UT to Lilliput Creek (Hog Branch Ponds)
Stream and Wetland Restoration Project

SCO No. 07-07155-01
DENR Contract No. D08049S
EEP Project No. 290
Brunswick County North Carolina

Year 3 of 5 Monitoring Report
Data Collection: January through December 2012
Submission Date: March 8, 2013

Prepared for:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
217 West Jones St., Suite 3000A, Raleigh, N.C. 27603

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Prepared by:

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2.0 TABLE OF CONTENTS

3.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is located in Boiling Spring Lakes, Brunswick County. The restoration project is located on a 516.73 acre tract. The purchase of the site (fee simple) was funded by both the State of North Carolina Ecosystem Enhancement Program and North Carolina Department of Agriculture and Consumer Sciences Plant Conservation Program in December 2004. The UT Lilliput Stream and Wetland Restoration Site was previously owned by International Paper and used in rotation as a pine plantation. Pine plantations in southeastern North Carolina are typically characterized by major site alterations constructed to provide sufficient surface and groundwater drainage in wet conditions which allows planted pine trees to grow and cultivate. Site alterations also destroy ecological function, decrease water quality and disrupts habitat for wildlife, including federally threatened and endangered species.

The goal for the UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is to restore ecological function, improve overall water quality, and enhance native wildlife habitat. This goal will be accomplished by two main objectives. The first objective is restoration of channelized tributaries to the headwater outer coastal plain stream type, as described in the "Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina" guidance document (COE 2005). The stream restoration will re-establish the riparian vegetation zone, re-connect flood plain areas, and enhance wildlife habitat. These ecological functions have been non-existent for decades due to the previous ditch and drainage regime. The second objective is to restore and enhance the altered wetlands. The restoration and enhancement of wetlands onsite will generate longer soil saturation periods and the result is improved water quality. Restoring the native hydrologic characteristics will also restore the conditions that are beneficial for the long-leaf pine community type that previously dominated the site before human intervention. The long-leaf pine forest will also restore native habitat for the red-cockaded woodpecker.

The UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site was previously a pine plantation. Pine plantations in southeastern North Carolina are typically characterized by major site alterations that were made to eliminate much of the wet conditions. When modified, these sites provide sufficient surface and groundwater drainage that allow planted loblolly pine (*Pinus taeda*) and long-leaf pine (*P. palustris*) trees to be cultivated. Foresters typically perform two major site alterations in preparation for a pine plantation: channelization of natural stream channels and bedding. These site alterations were utilized extensively throughout the project site. Restoring these alterations back to natural condition was key in both project design and implementation.

Stream restoration and stream preservation are both components of this project (Table 1). Stream restoration for UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is divided into two tributaries. The North Tributary (**1,535 linear feet**)

and South Tributary (**1,703 linear feet**) were constructed utilizing the previous referenced guidance entitled "Information Regarding Stream Restoration in the Outer Coastal Plain of North Carolina" (COE 2005). The referenced document states that restoration of dimension, pattern and profile in accordance with the typical natural channel design is often not appropriate in environments similar to the project site. For zero to first order headwater stream restoration, a width of 100 feet centered along the resulting valley will determine the area that can be considered for stream restoration (COE 2005). A total of **3,238 linear feet** of stream restoration will be provided in accordance with the enclosed plans. Stream preservation areas will consist of **5,332 linear feet** (See Table 1 for Project Components and Figure 1a for Component Location).

The wetland component of the UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site consists of non-riparian wetland preservation, restoration, enhancement, and riparian preservation. The non-riparian wetland preservation areas total **87.74 acres** and riparian wetland preservation areas total **20.45 acres**. These areas were delineated using guidelines described in the Corps of Engineers 1987 Manual (COE 1987). Non-riparian wetland enhancement totaling **96.46 acres** makes up the bulk of the project effort. Non-riparian wetland restoration totals **7.83 acres**. Vegetative enhancement was utilized by planting with native species and the hydrology enhanced through the stream restoration process. (See Table 1 for Project Components and Figure 1a for Component Location)

Fifteen (15) permanent vegetation plots and one (1) total stem count for Site 6 were established and used in annual vegetation monitoring. As per the mitigation plan, the final vegetative success criterion will be the survival of 260 5-year old planted woody stems per acre at the end of the year 5 monitoring period, which is based on the US Army Corps of Engineers Stream Mitigation Guidelines (COE 2003). Based on MY3 monitoring data, the site is meeting the minimum success requirement with an observed mean stem density of 462 planted stems per acre. When counting plants that have volunteered into the plots, 1280 stems per acre were identified. Vegetation plot locations are identified in Figure 2. Of the individual plots, only VP 13 did not meet the success criterion. Only four of the eighteen originally planted longleaf pine trees remain in this plot. This equates to 161.8 planted stems per acre. The health of the remaining trees is good (all rated 3 for vigor), however other vegetation is volunteering into the site and may be shading the longleaf stems. Titi (*Cyrilla racemiflora*), sweet pepperbush (*Clethra alnifolia*), gallberry (*Ilex glabra*), and red bay (*Persea palustris*) were noted within the plot. It may be beneficial to consult with a forester to determine if a controlled burn is necessary to thin out the area and improve the survivability of the remaining longleaf stems within the site. Although the plots located within the zero-order stream valleys meet the vegetative success criterion, the height of planted stems is deficient (average of less than 2.5 feet in height). Supplemental planting in these areas may be beneficial.

Stream monitoring was conducted in MY3 (2012). Visual and survey evidence exhibited the "braided" stream type featured in the Zero to First Order outer coastal plain stream

morphology. No areas of significant degradation or rill erosion were noted. Based on survey data collected from longitudinal profiles and eight fixed cross sections, the UT to Lilliput Stream Restoration Channel dimension and pattern are similar to as-built conditions (Appendix D).

The UT to Lilliput Creek (Hog Branch Ponds) Stream and Wetland Restoration Site is currently being monitored for hydrology using forty-one (41) water level monitoring gauges (28 groundwater monitoring gauges, 8 surface flow monitoring gauges, and 5 reference gauges). Some of these gauges were installed after the original restoration work occurred. Eight groundwater monitoring gauges were installed in December of 2010. Additionally, three reference gauges were installed in June of 2011.

During MY3 (2012), repairs to several gauges were necessary. The battery kits of eighteen gauges and the guide wires of two gauges were replaced. Four gauges were rendered inoperable due to equipment malfunction and had to be replaced with LMG gauges. Additionally, the four groundwater reference gauges (GND 1-4) were removed on October 15, 2012 because of a controlled burn that was planned in the reference area. The burn was indefinitely delayed and the gauges were reinstalled in February of 2013.

During Monitoring Year 3 (MY3) 2012, twenty-seven of the 28 groundwater monitoring gauges located within the restoration site exhibited groundwater within 12 inches of the soil surface for a duration in excess of the 12% hydrologic success criterion. Gauge 26 did not meet the success criterion and exhibited groundwater within 12 inches of the soil surface for 8% of the growing season. The hydrographs of this gauge show groundwater levels were within 12 inches of the soil surface for much of the 2012 growing season. However, water levels were elevated for brief periods and occasionally fell below 12 inches to an extent that the criterion of 33 consecutive days was not achieved. This gauge is positioned on the shoulder of the stream valley. Groundwater is continuously being discharged to the low part of the valley, resulting in fluctuating water levels. Gauge 26 (along with five other gauges) did not meet the hydrological success criterion in MY2 (2011). Please see Figure 2 for gauge locations.

A comparison between pre-construction monitoring data and post-construction monitoring data demonstrated an increase in hydroperiod within the enhancement areas. Gauge 11 exhibited 121 consecutive days (45% of the growing season) of groundwater within 12 inches of the soil surface. By comparison, the pre-construction monitoring (2005) gauge located in this area exhibited 14 consecutive days (6% of the growing season). Gauge 17 also exhibited 121 consecutive days (45% of the growing season) in MY3 while 2005 pre-construction monitoring data exhibited 11 consecutive days (5% of the growing season) in the same location.

As per the monitoring success criteria, surface water monitoring gauges must exhibit similar conditions to the on-site reference gauge and clearly show fluctuation in flow. For MY3 (2012), all surface water monitoring gauges exhibited fluctuations in water levels

and extended periods of above-ground flow. On average, the reference stream gauge documented a lower level of water in the channel and less variable flow than the on-site stream gauges (Appendix E). The reference stream is located in a more densely vegetated area than the on-site streams. The vegetation and surface roughness appears to be reducing peak discharge events.

During gauge downloads in MY3, it was observed that the access road on the eastern section of the tract was eroding. This erosion was likely a result of above-average rainfall in August that overtopped the sandy road. A new dirt road has been constructed in uplands so that access to the reference area is maintained. Currently, this issue appears to be resolved. LMG will continue to monitor this access road.

Summary information/data related to the occurrence of items such as beaver or encroachment and statistics related to performance of various project and monitoring elements can be found in the tables and figures in the report appendices. Narrative background and supporting information formerly found in these reports can be found in the mitigation and restoration plan documents available on EEP's website. All raw data supporting the tables and figures in the appendices are available from EEP upon request.

4.0 METHODOLOGY

Fifteen (15) permanent vegetation plots and one (1) total stem count for Site 6 are used for vegetation monitoring. All vegetation monitoring was completed in September 2012 utilizing the Carolina Vegetation Survey (CVS) – EEP protocol Level 2 (version 4.2) for fifteen (15) vegetation monitoring plots. A total stem count was utilized for Site 6.

Stream morphological monitoring was conducted in MY3. Surveyors shot elevations at eight designated cross section stations located along the northern and southern tributaries. Longitudinal profiles were also surveyed.

For MY3 2012, hydrology was monitored through a series of forty-one (41) water level monitoring gauges (28 groundwater monitoring gauges, 8 surface flow monitoring gauges, and 5 reference gauges). All gauges, including reference, were downloaded monthly utilizing Remote Data Systems data loggers and software.

Photo monitoring was conducted by walking the entire site. A digital camera was used to take photos at each predetermined photo point location.

5.0 REFERENCES

NCEEP. 2012. UT to Lilliput Stream and Wetland Restoration Project; Year 2 of 5 Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. February, 2012.

NCEEP. 2010. Content, Format and Data Requirements for EEP Baseline Monitoring Report. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 2.0 October 14, 2010.

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

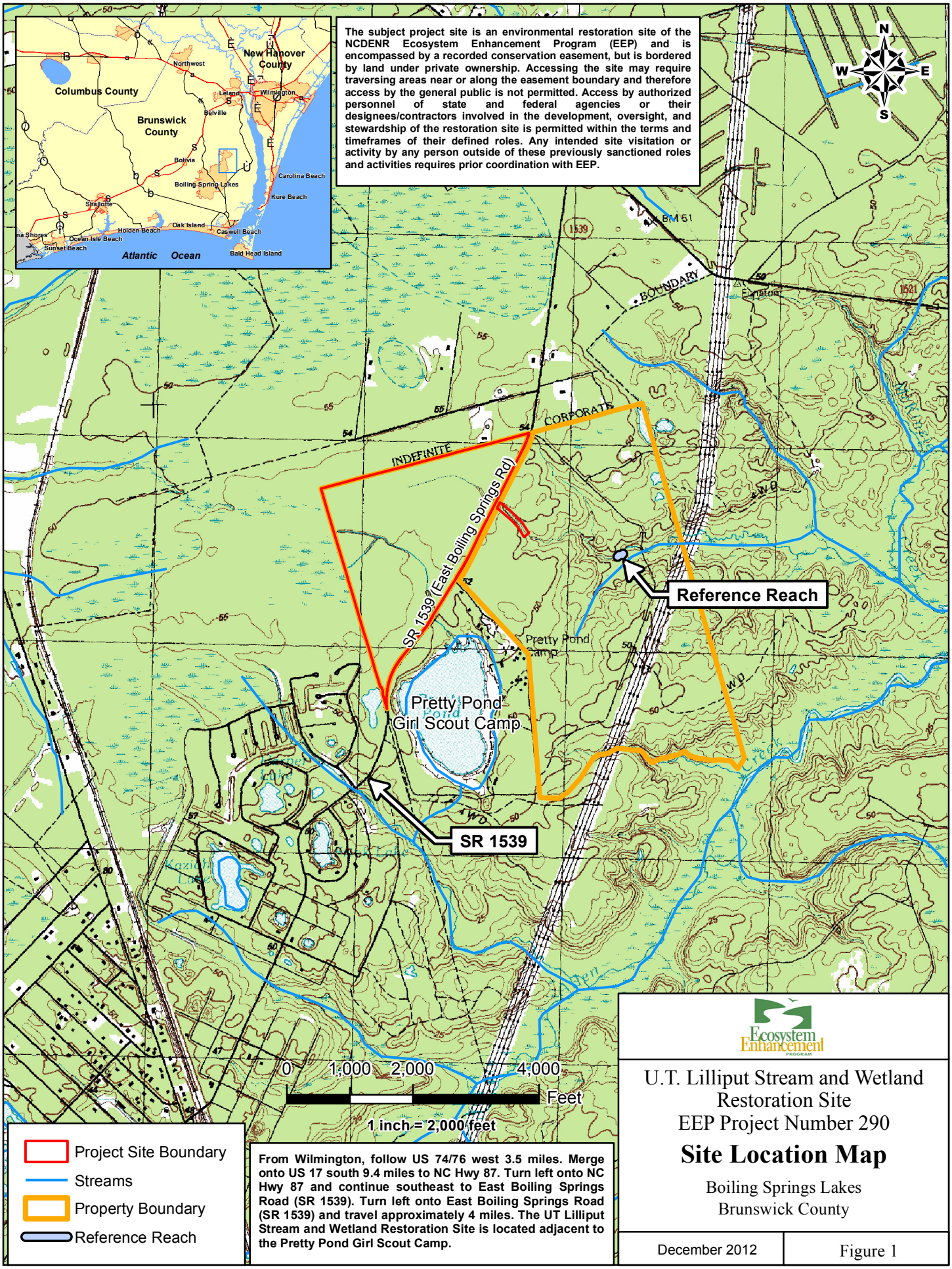
NCEEP. 2006. UT to Lilliput Stream and Wetland Restoration Project Restoration Plan. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, NC. Version 3, October 16, 2006.

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

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

6.0 PROJECT CONDITION AND MONITORING DATA APPENDICES

Appendix A.
Project Vicinity Map and Background Tables



Ecosystem Enhancement Program

U.T. Lilliput Stream and Wetland Restoration Site
EEP Project Number 290

Site Location Map

Boiling Springs Lakes
Brunswick County

December 2012 | Figure 1

Source: USGS 7.5 Minute Quadrangle, Funston, NC

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FIGURE 1a.

Project Components

U.T. to Lilliput Creek
(Hog Branch Ponds)
Stream and Wetland Restoration Site
Project No: D05053S
EEP No. 290

Brunswick County

Legend

Restoration Plan Component

- Property Boundary
- Stream Restoration (7.23 Ac., 3238 LF.)
- Wetland Restoration (7.83 Ac.)
- Wetland Enhancement (96.46 Ac.)
- Wetland Preservation (87.74 Ac.)
- Riverine Wetland Preservation (20.45 Ac.)
- Wetland in Powerline ROW (4.54 Ac.)
- Stream Preservation (100' buffer, 8.67 Ac., 5332 LF)

N
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0 250 500 1,000
Feet

Ecosystem Enhancement Program

December 2012

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Table 1. Project Components and Mitigation Credits

UT Lilliput Stream and Wetland Restoration Project, EEP No. 290

Mitigation Credits

	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals	3,238	1,066		4.09	7.83	65.778			

Project Components

Project Component	Stationing/ Location	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
0 to 1st Order Stream Restoration	Northern Tributary	1,535 LF	0 to 1st Order Stream Restoration	Restoration	1,535 LF	1:1
0 to 1st Order Stream Restoration	Southern Tributary	1,703 LF	0 to 1st Order Stream Restoration	Restoration	1,703 LF	1:1
Stream Preservation	See Figure 1a	5,332 LF	Preservation	Preservation (RE)	5,332 LF	5:1
Non-Riparian Wetland Restoration	See Figure 1a	7.83 ac	Restoration	Restoration	7.83 ac	1:1
Non-Riparian Wetland Enhancement	See Figure 1a	96.46 ac	Enhancement	Enhancement (RE)	96.46 ac	2:1
Non-Riparian Wetland Preservation	See Figure 1a	87.74 ac	Preservation	Preservation (RE)	87.74 ac	5:1
Riparian Wetland Preservation	See Figure 1a	20.45 ac	Preservation	Preservation (RE)	20.45 ac	5:1

Component Summation

Restoration Level	Stream (lf)	Riparian Wetland (ac)	Non-Riparian Wetland (ac)	Buffer (sq ft)	Upland (ac)
Restoration	3,238 LF		7.83 ac		
Enhancement			96.46 ac		
Enhancement I					
Enhancement II					
Creation					
Preservation	5,332 LF	20.45 ac	87.74 ac		
HQ Preservation					

BMP Elements*

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

*BMP Elements are not part of the UT Lilliput Project

Table 2. Project Activity and Reporting History UT Lilliput Stream and Wetland Restoration Project -EEP Project No. 290		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	NA	Oct-06
Final Design – Construction Plans	NA	Apr-08
Construction	NA	Feb-10
Temporary S&E mix applied to entire project area	NA	Mar-09
Permanent seed mix applied to entire project area	NA	Mar-09
Containerized and B&B plantings	NA	Feb-10
Baseline Monitoring Document (Year 0 Monitoring -baseline)	December-10	December-10
Year 1 Monitoring	December-10	January-11
Year 2 Monitoring	December-11	December-11
Year 3 Monitoring	December-12	December-12
Year 4 Monitoring		
Year 5 Monitoring		

Table 3. Project Contacts Table UT Lilliput Stream and Wetland Restoration Project	
EEP Project No. 290	
Designer Primary project design POC	Rummel, Klepper, and Kahl Engineers 900 Ridgefield Drive Suite 350; Raleigh, NC 27609 Pete Stafford (919) 878-9560
Construction Contractor Construction contractor POC	River Works Inc. 8000 Regency Parkway Cary, NC 27518 Mike Pedersen (919) 459-9001
Planting Contractor Planting Contractor POC	River Works Inc. 8000 Regency Parkway Cary, NC 27518 Mike Pedersen (919) 459-9001
Seeding Contractor Seeding Contractor POC	River Works Inc. 8000 Regency Parkway Cary, NC 27518 Mike Pedersen (919) 459-9001
Seed Mix Sources	Contact River Works Inc.
Nursery Stock Suppliers	Contact River Works Inc.
Monitoring Performers (MY1) Stream Monitoring POC Vegetation Monitoring POC Wetland Monitoring POC	Rummel, Klepper, and Kahl, LLP 900 Ridgefield Drive Suite 250; Raleigh, NC 27609 Pete Stafford (919) 878-9560 Pete Stafford (919) 878-9560 Pete Stafford (919) 878-9560
Monitoring Performers (MY2 & MY3) Vegetation Monitoring POC Wetland Monitoring POC	Land Management Group, Inc. P.O. Box 2522; Wilmington, NC 28402 Kim Williams (910) 452-0001 Kim Williams (910) 452-0001

Table 4. Project Baseline Information and Attributes		
UT Lilliput Stream and Wetland Restoration Project		
EEP Project No. 290		
Project Information		
Project Name	UT Lilliput Stream and Wetland Restoration Project	
Project County	Brunswick	
Project Area	600 acres	
Project Coordinates (Lat and Long)	34.078043,-78.026662	
Project Watershed Summary Information		
Physiographic Region	Coastal Plain	
River Basin	Cape Fear	
USGS HUC 8 Digit 03020103	USGS HUC 14 Digit 03030005070010	
NCDWQ Subbasin	3/6/2017	
Project Drainage Area	N/A	
Project Drainage impervious cover estimate (%)	< 5%	
CGIA Land Use Classification		
Reach Summary Information		
Parameters	**North Tributary**	**South Tributary**
Length of Reach	1,535 LF	1,703 LF
Valley Classification	0 to 1st order	0 to 1st order
Drainage Area	52.49 acres	66.94 acres
NCDWQ Stream Identification Score	N/A	N/A
NCDWQ Water Quality Classification	CNSW	CNSW
Morphological Description (stream type)	0 to 1st order	0 to 1st order
Evolutionary Trend	N/A	N/A
Underlying Mapped Soils	Leon	Murville
Drainage Class	Poorly Drained	Poorly Drained
Soil Hydric Status	Hydric A	Hydric A
Slope	0.001	0.001
FEMA Classification	Zone X	Zone X
Native Vegetation Community	N/A	N/A
Percent Composition Exotic Invasive Vegetation	< 1%	< 1%
Wetland Summary Information		
Parameter	**Wetland 1**	**Wetland 2**
Size (acres)	87.74	22.45
Wetland Type	Non-Riparian	Riparian
Mapped Soils Series	Murville and Leon	Muckalee
Drainage Class	Very poorly drained, poorly drained	Very poorly drained
Soil Hydric Status	A	A
Source of Hydrology	Groundwater	Groundwater
Hydrologic Impairment	N/A	N/A
Native Vegetation Community	Long Leaf Pine	Coastal Plain Blackwater Small Stream
Percent of Exotic/Invasive Veg	<1%	<1%

Table 4. Contd.			
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the US – Section 404	Yes	Yes	Upon Request
Waters of the US – Section 401	Yes	Yes	Upon Request
Endangered Species Act	Yes	Yes	Upon Request
Historic Preservation Act	Yes	Yes	Upon Request
Coastal Zone Management Act (CZMA) Coastal Area Management Act (CAMA)	Yes	Yes	Upon Request
FEMA Floodplain Compliance	Yes	Yes	Upon Request
Essential Fisheries Habitat	No		

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Appendix B.
Visual Assessment Data

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FIGURE 2

Current Conditions Plan View

U.T. to Lilliput Creek
(Hog Branch Ponds)
Stream and Wetland
Restoration Site
Project No: D05053S
EEP No. 290

Brunswick County

Legend

Vegetation Monitoring Counts

- Less Than 320 Planted Stems per Acre
- More Than 320 Planted Stems per Acre
- Areas of low vegetative growth
  (meets success criterion but vegetation is slow growing and has low vigor; may need supplemental planting)

Gauge Success Criteria

- < 12%
- > 12%

Restoration Plan Component

- Stream Restoration (7.23 Ac., 3238 LF.)
- Wetland Restoration (7.83 Ac.)
- Wetland Enhancement (96.46 Ac.)
- Property Boundary
- Wetland Preservation (87.74 Ac.)
- Riverine Wetland Preservation (20.45 Ac.)
- Wetland in Powerline ROW (4.54 Ac.)
- Stream Preservation
  (100' buffer, 8.67 Ac., 5332 LF)

N W E S

0 200 400 800 Feet

Ecosystem Enhancement PROGRAM

February 2013

SR 1539 (East Boiling Springs Rd)

Pretty Pond
Girl Scout Camp

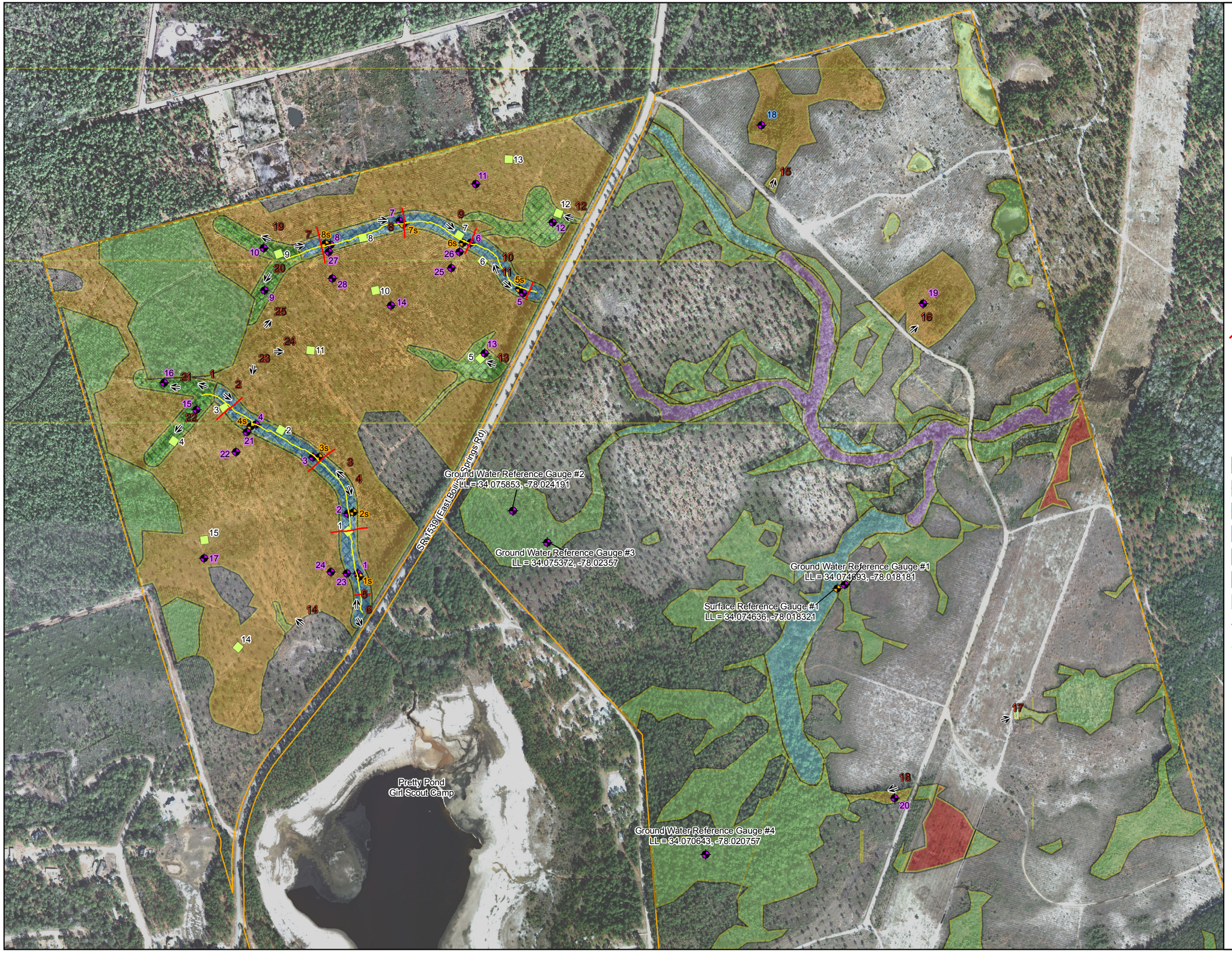

FIGURE 3

Monitoring Plan Features

U.T. Lilliput Stream and Wetland Restoration Site
Project No: D05053S
EEP No. 290

Brunswick County

Legend

- Vegetation Monitoring Plot
- Brunswick County Soils Survey

Monitoring Gauges

- Surface Gauges 2010
- Groundwater Gauges 2010/2011

Restoration Plan Component

- Stream Restoration (7.23 Ac., 3238 LF.)
- Wetland Restoration (7.83 Ac.)
- Wetland Preservation (87.74 Ac.)
- Riverine Wetland Preservation (11.78 Ac.)
- Wetland in Powerline ROW (4.54 Ac.)
- Wetland Enhancement (96.46 Ac.)
- Property Boundary
- Surveyed Cross Sections
- Surveyed Longitudinal Profile

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Feet

Ecosystem Enhancement Program

December 2012

Table 5a. Visual Stream Morphological Stability Assessment
Reach ID - Northern Tributary
Assessed Length - 1535 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation			N/A	N/A	N/A			
		2. Degradation			N/A	N/A	N/A			
	2. Riffle Condition	1. Texture/Substrate	N/A	N/A			N/A			
	3. Meander Pool Condition	1. Depth	N/A	N/A			N/A			
		2. Length	N/A	N/A			N/A			
	4. Thalweg Condition	1. Thalweg at upstream of meander bend	N/A	N/A			N/A			
		2. Thalweg centering at downstream of meander	N/A	N/A			N/A			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	100%
	2. Undercut	Banks undercut/overhanging			N/A	N/A	N/A	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, caving, or collapse			0	0	100%	N/A	N/A	100%
				TOTALS	0	0	100%	N/A	N/A	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	9	9			100%			
	2. Grade Control	Grade control exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining- Max Pool Depth: Mean Bankfull Depth Ratio >= 1.6 Rootwads/logs providng some cover at base flow	N/A	N/A			N/A			

Table 5b. Visual Stream Morphological Stability Assessment
Reach ID - Southern Tributary
Assessed Length - 1703 LF

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-Built	Number of Unstable Segments	Amount of Unstable Footage	% Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run Units)	1. Aggradation			N/A	N/A	N/A			
		2. Degradation			N/A	N/A	N/A			
	2. Riffle Condition	1. Texture/Substrate	N/A	N/A			N/A			
	3. Meander Pool Condition	1. Depth	N/A	N/A			N/A			
		2. Length	N/A	N/A			N/A			
	4. Thalweg Condition	1. Thalweg at upstream of meander bend	N/A	N/A			N/A			
		2. Thalweg centering at downstream of meander	N/A	N/A			N/A			
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover from poor growth and/or scour and erosion			0	0	100%	N/A	N/A	100%
	2. Undercut	Banks undercut/overhanging			N/A	N/A	N/A	N/A	N/A	N/A
	3. Mass Wasting	Bank slumping, caving, or collapse			0	0	100%	N/A	N/A	100%
				TOTALS	0	0	100%	N/A	N/A	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs	9	9			100%			
	2. Grade Control	Grade control exhibiting maintenance of grade across the sill	1	1			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	N/A	N/A			N/A			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	N/A	N/A			N/A			
	4. Habitat	Pool forming structures maintaining- Max Pool Depth: Mean Bankfull Depth Ratio >= 1.6 Rootwads/logs providng some cover at base flow	N/A	N/A			N/A			

Table 6. Vegetation Condition Assessment Table

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material	No bare areas located onsite for MY3 2012	N/A	N/A	N/A	N/A
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria	VP13 did not meet vegetative success criterion.	Red Square	1	0.02 ac	< .1%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year	Many stems in plots within stream valleys exhibited slow growth	Red dotted line	2	~ 11 ac	~ 10%

Appendix B - Stream and Cross Section Photos
(photos recorded on September 20 and December 10, 2012)

