Tulula Stream & Wetland Restoration

NCEEP Project Number: 392

Monitoring Year 6

2008 Final Report

Submitted to
Ecosystem Enhancement Program
North Carolina Department of Environment and Natural Resources
May 2009

1619 Mail Service Center
Raleigh, NC 27699

Tulula Stream and Wetland Restoration – 2008 Monitoring Report (MY 6)

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1.0 EXECUTIVE SUMMARY / PROJECT ABSTRACT

The Tulula Stream and Wetland Restoration Site is a 222 acre tract located in Graham County, North Carolina. In 1994, the North Carolina Department of Transportation (NCDOT) purchased the site for stream and wetland mitigation objectives associated with highway-related impacts in the mountain region. NCDOT formed a collaborative relationship between a diverse group of organizations with the goal of developing and implementing a restoration plan for Tulula Creek and associated wetland habitats. Collaborators included: the University of North Carolina at Asheville, the Center for Transportation and the Environment, the United States Army Corps of Engineers, the United States Fish and Wildlife Service, the North Carolina Department of Environment and Natural Resources, the North Carolina Wildlife Resources Commission, and private consultants.

Wetland and stream restoration included 102 acres of wetland restoration, 8,639 linear feet of stream restoration, 1,248 linear feet of stream preservation, and 121 acres of buffer protection. Initial data collection efforts included hydrologic monitoring beginning in 1998. Following stream and wetland restoration construction in 2002 the as-built/baseline data were collected. Monitoring Year 1 (MY 1) occurred in 2003 with 2008 representing Monitoring Year 6 (MY 6).

Morphological data collection efforts for MY 6 were limited due to an increase in project inundation associated with beaver activity. Inundation has increased to approximately 42 acres, a 49 percent increase from MY 5. Stream dimension and profile data were collected for three (Reach I, IA, and II) of the original eight monitoring reaches. Overall, stream dimension measurements for the surveyed cross-sections have shown little change over the six years of monitoring. Stream profiles indicate a high degree of bed profile variability between years for Reaches I, IA, and II. This can probably be attributed to flow changes caused by beaver dams constructed throughout the project site. Channel stability assessment and stream problem area documentation during previous monitoring efforts identified a limited number of feature issues; including bank scour, failing structures, and a head cut. High water levels due to beaver activities prevented an accurate visual stream stability assessment during MY 6. Additionally, annual increases in beaver inundation prevent accurate data correlation between monitoring years.

Previous wetland monitoring included 29 hydrology gauges throughout the project site. Gauges A4 and D3 were decommissioned in MY 6 due to persistent inundation at these locations. Additionally, 13 of the 27 remaining gauges malfunctioned between the 2007 and 2008 monitoring resulting in data gaps during the growing season. All malfunctioning gauges as well as the additional original Water Level (WL) gauges were replaced with Ecotone groundwater gauges in August 2008. Additionally, the existing rain gauge was replaced in 2008 due to an apparent malfunction in August 2007. Wetland hydrology monitoring included groundwater gauge and rain gauge downloads during monthly site visits from July to November. Of the 27 gauges monitored in MY 6, 18 met the established wetland success criteria. Differences in gauge data between MY 5 and MY 6 are likely attributed to data gaps from gauge malfunction and changes in hydrology associated with an increase in inundation from beaver impacts.

The MY 6 vegetation monitoring indicates that the project as a whole meets the established criteria for plant density, which is a minimum survival of 260 stems per acre at the end of Year 5 of the monitoring period. Five of the seven monitoring plots averaged 93% survival of planted stems between MY 5 and MY 6. The two additional plots (Plots 3 & 5) have experienced 100% mortality of planted stems due to inundation. Average stem density in MY 6 is approximately 388 stems per acre. Vegetation problem areas consist of some invasive/exotic species throughout the easement area. Efforts to control these species should be considered to prevent further spread and reduce competition to native species.

2.0 PROJECT BACKGROUND

2.1 Project Objectives

Specific project objectives were not stated in previous annual monitoring reports. The 2003 Tulula Stream and Wetland Restoration Report (NCDOT 2003) indicated the site was developed as a wetland and stream mitigation project designed to assist in replacing highway-related impacts in the mountain region.

2.2 Project Structure, Restoration Type, and Approach

Historically the Tulula Stream and Wetland Restoration Site contained a mountain floodplain forest-fen complex that contained a variety of unique wetland habitats. The project site was the last remaining sizeable swamp forest-fen complex in Graham County, North Carolina. Fewer than 250 acres of this rare community type are known to exist in the state. The site remained in a natural state until the mid-1980's when unauthorized golf course construction significantly impacted existing conditions. These impacts included significant alteration of the swamp-fen complex, the straightening of Tulula Creek, and the draining of existing wetlands.

In 1994 a collaborative effort began to develop and implement a plan to restore the site. Primary restoration components included natural stream design, plugging ditches, removing wetland fill, vernal pool creation, and vegetation plantings. Restoration was completed in 2002 and included 102 acres of wetland restoration, 121 acres of upland buffer protection, 8,639 linear feet of stream restoration, and 1,248 linear feet of stream preservation (Table 1a & 1b).

Table 1a. Project Components
Tulula Stream & Wetland / Project No. 392

Project Component or Reach ID	Existing Feet/Acres	Restoration Level	Approach	Footage or Acreage	Stationing	Buffer Acres	BMP Elements	Comment
Reach I	-	R	-	8,639 lf	-	121		
Reach II	-	P	-	1,248 lf	-			
Riverine Wetland	-	R		102 ac				

- Information unavailable.

Table 1b. Component Summations
Tulula Stream & Wetland / Project No. 392

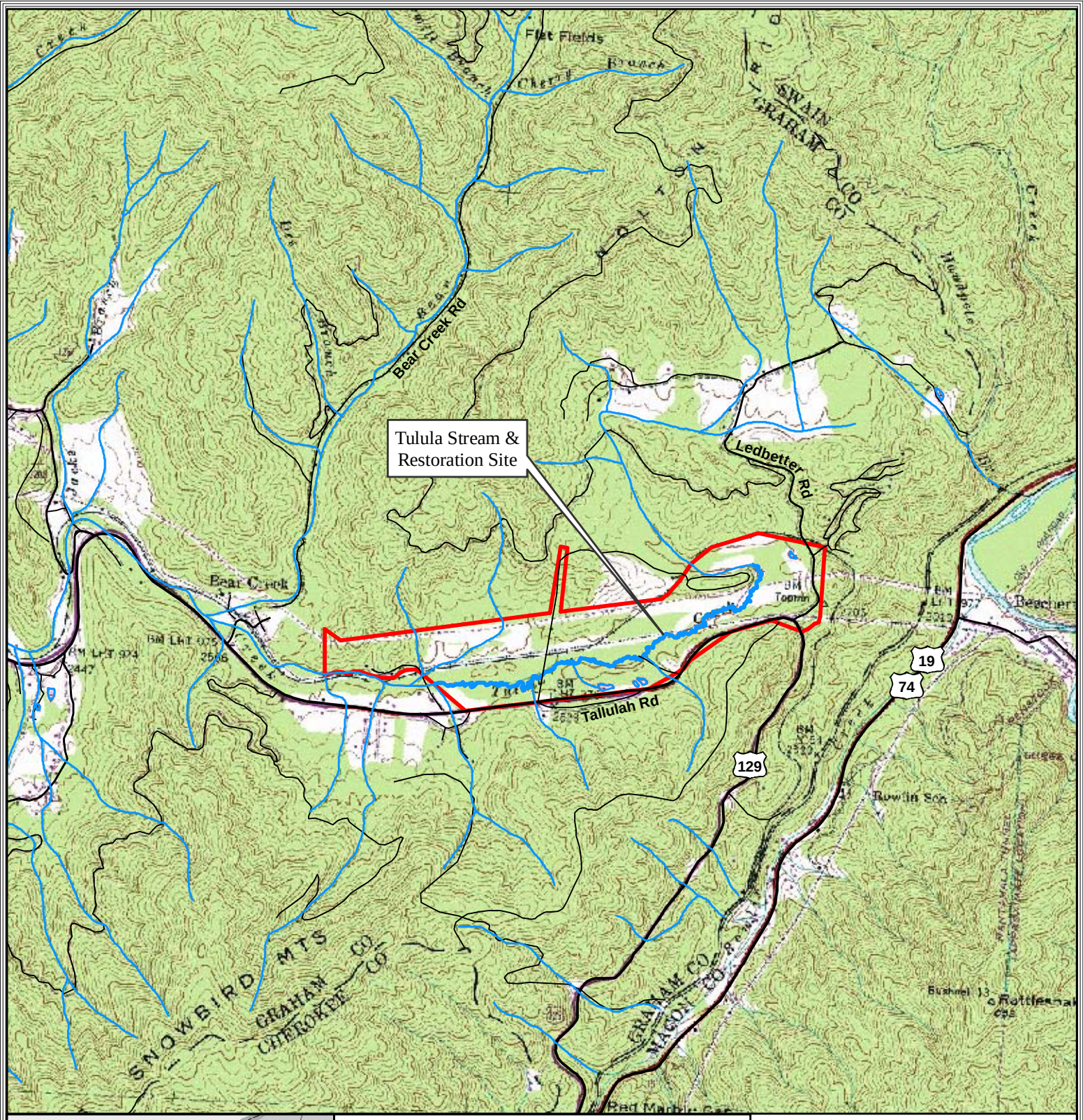
Restoration Level	Stream (lf)	Riparian Wetland (Ac)		Non-Ripar (Ac)	Upland (Ac)	Buffer (Ac)	BMP
		Riverine	Non-Riverine				
Restoration	8,639	102					
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation	1,248						
HQ Preservation							
		102	0				
Totals	**9,887**	102		0	0	121	0

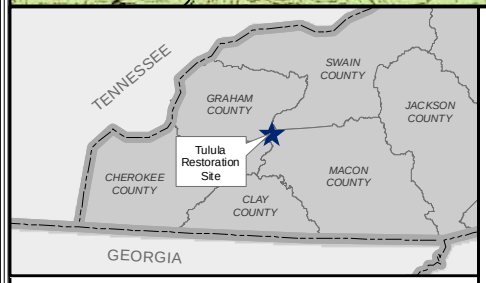
Non-Applicable

2.3 Location and Setting

The Tulula Stream and Wetland Restoration Site is located in Graham County, North Carolina within the Little Tennessee River Basin. The project site is within USGS 8-digit HUC unit 6010204 and the NCDWQ sub-basin 04-04-04. The project site is located off Highway 129 between Topton and Robbinsville (Figure 1).

The headwaters of Tulula Creek originate within the United States Forest Service Nantahala National Forest and drain south to the project site. The drainage area for Tulula Creek at the project site is 2.4 square-miles and primarily consists of forested land with limited agriculture and low density development.





Directions: From I-40, take NC Hwy 19/74 East. Turn right onto NC Hwy 129 just before reaching Andrews, NC. Continue for approx. 2 miles and turn right onto Ledbetter Rd. The entrance is a gated gravel drive to the left, approx. 1,000 feet off Ledbetter Rd and NC Hwy 129.

Figure 1 - Vicinity Map

Tulula Stream & Wetland Restoration Site

Project No. 392

Graham County, North Carolina

May 2009

N

EQUINOX ENVIRONMENTAL
CONSULTATION & DESIGN

Ecosystem Enhancement PROGRAM

0 1,000 2,000 3,000 4,000 Feet

7.5 Minute Series Hewitt Quadrangle

2.4 Project History and Background

Based on the Year 5 Monitoring Report (NCEEP 2008), the initial data collection efforts included hydrological monitoring gauge installation in May of 1998 prior to the start of construction. Stream and wetland restoration construction was completed in 2002 with final riparian revegetation completed in the spring of 2003. Additional wetland monitoring gauges were installed in April of 2003 after project completion. MY 1 monitoring began in 2003 with MY 6 completed in 2008.

The project activity and reporting history from 1998 to 2008 is presented in Table 2. Project personnel and contact information for the design and monitoring components is presented in Table 3. Table 4 presents background information for the project site.

Table 2. Project Activity and Reporting History
Tulula Stream & Wetland / Project No. 392

Activity or Report	Data Collection Complete	Actual Completion or Delivery
Restoration Plan	-	-
Initial Wetland Monitoring Gauges & Rain Gauge Installed	N/A	May 1998
Rain Gauge Replacement	N/A	May 2000
Final Design - 90%	-	-
Construction	N/A	2002
Mitigation Plan / As-built (Year 0 Monitoring - Baseline)	-	2002
Phase I Planting	N/A	April 2002
Phase II Planting	N/A	March 2003
Additional Wetland Gauges Installed	N/A	April 2003
Year 1 Monitoring	Nov 2003	Dec 2003
Year 2 Monitoring	Nov 2004	Dec 2004
Four additional vegetation monitoring plots established	Nov 2004	Nov 2004
Year 3 Monitoring	Dec 2005	Feb 2006
Year 4 Monitoring	Dec 2006	Jan 2007
Year 5 Monitoring	Dec 2007	March 2008
Wetland Gauges and Rain Gauge Replacement	N/A	Aug 2008
Year 6 Monitoring	Nov 2008	May 2009

- Information unavailable.

N/A - Item does not apply.

Table 3. Project Contacts Tulula Stream & Wetland / Project No. 392	
Designer	HSMM 1305 Navaho Drive Raleigh, NC 27609
Primary Project Design POC	Grant Ginn (Wolf Creek Engineering) (828)-505-2186
Construction Contractor	NCDOT Maintenance Crew Robinsville Depot
Construction Contractor POC	Unknown
Planting Contractor	Unknown
Planting Contractor POC	Unknown
Seeding Contractor	Unknown
Seeding Contractor POC	Unknown
Seed Mix Sources	Unknown
Nursery Stock Suppliers	Unknown
Monitoring Performers (Y1) - 2003	NCDOT - Wetland and Vegetation University of North Carolina Asheville - Stream
Stream Monitoring POC	Unknown
Vegetation Monitoring POC	Unknown
Wetland Monitoring POC	Unknown
Monitoring Performers (Y2) - 2004	NCDOT - Wetland and Vegetation University of North Carolina Asheville - Stream
Stream Monitoring POC	Unknown
Vegetation Monitoring POC	Unknown
Wetland Monitoring POC	Unknown
Monitoring Performers (Y3) - 2005	Soil & Environmental Consultants, PA 11010 Raven Ridge Road Raleigh, NC 26714
Stream Monitoring POC	Rebecca Wargo (919) 846-5900
Vegetation Monitoring POC	Jessica Regan (919) 846-5900
Wetland Monitoring POC	Jessica Regan (919) 846-5900
Monitoring Performers (Y4)- 2006	Soil & Environmental Consultants, PA 11010 Raven Ridge Road Raleigh, NC 26714
Stream Monitoring POC	Jessica Regan (919) 846-5900
Vegetation Monitoring POC	Jessica Regan (919) 846-5900
Wetland Monitoring POC	Jessica Regan (919) 846-5900
Monitoring Performers (Y5)- 2007	Soil & Environmental Consultants, PA 11010 Raven Ridge Road Raleigh, NC 26714
Stream Monitoring POC	Jessica Regan (919) 846-5900
Vegetation Monitoring POC	Jessica Regan (919) 846-5900
Wetland Monitoring POC	Jessica Regan (919) 846-5900
Monitoring Performers (Y6)- 2008	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801
Stream Monitoring POC	Steve Melton (828) 253-6856
Vegetation Monitoring POC	Sarah Marcinko (828) 253-6856
Wetland Monitoring POC	Win Taylor (828) 253-6856

Unknown - Information was unknown at time of report submittal.

Table 4. Project Background Tulula Stream & Wetland / Project No. 392	
Project County	Graham
Drainage Area	2.41 square miles
Drainage Impervious Cover Estimate (%)	0.1%
Stream Order	1st & 2nd
Physiographic Region	Blue Ridge
Ecoregion	High Mountain (66i)
Rosgen Classification of As-built	E4
Cowardin Classification	Palustrine
Dominant Soil Types	Rc, Rd, Tf, Tg, Wa
Reference Site ID	Unknown
USGS HUC for Project and Reference	6010204
NCDWQ Sub-basin for Project and Reference	04-04-04
NCDWQ Classification for Project and Reference	WS-III, Tr
Any Portion of Project Segment 303d Listed	No
Any Portion of Project Segment Upstream of a 303d	No
Reasons for 303d Listing or Stressor	N/A
% of Project Easement Fenced	0%

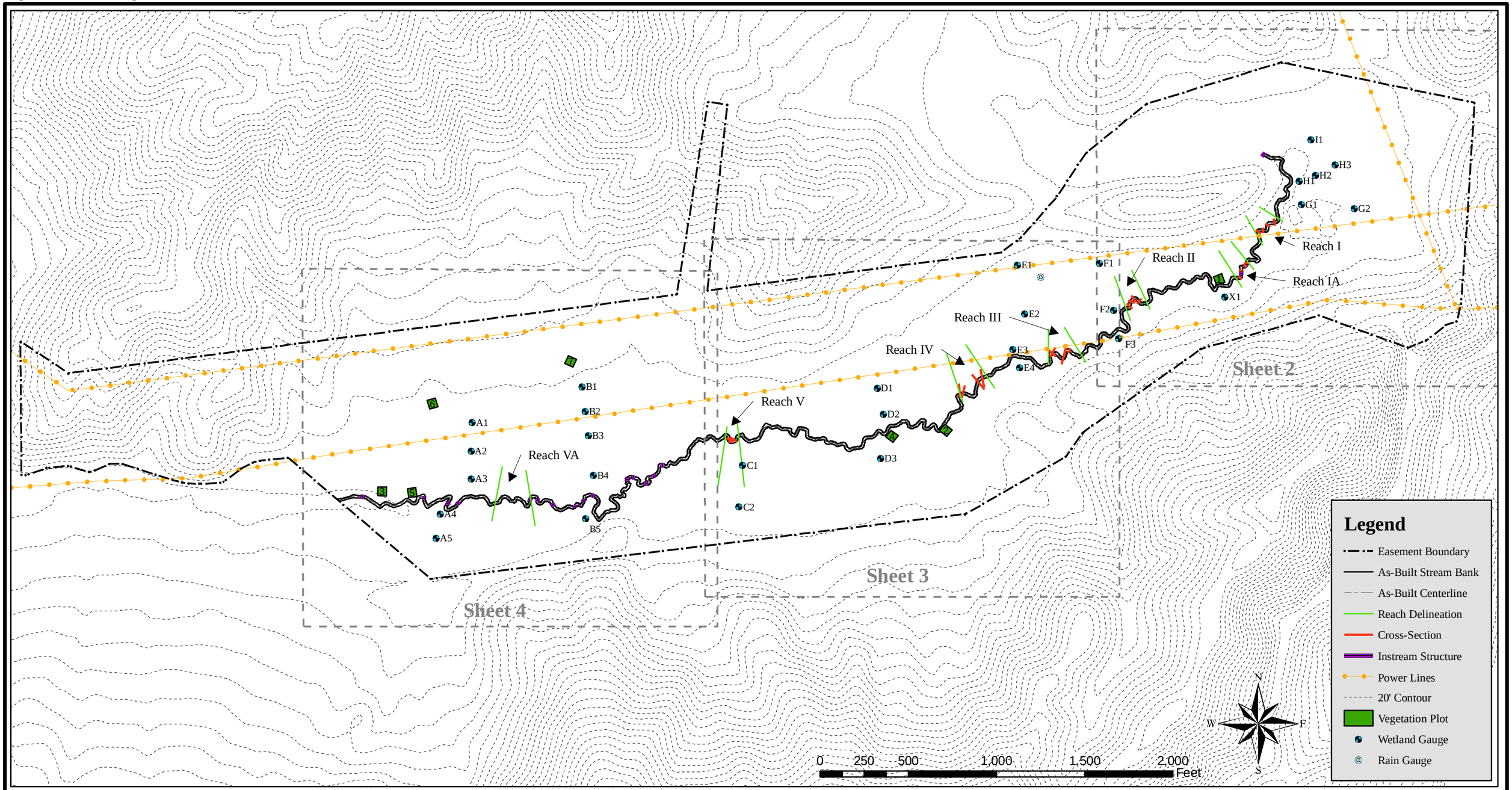
Unknown - Information was unknown at time of report submittal.

N/A - Item does not apply.

2.5 Monitoring Plan View

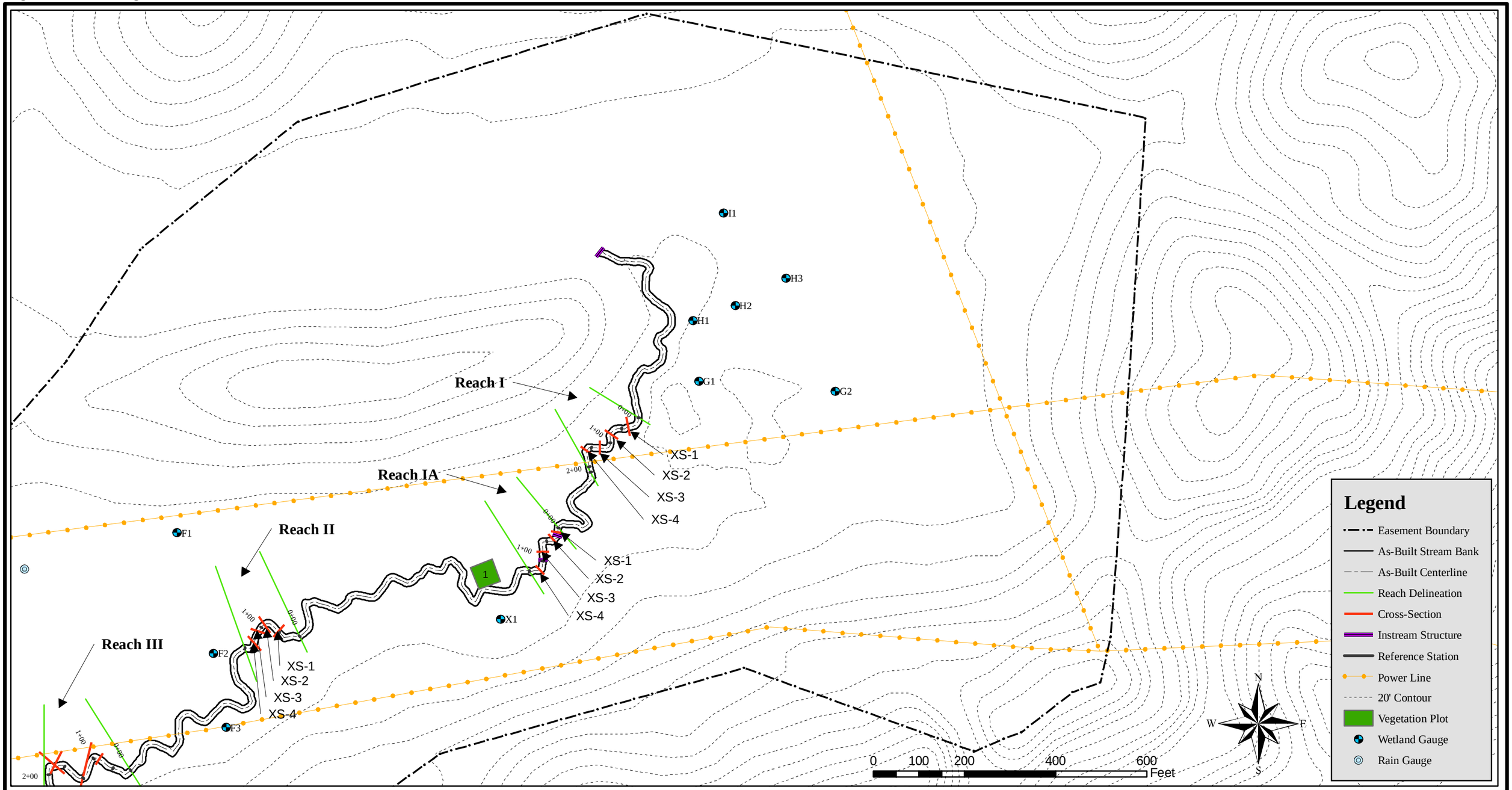
See Figure 2 – Monitoring Plan View.

Figure 2: Monitoring Plan View Sheet 1 of 4



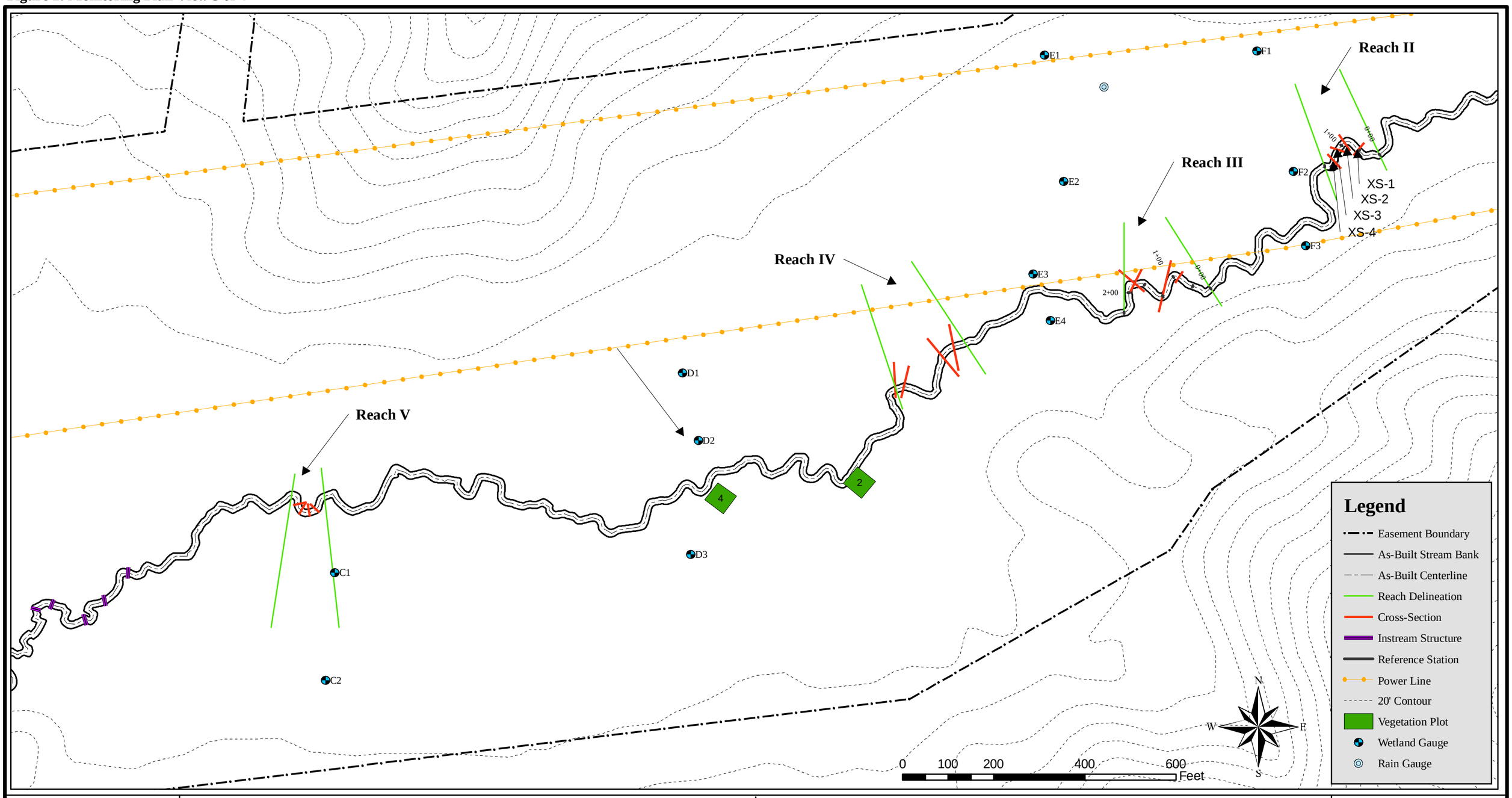
Prepared for	**Project:** Tulula Stream & Wetland Restoration Year 6 Monitoring Graham County, North Carolina	Notes: 1) Base Map from CAD file "TULULA 2007 MONT.AND PAPV.dwg" Provided by NCEEP	Prepared by
Ecosystem Enhancement Program	Sheet 1 of 4		EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Date	Project Number	
	May 2009	NCEEP # 392	

Figure 2: Monitoring Plan View Sheet 2 of 4



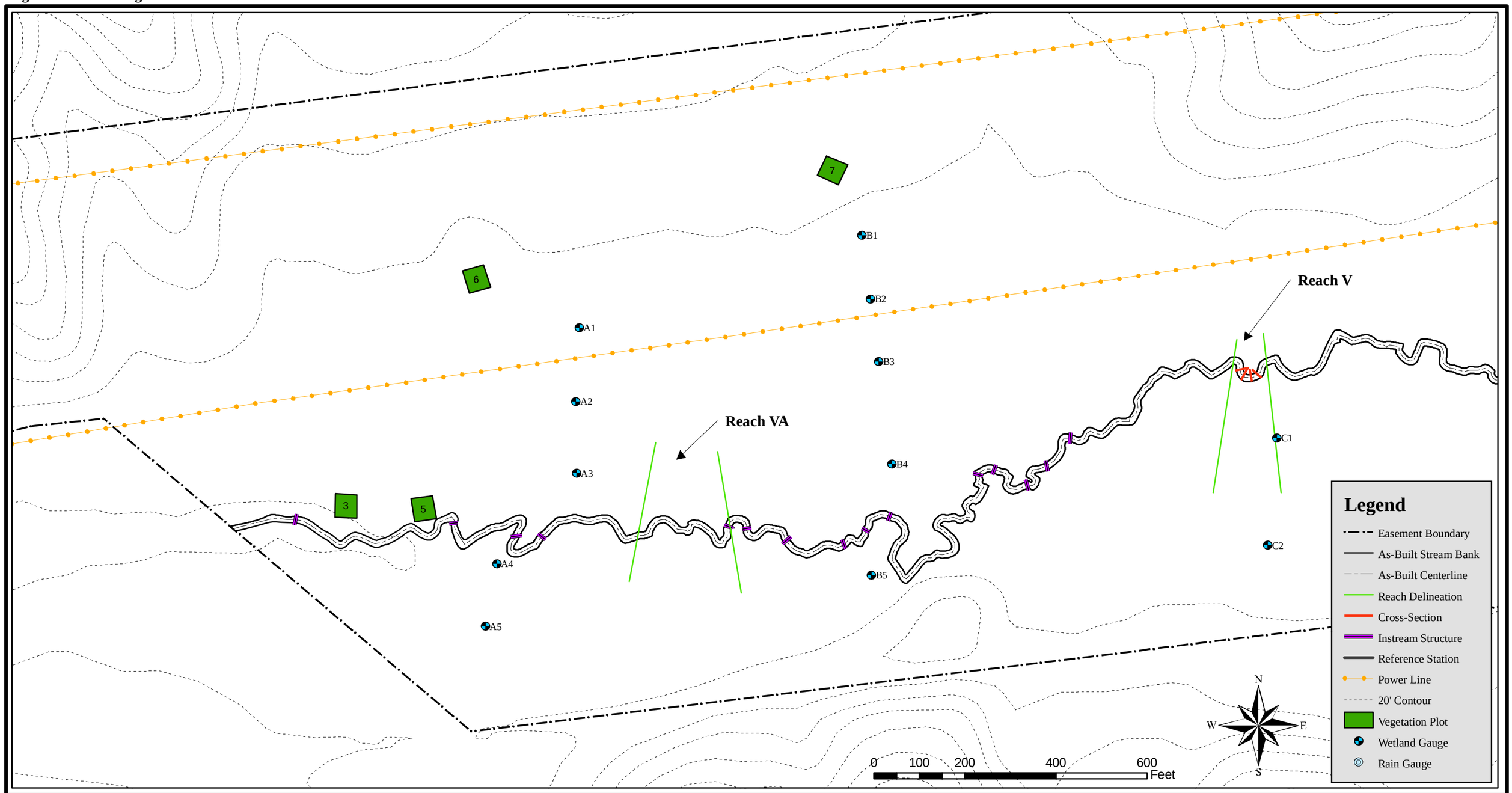
Prepared for	**Project:**	Notes: 1) Base Map from CAD file "TULULA 2007 MONT.AND PAPV.dwg" Provided by NCEEP	Prepared by
Ecosystem Enhancement Program	Tulula Stream & Wetland Restoration Year 6 Monitoring Graham County, North Carolina		EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Sheet 2 of 4		
	Date	Project Number	
	May 2009	NCEEP # 392	

Figure 2: Monitoring Plan View 3 of 4



Prepared for	**Project:**	Notes: 1) Base Map taken from CAD file "TULULA 2007 MONT.AND PAPV.dwg" Provided By NCEEP, Date 2007.	Prepared by
Ecosystem Enhancement Program	Tulula Stream & Wetland Restoration Year 6 Monitoring Graham County, North Carolina		EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Sheet 3 of 4		
	Date	Project Number	
	May 2009	NCEEP # 392	

Figure 2: Monitoring Plan View Sheet 4 of 4



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Ecosystem Enhancement Program	Tulula Stream & Wetland Restoration Year 6 Monitoring Graham County, North Carolina		EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Sheet 4 of 4		
	Date	Project Number	
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3.0 PROJECT CONDITION AND MONITORING RESULTS

The MY 6 vegetation, stream, and wetland data collection occurred between July and November 2008. Comparisons between MY 6 and previous project conditions and monitoring results data is limited due to data gaps for pre-construction and initial monitoring efforts. Additionally, monitoring efforts and the associated data have been reduced annually due to increases in project inundation from beaver activity.

