EEP Project Closeout Summary

Sturgeon City Phase II

The Sturgeon City Site on Wilson Bay is 2.50 acres in size. It is located adjacent to abandoned drying beds of an inactive wastewater treatment plant.

Restoration of the site involved cleaning and grading an area filled with trash and debris until the former level of the marsh was uncovered.

It was then planted with *Spartina cynosuroides* in the lower elevations and *Spartina patens* in the higher elevations.

Project ID and Status		**Project Settings & Class.**		**Project Timeline**	
Name	**Sturgeon City II**	**Basin**	Wilson Bay/New River	**Construction Completed**	2003
EEP ID #	367	**Physiographic Region**	coastal	**As-Built Survey**	2003
County	Onslow	**Ecoregion**	Carolina Flatwoods	**Monitoring Year-1**	2004
Project Type	Coastal Marsh brackish	**USGS Hydro Unit**	03030001	**Monitoring Year 2**	2005
Mitigation Type	Restoration	**NCDWQ Subbasin**	03-05-02	**Monitoring Year 3**	2006
Acreage	2.50	**Thermal Regime**	N/A	**Monitoring Year 4**	2007
Credits	2.50	**Designer**	Blue	**Monitoring Year 5**	2008
		Monitoring	Blue & Axiom	**Status**	Monitoring complete

Note : For Further information see the Sturgeon City Phase II Summary Monitoring Report following this page.

ANNUAL MONITORING REPORT
WILSON BAY (STURGEON CITY) PHASE II

WETLAND RESTORATION
ONSLOW COUNTY, NORTH CAROLINA
(EEP Project Number 367)

Monitoring Year 5 of 5 (2008)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

December 2008

ANNUAL MONITORING REPORT
WILSON BAY (STURGEON CITY) PHASE II

WETLAND RESTORATION
ONSLOW COUNTY, NORTH CAROLINA
(EEP Project Number 367)

Monitoring Year 5 of 5 (2008)

Submitted to:
North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

Prepared by:
Axiom Environmental, Inc.
2126 Rowland Pond Drive
Willow Spring, North Carolina 27592

Design Firm:
BLUE Land, Water, Infrastructure, PA
1271 Old US Highway 1 South
Southern Pines, North Carolina 28387

Axiom Environmental, Inc.

Ecosystem Enhancement PROGRAM

December 2008

EXECUTIVE SUMMARY

The Wilson Bay (Surgeon City) Wetland Restoration Phase II Site (Site) is located within the United States Geological Survey (USGS) Hydrologic Unit 03030001 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-05-02) of the White Oak River Basin. The Site includes 2.5 acres of brackish marsh restoration, located at Sturgeon City in Jacksonville, North Carolina in Onslow County. The Site is located adjacent to Thompson School Creek and Sturgeon City Park at an inactive municipal wastewater treatment plant. This report summarizes data for year 5 (2008) monitoring.

The primary goals of the project include the following.

1. Reduce nutrient and stormwater inputs to adjacent estaurine waters.
2. Stabilize the shoreline through restoration of native vegetation.
3. Improve the aesthetics to that of a natural estuarine marsh.
4. Enhance wildlife habitat.
5. Educate visitors about the importance of coastal wetlands.

Five vegetation plots were surveyed for herbaceous coverage in late June 2008 for the 2008 (year 5) monitoring season. Vegetative growth has been excellent in the brackish marsh, with many native volunteer salt marsh species; in addition an organic mat typical of a coastal salt marsh is continuing to develop.

No problem areas have been identified during the year 5 (2008) monitoring year. Site hydrology supports a coastal marsh as evidenced by sufficient flooding to support the growth of brackish marsh vegetation, the establishment of native volunteer salt marsh species, and the continued development of a native coastal marsh vegetative community structure. In summary, the Site is stable, the desired plant communities are developing, the plants are healthy, and the marsh has an aesthetic appeal.

Table of Contents

EXECUTIVE SUMMARY i
1.0 PROJECT BACKGROUND 1
1.1 Location and Setting 1
1.2 Mitigation Structure and Objectives 1
1.3 Project History and Background 3
1.4 Monitoring Plan View 4
2.0 PROJECT CONDITION AND MONITORING RESULTS 6
2.1 Vegetation Assessment 6
2.1.1 Soil Data 6
2.1.2 Vegetative Problem Areas 6
2.1.3 Stem Counts 6
2.1.4 Vegetation Plot Photos 9
2.2 Wetland Assessment 9
2.2.1 Wetland Problem Area Plan View 10
2.2.2 Wetland Criteria Attainment 10
4.0. REFERENCES 11

Appendices

APPENDIX A. VEGETATION PLOT PHOTOGRAPHS
APPENDIX B. YEAR 5 (2008) GROUNDWATER GAUGE GRAPHS
APPENDIX C. YEAR 4 (2007) GROUNDWATER GAUGE GRAPHS
APPENDIX D. YEAR 3 (2006) GROUNDWATER GAUGE GRAPHS

List of Figures

Figure 1. Site Location 2
Figure 2. Monitoring Plans 5
Figure 3. Monitoring Results 7

List of Tables

Table 1. Project Mitigation Structures and Objectives 1
Table 2. Project Activity and Reporting History 3
Table 3. Project Contact Table 3
Table 4. Project Background Table 4
Table 5. Preliminary Soil Data 6
Table 6. Marsh Stem Counts 8
Table 7. Vegetation Trends 8
Table 8. Summary of Groundwater Gauge Results for Years 1 through 5 10
Table 9. Wetland Criteria Attainment for Year 5 (2008) 10

1.0 PROJECT BACKGROUND

1.1 Location and Setting

The Wilson Bay (Surgeon City) Wetland Restoration Phase II Site (Site) is located within the United States Geological Survey (USGS) Hydrologic Unit 03030001 (North Carolina Division of Water Quality [NCDWQ] subbasin 03-05-02) of the White Oak River Basin. The Site includes 2.5 acres of brackish marsh restoration, located at Sturgeon City in Jacksonville, North Carolina in Onslow County (Figure 1). The Site is located adjacent to Thompson School Creek and Sturgeon City Park at an inactive municipal wastewater treatment plant.

Directions to the Site:
From Raleigh:

- Travel east on Interstate 40 to Exit 373 (NC24/903 east)
- Follow NC 24 to Jacksonville
- In Jacksonville, veer right onto Old Bridge Street to cross over the New River
- Turn right on Court Street
- At the end of Court Street take a left into the inactive wastewater treatment plant
- The Site is adjacent to Wilson Bay at the far end of the property

The Site is located in the Middle Atlantic Coastal Plain Physiographic Province, within the Carolina Flatwoods ecoregion.

1.2 Mitigation Structure and Objectives

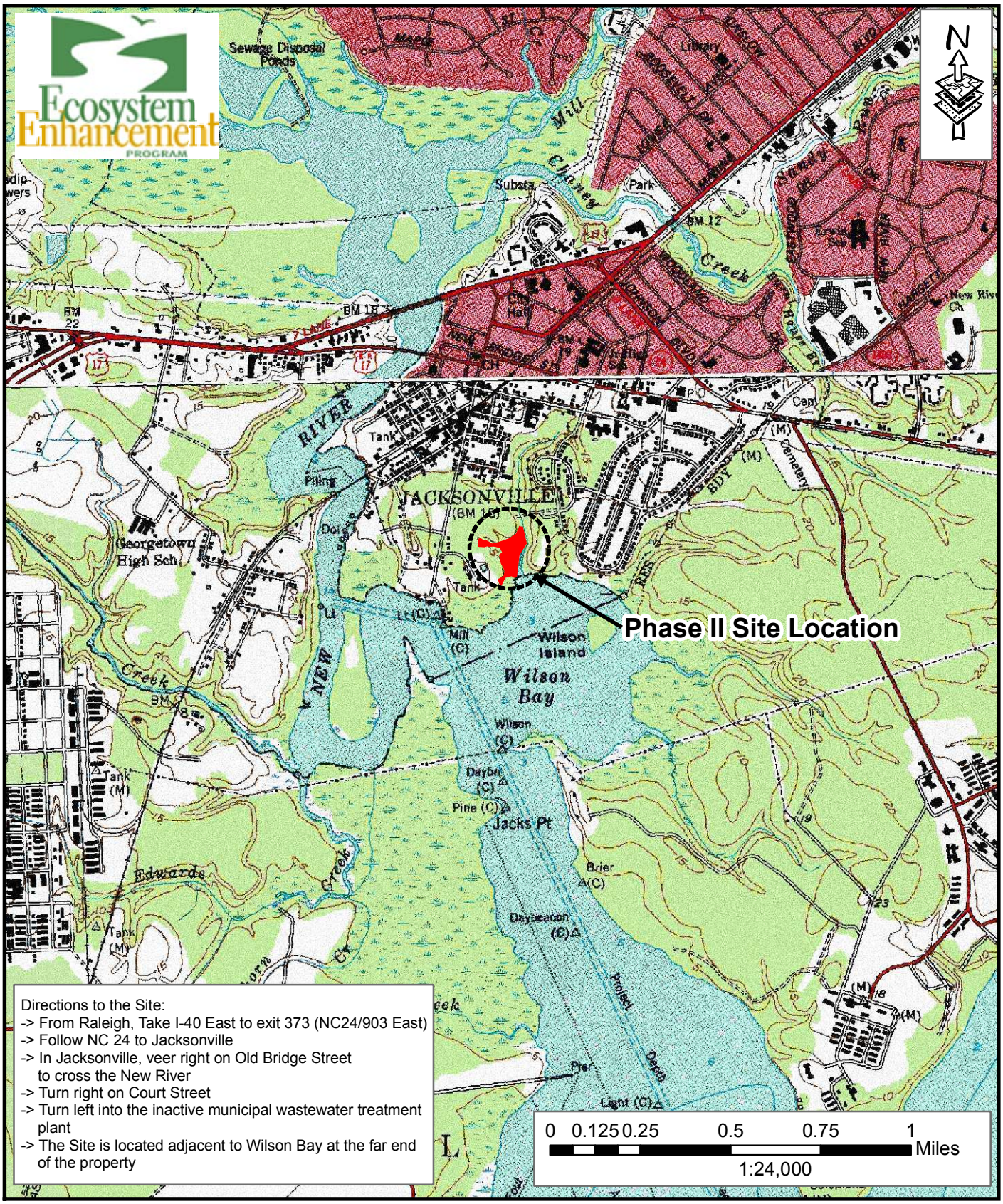
Prior to implementation of wetland restoration activities, the Site was used as a municipal wasterwater treatment plant.

