APPENDIX B

Saltmarsh Habitat Information in the Narrow River Drainage

John H. Chafee National Wildlife Refuge

Towns of South Kingstown and Narragansett

Washington County, Rhode Island

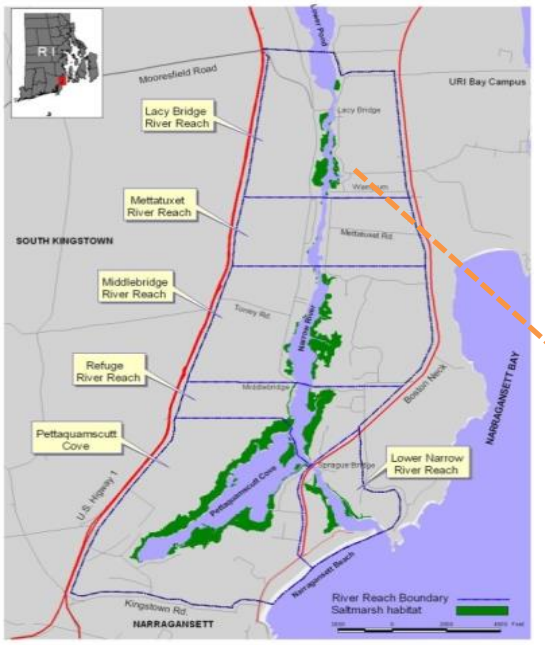
Overview:

This appendix provides broad level information regarding saltmarsh habitats in the Narrow River estuary.

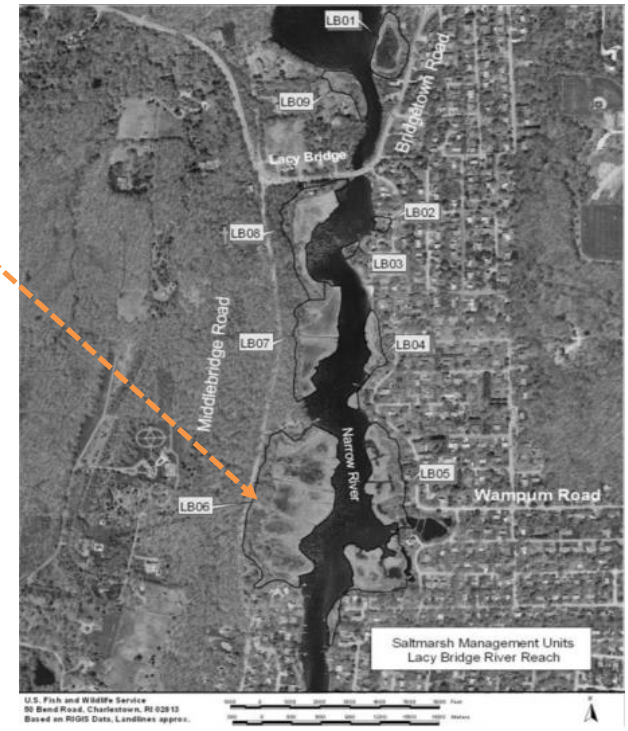
Organization of Information

The project area has been stratified into river reaches to facilitate analysis and restoration needs. Within each river reach, each saltmarsh was placed into saltmarsh management units. The salt marsh management units contain current saltmarsh, associated tidal (brackish) wetlands, shrub wetlands, and pools and pans. Generally, the two foot LIDAR elevation encompasses all current saltmarsh habitat. Possible areas where saltmarsh habitat may "migrate" into higher elevations are included within each unit, and include all between the two foot and four foot LIDAR elevation contours.

River Reaches in the Project Area Boundary

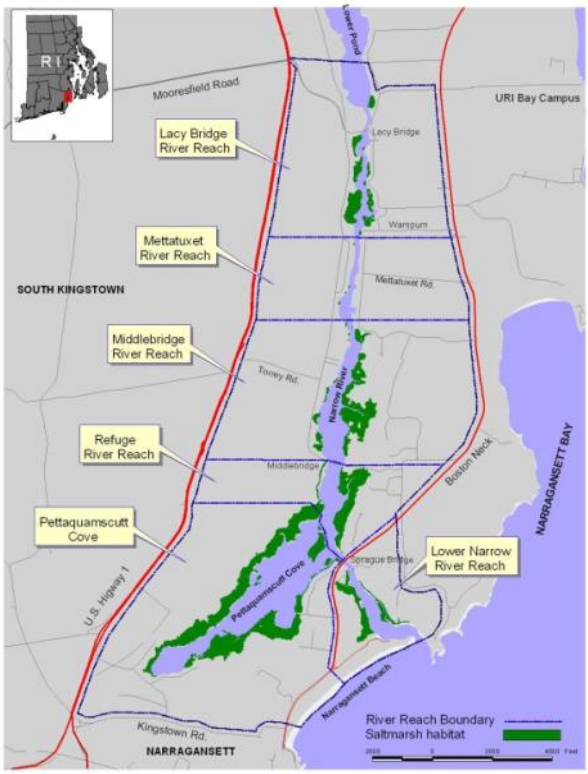


Saltmarsh Units, Lacy Bridge River Reach



Summary

The Narrow River estuary contains about 175 acres of saltmarsh primarily concentrated in the lower portions of the River below Middlebridge. Pools and pans comprise a substantial portion of the area, with well drained salt marsh comprising less than half (48%) of the salrtmarshes. Based on aerial imagry from 1939 - 2011, it appears that up to 40% of the pools and pans have developed since 1939. As a consequence most saltmarsh surfaces appear to be dominated by S. Alternaflora, with S. Patens occuring in upper elevations and in well drained areas near drainages.

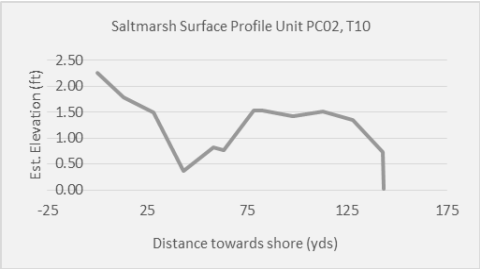


RIVER REACH	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTUARINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
Lacy Bridge	31.7	15.2	4.4	0.9	5.2	34.3	5.3	0.2	25.9	5.8	38.1
Mettatuxet	2.0	1.6	0.0	0.0	0.0		0.1	0.0	1.8	0.2	14.7
Middlebridge	83.3	31.6	3.3	4.9	8.2	26.0	9.2	2.1	51.1	32.2	102.2
Refuge	36.9	24.8	1.0	0.5	1.5	5.9	1.6	1.3	29.1	7.8	31.3
Pettaquamscutt Cove	169.0	86.8	5.7	14.2	20.0	23.0	12.6	0.6	119.9	49.1	56.5
Lower Narrow River	21.4	14.0	0.0	0.5	0.5	3.7	0.0	0.0	14.5	6.8	48.8
All River Reaches	344.2	174.0	14.3	21.0	35.4	20.3	28.8	4.2	242.3	101.9	58.6

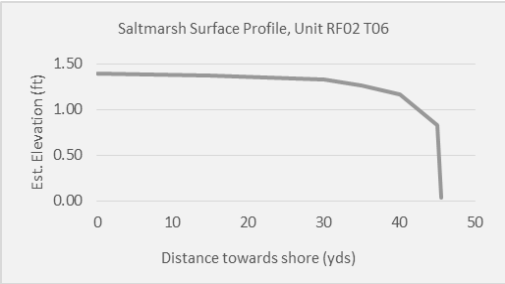
Saltmarsh Surface Profiles

Saltmarsh profiles vary markedly throughout the estuary, from relatively flat in the vicinity of Sedge Island to very

Irregular saltmarsh surface profile in Pettaquamscutt Cove.

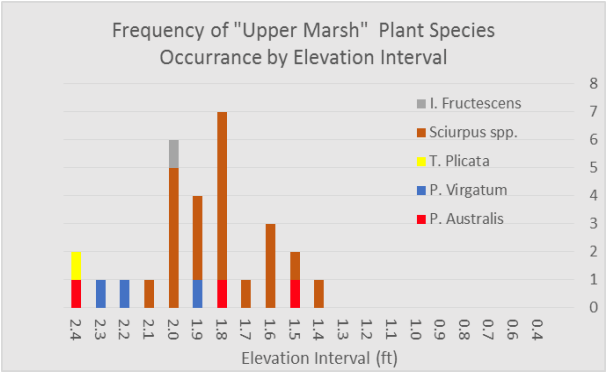


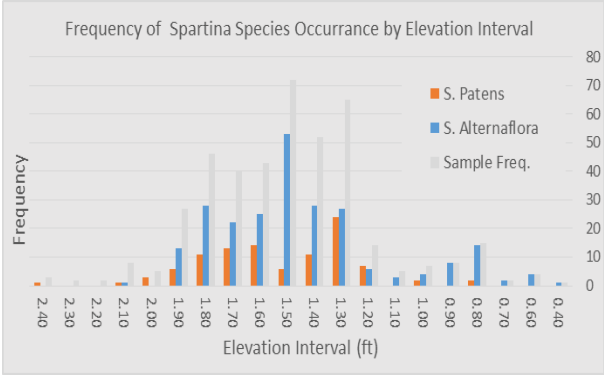
Well drained, consistent surface profile.



Plant Species Occurance by Elevation

During collection of surface profiles, the crew was asked to identify the dominant plant species witin a square meter of an elevation sample. While the results appear to characterize the distribution of "upper marsh" species, it dows not aide in identifyinf where S. patens is most domiant on the landscape. This species appears to be influenced both by elevation and proximity to drainage dicthes (well drained areas). The data in the graph below may be more influenced by sampling by elevation interval than dominance on the landscape.





ABOUT THE INFORMATION

Habitat Components:

Aerial imagry from2011 was used along with field knowledge to idenfity broad habitat categories:

Saltmarsh: Areas primarily dominated by S. Patens and S. Alternaflora

Tidal Marsh: Areas primarily dominated by cattail, sciurpus, and phragmites. Brackish to freshwater marsh.

Estuarine Shrub wetland: Areas dominated by Iva fructescens.

Pools and Pans: Areas on the marsh surface generally devoid of vegetation and either intermittantly of permantly flooded. Those found on 1939 aerial imagry deemed old pools and pans. These are generally freshwater in nature, and some depths exceed .75 meters.

Possible saltmarsh migration area: Areas below the fout foot LIDAR elevation, but not occupied by tidal marsh or shrub wetlands.

Saltmarsh drainage:

Aerial imagry from 1939, 1986, 2003 and 2011 were used to locate drainage ditches in the marsh, and to categorize them as to functioning or non-functioning. Some field verification was completed. Well drained areas were identified based on field observations and aerial image interpretation. Well drained areas generally occur within 50 feet of a functioning drainage. Increases in well drained areas based on ditch repair based on 50 foot buffer, except in areas where drainage did not discet a pool or pan, which reduced the buffer size.

