Thomas Bay Marsh, Brunswick, Maine
2011 Post-Construction Monitoring Report

Prepared By:
Matt Craig
Casco Bay Estuary Partnership
PO Box 9300
34 Bedford Street
Portland, ME 04104

Submitted To:
GOMC/NOAA CRP
#10-03 Thomas Bay Marsh/Adams Road

Date Submitted:
February 17, 2012

Casco Bay Estuary
PARTNERSHIP

Background

Thomas Bay marsh is an approximately 70 acre finger marsh located within the Town of Brunswick, Maine. The marsh adjoins the New Meadows River, a narrow tidal embayment in northeastern Casco Bay, where Adam's Road crosses a tidal creek, located at 43.901571°, -69.890102°. Adam's Road bisects Thomas Bay marsh. The causeway is one of the oldest roads in Brunswick, and predates an 1894 topographic map of the area.

Historically, Adam's Road has restricted tidal exchange between the downstream and upstream marsh. A causeway forms the bed of Adam's Road where it crosses Thomas Bay marsh. Until it was replaced in August 2011, the tidal creek passed under the road in a 60" diameter round metal culvert fitted within an older granite block structure. Over time, scour has produced scour pools on both sides of Adam's Road. The culvert also restricted flow, reducing the volume of saltwater that reached the landward side of the road during flood tides. The restricted tidal range has affected marsh hydrology upstream of Adam's Road, leading to the expansion of scrub/shrub and freshwater wetland habitat.

In 2010, Gulf of Maine Council/NOAA Habitat Restoration Partnership awarded a grant to the Casco Bay Estuary Partnership (CBEP) to work with the Brunswick Public Works department (BPW) and replace the existing round pipe with a larger volume pipe arch culvert. Construction occurred on August 17, 2011.

Monitoring Plan

CBEP is monitoring pre- and post- construction conditions at Thomas Bay marsh in accordance with a project-specific monitoring plan (CBEP 2011). The Plan is focused on understanding changes in hydrology, salinity, and vegetation in the marsh, especially in and around the area of the transition from salt-tolerant salt marsh dominants to species more typical of brackish or freshwater tidal marsh, resulting from the increased tidal exchange. CBEP will be monitoring several parameters at pre-scheduled intervals through 2016: tidal channel hydrology and salinity, groundwater elevations, pore water salinity, vegetation, and channel adjustment.

In 2011 CBEP staff established ten monitoring stations, with Station 1 at the southern end of the marsh downstream of Adams Road, and Station 10 at the head of the marsh. Stations 1 & 2 are downstream of Adams Road, and Stations 3 – 10 are upstream. CBEP set transects from the edge of the tidal creek to the upland edge for assessing vegetative cover at each station. Stations 2, 3, 7, 7A, 8, and 10 each have one deep and one shallow groundwater monitoring well, as well as one pore water salinity well. Pre-construction channel cross-sections were measured at Stations 2, 3, 7, 8, and 10. Approximate Station locations are provided in Figure 1. Tidal channel hydrology stations are shown in Figure 2.

CBEP staff created a monitoring database in Microsoft Access. All 2011 Station data have been entered into the database and eventually, the database will link to photos and scanned drawings recorded during vegetation and cross section surveys. A copy of the database is available from CBEP.

