/13

Appendix E

Hydrology Data

Table 12. Verification of Bankfull Events Five Mile Branch Stream and Wetland Restoration NCEEP # 92185			
Date of Data Collection	Date of Occurance	Method	Photo #
5/30/2012	Unknown	Debris on floodplain	In asbuilt report
10/8/2013	7/6/2013	Stream gauge	
10/8/2013	7/27/2013	Stream gauge and silt inside of rain gauge. 3.71 inches of rain.	
12/5/2103	11/27/2013	Stream gauge	

Table 13. Wetland Gauge Attainment Data
Five Mile Branch Stream and Wetland Restoration
NCEEP # 92185

Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2013)	Year 2 (2014)	Year 3 (2015)	Year 4 (2016)	Year 5 (2017)
1	Yes/125 days (68.3 percent)				
2	Yes/42 days (23.0 percent)				
3	Yes/42 days (23.0 percent)				
4	Yes/99 days (54.1 percent)				
5	Yes/89 days (48.6 percent)				
6	Yes/31 days (16.9 percent)				
7	Yes/30 days (16.4 percent)				
8	Yes/183 days (100.0 percent)				
9	Yes/41 days (22.4 percent)				
10	Yes/183 days (100.0 percent)				
11	Yes/30 days (16.4 percent)				
12	Yes/78 days (42.6 percent)				
13	Yes/81 days (44.3 percent)				
14	Yes/68 days (37.2 percent)				
15	Yes/42 days (23.0 percent)				
16	Yes/43 days (23.5 percent)				
17	No/4 days (2.2 percent)				
18	Yes/18 days (9.8 percent)				
19	Yes/63 days (34.4 percent)				
20	Yes/38 days (20.8rcent)				
21	Yes/183 days (100.0 percent)				

Table 13. Wetland Gauge Attainment Data
Five Mile Branch Stream and Wetland Restoration
NCEEP # 92185

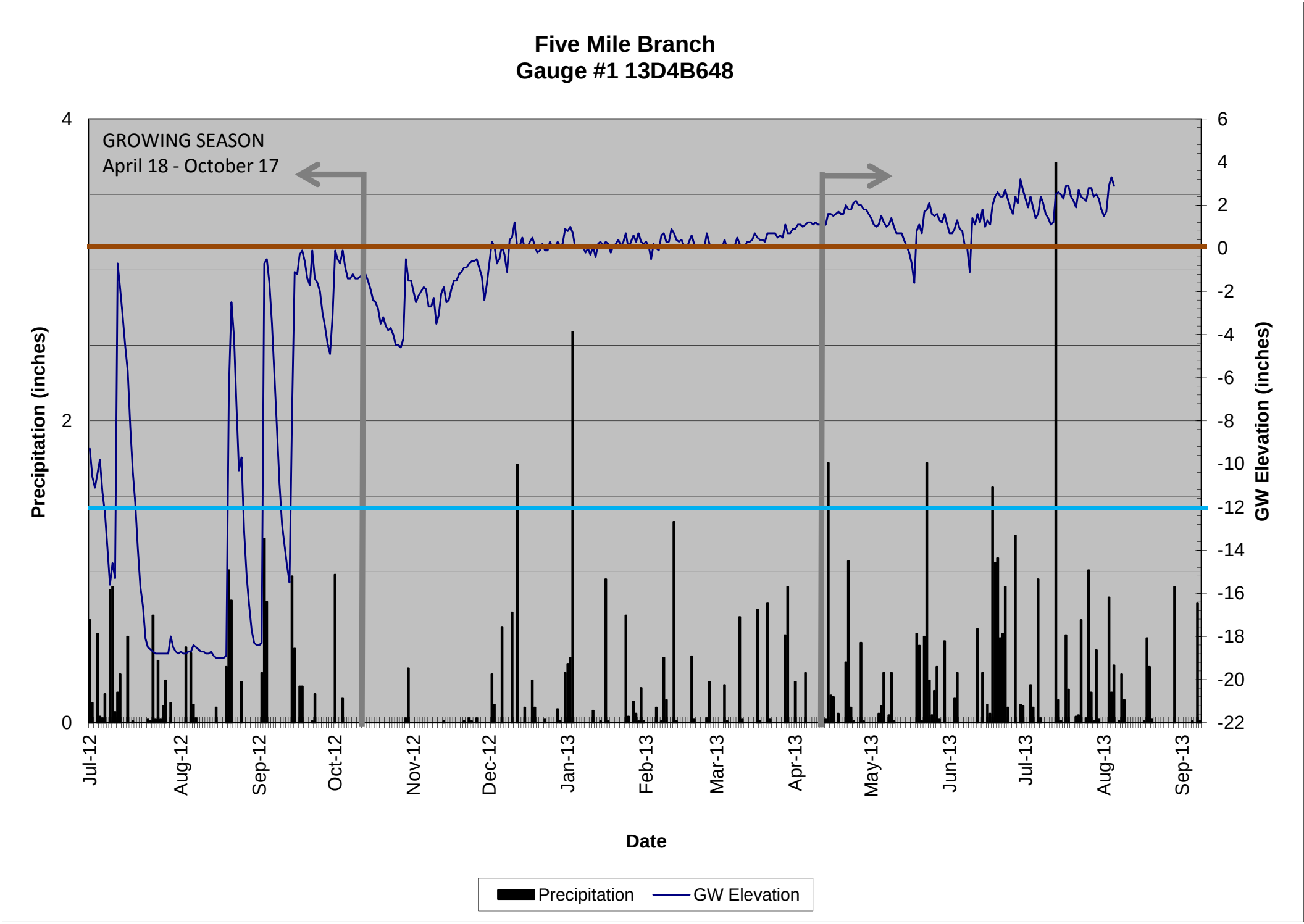
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2013)	Year 2 (2014)	Year 3 (2015)	Year 4 (2016)	Year 5 (2017)
22	Yes/183 days (100.0 percent)				
23	Yes/183 days (100.0 percent)				
24	Yes/31 days (16.9 percent)				
25	Yes/98 days (53.6 percent)				
26	Yes/100 days (54.6 percent)				
27	Yes/30 days (16.4 percent)				
28	Yes/14 days (7.7 percent)				
29	Yes/123 days (67.2 percent)				
30	Yes/37 days (20.2 percent)				

Table 14. Groundwater Gauge Downloading History
Five Mile Branch Stream and Wetland Restoration
NCEEP # 92185

		Download Event Date						
Number	Seriel Number	3/20/2013	4/3/2013	5/29/2013	6/4/2013	8/20/2013	12/5/2013	12/15/2013
1	13D4B648	ok	ok	Failed	No attempt.	ok	Replaced with EBD3010.	No attempt.
2	14E14322	Reprogrammed due to inconsistent logging interval.	Replaced with 12D4C9D8.	ok	No attempt.	ok	failed	No attempt.
3	1314FC9A	Failed	ok	ok	No attempt.	Failed	Replaced with 13152502.	No attempt.
4	13D49A3B	ok	ok	ok	No attempt.	ok	ok	No attempt.
5	14E16DC9	ok	ok	ok	No attempt.	ok	ok	No attempt.
6	14E1A3C5	Reprogrammed due to not downloading.	ok	ok	No attempt.	Failed	ok	No attempt.
7	13D4CA32	ok	ok	ok	No attempt.	ok	ok	No attempt.
8	13D49BC4	ok	ok	ok	No attempt.	ok	ok	No attempt.
9	136B6377	ok	ok	ok	No attempt.	Failed	Replaced with EBD20B9.	No attempt.
10	13D4B632	ok	ok	ok	No attempt.	ok	ok	No attempt.
11	14E178FC	ok	ok	ok	No attempt.	Failed	Replaced with EBD074F.	No attempt.
12	14E13DAE	ok	ok	ok	No attempt.	ok	ok	No attempt.
13	13D4A9D9	ok	ok	ok	No attempt.	ok	ok	No attempt.
14	13D4C9C5	ok	ok	ok	No attempt.	Failed	ok	No attempt.
15	A28B85B	ok	ok	ok	No attempt.	No attempt due to malfunctioning handheld.	No attempt.	No attempt.
16	11312B9E	ok	Failed	ok	No attempt.	No attempt due to malfunctioning handheld.	No attempt. Submerged	No attempt.
17	14E16DE5	ok	ok	ok	No attempt.	No attempt due to malfunctioning handheld.	ok	No attempt.
18	13153397	Failed	Replaced with 13D493A9.	No attempt due to accident.	No attempt. Could not locate.	No attempt due to malfunctioning handheld.	ok	No attempt.
19	14E15453	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
20	9DE6C32	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
21	9DE6D1F	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
22	EBD1038	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
23	13D4B61D	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
24	A287DCE	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok

Table 14. Groundwater Gauge Downloading History
Five Mile Branch Stream and Wetland Restoration
NCEEP # 92185

		Download Event Date						
Number	Seriel Number	3/20/2013	4/3/2013	5/29/2013	6/4/2013	8/20/2013	12/5/2013	12/15/2013
25	13D4B624	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
26	EBDD6BE	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
27	14E13D38	Reprogrammed due to no data.	ok	No attempt due to accident.	Reprogrammed due to inconsistent logging interval.	No attempt due to malfunctioning handheld.	No attempt.	ok
28	14E1973F	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
29	14E177C0	ok	ok	No attempt due to accident.	ok	No attempt due to malfunctioning handheld.	No attempt.	ok
30	13D4CA00	ok	ok	No attempt due to accident.	No attempt.	No attempt due to malfunctioning handheld.	No attempt.	ok
RAIN	13D4BAF9	ok	ok	ok full of ants	No attempt.	Failed. Silt in gauge from flooding.	Failed	Failed


Five Mile Branch
Gauge #1 13D4B648
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Date
Precipitation
GW Elevation

Five Mile Branch
Gauge #2 13D4C9D8

GROWING SEASON
April 18 - October 17

Precipitation (inches)

4
2
0

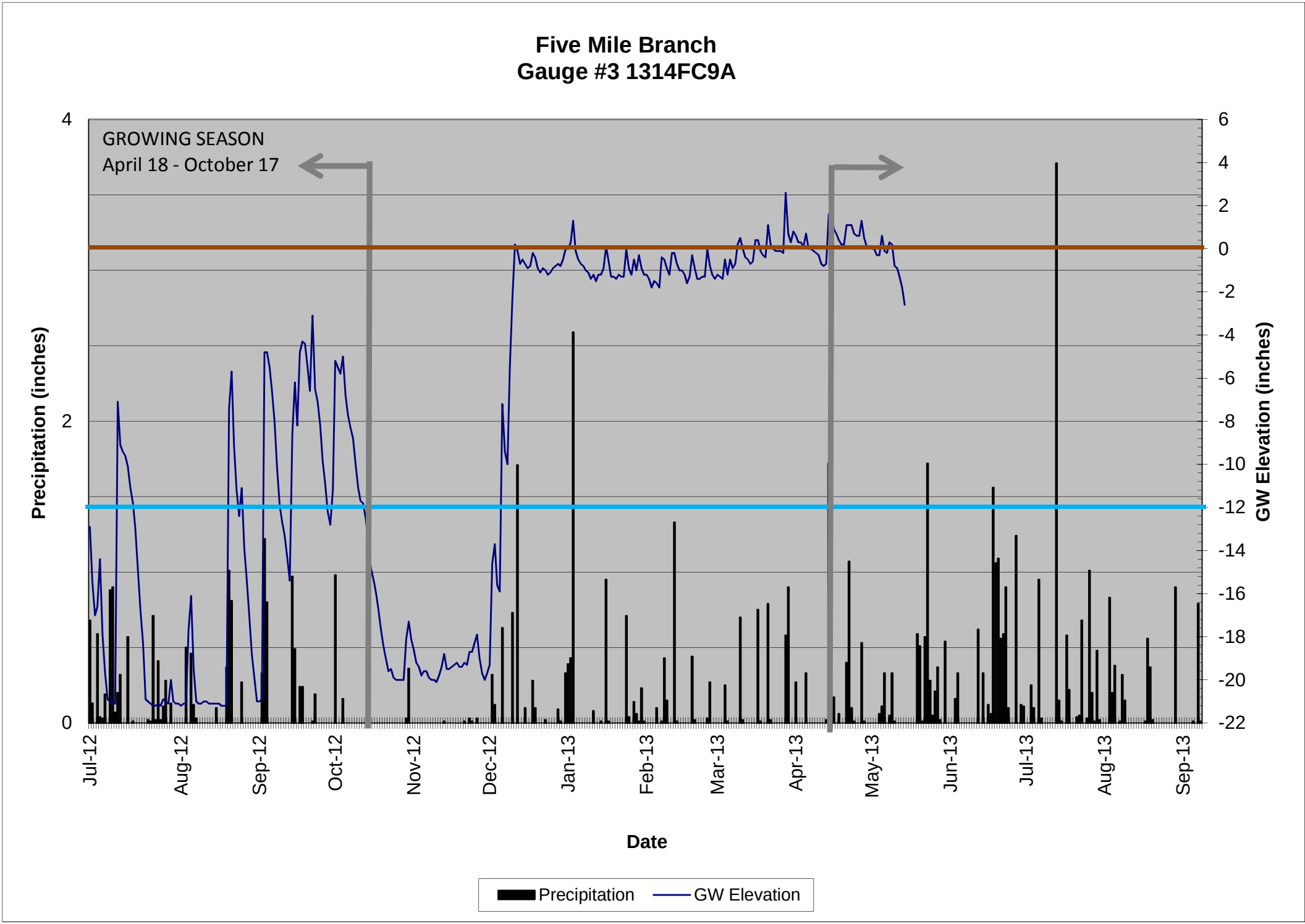
GW Elevation (inches)

