PLUM CREEK WETLAND RESTORATION
2009 MONITORING REPORT
MONITORING YEAR ONE

Brunswick County, NC
Lumber River Basin
Cataloging Unit: 03040207
EEP Project Number D06040-A

Prepared for:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

2009 Monitoring Report – Year 1
Final

Submitted
June 2010

Prepared for:

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FIGURES

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APPENDICES

1. Executive Summary/Project Abstract

The Louis Berger Group, Inc. (Berger) is restoring (1:1 restoration ratio) approximately 77 acres of non-riverine wetland and enhancing (2:1 enhancement ratio) approximately six acres of wetland in order to provide 80 non-riverine wetland mitigation units within the 89 acre Plum Creek Wetland Mitigation Site (Site). The Site is located in Brunswick County in the Lumber River Basin, USGS Hydrologic Unit 03040207. The project is being implemented through the North Carolina Ecosystem Enhancement Program's (NCEEP) Full Delivery Process. The results provided in this document reflect the monitoring completed for the first year following the completion of construction of the project.

The Site had 6 of the 9 plots meet the survival rate success criteria required for vegetation. Vegetation plots 4, 6, and 7 did not meet the 320 stems per acre criteria. However, all three plots were short only one stem from meeting the criteria. In addition, many volunteer species were well established on the Site. Overall, the Site met the criteria of 320 stems per acre. The overall planted stem density was 324 per acre and the total stem per acre, planted and natural, volunteer stems was 1929.

For site hydrology, approximately 10 percent of the Site recorded soil saturation within the upper 12-inches for greater than 12.5 percent of the growing season, and 55 percent of the Site was between 5 percent and 12.5 percent of the growing season. However, much of the state is recovering from a 3 year drought. The gauge graphs in Appendix B show signs that the Site may have begun to recover from the drought conditions just after the growing season ended. If this trend continues, it is likely the Site will meet the hydrology criteria in Year 2. Precipitation data can also be found in Appendix B.

2. Project Background

2.1. Project Objectives

The Louis Berger Group, Inc. (Berger) has restored the Plum Creek Wetland Mitigation Site (Site) in Brunswick County, North Carolina to provide the North Carolina Ecosystem Enhancement Program (NCEEP) with approximately 80 non-riverine wetland mitigation units needed to compensate for projects occurring within the Lumber River Basin. Approximately 77 acres of drained wetlands on Site were restored and six acres of existing, modified wetlands were enhanced.

In order to achieve project goals, the following objectives were implemented:

- The lateral ditches and southern ditch on Site were plugged. The west ditch and Boggy Branch were left intact to prevent hydrologic trespass on adjoining properties. Soil to construct ditch plugs was excavated from the Site and the borrow pits were graded to form small, shallow vernal pools.
- Existing vegetation (loblolly pine) was sheared, drum chopped, and left on Site to promote organic matter decomposition. There was no re-grading of the contours of the Site.
- Habitat benefits on Site will be achieved for both terrestrial and aquatic species by increasing micro-habitat diversity and vegetation diversity.

Restoring this wetland will immediately benefit the wildlife of the region by expanding wetland habitats for a variety of species including larger keystone species that require large corridors such as black bear (*Ursus americanus*). Managed by The Nature Conservancy, the Green Swamp Nature Preserve is located 0.5 miles to the north of the Site. The Plum Creek Wetland Mitigation Site connects and expands preserved habitat within the area. Similarly, the restored wetland may provide habitat for some threatened and endangered species listed for Brunswick County such as the wood stork (*Mycteria Americana*), rough-leafed loosestrife (*Lysimachia asperulifolia*), and Cooley's meadowrue (*Thalictrum cooleyi*). Wildlife habitat will also be improved by the creation of small vernal pools within the wetland matrix. These features will provide fish free environments for amphibian reproduction, openings for wildlife foraging, and improve overall habitat diversity within the Site.

2.2. Project Structure, Restoration Type, and Approach

Prior to the restoration, the Plum Creek Wetland Mitigation Site was a loblolly pine plantation for several generations of timber. The land was last timbered and replanted between 2002 and 2003.The Site is situated in a drained coastal plain pocosin (Beaverdam Bay) in the headwater region of Boggy Branch, which drains to Lockwoods Folly River. The site was drained by four separate trapezoidal ditches approximately 6-8 feet wide and 4-6 feet deep.

Approximately 83 acres of pond pine woodland have been restored and enhanced on the Plum Creek Wetland Mitigation Site. The original wetland was ditched, drained, and bedded to support loblolly pine production. The Site is bounded by deep drainage ditches to the west and south, and two ditches cross the width of the tract. Boggy Branch flows along the east side of the Site and is a tributary to Lockwoods Folly River. The west ditch drains to Clark Branch, another tributary to Lockwoods Folly River. The southern ditch connects the west ditch with Boggy Branch.

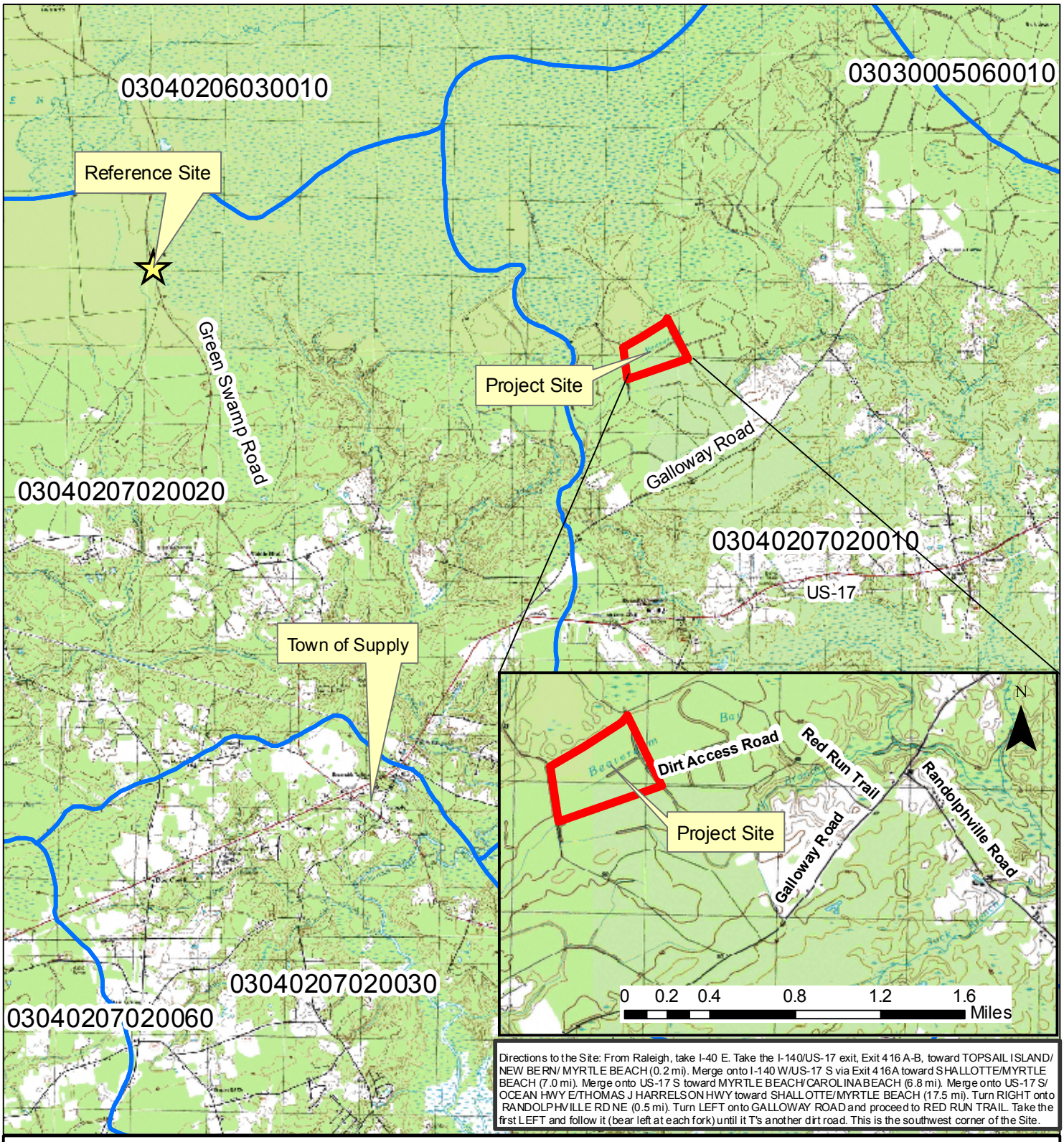
The existing three lateral ditches on Site were plugged at seven locations to restore hydrology to the site. The western ditch running parallel to the property boundary was left intact to prevent hydrologic trespass to the adjoining properties. On the east side of the Site, Boggy Branch was likewise left unaltered. The planting plan has incorporated the use of native species. Woody seedlings were planted in a naturalized pattern to avoid creating rows and monotypic stands.

The wetland restoration concept for Plum Creek is to restore the pre-existing hydrology to the drained hydric soils. Groundwater monitoring gauges were installed and will be monitoring monthly during the growing season. Restoring wetland hydrology will be accomplished through plugging the existing ditch network. Soil to construct ditch plugs was excavated from the Site and the borrow pits were graded to form small, shallow vernal pools. Existing vegetation was removed by shearing and drum chopping. In the process of drum chopping, the existing plantation beds were broken up to promote lateral surface water movement. Species were planted to target a pond pine woodland community.

2.3. Location and Setting

The Plum Creek Wetland Mitigation Site is an 89-acre site located in the Carolina Flatwoods ecoregion of the Middle Atlantic Coastal Plain (Griffith *et al*., 2002). The Site occurs in the headwaters of the Lumber River Basin: USGS Hydrologic Unit 03040207 and North Carolina Division of Water Quality (NCDWQ) subbasin 03-07-59 (Figure 1). Boggy Branch, which drains to the Lockwoods Folly River, flows along the eastern side of the Site. Land use immediately surrounding the Site is mostly silviculture with timber stands of varying ages in rotation. The Green Swamp Game Land is located to the northwest of the Site. A swine operation is located to the southeast of the Site.

Access to the site is obtained from a network of dirt roads located off of Galloway Road, as shown on Figure 1.



Directions to the Site: From Raleigh, take I-40 E. Take the I-140/US-17 exit, Exit 416 A-B, toward TOPSAIL ISLAND/ NEW BERN/ MYRTLE BEACH (0.2 mi). Merge onto I-140 W/US-17 S via Exit 416A toward SHALLOTTE/MYRTLE BEACH (7.0 mi). Merge onto US-17 S toward MYRTLE BEACH/CAROLINA BEACH (6.8 mi). Merge onto US-17 S/ OCEAN HWY E/THOMAS J HARRELSON HWY toward SHALLOTTE/MYRTLE BEACH (17.5 mi). Turn RIGHT onto RANDOLPHVILLE RD NE (0.5 mi). Turn LEFT onto GALLOWAY ROAD and proceed to RED RUN TRAIL. Take the first LEFT and follow it (bear left at each fork) until it T's another dirt road. This is the southwest corner of the Site.

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

Legend

- Project Easement Boundary
- Reference Site
- HUC 14 Boundary
- Roads

N

0 0.5 1 2 Miles

Source: USGS 7.5 Minute Topographic Map: Bolivia, NC

North Carolina
Ecosystem Enhancement Program

Plum Creek Wetland Mitigation Site
Brunswick County
EEP Project No. D06040-A

Project Vicinity Map

The Louis Berger Group, Inc.
1001 Wade Avenue, Suite 400
Raleigh, NC 27605

FIGURE 1

February 2010

2.4. Project History and Background

The Plum Creek Site was identified by Berger biologists as a potential restoration site. A Technical Proposal was submitted to NCEEP in March 2006. The existing conditions survey was performed and a Categorical Exclusion (CE) was submitted in February 2007. The CE was approved by the NCEEP in March 2007. The land was purchased from Plum Creek Timberlands in October 2007. In February 2007, nine groundwater monitoring gauges were installed at the site to monitor pre-construction groundwater levels. Also during this time, existing conditions were noted such as existing wetlands, plant communities, and soil characterizations. In July 2008, the Restoration Plan was submitted to NCEEP and approved in July 2008. Vegetation was also cleared in July 2008. Construction occurred in October 2008 and the Site was planted in December 2008. Data collected for Year 1 monitoring was collected in October and November 2009.

Exhibit Table 1: Project Restoration Components
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

Project Component or Reach ID	Total Acres[1]	Type	Restoration Level and Ratio	Comment
Planting Zone 1	77	Non-riverine/ Non-riparian	Restoration 1:1	Pond Pine Woodland Community
Existing Wetland WA	6	Non-riverine/ Non-riparian	Enhancement 2:1	Pond Pine Woodland Community
Mitigation Unit Summations				
Non-Riparian Wetland – 80 acres				

1 - The remaining acreage is either unsuitable for mitigation or will remain as upland.

Exhibit Table 2: Project Activity and Reporting History
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

Activity or Report	Data Collection Complete	Completion or Delivery
Technical Proposal	January 2006	March 2006
Categorical Exclusion	January 2007	February 2007
Restoration Plan	April 2008	July 2008
Existing Vegetation Removal	N/A	July 2008
Construction	N/A	October 2008
Planting	N/A	December 2008
Mitigation Plan / As-built (Year 0 Monitoring – baseline)	January 2009	April 2009
Year 1 Monitoring	November 2009	December 2009
Year 2 Monitoring	--	Fall 2010
Year 3 Monitoring	--	Fall 2011
Year 4 Monitoring	--	Fall 2012
Year 5 Monitoring	--	Fall 2013

Exhibit Table 3: Project Contacts Table Plum Creek Wetland Restoration EEP Project Number: D06040-A	
Designer Primary project design POC	The Louis Berger Group, Inc. 1001 Wade Avenue, Suite 400 Raleigh, North Carolina 27605 Michael O'Rourke (919-866-4421)
Construction Contractor Construction contractor POC	River Works, Inc 4117 Pleasant Garden Road Greensboro, NC 27406 Bill Wright (336-279-1002)
Planting Contractor Planting contractor POC	Superior Forestry Services, Inc. 36462 Highway 27 Tilley, AR 72679 John Foley (870-496-2442)
Nursery Stock Suppliers	Division of Forest Resources – Claridge Nursery (919-731-7988) Coastal Plain Nursery (252-482-5707)
Monitoring Performers	The Louis Berger Group, Inc. 1001 Wade Avenue, Suite 400 Raleigh, North Carolina 27605
Stream Monitoring POC	N/A
Vegetation Monitoring POC	Ray Bode, PWS (919-866-4420) Tina Sekula, PWS (919-866-4439)
Wetland Monitoring POC	Ray Bode, PWS (919-866-4420) Tina Sekula, PWS (919-866-4439)

Exhibit Table 4: Project Background Table Plum Creek Wetland Restoration EEP Project Number: D06040-A	
Project County	Brunswick County
Drainage area	110 acres
Drainage impervious cover estimate	0%
Stream Order	Boggy Branch – 1st order
Physiographic Region	Coastal Plain
Ecoregion	Carolina Flatwoods
Rosgen Classification of As-built	N/A
Cowardin Classification	PFO1
Dominant soil type	Torhunta Mucky Fine Sandy Loam
Reference site ID	"Road Gauge" Green Swamp Preserve
USGS HUC for Project and Reference	Project: 03040207020010
	Reference: 03040207020020
NCDWQ Sub-basin for Project and Reference	Project: 03-07-59
	Reference: 03-07-59
NCDWQ classification for Project and Reference	Project: (Boggy Branch) C; Sw
	Reference: (Middle River) C; Sw
Any portion of any project segment 303d	No

Exhibit Table 4: Project Background Table Plum Creek Wetland Restoration EEP Project Number: D06040-A	
listed?	
Any portion of any project segment upstream of a 303d listed segment	Yes (Lockwoods Folly River)
Reasons for 303d listing or stressor	Lockwoods Folly River – Shellfish harvesting closure; fecal coliform
% of project easement fenced	0%, East, west, and south boundaries are bordered by ditches. Access roads north and south of the site are all privately owned.