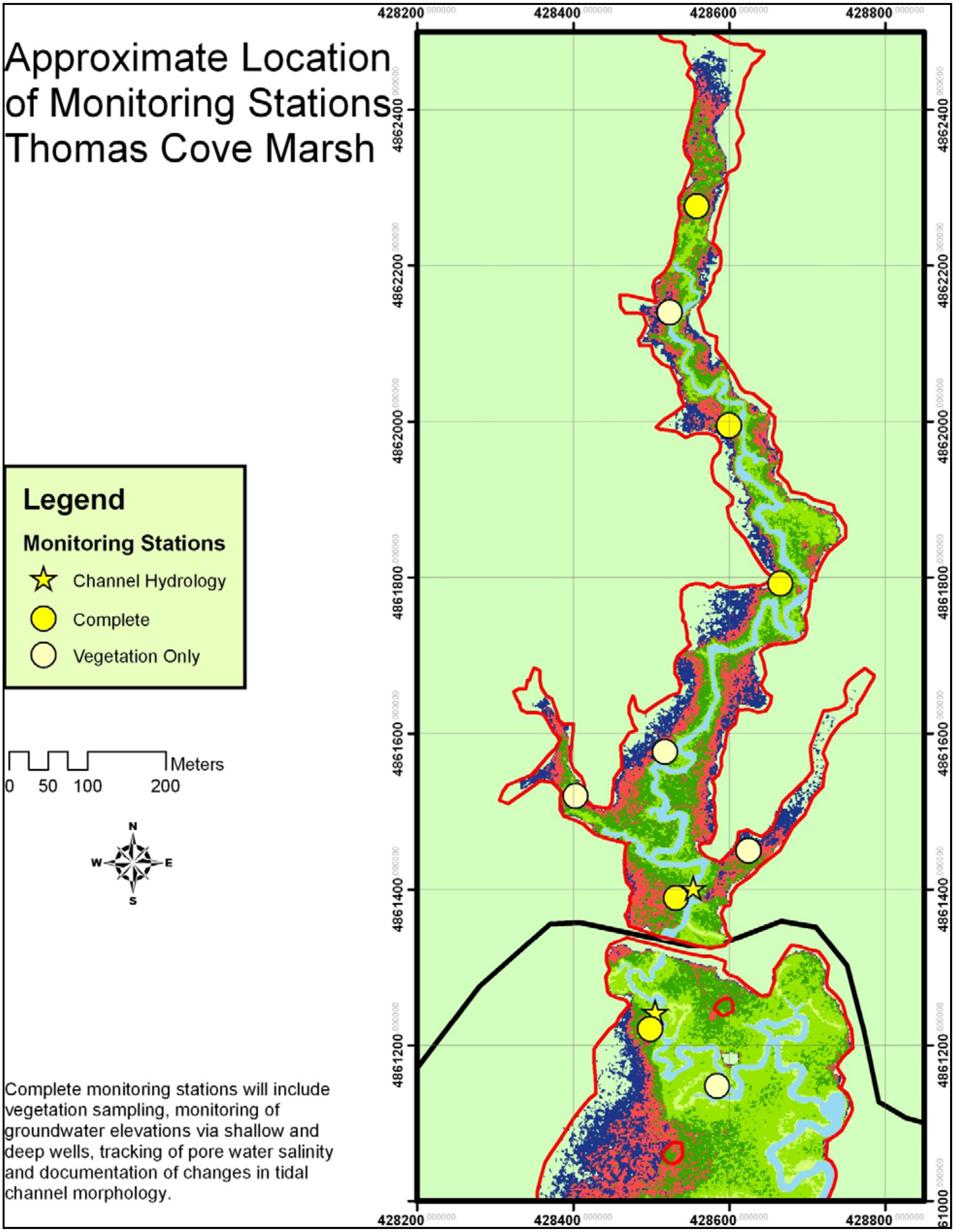

Figure 1. Approximate locations of monitoring stations at Thomas Cove marsh.

The monitoring plan specifies CBEP's reporting obligations to GOMC/NOAA for this project. CBEP is scheduled to prepare and submit annual data summaries to GOMC/NOAA in 2011 and 2012, as well as a final report in 2016. This document summarizes data collected in 2011.

Tidal Channel Hydrology Monitoring

Tidal stage data were collected upstream and downstream of Adams Road. All surface water elevations were tied to a local benchmark, referred to as the Top of Marsh Pin in engineering designs and surveys, using CBEP auto-levels staged on the shoulder of Adams Road. The elevation of the Marsh Pin, located adjacent to the upstream scour pool on the high marsh surface, is 5.25 feet NAVD88 (University of Southern Maine GIS Lab 2009).

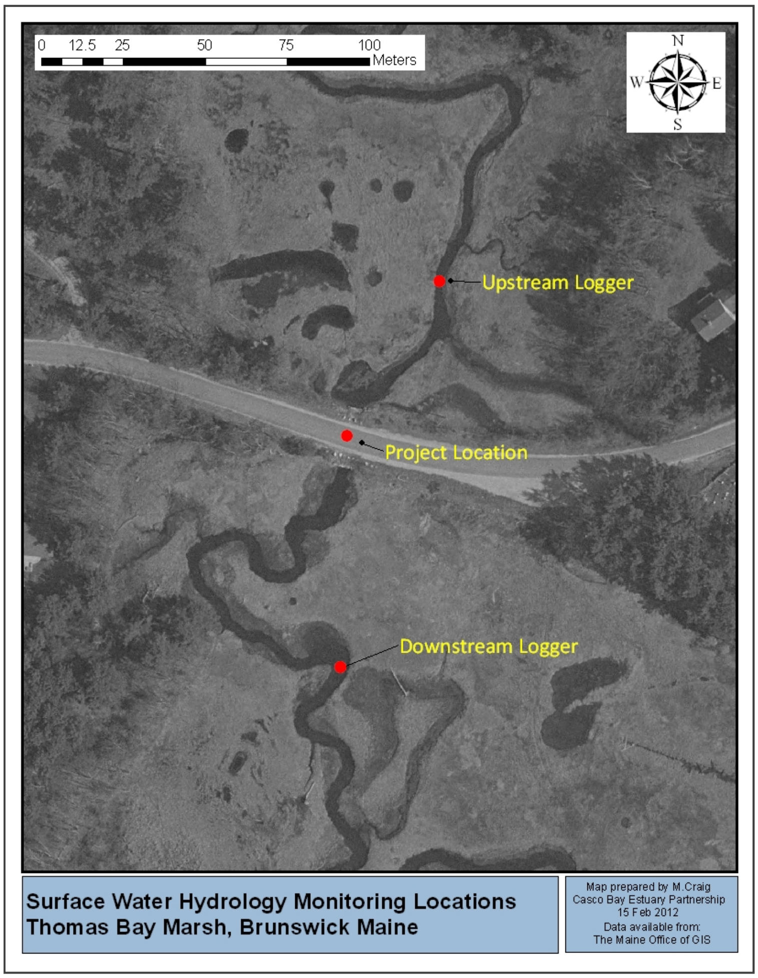

Figure 2. Surface water hydrology monitoring locations.

Pre-construction tidal stage data were collected using In-Situ, Inc. AquaTroll 200 pressure transducer data loggers with vented cables between March 31 and May 26 by CBEP. Loggers were deployed horizontally, in porous/drilled PVC piping secured to concrete blocks, with the cable running out of the creek channel and posted several feet above the high marsh surface on a metal fence post. Water level was recorded at 15 minute intervals, spanning two spring tide cycles, including an 11.7 foot projected high tide event on April 19. Data were periodically downloaded onto a laptop in the field via the cable, and loggers remained submerged for the entire deployment period. Figure 3 is a plot of pre-construction surface water hydrology data from March 31 to May 26. Figure 4 plots pre-construction data from May 1 to May 26. Figure 5 plots pre-construction data from May 16 to May 20 spring tide. Figure 6 is a plot of the pre-construction data on the April 19 spring tide. Surface water salinity was also recorded with the loggers. Figure 7 plots surface water salinity with 24 hour rainfall from April 1 to April 30.