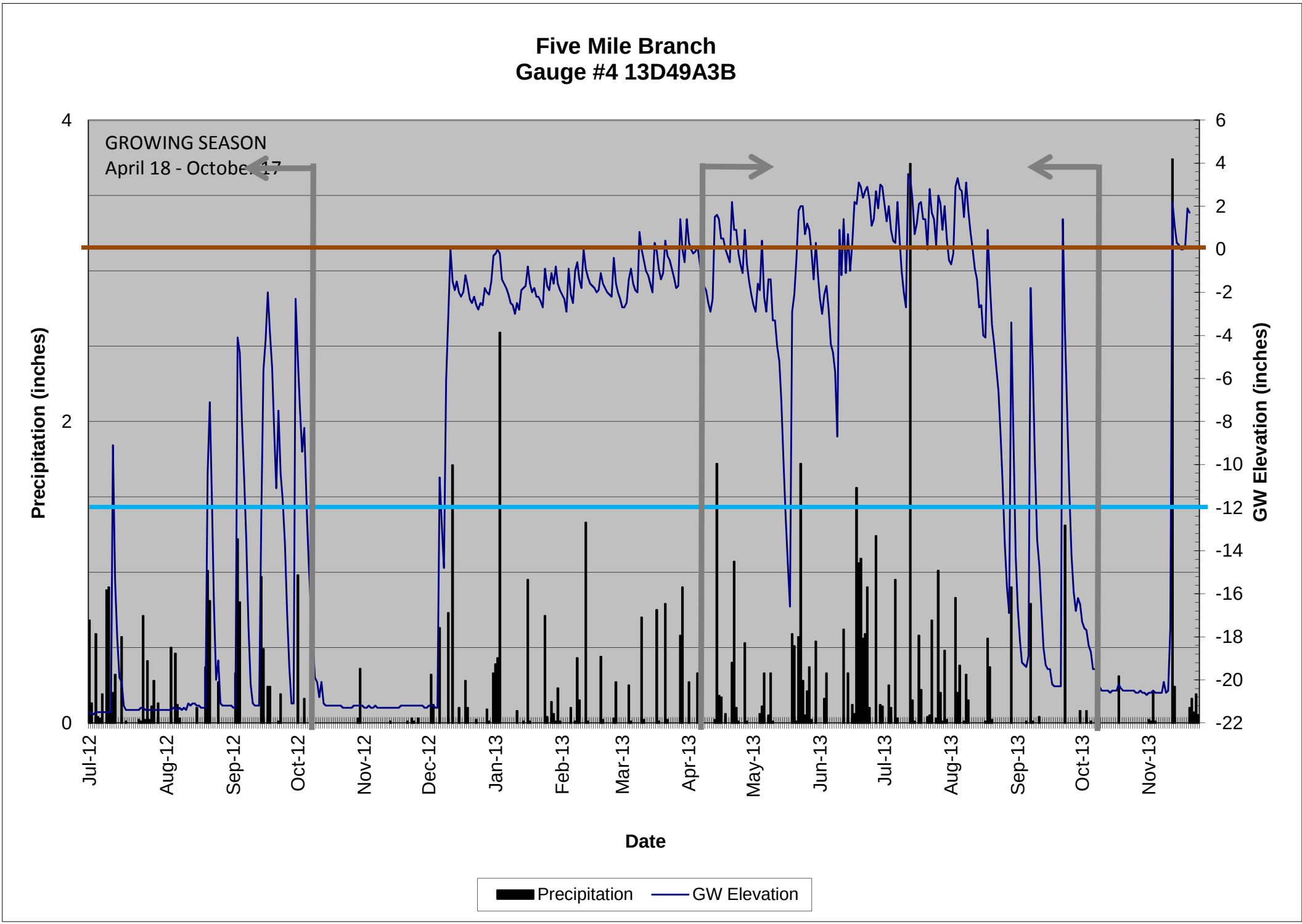
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24

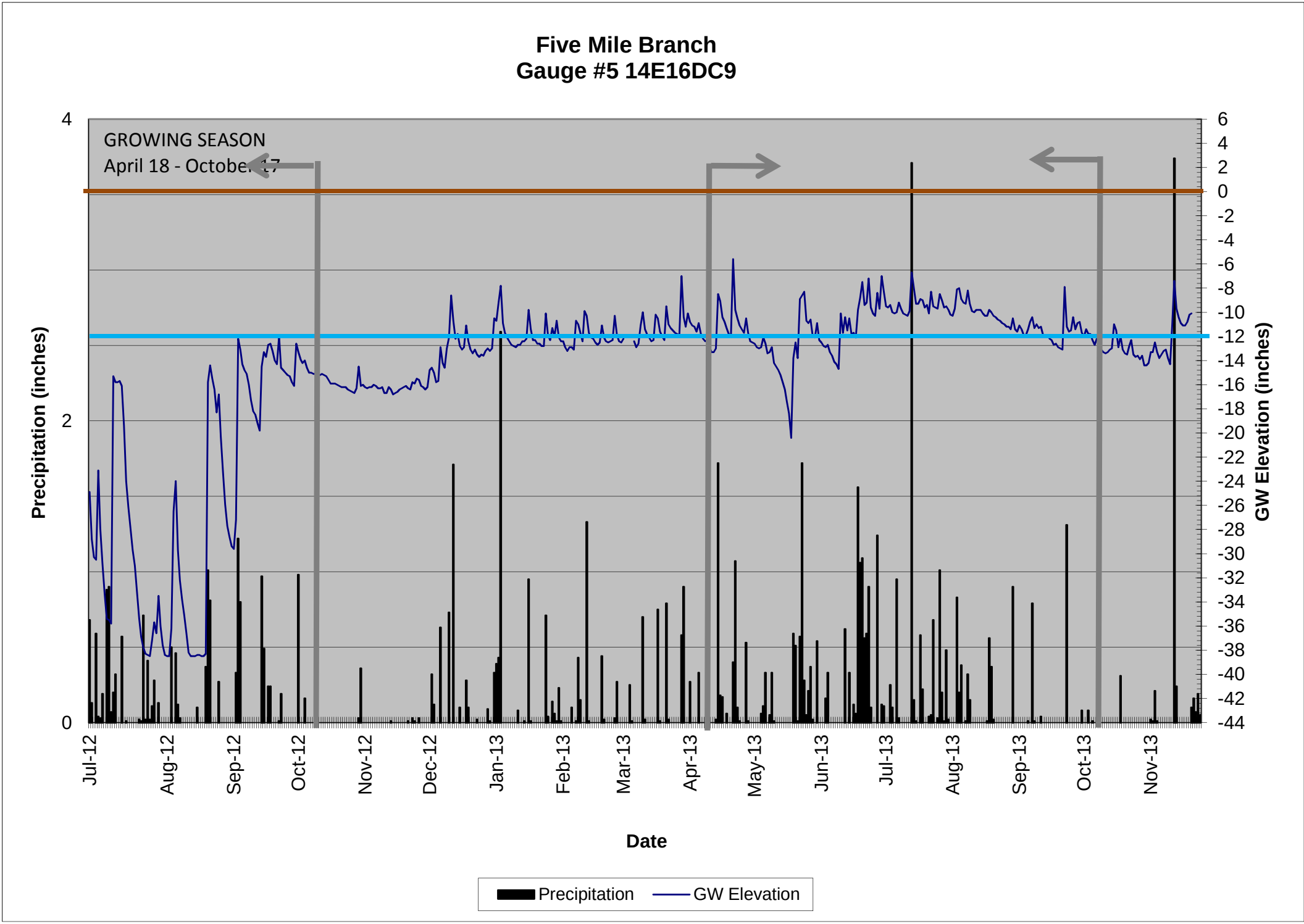
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13

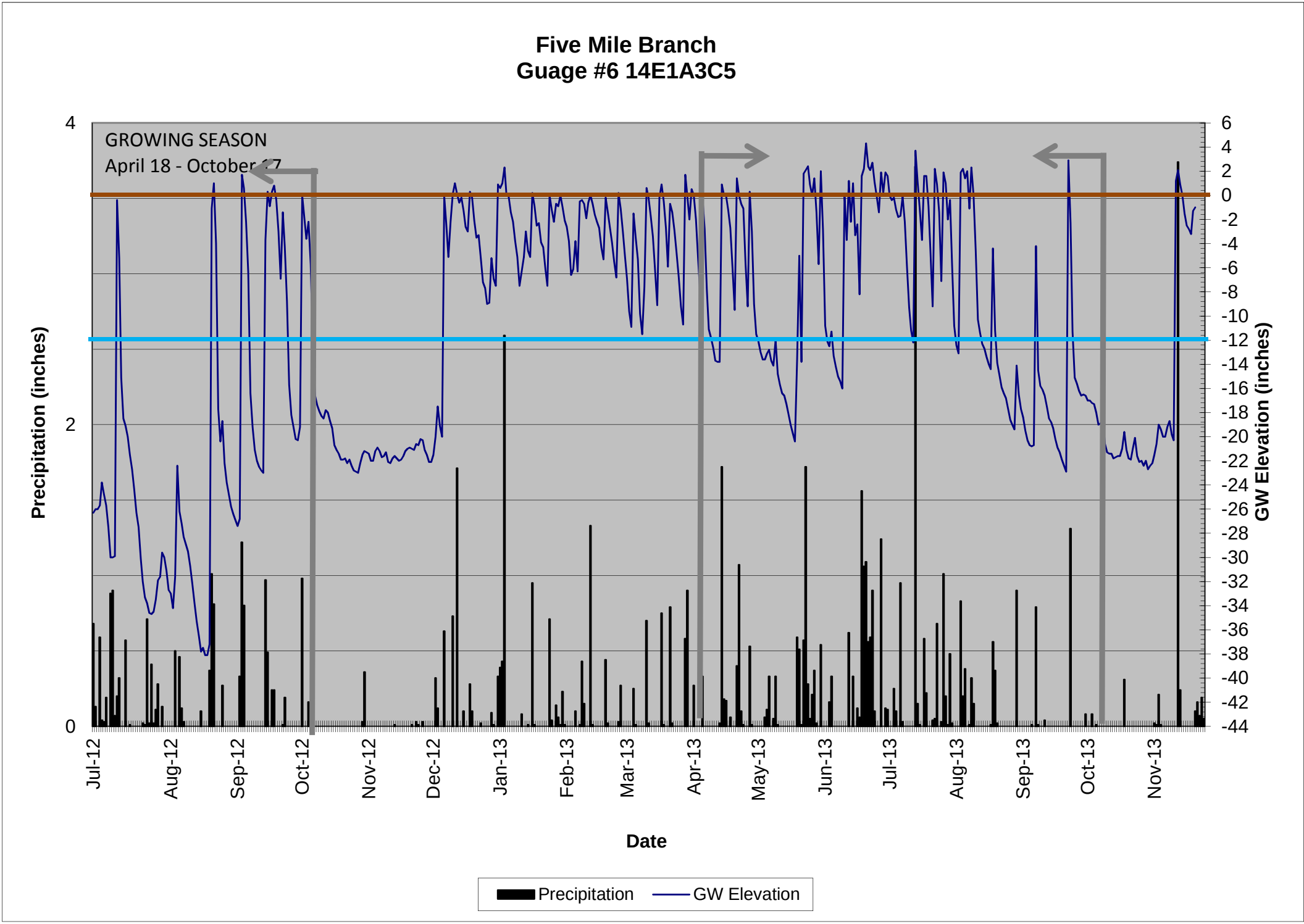
Date

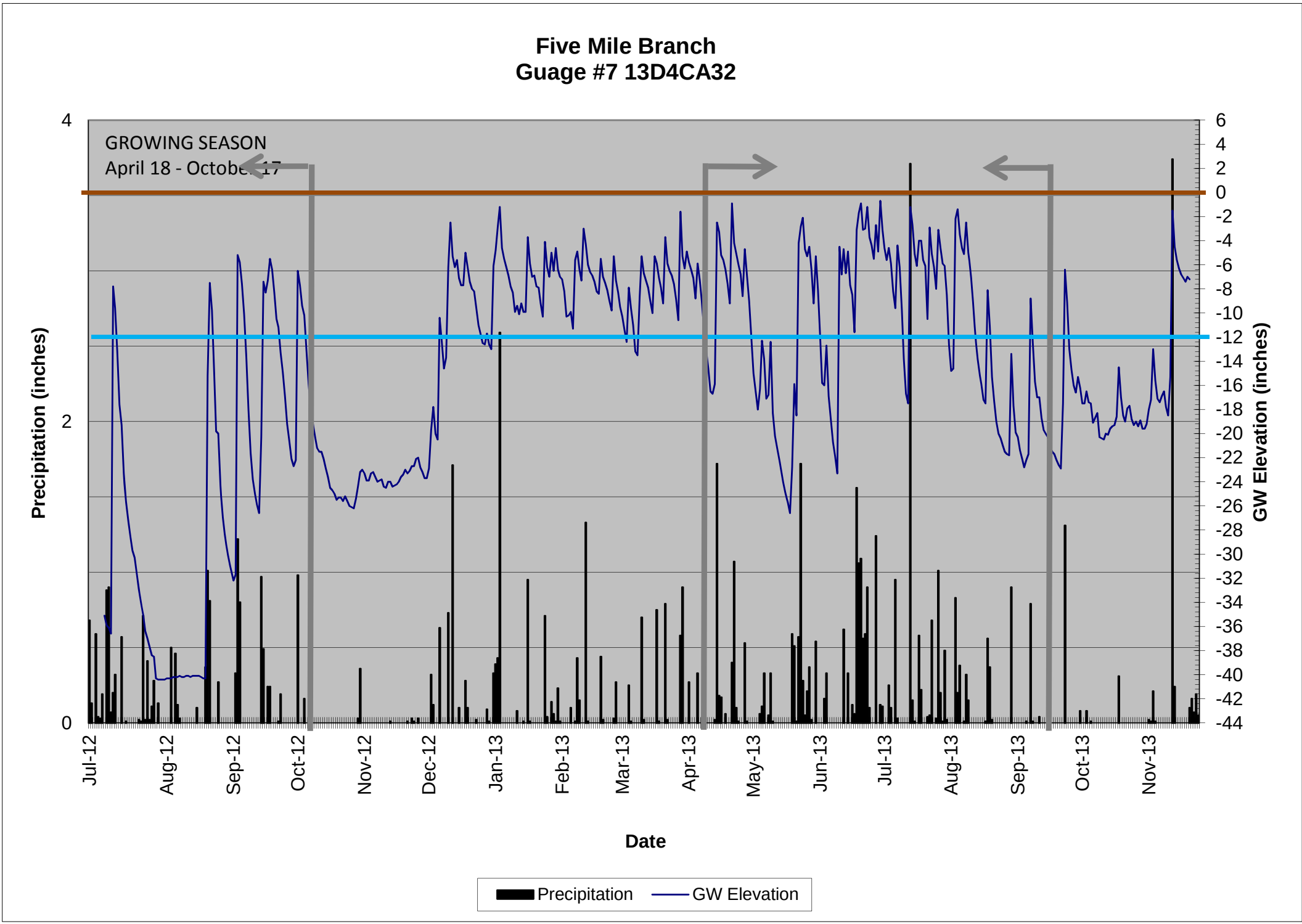
Precipitation
GW Elevation

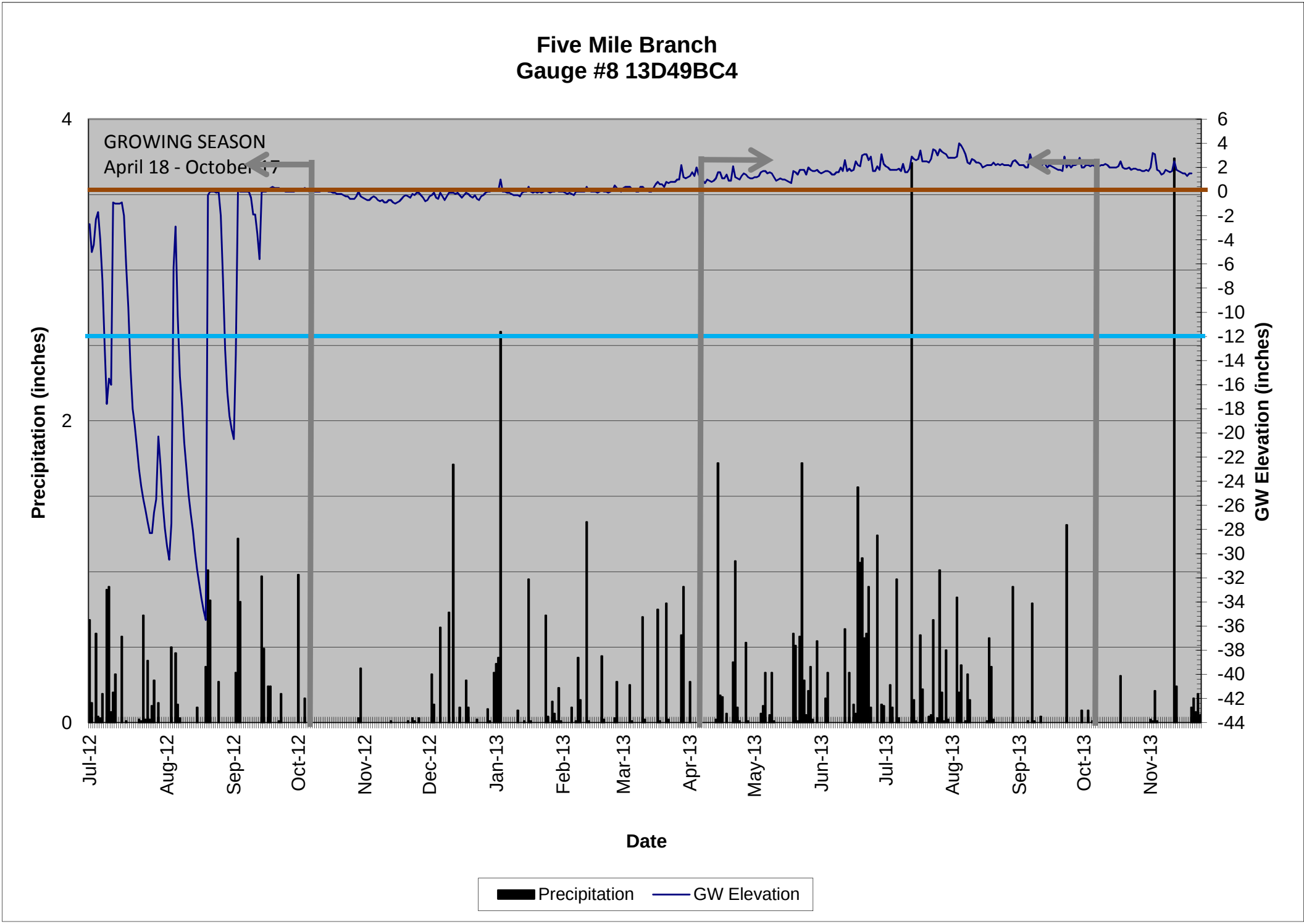

Five Mile Branch
Gauge #3 1314FC9A
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Date
Precipitation
GW Elevation

