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 5 of 5 Monitoring Report
Data Collection: January through December 2014
Submission Date: March 6, 2015

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:

Land Management Group, Inc.
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Wilmington, NC 28403
(910) 452-0001

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2.0 TABLE OF CONTENTS

3.0 PROJECT SUMMARY

3.1 Goals and Objectives

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 has been accomplished by implementing 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 second objective is to restore and enhance the altered wetlands.

3.2 Project Success Criteria

The wetland vegetative success criterion is 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). The wetland hydrological success criterion is a groundwater level within 12 inches of the soil surface for a minimum of 12% of the growing season. The stream morphology success criteria are based on overall performance of the designed zero to first order stream restoration so that no substantial aggradation, degradation, down-cutting, or erosion occurs. Surface water monitoring gauges must exhibit similar conditions to the on-site reference gauge and clearly show fluctuation in flow.

3.3 Site Location and History

The 516.73-acre site is located in Boiling Spring Lakes, Brunswick County (Figures 1a and 1b). It was previously owned by International Paper and used in rotation as a pine plantation. Two major site alterations that occurred within the project site included channelization of natural stream channels and bedding.

3.4 Project Components

Project components consist of stream restoration, stream preservation, non-riparian wetland preservation, restoration, enhancement, and riparian preservation (See Table 1 for Project Components and Figure 2 for Component Location). A total of **3,238 linear feet** of stream restoration was provided in accordance with the mitigation plan. Stream preservation areas consist of **5,332 linear feet**. The non-riparian wetland preservation areas total **87.74 acres** and riparian wetland preservation areas total **20.45 acres**. Non-riparian wetland enhancement totaling **96.46 acres** makes up the bulk of the project effort. Non-riparian wetland restoration totals **7.83 acres**.

3.5 Project Design/Approach

In order to meet the project goals, stream restoration re-established the riparian vegetation zone, re-connected flood plain areas, and enhanced wildlife habitat. These ecological functions had been non-existent for decades due to the previous ditch and drainage regime. The restoration and enhancement of wetlands onsite will likely improve water quality given increased flow dissipation and residence time of site hydrology. Restoring the natural hydrologic characteristics has also restored the conditions that are beneficial for the long-leaf

pine community type that previously dominated the site before human intervention.

3.6 Project Performance

3.6.1 *Vegetation Monitoring Results*

Sixteen (16) permanent vegetation plots were established and used in annual vegetation monitoring. Of these, fifteen (15) were set up and monitored using the Carolina Vegetation Survey (CVS) – EEP protocol Level 2 (version 4.2). The remaining plot was located at Site 6 and consisted of a total stem count because this restoration area was so small. Areas of slow vegetative growth identified within the stream valleys during previous monitoring events were replanted by the EEP in March of 2014 (Figure 3). These areas represented approximately 11 acres, or 10% of the entire site. Any supplemental plantings that were located within vegetative plots were identified and documented during Year 5 monitoring efforts.

During the MY5 monitoring event, the site exhibited a mean planted density of 504 stems per acre with a range of 161 to 971 stems per acre. When subtracting the supplemental stems recently planted, the mean stem density was 377 stems per acre with a range of 161 to 688 stems per acre. This was lower than the 421 stems per acre observed in 2013, but still surpassed the vegetative success criterion. When volunteers are included in the totals, the mean stem density was 4,840 stems per acre with a range of 1,457 to 9,672 stems per acre. Vegetation plot locations are identified in Figure 3. Of the individual plots, VP 3 and VP 13 did not meet the success criterion. Four stems in VP 3 died since the MY4 monitoring event and four additional stems continue to be missing. Currently, there are four original stems and one supplemental *Nyssa biflora* stem that was planted in the spring of 2014. As in MY4, only four of the eighteen originally planted longleaf pine trees remain in VP 13. This equates to 161.8 planted stems per acre. As in previous years, the health of the remaining trees in this plot is good (all rated 3 for vigor); however, volunteer vegetation is quite dense in this area and shading may be contributing to increased mortality of the longleaf stems.

Planted stem growth of vegetation within the plots located in the stream valleys (VP 1-4 & 6-9) continues to be slow (average of less than 2.5 feet in height for non-supplemental stems). However, the height of most stems has been slowly increasing each year. As noted above, supplemental planting occurred within the zero-order stream valleys in March of 2014 and the number of planted stems observed within the plots located in these areas increased.

As in previous years, a large number of volunteer shrubs was identified in most of the plots. Plots located within the stream valleys (VP 1-4 & 6-9) supported mostly volunteer loblolly pine trees. Other plots outside of the channels (VP 5; 10-15) contained high numbers of a variety of characteristic trees and shrubs including loblolly pine (*Pinus taeda*), huckleberry (*Gaylussacia frondosa*), and gallberry (*Ilex glabra*). The number of volunteers within the site steadily increased between MY1

and MY4, but then decreased between MY4 and MY5 as the plants have grown in size. Overall the diversity of native woody vegetation is excellent with between 4 and 12 native woody species noted per plot and 26 native woody species noted site wide.

The site's mean stem density surpassed the vegetative success criterion during all five years of monitoring (Table 9). Individually, VP 13 did not meet the planted criterion in Years 3 - 5 and VP 3 failed to meet it in Year 5. But as indicated above, together with the volunteer population the site is dense and diverse.

3.6.2 *Stream Monitoring Results*

Stream monitoring consisted of both visual and morphological (i.e. survey) assessment of the channels. Both channels exhibited evidence of the "braided" stream type characteristic of the Zero to First Order outer coastal plain stream morphology. The channels appear to be stable and no areas of significant degradation or rill erosion were noted. Based on survey data collected from longitudinal profiles and eight fixed cross sections, the channel dimension and pattern are similar to as-built conditions (Appendix D; Figure 4). No significant trends are seen when comparing cross section and longitudinal data between the monitoring years.

3.6.3 *Hydrology Monitoring Results*

The site is currently being monitored for hydrology using forty-three (43) water level monitoring gauges (28 groundwater monitoring gauges, 8 surface flow monitoring gauges, and 7 reference gauges (Figure 3).

During MY5 (2014), two gauges were replaced. Well #16 was destroyed by an ATV or wildlife and Gauge #4S was rendered inoperable due to equipment malfunction. Both gauges were replaced in February of 2014.

Groundwater Hydrology

In MY 5, all 28 groundwater monitoring gauges located within the mitigation site exhibited groundwater within 12 inches of the soil surface for a duration in excess of the 12% hydrologic success criterion (Table 10). The hydrographs of the gauges show groundwater levels were within 12 inches of the soil surface for much of the 2014 growing season (Appendix E). Please see Figure 3 for gauge locations.

A comparison between pre-construction monitoring data and post-construction monitoring data demonstrated an increase in hydroperiod within the enhancement areas. In MY5, Gauge 11 exhibited 69 consecutive days (26% 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 exhibited 72 consecutive days (27% of the growing season) in MY5 while 2005 pre-construction monitoring data exhibited 11 consecutive days (5% of the growing season) in the same location.

Throughout the five years of monitoring, the hydrology success criterion has largely been met on this site (Table 10). In MY2 (2011), six gauges did not meet the criteria. Rainfall was below normal during several months of the growing season in 2011 and likely attributed to this lack of wetland hydrology.

Stream Hydrology

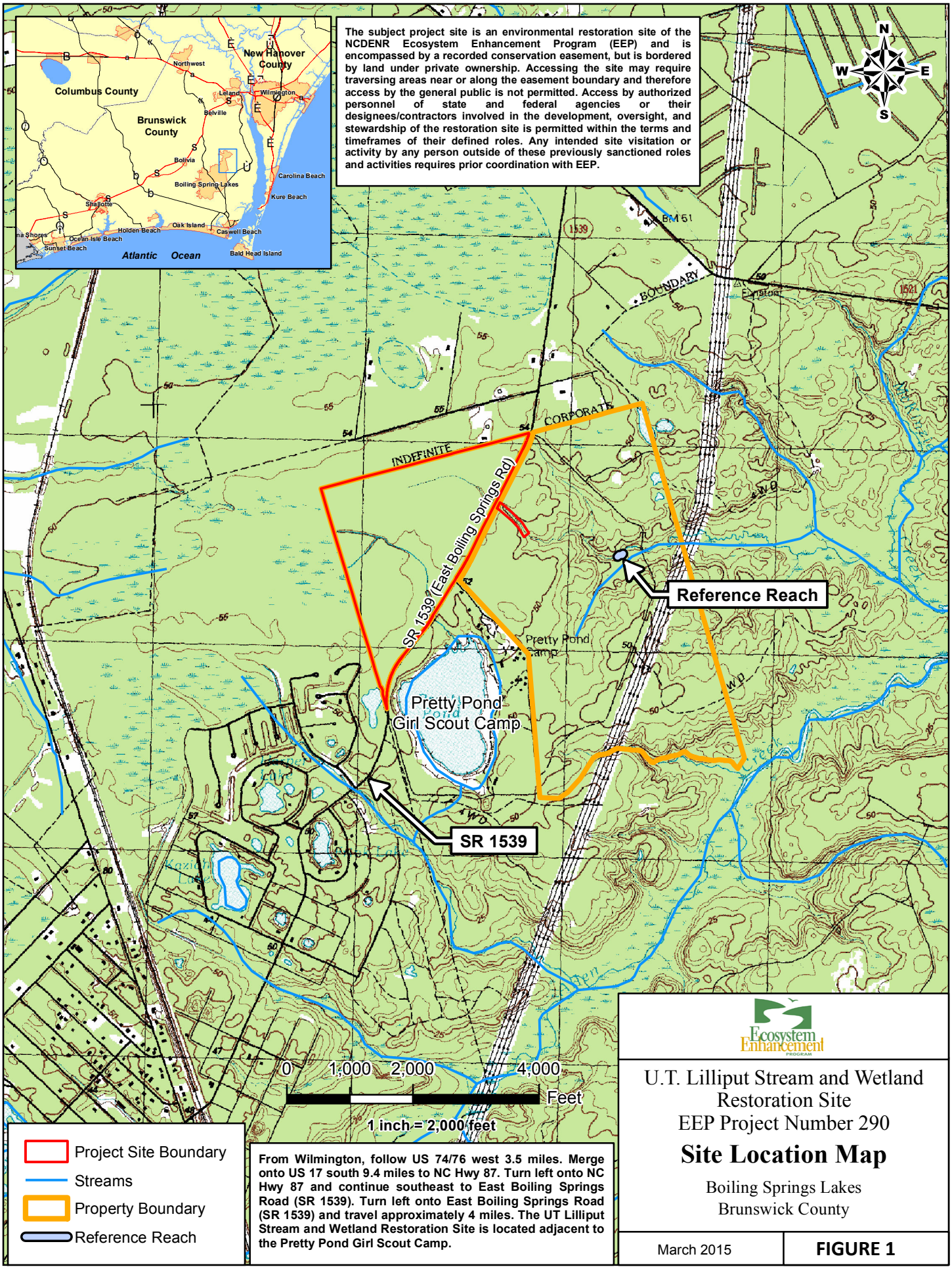
All surface water monitoring gauges exhibited fluctuations in water levels and extended periods of above-ground flow during MY5. As in previous years, the reference stream gauge documented a lower level of water in the channel and less variable flow than the on-site stream gauges (Appendix E). The reference stream is located in a more densely vegetated area than the on-site streams. The vegetation and surface roughness adjacent to the reference channel is likely reducing peak discharge events.

3.6.4 Verification of Component Boundaries

Verification of stream and wetland boundaries was conducted in the fall of 2013 to ensure that on-the-ground mitigation acreages match mapped boundaries as depicted in the mitigation plan. NC DWQ Stream Identification Forms (Ver. 4.11) and USACE Stream Assessment Worksheets were completed in several locations to determine the limits of streams on site. Based upon this assessment, the stream limits appear to be consistent with those depicted in the mitigation plan. The wetlands assessment was performed using the three parameter methodology outlined in the 1987 COE Wetland Delineation Manual and the Atlantic and Gulf Coastal Plain Regional Supplement to the COE Wetland Delineation Manual (USACE 2010). Several areas identified as wetland enhancement (6.1 acres total) and one area identified as wetland restoration (0.16 ac) in the mitigation plan did not meet hydric soil and/or wetland hydrology parameters (Figure 3).

4.0 PROJECT CONDITION AND MONITORING DATA APPENDICES

Appendix A.
Project Vicinity Map and Background Tables



Source: USGS 7.5 Minute Quadrangle, Funston, NC

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FIGURE 2.

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
W E
S

0 300 600 1,200
Feet

Ecosystem Enhancement Program

March 2015

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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	1,026		4.09	7.83 (7.67[1])	65.78 (62.73[1])			

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	4,932 LF	Preservation	Preservation (RE)	4,932 LF	5:1
Stream Preservation	See Figure 1a (area closest to road)	400 LF	Preservation	Preservation (RE)	400 LF	10:1
Non-Riparian Wetland Restoration	See Figure 1a	7.83 (7.67[1]) ac	Restoration	Restoration	7.83 (7.67[1]) ac	1:1
Non-Riparian Wetland Enhancement	See Figure 1a	96.46 (90.36[1]) ac	Enhancement	Enhancement (RE)	96.46 (90.36[1]) 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 (7.67[1]) ac		
Enhancement			96.46 (90.36[1]) 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

[1] Asset verification performed in 2013 determined that acreage of wetland restoration and enhancement decreased.

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	December-13	December-13
Year 5 Monitoring	December-14	March-15

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 - MY5) Vegetation Monitoring POC Wetland Monitoring POC	Land Management Group, Inc. 3805 Wrightsville Avenue, Suite 15; Wilmington, NC 28403 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	03-06-17	
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		

Appendix B.
Visual Assessment Data

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FIGURE 3.

Current Conditions Plan View
U.T. to Lilliput Creek
(Hog Branch Ponds)
Stream and Wetland
Restoration Site
Project No: D08049S
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 slow stem growth that received supplemental planting in March of 2014.

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)
- Preliminary wetlands assessment conducted in 2013 found these areas to be uplands (~6.3 acres)

0 200 400 800 Feet

N

Ecosystem Enhancement PROGRAM

March 2015

Preliminary Uplands
Preliminary Uplands
Preliminary Uplands
SR 1539 (East Boiling Springs Rd)
Pretty Pond
Girl Scout Camp

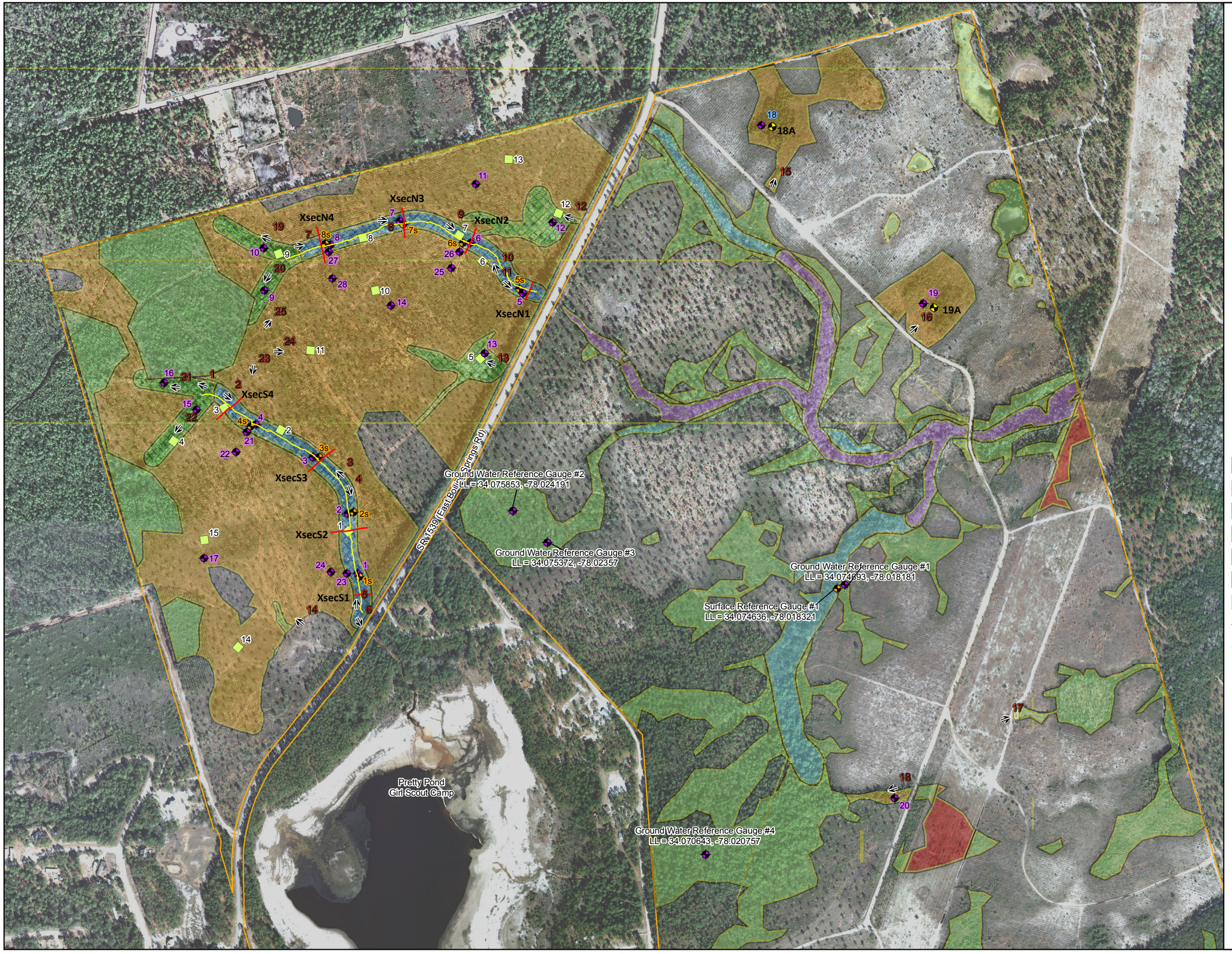


FIGURE 4.

Monitoring Plan Features

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

Brunswick County

Legend

- Vegetation Monitoring Plot
- Photo Point and Direction

Monitoring Gauges

- Surface Gauges 2010
- Groundwater Gauges 2010/2011
- New Gauge installed in February 2013

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

N
W E
S

0 250 500 1,000 Feet

Ecosystem Enhancement Program

March 2015

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 MY5 2014	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	VP 3 & 13 did not meet vegetative success criterion in MY5.	Red Square	2	0.04 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; supplemental planting occurred in 2014	Red dotted line	2	~ 11 ac	~ 10%

Stream Problem Areas UT to Lilliput Stream and Wetland Restoration Site EEP Project No. 290			
Feature Issue	Station Number	Suspected Cause	Photo Number
No issues identified	N/A	N/A	N/A

Vegetation Problem Areas UT to Lilliput Stream and Wetland Restoration Site EEP Project No. 290			
Feature Issue	Station Number	Suspected Cause	Photo Number
No issues identified	N/A	N/A	N/A

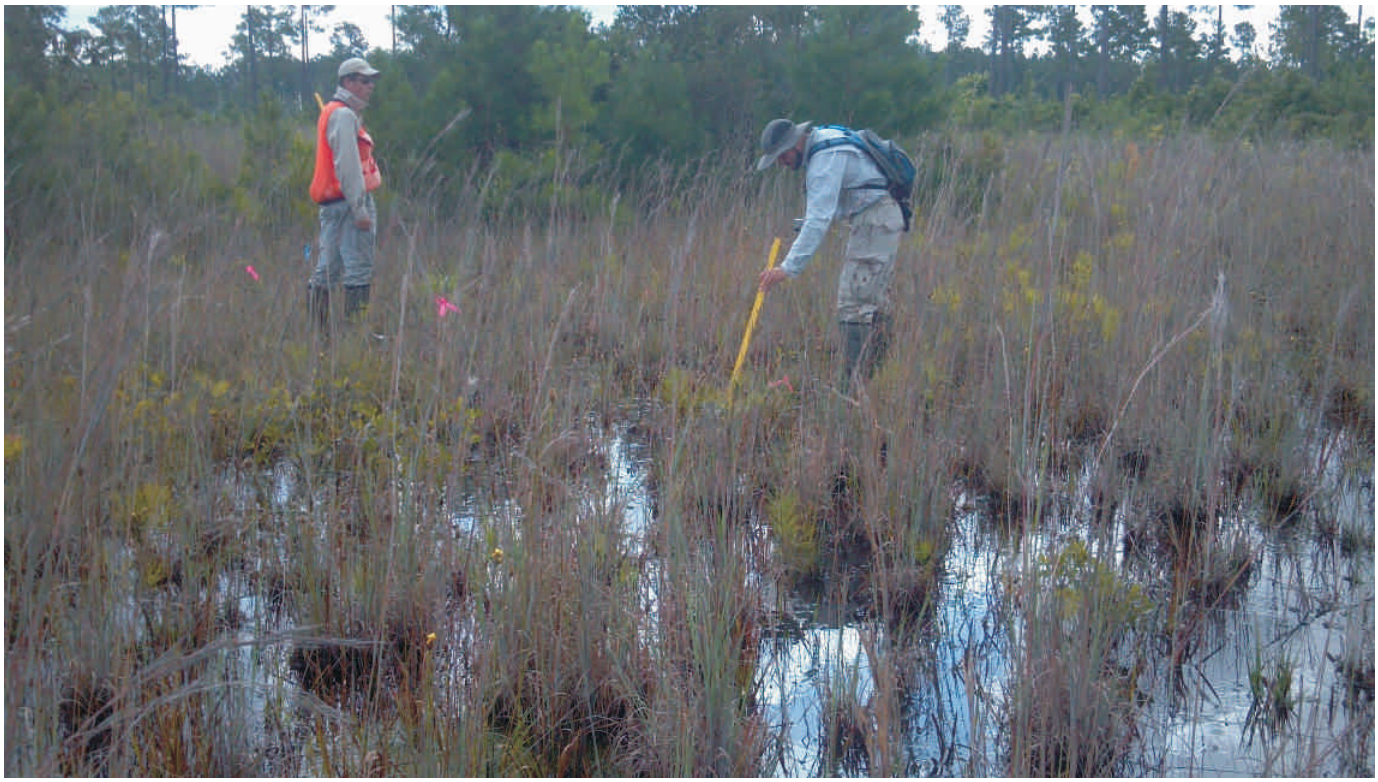


Photo Station 2: Vegetation Plot 3 in Southern Tributary (photo taken 9/16/14)

Photo Station 4: Southern Tributary (photo taken 9/16/14)

Photo Station 7: Vegetation Plot 8 in Northern Tributary (photo taken 9/16/14)

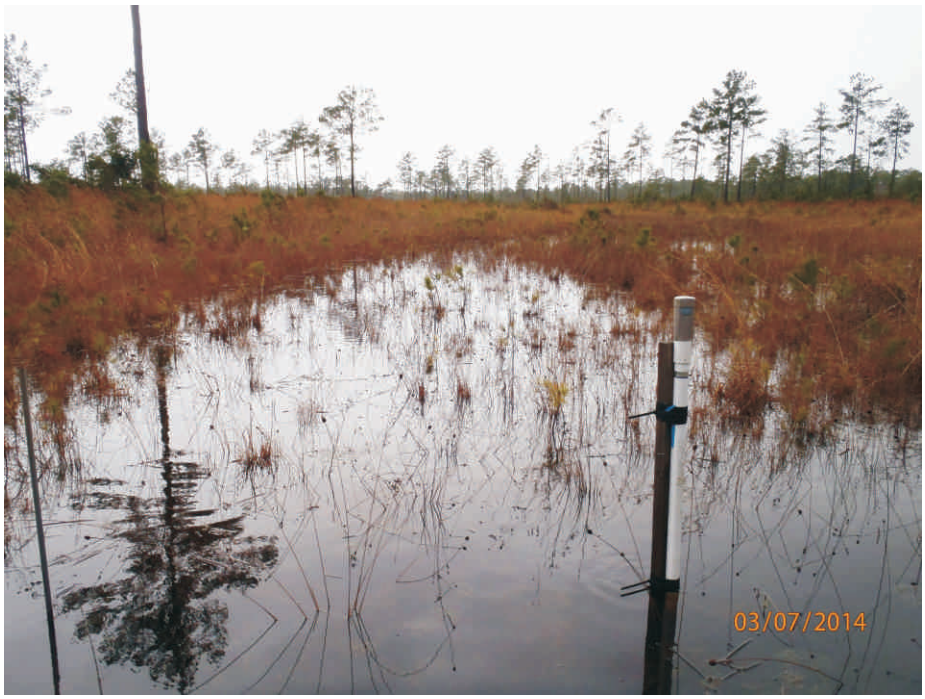


Photo Station 10: Northern Tributary (photo taken 3/7/14)

Photo Station 20: Upper Reach of Northern Tributary (photo taken 3/7/14)

Photo Station 21: Upper Reach of Southern Tributary (photo taken 9/16/14)

Picture 17

Picture 18

Pre-Restoration Photos Taken near VP 5

Vegetation Plot 5 (photo taken 9/16/14)

Picture 11

Picture 12

Pre-Restoration Photos Taken near VP 9

Vegetation Plot 9 (photo taken 9/16/14)

Picture 23

Picture 24

Pre-Restoration Photos Taken near VP 13

Vegetation Plot 13 (photo taken 9/16/14)

Picture 1

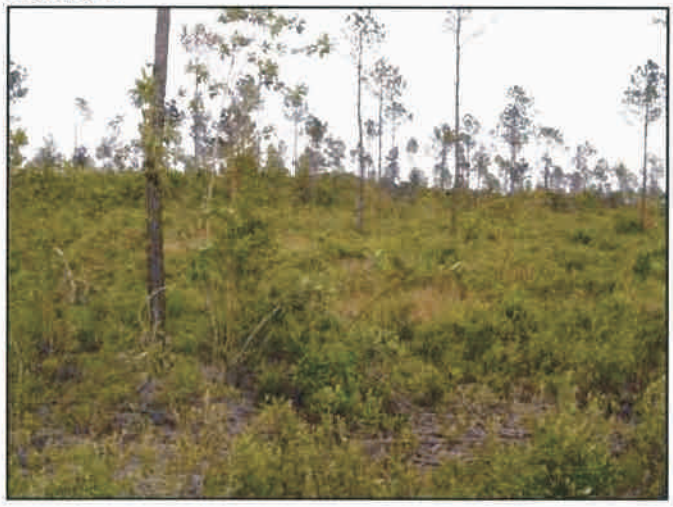
Picture 2

Pre-Restoration Photos Taken near VP 14

Vegetation Plot 14 (photo taken 9/16/14)

Picture 7

Picture 8



Pre-Restoration Photos taken near VP 15

Vegetation Plot 15 (photo taken 9/16/14)

Appendix C.
Vegetation Plot Data

Table 7. Vegetation Plot Criteria Attainment			
Tract	Vegetation Plot ID	Vegetation Survival Threshold Met?	Tract Mean
Southern Tributary	VP1	Y	88%
Southern Tributary	VP2	Y	
Southern Tributary	VP3	N	
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	3/6/2015 10:00
Database Name	UTLilliput_290_MY5_2014.mdb
Database Location	L:\Wetlands\2008\UT to Lilliput\Annual Monitoring Report\Year 5
Computer Name	KWILLIAMS
Description Worksheets in This Document	
Metadata	Description of database file, the report worksheets, and a summary of project and project data.
Proj Planted	Each project is listed with its PLANTED stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Proj Total Stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc)
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
Project Summary	
Project Code	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)

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2014)																								
			E290-LMG-0001			E290-LMG-0002			E290-LMG-0003			E290-LMG-0004			E290-LMG-0005			E290-LMG-0006			E290-LMG-0007			E290-LMG-0008			E290-LMG-0009		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																										
Aronia		Shrub																										
Aronia arbutifolia	red chokeberry	Shrub																										
Clethra alnifolia	sweet pepperbush	Shrub																										
Cyrilla racemiflora	swamp titi	Shrub						8			10																	14
Gaylussacia dumosa	dwarf huckleberry	Shrub																										
Gaylussacia frondosa	blue huckleberry	Shrub																		1								9
Gordonia lasianthus	loblolly bay	tree						1						1														
Ilex cassine	dahoon	Shrub																										
Ilex coriacea	large gallberry	Shrub																										
Ilex glabra	inkberry	Shrub						3									9			6								8
Ilex verticillata	common winterberry	Shrub				1	1	1				6	6	6										1	1	1		
Lyonia lucida	fetterbush lyonia	Shrub						4						6						13								
Lyonia mariana	piedmont staggerbush	Shrub																										
Magnolia virginiana	sweetbay	Tree	5	5	10	2	2	2				1	1	3							5	5	6	3	3	3	1	1	6
Morella cerifera	wax myrtle	shrub			3			7						1			1			2								8
Nyssa	tupelo	Tree																										
Nyssa biflora	swamp tupelo	Tree	3	3	9	4	4	4	1	1	1	6	6	6							1	1	1	3	3	3	5	5	5
Nyssa sylvatica	blackgum	Tree																										
Persea borbonia	redbay	tree																		4								
Persea palustris	swamp bay	tree																										
Pinus palustris	longleaf pine	Tree													6	6	6	4	4	4								
Pinus serotina	pond pine	Tree	4	4	4	8	8	8	4	4	4	2	2	2	6	6	6	11	11	11	4	4	4	3	3	3	3	3	3
Pinus taeda	loblolly pine	Tree			72			82			40			73			30			39			24			34			44
Quercus	oak	Tree										1	1	1							1	1	1	2	2	2			
Quercus laurifolia	laurel oak	Tree										1	1	1														
Quercus lyrata	overcup oak	Tree	2	2	2							6	6	6										1	1	1	3	3	3
Rhus copallinum	flameleaf sumac	shrub																										
Taxodium distichum	bald cypress	Tree										1	1	1										5	5	5	3	3	3
Vaccinium	blueberry	Shrub																										
Vaccinium corymbosum	highbush blueberry	Shrub																										
Vaccinium elliottii	Elliott's blueberry	Shrub																										
Zenobia	honeycup	Shrub																										
	Stem count		14	14	100	15	15	120	5	5	55	24	24	107	12	12	52	15	15	80	11	11	36	18	18	52	15	15	103
	size (ares)		1			1			1			1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		4	4	6	4	4	10	2	2	4	8	8	12	2	2	5	2	2	8	4	4	5	7	7	8	5	5	10
	Stems per ACRE		566.56	566.56	4046.9	607.03	607.03	4856.2	202.34	202.34	2225.8	971.25	971.25	4330.1	485.62	485.62	2104.4	607.03	607.03	3237.5	445.15	445.15	1456.9	728.43	728.43	2104.4	607.03	607.03	4168.3