Saltmarsh Surface Profiles:

Surface profiles were idenitifed collecting elevationas along transects within saltmarsh units using a laser level. In the Refuge and Pettaquamscutt Cove areas, the elevations were tied to a standard UFWS survey marker with known elevation (1.54 feet NGVD 1988). In other areas, profiles were taken but without a known field elevation. These data are relative to eachother but not a field elevation. The sample interval ranges between every 3 meters to every 15 meters dependng on the location. These data are not suitable for detailed task specific planning. At each elevation sample, the field crew examined the area a meter square to determine the dominant plant species.

Boat wake impacts

Information relative to possible impacts from boat wakes on saltmarsh shorelines was collected in 2008-2010. The river is heavily used in summertime to access Narragansett beach. Vessel counts on Sprague bridge found an average of 16 vessels per hour passing underneath the bridge in summer. The size of boat wakes was determined to be related to boat speed, vessel size, loading, and a Froude index which measures wave dissipation based on distance and depth. Boat wakes were found to be related to near shore turbidity and the amount of vegetation on the bank. An assessment of boat wake wave dissipation suggests areas farther than 300ft from a vessel will have wave dissipation to levels equivalent to a no wake speed.

Shoreline stability

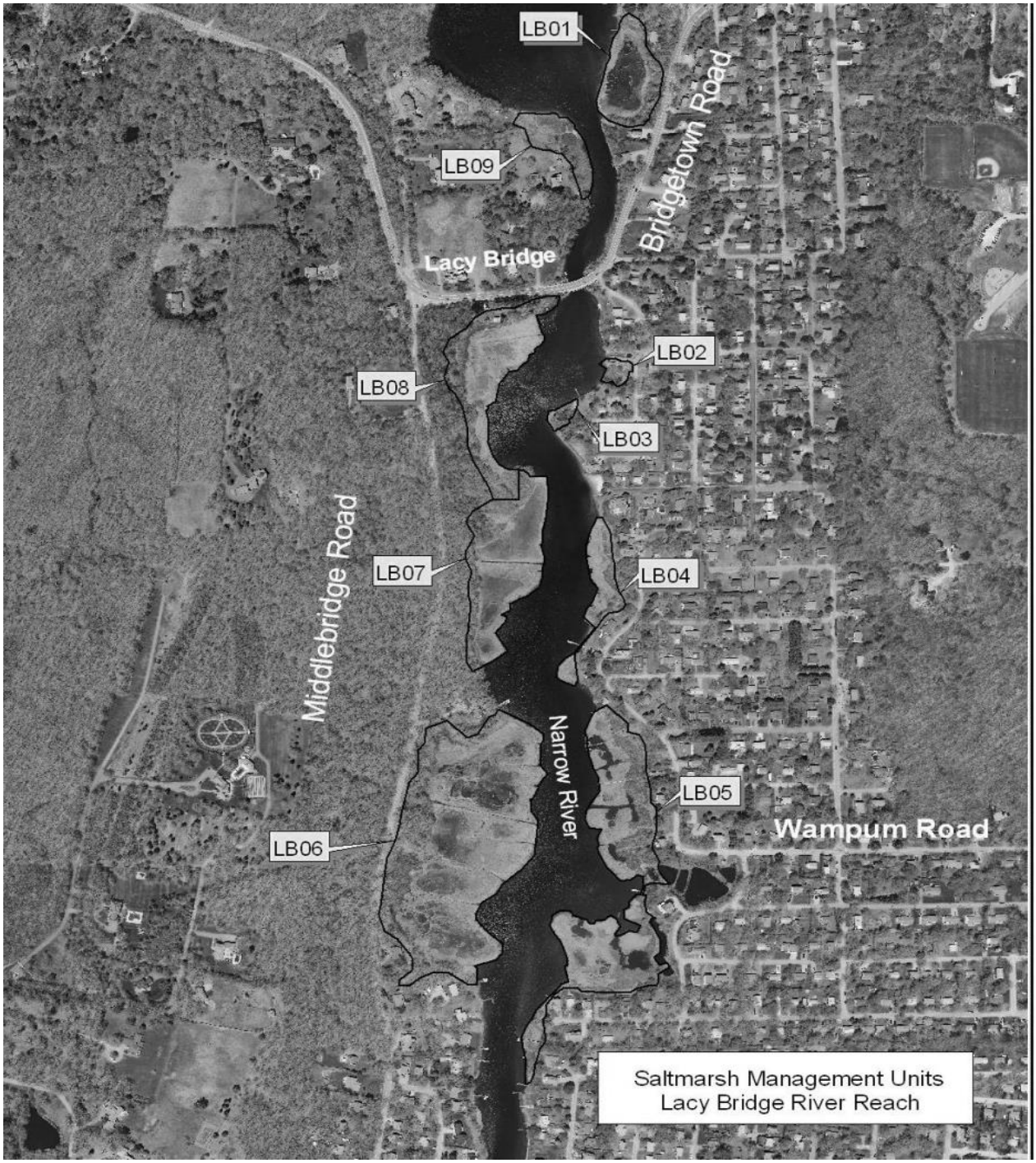
Shoreline stabi;ity surveys were undertaken in 2011 on refuge saltmarsh shorelines. Most shorelines are undercut on the River and in many sloughs. Bank height was highest in the lower narrow river, and most stable in the Middlebridge reach.

Lacy Bridge River Reach

I. Overview

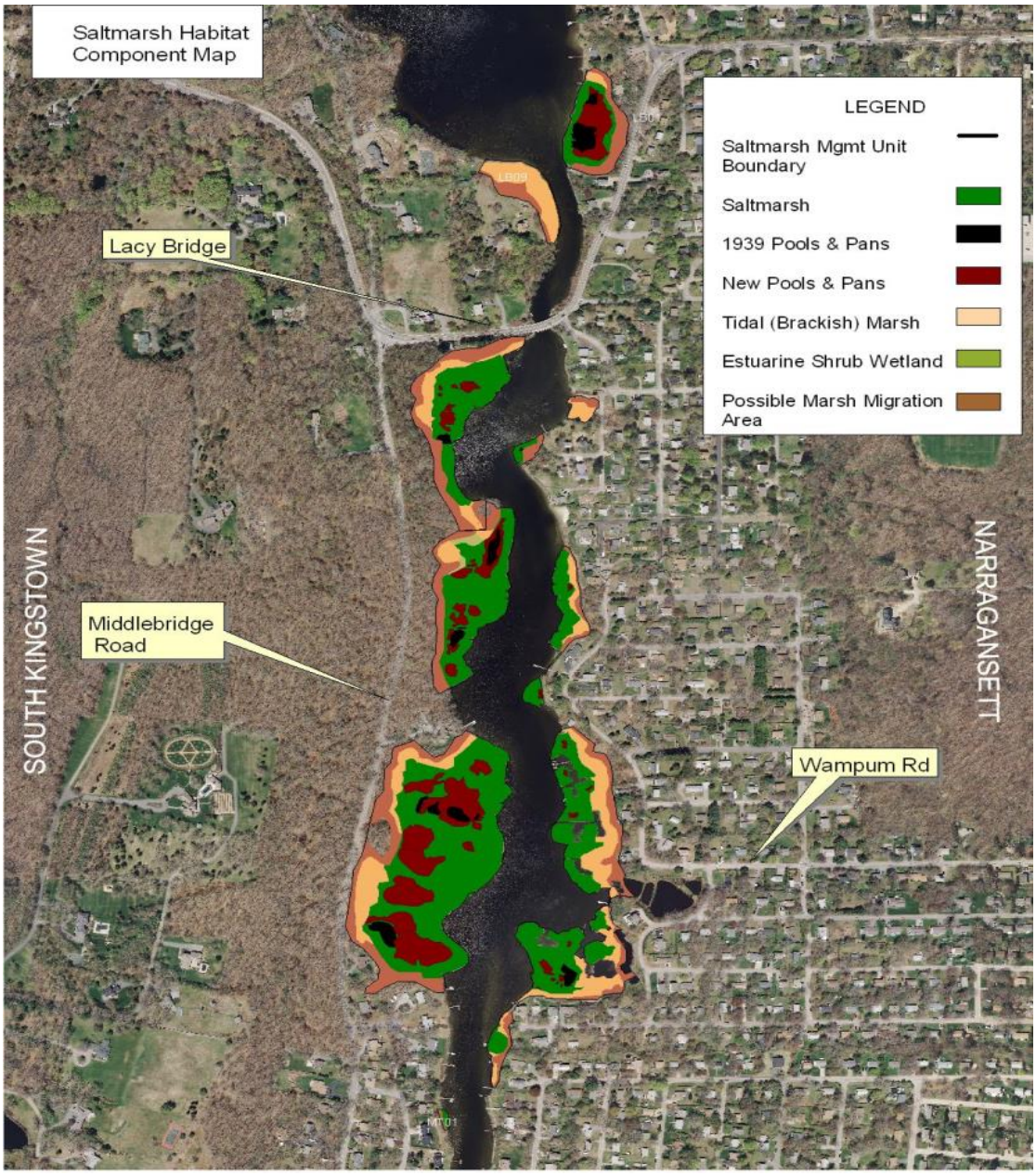
This reach contains the northern most extent of saltmarsh in the Narrow River. These 15 acres of saltmarsh may be isolated from downriver marshes except for small habitat patches in the Mettatuxett River reach. Larger marshes in South Kingstown are owned by Narrow River Land Trust. Most tidal (brackish) marsh dominated by phragmites; estuarine shrub wetlands dominated by I. Fructescens. Possible marsh migration areas questionable due to private ownership and developments.

