Year 1 Monitoring Report

Shepherds Tree Stream & Wetland Restoration

February 2006
S&EC Project No. 9440.D1
EEP Project No. 00078

Designed by KCI Associates of North Carolina, PA

Prepared for

Ecosystem Enhancement PROGRAM

NCEEP, 1652 Mail Service Center, Raleigh, NC 27699-1652

Table of Contents

I. Executive Summary / Project Abstract

Due to historic anthropogenic alterations, streams and wetlands within the Shepherds Tree restoration site were in an impaired state prior to restoration. The project, located in Iredell County, was designed using natural channel design methods. The restoration was completed in 2004. This report serves as the Year 1 (2005) Annual Monitoring Report.

Monitoring of the vegetated buffer was performed during the growing season of 2005, by Soil & Environmental Consultants, PA. Stem counts were preformed within the established vegetation monitoring plots, resulting in a live stem density of approximately 324 stems per acre.

Approximately 14,688 linear feet of stream restoration was performed as part of this restoration site, however, monitoring of the stream restoration will not begin until an as-built report has been prepared and submitted by the designer.

Sixteen (16) groundwater gauges were present onsite. Eight (8) of the sixteen (16) gauges onsite achieved wetland success criteria of saturation for 8% of the growing season (15 days).

II. Project Background

The background information for this report is referenced from a mitigation plan submitted by the Office of Natural Environment & Roadside Environmental Unit of the North Carolina Department of Transportation (NCDOT).

A. Location and Setting

The Shepherd's Tree Mitigation Site is a 160 acre tract located in Iredell County, NC. The site it located between Triplett Road (SR 2362) and Knox Farm Road (SR 2363). The restored channel is a tributary of Third Creek. The site location is shown on Figure 1.

B. Structure and Objectives

Agricultural practices in the vicinity of Third Creek included channelizing many of the streams resulting in the draining of floodplain wetlands. The intent of this project was to restore a wetland-stream complex to replace those ecological functions lost as a result of anthropogenic alterations.

The site was developed as mitigation for impacts within the Yadkin River Basin. Mitigation types proposed in the Mitigation Plan include: 48.56 acres of restoration and 37.71 acres of creation of Piedmont/Mountain Bottomland Hardwood Forest. The restoration of 5 acres of Piedmont/Mountain Swamp Hardwood Forest, the preservation of a Low Elevation Seep (4.54 acres) were also proposed. Stream mitigation included the restoration of 11,570 lf of perennial stream and 3,118 lf of intermittent stream.

Table I: Project Structure Table
Shepherds Tree Restoration Site (EEP Project #00078)

Segment/Reach ID	Linear Feet or Acreage
Perennial Stream Restoration	11,570 lf
Intermittent Stream Restoration	3,118 lf
Piedmont/Mountain Bottomland Hardwood Forest	86.27 ac
Piedmont/Mountain Swamp Hardwood Forest	5.0 ac
Low Elevation Seep	4.54 ac

Table II: Project Objectives Table
Shepherds Tree Restoration Site (EEP Project #00078)

Segment/Reach ID	Objectives	Linear Feet or Acreage	Comment
Perennial Stream	Restoration	11,570 lf	
Intermittent Stream	Restoration	3,118 lf	
Piedmont/Mountain Bottomland Hardwood Forest	Restoration/Creation	48.56 / 37.71 ac	
Piedmont/Mountain Swamp Hardwood Forest	Restoration	5.0 ac	
Low Elevation Seep	Preservation	4.54 ac	

C. Project History and Background

A mitigation plan was submitted in June 2001. It is to our understanding that construction was completed in 2004, however, an as-built report has not been submitted. This report serves as the Annual Monitoring report for Year 1 (2005).

Table III: Project Activity and Reporting History
Shepherds Tree Restoration Site (EEP Project #00078)

Activity or Report	Calendar Year of Completion or Planned Completion	Actual Completion Date
Mitigation Plan		Jun-01
Construction	2004	
As-Built report		
Initial-Year 1 monitoring	2005	Dec-05
Year 2 monitoring	2006	
Year 3 monitoring	2007	
Year 4 monitoring	2008	
Year 5 monitoring	2009	

The project was designed by: Construction was preformed by: Additional information regarding contractors is shown in Table IV.

Table IV: Project Contact Table
Shepherds Tree Stream and Wetland Mitigation Site (EEP Project #00078)

Designer	KCI Associates of North Carolina, PA Suite 200 Landmark Center I 4601 Six Forks Road Raleigh, NC 27609
Monitoring Performers	Soil and Environmental Consultants, PA 11010 Raven Ridge Road Raleigh, NC 27614
Stream Monitoring POC	N/A
Vegetation Monitoring POC	Jessica Regan, S&EC
Wetland Monitoring POC	Jessica Regan, S&EC

The project is located within Iredell County, portions of which are located within the Inner Peidmont geological region of the Piedmont of North Carolina. The site is located within a rural, agricultural area. Additional information regarding the restoration reach is included in Table V.

Table V: Project Background Table
Shepherds Tree Stream and Wetland Mitigation Site (EEP Project #00078)

Project County	Iredell
Drainage Area	N/A
Drainage impervious cover estimate (%)	10%
Stream Order	1st order
Physiographic Region	Piedmont
Ecoregion	Inner Peidmont Belt
Rosgen Classification of As-Built	N/A
Cowardin Classification	N/A
Dominant Soil Types	Chewacla, Conagree
USGS HUC for Project and Reference	3040102
NCDWQ Sub-basin for Project and Reference	30706
NCDWQ classification for Project and Reference	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	N/A
% of project easement fenced	100%

D. Monitoring Plan View

A series of monitoring devices were previously established onsite by NCDOT. Ten (10) vegetation monitoring plots are present onsite.

Permanent cross-sections may have been located on the stream restoration reaches, however the number and location is unknown due to the lack of an as-built report.

Nineteen (19) electronic monitoring gauges were previously installed onsite. Sixteen (16) are groundwater gauges and three (3) are surface gauges. The gauges have been configured to record water levels. A rain gauge is also present onsite, however no usable data was collected from it, as it has not been properly maintained. It is recommended that this rain gauge be replaced.

The locations of all monitoring devices are shown on Sheet 1 – Monitoring Plan View.

III. Project Condition and Monitoring Results

A. Vegetation Assessment

The wetland creation/restoration area (approximately 91 acres) was planted with various native hardwood tree and shrub species. Areas within the Duke Power right-of-way were planted strictly with herbaceous species. It is unknown when planting occurred.

Ten (10) 50'x 50'vegetation monitoring plots were established onsite by NCDOT. The success criteria for the site require a minimum of 320 live stems per acre for the first three (3) years of monitoring. At the end of Year 4, a density of 290 stems per acre is required. At the end of the 5-year monitoring period, a live stem density of 260 stems per acre must be achieved.

1. Soil Data

The project site is located in the Inner Piedmont of the North Carolina Piedmont physiographic province. Soils present in the riparian areas adjacent to the project are characteristic of those found in alluvial landforms in the Inner Piedmont. However, past agricultural practices have likely redistributed much of the naturally occurring soils on site. Chewacla and Conagree soils are the prevalent map units along the channel. Formed in fine loamy alluvial material, they are somewhat poorly drained with low natural fertility.

Table VI: Preliminary Soil Data
Shepherds Tree Stream and Wetland Restoration Site (EEP Project #00078)

Series	Max Depth (in.)	% Clay on Surface	K	T	OM %
Chewacla (Cw)	60	10-35	0.28	5	1.0-4.0
Conagree (Cy)	70	10-25	0.37	5	1.0-4.0

2. Problem Areas Plan View (vegetation)

During a field inspection on July 28, 2005, vegetative problem areas were observed. A large infestation of *Kudzu*, the highly invasive exotic plant was located within the restoration site. Photos of the invasive are included in Appendix A.

Table VII: Vegetative Problem Areas
Shepherds Tree Stream and Wetland Restoration Site (EEP Project #00078)

Feature Issues	Station numbers	Suspected Cause	Photo number
Kudzu	N/A	Invasive population	Vegetative Problem Area Photos 1-2

3. Vegetative Problem Areas Plan View

Vegetative problem areas are shown on Sheet 2 (Problem Area Plan View).

4. Stem Counts

On June 14, 2005, S&EC conducted vegetation counts within each plot. The results of this survey are shown below in Table VIII.

The following tree species were planted in the Wetland Creation Area: *Salix nigra* (Black Willow), Fraxinus pennsylvanica (Green Ash), *Liriodendron tulipifera* (Tulip poplar), *Plantanus occidentalis* (American sycamore), *Quercus nigra* (Water Oak), *Acer negundo* (Box elder), *Quercus michauxii* (Swamp Chestnut Oak), *Quercus pagoda* (Cherrybark Oak), *Quercus phellos* (Willow Oak), and *Cephalanthus occidentalis* (Buttonbush).

Table VIII: Stem Counts for Each Species Arranged by Plot
Shepherds Tree Stream and Wetland Mitigation Site (EEP Project #00078)

	Plots										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Year 1 Totals**
Salix nigra (Black Willow)							10	1			11
Fraxinus pennsylvanica (Green Ash)	2		4	15	3	3	4		10	10	51
Liriodendron tulipifera (Tulip poplar)	1		1	12							14
Platanus occidentalis (American sycamore)			9			2	1	10	6		28
Quercus nigra (Water oak)	1			2		2					5
Acer negundo (Box elder)			1			4			2		7
Quercus michauxii (Swamp Chestnut oak)		2	4	1		2			4		13
Quercus pagoda (Cherrybark Oak)	12		3	2	4	8		3	4	2	38
Quercus phellos (Willow oak)	2	3				1		1			7
Cephalanthus occidentalis (Buttonbush)	4	2	1	1	3		1				12
TOTALS	**22**	**7**	**23**	**33**	**10**	**22**	**16**	**15**	**26**	**12**	**186**
Live Stem Density	383	122	401	575	174	383	279	261	453	209	
Average Live Stem Density											**324**

The average stems per sample plot is 18.6 stems. Analysis of the 2005 vegetation monitoring of the site resulted in an average tree density of 324 stems per acre.

As no as-built report has been submitted to date, there are no initial counts of live stems planted, therefore, no survival percentages could be calculated.

5. Vegetation Photo Plots

Photos taken during the June 14, 2005, Vegetation Sampling event are included as Appendix A.

B. Stream Assessment

1. Problem Areas Plan View (Stream)

This portion of monitoring was not completed (per EEP directive) due to the lack of an as-built survey.

2. Problem Areas Table Summary

This portion of monitoring was not completed (per EEP directive) due to the lack of an as-built survey.

3. Numbered Issues Photo Section

This portion of monitoring was not completed (per EEP directive) due to the lack of an as-built survey.

4. Fixed Photo Station Photos

This portion of monitoring was not completed (per EEP directive) due to the lack of an as-built survey.