Restoration at the Site entailed 1) removal of trash laden fill material, 2) grading the Site to the desired elevations to restore wetland hydrology, and 3) planting the Site. The primary goals of this project were to reduce nutrient and stormwater inputs to adjacent estaurine waters, stabilize the shoreline through restoration of native vegetation, improve the aesthetics to that of a natural estuarine marsh, enhance wildlife habitat, and educate visitors about the importance of coastal wetlands. Project structures and objectives are summarized in Table 1.

Table 1. Project Mitigation Structures and Objectives

Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)

Project Segment or Reach ID	Mitigation Type	Approach	Linear Footage or Acreage	Stationing	Comment
Brackish Marsh	Restoration	---	2.50 acres	---	Planted with *Spartina cynosuroides* in the lower elevations and *Spartina patens* in the higher elevations.



Axiom Environmental, Inc
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

SITE LOCATION
WILSON BAY (STURGEON CITY) PHASE II
EEP Project Number 367
2008 Annual Monitoring Year 5 of 5
Onslow County, North Carolina

CLF

Date: July 2008

Project: 08-001

FIGURE 1

1.3 Project History and Background

Completed project activities, reporting history, and completion dates are summarized in Table 2.

Table 2. Project Activity and Reporting History

Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)

Activity or Report	Scheduled Completion	Data Collection Completion	Actual Completion or Delivery
Restoration Plan	2002	---	Mar. 24, 2003
Final Design – 90%	Unknown	---	Unknown
Construction	June 2003	---	October 2003
Temporary Sediment & Erosion Mix Applied	Not Applicable	Not Applicable	Not Applicable
Permanent Seed Mix Applied	Not Applicable	Not Applicable	Not Applicable
Brackish Marsh Planting	August 2003	---	June 2004
Containerized and B&B Plantings	Not Applicable	Not Applicable	Not Applicable
As-built Report (Year 0 Monitoring – map only)	2005	---	Unknown
Year 1 Monitoring (2004)	Fall 2004	---	Oct. 12, 2004
Year 2 Monitoring (2005)	Fall 2005	---	Sept. 22, 2005
Year 3 Monitoring (2006)	Fall 2006	---	Feb. 2007
Year 4 Monitoring (2007)	Fall 2007	---	Feb. 2008
Year 5 Monitoring (2008)	Fall 2008	Nov. 2008	Dec. 2008

Contact information regarding project designer, construction, planting contractor, and monitoring personnel are summarized in Table 3 and relevant project background information is summarized in Table 4.

Table 3. Project Contact Table

Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)

Designer	BLUE: Land, Water, Infrastructure, PA 1271 Old Highway 1 Southern Pines, NC 28387 Thomas Blue (910) 692-6461
Property Owner	City of Jacksonville PO Box 128 Jacksonville, North Carolina 28541 Glenn Hargett (910) 938-5200
Construction Contractor	Trader Construction Company 2500 Highway 70 East New Bern, North Carolina 28560 Carl Huddle (252) 633-2424

Table 3. Project Contact Table (continued)	
Planting Contractor	BLUE: Land, Water, Infrastructure, PA 1271 Old Highway 1 Southern Pines, NC 28387 Larry Hobbs (919)306-2410 Thomas Blue (910) 692-6461
Seeding Contractor	Unknown
Temporary Seed Mix Sources	Unknown
Nursery Stock Suppliers (marsh plants)	Campbells Greenhouse Raleigh, North Carolina Street Address and Point of Contact: Unknown
Monitoring Performers	Axiom Environmental, Inc. 2126 Rowland Pond Dr. Willow Spring, NC 27592 Grant Lewis 919-215-1693

Table 4. Project Background Table

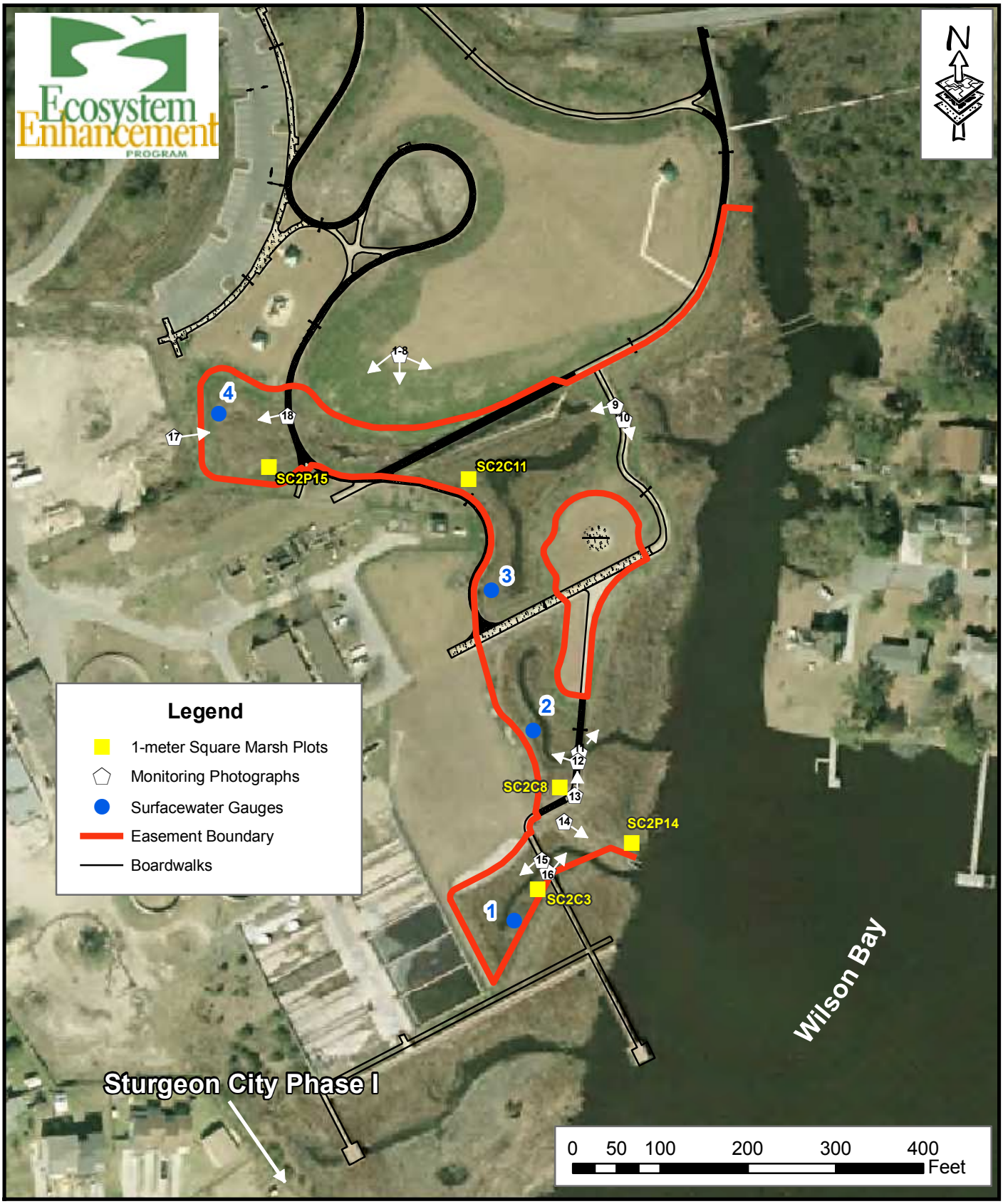
Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)

Project County	Onslow County, North Carolina
Drainage Area	~ 115 acres
Drainage impervious cover estimate (%)	~ 35 percent
Stream Order	First
Physiographic Region	Coastal Plain
Ecoregion	Carolina Flatwoods
Rosgen Classification of As-built	Not Applicable
Cowardin Classification	Estaurine Intertidal Emergent Persistant Irregularly Flooded (E21P)
Dominant Soil Types	Wando fine sand
Reference Site ID	No Reference
USGS HUC for Project and Reference	Project – 03030001
NCDWQ Subbasin for Project and Reference	Project – 03-05-02
NCDWQ Classification for Project and Reference	Project – SC HQW NSW
Any portion of any project segment 303d listed?	No (Stream Index #19-14)
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	Not Applicable
% of project easement fenced	None

1.4 Monitoring Plan View

Monitoring activities for the Site, including relevant structures and utilities, project features, specific project structures, and monitoring features are detailed in Figure 2.

Site features have been monitored with five 1-meter square marsh grass vegetation plots, four continuous recording surfacewater gauges, and photographic documentation.



Axiom Environmental, Inc
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax
Axiom Environmental, Inc.

MONITORING PLAN
WILSON BAY (STURGEON CITY) PHASE II
EEP Project Number 367
2008 Annual Monitoring Year 5 of 5
Onslow County, North Carolina

CLF	FIGURE
Date: July 2008	2
Project: 08-001	

2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Assessment

During late June 2008, five 1-meter square plots were sampled for herbaceous cover. Two plots were located in the *Spartina cynosuroides* area of the marsh, and three were located in the *Spartina patens* area. Plant height, numbers, and percent cover were measured and recorded in each plot. Plots were located as close as possible to the corresponding plot designation from the previous monitoring reports. In addition, the methodology from previous monitoring reports was followed and stems were not counted in the *Spartina patens* plots. The general condition of the marsh was assessed, and potential problem areas were also examined.

2.1.1 Soil Data

General soil conditions found onsite, including level of erosion and percentage of organic matter, are summarized in Table 5.

