Mason Property Wetland Mitigation Project

Hyde County, NC

2011 Annual Monitoring Report
Year 4

NCEEP Project Number D06001
Tar-Pamlico River Basin

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

Date: September, 2011

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.

Six water level monitoring gauges are installed at varying elevations throughout the site to measure subsurface water elevations. Two additional gauges are installed at reference sites for hydrology comparison. In 2011, 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 are installed and permanently monumented, one coincident with each of monitoring gauges 1 through 4. 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 fourth year of monitoring, all four plots met the Year 5 success criterion of 260 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 260 live stems per acre (the year 5 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%
Year 4 (2011)	30	21	27	21	21	28	21	15	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.

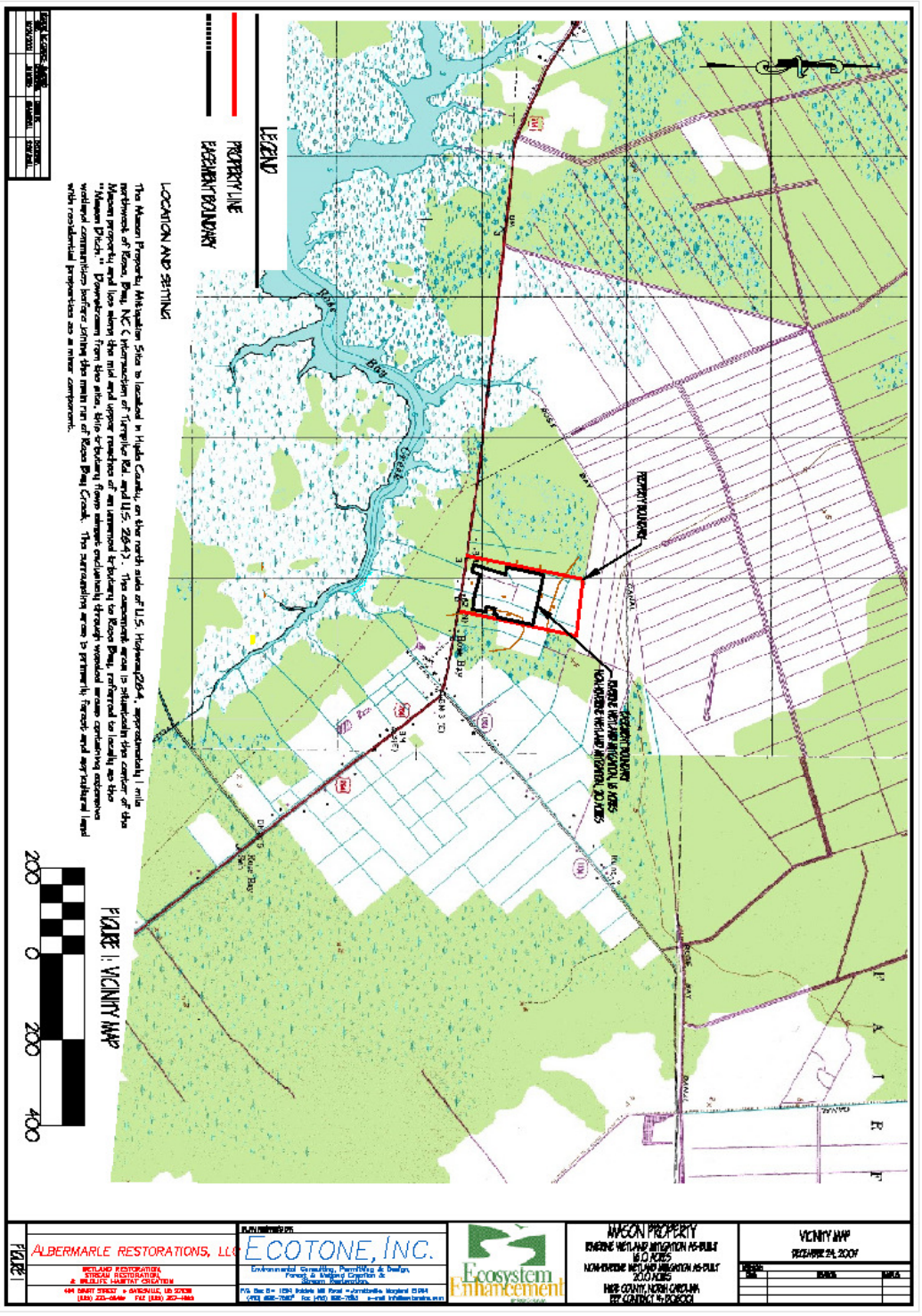
Table I. Project Restoration Components Mason Property Wetland Mitigation Site/EEP #D06001				
Community Type	**Pre-Existing Acreage**	**Post Construction Acreage**	**Credit Ratio (Restoration WMU)**	**Mitigation Units**
Riverine Wetland	0.0	16.0	1:1	16.0
Non-Riverine Wetland	0.0	20.0	1:1	20.0
			Total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

Figure 4. Composite Vicinity Map



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	November 2006
Final Design -90%	June 2006	November 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	September 2011	September 2011
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 site to 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. Monitoring Plan View: Gauges and Vegetation Plots