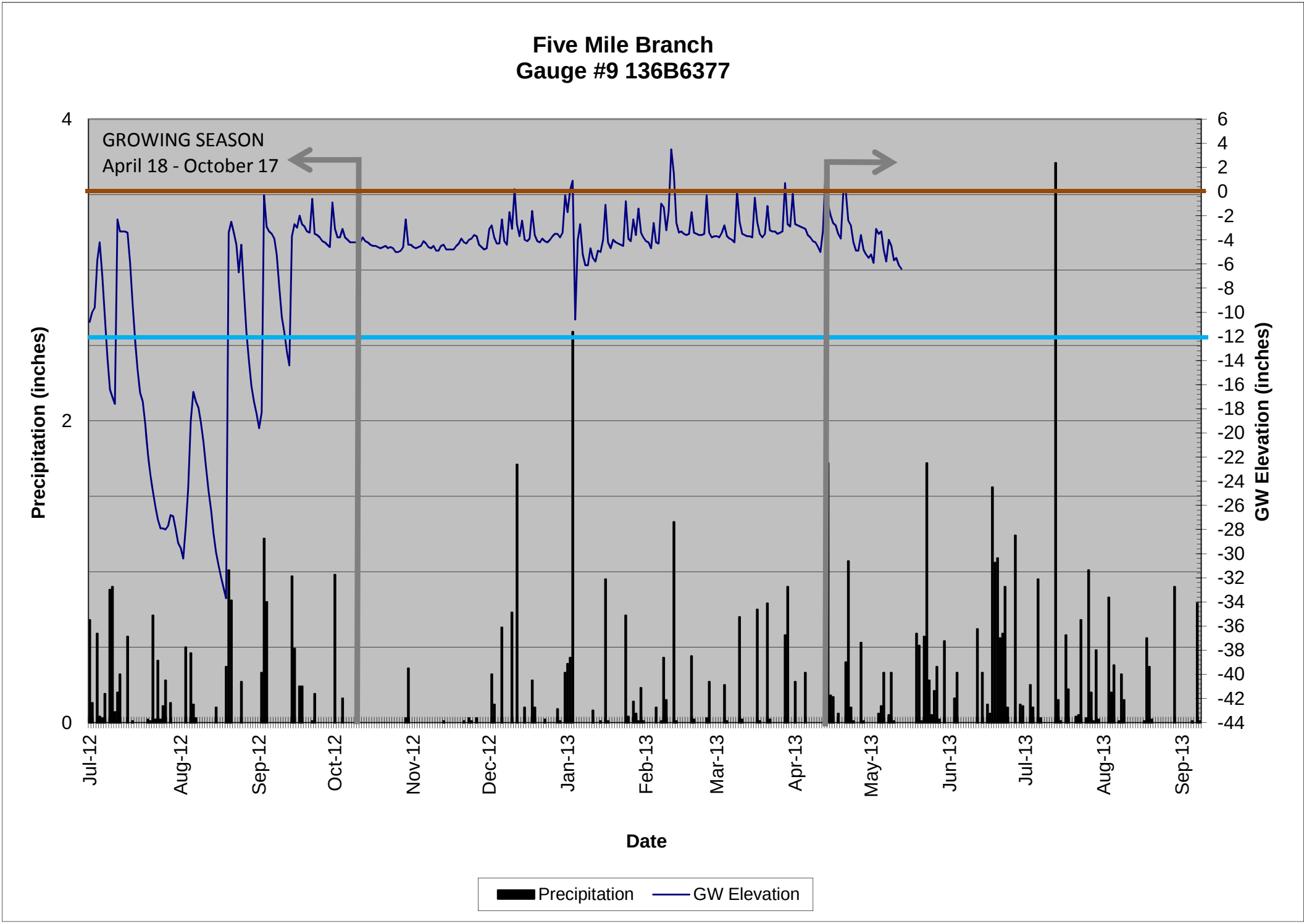

Five Mile Branch
Gauge #4 13D49A3B
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Precipitation
GW Elevation
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13

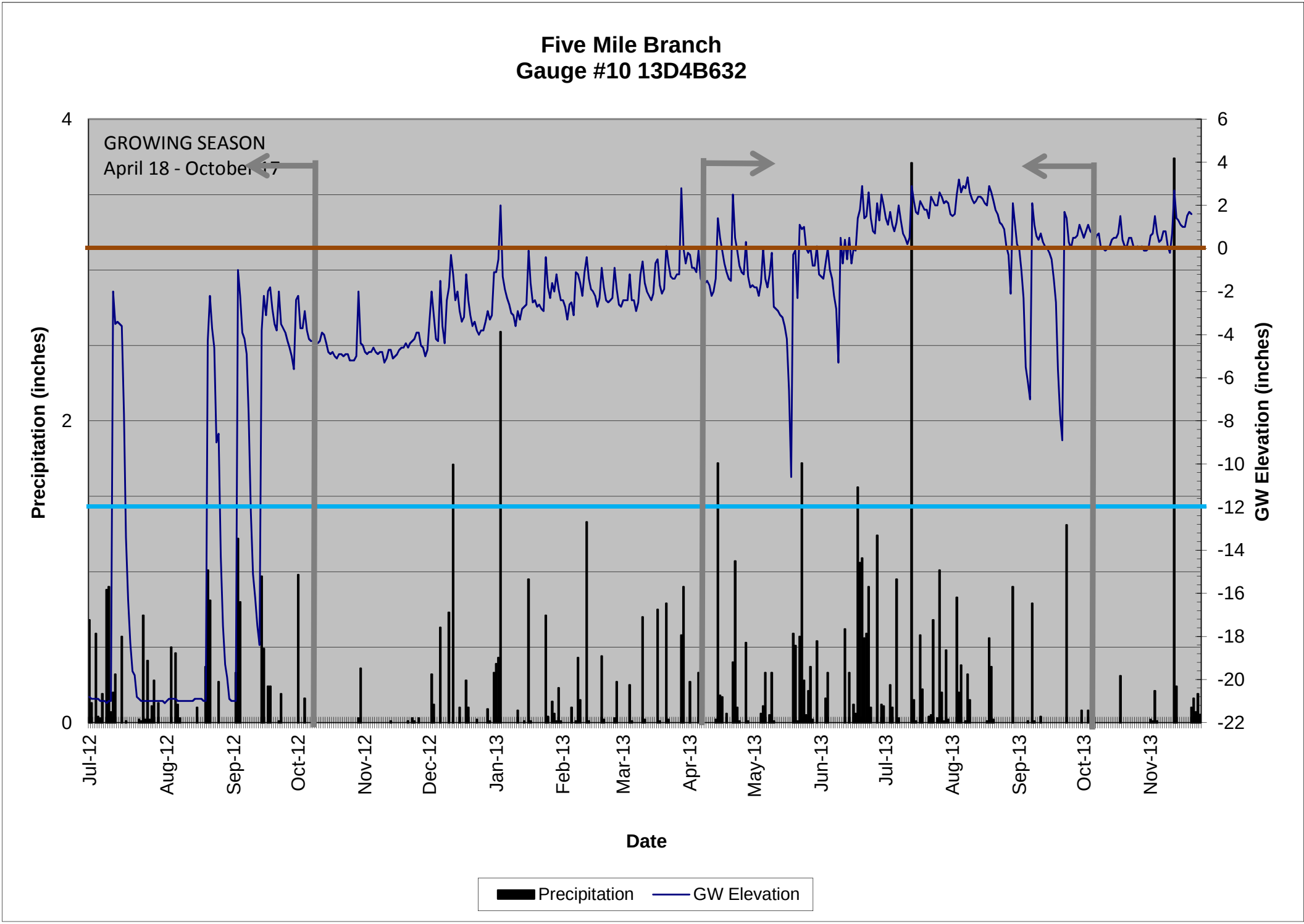

Five Mile Branch
Gauge #5 14E16DC9
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

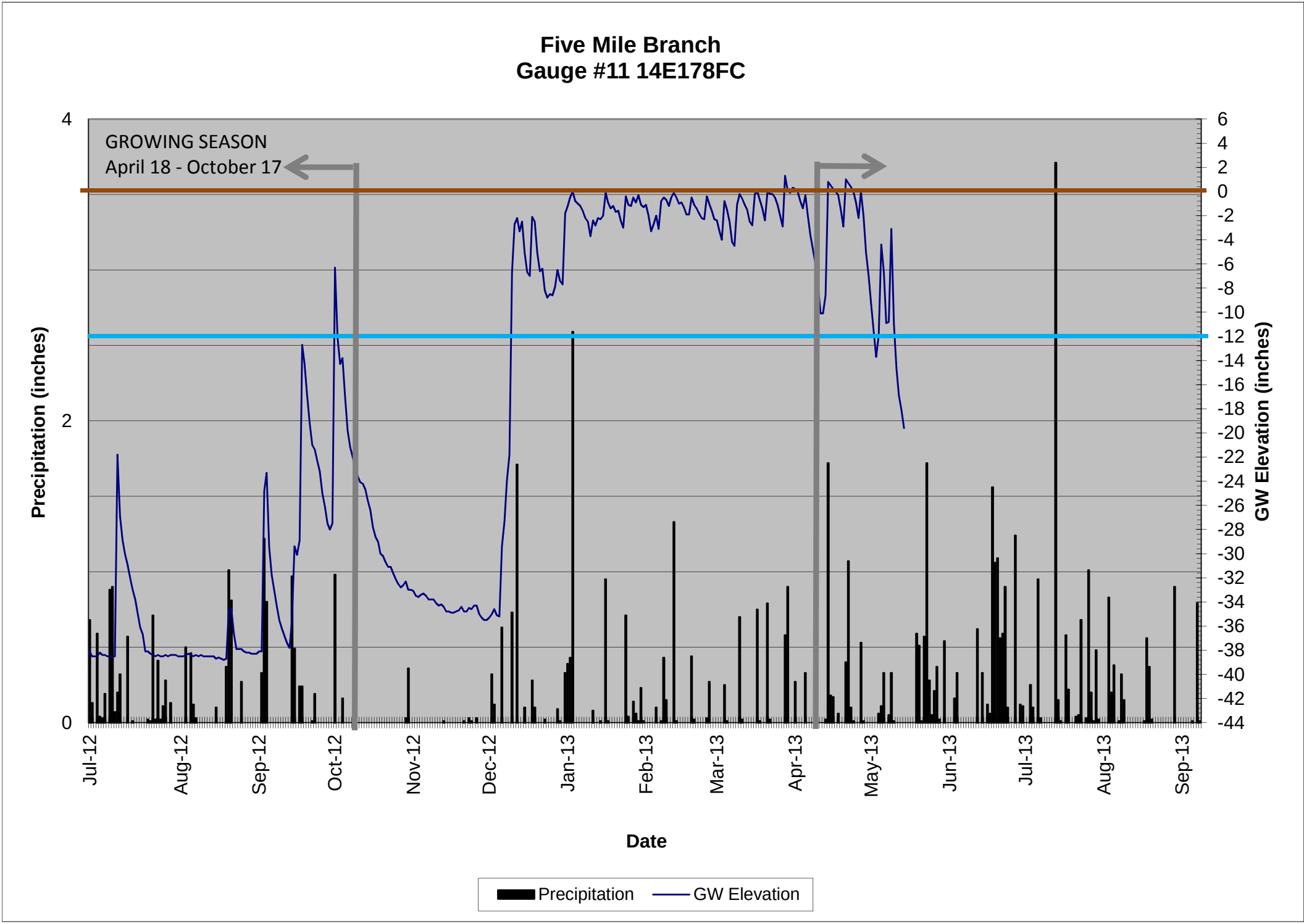

Five Mile Branch
Guage #6 14E1A3C5
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