Site	Species	Planted	MY5 Total
Site 6	*Taxodium distichum*	40	27

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

Fails to meet requirements

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

Scientific Name	Common Name	Species Type	Current Plot Data (MY5 2014)																			Annual Means											
			E290-LMG-0010			E290-LMG-0011			E290-LMG-0012			E290-LMG-0013			E290-LMG-0014			E290-LMG-0015			MY5 (2014)			MY4 (2013)			MY3 (2012)			MY2 (2011)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			1												1						2			2			6				
Aronia		Shrub																								185							
Aronia arbutifolia	red chokeberry	Shrub									1												1										
Clethra alnifolia	sweet pepperbush	Shrub												10									10			12			5				
Cyrilla racemiflora	swamp titi	Shrub			17									13						57			119			138			45				
Gaylussacia dumosa	dwarf huckleberry	Shrub												20			80						100			125							
Gaylussacia frondosa	blue huckleberry	Shrub			30			50												50			140			203							
Gordonia lasianthus	loblolly bay	tree												2									4			3							
Ilex cassine	dahoon	Shrub															4			1			5			3							
Ilex coriacea	large gallberry	Shrub																								166							
Ilex glabra	inkberry	Shrub			17			33			3			21			45			56			201			224			55				
Ilex verticillata	comn winterberry	Shrub																			8	8	8										
Lyonia lucida	fetterbush lyonia	Shrub						4			13												40			126			12				
Lyonia mariana	pt staggerbush	Shrub																		10			10			100							
Magnolia virginiana	sweetbay	Tree																		1	17	17	31	14	14	100	15	15	15	16	16	16	
Morella cerifera	wax myrtle	shrub			15			6			17			10			30						100			102			19				
Nyssa	tupelo	Tree																								5							
Nyssa biflora	swamp tupelo	Tree																			23	23	29	2	2	2	2	2	2	1	1	1	
Nyssa sylvatica	blackgum	Tree																								20							
Persea borbonia	redbay	tree			25			12			6			43			10			5			105			154							
Persea palustris	swamp bay	tree																											26				
Pinus palustris	longleaf pine	Tree	12	12	12	9	9	9	8	8	8	4	4	4	8	8	8	8	8	8	59	59	59	63	63	64	59	59	59	71	71	71	
Pinus serotina	pond pine	Tree							9	9	9										54	54	54	58	58	112	63	63	78	64	64	64	
Pinus taeda	loblolly pine	Tree			7			16			48			4			15			23			551			422			82				
Quercus	oak	Tree																			4	4	4	3	3	3	7	7	7	6	6	6	
Quercus laurifolia	laurel oak	Tree																			1	1	1	1	1	1	5	5	5	6	6	6	
Quercus lyrata	overcup oak	Tree																			12	12	12	15	15	15	20	20	20	25	25	25	
Rhus copallinum	flameleaf sumac	shrub									6												6			6							
Taxodium distichum	bald cypress	Tree																			9	9	9										
Vaccinium	blueberry	Shrub																								9			27				
Vaccinium corymbosum	highbush blueberry	Shrub			50			100						21									171			132							
Vaccinium elliottii	Elliott's blueberry	Shrub																								24							
Zenobia	honeycup	Shrub						9						13									22										
	Stem count		12	12	174	9	9	239	17	17	111	4	4	161	8	8	193	8	8	211	187	187	1794	156	156	2458	171	171	463	189	189	189	
	size (ares)		1			1			1			1			1			1			15			15			15			11				
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.37			0.37			0.37			0.27				
	Species count		1	1	9	1	1	9	2	2	9	1	1	11	1	1	8	1	1	9	9	9	26	7	7	28	7	7	16	7	7	7	
	Stems per ACRE		485.6	485.6	7042	364.2	364.2	9672	688	688	4492	161.9	161.9	6515	323.7	323.7	7810	323.7	323.7	8539	504.5	504.5	4840	420.9	420.9	6631	461.3	461.3	1249	695.3	695	695	

Color for Density

Exceeds requirements by 10%

Exceeds requirements, but by less than 10%

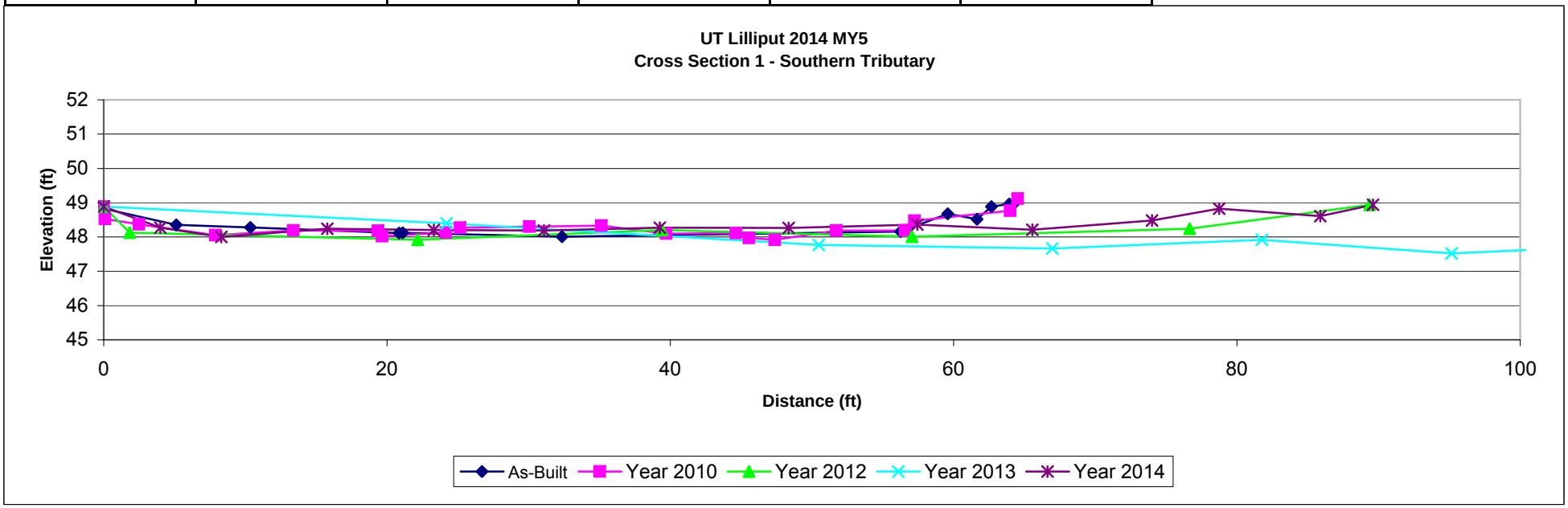
Fails to meet requirements

Appendix D.
Stream Survey Data

Project Name	UT to Lilliput
Watershed	Lilliput, MY5
Cross Section	1S
Drainage Area	66.94 ac
Date	12/15/2014
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		0	48.89		0.00	48.89	
5.13	48.35		0.09	48.53					1.83	48.13		24.2	48.4		3.99	48.27	
10.36	48.28		2.48	48.37					22.17	47.92		50.48	47.77		8.31	48.00	
20.86	48.11		7.88	48.05					39.42	48.2		66.97	47.66		15.78	48.24	
21.1	48.12		13.38	48.19					57.06	48.01		81.76	47.92		23.30	48.20	
32.36	48.01		19.37	48.18					76.66	48.24		95.15	47.52		31.09	48.19	
56.25	48.16		19.65	48.02					89.37	48.94		114.18	47.87		39.26	48.27	
59.59	48.68		24.16	48.13								138.24	48.84		48.35	48.26	
61.65	48.52		25.16	48.27											57.44	48.36	
62.67	48.89		30.04	48.3											65.56	48.21	
63.92	48.96		35.14	48.33											74.00	48.48	
64.23	48.96		39.71	48.1											78.76	48.83	
			44.64	48.11											85.88	48.61	
			45.56	47.97											89.60	48.94	
			47.38	47.92													
			51.71	48.19													
			56.59	48.19													
			57.23	48.47													
			64	48.77													
			64.52	49.12													

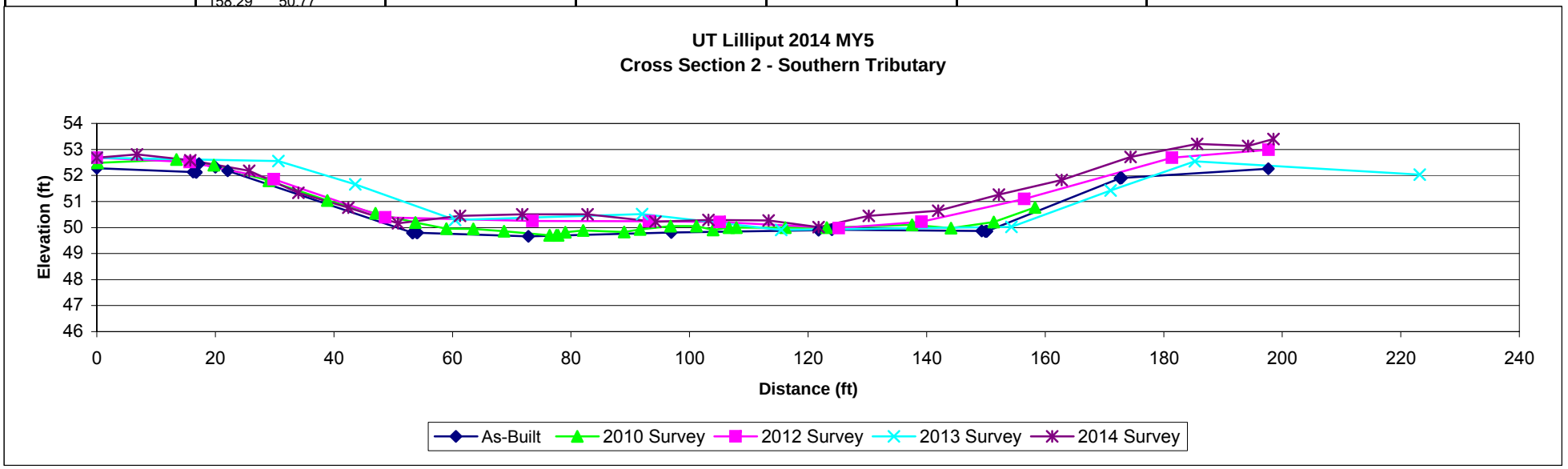
Southern Tributary Station 29+00 - SCX1
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 5
Cross Section	2S
Drainage Area	66.94 ac
Date	12/15/2014
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		0	52.68		0.00	52.68	
16.25	52.13		0.14	52.48					15.68	52.51		30.63	52.55		6.79	52.81	
16.73	52.13		13.46	52.61					29.88	51.85		43.6	51.66		15.78	52.58	
16.75	52.12		19.73	52.4					48.66	50.39		60.46	50.29		25.69	52.18	
16.75	52.12		29.04	51.8					73.52	50.25		92	50.52		34.00	51.33	
17.26	52.46		38.91	51.04					93.16	50.24		115.47	49.91		42.44	50.76	
20	52.32		47	50.55					105.09	50.21		154.32	50.02		50.81	50.16	
22.07	52.18		53.77	50.19					125.19	49.98		171.03	51.42		61.29	50.45	
53.26	49.8		58.97	49.96					139.15	50.22		185.26	52.54		71.79	50.51	
53.29	49.79		63.53	49.95					156.49	51.1		223.2	52.03		82.78	50.51	
53.99	49.8		68.72	49.86					181.4	52.68					94.27	50.22	
54.12	49.8		76.4	49.7					197.68	52.99					103.18	50.29	
72.82	49.66		77.52	49.7											113.36	50.27	
96.93	49.81		77.81	49.7											121.78	50.01	
121.79	49.9		79.02	49.82											130.25	50.45	
124.01	49.92		82.05	49.89											141.96	50.64	
149.28	49.87		88.99	49.83											152.21	51.26	
149.91	49.85		91.67	49.93											162.79	51.83	
150.07	49.85		96.79	50.05											174.39	52.71	
150.16	49.86		101.16	50.05											185.64	53.21	
172.65	51.89		103.95	49.91											194.22	53.13	
172.69	51.9		106.66	50											198.50	53.4	
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													

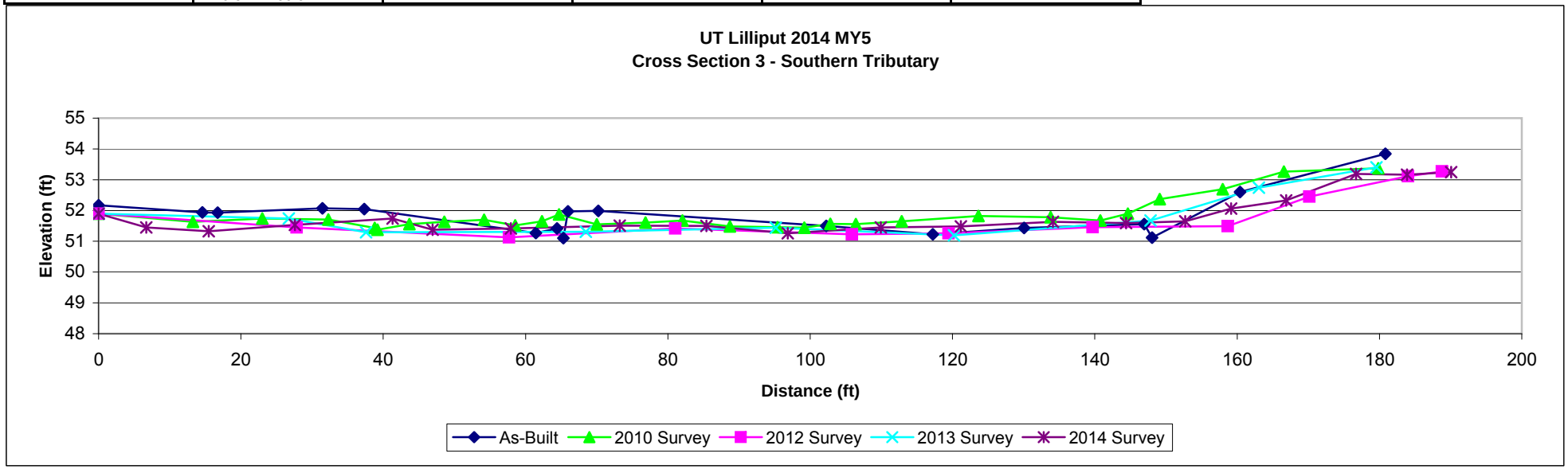
Southern Tributary Station 23+00 - SCX2
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 5
Cross Section	3S
Drainage Area	66.94 ac
Date	12/15/2014
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		0	51.90		0	51.9	
14.6	51.94		13.24	51.63					27.84	51.45		26.74	51.74		6.69	51.45	
16.72	51.93		23.01	51.74					57.68	51.13		37.57	51.29		15.48	51.33	
31.45	52.07		32.28	51.71					81.06	51.42		68.47	51.31		27.6	51.53	
37.34	52.05		38.82	51.43					105.87	51.23		95.17	51.44		41.31	51.74	
61.46	51.27		39.2	51.38					119.46	51.26		120.22	51.19		46.94	51.38	
64.43	51.42		43.69	51.56					139.7	51.46		147.84	51.67		57.95	51.42	
65.32	51.1		48.6	51.63					158.69	51.49		163.07	52.74		73.23	51.51	
65.95	51.97		54.17	51.7					170.14	52.45		179.56	53.40		85.43	51.5	
70.21	51.99		58.55	51.52					184.01	53.11					96.85	51.26	
102.27	51.5		62.3	51.65					188.8	53.27					109.91	51.45	
117.25	51.23		64.72	51.87											121.16	51.48	
130.06	51.43		70.01	51.55											134.1	51.63	
146.95	51.56		76.86	51.61											144.38	51.59	
148.06	51.12		82.04	51.67											152.71	51.65	
160.4	52.6		88.7	51.48											159.15	52.06	
180.84	53.84		95.41	51.46											166.88	52.33	
			99.19	51.44											176.72	53.19	
			102.84	51.57											183.87	53.16	
			106.43	51.56											190.07	53.25	
			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													

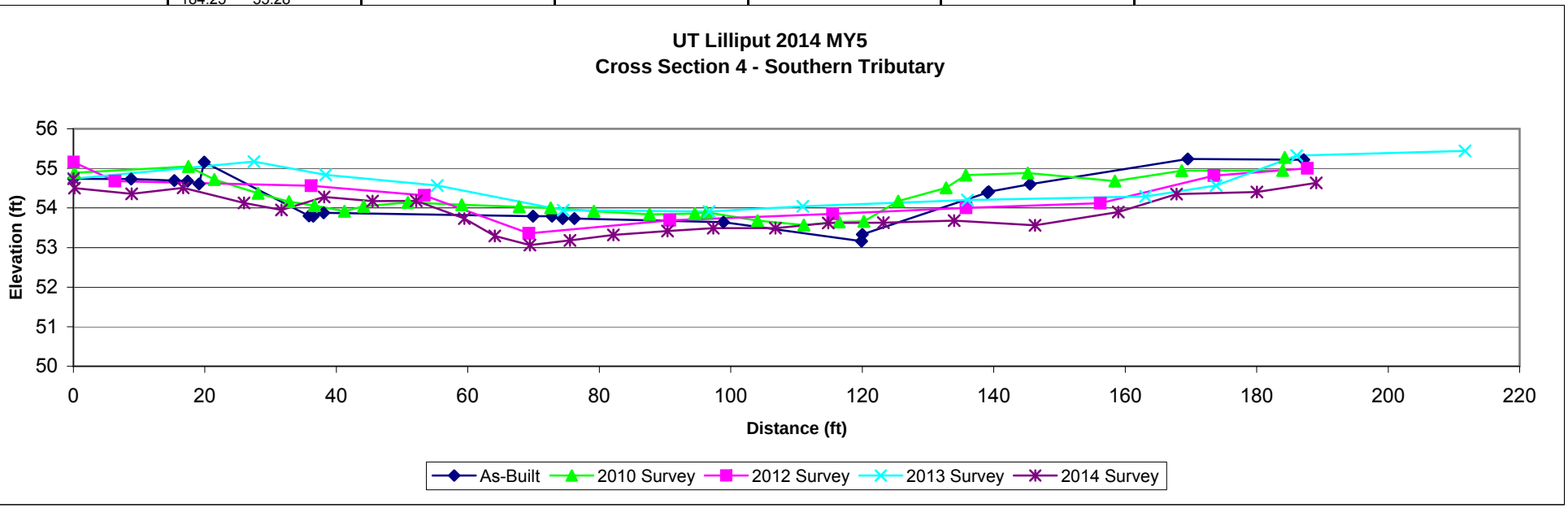
Southern Tributary Station 23+00 - SCX3
Looking upstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 5
Cross Section	4S
Drainage Area	66.94 ac
Date	12/15/2014
Crew	Paramounte

Southern Tributary Station 15+00 - SCX4
Looking downstream

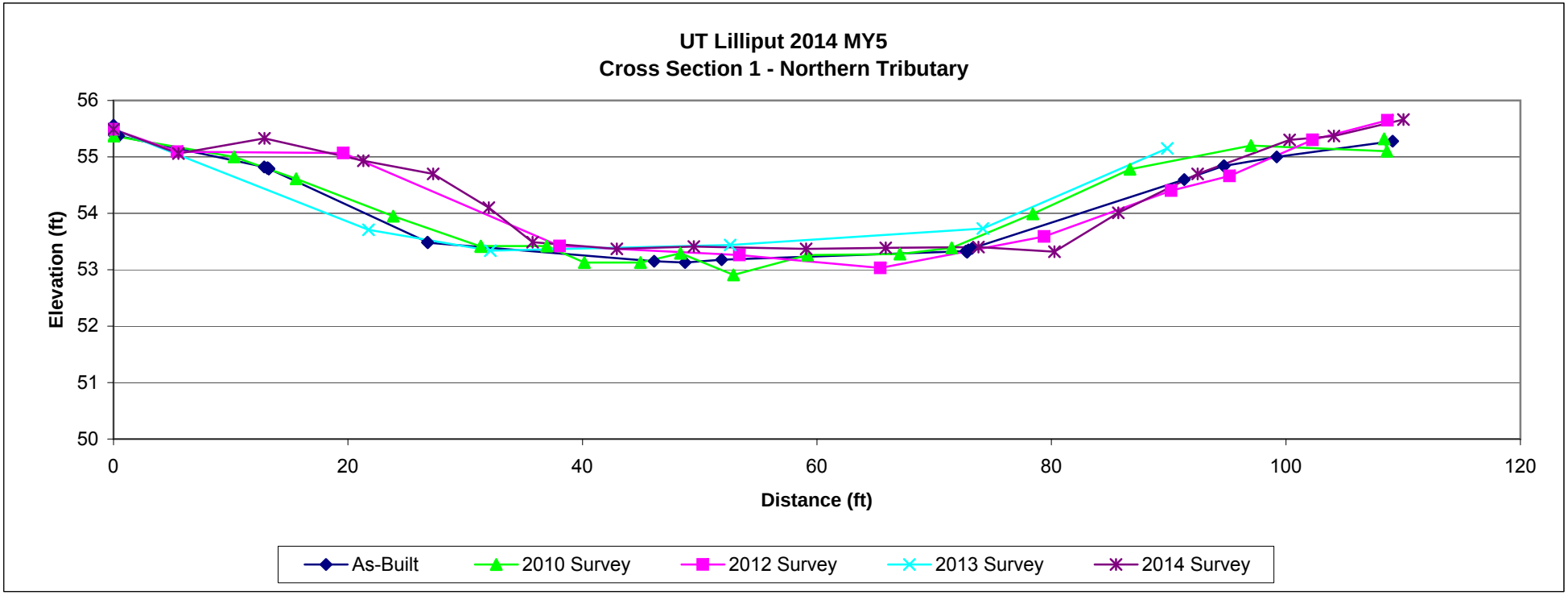
As-built Survey			2010 Survey			2011 Survey			2012 Survey			2013 Survey			2014 Survey		
Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes	Station	Elev	Notes
0	54.74		0	55.16		N/A			0	55.16		0	54.74		0.00	54.74	
8.78	54.73		0.15	54.89					6.33	54.68		27.46	55.17		0.14	54.5	
15.36	54.69		17.5	55.05					36.15	54.56		38.37	54.84		8.87	54.36	
17.37	54.68		21.43	54.72					53.37	54.32		55.37	54.57		16.69	54.51	
19.1	54.61		28.11	54.37					69.3	53.36		74.51	53.94		25.95	54.13	
19.91	55.16		32.8	54.16					90.73	53.69		96.71	53.91		31.64	53.95	
35.85	53.8		36.68	54.06					115.5	53.85		110.95	54.04		38.13	54.28	
36.47	53.79		41.24	53.92					135.78	54		135.98	54.2		45.49	54.17	
38.08	53.88		44.17	54.04					156.2	54.12		163.09	54.29		52.15	54.18	
69.9	53.79		50.87	54.14					173.52	54.82		173.84	54.57		59.49	53.73	
72.79	53.79		59.07	54.08					187.72	55		186.1	55.32		64.10	53.29	
74.41	53.73		67.83	54.03								211.71	55.44		69.46	53.06	
76.19	53.73		72.61	54											75.54	53.18	
98.88	53.64		79.17	53.92											82.13	53.32	
119.88	53.16		87.63	53.84											90.36	53.42	
120	53.33		94.53	53.86											97.33	53.49	
139.03	54.39		96.31	53.89											106.81	53.49	
139.26	54.41		104.06	53.68											114.84	53.62	
145.55	54.6		111.12	53.57											123.23	53.63	
169.51	55.24		116.5	53.65											133.98	53.68	
187.17	55.22		120.25	53.66											146.27	53.56	
			125.49	54.17											158.93	53.9	
			132.75	54.51											167.81	54.35	
			135.77	54.83											180.02	54.4	
			145.16	54.88											189.07	54.63	
			158.45	54.68													
			168.6	54.94													
			183.97	54.95													
			184.25	55.28													



Project Name	UT to Lilliput
Watershed	Lilliput, MY5
Cross Section	N1
Drainage Area	52.49
Date	12/15/2014
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	55.49		0.00	55.49	
0.07	55.39		0.02	55.37					5.42	55.09		21.74	53.71		5.54	55.06	
0.44	55.37		10.28	55					19.6	55.07		32.14	53.34		12.87	55.33	
12.86	54.82		15.58	54.61					38.05	53.42		52.59	53.44		21.31	54.93	
13.11	54.8		23.87	53.95					53.38	53.26		74.14	53.73		27.27	54.7	
13.14	54.81		31.33	53.41					65.41	53.03		89.88	55.15		32.01	54.1	
13.23	54.79		31.33	53.42					79.37	53.59					35.75	53.49	
13.25	54.79		36.95	53.42					90.2	54.4					42.94	53.37	
13.25	54.79		40.17	53.13					95.19	54.66					49.50	53.41	
26.79	53.49		44.95	53.13					102.26	55.3					59.07	53.37	
26.8	53.48		48.35	53.29					108.67	55.65					65.86	53.39	
46.12	53.15		52.89	52.91											73.78	53.4	
48.76	53.13		59.18	53.26											80.25	53.32	
51.88	53.18		67.07	53.28											85.71	54.01	
72.69	53.33		71.5	53.39											92.48	54.7	
72.8	53.31		78.4	53.99											100.31	55.3	
72.91	53.35		86.69	54.78											104.09	55.37	
73.23	53.38		97.03	55.2											110.03	55.66	
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																

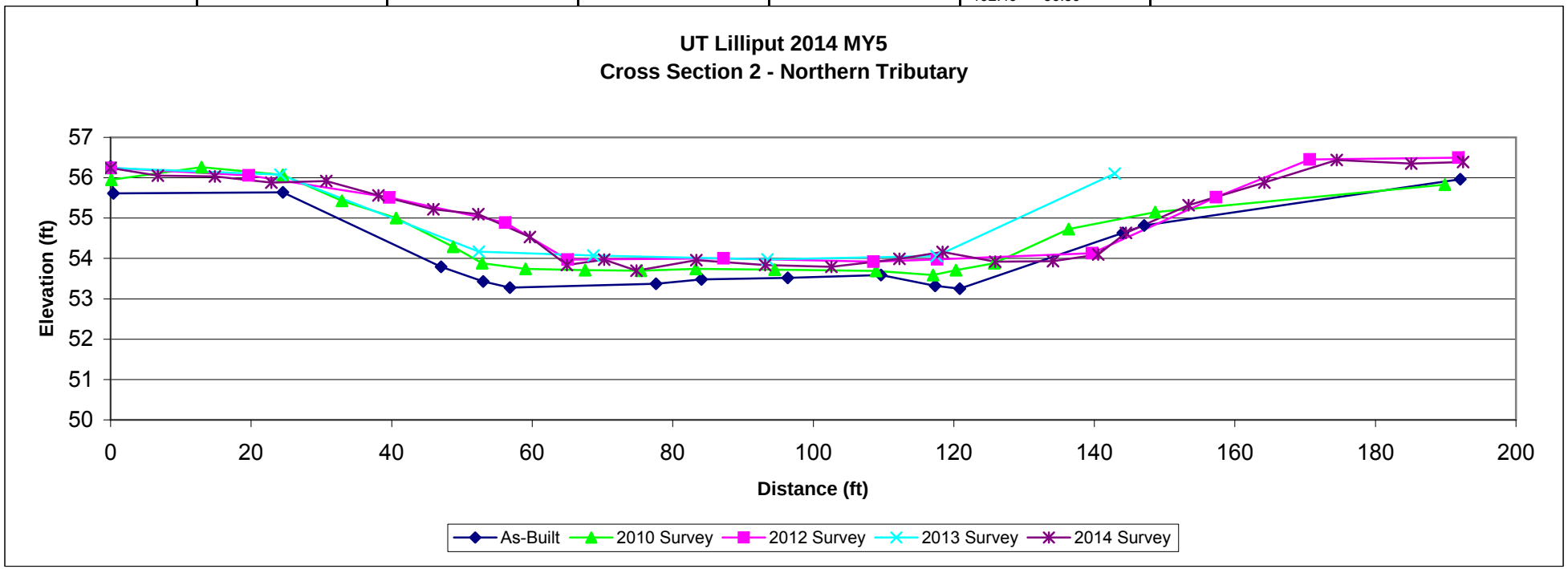
Northern Tributary Station 28+25 - NCX1
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY5
Cross Section	N2
Drainage Area	52.49
Date	12/15/2014
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	56.24		0.00	56.24	
0.4	55.61		0.1	55.95					19.65	56.06		24.17	56.08		6.72	56.05	
24.51	55.64		12.95	56.26					39.64	55.51		52.41	54.17		14.83	56.03	
47.03	53.79		24.5	56.07					56.16	54.89		68.69	54.07		22.88	55.88	
53.04	53.43		32.94	55.43					65.04	53.97		93.47	53.98		30.69	55.92	
56.82	53.28		40.64	55					87.21	54		117.51	54.06		38.10	55.56	
77.6	53.37		48.75	54.29					108.58	53.92		142.9	56.1		45.93	55.22	
84.09	53.48		52.86	53.88					117.63	53.98					52.31	55.10	
96.35	53.52		59.07	53.74					139.66	54.13					59.68	54.53	
109.63	53.59		67.53	53.71					157.3	55.52					64.93	53.84	
117.34	53.32		75.47	53.7					170.66	56.45					70.25	53.97	
120.85	53.25		83.29	53.74					191.83	56.5					74.84	53.70	
144.04	54.63		94.51	53.72											83.34	53.96	
147.08	54.82		108.93	53.69											93.15	53.84	
192.06	55.96		117.04	53.59											102.59	53.79	
			120.29	53.71											112.24	53.99	
			125.76	53.88											118.39	54.16	
			136.35	54.73											125.89	53.92	
			148.67	55.15											134.12	53.93	
			189.88	55.83											140.55	54.10	
															144.48	54.63	
															153.42	55.32	
															164.18	55.88	
															174.51	56.44	
															185.11	56.35	
															192.49	56.39	

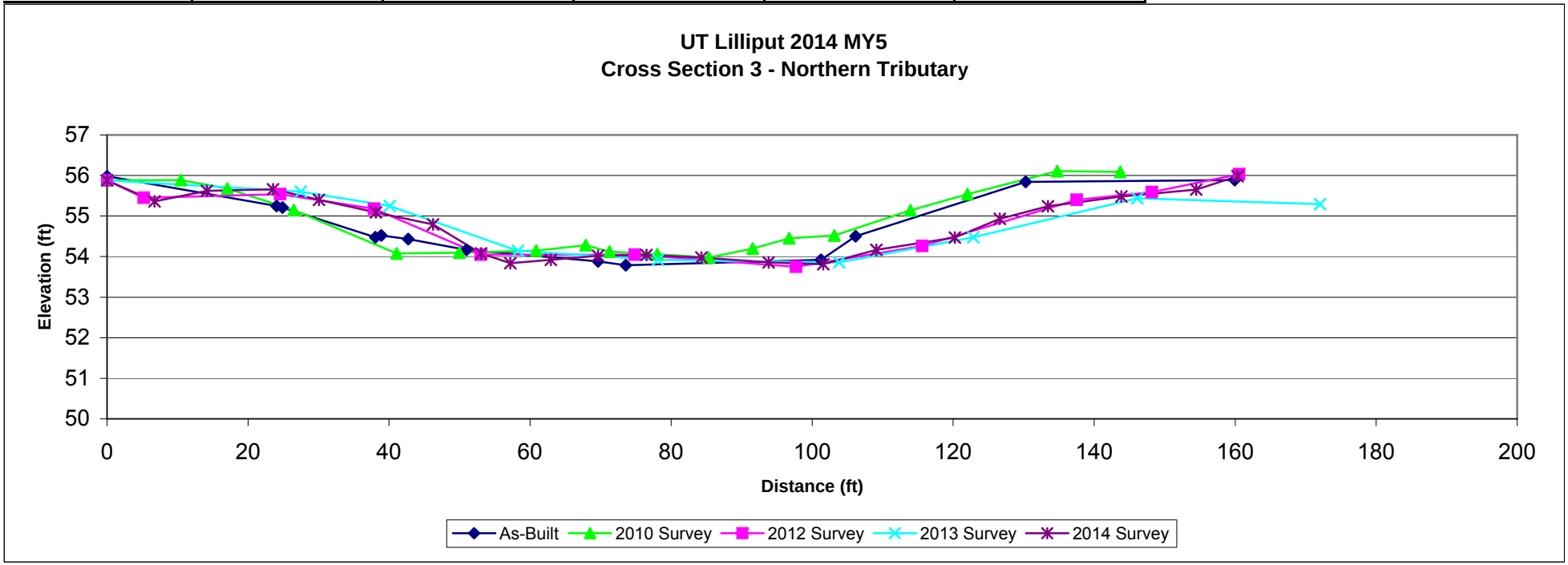
Northern Tributary Station 21+00 - NCX2
Looking downstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 5
Cross Section	N3
Drainage Area	52.49
Date	12/15/2014
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		0	55.88		0.00	55.88	
24.05	55.25		10.48	55.89					5.22	55.45		27.48	55.6		6.72	55.36	
24.89	55.21		17.07	55.68					24.55	55.54		40.08	55.25		14.15	55.62	
38.04	54.48		26.47	55.15					37.87	55.18		58.27	54.14		23.54	55.66	
38.91	54.52		41.07	54.08					53	54.05		78.15	53.92		30.05	55.40	
42.7	54.43		49.96	54.1					74.84	54.05		103.85	53.86		38.13	55.09	
50.97	54.17		60.88	54.15					97.72	53.75		122.88	54.48		46.25	54.79	
69.64	53.88		67.88	54.28					115.63	54.26		146.11	55.44		53.06	54.08	
73.57	53.79		71.28	54.12					137.54	55.4		172.04	55.29		57.20	53.84	
101.27	53.92		78.04	54.06					148.2	55.59					62.94	53.92	
106.16	54.5		85.34	53.98					160.55	56.03					69.65	54.02	
130.28	55.84		91.58	54.2											76.51	54.04	
159.93	55.89		96.76	54.45											84.30	53.98	
			103.14	54.52											93.84	53.86	
			113.94	55.14											101.58	53.81	
			122.02	55.54											109.10	54.17	
			134.77	56.11											120.25	54.47	
			143.73	56.09											126.61	54.93	
															133.47	55.24	
															143.84	55.48	
															154.49	55.65	
															160.36	55.98	