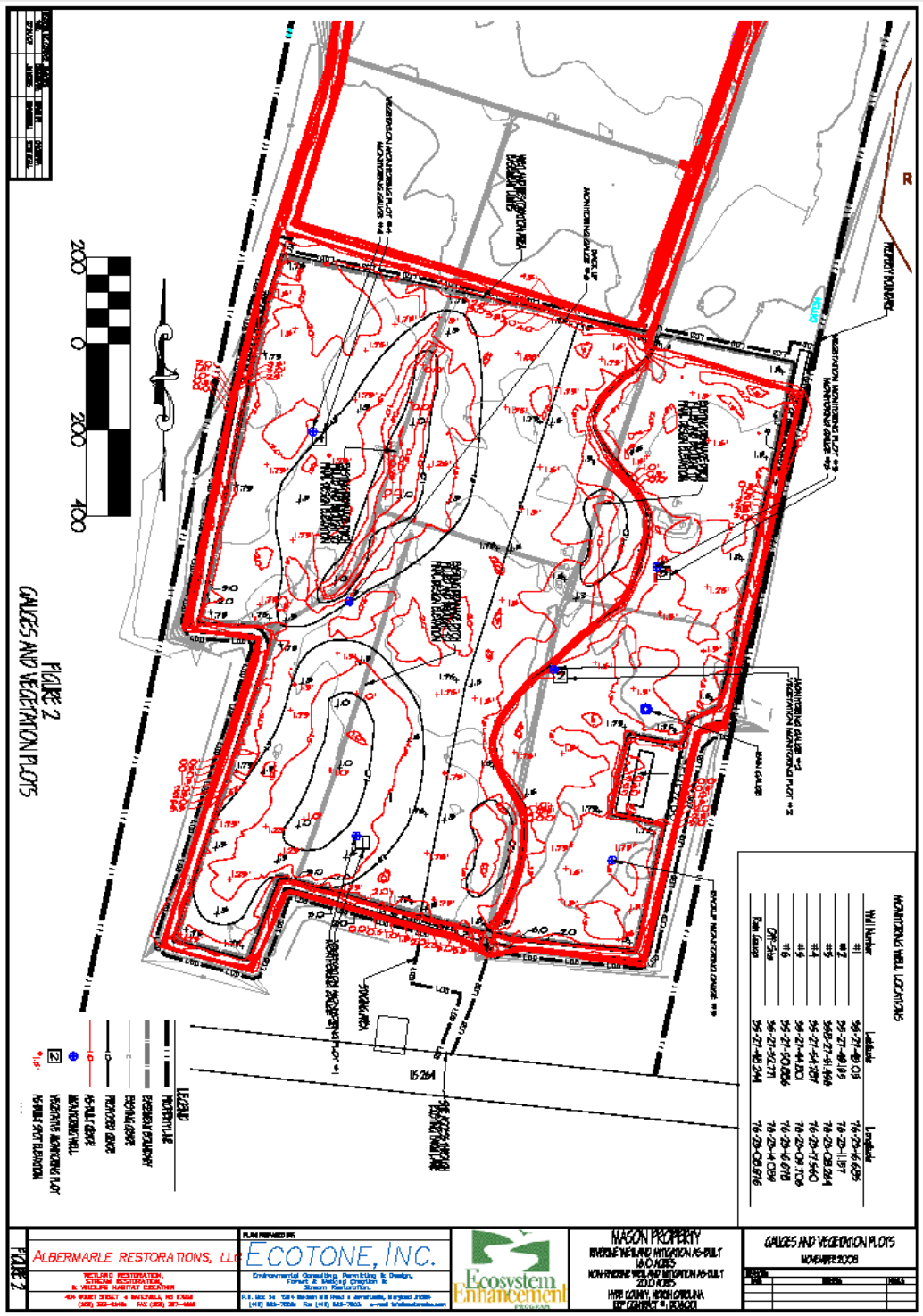
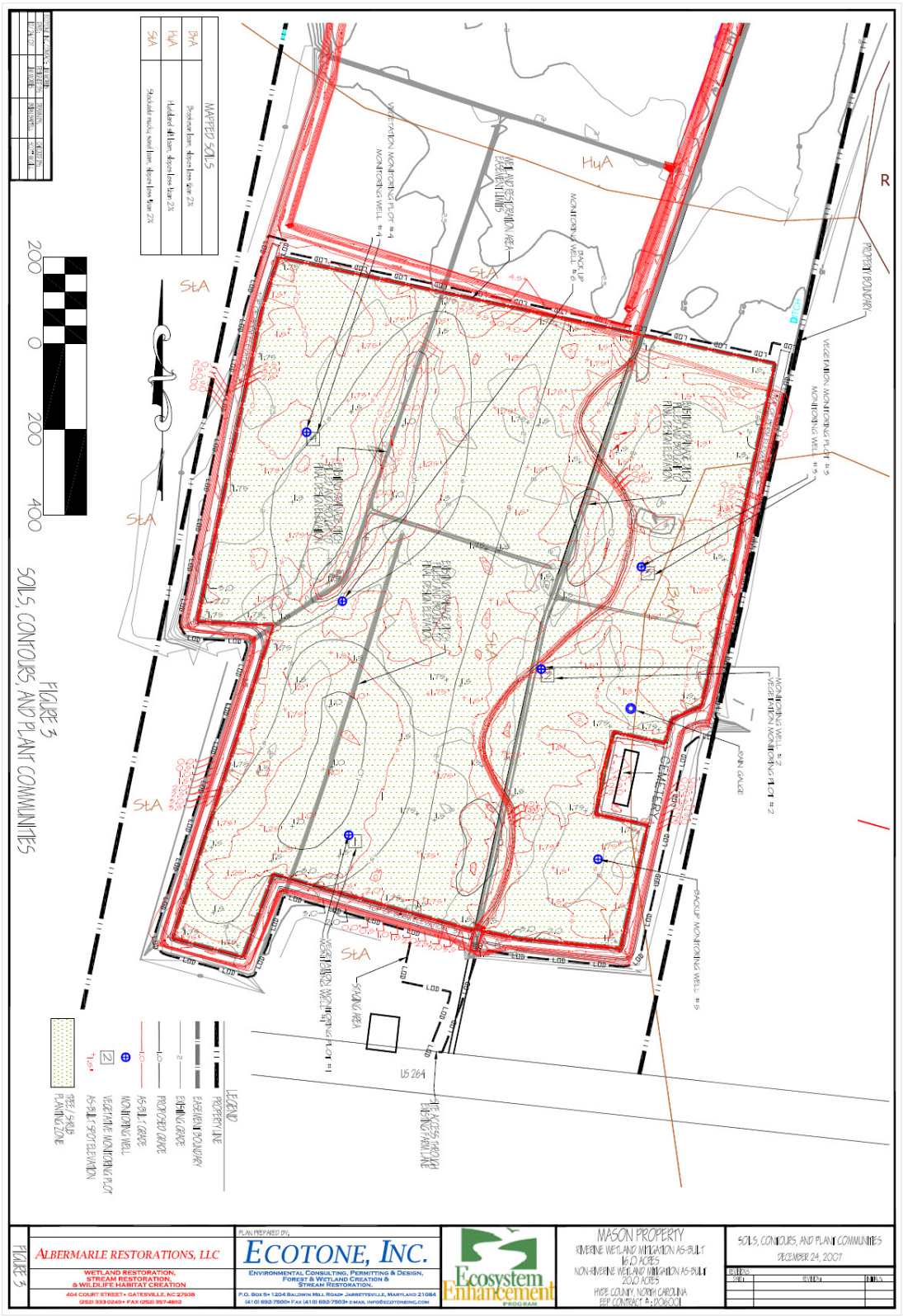


Figure 3. Monitoring Plan View: Soils, Contours and Plant Communities



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). At the start of the 2011 growing season the planted stems averaged 423 stems per acre.

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 5 success criterion of a minimum of 260 stems per acre after the fifth growing season. Over the entire project, the survival rate averaged 392 planted stems per acre. Severe tidal flooding as a result of Hurricane Irene in late August, 2011, caused severe browning of nearly all vegetation, both planted and natural. Photos of the foliage of some cypress trees in Appendix A show the severity of salt damage which was typical and widespread across the project site.

During the vegetation assessment which was completed in September, 2011, approximately two weeks after the storm related flooding, many of the cypress trees appeared to have viable leaf buds, which indicate they may survive the salt intrusion. Factors affecting the survival of all

planted stems include the depth of salt penetration into the trees' root zone, the relative salinity levels and whether or not the leaf buds break open in the fall of 2011. Late bud break could deplete root carbohydrate stocks which may adversely affect spring leaf-out in 2012. Live buds were less obvious on buttonbush and willow oak, though many of these stems are tall enough that their uppermost buds may have escaped serious damage.