3.1 Vegetation Assessment

Vegetation monitoring data collected on July 10 and August 5, 2008 indicated that the project successfully met the established criteria for plant density, which is a minimum survival of 260 stems per acre at the end of the Year 5 monitoring period. Average stem density in MY 6 is approximately 388 stems per acre.

On average, there was 93% survival of planted stems between MY 5 and MY 6 among five of the seven previously established vegetation monitoring plots. In particular, the 100% mortality recorded for planted vegetation in monitoring plots 3 and 5 is attributed to inundation resulting from beaver activity. Evidently, these plots do not meet the established vegetative success criteria as indicated in Appendix D – Integrated Current Condition Plan View. The modification in hydrologic conditions has facilitated the encroachment and dominance of species better adapted to anaerobic conditions, including Soft rush (*Juncus effuses ssp. solutus*) and, to a lesser extent, Tag alder (*Alnus serrulata*).

Several monitoring activities in previous years, however, departed from standard monitoring methodologies. These included the 2007 vegetation monitoring protocol. In that year, the seven previously established vegetation plots were not monitored using the standard CVS-EEP Protocol for Recording Vegetation (Lee *et al*. 2006). While the monitoring protocol employed was not explicitly stated in previous monitoring reports, it appears that only the stems of planted species were flagged and tallied on an annual basis. Equinox deviated slightly from this methodology by recording both natural and planted stems. Furthermore, unless stems clearly occurred within the plot boundaries, they were not recorded. All previously flagged and clearly planted trees were re-marked with orange flagging tape and recruits were marked with blue tape.

In addition to and as a result of different monitoring methodologies, there were discrepancies between MY 5 and MY 6 vegetation monitoring data. First, MY 6 monitoring found several small White oak (*Quercus alba*) and Northern red oak (*Quercus rubra var. rubra*) stems concealed beneath more vigorous vegetation in monitoring plot 1. These had not been previously flagged or recorded. The reduced fitness observed among these seedlings appears to be due to extensive shading from Tag alder, Virgin's bower (*Clematis virginiana*), Swamp wisteria (*Wisteria frutescens*), and blackberry (*Rubus sp*.). Second, several mature trees of Black cherry (*Prunus serotina var. serotina*), Black gum (*Nyssa sylvatica*), White oak, and Tulip poplar (*Liriodendron tulipifera*) were unmarked, but clearly occurred within the boundaries of plots 2, 6, and 7—these stems were flagged and recorded in MY 6. In contrast, numerous trees were flagged, but did not occur within the bounds of plot 6. These differences, in conjunction with some tree mortality, account for the reduction in stem density between MY 5 and MY 6. Nonetheless, the Tulula Stream and Wetland Restoration Site still has a stem density

approximately 50% higher than the minimum established requirement. Taxonomic nomenclature follows Weakley (2008).

3.1.1 Vegetation Problem Areas
Vegetation problem areas pertain to the presence of some invasive/exotic species throughout the easement area. A total of eight invasive/exotic species were identified (Appendix A – Table A2). Species are primarily associated with the power-line corridors and other disturbed areas but were also noted within the forested riparian and upland areas.

3.1.2 Vegetation Problem Area Plan View
See Appendix D – Integrated Project Current Condition Plan View.

3.2 Stream Assessment
Stream data collection efforts in MY 6 were limited due to an increase in stream project inundation associated with on-site beaver activity. Additionally high water levels have caused the riffle reaches to function as runs. For the purpose of labeling consistency between monitoring years the following tables and figures continue to use the riffle nomenclature.

3.2.1 Morphometric Criteria
Morphological assessments were conducted on September 25, 2008 for three of the four reaches (Reach I, IA, and II) surveyed in MY 5. Inundation prevented surveying Reach III. Stream dimension monitoring was carried out at four cross-sections in each reach (two riffles and two pools). The length of the stream profile monitoring reaches was 228 feet for Reach I, 131 feet for Reach IA, and 175 feet for Reach II.

Based on previous monitoring data there appeared to be a significant decline in bankfull cross-sectional area between MY 2 and MY 3 without an associated change in channel dimension (NCEEP 2006). This discrepancy in bankfull area is directly correlated to differences in bankfull elevation identification. During MY 6, bankfull elevation was identified as top-of-bank, which correlates with the bankfull widths recorded during the as-built through MY 2 periods. Dimension parameters for MY 3 through MY 5 were recalculated based on bankfull elevation set at top-of-bank.

Previous monitoring reports included profile data for riffle length and slope. Due to beaver inundation in 2008 riffles were absent preventing profile measurements for these stream features in MY 6.

3.2.2 Hydrologic Criteria
The Tulula Stream and Wetland Restoration Site does not have an existing crest gauge nor is there a USGS monitoring station in the project vicinity that would provide a comparable discharge data. Bankfull event documentation during previous monitoring efforts was based on visual observations, including wrack lines, stained/displaced/flattened vegetation, and sediment deposition. Previous monitoring reports indicated one or more bankfull events each year during MY 3 through MY 5. While bankfull event indicators in MY 6 were difficult to identify due to the beaver impacts on natural stream flow, there appeared to be at least one bankfull event in 2008 (Table 5).

Table 5. Verification of Bankfull Events Tulula Stream & Wetland / Project No. 392			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo # (if available)**
2005	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition	
2006	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition	
2007	Unknown	Wrack lines, stained vegetation, displaced/flattened vegetation, and sediment deposition	
9/25/2008	Unknown	Photographed On-site	Reach IA - XS #1

3.2.3 Current Condition Plan View
See Appendix D – Integrated Project Current Condition Plan View.

3.2.4 Stream Problem Areas
Previous monitoring efforts identified a number of stream problem areas, including bank scour, failing structures, debris jams, and a headcut. High water levels in MY 6 prevented an accurate reassessment of those pre-existing problem areas. With the exception of additional beaver inundation, no additional problem areas were identified during the MY 6 stream problem area assessment (Appendix B – Table B1).

Stream and upland inundation has increased annually since the MY 3. The inundated area for the project site has increased to 41.6 acres in MY 6 compared to 20.2 acres in MY 5 (Appendix D – Integrated Project Current Condition Plan View).

3.2.5 Numbered Issue Photos
Beaver inundation prevented accurate photo documentation of stream problem areas.

3.2.6 Fixed Station Photos
Fixed photo stations established for the Tulula Stream and Wetland Restoration Site were limited to the surveyed cross-section stations (Appendix B).

3.2.7 Stream Stability Assessment
Beaver inundation prevented the visual morphological stability assessment in MY 6 (Appendix B – Table B2). Additionally, the Visual Morphological Stability Assessment tables from previous monitoring reports indicate 11 riffles, 10 pools, and no vanes or root wads for the total number per as-built (NCEEP 2007 & 2008). These as-built numbers are not indicative of the entire project and it is uncertain as to which reach or reaches the visual assessment was conducted during previous monitoring years. If during future monitoring efforts a visual assessment is ascertainable there will likely be discrepancies between years due to the total number per as-built feature numbers reported in the 2006 and 2007 monitoring reports. Table 6 presents the categorical stream feature summary for the unknown reach or reaches assessed from MY 3 to MY 5.

Table 6. Categorical Stream Feature Visual Stability Assessment Tulula Stream & Wetland / Project No. 392							
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**	**MY-06**
A. Riffles	-	-	-	96%	95%	95%	*
B. Pools	-	-	-	100%	100%	100%	*
C. Thalweg	-	-	-	100%	100%	100%	*
D. Meanders	-	-	-	79%	100%	100%	*
E. Bed General	-	-	-	96%	97%	97%	*
F. Bank Condition	-	-	-	100%	99%	99%	*
G. Vanes / J Hooks etc.	-	-	-	**	**	**	*
H. Wads and Boulders	-	-	-	N/A	N/A	N/A	*

*Beaver inundation prevented accurate visual observations of categorical stream features.

**Previous reports identified failing structures within Table 6 but were not reported in Table 7.

- Information unavailable.

N/A - Item does not apply.

3.2.8 Quantitative Measures Summary

Quantitative stream monitoring data are summarized in Tables 7 and 8. Pre-existing and as-built data were not available for inclusion in the Baseline Morphology and Hydraulic Monitoring Summary Table (Table 7). Annual quantitative summary data for all cross-sectional and longitudinal profile surveys are presented in Table 8. The associated cross-sectional and longitudinal profiles for Reaches I, IA, and II are located in Appendix B.

Table 7. Baseline Morphology and Hydraulic Monitoring Summary Tulula Stream & Wetland / Project No. 392																			
Parameter	**USGS Gauge Data**			**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream**			**Design**			**As-built**		
Dimension	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
BF Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Floodprone Width (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Cross Sectional Area (ft^2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Mean Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BF Max Depth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Width/Depth Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrenchment Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bank Height Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wetted Perimeter(ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydraulic Radius (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pattern																		
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Meander Width Ratio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Profile																		
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Substrate																		
d50 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d84 (mm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																		
Valley Length (ft)		-			-			-			-			-			-	
Channel Length (ft)		-			-			-			-			-			-	
Sinuosity		-			-			-			-			-			-	
Water Surface Slope (ft/ft)		-			-			-			-			-			-	
BF Slope (ft/ft)		-			-			-			-			-			-	
Rosgen Classification		-			-			-			-			E4			-	
Habitat Index		N/A			N/A			-			-			N/A			-	
Macrobenthos		N/A			N/A			-			-			N/A			-	

- Information unavailable.
N/A - Item does not apply.

Table 8. Morphology and Hydraulic Monitoring Summary
Reaches I & IA
Tulula Stream and Wetland/Project No. 392

Survey Reach I (228 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**
BF Width (ft)	13.8	13.8	13.8	12.2	12.8	12.9	12.6	15.7	15.7	15.7	13.7	13.7	13.6	13.3	11.8	11.8	11.8	10.8	11.7	11.6	11.7	15.7	15.7	15.7	14.6	14.8	14.2	14.8
Floodprone Width (ft)	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50
BF Cross Sectional Area (ft^2)	18.8	21.9	19.0	18.5	19.1	18.0	17.4	27.9	24.2	25.2	17.7	17.3	17.6	17.0	14.0	15.7	15.1	16.7	15.5	17.9	17.1	27.6	28.0	26.2	25.2	24.9	23.7	24.6
BF Mean Depth (ft)	1.4	1.6	1.4	1.5	1.5	1.4	1.4	1.8	1.5	1.6	1.3	1.3	1.3	1.3	1.2	1.3	1.3	1.5	1.3	1.5	1.5	1.8	1.8	1.7	1.7	1.7	1.7	1.7
BF Max Depth (ft)	2.4	2.8	2.6	2.8	2.9	2.9	2.5	3.3	2.9	3.0	2.5	2.5	2.5	2.5	2.2	2.9	3.1	3.8	3.7	4.0	3.4	3.2	3.3	3.3	3.3	3.4	3.4	3.4
Width/Depth Ratio	-	-	-	8.0	8.6	9.2	9.1	-	-	-	10.6	10.8	10.6	10.4	-	-	-	7.0	8.9	7.6	8.0	-	-	-	8.4	8.8	8.5	8.9
Entrenchment Ratio	-	-	-	>4.1	>3.9	>3.9	>4.0	-	-	-	>3.7	>3.7	>3.7	>3.8	-	-	-	>4.6	>4.3	>4.3	>4.3	-	-	-	>3.4	>3.4	>3.5	>3.4
Bank Height Ratio	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0
Wetted Perimeter (ft)	-	-	-	13.7	14.3	14.5	14.1	-	-	-	15.2	15.0	15.1	14.8	-	-	-	13.8	14.5	15.1	14.1	-	-	-	16.5	16.6	16.2	17.0
Hydraulic Radius (ft)	-	-	-	1.3	1.3	1.2	1.2	-	-	-	1.2	1.2	1.2	1.1	-	-	-	1.2	1.1	1.2	1.2	-	-	-	1.5	1.5	1.5	1.4
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Data recalculated based on bankfull elevation set at top of low bank. - Information unavailable. N/A - Item does not apply.

Survey Reach IA (131 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**
BF Width (ft)	10.5	10.5	10.5	9.8	9.4	10.0	10.0	10.5	10.5	10.5	9.1	9.7	10.1	9.0	13.1	13.1	13.1	11.9	12.4	12.0	12.4	12.5	13.1	13.1	10.9	11.4	11.7	12.3
Floodprone Width (ft)	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50
BF Cross Sectional Area (ft^2)	13.8	16.4	15.9	15.9	17.0	16.7	16.2	18.4	19.7	18.6	16.1	18.7	16.6	15.9	20.3	22.1	22.0	21.8	20.5	23.1	21.1	18.3	18.4	18.8	17.4	17.6	17.0	17.0
BF Mean Depth (ft)	1.3	1.6	1.5	1.6	1.8	1.7	1.6	1.8	1.9	1.8	1.8	1.9	1.6	1.8	1.6	1.7	1.7	1.8	1.7	1.9	1.7	1.5	1.4	1.4	1.6	1.5	1.5	1.4
BF Max Depth (ft)	2.6	3.3	3.3	3.0	3.1	2.9	2.9	3.0	3.1	3.0	3.0	3.0	3.0	2.8	2.7	3.0	3.0	2.9	3.0	3.3	3.0	2.5	2.6	2.7	2.6	2.6	2.5	2.5
Width/Depth Ratio	-	-	-	6.1	5.2	6.0	6.1	-	-	-	5.1	5.0	6.2	5.1	-	-	-	6.5	7.5	6.3	7.3	-	-	-	6.8	7.4	8.1	8.9
Entrenchment Ratio	-	-	-	>5.1	>5.3	>5.0	>5.0	-	-	-	>5.5	>5.2	>4.9	>5.6	-	-	-	>4.2	>4.0	>4.2	>4.0	-	-	-	>4.6	>4.4	>4.3	>4.1
Bank Height Ratio	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0
Wetted Perimeter (ft)	-	-	-	12.2	11.7	12.1	12.0	-	-	-	11.9	12.8	12.7	11.8	-	-	-	14.0	14.1	14.4	14.6	-	-	-	13.8	13.7	13.9	14.6
Hydraulic Radius (ft)	-	-	-	1.3	1.4	1.4	1.4	-	-	-	1.4	1.5	1.3	1.3	-	-	-	1.6	1.5	1.6	1.4	-	-	-	1.3	1.3	1.2	1.2
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Data recalculated based on bankfull elevation set at top of low bank. - Information unavailable. N/A - Item does not apply.

Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Reaches II & III
Tulula Stream and Wetland/Project No. 392

Survey Reach II (175 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**
BF Width (ft)	16.4	16.4	16.4	14.9	15.1	15.3	15.2	16.4	16.4	16.4	15.4	15.4	^13.0	15.4	13.1	13.1	13.1	12.3	12.4	12.4	12.3	14.4	14.4	14.4	14.0	14.2	14.3	14.2
Floodprone Width (ft)	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50	-	-	-	>50	>50	>50	>50
BF Cross Sectional Area (ft^2)	20.3	21.9	21.9	19.9	19.0	20.9	19.4	25.0	27.8	26.0	25.0	24.6	23.3	22.4	14.8	16.4	16.3	15.4	16.5	16.9	15.9	23.3	24.8	24.4	26.3	27.5	27.4	24.3
BF Mean Depth (ft)	1.2	1.3	1.3	1.3	1.3	1.4	1.3	1.5	1.7	1.6	1.6	1.6	1.8	1.5	1.1	1.3	1.2	1.3	1.3	1.4	1.3	1.6	1.7	1.7	1.9	1.9	1.9	1.7
BF Max Depth (ft)	2.1	2.6	2.7	2.7	2.7	2.9	2.6	3.0	3.2	3.2	3.0	3.0	3.1	2.9	1.9	2.2	2.4	2.4	2.8	2.7	2.6	2.6	2.8	2.8	3.0	3.0	3.0	2.7
Width/Depth Ratio	-	-	-	11.2	12.0	11.2	11.9	-	-	-	9.5	9.7	7.2	10.6	-	-	-	9.8	9.3	9.1	9.5	-	-	-	7.5	7.3	7.5	8.3
Entrenchment Ratio	-	-	-	>3.4	>3.3	>3.3	>3.3	-	-	-	>3.2	>3.2	>3.8	>3.2	-	-	-	>4.1	>4.0	>4.0	>4.1	-	-	-	>3.6	>3.5	>3.5	>3.5
Bank Height Ratio	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0	-	-	-	1.0	1.0	1.0	1.0
Wetted Perimeter (ft)	-	-	-	16.1	16.4	16.7	16.5	-	-	-	16.9	17.0	14.3	16.8	-	-	-	13.4	13.7	13.7	13.5	-	-	-	15.7	16.0	16.1	15.7
Hydraulic Radius (ft)	-	-	-	1.2	1.2	1.3	1.2	-	-	-	1.5	1.5	1.3	1.3	-	-	-	1.2	1.2	1.2	1.2	-	-	-	1.7	1.7	1.7	1.5
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Data recalculated based on bankfull elevation set at top of low bank. ^ Cross-sectional data points were not collected across the entire transect. - Information unavailable. N/A - Item does not apply

Survey Reach III (278 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4***	**MY5***	**MY6**
BF Width (ft)	13.1	13.1	13.8	12.2	13.0	12.0	**	19.0	19.0	19.0	18.1	18.1	18.1	**	17.1	16.4	17.1	16.7	16.5	16.0	**	17.7	17.7	18.4	17.4	18.8	17.8	**
Floodprone Width (ft)	-	-	-	>50	>50	>50	**	-	-	-	>50	>50	>50	**	-	-	-	>50	>50	>50	**	-	-	-	>50	>50	>50	**
BF Cross Sectional Area (ft^2)	18.3	20.1	21.1	20.0	22.6	21.6	**	30.8	32.8	30.6	29.7	30.5	29.4	**	25.5	24.7	25.5	26.1	27.1	25.6	**	21.3	22.5	21.2	21.2	20.8	24.4	**
BF Mean Depth (ft)	1.4	1.5	1.5	1.6	1.7	1.8	**	1.6	1.7	1.6	1.6	1.7	1.6	**	1.5	1.5	1.5	1.6	1.6	1.6	**	1.2	1.3	1.2	1.2	1.1	1.4	**
BF Max Depth (ft)	2.4	3.2	3.2	3.3	3.6	3.4	**	3.1	3.3	3.3	3.1	3.3	3.3	**	2.8	2.8	3.0	3.3	3.3	3.1	**	2.5	3.1	3.1	3.0	2.9	3.1	**
Width/Depth Ratio	-	-	-	7.4	7.5	6.7	**	-	-	-	11.1	10.7	11.2	**	-	-	-	10.7	10.1	9.9	**	-	-	-	14.2	17.0	13.0	**
Entrenchment Ratio	-	-	-	>4.1	>3.8	>4.2	**	-	-	-	>2.8	>2.8	>2.8	**	-	-	-	>3.0	>3.0	>3.1	**	-	-	-	>2.9	>2.7	>2.8	**
Bank Height Ratio	-	-	-	1.0	1.0	1.0	**	-	-	-	1.0	1.0	1.0	**	-	-	-	1.0	1.0	1.0	**	-	-	-	1.0	1.0	1.0	**
Wetted Perimeter (ft)	-	-	-	15.1	15.3	14.4	**	-	-	-	20.1	19.6	19.9	**	-	-	-	18.5	18.1	17.9	**	-	-	-	19.1	20.1	19.3	**
Hydraulic Radius (ft)	-	-	-	1.3	1.5	1.5	**	-	-	-	1.5	1.6	1.5	**	-	-	-	1.4	1.5	1.4	**	-	-	-	1.1	1.0	1.3	**
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Data recalculated based on bankfull elevation set at top of low bank. **Data not collected due to beaver inundation. - Information unavailable. N/A - Item does not apply.

Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Reaches IV & IVA
Tulula Stream and Wetland/Project No. 392

Survey Reach IV (241 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**
BF Width (ft)	12.5	12.5	12.5	11.0	**	**	**	14.4	14.4	14.4	13.6	**	**	**	13.1	13.1	13.1	12.3	**	**	**	15.1	14.4	18.4	13.7	**	**	**
Floodprone Width (ft)	-	-	-	>50	**	**	**	-	-	-	>50	**	**	**	-	-	-	>50	**	**	**	-	-	-	>50	**	**	**
BF Cross Sectional Area (ft^2)	17.2	17.5	17.5	15.5	**	**	**	24.7	23.4	23.6	23.1	**	**	**	23.3	22.1	20.6	22.5	**	**	**	27.3	27.5	26.8	26.0	**	**	**
BF Mean Depth (ft)	1.4	1.4	1.4	1.4	**	**	**	1.7	1.6	1.6	1.7	**	**	**	1.8	1.7	1.6	1.8	**	**	**	1.8	1.9	1.5	1.9	**	**	**
BF Max Depth (ft)	2.3	2.4	2.6	2.7	**	**	**	3.1	3.0	3.2	3.1	**	**	**	3.3	3.1	3.2	3.9	**	**	**	3.3	3.3	3.3	3.3	**	**	**
Width/Depth Ratio	-	-	-	7.8	**	**	**	-	-	-	8.0	**	**	**	-	-	-	6.7	**	**	**	-	-	-	7.2	**	**	**
Entrenchment Ratio	-	-	-	>4.5	**	**	**	-	-	-	>3.7	**	**	**	-	-	-	>4.1	**	**	**	-	-	-	>3.7	**	**	**
Bank Height Ratio	-	-	-	1.0	**	**	**	-	-	-	1.0	**	**	**	-	-	-	1.0	**	**	**	-	-	-	1.0	**	**	**
Wetted Perimeter (ft)	-	-	-	12.5	**	**	**	-	-	-	15.2	**	**	**	-	-	-	14.9	**	**	**	-	-	-	15.5	**	**	**
Hydraulic Radius (ft)	-	-	-	1.2	**	**	**	-	-	-	1.5	**	**	**	-	-	-	1.5	**	**	**	-	-	-	1.7	**	**	**
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Data recalculated based on bankfull elevation set at top of low bank. **Data not collected due to beaver inundation. - Information unavailable. N/A - Item does not apply.

Survey Reach IVA (length unknown)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
BF Width (ft)	12.50	12.50	12.50	**	**	**	**	13.80	13.80	13.80	**	**	**	**	15.10	15.10	15.70	**	**	**	**	13.80	13.80	13.80	**	**	**	**
Floodprone Width (ft)	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
BF Cross Sectional Area (ft^2)	14.66	15.40	15.54	**	**	**	**	19.49	21.11	20.50	**	**	**	**	21.90	21.52	20.16	**	**	**	**	19.17	21.73	20.88	**	**	**	**
BF Mean Depth (ft)	1.17	1.23	1.24	**	**	**	**	1.41	1.53	1.49	**	**	**	**	1.45	1.42	1.28	**	**	**	**	1.39	1.57	1.51	**	**	**	**
BF Max Depth (ft)	1.97	2.49	2.49	**	**	**	**	3.02	3.25	3.25	**	**	**	**	2.69	2.82	2.59	**	**	**	**	2.85	3.15	3.18	**	**	**	**
Width/Depth Ratio	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Entrenchment Ratio	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Bank Height Ratio	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Wetted Perimeter (ft)	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Hydraulic Radius (ft)	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Data not collected due to beaver inundation. - Information unavailable. N/A - Item does not apply.

Table 8 Continued. Morphology and Hydraulic Monitoring Summary
Reaches V & VA
Tulula Stream and Wetland/Project No. 392

Survey Reach V (114 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3***	**MY4**	**MY5**	**MY6**
BF Width (ft)	15.1	15.1	15.1	16.8	**	**	**	16.4	15.8	16.4	13.0	**	**	**	13.8	13.8	13.8	12.9	**	**	**	16.4	16.4	16.4	12.3	**	**	**
Floodprone Width (ft)	-	-	-	>50	**	**	**	-	-	-	>50	**	**	**	-	-	-	>50	**	**	**	-	-	-	>50	**	**	**
BF Cross Sectional Area (ft^2)	17.1	20.5	19.6	27.5	**	**	**	24.1	25.4	24.7	15.4	**	**	**	15.4	16.7	16.6	20.1	**	**	**	28.3	29.2	27.2	15.4	**	**	**
BF Mean Depth (ft)	1.1	1.4	1.3	1.6	**	**	**	1.5	1.6	1.5	1.2	**	**	**	1.1	1.2	1.2	1.6	**	**	**	1.7	1.8	1.7	1.2	**	**	**
BF Max Depth (ft)	1.9	2.6	2.5	2.8	**	**	**	2.4	2.7	2.6	2.2	**	**	**	1.9	2.8	2.8	2.6	**	**	**	3.0	3.1	3.2	2.5	**	**	**
Width/Depth Ratio	-	-	-	10.3	**	**	**	-	-	-	10.9	**	**	**	-	-	-	8.3	**	**	**	-	-	-	9.9	**	**	**
Entrenchment Ratio	-	-	-	>3.0	**	**	**	-	-	-	>3.9	**	**	**	-	-	-	>3.9	**	**	**	-	-	-	>4.1	**	**	**
Bank Height Ratio	-	-	-	1.0	**	**	**	-	-	-	1.0	**	**	**	-	-	-	1.0	**	**	**	-	-	-	1.0	**	**	**
Wetted Perimeter (ft)	-	-	-	18.0	**	**	**	-	-	-	14.0	**	**	**	-	-	-	14.4	**	**	**	-	-	-	13.6	**	**	**
Hydraulic Radius (ft)	-	-	-	1.5	**	**	**	-	-	-	1.1	**	**	**	-	-	-	1.4	**	**	**	-	-	-	1.1	**	**	**
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

*Data recalculated based on bankfull elevation set at top of low bank. **Data not collected due to beaver inundation. - Information unavailable. N/A - Item does not apply.

Survey Reach VA (286 feet)

Parameter	Cross Section 1 Riffle							Cross Section 2 Pool							Cross Section 3 Riffle							Cross Section 4 Pool						
Dimension	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**	**AS BUILT**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**MY6**
BF Width (ft)	9.80	-	9.80	**	**	**	**	11.80	-	11.80	**	**	**	**	15.10	-	15.10	**	**	**	**	10.50	-	10.50	**	**	**	**
Floodprone Width (ft)	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
BF Cross Sectional Area (ft^2)	15.21	-	16.94	**	**	**	**	18.16	-	19.61	**	**	**	**	18.56	-	19.44	**	**	**	**	16.62	-	18.11	**	**	**	**
BF Mean Depth (ft)	1.55	-	1.73	**	**	**	**	1.54	-	1.66	**	**	**	**	1.23	-	1.29	**	**	**	**	1.58	-	1.72	**	**	**	**
BF Max Depth (ft)	2.46	-	2.72	**	**	**	**	2.72	-	3.05	**	**	**	**	2.23	-	2.46	**	**	**	**	2.43	-	3.12	**	**	**	**
Width/Depth Ratio	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Entrenchment Ratio	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Bank Height Ratio	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Wetted Perimeter (ft)	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Hydraulic Radius (ft)	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**	-	-	-	**	**	**	**
Substrate																												
d50 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
d84 (mm)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

**Data not collected due to beaver inundation. - Information unavailable. N/A - Item does not apply.

Table 8 Continued. Pattern, Profile, and Additional Reach Parameters
Tulula Stream and Wetland/Project No. 392

Parameter	AS BUILT (2002)			MY-01 (2003)			MY-02 (2004)			MY-03 (2005)			MY-04 (2006)			MY-05 (2007)			MY-06 (2008)		
Pattern	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**	**Min**	**Max**	**Med**
Channel Beltwidth (ft)	-	-	-	-	-	-	-	-	-	30.12	108.90	55.83	23.38	92.77	52.60	26.78	98.25	54.28	23.10	96.94	54.79
Radius of Curvature (ft)	-	-	-	-	-	-	-	-	-	18.10	76.34	29.21	15.91	59.48	33.62	15.63	65.45	35.67	15.45	39.15	19.44
Meander Wavelength (ft)	-	-	-	-	-	-	-	-	-	35.68	125.91	81.86	38.01	125.21	87.56	38.50	130.25	88.26	63.91	104.08	71.95
Meander Width Ratio	-	-	-	-	-	-	-	-	-	3.16	11.44	5.86	3.86	12.15	6.69	3.96	12.53	7.01	3.36	7.78	4.22
Profile																					
Riffle Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	5.00	21.00	12.75	6.08	10.94	8.28	***	***	***
Riffle Slope (ft/ft)	-	-	-	-	-	-	-	-	-	0.0012	0.0067	0.0034	0.0025	0.0063	0.0042	0.0057	0.0207	0.0122	***	***	***
Pool Length (ft)	-	-	-	-	-	-	-	-	-	9.27	21.03	13.60	4.03	14.40	10.90	7.64	17.54	13.43	7.00	32.50	15.00
Pool Spacing (ft)	-	-	-	-	-	-	-	-	-	15.60	43.65	25.74	35.85	67.17	48.71	58.00	77.80	65.35	20.10	76.60	24.80
Additional Reach Parameters																					
Valley Length (ft)	-			-			-			6,062			6,062			6,062			6,062		
Channel Length (ft)	-			-			-			8,715			8,715			8,715			8,715		
Sinuosity	-			-			-			1.44			1.44			1.44			1.44		
Water Surface Slope (ft/ft)	-			-			-			-			-			-			***		
BF Slope (ft/ft)	-			-			-			0.004			0.004			0.004			0.004		
Rosgen Classification	-			-			-			E4			E4			E4			E4		
Habitat Index	N/A			N/A			N/A			N/A			N/A			N/A			N/A		
Macrobenthos	N/A			N/A			N/A			N/A			N/A			N/A			N/A		

***Calculations not representative due to beaver innundation. - Information unavailable. N/A - Item does not apply.

3.3 Wetland Assessment

During the initial site assessment 28 of the 29 wetland gauges were located (Appendix D – Integrated Project Current Condition Plan View). High water levels prevented locating Gauge A4. Wetland monitoring gauges for the project site included a combination of the original WL gauges (n = 20) and the newer Ecotone gauges (n = 8). Of the existing gauges, Ecotone Gauge G2 was not working and was replaced on July 10, 2008. Additionally all of the original WL gauges with the exception of Gauge D3 were replaced with Ecotone gauges on August 5th and 21st of 2008. Gauge D3 was removed and not replaced due to high water levels. Due to gauge download problems the data from the removed gauges were downloaded by Remote Data Systems Incorporated for inclusion within the data analysis. Of these gauges data gaps existed for 14 of the 21 gauges removed. Additionally, based on the 2007 Monitoring Report the onsite rain gauge malfunctioned in August of 2007 and was not replaced. The rain gauge was replaced with an Ecotone on July 10, 2008.