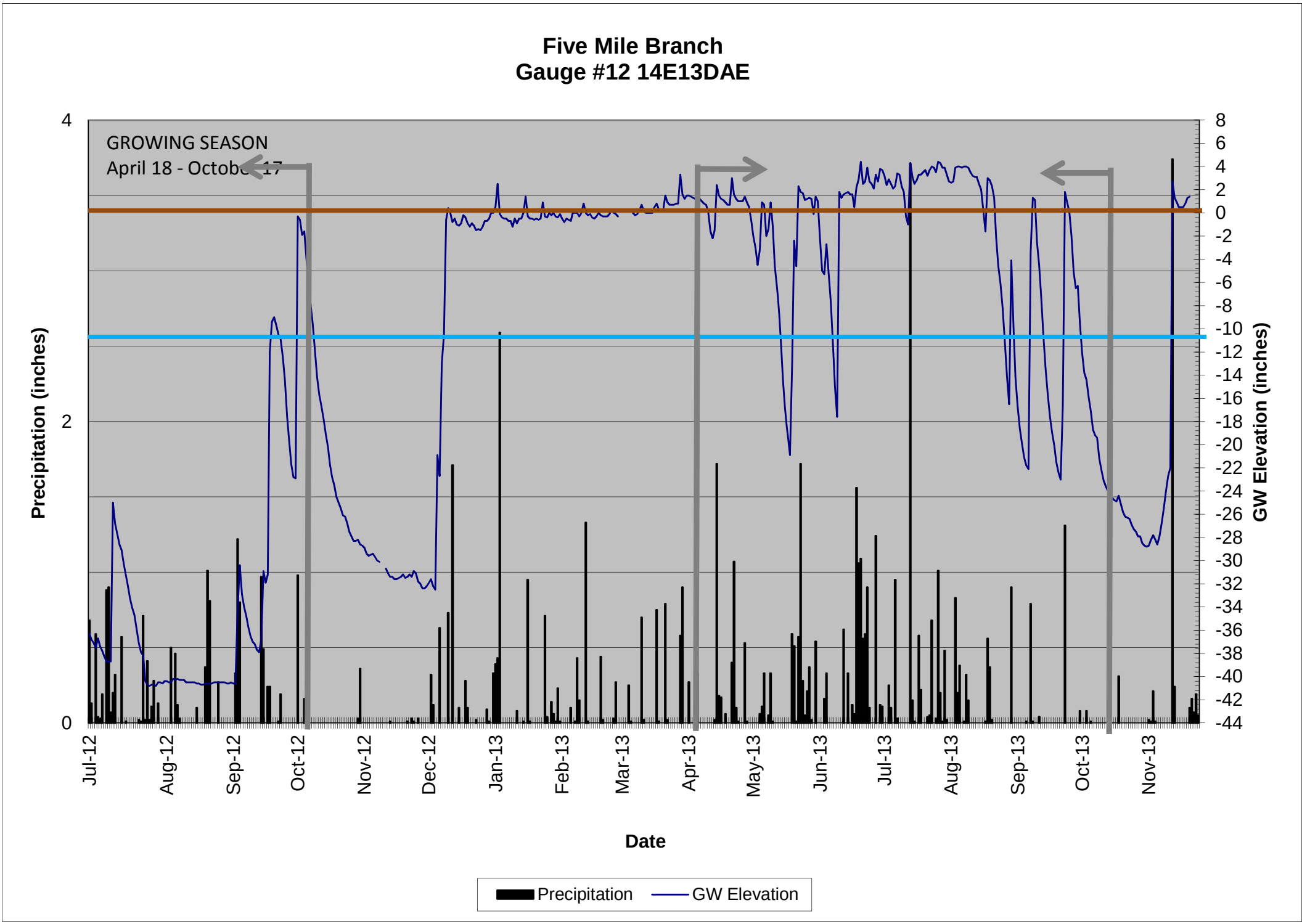

Five Mile Branch
Guage #7 13D4CA32
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Precipitation
GW Elevation
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13

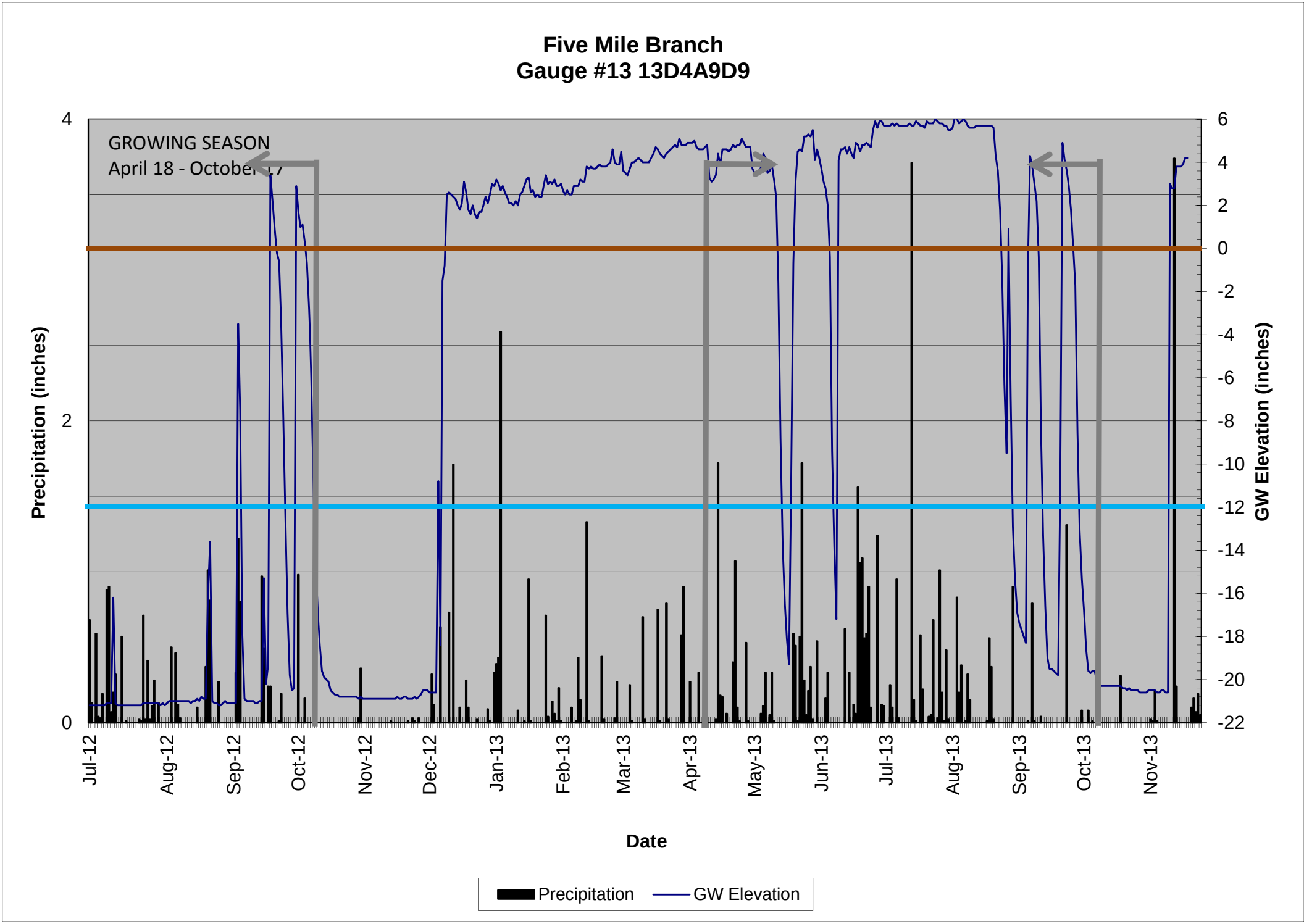

Five Mile Branch
Gauge #8 13D49BC4
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

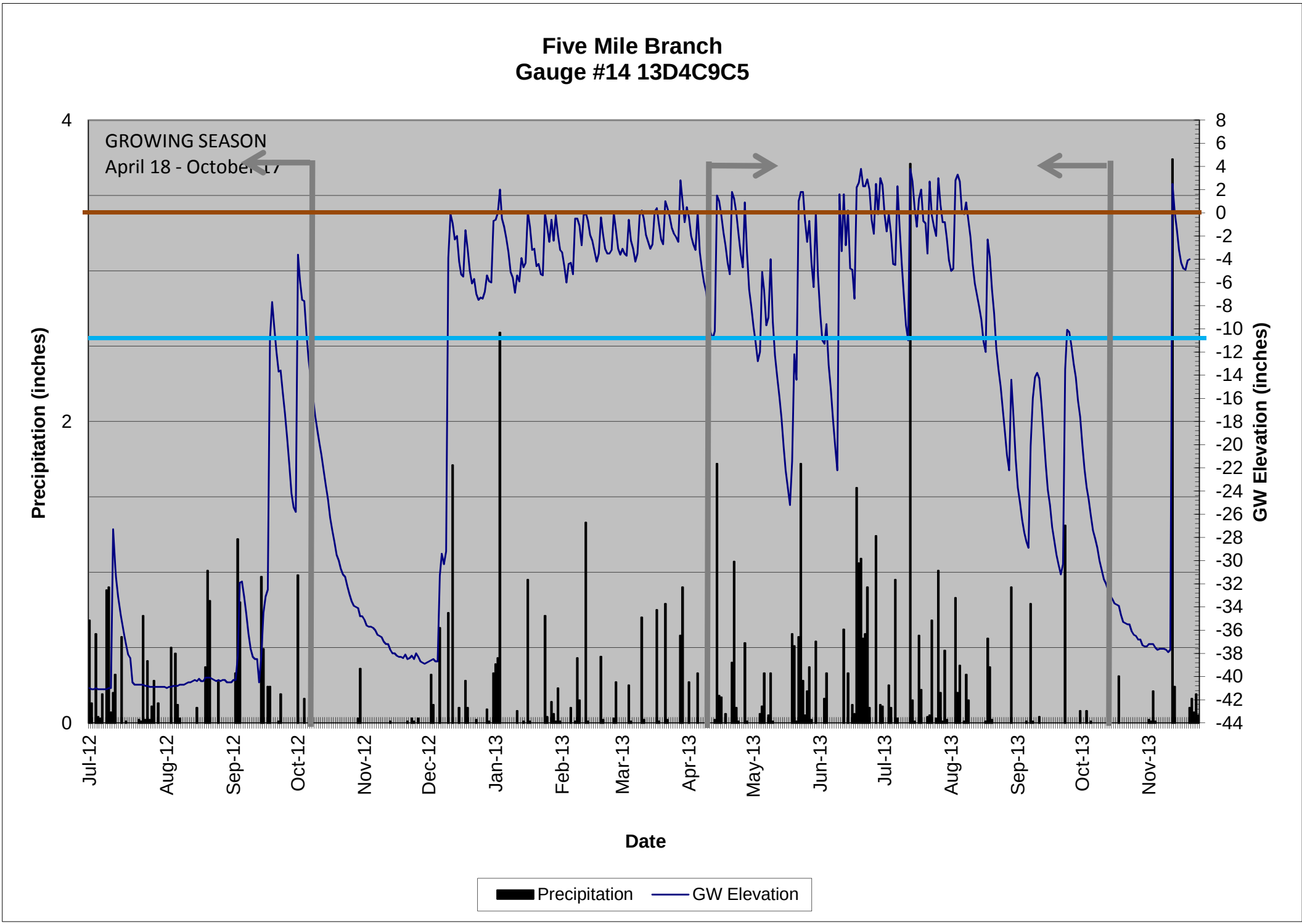

Five Mile Branch
Gauge #9 136B6377
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Date
Precipitation
GW Elevation

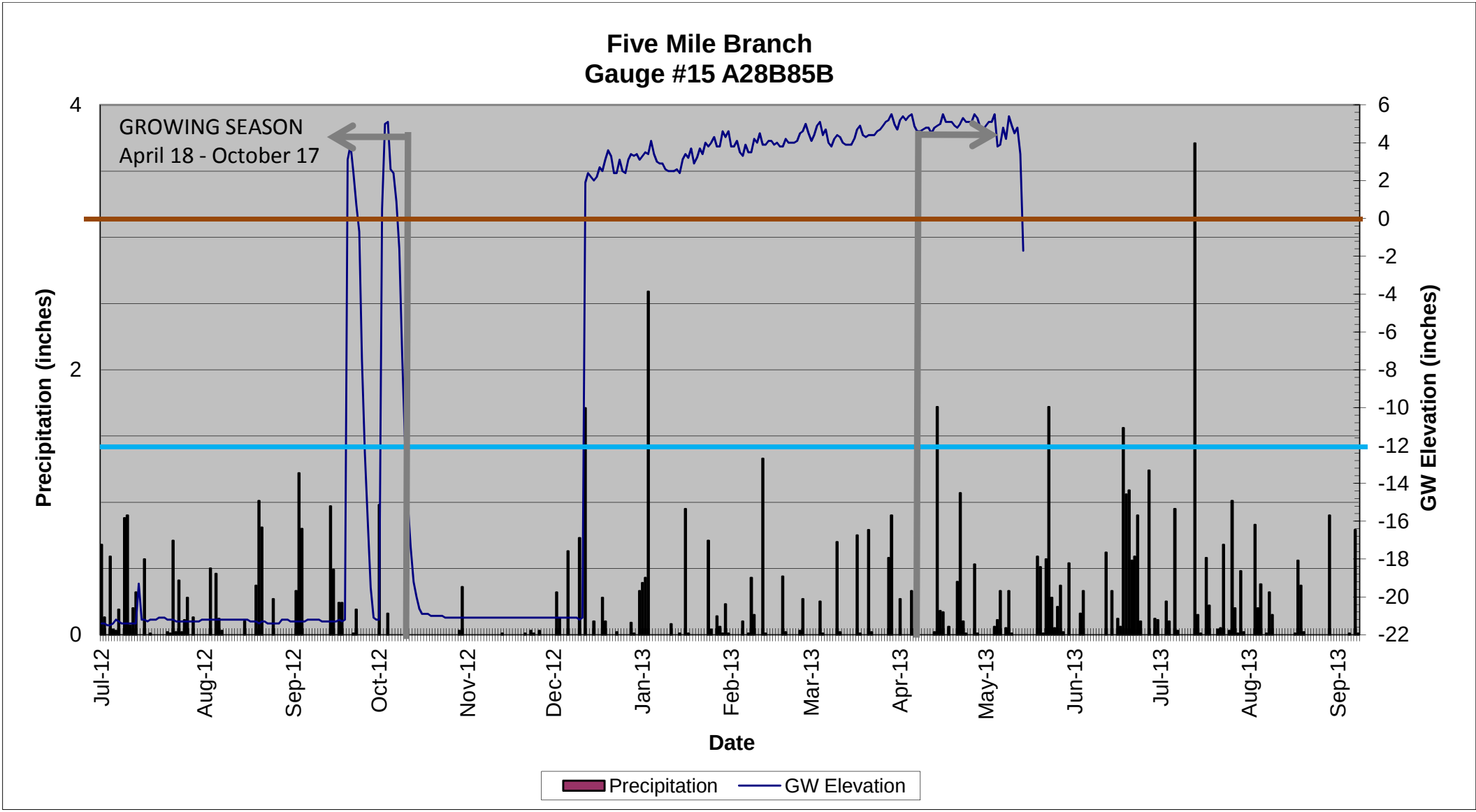

Five Mile Branch
Gauge #10 13D4B632
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