Table 5. Preliminary Soil Data

Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)

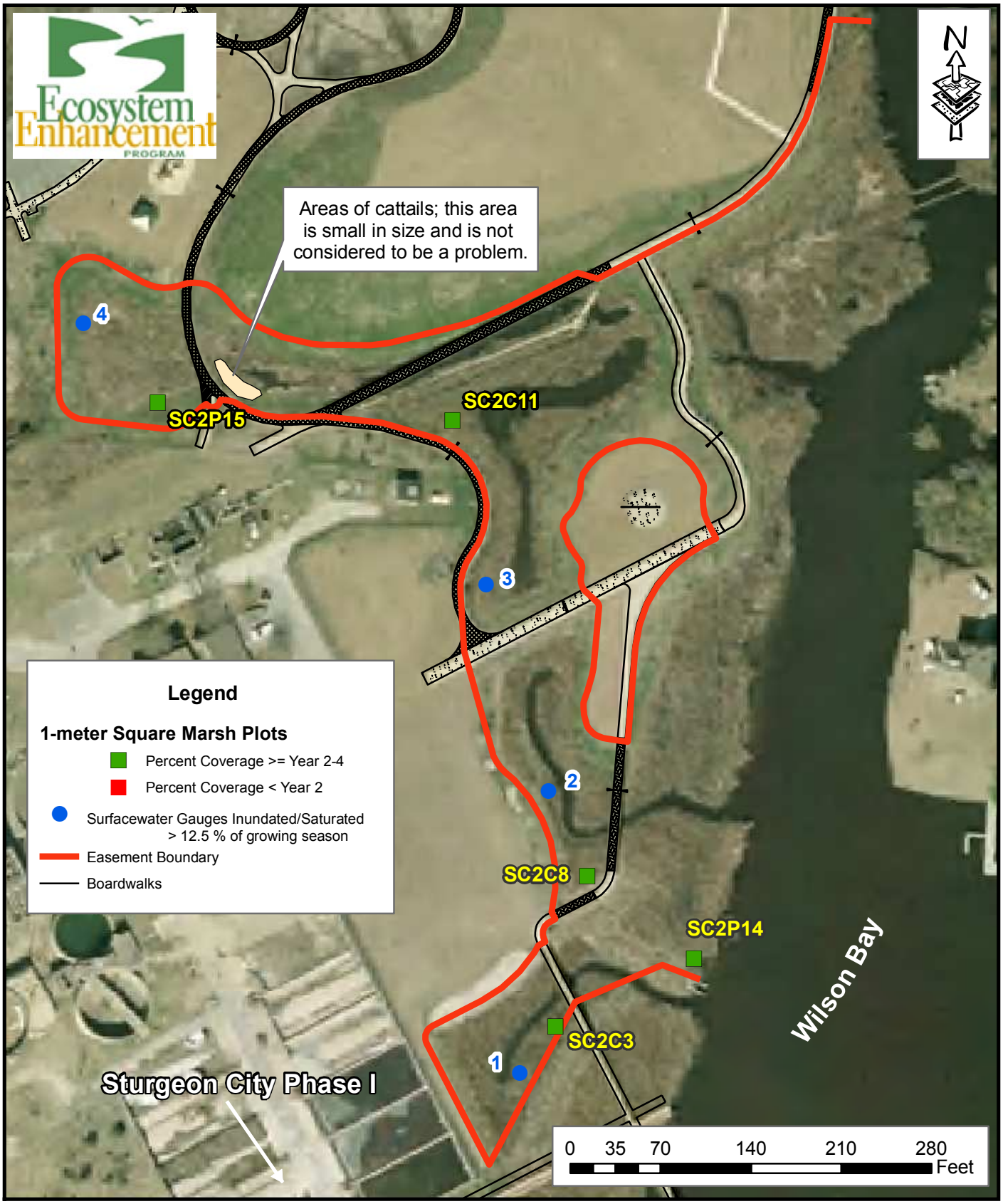
Series	Max Depth (inches)	% Clay on Surface	K	T	OM %
Wando	85	1	0.1	5	<1
Pactolus	72	2-12	0.1	5	0.5-2

2.1.2 Vegetative Problem Areas

No vegetation problem areas were identified within the Site during year 5 (2008) annual monitoring.

2.1.3 Stem Counts

Marsh vegetation was assessed by sampling five 1-meter by 1-meter plots using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee et al. 2006) (http://cvs.bio.unc.edu/methods.htm); two plots are located in the *Spartina cynosuroides* area of the marsh and three in the *Spartina patens* area. Percent cover from year 4 (2007) are summarized in Table 6 and vegetation trends for the five monitoring years are summarized in Table 7. The taxonomic standard for vegetation used for this document was *Flora of the Carolinas, Virginia,Georgia, and Surrounding Areas* (Weakley 2007). No reference area was studied; therefore, no comparisons could be made to reference conditions.



Axiom Environmental, Inc
2126 Rowland Pond Drive
Willow Spring, NC 27592
(919) 215-1693
(919) 341-3839 fax

MONITORING RESULTS
WILSON BAY (STURGEON CITY) PHASE II
EEP Project Number 367
2008 Annual Monitoring Year 5 of 5
Onslow County, North Carolina

CLF

Date: Dec 2008

Project: 08-001

FIGURE 3

Table 6. Marsh Stem Counts

Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)

Desired Species	Plot	Stem Count	Height (meters)	Percent Coverage of Desired Species	Notes Other Plants within Plots
Spartina cynosuroides	C3	NA	2.0	80	*Scirpus* sp. – 10% cover
	C8	NA	2.3	100	--
	C11	NA	2.0	80	--
Spartina patens	P14	NA	0.9	55	*S. cynosuroides* - 5% cover, *Solidago* sp., various grass species – 5% cover, matted grasses – 35% cover
	P15	NA	1.2	80	*S. cynosuroides* - 15% cover, *Paspalum urvillei, Ipomea* sp., *Hydrocotyle* sp. - 5% cover

Table 7. Vegetation Trends

Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number .00091)

Lower Marsh (*Spartina cynosuroides*) Data Range				
Monitoring Year	**Firm**	**Stem Count**	**Height (meters)**	**Percent Cover**
2004 (year 1)	No measurements taken			
2005 (year 2)	BLWI	47-78	1.4-3.3	45-60
2006 (year 3)	AXE	48-71	2.2-2.4	30-60
2007 (year 4)	AXE	Not applicable	2.4-2.8	70-100
2008 (year5)	AXE	Not applicable	2.0-2.3	80-100
Upper Marsh (*Spartina patens*) Data Range				
Monitoring Year	**Firm**	**Stem Count**	**Height (meters)**	**Percent Cover**
2004 (year 1)	No measurements taken			
2005 (year 2)	BLWI	Not applicable	0.45-1.3	40-50
2006 (year 3)	AXE	Not applicable	0.9-2.3	50-70
2007 (year 4)	AXE	Not applicable	0.7-1.0	40-80
2008 (year 5)	AXE	Not applicable	0.9-1.2	55-80

Site vegetation success will be determined based on year-to-year comparisons of the stem counts, plant heights, and will require 75 percent coverage of marsh species at the end of the five-year monitoring period.

The average percent coverage within the lower marsh (*Spartina cynosuroides*) was between 80 and 100 percent coverage with *Spartina cynosuroides* and within the upper marsh (*Spartina patens*) was between 55 and 80 percent coverage with *Spartina patens* for year 5 (2008) monitoring. The average percent coverage across the Site is increasing and should be considered successful.

2.1.4 Vegetation Plot Photos

Photographs taken in the vegetation monitoring area are included in Appendix A; locations of each are depicted on Figure 2. The photographs show that the marsh grasses are growing well and the Site is functioning as a brackish marsh wetland system.

2.2 Wetland Assessment

Four surfacewater monitoring gauges have been maintained and monitored throughout the year 5 (2008) growing season. The gauges are located within the *Spartina cynosuroides* area between the 1 and 1.5-foot contours and record daily readings of the groundwater levels. Daily rainfall data recorded from a rain gauge maintained and monitored at the nearby New River Station in Jacksonville, North Carolina was used for seasonal comparison (Weather Underground 2008). The graphs of groundwater hydrology and precipitation are included in Appendix B.

No specific success criteria were established for this project; however, hydrologic success is based on sufficient Site flooding to support the marsh vegetation. General success criteria for wetland groundwater hydrology require inundation or saturation within 12 inches of the ground surface for a consecutive period of 12.5 percent of the growing season. The growing season in Onslow County begins April 8 and ends November 5 (212 days).

Surfacewater gauges provided unreliable data during year 2 (2005) monitoring and no gauge data is available for years 1 and 2 (2004 and 2005) monitoring. The gauge graphs for years 3 through 5 (2006-2008) are included in Appendices B-D. The following table summarizes success criteria achievement for surfacewater gauges over the monitoring period.

Groundwater hydrology within 12 inches of the soil surface occurred for greater than 12.5 percent of the growing season for the year 5 (2008) growing season. Site hydrology supports a coastal marsh as evidenced by sufficient flooding to support the growth of brackish marsh vegetation, the establishment of native volunteer salt marsh species, and the continued development of a native coastal marsh vegetative community structure. In summary, the Site is stable, the desired plant communities are developing, the plants are healthy, and the marsh has an aesthetic appeal.

Table 8. Summary of Groundwater Gauge Results for Years 1 through 5 Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project Number 367)					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season Saturated or Inundated within 12 inches of the Ground Surface (Percentage)				
	Year 1 (2004)	Year 2 (2005)	Year 3 (2006)	Year 4 (2007)	Year 5 (2008)
1	No Data*	No Data*	Yes/212 days (100 %)	Yes/212 days (100 %)	Yes/212 days (100 %)
2	No Data*	No Data*	Yes/36 days (17.0 %)	Yes/37 days (17.5 %)	Yes/71 days (33.5 %)
3	No Data*	No Data*	Yes/69 days (32.5 %)	Yes/176 days (83.0 %)	Yes/212 days (100 %)
4	No Data*	No Data*	Yes/212 days (100 %)	Yes/212 days (100 %)	Yes/212 days (100 %)
Gauge	Percentage of Growing Season the Ground Surface was Inundated				
	Year 1 (2004)	Year 2 (2005)	Year 3 (2006)	Year 4 (2007)	Year 5 (2008)
1	No Data*	No Data*	71	92	92
2	No Data*	No Data*	11	23	30
3	No Data*	No Data*	33	40	67
4	No Data*	No Data*	58	95	93

* - The surfacewater gauges provided unreliable data during year 2 (2005) monitoring and no data is available for years 1 or 2 (2004 or 2005).

2.2.1 Wetland Problem Area Plan View

No wetland problem areas have been identified during the year 5 (2008) monitoring year.

2.2.2 Wetland Criteria Attainment

All monitored gauges within restoration areas were inundated/saturated within 12 inches of the surface for greater than 12.5 percent of the growing season with sufficient flooding to support brackish marsh vegetation (Table 9). Hydrographs containing precipitation data for each gauge can be found in Appendix B. Percent coverage of planted species is increasing since year 2 (2005) monitoring. Photographs within the Site can be found in Appendix A.

Table 9. Wetland Criteria Attainment for Year 5 (2008) Wilson Bay (Sturgeon City) Wetland Restoration Phase II (EEP Project 367)						
Gauge ID	Hydrology Threshold Met?	Hydrophytic Vegetation Criteria Met?	Site Mean	Vegetation Plot ID	Vegetation Survival Threshold Met?	Site Mean
1	Yes	Yes	100 %	C3	Yes	100 %
2	Yes	Yes		C8	Yes	
3	Yes	Yes		C11	Yes	
4	Yes	Yes		P14	Yes	
				P15	Yes	

4.0. REFERENCES

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

United States. Department of Agriculture (USDA). 1992. Soil Survey of Onslow County, North Carolina. United States Department of Agriculture.

Weakley, Alan S. 2007. Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas (online). Available: http://www.herbarium.unc.edu/WeakleysFlora.pdf [February 1, 2008]. University of North Carolina Herbarium, North Carolina Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.