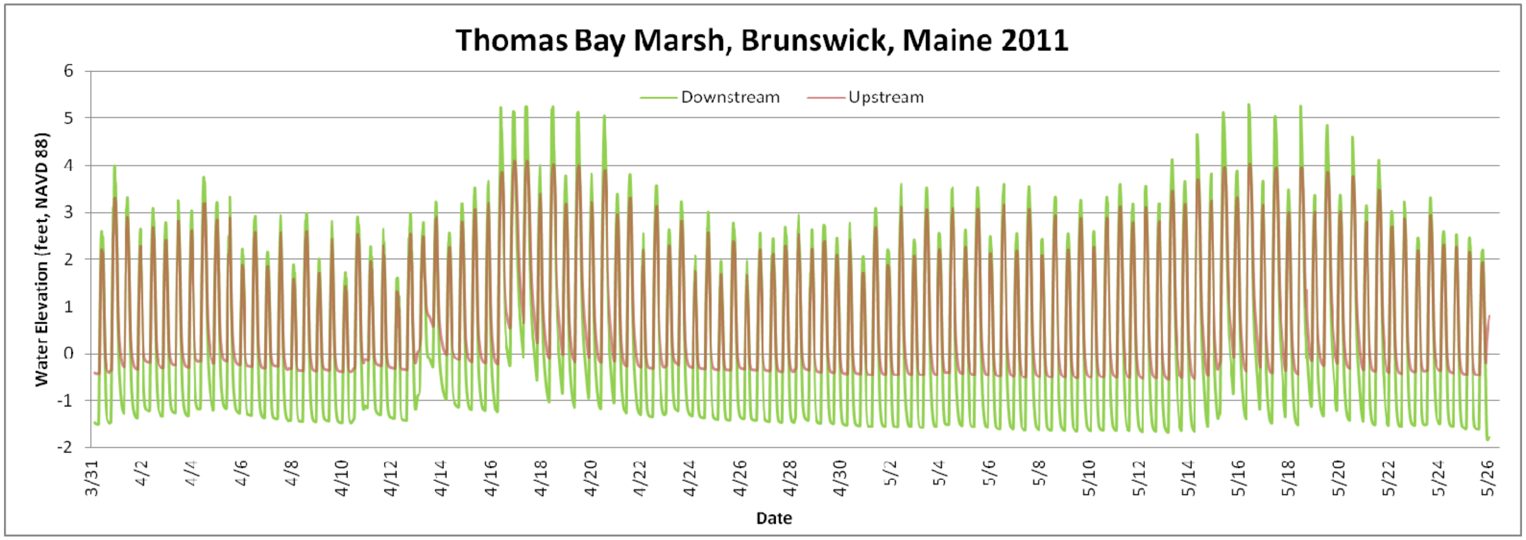

Figure 3. Thomas Bay marsh pre-construction data from March 31 to May 26, 2011.

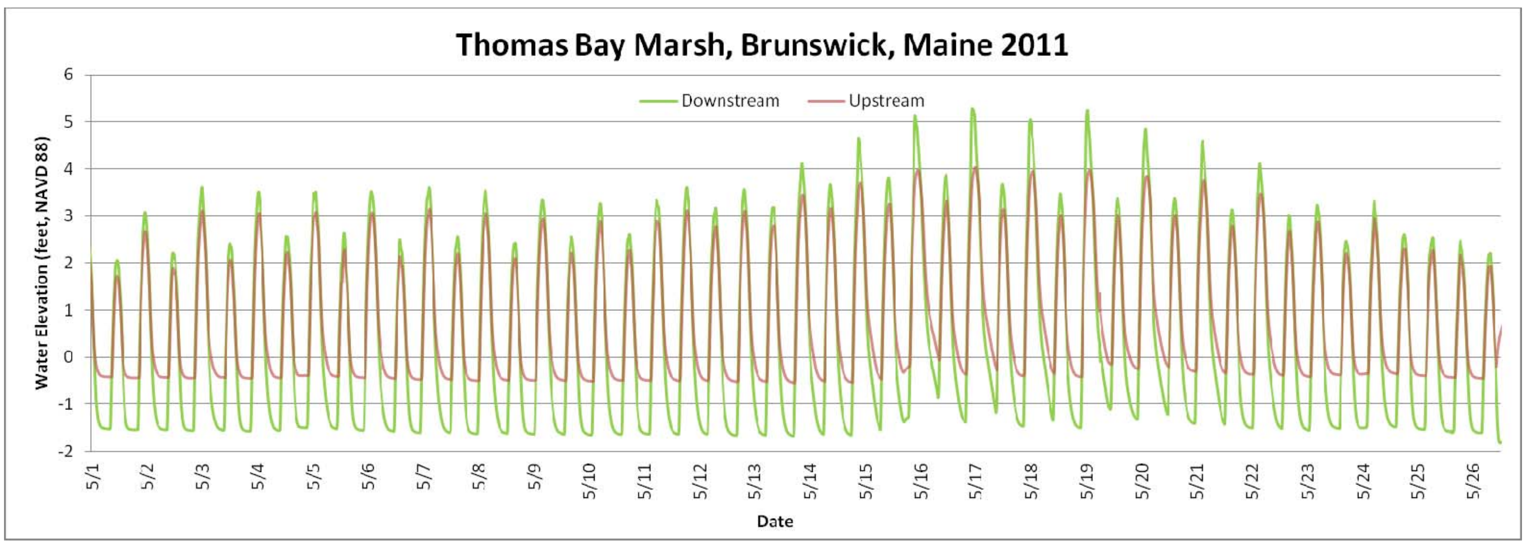

Figure 4. Thomas Bay marsh pre-construction data from May 1 to May 26, 2011.

