Mason Property Wetland Mitigation Project

Hyde County, NC

2010 Annual Monitoring Report
Year 3

NCEEP Project Number D06001
Tar-Pamlico River Basin

Submitted to
NCDENR/Ecosystem Enhancement Program
2728 Capital Blvd.
Raleigh, NC 27604

Date: December, 2010

Monitoring:
Albemarle Restorations, LLC
P. O. Box 176
Fairfield, NC 27826

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Executive Summary

The Mason Property Wetland Mitigation Site is a riverine and non-riverine wetland restoration project located on U. S. Rt. 264 at Rose Bay in Hyde County, North Carolina. It was constructed by Albemarle Restorations, LLC, under contract with EEP to provide compensatory wetland mitigation credits in the Tar-Pamlico River Basin. Construction activities, in accordance with the approved restoration plan, began March 14, 2007, and were completed on May 14, 2007. The resulting features include a main swamp run and adjacent areas of lower elevation that retain flood water for extended periods. Tree and shrub planting on the project site occurred in May, 2007 using bare-root seedlings and containerized stock from a species list that produced a diverse species mix across the site and throughout the various elevations. Supplemental planting was done in 2009 and again in 2010 in specific areas on the site.

Six water level monitoring gauges were installed in May, 2007 at varying elevations throughout the site to measure subsurface water elevations. Two more gauges were installed at reference sites for hydrology comparison. In 2010, all of the monitoring gauges met the hydrologic success criterion of maintained groundwater levels within 12 inches of the soil surface for 21 consecutive days during the growing season.

Four vegetative monitoring plots were installed and permanently monumented, one coincident with each of four of the monitoring gauges. Their locations ensure an accurate sampling of the entire vegetative community. Each plot is a 10m X 10m square, as recommended by the CVS-EEP Protocol for recording vegetation sampling. In this second year of monitoring, all four plots met the Year 3 success criterion of 320 living planted stems per acre.

Table ES-1 shows the levels of success attained by each of the water level monitoring gauges and the vegetation plots since monitoring began. Success criterion for hydrology is 8% of the growing season (21 days). Table C-1 in Appendix C has a detailed breakdown of hydrologic success. Success criterion for the vegetation plots is 320 live stems per acre (the year 3 criterion for survival).

Table ES-1. Project Success Summary (longest hydroperiod as a percent of the growing season)

	Gauge								Percent	Vegetation Plot				Percent
	1	2	3	4	5	6	7*	8*	Success	1	2	3	4	Success
Year 1 (2008)	38	33	36	34	35	36	61	16	100%	Y	Y	N	N	50%
Year 2 (2009)	55	35	30	51	35	45	46	49	100%	Y	Y	Y	Y	100%
Year 3 (2010)	12	18	19	18	18	18	100	18	100%	Y	Y	Y	Y	100%

* Gauges 7 & 8 are reference gauges and not included in Percent Success

Figures in GREEN made hydrology for 8% of the growing season, figures in RED did not

I. Project Background

1.0 Project Objectives

The goal of the Mason Property Mitigation Project was to create both riverine and non-riverine wetland systems that will accomplish several goals. Primary among those goals is the establishment of functioning wetlands that will aid in flood attenuation and improve water quality on site and downstream. The project is to serve as compensation for wetland loss in the Tar-Pamlico River Basin. The restoration plan was developed and implemented to eliminate pattern drainage and restore topography and hydrology that more closely resembled that of similar undisturbed land. Construction resulted in the development of a broad, frequently flooded swamp run following the historical path as evidenced by aerial photographs and signature topography. Subsequent planting was designed to restore a wetland forest ecosystem that is typically found in the immediate area characteristic of similar soils, topography and hydrology.

The specific project goals and objectives include:

1) Provide floodflow attenuation.
2) Water quality improvement through sediment, toxicant, and nutrient retention and reduction.
3) Slow over bank flow rates and provide storage and desynchronization of flood waters.
4) Alleviate downstream flooding issues by lessening the effect of pulse or flashy flows.
5) Provide shading through forest cover to reduce algae growth and associated low dissolved oxygen levels in surface water moving through the site.
6) The production and export of food sources.
7) The creation of wildlife habitat and recreational opportunities.

2.0 Project Structure, Restoration Type, and Approach

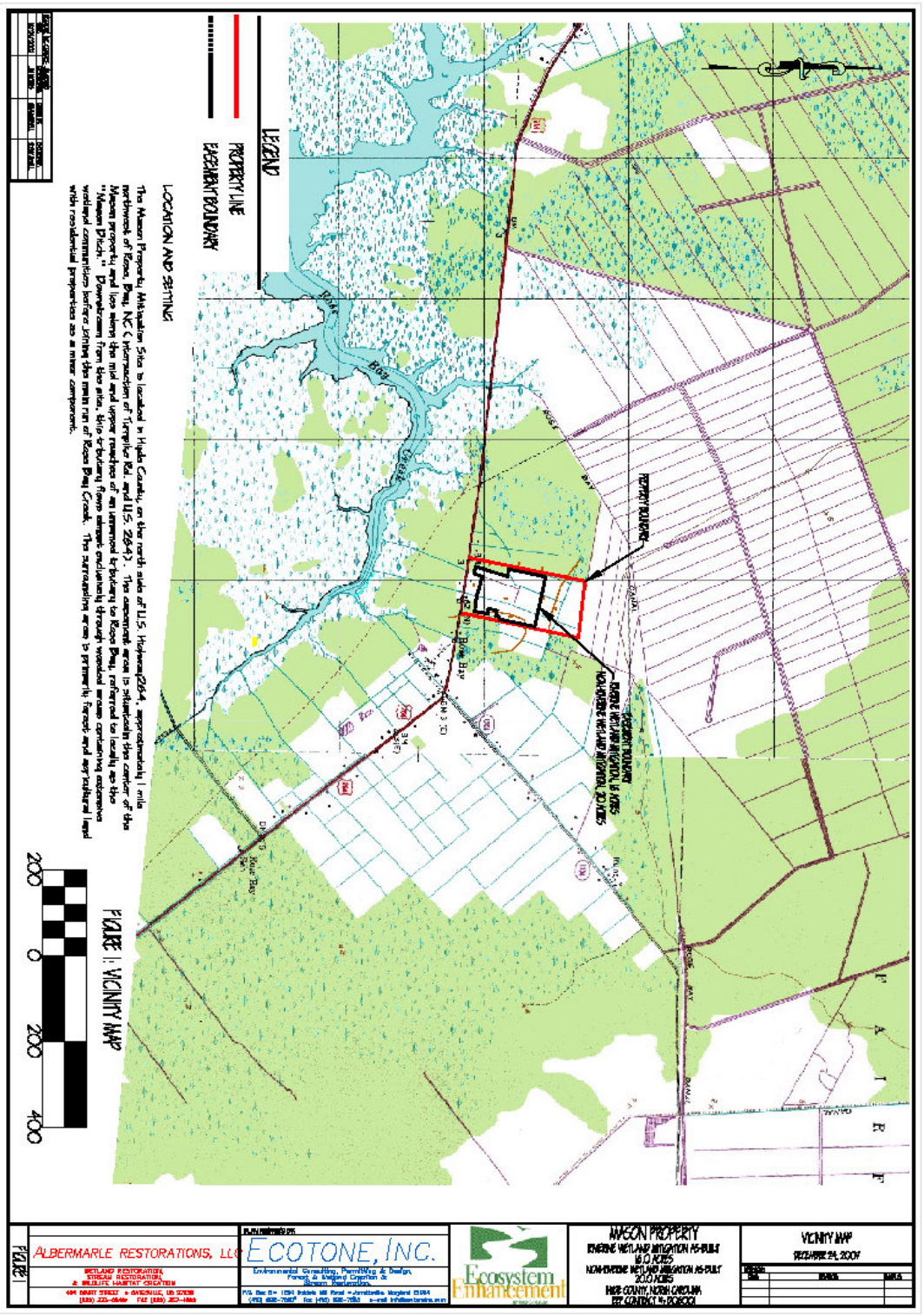
Table I lists the estimated wetland acreage by community type to be restored on the Mason Property. The mitigation plan provides for the restoration of 16.0 acres of riverine wetlands and 20.0 acres of non-riverine wetlands. The 36.0 acre easement area is located within the boundaries of the larger Mason farm which has been used for row crop production. The project area was bisected by a deep drainage ditch that acted as a stream that ran from north to south through the property. Degradation to the channel and surrounding areas by past agricultural activities, including channel straightening and planting of row crops up to the channel edges had eliminated any significant natural habitat on the site and allowed excessive nutrient and sediment accumulation in the channel. Construction, in accordance with the approved restoration plan, began in March of 2007 and was completed in May of 2007. The resulting features and topography allow for frequent over bank flooding of the newly created swamp run, which in turn allows for adjacent areas that are lower in elevation to retain water even after stream flow returns to normal.