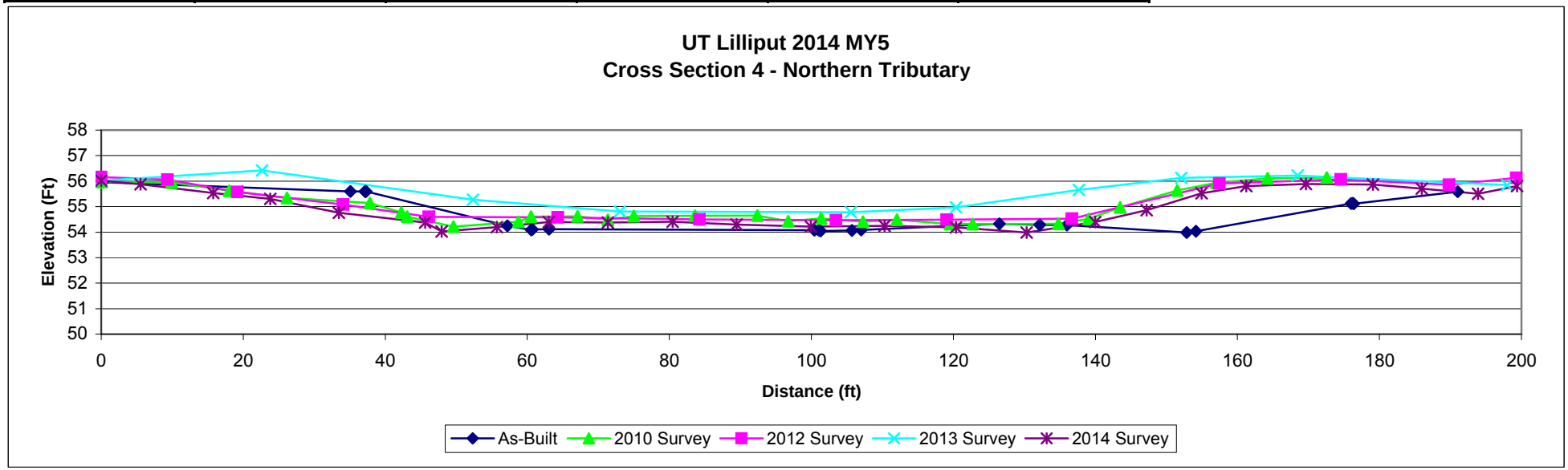
Northern Tributary Station 21+00 - NCX3
Looking upstream



Project Name	UT to Lilliput
Watershed	Lilliput, MY 5
Cross Section	N4
Drainage Area	52.49
Date	12/15/2014
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	56.02		0.00	56.02	
0.18	55.96		0.09	55.97					9.34	56.06		22.64	56.42		5.55	55.88	
35.09	55.59		9.96	55.95					19.18	55.57		52.36	55.27		15.77	55.53	
37.17	55.59		18.02	55.63					34.04	55.08		73.03	54.81		23.79	55.3	
37.2	55.59		26.17	55.34					46.13	54.6		105.57	54.78		33.46	54.76	
37.3	55.59		37.86	55.14					64.29	54.58		120.37	54.97		45.60	54.38	
57.19	54.25		42.25	54.77					84.27	54.5		137.68	55.66		47.94	54.03	
60.55	54.09		43.1	54.61					103.46	54.47		152.11	56.13		55.71	54.2	
60.72	54.11		49.61	54.22					119.05	54.49		168.49	56.22		63.04	54.4	
63.06	54.12		58.74	54.41					136.67	54.53		197.97	55.85		71.36	54.38	
100.42	54.08		60.54	54.61					157.47	55.91					80.48	54.41	
101.05	54.08		67.09	54.62					174.57	56.07					89.46	54.3	
101.29	54.05		71.34	54.49					189.8	55.86					99.91	54.22	
105.71	54.07		75.01	54.63					199.27	56.13					110.32	54.25	
107.01	54.09		83.61	54.64											120.38	54.19	
126.47	54.33		92.39	54.65											130.33	53.98	
132.17	54.29		96.75	54.43											139.96	54.4	
136	54.28		101.36	54.54											147.21	54.86	
152.86	53.98		107.27	54.41											154.95	55.52	
154.15	54.04		112.06	54.49											161.24	55.81	
176.01	55.12		119.55	54.32											169.66	55.89	
176.22	55.13		122.71	54.32											179.08	55.87	
176.36	55.113		134.82	54.33											185.96	55.71	
191.03	55.58		139.05	54.52											193.90	55.5	
			143.49	54.97											199.39	55.81	
			151.53	55.64													
			157.04	55.94													
			164.26	56.11													
			172.58	56.14													

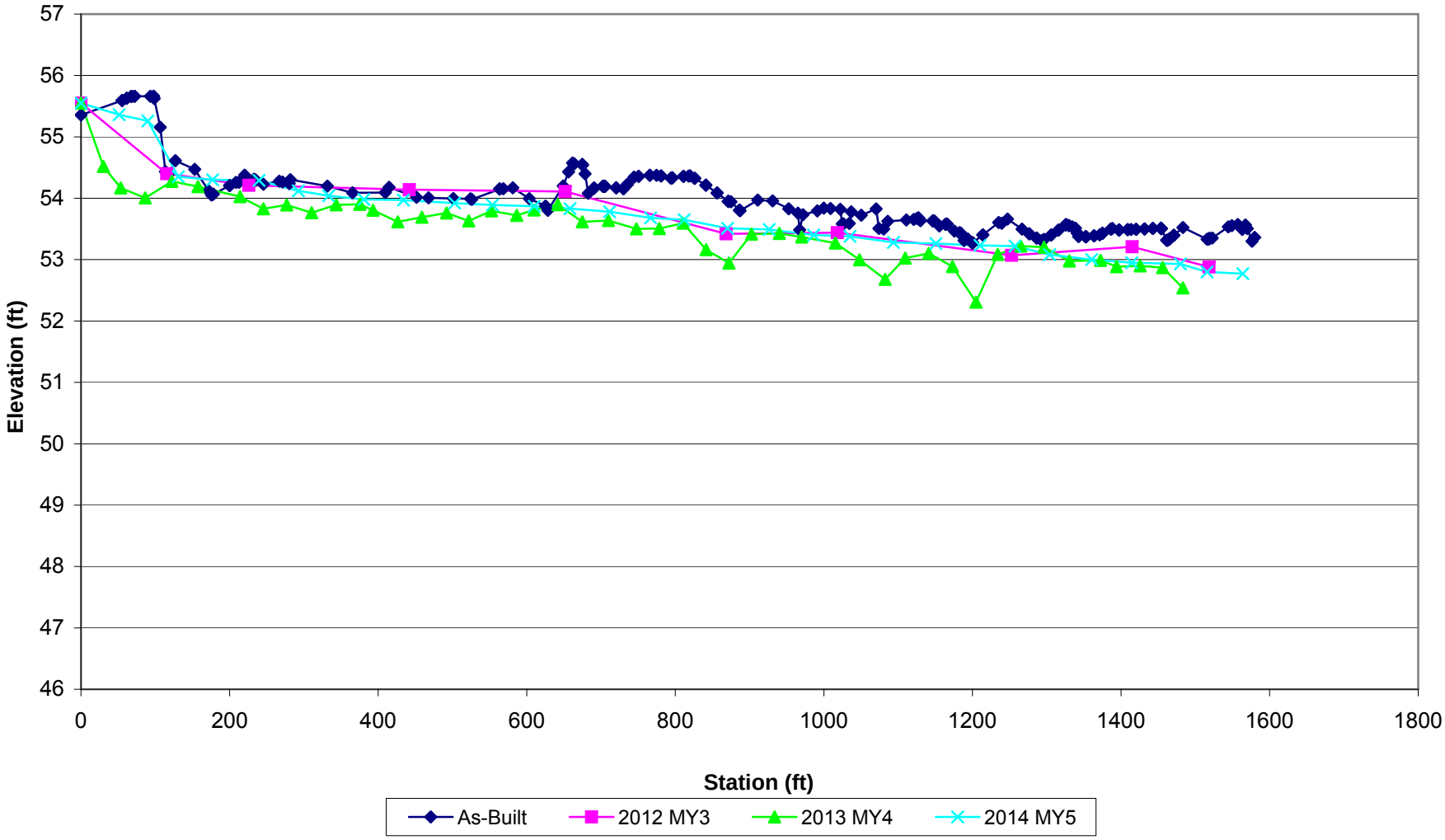
Northern Tributary Station 14+00 - NCX4
Looking downstream



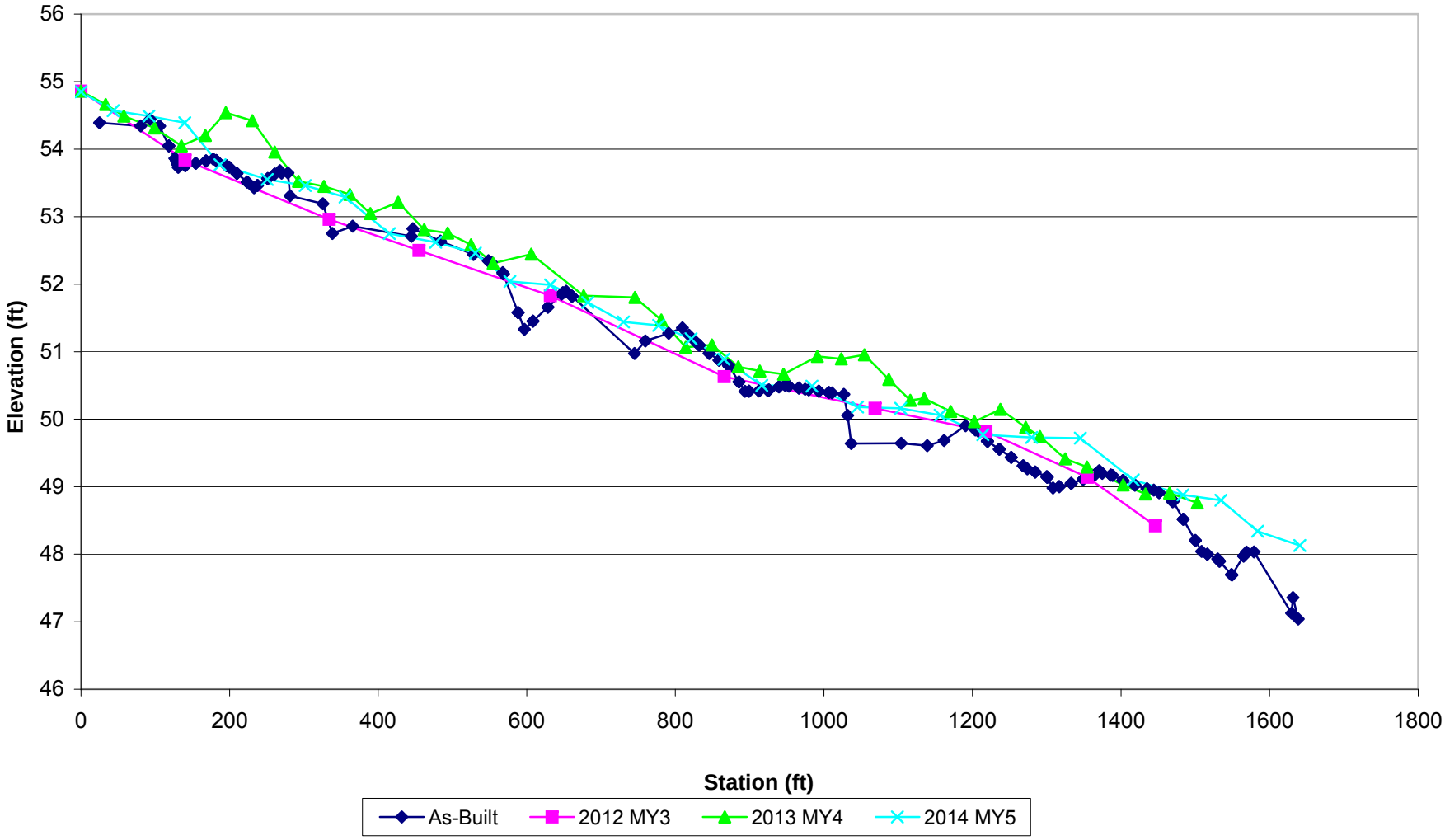
UT to Lilliput Stream and Wetland Restoration Project

Longitudinal Profile

Northern Tributary

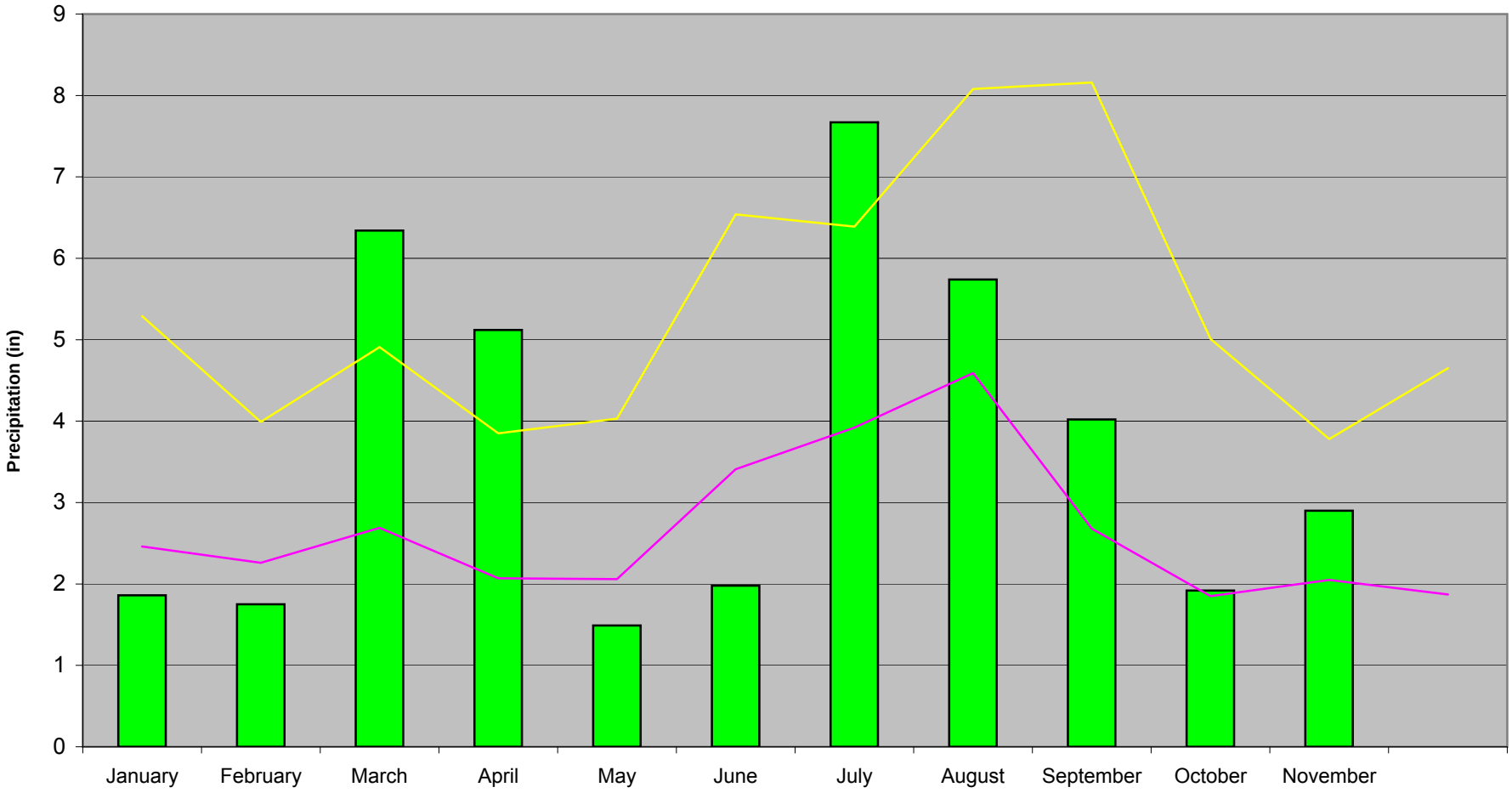


UT to Lilliput Stream and Wetland Restoration Project
Longitudinal Profile
Southern Tributary



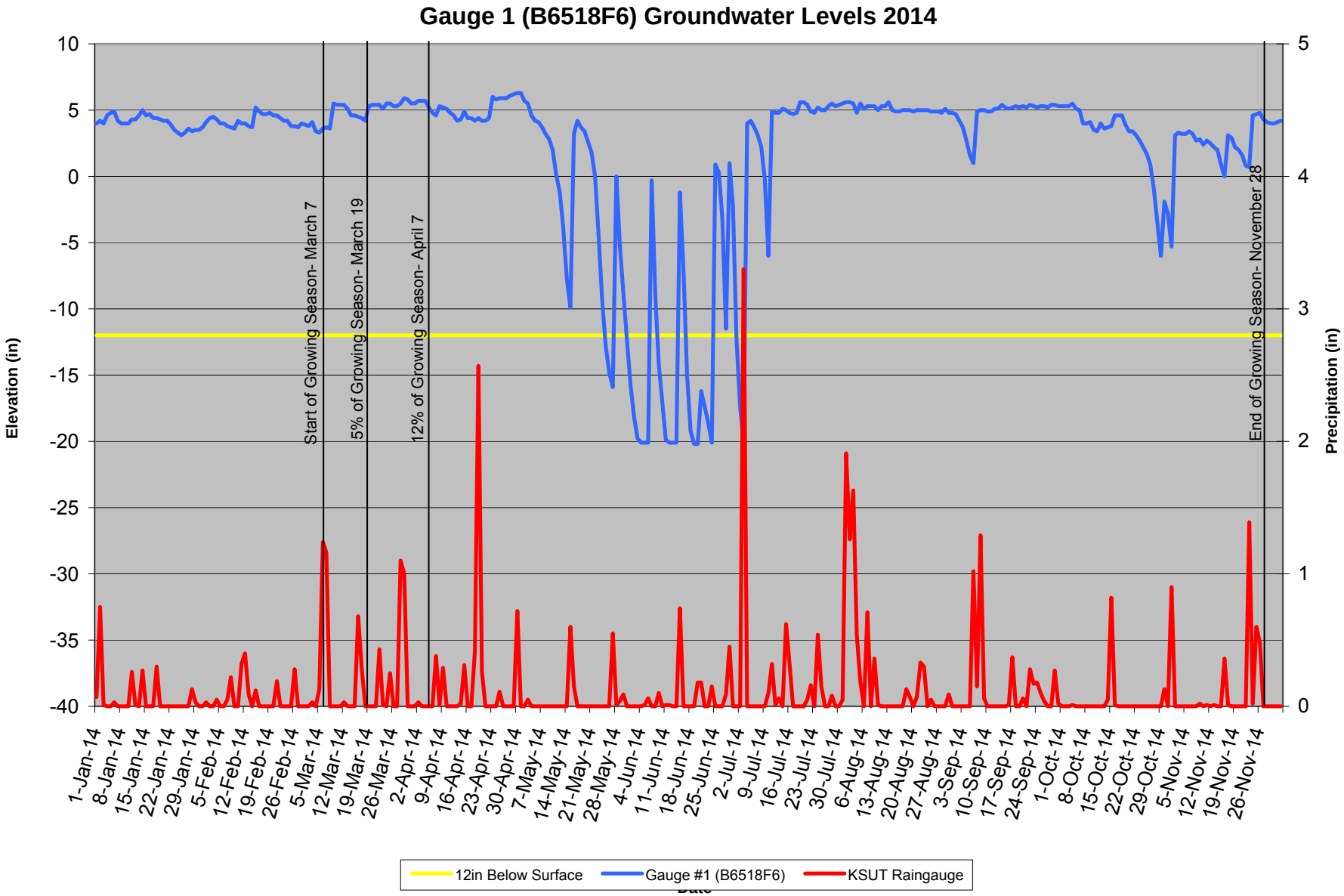
Appendix E.
Hydrologic Data

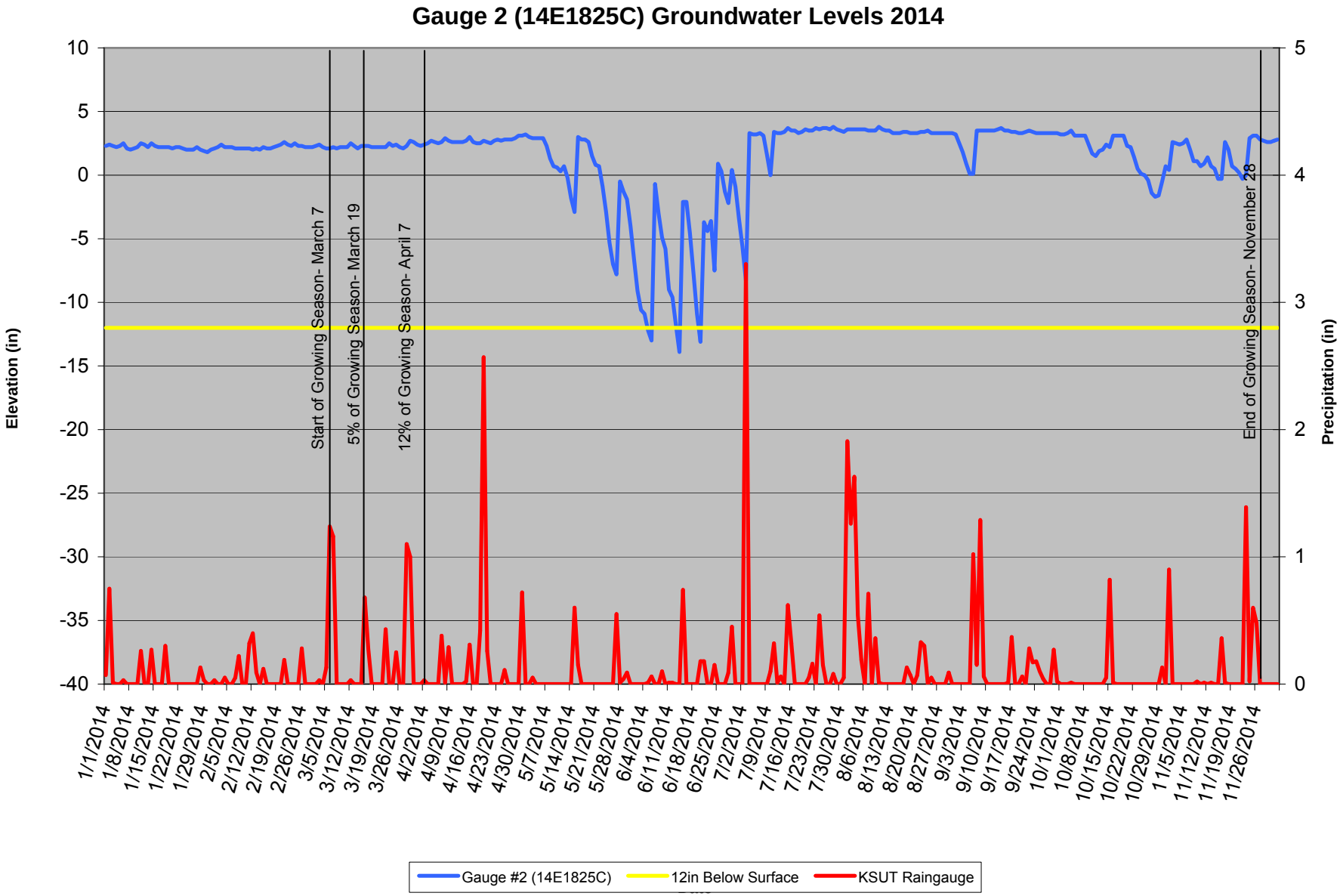
UT to Lilliput Stream and Wetland Restoration Project
30 & 70 Percentile Graph for Rainfall in 2014
Data up to December 2, 2014

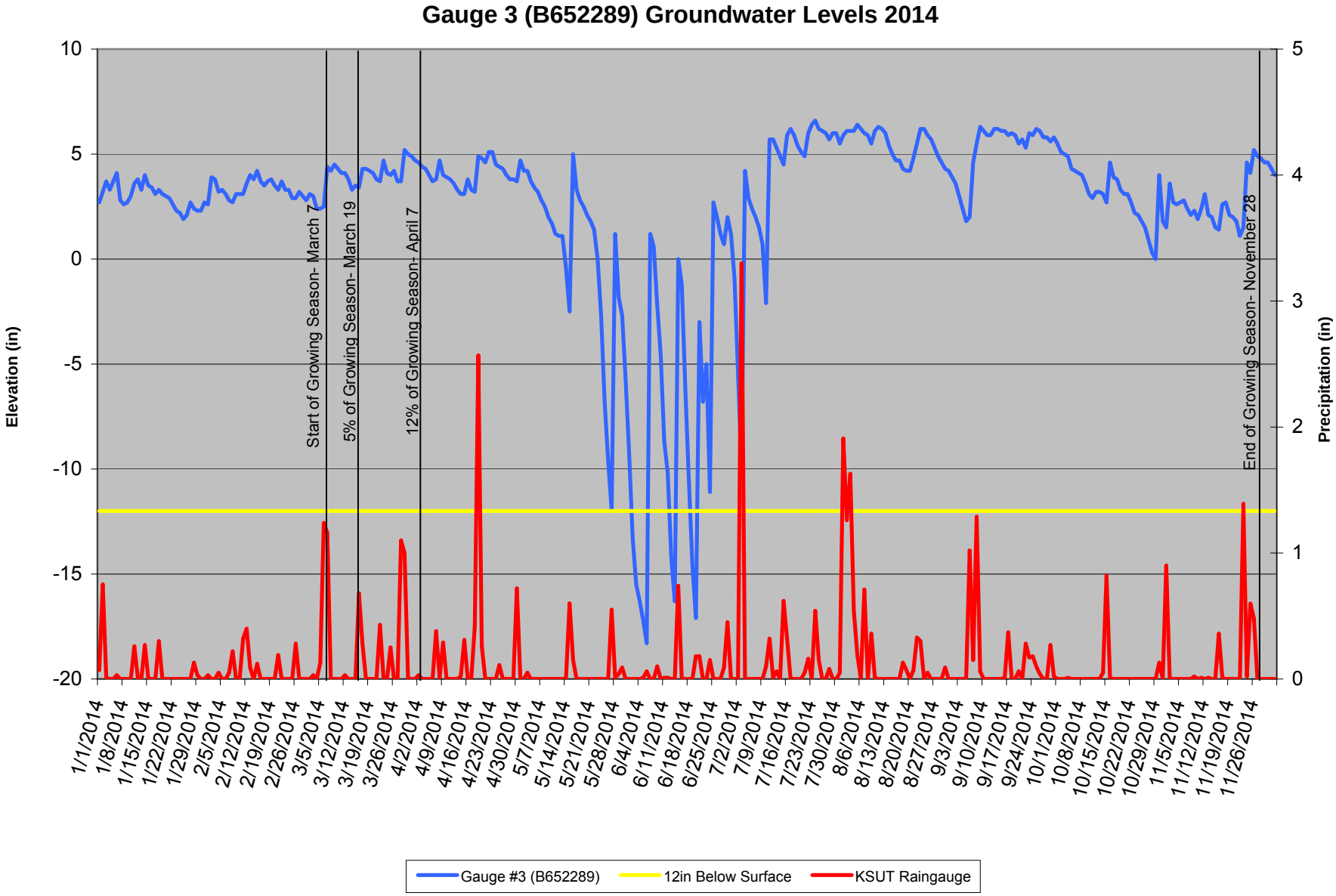


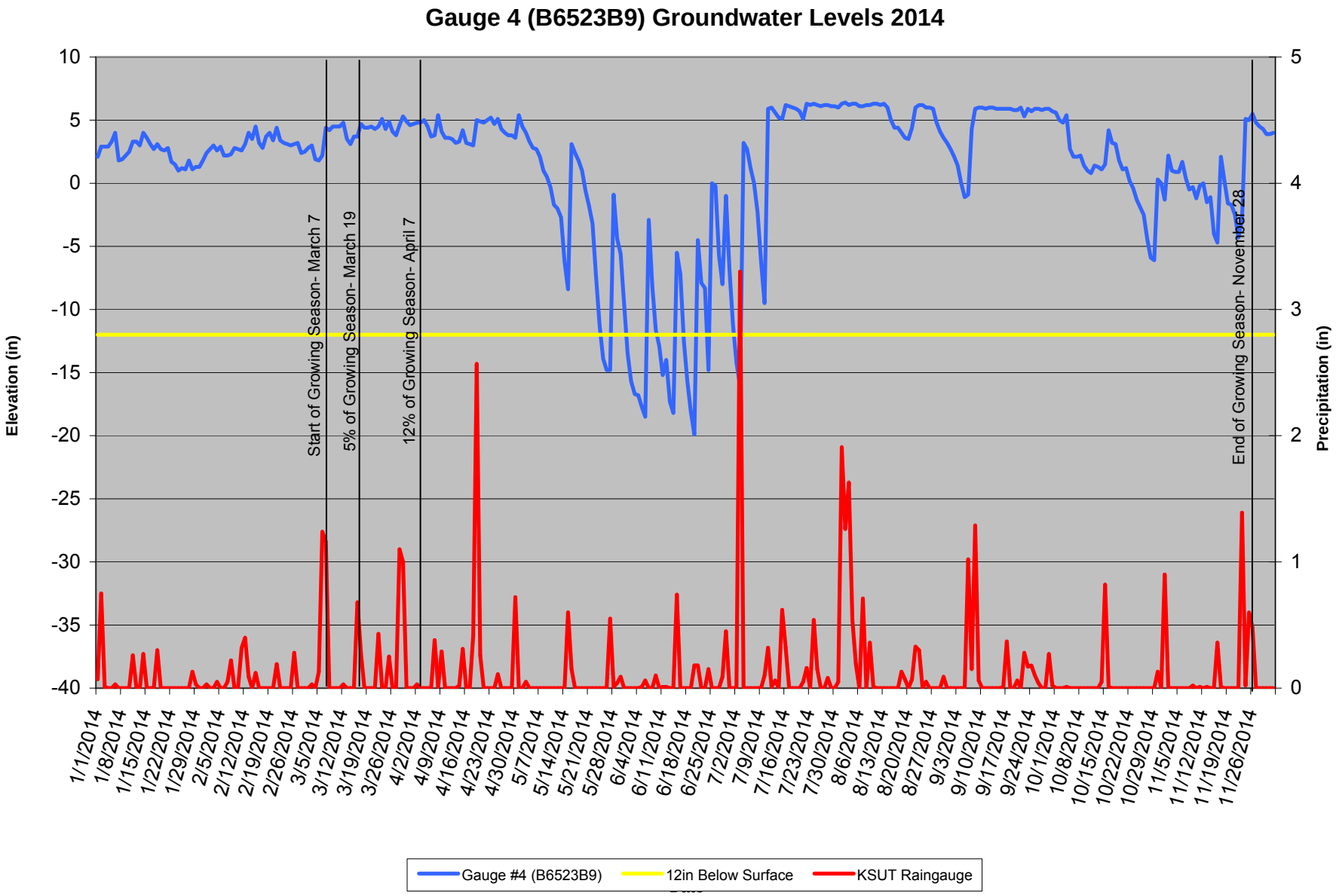
Precipitation data obtained from:
Brunswick County Airport - station KSUT
(www.nc-climate.ncsu.edu)