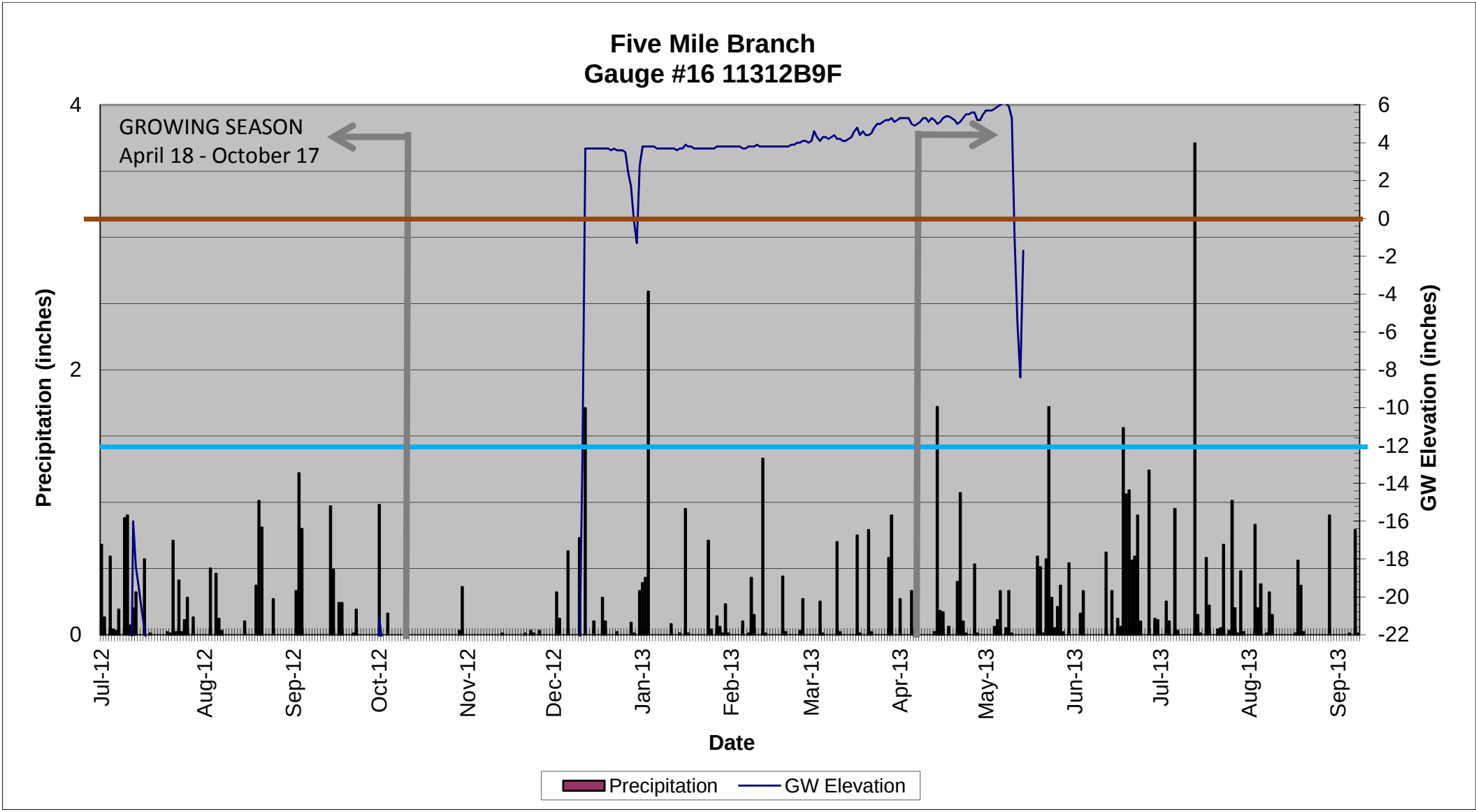

Five Mile Branch
Gauge #11 14E178FC
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Date
Precipitation
GW Elevation

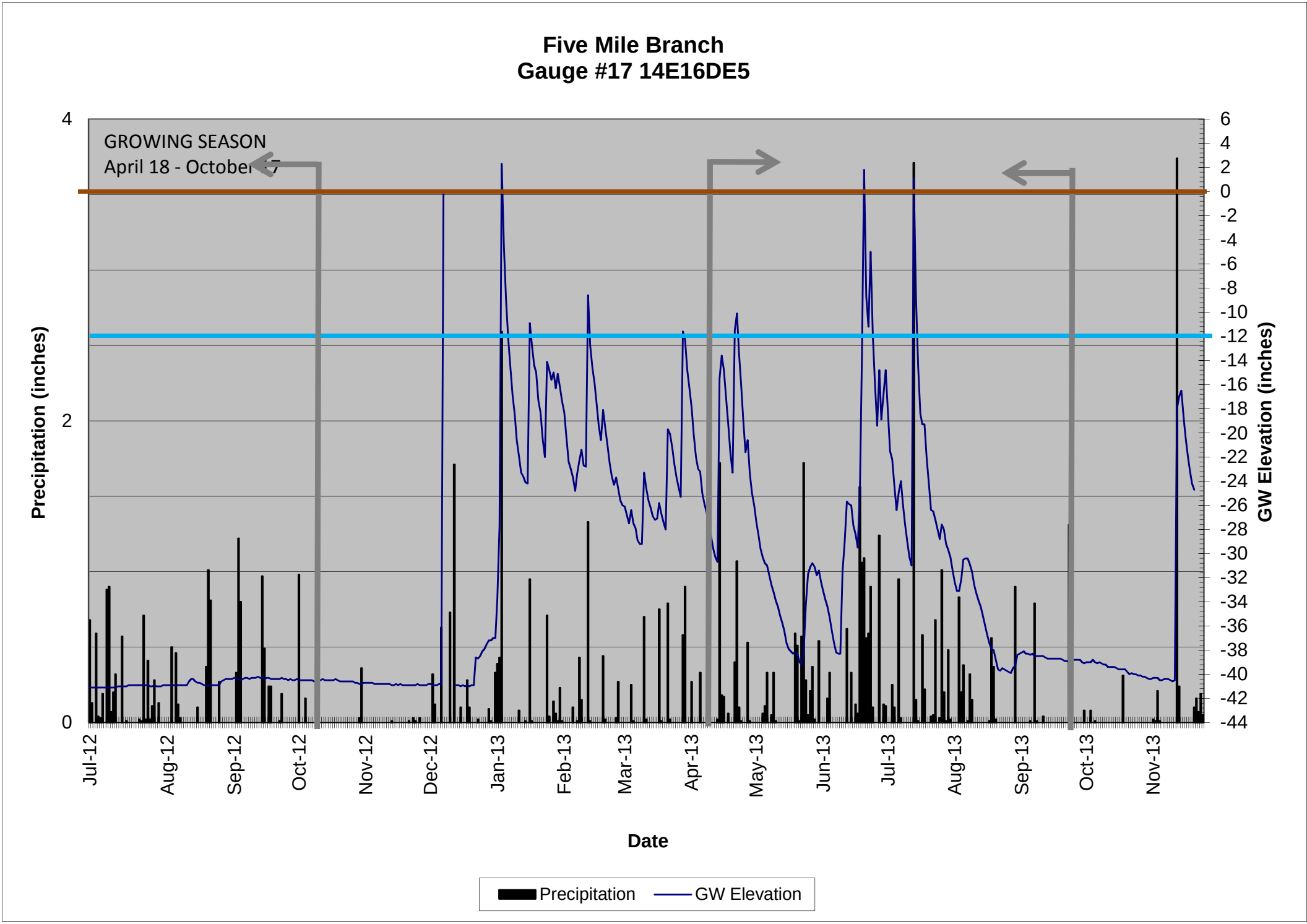

Five Mile Branch
Gauge #12 14E13DAE
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Precipitation
GW Elevation


Five Mile Branch
Gauge #13 13D4A9D9
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation


Five Mile Branch
Gauge #14 13D4C9C5
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Precipitation
GW Elevation


Five Mile Branch
Gauge #15 A28B85B
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Date
Precipitation
GW Elevation


Five Mile Branch
Gauge #16 11312B9F
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Precipitation
GW Elevation