5. Stability Assessment

This portion of monitoring was not completed (per EEP directive) due to the lack of an as-built survey.

6. Quantitative Morphology

This portion of analysis was not completed (per EEP directive) due to the lack of an as-built survey.

C. Wetland Assessment

Sixteen (16) groundwater monitoring gauges along with one (1) rain gauge and three (3) surface gauges were installed onsite by NCDOT. The groundwater gauges record daily readings of depth to groundwater.

Success criteria for wetland hydrology require that the area be inundated or saturated within 12" of the ground surface for a period of 8% of the growing season. The growing season in Iredell County begins April 14 and ends October 24. In order to attain hydrologic success, saturation within 12" of the ground surface is required for 15 consecutive days.

1. Problem Areas Plan View (Wetland)

An assessment of the stability of the wetland was preformed on during monthly visits that occurred from May through December, 2005, by S&EC. Groundwater gauges were downloaded monthly.

As shown on the Problem Area Plan View (Sheet 2), eight (8) of the sixteen (16) gauges onsite achieved wetland success criteria of saturation for 8% of the growing season (15 days).

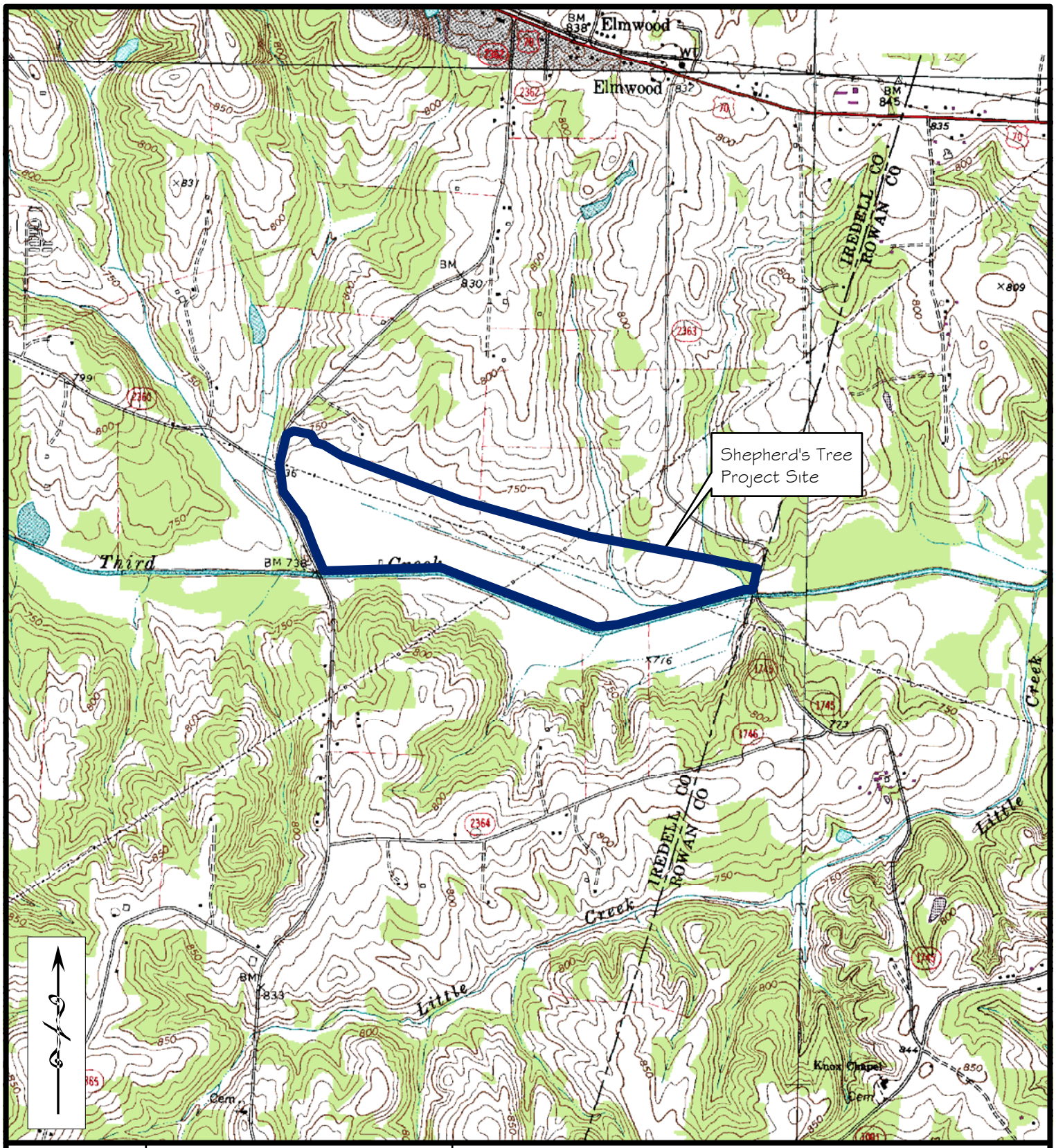
2. Wetland Criteria Attainment

Table XIII: Wetland Criteria Attainment
Shepherds Tree Stream and Wetland Mitigation Site (EEP Project # 00078)

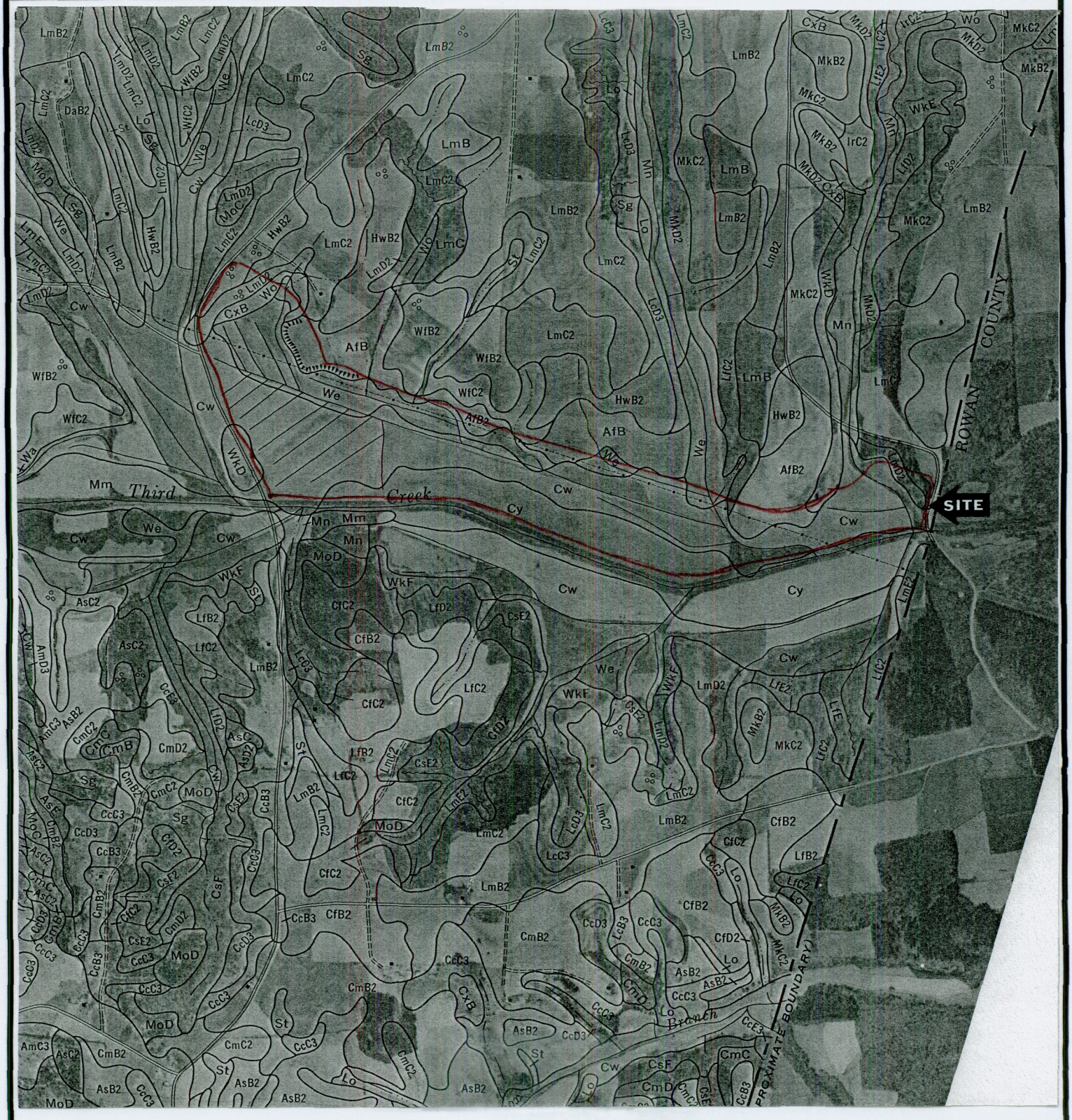
Well ID	Well Hydrology Threshold Met?		Vegetation Plot ID	Vegetation Survival Threshold Met?
G1	Y		Plot 1	Y
G2	N		Plot 2	Y
G3	N		Plot 3	Y
G4	Y		Plot 4	Y
G5	N		Plot 5	Y
G6	N		Plot 6	Y
G7	N		Plot 7	Y
G8	Y		Plot 8	Y
G9	Y		Plot 9	Y
G10	Y		Plot 10	Y
G11	Y			
G12	Y			
G13	N			
G14	Y			
G15	N			
G16	N			

IV. Methodology Section

No unavoidable deviations from initially prescribed methodologies were implemented as a part of monitoring Year 1 (2005) activities.



Project No. 9440.D1	Figure 1 - Vicinity Map Shepherd's Tree Mitigation Site NCEEP Year 1 of 5 Iredell County, NC	S&EC Soil & Environmental Consultants, PA 11010 Raven Ridge Rd. • Raleigh, NC 27614 (919) 846-5900 • (919) 846-3467 Web Page: www.SandEC.com
Project Mgr.: JR		
Scale: 1" = 2,000'		
12/08/05	Shepherd/Cleveland Quadrangle	Ecosystem Enhancement Program



Project No. 9440.D1	Figure 2 - Soils Map	S&EC Soil & Environmental Consultants, PA 11010 Raven Ridge Rd.• Raleigh, NC 27614 (919) 846-5900 • (919) 846-9467 Web Page: www.SandEC.com
Project Mgr.: JR	Shepherd's Tree NCEEP Year 1 of 5 Iredell County, NC	Ecosystem Enhancement Program
Scale: 1" = 1,320'		
12/08/05	Iredell County Soil Survey	

Shepherds Tree Stream and Wetland Restoration
Monitoring Year 1 of 5

NORTH

SCALE 1" = 500'

250 0 500

CONTOUR INTERVAL = 5'

KNOX FARM RD. (SR 2363)

THIRD CREEK

G1 G2 G3 G4 G5 G6 G7 G8 G9 G10 G11 G12 G13 G14 G15 G16

SG1 SG2 SG3

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10

EXISTING GROUNDWATER GAUGE

SURFACE GAUGE

RAIN GAUGE

VEGETATION PLOT

Notes:

1.) Streams, roads, and contours from NCDOT GIS layers. Original restoration design prepared by KCI Technologies, Inc. Restoration as-built has not been prepared.