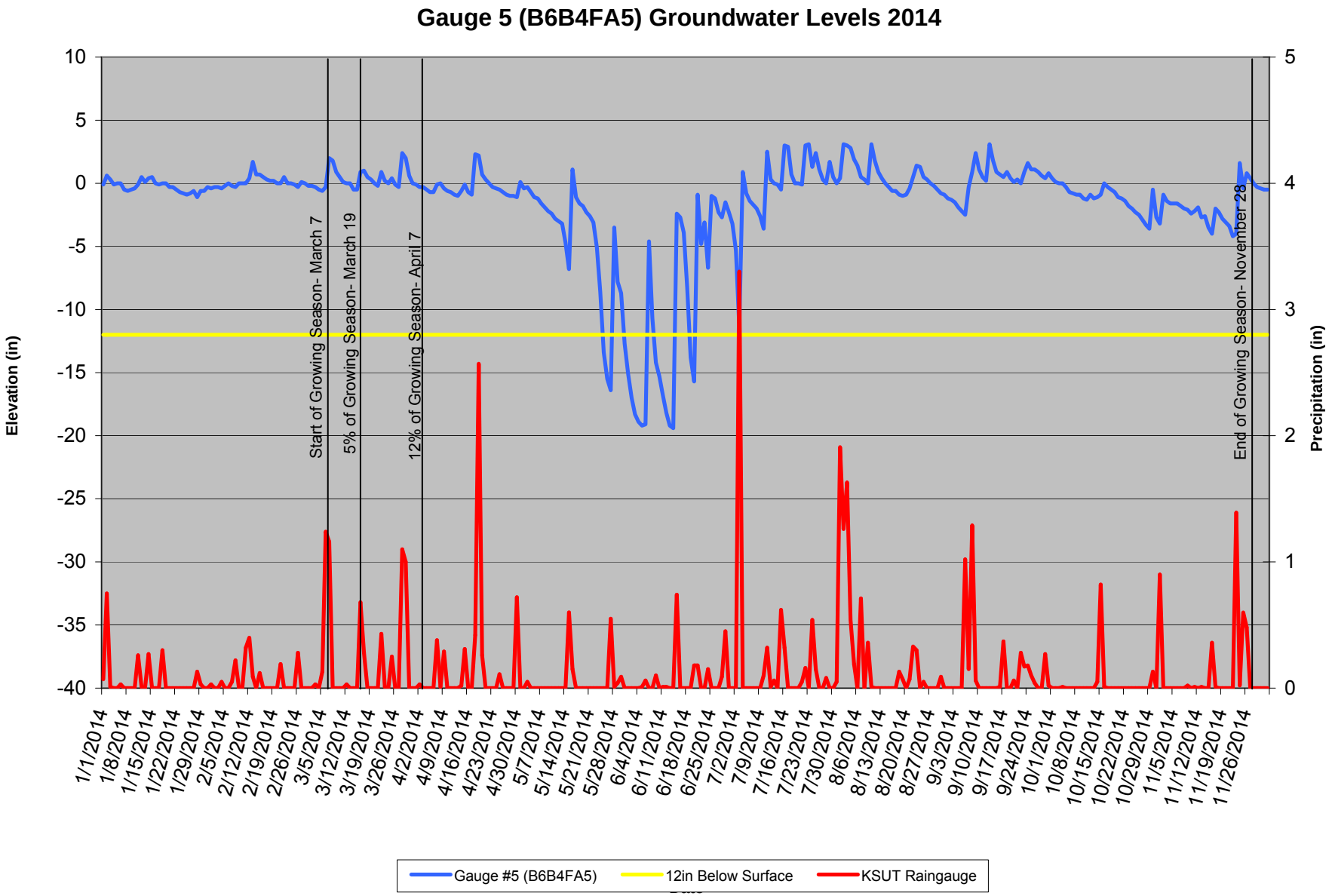
30% & 70% precipitation data obtained from
Brunswick County - Longwood WETS Station
NC5116 1978-2009 (wcc.nrcs.usda.gov)


Gauge 1 (B6518F6) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1-Jan-14
8-Jan-14
15-Jan-14
22-Jan-14
29-Jan-14
5-Feb-14
12-Feb-14
19-Feb-14
26-Feb-14
5-Mar-14
12-Mar-14
19-Mar-14
26-Mar-14
2-Apr-14
9-Apr-14
16-Apr-14
23-Apr-14
30-Apr-14
7-May-14
14-May-14
21-May-14
28-May-14
4-Jun-14
11-Jun-14
18-Jun-14
25-Jun-14
2-Jul-14
9-Jul-14
16-Jul-14
23-Jul-14
30-Jul-14
6-Aug-14
13-Aug-14
20-Aug-14
27-Aug-14
3-Sep-14
10-Sep-14
17-Sep-14
24-Sep-14
1-Oct-14
8-Oct-14
15-Oct-14
22-Oct-14
29-Oct-14
5-Nov-14
12-Nov-14
19-Nov-14
26-Nov-14
12in Below Surface
Gauge #1 (B6518F6)
KSUT Raingauge

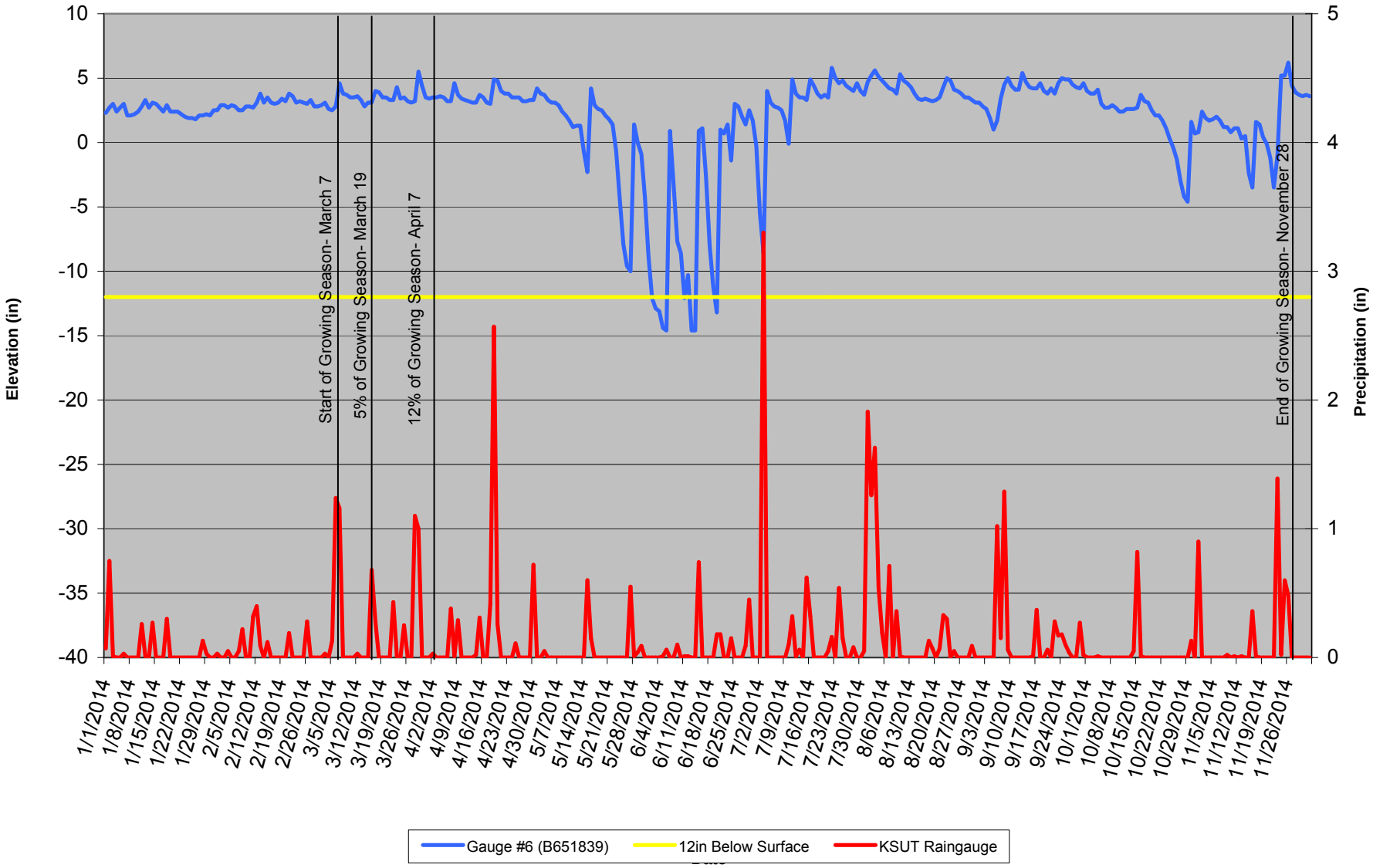

Gauge 2 (14E1825C) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #2 (14E1825C)
12in Below Surface
KSUT Raingauge

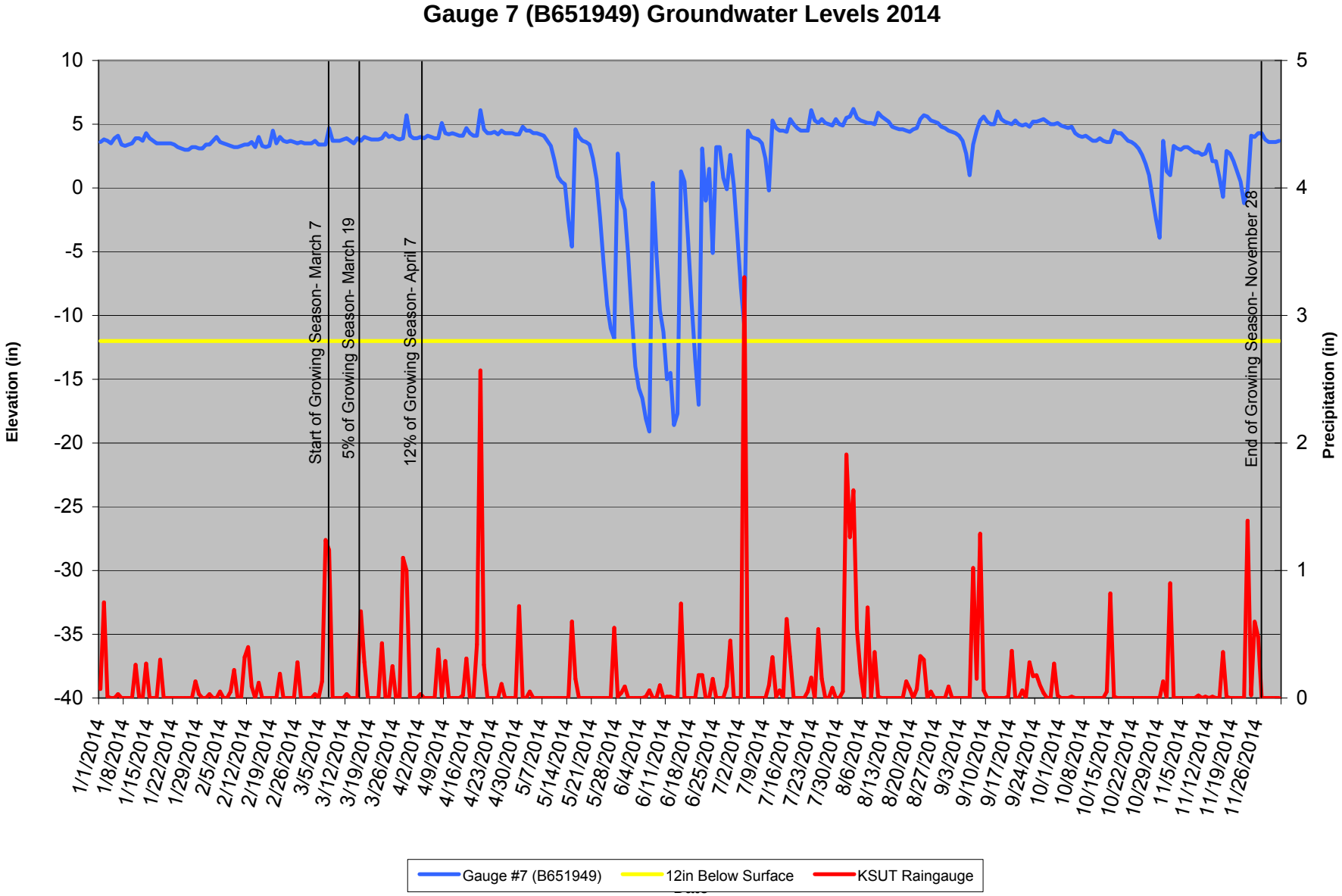

Gauge 3 (B652289) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #3 (B652289)
12in Below Surface
KSUT Raingauge

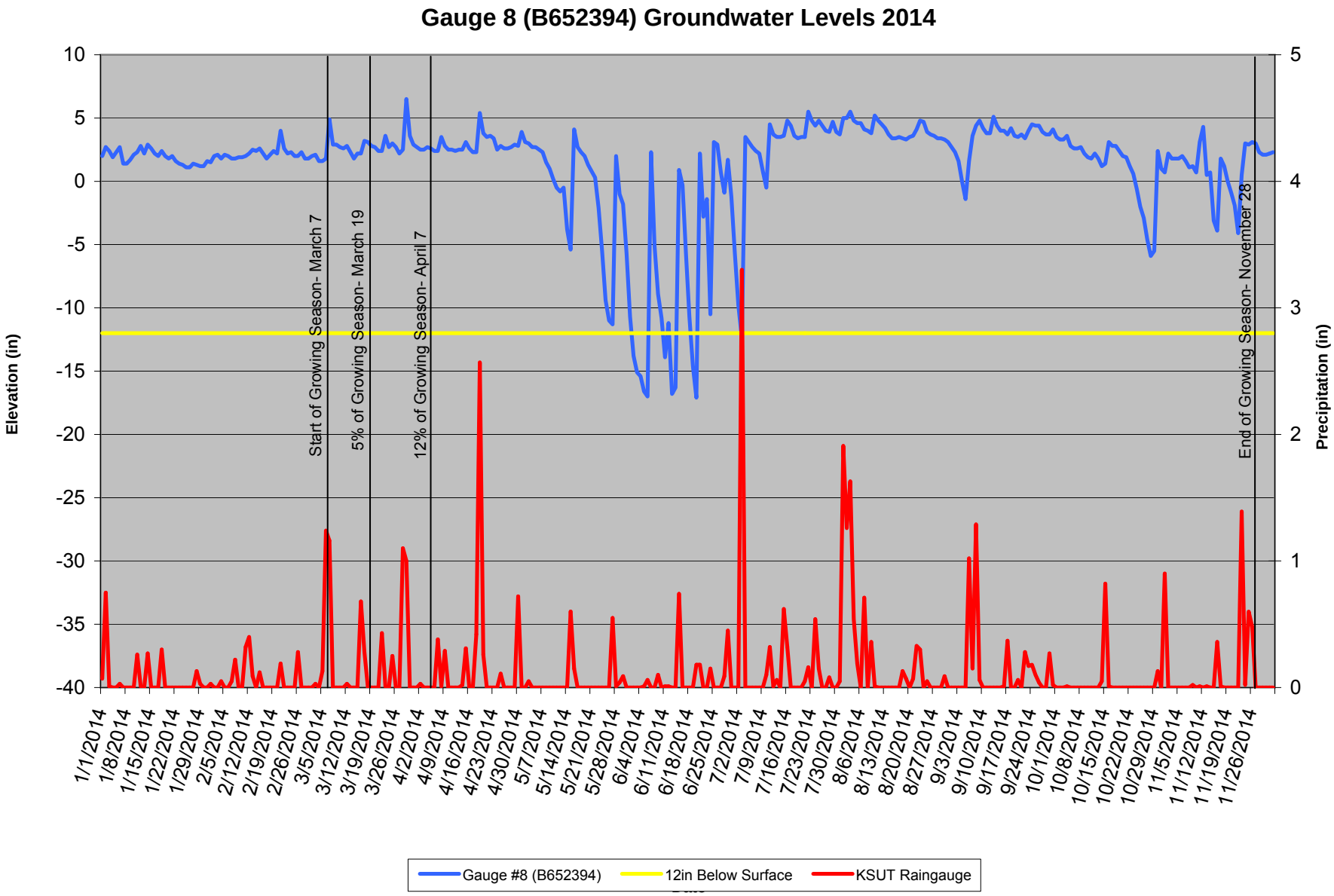

Gauge 4 (B6523B9) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #4 (B6523B9)
12in Below Surface
KSUT Raingauge

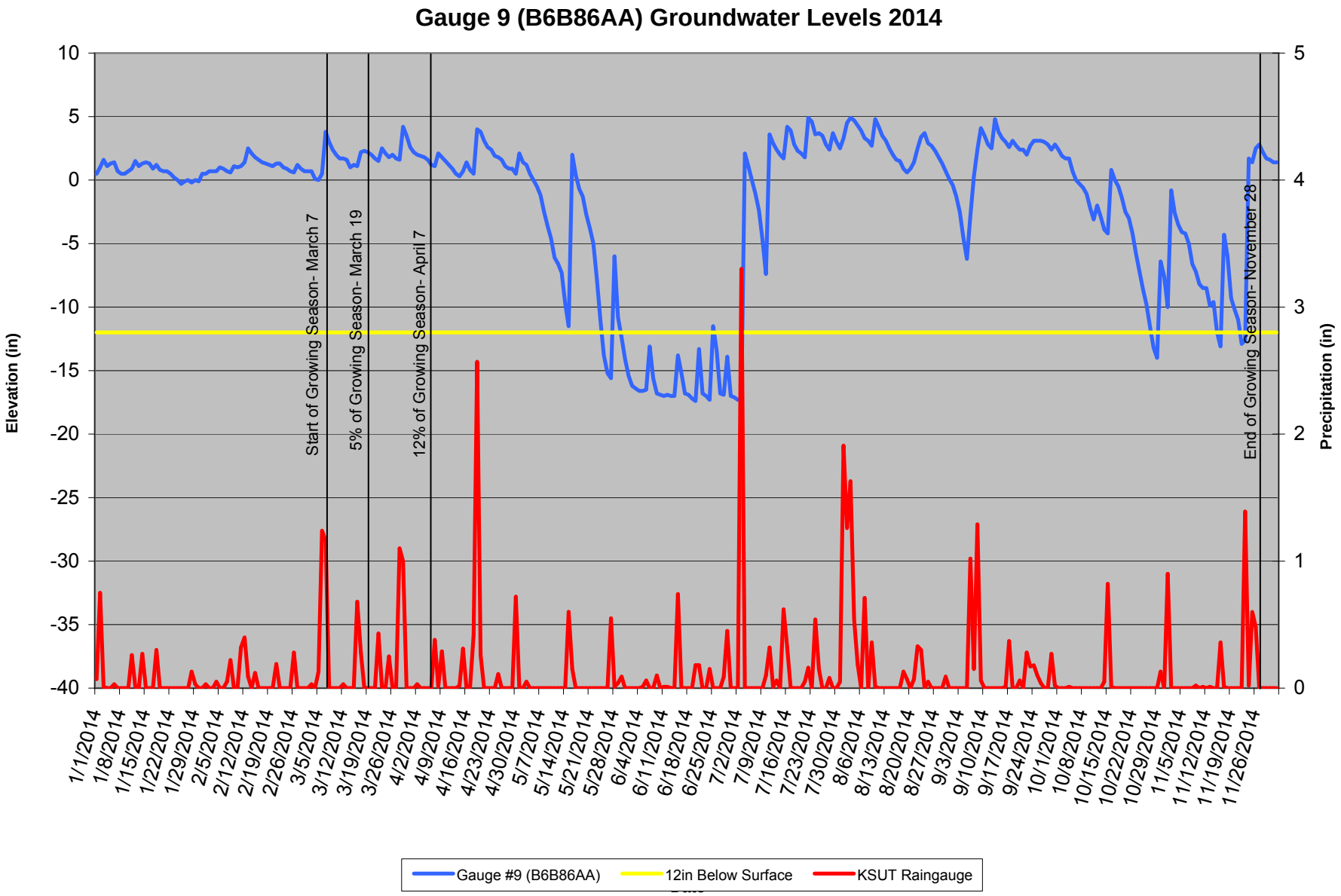

Gauge 5 (B6B4FA5) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #5 (B6B4FA5)
12in Below Surface
KSUT Raingauge

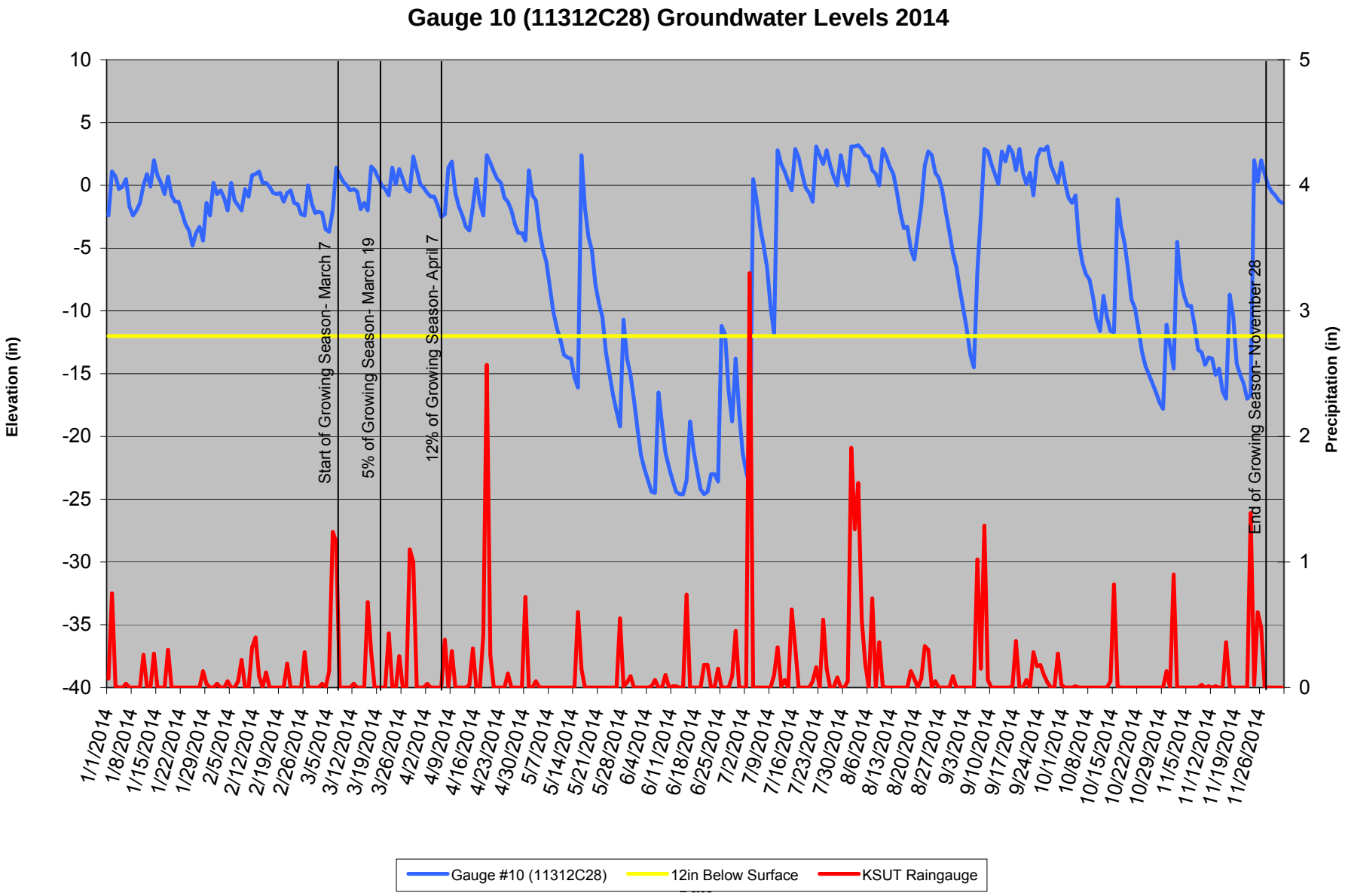
Gauge 6 (B651839) Groundwater Levels 2014

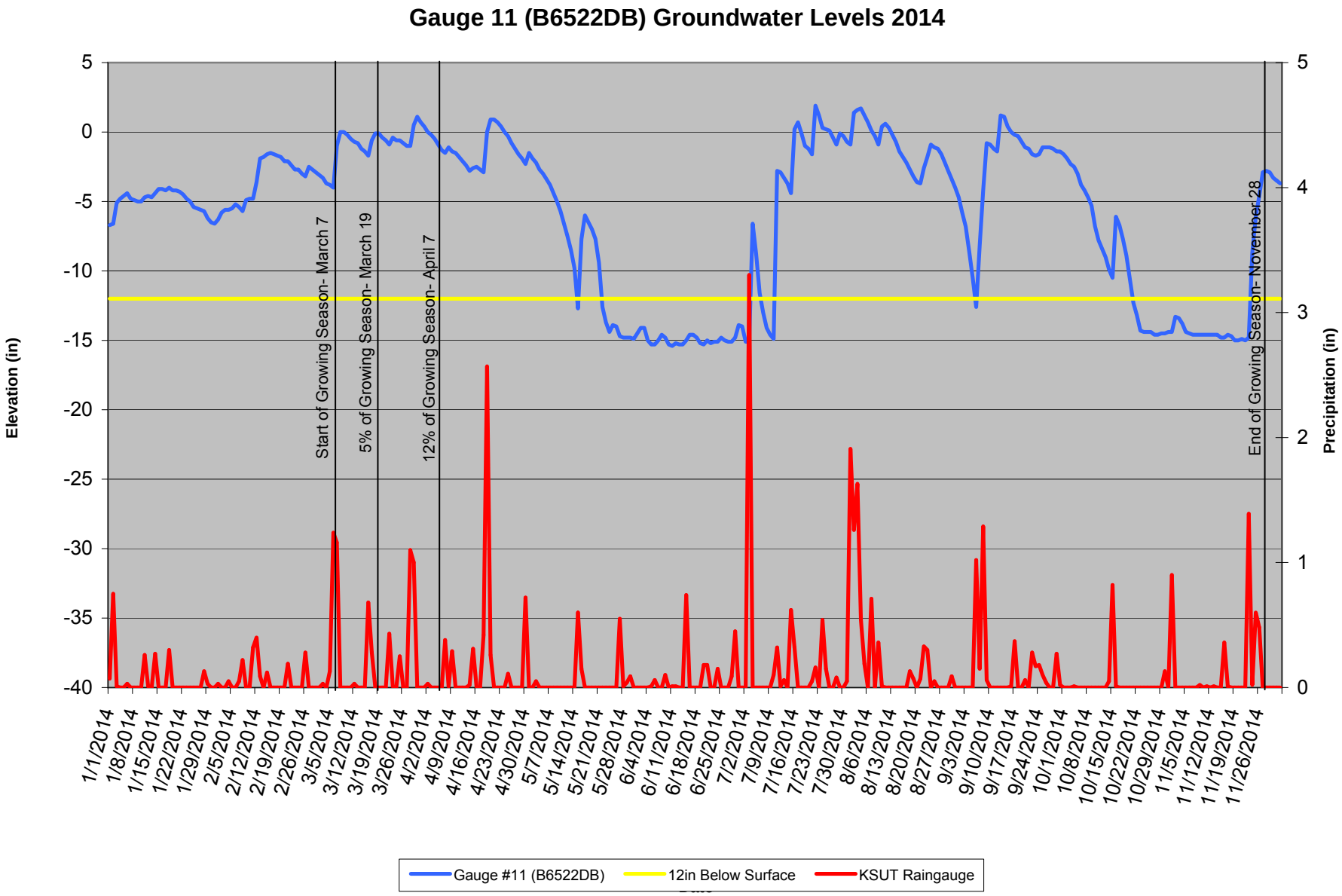


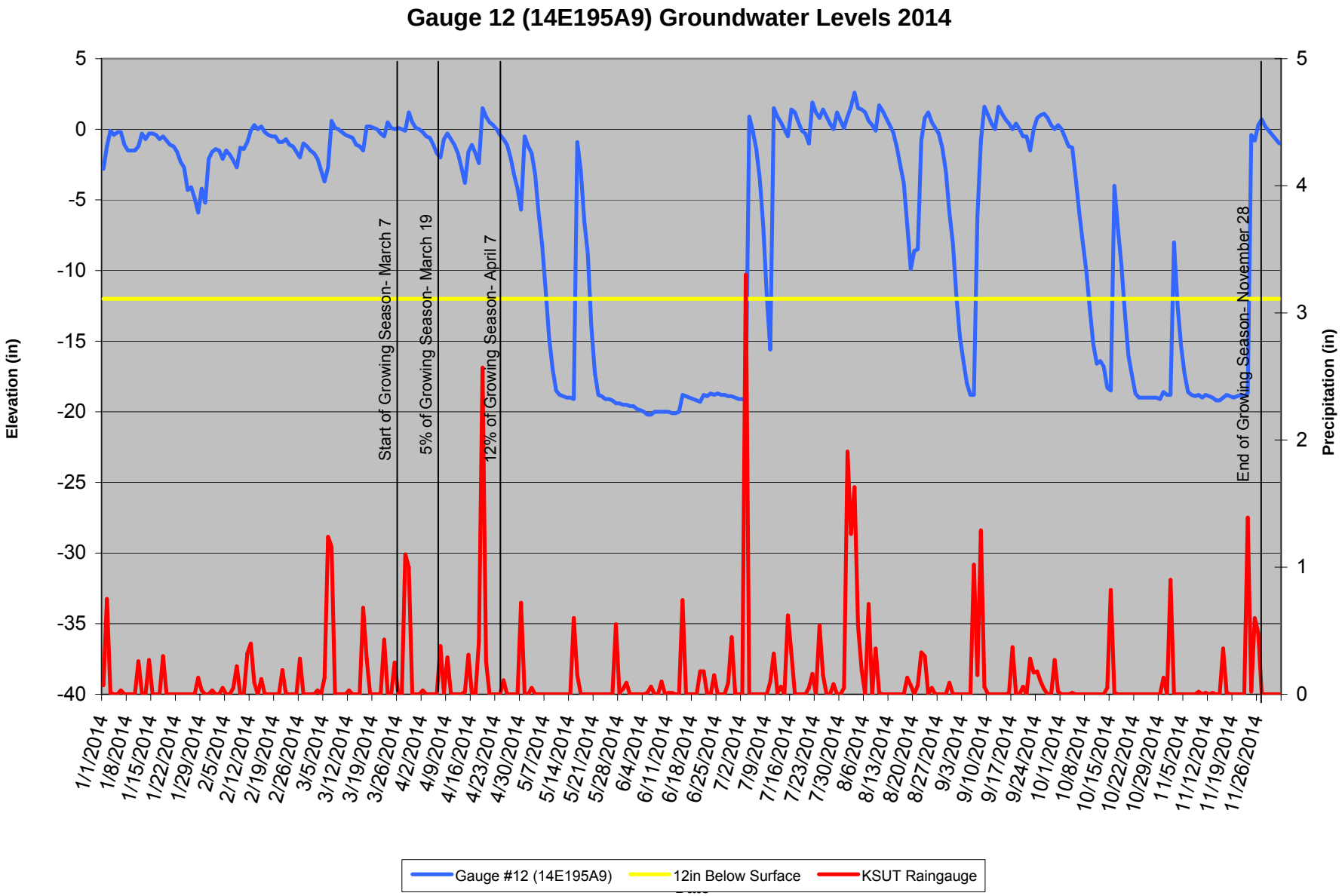

Gauge 7 (B651949) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #7 (B651949)
12in Below Surface
KSUT Raingauge