Coffeeweed (*Sesbania herbacia)* appeared to have re-emerged during the 2011 growing season but was completely defoliated during the hurricane in August, 2011. It remains to be seen how much viable seed it produced and to what extent it will be a problem in 2012.

1.2 Vegetation Monitoring Plan View (Integrated)

Due to the fact that the entire project area suffered damage, Appendix D contains photos instead of a map that more accurately illustrate the damage caused by salt water flooding during Hurricane Irene in August, 2011. If not for the salt damage, few, if any problem areas would have been reported.

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 are deployed across the site and two more are installed in reference areas. All six gauges met the success criteria for the site in 2011 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.

Salt water intrusion was suspected of causing damage to planted stems in the past, but the photos in Appendix A illustrate beyond a doubt that this is indeed a potential problem. Also, refer to the hydrographs in Appendix D for peak high water marks during Hurricane Irene in August, 2011. Gauges 3 and 6 recorded the highest water mark during the storm at 4.0 feet above ground level. The other gauges recorded various water levels from 2.6 feet to 3.9 feet above ground level. These high water levels were very short-lived, but lasted long enough to cause damage to foliage. Green, live buds were observed on many stems during data collection which indicates the salt damage may be superficial. The vegetation will be reassessed after leaf-out in 2012.

2.2 Wetland Monitoring Plan View (Integrated)

The photos in Appendix D illustrate the problems 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 (30%)	100%	1	Y	100%
2	Y (21%)		2	Y	
3	Y (27%)		3	Y	
4	Y (21%)		4	Y	
5	Y (21%)		No Plot	N/A	
6	Y (28%)		No Plot	N/A	
7	Y (21%)		No Plot	N/A	
8	Y (15%)		No Plot	N/A	

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 photo evidence from September, 2011, saltwater intrusion caused by wind-driven high tide events. Tree survival in 2011 appeared to be at a sustainable level but it remains to be seen if the planted stock can overcome the salt water damage from Hurricane Irene in August, 2011. 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, and probably less subject to saltwater intrusion though still subject to total inundation during very wet periods or excessively high tides. The 2011 vegetation assessment was done ten days after Hurricane Irene passed through the area and as can be seen on the hydrographs, the entire site was still flooded to a depth of nearly twelve inches. Given the past hydrologic performance of this project, it is likely the site will remain flooded, to some extent, until drier weather returns in the summer of 2012. Upcoming fall rains should help dilute the salt content which may prove beneficial to continued tree survival and growth.

III. Methodology Section

Year 4 monitoring for the Mason project occurred in 2011. 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	9/8/2011 17:00
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 Species	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			4
	Taxodium distichum			32			2
	Myrica cerifera			1			
TOT:	**7**			**38**			**10**

Table 3. Damage by Species				
	Species	**All Damage Categories**	**(no damage)**	**Hurricane**
	Cephalanthus occidentalis	4	1	3
	Clethra alnifolia	1	1	
	Myrica cerifera	1		1
	Nyssa biflora	1	1	
	Quercus bicolor	1	1	
	Quercus phellos	6	4	2
	Taxodium distichum	34	2	32
TOT:	**7**	**48**	**10**	**38**

Table 4. Damage by Plot				
	plot	**All Damage Categories**	**(no damage)**	**Hurricane**
	D06001-ABET-0001-year:4	11	1	10
	D06001-ABET-0002-year:4	14	6	8
	D06001-ABET-0003-year:4	13	1	12
	D06001-ABET-0004-year:4	10	2	8
TOT:	**4**	**48**	**10**	**38**

Table 5. Stem count by plot and species								
	Species	**Total Planted Stems**	**# plots**	**avg# stems**	**Plot 1, year:4**	**Plot 2, year:4**	**Plot 3, year:4**	**Plot 4, year:4**
	Cephalanthus occidentalis	3	3	1	1		1	1
	Myrica cerifera	1	1	1		1		
	Quercus phellos	2	1	2		2		
	Taxodium distichum	32	4	8	9	5	11	7
TOT:	**4**	**38**	**4**		**10**	**8**	**12**	**8**
	Average per acre	392			412	330	495	330

Table 6. Vegetation Problem Areas			
Feature/Issue	Plot	Probable Cause	Photo #
Possible mortality caused by saltwater intrusion	Entire project area	Saltwater intrusion during Hurricane Irene	VPA 1, 2, 3

View from Gauge 1 shows project is completely flooded in March 2011.

View of run from Gauge 3 shows complete flooding in March 2011.

The swamp run in July, 2011 near gauge 3. Run is completely dry.

VPA 1

Salt water damage after Hurricane Irene in August, 2011. Note live buds on stem.

VPA 2

Similar photo from September, 2011 shows live buds on salt damaged cypress stem.

VPA 3

Photo from September, 2011 showing general salt damage from Hurricane Irene.