3. Project Condition and Monitoring Results

3.1. Vegetative Assessment

Vegetation monitoring was performed by Berger biologists October 28-30, 2009. Locations of vegetation plots are shown on Figure 2. Vegetation plot photos were taken standing at the southwest corner looking diagonally to the northeast corner. In addition to the planted woody species, several volunteer species are established such as: swamp bay (*Persea palustris*), titi (*Cyrilla racemiflora*), winged sumac (*Rhus copallinum*), red maple (*Acer rubrum*), fetterbush (*Leucothoe racemosa*), inkberry (*Ilex glabra*), and sweet bay (*Magnolia virginiana*). Dominant herbaceous species include: blackberry (*Rubus* sp.), rice cut grass (*Leersia oryzoides*), broomsedge bluestem (*Andropogon virginicus*), goldenrod (*Solidago* sp.), and evening trumpetflower (*Gelsemium sempervirens*).

Table 5b below in Section 3.3.2 show the Site had 6 of the 9 plots meet the survival rate success criteria required for vegetation. Vegetation plots 4, 6, and 7 did not meet the 320 stems per acre criteria. However, all three plots were short only one stem from meeting the criteria. In addition, many volunteer species were well established on the Site. Overall, the Site met the criteria of 320 stems per acre. The overall planted stem density was 324 per acre and the total stem per acre, planted and natural, volunteer stems was 1929.

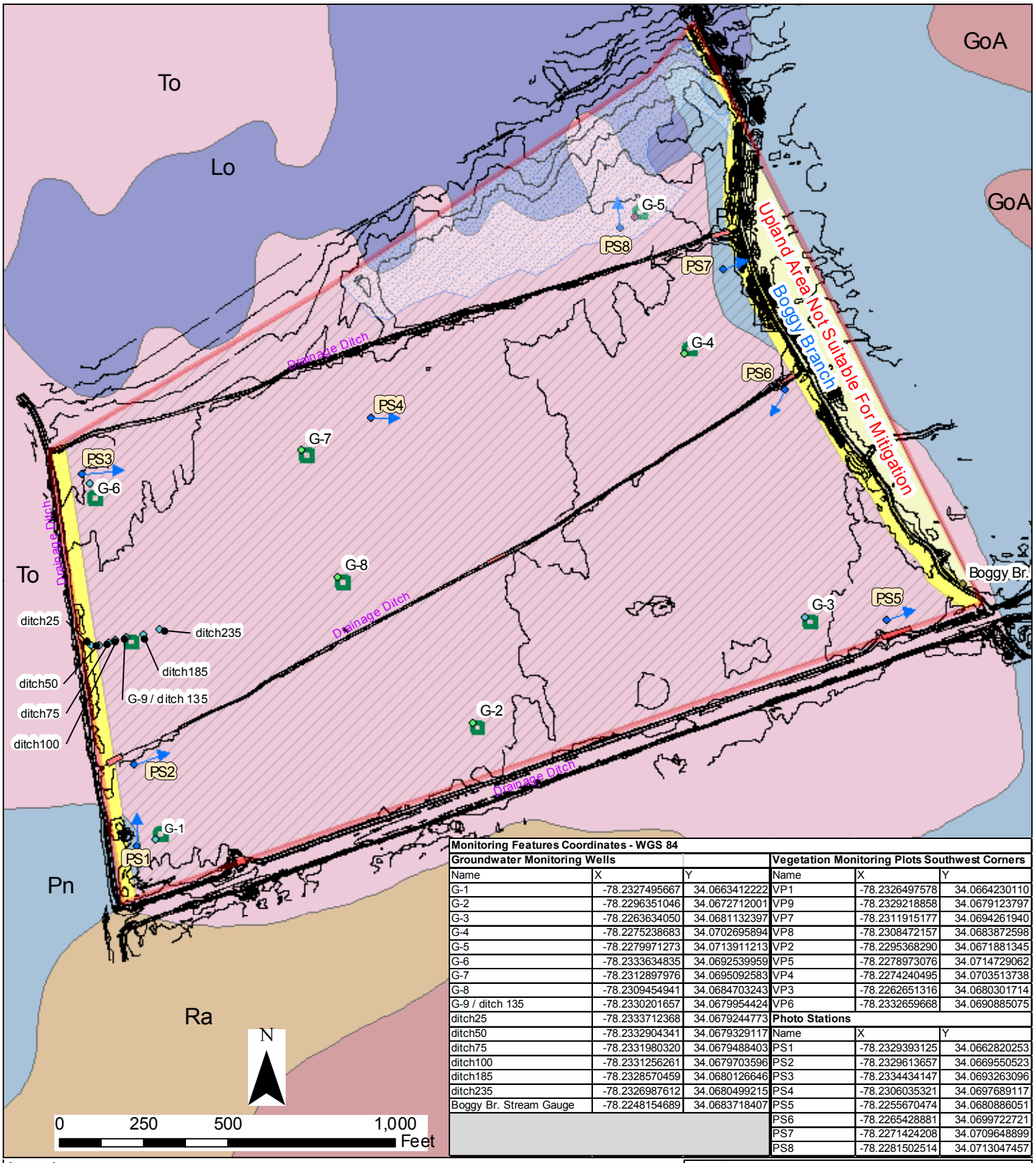
Monitoring data and photographs from the vegetation plots can be found in Appendix A.

3.1.1. Vegetative Problem Areas

No problem areas were identified on Site.

3.2. Stream Assessment

There is no stream restoration component to this project; therefore, a stream assessment does not apply.



Monitoring Features Coordinates - WGS 84

Groundwater Monitoring Wells

Name	X	Y
G-1	-78.2327495667	34.0663412222
G-2	-78.2296351046	34.0672712001
G-3	-78.2263634050	34.0681132397
G-4	-78.2275238683	34.0702695894
G-5	-78.2279971273	34.0713911213
G-6	-78.2333634835	34.0692539959
G-7	-78.2312897976	34.0695092583
G-8	-78.2309454941	34.0684703243
G-9 / ditch 135	-78.2330201657	34.0679954424
ditch25	-78.2333712368	34.0679244773
ditch50	-78.2332904341	34.0679329117
ditch75	-78.2331980320	34.0679488403
ditch100	-78.2331256261	34.0679703596
ditch185	-78.2328570459	34.0680126646
ditch235	-78.2326987612	34.0680499215
Boggy Br. Stream Gauge	-78.2248154689	34.0683718407

Vegetation Monitoring Plots Southwest Corners

Name	X	Y
VP1	-78.2326497578	34.0664230110
VP9	-78.2329218858	34.0679123797
VP7	-78.2311915177	34.0694261940
VP8	-78.2308472157	34.0683872598
VP2	-78.2295368290	34.0671881345
VP5	-78.2278973076	34.0714729062
VP4	-78.2274240495	34.0703513738
VP3	-78.2262651316	34.0680301714
VP6	-78.2332659668	34.0690885075

Photo Stations

Name	X	Y
PS1	-78.2329393125	34.0662820253
PS2	-78.2329613657	34.0669550523
PS3	-78.2334434147	34.0693263096
PS4	-78.2306035321	34.0697689117
PS5	-78.2255670474	34.0680886051
PS6	-78.2265428881	34.0699722721
PS7	-78.2271424208	34.0709648899
PS8	-78.2281502514	34.0713047457

Legend

- Project Easement Boundary
- Wetland Enhancement
- Photo Station and View Direction
- Contours
- Vegetation Monitoring Plots
- Ditch Plugs
- Non-Restored Upland Area
- Pond Pine Woodland
- Nonriverine Wet Hardwood Forest

Groundwater Monitoring Wells

- hydrology greater than 12.5 percent
- hydrology less than 12.5 percent
- hydrology not met
- Boggy Branch Gauge

USDA Soil

- Goldsboro Fine Sandy Loam, 0 To 2 Percent Slopes
- Leon Fine Sand, 0 To 2 Percent Slopes
- Lynchburg Fine Sandy Loam
- Pantego Mucky Loam
- Rains Fine Sandy Loam
- Torhunta Mucky Fine Sandy Loam

North Carolina
Ecosystem Enhancement Program

Plum Creek Wetland Mitigation Site
Brunswick County
EEP Project No. D06040-A

Monitoring Plan View

The Louis Berger Group, Inc.
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FIGURE 2
February 2010

3.3. Wetlands Assessment

3.3.1. Wetland Problem Areas

While the hydrology was not met unilaterally, it is assumed that this condition was a product of having to overcome a groundwater deficit greatly exaggerated due to the preceding years of drought. Therefore, no problem areas were identified on Site.

3.3.2. Wetland Criteria Attainment Table

Exhibit Table 5 (a): Wetland Criteria Attainment – Hydrology
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

Tract	Well ID	Well Hydrology Threshold Met? (> 12.5% of growing season)	Well Hydrology Threshold Met? (> 5%, but < 12.5% of growing season)	Number of Consecutive Days Hydrology Was Met and Percentage of the Growing Season	Tract Mean
Plum Creek Wetland Restoration Site	1	N	N	3 days (1%)	**10%** (>12.5% of growing season) **55%** (> 5% but < 12.5% of growing season)
	2	N	Y	19 days (8%)	
	3	N	N	9 days (4%)	
	4	N	Y	22 days (9%)	
	5	Y	Y	41 days (16%)	
	6	N	N	3 days (1%)	
	7	N	Y	24 days (10%)	
	8	N	Y	22 days (9%)	
	9	N	N	12 days (5%)	

Exhibit Table 5 (b): Wetland Criteria Attainment – Vegetation
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

Tract	Veg Plot ID	Veg Survival Threshold Met? (320 stems per acre)	Planted Stems per Acre	Volunteer Stems per Acre[2]	Tract Mean
Plum Creek Wetland Restoration Site	1	Y	445	3278	**67%**
	2	Y	320	1740	
	3	Y	364	566	
	4	N[1]	283	890	
	5	Y	320	1902	
	6	N[1]	283	1659	
	7	N[1]	283	1456	
	8	Y	364	3278	
	9	Y	320	1133	
	Total stems per acre for the Site:		331	1767	

1 - One stem short of meeting the 320 stem/ac threshold.
2 - Volunteer species were sub-sampled in each plot. 1m x 10m subplot on west side of plot

Table 5a shows approximately 10 percent of the Site recorded soil saturation within the upper 12-inches for greater than 12.5 percent of the growing season, and 55 percent of the Site was between 5 percent and 12.5 percent of the growing season. However, much of the state is recovering from a 3 year drought. The gauge graphs in Appendix B show signs that the Site may have begun to recover from the drought conditions just after the growing season ended. If this trend continues, it is likely the Site will meet the hydrology criteria in Year 2. Reference well locations can be found on Figure 1. Precipitation data can also be found in Appendix B.

Soil profiles were dug at each well location. All profiles displayed hydric soil characteristics of low chroma soil color. The majority of the soils at the site consisted of a 10YR 2/1 sandy clay loam.

3.4. Photo Stations

Eight fixed photo stations were established throughout the Site. These locations are presented in Figure 2. Photographs were taken during the monitoring efforts in October. Photographs can be found in Appendix C.

4. Methodology Section

4.1. Vegetation

Vegetative data will be sampled every monitoring year for five years. Survival criteria of planted woody stems will be 320 stems per acre in Year 3, 288 stems per acre in Year 4, and 260 stems per acre at the completion of the project monitoring period at Year 5.

Nine vegetation plots were established on Site. All plots are 10 meters by 10 meters in size. Plots were established at each monitoring well location (See Figure 2). Each plot is identified by its corresponding well as shown on Figure 2. The plots were established throughout the Site in order to gain a representative view of the overall success of the plant community.

The CVS-EEP Level 1 was used for assessing vegetative success. Level 1 is the inventory of planted stems. Although Berger is only required to perform a Level 1 assessment under the existing contract, Berger also performed a Level 2 assessment to more accurately present the vegetative success of the plot and to help show the hydrologic success criteria for the Site. A Level 2 assessment includes an inventory of planted and natural stems and is applicable to all woody stems (planted and natural in separate categories) in the plot to assure an accurate assessment of woody-plant restoration on the site. A Level 2 assessment will help the Site attain hydrological success by documenting the presence of hydrophytic vegetation as described in Section 4.2 below.

4.2. Hydrology

Hydrology will be considered successful by two metrics, per the USACE wetland delineation manual (Environmental Laboratory, 1987). One criterion provides for hydrologic success if the soil is ponded, flooded, or saturated within 12 inches of the soil surface continuously for at least 12.5 percent of the growing season, assuming normal precipitation. The second alternative measurement of success would be to attain ponded, flooded, or saturated conditions within 12 inches of the soil surface continuously between 5 and 12.5 percent of the growing

season, provided the hydric soil and hydrophytic vegetation wetland criteria are also met. In Brunswick County, the growing season is typically 249 days, assuming a temperature of above 28 degrees F and a frequency of 5 of 10 years (NRCS, 2009). The growing season in Brunswick County typically occurs between approximately March 15 and November 18 in a given calendar year. As a result, 5 to 12.5 percent of the growing season is 12 to 31 days.

The groundwater hydrology of the Plum Creek Site will be monitored during the growing season in accordance with USACE guidelines through the use of shallow monitoring wells with automatic data loggers (USACE, 2003). Groundwater data will be collected from 15 monitoring wells. Nine wells were established throughout the site to accurately obtain a representative view of the groundwater hydrology. Six additional wells were installed in the western central portion of the site, perpendicular the western border ditch (Figure 2). The purpose of these wells is to show the linear extent of drawn down effect of the ditch on the wetland.

A stream gauge was installed in Boggy Branch, within the property boundaries, for informational purposes only. The stream gauge will keep records of the level of water in Boggy Branch. No success criteria are attached to the gauge.

5. References

US Army Corps of Engineers, 2003. Stream Mitigation Guidelines. Prepared by: USACE, NCDWQ, USEPA, NCWRC.