II. Saltmarsh Management Units:



III. Habitat Components:

UNIT	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								POSSIBLE FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTURINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
ALL	31.7	15.2	4.4	0.9	5.2	34.3	5.3	0.2	25.9	5.8	38.1
LB01	2.1	0.8	0.5	0.2	0.7	93.9	0.1		1.6	0.6	73.9
LB02	0.3	0.0		0.0	0.0		0.2		0.2	0.1	
LB03	0.2	0.1			0.0				0.1	0.1	109.1
LB04	1.2	0.8	0.0		0.0	2.6	0.3		1.1	0.1	18.2
LB05	6.4	3.3	0.1	0.1	0.2	6.3	1.9		5.4	0.9	28.0
LB06	12.2	6.1	3.0	0.4	3.3	55.2	1.1		10.5	1.7	27.6
LB07	4.2	2.3	0.5	0.2	0.7	30.5	0.2	0.2	3.4	0.8	34.3
LB08	3.9	1.9	0.2	0.0	0.2	12.2	0.6		2.8	1.2	61.9
LB09	1.2	0.0					0.9		0.9	0.3	



IV. Marsh Surface Conditions and Drainage (NOTE IMAGES FOUND IN APPENDIX G)

UNIT	MARSH SURFACE DRAINS						CONDITION OF MARSH SURFACE				
	FUNCTIONAL DRAINAGE (FT)				NONFUNCTIONAL (FT)		CURRENT WELL DRAINED MARSH SURFACE		WELL DRAINED MARSH W/ DITCH REPAIR		
	DITCH / SLOUGH	SHORELINE	TOTAL	DENSITY	TOTAL	DENSITY	ACRES	PERCENT	NEW AC	TOTAL	PERCENT
ALL LB	6003.0	8628.0	14631.0	715.5	2281.0	111.5	11.4	55.9	4.0	15.5	75.7
LB01		481.0	481.0	327.2		0.0	0.4	23.8		0.4	23.8
LB02		134.0	134.0							0.0	
LB03		223.0	223.0	2027.3		0.0	0.1	90.9		0.1	90.9
LB04		882.0	882.0	1116.5	455.0	575.9	0.7	88.6	0.0	0.7	93.8
LB05	3474.0	2322.0	5796.0	1641.9	483.0	136.8	3.1	86.7	0.2	3.3	93.2
LB06	1855.0	1628.0	3483.0	370.9	1103.0	117.5	4.3	46.1	3.3	7.6	81.0
LB07	363.0	1345.0	1708.0	561.8	59.0	19.4	1.5	48.7	0.3	1.7	57.3
LB08	311.0	1027.0	1338.0	631.1	181.0	85.4	1.4	67.0	0.2	1.6	77.6
LB09		586.0	586.0								

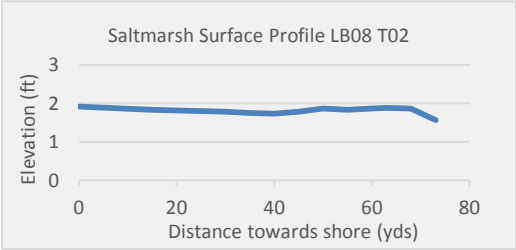
V. Shoreline Conditions

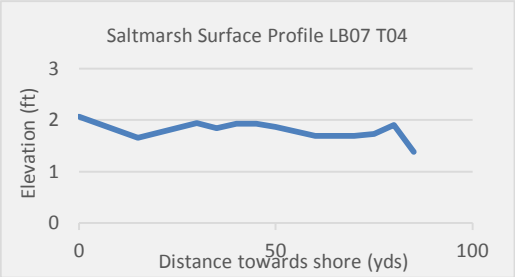
Not available

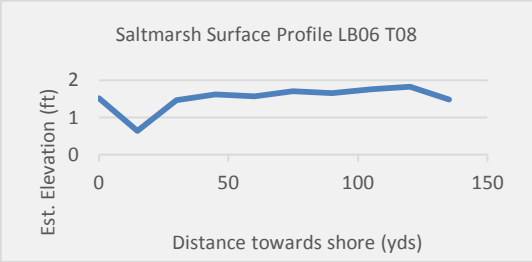
Susceptibilty to boat wake impacts: Low

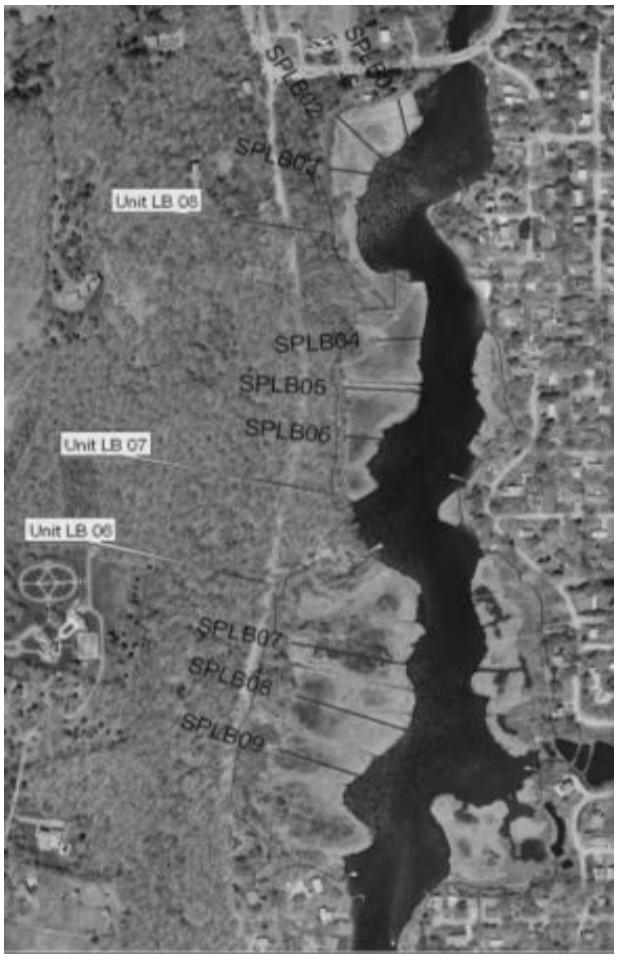
VI. Representative Saltmarsh Surface Profiles:

NOTE: Data not tied to known elevation. Reported elevations relative to each other, not to a set elevation in the field. See Appendix A for specific profile data.







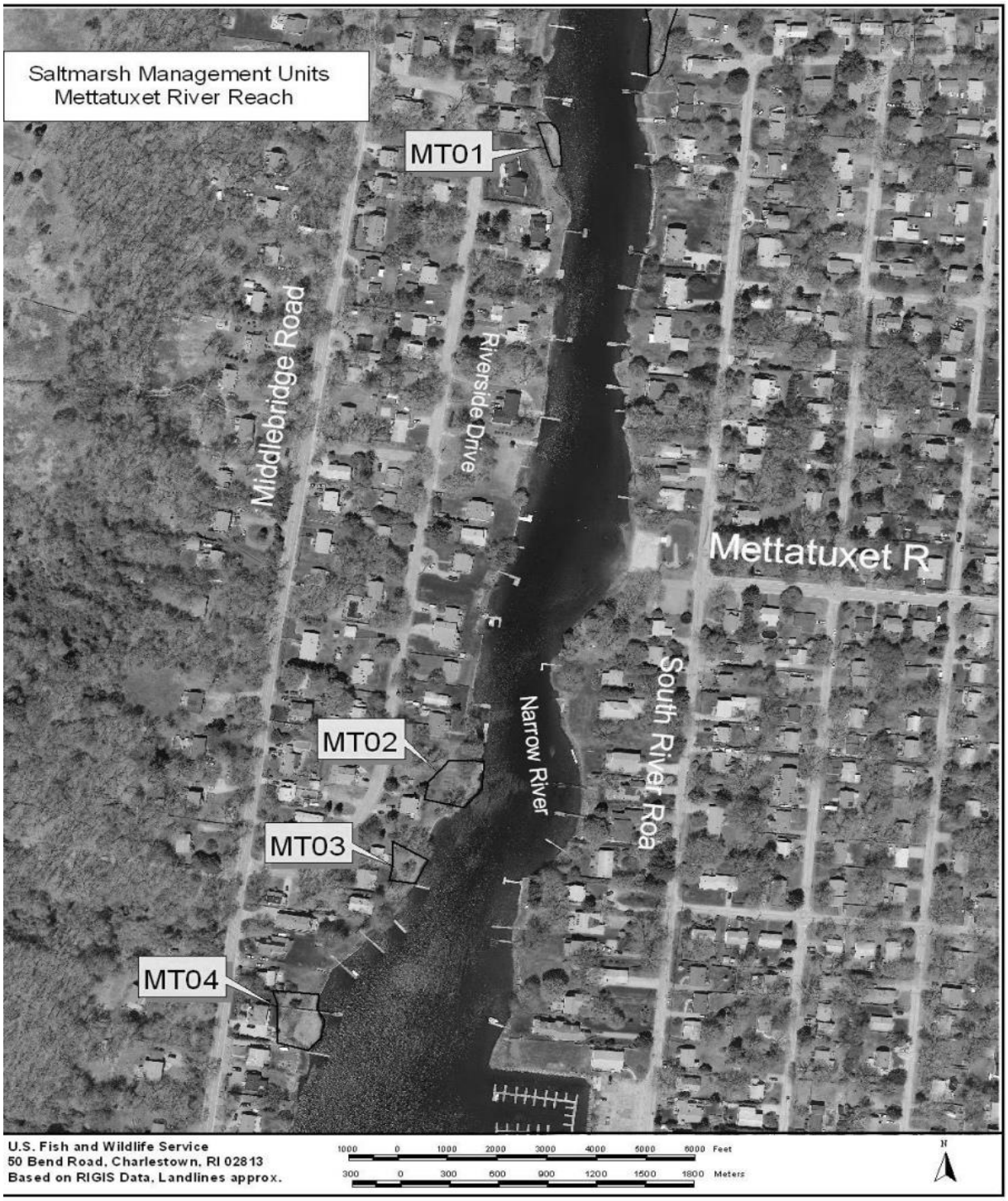


Mettatuxet River Reach

I. Overview

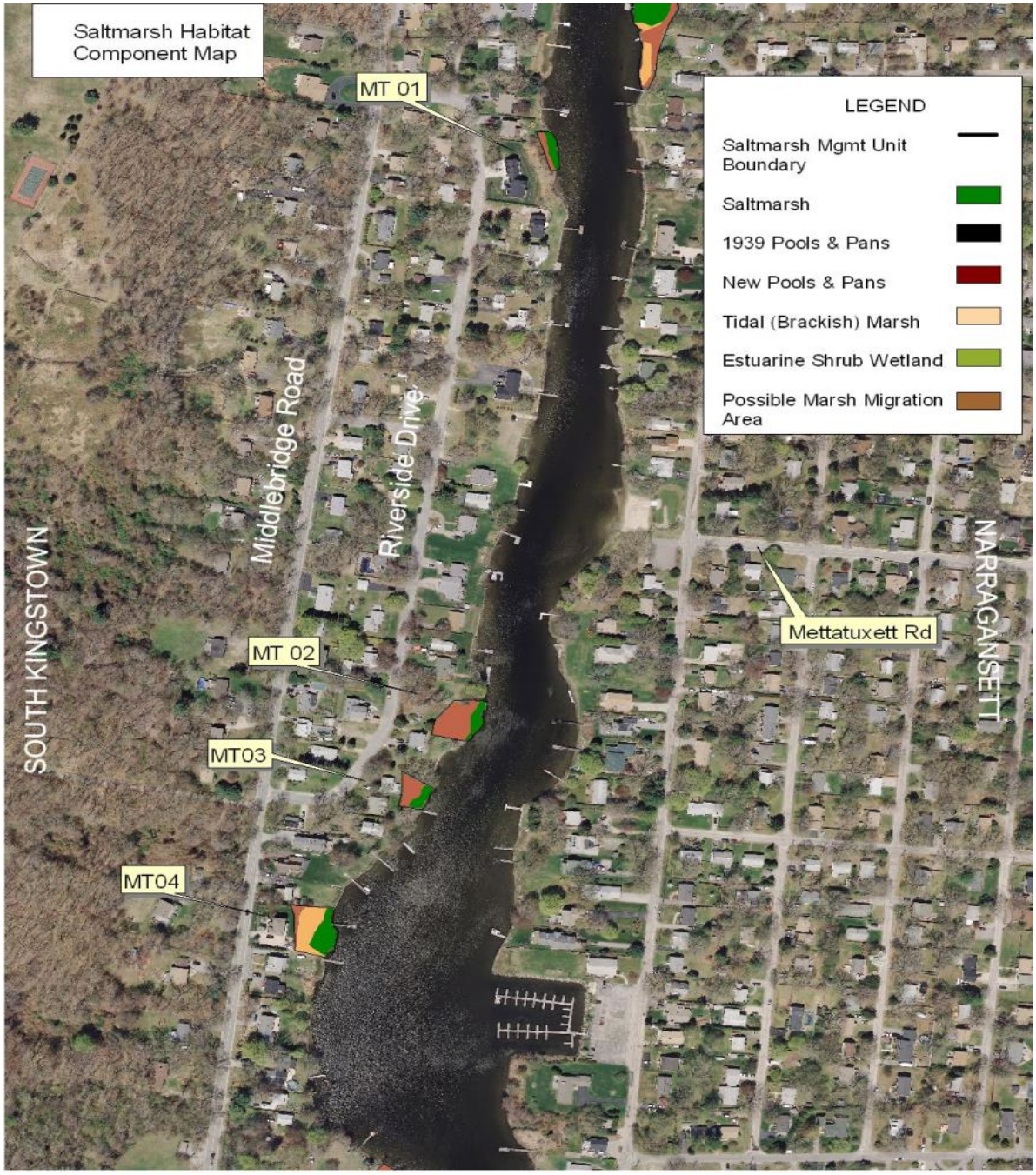
This reach contains small, privately owned fringe marsh patches. Their value in "connecting" the Lacy Bridge River reach marshes to those downriver is unknown. Small size, high public use and disturbance may limit nesting values. Most tidal (brackish) marsh dominated by phragmites. Possible migration areas questionable due to private ownership and developments.