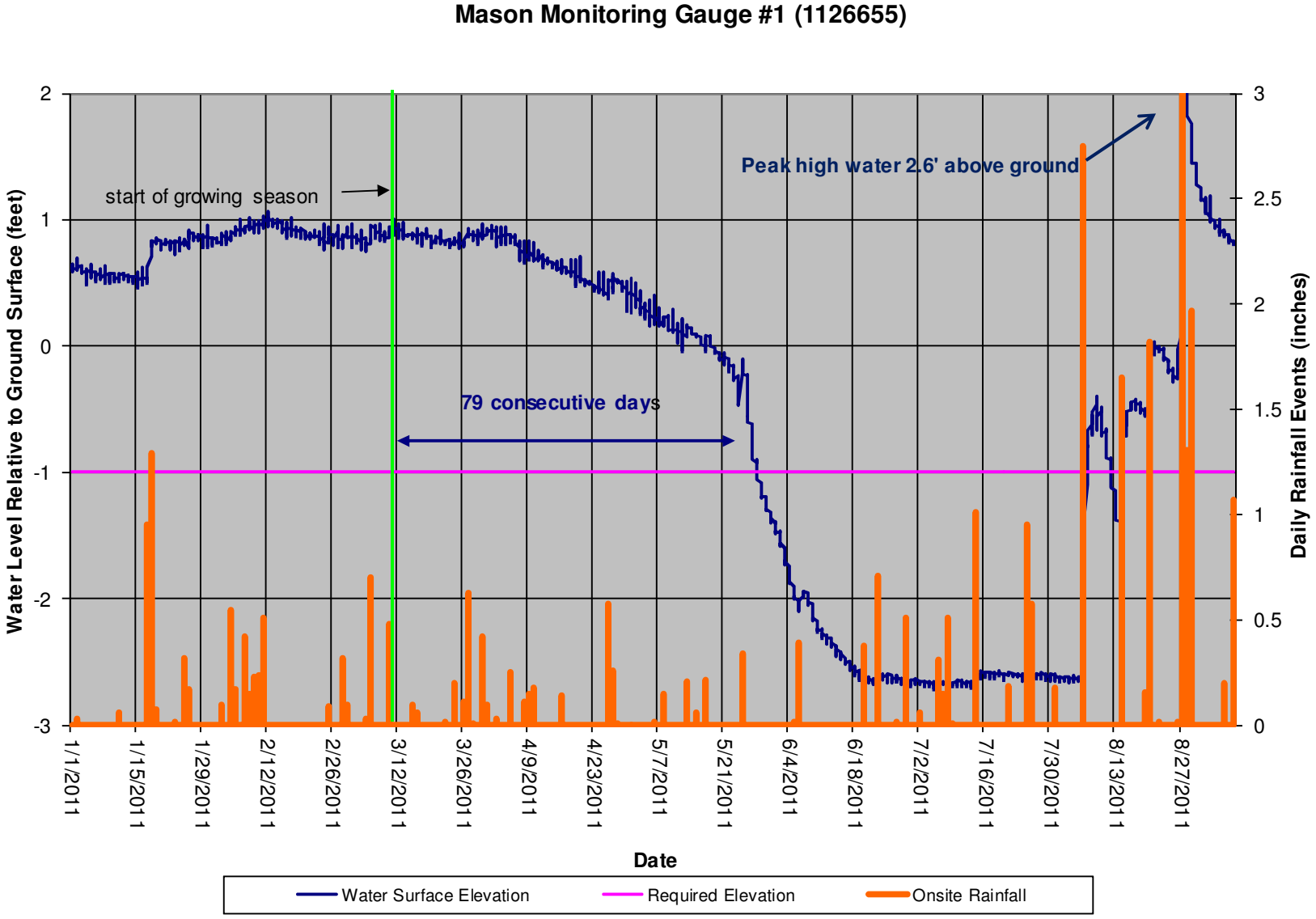
Appendix B

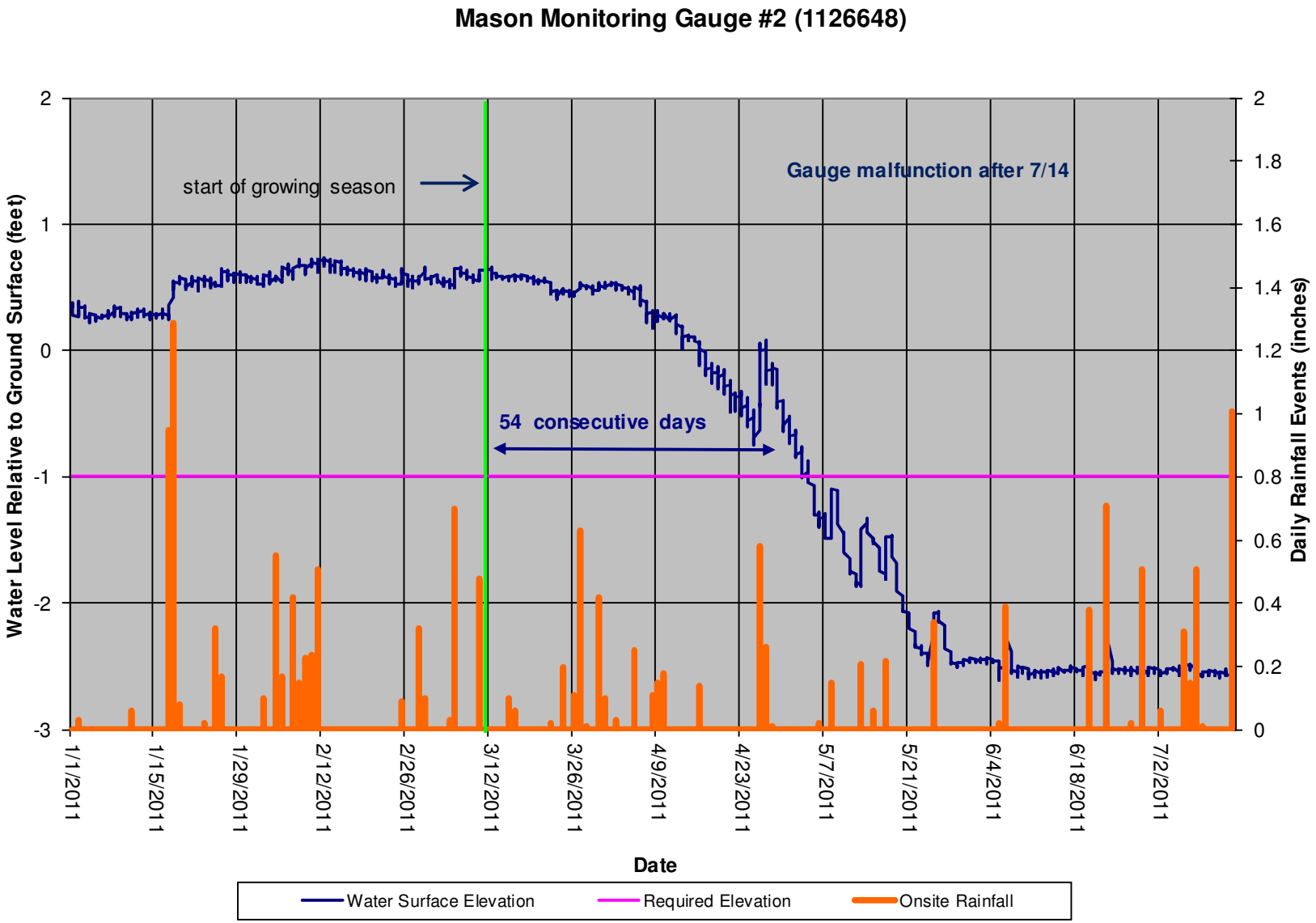
Geomorphologic Raw Data

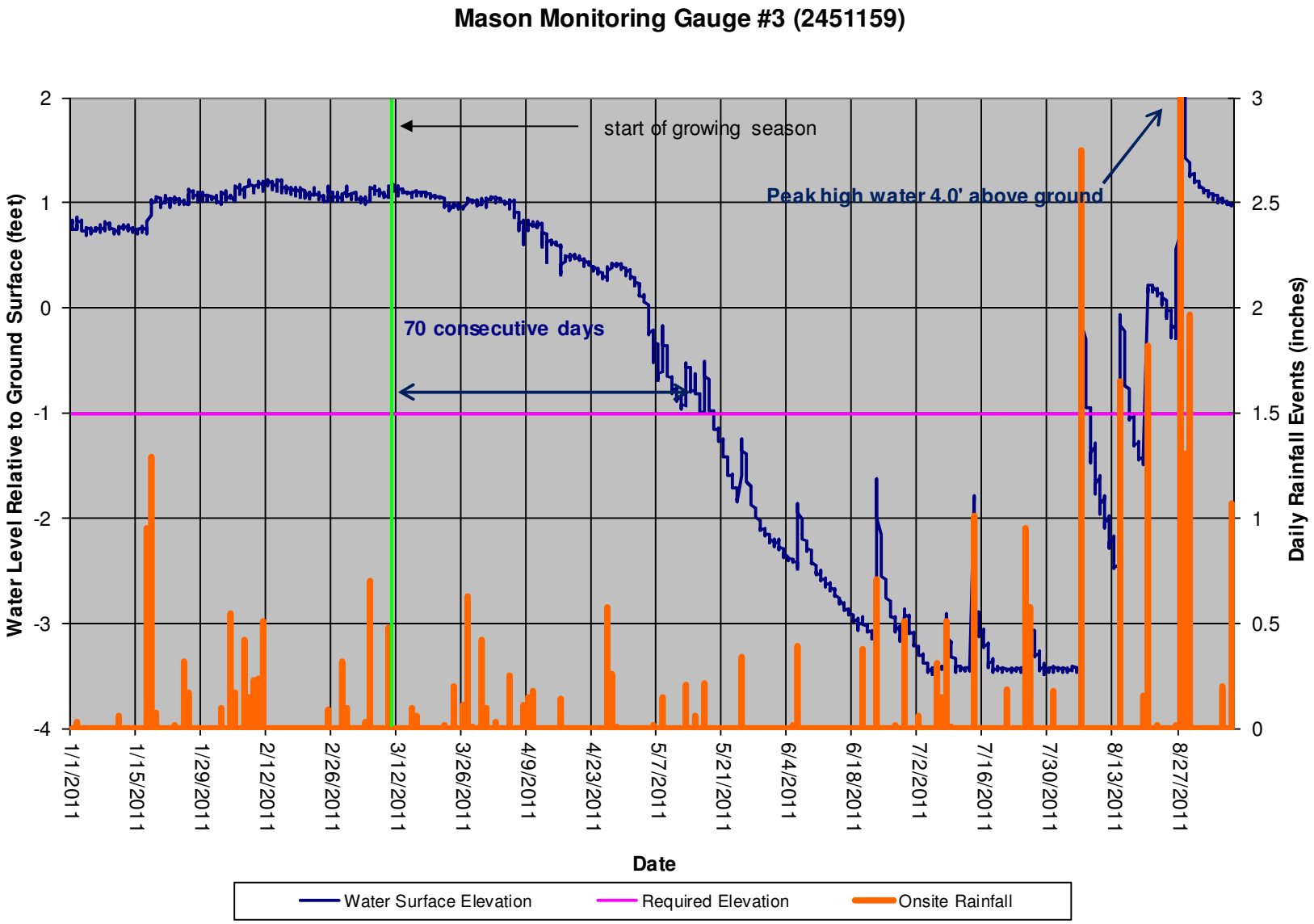
Not used in this report

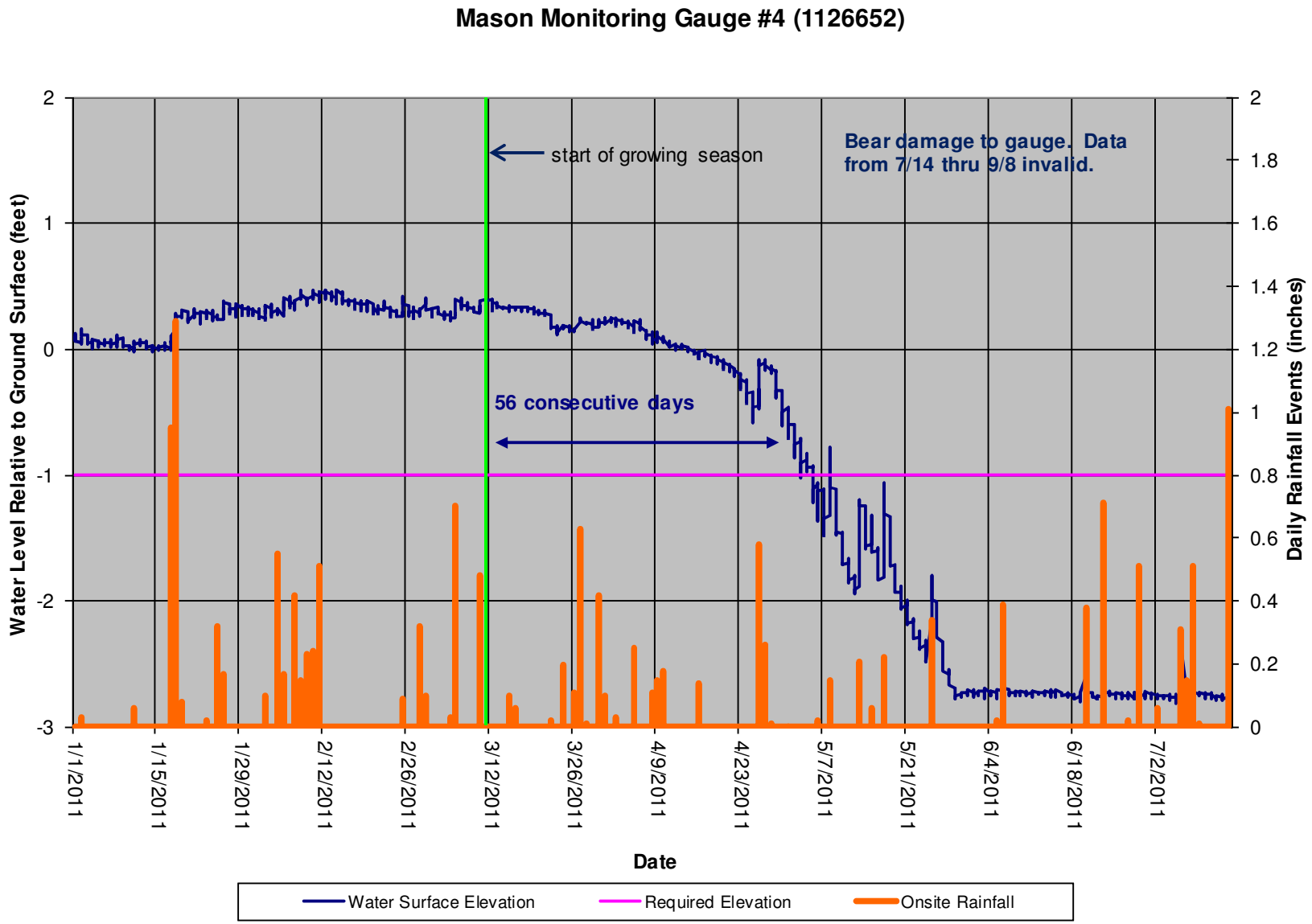