Photo Station 1. Southern Tributary Station 15+00 - SCX4 - Looking downstream

Photo Station 2. Southern Tributary Station 15+00 - SCX4 - Looking upstream

Photo Station 3. Southern Tributary Station 23+00 - SCX3 - Looking upstream

Photo Station 4. Southern Tributary Station 23+00 - SCX2 - Looking downstream

Photos recorded on September 20 and December 10, 2012

Photo Station 5. Southern Tributary Station 29+00 - SCX1 - Looking upstream

Photo Station 6. Southern Tributary Station 29+00 - SCX1 - Looking downstream

Photos recorded on September 20 and December 10, 2012

Photo Station 7. Northern Tributary Station 14+00 - NCX4 - Looking downstream

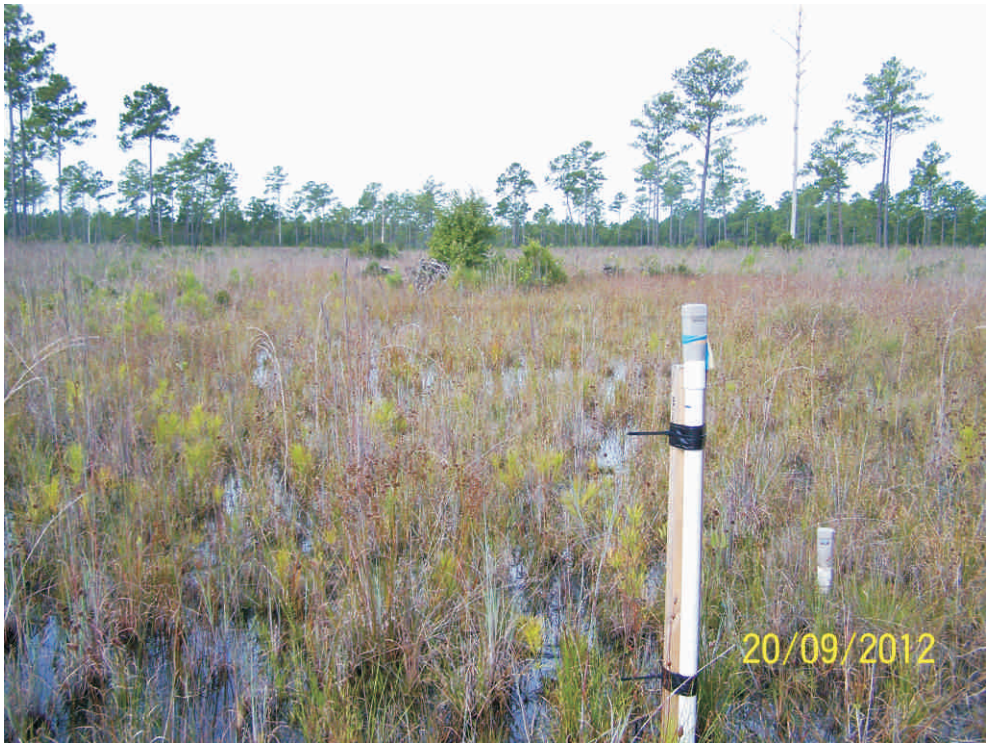


Photo Station 8. Northern Tributary Station 21+00 - NCX3 - Looking upstream

Photos recorded on September 20 and December 10, 2012

Photo Station 9. Northern Tributary Station 21+00 - NCX2 - Looking downstream

Photo Station 10. Northern Tributary Station 28+25 - NCX1 - Looking upstream

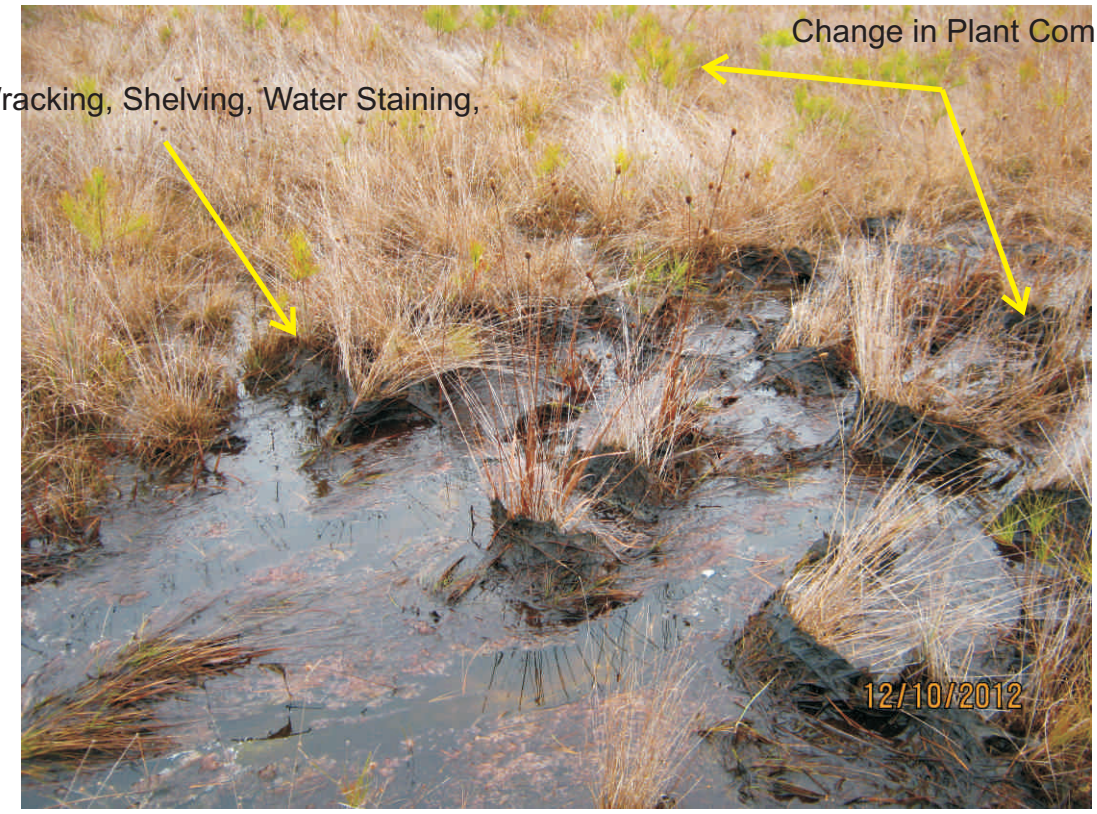
Photos recorded on September 20 and December 10, 2012

Photo Station 11. Northern Tributary Station 28+25 - NCX1 - Looking downstream

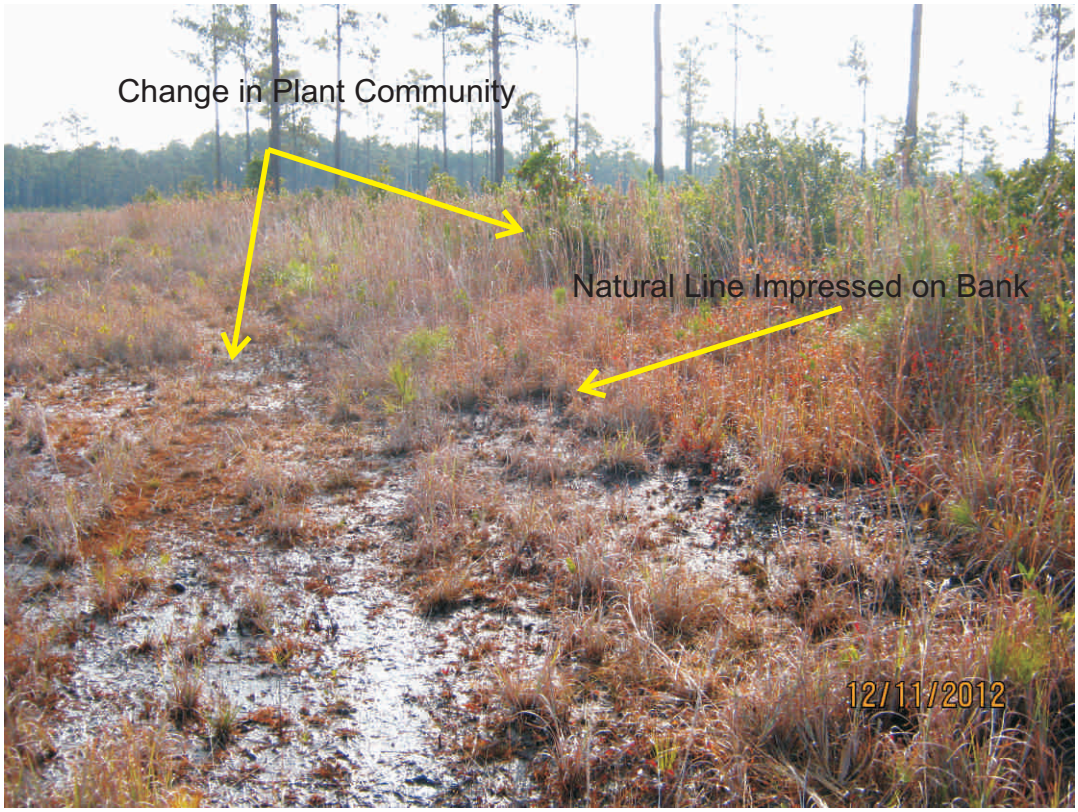
Photos recorded on September 20 and December 10, 2012

View of OHWM on North Tributary

View of OHWM on North Tributary



View of OHWM on South Tributary



View of OHWM on South Tributary

Appendix B - Wetland and General Site Photos (all photos recorded on September 20, 2012)

Photo Station 12. Site 1 - Looking West

Photo Station 13. Site 2 - Looking West

Photos recorded on September 20 and December 10, 2012

Photo Station 14. Site 3 - Looking West

Photo Station 15. Site 4 - Looking North

Photos recorded on September 20 and December 10, 2012

Photo Station 16. Site 5- Looking Northeast

Photo Station 17. Site 6 - Looking Northeast

Photos recorded on September 20 and December 10, 2012

Photo Station 18. Site 7 - Looking West

Photo Station 19. Northern Headwater Wetland - North Prong

Photos recorded on September 20 and December 10, 2012

Photo Station 20. Northern Headwater Wetland - South Prong

Photo Station 21. Southern Headwater Wetland - North Prong

Photos recorded on September 20 and December 10, 2012

Photo Station 22. Southern Headwater Wetland - South Prong

Photo Station 23. General Site View - Wetland Enhancement Area

Photos recorded on September 20 and December 10, 2012

Photo Station 24. General Site View - Wetland Enhancement Area

Photo Station 25. General Site View - Wetland Enhancement Area

Photos recorded on September 20 and December 10, 2012

Vegetation Plot Photos (all photos recorded on September 20 and 21, 2012)

Vegetation Plot 1

Vegetation Plot 2

Photos recorded on September 20 and December 10, 2012

Vegetation Plot 3

Vegetation Plot 4

Photos recorded on September 20 and December 10, 2012

Vegetation Plot 5

Vegetation Plot 6

Photos recorded on September 20 and December 10, 2012

Vegetation Plot 7

Vegetation Plot 8

Photos recorded on September 20 and December 10, 2012

Vegetaton Plot 9

Vegetation Plot 10

Photos recorded on September 20 and December 10, 2012

Vegetation Plot 11

Vegetation Plot 12

Photos recorded on September 20 and December 10, 2012

Vegetation Plot 13

Vegetation Plot 14

Photos recorded on September 20 and December 10, 2012

Vegetation Plot 15

Site 6 - Total Stem Count

Photos recorded on September 20 and December 10, 2012

Appendix C.
Vegetation Plot Data

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Table 7. Vegetation Plot Criteria Attainment			
Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
Southern Tributary	VP1	Y	94%
Southern Tributary	VP2	Y	
Southern Tributary	VP3	Y	
Southern Headwater Wetland	VP4	Y	
Site 2	VP5	Y	
Northern Tributary	VP6	Y	
Northern Tributary	VP7	Y	
Northern Tributary	VP8	Y	
Northern Headwater Wetland	VP9	Y	
Wetland Enhancement	VP10	Y	
Wetland Enhancement	VP11	Y	
Site 1	VP12	Y	
Wetland Enhancement	VP13	N	
Wetland Enhancement	VP14	Y	
Wetland Enhancement	VP15	Y	
Site 6	Site 6 (Total Count)	Y	

Table 8. CVS Vegetation Plot Metadata UT to Lilliput Creek EEP No. 290	
Report Prepared By	Kim Williams
Date Prepared	3/8/2013 10:00
Database Name	UTLilliput_290_MY3_2012.mdb
Database Location	L:\Wetlands\2008\UT to Lilliput\Annual Monitoring Report\Year 3\Revisions
Computer Name	KWILLIAMS
Description Worksheets in This Document	
Metadata	Description of database file, the report worksheets, and a summary of project and project data.
Proj Planted	Each project is listed with its PLANTED stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Proj Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc)
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
Project Summary	
Project Code	290
Project Name	UT Lilliput
Description	Stream and Wetland Restoration Project
River Basin	Cape Fear
Length (ft)	3238
Stream-to-Edge Width (ft)	
Area (sq m)	
Required Plots (calculated)	16

Table 9. Planted and total stem counts (species by plot with annual means)

CURRENT DATA MY3 (2012)																														MEANS	
			PLOT 1		PLOT 2		PLOT 3		PLOT 4		PLOT 5		PLOT 6		PLOT 7		PLOT 8		PLOT 9		PLOT 10		PLOT 11		PLOT 12		PLOT 13		PLOT 14		PLOT 15		MY3 (2012)	
Scientific Name	Common Name	Type	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T	P	T
Acer rubrum	red maple	tree																				5								1			0	6
Clethra alnifolia	sweet pepperbush	shrub																										5					0	5
Cyrilla racemiflora	titi	shrub																		5				10				20				10	0	45
Ilex glabra	gallberry	shrub												5										20		10		5		5		10	0	55
Lyonia lucida	lyonia	shrub												2								10											0	12
Magnolia virginiana	sweetbay	tree	5	5	2	2									4	4	3	3	1	1													15	15
Morella cerifera	wax myrtle	shrub																		10						2				15			0	27
Nyssa biflora	swamp tupelo	tree			1	1											1	1															2	2
Persea palustris	red bay	shrub																				10				5		10				1	0	26
Pinus palustris	longleaf pine	tree									4	4	5	5							12	12	9	9	7	7	4	4	9	9	9	9	59	59
Pinus serotina	pond pine	tree	5	5	7	7	6	6	2	2	6	6	12	17	6	6	7	7	3	3					9	9						10	63	78
Pinus taeda	loblolly pine	tree		10		5		10		10		10				5		5		5						20				5			0	85
Quercus sp.	oak sp.	tree					1	1	1	1					2	2	3	3															7	7
Quercus laurifolia	laurel oak	tree			1	1	2	2	1	1							1	1															5	5
Quercus lyrata	overcup oak	tree	2	2	2	2	3	3	6	6					2	2			5	5													20	20
Vaccinium	blueberry	shrub																		2				25									0	27
Type = Tree or Shrub	Plot Area (ac)		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025		0.025					
P = Planted Only	Species Count		3	4	5	6	4	5	4	5	2	3	2	4	4	5	5	6	3	7	1	4	1	4	2	6	1	5	1	5	1	5		
T = Total (planted and volunteers)	Stem Count		12	22	13	18	12	22	10	20	10	20	17	29	14	19	15	20	9	31	12	37	9	64	16	53	4	44	9	35	9	40	171	474
	Stems/Ac		485.28	889.68	525.72	727.92	485.28	889.68	404.4	808.8	404.4	808.8	687.48	1172.8	566.16	768.36	606.6	808.8	363.96	1253.6	485.28	1496.3	363.96	2588.2	647.04	2143.3	161.76	1779.4	363.96	1415.4	363.96	1617.6	**461.7**	**1279.8**

Site	Species	Planted	MY3 Total
Site 6	*Taxodium distichum*	40	34*

* Plot boundaries could not be located.

Fails to meet requirements

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Appendix D.
Stream Survey Data

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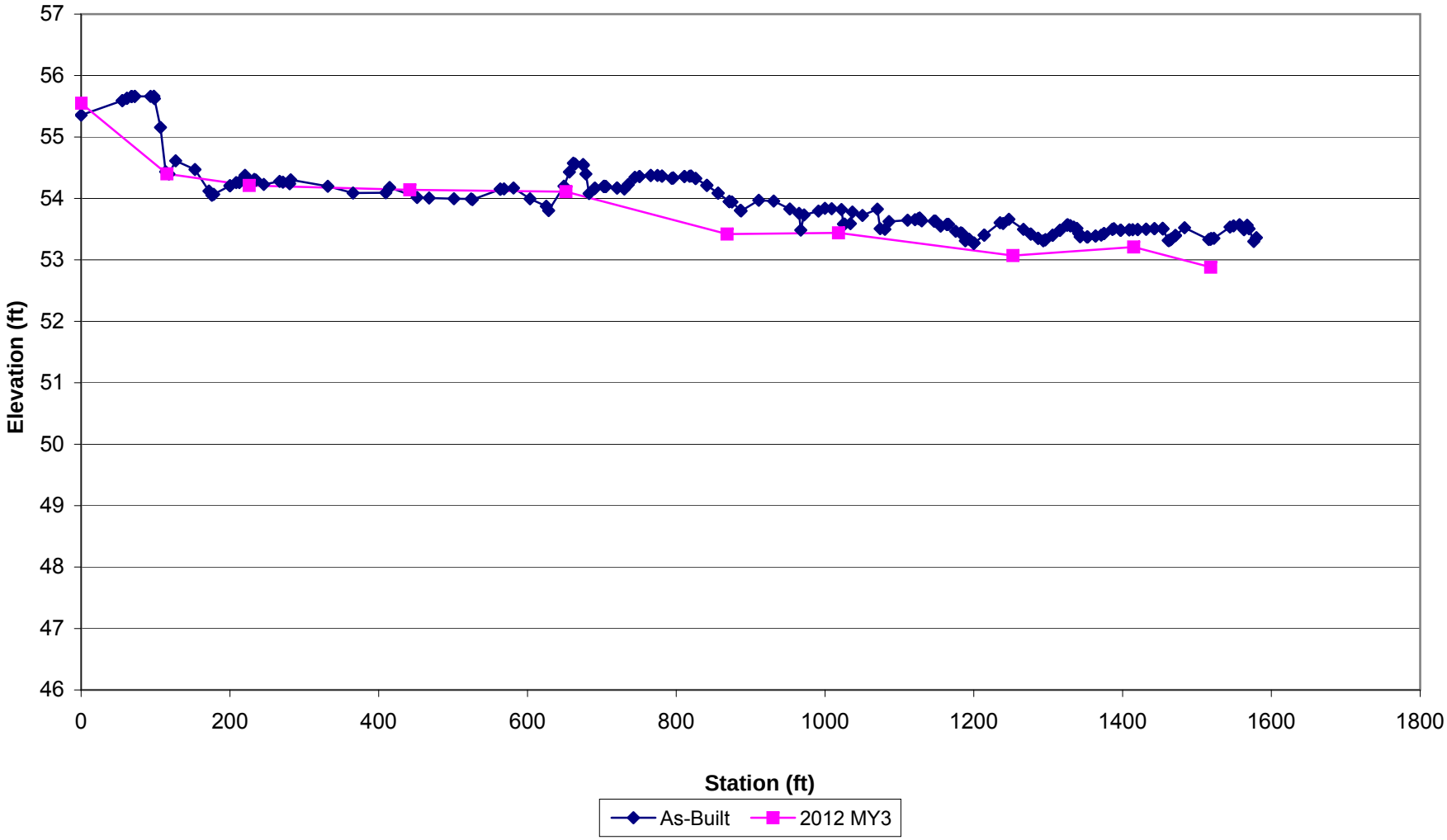
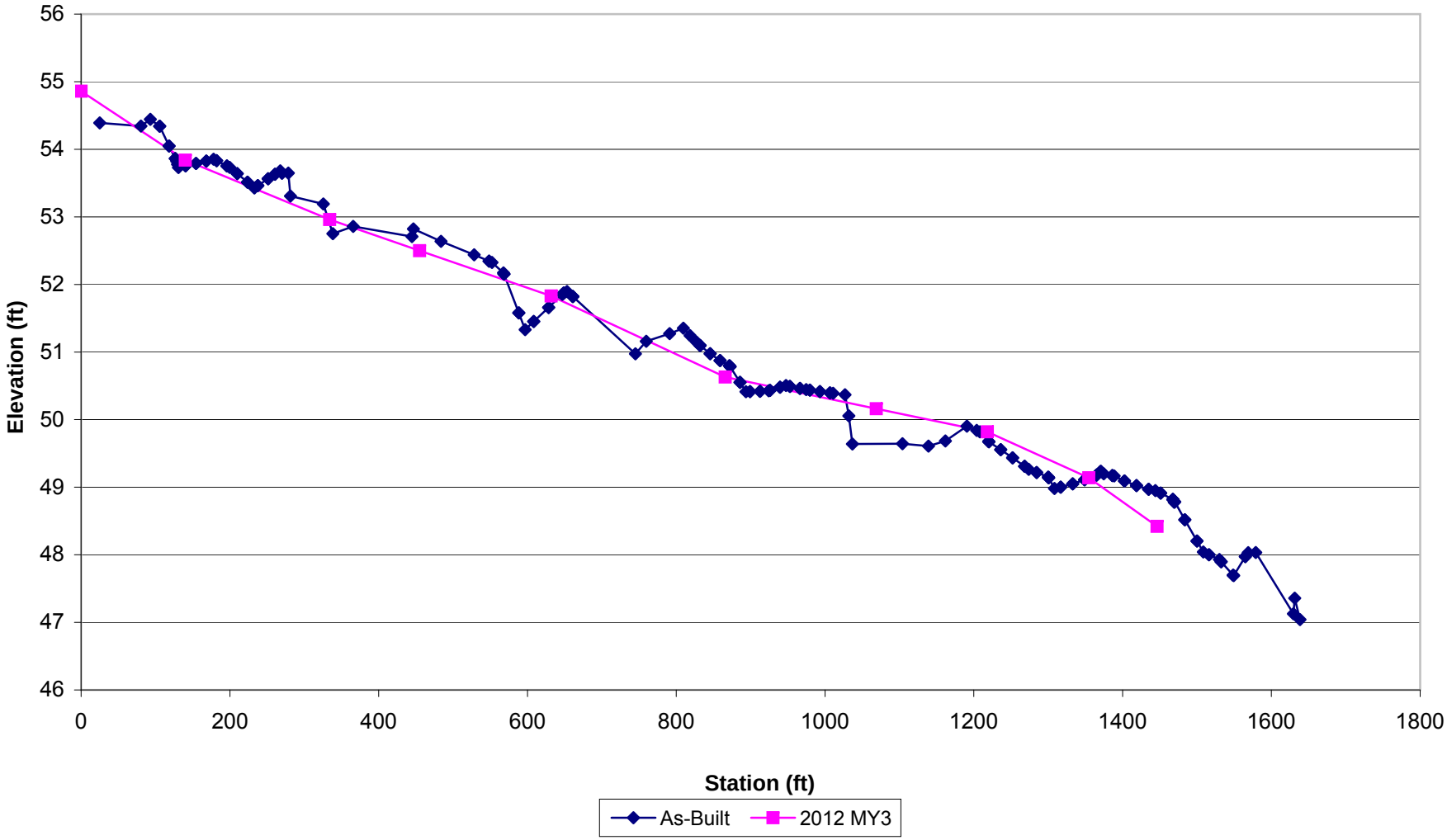
UT to Lilliput Stream and Wetland Restoration Project
Longitudinal Profile
Northern Tributary



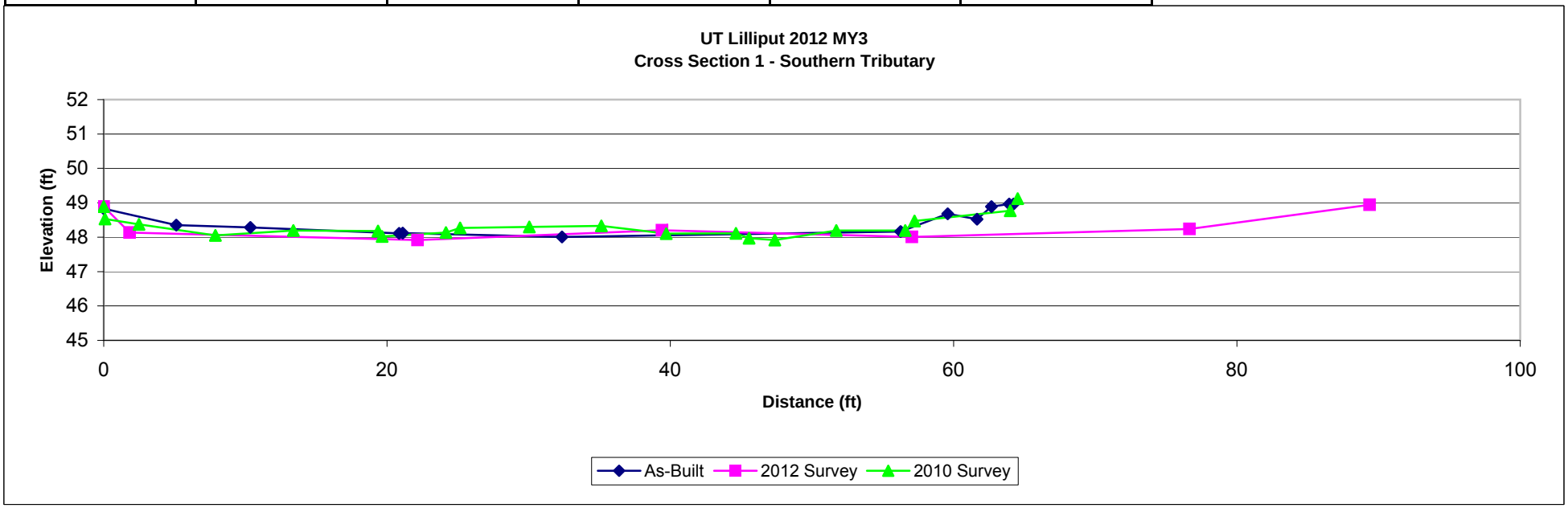
UT to Lilliput Stream and Wetland Restoration Project
Longitudinal Profile
Southern Tributary



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	1S
Drainage Area	66.94 ac
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	48.83		0	48.89		N/A			0	48.89							
5.13	48.35		0.09	48.53					1.83	48.13							
10.36	48.28		2.48	48.37					22.17	47.92							
20.86	48.11		7.88	48.05					39.42	48.2							
21.1	48.12		13.38	48.19					57.06	48.01							
32.36	48.01		19.37	48.18					76.66	48.24							
56.25	48.16		19.65	48.02					89.37	48.94							
59.59	48.68		24.16	48.13													
61.65	48.52		25.16	48.27													
62.67	48.89		30.04	48.3													
63.92	48.96		35.14	48.33													
64.23	48.96		39.71	48.1													
			44.64	48.11													
			45.56	47.97													
			47.38	47.92													
			51.71	48.19													
			56.59	48.19													
			57.23	48.47													
			64	48.77													
			64.52	49.12													

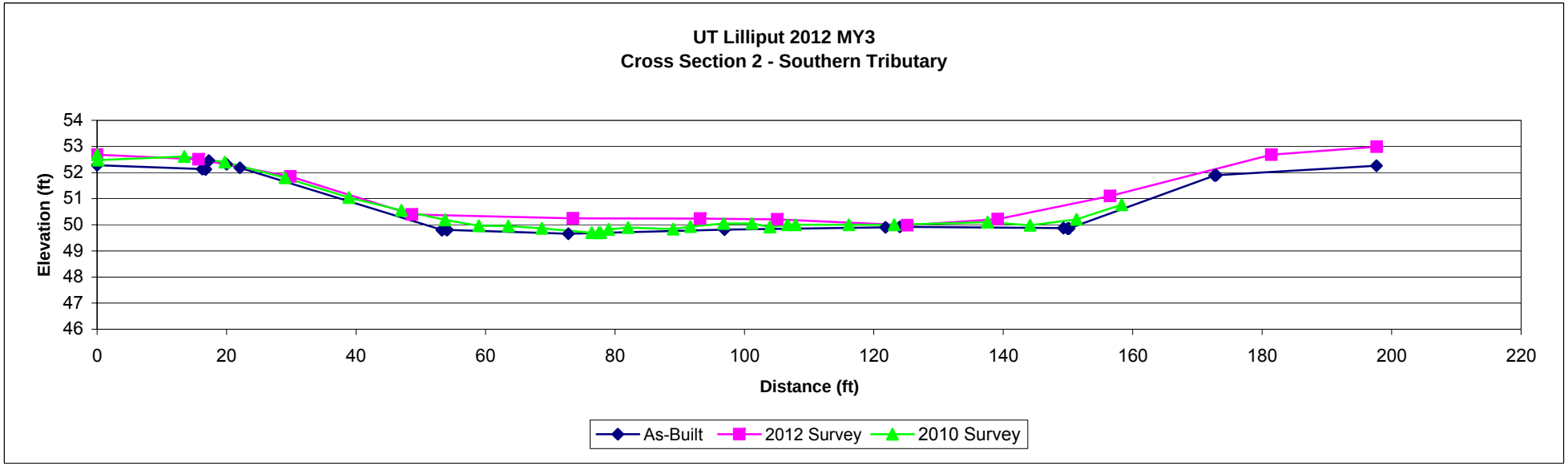
Southern Tributary Station 29+00 - SCX1
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	2S
Drainage Area	66.94 ac
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	52.28		0	52.68		N/A			0	52.68							
16.25	52.13		0.14	52.48					15.68	52.51							
16.73	52.13		13.46	52.61					29.88	51.85							
16.75	52.12		19.73	52.4					48.66	50.39							
16.75	52.12		29.04	51.8					73.52	50.25							
17.26	52.46		38.91	51.04					93.16	50.24							
20	52.32		47	50.55					105.09	50.21							
22.07	52.18		53.77	50.19					125.19	49.98							
53.26	49.8		58.97	49.96					139.15	50.22							
53.29	49.79		63.53	49.95					156.49	51.1							
53.99	49.8		68.72	49.86					181.4	52.68							
54.12	49.8		76.4	49.7					197.68	52.99							
72.82	49.66		77.52	49.7													
96.93	49.81		77.81	49.7													
121.79	49.9		79.02	49.82													
124.01	49.92		82.05	49.89													
149.28	49.87		88.99	49.83													
149.91	49.85		91.67	49.93													
150.07	49.85		96.79	50.05													
150.16	49.86		101.16	50.05													
172.65	51.89		103.95	49.91													
172.69	51.9		106.66	50													
172.91	51.9		107.92	50													
197.64	52.26		116.14	50													
			123.16	50													
			137.55	50.1													
			144.13	49.98													
			151.32	50.21													
			158.29	50.77													