II. Saltmarsh Management Units:



III. Habitat Components:

UNIT	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								POSSIBLE FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTURINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
ALL	2.0	1.6	0.0	0.0	0.0		0.1	0.0	1.8	0.2	14.7
MT01	0.4	0.4							0.4	0.0	6.6
MT02	0.5	0.4							0.4	0.1	35.9
MT03	0.1	0.0							0.0	0.1	183.9
MT04	1.0	0.9					0.1		1.0	0.0	2.3

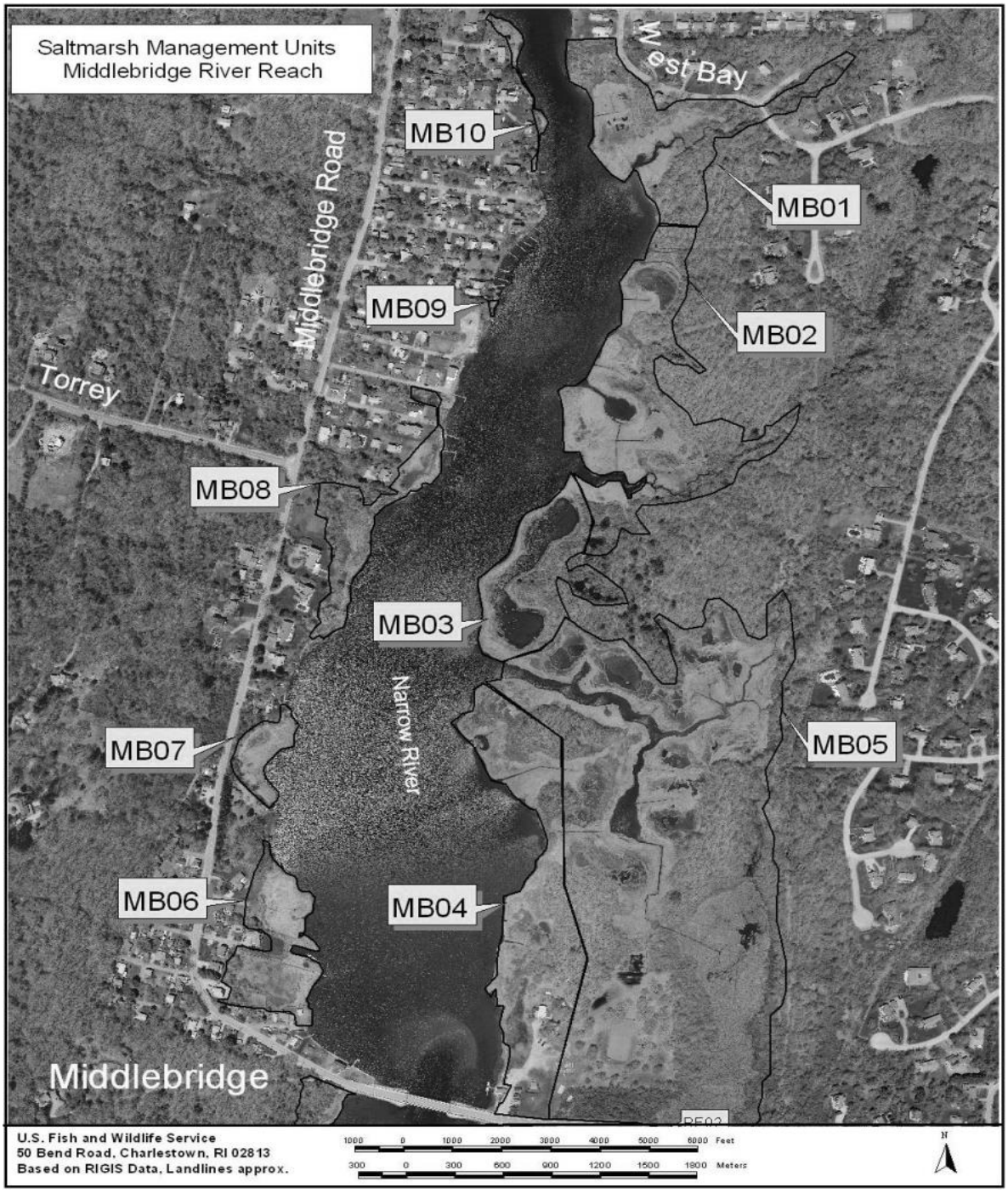


Middlebridge River Reach

I. Overview

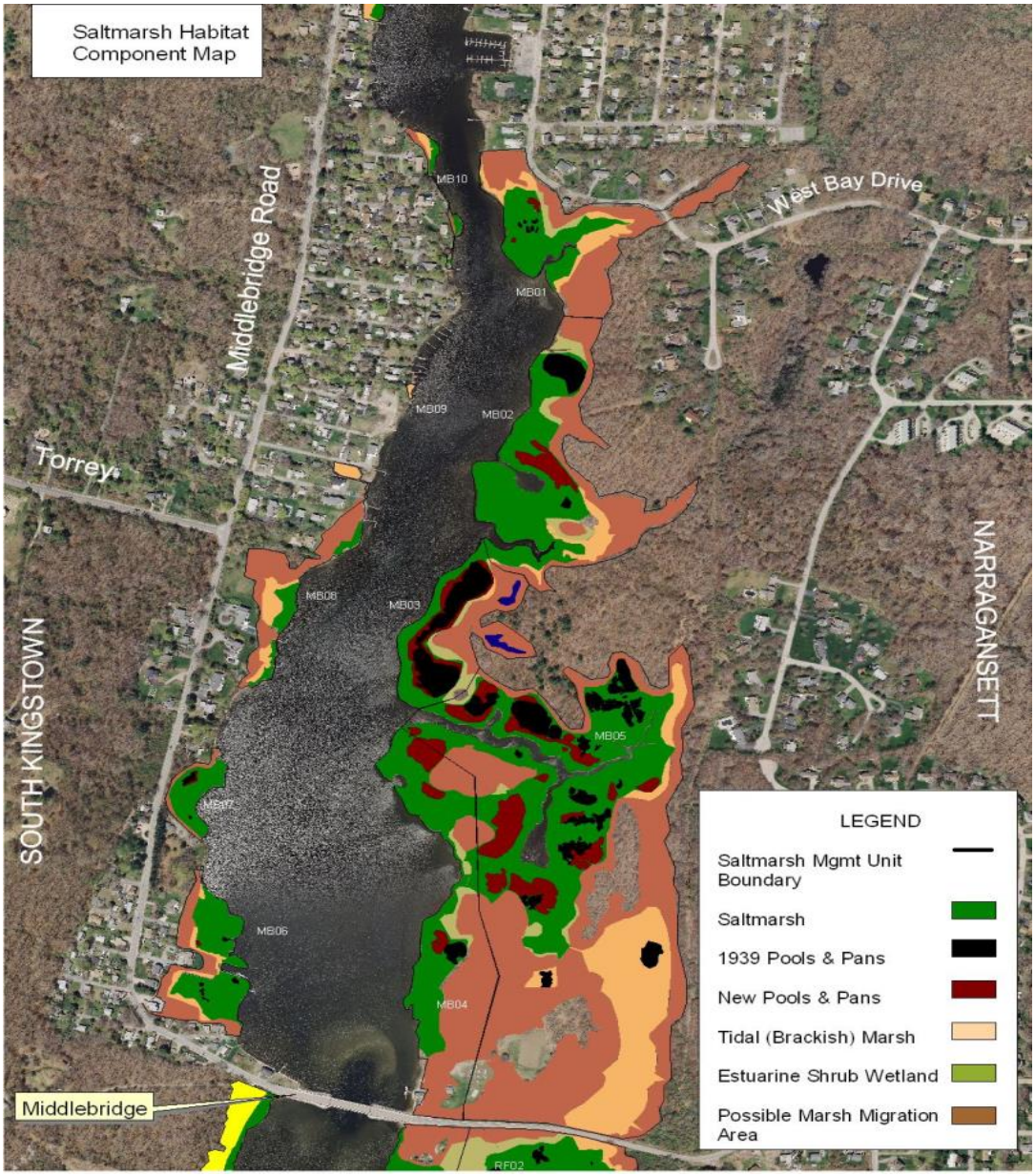
This reach contains 32 acres of saltmarsh - fringe marshes on the West side of the river and a sizable acreage within the slough on the Eastern side. Tidal wetlands a mix between phragmites and sciurpus. Reach has most estuarine shrub wetland, and the largest possible saltmarsh migration area. Bulk of migration area is a mix of tidal marsh (cattail) on the refuge and upland owned by the Town of Narragansett at Middlebridge. Boat wake impacts are rated low on East side of River and moderate on West side. Banks appear stable.