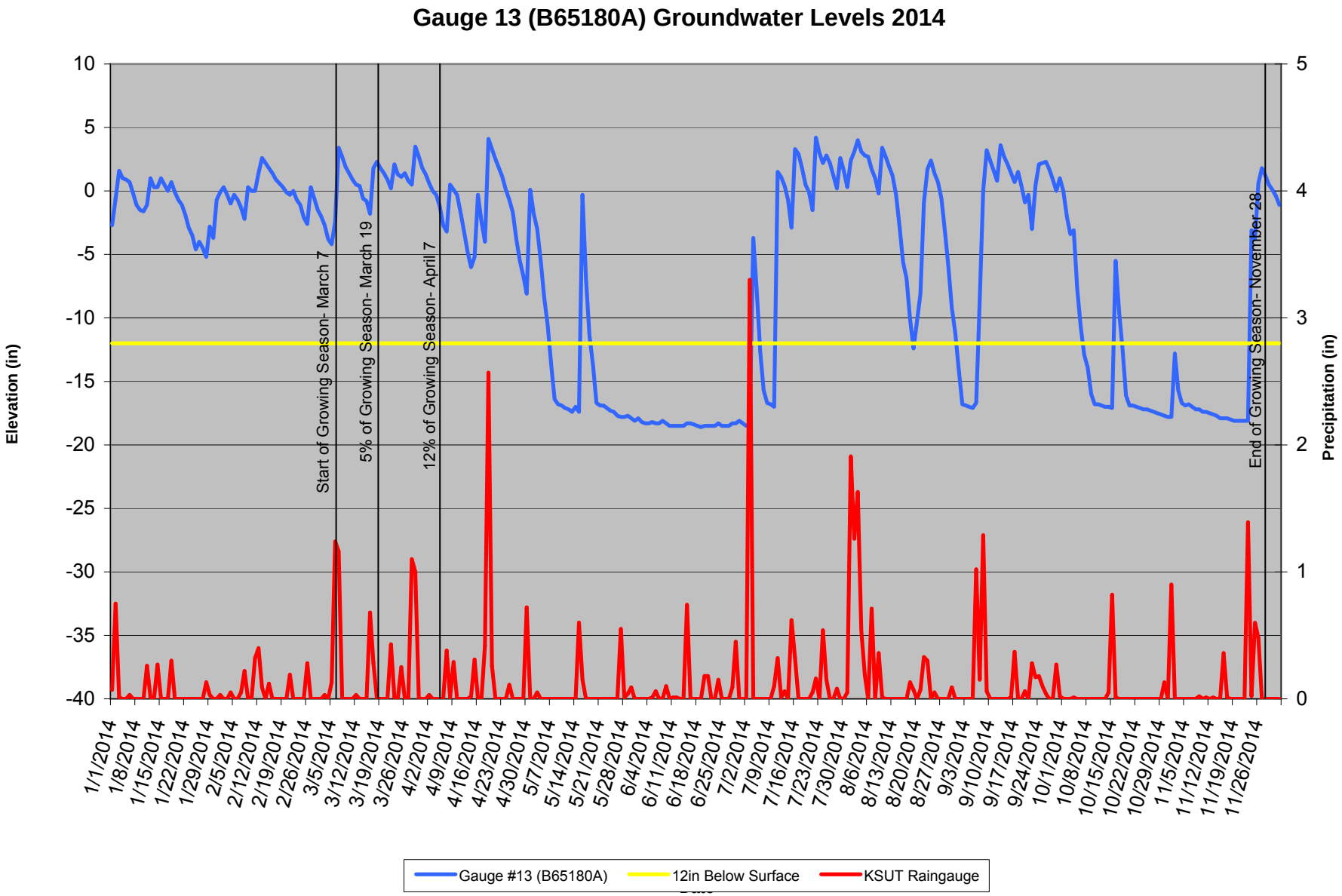

Gauge 8 (B652394) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #8 (B652394)
12in Below Surface
KSUT Raingauge

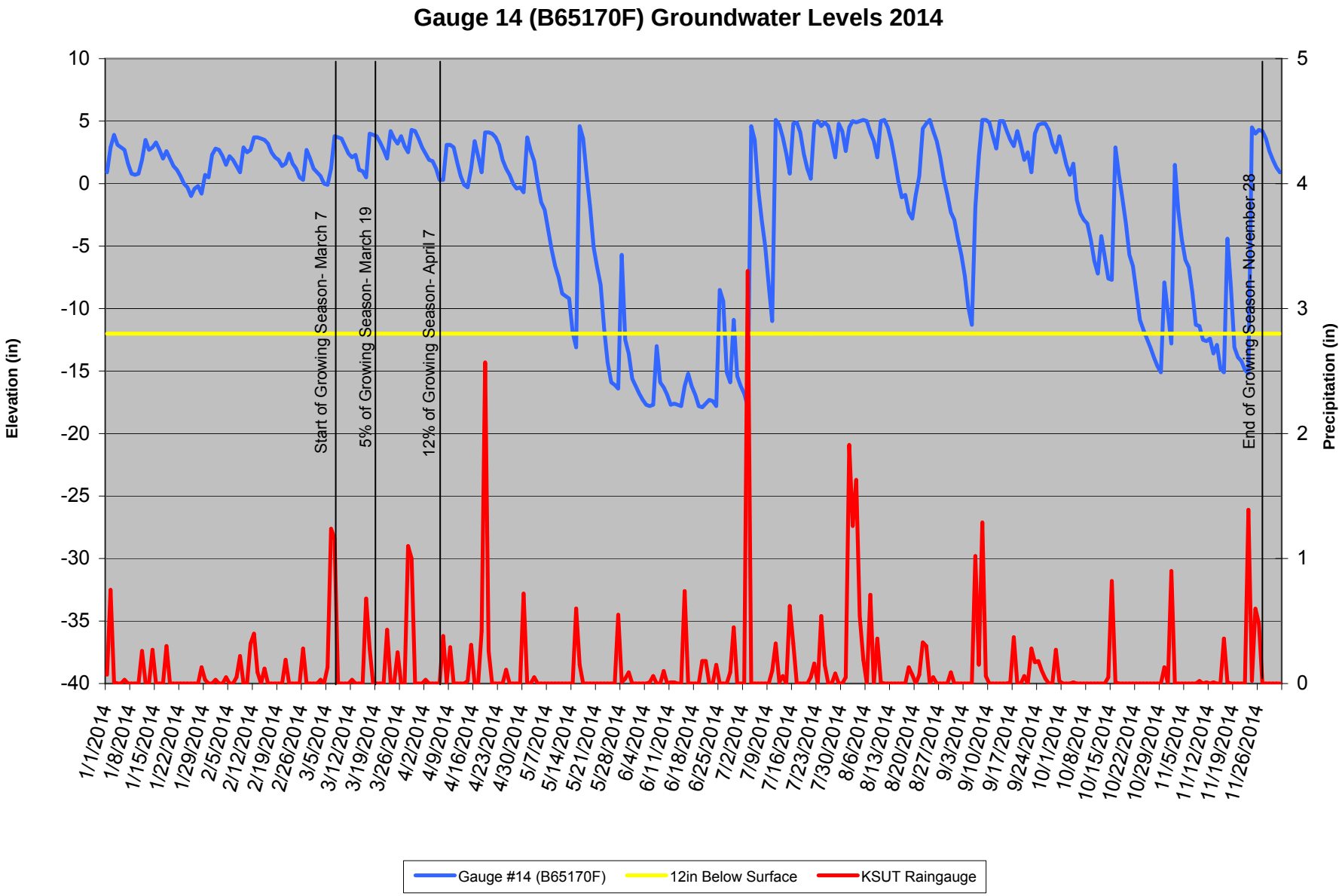

Gauge 9 (B6B86AA) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #9 (B6B86AA)
12in Below Surface
KSUT Raingauge


Gauge 10 (11312C28) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #10 (11312C28)
12in Below Surface
KSUT Raingauge

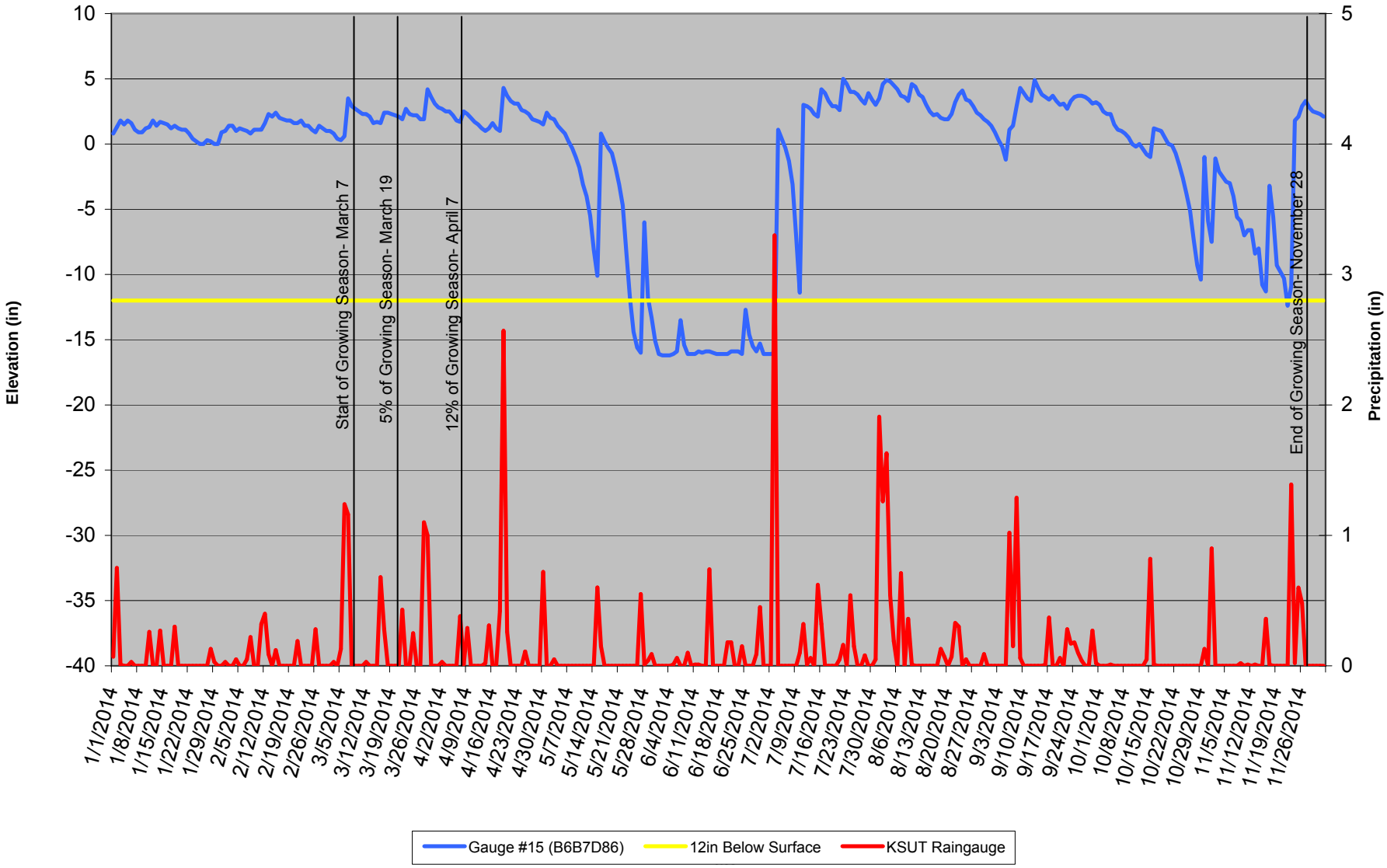

Gauge 11 (B6522DB) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #11 (B6522DB)
12in Below Surface
KSUT Raingauge

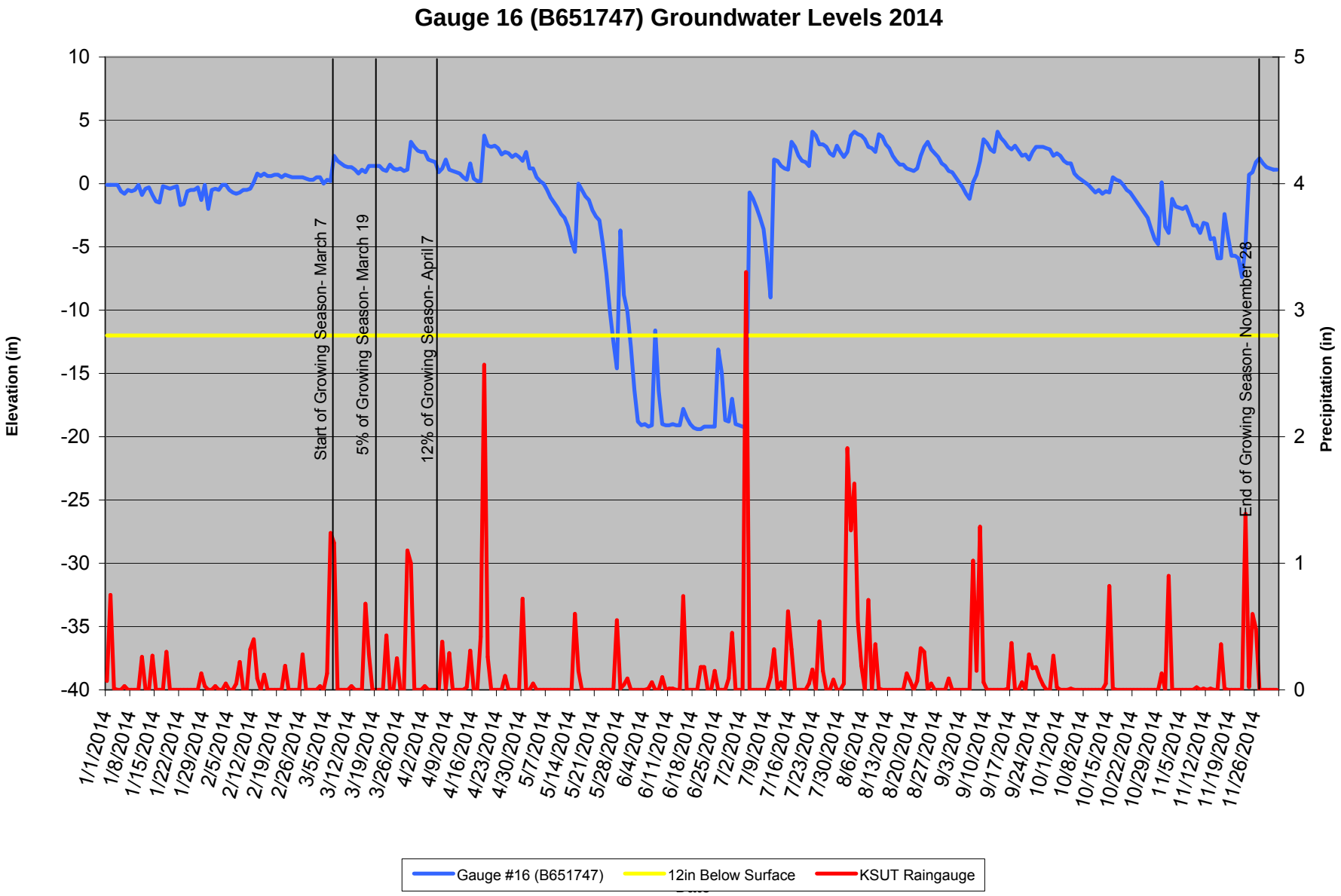

Gauge 12 (14E195A9) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #12 (14E195A9)
12in Below Surface
KSUT Raingauge

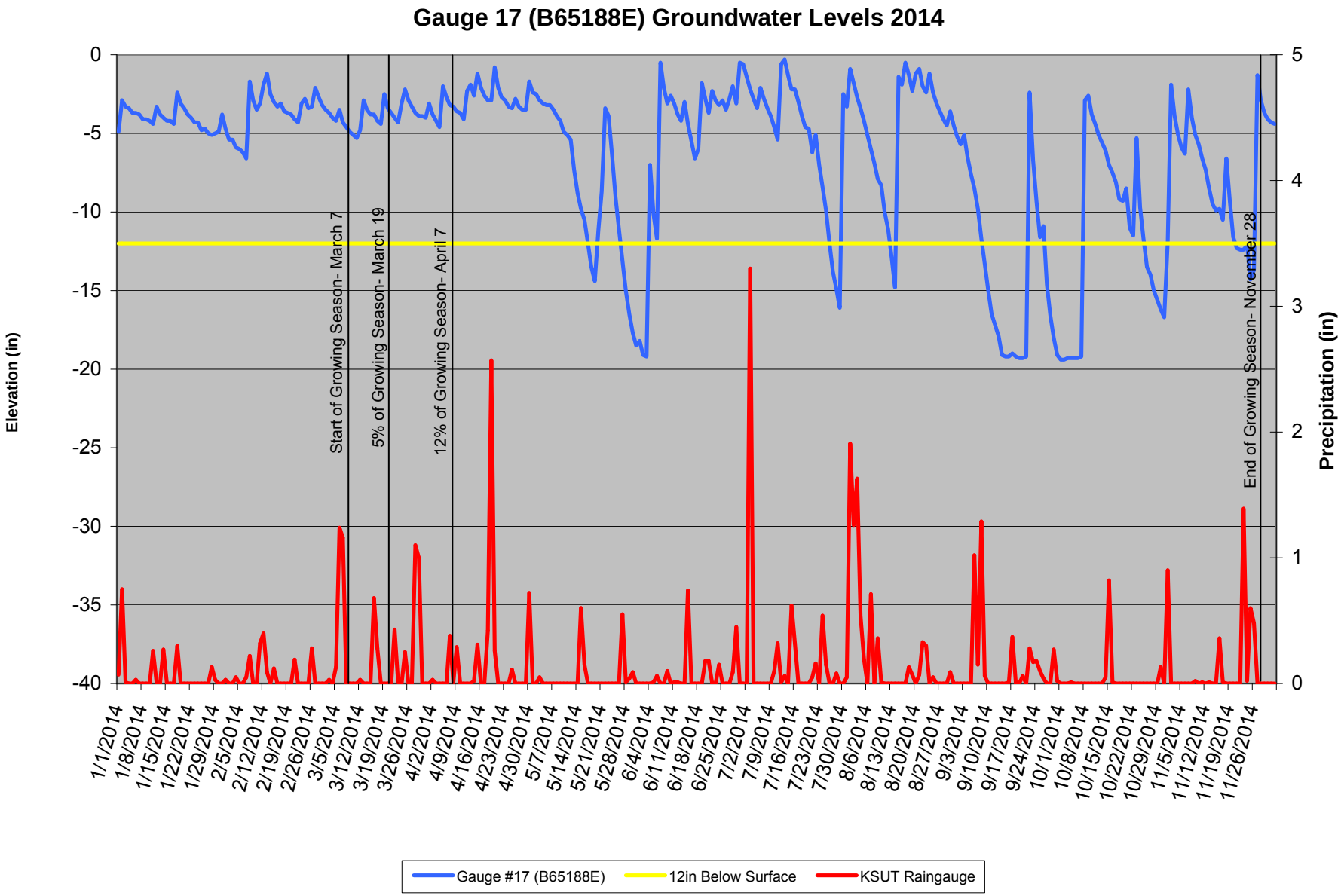

Gauge 13 (B65180A) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #13 (B65180A)
12in Below Surface
KSUT Raingauge

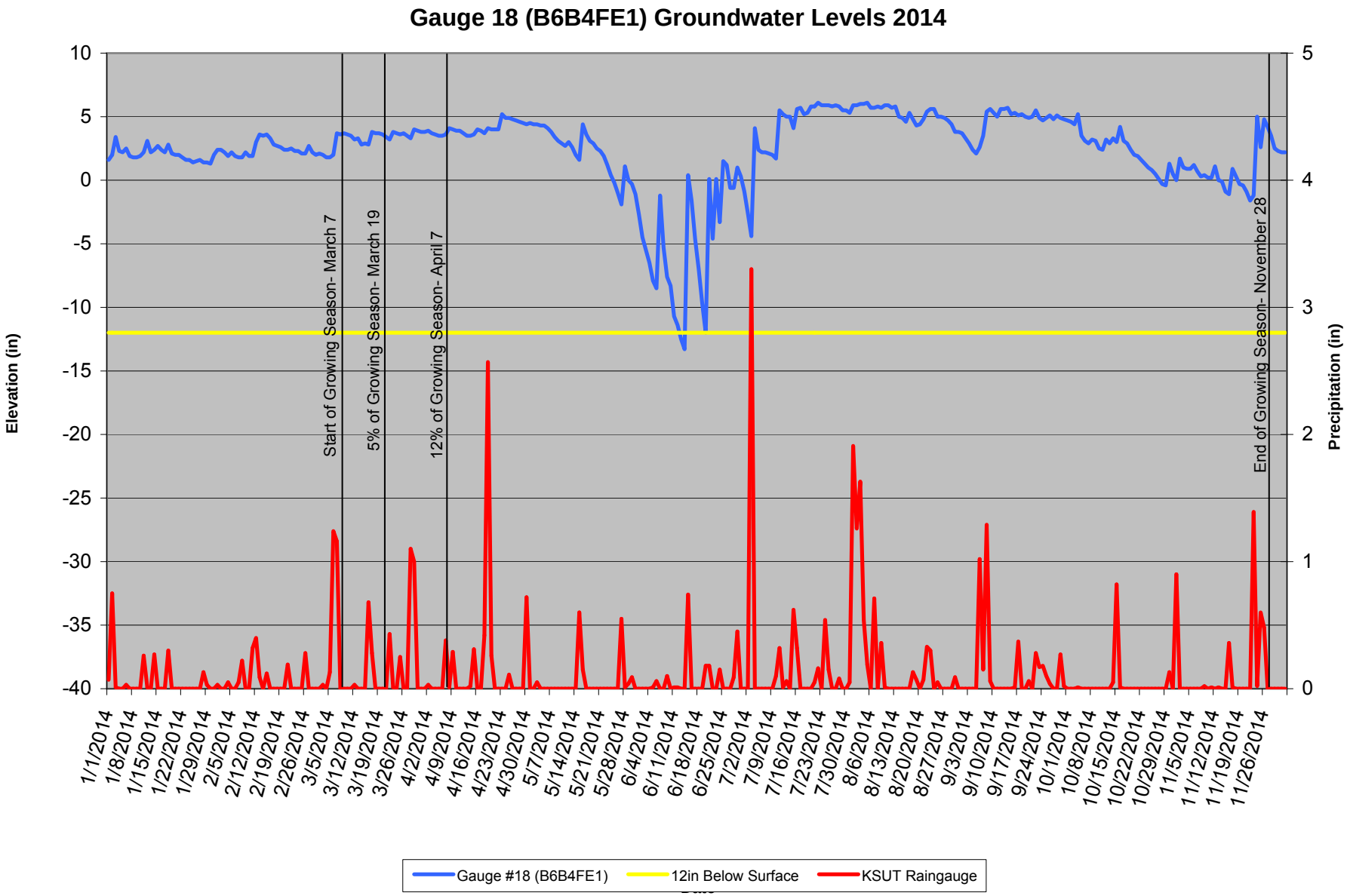

Gauge 14 (B65170F) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #14 (B65170F)
12in Below Surface
KSUT Raingauge

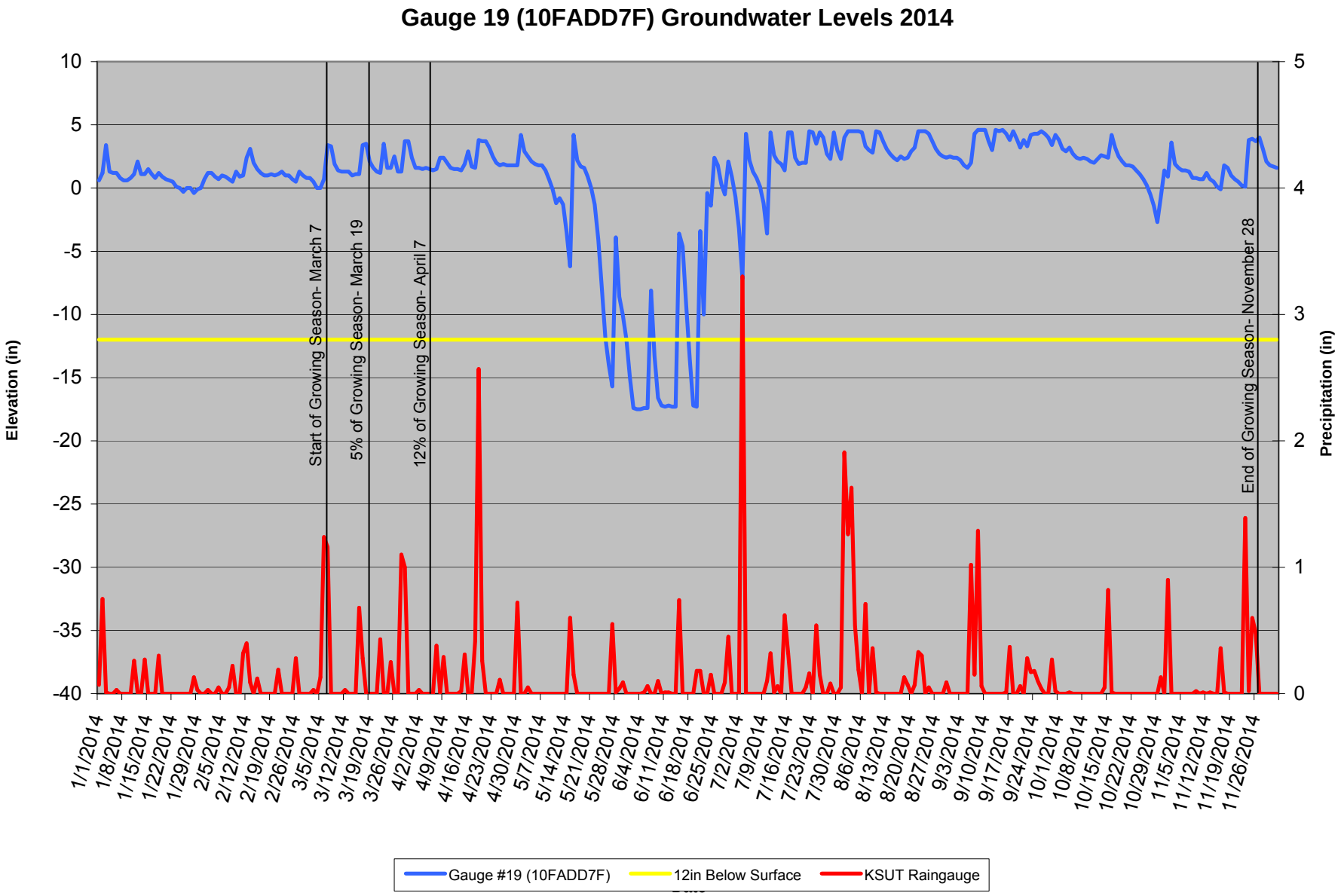
Gauge 15 (B6B7D86) Groundwater Levels 2014