2.) All locations are approximate.

MONITORING PLAN VIEW

NOVEMBER 2005

File: Sec\Jobs7-9\9440.01\PAP\PAP1.dwg

Project No.: 9440.01
Proj. Mgr.: PKS
Drawn: JER
Scale: 1" = 500'
Sheet No.: 1 OF 2

Project: SHEPHERDS TREE STREAM & WETLAND RESTORATION
Location: IREDELL CO., NC
Client: NCEEP
Sheet Title: MONITORING PLAN VIEW

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Ecosystem Enhancement Program

NORTH

SCALE 1" = 500'

250 0 500

CONTOUR INTERVAL = 5'

EXISTING GROUNDWATER GAUGE - MET HYDROLOGY

EXISTING GROUNDWATER GAUGE - DID NOT MEET HYDROLOGY

SURFACE GAUGE

RAIN GAUGE

PAPV LEGEND

VEGETATION PROBLEM AREAS-MODERATE

VEGETATION PROBLEM AREAS-SEVERE

KNOX FARM RD. (SR 2363)

THIRD CREEK

KUDZU EXTENTS

G1 G2 G3 G4 G5 G6 G7 G8 G9 G10 G11 G12 G13 G14 G15 G16

SG1 SG2 SG3

Notes:

1.) Streams, roads, and contours from NCDOT GIS layers. Original restoration design prepared by KCI Technologies, Inc. Restoration as-built has not been prepared.

2.) Groundwater data collected monthly by Soil and Environmental Consultants, PA.

3.) All locations are approximate.

4.) Success criteria for wetland hydrology require that the area be inundated or saturated within 12" of the ground surface for a period of 8% of the growing season. The growing season in Iredell County begins April 14 and ends October 24. In order to attain hydrologic success, saturation within 12" of the ground surface is required for 12 consecutive days.

PROBLEM AREA PLAN VIEW

NOVEMBER 2005

File: SecUobs7-9\9440.D1\PAPV\PAPV.dwg

Project: SHEPHERDS TREE STREAM & WETLAND RESTORATION

Location: IREDELL CO., NC

Client: NCEEP

Sheet Title: PROBLEM AREA PLAN VIEW

Project No.: 9440.D1

Proj. Mgr.: PKS

Drawn: JER

Scale: 1" = 500'

Sheet No.: 2 OF 2

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APPENDIX A

APPENDIX A –

Vegetation Survey Data Tables

Table VIII: Stem Counts for Each Species Arranged by Plot
Shepherds Tree Stream and Wetland Mitigation Site (EEP Project #00078)

	Plots										Year 1
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Totals**
Salix nigra (Black Willow)							10	1			11
Fraxinus pennsylvanica (Green Ash)	2		4	15	3	3	4		10	10	51
Liriodendron tulipifera (Tulip poplar)	1		1	12							14
Platanus occidentalis (American sycamore)			9			2	1	10	6		28
Quercus nigra (Water oak)	1			2		2					5
Acer negundo (Box elder)			1			4			2		7
Quercus michauxii (Swamp Chestnut oak)		2	4	1		2			4		13
Quercus pagoda (Cherrybark Oak)	12		3	2	4	8		3	4	2	38
Quercus phellos (Willow oak)	2	3				1		1			7
Cephalanthus occidentalis (Buttonbush)	4	2	1	1	3		1				12
TOTALS	**22**	**7**	**23**	**33**	**10**	**22**	**16**	**15**	**26**	**12**	**186**
Live Stem Density	383	122	401	575	174	383	279	261	453	209	
Average Live Stem Density											**324**

EEP Stem Count Data Sheet

EEP Project #:	**00078**	**Date:** 6/14/2005
Project Name:	**Shepherd's Tree**	**Staff Name:** David Gainey
Monitoring Contractor:	**S&EC**	**Staff Name:** Jessica Regan
County:	**Iredell**	
8 Digit Catalog Unit	**03040102**	Sunny, 96 degrees
Stream/Wetland Name:		

Plot Location

Plot ID	Species	2004	Stem #
1	Green Ash		2
1	Tulip Poplar		1
1	Water Oak		1
1	Cherrybark Oak		12
1	Willow Oak		2
1	Buttonbush		4

Plot Location

Plot ID	Species	2004	Stem #
2	Swamp Oak		2
2	Willow Oak		3
2	Buttonbush		2
2			
2			
2			

Plot Location

Plot ID	Species	2004	Stem #
3	Swamp Oak		4
3	Sycamore		9
3	Buttonbush		1
3	Green Ash		4
3	Cherrybark Oak		3
3	Box elder		1
3	Tulip Poplar		1

Plot Location

Plot ID	Species	2004	Stem #
4	Tulip Poplar		12
4	Green Ash		15
4	Cherrybark Oak		2
4	Swamp Oak		1
4	Water Oak		2
4	Buttonbush		1

Plot Location

Plot ID	Species	2004	Stem #
5	Cherrybark Oak		4
5	Buttonbush		3
5	Green Ash		3
5			
5			
5			

Plot Location

Plot ID	Species	2004	Stem #
6	Cherrybark Oak		8
6	Green Ash		3
6	Sycamore		2
6	Box elder		4
6	Willow Oak		1
6	Water Oak		2
6	Swamp Oak		2

Plot Location

Plot ID	Species	2004	Stem #
7	Green Ash		4
7	Sycamore		1
7	Black Willow		10
7	Buttonbush		1
7			
7			

Plot Location

Plot ID	Species	2004	Stem #
8	Sycamore		10
8	Willow Oak		1
8	Cherrybark Oak		3
8	Black Willow		1
8			
8			

Plot Location

Plot ID	Species	2004	Stem #
9	Swamp Oak		4
9	Cherrybark Oak		4
9	Green Ash		10
9	Sycamore		6
9	Box Elder		2
9			

Plot Location

Plot ID	Species	2004	Stem #
10	Green Ash		10
10	Cherrybark Oak		2
10			
10			
10			
10			

APPENDIX A –

Vegetation Problem Area Photos

Photo 1—*Kudzu* population

Photo 2—*Kudzu* population

APPENDIX A –

Vegetation Monitoring Plot Photos

Vegetation Plot #1—Year 1 (2005)

Vegetation Plot #2—Year 1 (2005)

Vegetation Plot #3—Year 1 (2005)

Vegetation Plot #4—Year 1 (2005)

Vegetation Plot #5—Year 1 (2005)

Vegetation Plot #6—Year 1 (2005)

Vegetation Plot #7—Year 1 (2005)

Vegetation Plot #8—Year 1 (2005)

Vegetation Plot #9—Year 1 (2005)

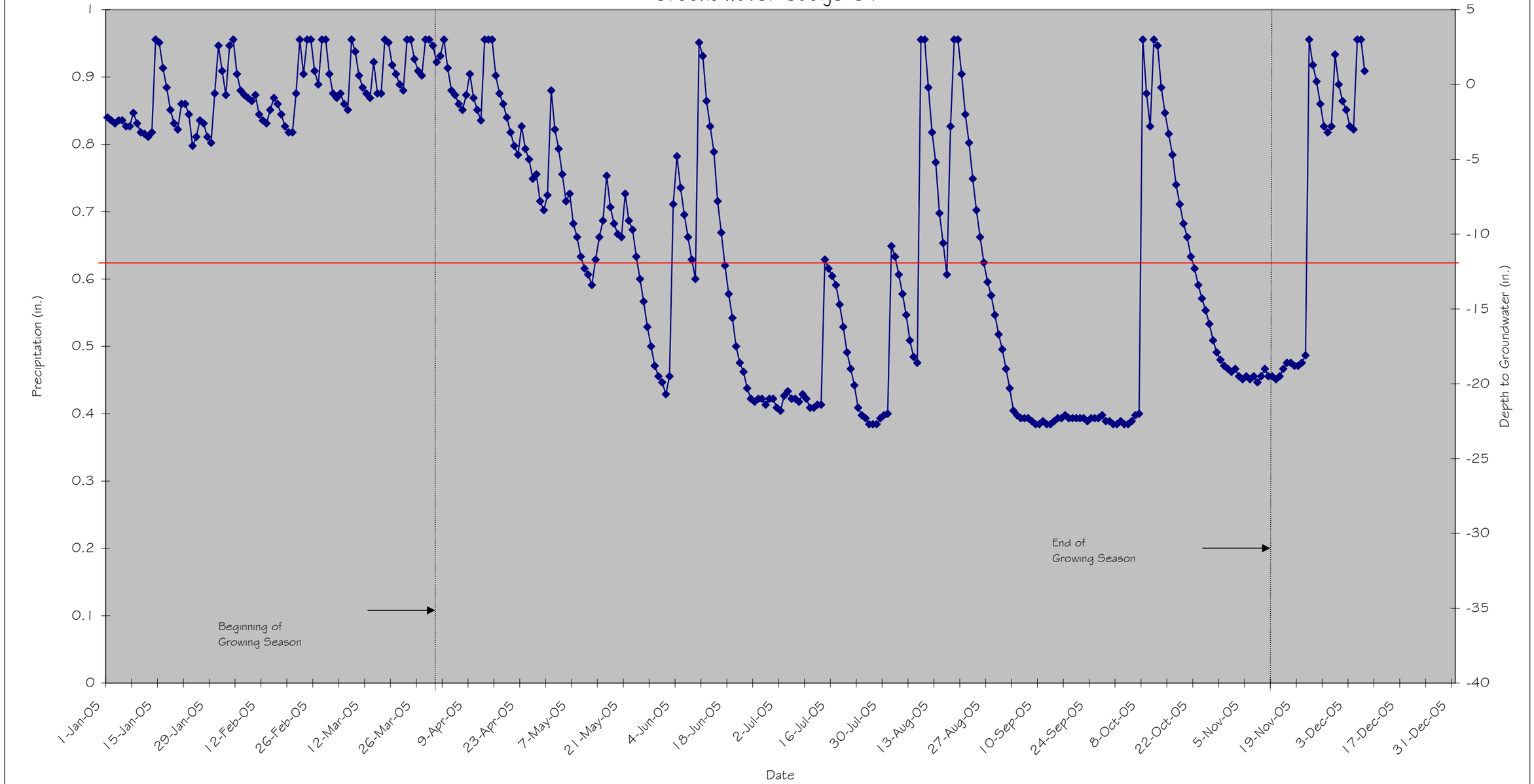
Vegetation Plot #10—Year 1 (2005)