Appendix C

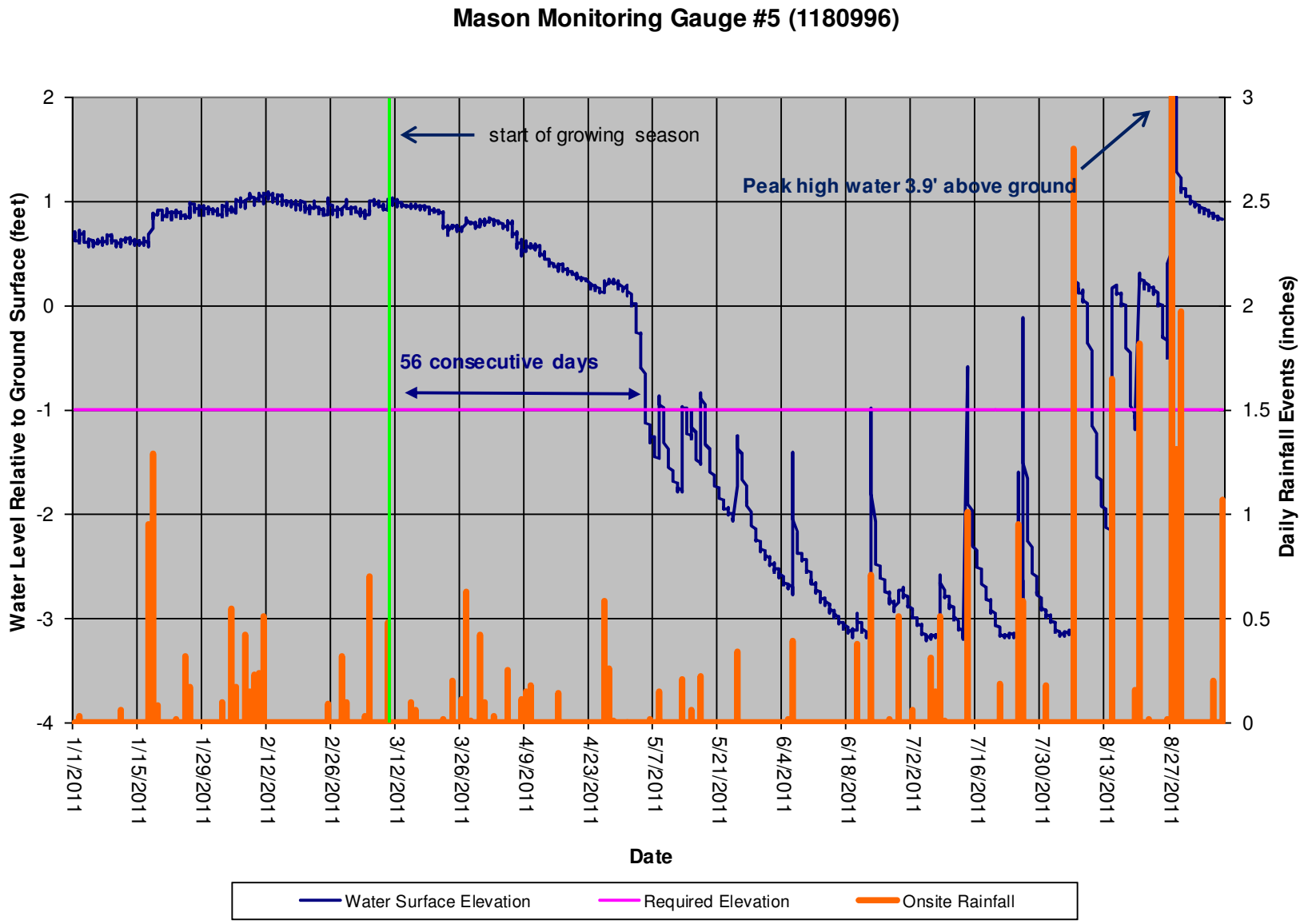
Hydrologic Data Tables

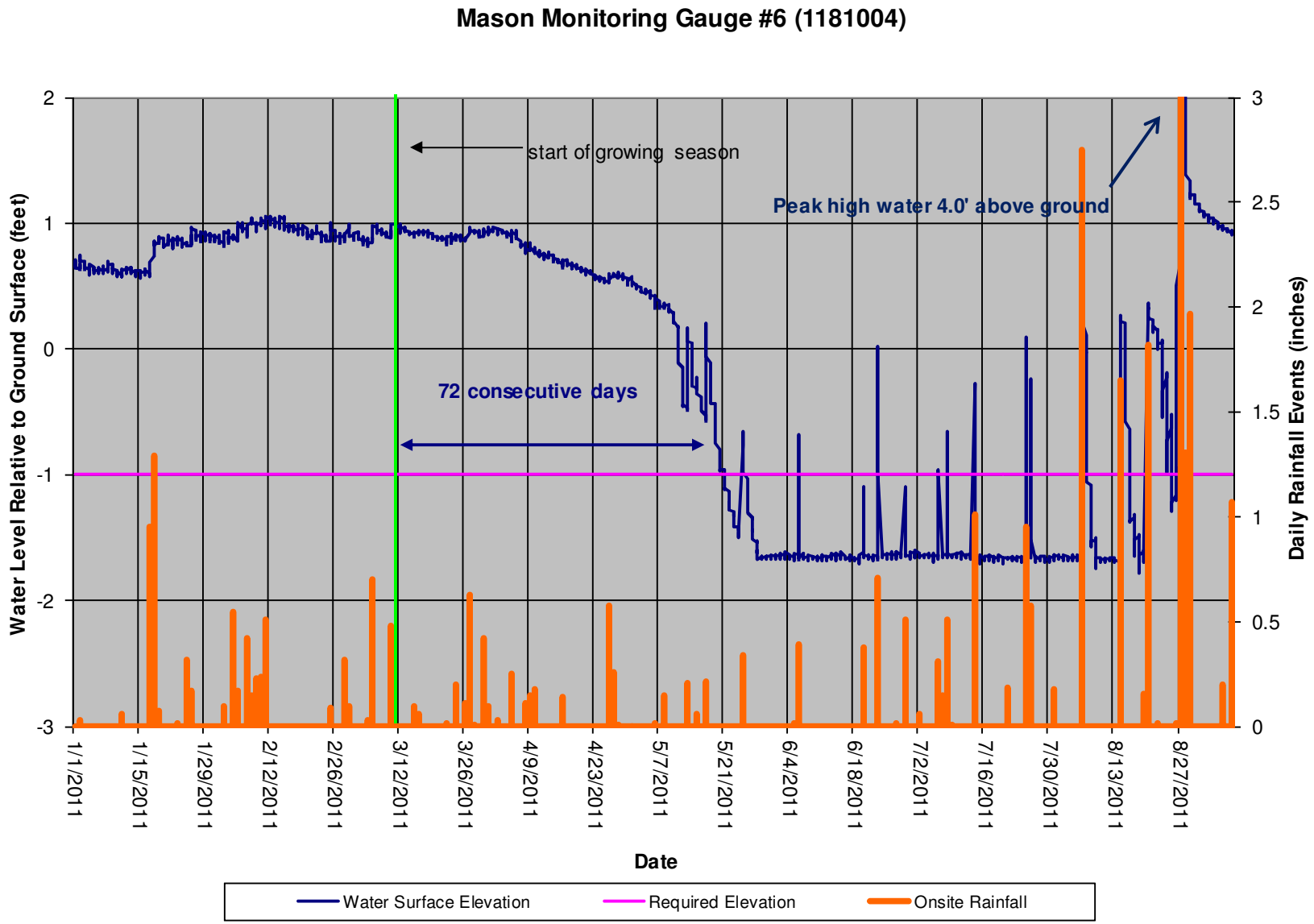

Mason Monitoring Gauge #1 (1126655)
start of growing season
Peak high water 2.6' above ground
79 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
2
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
7/16/2011
7/30/2011
8/13/2011
8/27/2011
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall