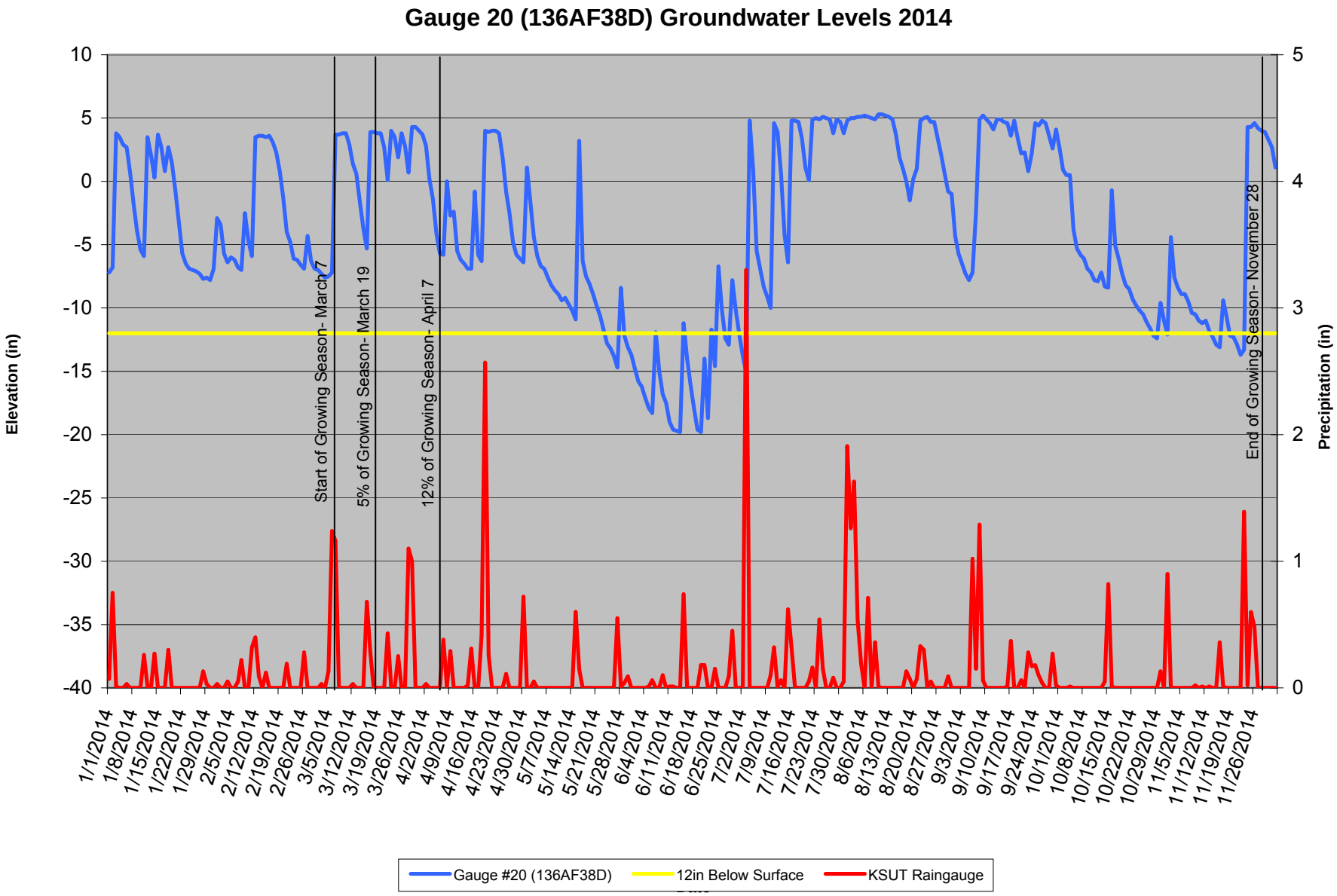


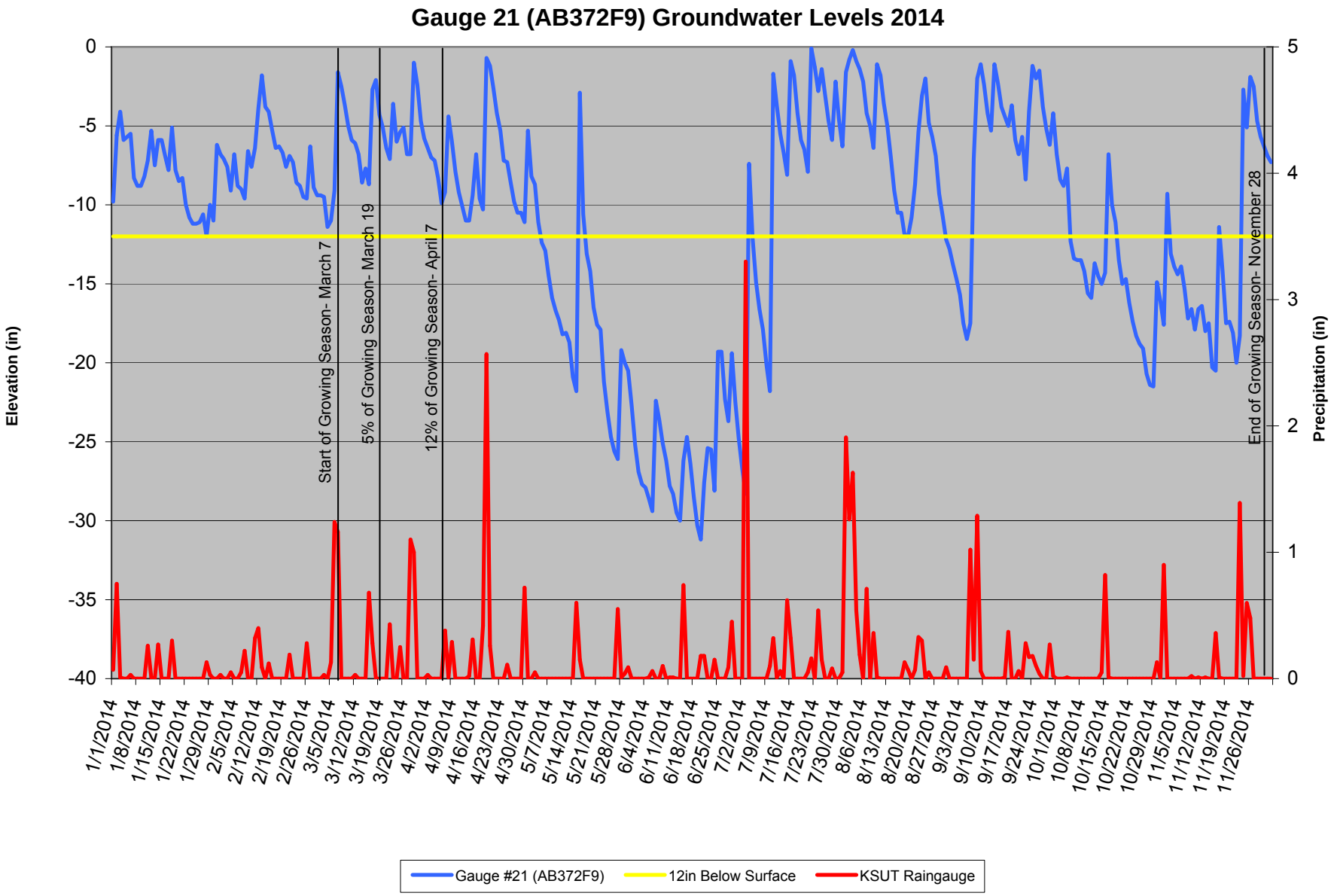

Gauge 16 (B651747) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #16 (B651747)
12in Below Surface
KSUT Raingauge

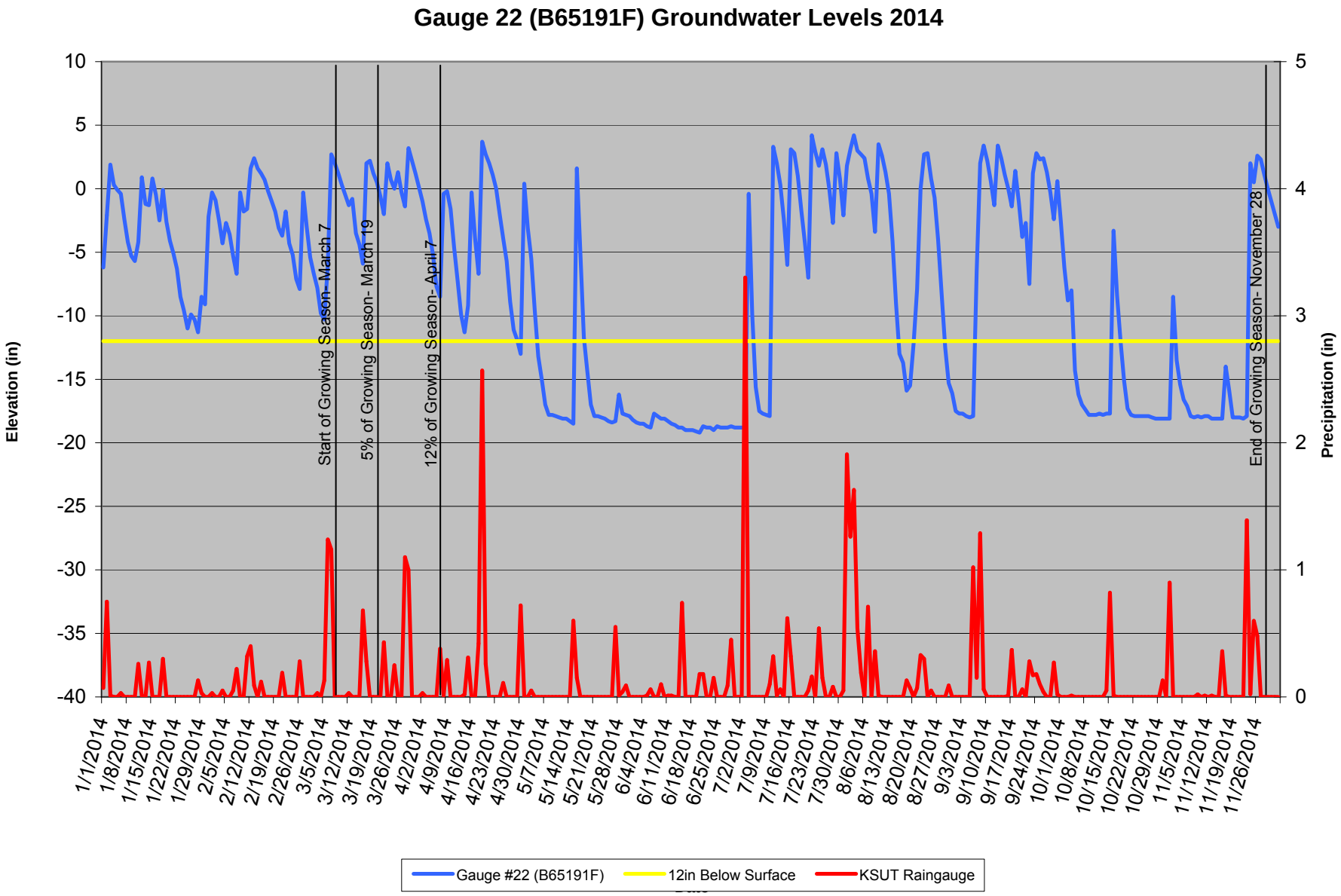

Gauge 17 (B65188E) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #17 (B65188E)
12in Below Surface
KSUT Raingauge


Gauge 18 (B6B4FE1) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #18 (B6B4FE1)
12in Below Surface
KSUT Raingauge

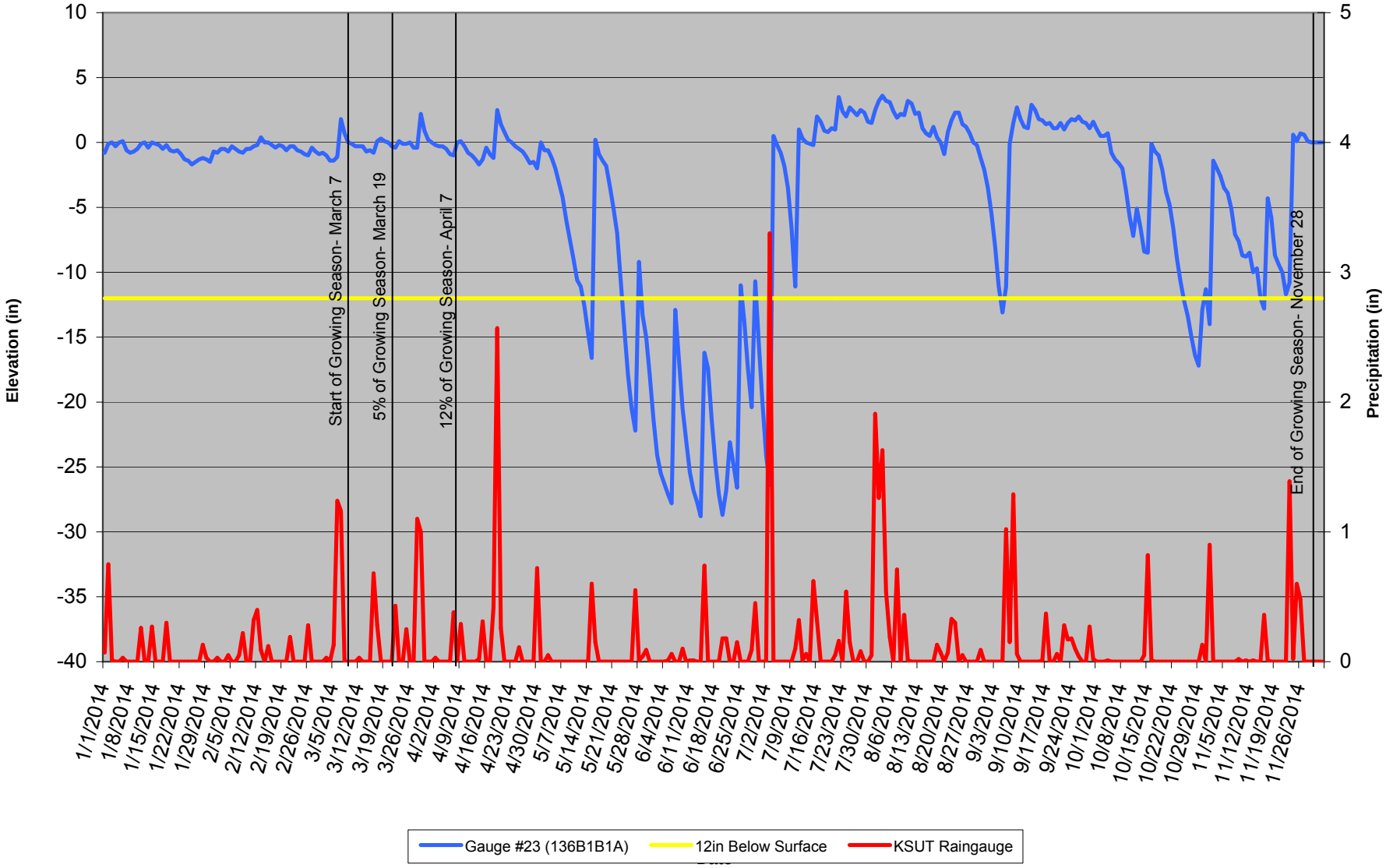

Gauge 19 (10FADD7F) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #19 (10FADD7F)
12in Below Surface
KSUT Raingauge

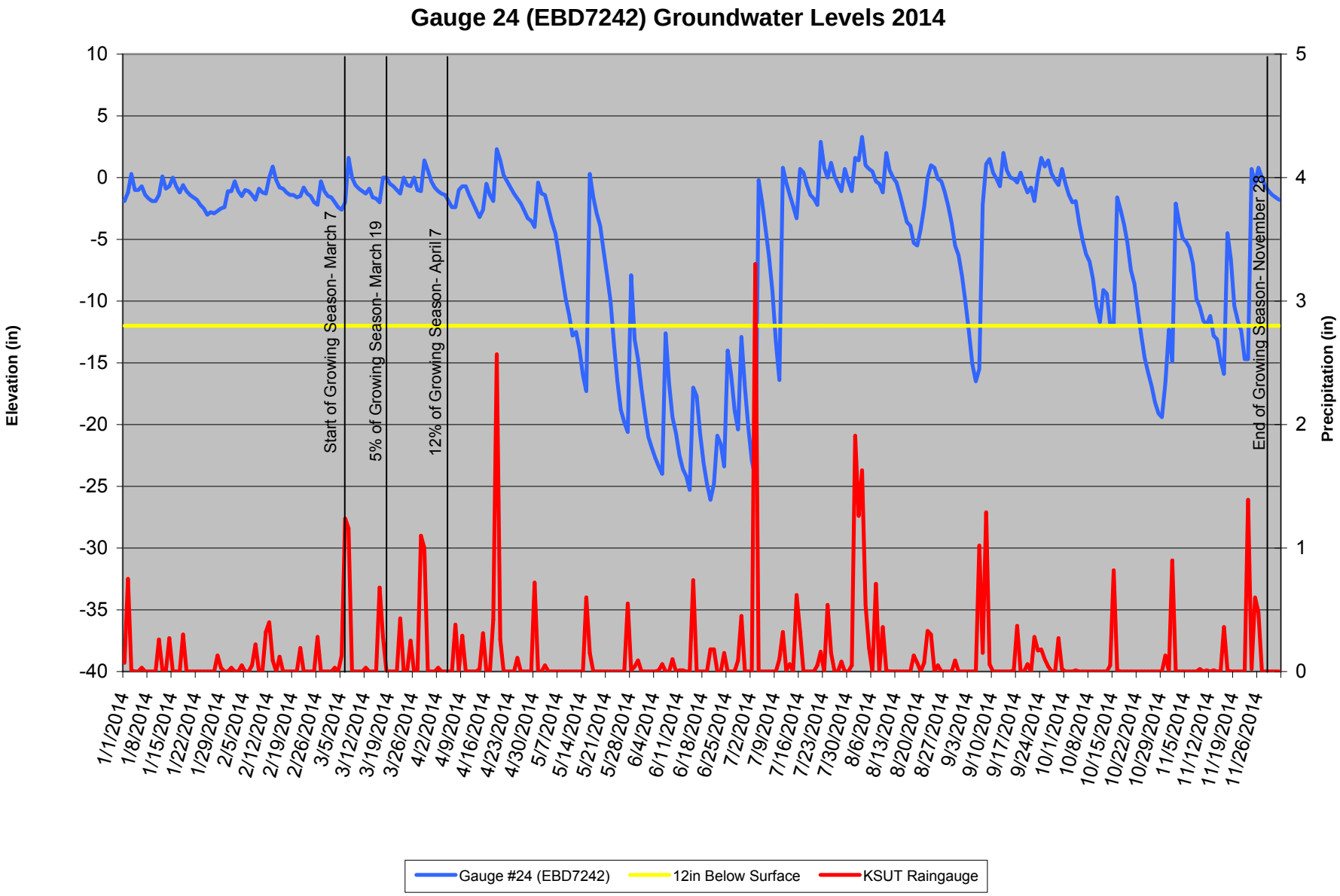

Gauge 20 (136AF38D) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #20 (136AF38D)
12in Below Surface
KSUT Raingauge

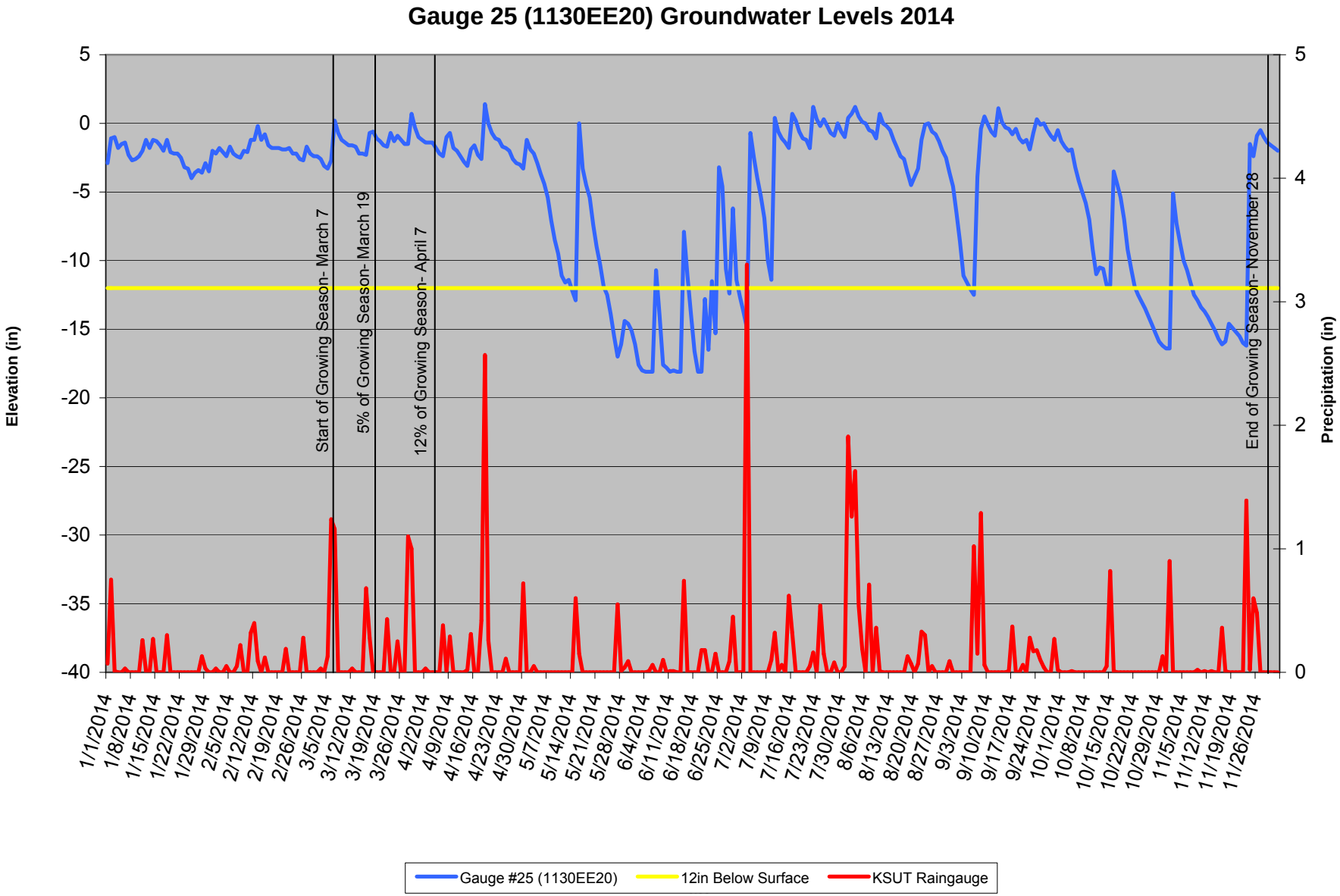

Gauge 21 (AB372F9) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #21 (AB372F9)
12in Below Surface
KSUT Raingauge

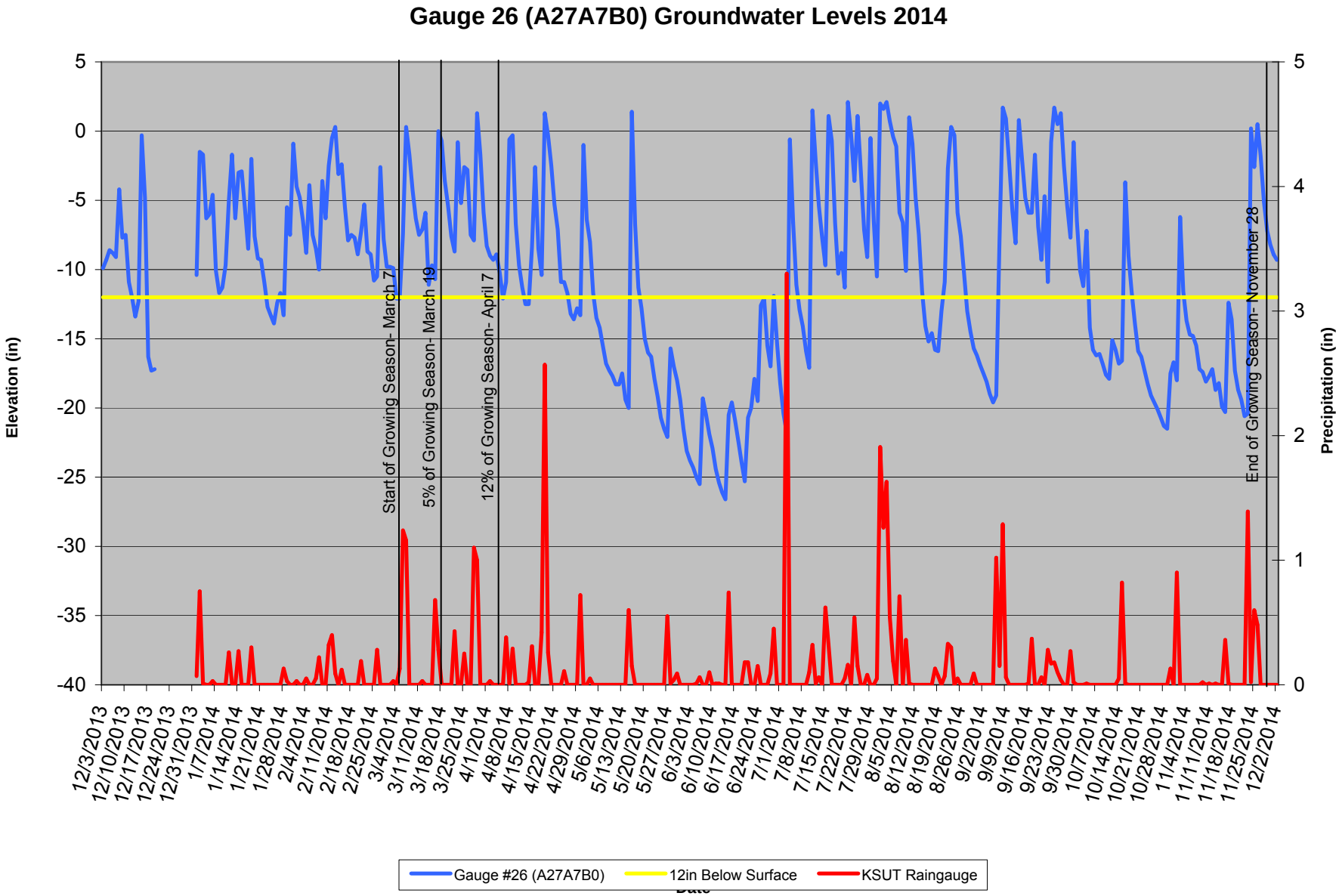

Gauge 22 (B65191F) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #22 (B65191F)
12in Below Surface
KSUT Raingauge

Gauge 23 (136B1B1A) Groundwater Levels 2014

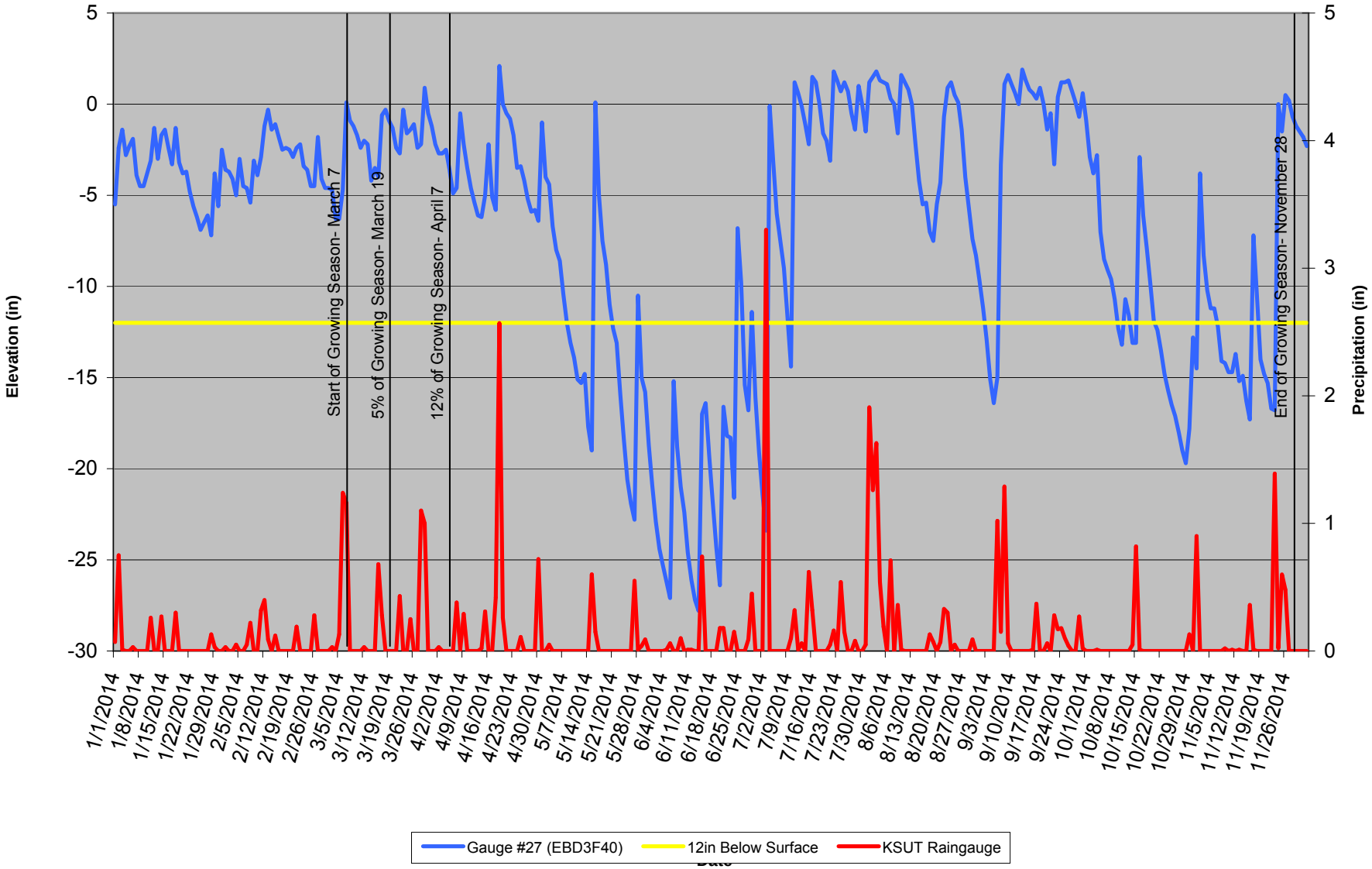


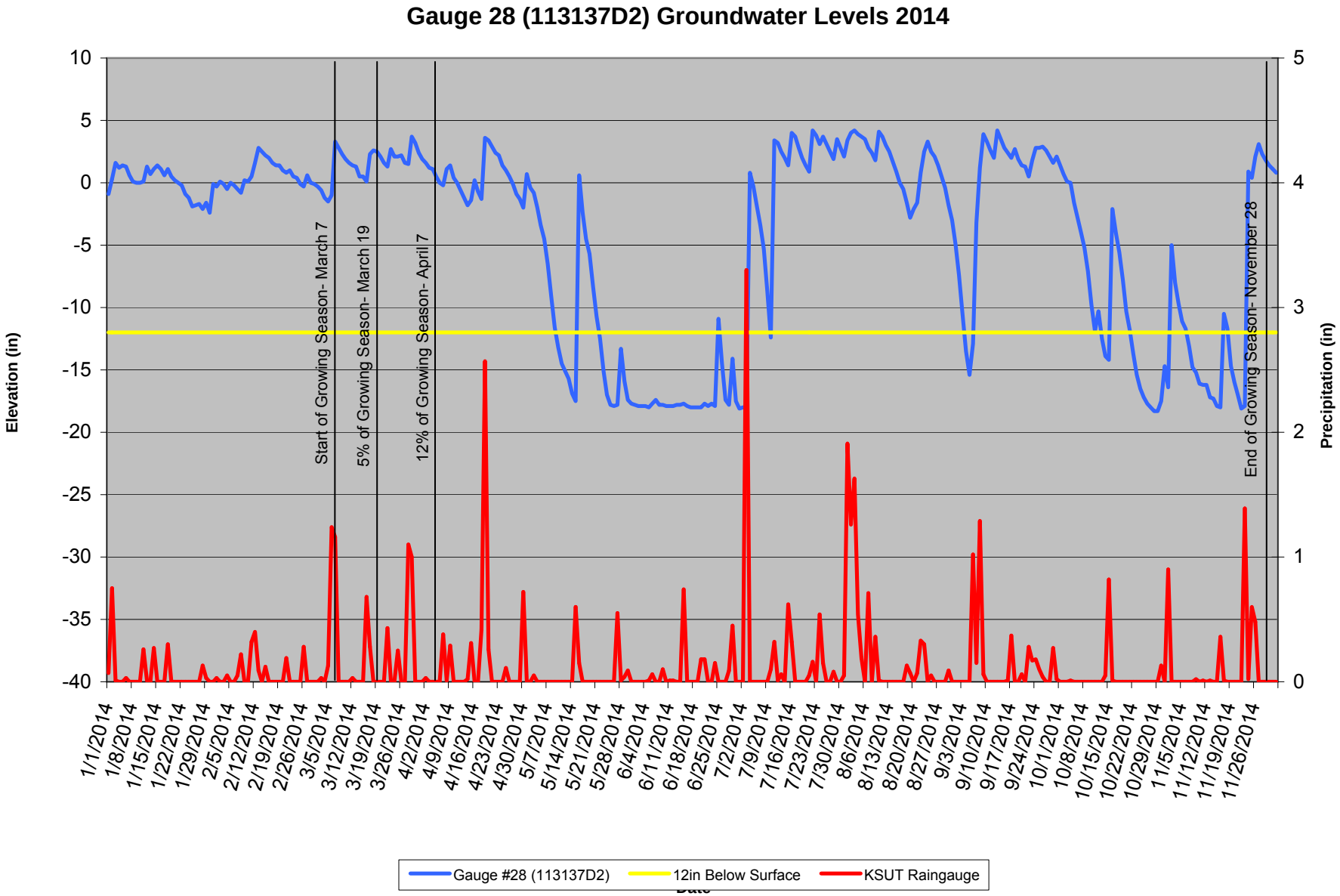

Gauge 24 (EBD7242) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #24 (EBD7242)
12in Below Surface
KSUT Raingauge