APPENDIX B

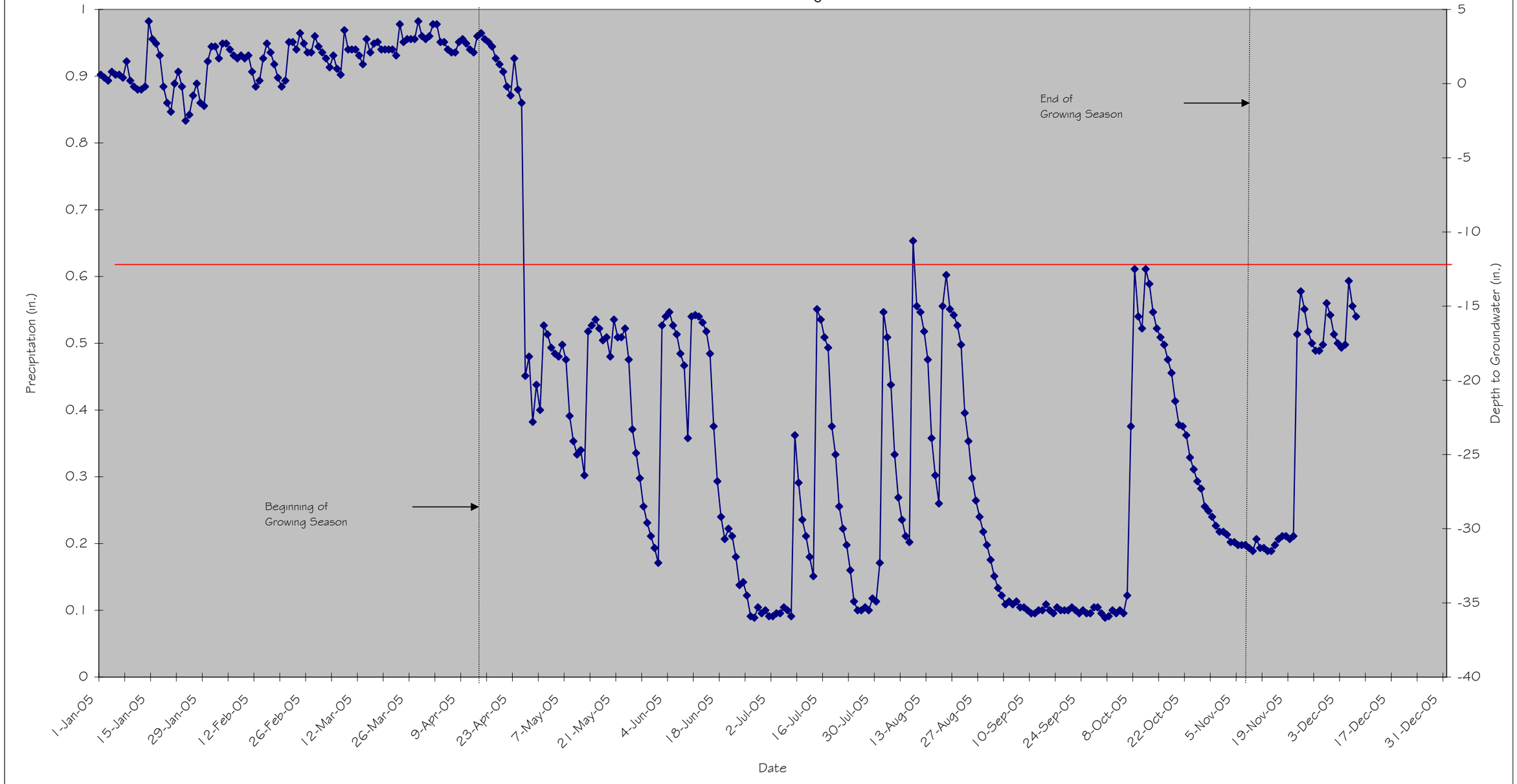
APPENDIX B –

Groundwater Gauge Summary Information

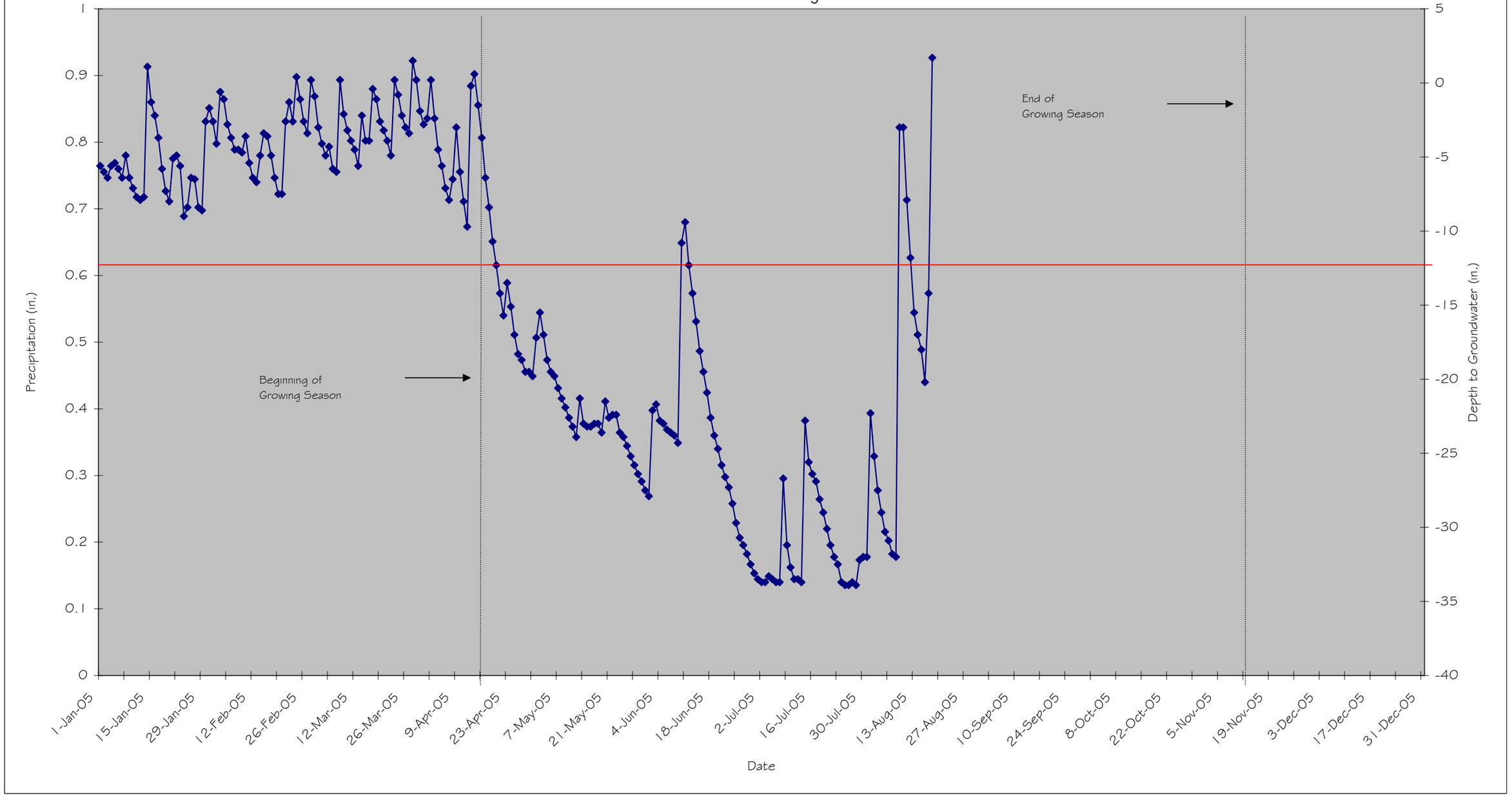
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G1



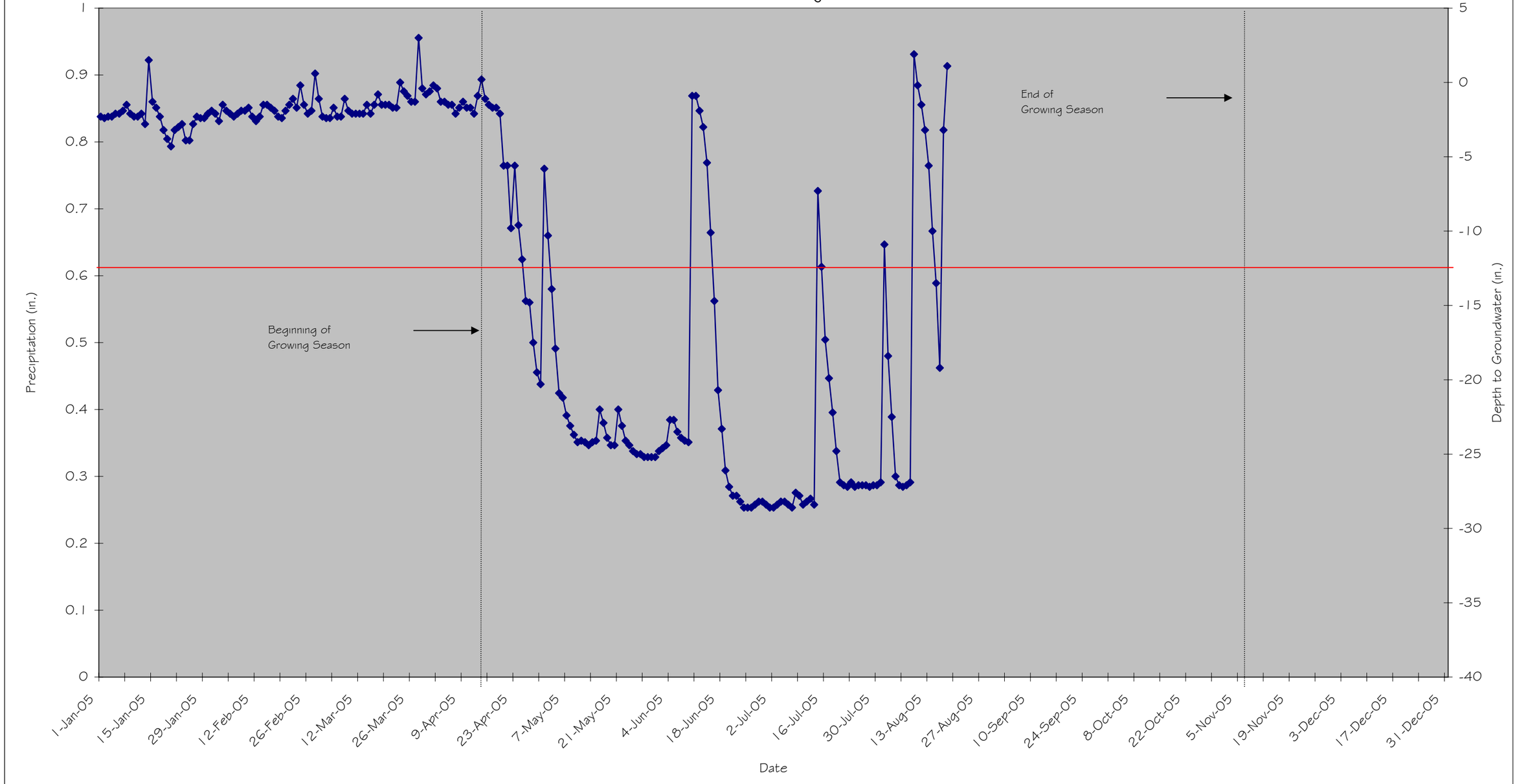
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G2