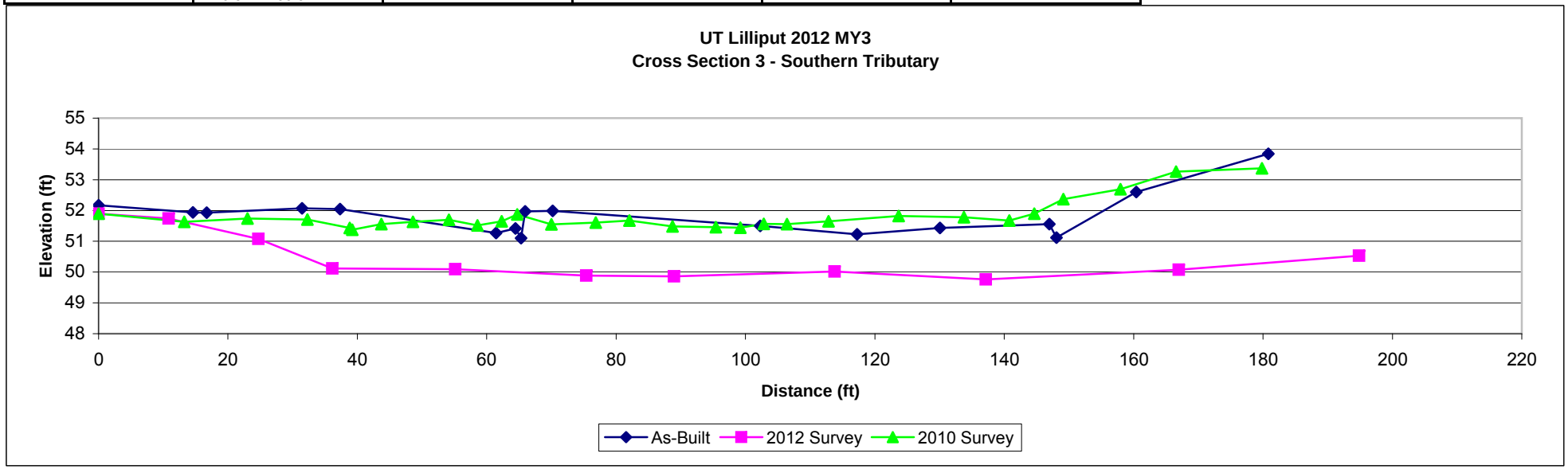
Southern Tributary Station 23+00 - SCX2
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	3S
Drainage Area	66.94 ac
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	52.17		0	51.9		N/A			0	51.9							
14.6	51.94		13.24	51.63					10.83	51.74							
16.72	51.93		23.01	51.74					24.7	51.08							
31.45	52.07		32.28	51.71					36.15	50.12							
37.34	52.05		38.82	51.43					55.14	50.09							
61.46	51.27		39.2	51.38					75.38	49.89							
64.43	51.42		43.69	51.56					88.97	49.86							
65.32	51.1		48.6	51.63					113.78	50.02							
65.95	51.97		54.17	51.7					137.16	49.76							
70.21	51.99		58.55	51.52					167	50.08							
102.27	51.5		62.3	51.65					194.84	50.53							
117.25	51.23		64.72	51.87													
130.06	51.43		70.01	51.55													
146.95	51.56		76.86	51.61													
148.06	51.12		82.04	51.67													
160.4	52.6		88.7	51.48													
180.84	53.84		95.41	51.46													
			99.19	51.44													
			102.84	51.57													
			106.43	51.56													
			112.85	51.65													
			123.66	51.82													
			133.77	51.78													
			140.78	51.67													
			144.63	51.9													
			149.13	52.37													
			157.97	52.69													
			166.56	53.26													
			179.84	53.37													

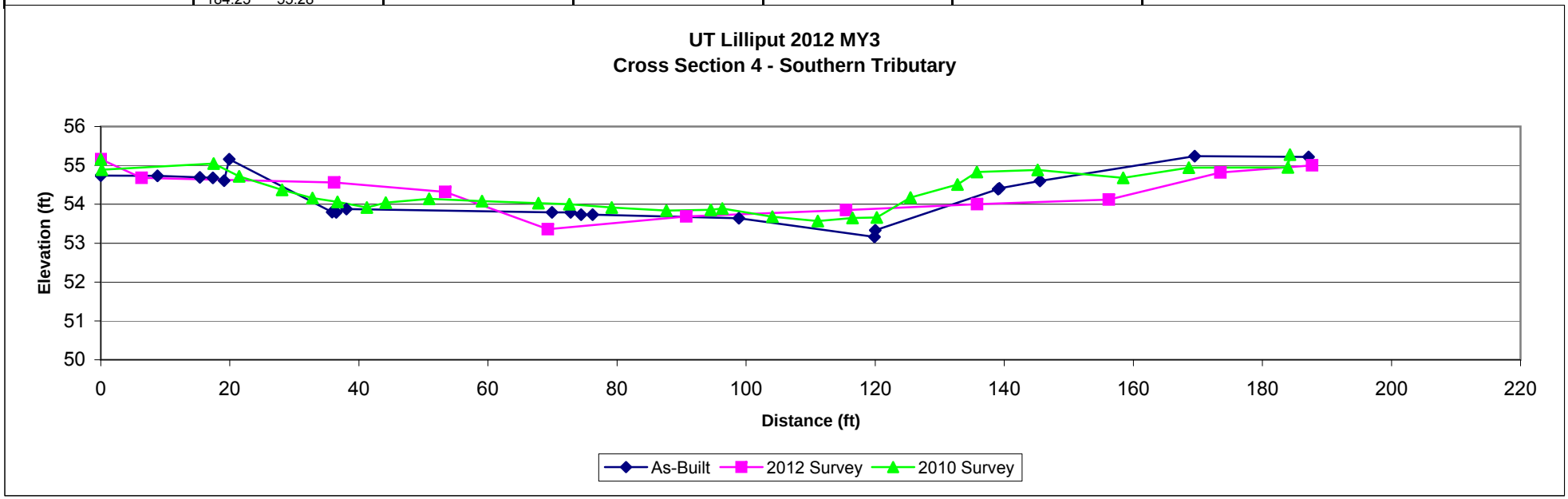
Southern Tributary Station 23+00 - SCX3
Looking upstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	4S
Drainage Area	66.94 ac
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	54.74		0	55.16		N/A			0	55.16							
8.78	54.73		0.15	54.89					6.33	54.68							
15.36	54.69		17.5	55.05					36.15	54.56							
17.37	54.68		21.43	54.72					53.37	54.32							
19.1	54.61		28.11	54.37					69.3	53.36							
19.91	55.16		32.8	54.16					90.73	53.69							
35.85	53.8		36.68	54.06					115.5	53.85							
36.47	53.79		41.24	53.92					135.78	54							
38.08	53.88		44.17	54.04					156.2	54.12							
69.9	53.79		50.87	54.14					173.52	54.82							
72.79	53.79		59.07	54.08					187.72	55							
74.41	53.73		67.83	54.03													
76.19	53.73		72.61	54													
98.88	53.64		79.17	53.92													
119.88	53.16		87.63	53.84													
120	53.33		94.53	53.86													
139.03	54.39		96.31	53.89													
139.26	54.41		104.06	53.68													
145.55	54.6		111.12	53.57													
169.51	55.24		116.5	53.65													
187.17	55.22		120.25	53.66													
			125.49	54.17													
			132.75	54.51													
			135.77	54.83													
			145.16	54.88													
			158.45	54.68													
			168.6	54.94													
			183.97	54.95													
			184.25	55.28													

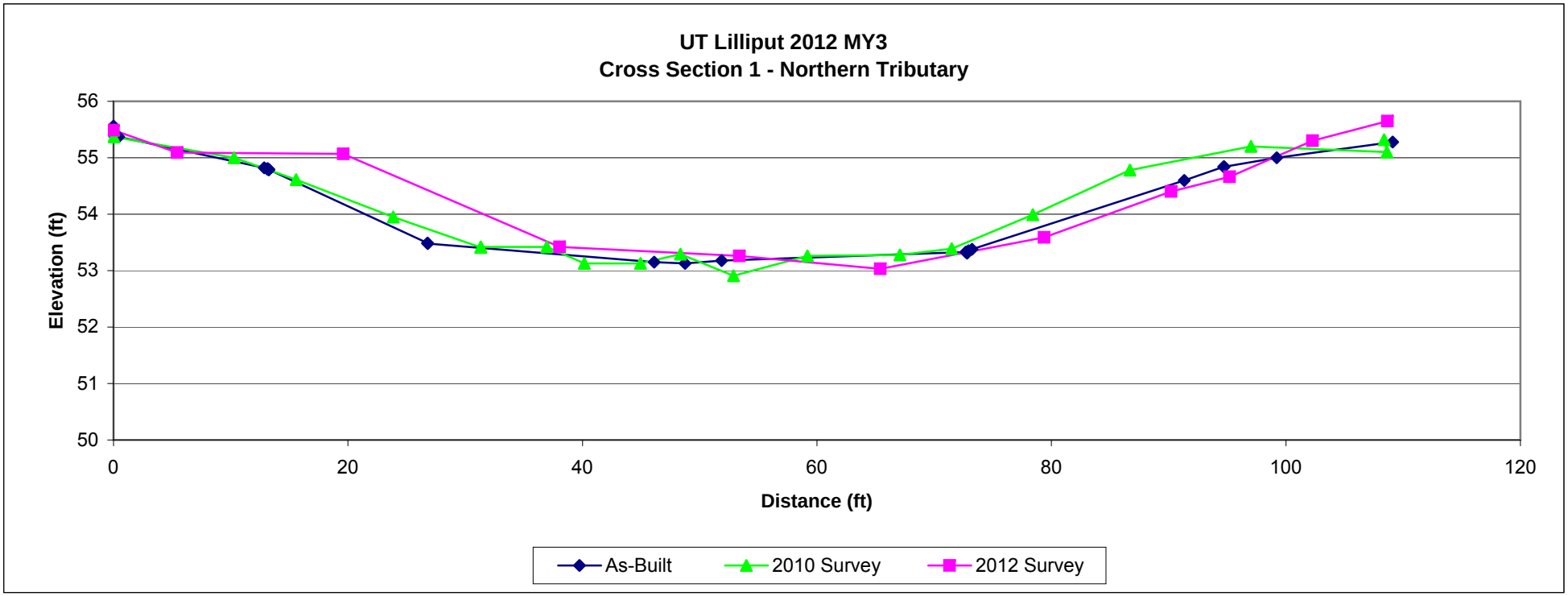
Southern Tributary Station 15+00 - SCX4
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	N1
Drainage Area	52.49
Date	2/28/2013
Crew	Paramounte

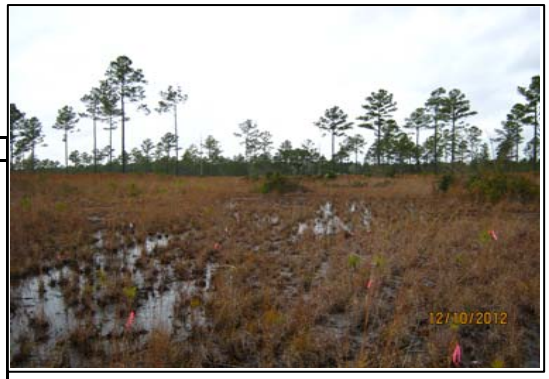
As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	55.56		0	55.49		N/A			0	55.49							
0.07	55.39		0.02	55.37					5.42	55.09							
0.44	55.37		10.28	55					19.6	55.07							
12.86	54.82		15.58	54.61					38.05	53.42							
13.11	54.8		23.87	53.95					53.38	53.26							
13.14	54.81		31.33	53.41					65.41	53.03							
13.23	54.79		31.33	53.42					79.37	53.59							
13.25	54.79		36.95	53.42					90.2	54.4							
13.25	54.79		40.17	53.13					95.19	54.66							
26.79	53.49		44.95	53.13					102.26	55.3							
26.8	53.48		48.35	53.29					108.67	55.65							
46.12	53.15		52.89	52.91													
48.76	53.13		59.18	53.26													
51.88	53.18		67.07	53.28													
72.69	53.33		71.5	53.39													
72.8	53.31		78.4	53.99													
72.91	53.35		86.69	54.78													
73.23	53.38		97.03	55.2													
91.32	54.6		108.62	55.1													
94.69	54.84		108.38	55.32													
94.73	54.84																
99.22	55																
109.11	55.28																

Northern Tributary Station 28+25 - NCX1
Looking upstream

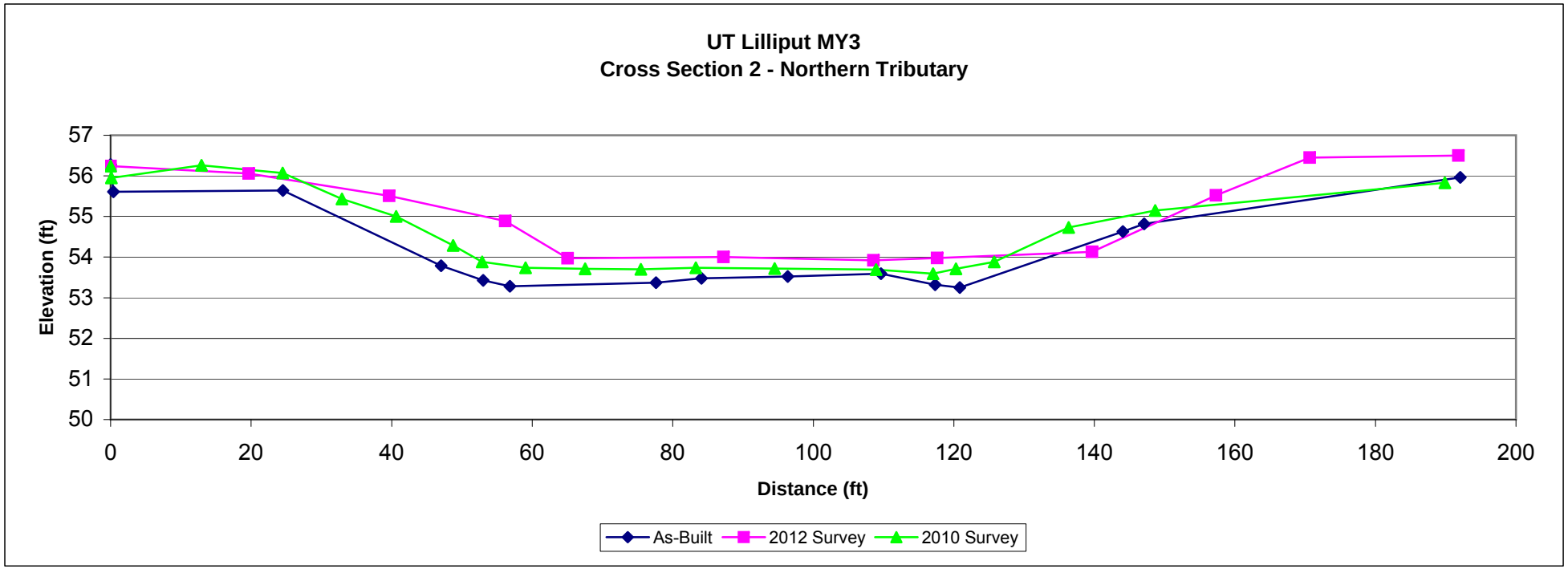


Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	N2
Drainage Area	52.49
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	56.28		0	56.24		N/A			0	56.24							
0.4	55.61		0.1	55.95					19.65	56.06							
24.51	55.64		12.95	56.26					39.64	55.51							
47.03	53.79		24.5	56.07					56.16	54.89							
53.04	53.43		32.94	55.43					65.04	53.97							
56.82	53.28		40.64	55					87.21	54							
77.6	53.37		48.75	54.29					108.58	53.92							
84.09	53.48		52.86	53.88					117.63	53.98							
96.35	53.52		59.07	53.74					139.66	54.13							
109.63	53.59		67.53	53.71					157.3	55.52							
117.34	53.32		75.47	53.7					170.66	56.45							
120.85	53.25		83.29	53.74					191.83	56.5							
144.04	54.63		94.51	53.72													
147.08	54.82		108.93	53.69													
192.06	55.96		117.04	53.59													
			120.29	53.71													
			125.76	53.88													
			136.35	54.73													
			148.67	55.15													
			189.88	55.83													



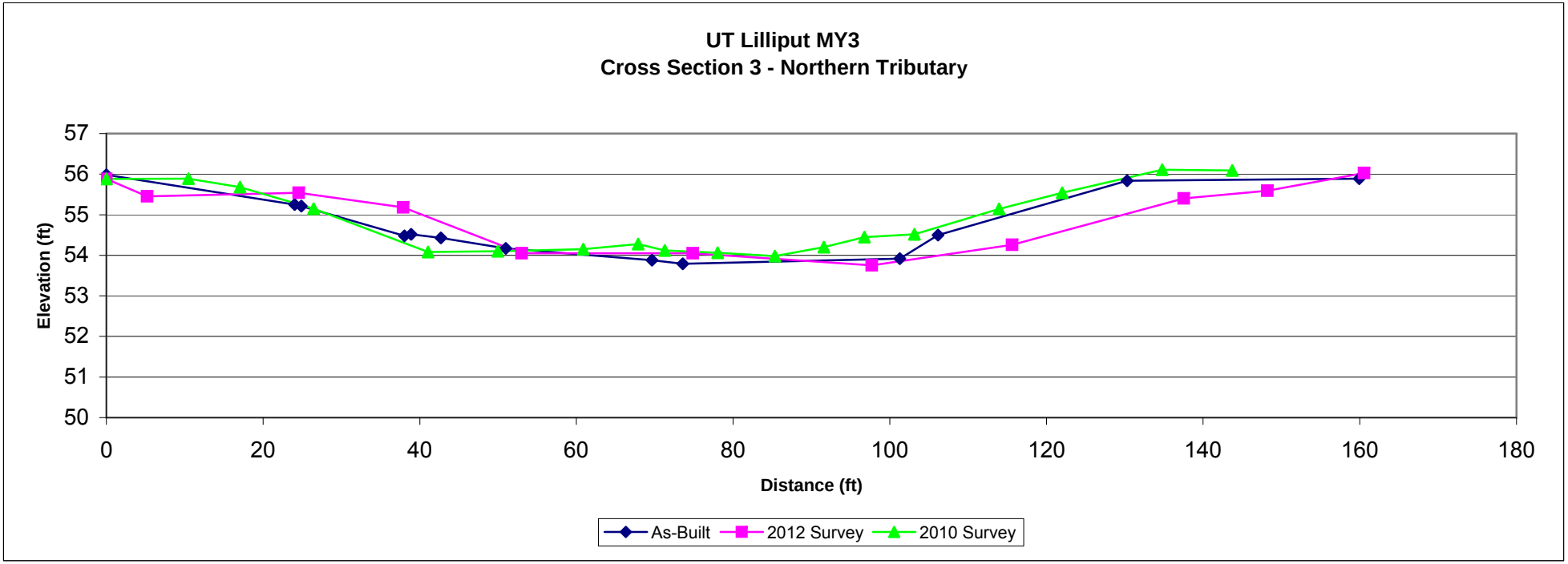
Northern Tributary Station 21+00 - NCX2
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	N3
Drainage Area	52.49
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	55.98		0	55.88		N/A			0	55.88							
24.05	55.25		10.48	55.89					5.22	55.45							
24.89	55.21		17.07	55.68					24.55	55.54							
38.04	54.48		26.47	55.15					37.87	55.18							
38.91	54.52		41.07	54.08					53	54.05							
42.7	54.43		49.96	54.1					74.84	54.05							
50.97	54.17		60.88	54.15					97.72	53.75							
69.64	53.88		67.88	54.28					115.63	54.26							
73.57	53.79		71.28	54.12					137.54	55.4							
101.27	53.92		78.04	54.06					148.2	55.59							
106.16	54.5		85.34	53.98					160.55	56.03							
130.28	55.84		91.58	54.2													
159.93	55.89		96.76	54.45													
			103.14	54.52													
			113.94	55.14													
			122.02	55.54													
			134.77	56.11													
			143.73	56.09													

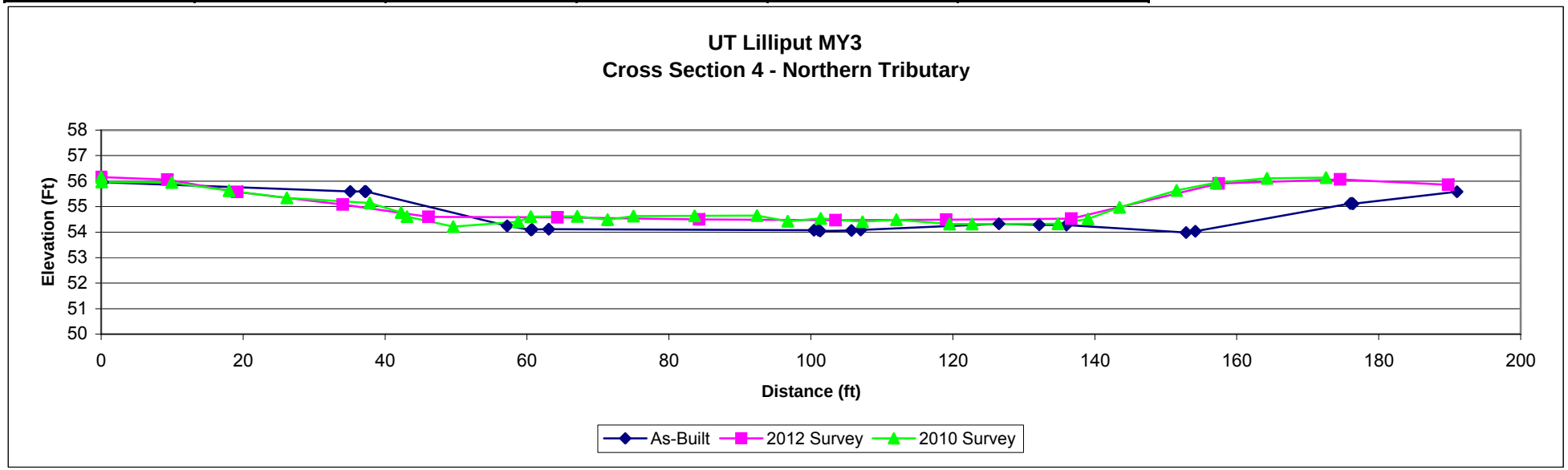
Northern Tributary Station 21+00 - NCX3
Looking upstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 3
Cross Section	N4
Drainage Area	52.49
Date	2/28/2013
Crew	Paramounte

As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	56.02		0	56.16		N/A			0	56.16							
0.18	55.96		0.09	55.97					9.34	56.06							
35.09	55.59		9.96	55.95					19.18	55.57							
37.17	55.59		18.02	55.63					34.04	55.08							
37.2	55.59		26.17	55.34					46.13	54.6							
37.3	55.59		37.86	55.14					64.29	54.58							
57.19	54.25		42.25	54.77					84.27	54.5							
60.55	54.09		43.1	54.61					103.46	54.47							
60.72	54.11		49.61	54.22					119.05	54.49							
63.06	54.12		58.74	54.41					136.67	54.53							
100.42	54.08		60.54	54.61					157.47	55.91							
101.05	54.08		67.09	54.62					174.57	56.07							
101.29	54.05		71.34	54.49					189.8	55.86							
105.71	54.07		75.01	54.63					199.27	56.13							
107.01	54.09		83.61	54.64													
126.47	54.33		92.39	54.65													
132.17	54.29		96.75	54.43													
136	54.28		101.36	54.54													
152.86	53.98		107.27	54.41													
154.15	54.04		112.06	54.49													
176.01	55.12		119.55	54.32													
176.22	55.13		122.71	54.32													
176.36	55.113		134.82	54.33													
191.03	55.58		139.05	54.52													
			143.49	54.97													
			151.53	55.64													
			157.04	55.94													
			164.26	56.11													
			172.58	56.14													

Northern Tributary Station 14+00 - NCX4
Looking downstream



Appendix E.
Hydrologic Data

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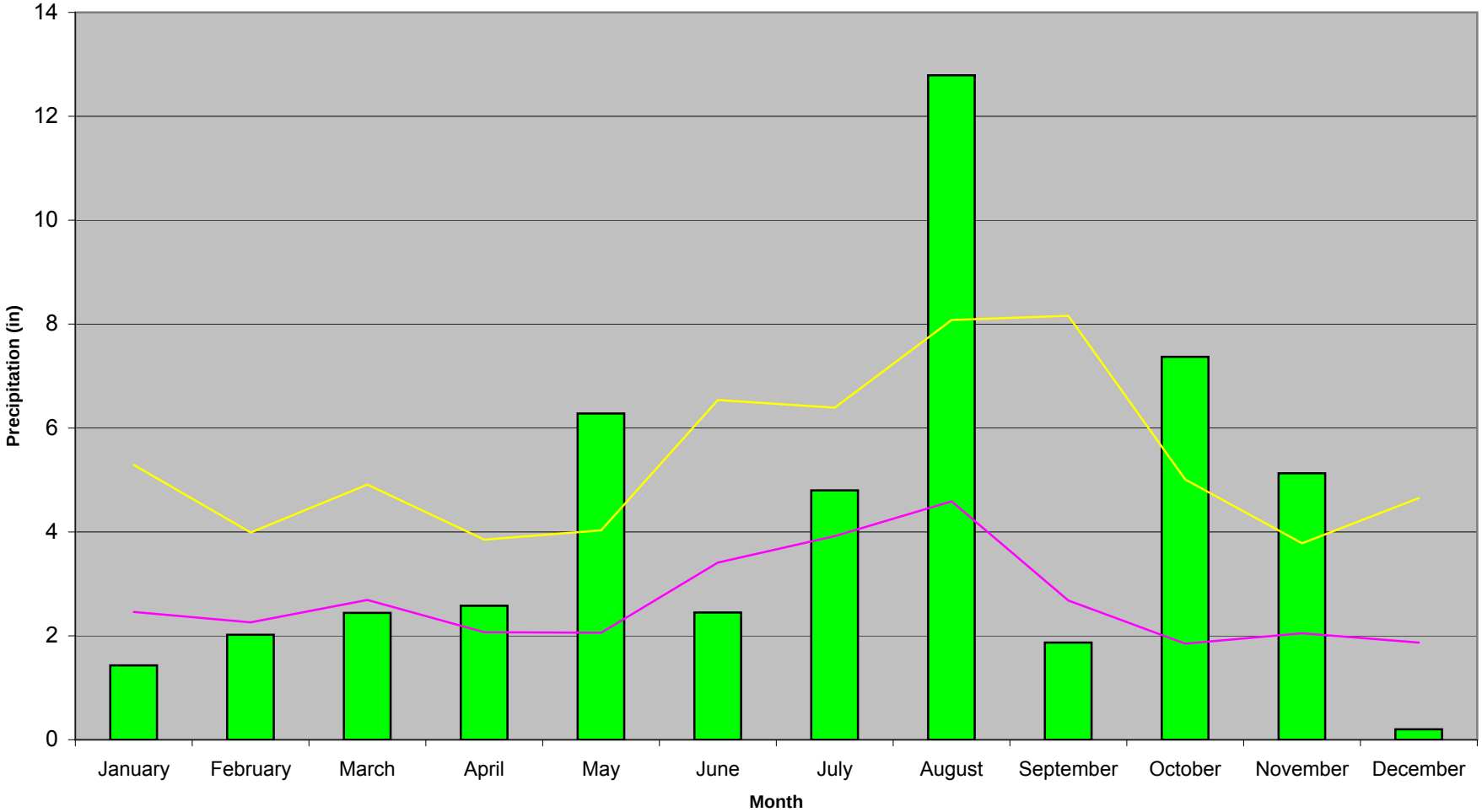
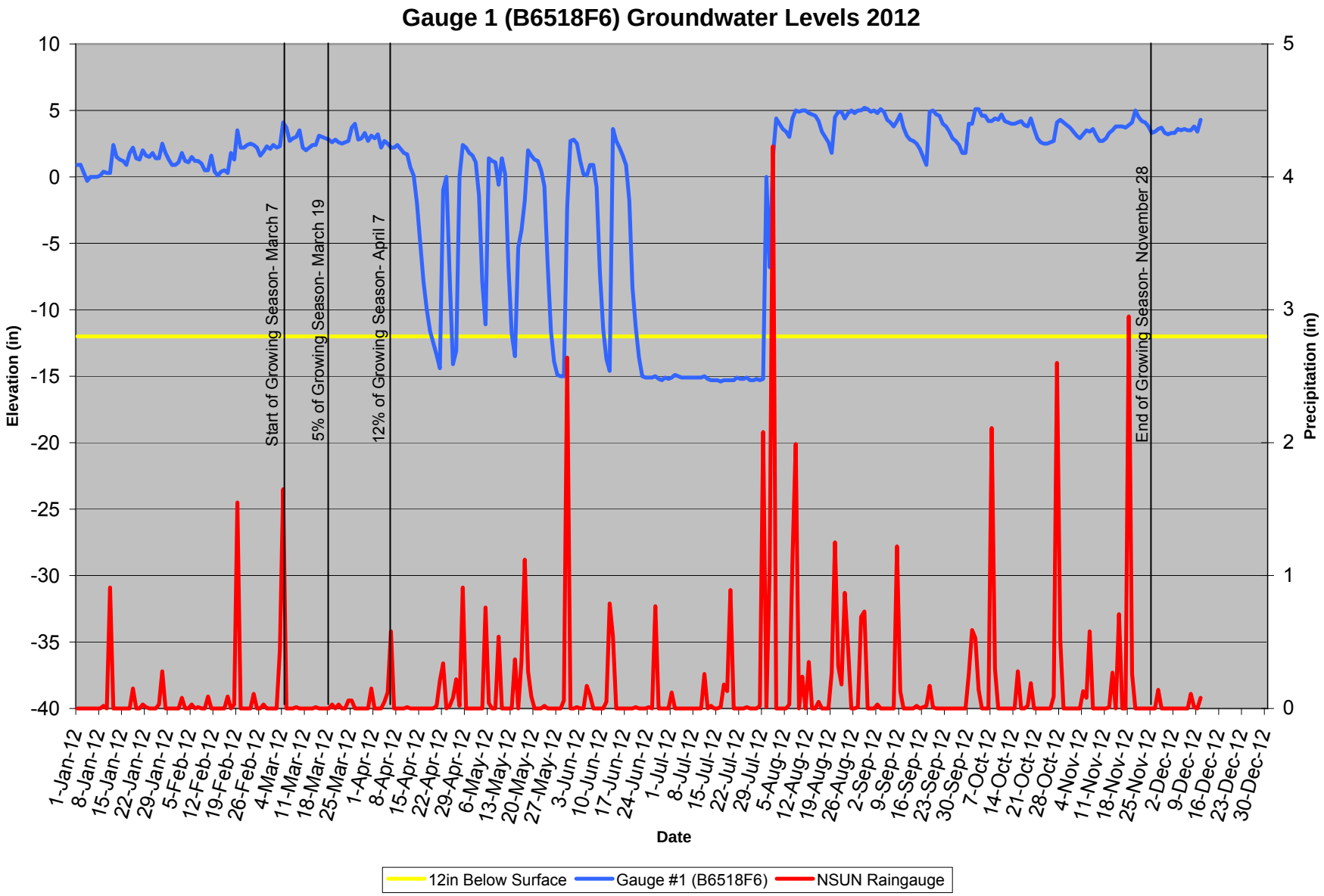
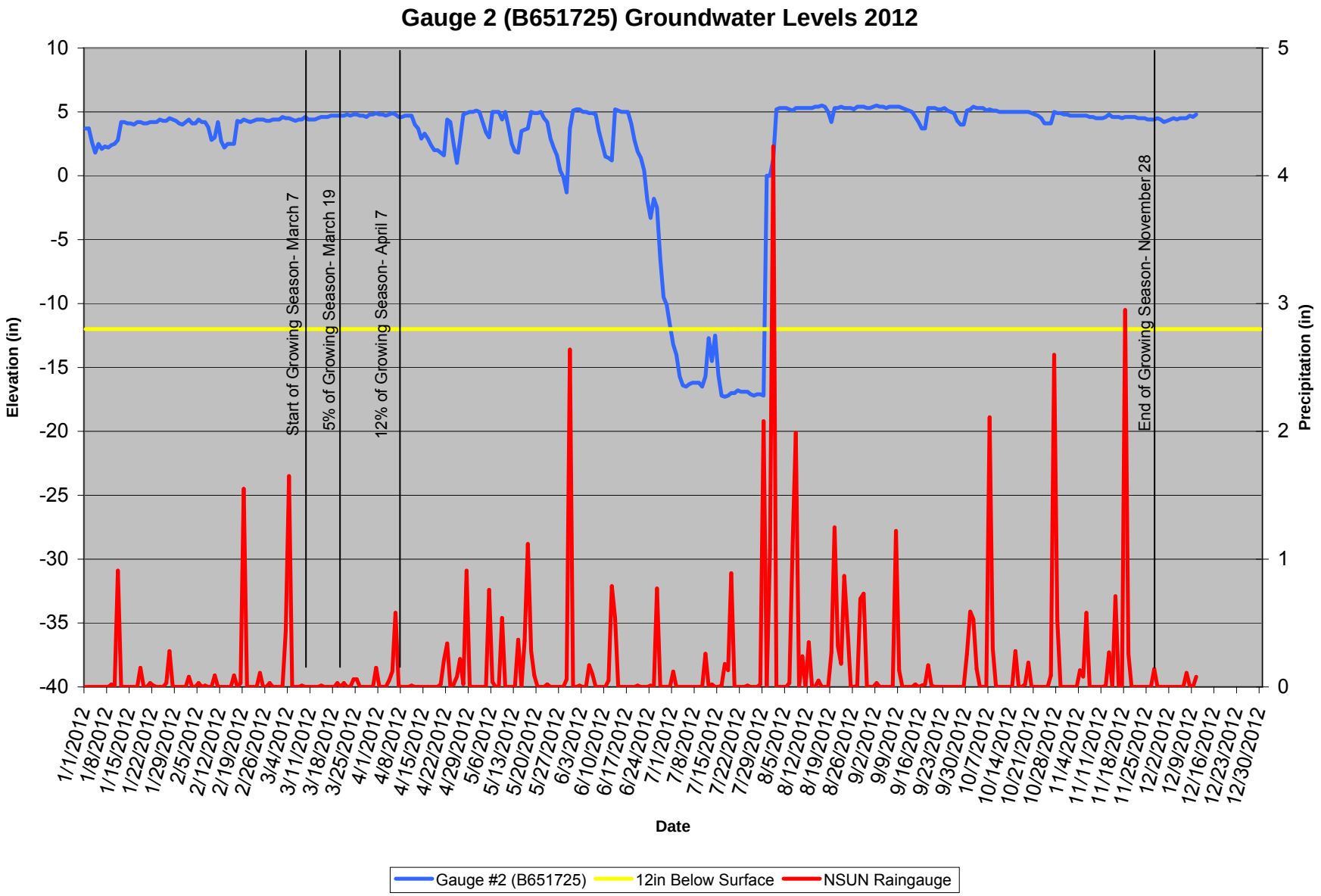
UT to Lilliput Stream and Wetland Restoration Project
30 & 70 Percentile Graph for Rainfall in 2012
Data up to December 10, 2012