II. Saltmarsh Management Units:



III. Habitat Components:

UNIT	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								POSSIBLE FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTURINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
ALL	83.3	31.6	3.3	4.9	8.2	26.0	9.2	2.1	51.1	32.2	102.2
MB01	6.8	2.4	0.0	0.0	0.1	3.2	0.8	0.2	3.5	3.3	137.8
MB02	13.6	8.5	0.0	0.5	0.5	6.5	0.7	0.7	10.4	3.2	38.1
MB03	5.6	1.6	0.0	1.5	1.5	96.2	0.1	0.4	3.6	2.0	129.0
MB04	10.3	4.8	0.5	0.2	0.7	13.9		0.4	5.8	4.4	93.2
MB05	39.1	10.5	2.6	2.7	5.3	50.4	6.9	0.4	23.0	16.0	153.4
MB06	3.3	2.2	0.0	0.0	0.0	2.0			2.2	1.1	50.2
MB07	1.2	0.9	0.0	0.0	0.1	6.7			1.0	0.2	22.4
MB08	3.1	0.6					0.7		1.3	1.8	297.8
MB09	0.0	0.0					0.0		0.0		
MB10	0.3	0.1					0.1		0.2	0.1	78.6

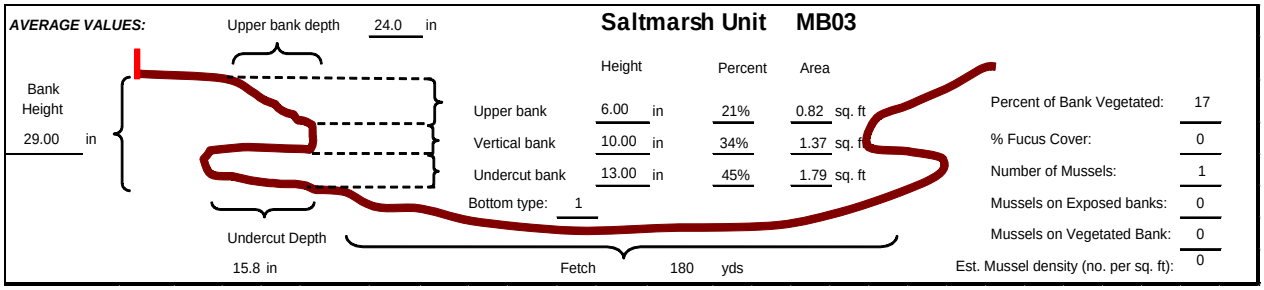


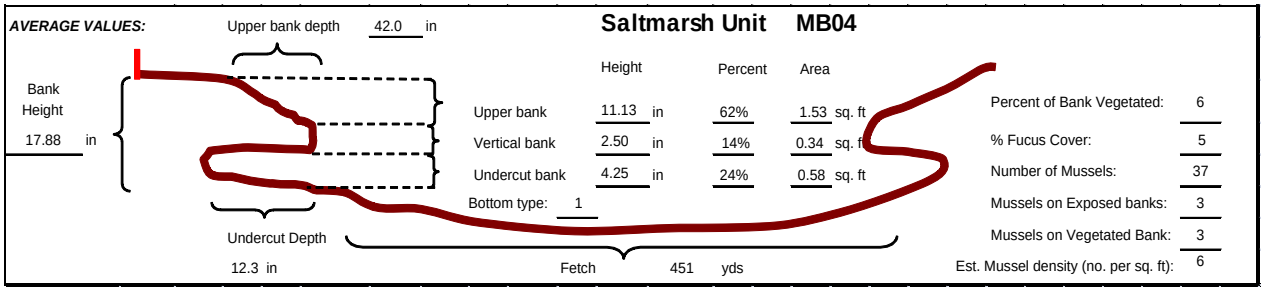
IV. Marsh Surface Conditions and Drainage (NOTE MAPS SHOWN IN APPENDIX G):

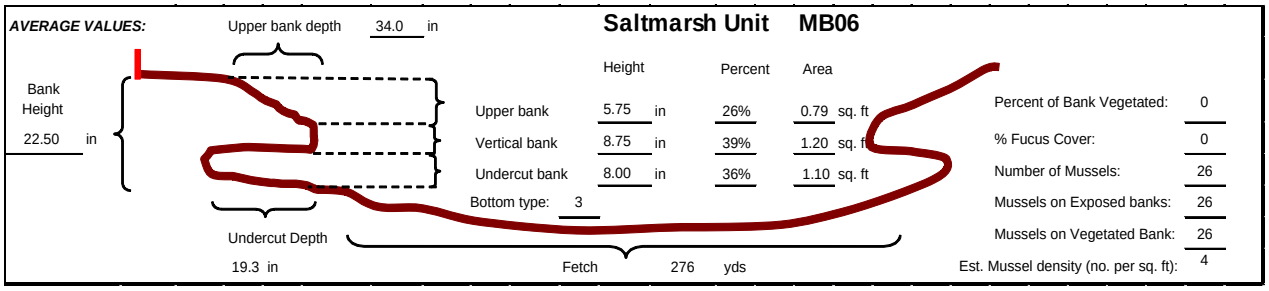
UNIT	MARSH SURFACE DRAINS						CONDITION OF MARSH SURFACE				
	FUNCTIONAL DRAINAGE (FT)				NONFUNCTIONAL (FT)		CURRENT WELL DRAINED MARSH SURFACE		WELL DRAINED MARSH W/ DITCH REPAIR		
	DITCH / SLOUGH	SHORELINE	TOTAL	DENSITY	TOTAL	DENSITY	ACRES	PERCENT	NEW AC	TOTAL	PERCENT
ALL	12366.0	8542.0	20908.0	526.1	1887.0	47.5	17.5	44.1	3.4	20.9	52.5
MB01	1567.0	936.0	2503.0	1009.3	660.0	266.1	1.7	69.8	0.3	2.0	82.5
MB02	2173.0	1183.0	3356.0	370.8	483.0	53.4	4.0	44.0	0.5	4.4	49.1
MB03	923.0	1020.0	1943.0	626.0		0.0	0.9	28.7		0.9	28.7
MB04	473.0	2230.0	2703.0	498.7	387.0	71.4	2.8	52.2	1.1	3.9	71.7
MB05	7230.0		7230.0	459.8	238.0	15.1	6.1	38.9	1.4	7.5	47.9
MB06		1229.0	1229.0	548.4	119.0	53.1	0.9	37.9		0.9	37.9
MB07		556.0	556.0	562.2		0.0	0.5	47.5	0.1	0.6	58.1
MB08		796.0	796.0	1351.4		0.0	0.5	86.6		0.5	86.6
MB09		69.0	69.0							0.0	
MB10		523.0	523.0	3735.7		0.0	0.1	100.0		0.1	100.0

V. Saltmarsh Shoreline Conditions

Data summarized by saltmarsh management unit from shoreline stability surveys completed in 2012.
Susceptibilty to boat wake impacts: Moderate on western shore; low on eastern shore.