Table I. Project Restoration Components Mason Property Wetland Mitigation Site/EEP #D06001				
Community Type	**Pre-Existing Acreage**	**Post Construction Acreage**	**Credit Ratio (Restoration WMU)**	**Mitigation Units**
Riverine Wetland	0.0	16.0	1:1	16.0
Non-Riverine Wetland	0.0	20.0	1:1	20.0
			Total	36.0

3.0 Location and Setting

The Mason Property Mitigation Site is located in Hyde County, on the north side of U.S. Highway 264, approximately 1 mile northwest of Rose Bay, NC (intersection of Turnpike Rd. and U.S. 264). The easement area is situated in the center of the Mason property and lies along the mid and upper reaches of an unnamed tributary to Rose Bay, referred to locally as the "Mason Ditch." Downstream from this site, the tributary flows almost exclusively through wooded areas containing extensive wetland communities before joining the main run of Rose Bay Creek. The surrounding area is primarily forest and agricultural land with residential properties as a minor component.

Figure 1 is a location map for the project area. Directions to the site are as follows: travel west from Rose Bay on U.S. Hwy. 264 approximately 1 mile and turn right (north) onto the property. Access to the site is via a farm path.


LEGEND
PROPERTY LINE
EASEMENT BOUNDARY
LOCATION AND SETTING
FIGURE 1: VICINITY MAP
ALBEMARLE RESTORATIONS, LLC
ECOTONE, INC.
Ecosystem Enhancement
MASON PROPERTY
VICINITY MAP
DECEMBER 24, 2009

4.0 Project History and Background

Table II provides the history of data collection and actual completion of various milestones of the Mason Property Wetland Mitigation Site.

Table II. Project Activity and Reporting History Mason Property Wetland Mitigation Project/EEP #D06001		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	June 2006	Novermber 2006
Final Design -90%	June 2006	Novermber 2006
Construction	N/A	May 2007
Temporary S & E mix applied to entire project area	N/A	May 2007
Permanent seed mix applied to entire project area	N/A	May 2007
Containerized and Bare Root Planting	N/A	May 2007
Mitigation Plan/As-built (Year 1 monitoring - baseline)	Oct. 07/Sept. 08	December 2008
Year 2 monitoring	September 2009	January 2010
Year 3 monitoring	September 2010	December 2010
Year 4 monitoring		
Year 5 monitoring		

Points of contact for the various phases of the MPWMS are provided in Table III.

Table III. Project Contacts Mason Property Wetland Mitigation Site/EEP #D06001	
Designer Primary Project design POC	Ecotone, Inc. 1204 Baldwin Mill Road Jarrettsville, MD 21804 Scott McGill (410-692-7500)
Construction Contractor Construction contractor POC	Armstrong, Inc. P. O. Box 96 25852 US Hwy 64 Pantego, NC 27860 Tink Armstrong (252-943-2082)
Planting Contractor Planting contractor POC	Williams Forestry Service, Inc. P. O. Box 189 Millville, PA 17846 Christian Duffy (570-458-0766)
Seeding Contractor Seed planting contractor POC	Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932 Mary-Margaret McKinney (252-482-8491)
Seed mix sources	Earnst Conservation Seeds, LLP, Meadville, PA
Nursery stock suppliers	Williams Forestry Service, Inc., International Paper, Inc.
Monitoring Consultants Wetland and Vegetation POC	Woods, Water and Wildlife, Inc. P. O. Box 176 Fairfield, NC 27826 Ashby Brown (800-509-0190)

Project background information for the MPWMS is provided in Table IV.

Table IV. Project Background Mason Property Wetland Mitigation Site/EEP #D06001	
Project County	Hyde County
Drainage Area	36.0 acres within easement boundary
Drainage impervious cover estimate (%)	0
Physiographic Reion	Coastal Plain
Ecoregion	8.5.1 Middle Atlantic Coastal Plain
Rosgen Classification of As-built	N/A
Cowardin Classification	PEM, PSS, PFO
Dominant Soil Types	Stockade sand loam, Hydeland silt loam, Brookman loam
Reference site ID	Rose Bay, Hyde county, NC
USGS HUC for Project and Reference	03020105
NCDWQ Sub-basin for Project and Reference	03-03-08
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?	Yes, Pamlico River
Reasons for 303d listing or stressor?	Ag, Urban Runoff, Septic
% of project easement fenced	None

5. Monitoring Plan View

Six water level monitoring gauges are installed at key locations across the property in order to assess the groundwater levels throughout the year at various elevations and topographies. These gauges are suspended in two-inch pvc pipe that is set approximately four feet vertically into the ground. Two reference gauges are also installed offsite to provide a means of comparison to naturally functioning wetlands. In addition, a rain gauge is installed on siteto capture and record on-site precipitation.

Vegetation monitoring was done on the four permanent sampling plots. Each plot is referenced by one of four monitoring gauges which serve as the plot origin and as a photo station for that plot. The plots are ten meters square and are situated to give an accurate sample of the planted and natural woody vegetation. For each site, the data recorded matches that required of the *CVS-EEP Protocol for Recording Vegetation, v 4.0, 2006,* level 1-2.

Figures 2 and 3 provide plan views of the site showing all monitoring features including gauges, sampling plots and the rain gauge, soils, contours and plant communities.

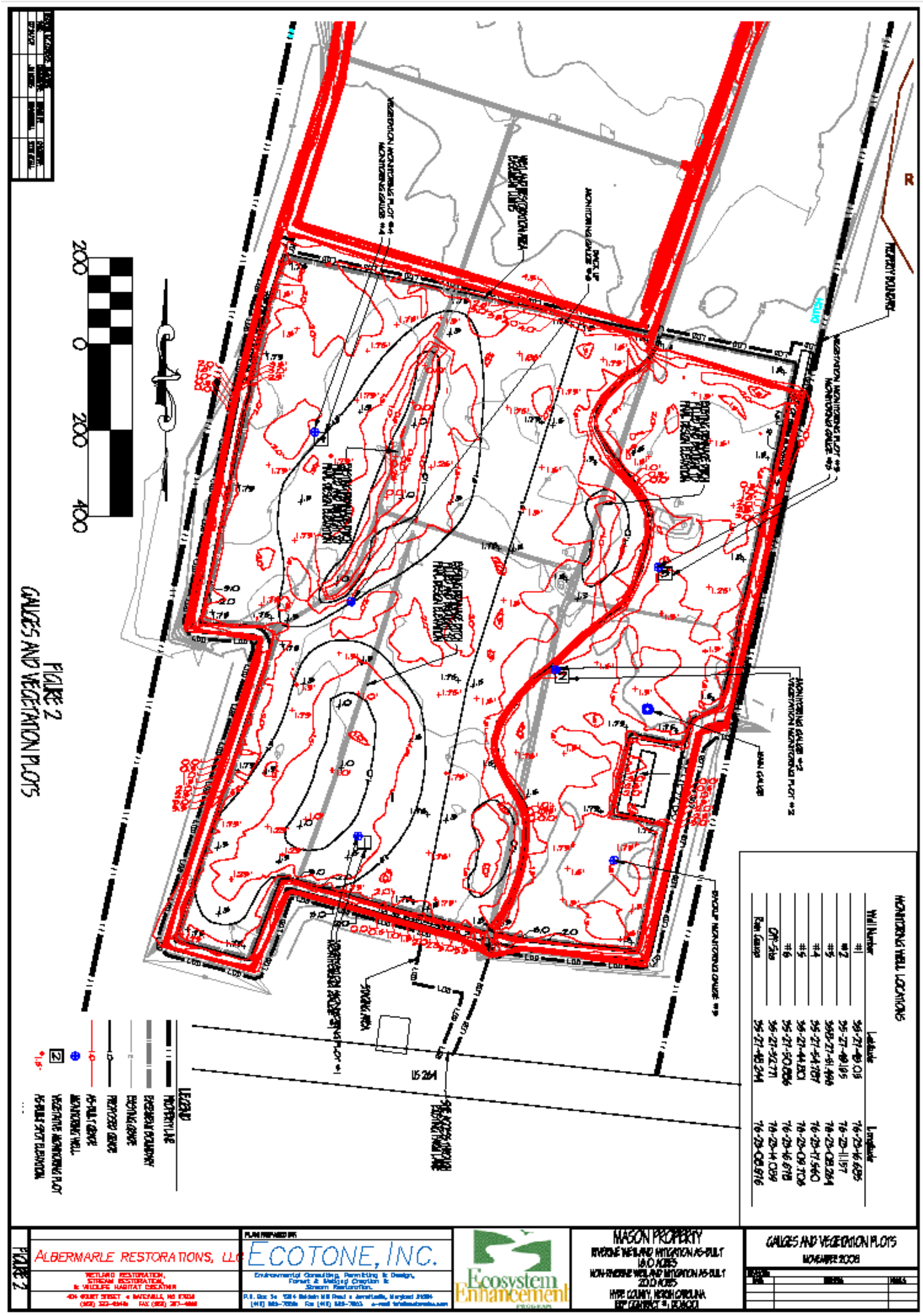
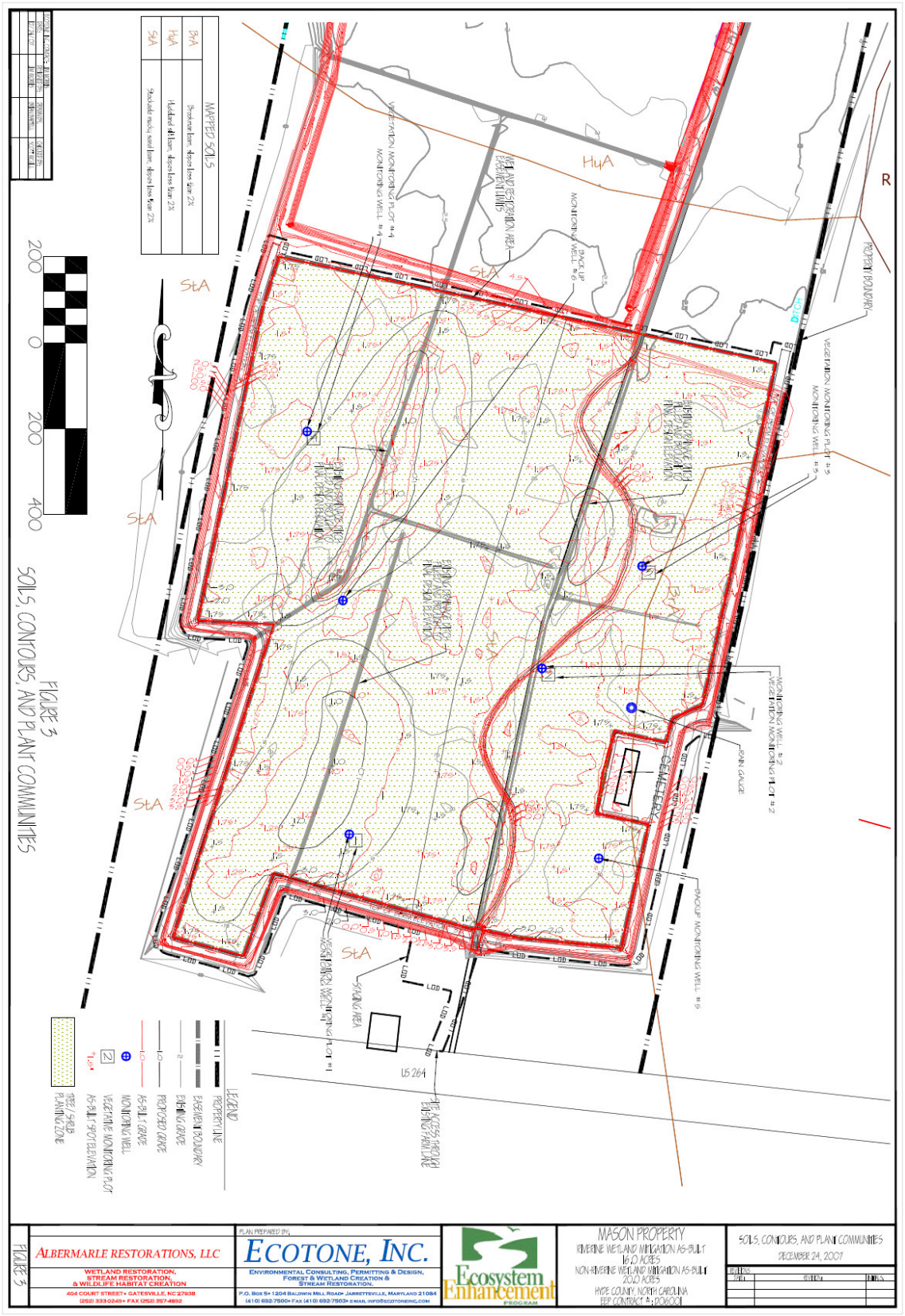