Success criteria for wetland hydrology require inundation or saturation within 12-inches of the ground surface for a consecutive period of 12.5% of the growing season (29 consecutive days). The growing season in Graham County begins on or about March 26 and ends on or about November 11 (230 days). Of the 27 wetland gauges monitored during 2008, 18 gauges met the wetland hydrology requirements (Table 9). Gauges A2, B1, B3, F1, G1, G2, H2, H3, and I1 failed to meet hydrology requirements in 2008. These results are similar to that seen in MY 5 with the exception of Gauges D1, F1, F2, F3, G1, and H2. Gauge D1, F2, and F3 met hydrology during MY 6 as compared to MY 5. Significant data gaps occurred for Gauges F1 and G1 which is the likely result for not meeting hydrology in MY 6 as compared to MY 5. Gauge H2 was reported as meeting hydrology in MY 5 Table XIII but upon review of available data sets this appears to be incorrect.

Table 9. Wetland Criteria Attainment Tulula Stream & Wetland / Project No. 392					
Well ID	**Well Hydrology Threshold Met**	**Transect Mean**	**Vegetation Plot ID**	**Vegetation Survival Threshold Met**	**Site Mean**
A1	Y*	**80%**	1	Y	**71%**
A2	N		2	Y	
A3	Y*		3	N	
A4	**		4	Y	
A5	Y		5	N	
B1	N	**60%**	6	Y	
B2	Y		7	Y	
B3	N*				
B4	Y*				
B5	Y				
C1	Y*	**100%**			
C2	Y				
D1	Y	**100%**			
D2	Y*				
D3	**				
E1	Y	**100%**			
E2	Y*				
E3	Y				
E4	Y*				
F1	N*	**66%**			
F2	Y				
F3	Y				
G1	N*	**0%**			
G2	N*				
H1	Y*	**33%**			
H2	N				
H3	N				
I1	N*	**0%**			
X1	Y	**100%**			

*Data gaps during growing season.

**Gauge no longer monitoried due to innundation but considered to meet hyrdrology for transect calculations.

3.3.1 Wetland Problem Area Plan View

See Appendix D – Integrated Project Current Condition Plan View

4.0 Methodology

The methodologies utilized in 2008 were intended to replicate those methods employed during previous monitoring years and are based on standard guidance and procedures documents (Rosgen 1996, USACOE 2003, USACOE 1987). However, some vegetation monitoring activities conducted in prior years deviated from standard monitoring methodologies and is reported in Section 3.1, Vegetation Assessment.

5.0 References

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Appendix A
Tulula Stream & Wetland Restoration
Vegetation Data

Table A1. Stem Count by Plot and Species
Tulula Stream & Wetland / Project No. 392

Species	Plot ID Number							Year 6
	1	**2**	**3**	**4**	**5**	**6**	**7**	**Totals**
Nyssa sylvatica	0	0	0	0	0	0	2	**2**
Quercus rubra var. rubra	6	0	0	0	0	3	2	**11**
Betula nigra	0	3	0	0	0	0	0	**3**
Liriodendron tulipifera	0	4	0	14	0	12	1	**31**
Quercus alba	13	3	0	1	0	1	0	**18**
Prunus serotina var. serotina	0	0	0	0	0	0	2	**2**
Year 6 Totals	**19**	**10**	**0**	**15**	**0**	**16**	**7**	**67**
Year 5 Totals	14	13	0	17	0	17	10	**71**
Year 4 Totals	17	13	11	17	0	18	11	**87**
Year 3 Totals	21	13	14	18	4	18	11	**99**
Year 2 Totals	32	26	25	22	4	23	15	**147**
Year 1 Totals*	31	29	29	N/A	N/A	N/A	N/A	**89**
Year 6 Plot Live Stem Density (trees/ac)	**769**	**405**	**0**	**607**	**0**	**648**	**283**	
Year 6 Average Live Stem Density (trees/ac)								**388**

*Vegetation monitoring plots 4, 5, 6, and 7 were not installed until Monitoring Year 2.
N/A – Item does not apply.

Table A2. Vegetation Problem Areas Tulula Stream & Wetland / Project No. 392			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Invasive / Exotic Populations	See CCPV	*Elaeagnus* species: Onsite seed source	VPA 1
	See CCPV	*Lespedeza bicolor*: Onsite seed source	
	See CCPV	*Lespedeza cuneata*: Onsite seed source	VPA 2
	See CCPV	*Ligustrum* species: Onsite seed source	
	See CCPV	*Lonicera japonica*: Onsite seed and vine source	
	See CCPV	*Microstegium vimineum*: Onsite seed source	
	See CCPV	*Pueraria montana*: Onsite seed and vine source	VPA 3
	See CCPV	*Rosa multiflora*: Onsite seed source	

Vegetation Problem Area (VPA 1) – *Elaeagnus* species
Monitoring Year 6 – July 10, 2008

Vegetation Problem Area (VPA 2) – *Lespedeza cuneata*
Monitoring Year 6 – July 10, 2008

Vegetation Problem Area (VPA 3) – *Pueraria Montana*
Monitoring Year 6 – July 10, 2008

Vegetation Monitoring Plot #1
Monitoring Year 6 – August 5, 2008

Vegetation Monitoring Plot #2
Monitoring Year 6 – August 5, 2008

Vegetation Monitoring Plot #3
Monitoring Year 6 – July 10, 2008

Vegetation Monitoring Plot #4
Monitoring Year 6 – August 5, 2008

Vegetation Monitoring Plot #5
Monitoring Year 6 – July 10, 2008

Vegetation Monitoring Plot #6
Monitoring Year 6 – August 5, 2008

Vegetation Monitoring Plot #7
Monitoring Year 6 – August 5, 2008

Appendix B
Tulula Stream & Wetland Restoration
Geomorphologic Data

Table B1. Stream Problem Areas
Tulula Stream & Wetland / Project No. 392

Feature Issue	Station Numbers	Suspected Cause	Photo Number
None observed due to beaver inundation	N/A	N/A	SPA 1

N/A - Item does not apply.

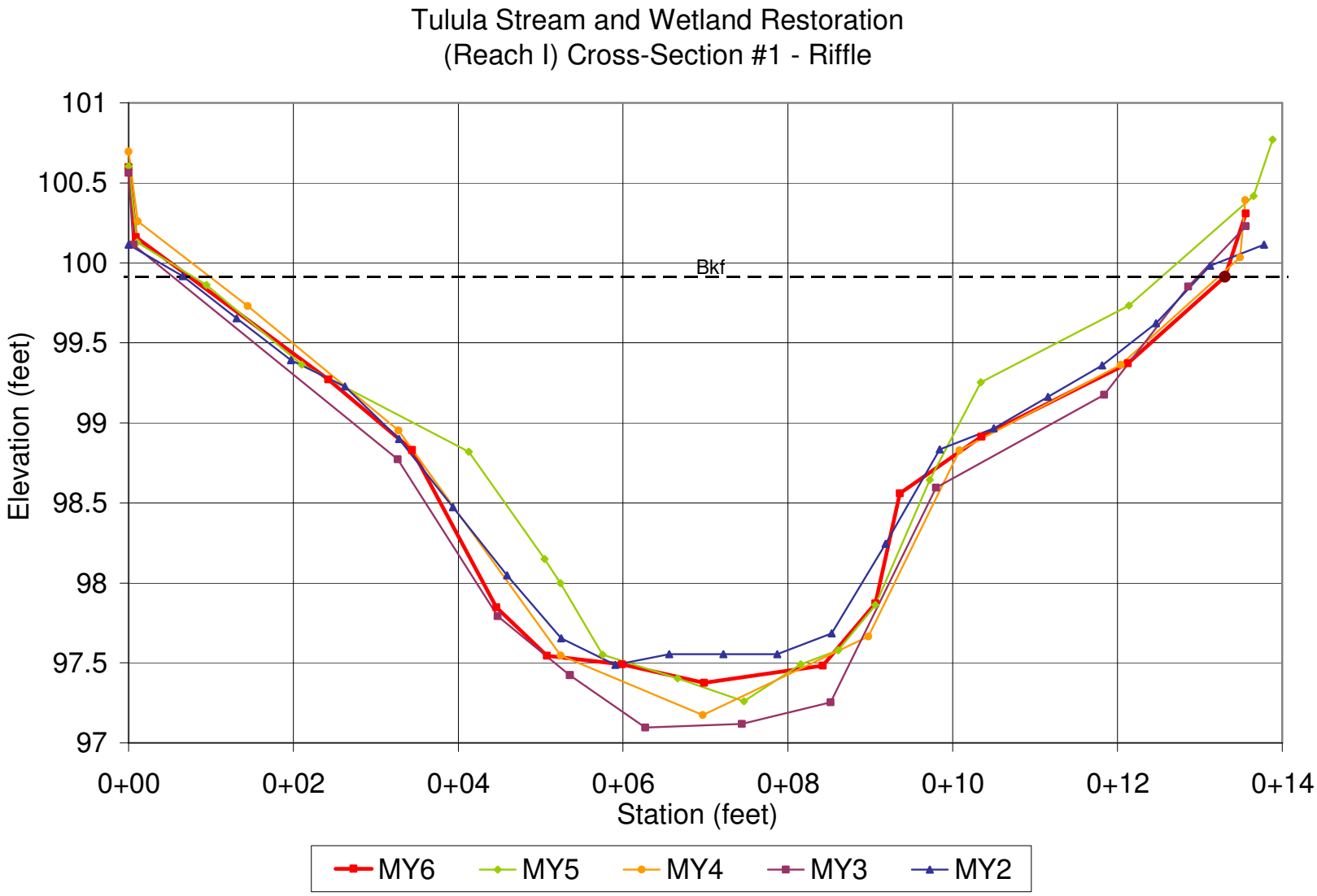
Stream Problem Area (SPA 1) – Inundated stream channel due to beaver activity
Monitoring Year 6 – September 25, 2008

Table B2. Visual Morphological Stability Assessment
Tulula Stream & Wetland / Project No. 392

Feature Category	Metric (Per As-built and Reference Baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / Feet in Unstable State	% Perform. in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	-	-	N/A	-	
	2. Armor stable (e.g. no displacement)?	-	-	N/A	-	
	3. Facet grade appears stable?	-	-	N/A	-	
	4. Minimal evidence of embedding/fining?	-	-	N/A	-	
	5. Length appropriate?	-	-	N/A	-	-
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	-	-	N/A	-	
	2. Sufficiently deep (Max Pool D : Mean Bkf >1.6)	-	-	N/A	-	
	3. Length appropriate?	-	-	N/A	-	-
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	-	-	N/A	-	
	2. Downstream of meander (glide/inflection) centering?	-	-	N/A	-	-
D. Meanders	1. Outer bend in state of limited/controlled erosion?	-	-	N/A	-	
	2. Of those eroding, # w/ concomitant point bar formation?	-	-	N/A	-	
	3. Apparent Rc within spec?	-	-	N/A	-	
	4. Sufficient floodplain access and relief?	-	-	N/A	-	-
E. Bed General	1. General channel bed aggradation areas (bar formation)?	N/A	N/A	-	-	
	2. Channel bed degradation - areas of increasing down cutting or head cutting?	N/A	N/A	-	-	-
F. Bank	1. Actively eroding, wasting, or slumping bank?	N/A	N/A	-	-	-
G. Vanes	1. Free of back or arm scour?	-	-	N/A	-	
	2. Height appropriate?	-	-	N/A	-	
	3. Angle and geometry appear appropriate?	-	-	N/A	-	
	4. Free of piping or other structural failures?	-	-	N/A	-	-
H. Wads/Boulders	1. Free of scour?	-	-	N/A	-	
	2. Footing stable?	-	-	N/A	-	-

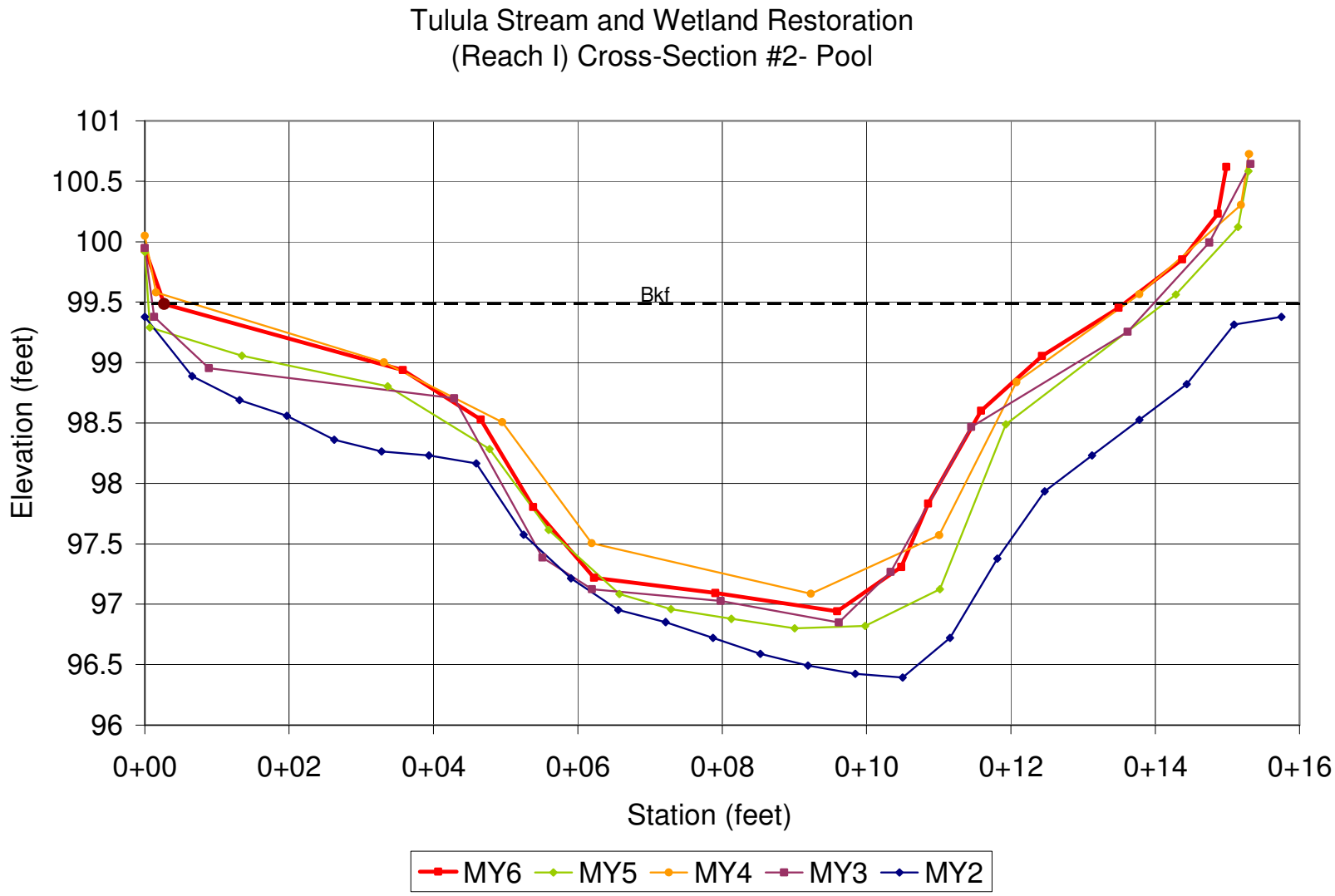
- Beaver inundation prevented visual morphological stability assessment.

N/A - Item does not apply.


Tulula Stream and Wetland Restoration
(Reach I) Cross-Section #1 - Riffle
101
100.5
100
99.5
99
98.5
98
97.5
97
Elevation (feet)
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
0+12
0+14
Station (feet)
MY6
MY5
MY4
MY3
MY2

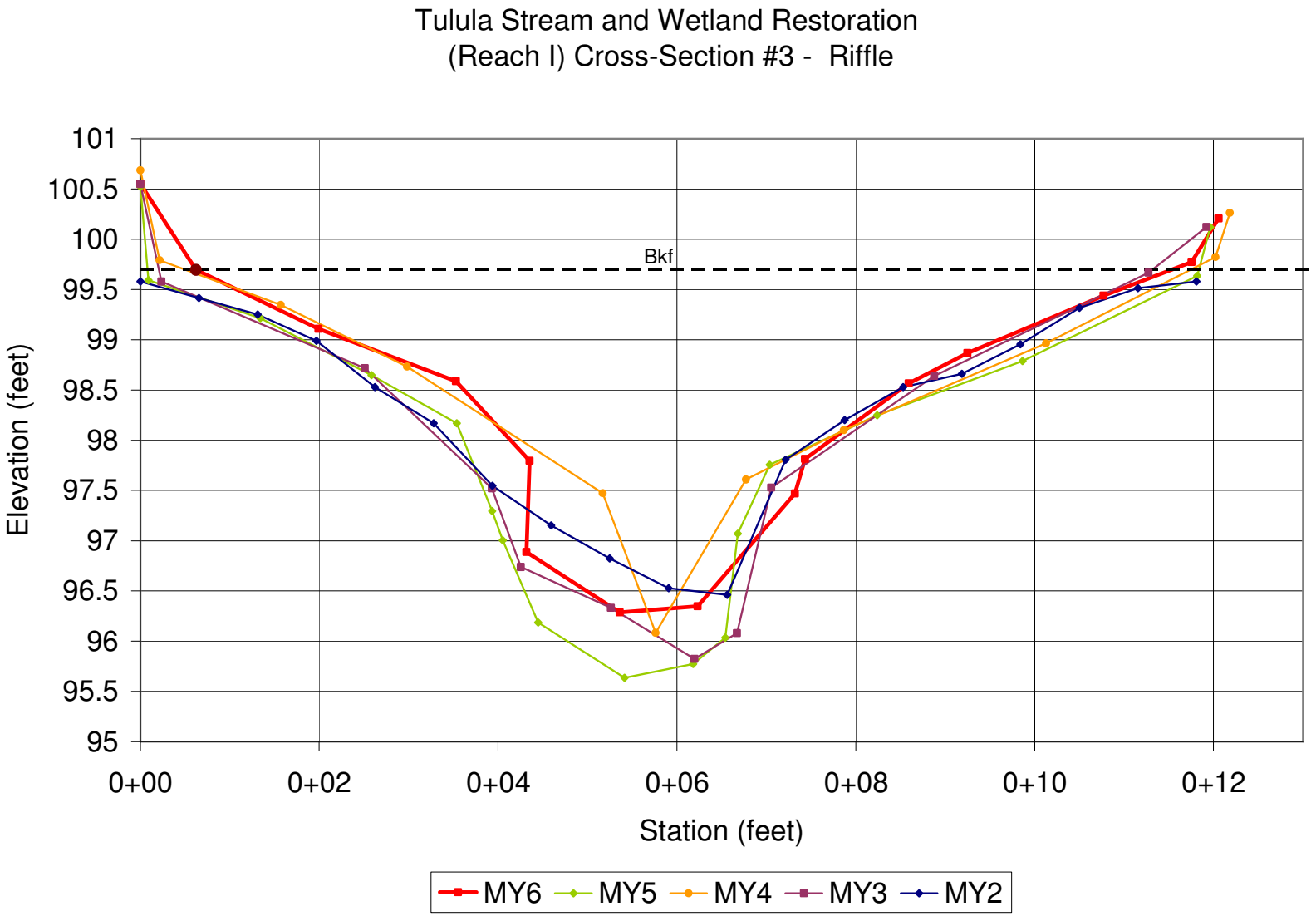
Reach I – Cross Section #1 – Riffle
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach I – Cross Section #1 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008


Tulula Stream and Wetland Restoration
(Reach I) Cross-Section #2- Pool
Elevation (feet)
101
100.5
100
99.5
99
98.5
98
97.5
97
96.5
96
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
0+12
0+14
0+16
Station (feet)
MY6
MY5
MY4
MY3
MY2

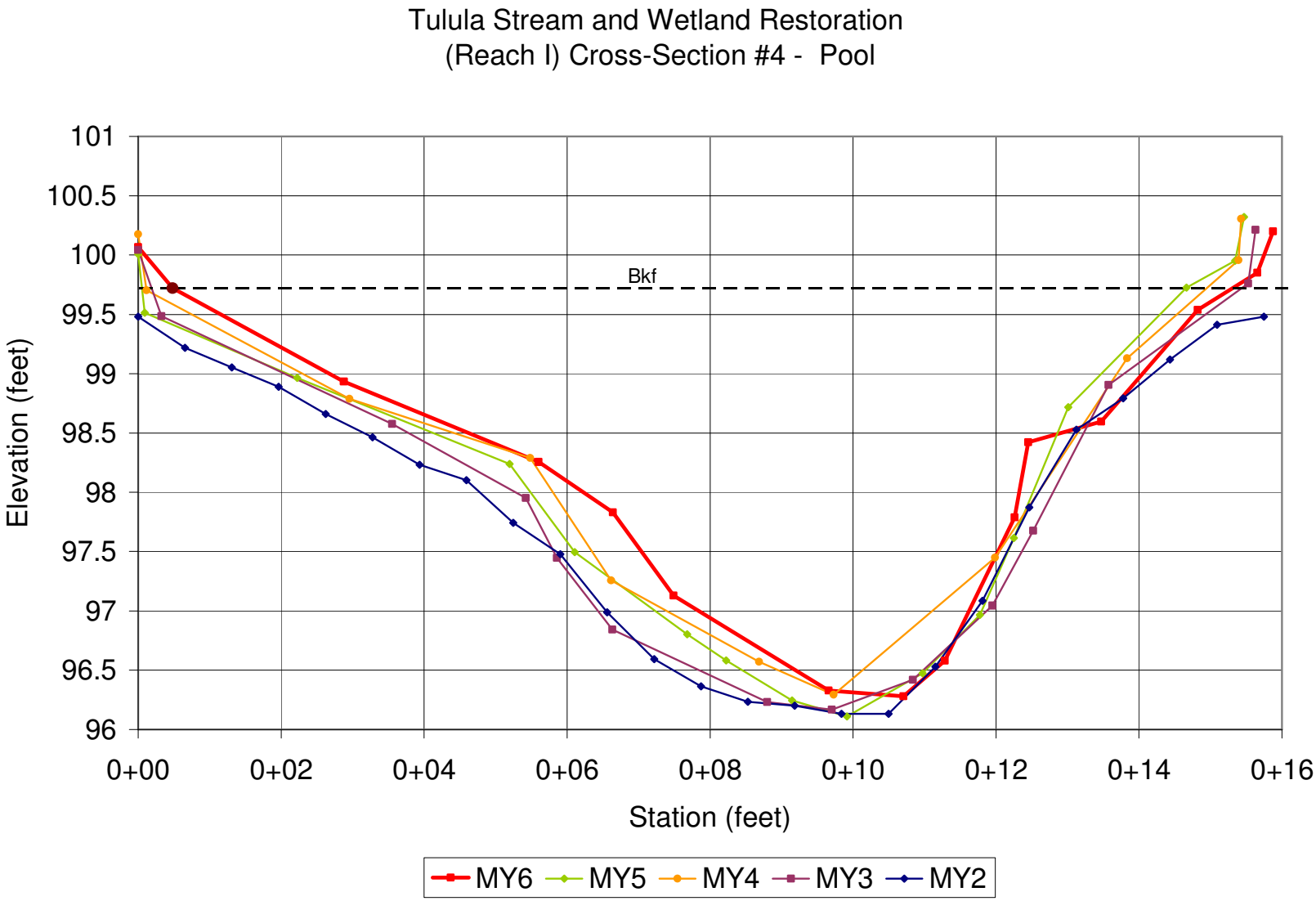
Reach I – Cross Section #2 – Pool
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach I – Cross Section #2 – Pool
Looking Upstream
Monitoring Year 6 – September 25, 2008


Tulula Stream and Wetland Restoration
(Reach I) Cross-Section #3 - Riffle
Elevation (feet)
101
100.5
100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
0+12
Station (feet)
MY6
MY5
MY4
MY3
MY2

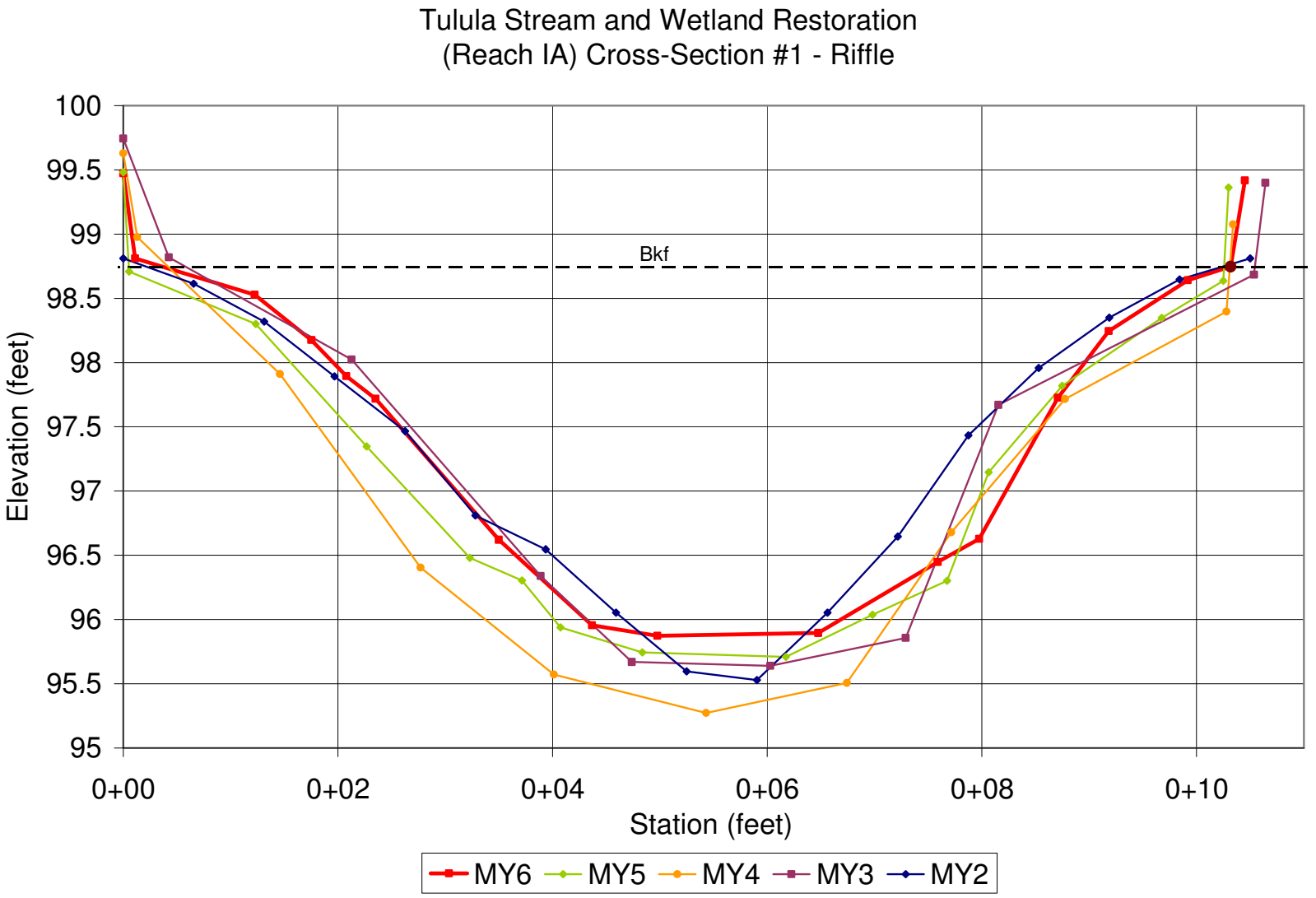
Reach I – Cross Section #3 – Riffle
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach I – Cross Section #3 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008


Tulula Stream and Wetland Restoration
(Reach I) Cross-Section #4 - Pool
Elevation (feet)
101
100.5
100
99.5
99
98.5
98
97.5
97
96.5
96
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
0+12
0+14
0+16
Station (feet)
MY6
MY5
MY4
MY3
MY2