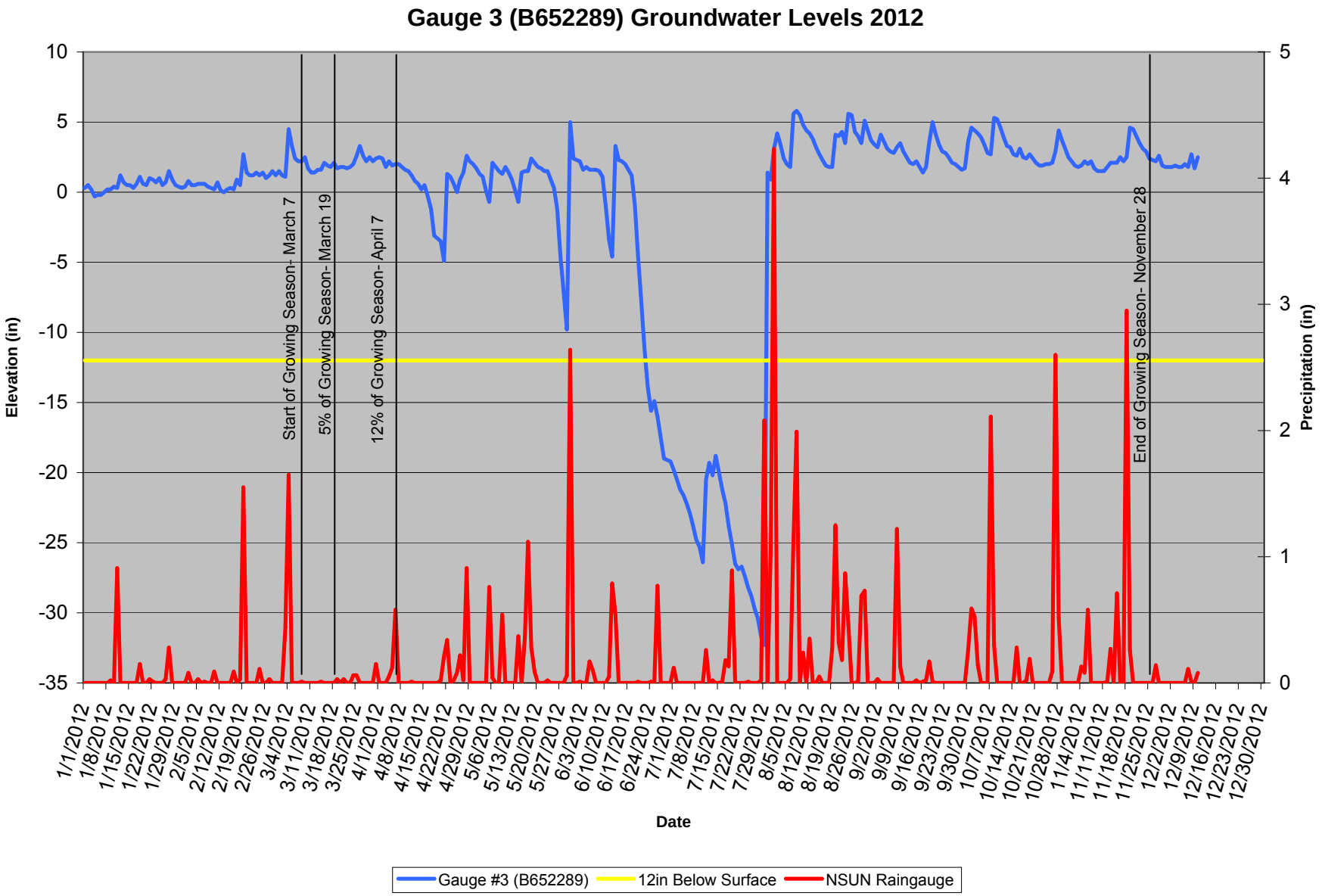


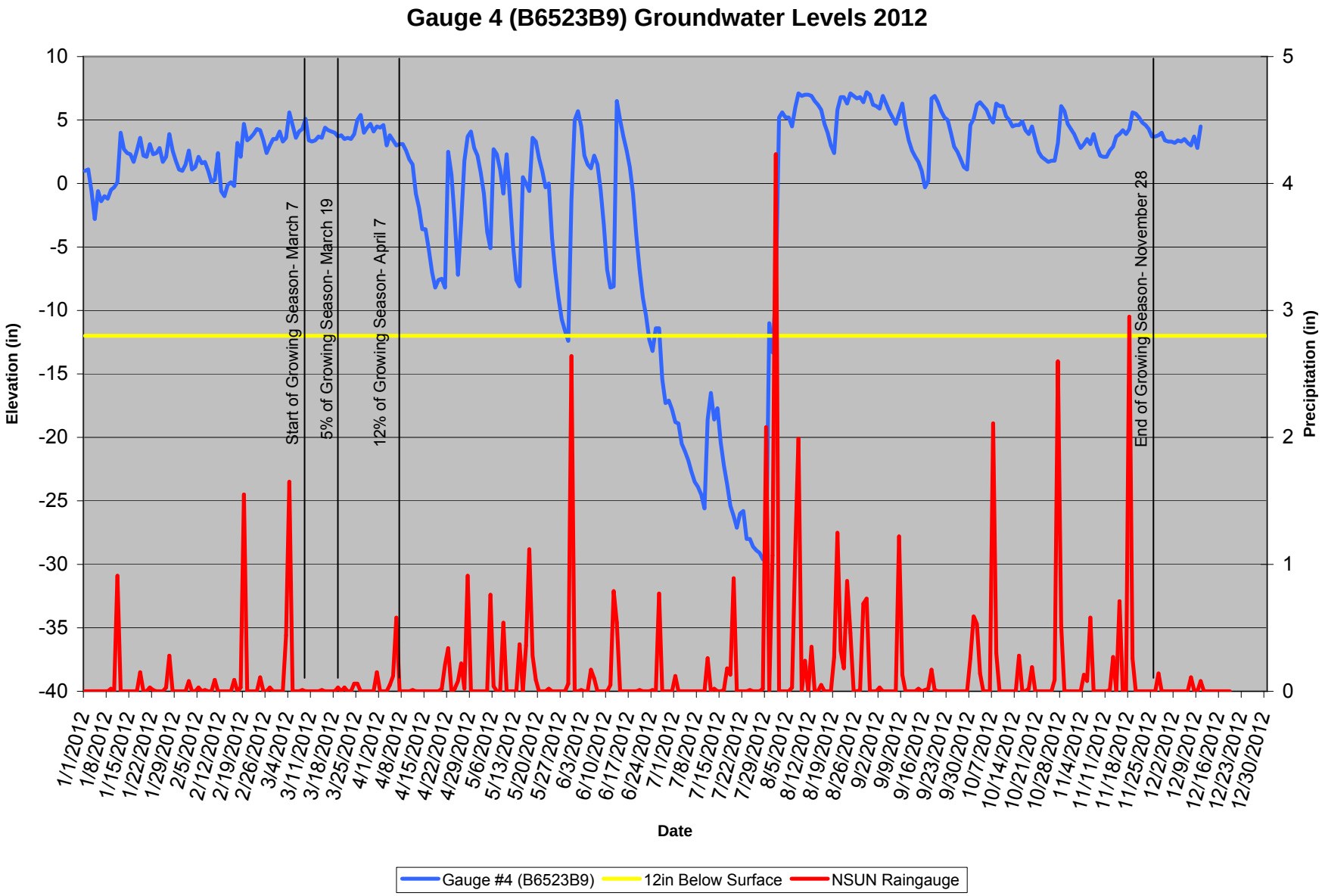
Precipitation data obtained from:
Military Ocean Terminal at Sunny Point - station NSUN (www.nc-climate.ncsu.edu)

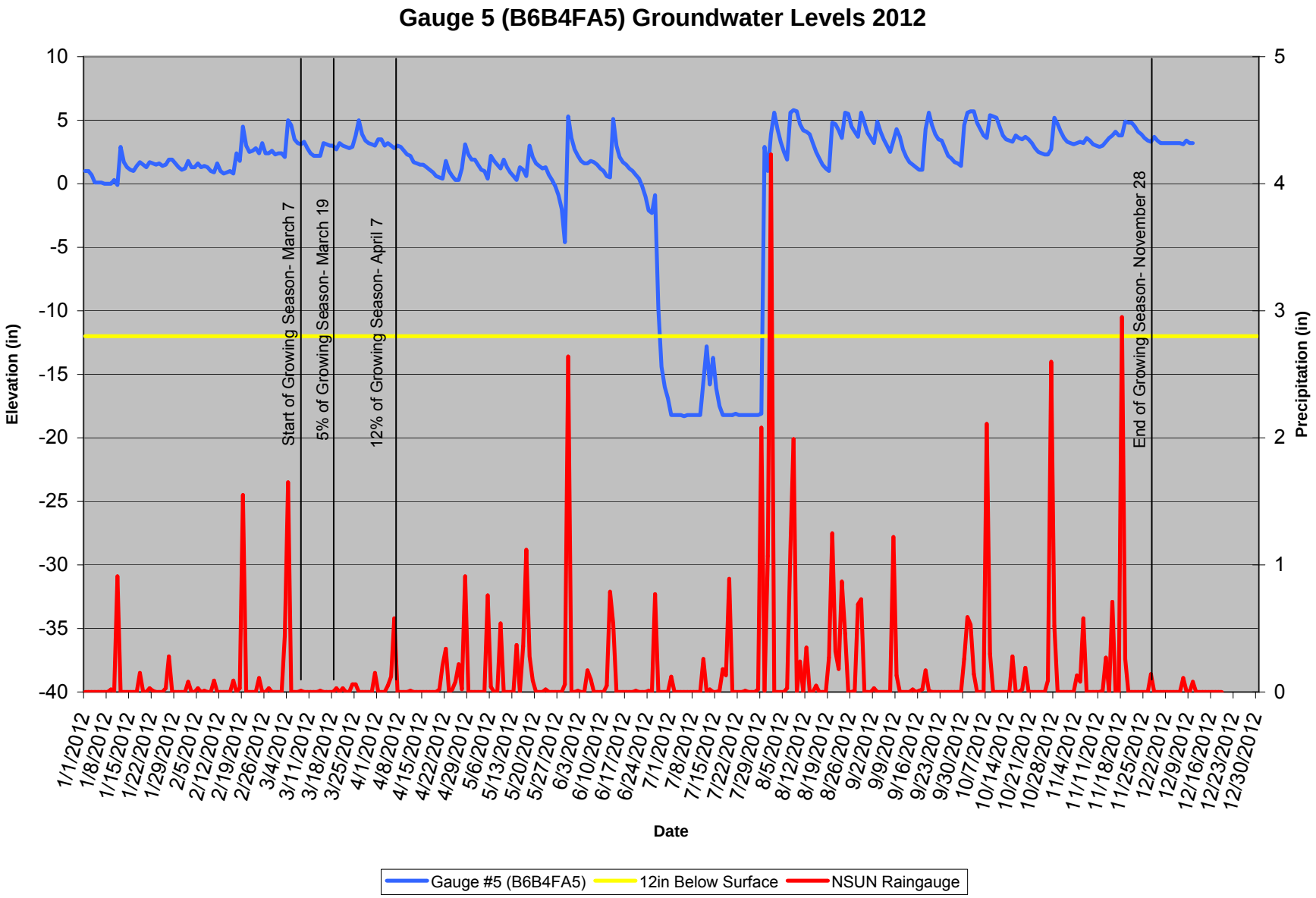
30% & 70% precipitation data obtained from Brunswick County - Longwood WETS Station NC5116 1978-2009 (wcc.nrcs.usda.gov)

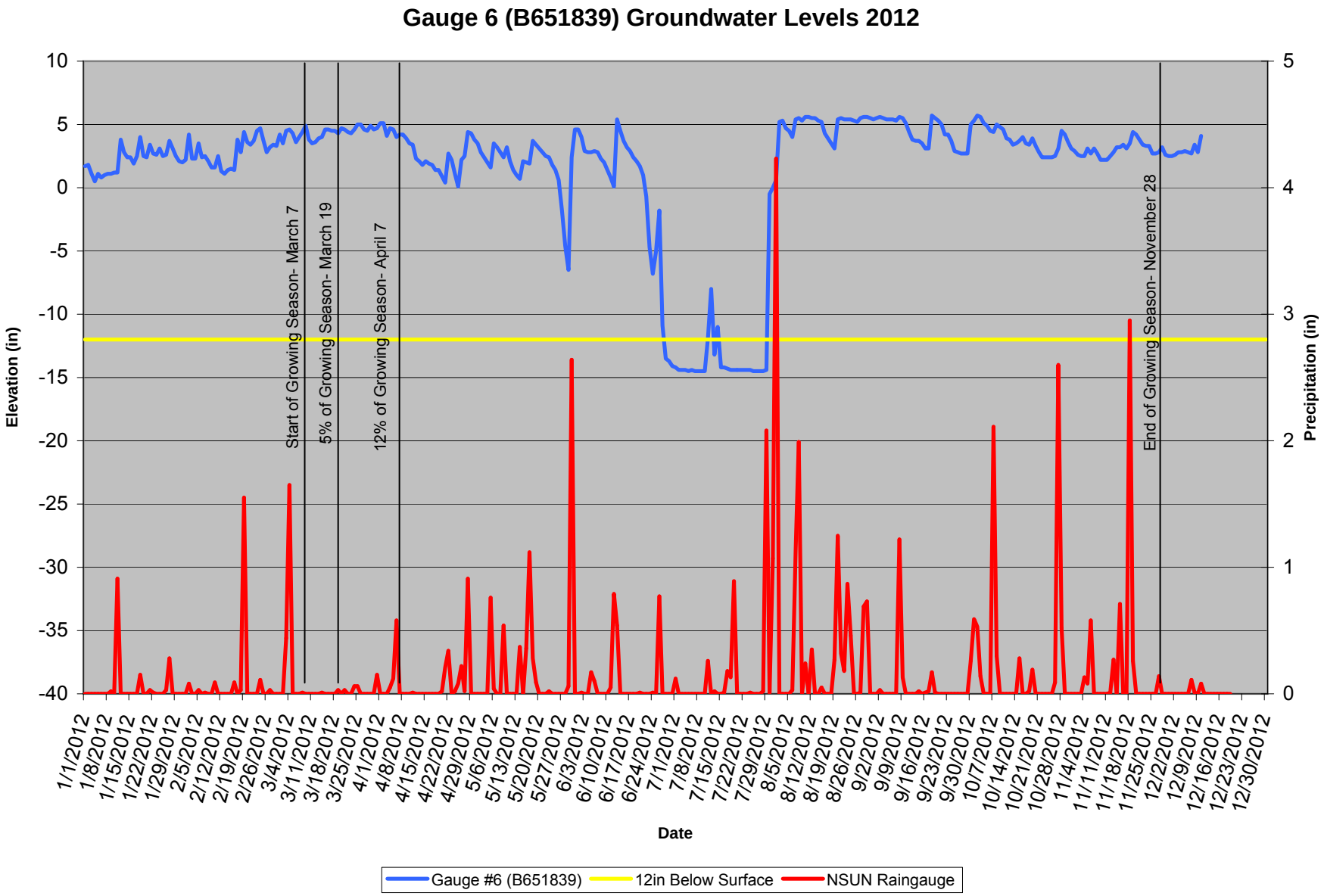

Gauge 1 (B6518F6) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
12in Below Surface
Gauge #1 (B6518F6)
NSUN Raingauge

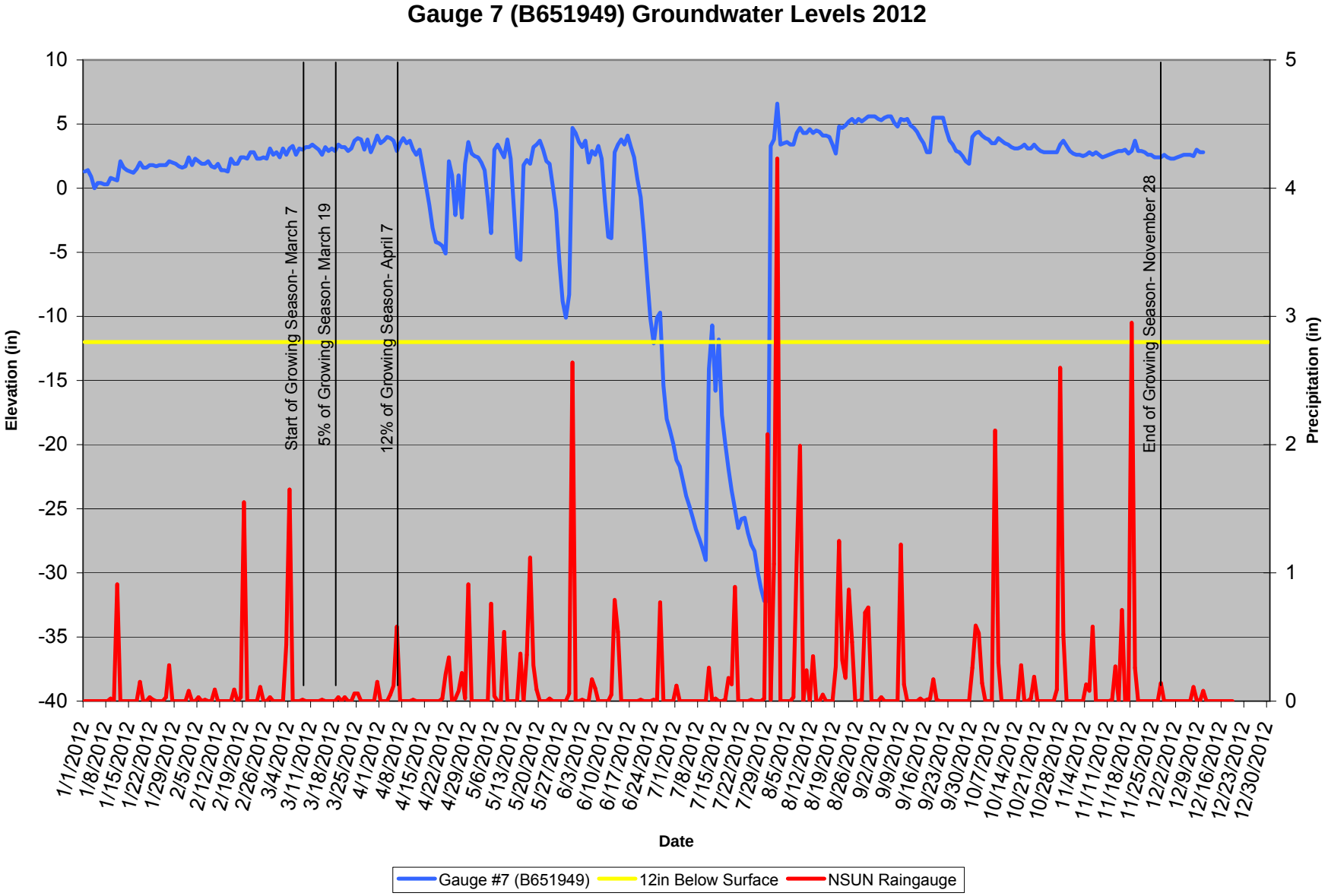

Gauge 2 (B651725) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #2 (B651725)
12in Below Surface
NSUN Raingauge

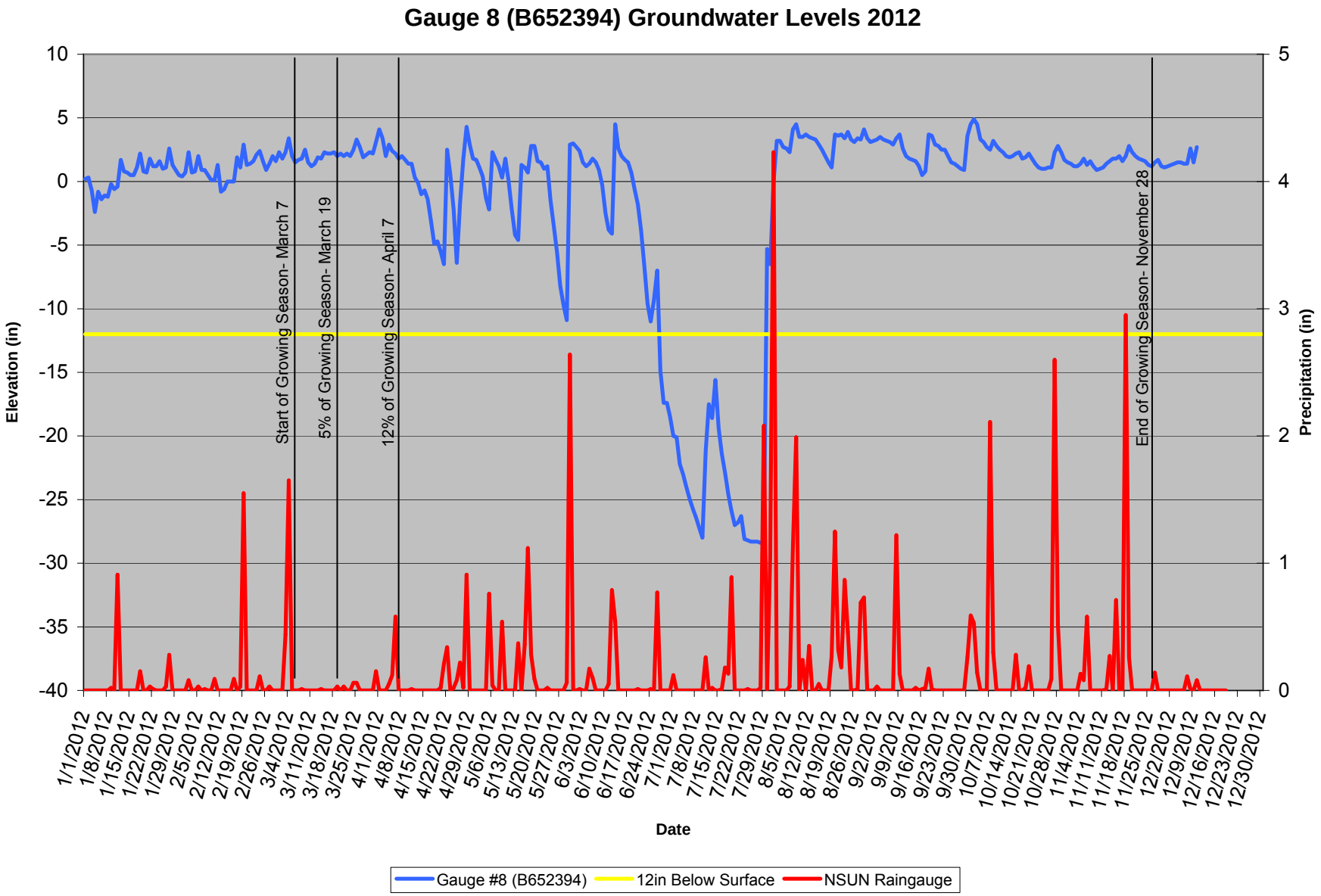

Gauge 3 (B652289) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #3 (B652289)
12in Below Surface
NSUN Raingauge

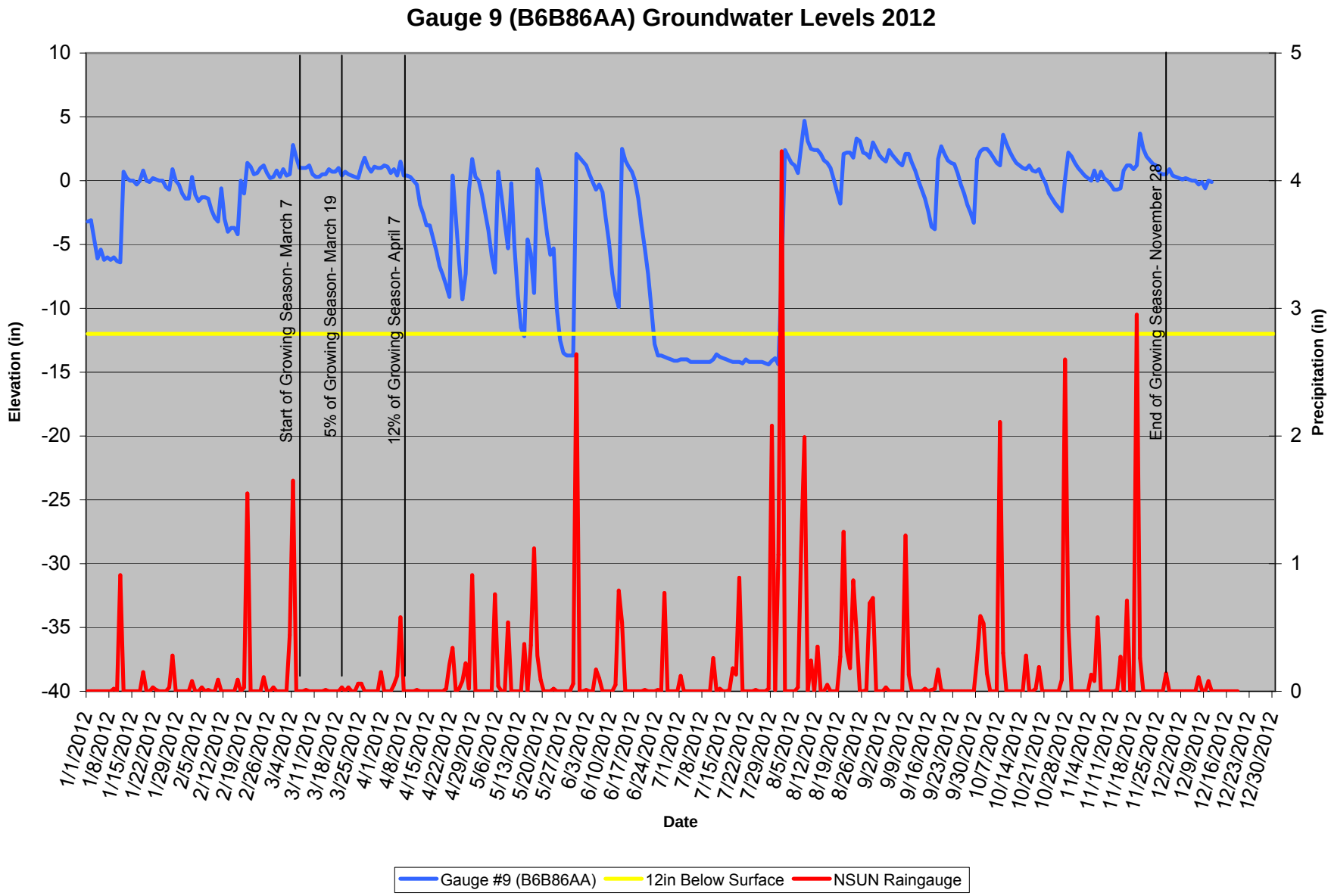

Gauge 4 (B6523B9) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #4 (B6523B9)
12in Below Surface
NSUN Raingauge