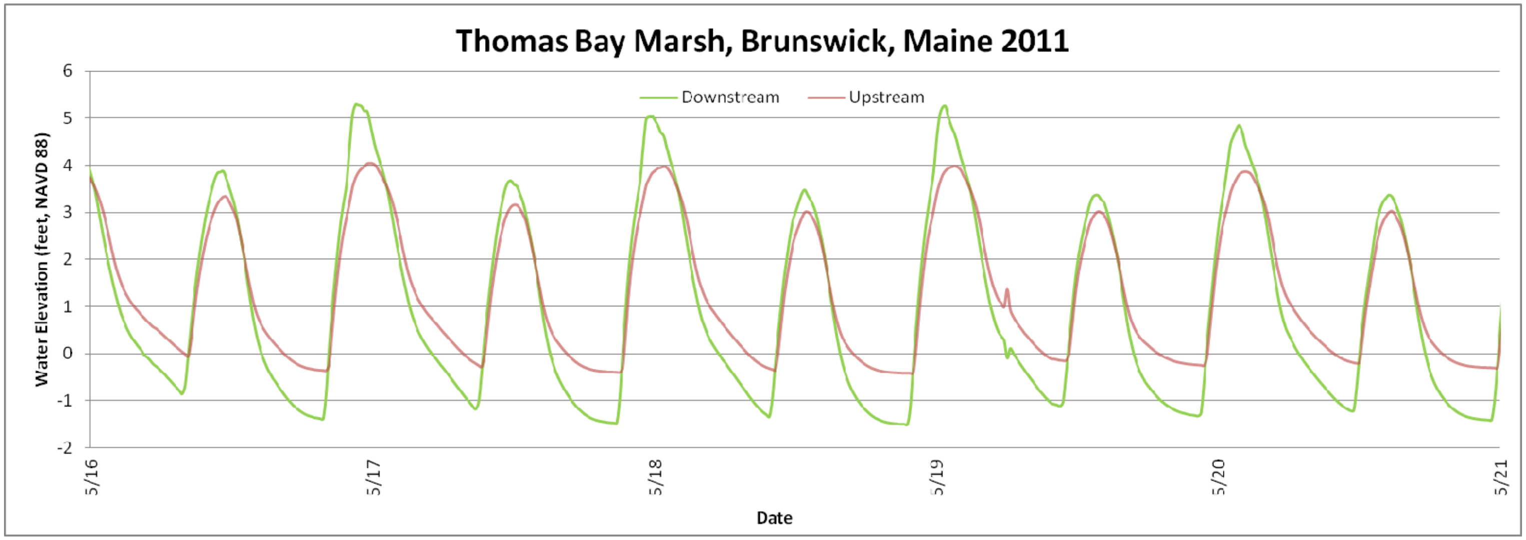

Figure 5. Thomas Bay marsh pre-construction data, May 16 to May 20, 2011.

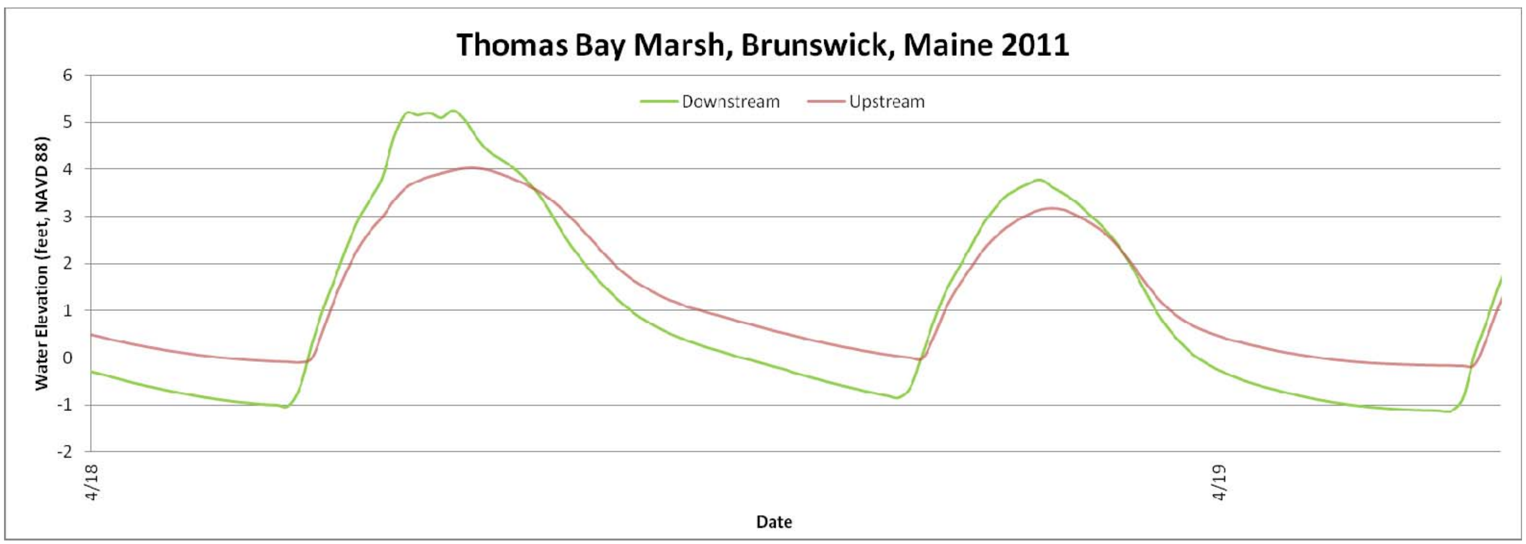

Figure 6. Thomas Bay marsh pre-construction data, April 18 to April 19 spring tide, 2011.