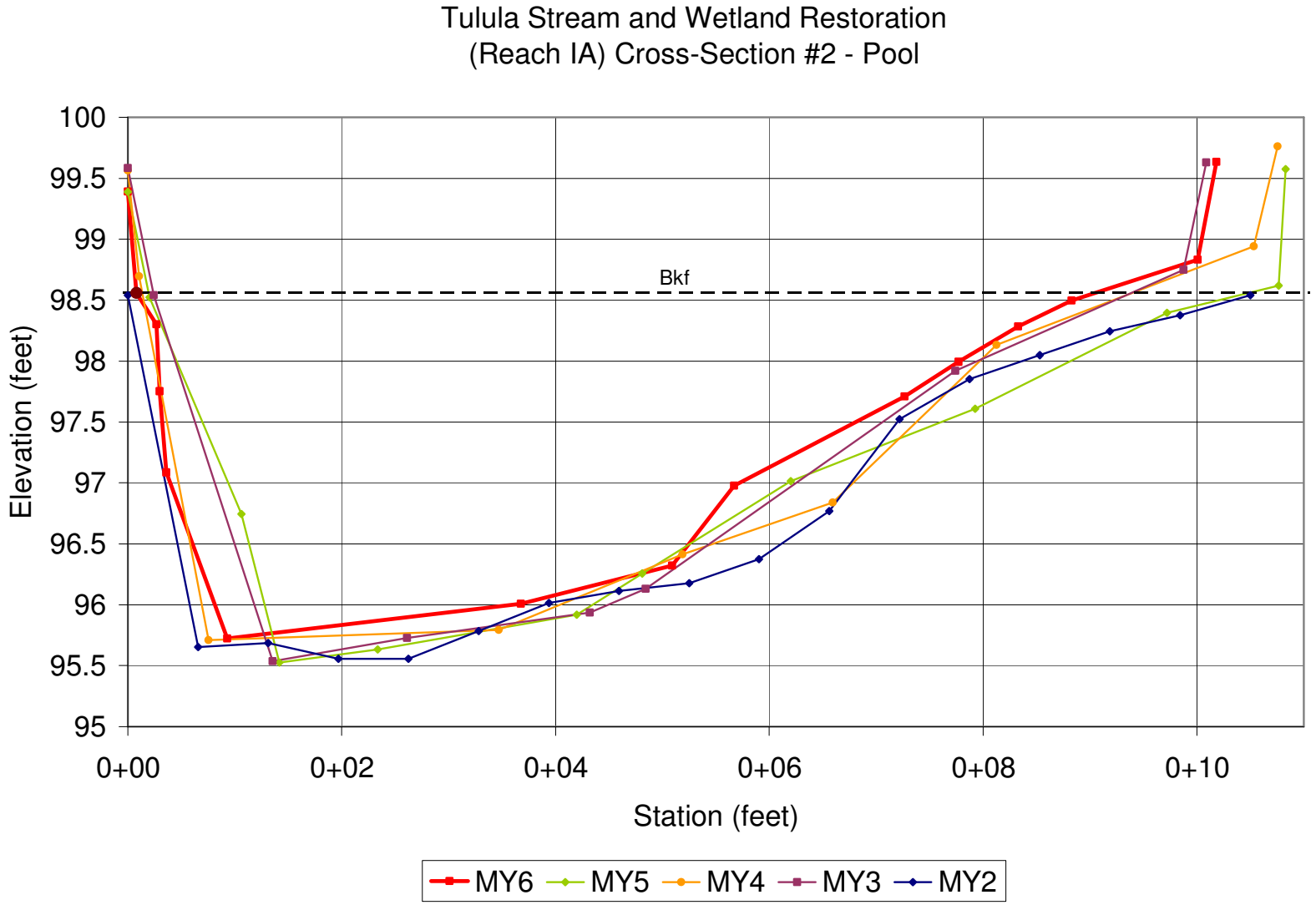
Reach I – Cross Section #4 – Pool
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach I – Cross Section #4 – Pool
Looking Upstream
Monitoring Year 6 – September 25, 2008


Tulula Stream and Wetland Restoration
(Reach IA) Cross-Section #1 - Riffle
100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
Elevation (feet)
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
Station (feet)
MY6
MY5
MY4
MY3
MY2

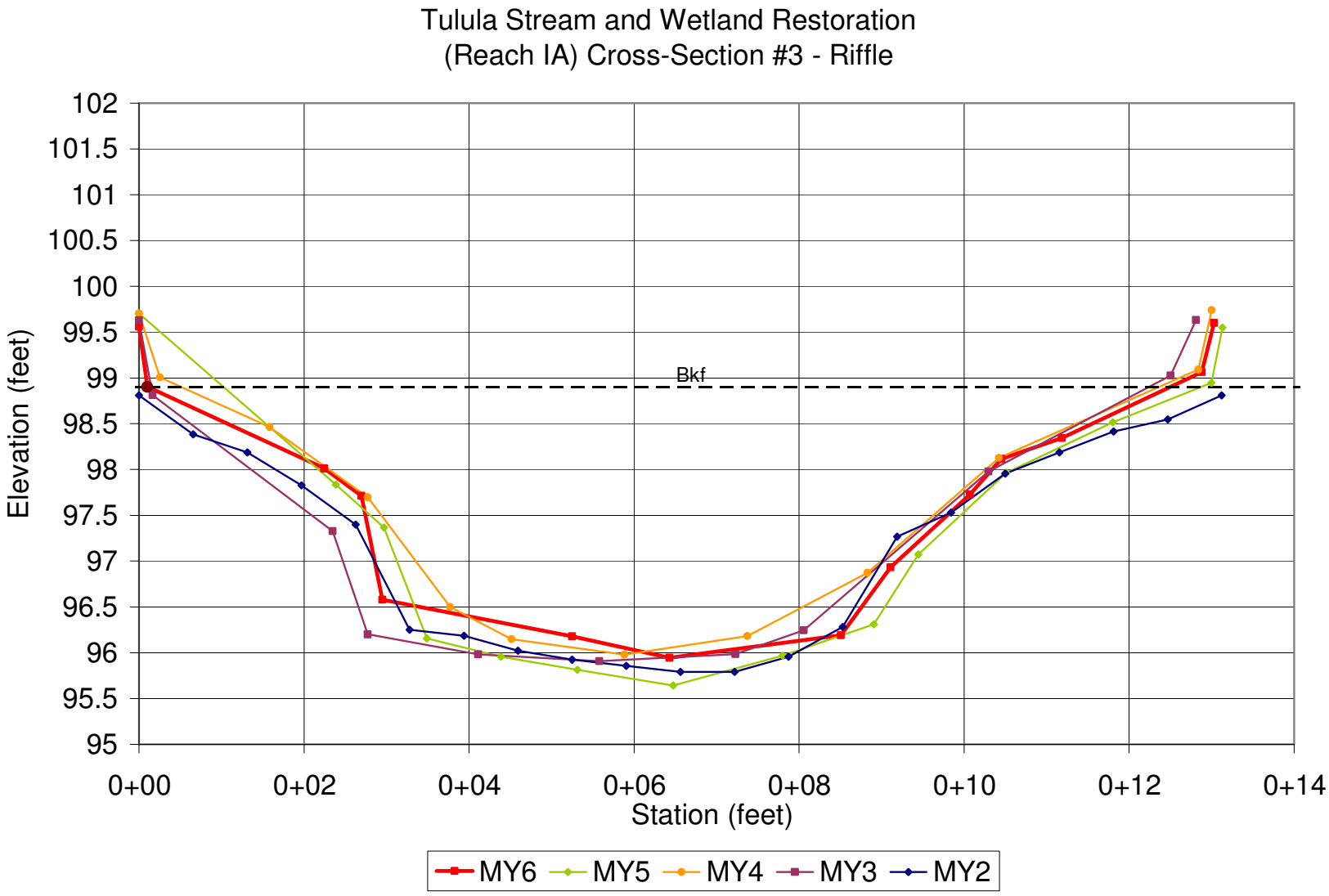
Reach IA – Cross Section #1 – Riffle
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach IA – Cross Section #1 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008


Tulula Stream and Wetland Restoration
(Reach IA) Cross-Section #2 - Pool
Elevation (feet)
100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
Station (feet)
MY6
MY5
MY4
MY3
MY2

Reach IA – Cross Section #2 – Pool
Looking Downstream
Monitoring Year 6 – September 25, 2008

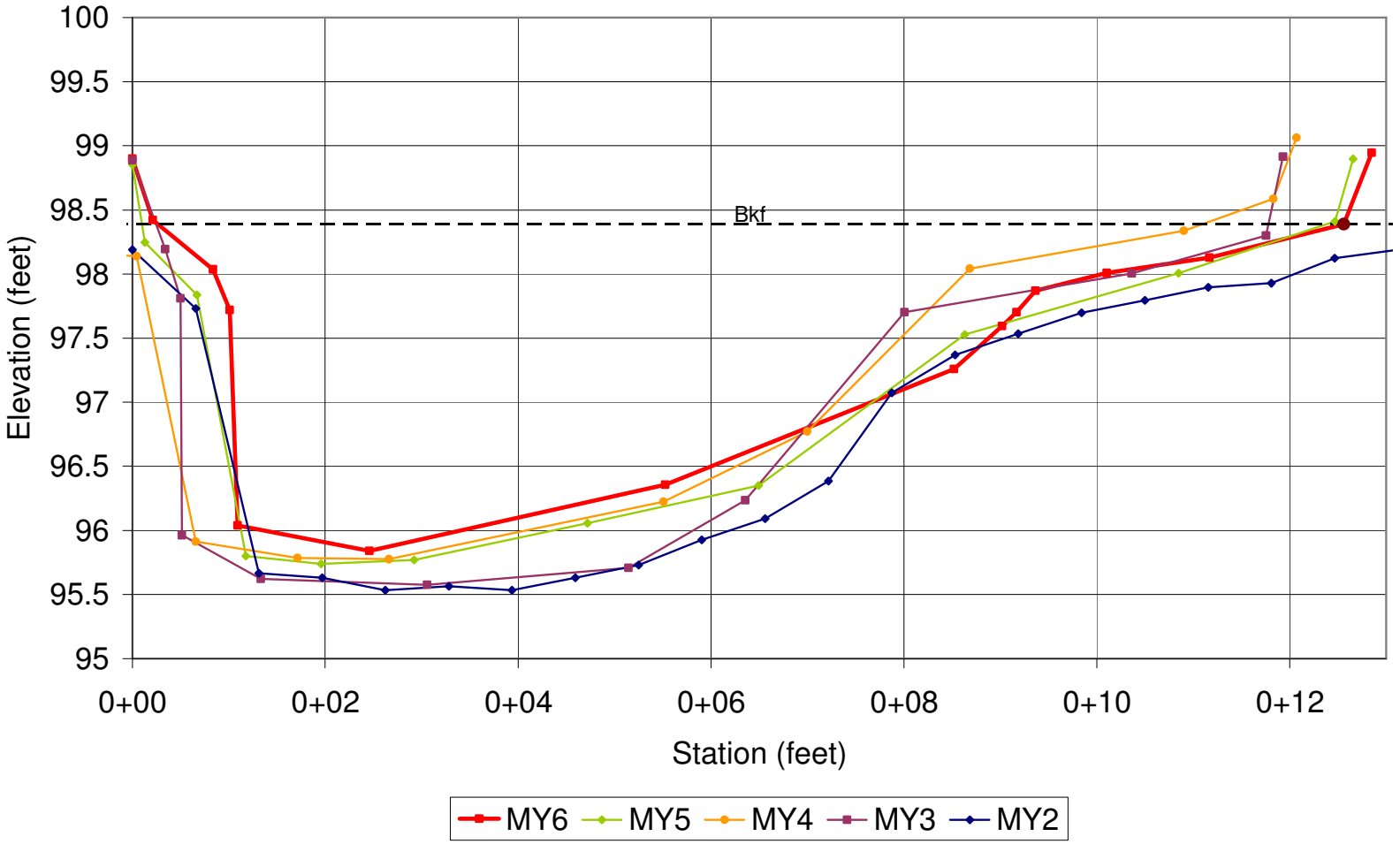
Reach IA – Cross Section #2 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008


Tulula Stream and Wetland Restoration
(Reach IA) Cross-Section #3 - Riffle
Elevation (feet)
102
101.5
101
100.5
100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
95
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
0+12
0+14
Station (feet)
MY6
MY5
MY4
MY3
MY2

Reach IA – Cross Section #3 – Riffle
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach IA – Cross Section #3 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008

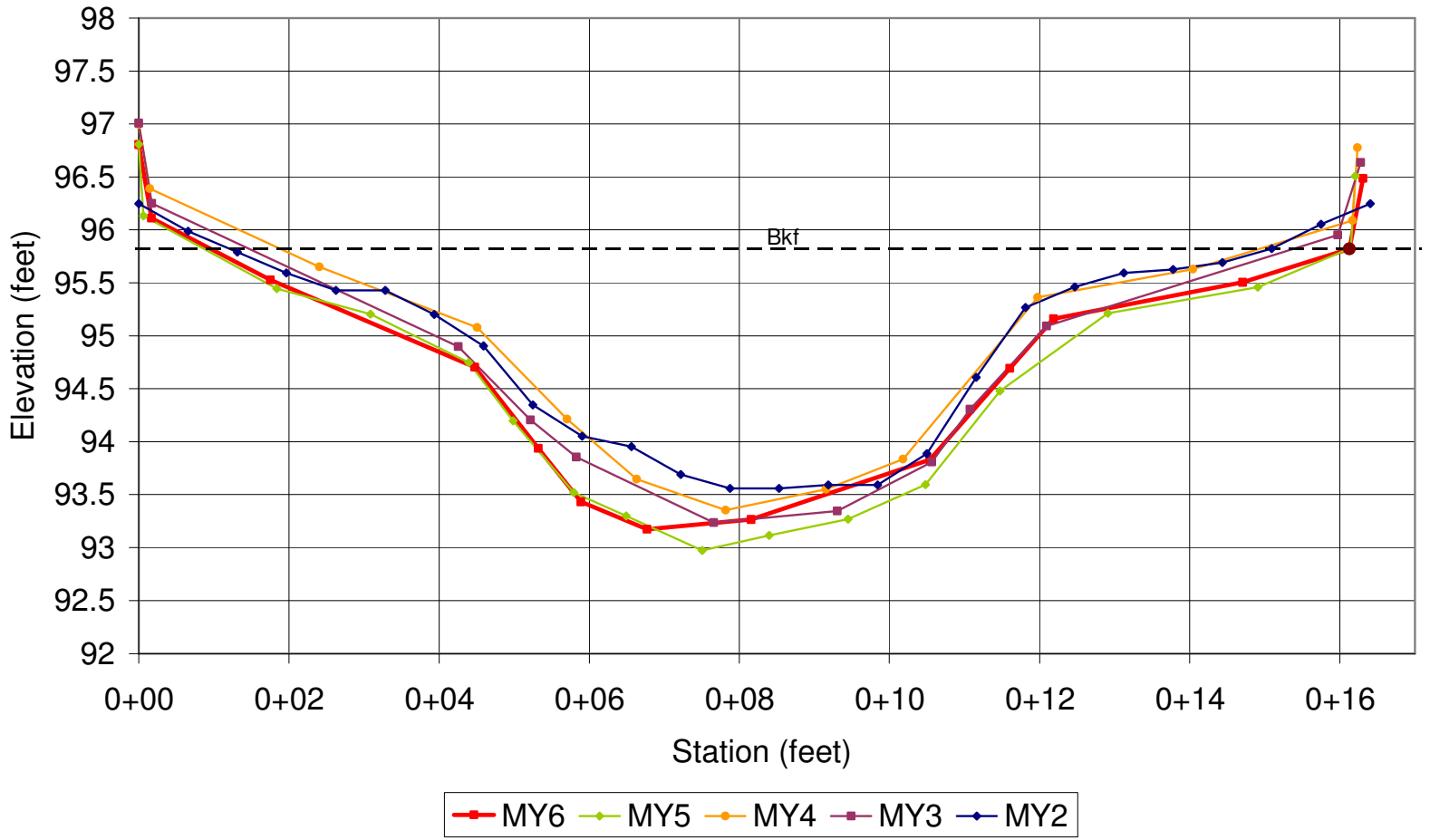
Tulula Stream and Wetland Restoration
(Reach IA) Cross-Section #4 - Pool



Reach IA – Cross Section #4 – Pool
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach IA – Cross Section #4 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008

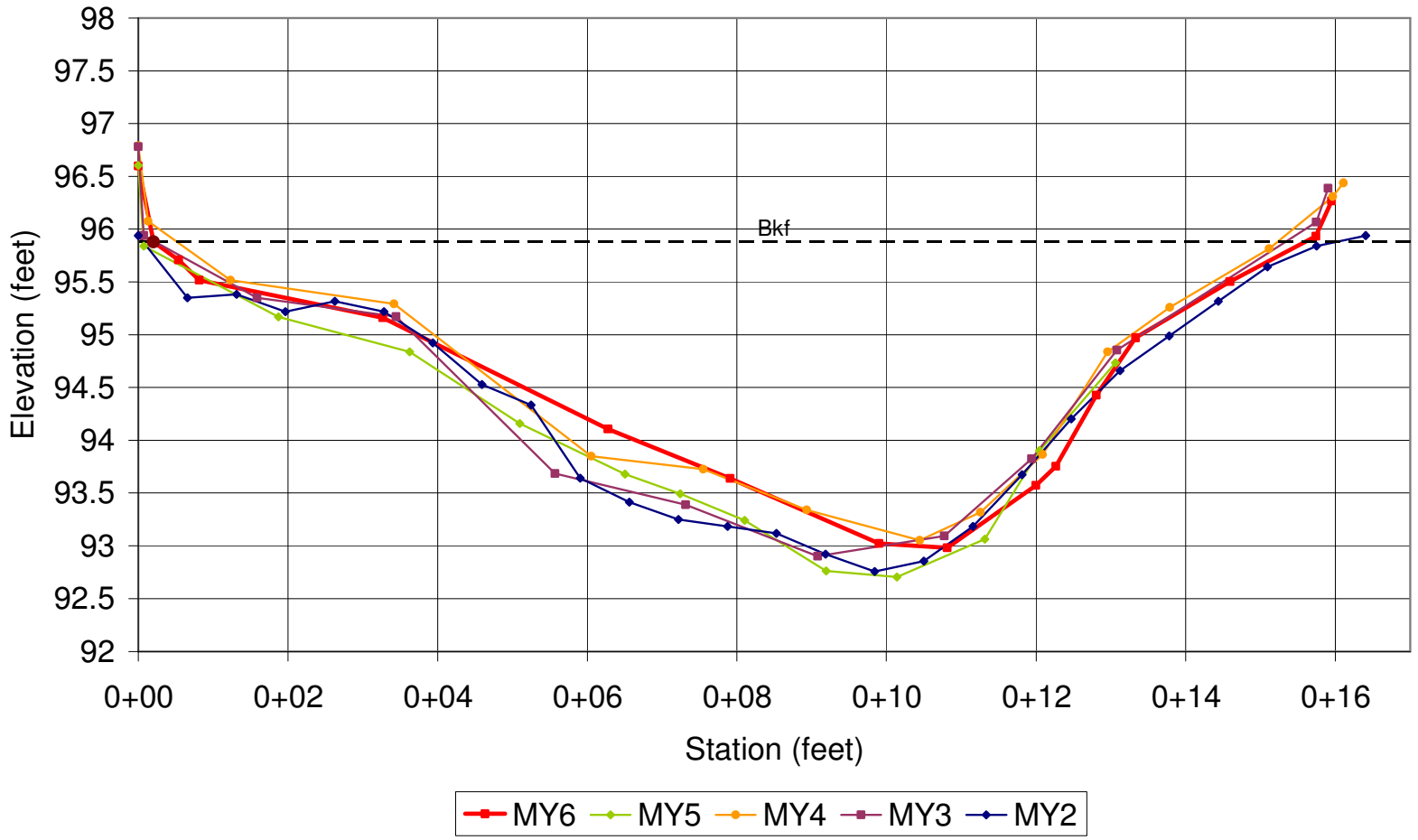
Tulula Stream and Wetland Restoration
(Reach II) Cross-Section #1 - Riffle



Reach II – Cross Section #1 – Riffle
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach II – Cross Section #1 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008

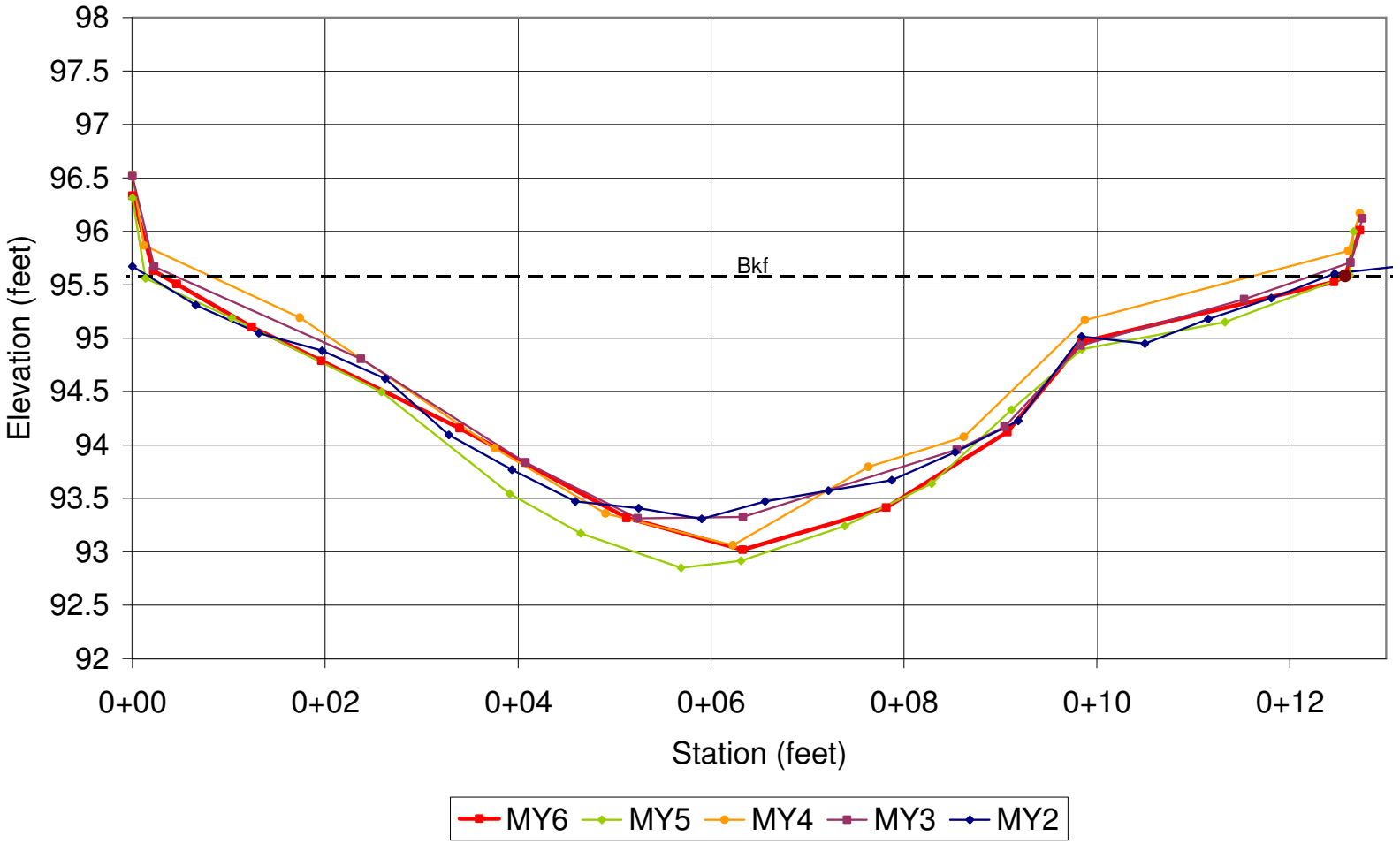
Tulula Stream and Wetland Restoration
(Reach II) Cross-Section #2 - Pool



Reach II – Cross Section #2 – Pool
Looking Downstream
Monitoring Year 6 – September 25, 2008

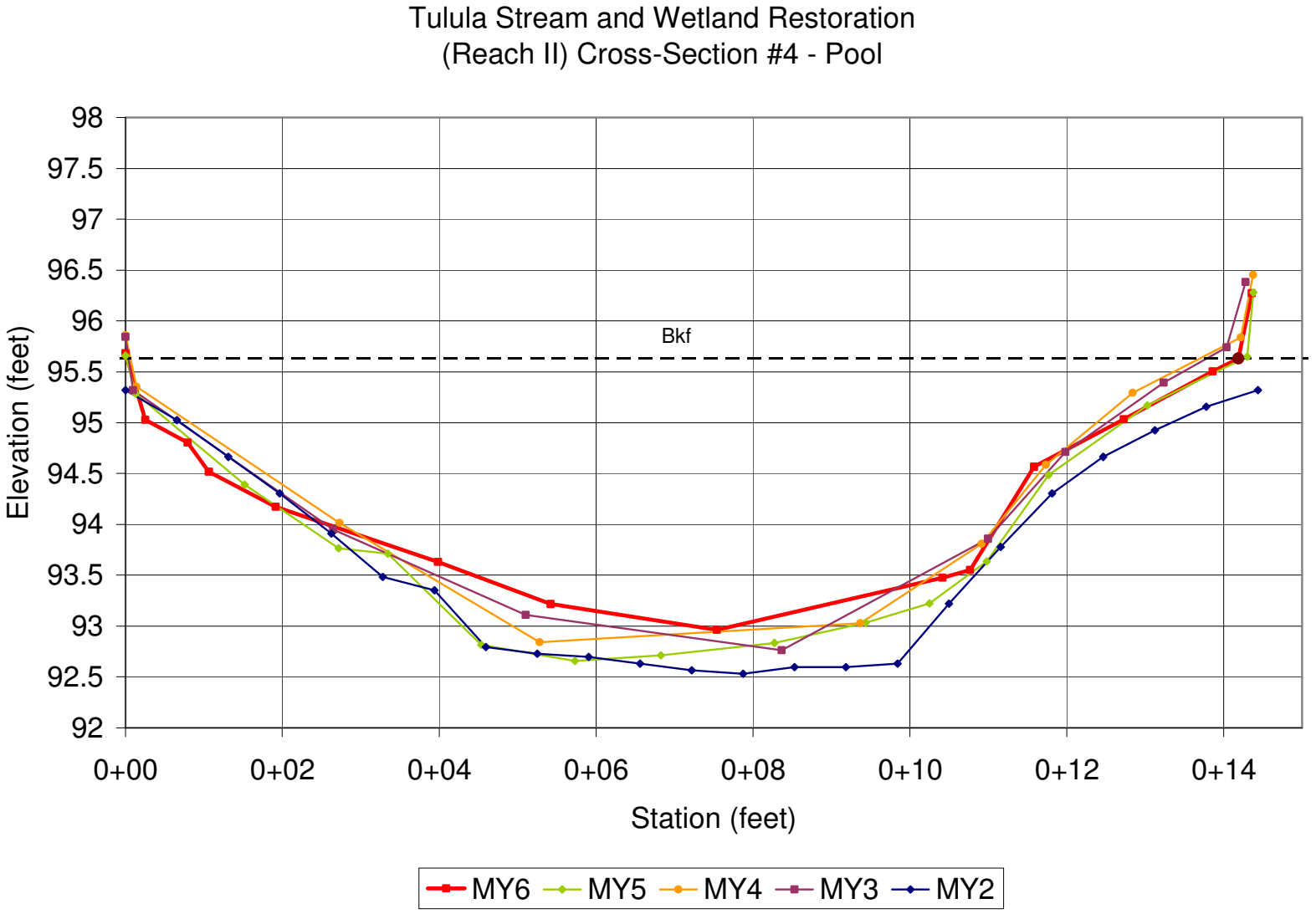
Reach II – Cross Section #2 – Pool
Looking Upstream
Monitoring Year 6 – September 25, 2008

Tulula Stream and Wetland Restoration
(Reach II) Cross-Section #3 - Riffle



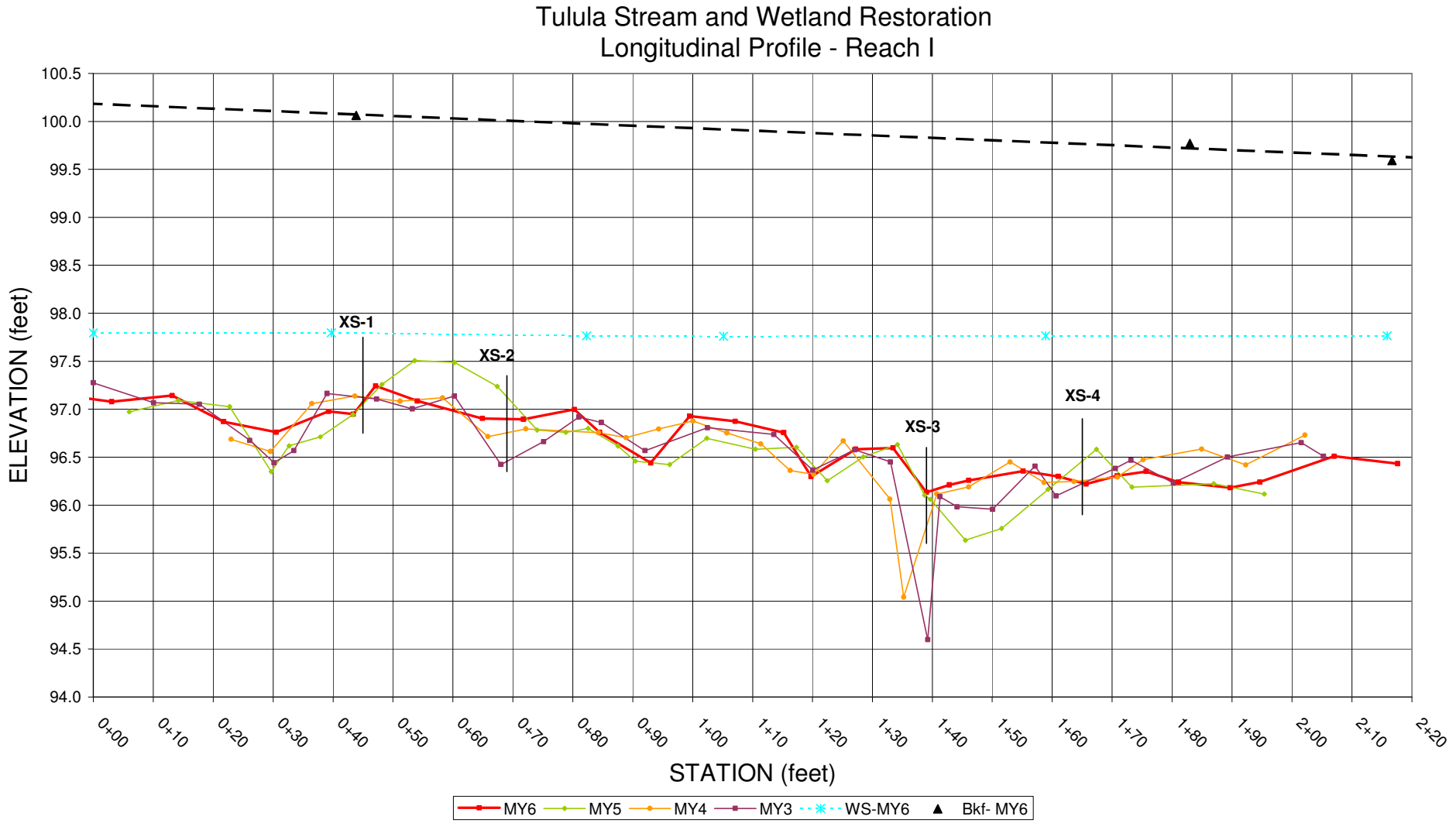
Reach II – Cross Section #3 – Riffle
Looking Downstream
Monitoring Year 6 – September 25, 2008