FIGURE 2
GAUGES AND VEGETATION PLOTS
LEGEND
MONITORING WELL LOCATIONS
ALBERMARLE RESTORATIONS, LLC
ECOTONE, INC.
Ecosystem Enhancement Program
MASON PROPERTY
GAUGES AND VEGETATION PLOTS


MAPPED SOILS
StA
HyA
BrA
LEGEND
PROPERTY LINE
EASEMENT BOUNDARY
EXISTING GRADE
PROPOSED GRADE
AS-BUILT GRADE
MONITORING WELL
VEGETATION MONITORING PLOT
AS-BUILT SPOT ELEVATION
TREE / SHRUB PLANTING ZONE
MASON PROPERTY
RIVERINE WETLAND MITIGATION AS-BUILT
16.0 ACRES
NON-RIVERINE WETLAND MITIGATION AS-BUILT
20.0 ACRES
HYDE COUNTY, NORTH CAROLINA
SOILS, CONTOURS, AND PLANT COMMUNITIES
DECEMBER 24, 2007
ALBEMARLE RESTORATIONS, LLC
WETLAND RESTORATION, STREAM RESTORATION, & WILDLIFE HABITAT CREATION
ECOTONE, INC.
ENVIRONMENTAL CONSULTING, PERMITTING & DESIGN, FOREST & WETLAND CREATION & STREAM RESTORATION.
Ecosystem Enhancement PROGRAM
FIGURE 3
SOILS, CONTOURS, AND PLANT COMMUNITIES

II. Project Condition and Monitoring Results

1.0 Vegetation Assessment

The vegetation success criterion was developed in accordance with the CVS-EEP protocol. The Mason project was planned to include various topographies and a contiguous plant community consistent with those found naturally occurring along swamp runs and associated broad hardwood flats. The species mix was based on the vegetation noted at the reference site and all species are classified from FAC to OBL (Table V). The site was originally planted at a rate of 275 stems per acre in May of 2007. In February of 2008, an additional 175 stems per acre were installed bringing the total stocking at the start of the 2008 growing season to 450 stems per acre.

In March of 2010 an additional 2,700 containerized trees were added to bolster stocking levels in areas that appeared to be suffering from salt water damage caused by backflow over the outlet plug during periods of high tide.

Table V. Species by Vegetation Type		
Mason Property Wetland Mitigation Project/EEP #D06001		
Trees		
Common Name	**Scientific Name**	**Wetland Indicator Status**
Bald Cypress	Taxodium distichum	OBL
Red Maple	Acer rubrum var. Trilobum	FACW-
Water tupelo	Nyssa aquatica	OBL
Swamp Black Gum	Nyssa biflora	FAC
Willow Oak	Quercus phellos	FACW-
Swamp White Oak	Quercus bicolor	FACW+
Water Oak	Quercus nigra	FAC
Shrubs		
Common Name	**Scientific Name**	**Wetland Indicator Status**
High Tide Bush	Baccharis halimifolia	FAC
Swamp Cyrilla	Cyrilla racemiflora	FACW
Sweet Pepperbush	Clethra alnifolia	FACW
Virginia Sweetspire	Itea virginica	FACW+
Button Bush	Cephalanthus occidentalis	OBL
Tag Alder	Alnus serrulata	FACW
Wax Myrtle	Myrica cerifera	FAC+
Sweetbay	Magnolia virginiana	FACW+

1.1 Vegetation Discussion and Problem Areas

All four monitoring plots met the Year 3 success criterion of a minimum of 320 stems per acre after the third growing season. Over the entire project, the survival rate averaged 423 planted stems per acre. Local farmers have observed periodic saltwater intrusion and in September of 2010, after the remnants of Tropical Storm Nicole passed up the coast, video evidence of saltwater flowing into the project was captured.

Saltwater flowing into the project will be well diluted when there is ample standing water already in the project, but wind driven high tides can occur during dry periods, and undiluted saltwater will have a much more dramatic effect on tree mortality and growth especially in the first few years as trees are trying to become established after planting. Figure 4 in Appendix D shows the delineation, based on vegetative cover, between the areas that appear to be less susceptible to both saltwater damage and prolonged, deep standing water from those that are more susceptible. The area identified by blue hatching appears to be less prone to water damage.

Water oak (*Q. phellos*), buttonbush (*C. occidentalis*) and bald cypress (*T. distichum*) proved to be the hardiest species as they are all obligate wetland species. During March of 2009, an additional 8,000 stems of water oak and bald cypress were planted to once again bring the density up to approximately 450 stems per acre. The containerized stock that was added in March of 2010 was bald cypress (*T. distichum*) and buttonbush (*C. occidentalis*) as they have been noted to exhibit some tolerance to salinity, were on the original planting schedule for this project, and have survived the site so far. Due to the site's robust wetland hydrology and long periods of inundation, there are few options for site maintenance beyond manual herbaceous competition control to improve tree survival. Herbaceous competition is thought to be a problem secondary to the length of constant inundation and soil salinity levels. Once again in 2010, coffeeweed (*Sesbania herbacia)* began to appear on site and was manually chopped for control, but was still present at the time of vegetation sampling as can be seen in the photos.

1.2 Vegetation Monitoring Plan View (Integrated)

Figure 4 in Appendix D illustrates the development of cover types caused by suspected effects of depth and length of inundation and salinity. Refer to **3.0 Project Success Discussion** for further discussion of developing cover types.

2.0 Wetland Assessment

The hydrologic success criterion is to achieve a minimum of 21 consecutive days where the groundwater level is within 12 inches of the soil surface during the growing season. The growing season for this site is from March 11 to November 27, a period of 261 days (WETS Table for Belhaven, Beaufort County, NC). Success for any particular monitoring location is to show soil saturation to within 12 inches of the surface for 21 consecutive days during that period.

Six continuous monitoring gauges were deployed across the site and two more were installed in reference areas. All six gauges met the success criteria for the site in 2010 as did the two reference gauges.