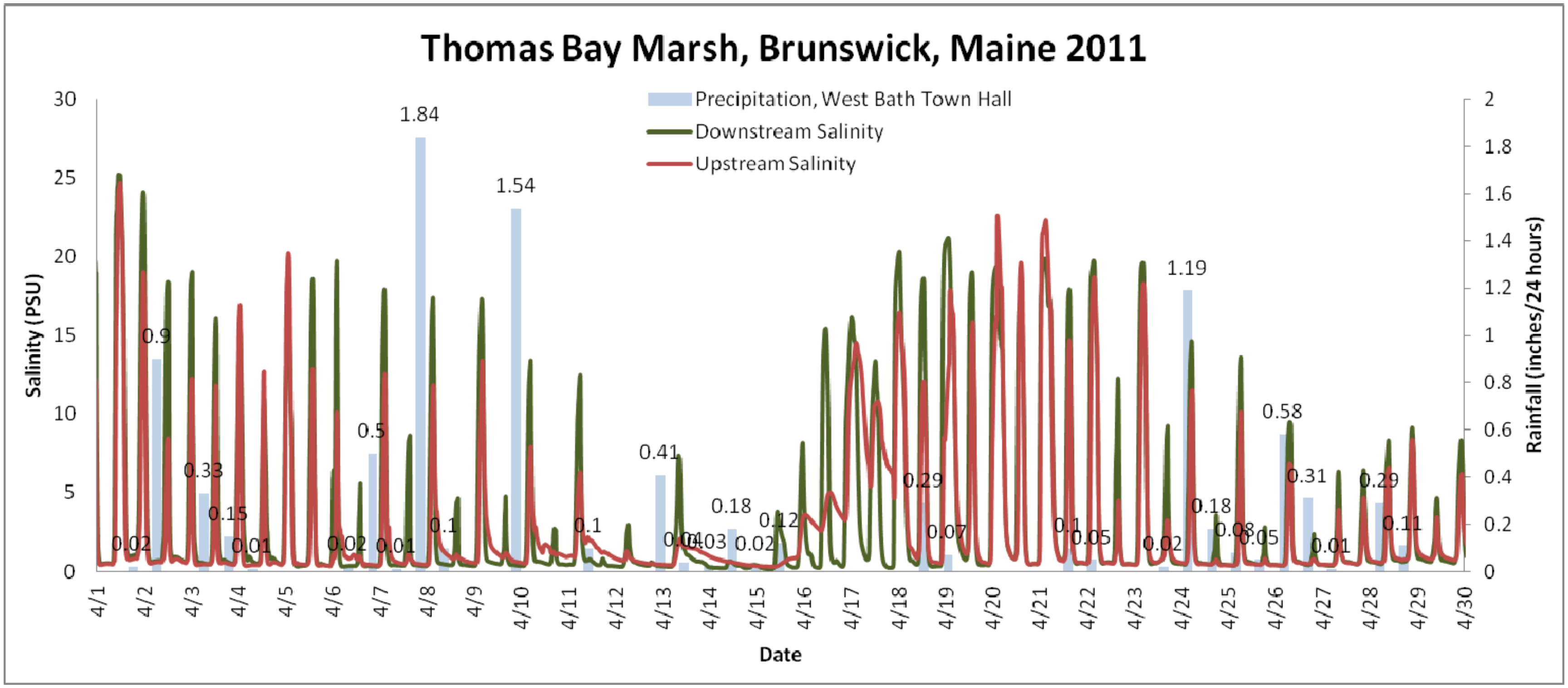

Figure 7. Thomas Bay marsh pre-construction surface water salinity levels, April 2011.

Additional pre-construction tidal stage and salinity data, as well as post-construction tidal stage and salinity data, were collected by CBEP using AquaTroll 200 loggers between July 25 and October 19. Loggers were deployed horizontally, in porous/drilled PVC piping attached to a flat concrete block (Photo 1), with the cable running out of the creek channel and staked above the high marsh surface. Water level was recorded at 15 minute intervals. Data were periodically downloaded onto a laptop. Loggers remained deployed during construction, which generated heavy in-stream sediment plumes on August 16 that lasted for several days afterward.

Photo 1. Upstream logger, post-construction.

Review of the logger data collected during the second deployment, from July to October, show that the data are not suitable for presentation in this report, or for comparison with the March to May data set. Plots of the post-construction data show drift, as well as unexplainable discrepancies between pre-construction and post-construction tidal range, unexplainable discrepancies between logger-recorded water depth and surveyed water height, and errors in other recorded parameters.

The exact cause(s) of errors in data collection during the July – October deployment cannot be isolated from reviewing the data. Most likely, a combination of factors contributed to the erroneous measurements:

- Equipment fouling. Particularly post-construction, both loggers were heavily fouled, as evidenced by Photo 1. Sediment build up within the PVC pipe and around the equipment sensors was clearly exacerbated by construction activities, as well as active channel adjustment post-construction.
- Change in logger elevation. Active channel adjustment post-construction may have changed logger elevations over the course of the deployment period. Although survey data do not indicate this occurred, the upstream concrete block was clearly buried into the channel bottom. Logger elevation could have also shifted during field cleaning.
- Survey error. The elevation of the loggers relative to the Marsh Pin could have been misread during surveying. Also, although elevations were surveyed at the upstream logger on two occasions, the elevation of the downstream logger was surveyed once.
- Equipment malfunction. In-Situ's equipment maintenance recommendations call for loggers to be calibrated by the manufacturer within 12-16 months of the initial

deployment. This calibration was overdue for July – October deployment. Some data variability from one or both loggers may be attributable to sensor drift.

CBEP will take a number of steps to ensure accurate collection of post-construction data in 2012, including:

- Switch to a more standard vertical deployment system/Stilling Well, in order to stabilize logger elevation, as well as to reduce fouling within casing and around sensors.
- Send loggers to manufacturer for factory calibration.
- Deploy equipment for a maximum of one month. Loggers will be calibrated and thoroughly cleaned in the office between deployments.
- Take multiple measurements of logger elevations at deployment and at removal to check measurement accuracy and consistency.

Cross Sectional Area

Pre-construction channel cross sections were surveyed on August 9 at Stations 2, 3, 7, 8, and 10. Generally, cross sectional area decreases moving from south to north.