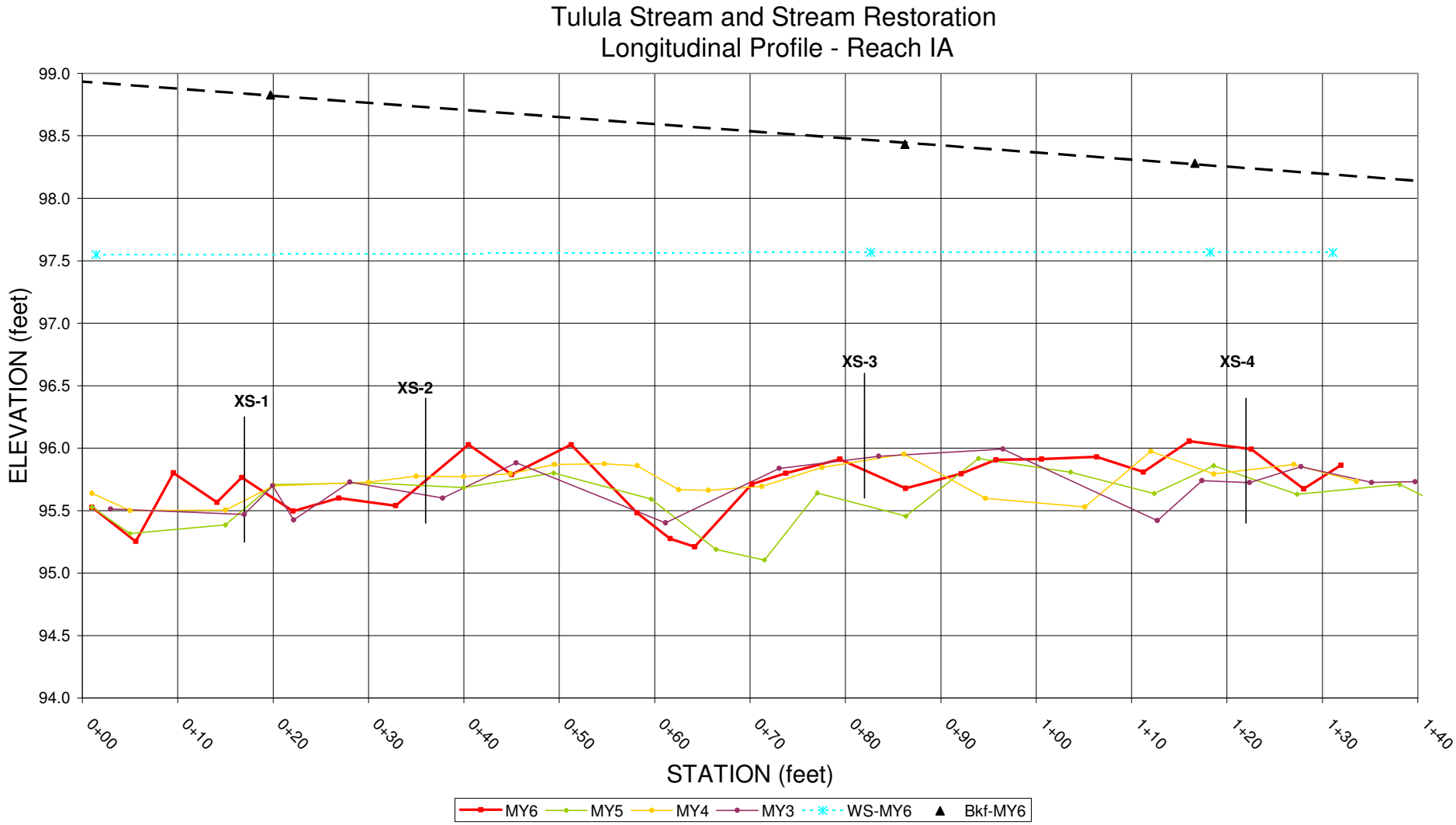
Reach II – Cross Section #3 – Riffle
Looking Upstream
Monitoring Year 6 – September 25, 2008

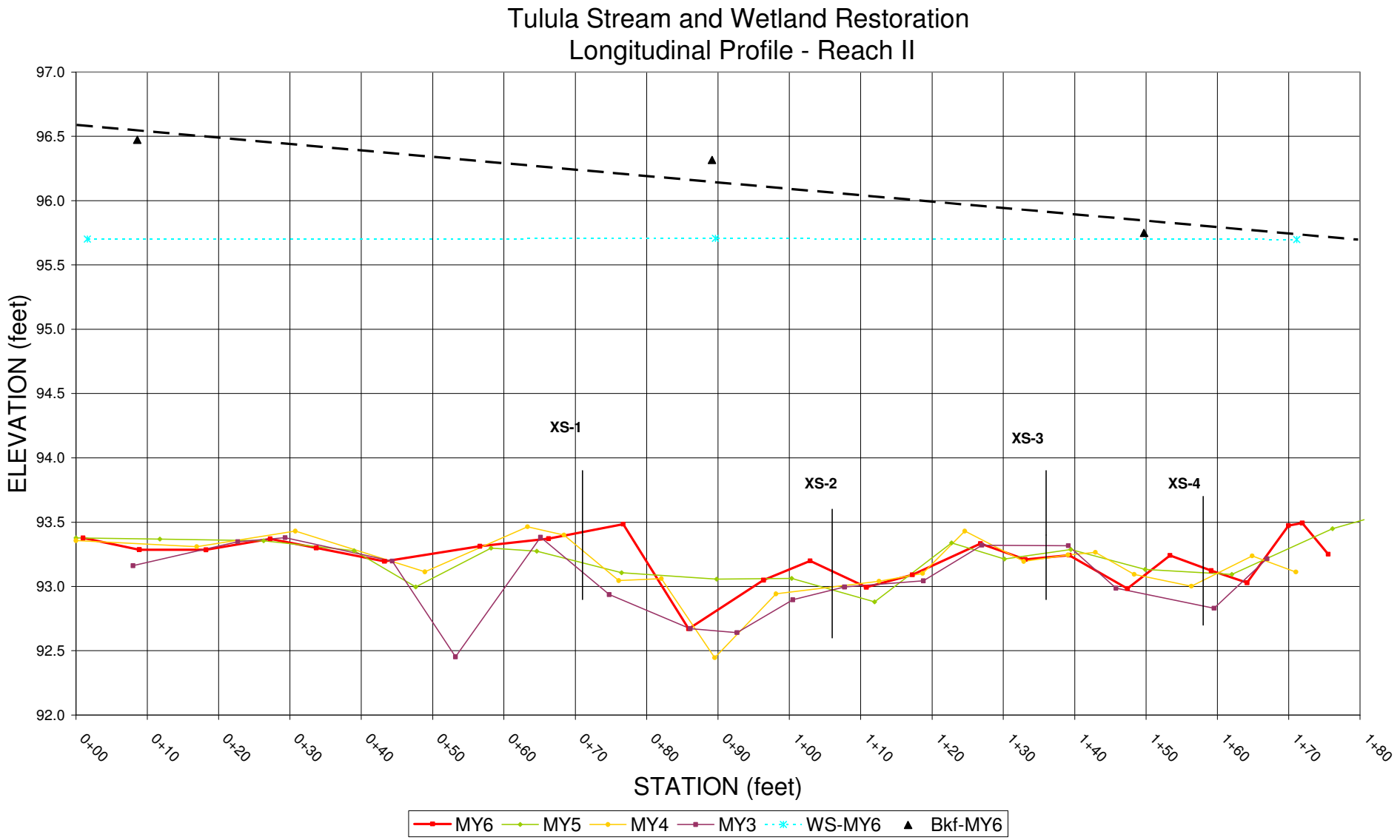

Tulula Stream and Wetland Restoration
(Reach II) Cross-Section #4 - Pool
Elevation (feet)
98
97.5
97
96.5
96
95.5
95
94.5
94
93.5
93
92.5
92
Bkf
0+00
0+02
0+04
0+06
0+08
0+10
0+12
0+14
Station (feet)
MY6
MY5
MY4
MY3
MY2

Reach II – Cross Section #4 – Pool
Looking Downstream
Monitoring Year 6 – September 25, 2008

Reach II – Cross Section #4 – Pool
Looking Upstream
Monitoring Year 6 – September 25, 2008

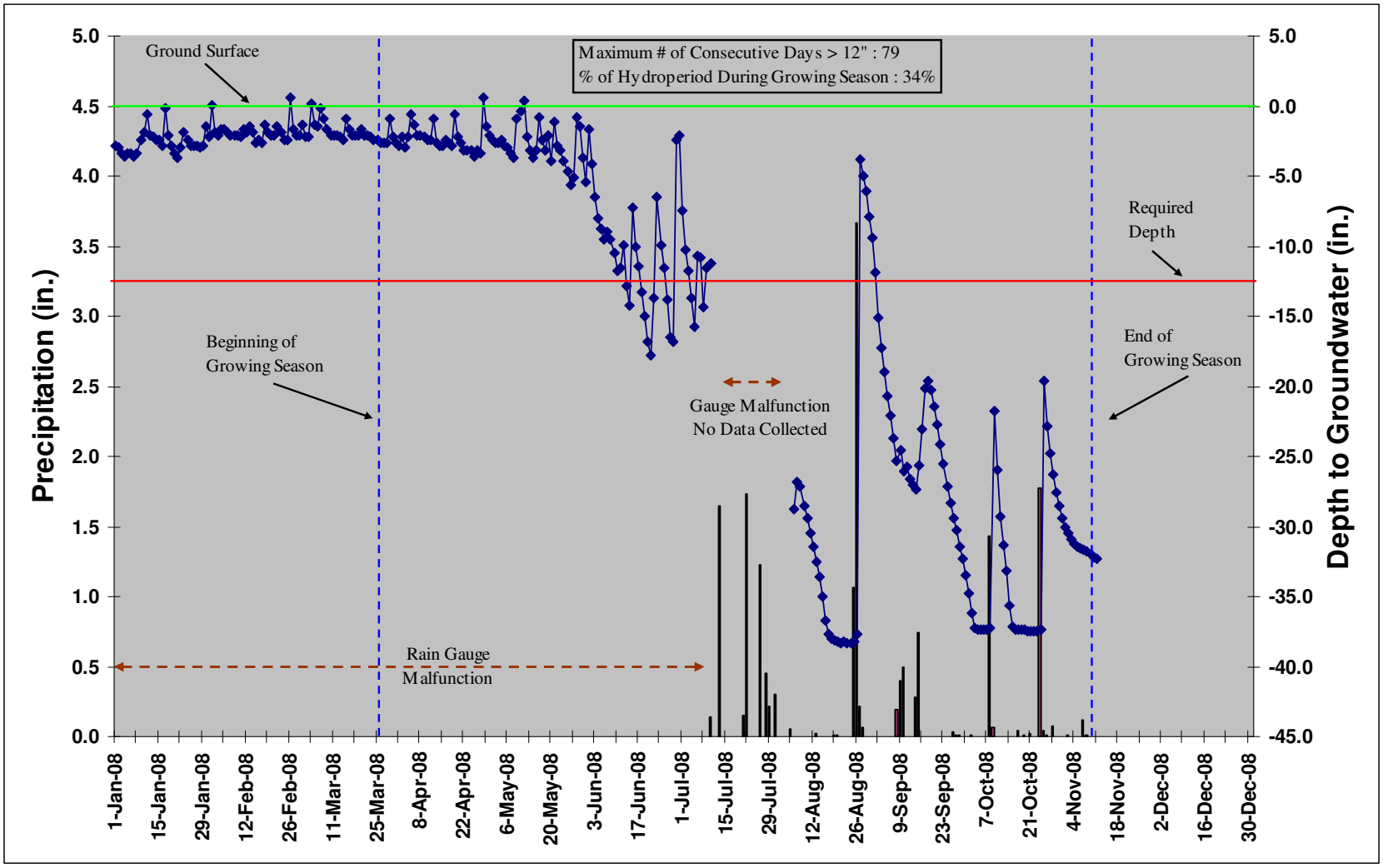

Tulula Stream and Wetland Restoration
Longitudinal Profile - Reach I
ELEVATION (feet)
100.5
100.0
99.5
99.0
98.5
98.0
97.5
97.0
96.5
96.0
95.5
95.0
94.5
94.0
XS-1
XS-2
XS-3
XS-4
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
0+90
1+00
1+10
1+20
1+30
1+40
1+50
1+60
1+70
1+80
1+90
2+00
2+10
2+20
STATION (feet)
MY6
MY5
MY4
MY3
WS-MY6
Bkf- MY6


Tulula Stream and Stream Restoration
Longitudinal Profile - Reach IA
ELEVATION (feet)
99.0
98.5
98.0
97.5
97.0
96.5
96.0
95.5
95.0
94.5
94.0
XS-1
XS-2
XS-3
XS-4
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
0+90
1+00
1+10
1+20
1+30
1+40
STATION (feet)
MY6
MY5
MY4
MY3
WS-MY6
Bkf-MY6

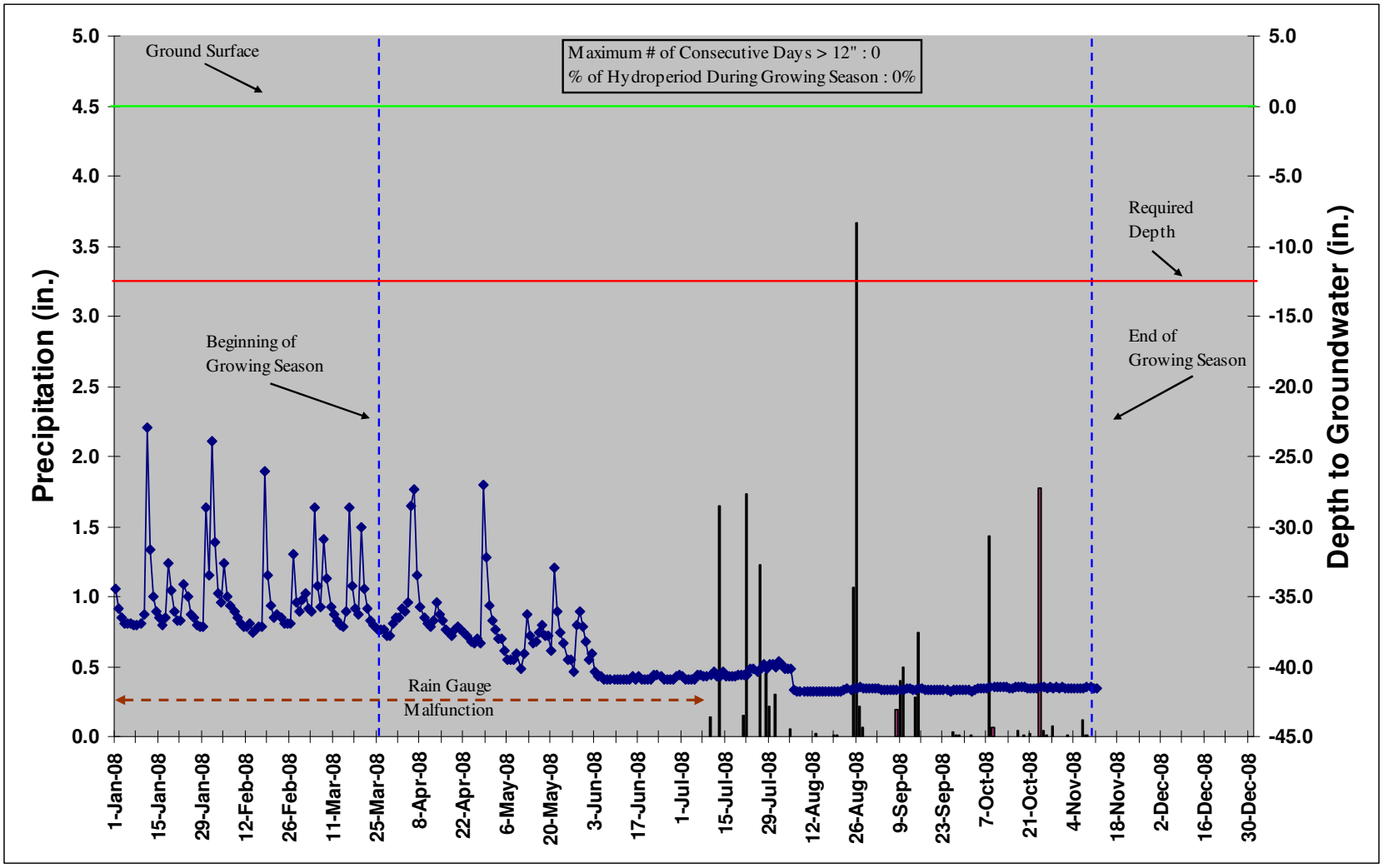

Tulula Stream and Wetland Restoration
Longitudinal Profile - Reach II
ELEVATION (feet)
97.0
96.5
96.0
95.5
95.0
94.5
94.0
93.5
93.0
92.5
92.0
XS-1
XS-2
XS-3
XS-4
0+00
0+10
0+20
0+30
0+40
0+50
0+60
0+70
0+80
0+90
1+00
1+10
1+20
1+30
1+40
1+50
1+60
1+70
1+80
STATION (feet)
MY6
MY5
MY4
MY3
WS-MY6
Bkf-MY6

Appendix C
Tulula Stream & Wetland Restoration
Wetland Data

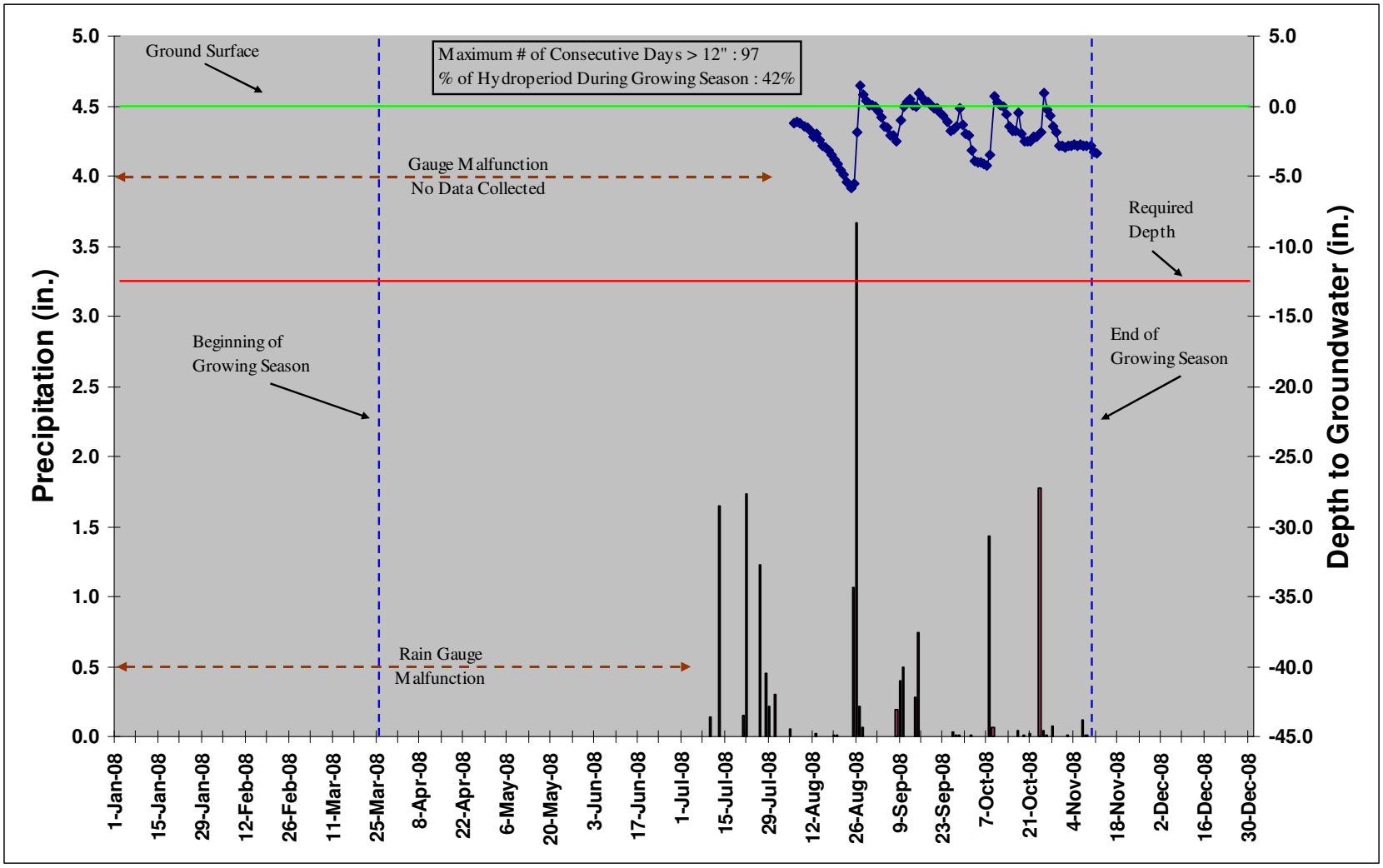
Tulula Stream and Wetland Restoration
Groundwater Gauge A1



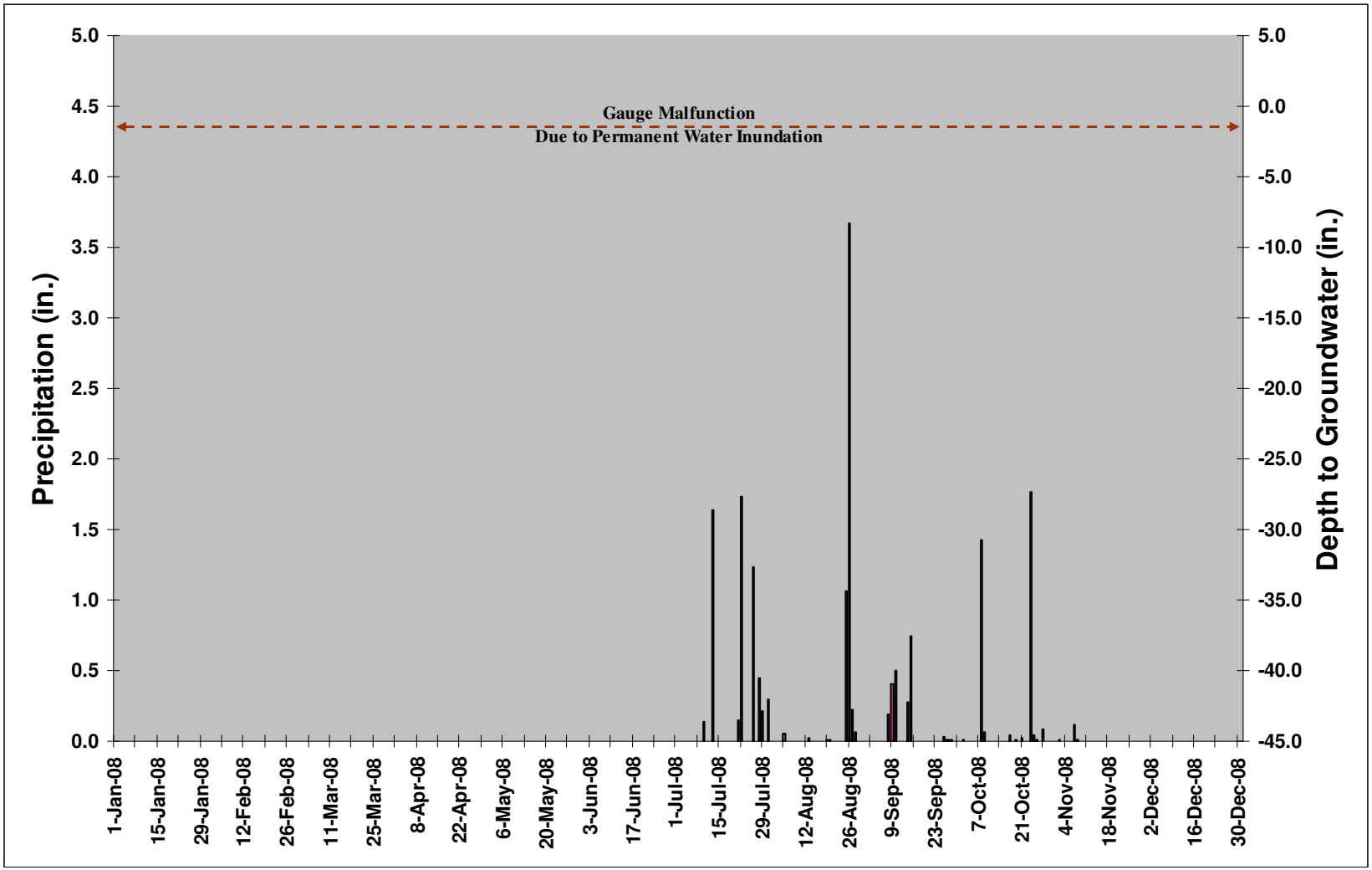
Tulula Stream and Wetland Restoration
Groundwater Gauge A2



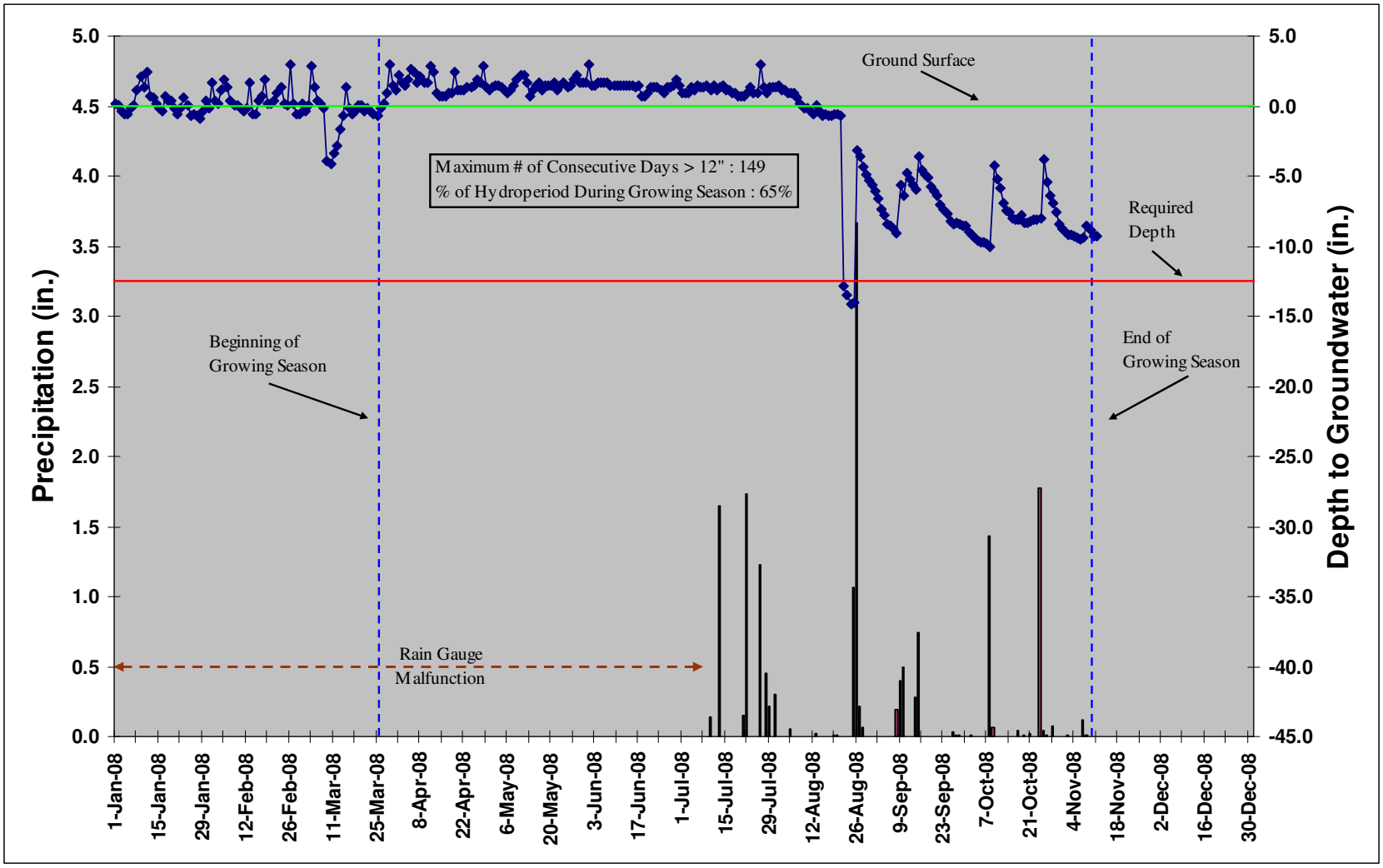
Tulula Stream and Wetland Restoration
Groundwater Gauge A3



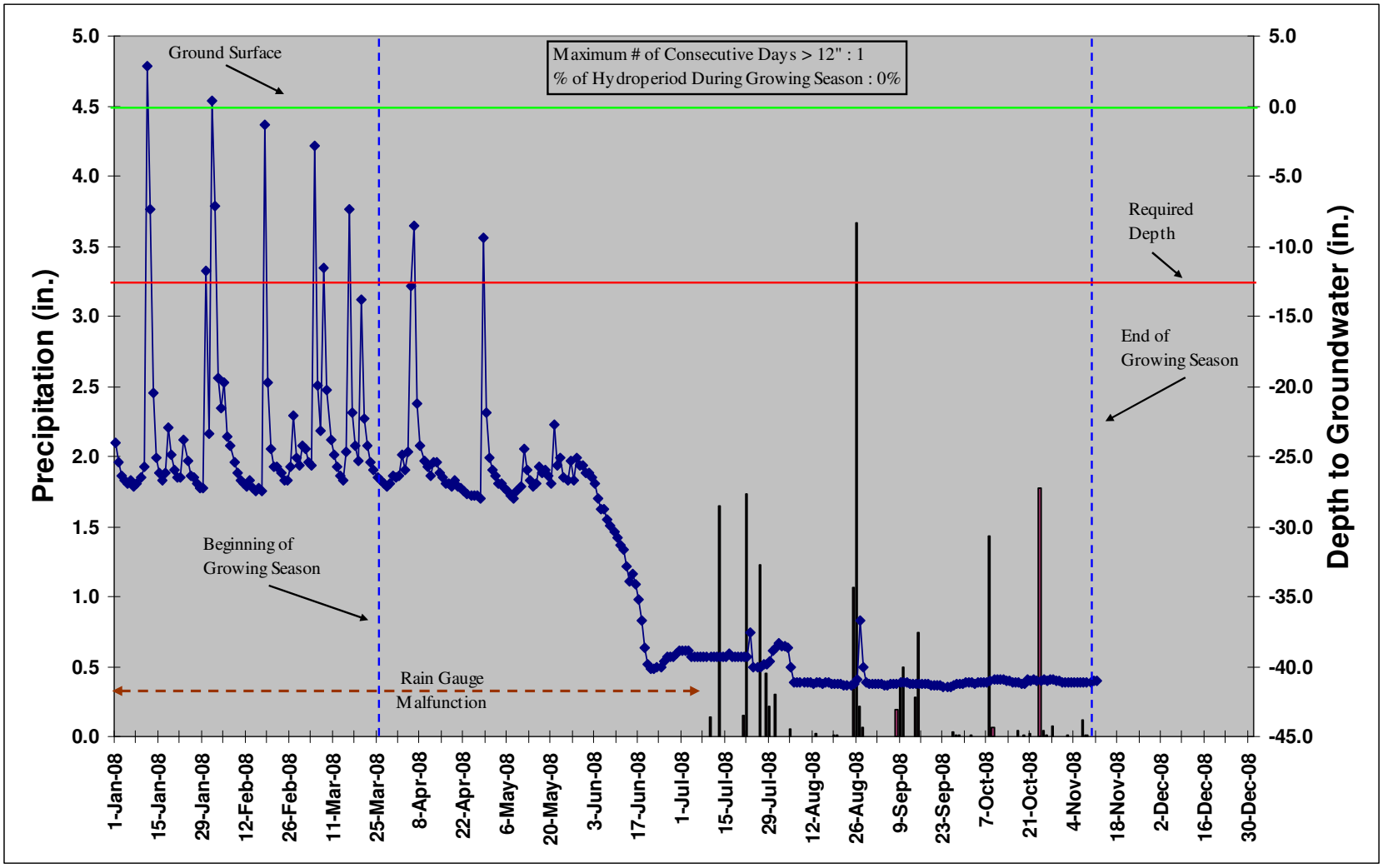
Tulula Stream and Wetland Restoration
Groundwater Gauge A4