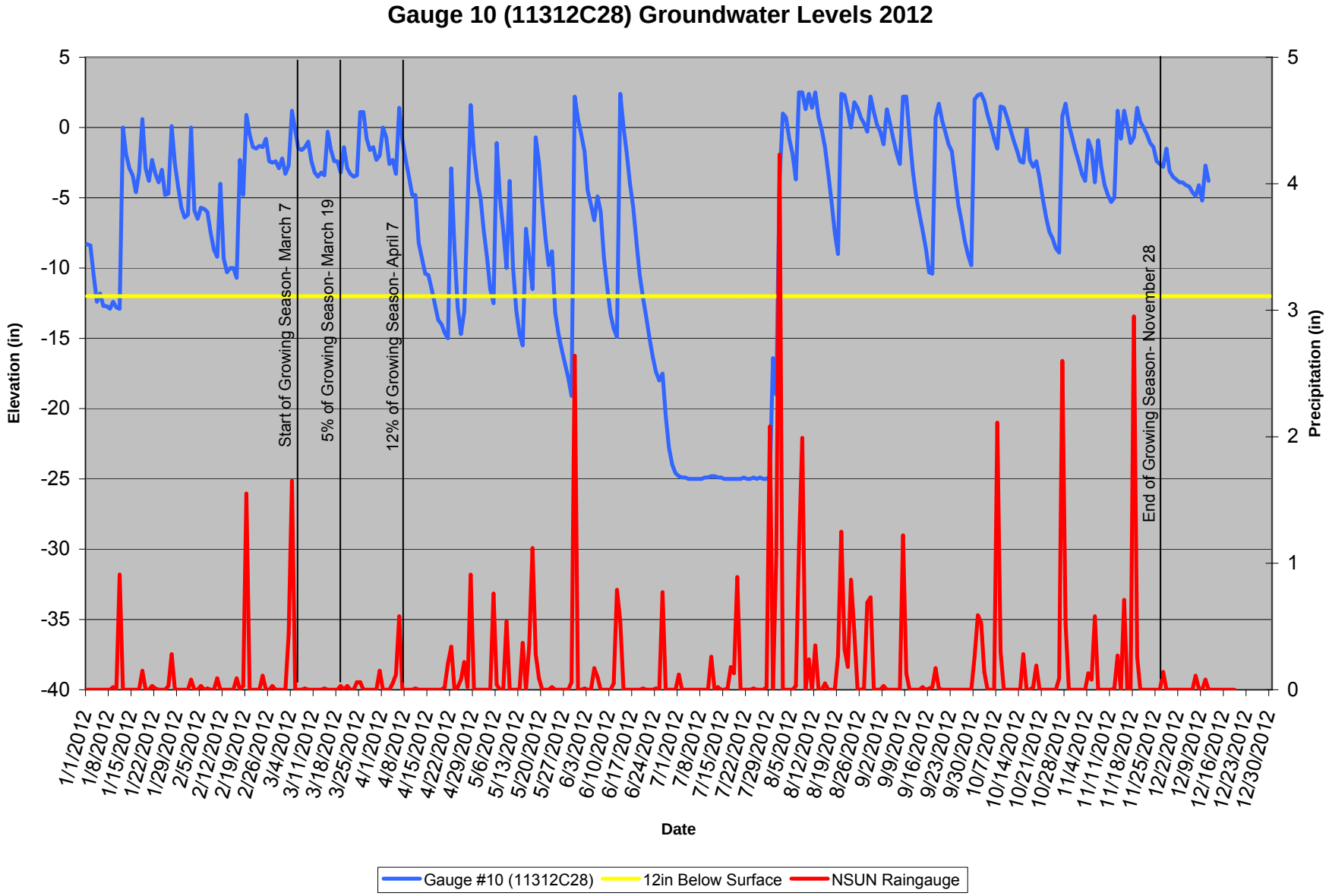

Gauge 5 (B6B4FA5) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #5 (B6B4FA5)
12in Below Surface
NSUN Raingauge

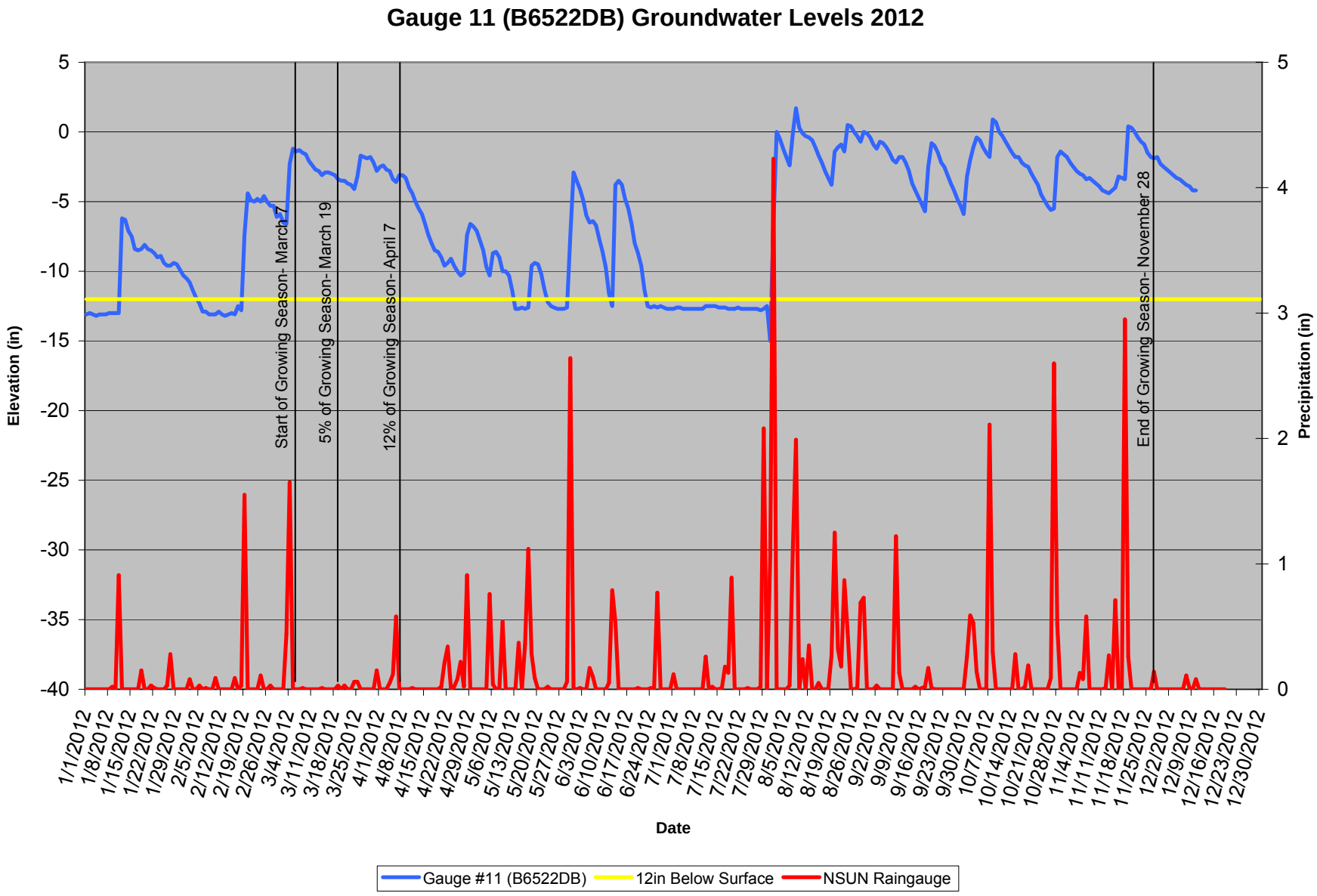

Gauge 6 (B651839) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #6 (B651839)
12in Below Surface
NSUN Raingauge

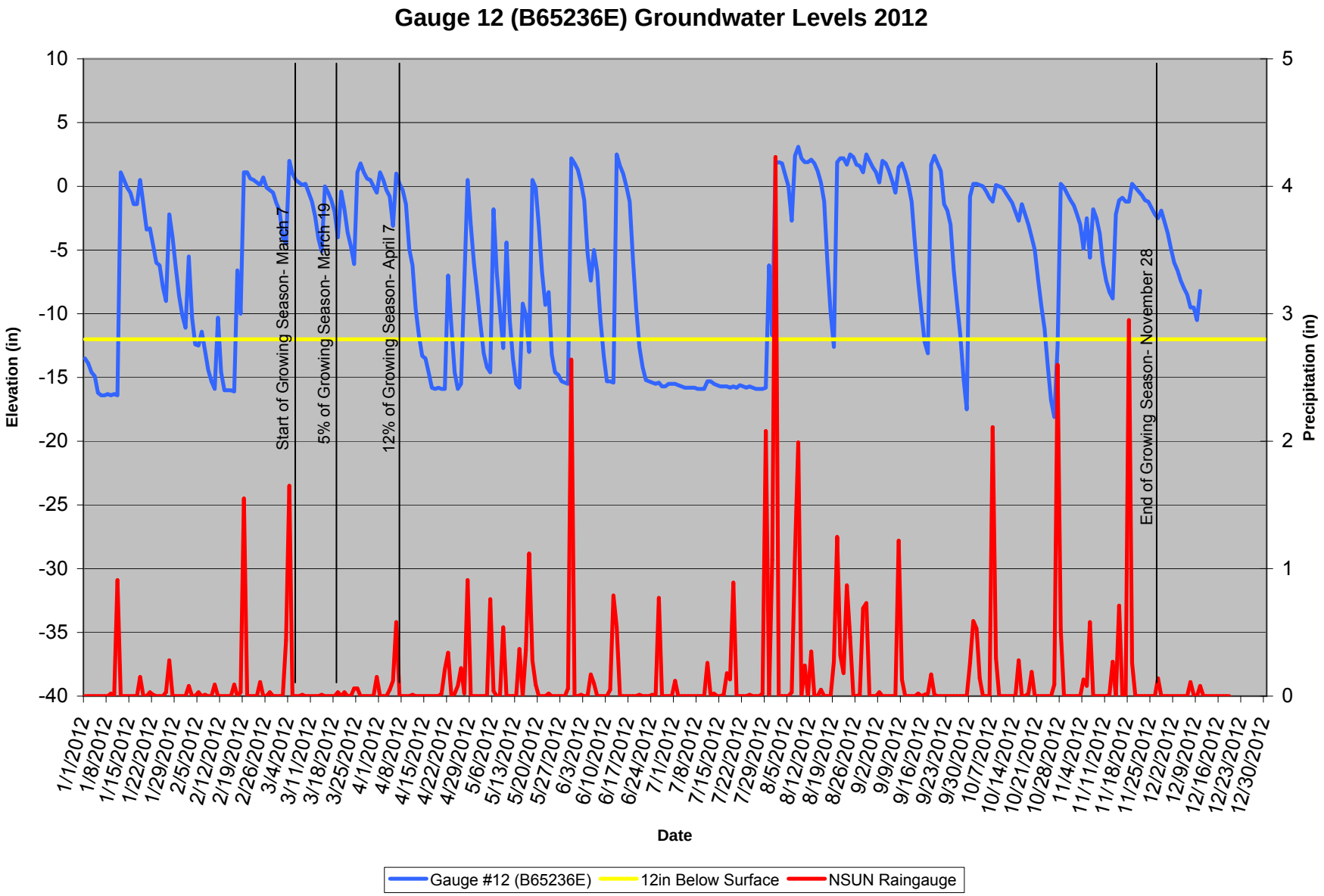

Gauge 7 (B651949) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #7 (B651949)
12in Below Surface
NSUN Raingauge

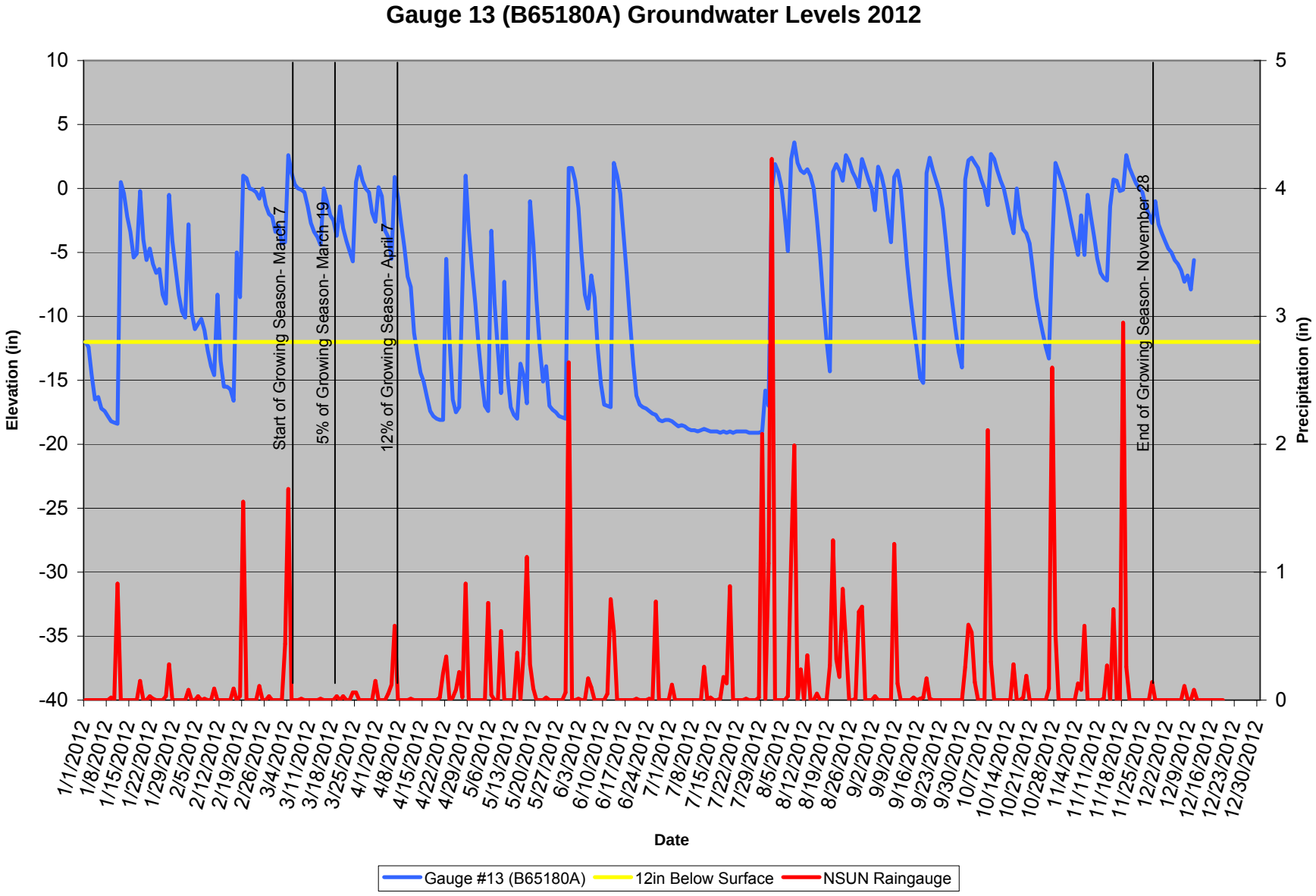

Gauge 8 (B652394) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #8 (B652394)
12in Below Surface
NSUN Raingauge

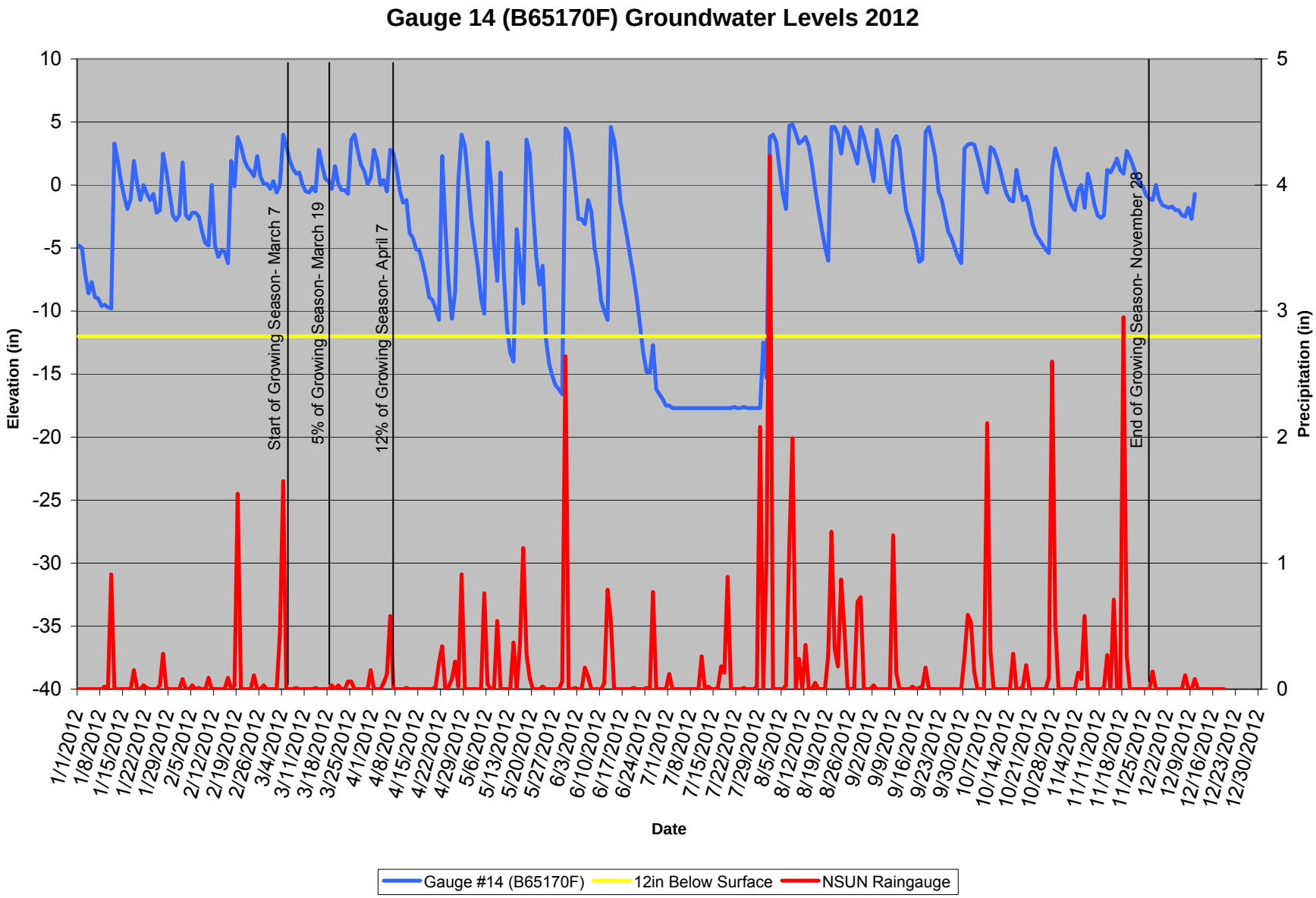

Gauge 9 (B6B86AA) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #9 (B6B86AA)
12in Below Surface
NSUN Raingauge

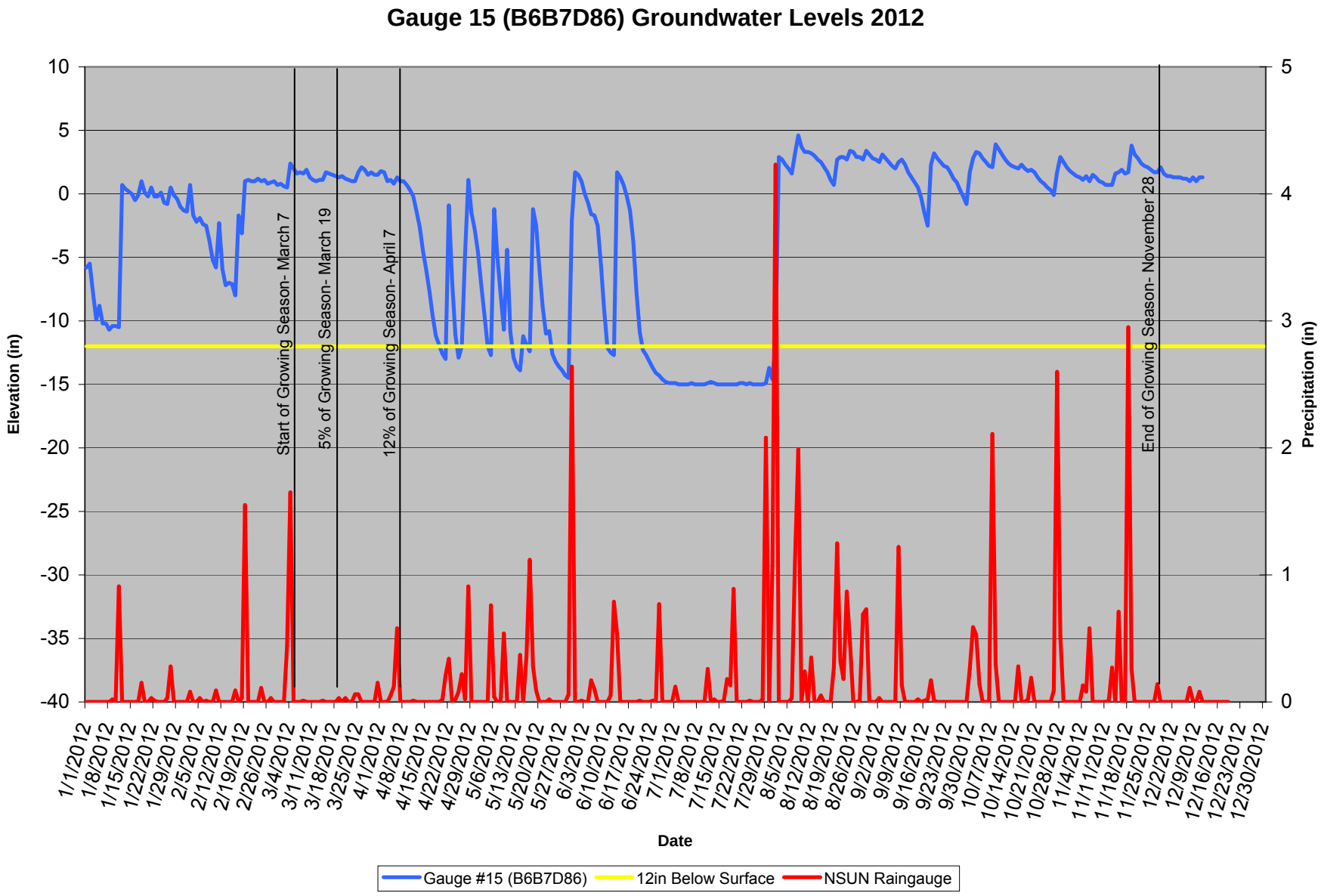

Gauge 10 (11312C28) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #10 (11312C28)
12in Below Surface
NSUN Raingauge

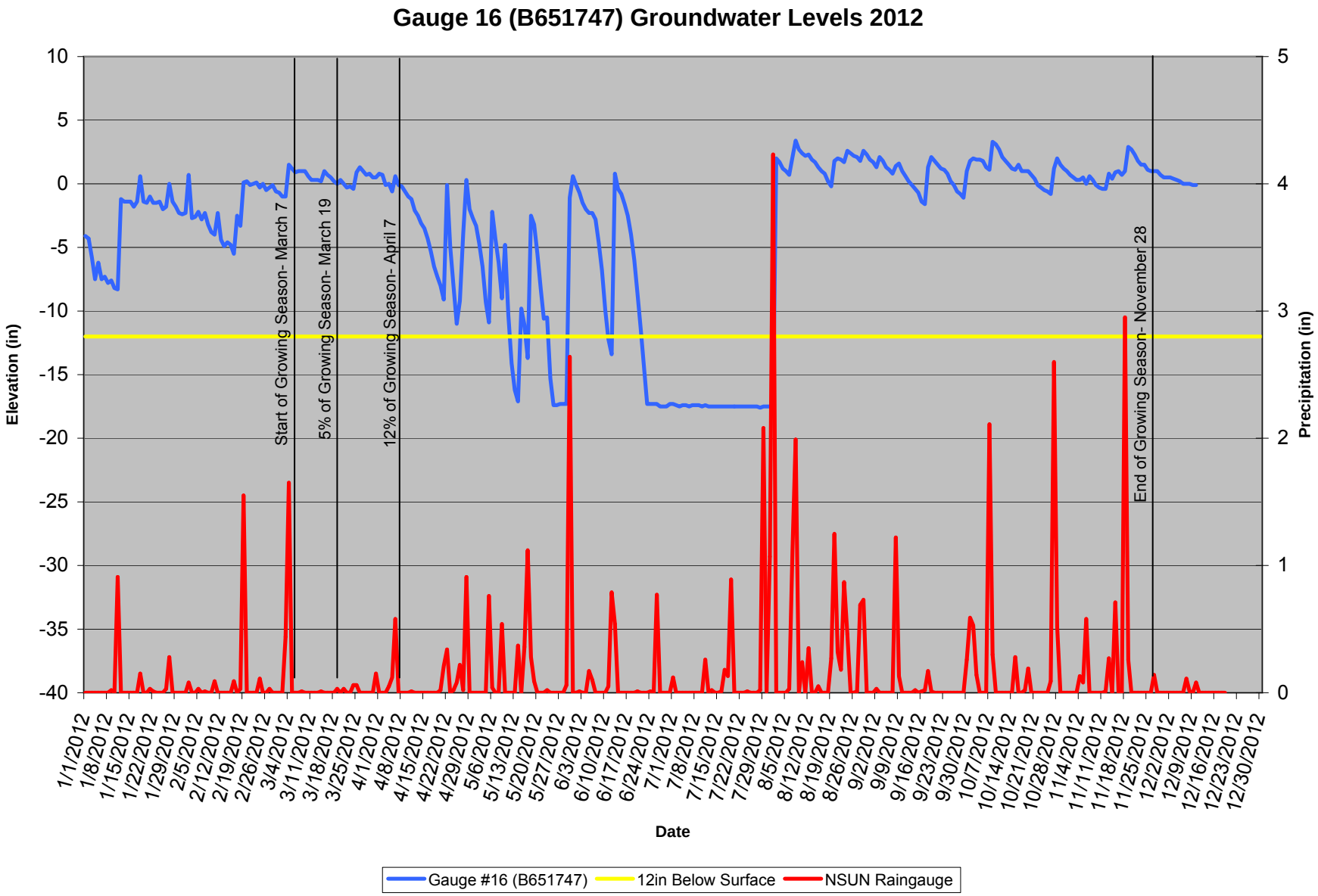

Gauge 11 (B6522DB) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #11 (B6522DB)
12in Below Surface
NSUN Raingauge

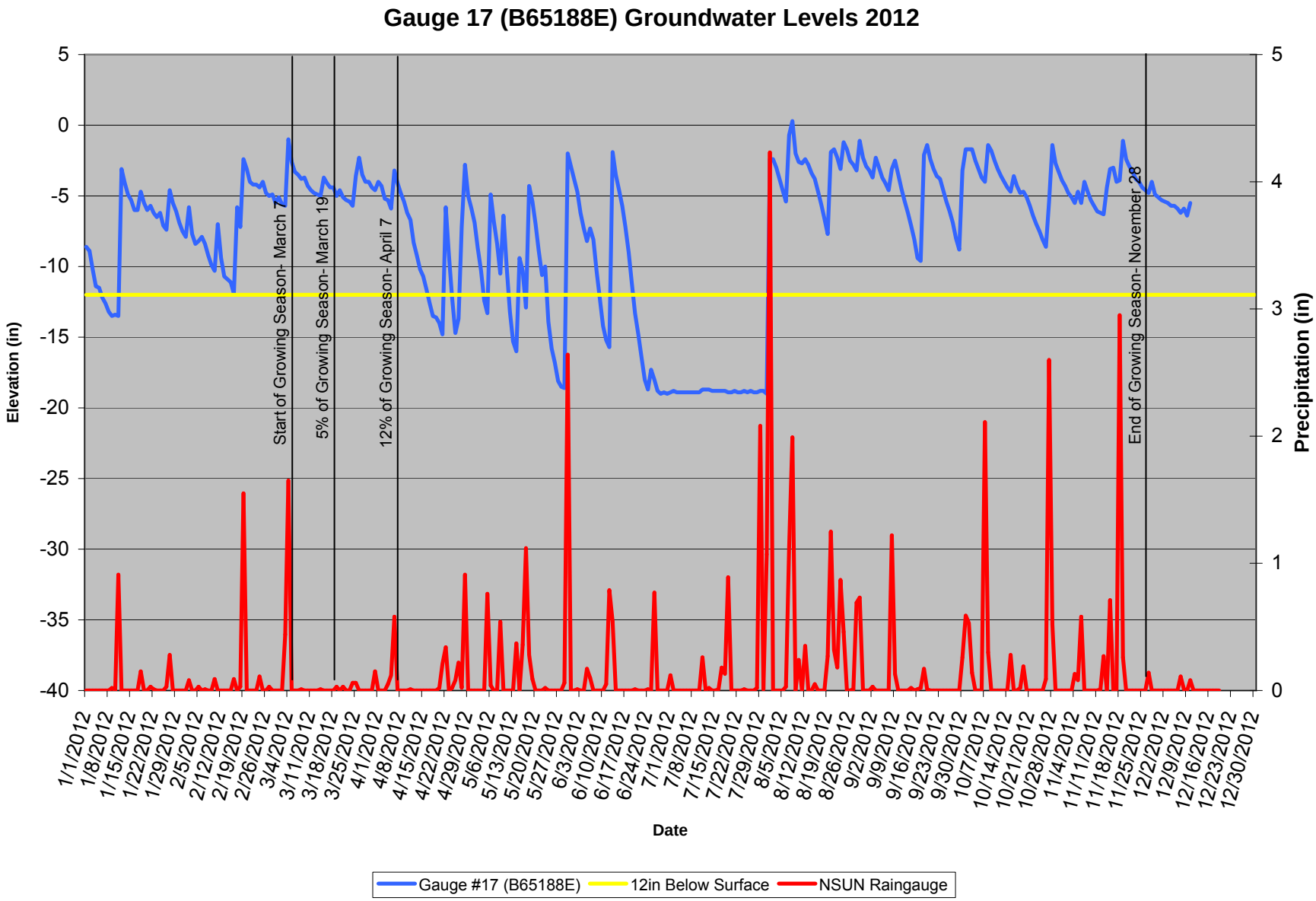

Gauge 12 (B65236E) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #12 (B65236E)
12in Below Surface
NSUN Raingauge