Environmental Laboratory, 1987. Corps of Engineers Wetlands Delineation Manual, Technical Report Y-87-1, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Griffith, G.E., Omernik, J.M., Comstock, J.A., Schafale, M.P., McNab, W.H., Lenat, D.R.,MacPherson, T.F. 2002. Ecoregions of North Carolina (map scale 1:1,500,000). U.S. EPA. Corvallis, OR.

Natural Resources Conservation Service. Climate Information – Wetlands Retrieval for North Carolina. Brunswick County. Available URL: http://www.wcc.nrcs.usda.gov/cgibin/getwetco.pl?state=nc. Accessed: January 15, 2009.

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 Available URL: http://cvs.bio.unc.edu/methods.htm.

Appendix A: Vegetation Data Tables and Photographs

1. Vegetation Data Tables

Appendix A, Table 1: Vegetation Metadata Plum Creek Wetland Restoration EEP Project Number: D06040-A	
Report Prepared By	Tina Sekula
Date Prepared	1/13/2010 8:41
Database name	cvs-eep-entrytool-v2.2.7.mdb
Database location	G:\JR_PROJECTS\JR5155_Plum_Creek_W_Rest\Monitoring_Data\2009 Veg Data
Computer name	RAL-TSEKULA
File size	36569088
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
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 species	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 species	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and species	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
ALL Stems by Plot and species	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	92549
Project Name	Plum Creek Wetland Restoration Site

Appendix A, Table 1: Vegetation Metadata (cont'd) Plum Creek Wetland Restoration EEP Project Number: D06040-A	
Description	The project involves the construction of approximately 80 acres of non-riverine wetland restoration.
River Basin	Lumber
Length(ft)	N/A
Stream-to-edge width (ft)	N/A
Area (sq m)	N/A
Required Plots (calculated)	N/A
Sampled Plots	9

Appendix A, Table 2: Vegetation Vigor by Species
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

	Species	CommonName	4	3	2	1	0	Missing	Unknown
	Chamaecyparis thyoides	Atlantic white cedar		3	2		3		
	Gordonia lasianthus	loblolly bay		9	1		6	4	
	Pinus serotina	pond pine		54	1		1	8	
	Quercus laurifolia	laurel oak		1				1	
	Quercus michauxii	swamp chestnut oak		1					
TOT:	**5**	**5**		**68**	**4**		**10**	**13**	

Appendix A, Table 3: Vegetation Damage by Species
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

	Species	Common Name	Count of Damage Categories	(no damage)	Deer	Unknown
	Chamaecyparis thyoides	Atlantic white cedar	3	5		3
	Gordonia lasianthus	loblolly bay	3	17	3	
	Pinus serotina	pond pine	0	64		
	Quercus laurifolia	laurel oak	0	2		
	Quercus michauxii	swamp chestnut oak	0	1		
TOT:	**5**	**5**	**6**	**89**	**3**	**3**

Appendix A, Table 4: Vegetation Damage by Plot Plum Creek Wetland Restoration EEP Project Number: D06040-A					
	plot	**Count of Damage Categories**	**(no damage)**	**Deer**	**Unknown**
	92549-01-1-year:1	0	12		
	92549-01-2-year:1	1	10	1	
	92549-01-3-year:1	1	9	1	
	92549-01-4-year:1	1	9		1
	92549-01-5-year:1	3	9	1	2
	92549-01-6-year:1	0	10		
	92549-01-7-year:1	0	9		
	92549-01-8-year:1	0	10		
	92549-01-9-year:1	0	11		
TOT:	**9**	**6**	**89**	**3**	**3**

Appendix A, Table 5: Stem County by Plot and Species
Plum Creek Wetland Restoration
EEP Project Number: D06040-A

	Comment	Species	CommonName	Total Stems	# plots	avg# stems	92549-01-1-year:1	92549-01-2-year:1	92549-01-3-year:1	92549-01-4-year:1	92549-01-5-year:1	92549-01-6-year:1	92549-01-7-year:1	92549-01-8-year:1	92549-01-9-year:1
		Acer rubrum	red maple	1	1	1							1		
		Chamaecyparis thyoides	Atlantic white cedar	8	4	2			1	1	4				2
		Cyrilla racemiflora	swamp titi	150	8	18.75	18	25	1	19	13		10	45	19
		Gordonia lasianthus	loblolly bay	16	8	2	1	2	3	2	3		1	1	3
		Ilex glabra	inkberry	38	5	7.6		4			2		13	11	8
		Lyonia lucida	fetterbush lyonia	27	1	27					27				
		Magnolia virginiana	sweetbay	5	1	5		5							
		Persea palustris	swamp bay	32	8	4	15	4	1	2	2	4	2	2	
		Pinus serotina	pond pine	56	9	6.22	8	7	6	5	4	8	6	7	5
		Pinus taeda	loblolly pine	1	1	1							1		
		Quercus laurifolia	laurel oak	1	1	1	1								
		Quercus michauxii	swamp chestnut oak	1	1	1	1								
		Rhus copallinum	flameleaf sumac	102	8	12.75	12	5	12	1	3	37	9	23	
		Unknown		1	1	1									1
TOT:	**0**	**14**	**13**	**439**	**14**		**56**	**52**	**24**	**30**	**58**	**49**	**43**	**89**	**38**

2. Vegetation Problem Area Photos

No problems areas were observed on Site for Year 1.

3. Vegetation Monitoring Plot Photos

Veg Plot 1, view from southwest corner, looking northeast. (10/28/09)

Veg Plot 2, view from southwest corner, looking northeast. (10/29/09)

Veg Plot 3, view from southwest corner, looking northeast. (10/29/09)

Veg Plot 4, view from southwest corner, looking northeast. (10/29/09)

Veg Plot 5, view from southwest corner, looking northeast. (10/29/09)

Veg Plot 6, view from southwest corner, looking northeast. (10/28/09)

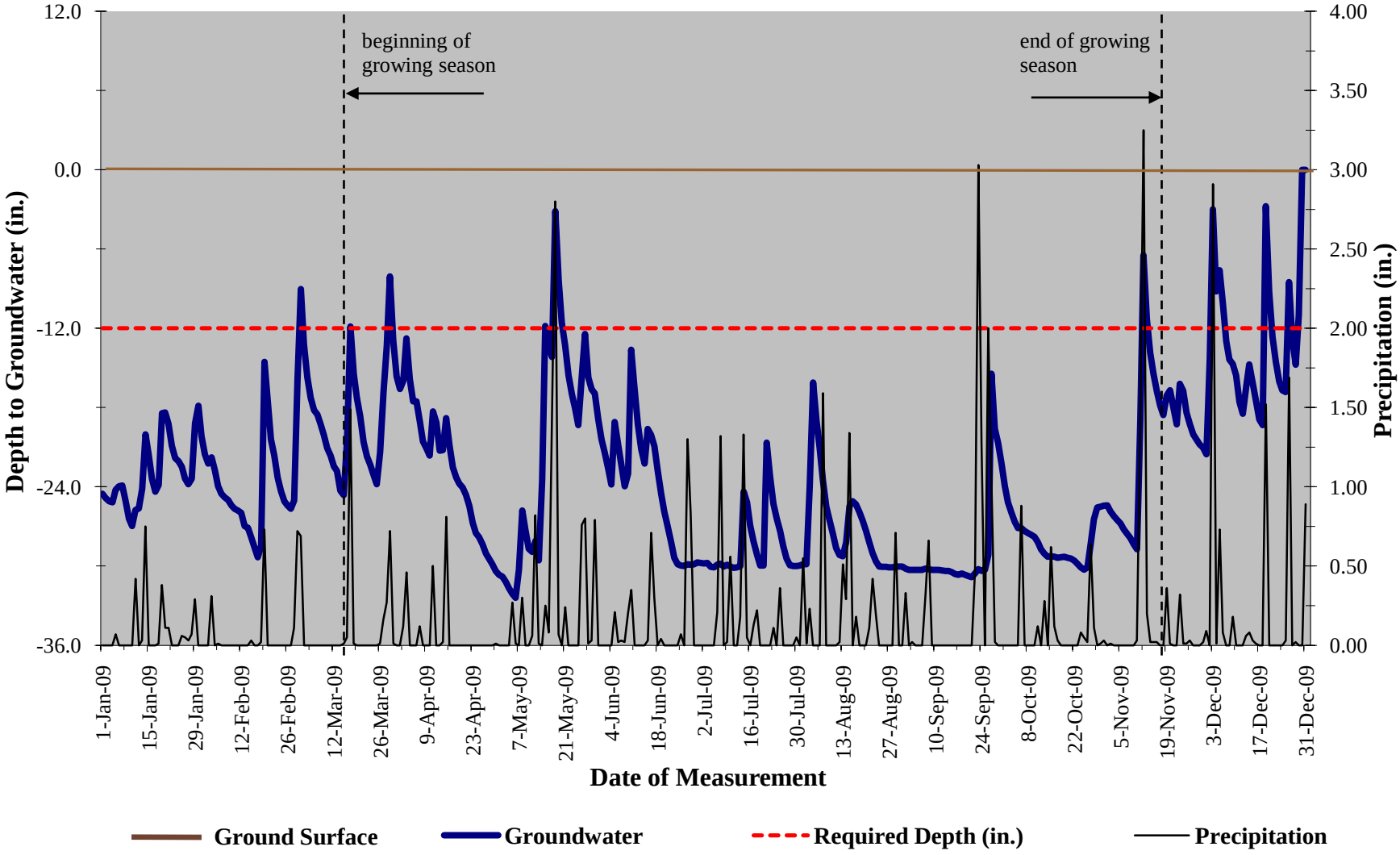
Veg Plot 7, view from southwest corner, looking northeast. (10/29/09)

Veg Plot 8, view from southwest corner, looking northeast. (10/28/09)

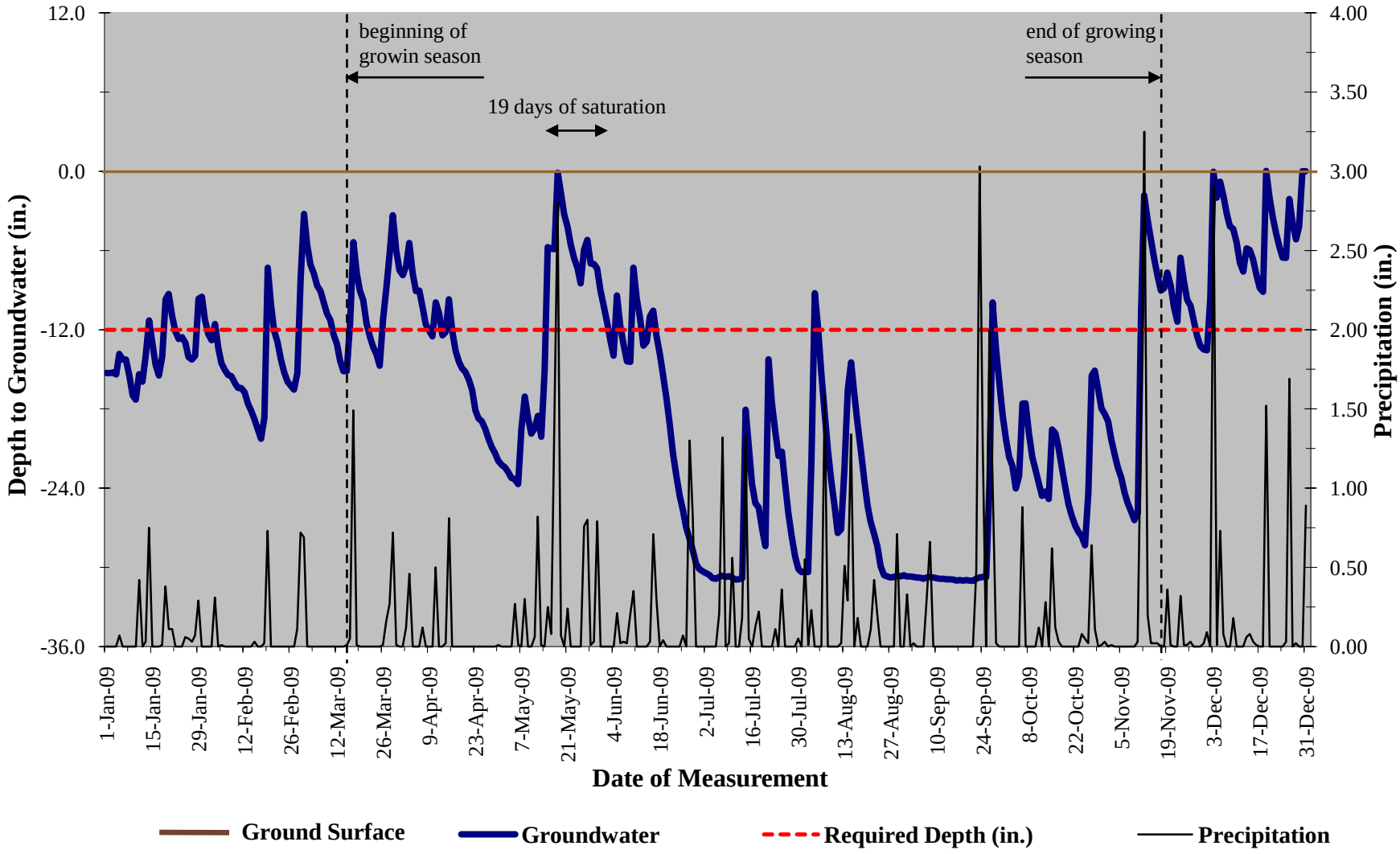
Veg Plot 9, view from southwest corner, looking northeast. (10/28/09)