2.1 Wetland Discussion and Problem Areas

Drainage from the project area can only occur during times when water levels onsite are high enough to overcome the level of the retaining structure at the outfall end of the project *and* the level of the water beyond the outfall end is low enough to accommodate additional runoff which is dependant on daily tidal fluctuations. This combination causes the site to maintain robust hydrology for long periods and even during seasons when rainfall is less than average.

The remnants of the tropical storm in September provided evidence of tidal flows entering the site from the ditch that leads from the site to Rose Bay Creek. Considering the site's close proximity to Rose Bay, wind driven tidal intrusions into the Mason wetland site are expected and are common occurrences in adjacent existing wetland systems in the Rose Bay watershed.

2.2 Wetland Monitoring Plan View (Integrated)

Figure 4, Appendix D indicates the areas discussed above

Table VI. Hydrology and Vegetation Criteria Success by Plot
Mason Property Wetland Mitigation Project/EEP #D06001

Well	Hydrology Success Met	Hydrology Mean	Vegetation Plot	Vegetation Success Met	Vegetation Mean
1	Y	100%	1	Y	100%
2	Y		2	Y	
3	Y		3	Y	
4	Y		4	Y	
5	Y		No Plot	No Plot	
6	Y		No Plot	No Plot	
7	Y (Ref)		Reference Well	Reference Well	
8	Y (Ref)		Reference Well	Reference Well	

3.0 Project Success Discussion

Achieving successful hydrology on the Mason project has not proven to be difficult. Tree survival and growth have been more of a challenge due to the heavy herbaceous cover, high water levels which hamper seedling development and now, as shown by the video evidence from September, 2010, saltwater incursion caused by wind-driven high tide events. Tree survival in 2010 appeared to be at a sustainable level such that minor mortality in the future should not be a problem. Gauges 1, 2 and 3 and their corresponding vegetation plots are located on areas of the project that are most likely to experience prolonged inundation and occasional exposure to saltwater. The herbaceous cover at these gauges/plots is primarily cattails (*Typha latifolia)* and coffeeweed (*Sesbania herbacia),* which are largely absent at gauge/plot 4 where tree growth appears to be better on average and the vegetative cover is more diverse.

The site topography is such that the area around gauge/plot 4 is less subject to minor flooding, though still subject to total inundation during very wet periods and probably less subject to saltwater intrusion. The area shown on Figure 4 in Appendix D (identified by blue cross-hatching) identifies a large portion of the site where this appears to be the case, based on tree growth, species mix and herbaceous cover. There are other smaller pockets, inclusions and ridges that share the same vegetative features, but this area is the largest contiguous acreage of this cover type. This distinction is not made to delineate wetland types, but to assess the

development of the vegetative cover. Saltwater intrusion has been documented (though the extent is unknown) and length of inundation between the two vegetative cover types can vary depending on rainfall patterns. The depth of standing water, the length of time it stands and its salinity levels and combinations of these factors has had an effect on the development of these two distinct cover types.

Further evidence of these effects can be seen by comparing the hydrographs in Appendix C. Gauge 4 does not show the same sensitivity to periodic minor rainfall events as the other gauges, including gauges 5 and 6 (gauge 6 is on the borderline between the two vegetative cover types). During the period from the end of April, when rainfall lessened considerably, until the end of September when Tropical Storm Nicole produced very heavy rainfall, gauge 4 shows less peaks and a generally less sensitive water table than the other five gauges on the project.

III. Methodology Section

Year 3 monitoring for the Mason project occurred in 2010. Monitoring and vegetation sampling procedures were established in the mitigation plan for this project and no deviations were made.

Appendix A

Vegetation Data Tables

Site Photos

1. Vegetation Data Tables

Table 1. Project Summary	
Report Prepared By	Ashby Brown
Date Prepared	10/15/2010 15:42
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	This worksheet, which is a summary of the project and the project data.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
ALL Stems by Plot and spp	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	D06001
project Name	Mason Riverine
Description	Mason Riverine wetland project in Hyde county, NC
River Basin	Tar-Pamlico
Sampled Plots	4

Table 2. Vigor by Species							
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**
	Cephalanthus occidentalis	3	1				
	Clethra alnifolia						1
	Nyssa biflora			1			
	Quercus bicolor						1
	Quercus phellos		2	2			3
	Taxodium distichum	11	18	2			2
	Unknown						2
	Myrica cerifera	1					1
TOT:	**8**	**15**	**21**	**5**			**10**

Table 3. Damage by Species			
	Species	**All Damage Categories**	**(no damage)**
	Cephalanthus occidentalis	4	4
	Clethra alnifolia	1	1
	Myrica cerifera	2	2
	Nyssa biflora	1	1
	Quercus bicolor	1	1
	Quercus phellos	7	7
	Taxodium distichum	33	33
	Unknown	2	2
TOT:	**8**	**51**	**51**

Table 4. Damage by Plot			
	plot	**All Damage Categories**	**(no damage)**
	D06001-ABET-0001-year:3	14	14
	D06001-ABET-0002-year:3	14	14
	D06001-ABET-0003-year:3	13	13
	D06001-ABET-0004-year:3	10	10
TOT:	**4**	**51**	**51**

Table 5. Stem Count by Plot and Species								
	Species	**Total Planted Stems**	**# plots**	**avg# stems**	**Plot 1, Year 3**	**Plot 2, Year 3**	**Plot 3, Year 3**	**Plot 4, Year 3**
	Cephalanthus occidentalis	4	3	1.33	2		1	1
	Myrica cerifera	1	1	1		1		
	Nyssa biflora	1	1	1				1
	Quercus phellos	4	1	4		4		
	Taxodium distichum	31	4	7.75	9	4	11	7
TOT:	**5**	**41**	**5**		**11**	**9**	**12**	**9**
	Average per Acre	423			454	371	495	371

Table 6. Vegetation Problem Areas			
Feature/Issue	Plot	Probable Cause	Photo #
Mortality/poor growth caused by soil salinity	1,2,3	Saltwater intrusion during very high tides	Refer to video on accompanying CD
Heavy herbaceous competition	All	Cattails/Coffeeweed	VPA 1-3

VPA 1

Heavy cattail emergence in April, site is dry

VPA 2

Coffeeweed is still present and re-emerging in October

VPA 3

The swamp run in April near gauge 3, low water, heavy cattails

Buttonbush (C. occidentalis) is able to survive

Main run near gauge 3 in October after Tropical Storm Nicole
Water beyond limits of the run is approximately 12” deep