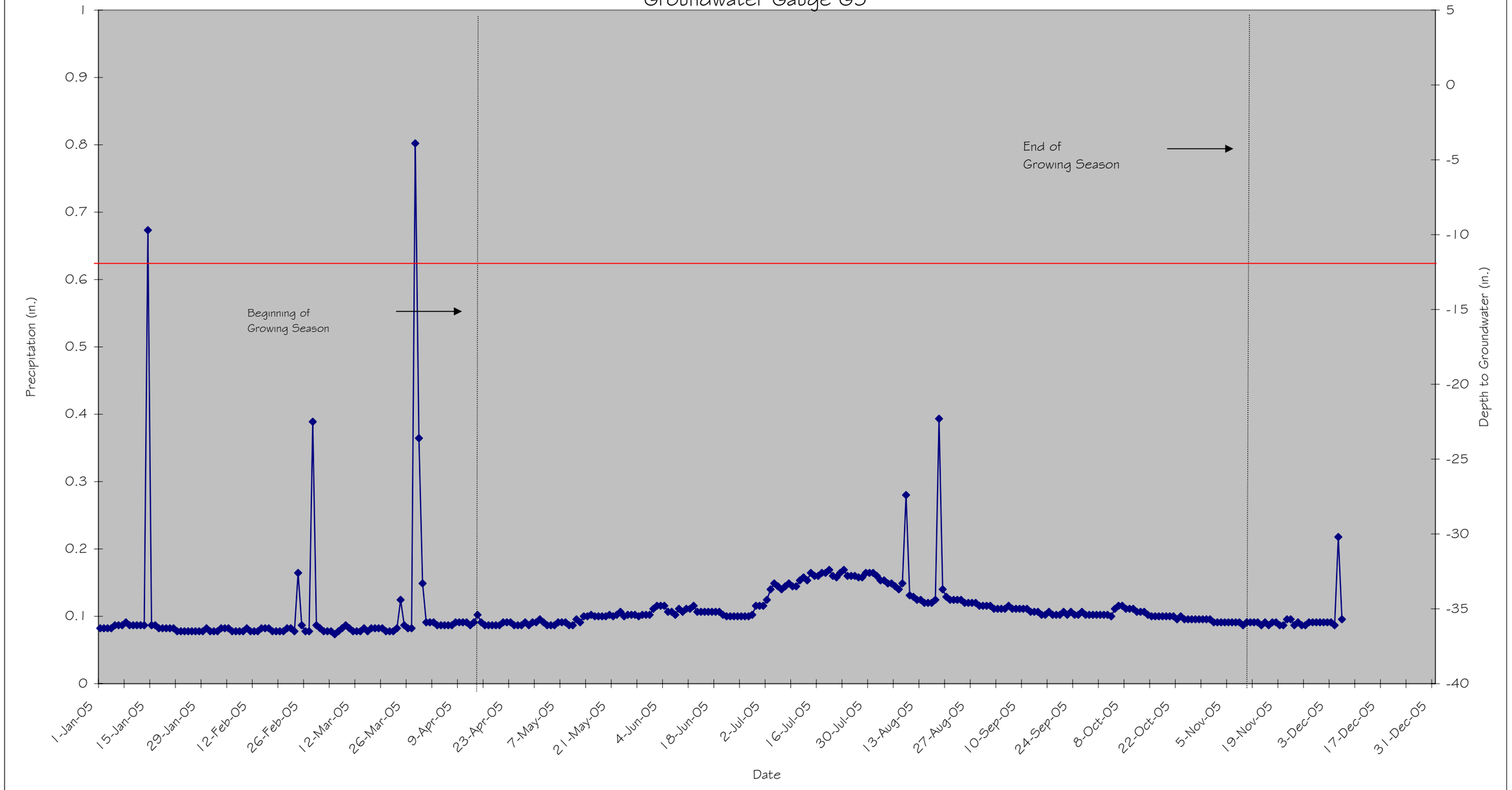
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G3



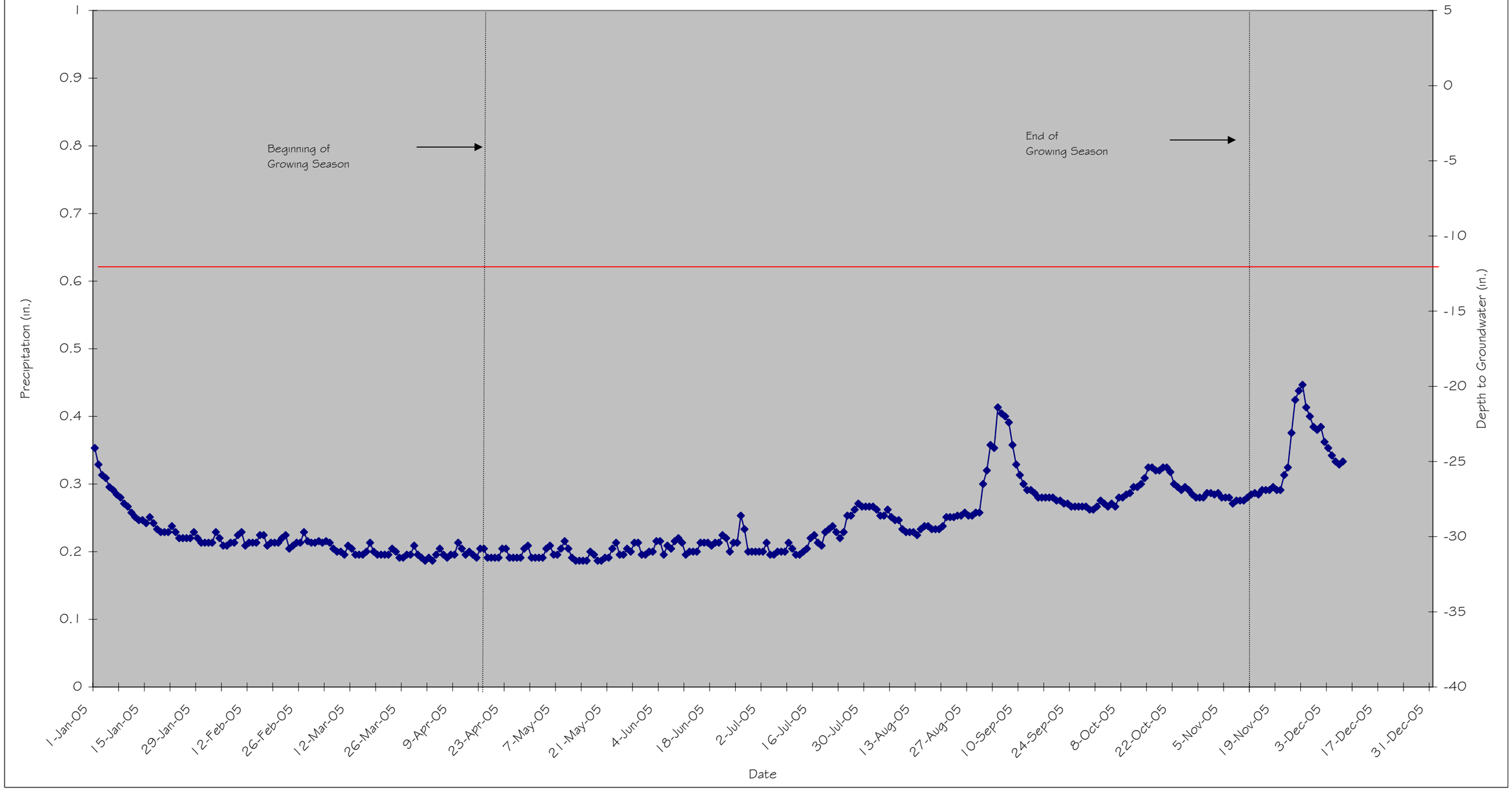
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G4



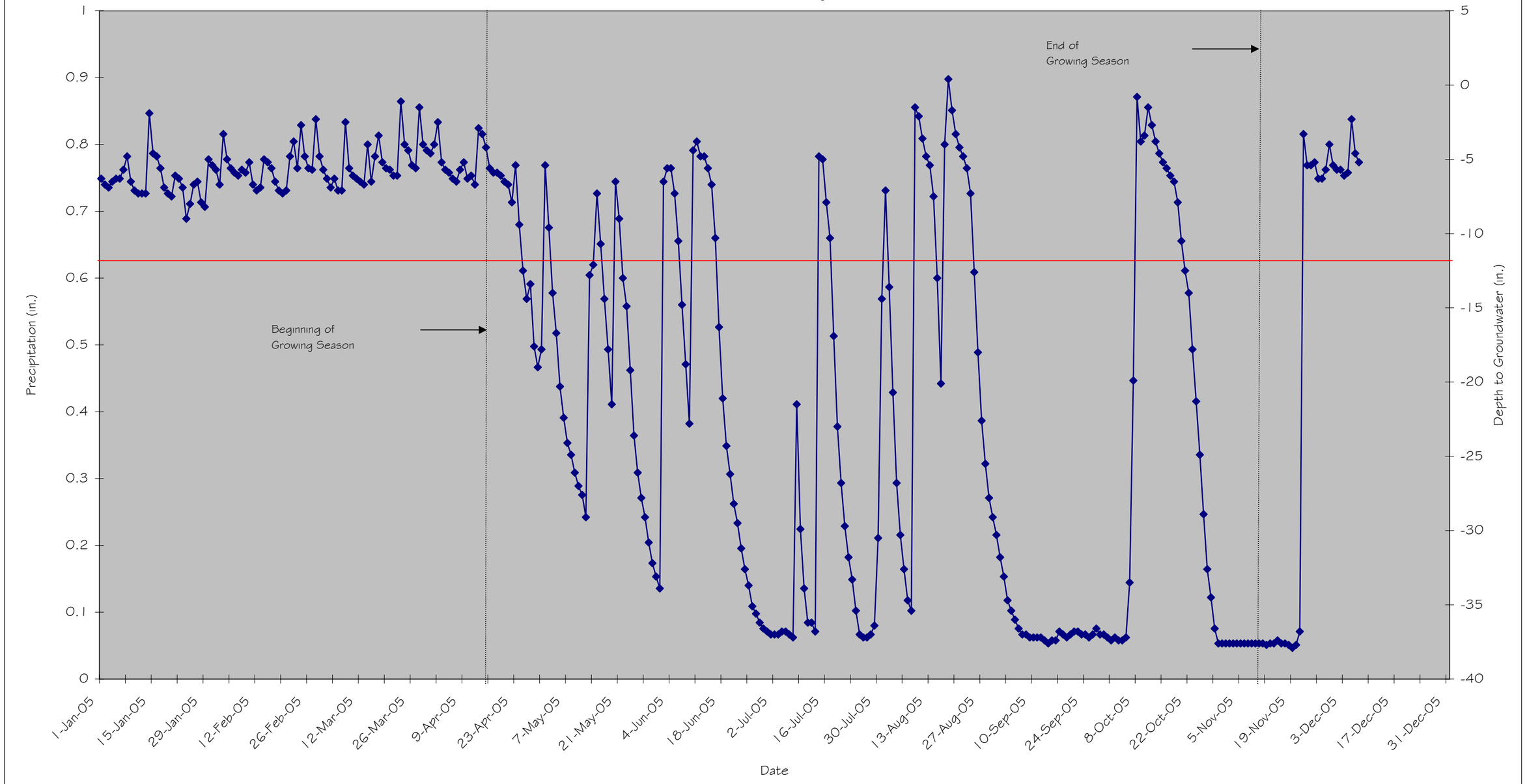
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G5