Appendix B: Hydrological Data

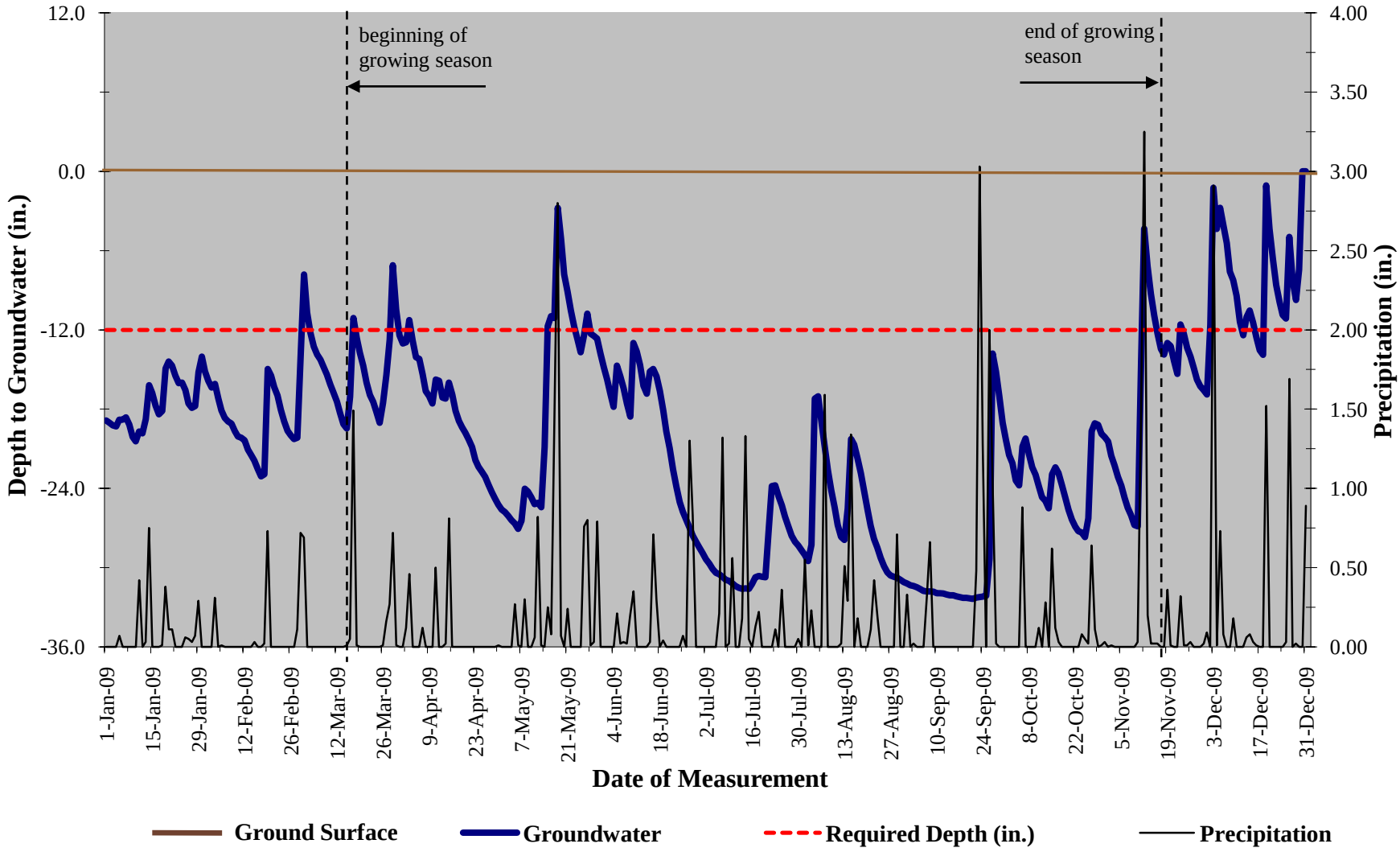
Plum Creek Wetland Mitigation
Gauge G-1 (Serial No. EBD3BBC)
Project Site



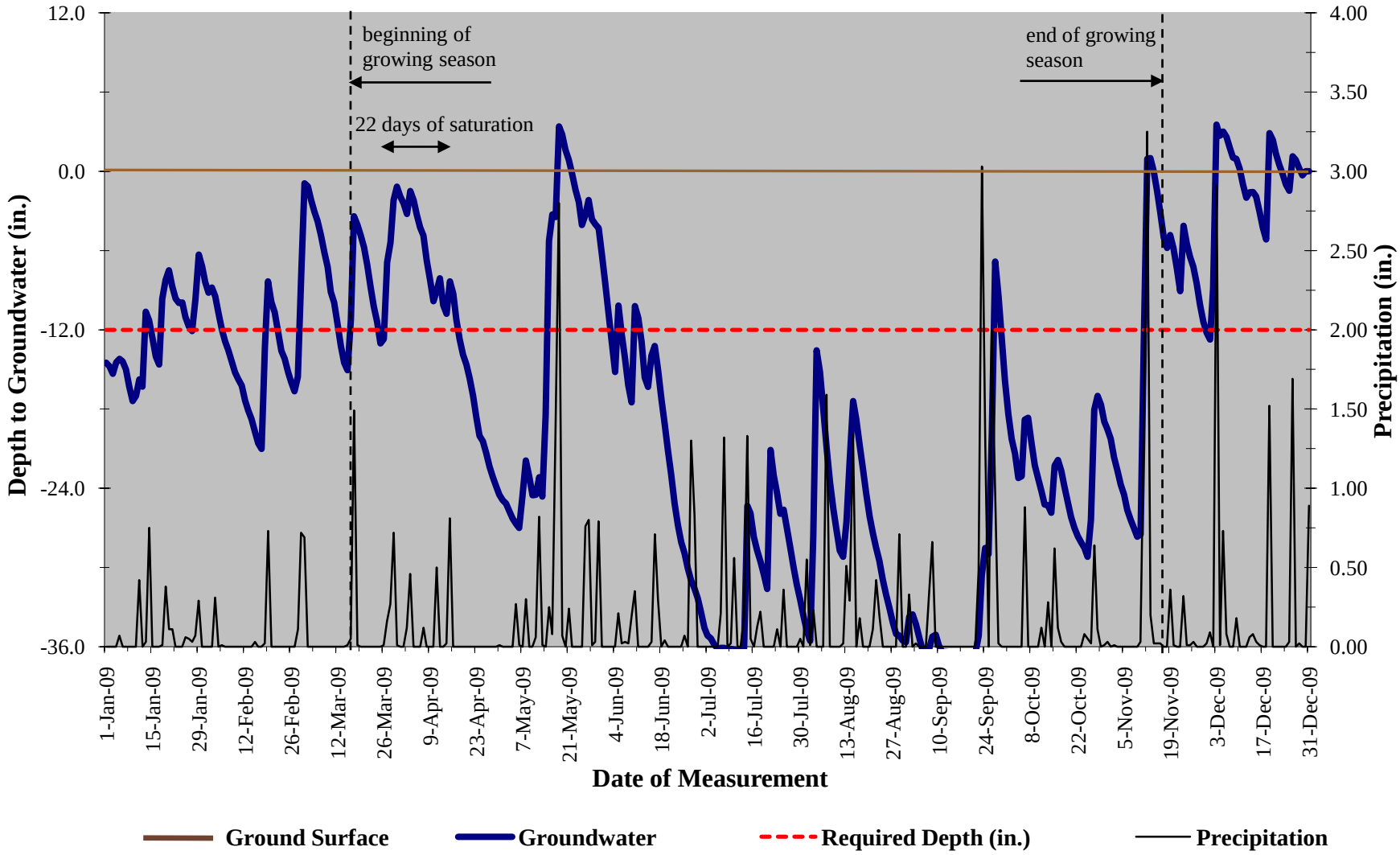
Plum Creek Wetland Mitigation
Gauge G-2 (Serial No. EBD77A1)
Reference Wetland