Weatherground. 2008. New River MCAS Station in Jacksonville, North Carolina. (online). Available: http://www.wunderground.com/cgi-bin/findweather/getForecast?query=jacksonville%2C+nc [October 26, 2008]. Weather Underground.

APPENDIX A

VEGETATION MONITORING PLOT PHOTOGRAPHS

Appendix A

Vegetation Monitoring Photographs

Taken June 26, 2008

Photographs 1-8: Panoramic from east to south to west looking towards the Site.

Picture 9

Picture 10

Picture 11

Vegetation Monitoring Photographs (cont'd)

Taken June 26, 2008

Picture 12

Picture 13

Picture 14

Picture 15

Picture 16

Vegetation Monitoring Photographs (cont'd)

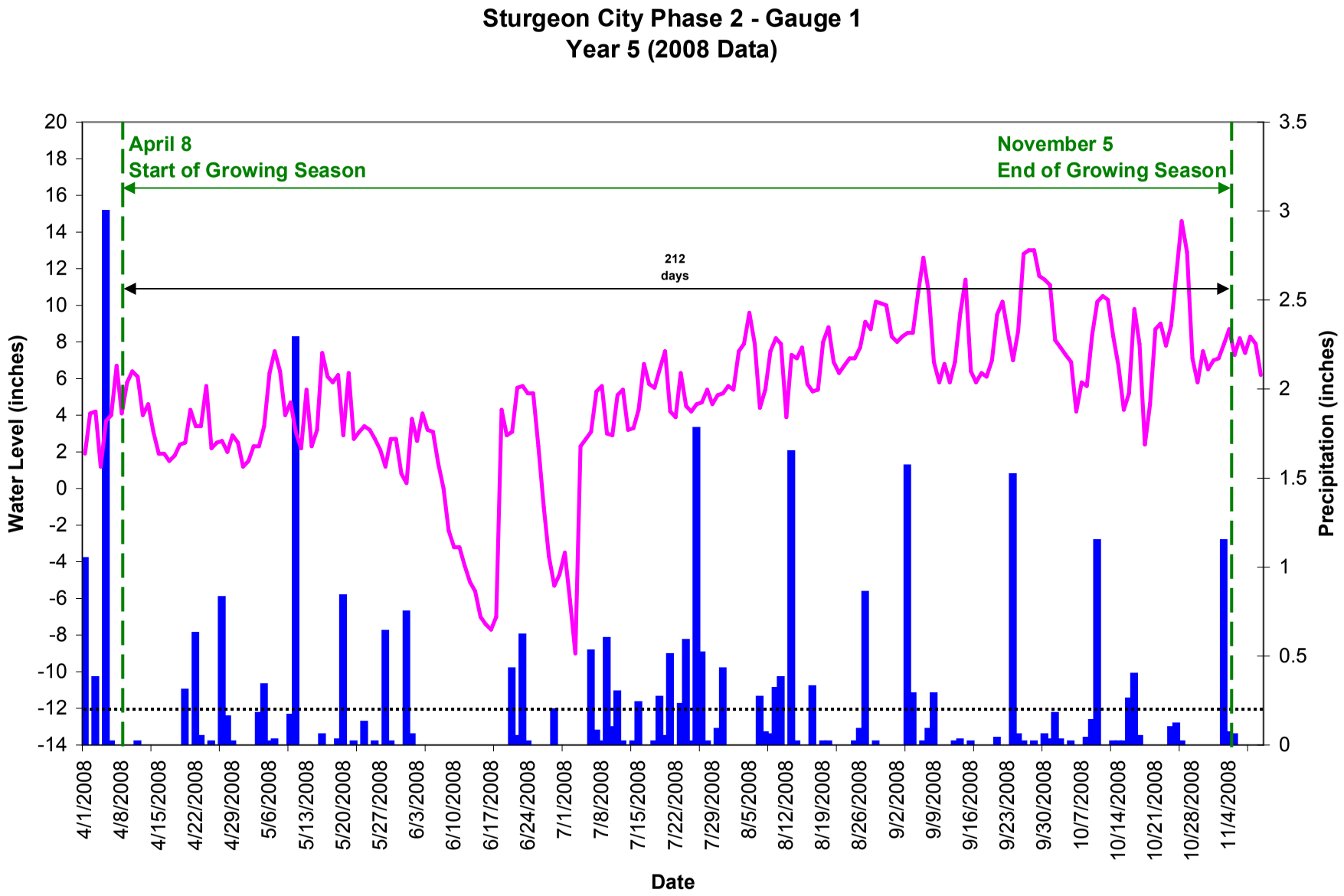
Taken June 26, 2008

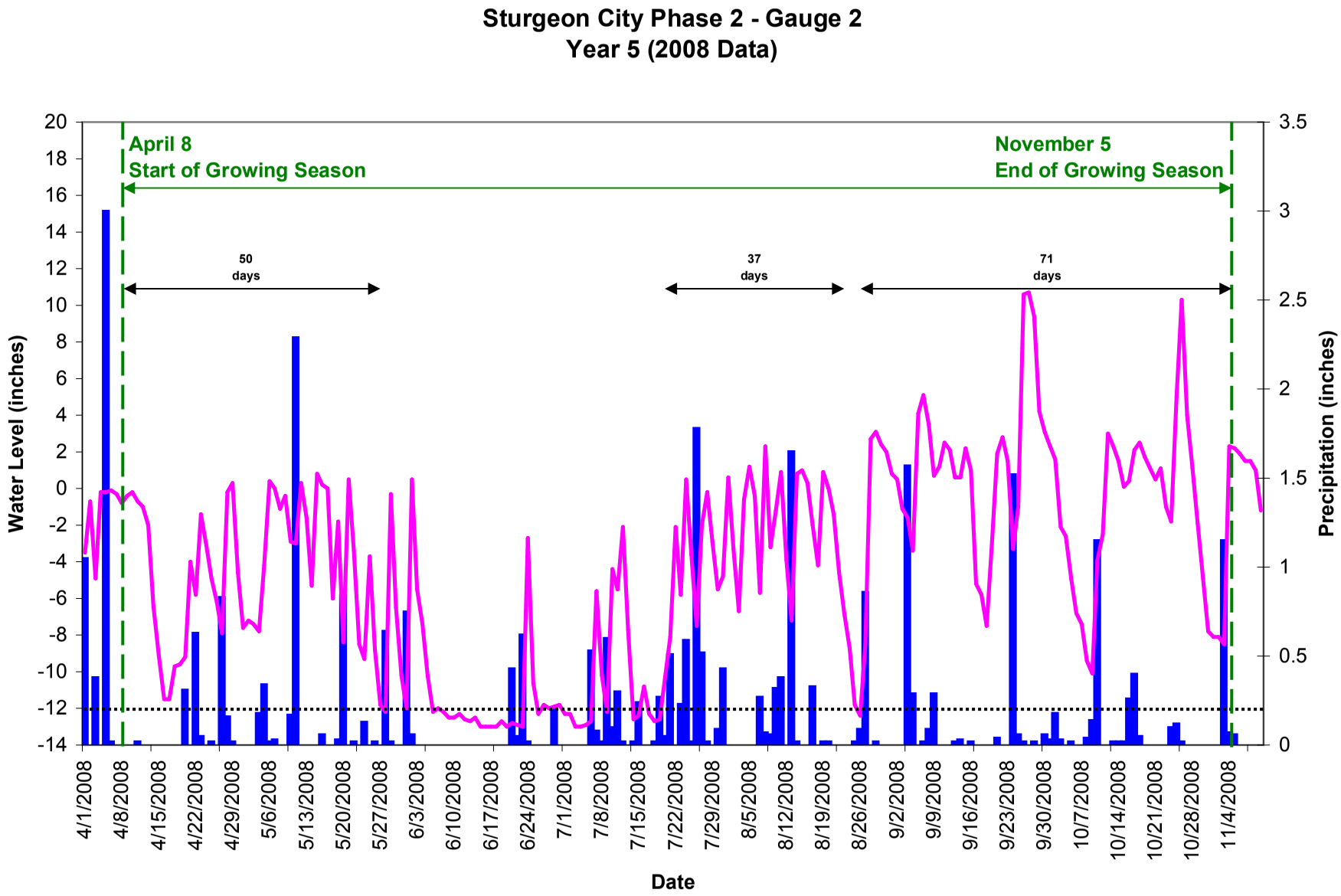
Picture 17

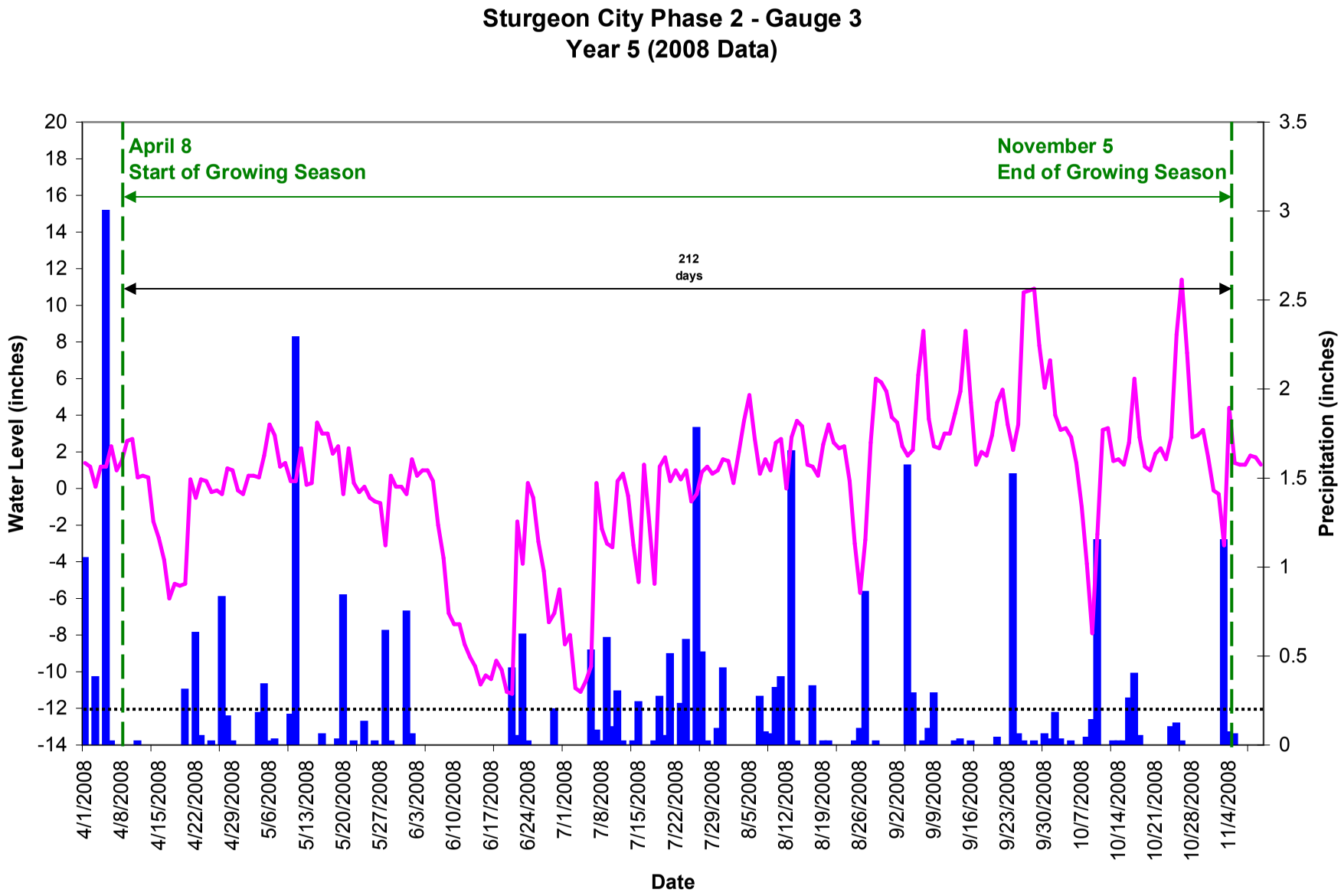
Picture 18

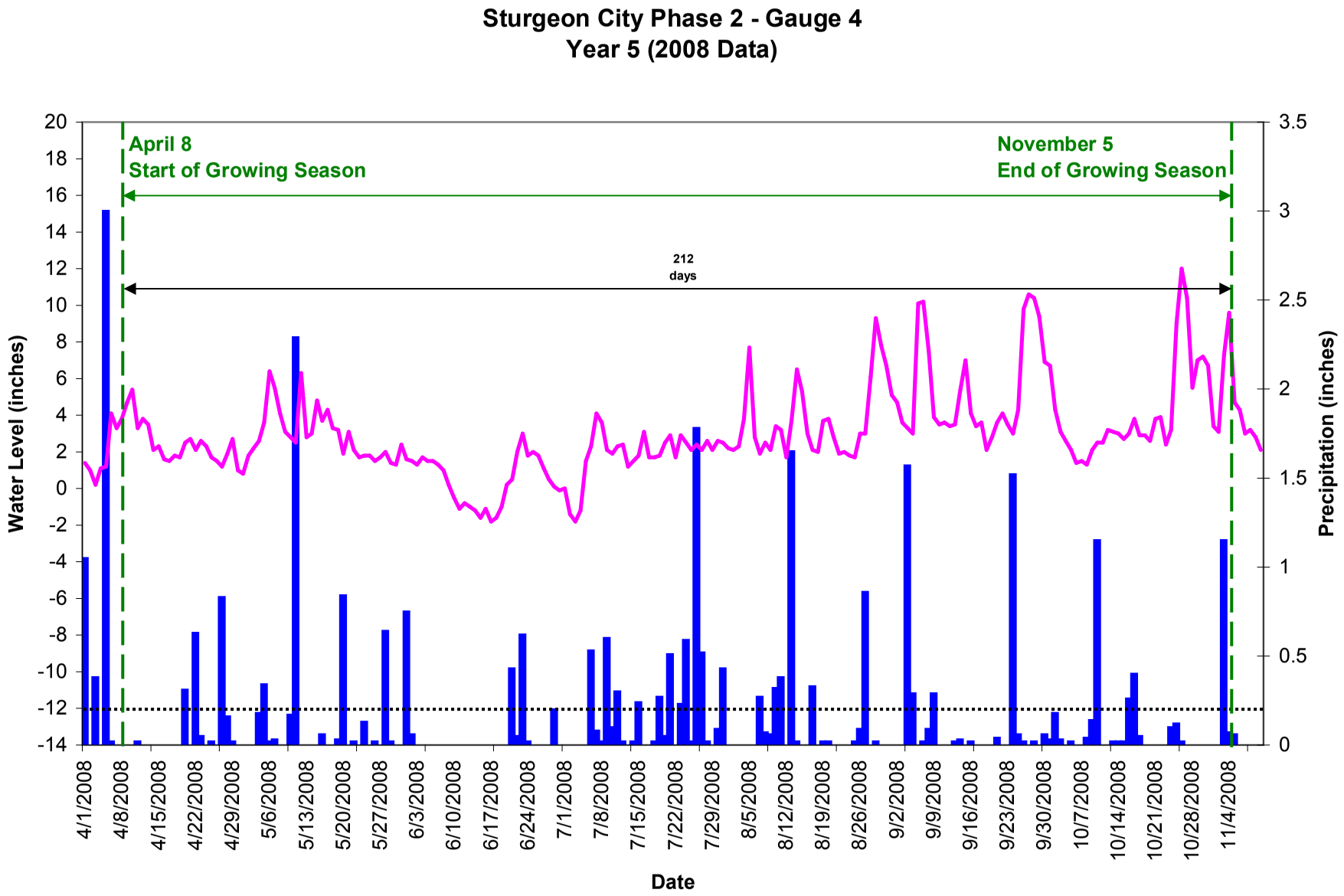
APPENDIX B

YEAR 5 (2008) GROUNDWATER GAUGE GRAPHS


Sturgeon City Phase 2 - Gauge 1
Year 5 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008

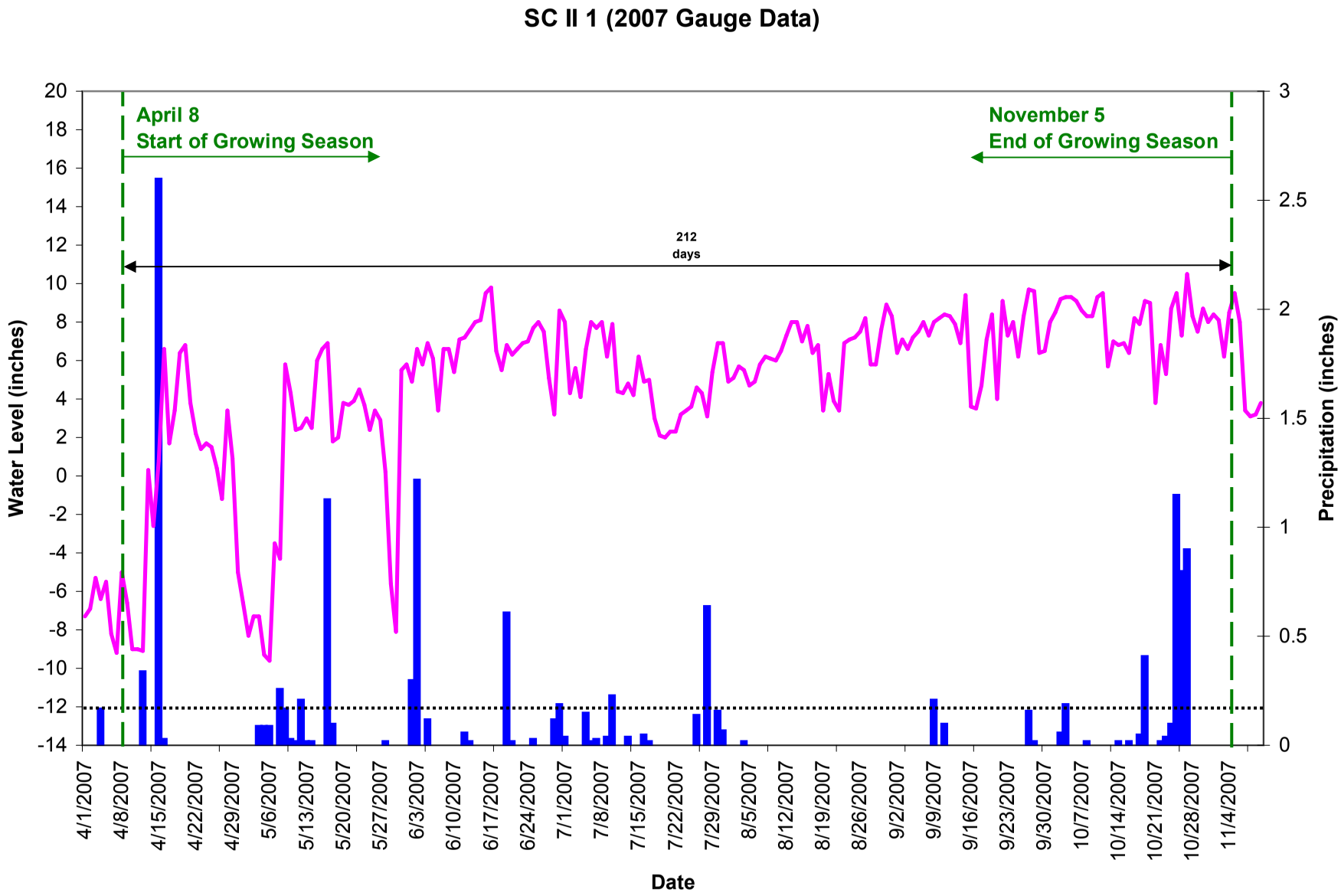

Sturgeon City Phase 2 - Gauge 2
Year 5 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
50
days
37
days
71
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008