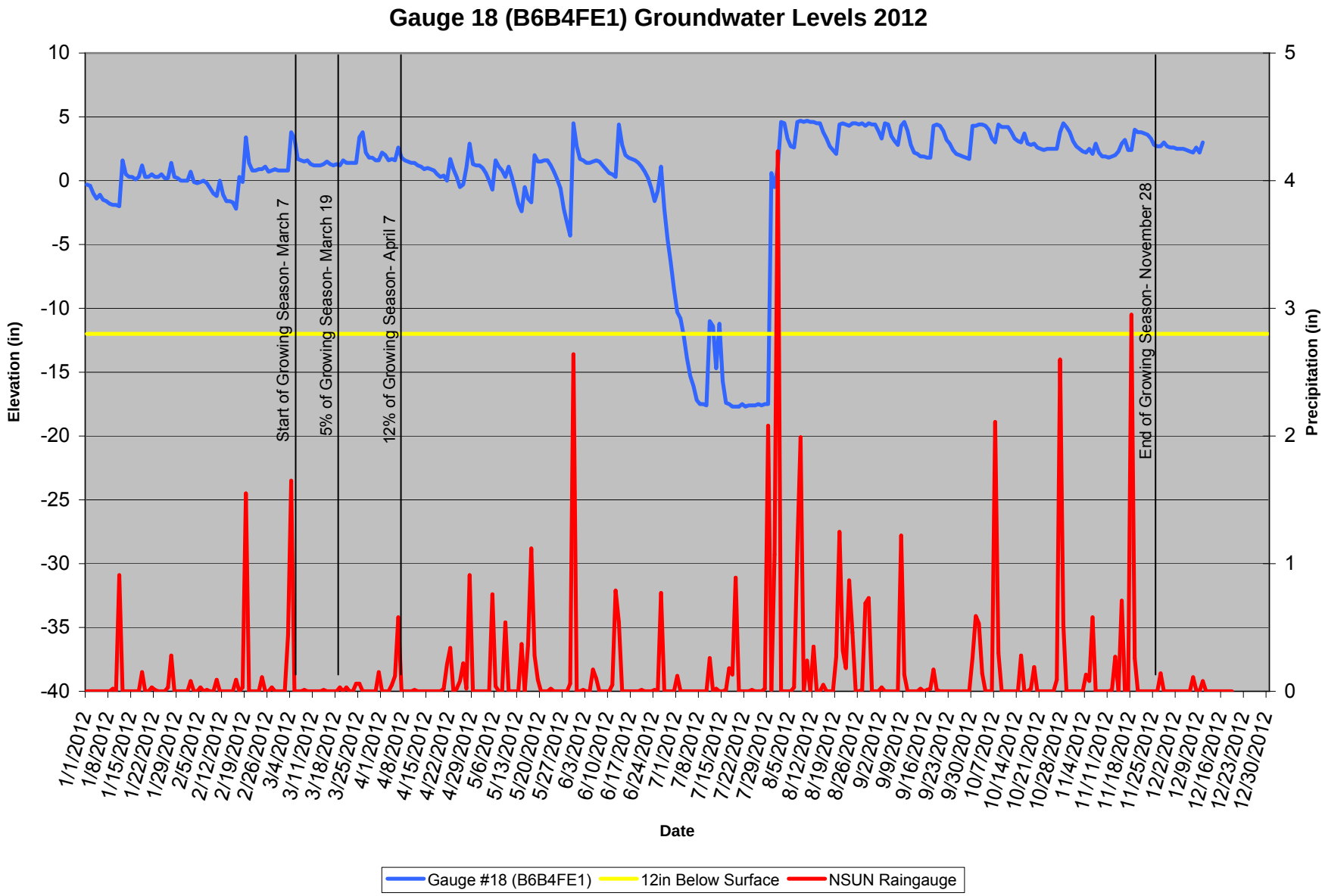

Gauge 13 (B65180A) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #13 (B65180A)
12in Below Surface
NSUN Raingauge

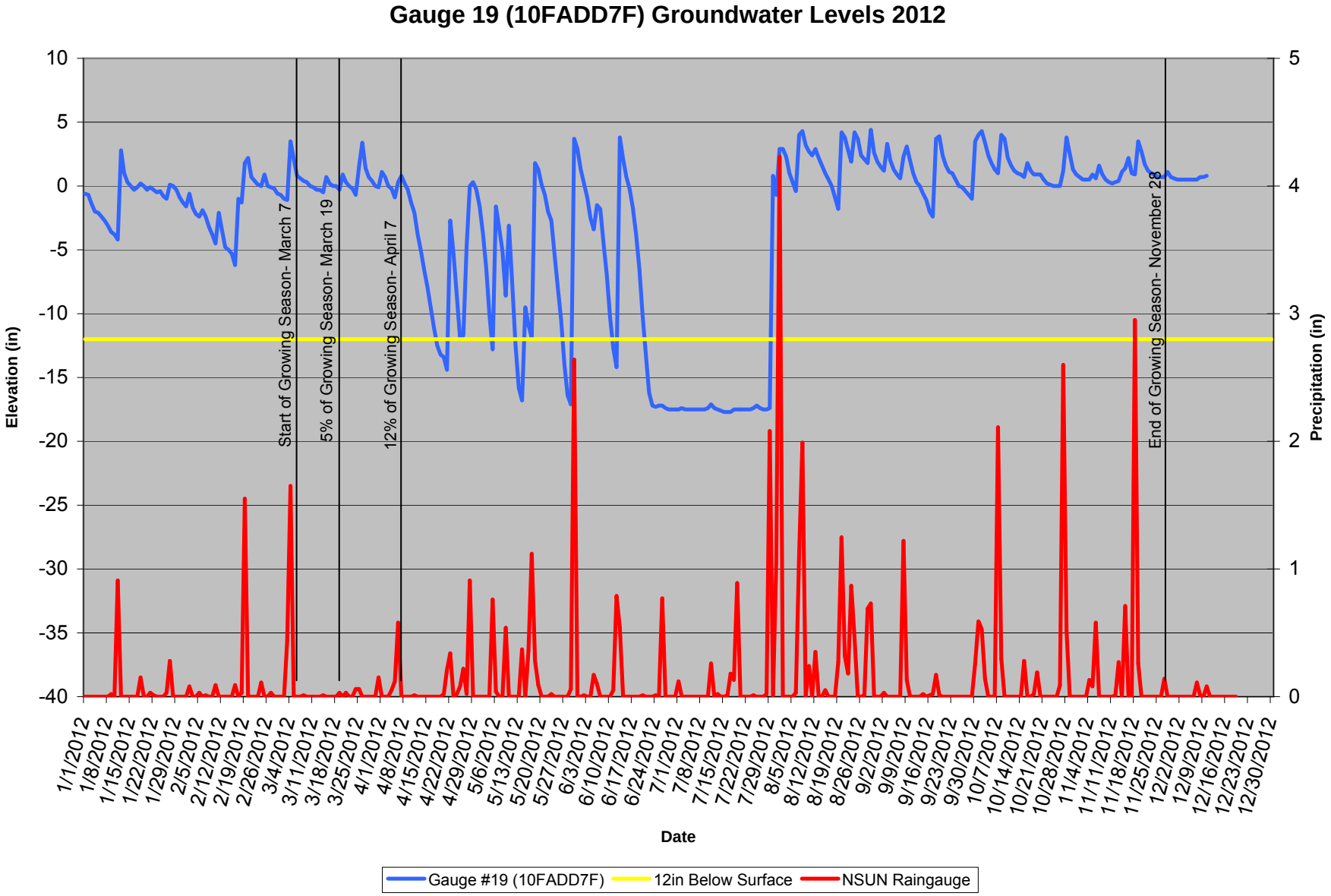

Gauge 14 (B65170F) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #14 (B65170F)
12in Below Surface
NSUN Raingauge

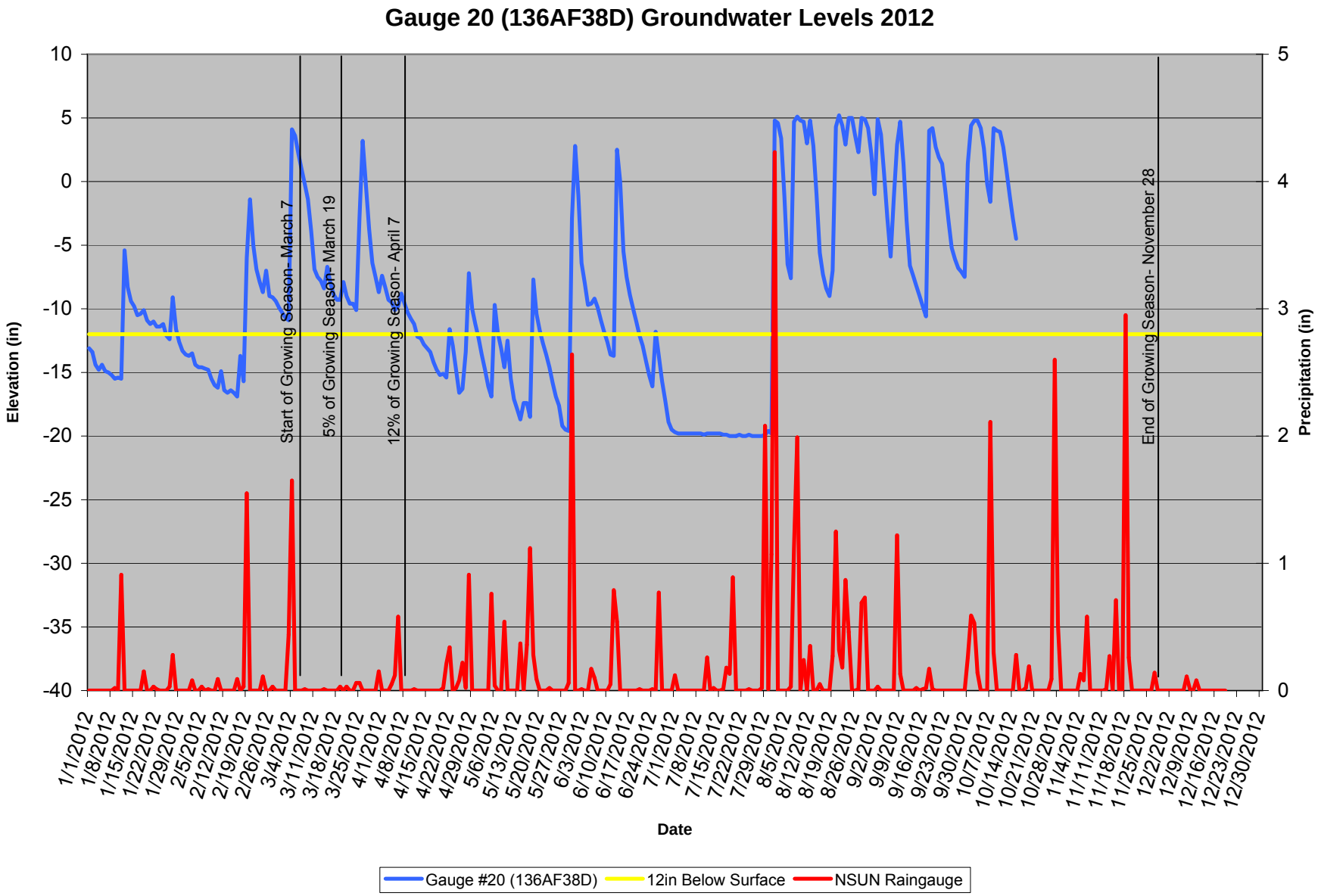

Gauge 15 (B6B7D86) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #15 (B6B7D86)
12in Below Surface
NSUN Raingauge

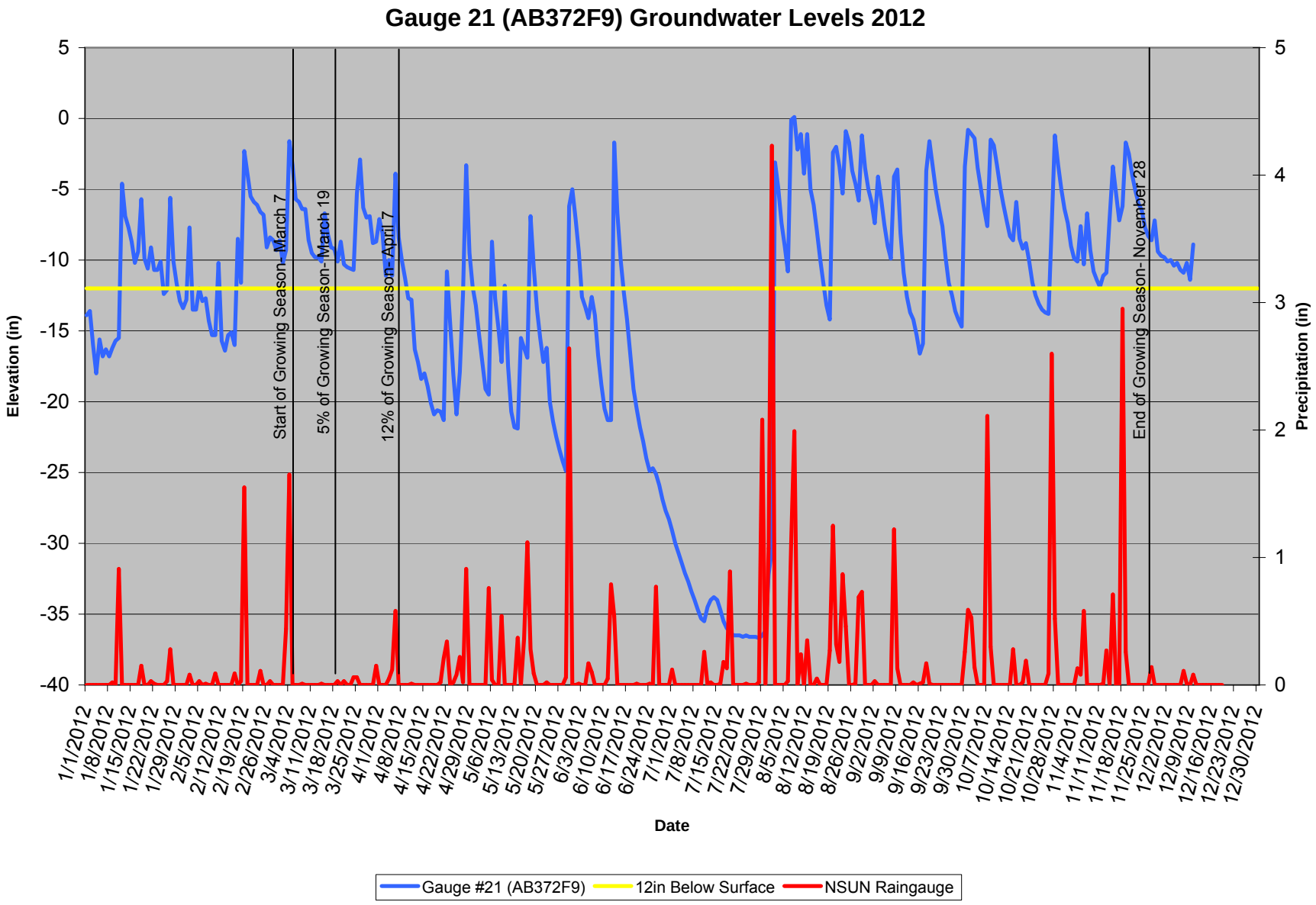

Gauge 16 (B651747) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #16 (B651747)
12in Below Surface
NSUN Raingauge

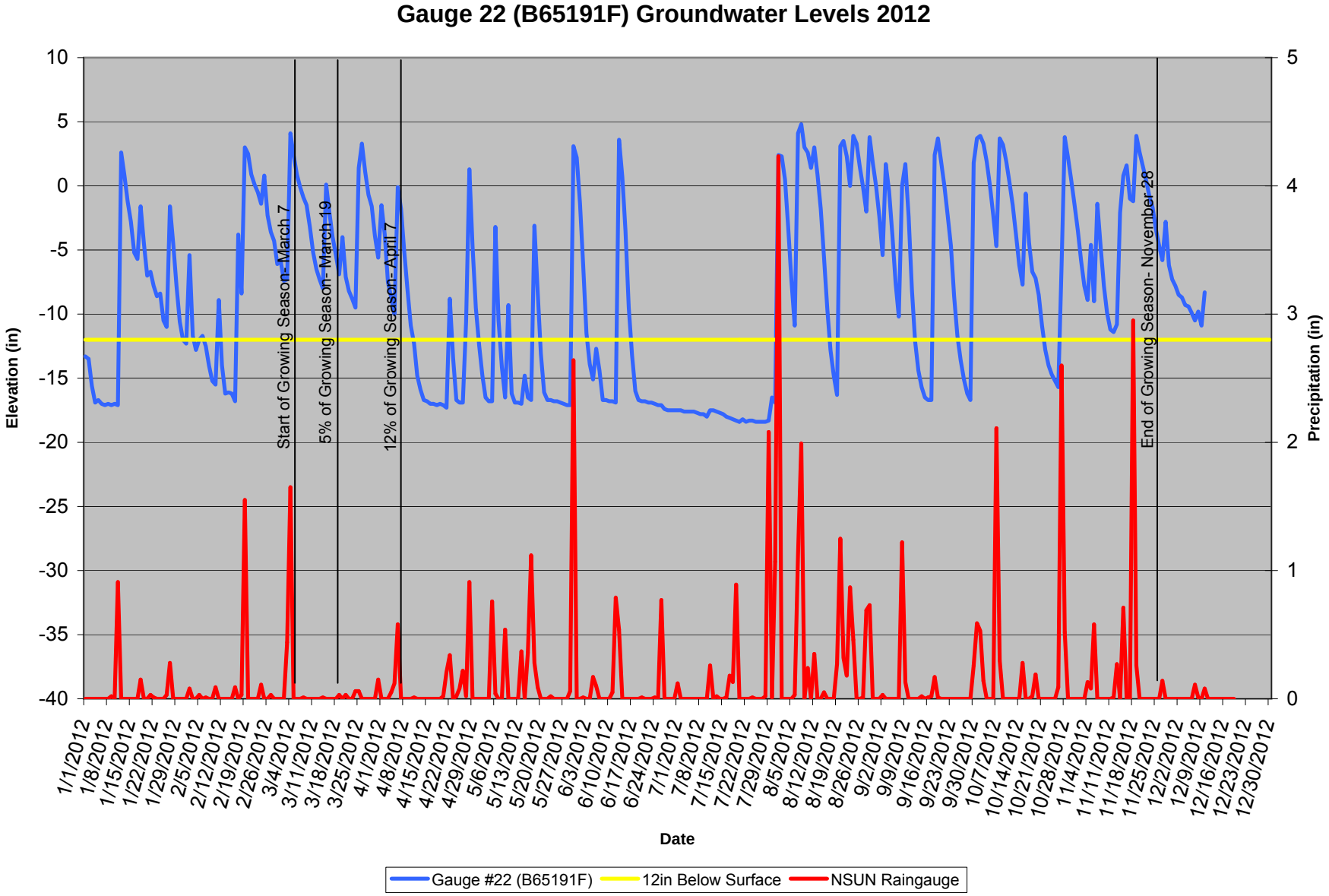

Gauge 17 (B65188E) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #17 (B65188E)
12in Below Surface
NSUN Raingauge


Gauge 18 (B6B4FE1) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #18 (B6B4FE1)
12in Below Surface
NSUN Raingauge

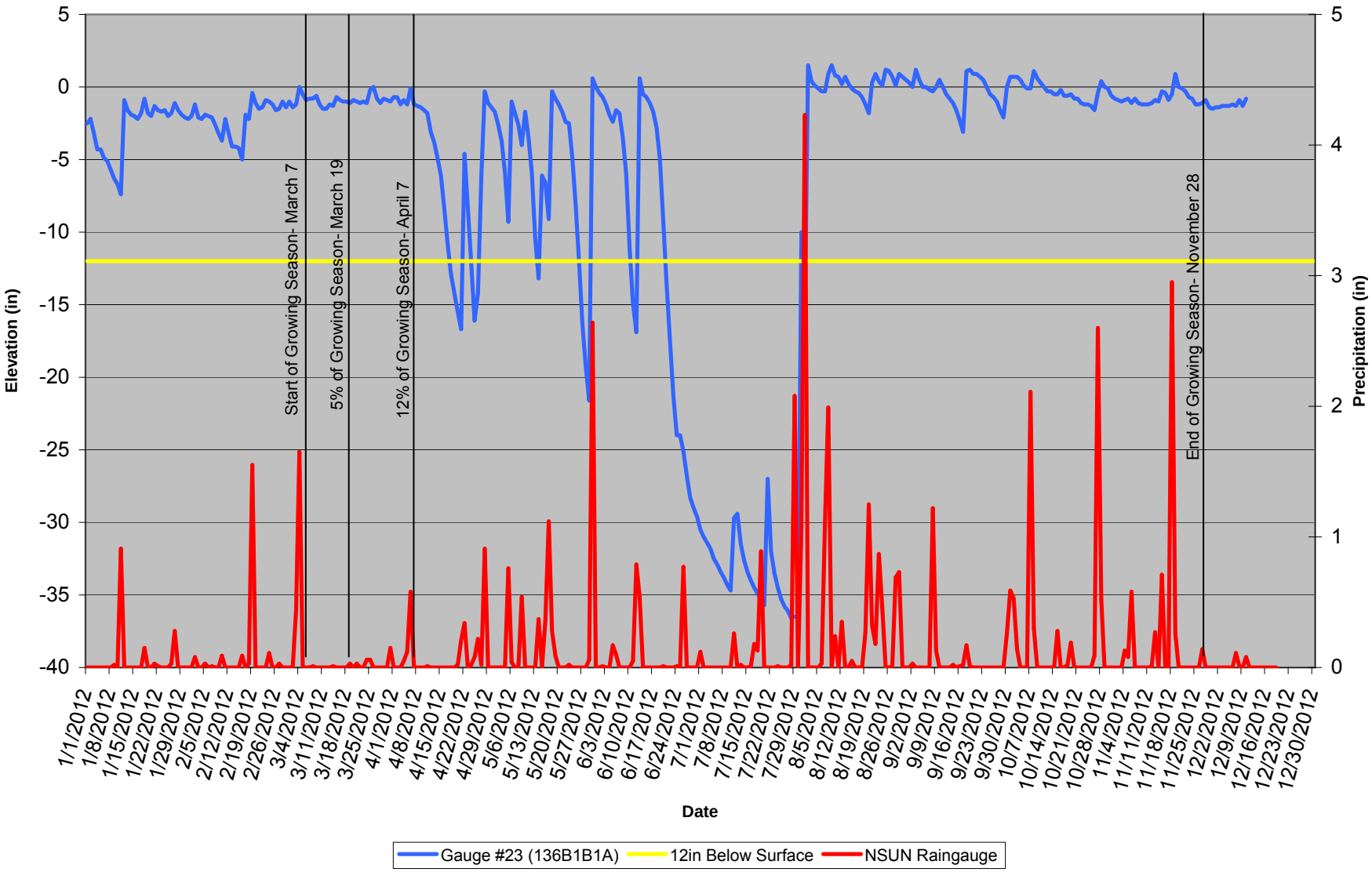

Gauge 19 (10FADD7F) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #19 (10FADD7F)
12in Below Surface
NSUN Raingauge

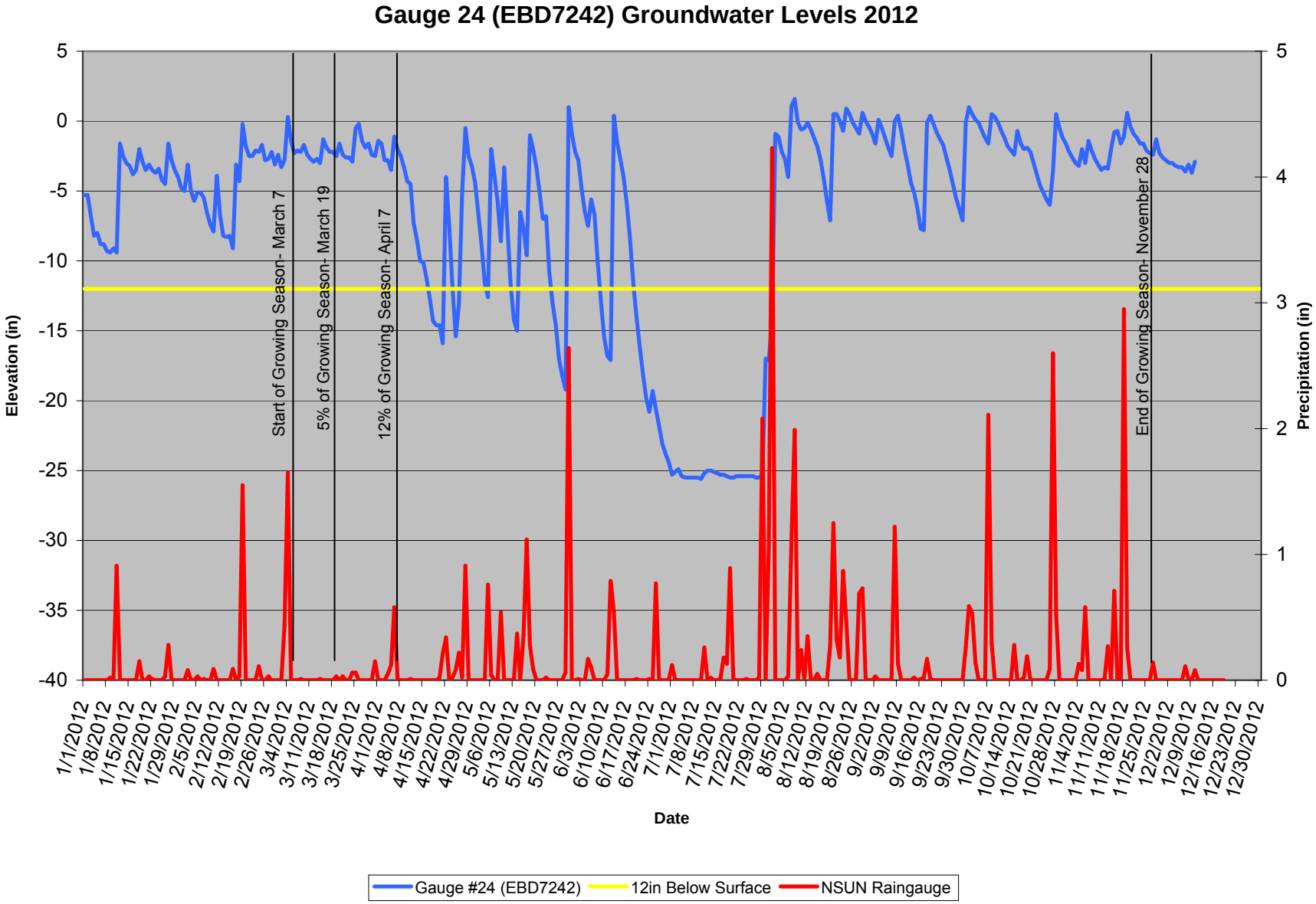

Gauge 20 (136AF38D) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #20 (136AF38D)
12in Below Surface
NSUN Raingauge

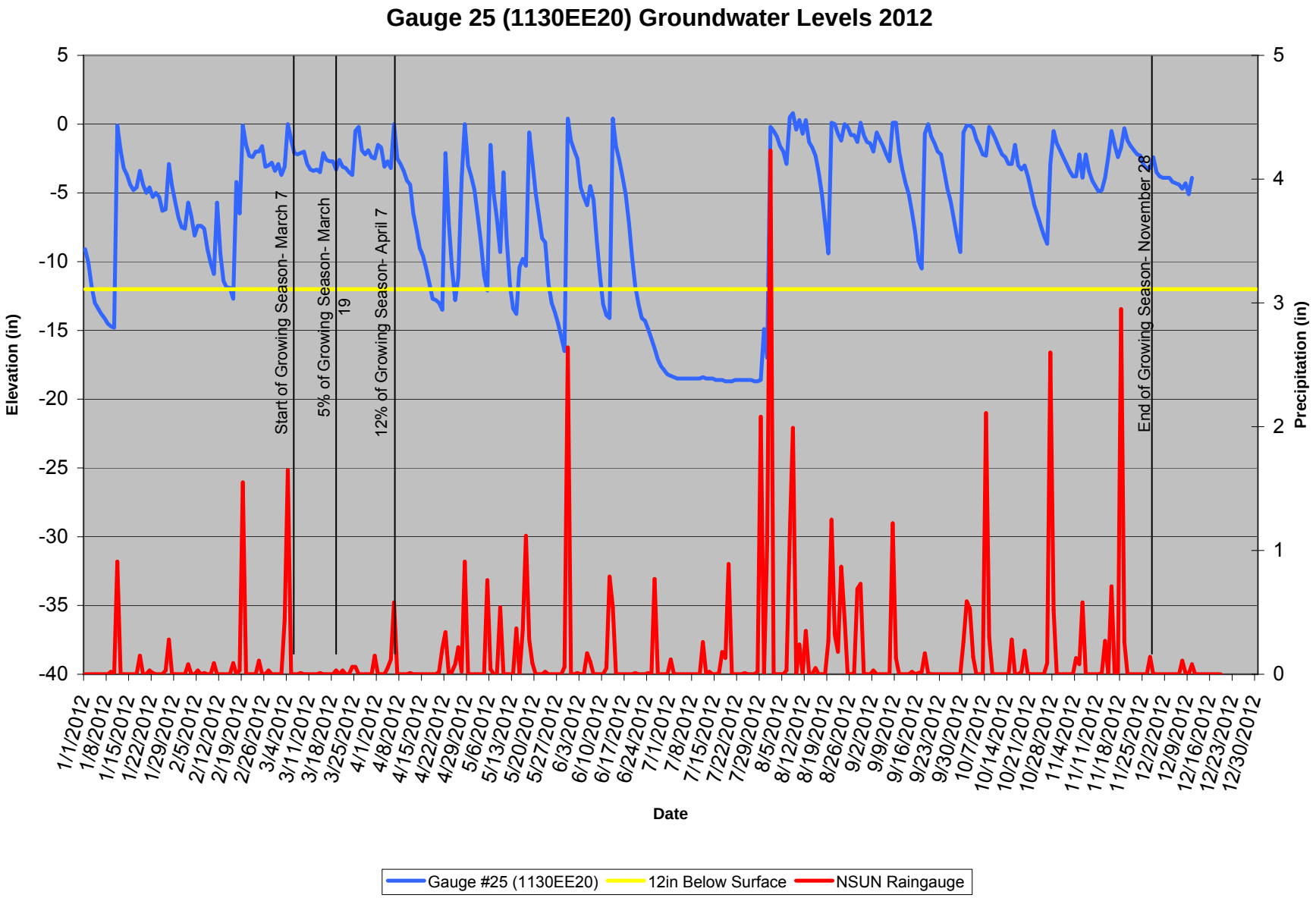

Gauge 21 (AB372F9) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #21 (AB372F9)
12in Below Surface
NSUN Raingauge

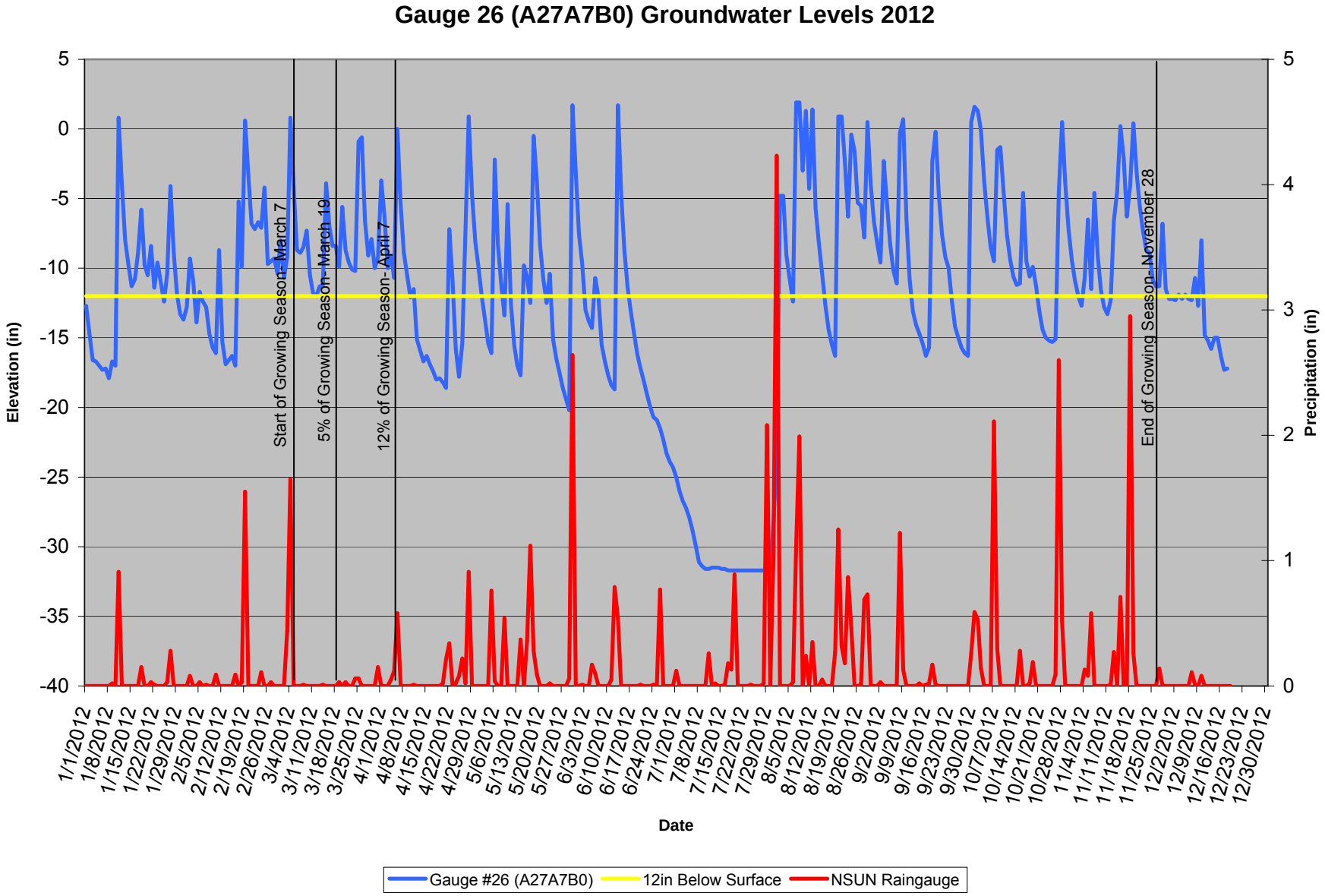

Gauge 22 (B65191F) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #22 (B65191F)
12in Below Surface
NSUN Raingauge