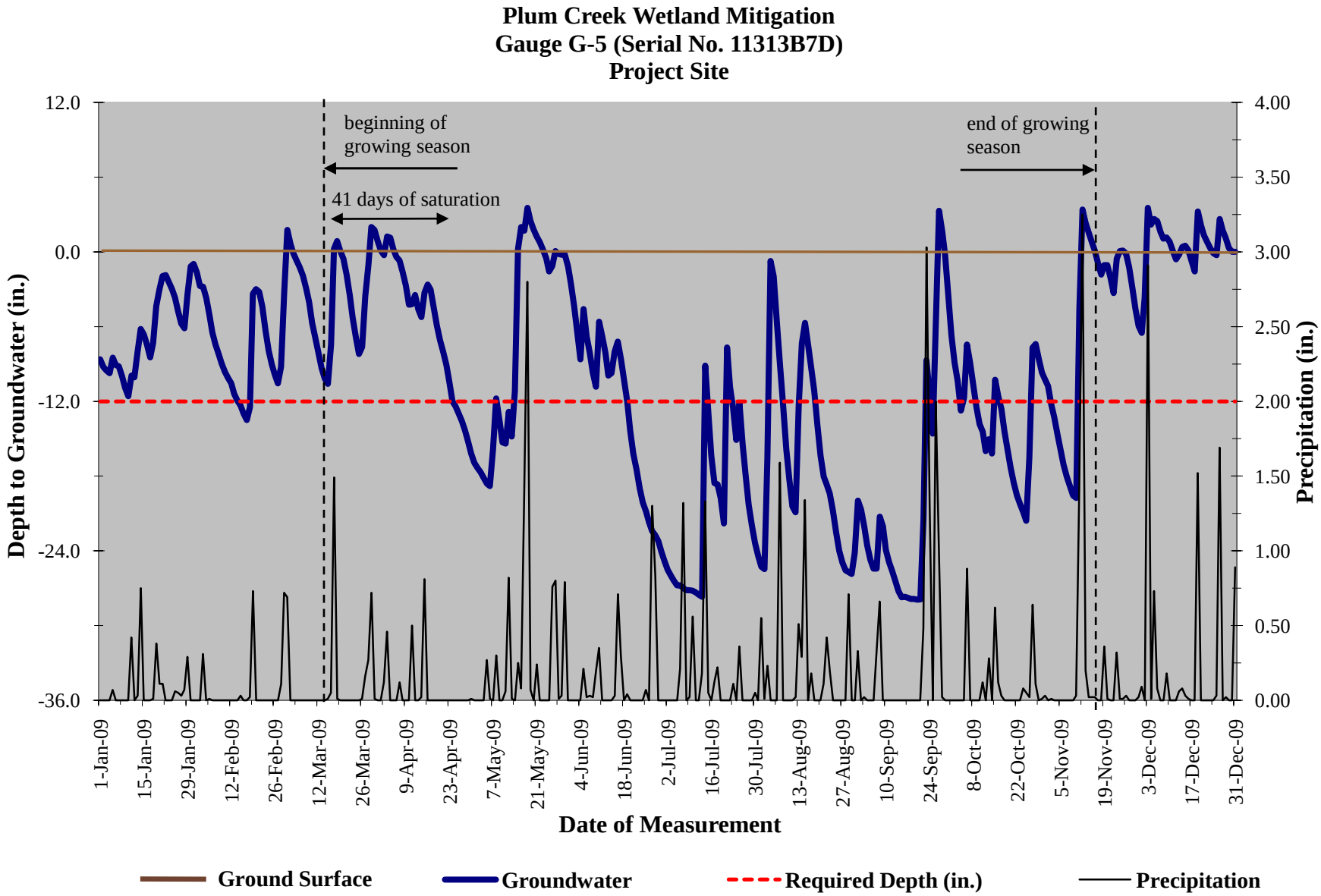


Plum Creek Wetland Mitigation
Gauge G-3 (Serial No. 11313B87)
Project Site

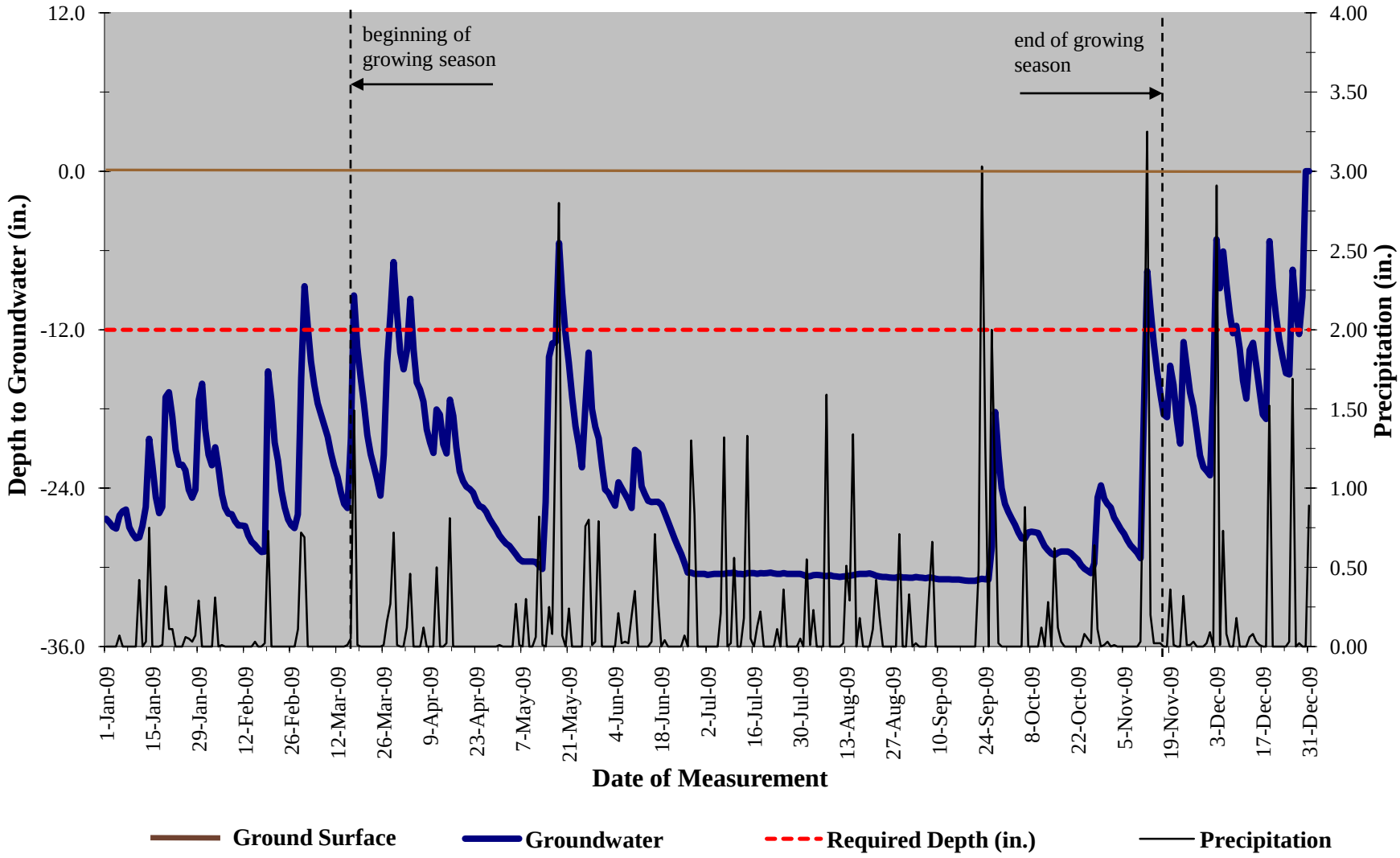


Plum Creek Wetland Mitigation
Gauge G-4 (Serial No. 1130ED8A)
Project Site

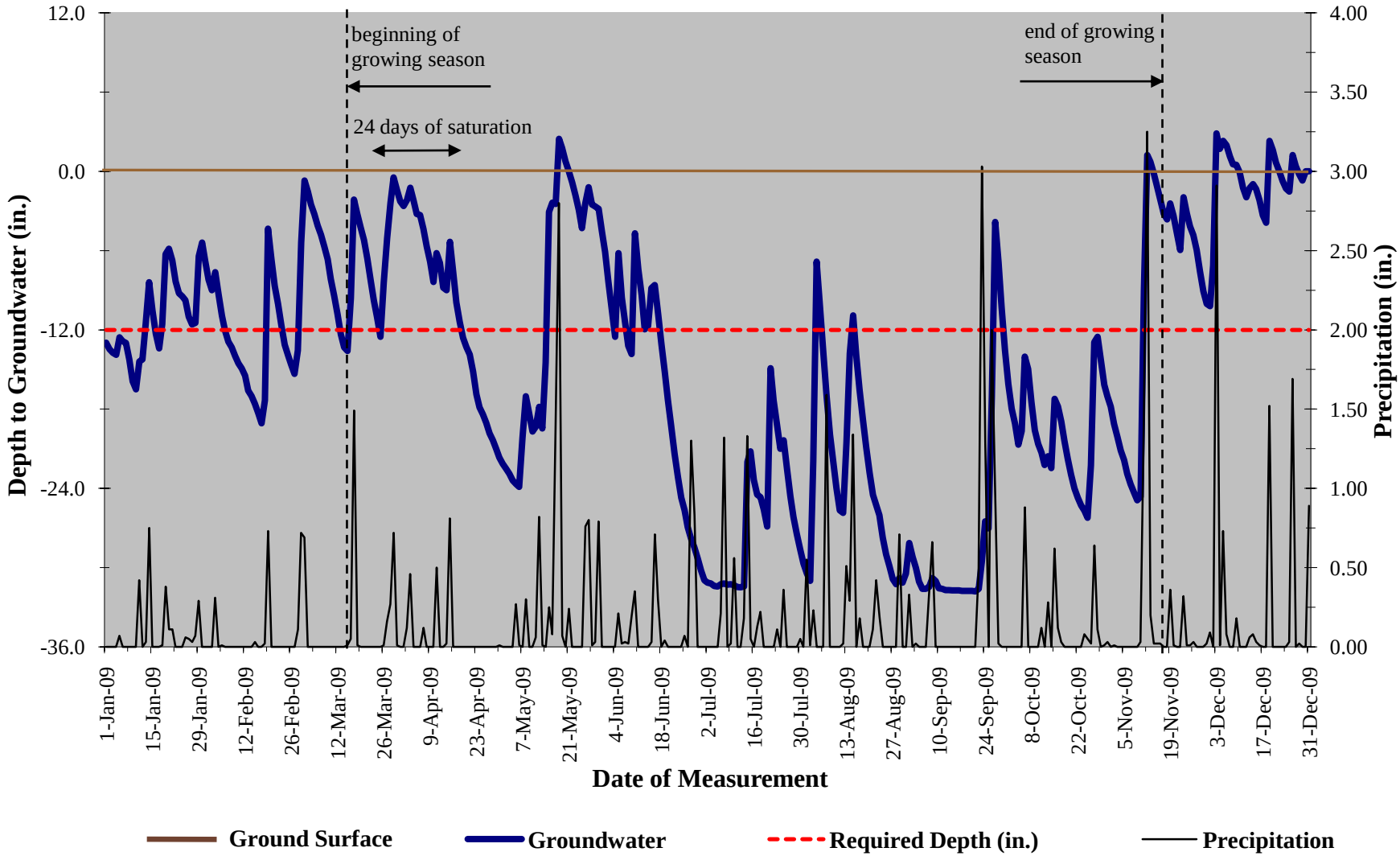



Plum Creek Wetland Mitigation
Gauge G-5 (Serial No. 11313B7D)
Project Site
beginning of growing season
41 days of saturation
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
12.0
0.0
-12.0
-24.0
-36.0
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-09
15-Jan-09
29-Jan-09
12-Feb-09
26-Feb-09
12-Mar-09
26-Mar-09
9-Apr-09
23-Apr-09
7-May-09
21-May-09
4-Jun-09
18-Jun-09
2-Jul-09
16-Jul-09
30-Jul-09
13-Aug-09
27-Aug-09
10-Sep-09
24-Sep-09
8-Oct-09
22-Oct-09
5-Nov-09
19-Nov-09
3-Dec-09
17-Dec-09
31-Dec-09
Date of Measurement
Ground Surface
Groundwater
Required Depth (in.)
Precipitation

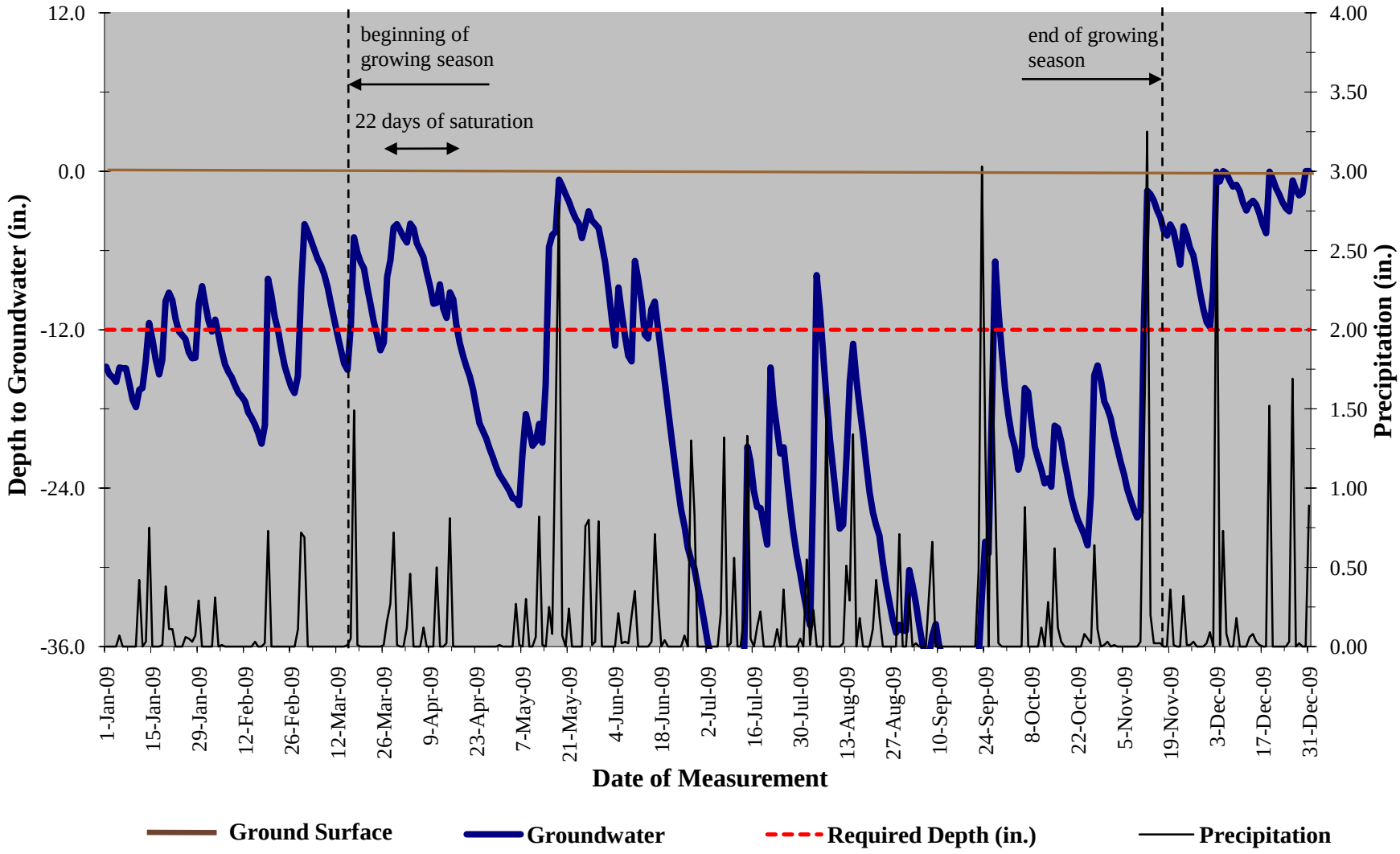
Plum Creek Wetland Mitigation
Gauge G-6 (Serial No. EBD218E)
Project Site