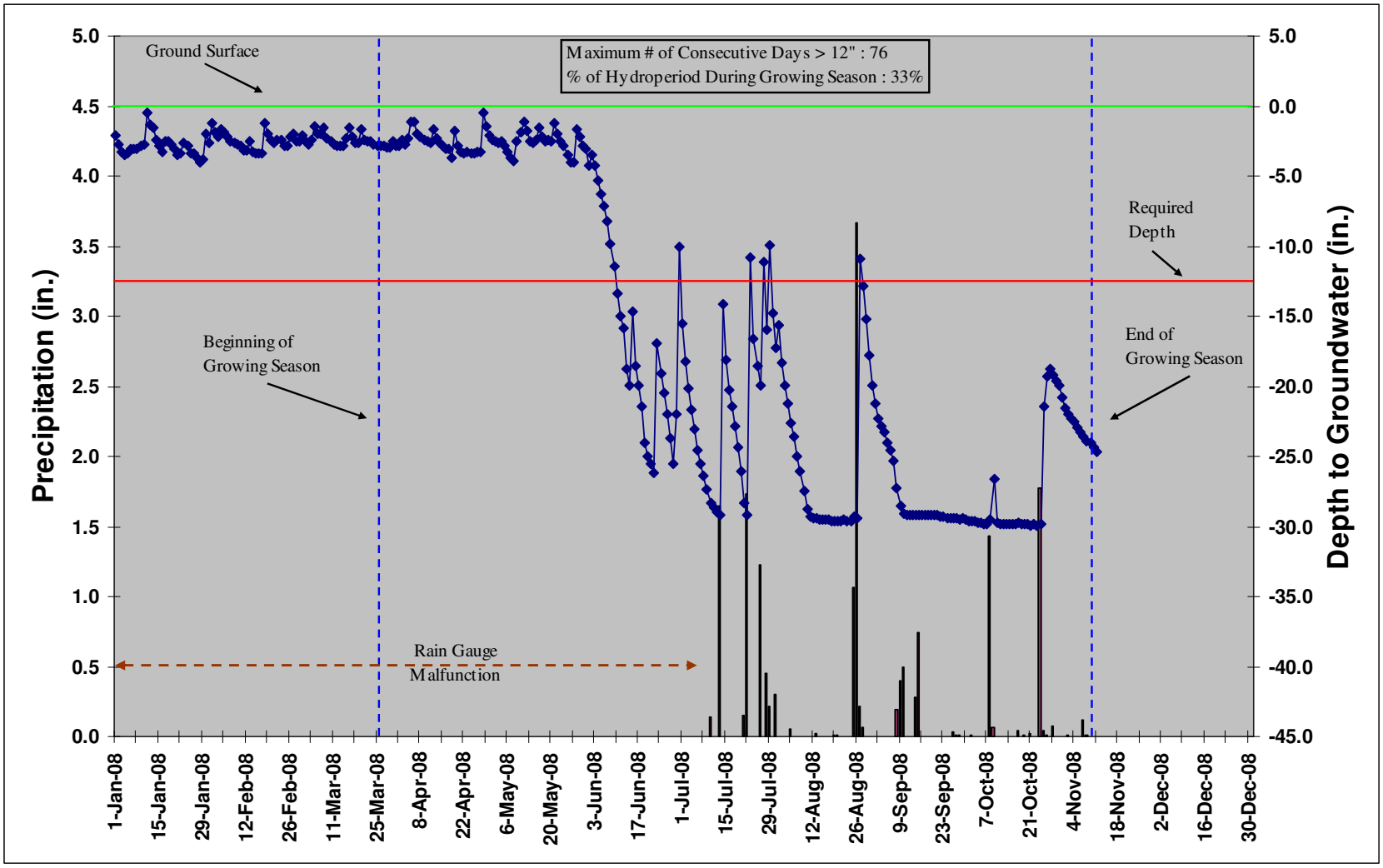
Tulula Stream and Wetland Restoration
Groundwater Gauge A5



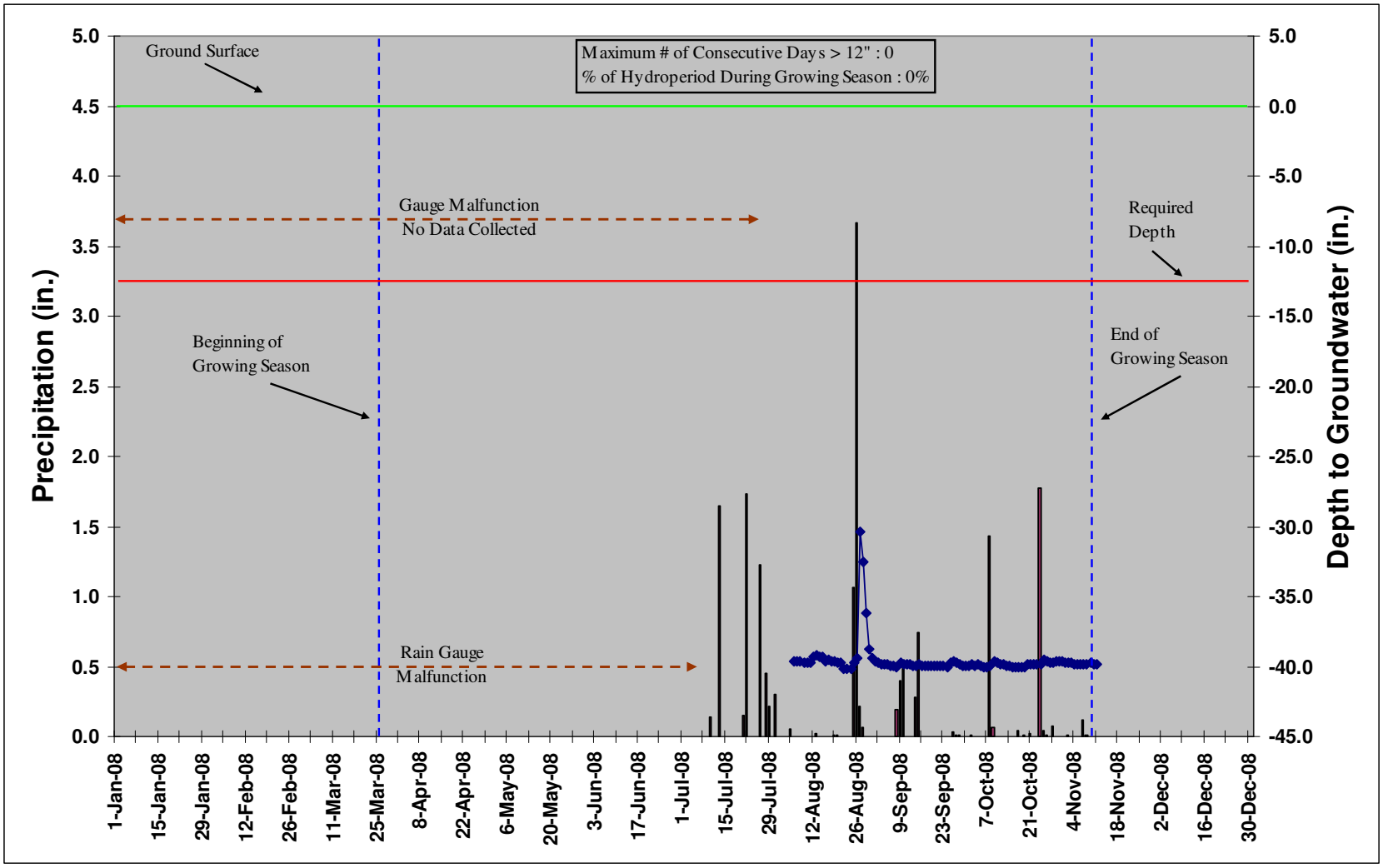
Tulula Stream and Wetland Restoration
Groundwater Gauge B1



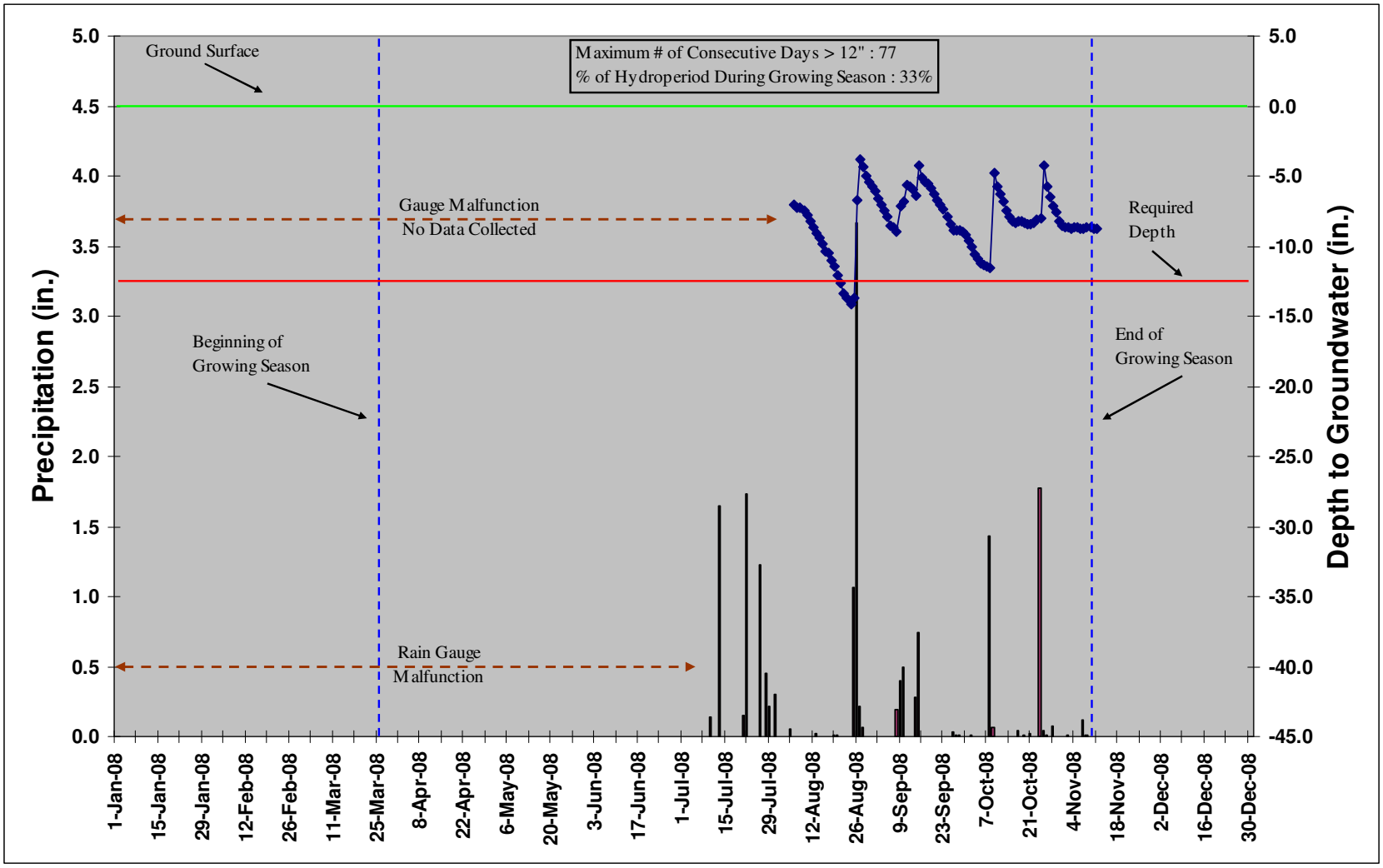
Tulula Stream and Wetland Restoration
Groundwater Gauge B2



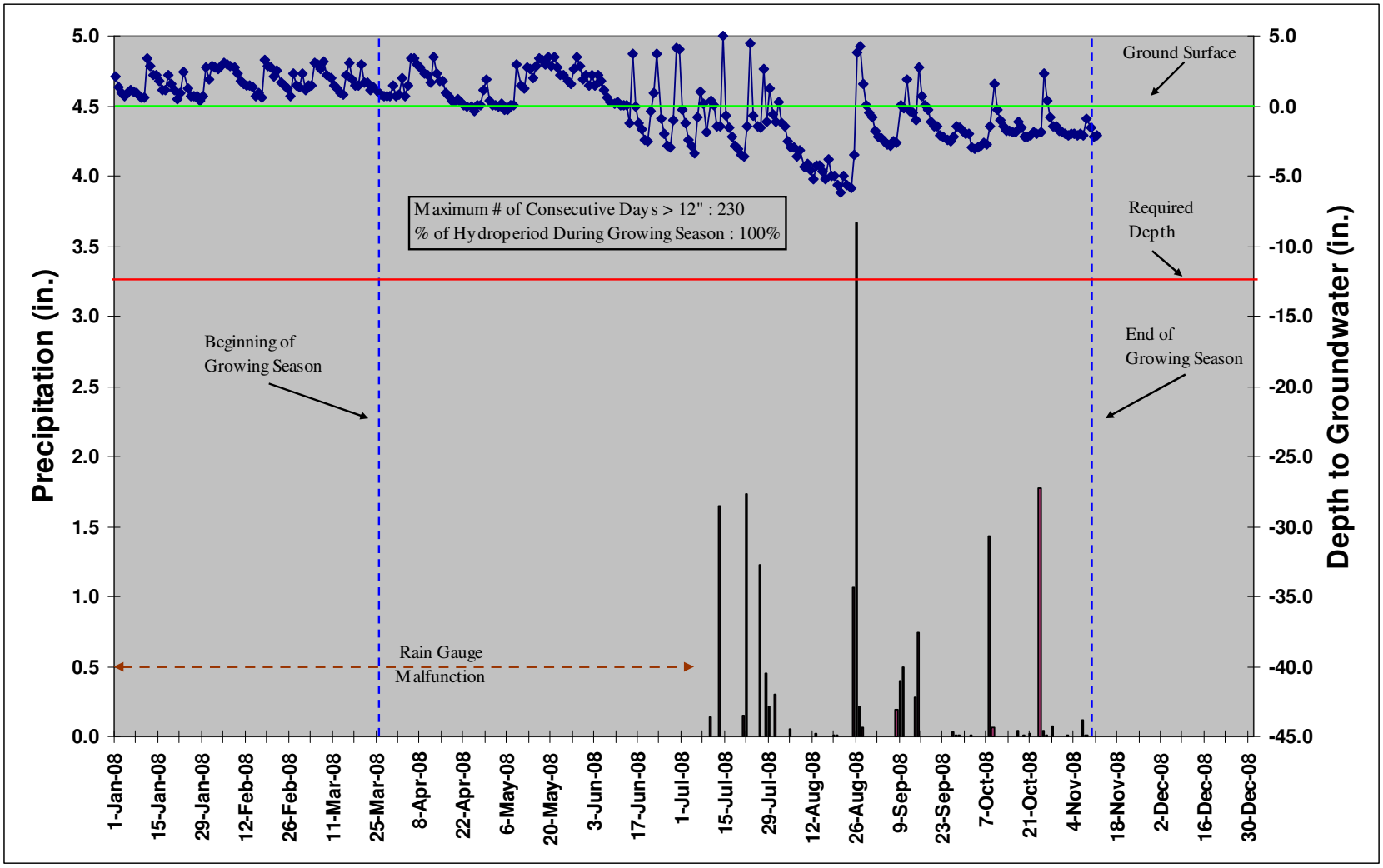
Tulula Stream and Wetland Restoration
Groundwater Gauge B3



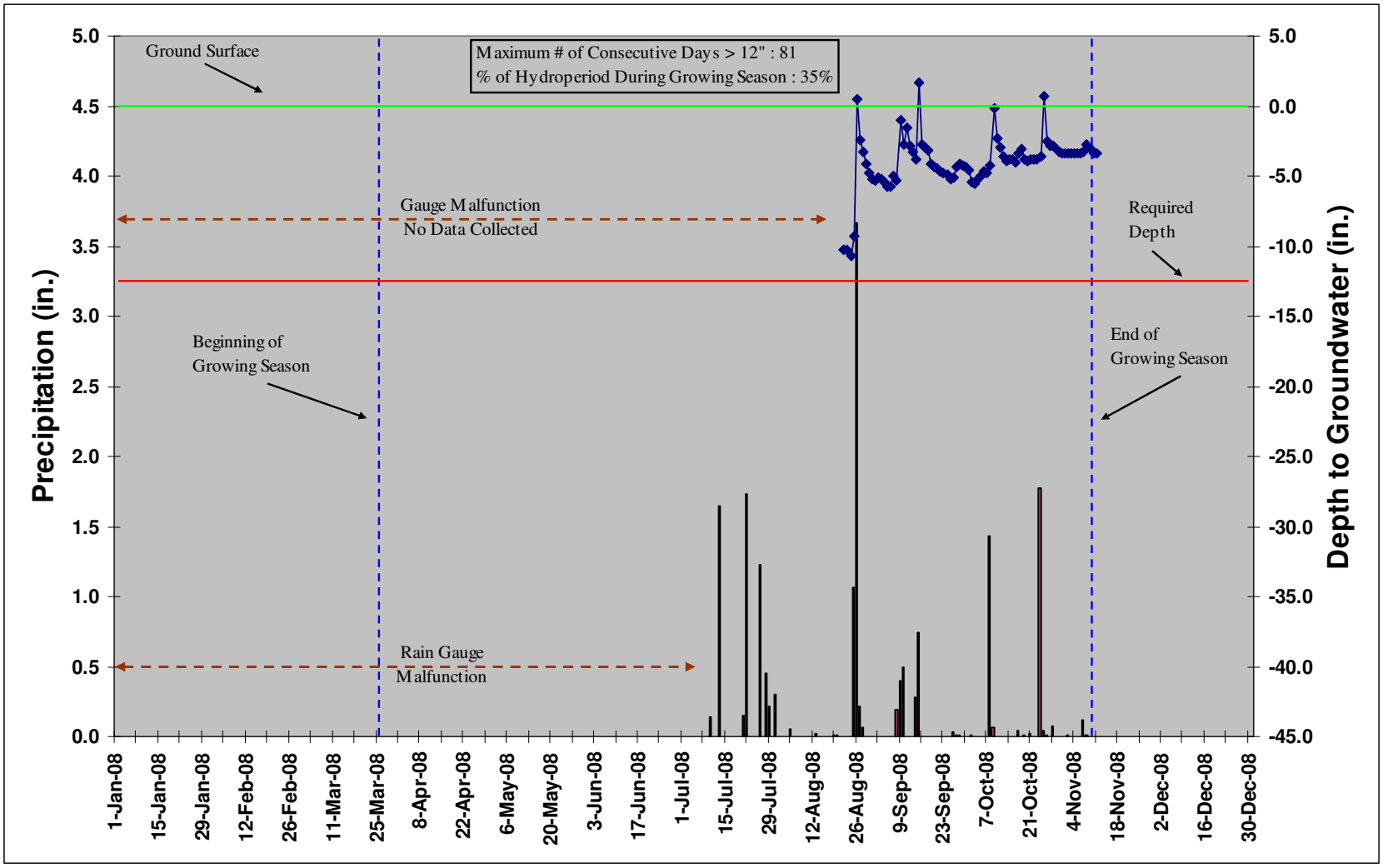
Tulula Stream and Wetland Restoration
Groundwater Gauge B4



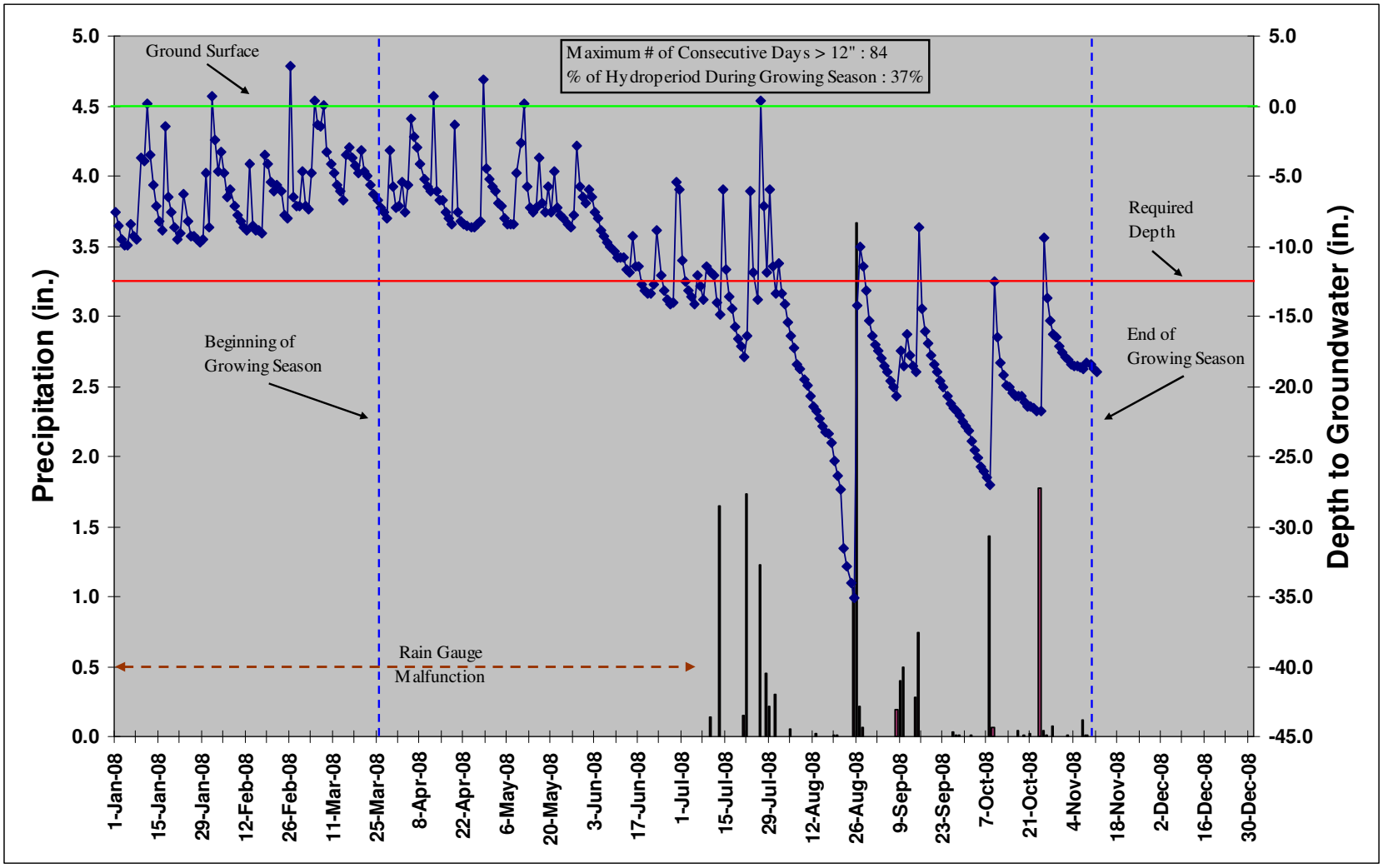
Tulula Stream and Wetland Restoration
Groundwater Gauge B5



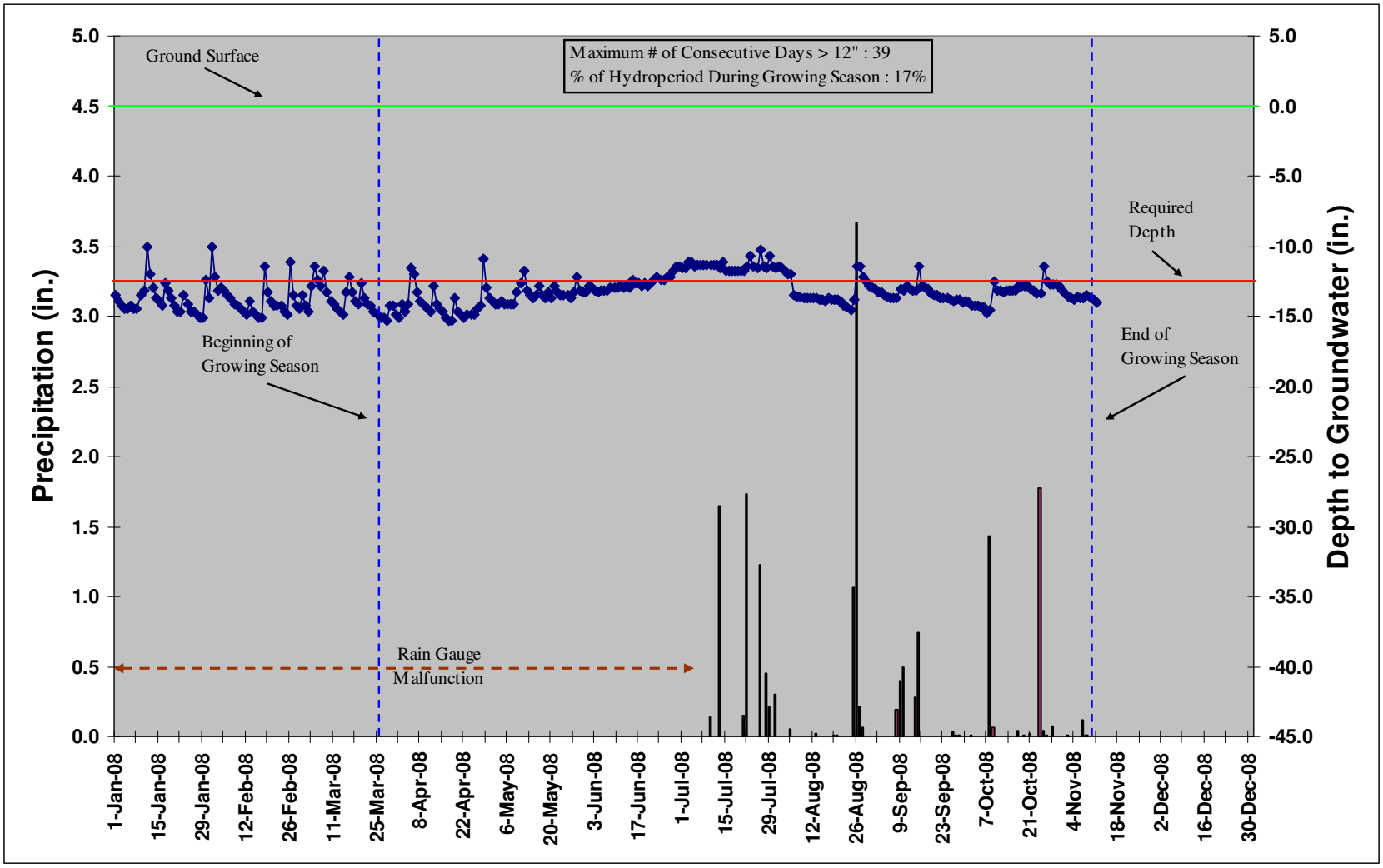
Tulula Stream and Wetland Restoration
Groundwater Gauge C1



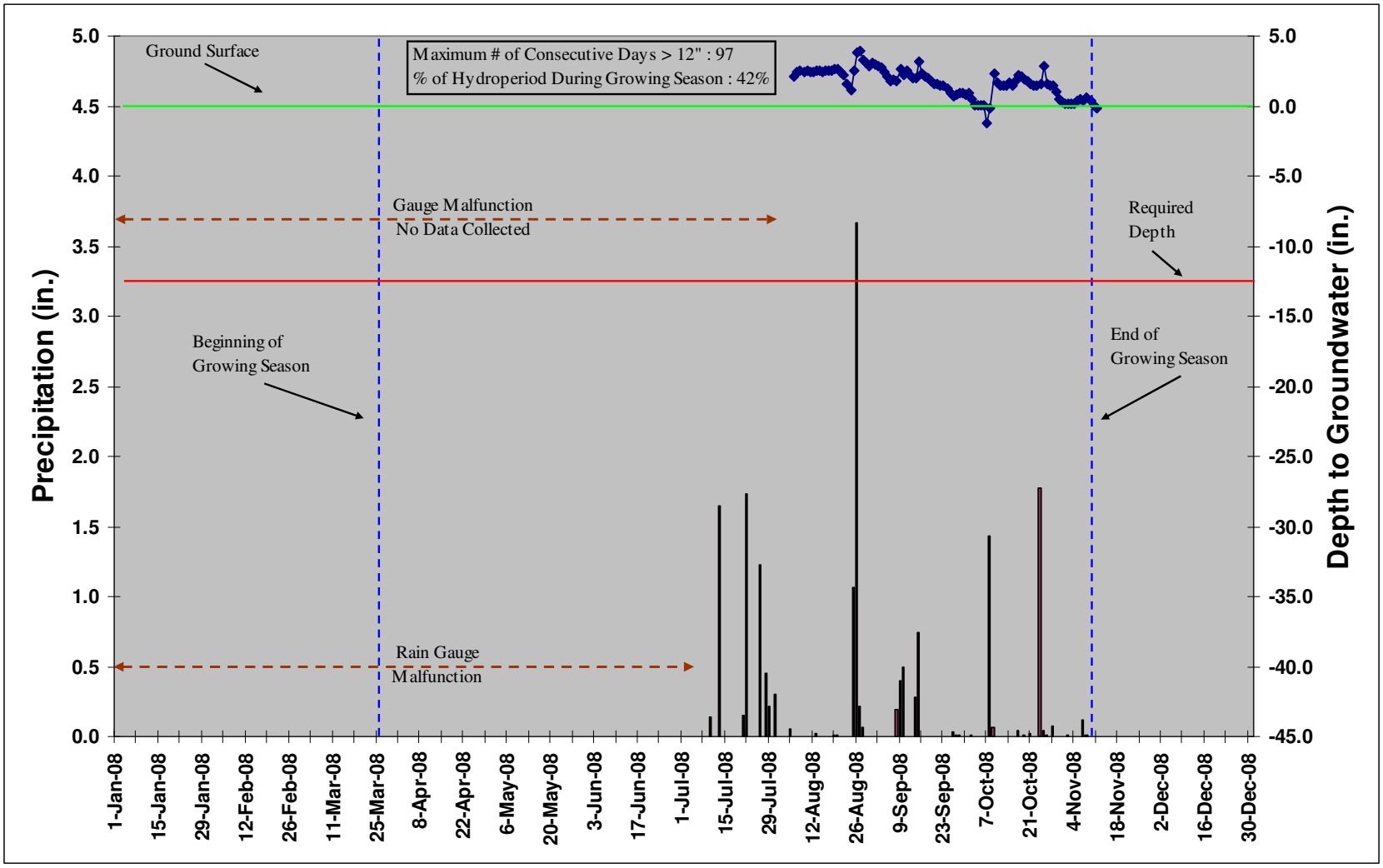
Tulula Stream and Wetland Restoration
Groundwater Gauge C2