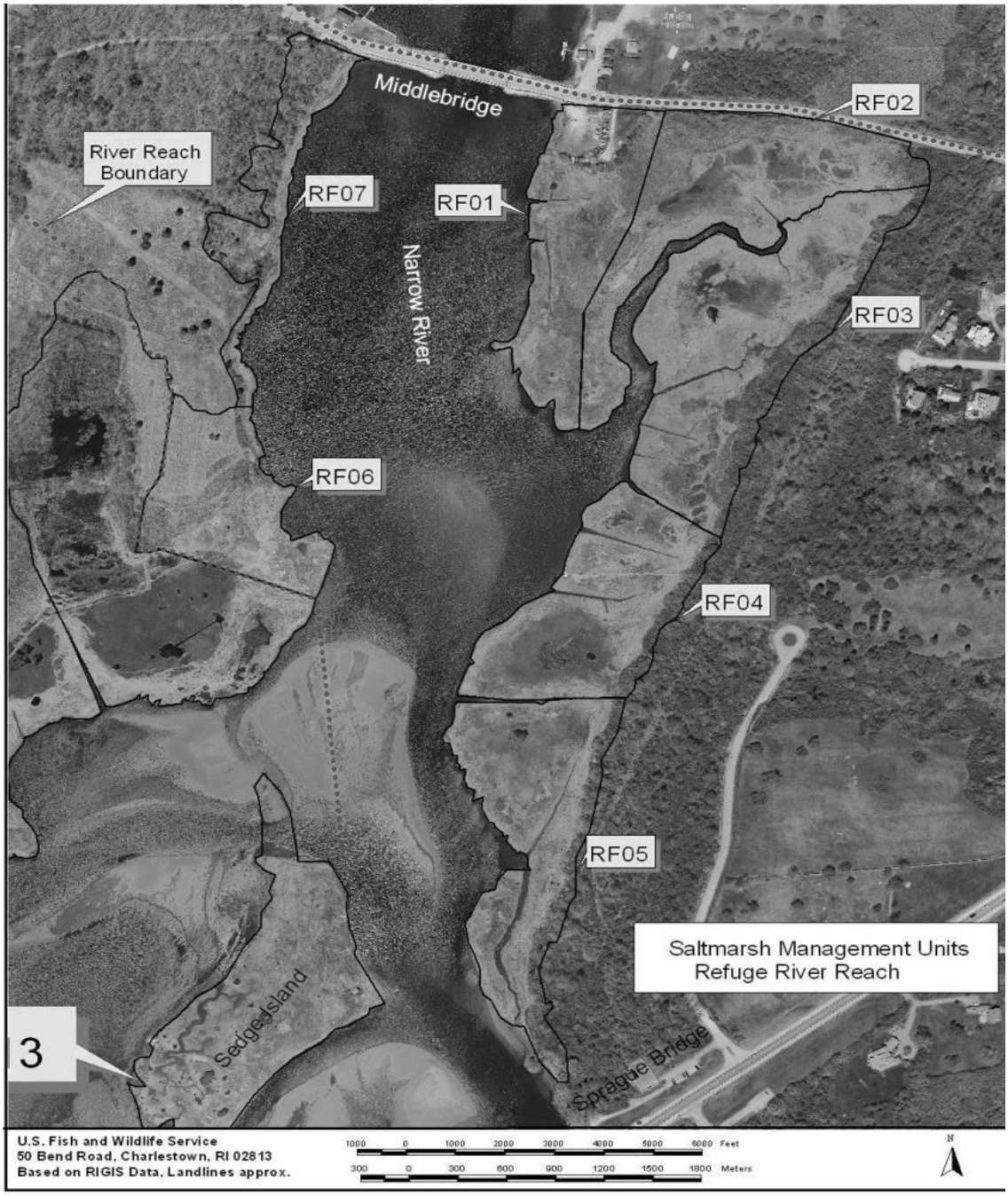


Refuge River Reach

I. Overview

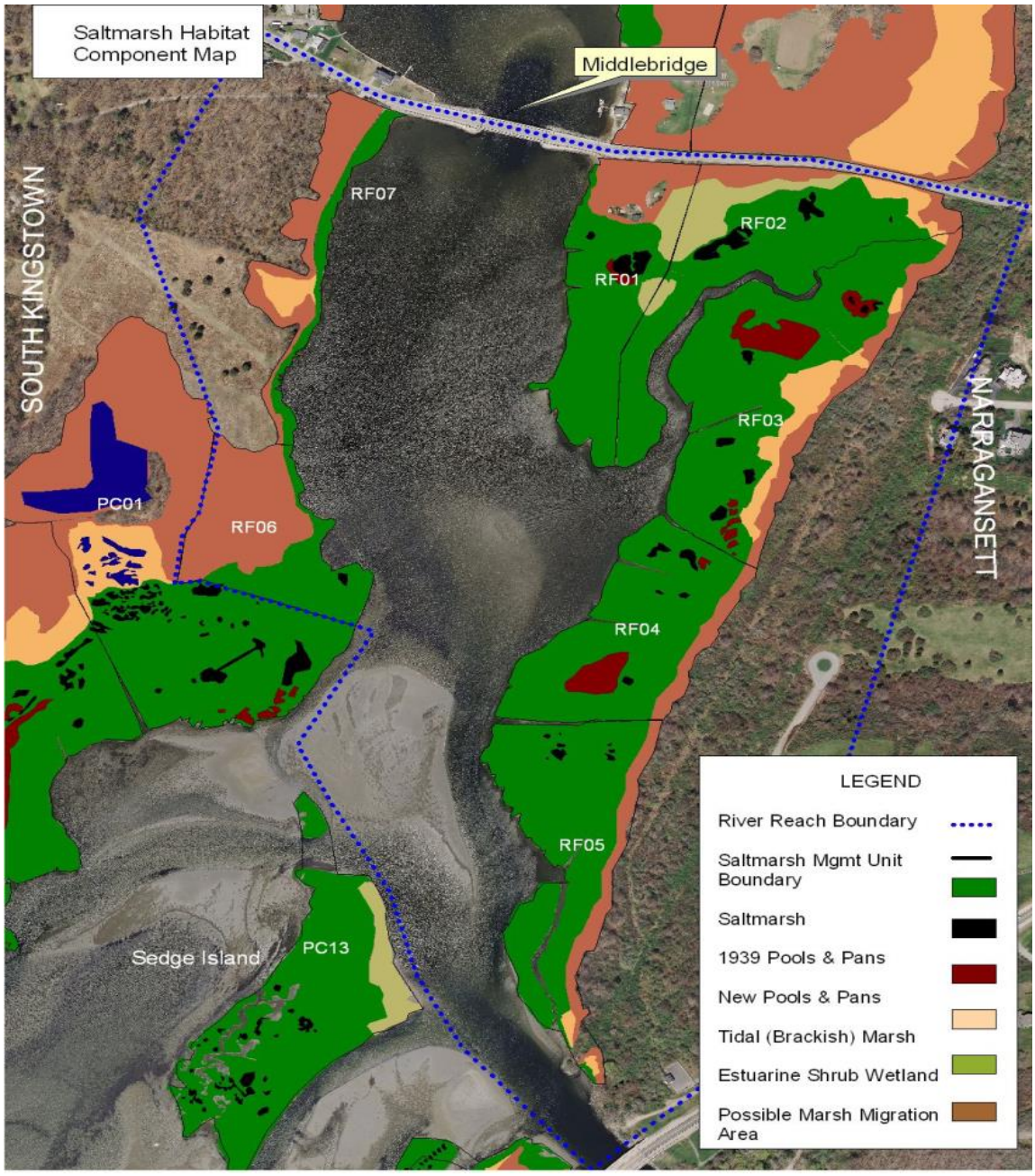
A high energy river reach with substantial shoreline erosion and moderate to high boat wake impacts and wind driven waves (accelerated/aggravated rates of erosion). Much of the RF01, RF04, and RF05 shoreline is actively peeling and eroding. The peninsula at RF01 will be lost in near future without intervention. RF05 island has large blocks of marsh eroding, propeller scars have increased susceptibility to erosion. High use by saltmarsh sparrows in RF01-RF03. Fringe marshes on West side have public trails on marsh surface. Several distinct layers of peat deposition apparent. Profile data suggest the marsh surface in the Eastern slough (RF02, RF03) are two to three inches lower than in other portions of estuary.

II. Saltmarsh Management Units:



III. Habitat Components:

UNIT	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								POSSIBLE FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTURINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
ALL	36.9	24.8	1.0	0.5	1.5	5.9	1.6	1.3	29.1	7.8	31.3
RF01	4.6	3.2	0.0	0.2	0.2	6.6		0.4	3.8	0.9	26.8
RF02	6.0	4.1		0.1	0.1	1.5	0.3	0.9	5.4	0.6	15.2
RF03	8.4	5.8	0.6	0.1	0.7	12.7	0.9		7.4	1.0	17.0
RF04	5.5	4.6	0.3	0.1	0.4	8.6			5.0	0.5	11.0
RF05	5.8	4.9		0.0	0.0	0.8	0.1		5.0	0.9	17.5
RF06	3.9	1.5		0.0	0.0	1.9			1.5	2.4	156.0
RF07	2.6	0.8				0.0	0.3		1.0	1.6	210.9



IV. Marsh Surface Conditions and Drainage (NOTE MAPS SHOWN IN APPENDIX G)

UNIT	MARSH SURFACE DRAINS						CONDITION OF MARSH SURFACE				
	FUNCTIONAL DRAINAGE (FT)				NONFUNCTIONAL (FT)		CURRENT WELL DRAINED MARSH SURFACE		WELL DRAINED MARSH W/ DITCH REPAIR		
	DITCH / SLOUGH	SHORELINE	TOTAL	DENSITY	TOTAL	DENSITY	ACRES	PERCENT	NEW AC	TOTAL	PERCENT
ALL	7035.0	5640.0	12675.0	482.1	1810.0	68.8	12.1	46.1	1.8	13.9	52.9
RF01	583.0	1306.0	1889.0	558.9	174.0	51.5	0.4	11.5	0.4	0.8	23.1
RF02	1656.0		1656.0	393.3	1094.0	259.9	2.3	54.2	1.0	3.2	77.0
RF03	3039.0	109.0	3148.0	481.8	245.0	37.5	3.4	51.7	0.3	3.7	56.8
RF04	943.0	840.0	1783.0	357.7	297.0	59.6	1.7	33.1	0.1	1.8	35.4
RF05	814.0	1491.0	2305.0	471.1		0.0	3.0	61.9		3.0	61.9
RF06		759.0	759.0	493.8		0.0	0.7	42.9		0.7	42.9
RF07		1135.0	1135.0	1509.3		0.0	0.7	95.7		0.7	95.7

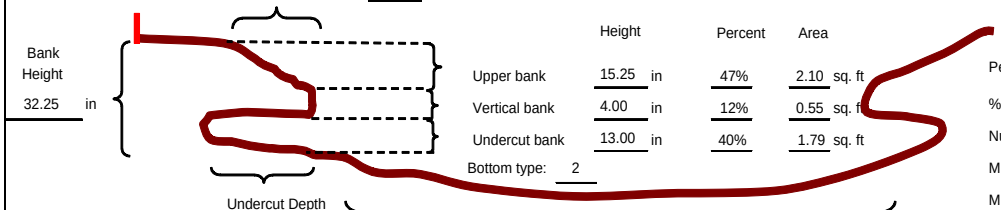
V. Saltmarsh Shoreline Conditions

Data summarized by saltmarsh management unit from shoreline stability surveys completed in 2012.

Susceptibilty to boat wake impacts: High at RF04 and RF05. Moderate RF01, RF06, RF07. Boats pass wihin 50 feet of RF05 shoreline. Overall stability of saltmarsh shporelines is very low in RF02,RF04, RF05.

AVERAGE VALUES: Upper bank depth 38.0 in

Saltmarsh Unit RF03



Bank Height 32.25 in

	Height	Percent	Area
Upper bank	15.25 in	47%	2.10 sq. ft
Vertical bank	4.00 in	12%	0.55 sq. ft
Undercut bank	13.00 in	40%	1.79 sq. ft

Bottom type: 2

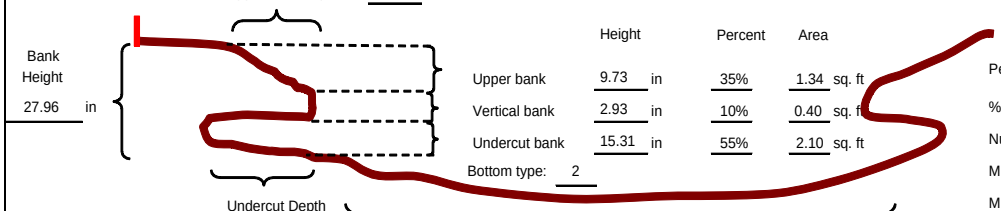
Undercut Depth 16.5 in

Fetch 200 yds

Percent of Bank Vegetated:	26
% Fucus Cover:	5
Number of Mussels:	11
Mussels on Exposed banks:	0
Mussels on Vegetated Bank:	0
Est. Mussel density (no. per sq. ft):	2

AVERAGE VALUES: Upper bank depth 33.3 in

Saltmarsh Unit RF04



Bank Height 27.96 in

	Height	Percent	Area
Upper bank	9.73 in	35%	1.34 sq. ft
Vertical bank	2.93 in	10%	0.40 sq. ft
Undercut bank	15.31 in	55%	2.10 sq. ft

Bottom type: 2

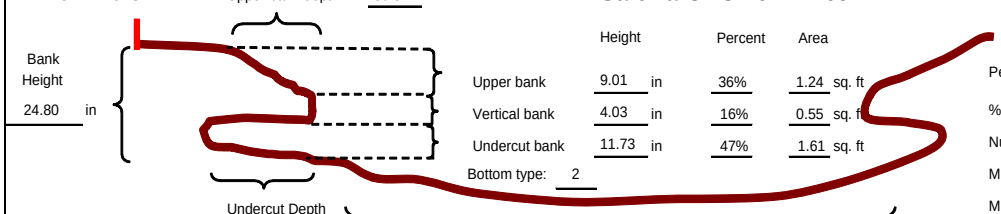
Undercut Depth 10.1 in

Fetch 307 yds

Percent of Bank Vegetated:	17
% Fucus Cover:	0
Number of Mussels:	0
Mussels on Exposed banks:	1
Mussels on Vegetated Bank:	1
Est. Mussel density (no. per sq. ft):	0

AVERAGE VALUES: Upper bank depth 30.5 in

Saltmarsh Unit RF05



Bank Height 24.80 in

	Height	Percent	Area
Upper bank	9.01 in	36%	1.24 sq. ft
Vertical bank	4.03 in	16%	0.55 sq. ft
Undercut bank	11.73 in	47%	1.61 sq. ft

Bottom type: 2

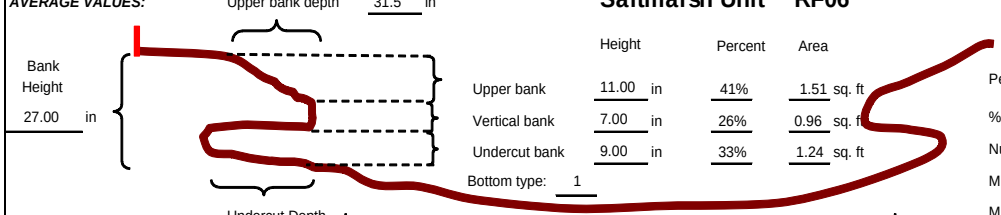
Undercut Depth 13.0 in

Fetch 117 yds

Percent of Bank Vegetated:	16
% Fucus Cover:	7
Number of Mussels:	4
Mussels on Exposed banks:	1
Mussels on Vegetated Bank:	1
Est. Mussel density (no. per sq. ft):	1