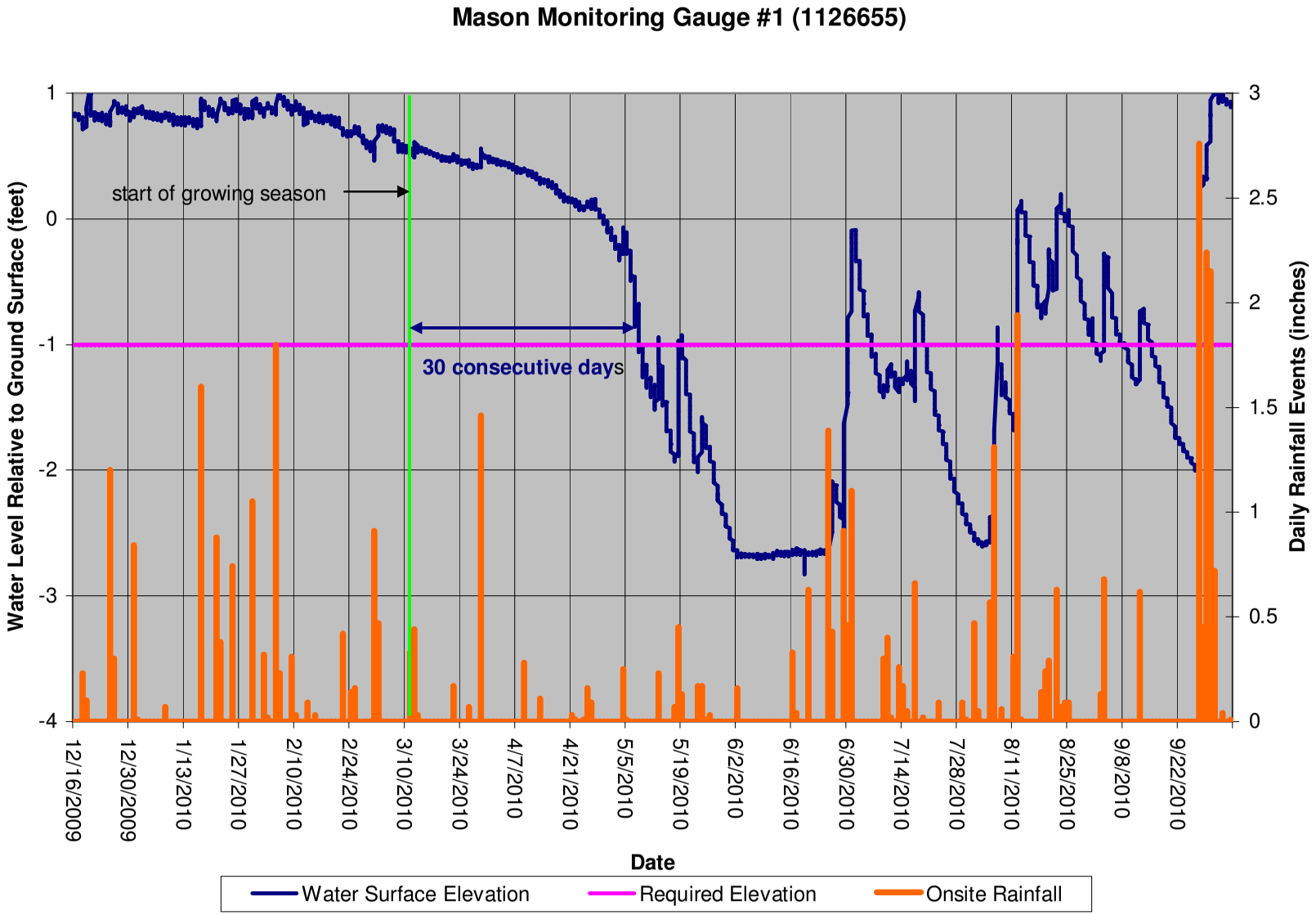
Appendix B

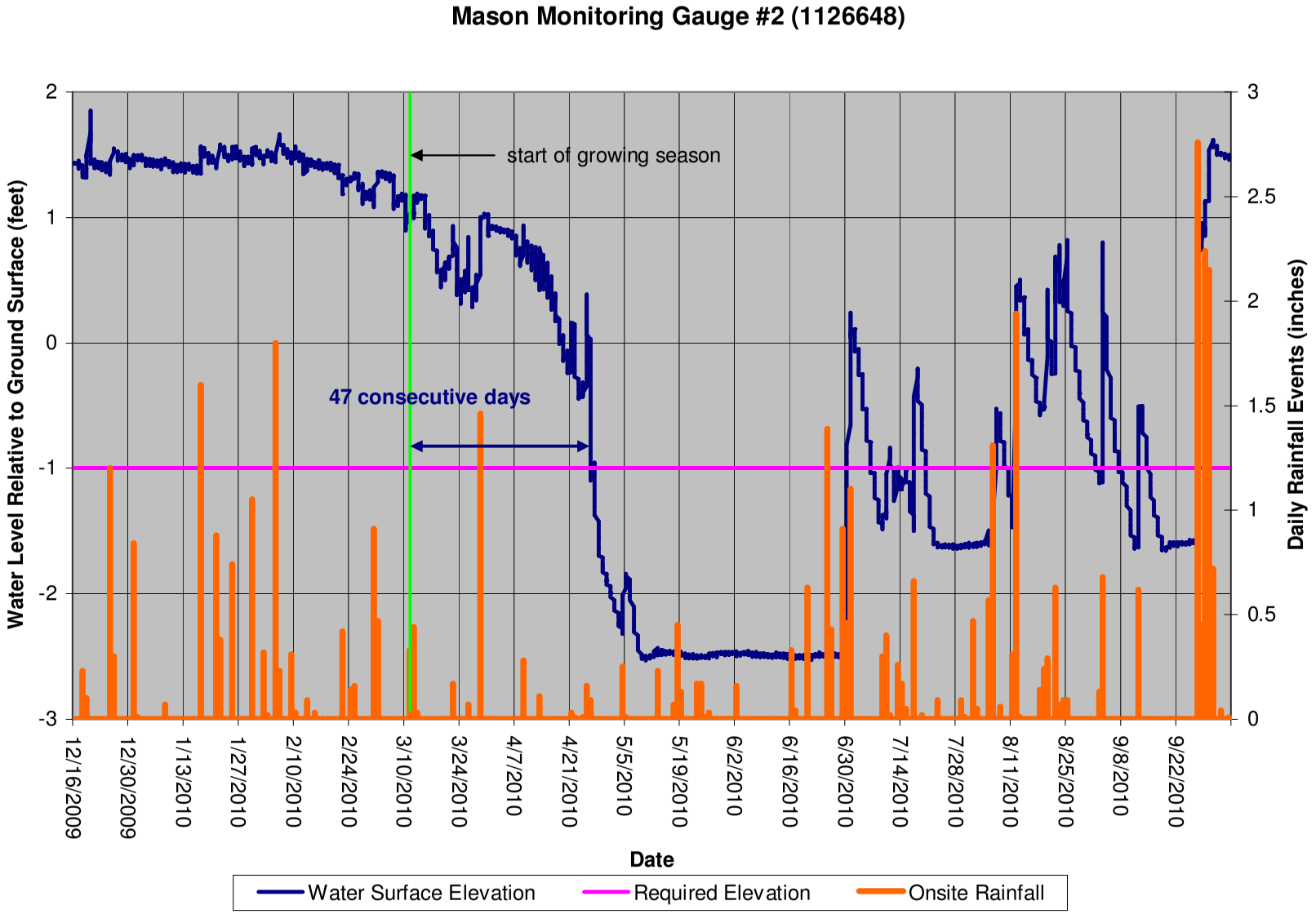
Geomorphologic Raw Data

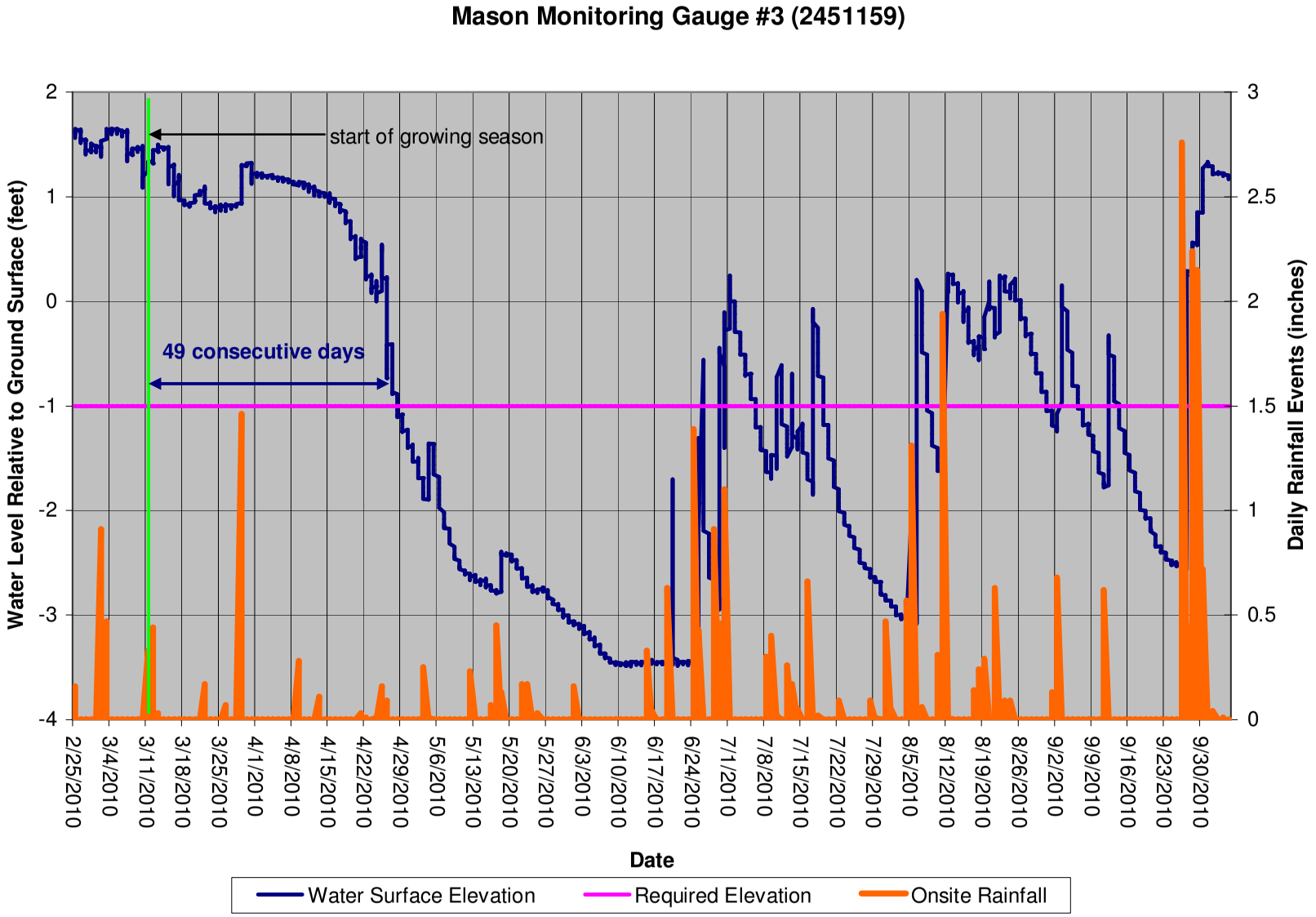
Not used in this report

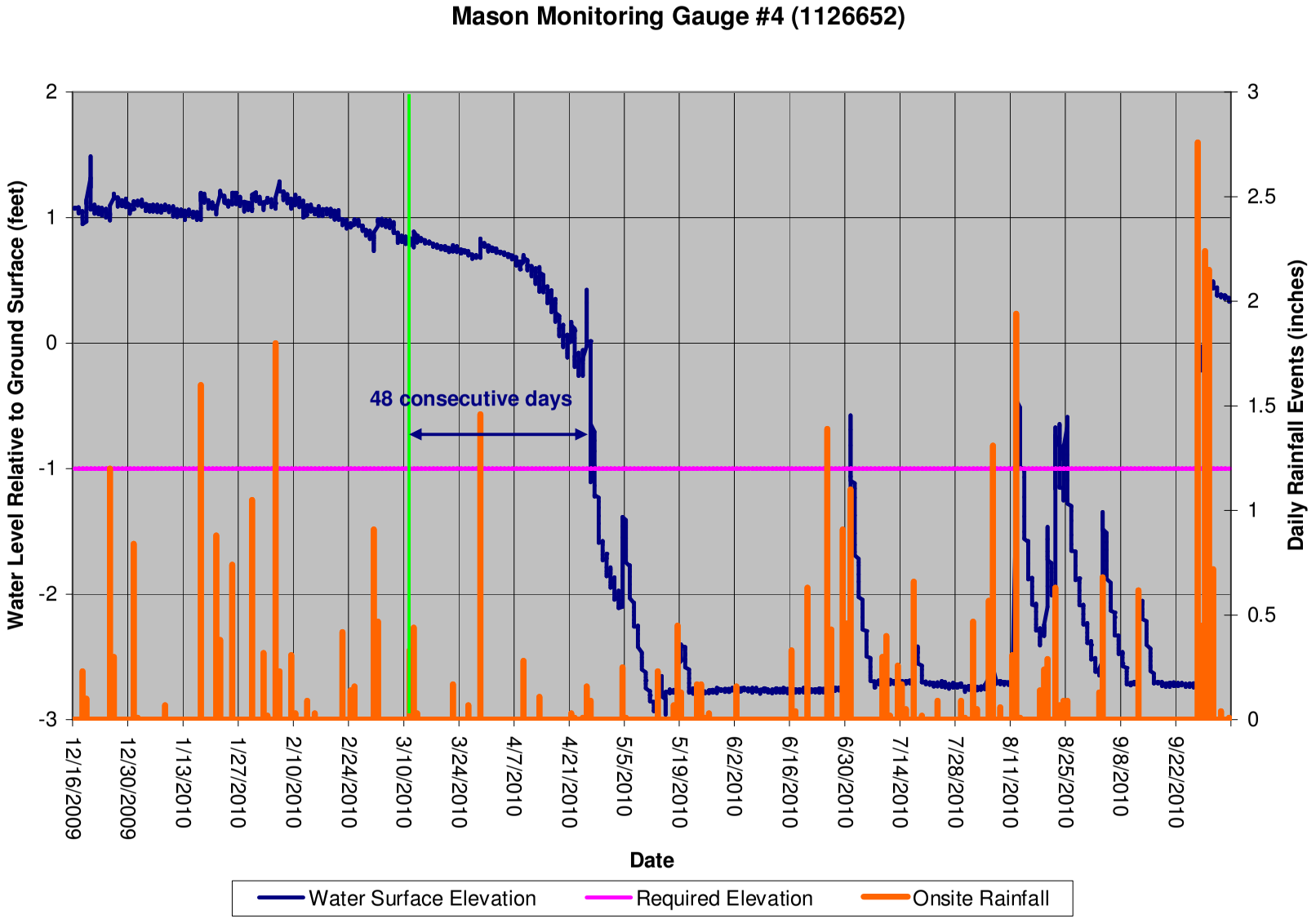
Appendix C

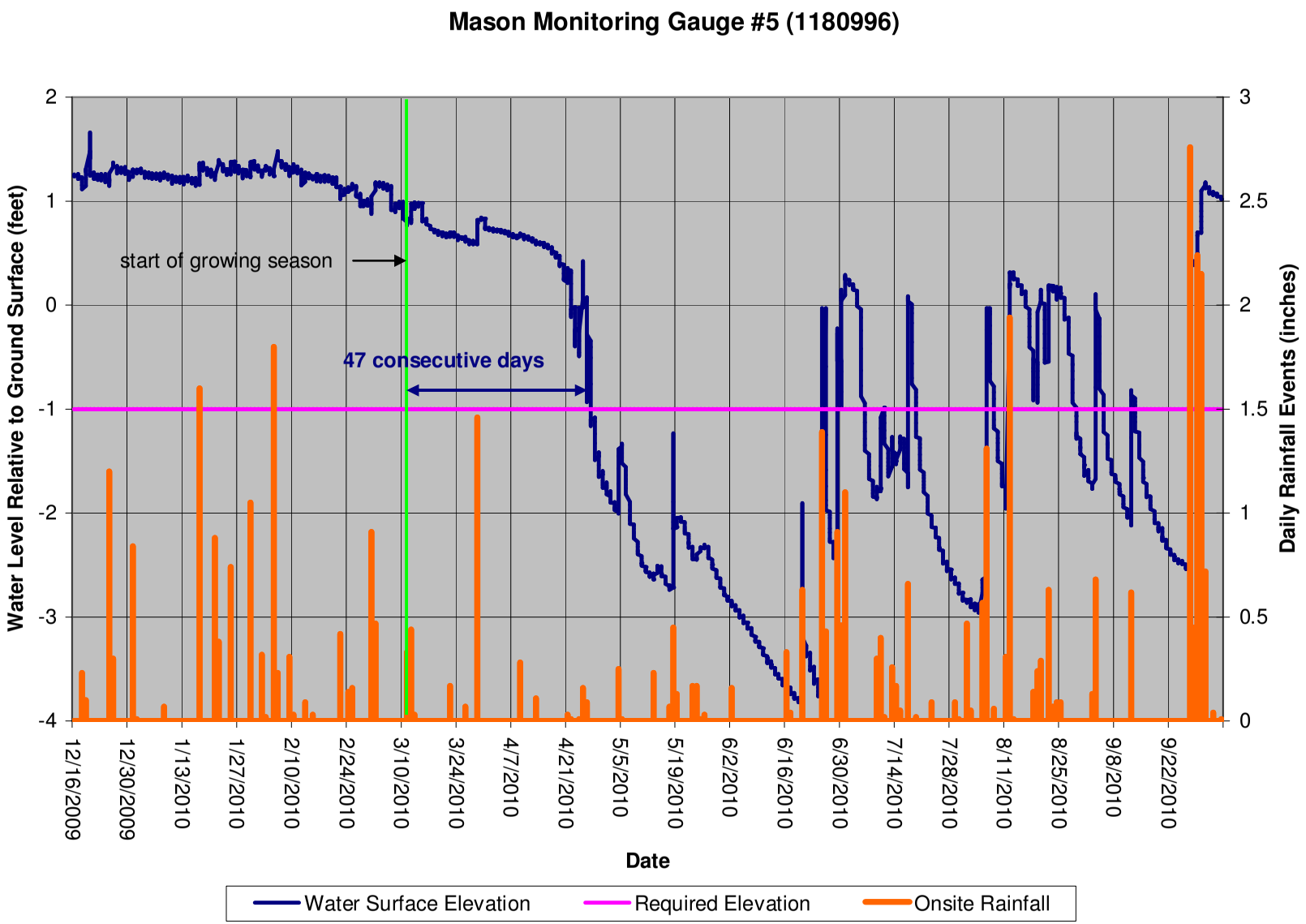
Hydrologic Data Tables

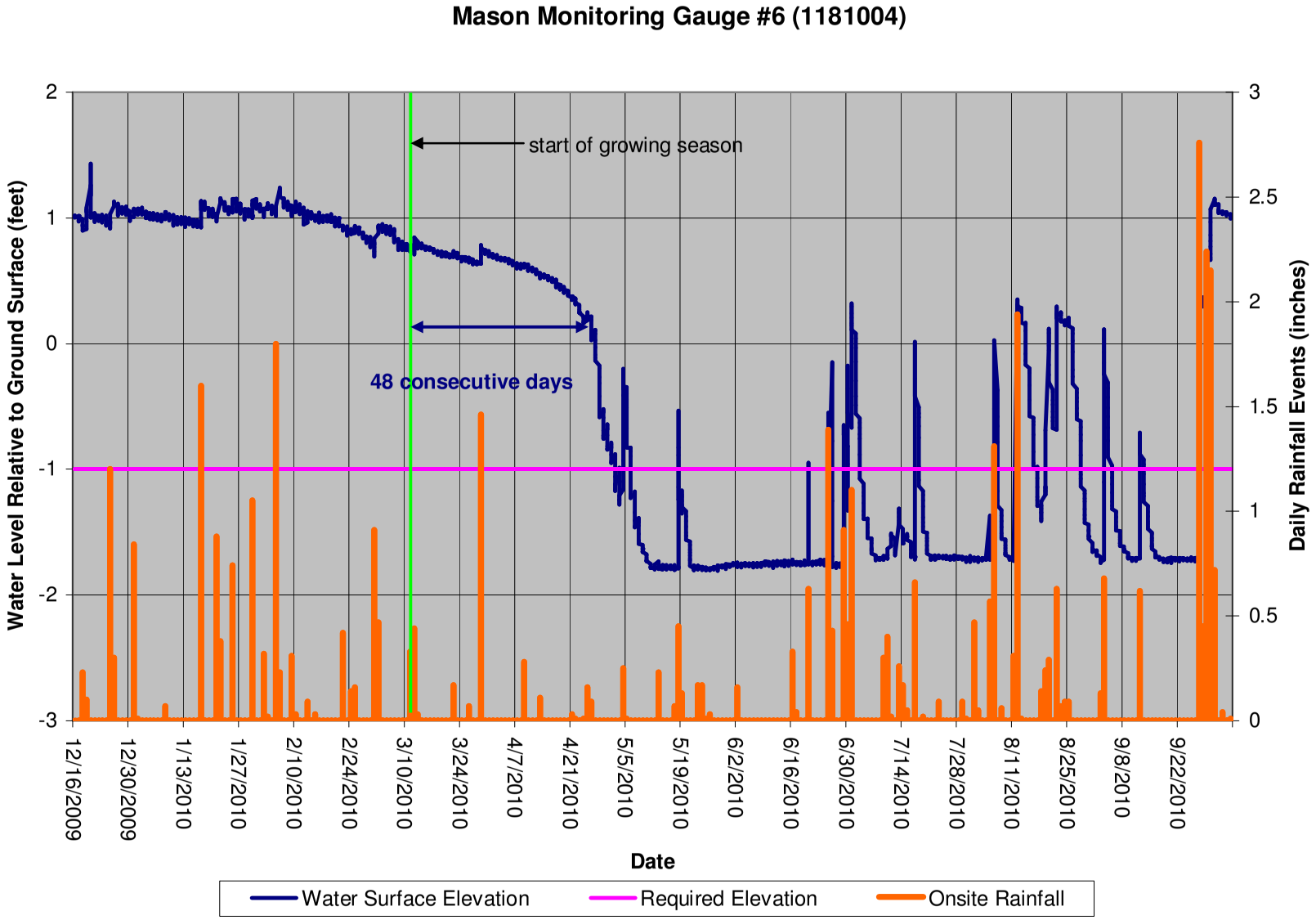

Mason Monitoring Gauge #1 (1126655)
start of growing season
30 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
1
0
-1
-2
-3
-4
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall

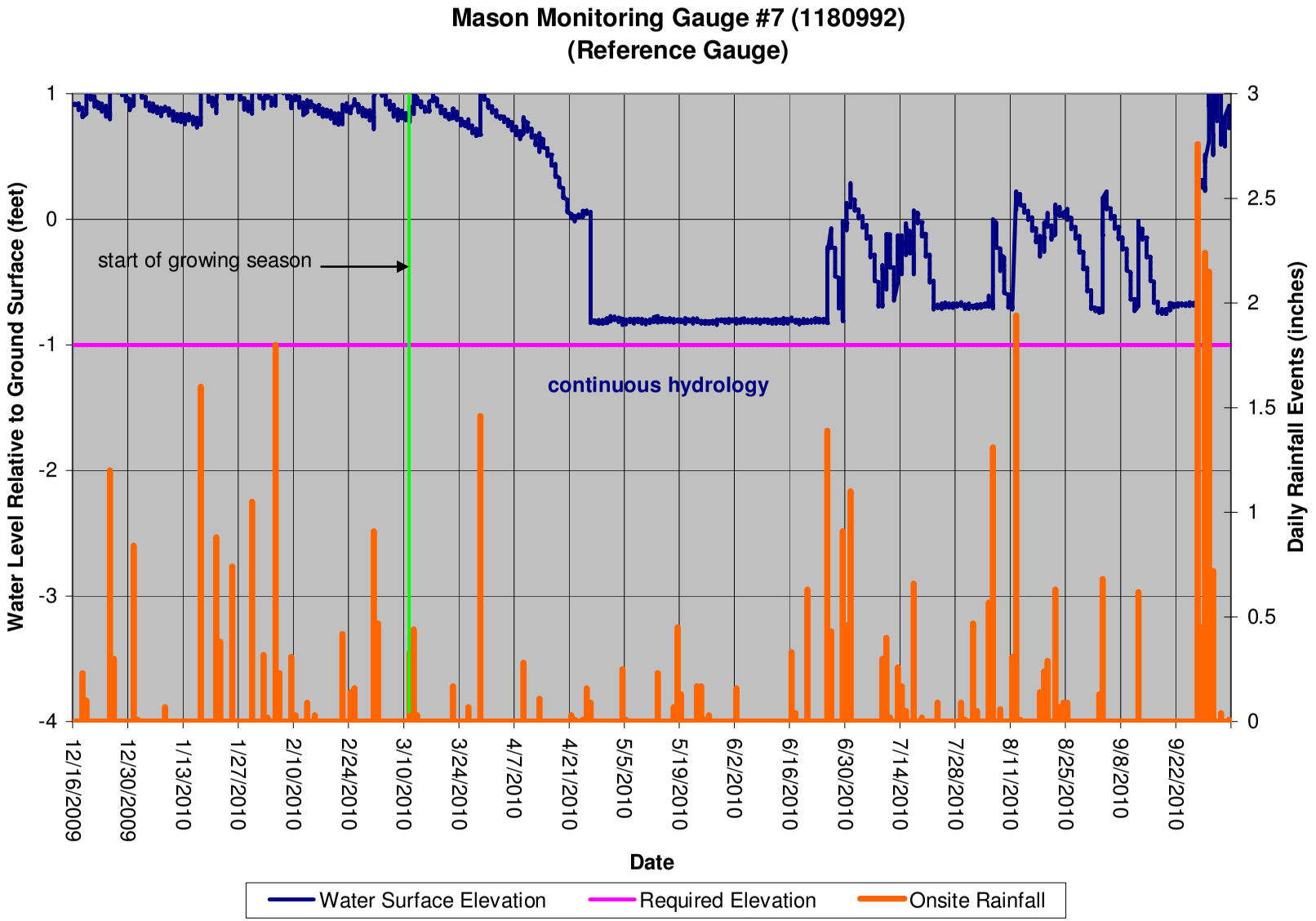

Mason Monitoring Gauge #2 (1126648)
start of growing season
47 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
2
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #3 (2451159)
start of growing season
49 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall
2
1
0
-1
-2
-3
-4
3
2.5
2
1.5
1
0.5
0
2/25/2010
3/4/2010
3/11/2010
3/18/2010
3/25/2010
4/1/2010
4/8/2010
4/15/2010
4/22/2010
4/29/2010
5/6/2010
5/13/2010
5/20/2010
5/27/2010
6/3/2010
6/10/2010
6/17/2010
6/24/2010
7/1/2010
7/8/2010
7/15/2010
7/22/2010
7/29/2010
8/5/2010
8/12/2010
8/19/2010
8/26/2010
9/2/2010
9/9/2010
9/16/2010
9/23/2010
9/30/2010


Mason Monitoring Gauge #4 (1126652)
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
48 consecutive days
2
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #5 (1180996)
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
start of growing season
47 consecutive days
2
1
0
-1
-2
-3
-4
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #6 (1181004)
start of growing season
48 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
2
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #7 (1180992)
(Reference Gauge)
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
start of growing season
continuous hydrology
1
0
-1
-2
-3
-4
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall