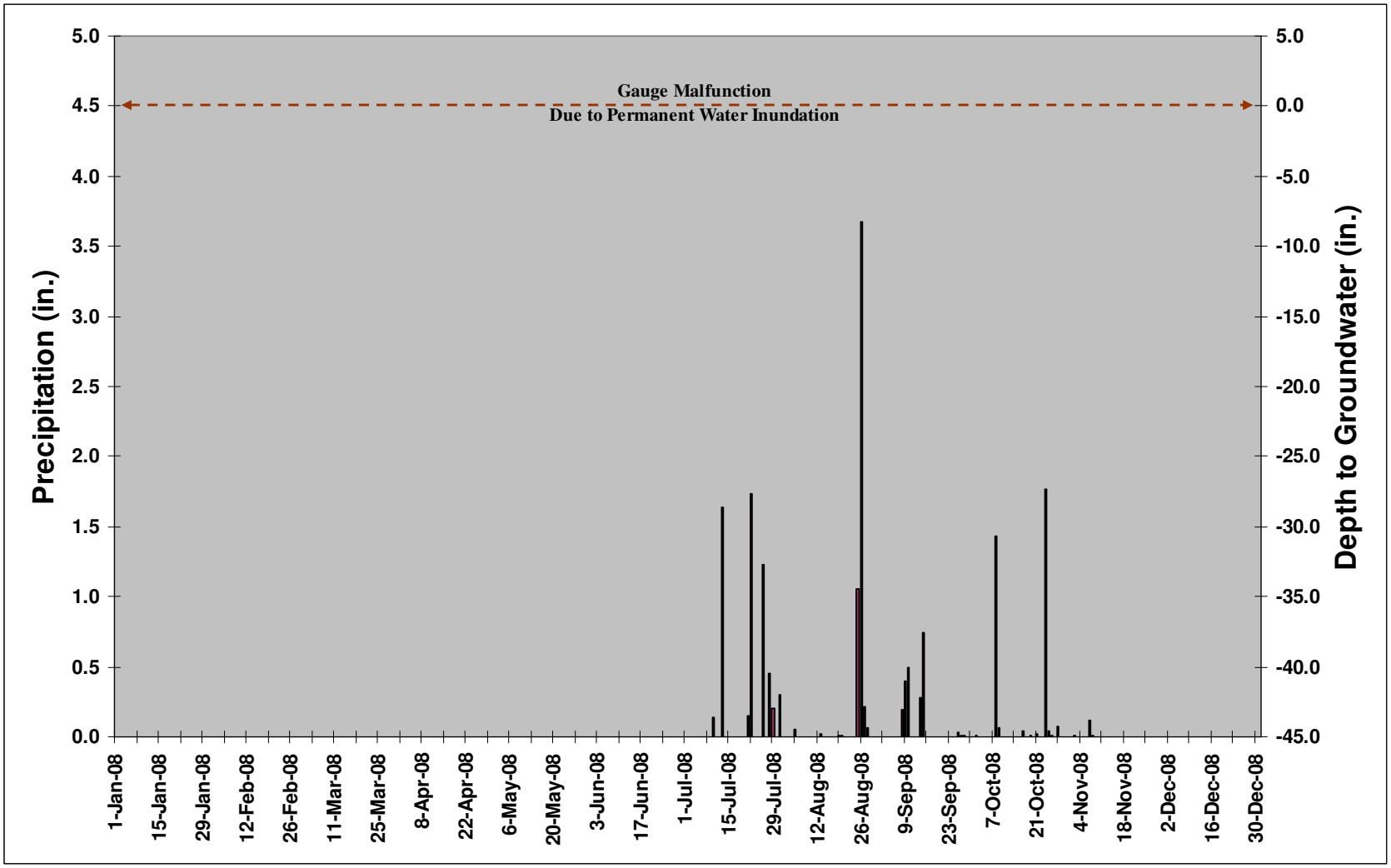
Tulula Stream and Wetland Restoration
Groundwater Gauge D1



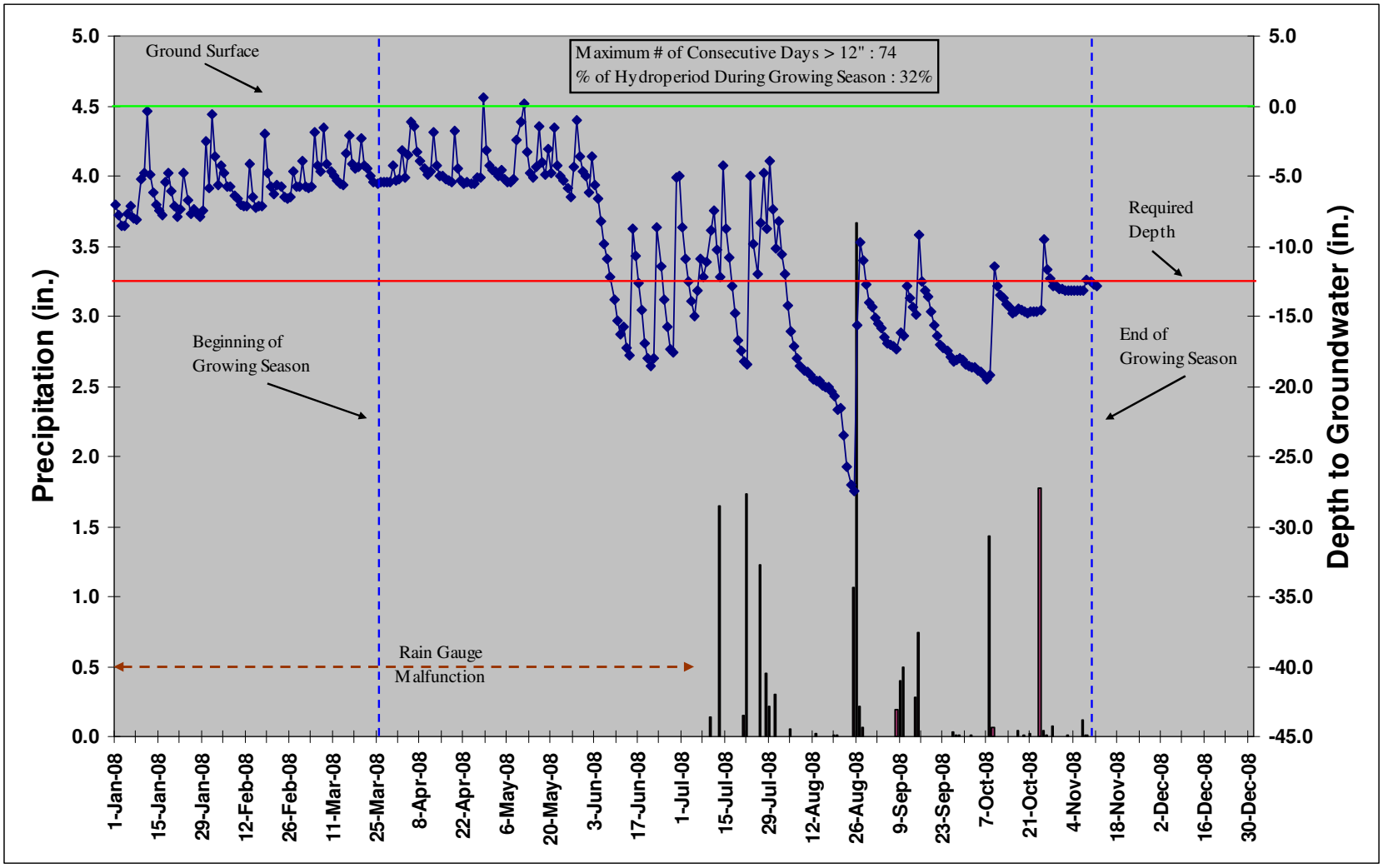
Tulula Stream and Wetland Restoration
Groundwater Gauge D2



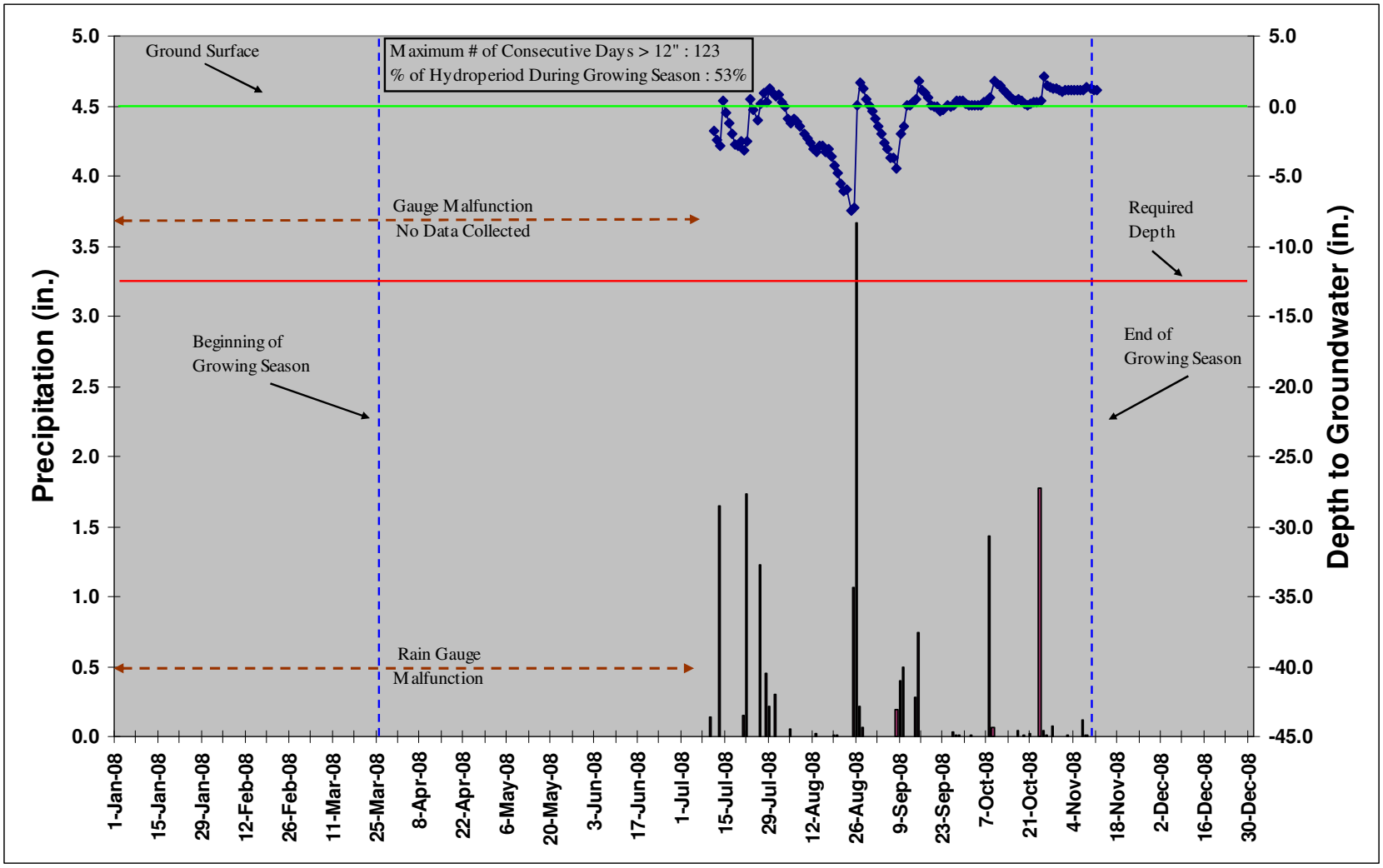
Tulula Stream and Wetland Restoration
Groundwater Gauge D3



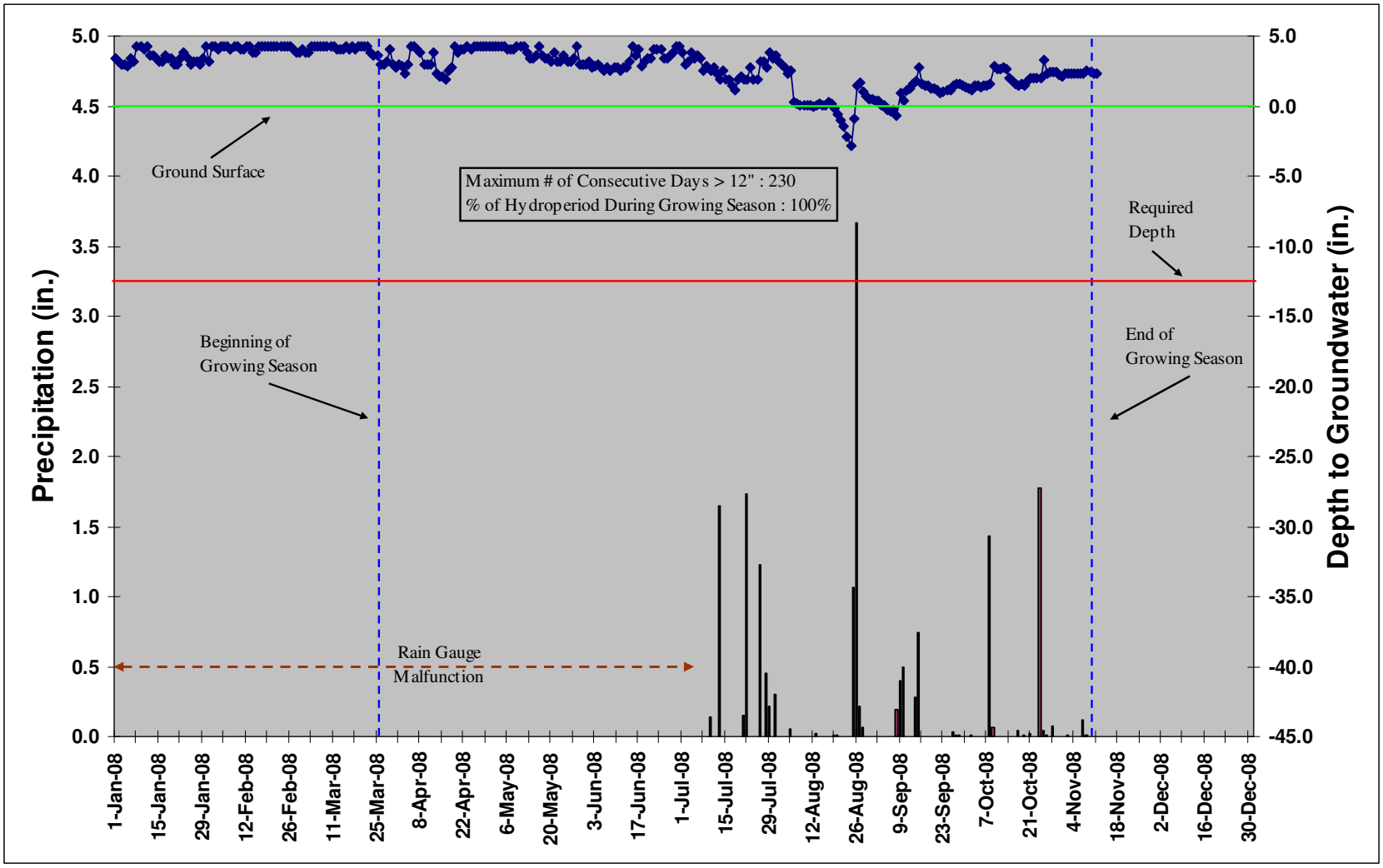
Tulula Stream and Wetland Restoration
Groundwater Gauge E1



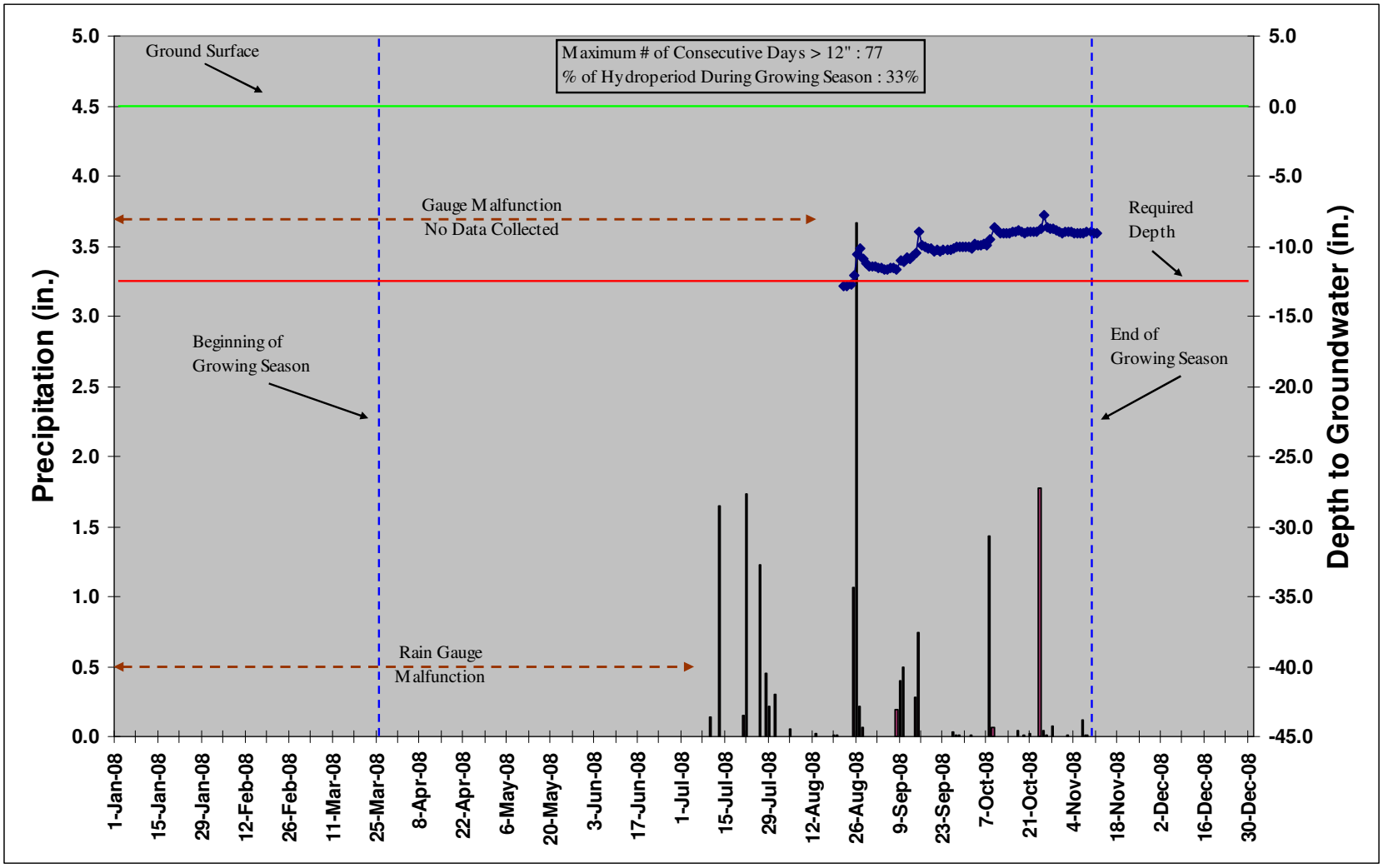
Tulula Stream and Wetland Restoration
Groundwater Gauge E2



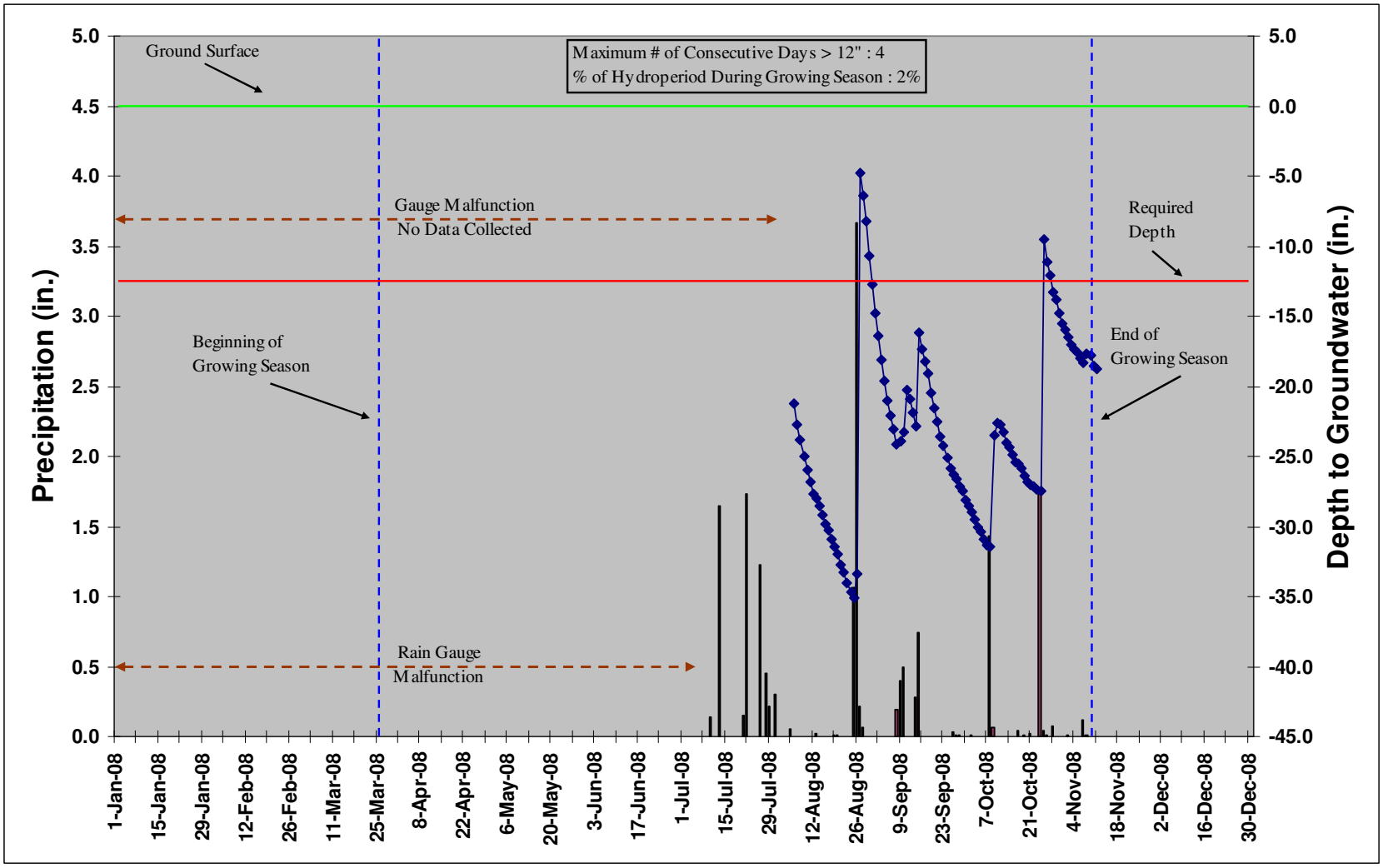
Tulula Stream and Wetland Restoration
Groundwater Gauge E3



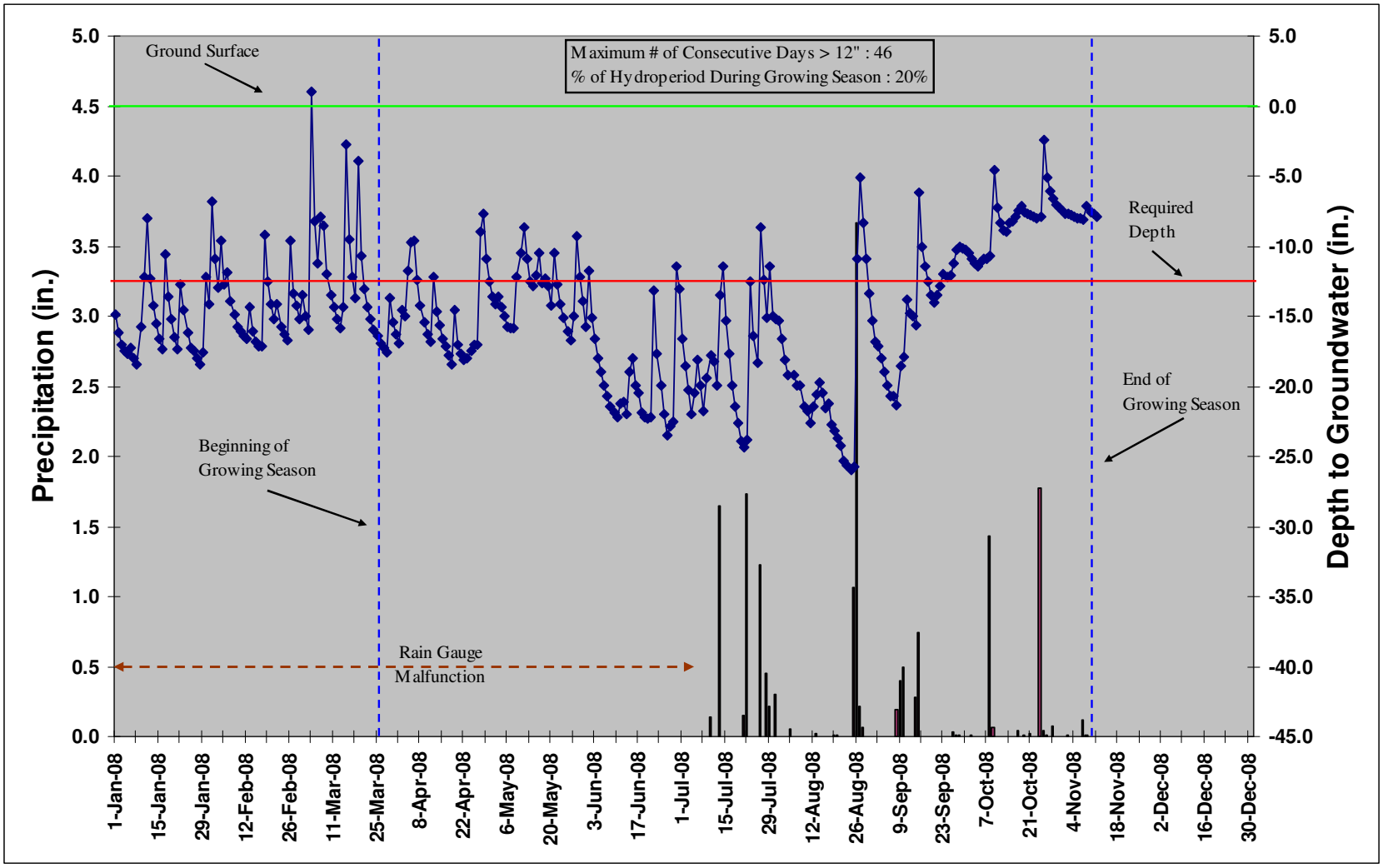
Tulula Stream and Wetland Restoration
Groundwater Gauge E4



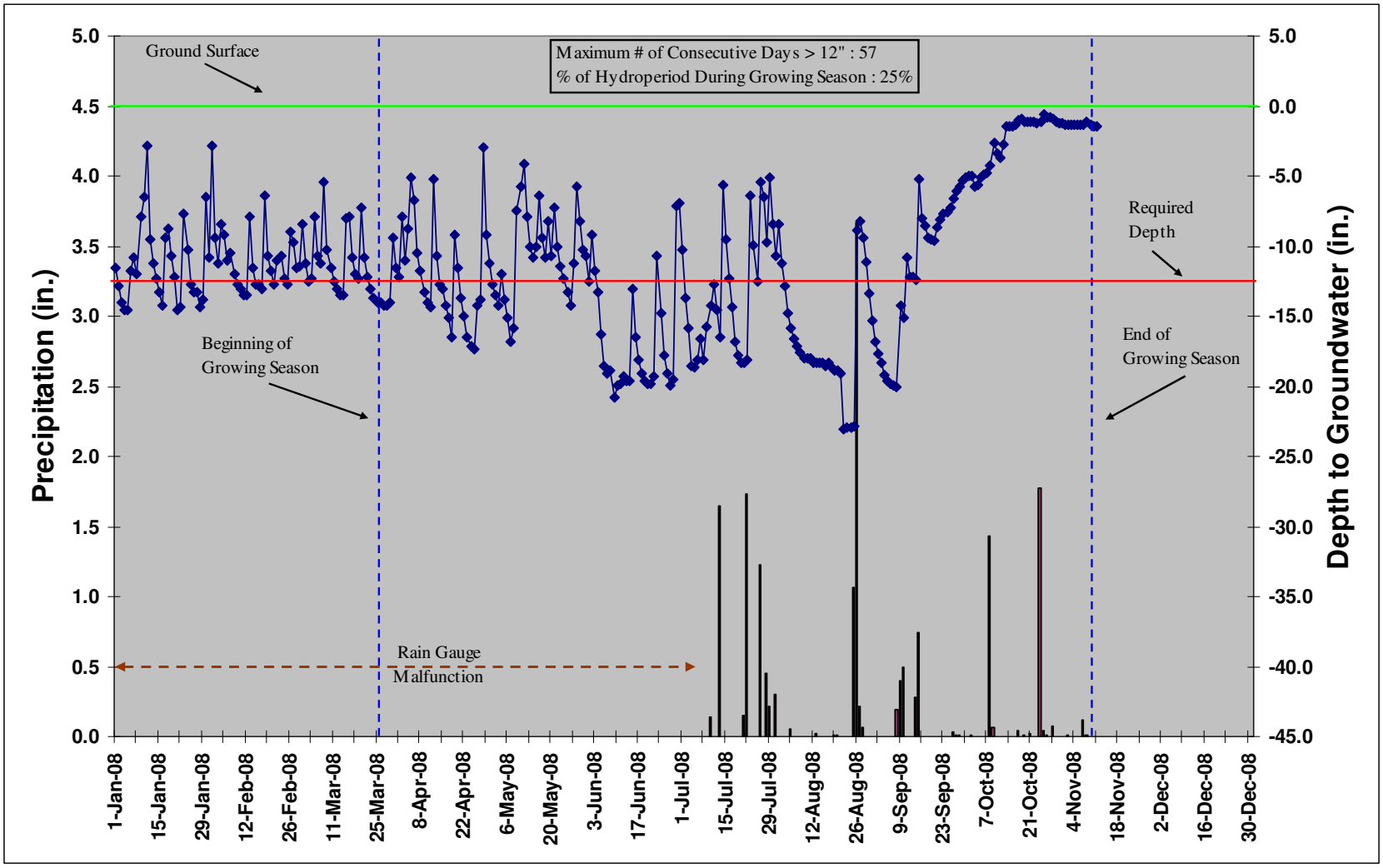
Tulula Stream and Wetland Restoration
Groundwater Gauge F1