Five Mile Branch
Gauge #17 14E16DE5
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
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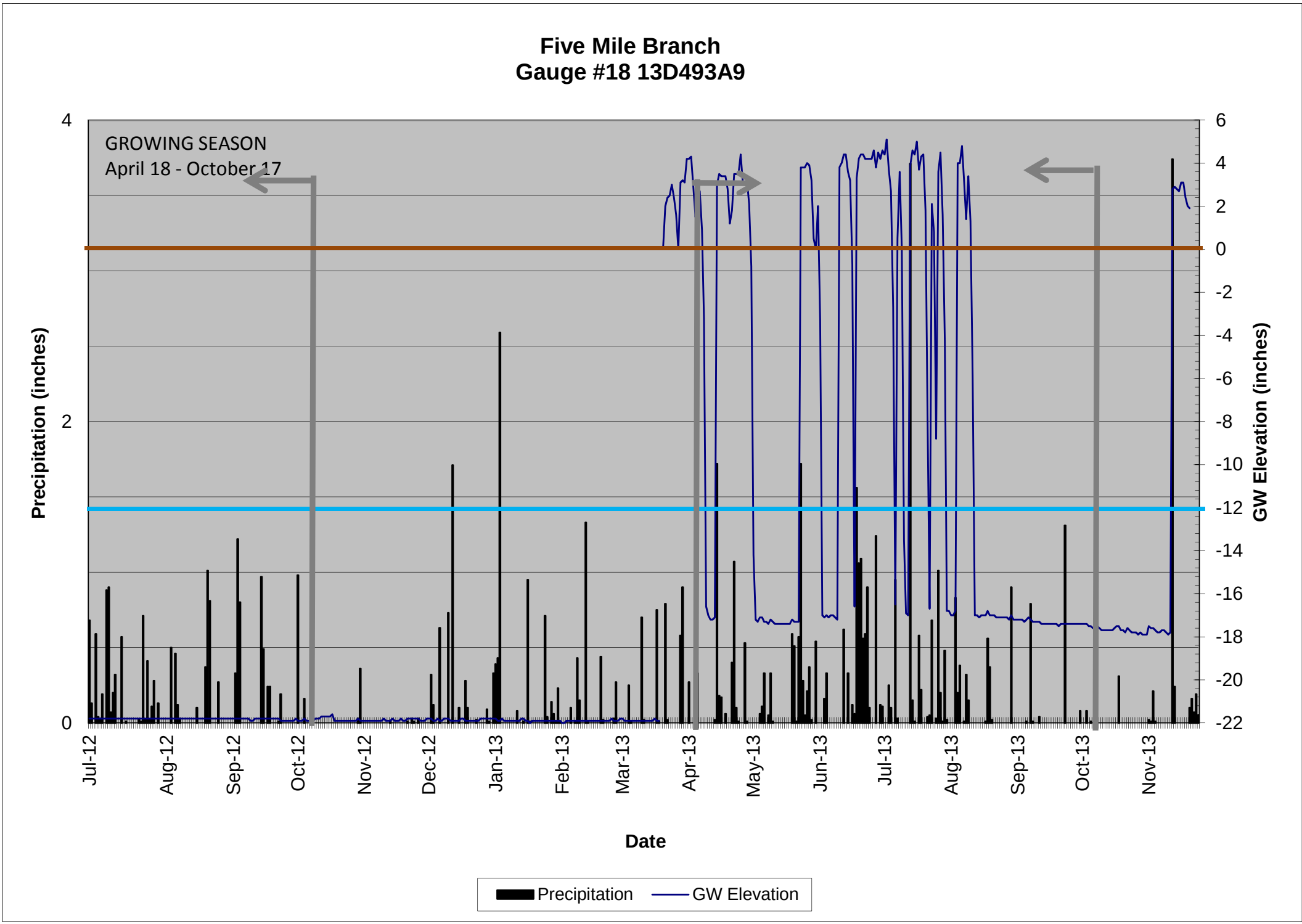
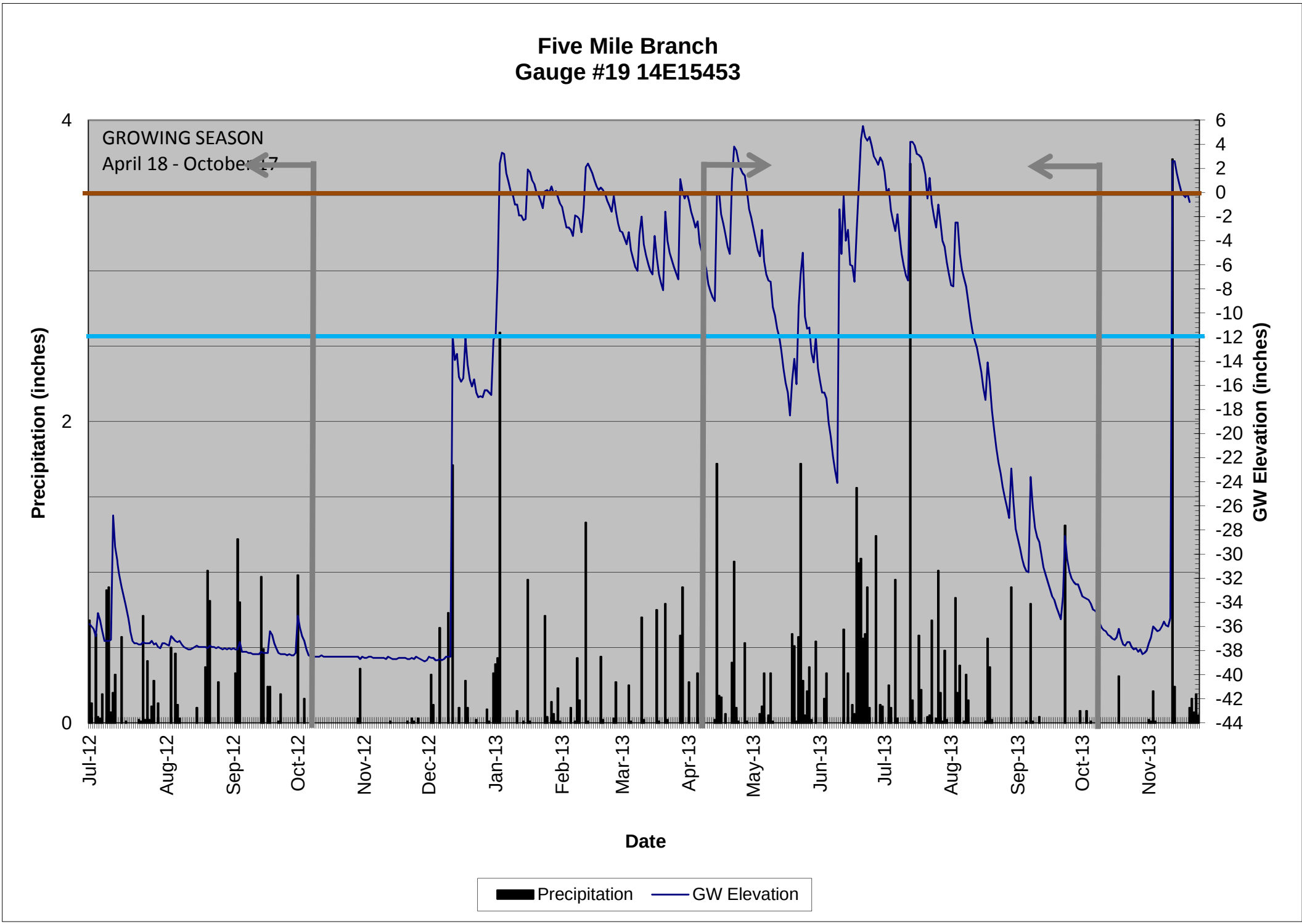
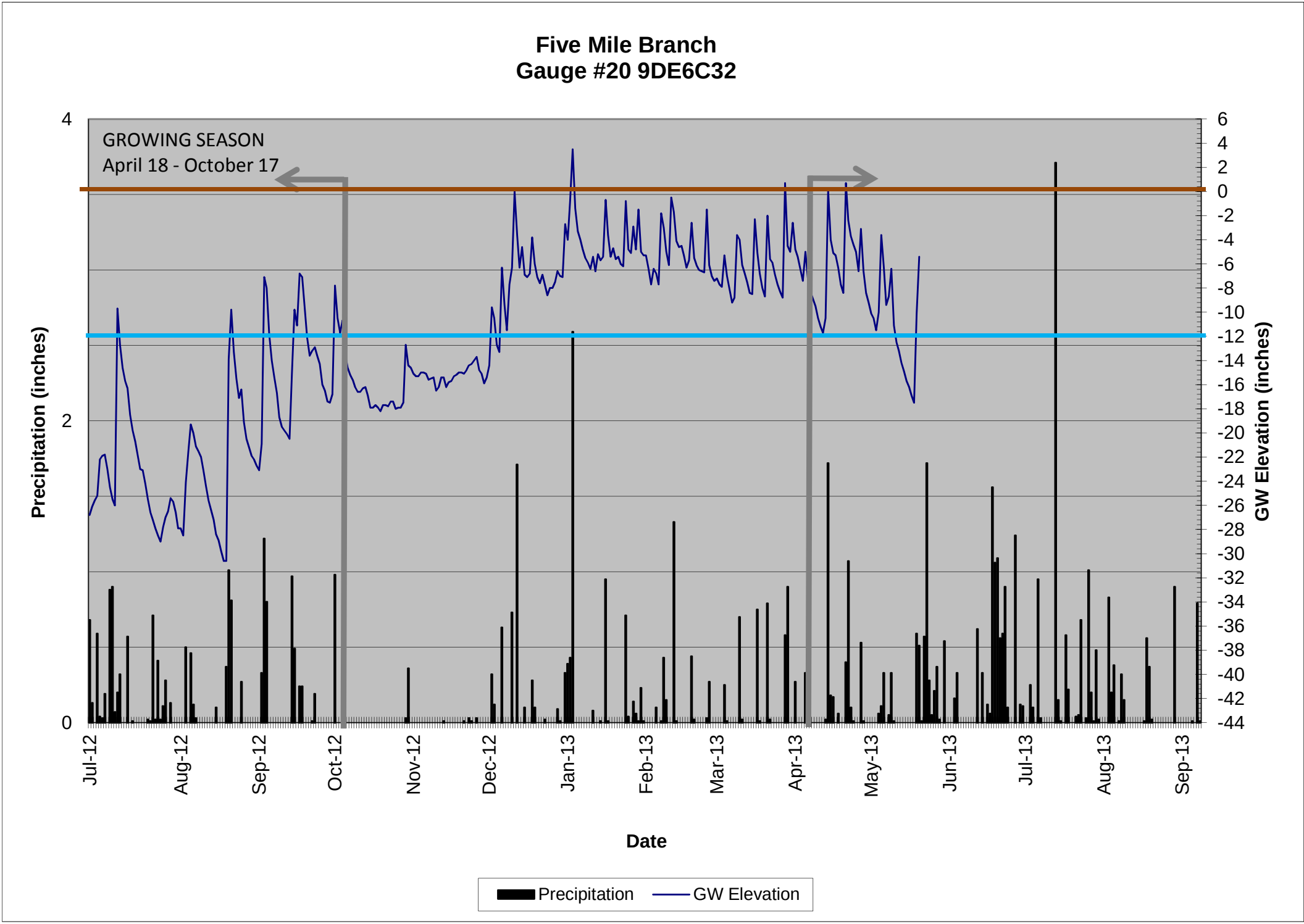
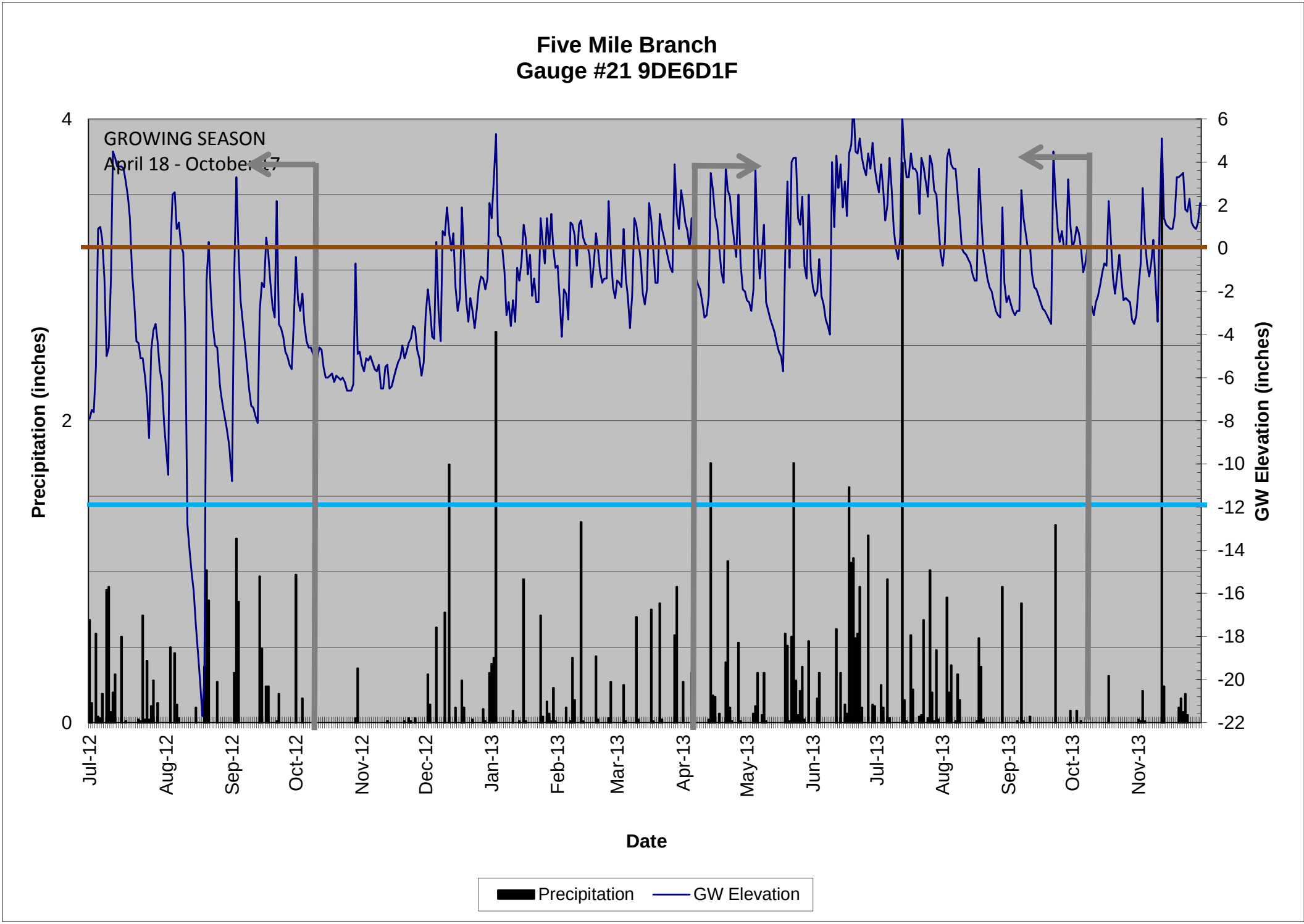
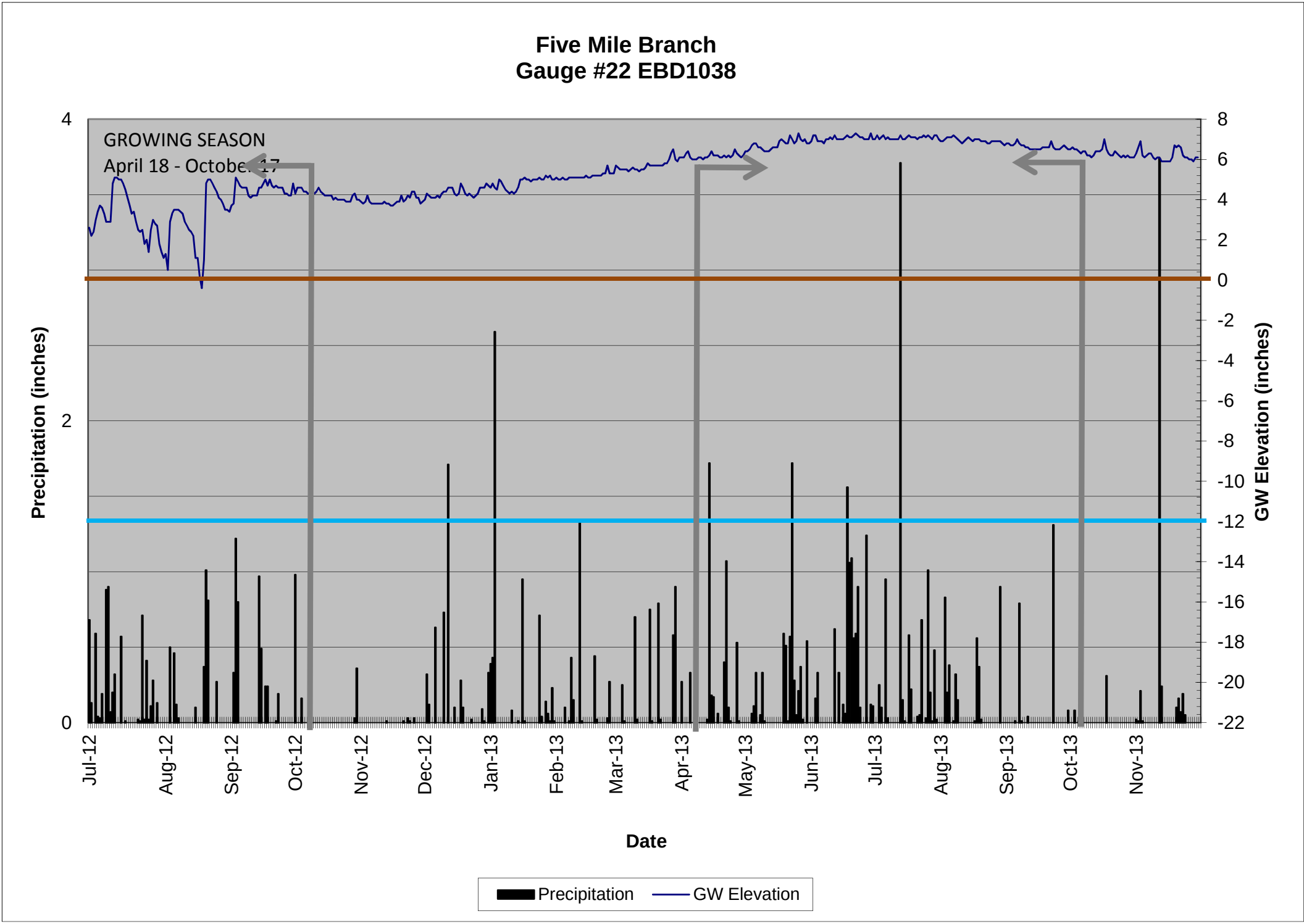
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

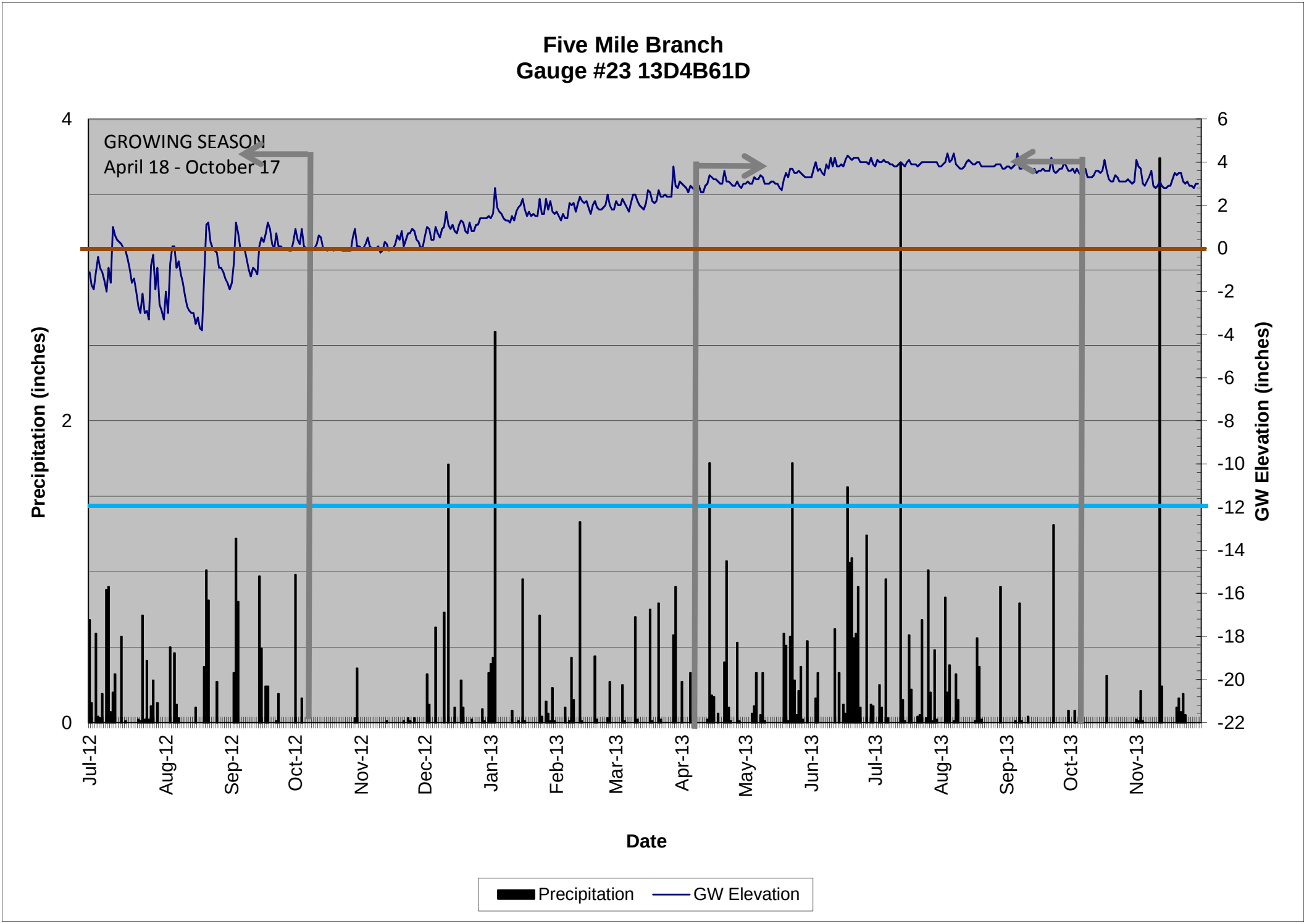

Five Mile Branch
Gauge #18 13D493A9
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