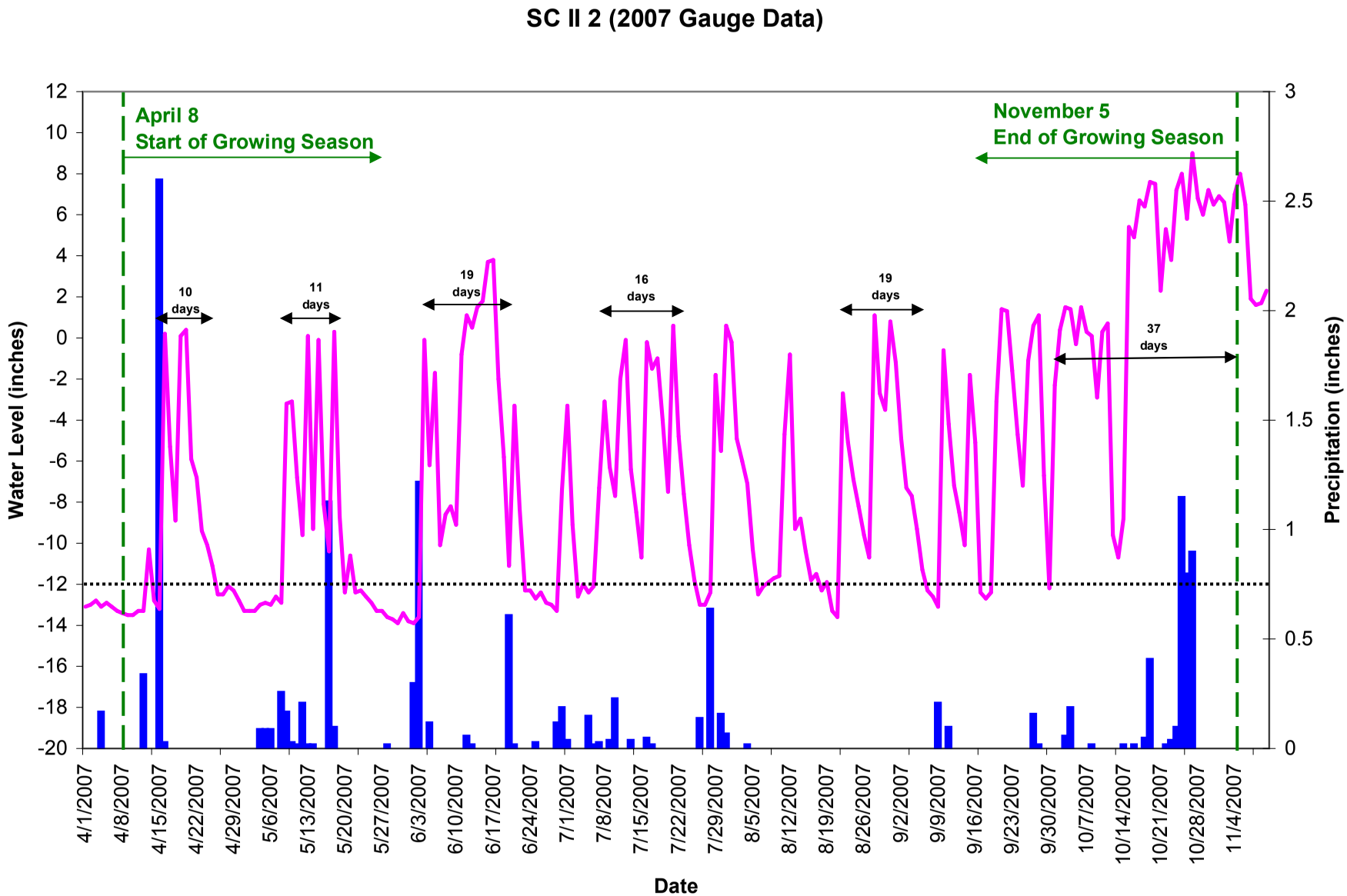

Sturgeon City Phase 2 - Gauge 3
Year 5 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008

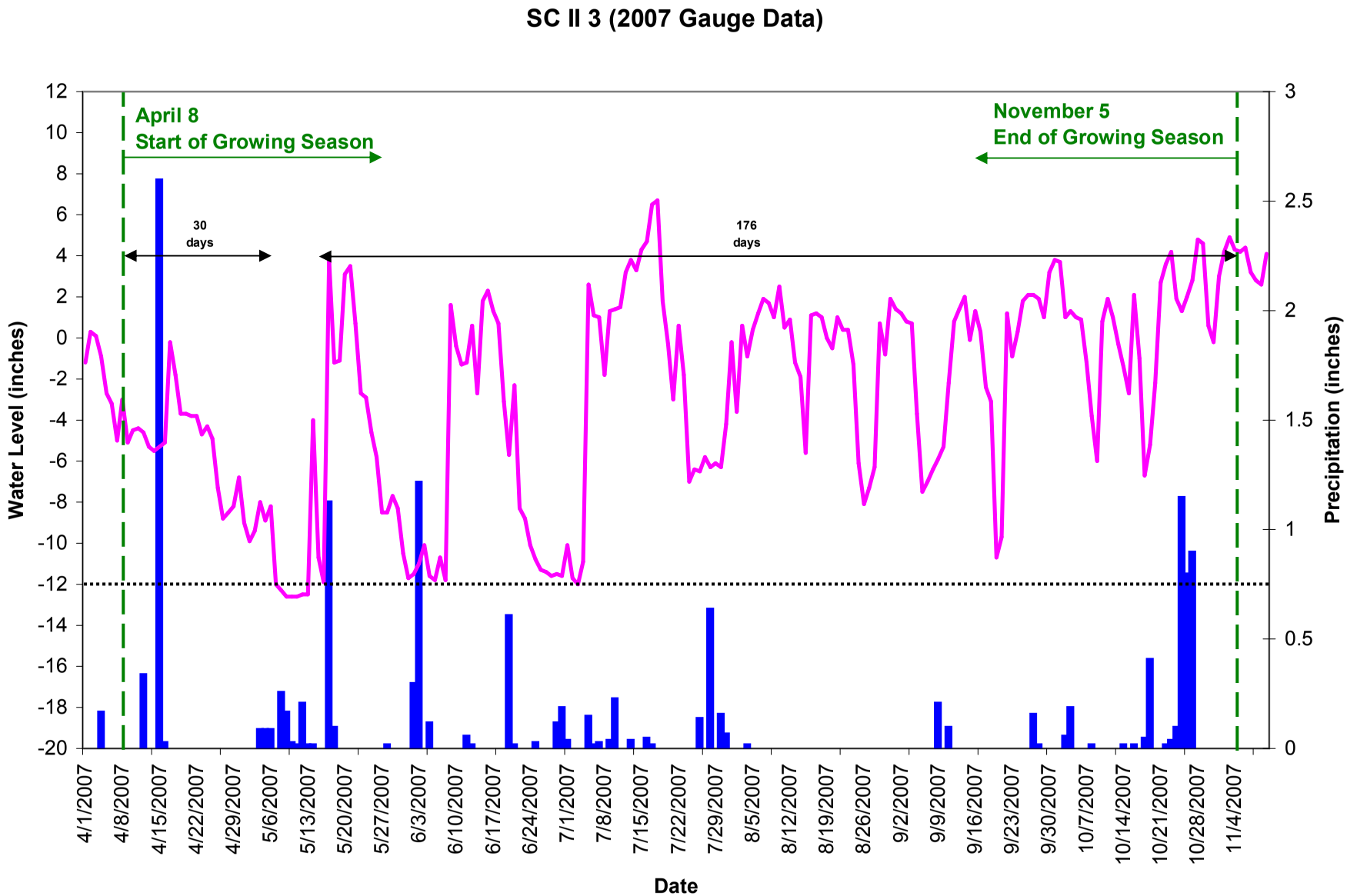

Sturgeon City Phase 2 - Gauge 4
Year 5 (2008 Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2008
4/8/2008
4/15/2008
4/22/2008
4/29/2008
5/6/2008
5/13/2008
5/20/2008
5/27/2008
6/3/2008
6/10/2008
6/17/2008
6/24/2008
7/1/2008
7/8/2008
7/15/2008
7/22/2008
7/29/2008
8/5/2008
8/12/2008
8/19/2008
8/26/2008
9/2/2008
9/9/2008
9/16/2008
9/23/2008
9/30/2008
10/7/2008
10/14/2008
10/21/2008
10/28/2008
11/4/2008

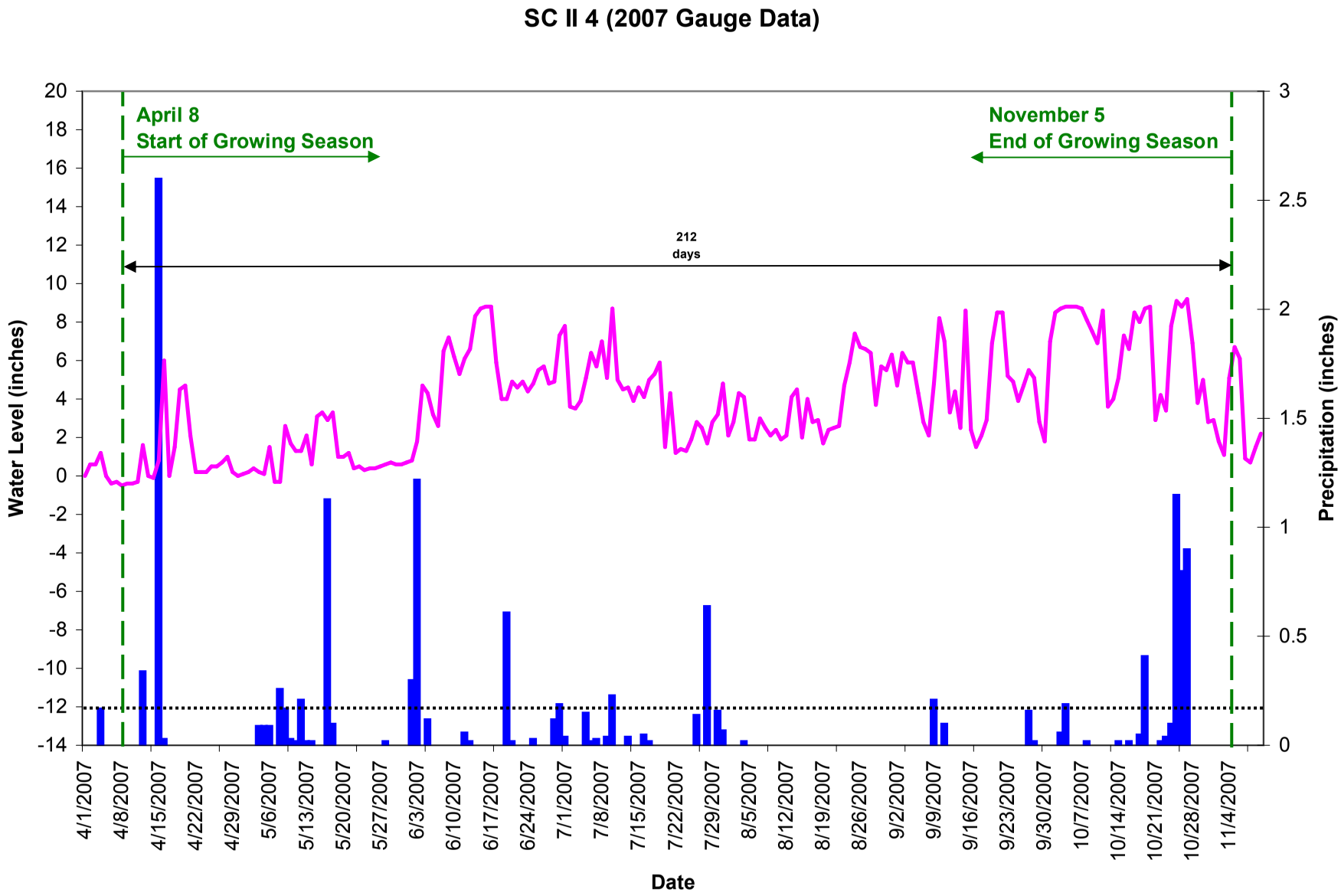
APPENDIX C

YEAR 4 (2007) GROUNDWATER GAUGE GRAPHS


SC II 1 (2007 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
3
2.5
2
1.5
1
0.5
0
4/1/2007
4/8/2007
4/15/2007
4/22/2007
4/29/2007
5/6/2007
5/13/2007
5/20/2007
5/27/2007
6/3/2007
6/10/2007
6/17/2007
6/24/2007
7/1/2007
7/8/2007
7/15/2007
7/22/2007
7/29/2007
8/5/2007
8/12/2007
8/19/2007
8/26/2007
9/2/2007
9/9/2007
9/16/2007
9/23/2007
9/30/2007
10/7/2007
10/14/2007
10/21/2007
10/28/2007
11/4/2007