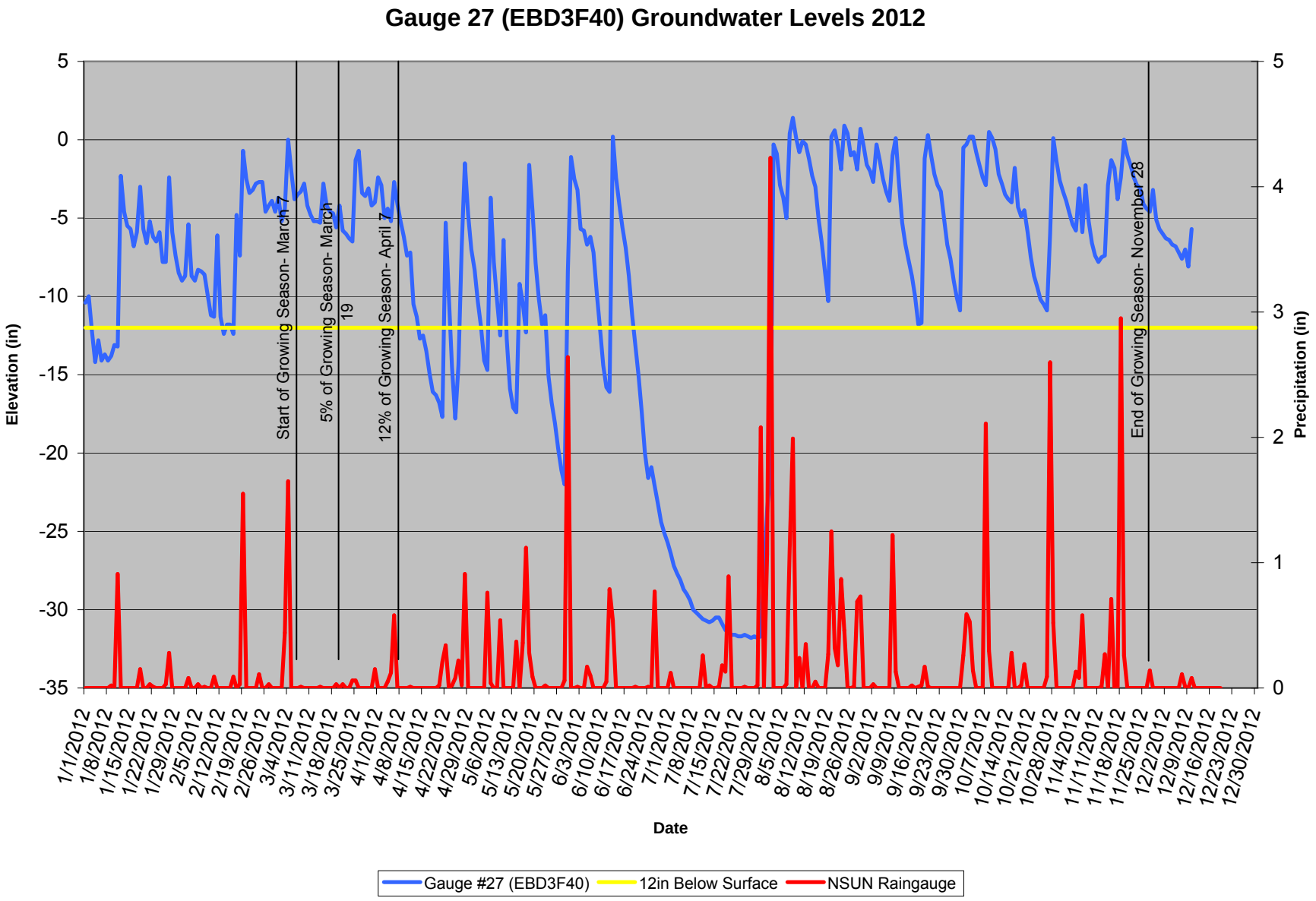
Gauge 23 (136B1B1A) Groundwater Levels 2012

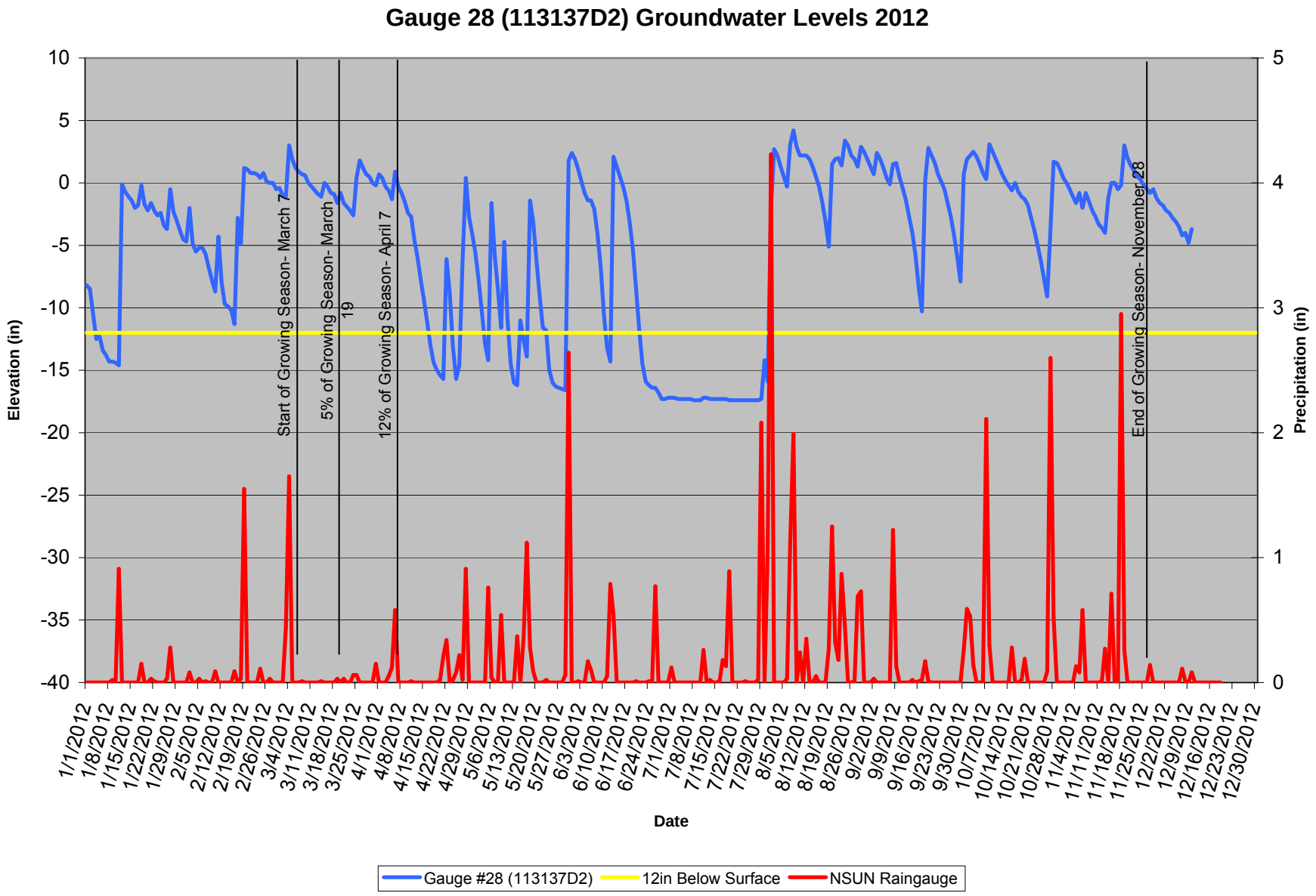



Gauge 24 (EBD7242) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Date
Gauge #24 (EBD7242)
12in Below Surface
NSUN Raingauge


Gauge 25 (1130EE20) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #25 (1130EE20)
12in Below Surface
NSUN Raingauge

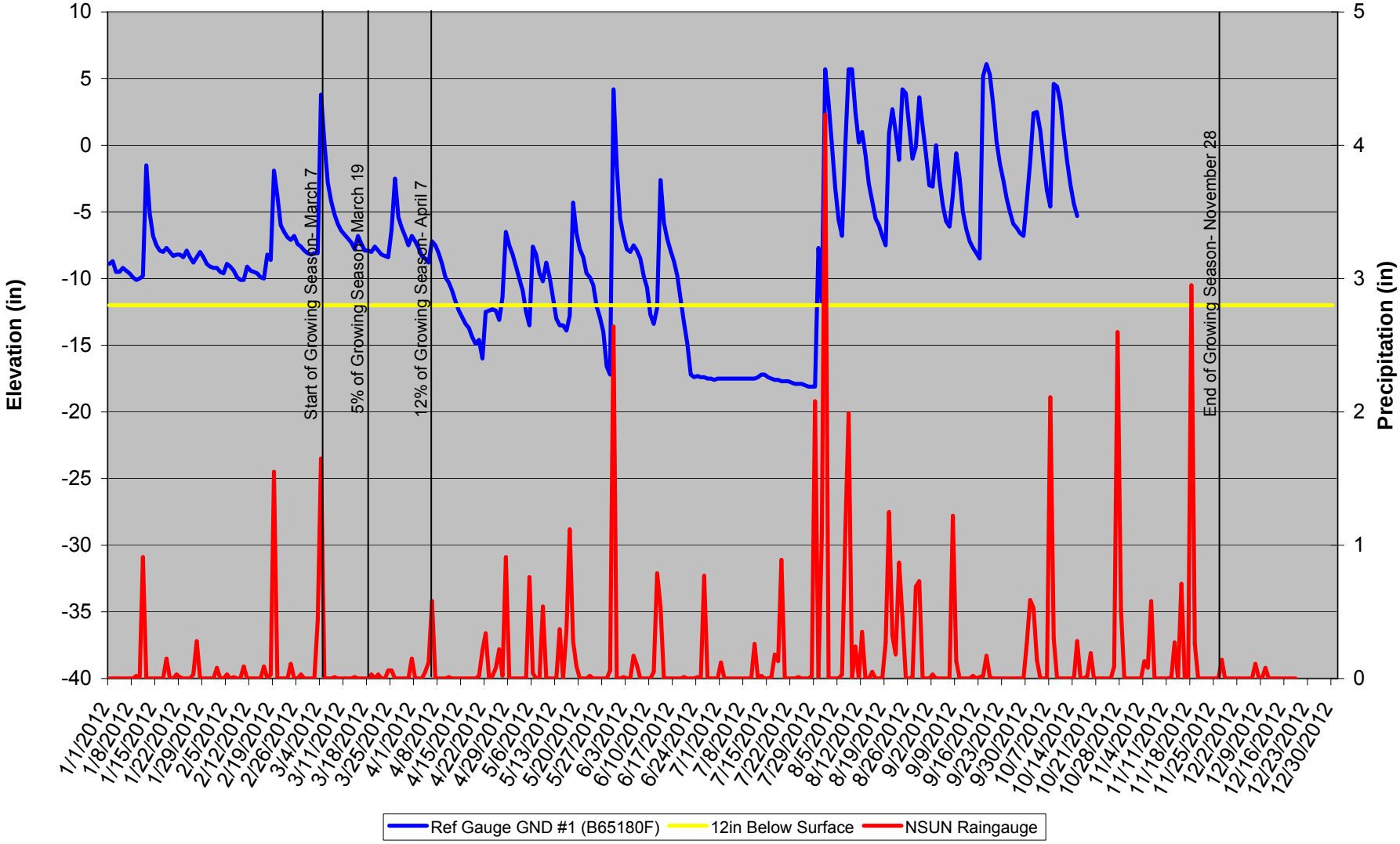

Gauge 26 (A27A7B0) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #26 (A27A7B0)
12in Below Surface
NSUN Raingauge


Gauge 27 (EBD3F40) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #27 (EBD3F40)
12in Below Surface
NSUN Raingauge


Gauge 28 (113137D2) Groundwater Levels 2012
Elevation (in)
Precipitation (in)
Date
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Gauge #28 (113137D2)
12in Below Surface
NSUN Raingauge

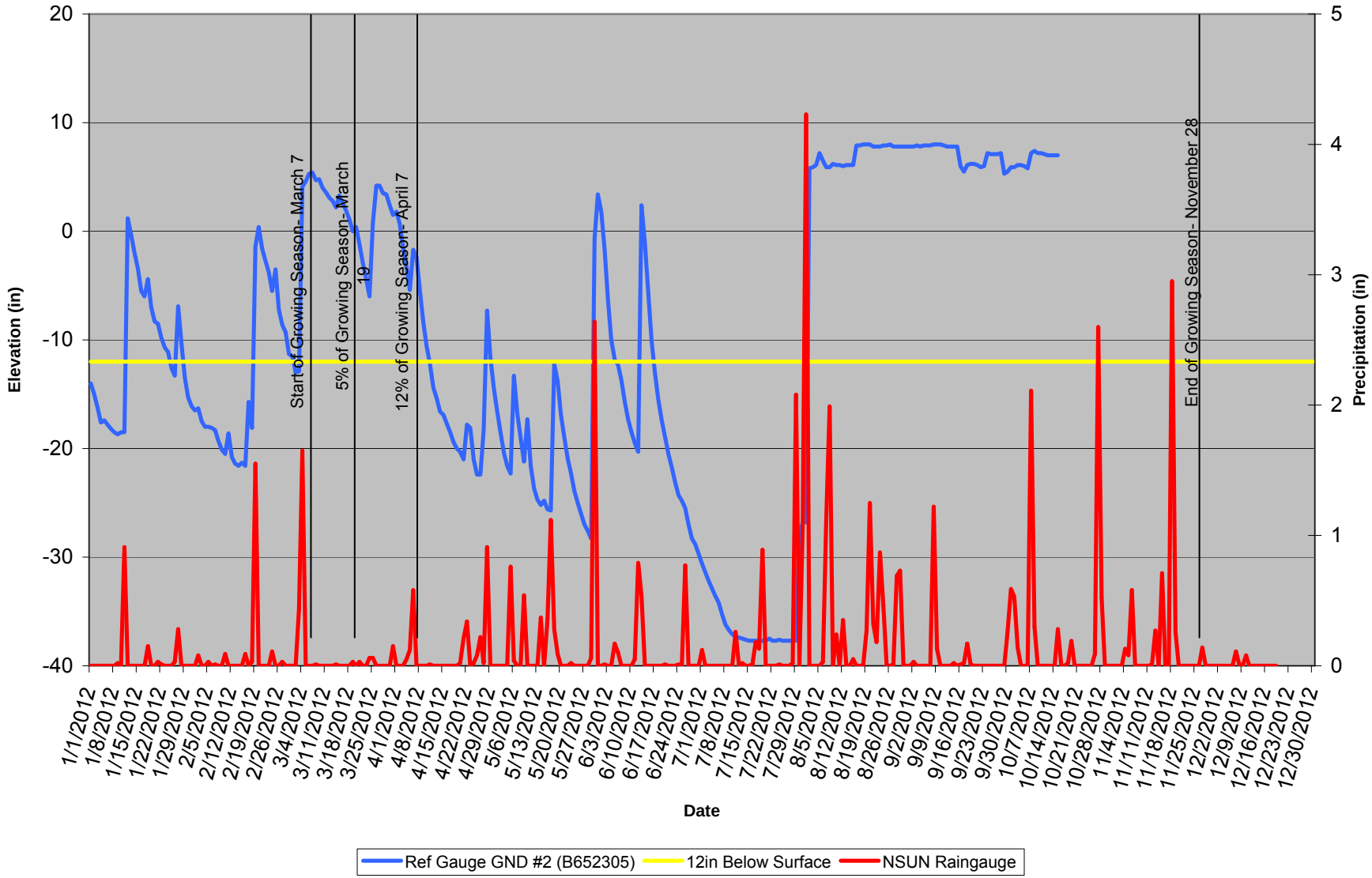
Reference Gauge G1 (B65180F) Groundwater Levels 2012

Gauge removed October 15, 2012



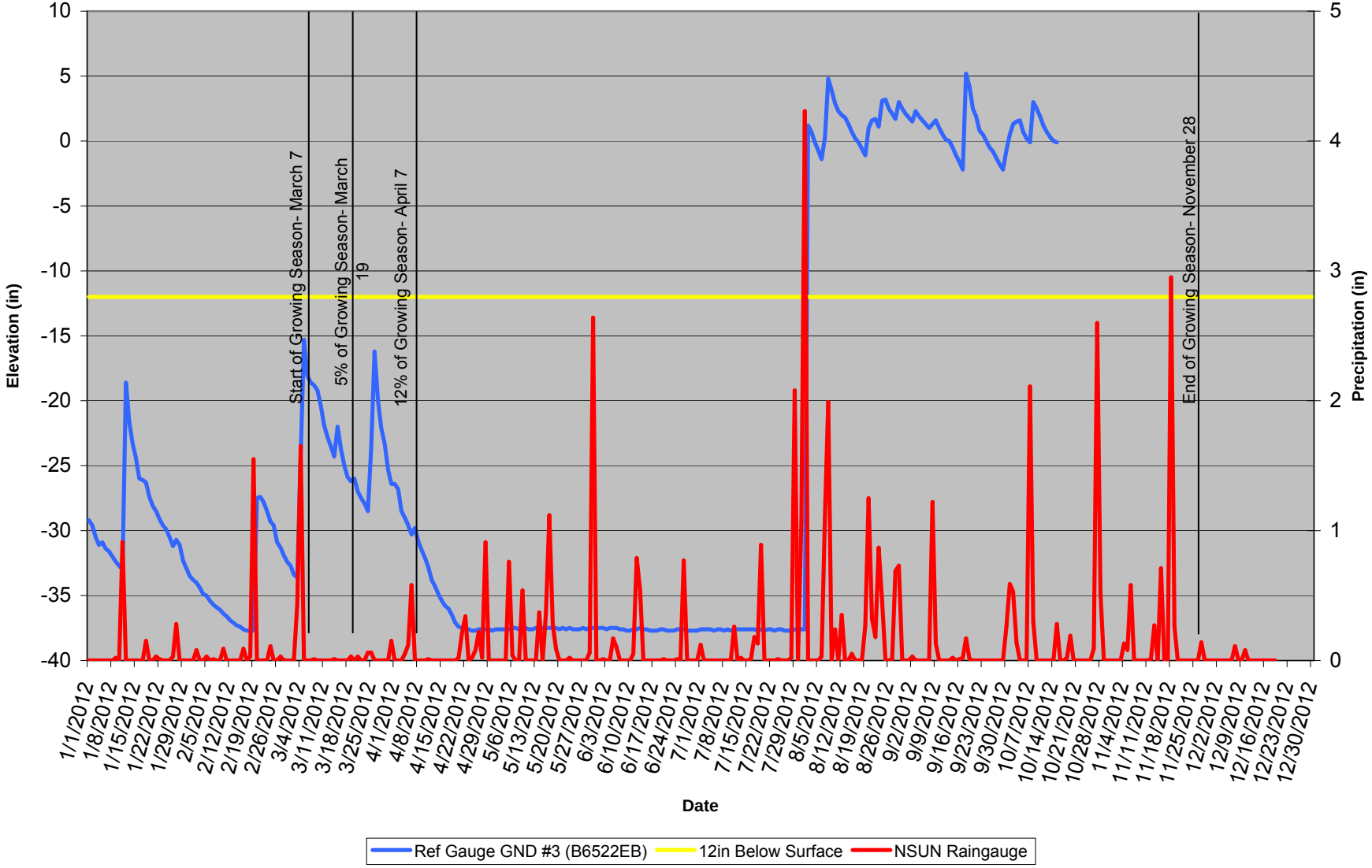
Reference Gauge G2 (B652305) Groundwater Levels 2012

Gauge removed October 15, 2012



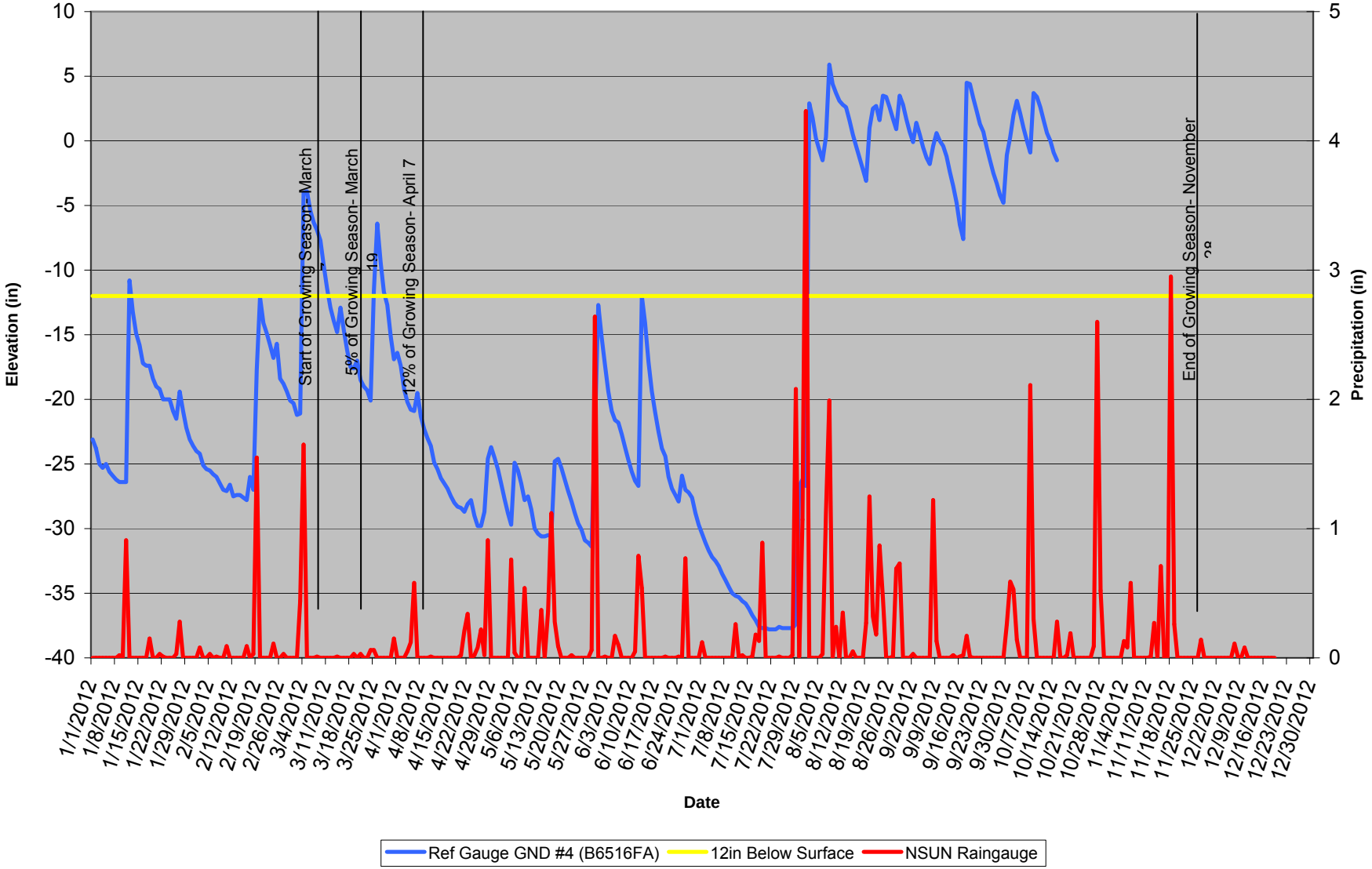
Reference Gauge G3 (B6522EB) Groundwater Levels 2012