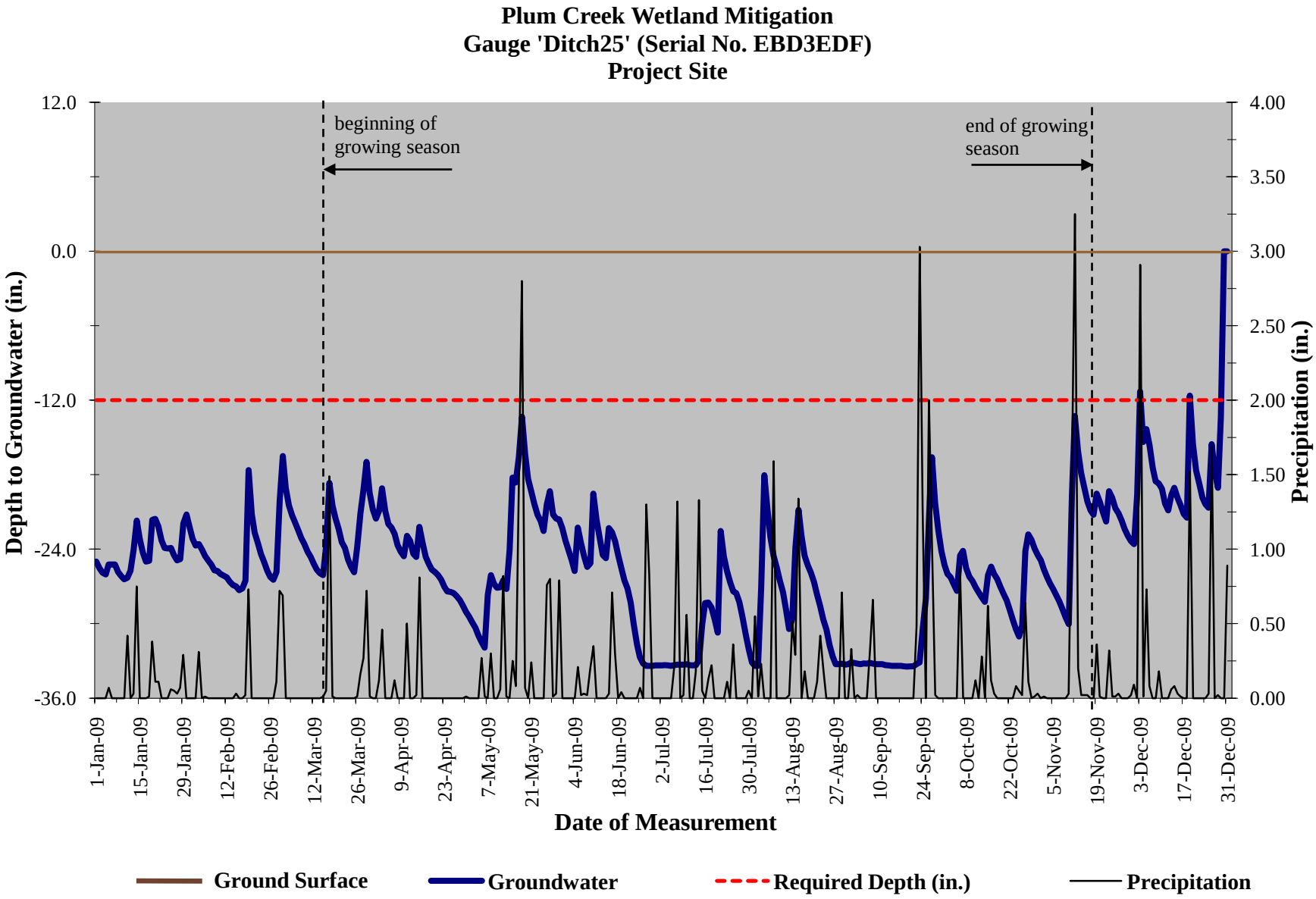


Plum Creek Wetland Mitigation
Gauge G-7 (Serial No. EBD2A12)
Project Site

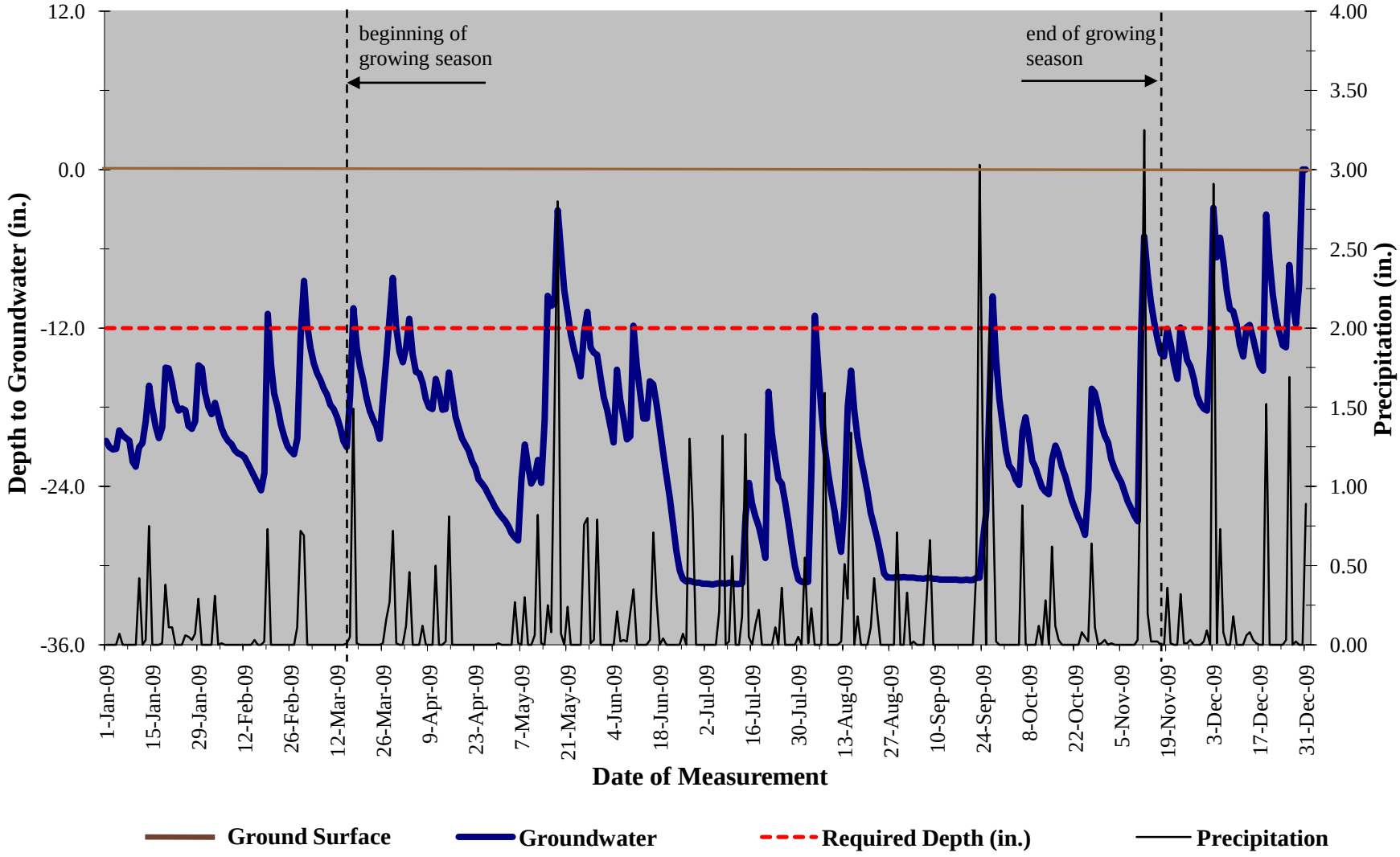


Plum Creek Wetland Mitigation
Gauge G-8 (Serial No. 1130ED80)
Project Site

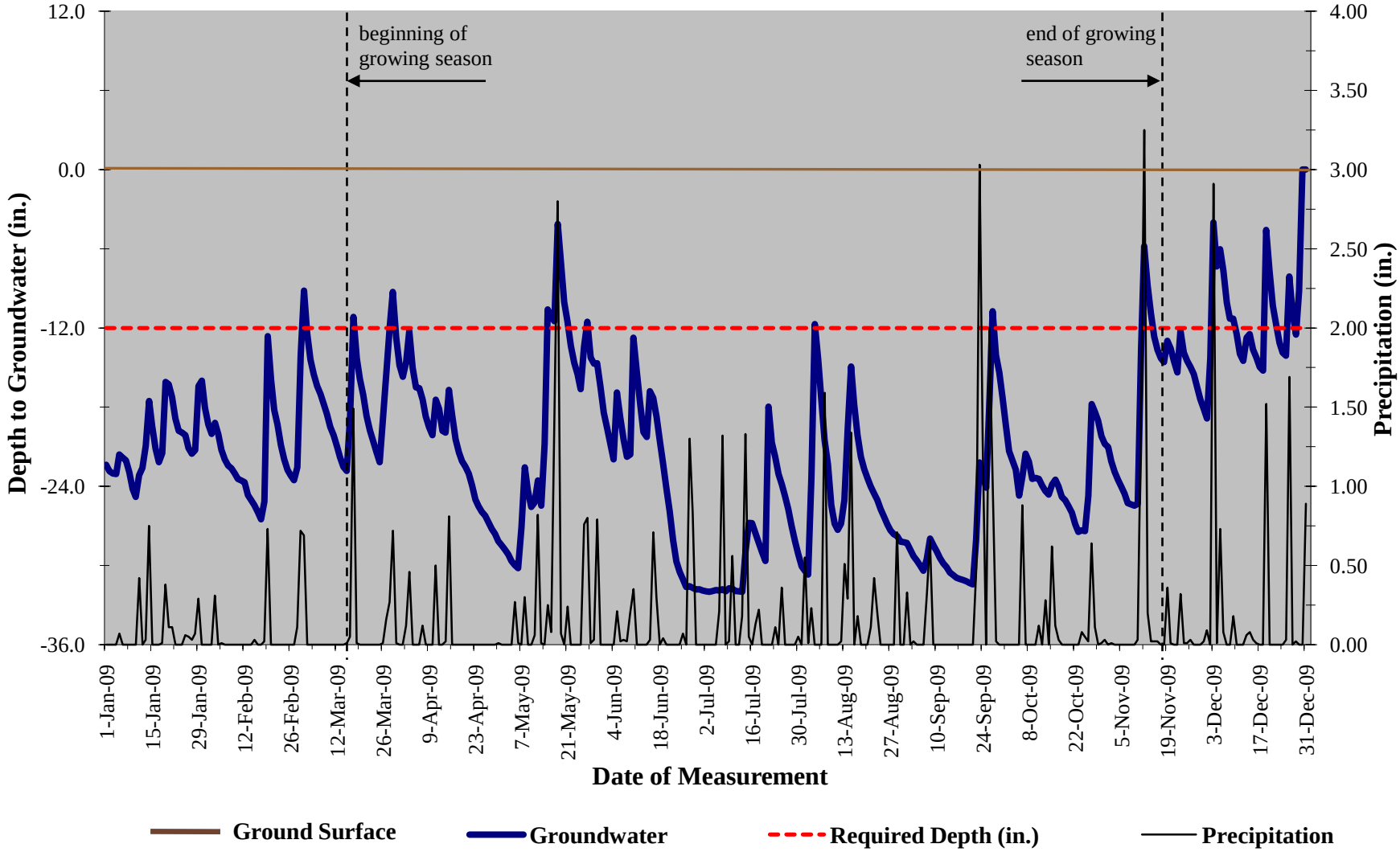



Plum Creek Wetland Mitigation
Gauge 'Ditch25' (Serial No. EBD3EDF)
Project Site
beginning of growing season
end of growing season
Depth to Groundwater (in.)
Precipitation (in.)
12.0
0.0
-12.0
-24.0
-36.0
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
1-Jan-09
15-Jan-09
29-Jan-09
12-Feb-09
26-Feb-09
12-Mar-09
26-Mar-09
9-Apr-09
23-Apr-09
7-May-09
21-May-09
4-Jun-09
18-Jun-09
2-Jul-09
16-Jul-09
30-Jul-09
13-Aug-09
27-Aug-09
10-Sep-09
24-Sep-09
8-Oct-09
22-Oct-09
5-Nov-09
19-Nov-09
3-Dec-09
17-Dec-09
31-Dec-09
Date of Measurement
Ground Surface
Groundwater
Required Depth (in.)
Precipitation

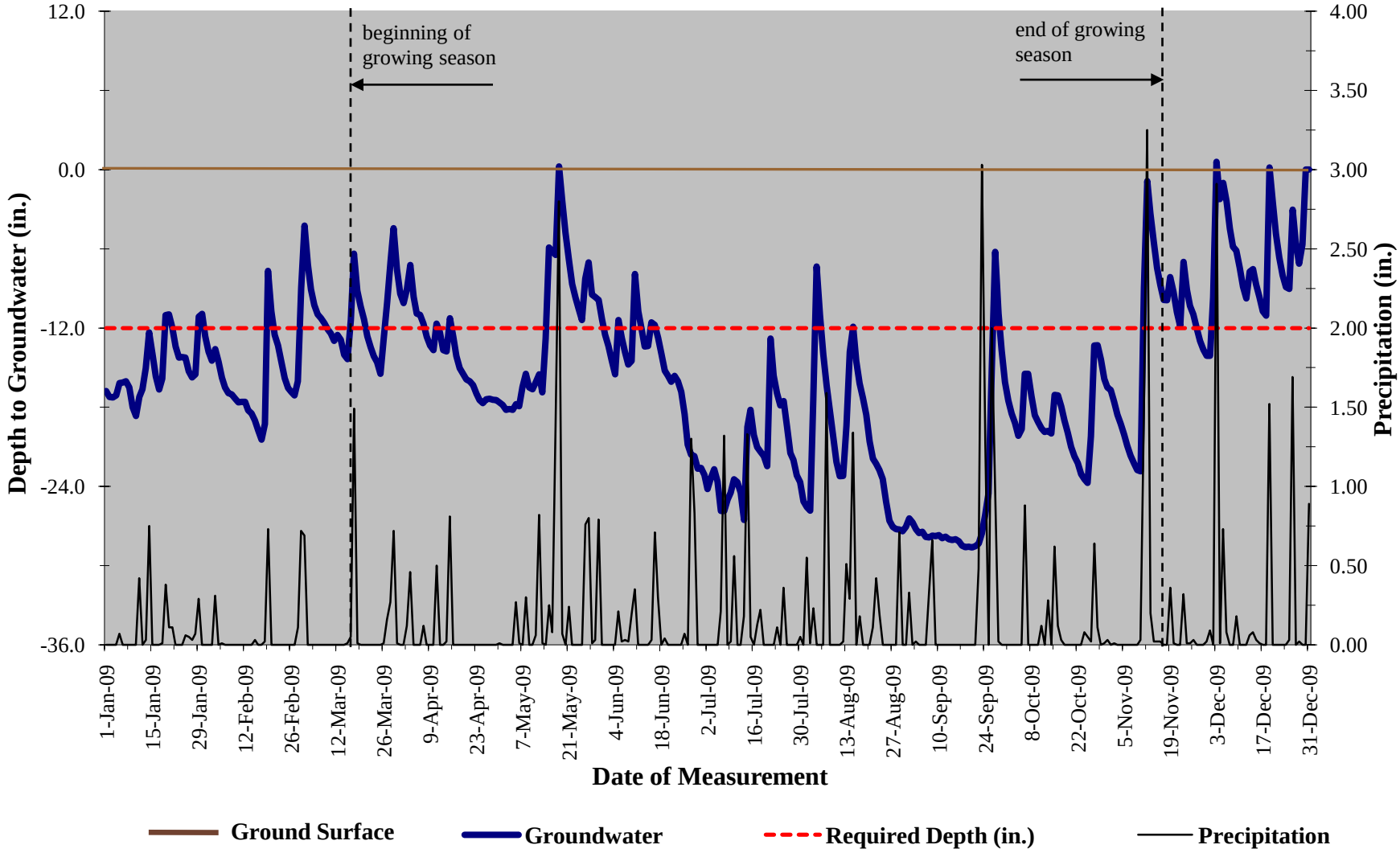
Plum Creek Wetland Mitigation
Gauge 'Ditch50' (Serial No. EBD64BE)
Project Site



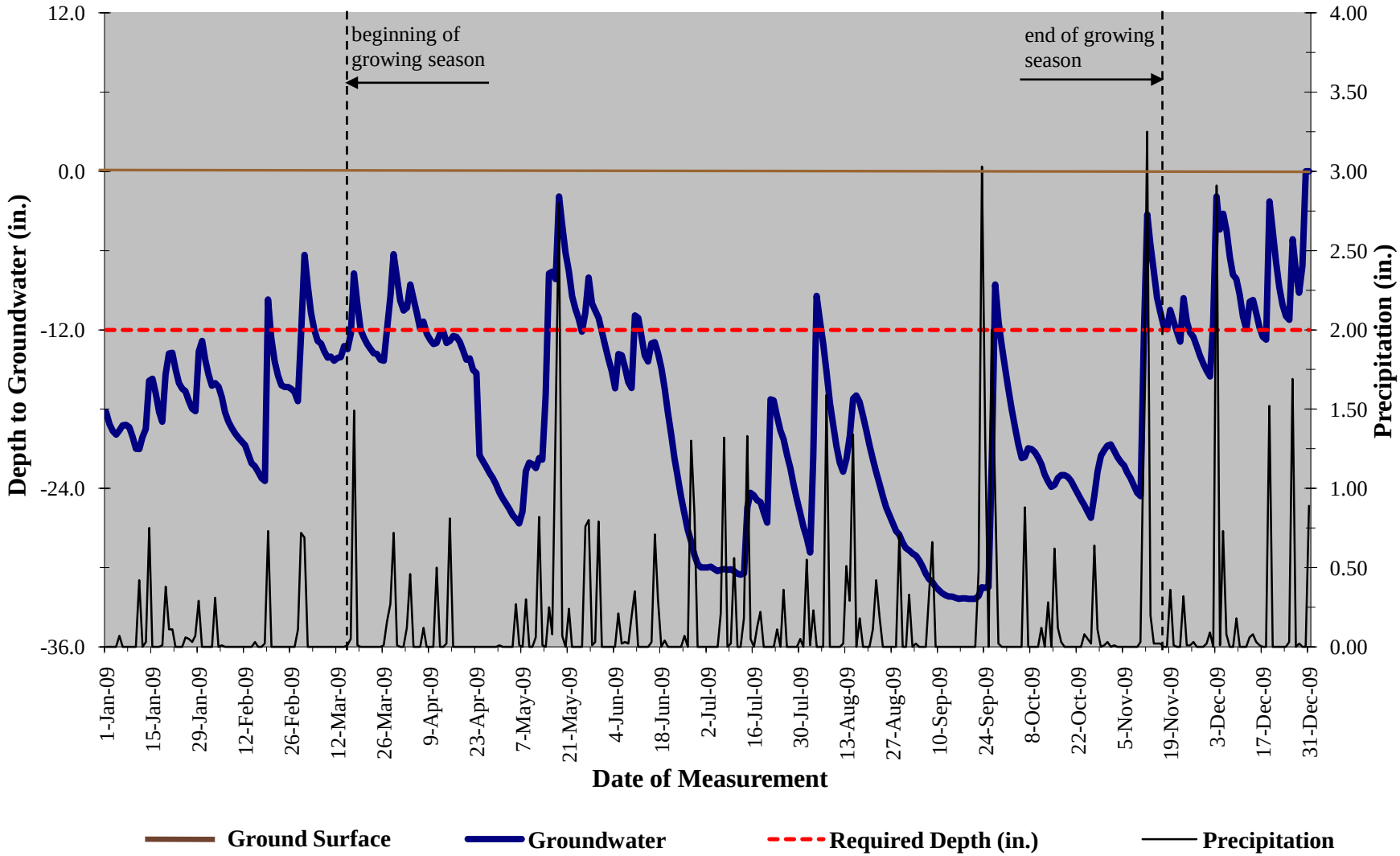
Plum Creek Wetland Mitigation
Gauge 'Ditch75' (Serial No. EBDBA05)
Project Site



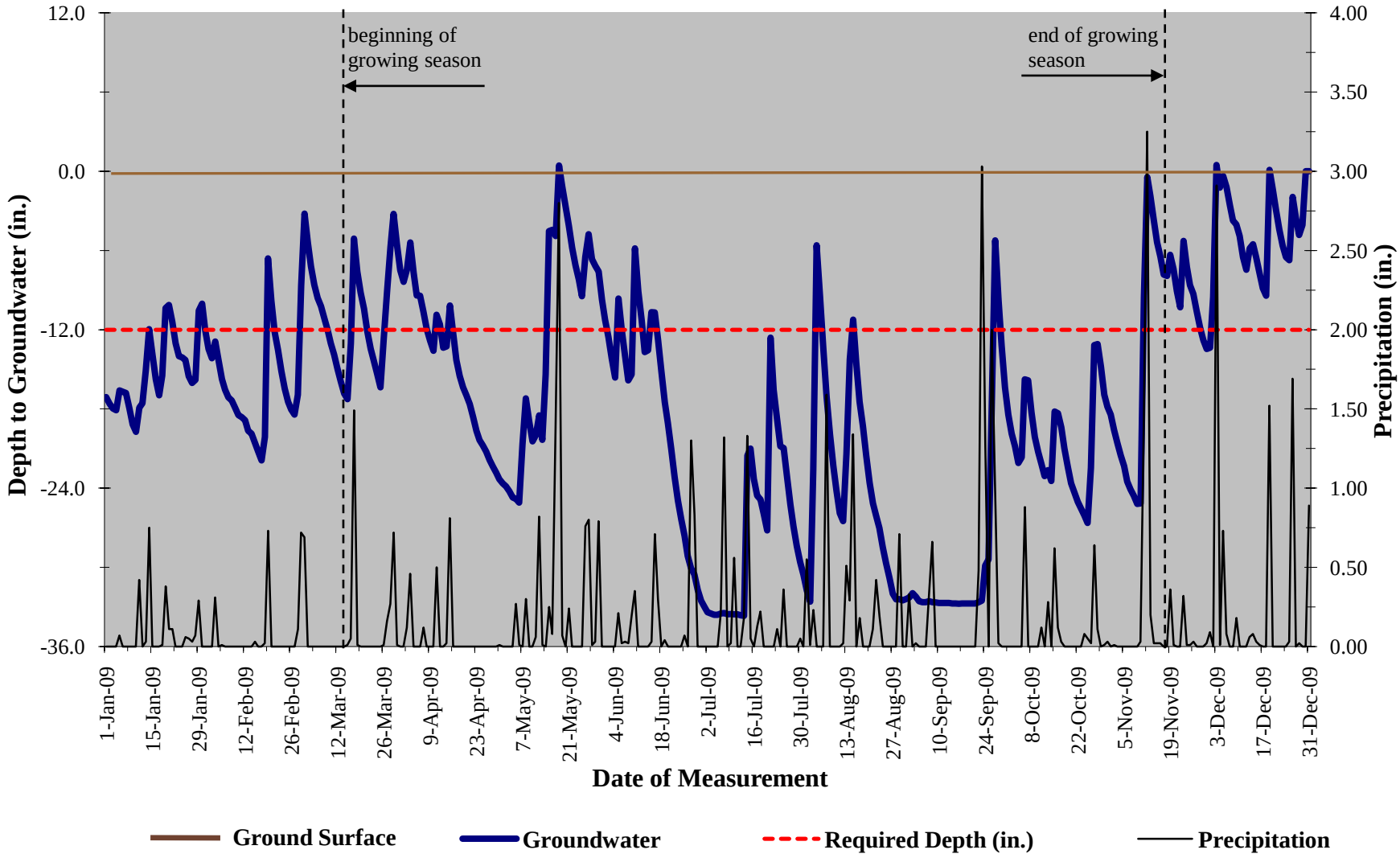
Plum Creek Wetland Mitigation
Gauge 'Ditch100' (Serial No. 11310FEA)
Project Site