AVERAGE VALUES: Upper bank depth 31.5 in

Saltmarsh Unit RF06



Bank Height 27.00 in

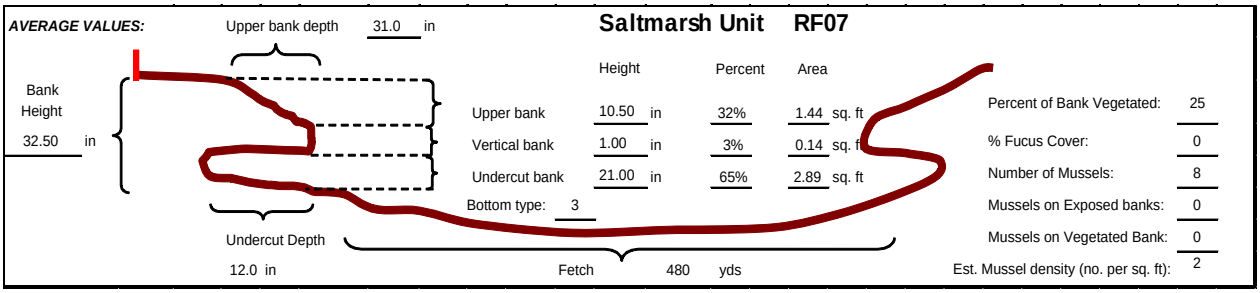
	Height	Percent	Area
Upper bank	11.00 in	41%	1.51 sq. ft
Vertical bank	7.00 in	26%	0.96 sq. ft
Undercut bank	9.00 in	33%	1.24 sq. ft

Bottom type: 1

Undercut Depth 19.0 in

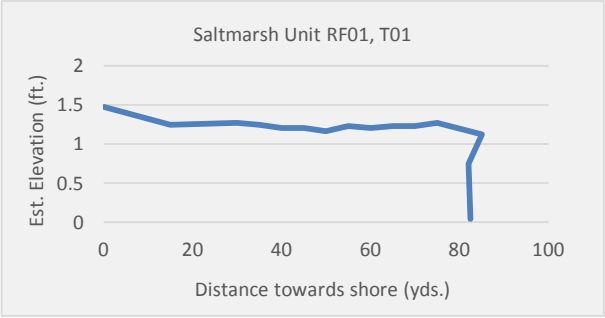
Fetch 412 yds

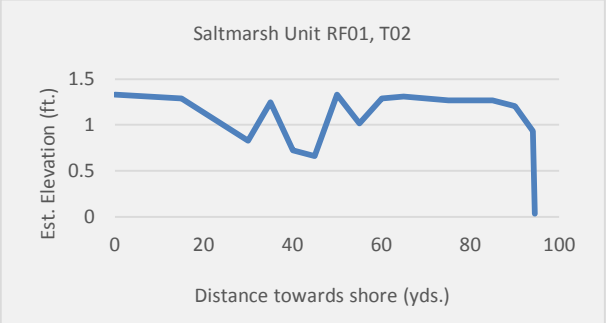
Percent of Bank Vegetated:	30
% Fucus Cover:	0
Number of Mussels:	12
Mussels on Exposed banks:	2
Mussels on Vegetated Bank:	2
Est. Mussel density (no. per sq. ft):	2

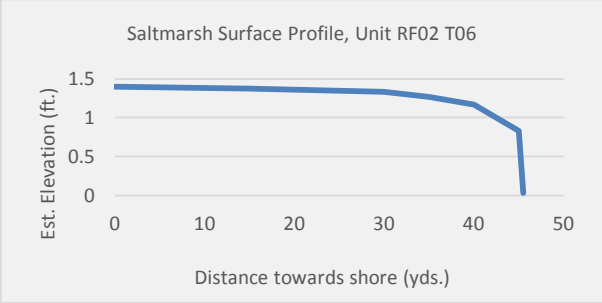


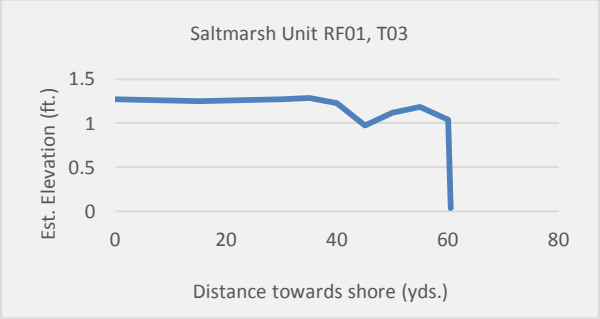
VI. Saltmarsh Profiles

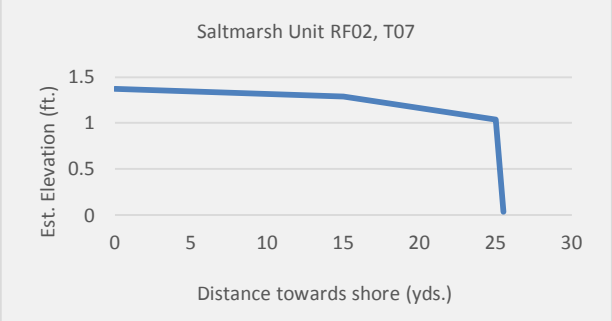
NOTE: Data tied to known elevation of survey marker located in SMU RF02. Expand graph to view details.

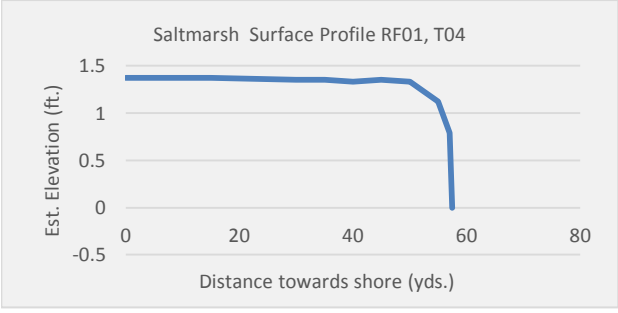


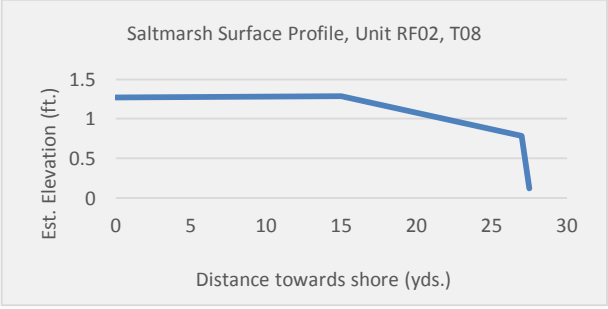


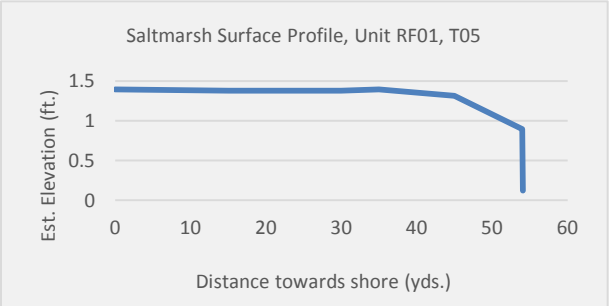




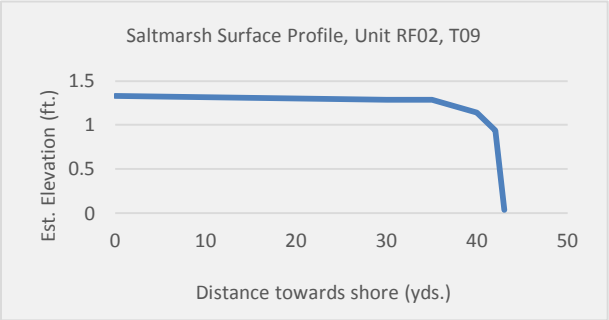


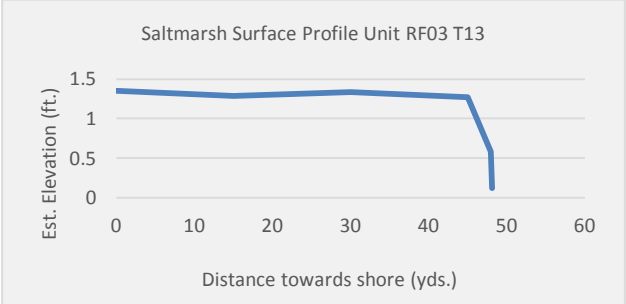


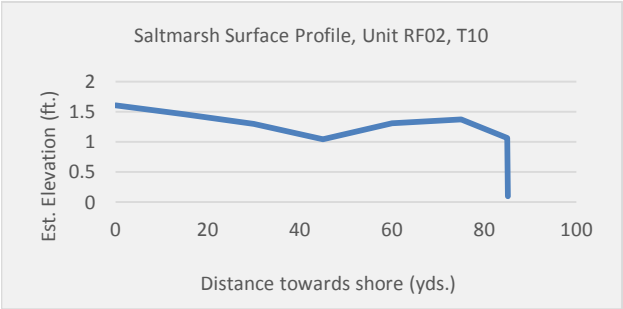


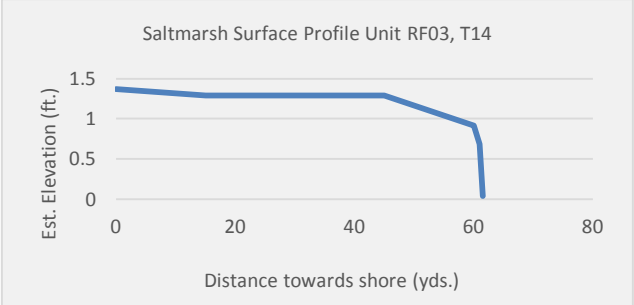

Saltmarsh Surface Profile, Unit RF01, T05
Est. Elevation (ft.)
1.5
1
0.5
0
0
10
20
30
40
50
60
Distance towards shore (yds.)