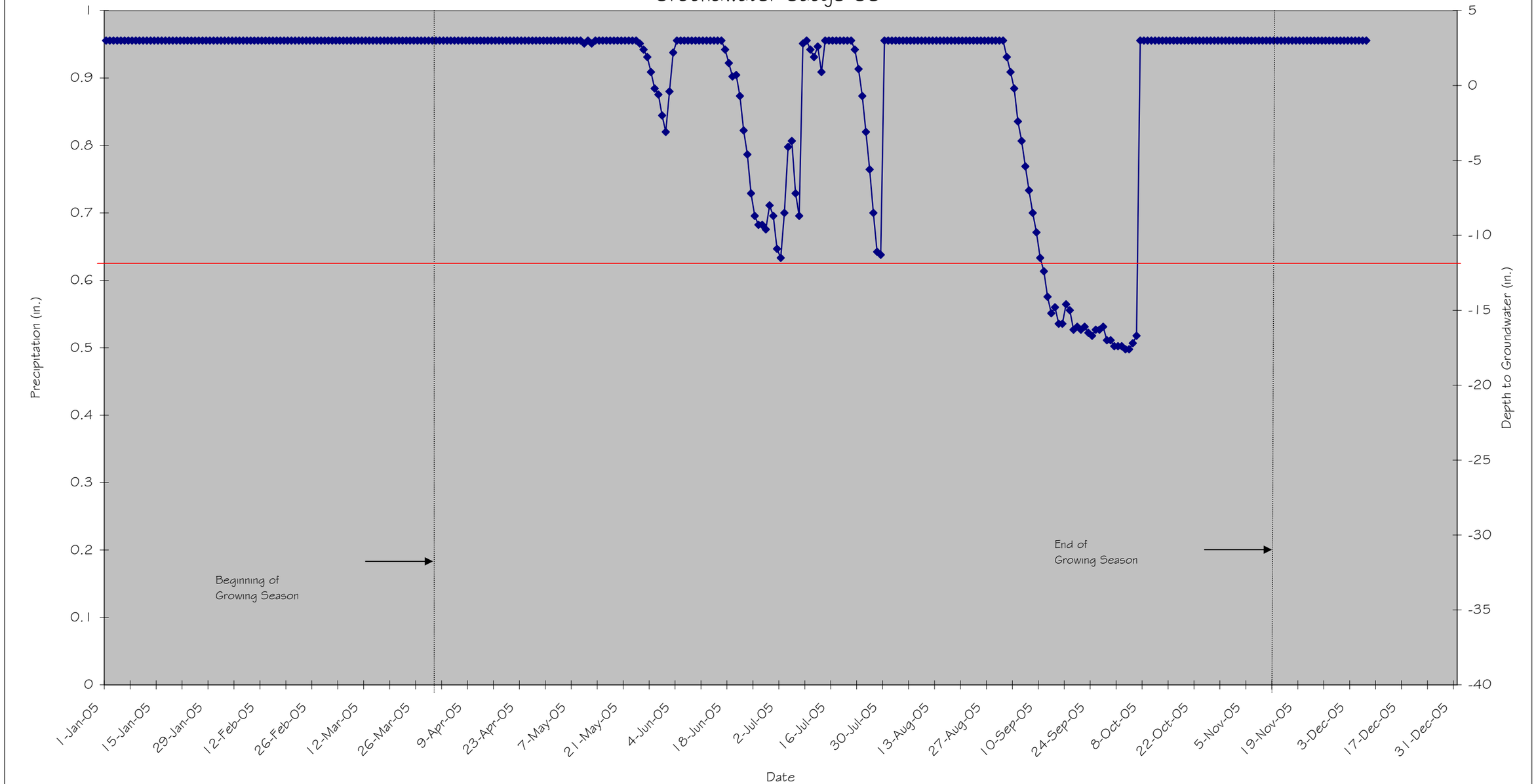
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G6



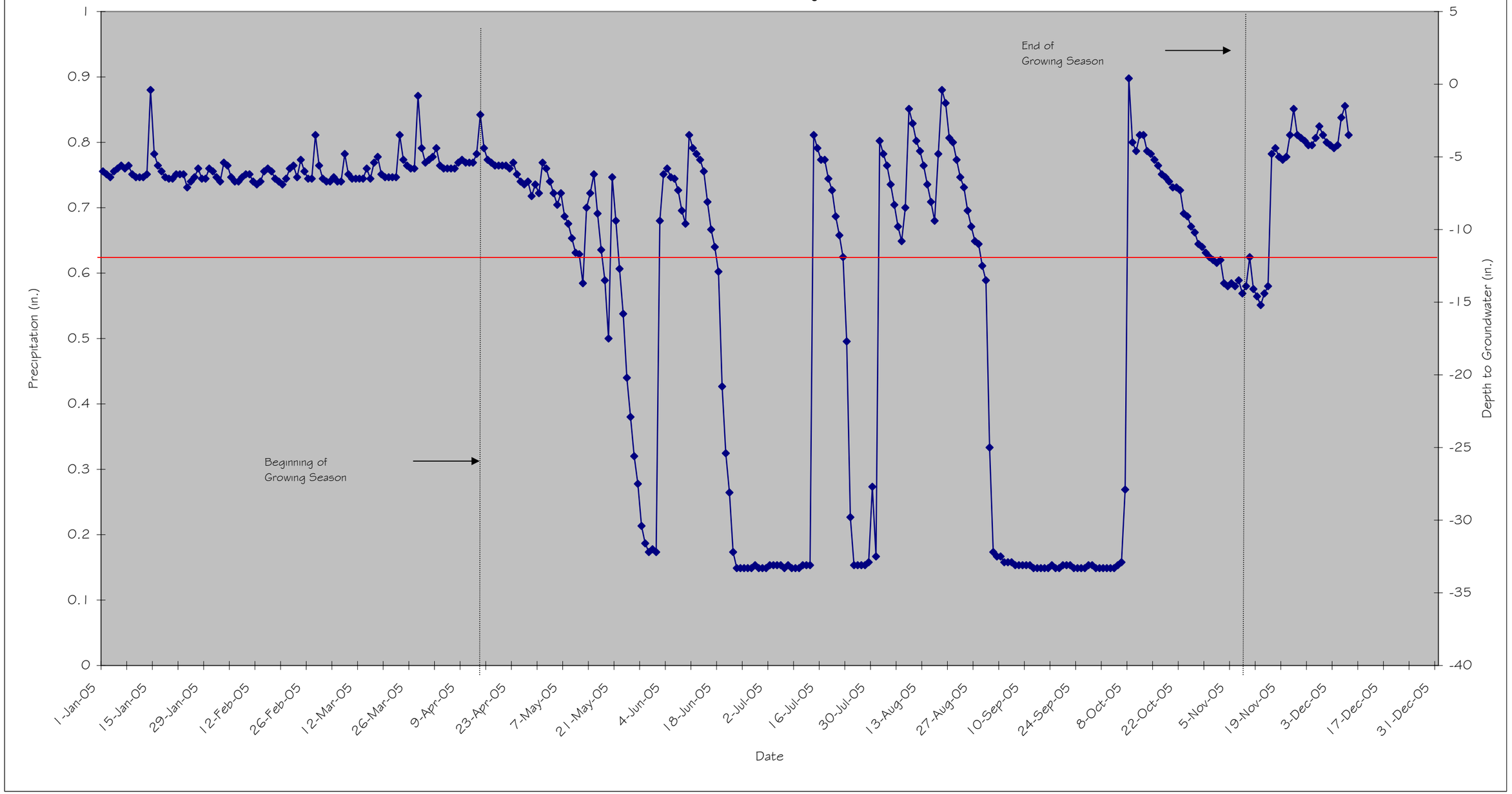
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G7