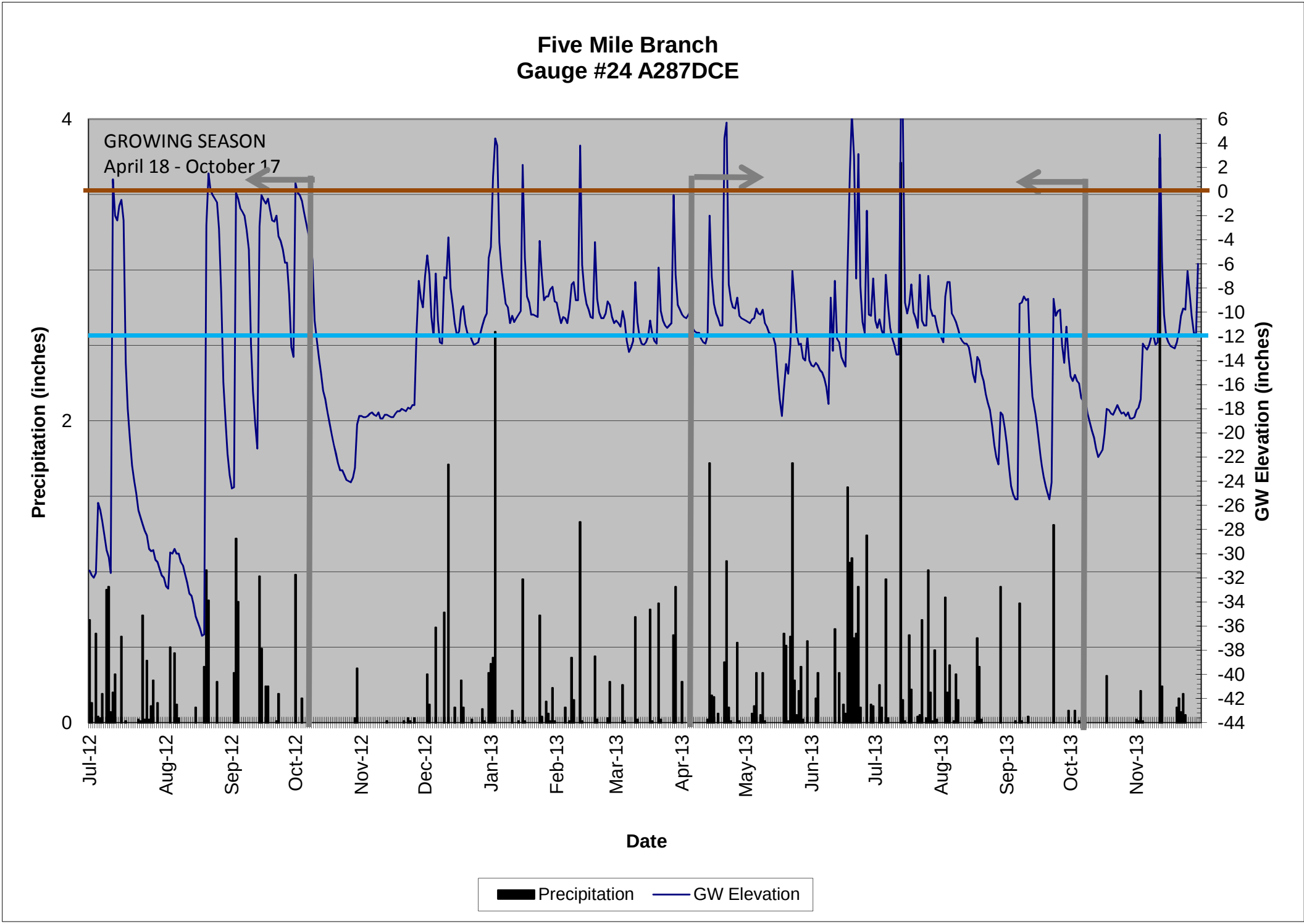

Five Mile Branch
Gauge #19 14E15453
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

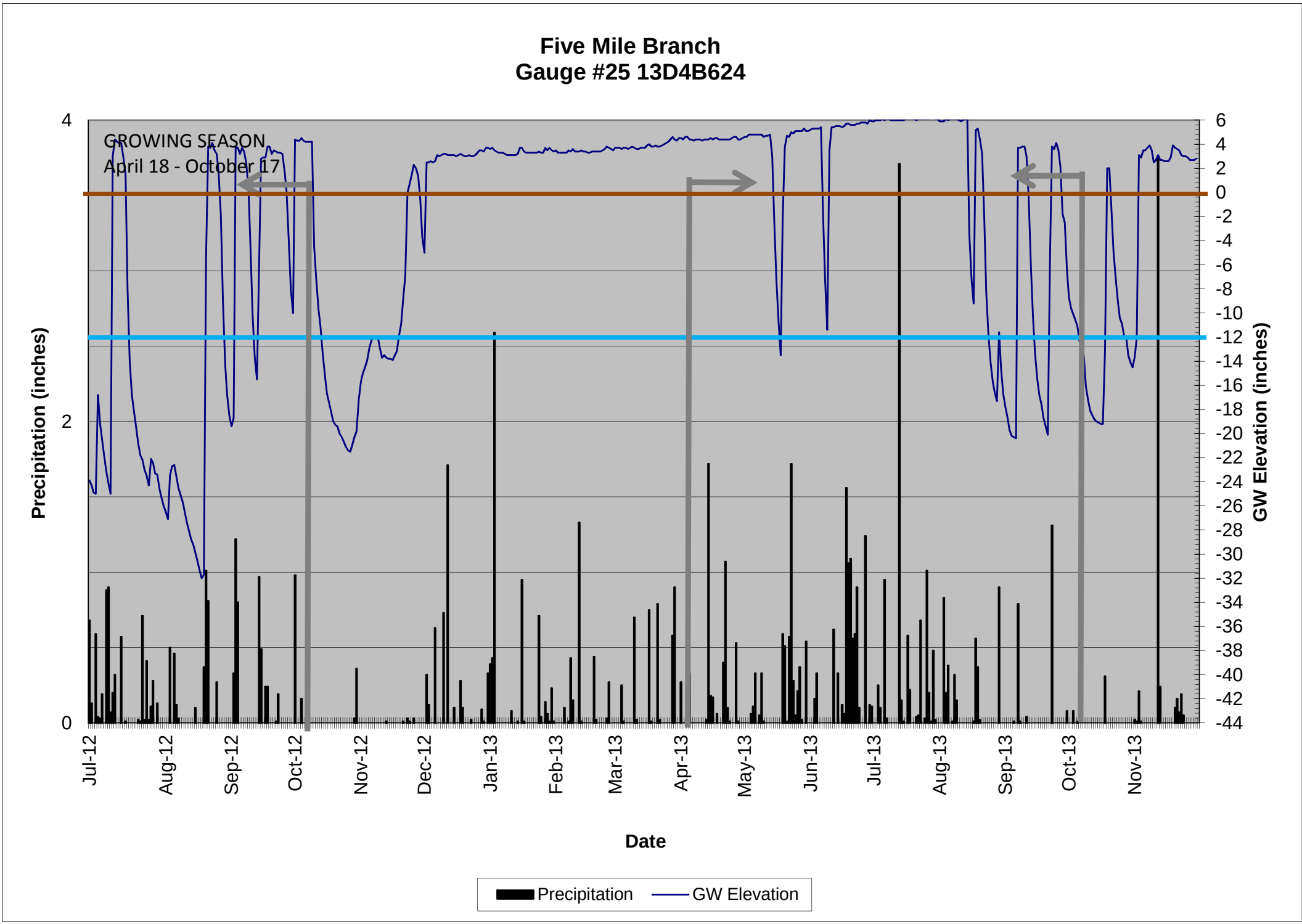

Five Mile Branch
Gauge #20 9DE6C32
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Date
Precipitation
GW Elevation

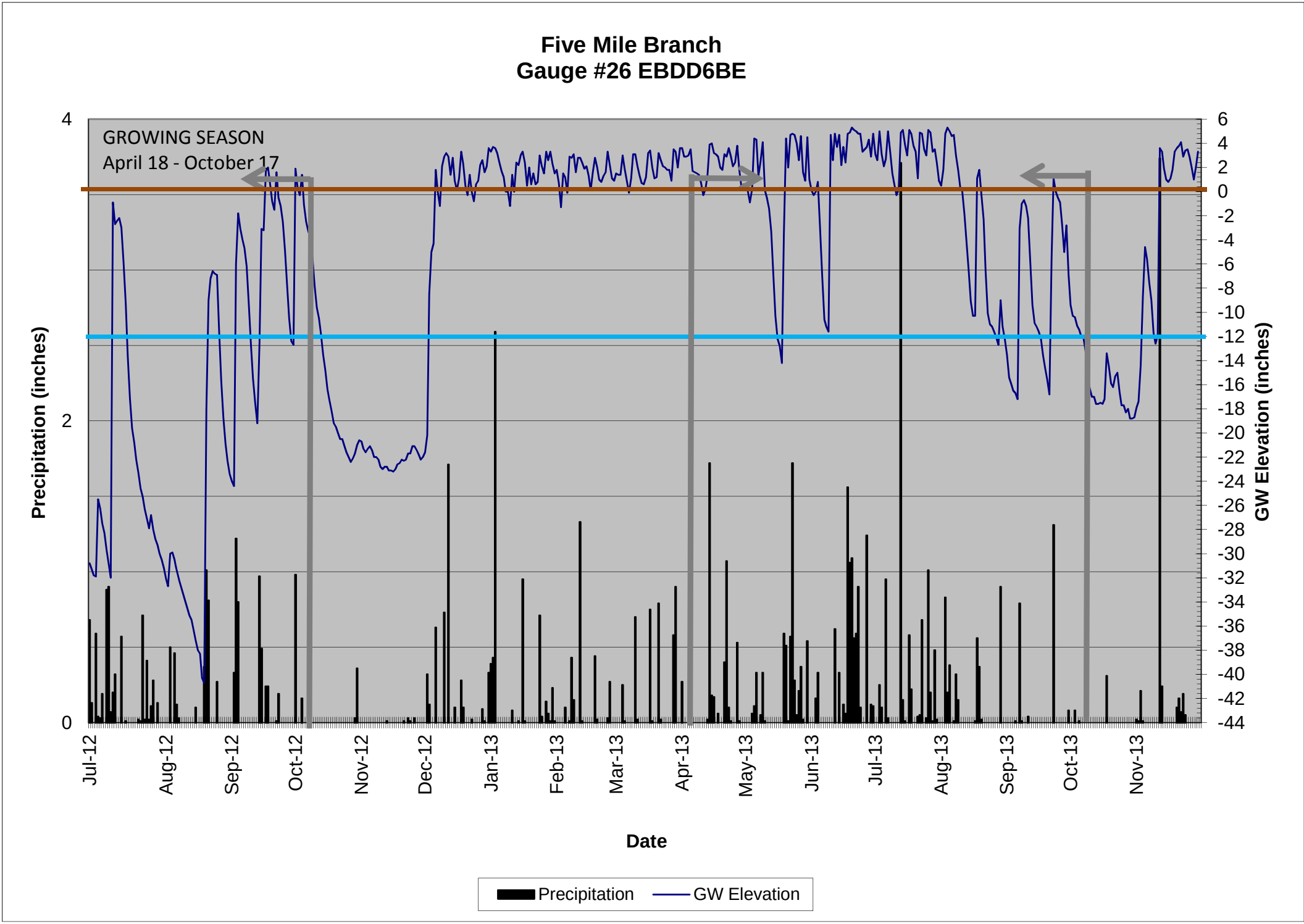

Five Mile Branch
Gauge #21 9DE6D1F
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

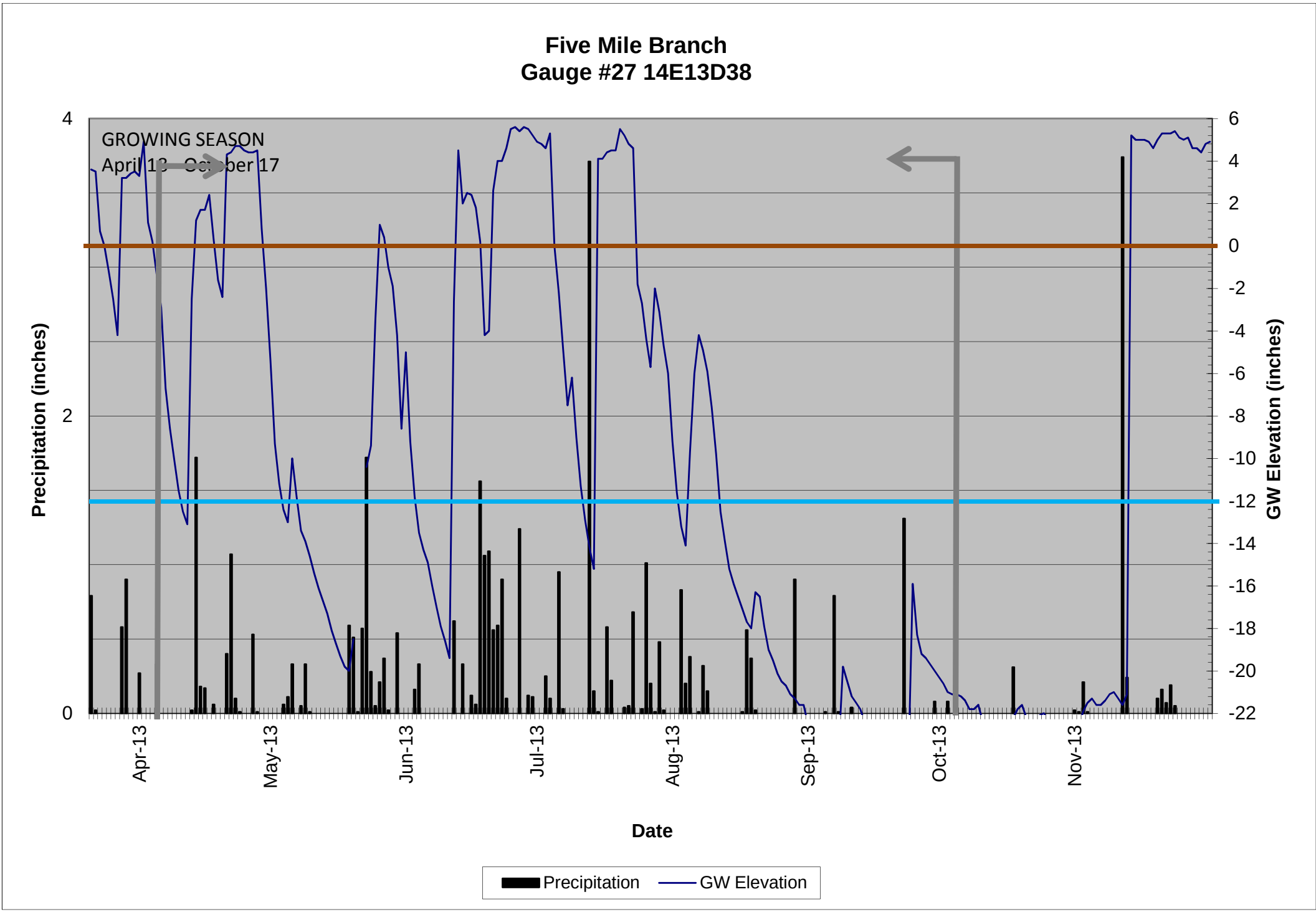

Five Mile Branch
Gauge #22 EBD1038
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