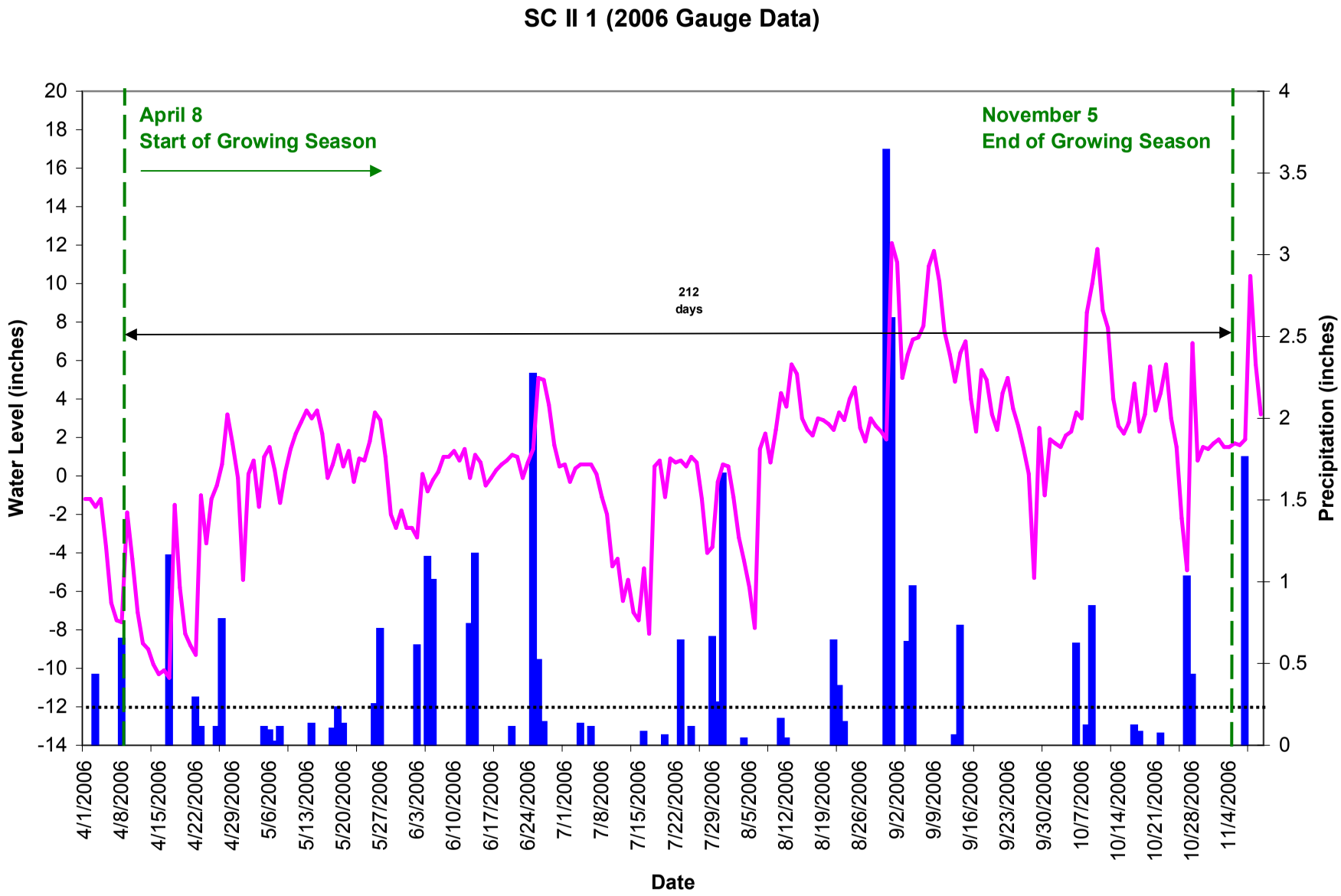

SC II 2 (2007 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
10 days
11 days
19 days
16 days
19 days
37 days
Water Level (inches)
Precipitation (inches)
Date
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
3
2.5
2
1.5
1
0.5
0
4/1/2007
4/8/2007
4/15/2007
4/22/2007
4/29/2007
5/6/2007
5/13/2007
5/20/2007
5/27/2007
6/3/2007
6/10/2007
6/17/2007
6/24/2007
7/1/2007
7/8/2007
7/15/2007
7/22/2007
7/29/2007
8/5/2007
8/12/2007
8/19/2007
8/26/2007
9/2/2007
9/9/2007
9/16/2007
9/23/2007
9/30/2007
10/7/2007
10/14/2007
10/21/2007
10/28/2007
11/4/2007

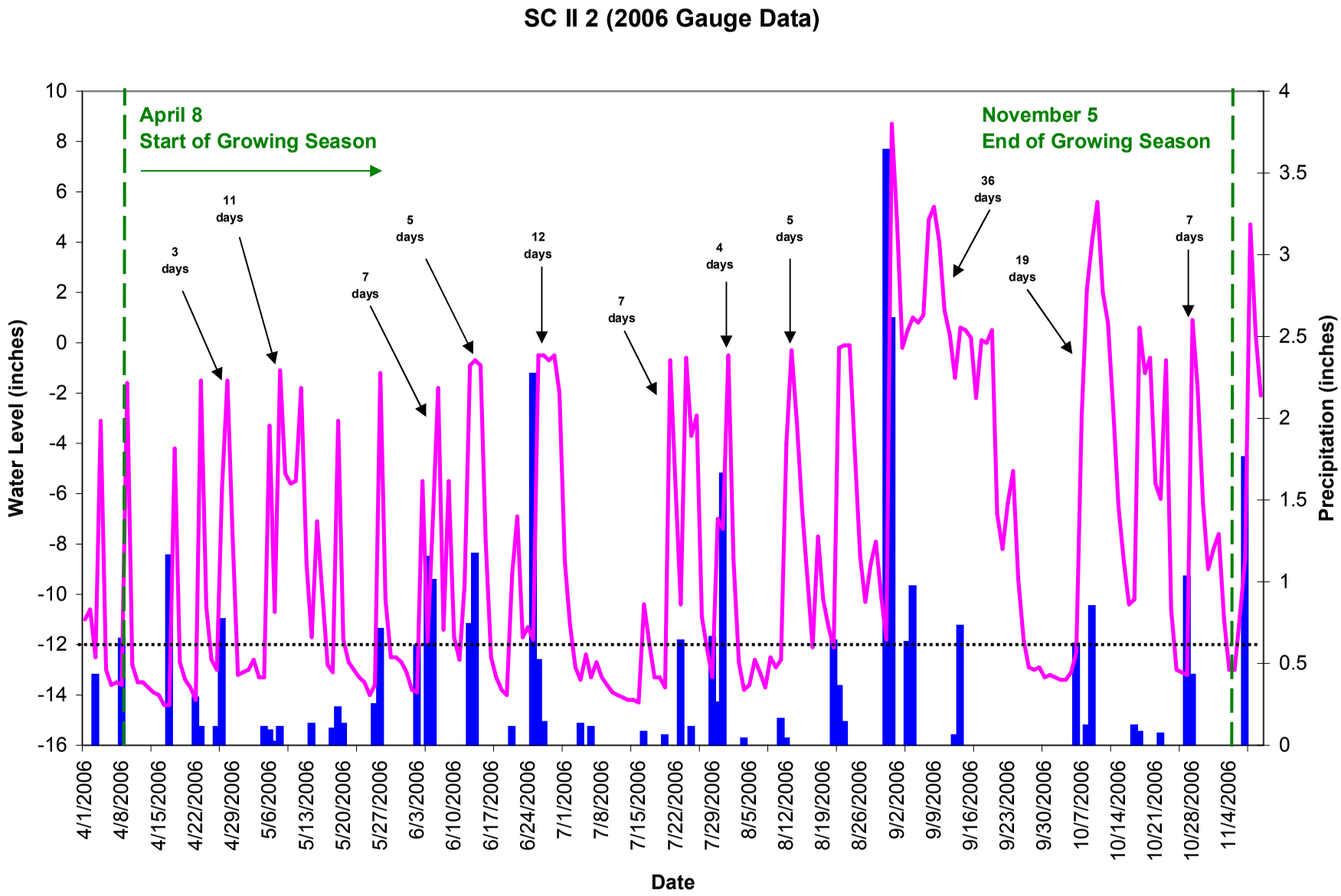

SC II 3 (2007 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
30
days
176
days
Water Level (inches)
Precipitation (inches)
Date
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
3
2.5
2
1.5
1
0.5
0
4/1/2007
4/8/2007
4/15/2007
4/22/2007
4/29/2007
5/6/2007
5/13/2007
5/20/2007
5/27/2007
6/3/2007
6/10/2007
6/17/2007
6/24/2007
7/1/2007
7/8/2007
7/15/2007
7/22/2007
7/29/2007
8/5/2007
8/12/2007
8/19/2007
8/26/2007
9/2/2007
9/9/2007
9/16/2007
9/23/2007
9/30/2007
10/7/2007
10/14/2007
10/21/2007
10/28/2007
11/4/2007