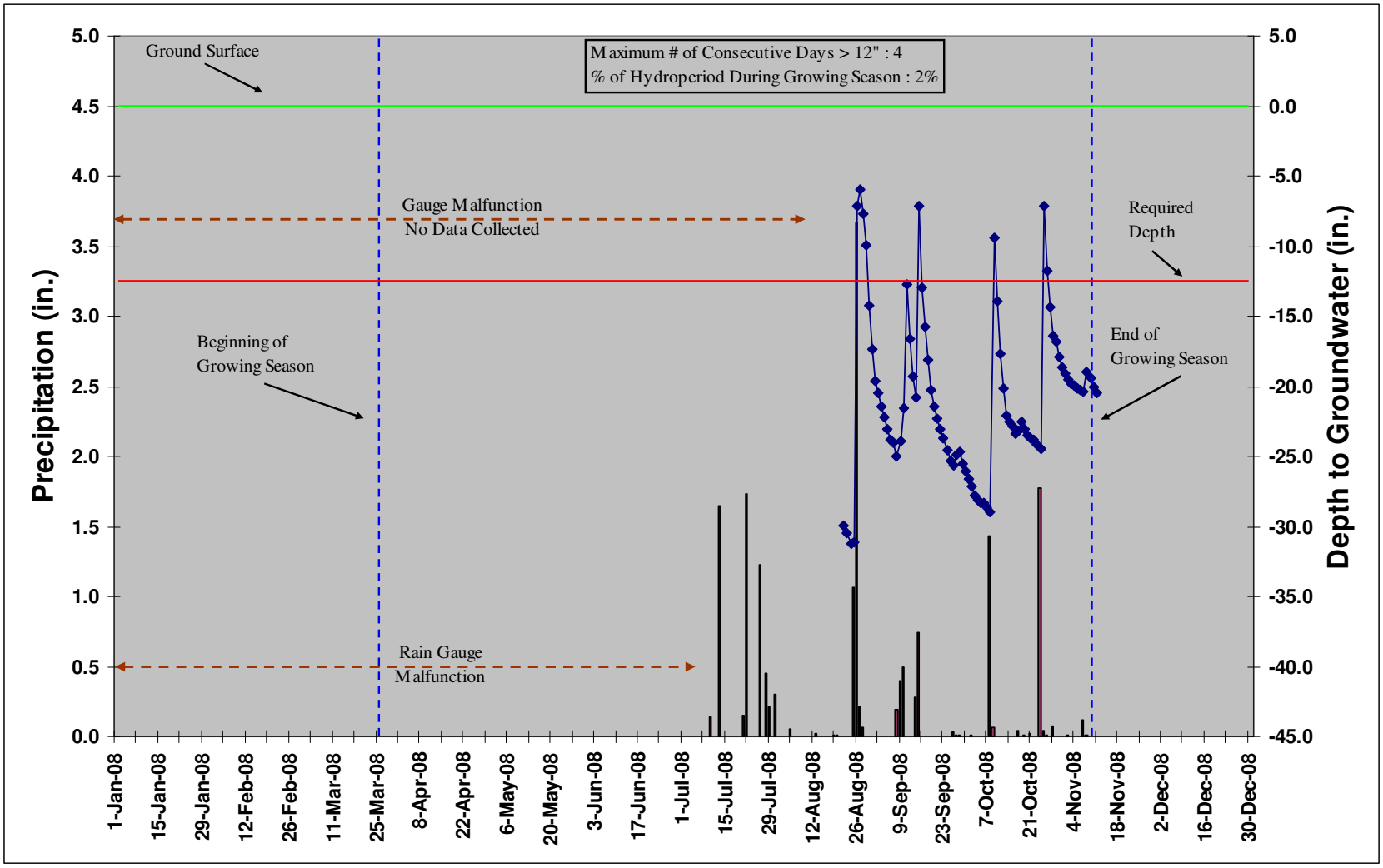
Tulula Stream and Wetland Restoration
Groundwater Gauge F2



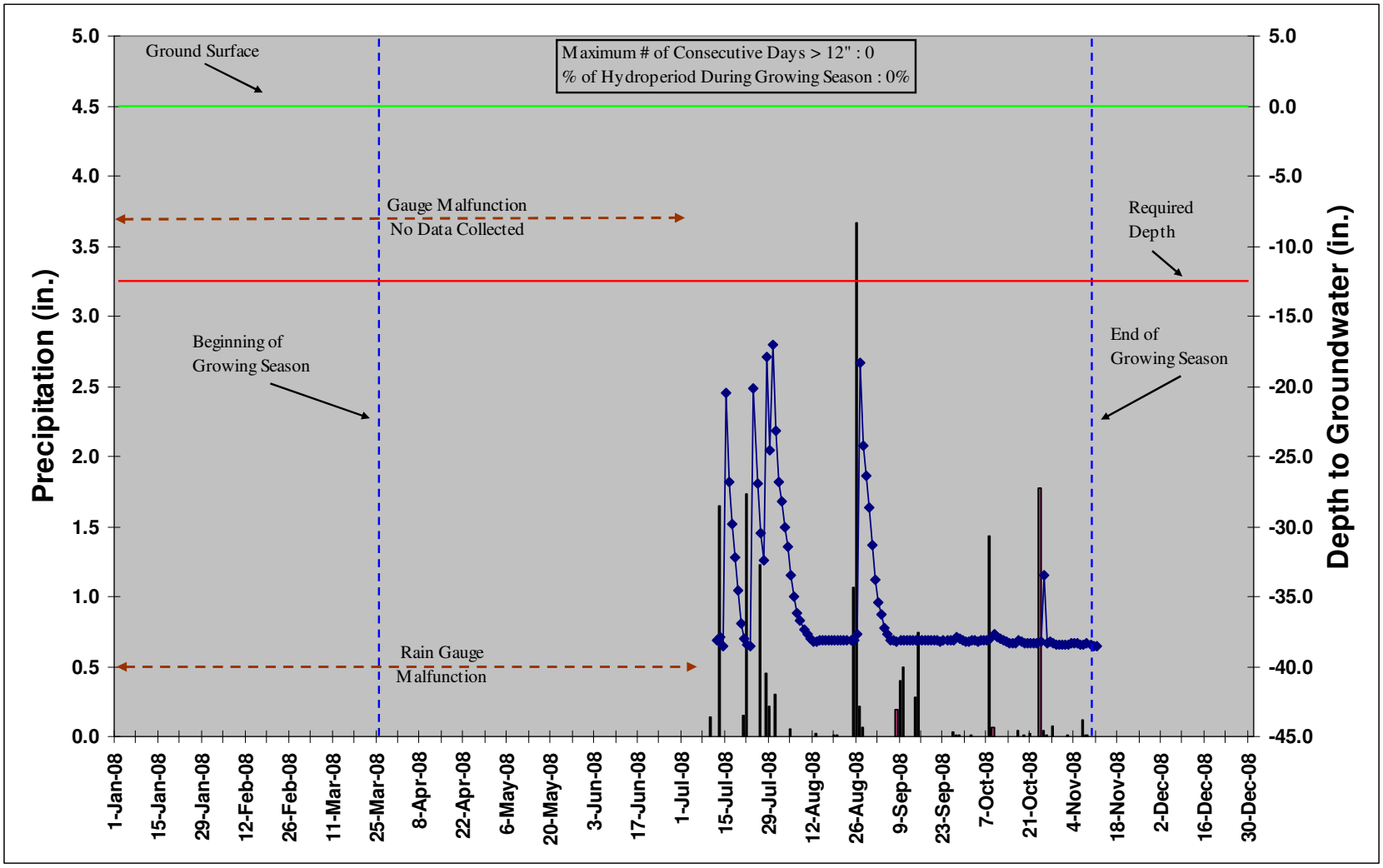
Tulula Stream and Wetland Restoration
Groundwater Gauge F3



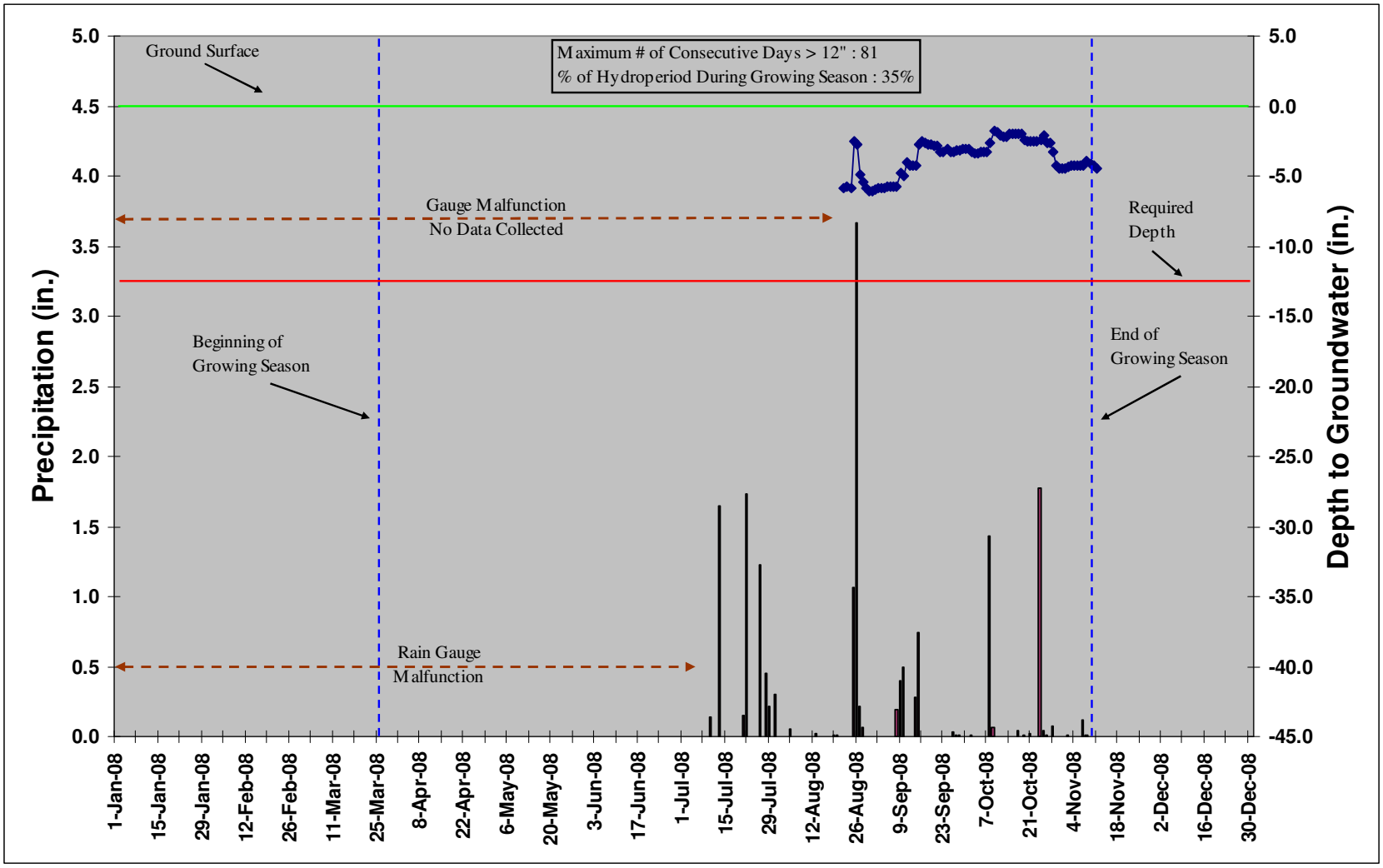
Tulula Stream and Wetland Restoration
Groundwater Gauge G1



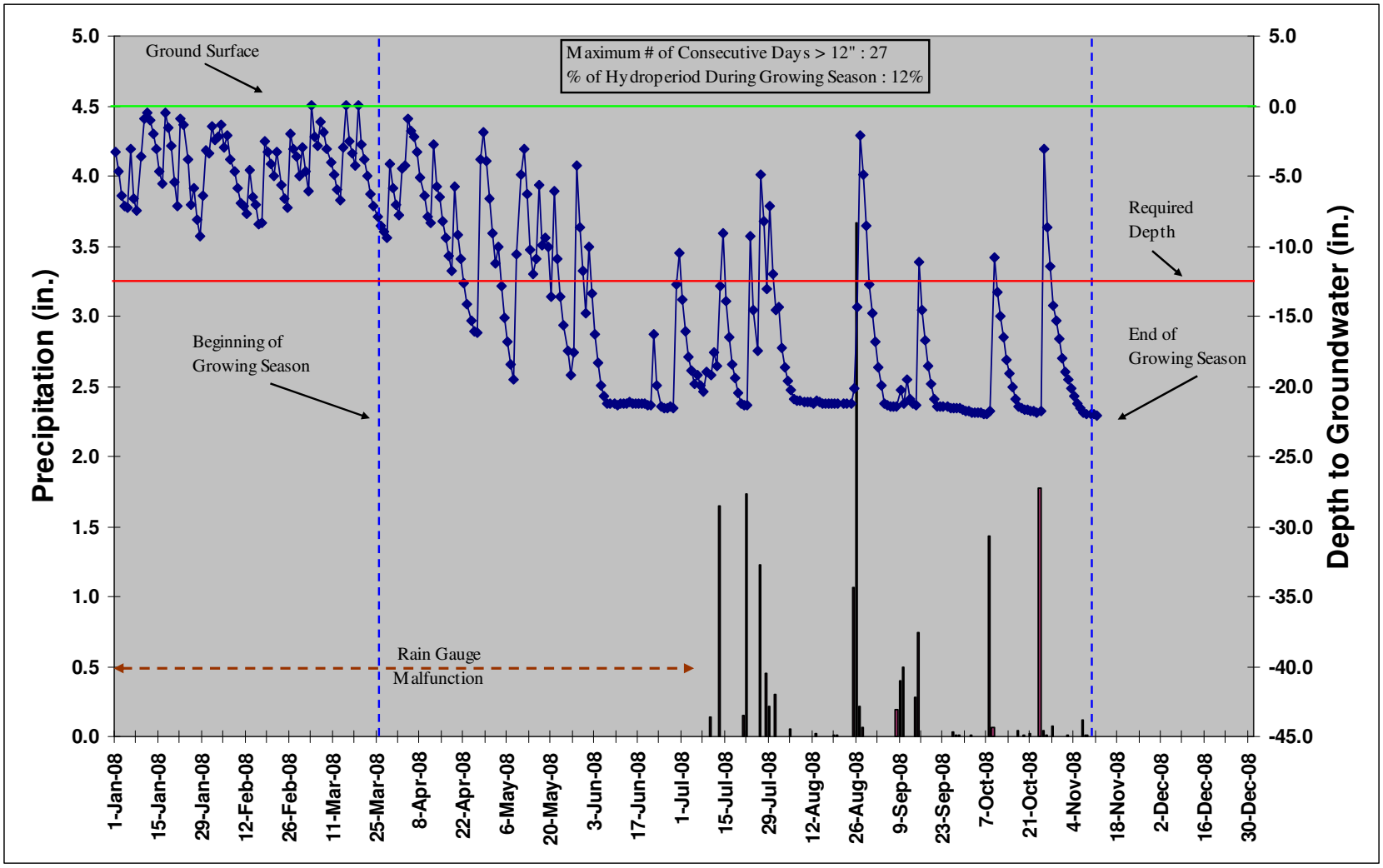
Tulula Stream and Wetland Restoration
Groundwater Gauge G2



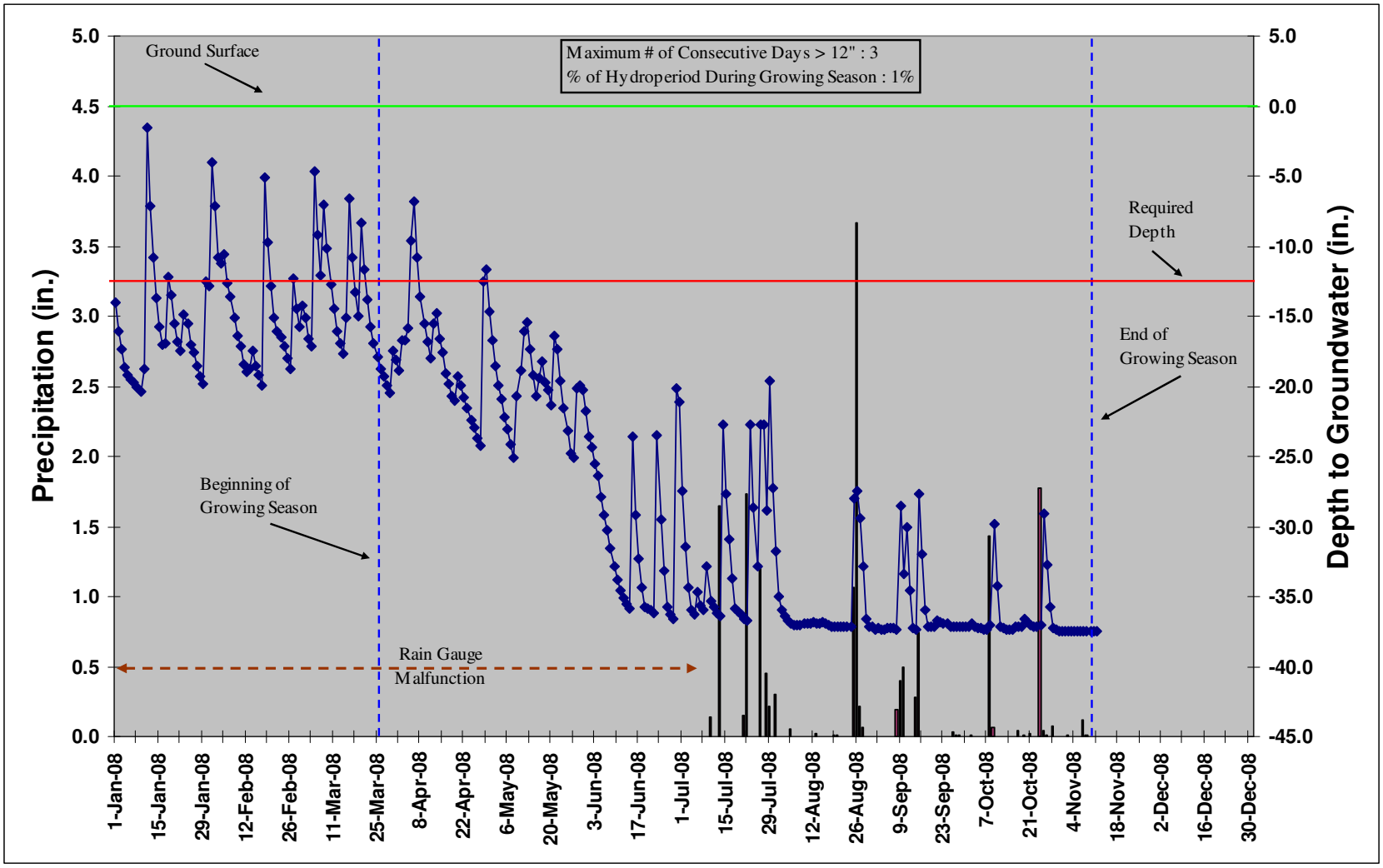
Tulula Stream and Wetland Restoration
Groundwater Gauge H1



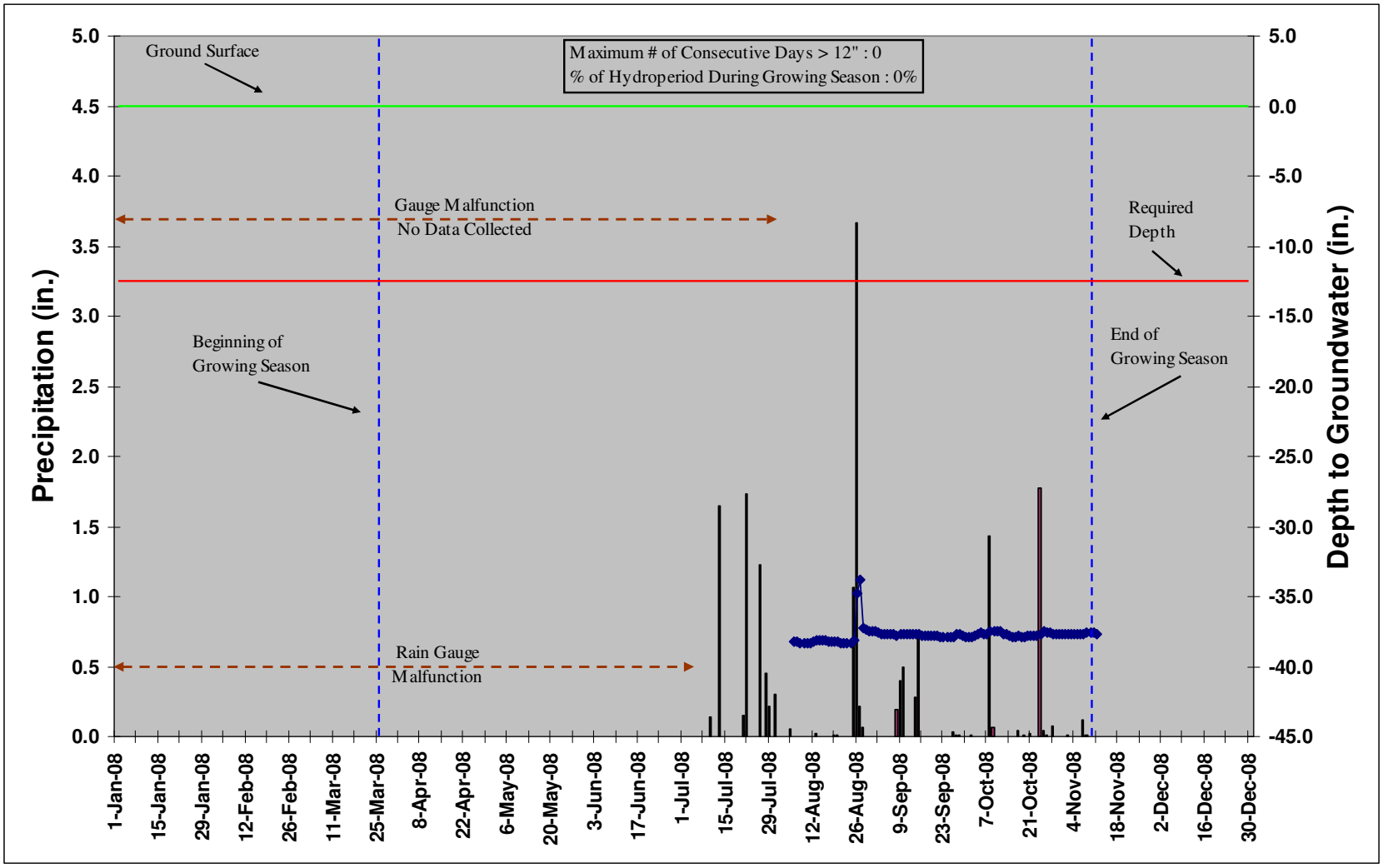
Tulula Stream and Wetland Restoration
Groundwater Gauge H2



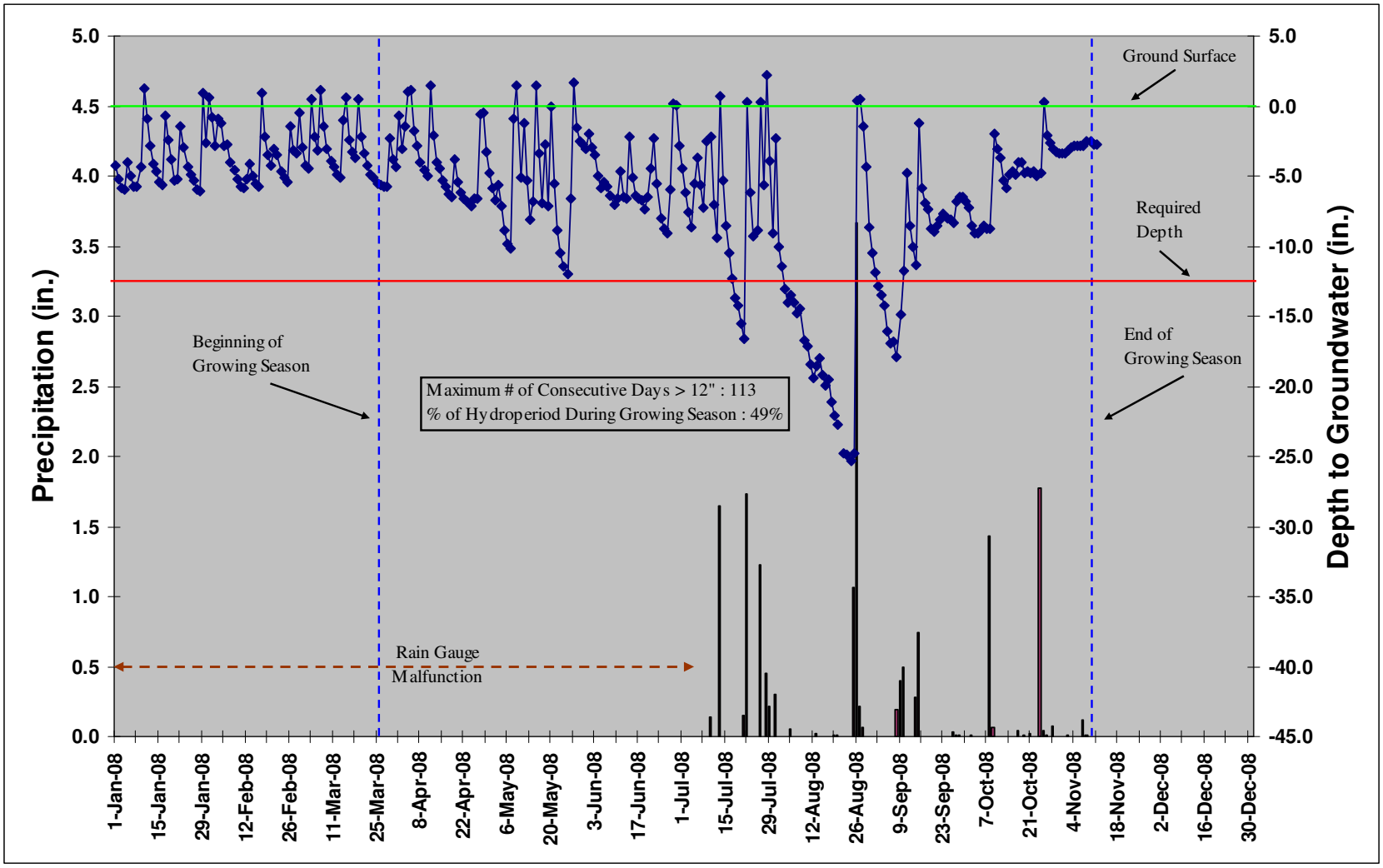
Tulula Stream and Wetland Restoration
Groundwater Gauge H3



Tulula Stream and Wetland Restoration
Groundwater Gauge I1

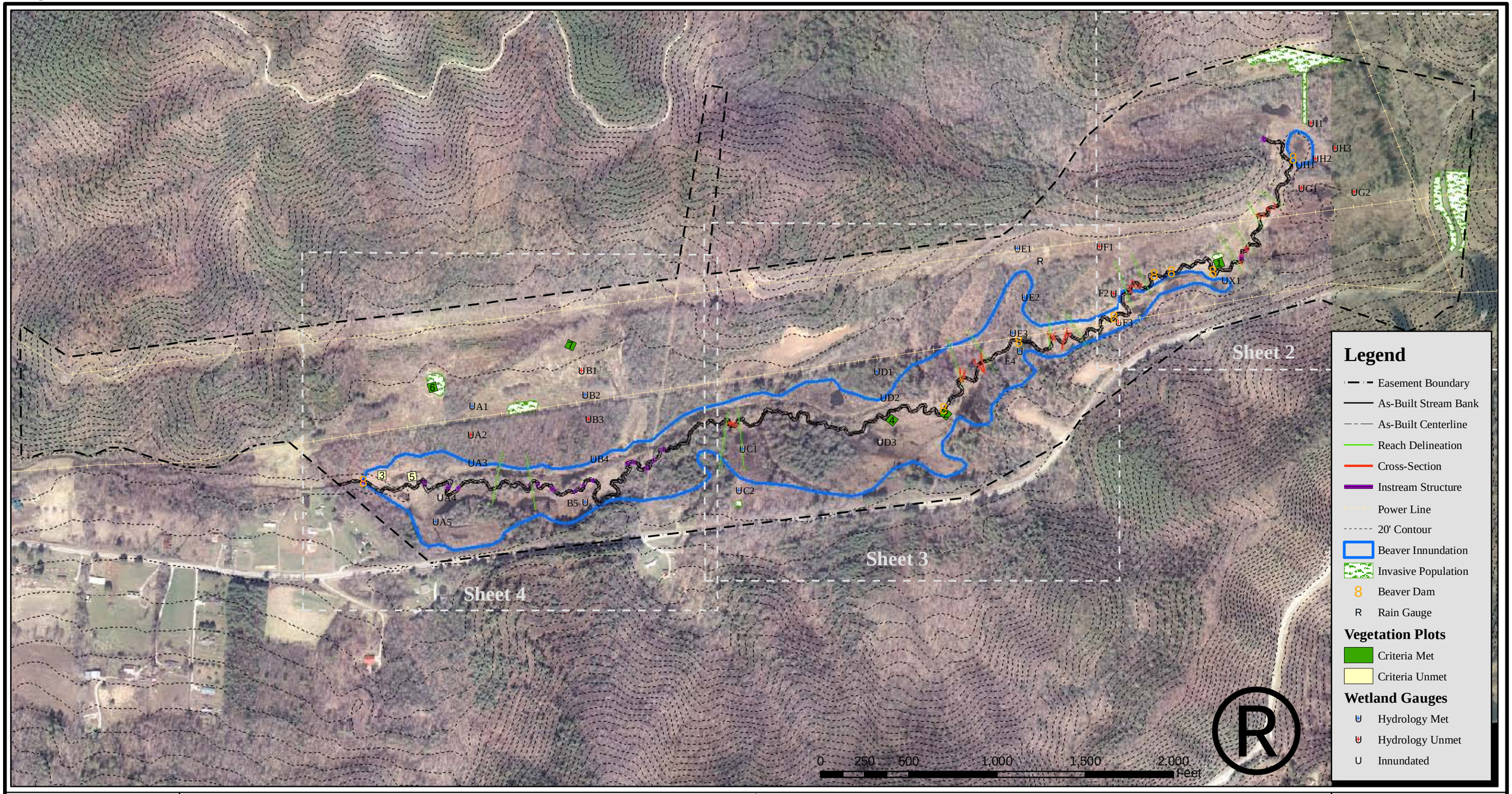


Tulula Stream and Wetland Restoration
Groundwater Gauge X1



Appendix D
Tulula Stream & Wetland Restoration
Integrated Current Condition Plan View

Intergrated Current Condition Plan View



Prepared for	**Project:**	Notes:	Prepared by
Ecosystem Enhancement Program	Tulula Stream & Wetland Restoration Year 6 Monitoring Graham County, North Carolina	1) Base Map taken from CAD file "TULULA 2007 MONT.AND PAPV.dwg" Provided by NCEEP 2) Stream problems identified in 2007 were obscured and no new areas were identified in 2008 due to beaver innundation 3) 2004 Graham County Aerial Photo & 2006 Macon County Aerial Photo	EQUINOX ENVIRONMENTAL CONSULTATION & DESIGN
	Sheet 1 of 4		
	Date	Project Number	
	May 2009	NCEEP # 392	

Integrated Current Condition Plan View

Prepared for	**Project:** Tulula Stream & Wetland Restoration Year 6 Monitoring Graham County, North Carolina	Notes: 1) Base Map from CAD file "TULULA 2007 MONT.AND PAPV.dwg" Provided by NCEEP 2) Stream problems identified in 2007 were obscured and no new areas were identified in 2008 due to beaver innundation 3) 2004 Graham County Aerial Photo & 2006 Macon County Aerial Photo	Prepared by
	Sheet 2 of 4		
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Integrated Current Condition Plan View

Prepared for	**Project:**	Notes:	Prepared by
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	Sheet 3 of 4		
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Integrated Current Condition Plan View

Prepared for	**Project:**	Notes:	Prepared by
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