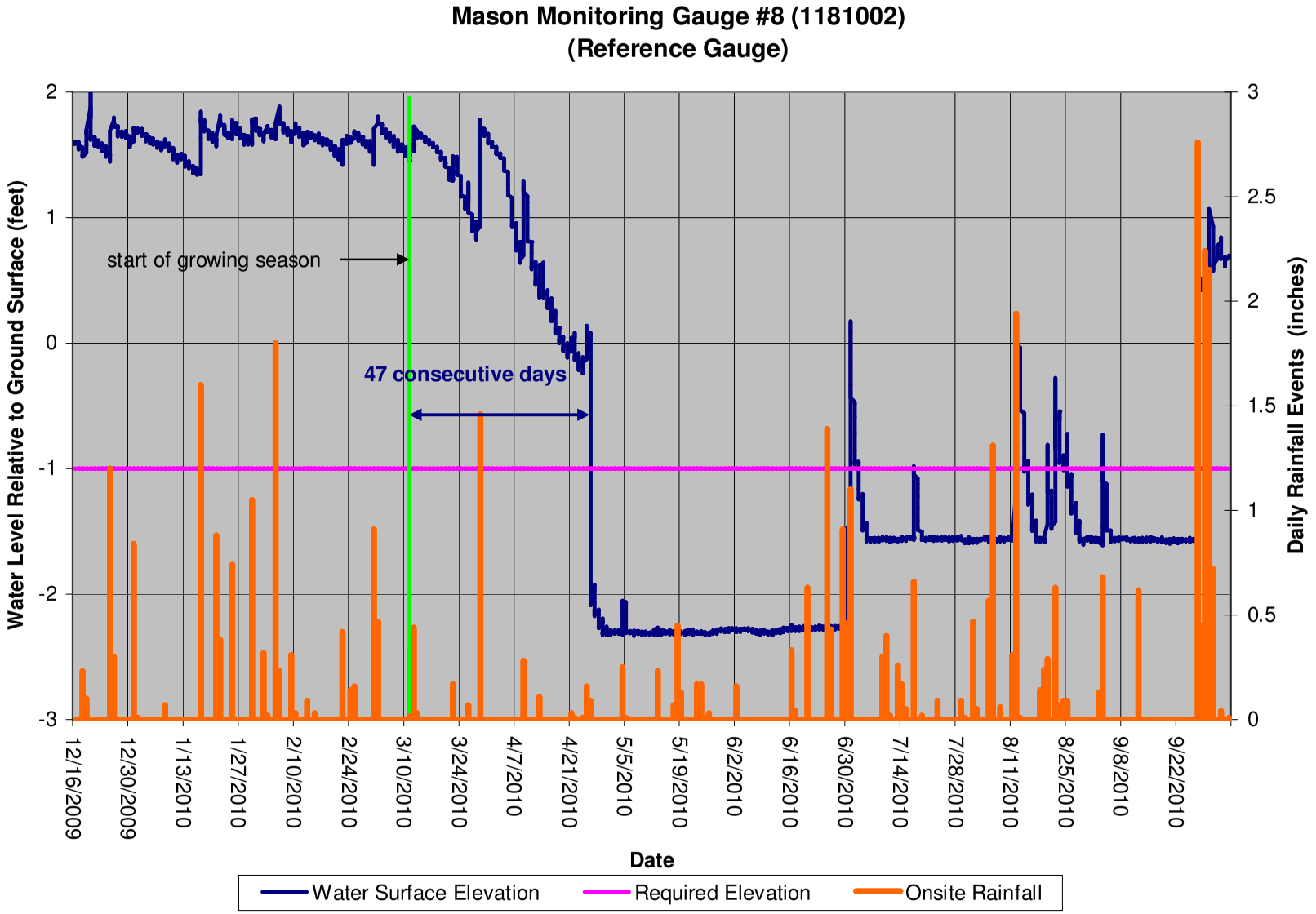
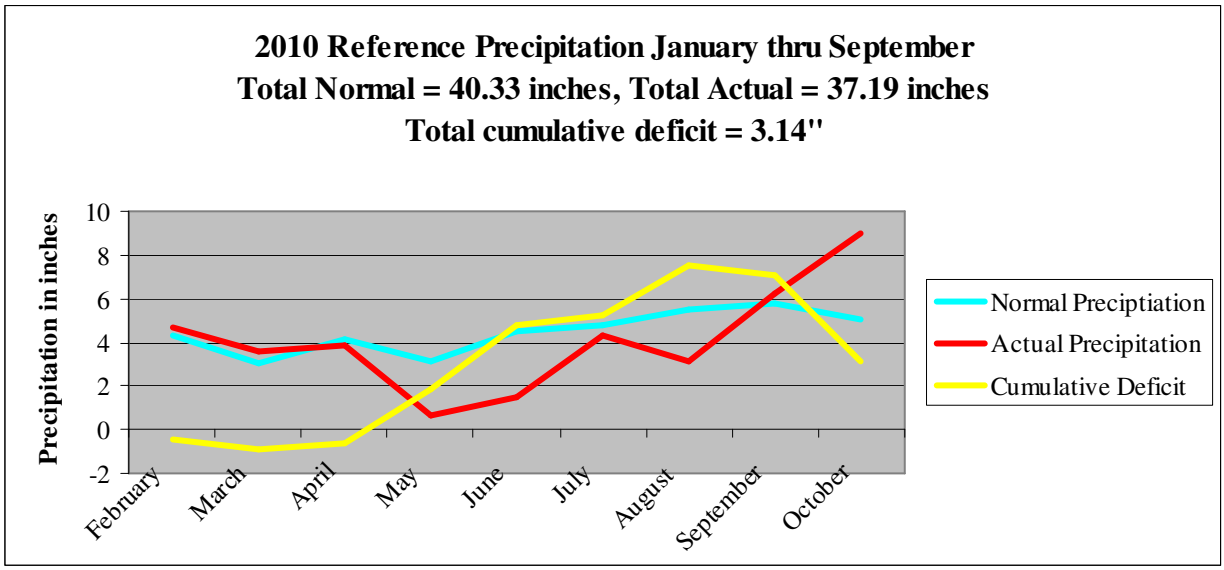

Mason Monitoring Gauge #8 (1181002)
(Reference Gauge)
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
start of growing season
47 consecutive days
2
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
12/16/2009
12/30/2009
1/13/2010
1/27/2010
2/10/2010
2/24/2010
3/10/2010
3/24/2010
4/7/2010
4/21/2010
5/5/2010
5/19/2010
6/2/2010
6/16/2010
6/30/2010
7/14/2010
7/28/2010
8/11/2010
8/25/2010
9/8/2010
9/22/2010
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall

Table C-1															
Longest Consecutive Successful Hydrologic Period in Days and Success at 5% and 8% of Growing Season															
	Year 1			Current Year			Year 3			Year 4			Year 5		
Gauge	Days	5%	8%	Days	5%	8%	Days	5%	8%	Days	5%	8%	Days	5%	8%
1	99	Y	Y	143	Y	Y	30	Y	Y						
2	86	Y	Y	91	Y	Y	47	Y	Y						
3	95	Y	Y	79	Y	Y	49	Y	Y						
4	88	Y	Y	133	Y	Y	48	Y	Y						
5	92	Y	Y	91	Y	Y	47	Y	Y						
6	93	Y	Y	118	Y	Y	48	Y	Y						
7 (Ref)	158	Y	Y	119	Y	Y	***	Y	Y						
8 (Ref)	41	Y	Y	129	Y	Y	47	Y	Y						

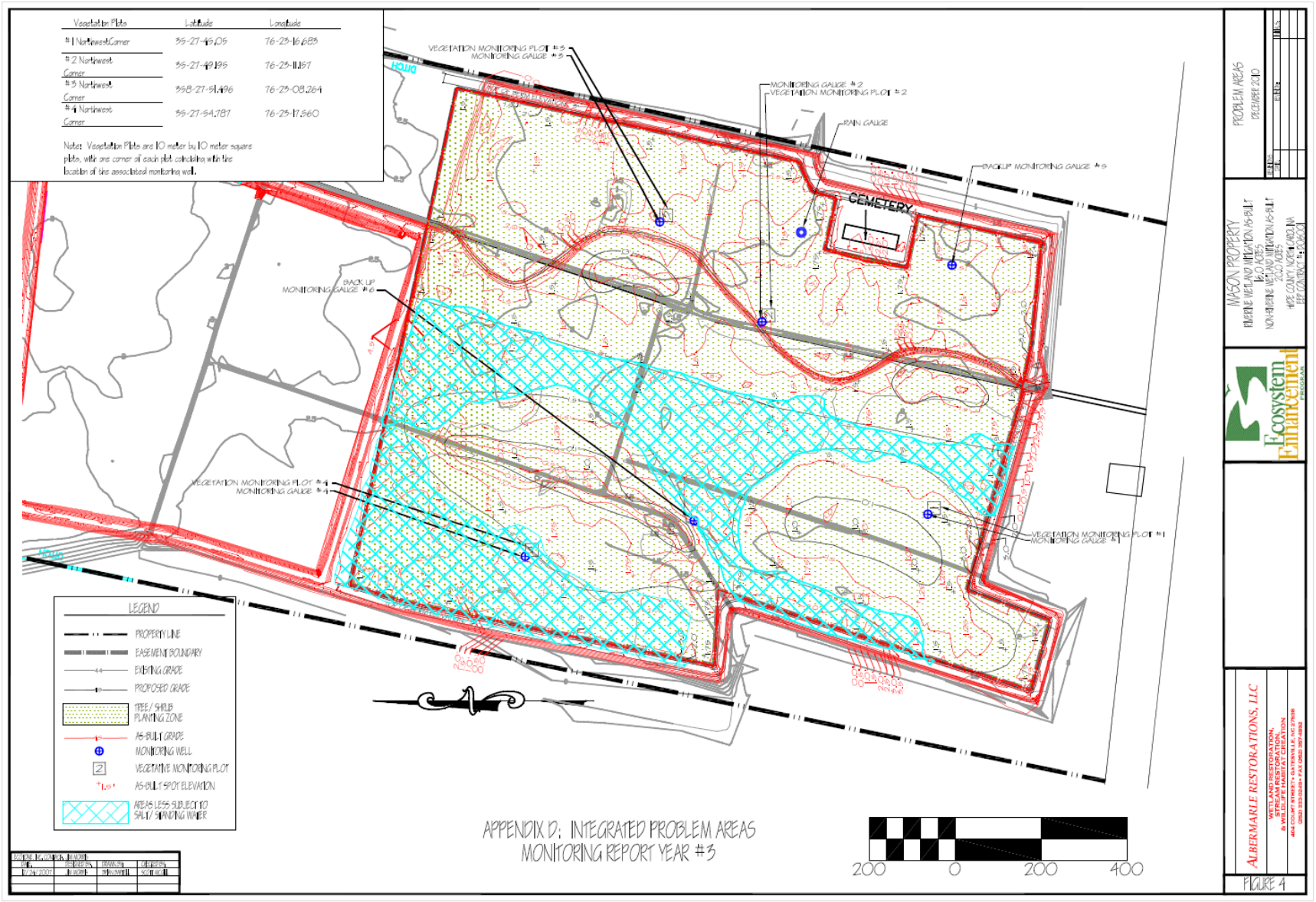
5% of growing season is 13 days, 8% is 21 days

*** Gauge 7 showed continuous successful hydrology thru 2010



Appendix D

Problem Areas Plan View (Integrated)



APPENDIX D: INTEGRATED PROBLEM AREAS
MONITORING REPORT YEAR #3

FIGURE 4