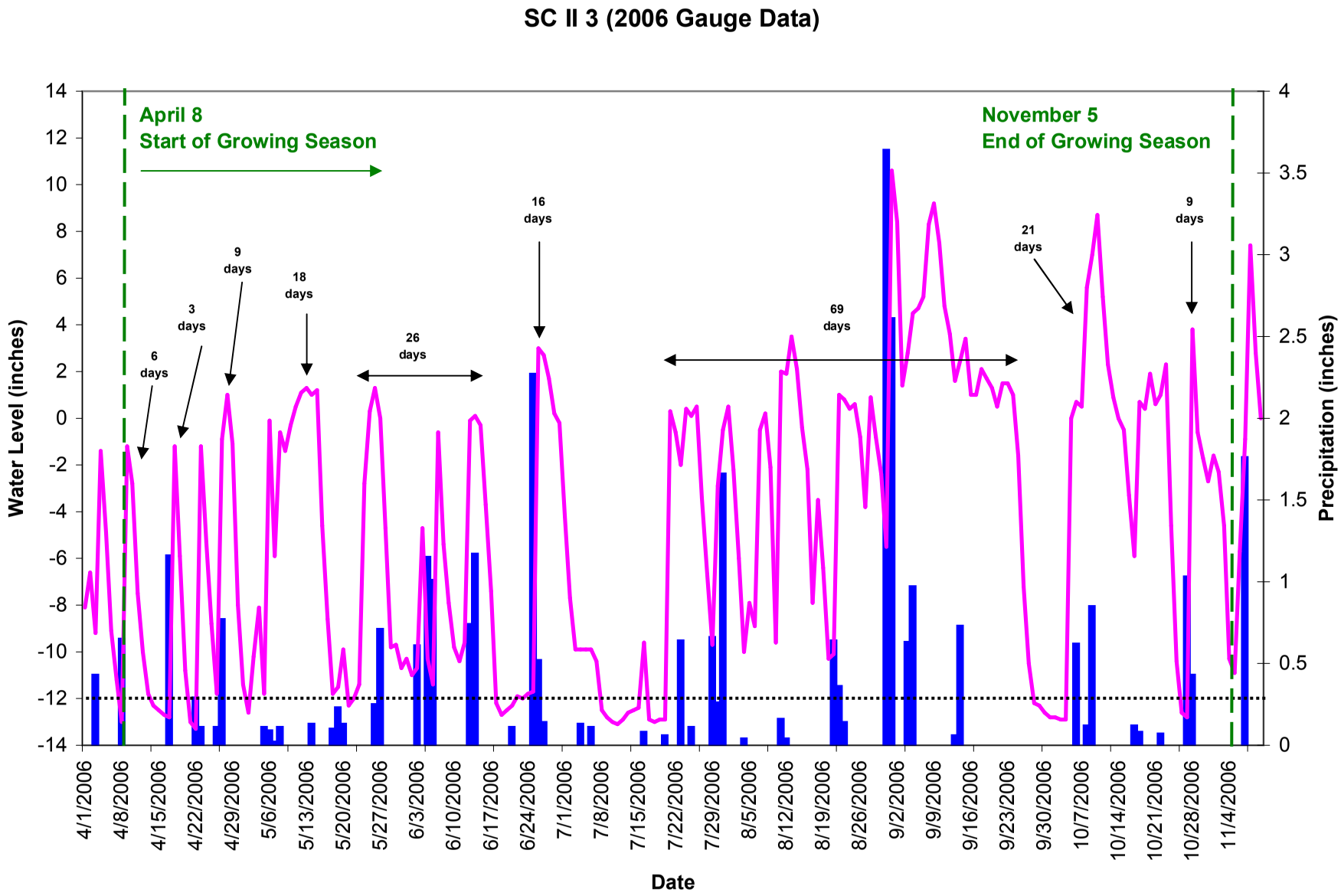

SC II 4 (2007 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
3
2.5
2
1.5
1
0.5
0
4/1/2007
4/8/2007
4/15/2007
4/22/2007
4/29/2007
5/6/2007
5/13/2007
5/20/2007
5/27/2007
6/3/2007
6/10/2007
6/17/2007
6/24/2007
7/1/2007
7/8/2007
7/15/2007
7/22/2007
7/29/2007
8/5/2007
8/12/2007
8/19/2007
8/26/2007
9/2/2007
9/9/2007
9/16/2007
9/23/2007
9/30/2007
10/7/2007
10/14/2007
10/21/2007
10/28/2007
11/4/2007

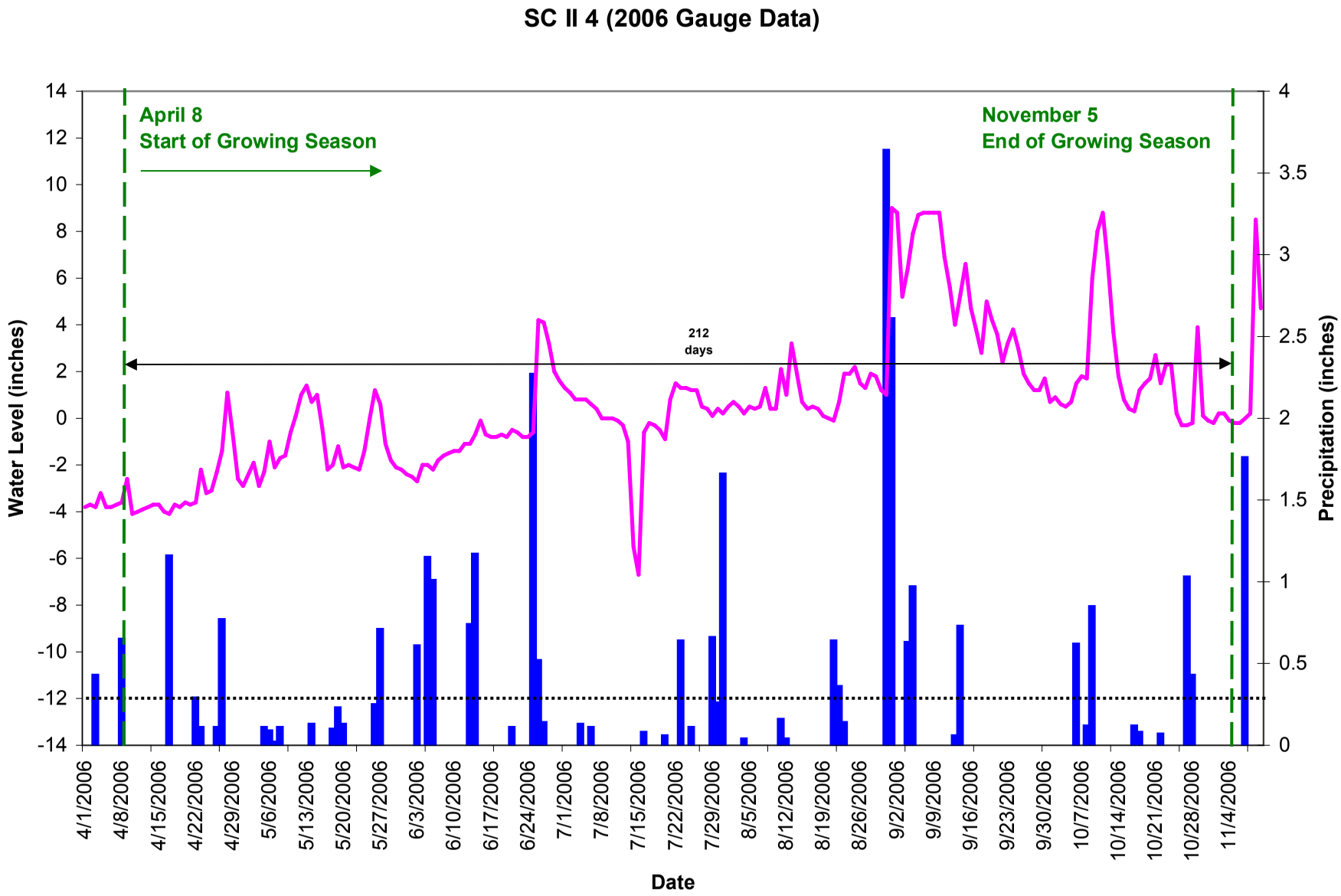
APPENDIX D

YEAR 3 (2006) GROUNDWATER GAUGE GRAPHS


SC II 1 (2006 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
20
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
4
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2006
4/8/2006
4/15/2006
4/22/2006
4/29/2006
5/6/2006
5/13/2006
5/20/2006
5/27/2006
6/3/2006
6/10/2006
6/17/2006
6/24/2006
7/1/2006
7/8/2006
7/15/2006
7/22/2006
7/29/2006
8/5/2006
8/12/2006
8/19/2006
8/26/2006
9/2/2006
9/9/2006
9/16/2006
9/23/2006
9/30/2006
10/7/2006
10/14/2006
10/21/2006
10/28/2006
11/4/2006


SC II 2 (2006 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
3 days
11 days
7 days
5 days
12 days
7 days
4 days
5 days
36 days
19 days
7 days
Water Level (inches)
Precipitation (inches)
Date
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
4
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2006
4/8/2006
4/15/2006
4/22/2006
4/29/2006
5/6/2006
5/13/2006
5/20/2006
5/27/2006
6/3/2006
6/10/2006
6/17/2006
6/24/2006
7/1/2006
7/8/2006
7/15/2006
7/22/2006
7/29/2006
8/5/2006
8/12/2006
8/19/2006
8/26/2006
9/2/2006
9/9/2006
9/16/2006
9/23/2006
9/30/2006
10/7/2006
10/14/2006
10/21/2006
10/28/2006
11/4/2006


SC II 3 (2006 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
6 days
3 days
9 days
18 days
26 days
16 days
69 days
21 days
9 days
Water Level (inches)
Precipitation (inches)
Date
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
4
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2006
4/8/2006
4/15/2006
4/22/2006
4/29/2006
5/6/2006
5/13/2006
5/20/2006
5/27/2006
6/3/2006
6/10/2006
6/17/2006
6/24/2006
7/1/2006
7/8/2006
7/15/2006
7/22/2006
7/29/2006
8/5/2006
8/12/2006
8/19/2006
8/26/2006
9/2/2006
9/9/2006
9/16/2006
9/23/2006
9/30/2006
10/7/2006
10/14/2006
10/21/2006
10/28/2006
11/4/2006


SC II 4 (2006 Gauge Data)
April 8
Start of Growing Season
November 5
End of Growing Season
212
days
Water Level (inches)
Precipitation (inches)
Date
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
4
3.5
3
2.5
2
1.5
1
0.5
0
4/1/2006
4/8/2006
4/15/2006
4/22/2006
4/29/2006
5/6/2006
5/13/2006
5/20/2006
5/27/2006
6/3/2006
6/10/2006
6/17/2006
6/24/2006
7/1/2006
7/8/2006
7/15/2006
7/22/2006
7/29/2006
8/5/2006
8/12/2006
8/19/2006
8/26/2006
9/2/2006
9/9/2006
9/16/2006
9/23/2006
9/30/2006
10/7/2006
10/14/2006
10/21/2006
10/28/2006
11/4/2006