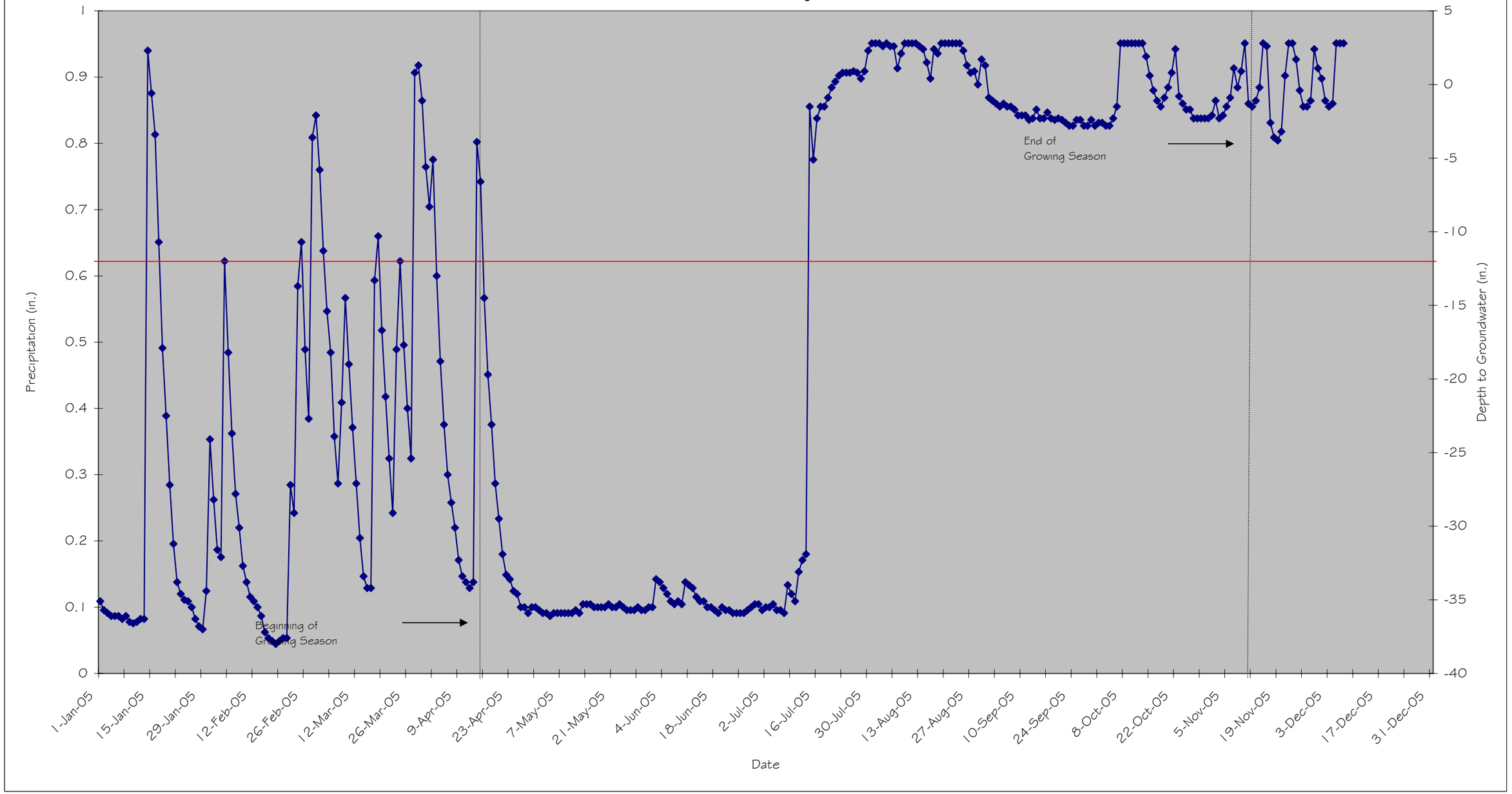
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G8



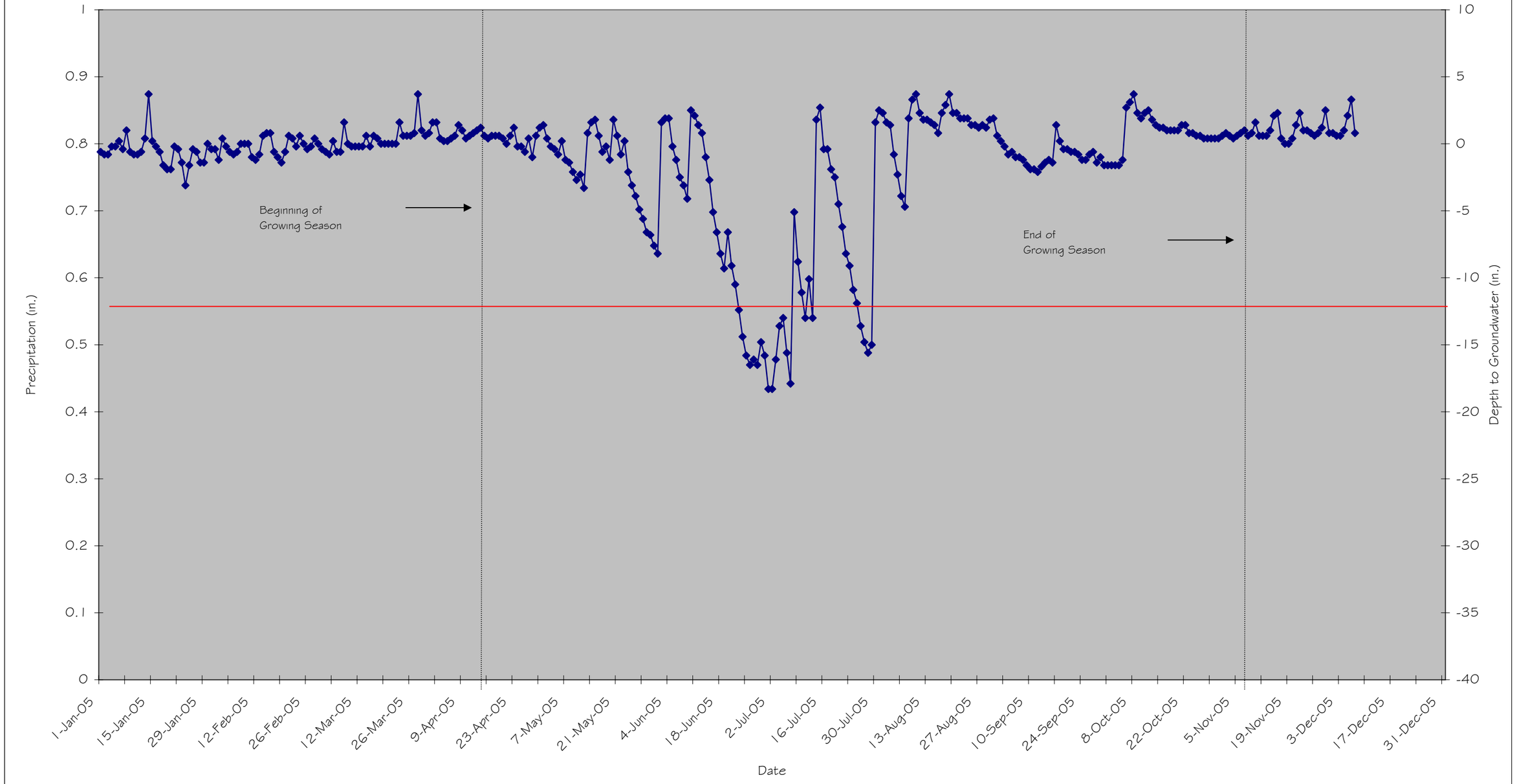
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G9



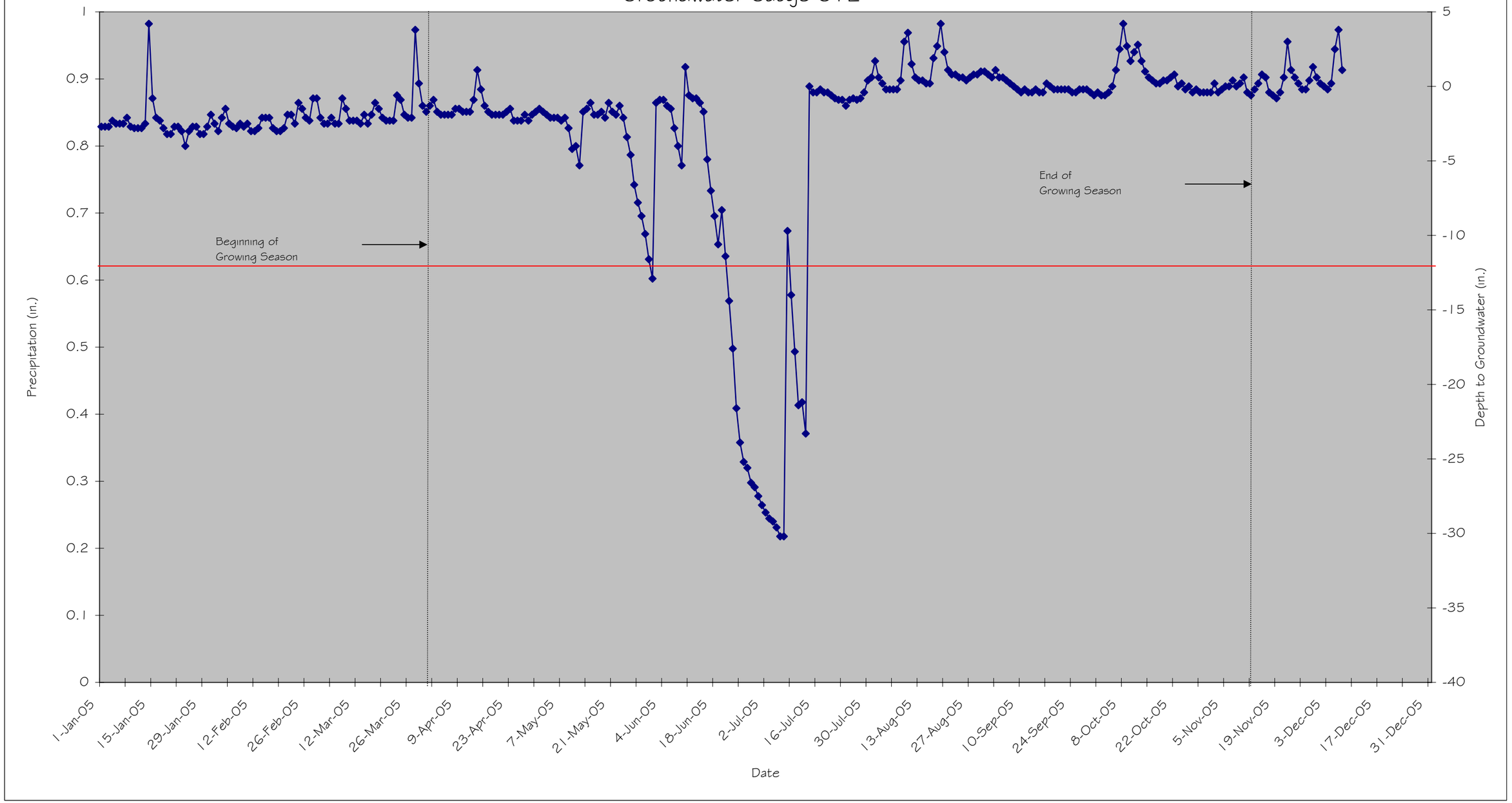
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G10