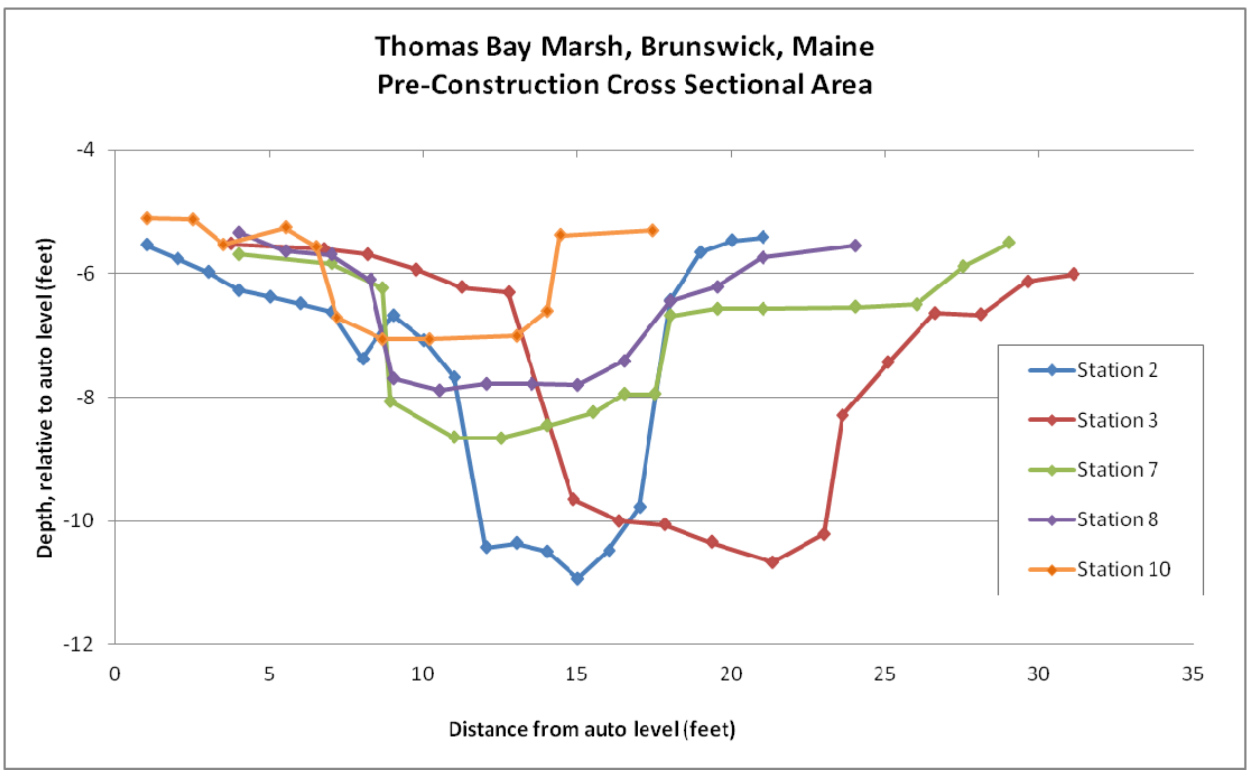

Figure 8. Pre-construction cross-sectional area on 8/9/2011. Note: elevations are relative within a given transect, but not across transects.

Vegetation

Pre-construction vegetation data were collected on August 12 using 1 meter^2 plots along transects set at each of the ten monitoring stations. Transects started at the edge of the tidal creek and ended at the upland transition. Transects were set on the western side of the creek to simplify access. Photo stations were established with four photos per Station facing north, south, east, and west.

Photo 2. Typical cluster of Station wells.

Summary report tables of the 2011 vegetation data for each station are provided in Attachment A.

Pore Water Salinity

Pore water samples were collected from capped and vented PVC wells. Salinity was measured using handheld refractometers. Measurements were collected and recorded at Stations 2, 3, 7, 7a, and 10. Two pre-construction samples were collected at Stations 2, 3, 7, and 7a, and one pre-construction sample was collected at Station 10. Figure 9 plots pore water salinity measurements. Generally, pore water salinity measurements were observed to decrease moving northward/inland into the marsh system.

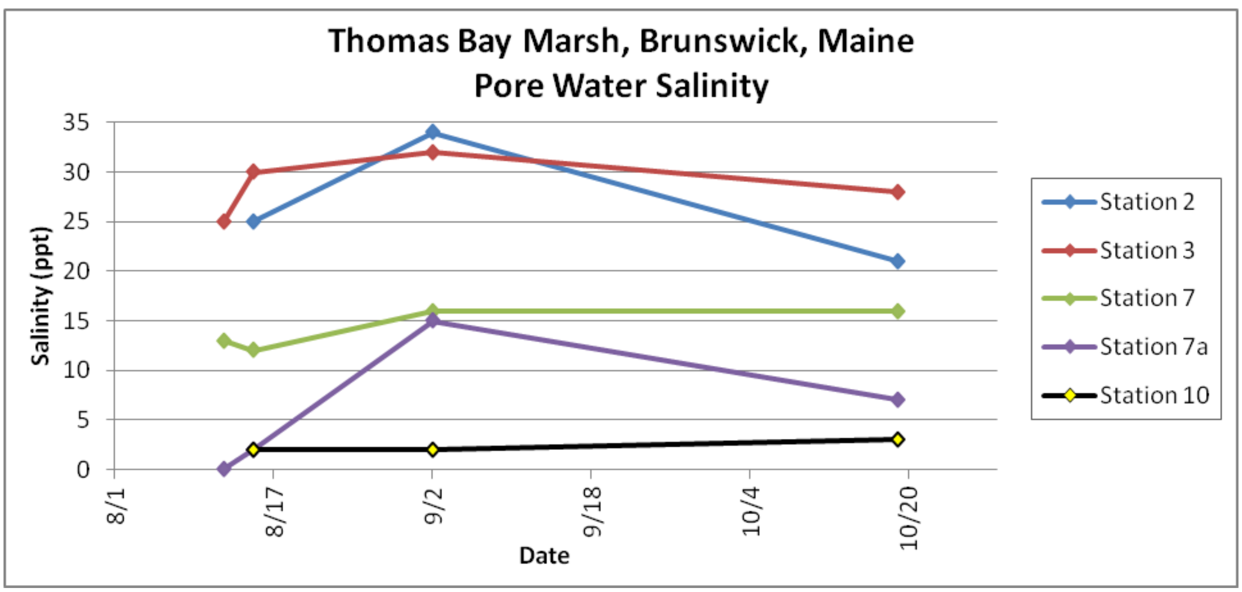

Figure 9. Pore water salinity measurements pre- and post- construction.

Surface water samples were collected at Stations 7, 8, and 10. Surface water samples were not collected at Stations 2 or 3 due to the ability of InSitu loggers to collect salinity data. Surface water salinity at Stations 7, 8, and 10 ranged from 0 ppt at Station 10 to 4 ppt at Station 7. Data are not presented here due to the limited number of samples (twelve).

Photo 3. Installing a deep water monitoring well.