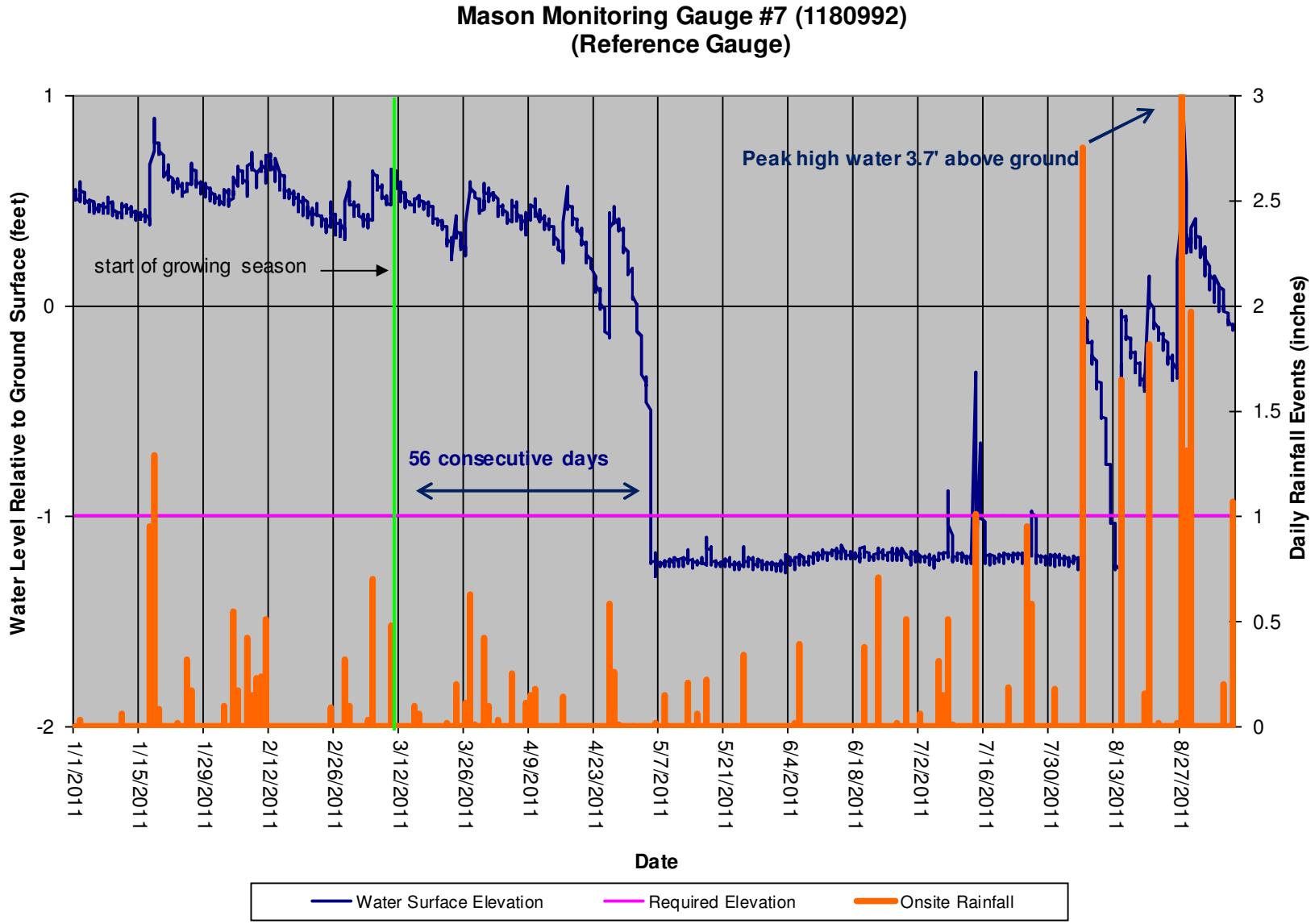

Mason Monitoring Gauge #2 (1126648)
start of growing season
Gauge malfunction after 7/14
54 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
2
1
0
-1
-2
-3
1.8
1.6
1.4
1.2
0.8
0.6
0.4
0.2
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #3 (2451159)
start of growing season
Peak high water 4.0' above ground
70 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
2
1
0
-1
-2
-3
-4
3
2.5
2
1.5
1
0.5
0
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
7/16/2011
7/30/2011
8/13/2011
8/27/2011
Date
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #4 (1126652)
start of growing season
Bear damage to gauge. Data from 7/14 thru 9/8 invalid.
56 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
Date
2
1
0
-1
-2
-3
1.8
1.6
1.4
1.2
0.8
0.6
0.4
0.2
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #5 (1180996)
start of growing season
Peak high water 3.9' above ground
56 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
Date
2
1
0
-1
-2
-3
-4
3
2.5
2
1.5
1
0.5
0
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
7/16/2011
7/30/2011
8/13/2011
8/27/2011
Water Surface Elevation
Required Elevation
Onsite Rainfall


Mason Monitoring Gauge #6 (1181004)
start of growing season
Peak high water 4.0' above ground
72 consecutive days
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
Date
2
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
7/16/2011
7/30/2011
8/13/2011
8/27/2011
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)
Date
start of growing season
56 consecutive days
Peak high water 3.7' above ground
1
0
-1
-2
3
2.5
2
1.5
1
0.5
0
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
7/16/2011
7/30/2011
8/13/2011
8/27/2011
Water Surface Elevation
Required Elevation
Onsite Rainfall