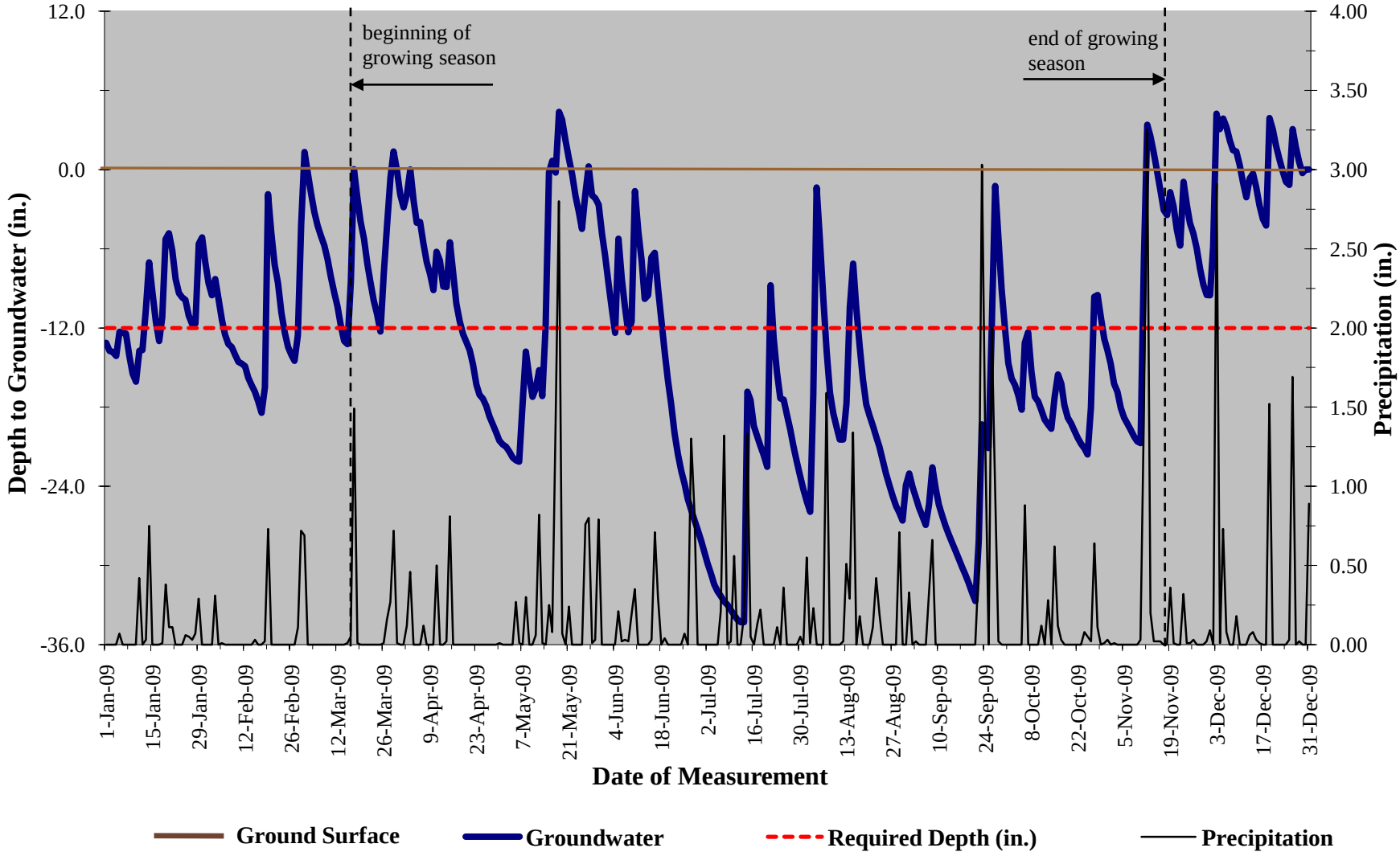
Plum Creek Wetland Mitigation
Gauge G-9 (Serial No. EBD5020)
Project Site



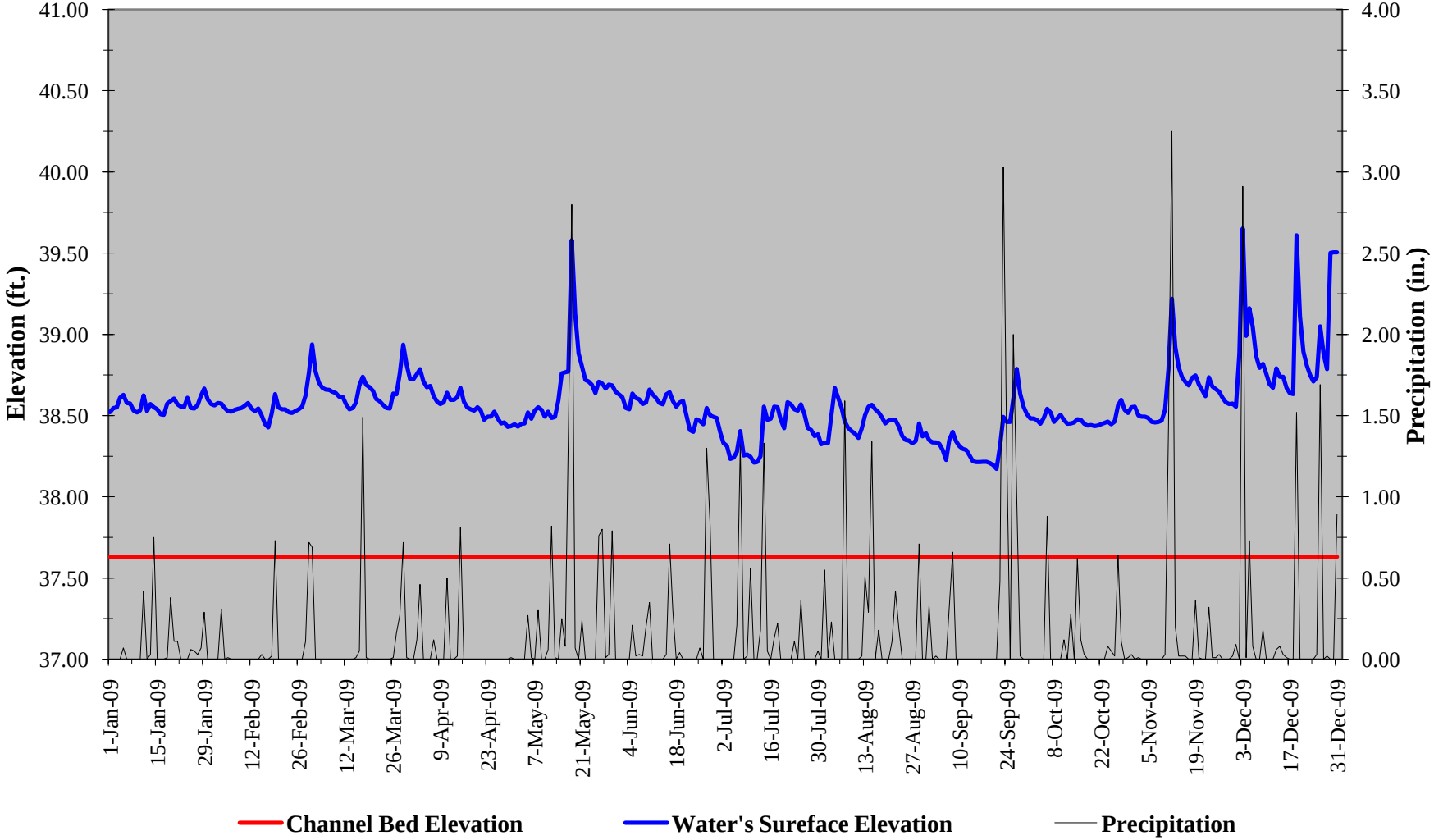
Plum Creek Wetland Mitigation
Gauge 'Ditch185' (Serial No. 11313BC2)
Project Site



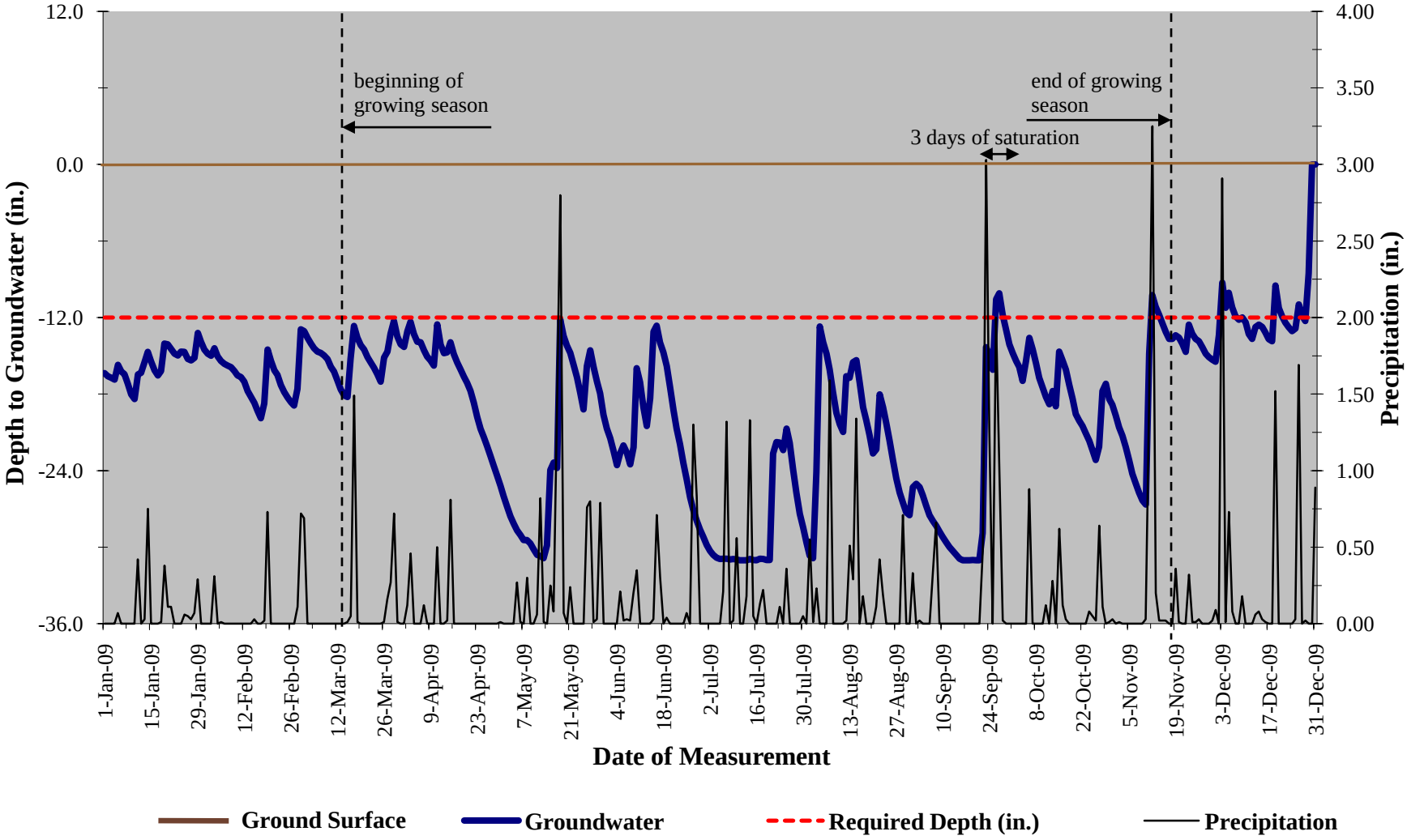
Plum Creek Wetland Mitigation
Gauge "Ditch235' (Serial No. A28C5CB)
Project Site