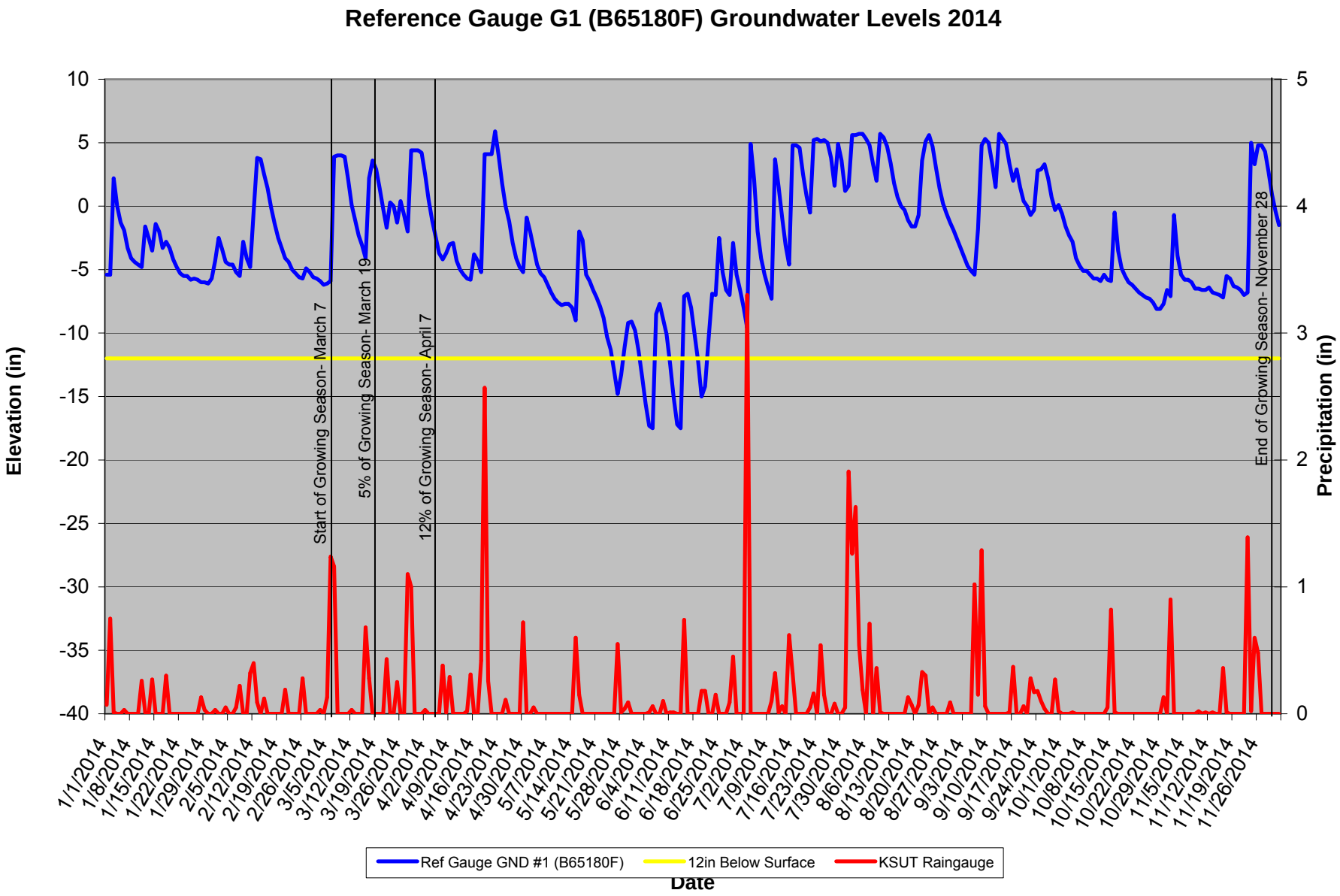

Gauge 25 (1130EE20) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #25 (1130EE20)
12in Below Surface
KSUT Raingauge


Gauge 26 (A27A7B0) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
12/3/2013
12/10/2013
12/17/2013
12/24/2013
12/31/2013
1/7/2014
1/14/2014
1/21/2014
1/28/2014
2/4/2014
2/11/2014
2/18/2014
2/25/2014
3/4/2014
3/11/2014
3/18/2014
3/25/2014
4/1/2014
4/8/2014
4/15/2014
4/22/2014
4/29/2014
5/6/2014
5/13/2014
5/20/2014
5/27/2014
6/3/2014
6/10/2014
6/17/2014
6/24/2014
7/1/2014
7/8/2014
7/15/2014
7/22/2014
7/29/2014
8/5/2014
8/12/2014
8/19/2014
8/26/2014
9/2/2014
9/9/2014
9/16/2014
9/23/2014
9/30/2014
10/7/2014
10/14/2014
10/21/2014
10/28/2014
11/4/2014
11/11/2014
11/18/2014
11/25/2014
12/2/2014
Gauge #26 (A27A7B0)
12in Below Surface
KSUT Raingauge

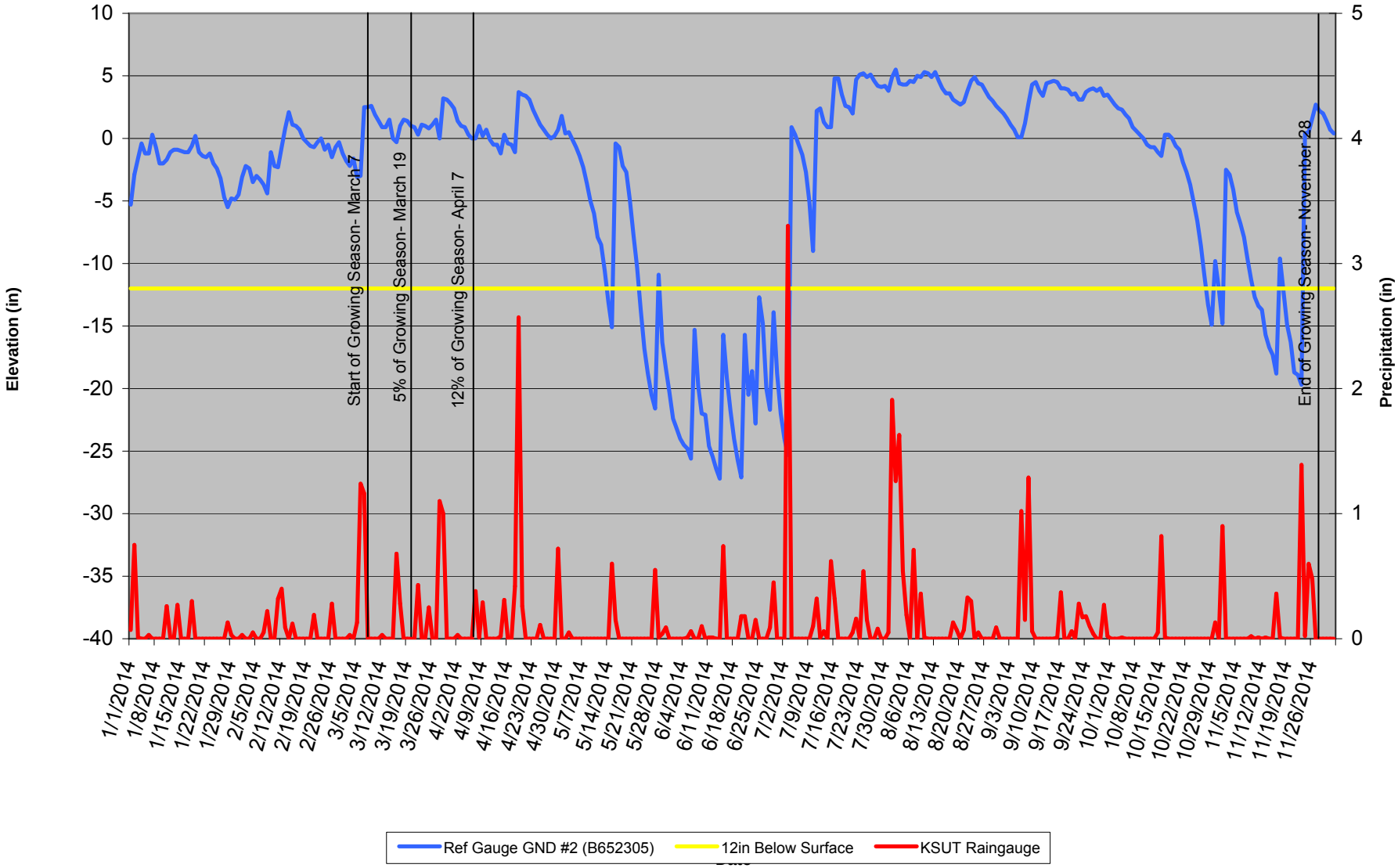
Gauge 27 (EBD3F40) Groundwater Levels 2014



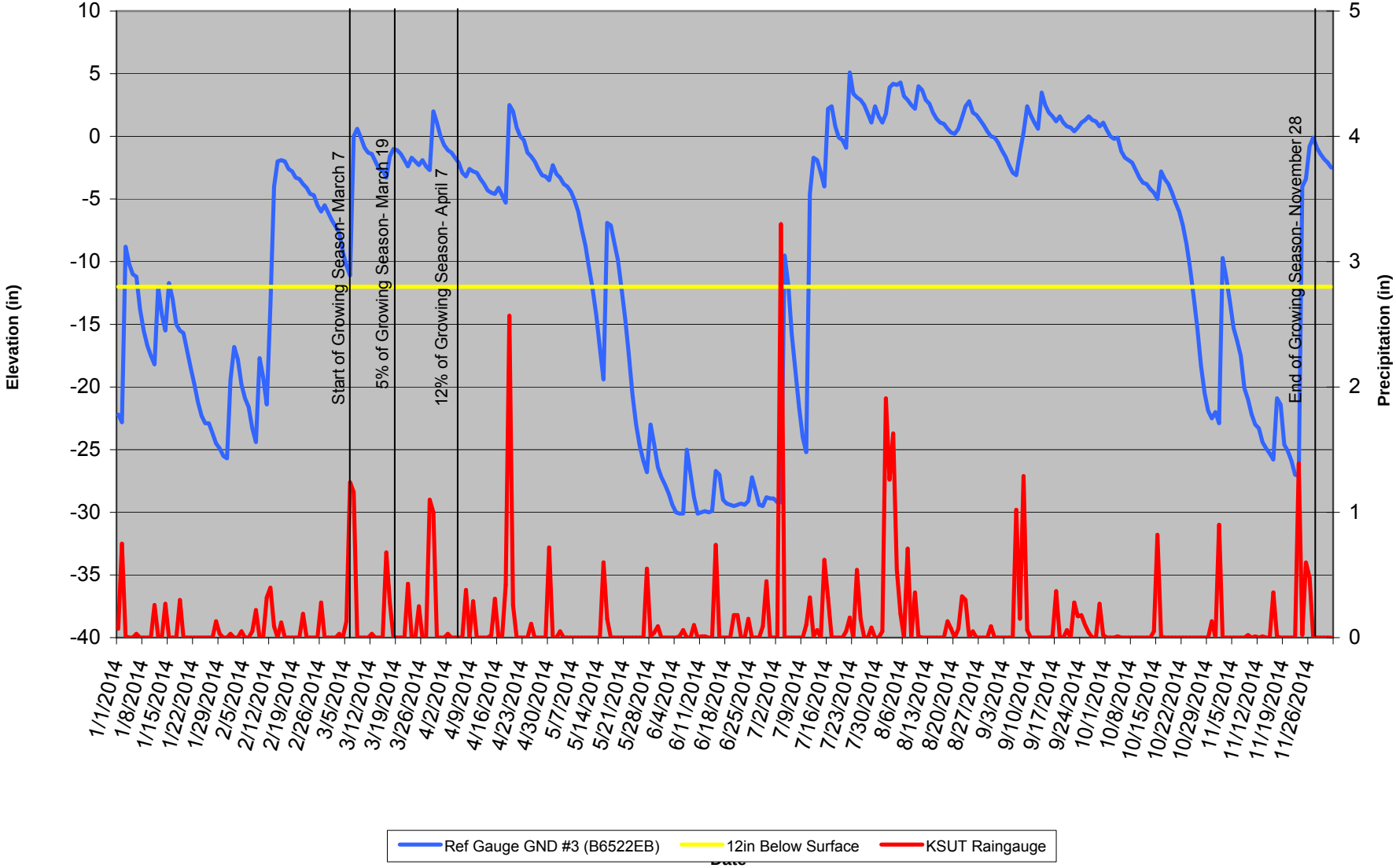

Gauge 28 (113137D2) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Gauge #28 (113137D2)
12in Below Surface
KSUT Raingauge

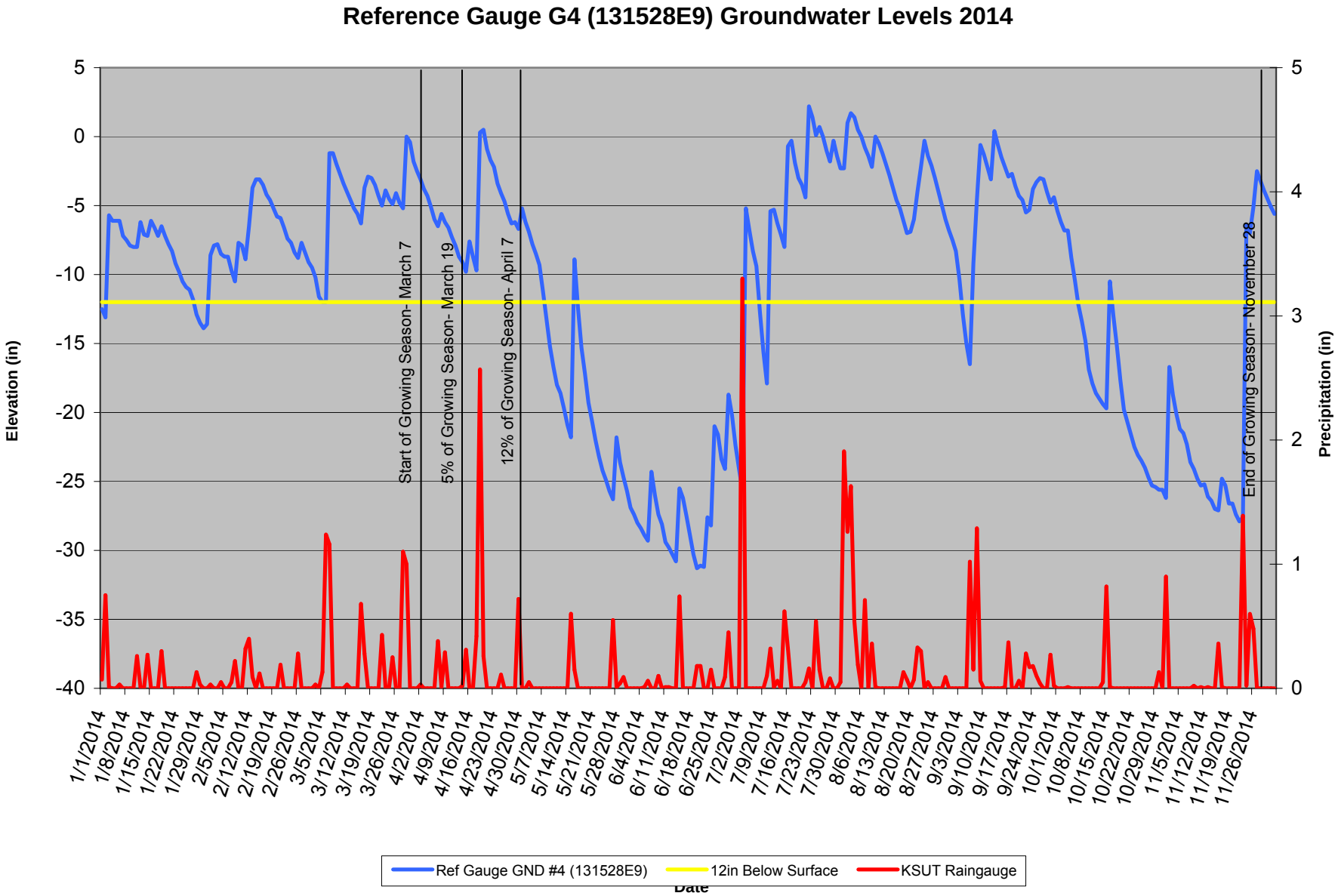

Reference Gauge G1 (B65180F) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Ref Gauge GND #1 (B65180F)
12in Below Surface
KSUT Raingauge
Date

Reference Gauge G2 (B652305) Groundwater Levels 2014

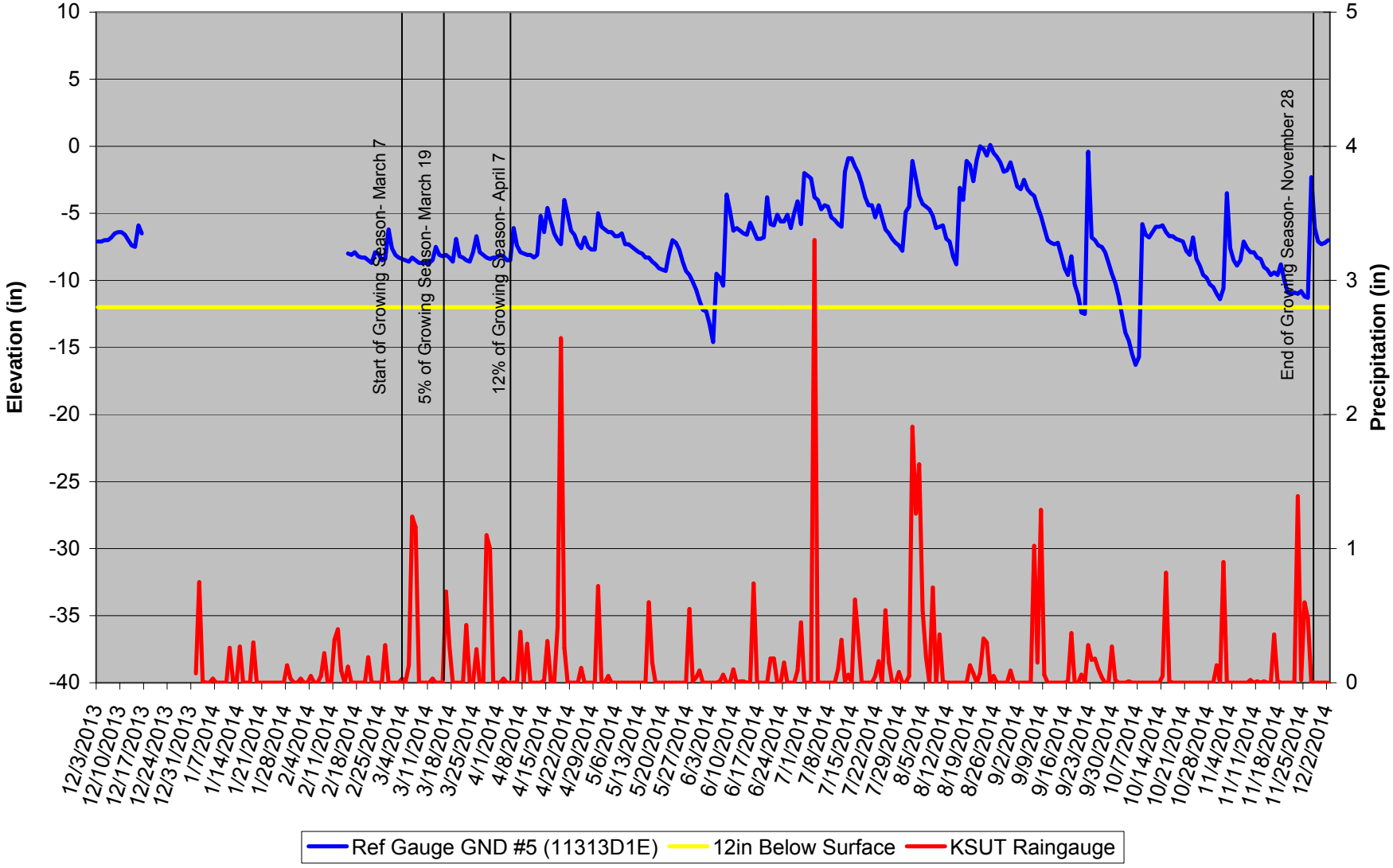


Reference Gauge G3 (B6522EB) Groundwater Levels 2014

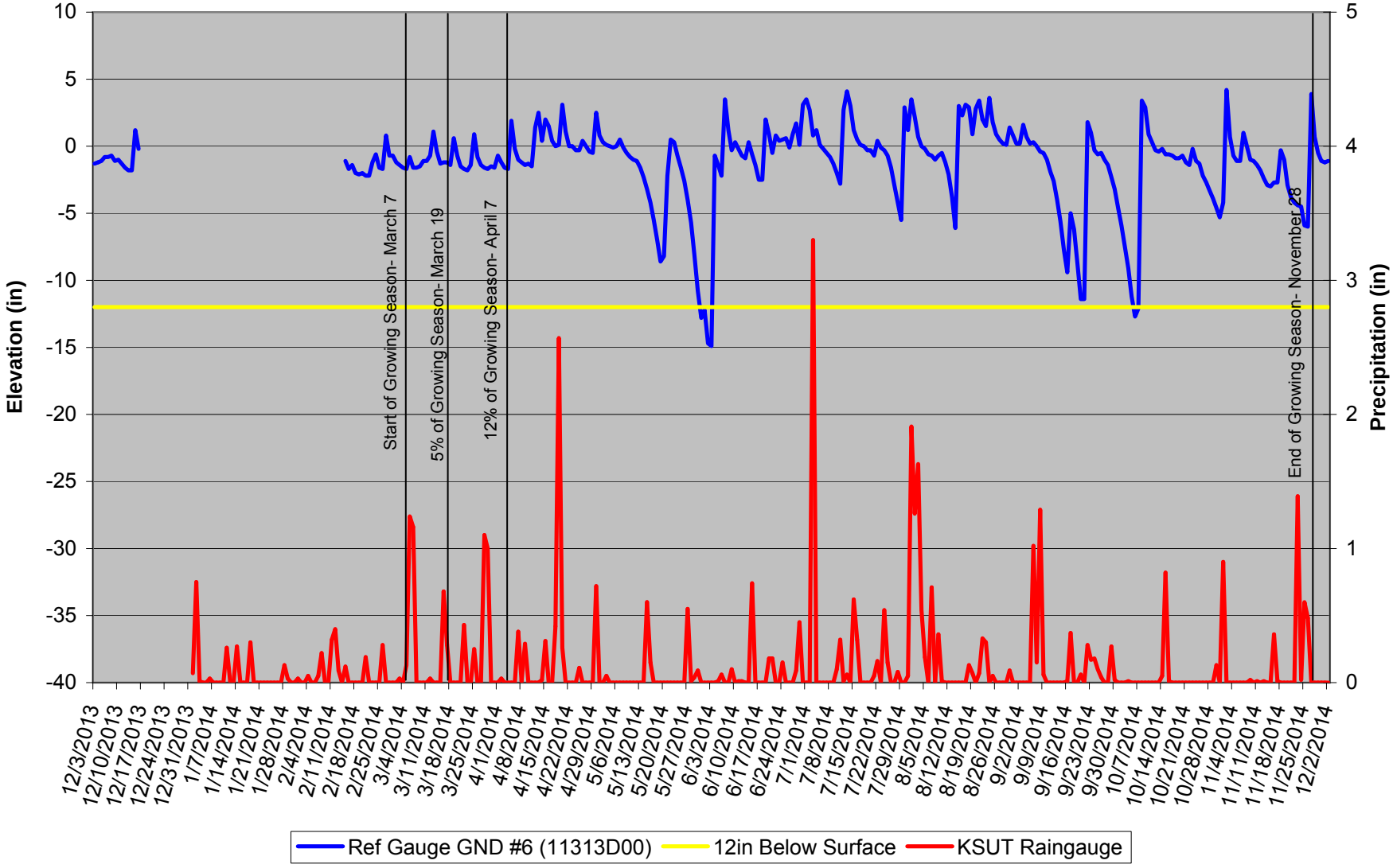



Reference Gauge G4 (131528E9) Groundwater Levels 2014
Elevation (in)
Precipitation (in)
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
Ref Gauge GND #4 (131528E9)
12in Below Surface
KSUT Raingauge
Date

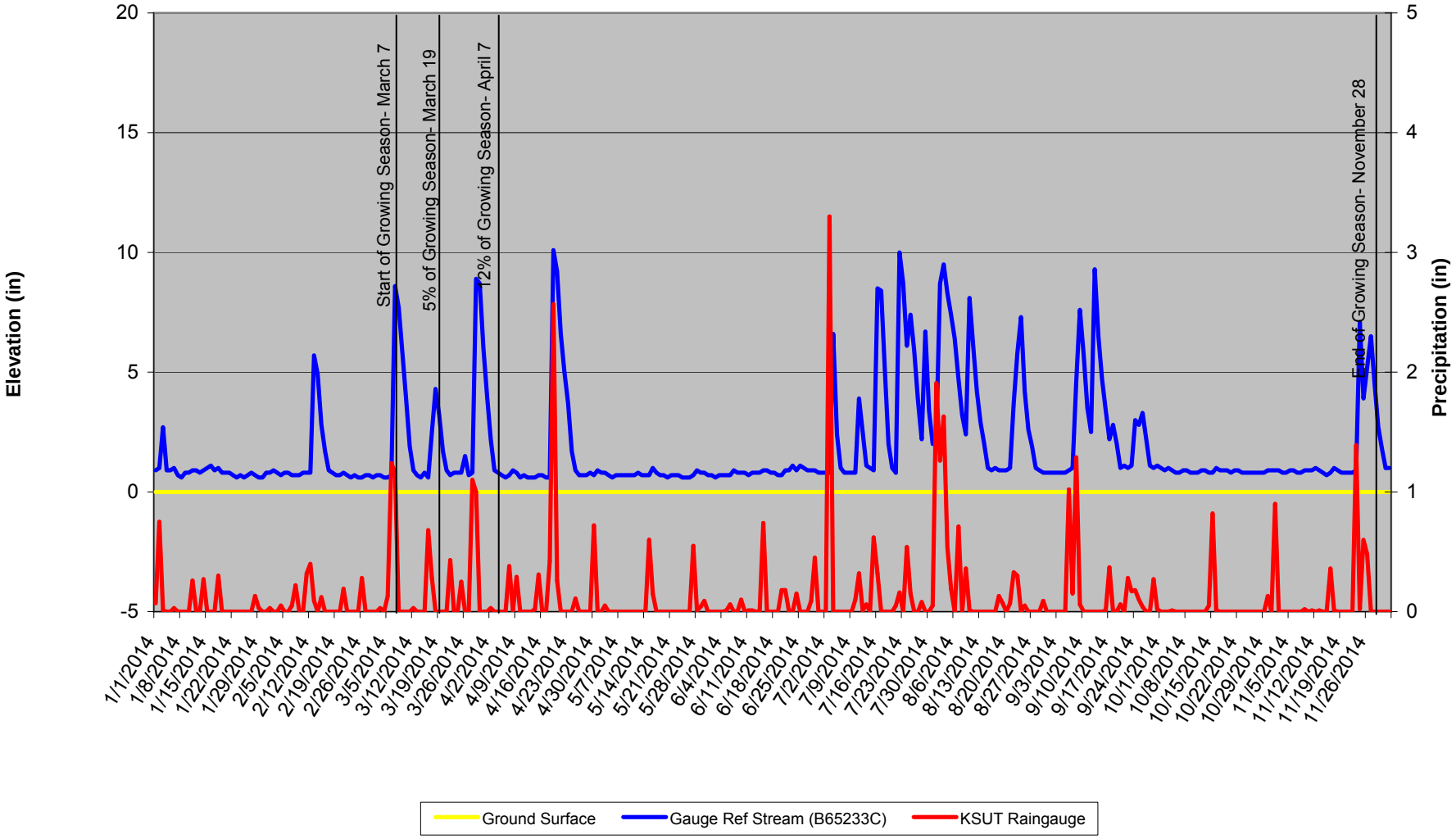
Reference Gauge G5 (11313D1E) Groundwater Levels 2014



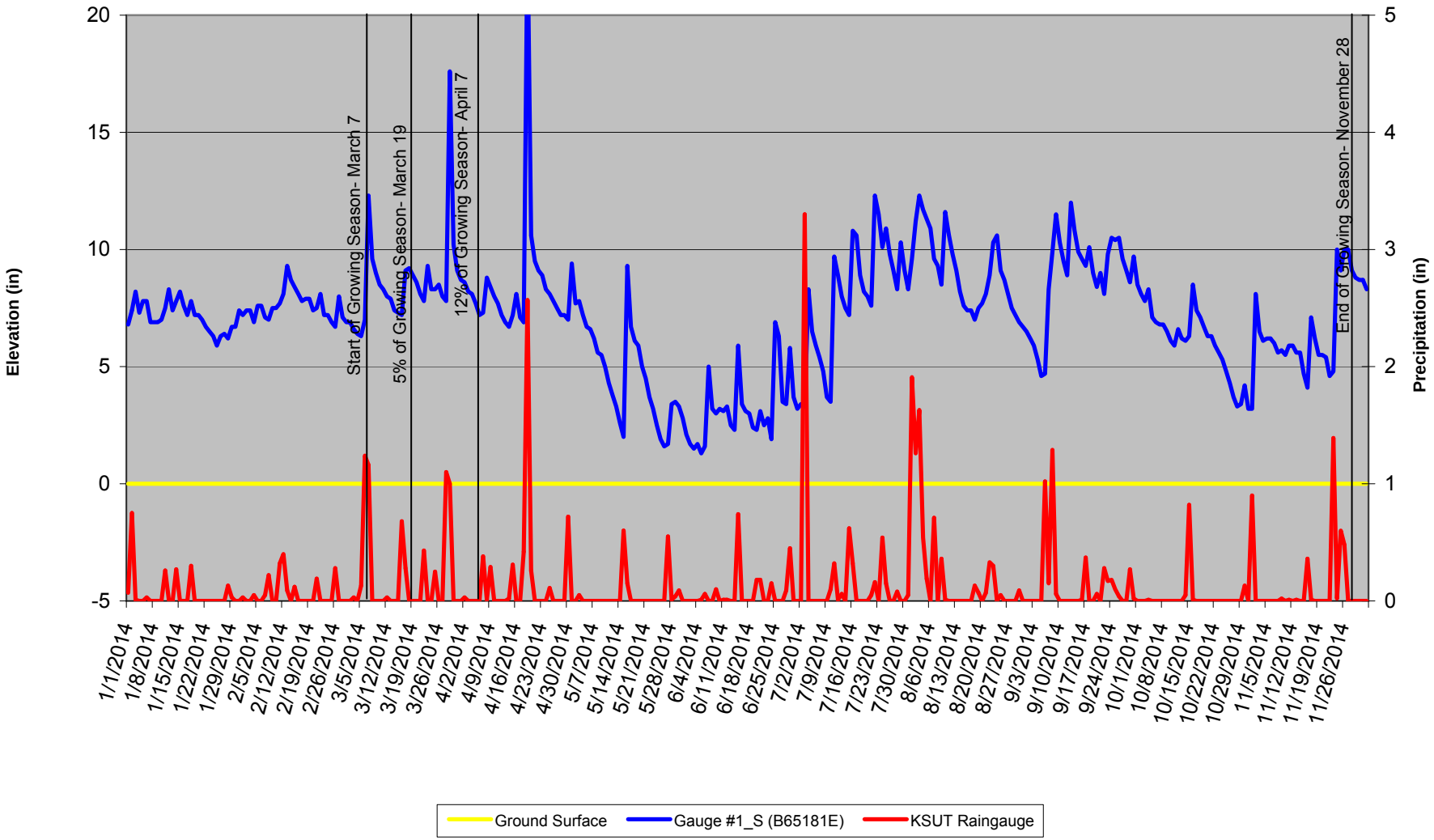
Reference Gauge G6 (11313D00) Groundwater Levels 2014