Gauge removed October 15, 2012

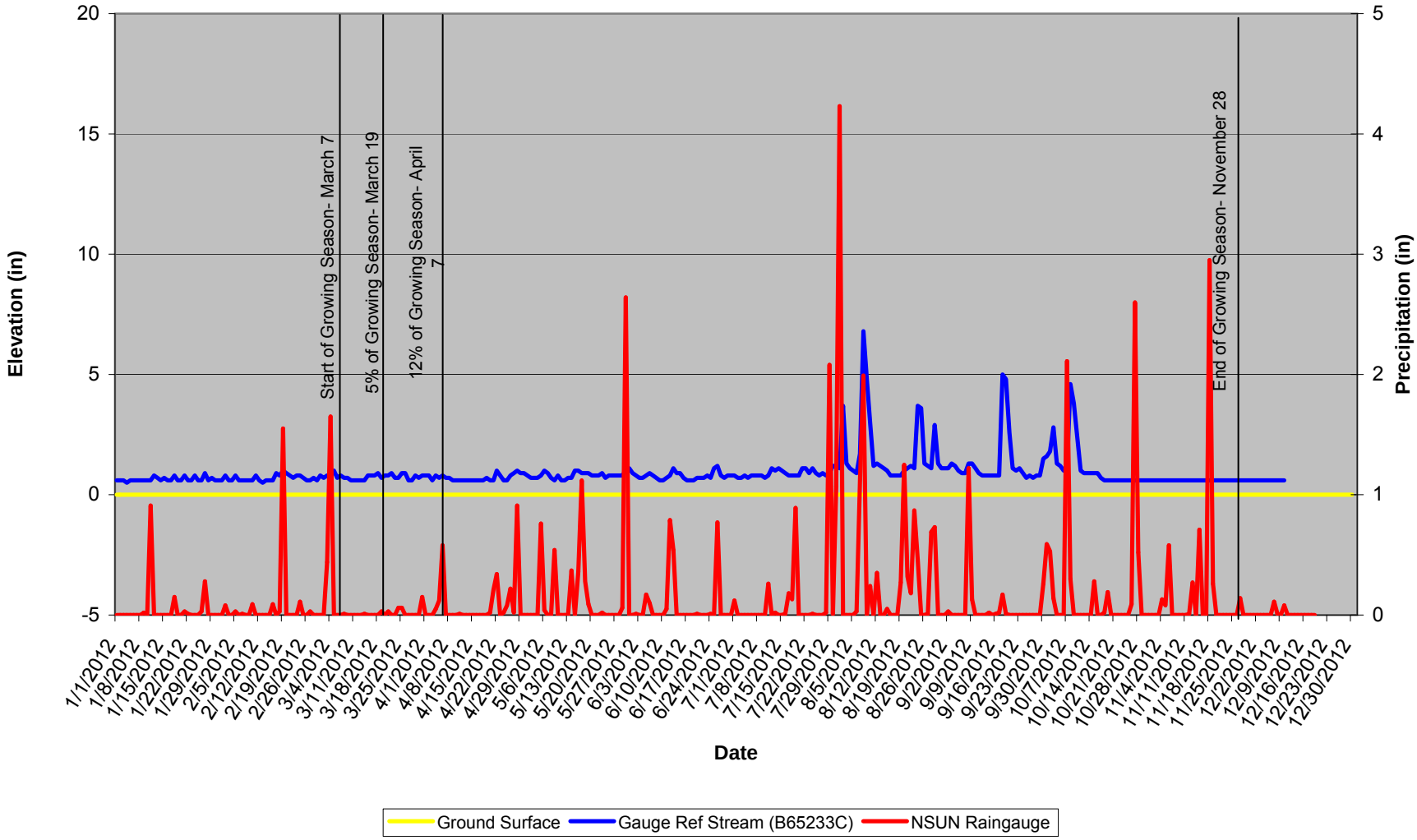


Reference Gauge G4 (B6516FA) Groundwater Levels 2012

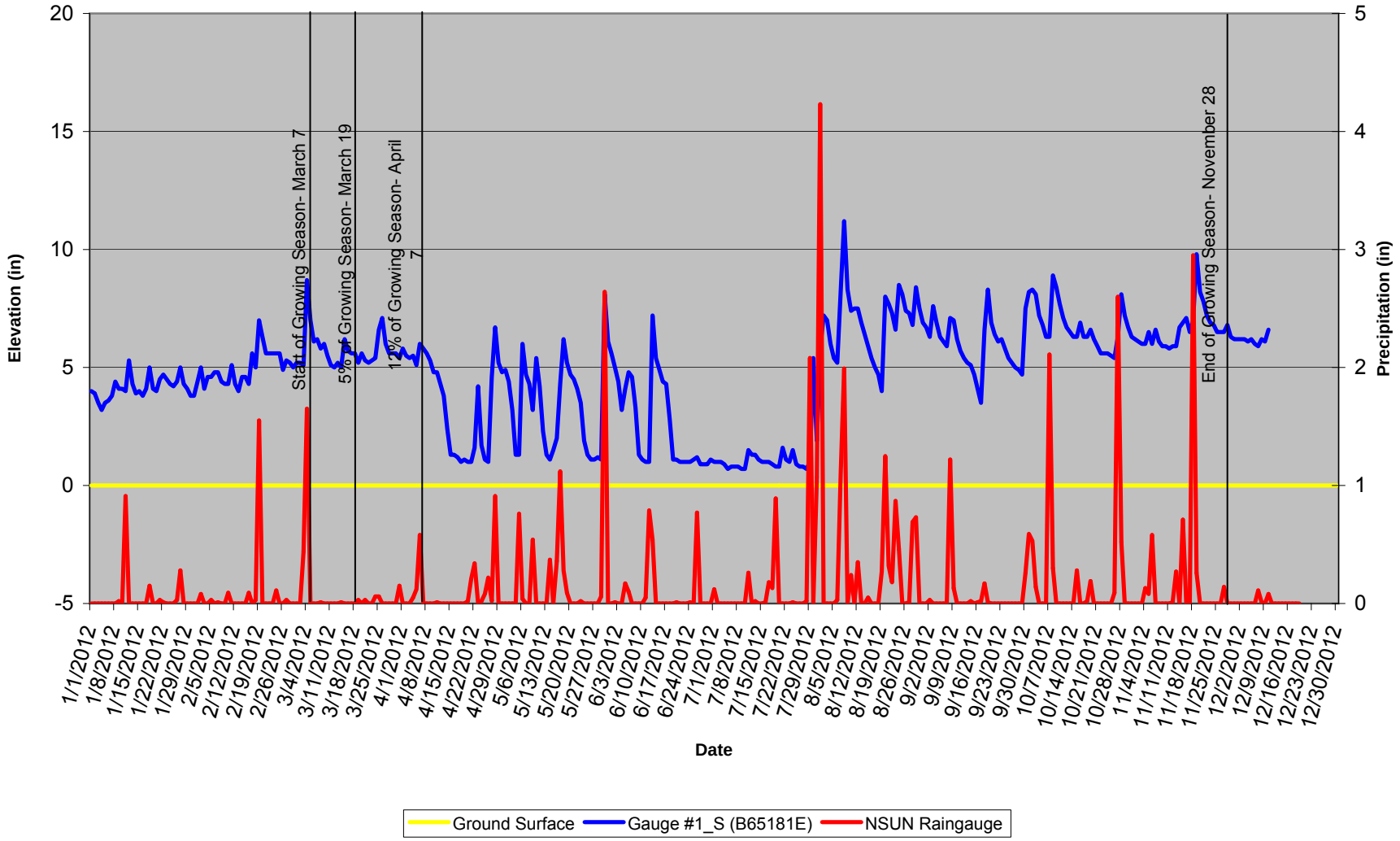
Gauge removed October 15, 2012

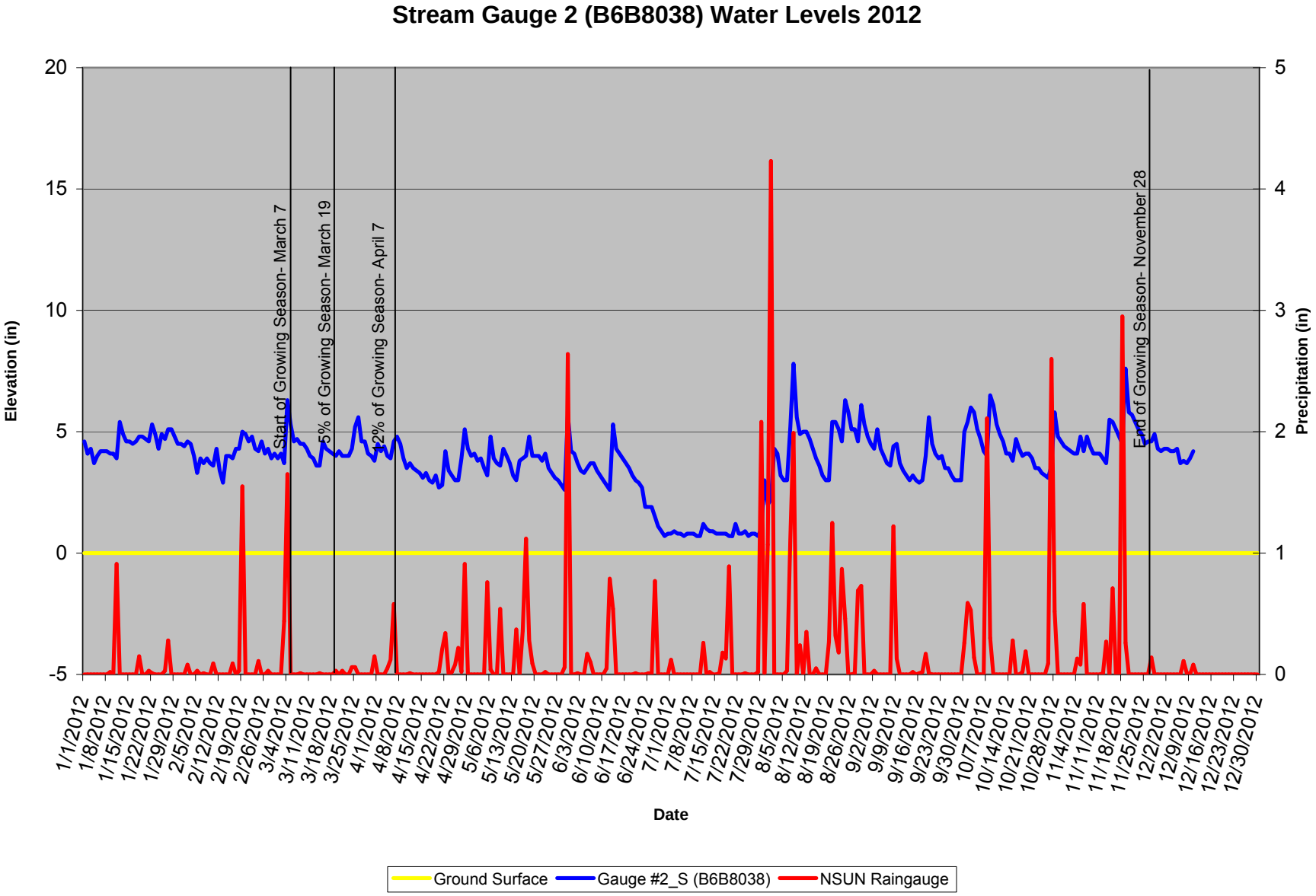


Reference Stream Gauge (B65233C) Water Levels 2012

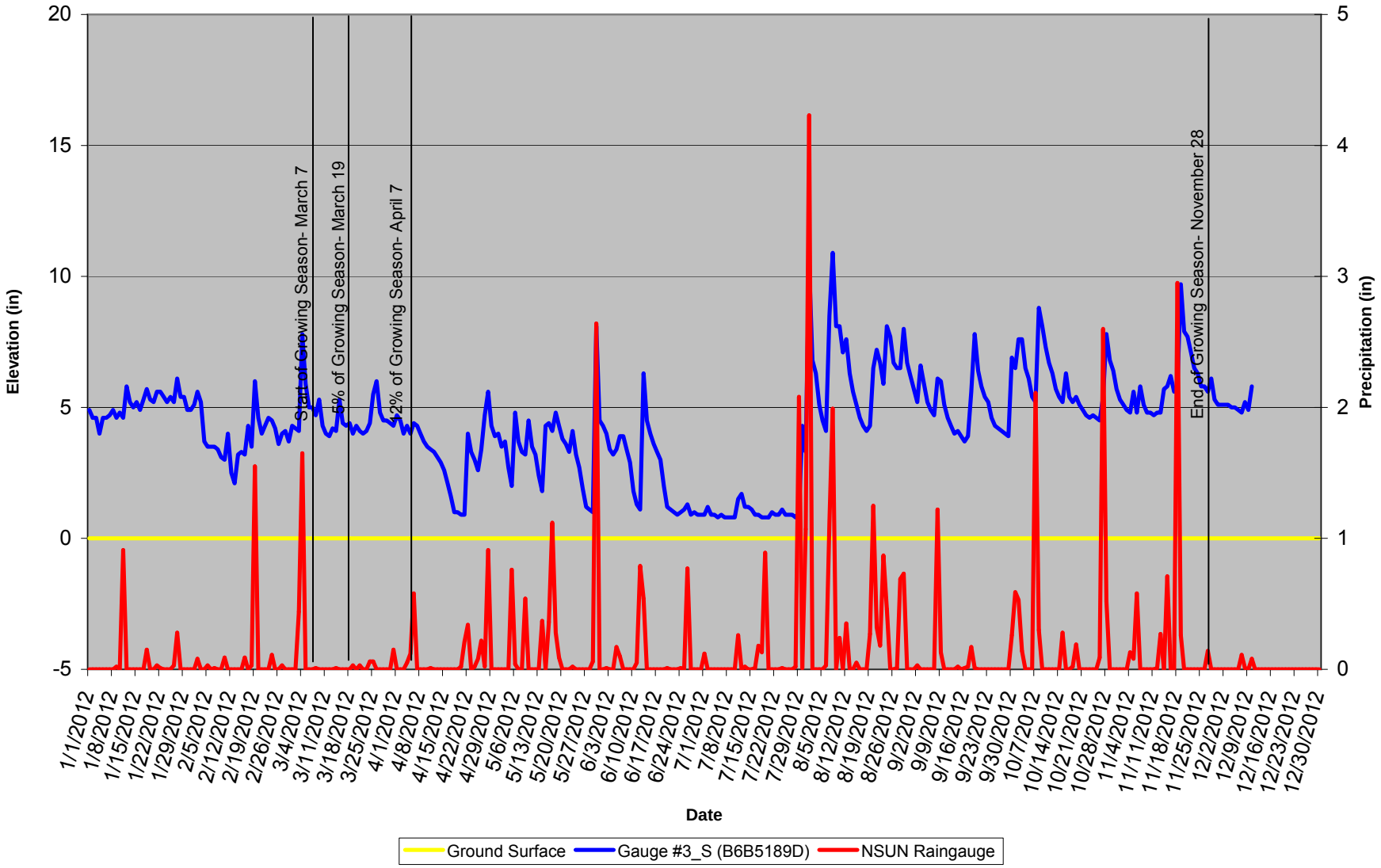


Stream Gauge 1 (B65181E) Water Levels 2012

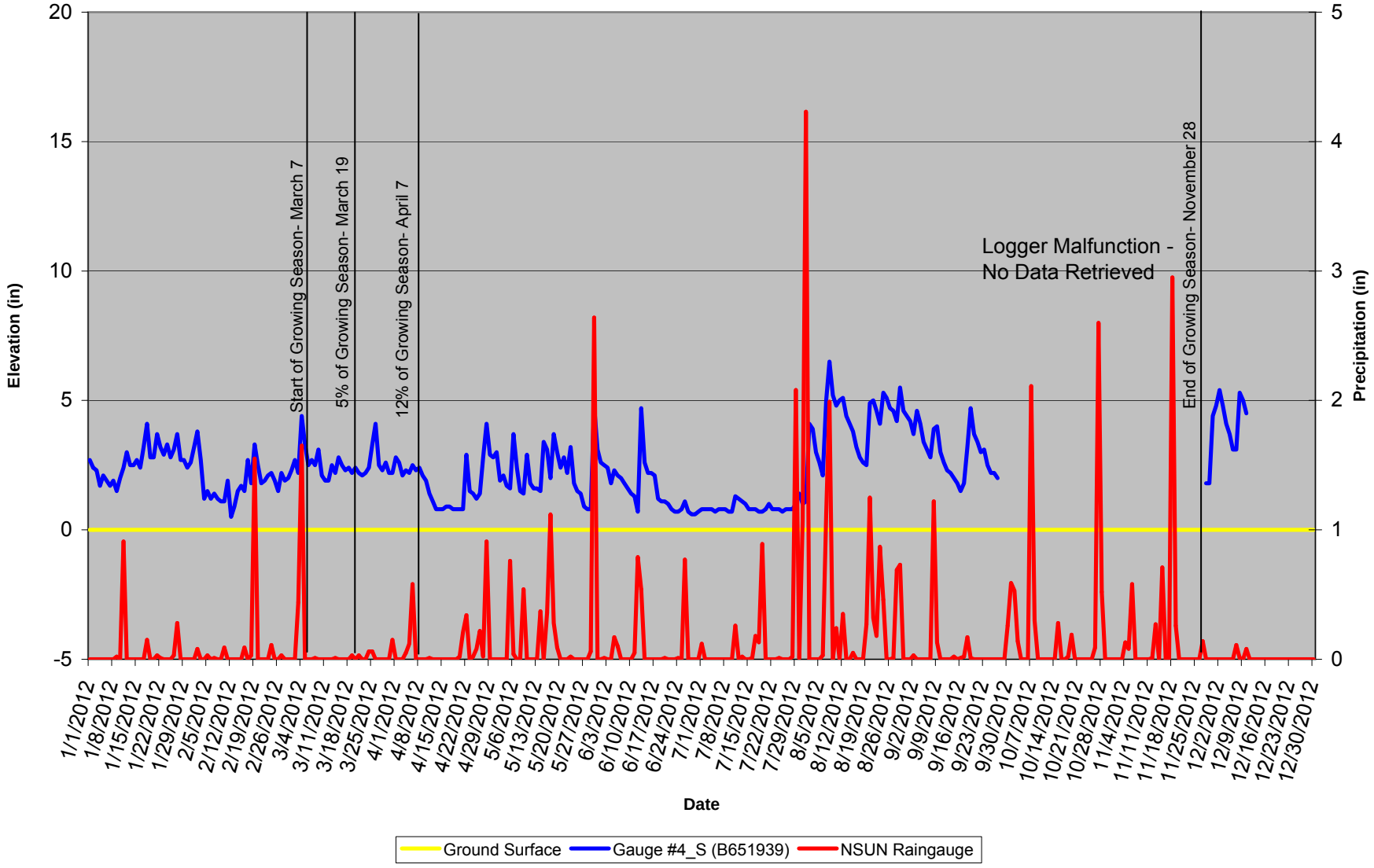



Stream Gauge 2 (B6B8038) Water Levels 2012
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
42% of Growing Season- April 7
End of Growing Season- November 28
Date
Ground Surface
Gauge #2_S (B6B8038)
NSUN Raingauge

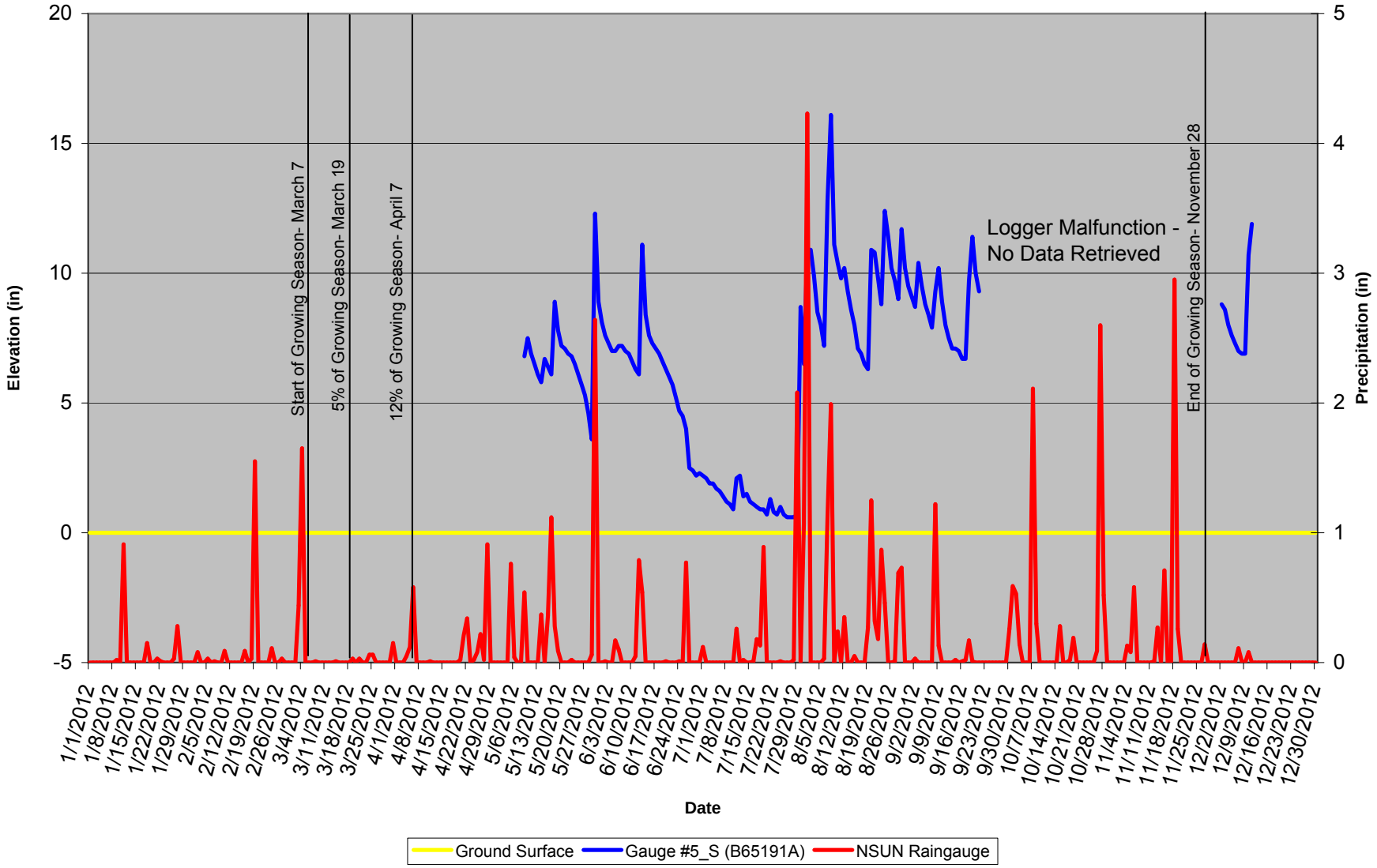
Stream Gauge 3 (B6B5189D) Water Levels 2012



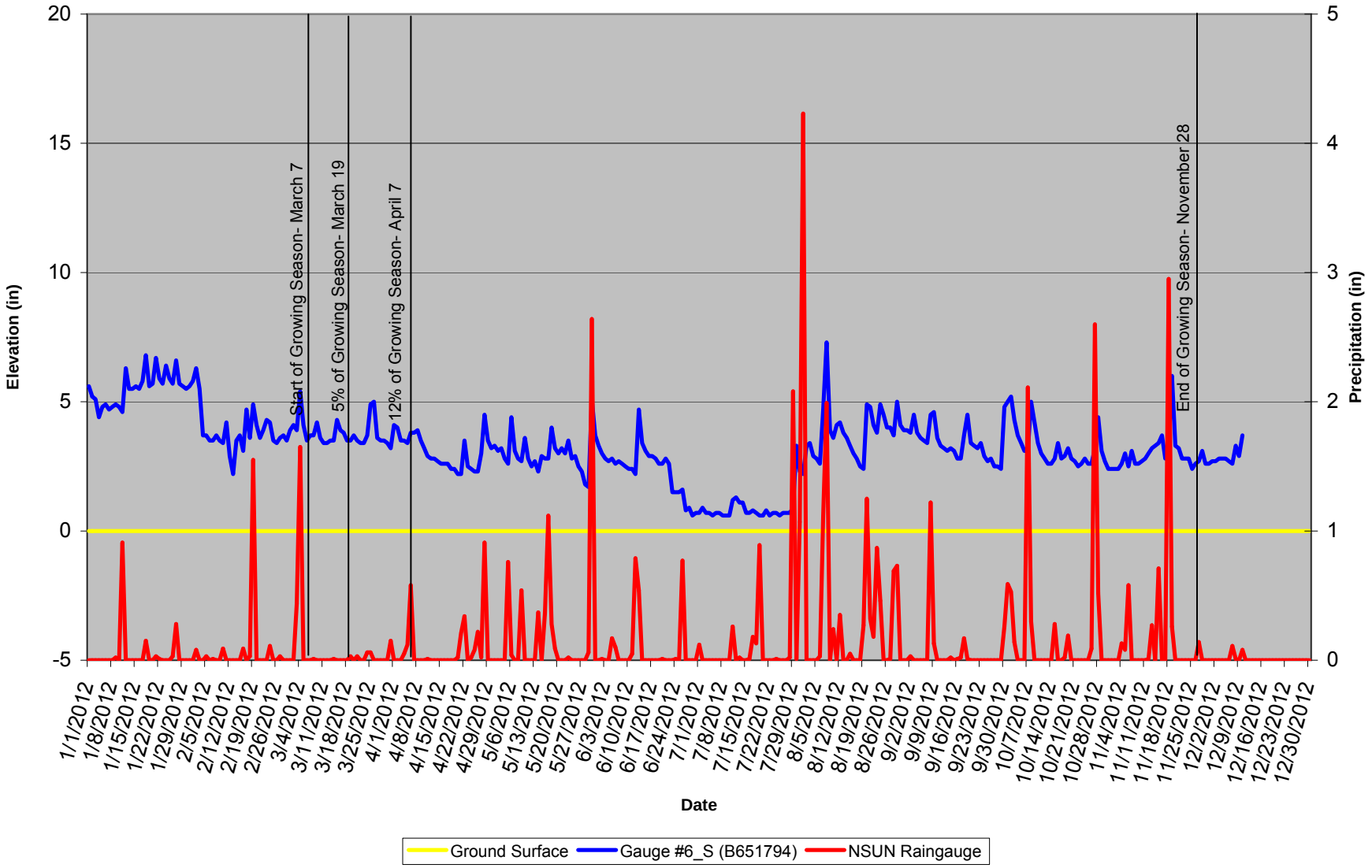
Stream Gauge 4 (B651939) Water Levels 2012



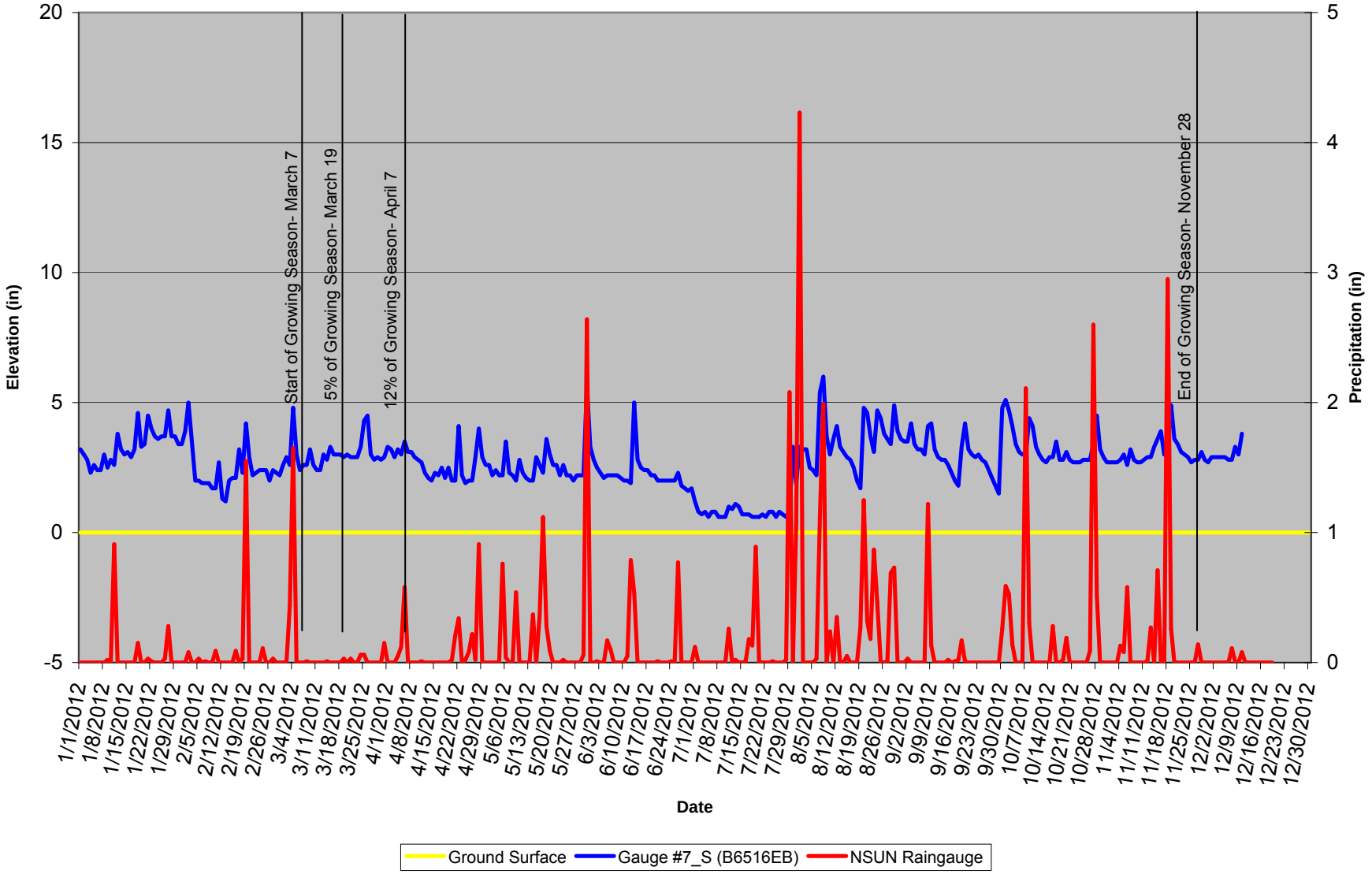
Stream Gauge 5 (B65191A) Water Levels 2012



Stream Gauge 6 (B651794) Water Levels 2012



Stream Gauge 7 (B6516eB) Water Levels 2012



Stream Gauge 8 (B6518D8) Water Levels 2012

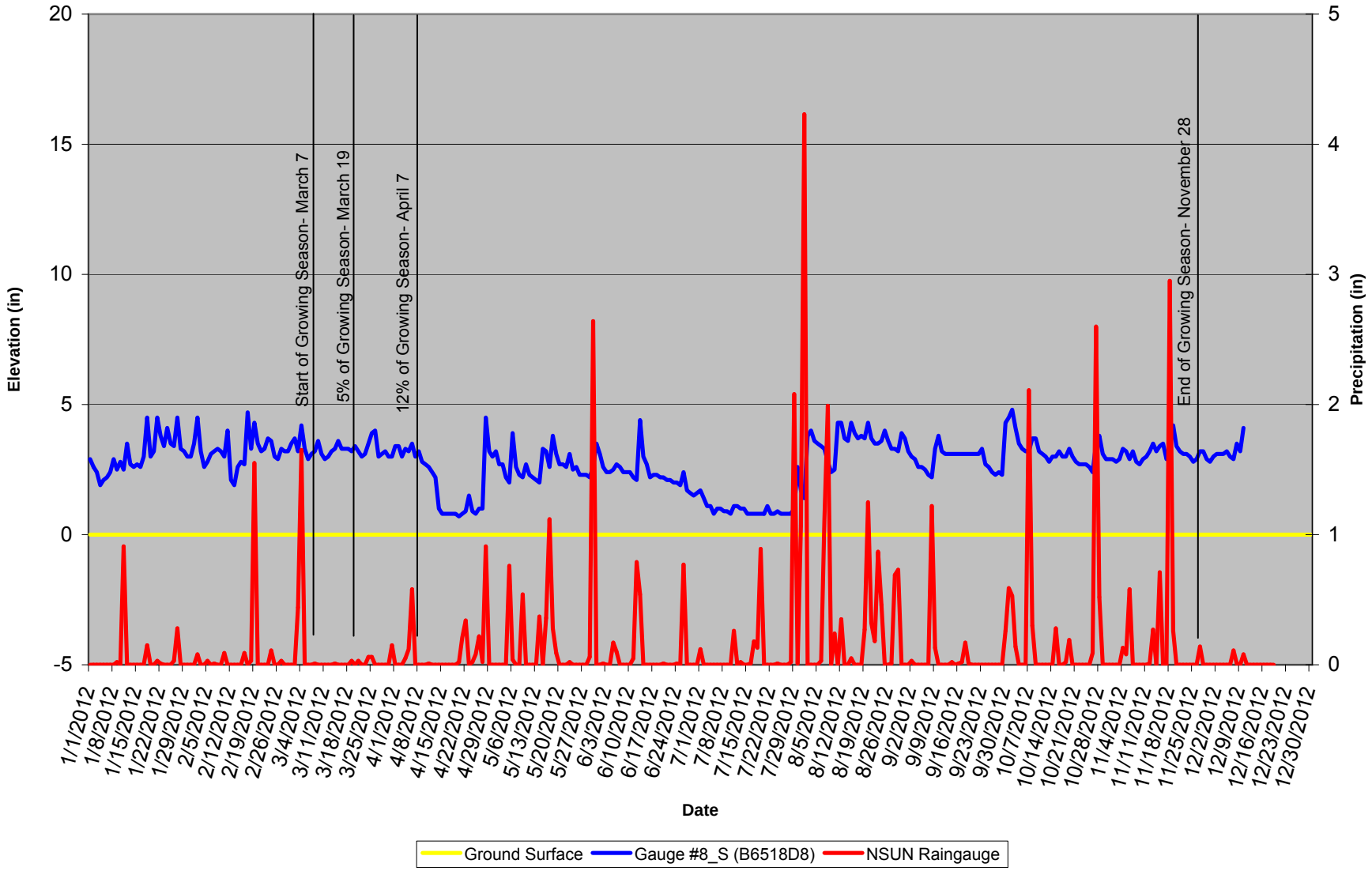


Table 10. Wetland gauge attainment data

Summary of Groundwater Gauge Results for Years 1 through 5					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage)				
	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
1	Yes/43 days (16%)	Yes/108 days (40%)	Yes/121 days (45%)		
2	Yes/68 days (25%)	Yes/126 days (47%)	Yes/121 days (45%)		
3	Yes/44 days (16%)	Yes/127 days (47%)	Yes/121 days (45%)		
4	Yes/43 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)		
5	Yes/43 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)		
6	Yes/63 days (24%)	Yes/126 days (47%)	Yes/121 days (45%)		
7	Yes/42 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)		
8	Yes/42 days (16%)	Yes/125 days (47%)	Yes/121 days (45%)		
9	Yes/58 days (22%)	Yes/125 days (47%)	Yes/121 days (45%)		
10	Yes/36 days (14%)	Yes/33 days (12%)	Yes/121 days (45%)		
11	Yes/57 days (22%)	Yes/106 days (40%)	Yes/121 days (45%)		
12	Yes/33 days (13%)	No/23 days (9%)	Yes/31 days (12%)		
13	Yes/36 days (13%)	No/23 days (9%)	Yes/31 days (12%)		
14	Yes/40 days (16%)	Yes/116 days (43%)	Yes/121 days (45%)		
15	Yes/41 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)		
16	Yes/57 days (22%)	Yes/99 days (37%)	Yes/121 days (45%)		
17	Yes/43 days (16%)	Yes/99 days (37%)	Yes/121 days (45%)		
18	Yes/126 days (47%)	Yes/126 days (47%)	Yes/121 days (45%)		
19	Yes/63 days (24%)	Yes/126 days (47%)	Yes/121 days (45%)		
20	Yes/32 days (13%)	Yes/116 days (43%)	Yes/121 days (45%)		
21	Installed 12/10	No/19 days (7%)	Yes/31 days (12%)		
22	Installed 12/10	No/19 days (7%)	Yes/34 days (13%)		
23	Installed 12/10	Yes/116 days (43%)	Yes/121 days (45%)		
24	Installed 12/10	Yes/109 days (41%)	Yes/121 days (45%)		
25	Installed 12/10	Yes/74 days (28%)	Yes/121 days (45%)		
26	Installed 12/10	No/25 days (9%)	No/22 days (8%)		
27	Installed 12/10	No/25 days (9%)	Yes/121 days (45%)		
28	Installed 12/10	Yes/40 days (15%)	Yes/121 days (45%)		