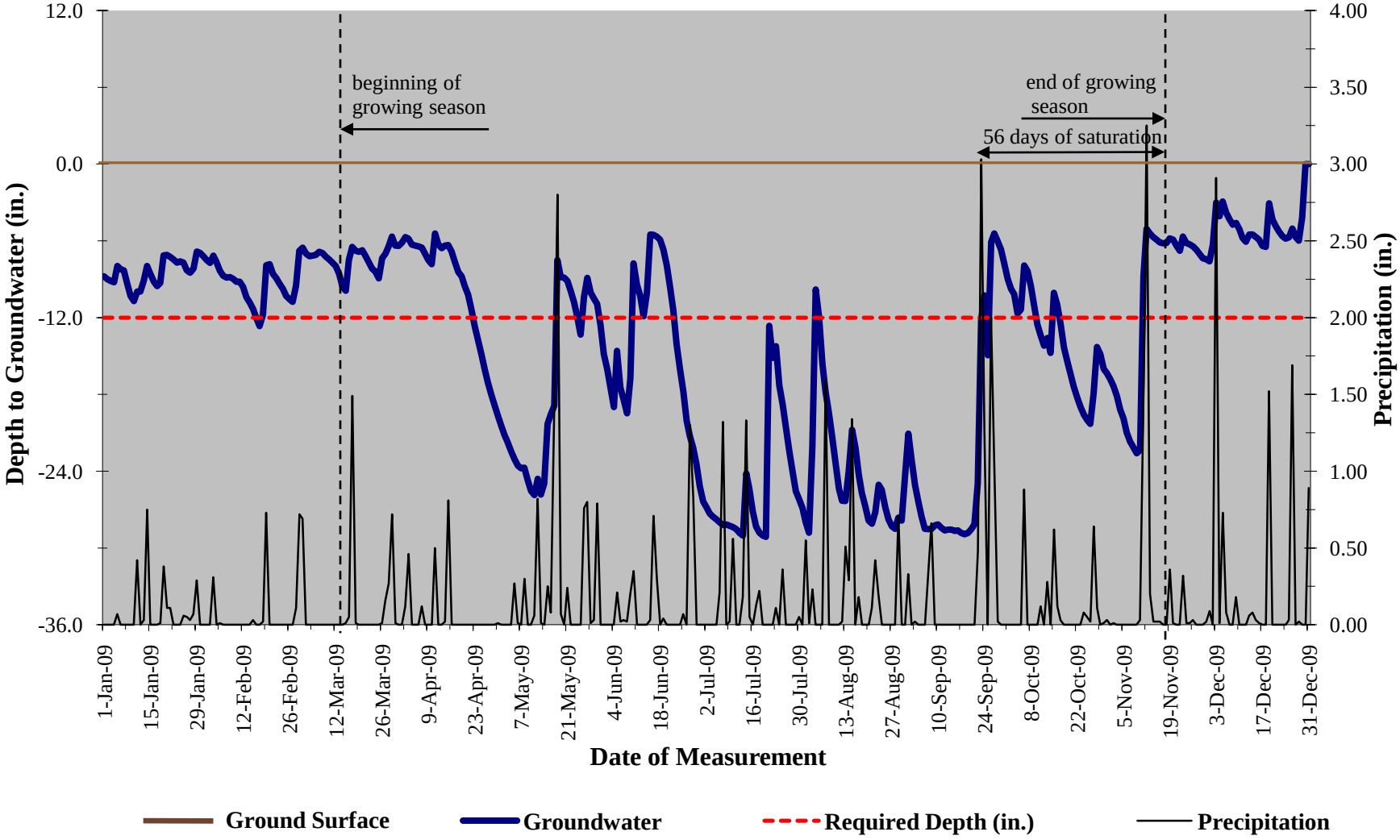
Plum Creek Mitigation Site
Stream Gauge SG-1 (Serial No. 9DE767F)



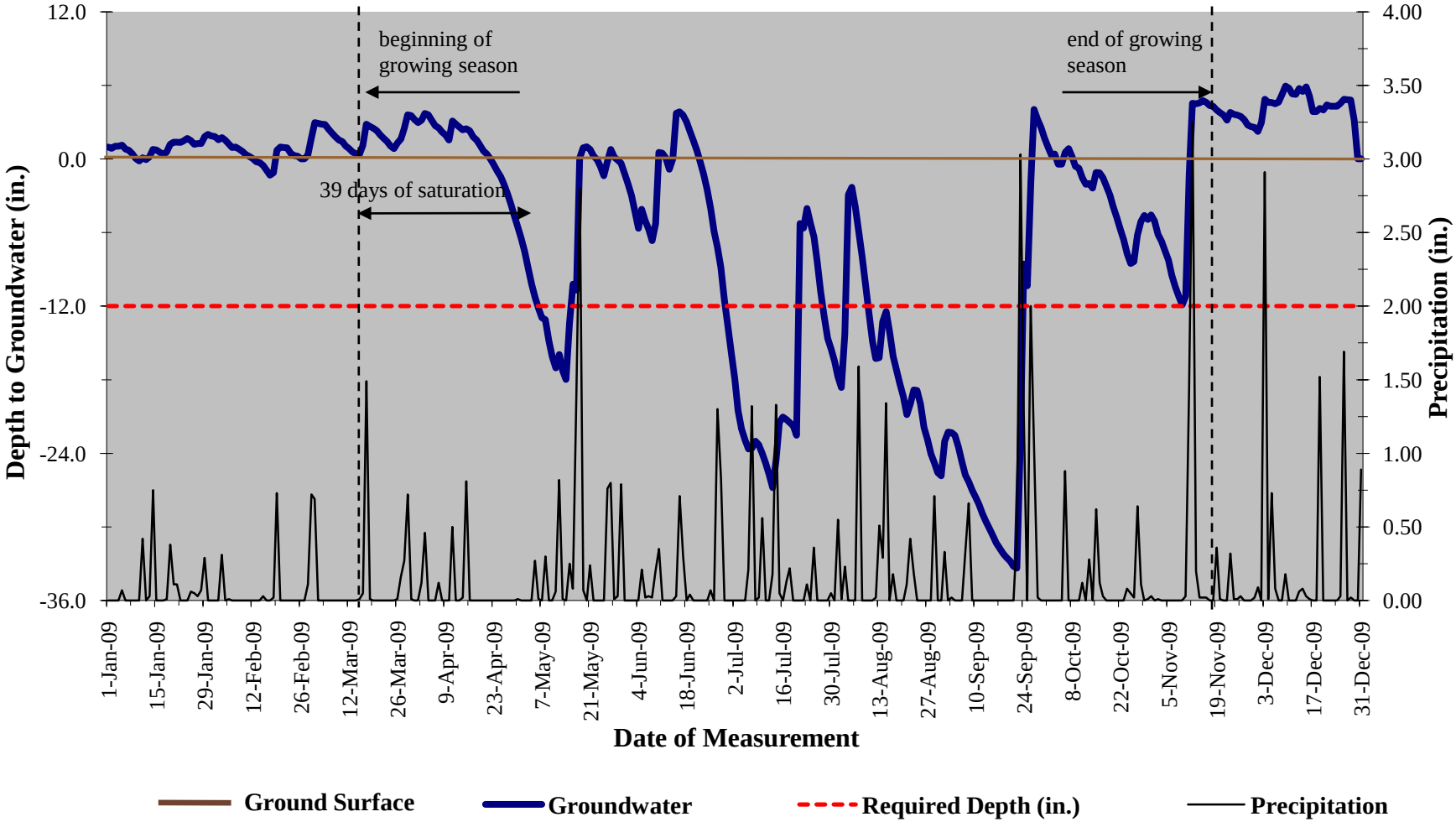
Plum Creek Wetland Mitigation Reference Site
POND GAUGE {Formerly PC-REF1} (Serial No. EBD2B2F)
Upland Non-Hydric Soil Reference Well



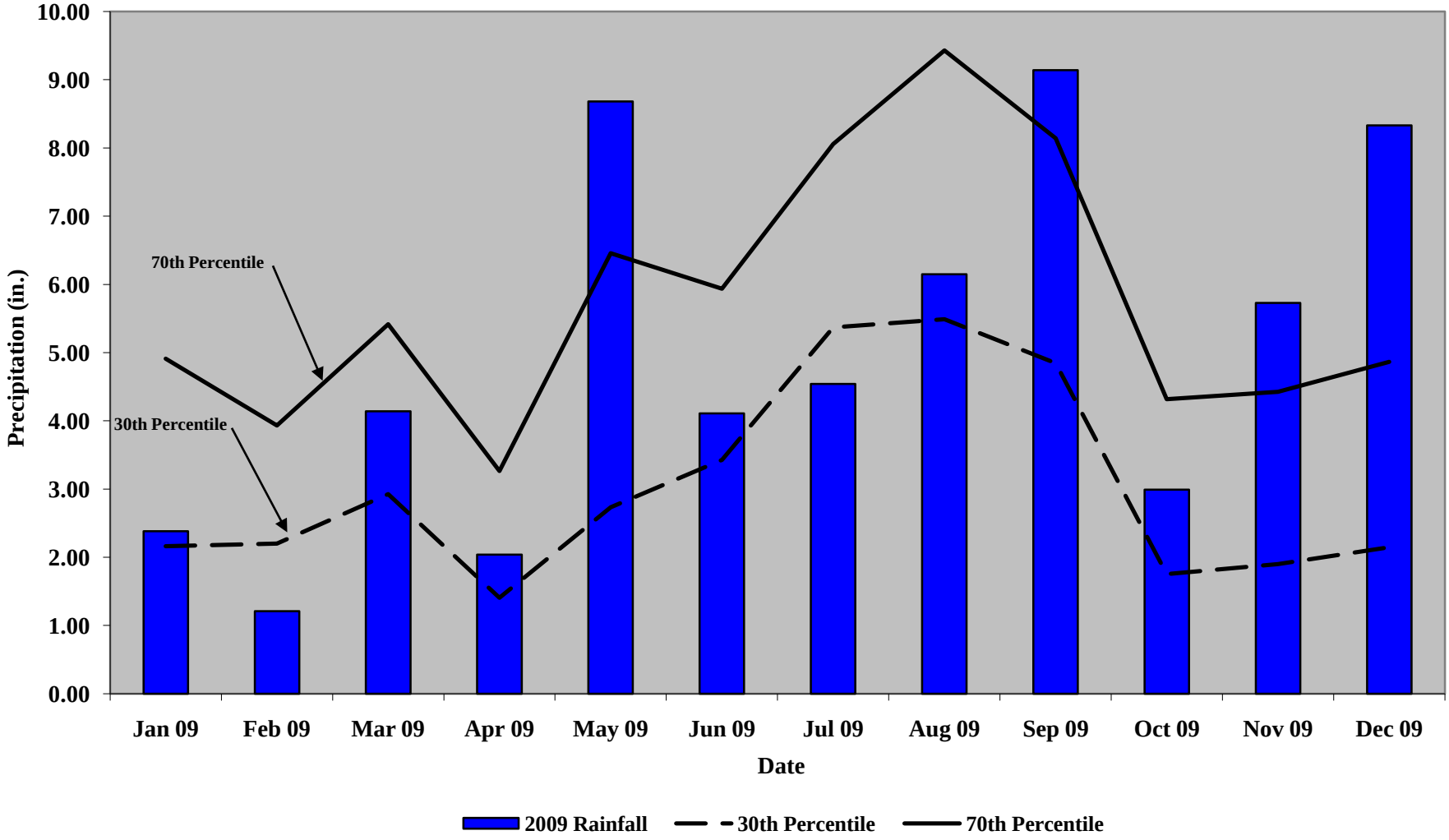
Plum Creek Wetland Mitigation Reference Guage
ROAD GAUGE {Formerly PLUM REF} (Serial No. 9DE6C99)
Wetland Reference



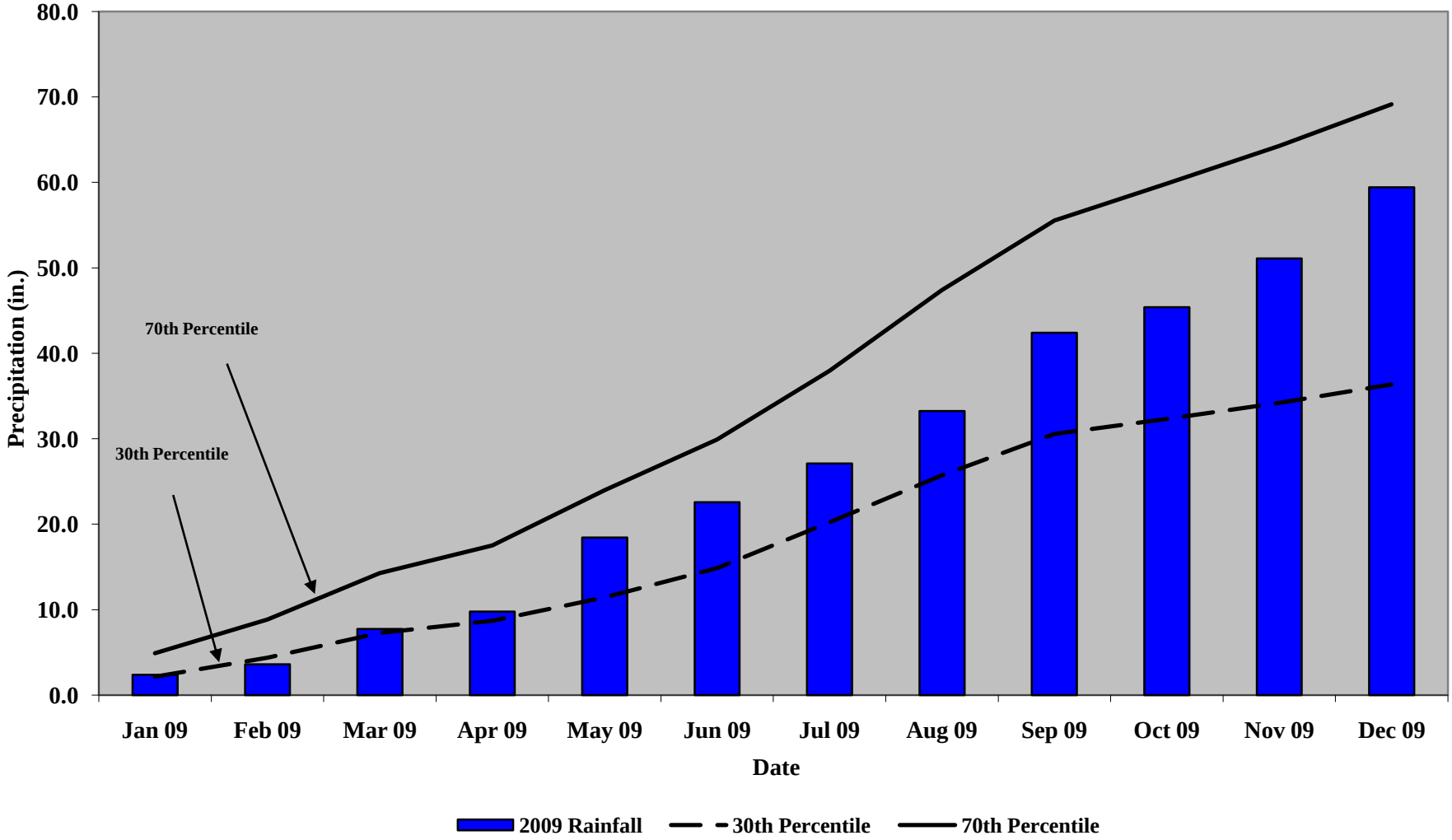
Plum Creek Wetland Mitigation Reference Site
FOREST GAUGE {Formerly REF 2} (Serial No. EBCFCF6)
Wetland Reference



Plum Creek 30-70 Percentile Graph
Wilmington, North Carolina



Plum Creek 30-70 Percentile Graph
Wilmington, North Carolina



Appendix C: Photo Stations


Photo Station 1, view looking north. (10/28/09)


Photo Station 2, view looking east. (10/28/09)


Photo Station 3, view looking east. (10/28/09)


Photo Station 4, view looking east. (10/29/09)


Photo Station 5, view looking east. (10/29/09)


Photo Station 6, view looking west. (10/29/09)

Photo Station 7, view looking east. (10/29/09)

Photo Station 8, view looking north. (10/29/09)