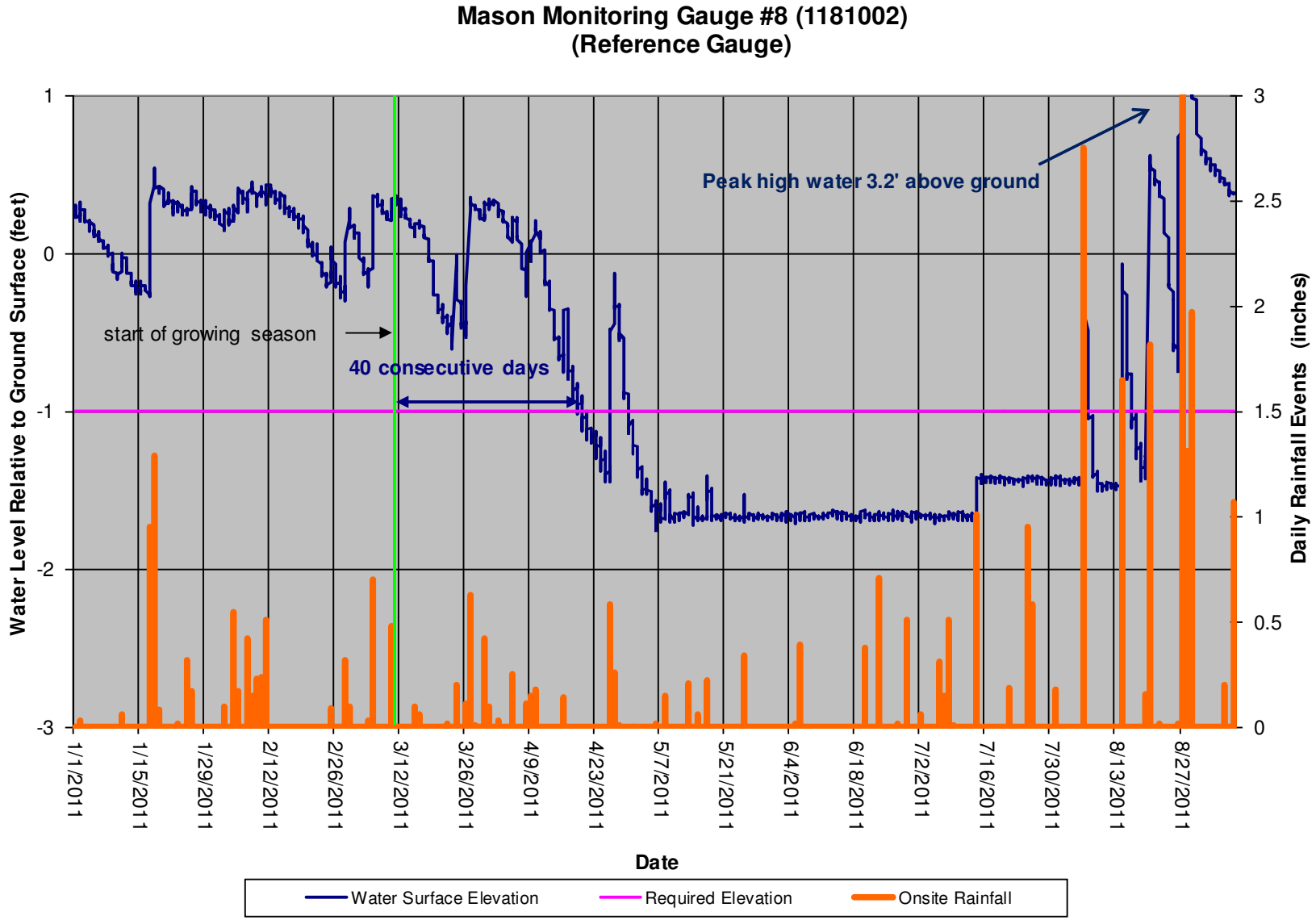
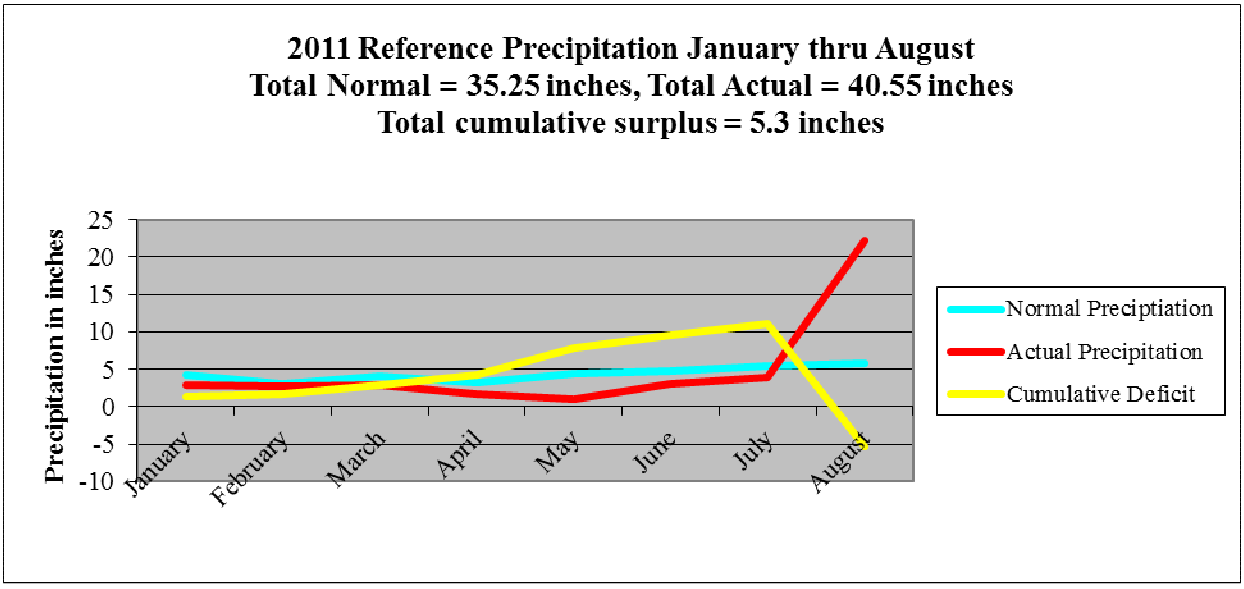

Mason Monitoring Gauge #8 (1181002)
(Reference Gauge)
Water Level Relative to Ground Surface (feet)
Daily Rainfall Events (inches)
Peak high water 3.2' above ground
start of growing season
40 consecutive days
1
0
-1
-2
-3
3
2.5
2
1.5
1
0.5
0
1/1/2011
1/15/2011
1/29/2011
2/12/2011
2/26/2011
3/12/2011
3/26/2011
4/9/2011
4/23/2011
5/7/2011
5/21/2011
6/4/2011
6/18/2011
7/2/2011
7/16/2011
7/30/2011
8/13/2011
8/27/2011
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	38	Y	Y	143	55	Y	Y	30	12	Y	Y	79	30	Y	Y				
2	86	33	Y	Y	91	35	Y	Y	47	18	Y	Y	54	21	Y	Y				
3	95	36	Y	Y	79	30	Y	Y	49	19	Y	Y	70	27	Y	Y				
4	88	34	Y	Y	133	51	Y	Y	48	18	Y	Y	56	21	Y	Y				
5	92	35	Y	Y	91	35	Y	Y	47	18	Y	Y	56	21	Y	Y				
6	93	36	Y	Y	118	45	Y	Y	48	18	Y	Y	72	28	Y	Y				
7 (Ref)	158	61	Y	Y	119	46	Y	Y	261	100	Y	Y	56	21	Y	Y				
8 (Ref)	41	16	Y	Y	129	49	Y	Y	47	18	Y	Y	40	15	Y	Y				

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



Appendix D

Problem Areas Plan View (Integrated)

In lieu of an integrated map, some photos are offered as evidence of the potential damage caused by Hurricane Irene in late August of 2011. Vegetation across the project site shows stress and premature leave browning or leaf drop due to salt water intrusion during the storm. The long-term effects of this salt damage are unknown at this point.

Typical example of damage from salt water flooding post Irene.

Entire project site was inundated with salt water causing widespread browning of vegetation.

Typical browning of the vegetation on the project site. Some live leaf material above the 4.0' high water mark appears to have survived.