Groundwater Depth

Groundwater depth from the surface was measured at shallow and deep monitoring wells at Stations 2, 3, 7, 7a, and 10 on. With the exception of Station 10, two measurements were taken at each Station prior to construction. Station 10 had one measurement taken for deep and shallow well groundwater depths pre-construction. Figure 10 plots shallow and deep groundwater depths at each Station.

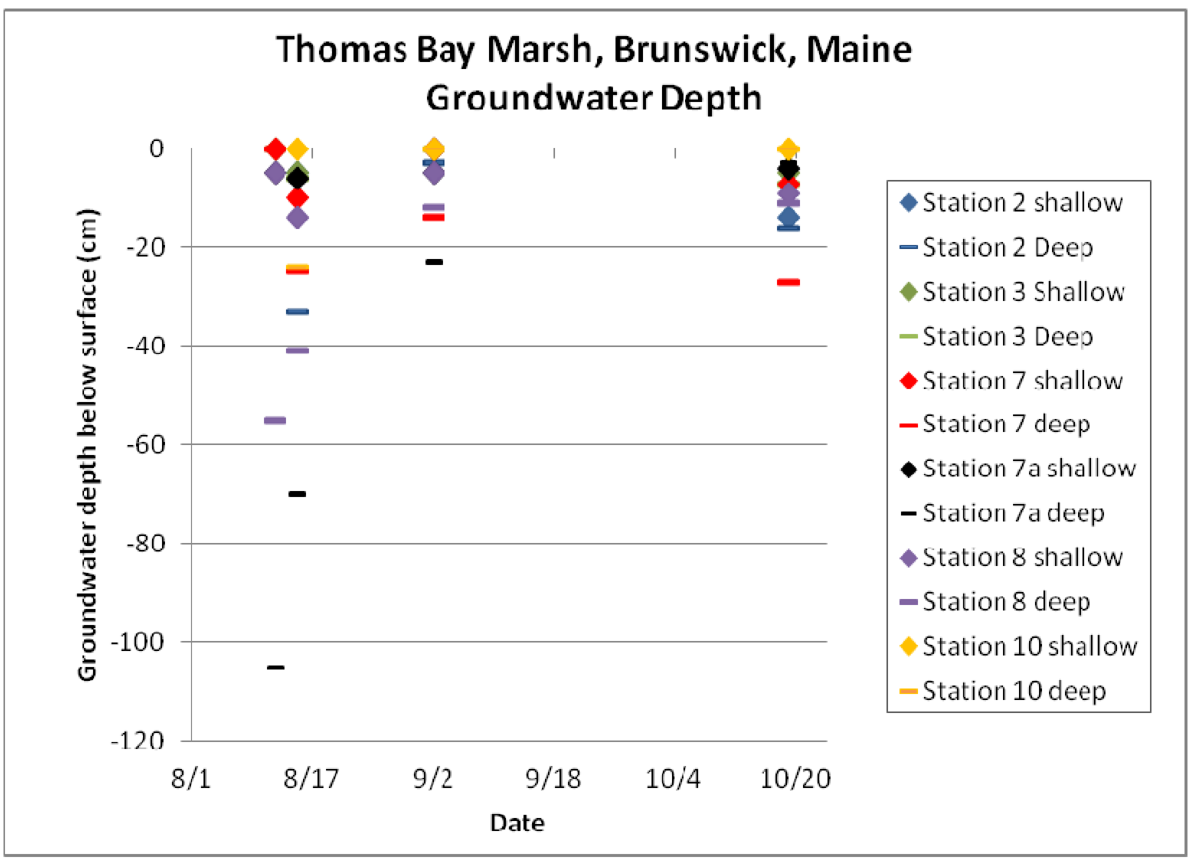

Figure 10. Groundwater depth from surface in shallow and deep monitoring wells.

References

Casco Bay Estuary Partnership 2011. *Monitoring Plan for Tidal Restriction Restoration at Thomas Cove Marsh.*

University of Southern Maine GIS Lab, 2009. RTK-GPS data.

Attachment A – Pre-construction vegetation transect summary reports.

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
1	8/11/2011	428474	4860982	128	10	11

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 13
SPAL	Spartina	alterniflora	9	82	44	
SPPA	Spartina	patens	8	73	39	
SCPU	Scoenoplectus	pungens	4	36	28	
AGST	Agrostis	stolonifera	2	18	53	
BOMA	Bolboschoenus	maritimus	2	18	33	
DISP	Distichlis	spicata	2	18	28	
TRMA	Triglochin	maritima	2	18	25	
SAEU	Salicornia	europaea	2	18	1	
ASSP	Aster	spp.	1	9	20	
JUSP	Juncus	sp.	1	9	10	
SPPE	Spartina	pectinata	1	9	5	
JUAR	Juncus	arcticus	1	9	2	
TYLA	Typha	latifolia	1	9	1	
Wrck	Wrack		3	27	32	
OpnW	Open Water		2	18	20	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
2	8/9/2011	438505	4861196	71	6	11

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 11
SPPA	Spartina	patens	6	55	68	
BOMA	Bolboschoenus	maritimus	4	36	34	
AGST	Agrostis	stolonifera	3	27	23	
FERU	Festuca	rubra	3	27	13	
SPAL	Spartina	alterniflora	2	18	54	
CAPA	Carex	paleacea	2	18	23	
JUSP	Juncus	sp.	2	18	11	
DISP	Distichlis	spicata	2	18	4	
SPPE	Spartina	pectinata	1	9	40	
TYLA	Typha	latifolia	1	9	15	
TRMA	Triglochin	maritima	1	9	0	
Wrck	Wrack		3	27	53	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
3	8/9/2011	428537	4861390	77	7	11

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 11
SPPA	Spartina	patens	9	82	85	
AGST	Agrostis	stolonifera	3	27	3	
SPPE	Spartina	pectinata	2	18	28	
SCPU	Scoenoplectus	pungens	2	18	27	
LYTE	Lysimachia	terrestris	2	18	13	
SPAL	Spartina	alterniflora	2	18	10	
CASP	Carex	sp.	1	9	40	
FERU	Festuca	rubra	1	9	20	
COSP	Convolvulus	sp.	1	9	10	
ASSP	Aster	spp.	1	9	5	
JUSP	Juncus	sp.	1	9	0	
Wrck	Wrack		5	46	14	
Bare	Bare	Ground	1	9	40	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
4	8/12/2011	428620	4861443	31	3	10