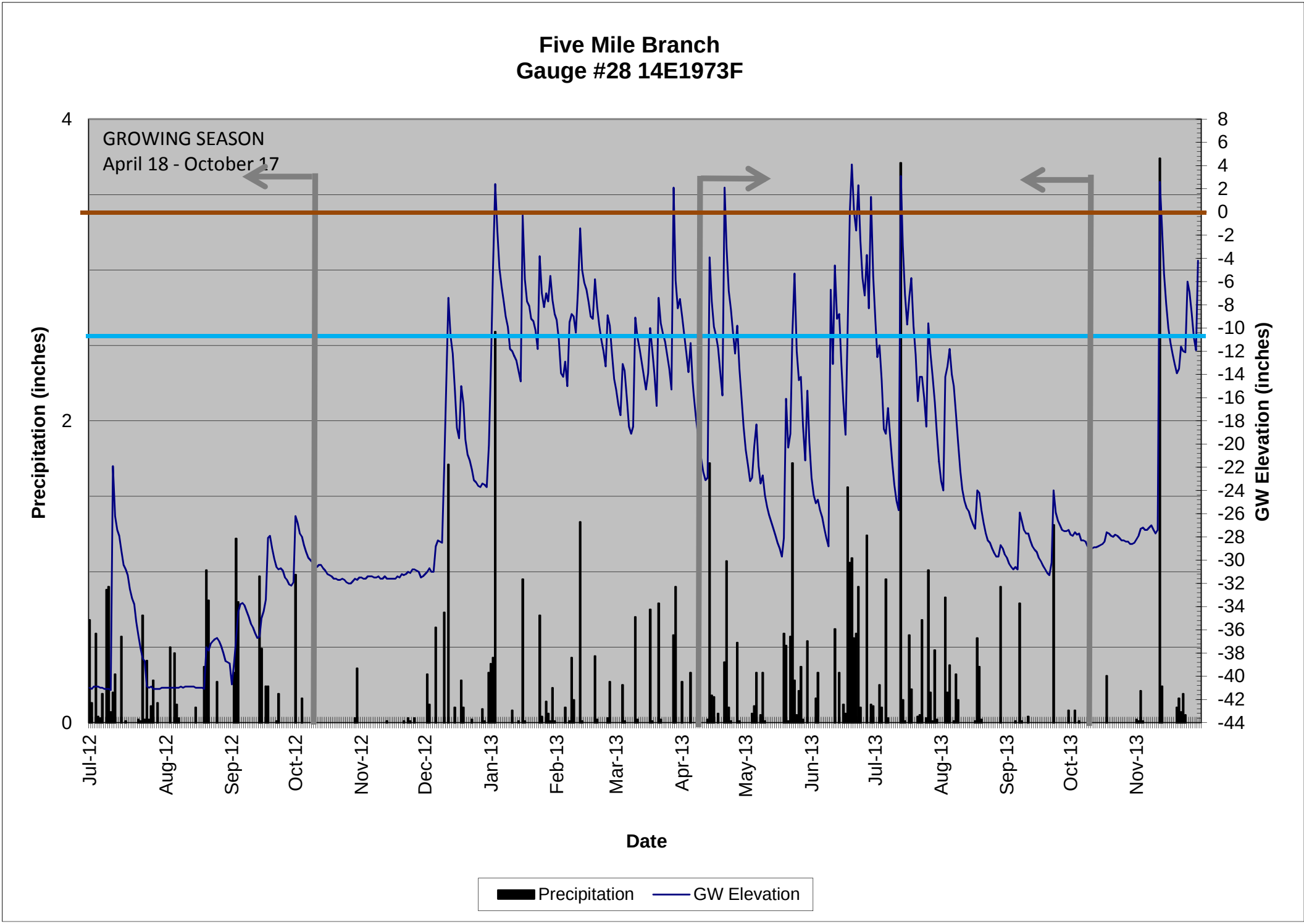

Five Mile Branch
Gauge #23 13D4B61D
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation

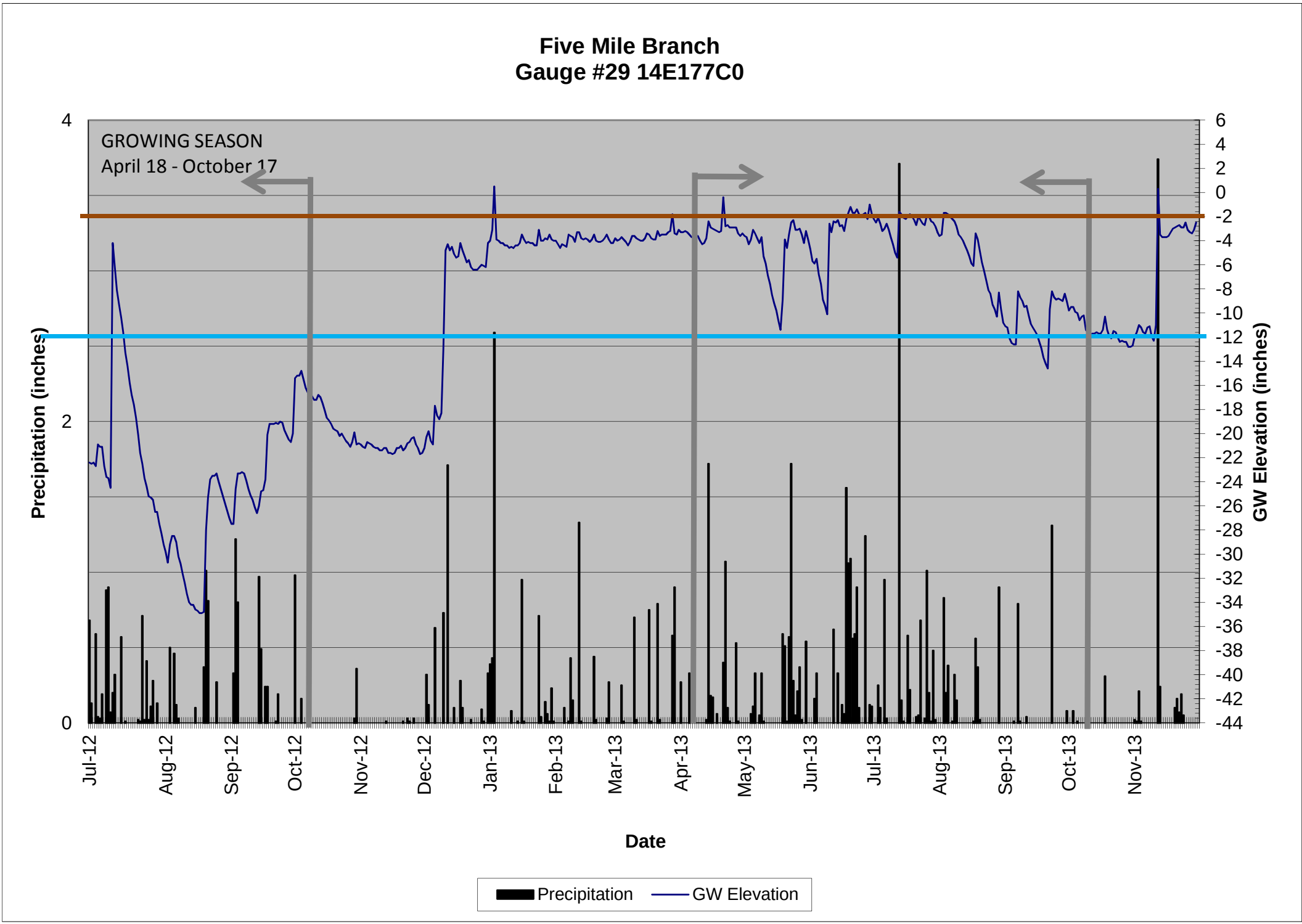

Five Mile Branch
Gauge #24 A287DCE
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Precipitation
GW Elevation
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13

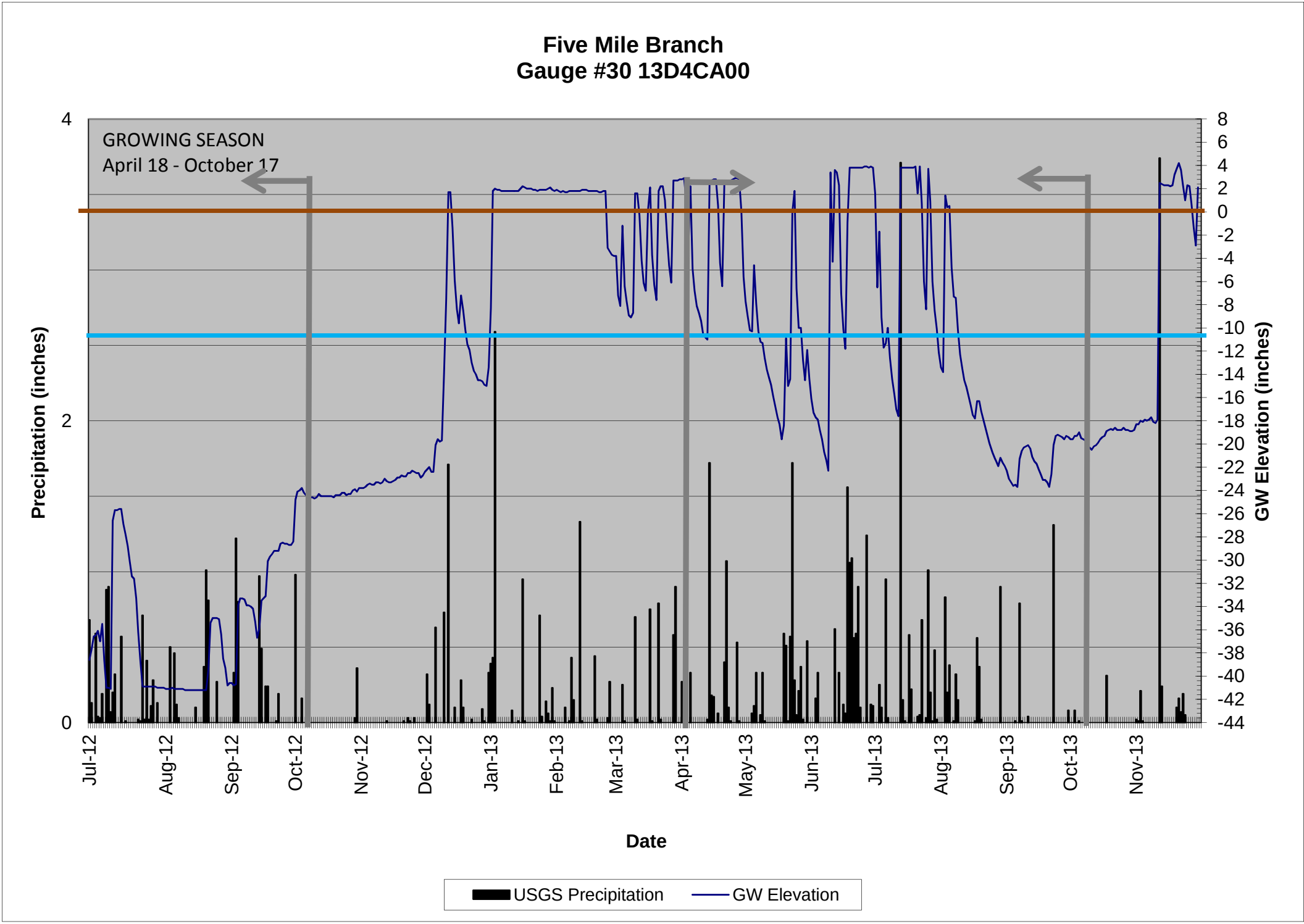

Five Mile Branch
Gauge #25 13D4B624
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Precipitation
GW Elevation


Five Mile Branch
Gauge #26 EBDD6BE
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation


Five Mile Branch
Gauge #27 14E13D38
GROWING SEASON
April 13 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
Precipitation
GW Elevation


Five Mile Branch
Gauge #28 14E1973F
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Precipitation
GW Elevation


Five Mile Branch
Gauge #29 14E177C0
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
Date
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Precipitation
GW Elevation


Five Mile Branch
Gauge #30 13D4CA00
GROWING SEASON
April 18 - October 17
Precipitation (inches)
GW Elevation (inches)
4
2
0
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
-42
-44
Jul-12
Aug-12
Sep-12
Oct-12
Nov-12
Dec-12
Jan-13
Feb-13
Mar-13
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Date
USGS Precipitation
GW Elevation

Appendix F

Photographs

Photo Point 1. Boulder Vane 12/5/13

Photo Point 3. Looking downstream 12/5/13

Photo Point 1. Looking downstream 12/5/13

Photo Point 4. Floodplain looking east 12/5/13

Photo Point 2. Looking downstream 12/5/13

Photo Point 4. Boulder Vane 12/5/13

Photo Point 5. Cross Vane 12/5/13

Photo Point 7. Floodplain looking east 12/5/13

Photo Point 6. Boulder Vane 12/5/13

Photo Point 7. Floodplain looking west 12/5/13

Photo Point 7. Boulder Vane 12/5/13

Photo Point 8. Floodplain pool looking east 12/5/13

Photo Point 9. Cross Vane 12/5/13

Photo Point 10. Floodplain looking west 12/5/13

Photo Point 10. Cross Vane 12/5/13

Photo Point 11. Looking downstream 12/5/13

Photo Point 10. Floodplain looking east 12/5/13

Photo Point 12. Floodplain looking west 12/5/13

Photo Point 12. Floodplain pool looking east 12/5/13

Photo Point 14. Floodplain pool looking east 12/5/13

Photo Point 13. Floodplain pool looking west 12/5/13

Photo Point 15. Floodplain pool looking west 12/5/13

Photo Point 13. Floodplain looking east 12/5/13

Photo Point 15. Floodplain looking east 12/5/13

Photo Point 16. Looking downstream 12/5/13

Photo Point 17. Floodplain looking north 12/5/13

Photo Point 16. Looking upstream 12/5/13

Photo Point 17. Floodplain looking east 12/5/13

Photo Point 17. Floodplain looking west 12/5/13

Photo Point 18. Cross Vane 12/5/13

Photo Point 19. Boulder Vanes 12/5/13

Photo Point 20. Looking downstream 12/5/13

Photo Point 20. Looking upstream 12/5/13

Photo Point 21. Rootwads 12/5/13

Photo Point 23. Boulder Vane 12/5/13

Photo Point 21. Looking downstream 12/5/13

Photo Point 23. Fallen tree 12/5/13

Photo Point 22. Cross Vane 12/5/13

Photo Point 24. Rootwads 12/5/13

Photo Point 24. Looking downstream 12/5/13

Photo Point 26. Rootwads 12/5/13

Photo Point 25. Cross Vane 12/5/13

Photo Point 26. Floodplain looking downstream 12/5/13

Photo Point 25. Cross Vane. Left arm scour. 12/5/13

Photo Point 27. Floodplain pool looking west 12/5/13

Photo Point 28. Floodplain looking west 12/5/13

Photo Point 28. Confluence looking east 12/5/13

Photo Point 30. Cross Vane 12/15/13

Photo Point 29. Looking downstream 12/15/13

Photo Point 31. Floodplain pool looking northwest 12/15/13

Photo Point 29. Floodplain looking east 12/15/13

Photo Point 31. Floodplain looking east 12/15/13

Photo Point 32. Looking downstream 12/15/13

Photo Point 34. Boulder Vane 12/15/13

Photo Point 33. Floodplain looking west 12/15/13

Photo Point 35. Boulder Vane 12/15/13

Photo Point 34. Boulder Vane 12/15/13

Photo Point 35. Boulder Vane 12/15/13

Photo Point 36. Looking downstream 12/15/13

Photo Point 37. Floodplain looking east 12/15/13

Photo Point 36. Looking upstream 12/15/13

Photo Point 38. Cross Vane 12/15/13

Photo Point 37. Floodplain pool looking north 12/15/13

Photo Point 38. Looking south 12/15/13

Photo Point 39. Looking upstream 12/15/13

Photo Point 40 Cross Vane 12/15/13

Photo Point 39. Looking downstream 12/15/13

Photo Point 40. Looking downstream 12/15/13

Photo Point 39. Floodplain looking east 12/15/13

Photo Point 41. Floodplain looking west 12/15/13