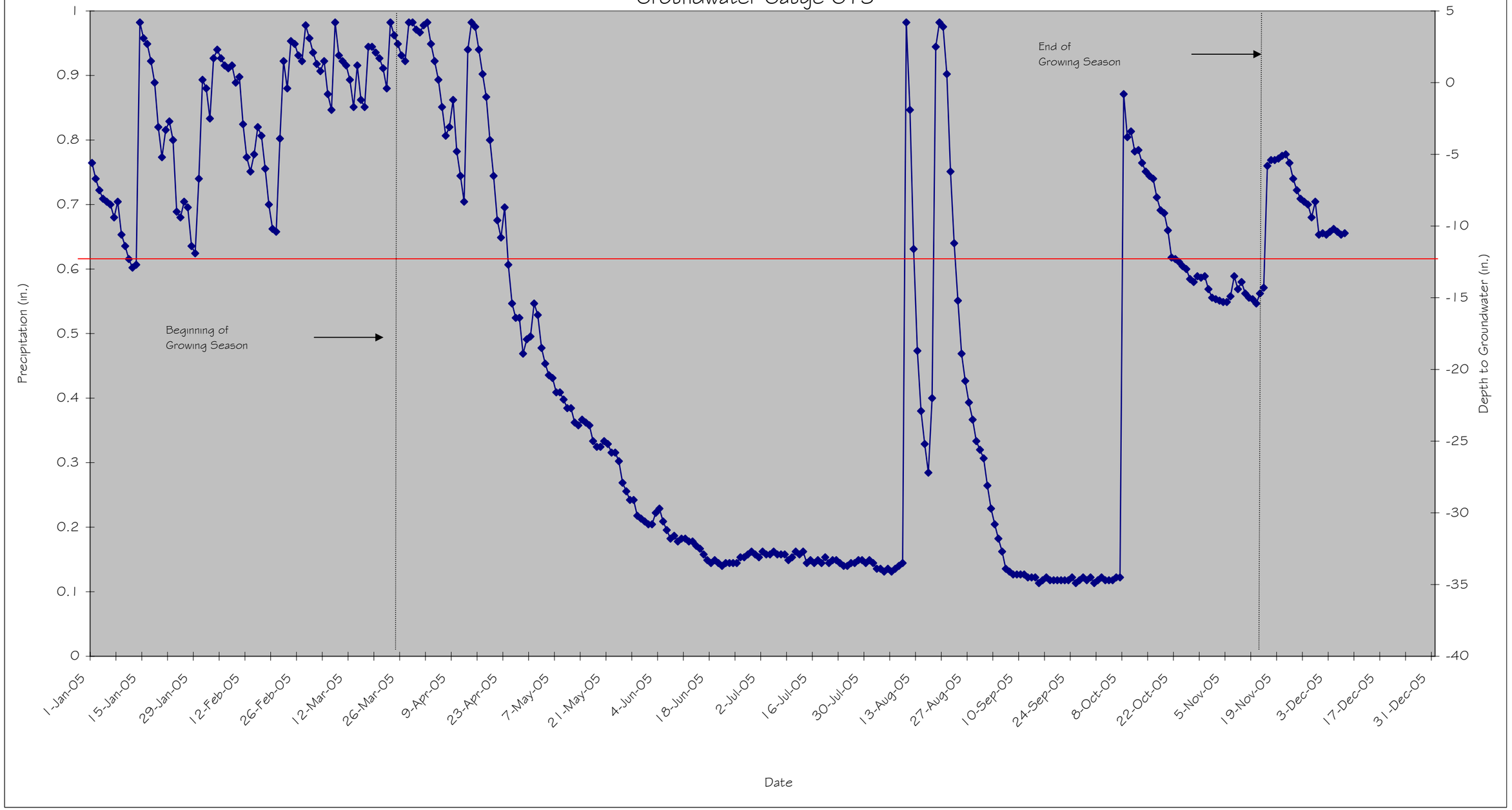
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G11



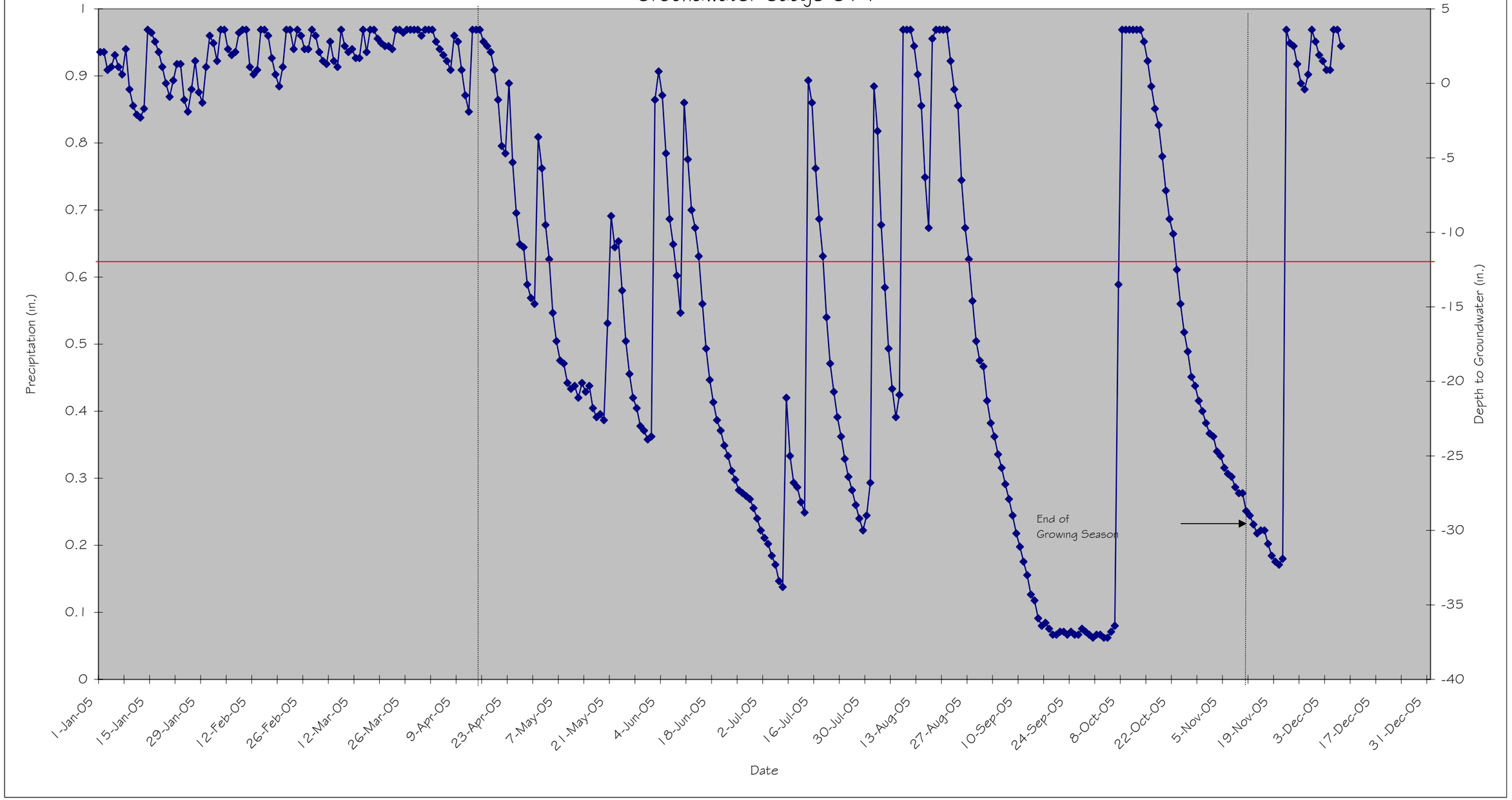
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G12



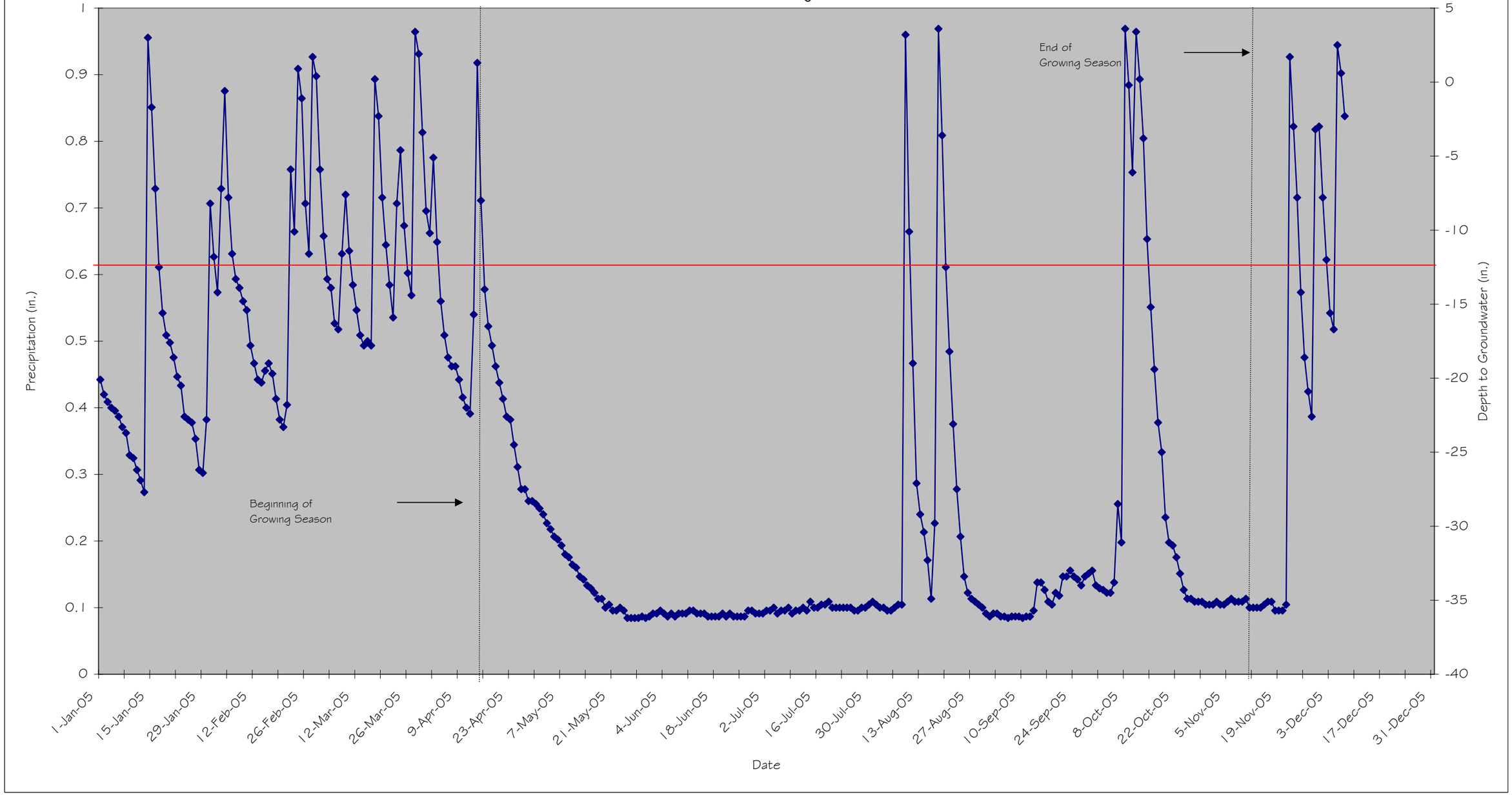
Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G13



Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G14



Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G15



Shepherds Tree Stream and Wetland Restoration Site
Groundwater Gauge G16