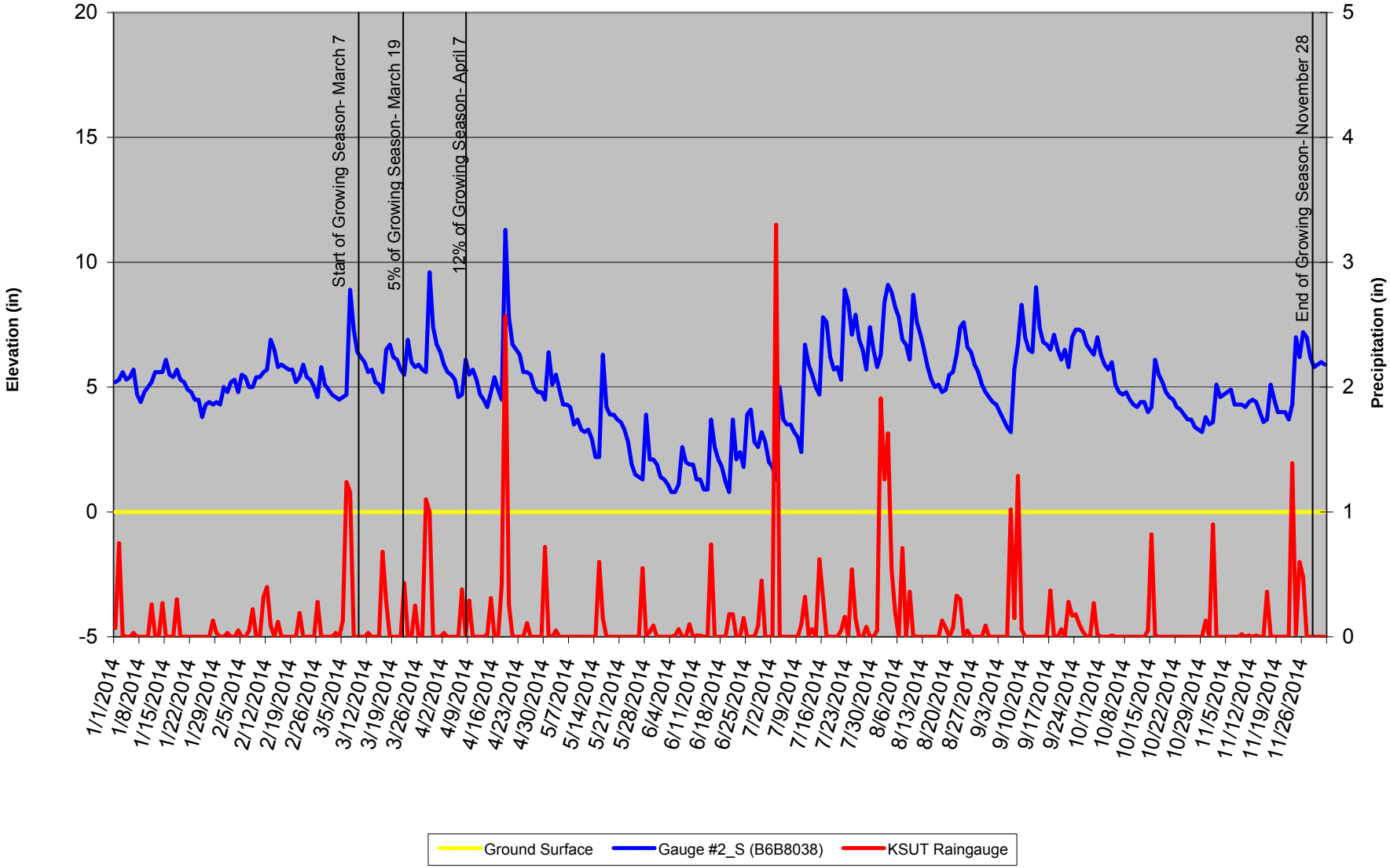
Reference Stream Gauge (B65233C) Water Levels 2014



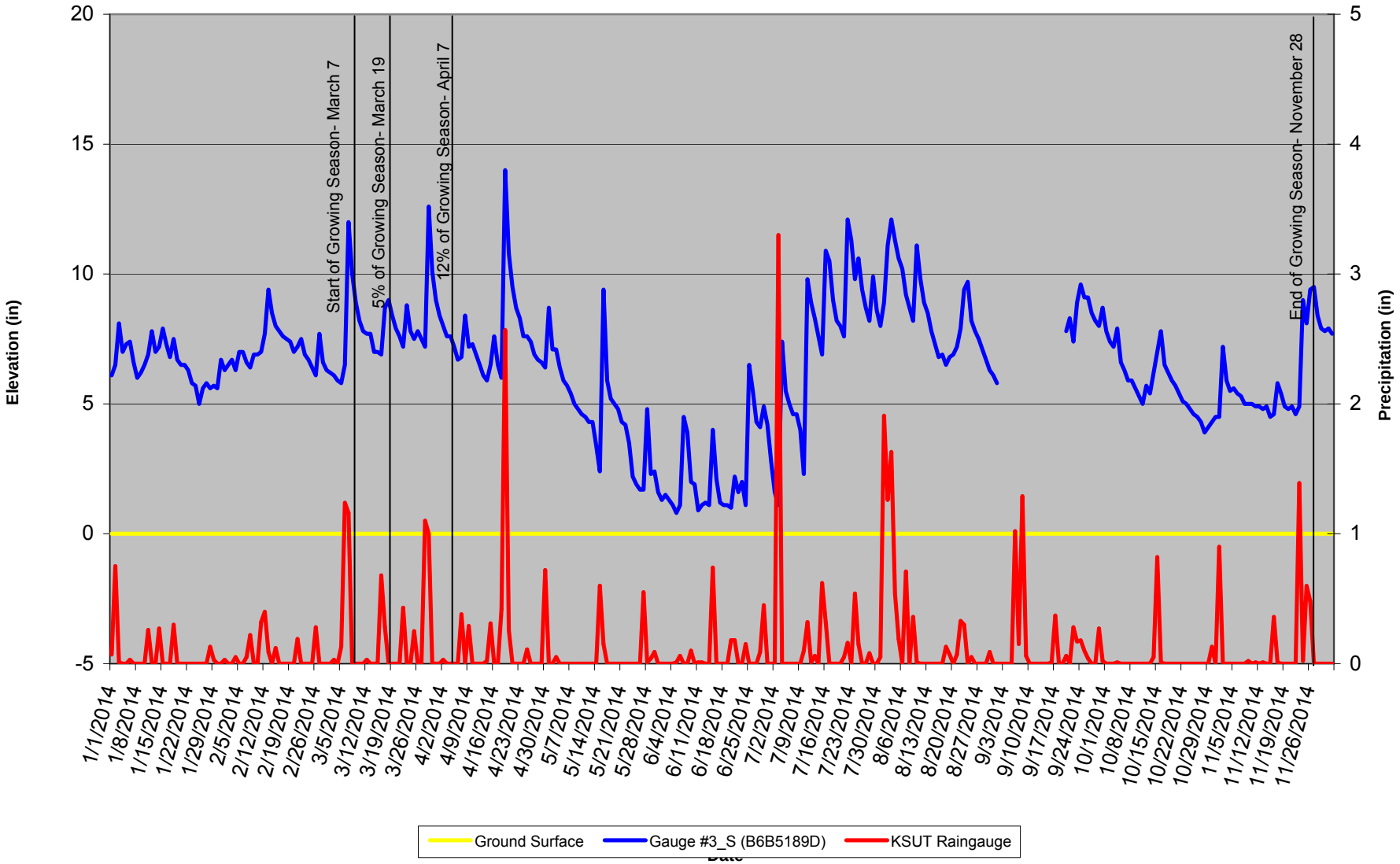
Stream Gauge 1 (B65181E) Water Levels 2014



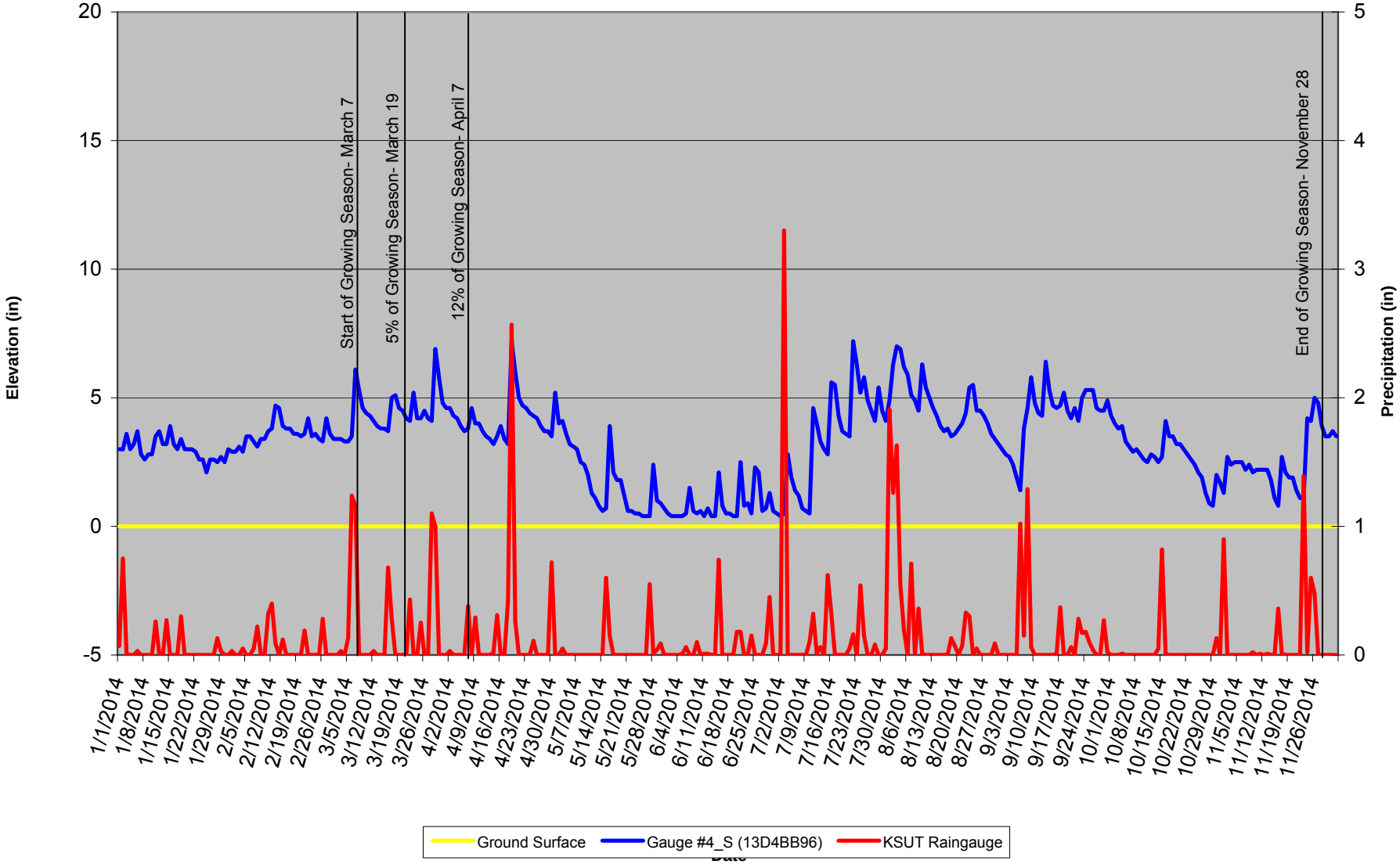
Stream Gauge 2 (B6B8038) Water Levels 2014

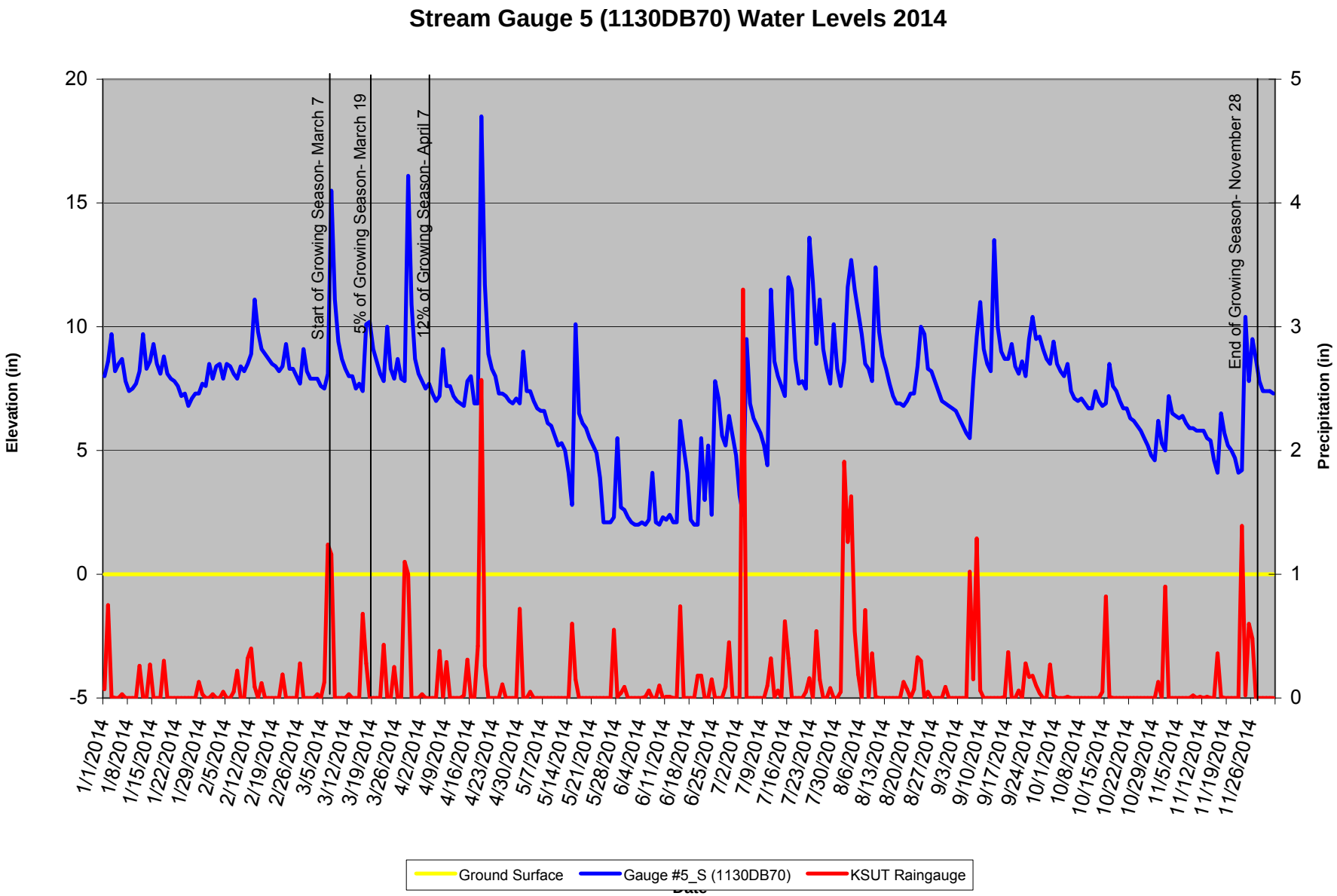


Stream Gauge 3 (B6B5189D) Water Levels 2014

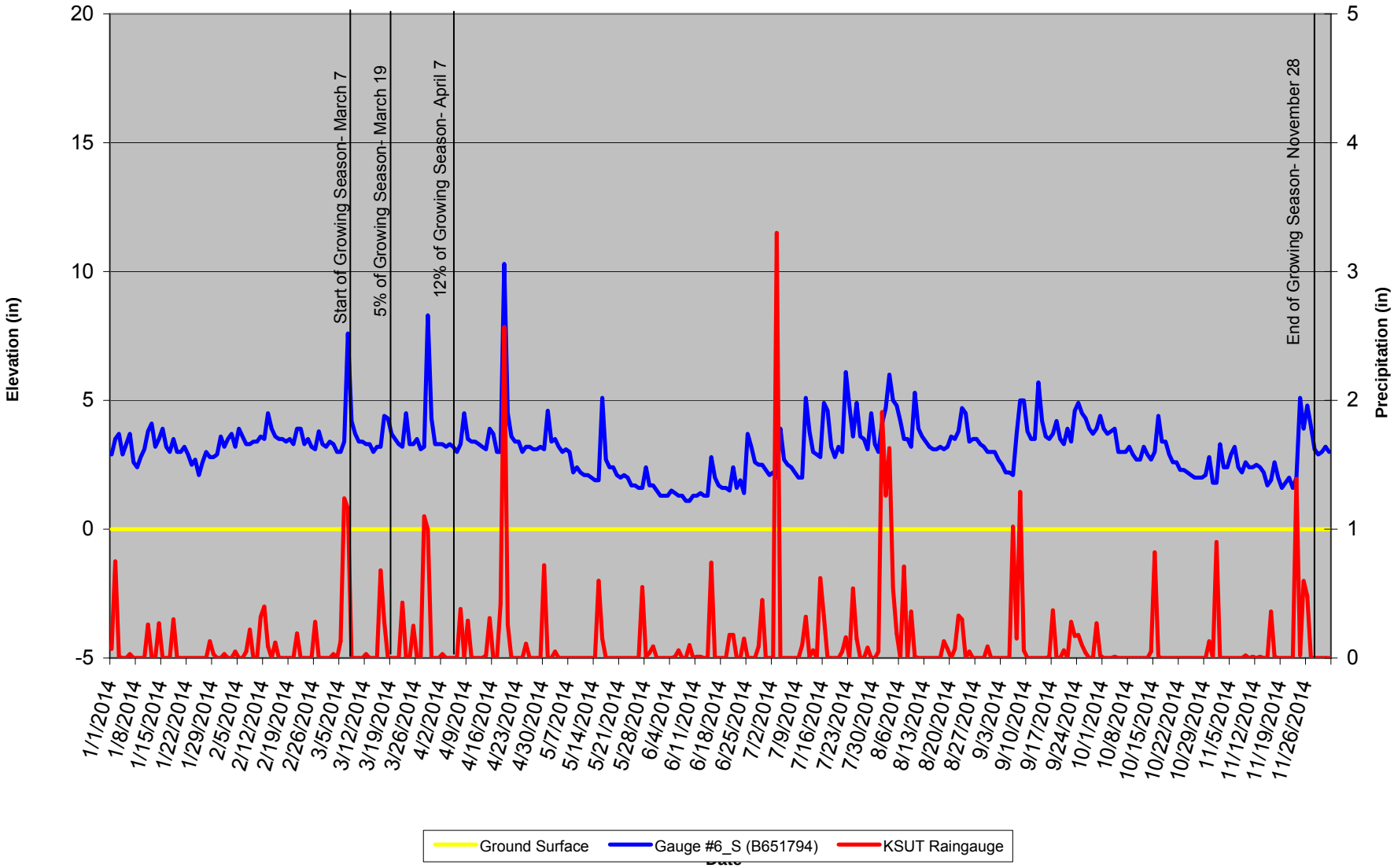


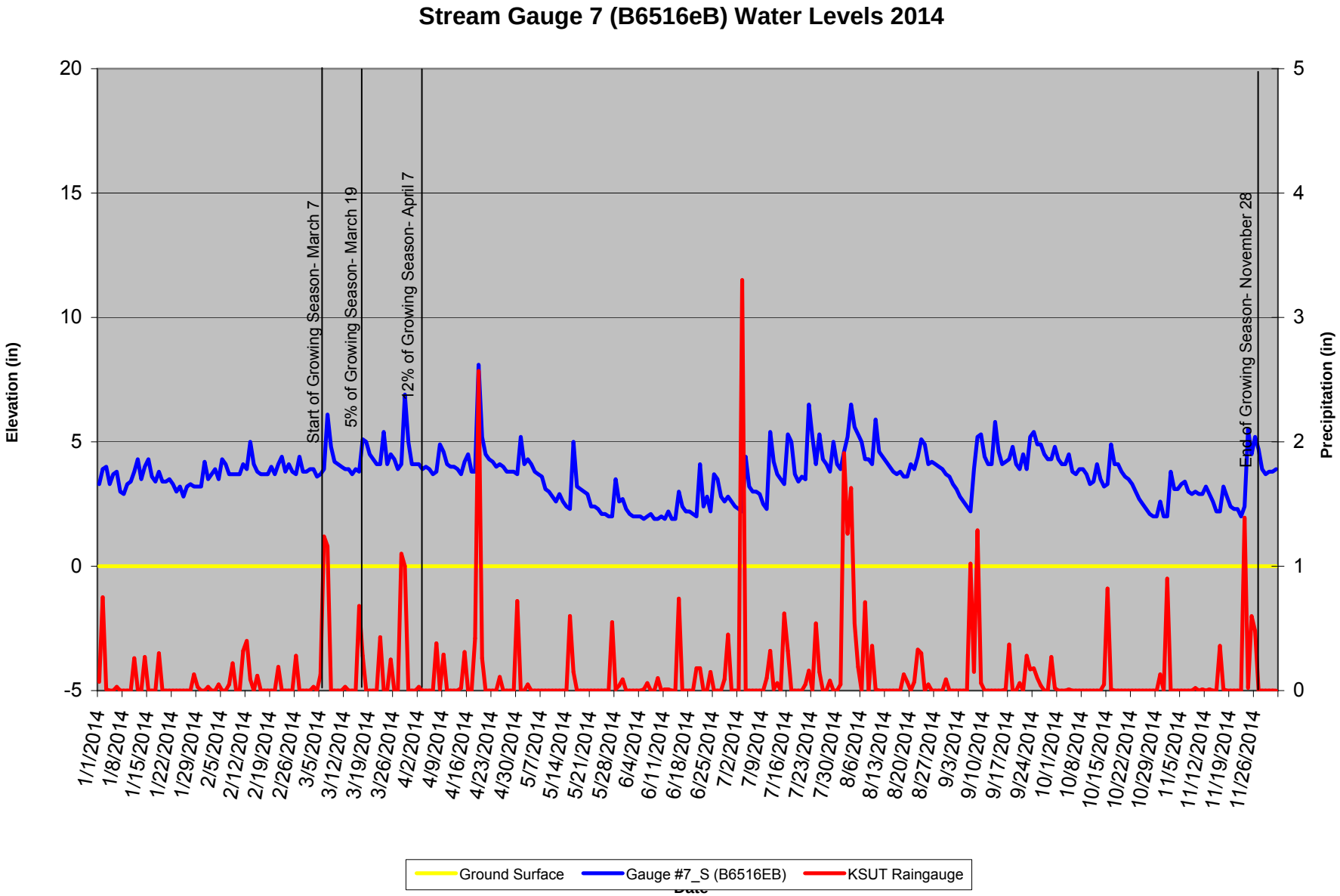
Stream Gauge 4 (13D4BB96) Water Levels 2014




Stream Gauge 5 (1130DB70) Water Levels 2014
Elevation (in)
Precipitation (in)
20
15
10
5
0
-5
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Ground Surface
Gauge #5_S (1130DB70)
KSUT Raingauge

Stream Gauge 6 (B651794) Water Levels 2014




Stream Gauge 7 (B6516eB) Water Levels 2014
Elevation (in)
Precipitation (in)
20
15
10
5
0
-5
5
4
3
2
1
0
Start of Growing Season- March 7
5% of Growing Season- March 19
12% of Growing Season- April 7
End of Growing Season- November 28
1/1/2014
1/8/2014
1/15/2014
1/22/2014
1/29/2014
2/5/2014
2/12/2014
2/19/2014
2/26/2014
3/5/2014
3/12/2014
3/19/2014
3/26/2014
4/2/2014
4/9/2014
4/16/2014
4/23/2014
4/30/2014
5/7/2014
5/14/2014
5/21/2014
5/28/2014
6/4/2014
6/11/2014
6/18/2014
6/25/2014
7/2/2014
7/9/2014
7/16/2014
7/23/2014
7/30/2014
8/6/2014
8/13/2014
8/20/2014
8/27/2014
9/3/2014
9/10/2014
9/17/2014
9/24/2014
10/1/2014
10/8/2014
10/15/2014
10/22/2014
10/29/2014
11/5/2014
11/12/2014
11/19/2014
11/26/2014
Ground Surface
Gauge #7_S (B6516EB)
KSUT Raingauge

Stream Gauge 8 (B6518D8) Water Levels 2014

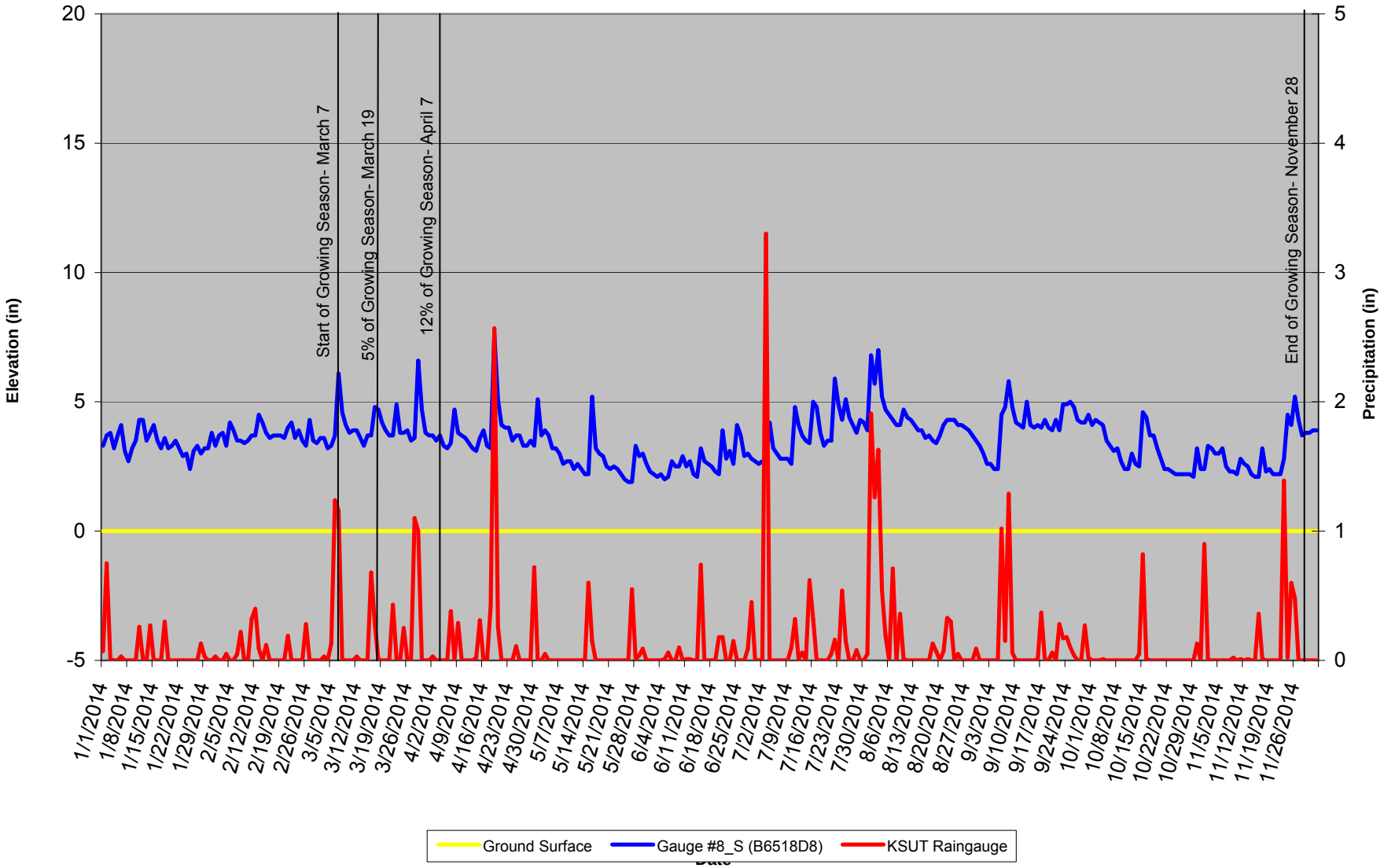


Table 10. Wetland gauge attainment data

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%)	Yes/93 days (35%)	Yes/148 days (55%)
2	Yes/68 days (25%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/268 days 100%)	Yes/161 days (60%)
3	Yes/44 days (16%)	Yes/127 days (47%)	Yes/121 days (45%)	Yes/107 days (40%)	Yes/157 days (58%)
4	Yes/43 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/104 days (39%)	Yes/148 days (55%)
5	Yes/43 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/197 days (73%)	Yes/161 days (60%)
6	Yes/63 days (24%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/198 days (74%)	Yes/161 days (60%)
7	Yes/42 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/194 days 725%)	Yes/161 days (60%)
8	Yes/42 days (16%)	Yes/125 days (47%)	Yes/121 days (45%)	Yes/104 days (39%)	Yes/148 days (55%)
9	Yes/58 days (22%)	Yes/125 days (47%)	Yes/121 days (45%)	Yes/101 days (37%)	Yes/116 days (43%)
10	Yes/36 days (14%)	Yes/33 days (12%)	Yes/121 days (45%)	Yes/72 days (27%)	Yes/64 days (24%)
11	Yes/57 days (22%)	Yes/106 days (40%)	Yes/121 days (45%)	Yes/97 days (36%)	Yes/69 days (26%)
12	Yes/33 days (13%)	No/23 days (9%)	Yes/31 days (12%)	Yes/69 days (26%)	Yes/62 days (23%)
13	Yes/36 days (13%)	No/23 days (9%)	Yes/31 days (12%)	Yes/69 days (26%)	Yes/61 days (23%)
14	Yes/40 days (16%)	Yes/116 days (43%)	Yes/121 days (45%)	Yes/84 days (31%)	Yes/116 days (42%)
15	Yes/41 days (16%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/102 days (37%)	Yes/148 days (55%)
16	Yes/57 days (22%)	Yes/99 days (37%)	Yes/121 days (45%)	Yes/104 days (39%)	Yes/148 days (55%)
17	Yes/43 days (16%)	Yes/99 days (37%)	Yes/121 days (45%)	Yes/73 days (27%)	Yes/72 days (27%)
18	Yes/126 days (47%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/121 days (45%)	Yes/167 days (62%)
19	Yes/63 days (24%)	Yes/126 days (47%)	Yes/121 days (45%)	Yes/178 days (66%)	Yes/161 days (60%)
20	Yes/32 days (13%)	Yes/116 days (43%)	Yes/121 days (45%)	Yes/196 days (73%)	Yes/116 days (42%)
21	Installed 12/10	No/19 days (7%)	Yes/31 days (12%)	Yes/68 days (25%)	Yes/59 days (22%)
22	Installed 12/10	No/19 days (7%)	Yes/34 days (13%)	Yes/67 days (25%)	Yes/54 days (20%)
23	Installed 12/10	Yes/116 days (43%)	Yes/121 days (45%)	Yes/74 days (28%)	Yes/67 days (25%)
24	Installed 12/10	Yes/109 days (41%)	Yes/121 days (45%)	Yes/73 days (28%)	Yes/65 days (24%)
25	Installed 12/10	Yes/74 days (28%)	Yes/121 days (45%)	Yes/84 days (31%)	Yes/68 days (25%)
26	Installed 12/10	No/25 days (9%)	No/22 days (8%)	Yes/62 days (23%)	Yes/35 days (13%)
27	Installed 12/10	No/25 days (9%)	Yes/121 days (45%)	Yes/70 days (26%)	Yes/63 days (23%)
28	Installed 12/10	Yes/40 days (15%)	Yes/121 days (45%)	Yes/72 days (27%)	Yes/64 days (24%)