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 12
SCPU	Scoenoplectus	pungens	8	80	47	
ASSP	Aster	spp.	8	80	8	
AGST	Agrostis	stolonifera	7	70	16	
SPPA	Spartina	patens	7	70	15	
BOMA	Bolboschoenus	maritimus	3	30	62	
TRMA	Triglochin	maritima	3	30	20	
SPPE	Spartina	pectinata	3	30	12	
JUAR	Juncus	arcticus	1	10	30	
SPAL	Spartina	alterniflora	1	10	15	
ANPO	Anserina	potentilla	1	10	5	
ATTR	Atriplex	triangularis	1	10	3	
PESA	Persicaria	sagittata	1	10	0	
OpnW	Open Water		1	10	10	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
5	8/12/2011	428401	4861529	21	2	10

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 11
CAUT	Carex	utriculata	10	100	35	
ASSP	Aster	spp.	10	100	19	
AGST	Agrostis	stolonifera	9	90	40	
COSP	Convolvulus	sp.	6	60	6	
SCPU	Scoenoplectus	pungens	5	50	10	
CACA	Calamagrostis	canadaensis	4	40	30	
SPPE	Spartina	pectinata	4	40	14	
JUSP	Juncus	sp.	2	20	13	
SOSE	Solidago	sempervirens	2	20	9	
SPPA	Spartina	patens	1	10	35	
ELPY	Elymus	pycnanthus	1	10	5	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
6	8/12/2011	428542	4861563	45	4	11

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 16
DISP	Distichlis	spicata	7	64	20	
SCPU	Scoenoplectus	pungens	6	55	29	
JUGE	Juncus	gerardii	5	46	58	
JUSP	Juncus	sp.	5	46	32	
AGST	Agrostis	stolonifera	4	36	33	
SPPE	Spartina	pectinata	4	36	6	
SPPA	Spartina	patens	3	27	41	
ASSP	Aster	spp.	3	27	6	
ANPO	Anserina	potentilla	3	27	4	
COSP	Convolvulus	sp.	2	18	21	
GLMA	Glaux	maritima	2	18	14	
BOMA	Bolboschoenus	maritimus	2	18	10	
TRMA	Triglochin	maritima	2	18	8	
SPAL	Spartina	alterniflora	2	18	5	
JUAR	Juncus	arcticus	1	9	25	
FERU	Festuca	rubra	1	9	10	
Wrck	Wrack		1	9	40	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
7	**8/12/2011**	**428620**	**4861725**	**23**	**2.5**	**10**

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 13
SPPA	Spartina	patens	7	70	74	
AGST	Agrostis	stolonifera	6	60	22	
JUGE	Juncus	gerardii	5	50	20	
SCPU	Scoenoplectus	pungens	4	40	34	
FERU	Festuca	rubra	3	30	5	
SPAL	Spartina	alterniflora	2	20	9	
CACA	Calamagrostis	canadaensis	2	20	5	
SPPE	Spartina	pectinata	2	20	4	
JUAR	Juncus	arcticus	1	10	15	
DISP	Distichlis	spicata	1	10	15	
CAOV	Carex	ovales	1	10	10	
ANPO	Anserina	potentilla	1	10	0	
COSP	Convolvulus	sp.	1	10	0	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
8	**8/12/2011**	**428603**	**4862012**	**38**	**3.5**	**10**

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 11
SCAC	Schoenoplectus	acutus	10	100	36	
JUSP	Juncus	sp.	9	90	20	
FERU	Festuca	rubra	8	80	23	
COSP	Convolvulus	sp.	8	80	9	
CACA	Calamagrostis	canadaensis	5	50	15	
SPPE	Spartina	pectinata	5	50	10	
AGST	Agrostis	stolonifera	4	40	18	
ASSP	Aster	spp.	4	40	4	
TYLA	Typha	latifolia	2	20	23	
CAUT	Carex	utriculata	2	20	13	
THPA	Thelypterus	palustris	1	10	35	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
9	8/12/2011	428530	4862138	25	2.5	10

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 15
CAUT	Carex	utriculata	10	100	50	
GASp	Galium	Sp.	7	70	4	
CALA	Carex	lacustris	5	50	26	
JUSP	Juncus	sp.	5	50	11	
TYLA	Typha	latifolia	4	40	14	
SPLA	Spirea	latifolia	3	30	35	
SCAC	Schoenoplectus	acutus	3	30	3	
HYMU	Hypericum	mutulum	3	30	2	
CACA	Calamagrostis	canadaensis	2	20	25	
SPSp	Sphagnum	Sp.	2	20	17	
LYTE	Lysimachia	terrestris	2	20	0	
ALSp	Alnus	Sp.	1	10	15	
COSP	Convolvulus	sp.	1	10	5	
IMCA	Impatiens	capensis	1	10	5	
THPA	Thelypterus	palustris	1	10	0	

Station	Date	UTM Easting	UTM Northing	Transect Length (m)	Spacing of Plots (m)	Number of Plots
10	8/12/2011	428548	4862257	15	2	7

			Number of Plots	Percent of Plots	Avg Percent Cover	Species Richness 13
CACA	Calamagrostis	canadaensis	7	100	25	
TYLA	Typha	latifolia	7	100	21	
SPLA	Spirea	latifolia	6	86	32	
CAUT	Carex	utriculata	4	57	39	
GASp	Galium	Sp.	4	57	3	
IMCA	Impatiens	capensis	3	43	7	
Unkn	Unknown	Sp.	2	29	8	
POSp	Polygonum	Sp.	2	29	2	
LYTE	Lysimachia	terrestris	1	14	10	
ANPO	Anserina	potentilla	1	14	2	
POHA	Polygonum	hasatum	1	14	1	
THPA	Thelypterus	palustris	1	14	1	
HYMU	Hypericum	mutulum	1	14	0	