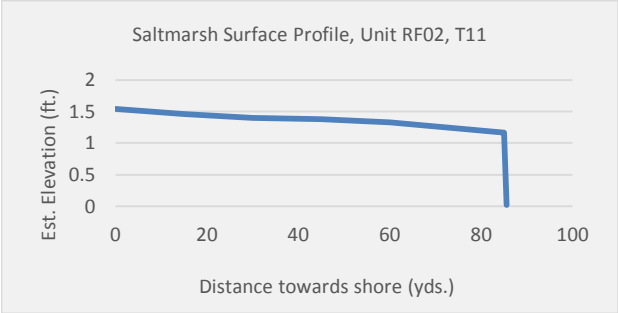
SPRF01
SPRF02
SPRF03
SPRF04
SPRF05
SPRF08
SPRF09
SPRF10
SPRF11
SPRF12
SPRF14
SPRF15
SPRF16
SPRF17
SPRF18

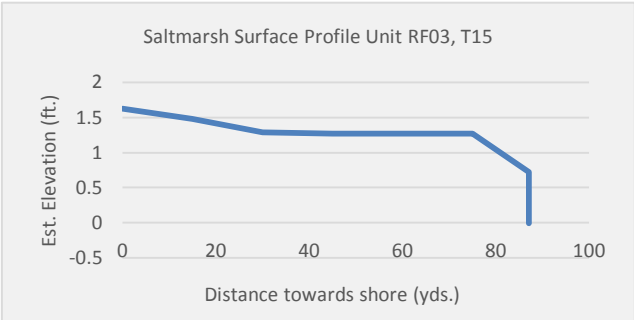

Saltmarsh Surface Profile, Unit RF02, T09
Est. Elevation (ft.)
1.5
1
0.5
0
0
10
20
30
40
50
Distance towards shore (yds.)

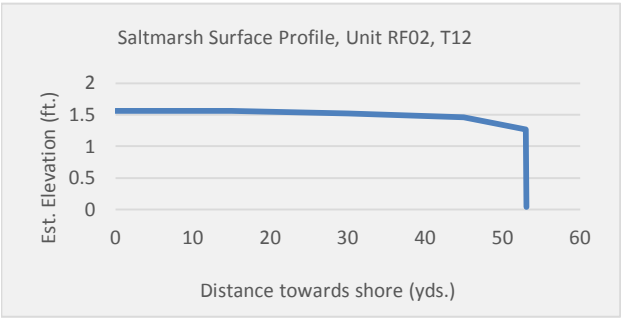

Saltmarsh Surface Profile Unit RF03 T13
Est. Elevation (ft.)
1.5
1
0.5
0
0
10
20
30
40
50
60
Distance towards shore (yds.)

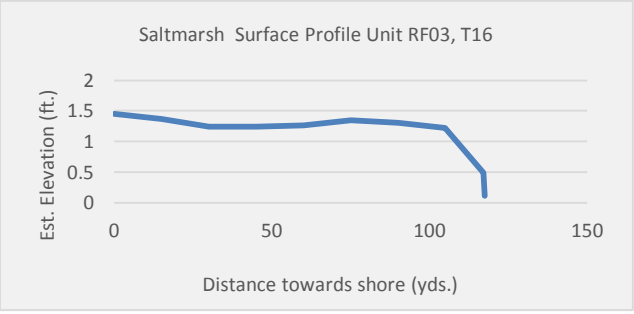

Saltmarsh Surface Profile, Unit RF02, T10
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
20
40
60
80
100
Distance towards shore (yds.)

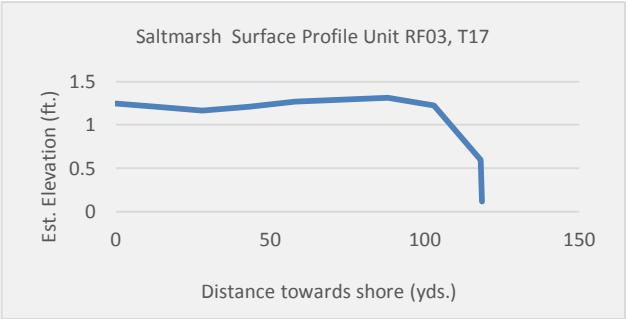

Saltmarsh Surface Profile Unit RF03, T14
Est. Elevation (ft.)
1.5
1
0.5
0
0
20
40
60
80
Distance towards shore (yds.)


Saltmarsh Surface Profile, Unit RF02, T11
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
20
40
60
80
100
Distance towards shore (yds.)

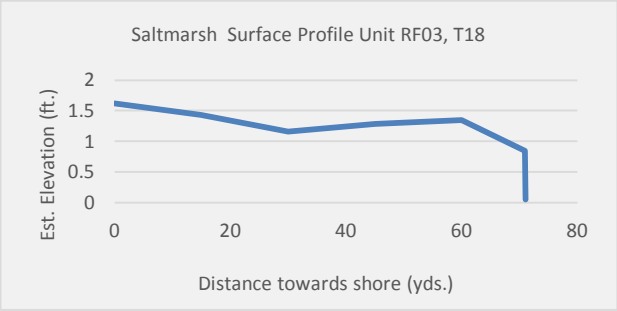

Saltmarsh Surface Profile Unit RF03, T15
Est. Elevation (ft.)
2
1.5
1
0.5
0
-0.5
0
20
40
60
80
100
Distance towards shore (yds.)

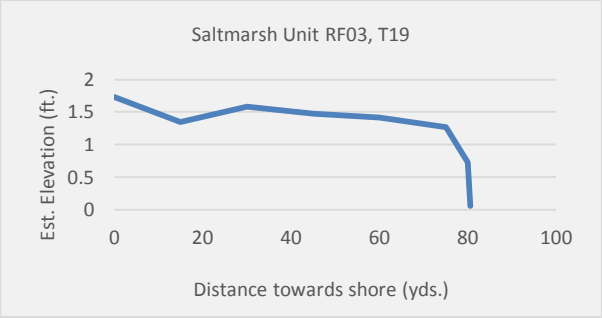

Saltmarsh Surface Profile, Unit RF02, T12
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
10
20
30
40
50
60
Distance towards shore (yds.)

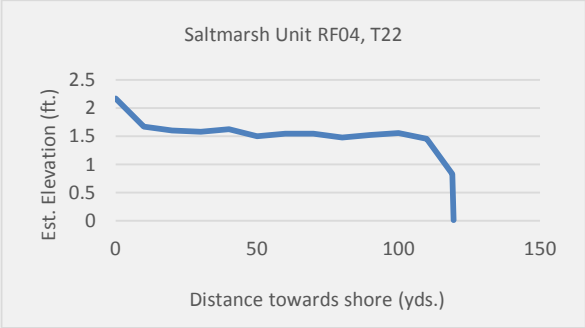

Saltmarsh Surface Profile Unit RF03, T16
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
50
100
150
Distance towards shore (yds.)

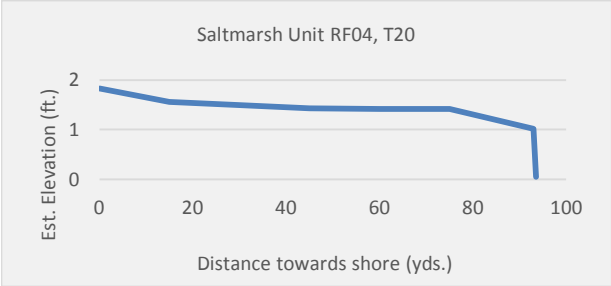

Saltmarsh Surface Profile Unit RF03, T17
Est. Elevation (ft.)
1.5
1
0.5
0
0
50
100
150
Distance towards shore (yds.)

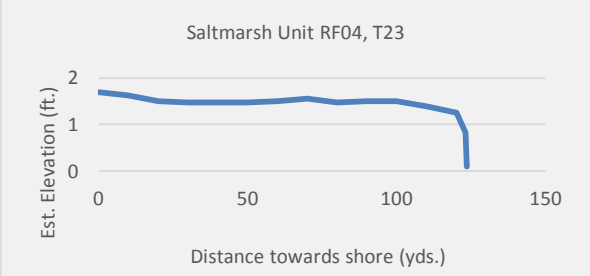
SPRF01
SPRF02
SPRF03
SPRF04
SPRF05
SPRF08
SPRF09
SPRF10
SPRF11
SPRF12
SPRF14
SPRF15
SPRF16
SPRF17
SPRF18
SPRF19
SPRF20
SPRF21

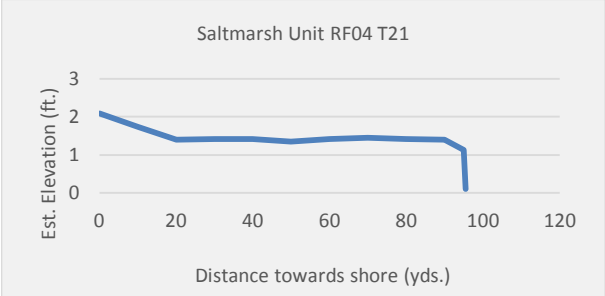

Saltmarsh Surface Profile Unit RF03, T18
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
20
40
60
80
Distance towards shore (yds.)

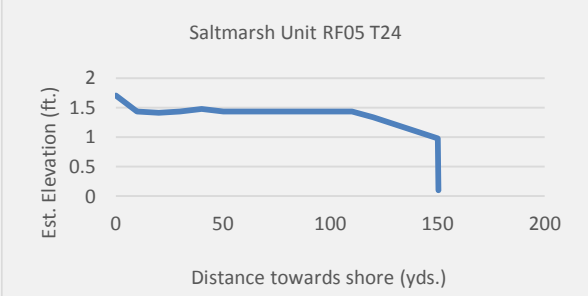

Saltmarsh Unit RF03, T19
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
20
40
60
80
100
Distance towards shore (yds.)

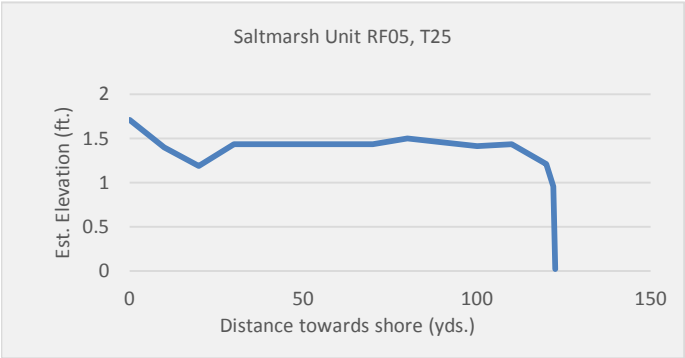

Saltmarsh Unit RF04, T22
Est. Elevation (ft.)
2.5
2
1.5
1
0.5
0
0
50
100
150
Distance towards shore (yds.)

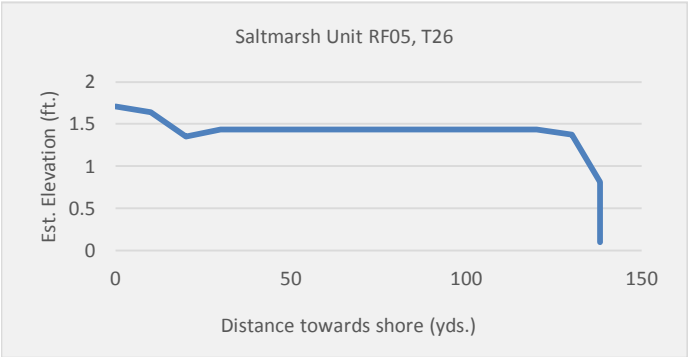

Saltmarsh Unit RF04, T20
Est. Elevation (ft.)
2
1
0
0
20
40
60
80
100
Distance towards shore (yds.)

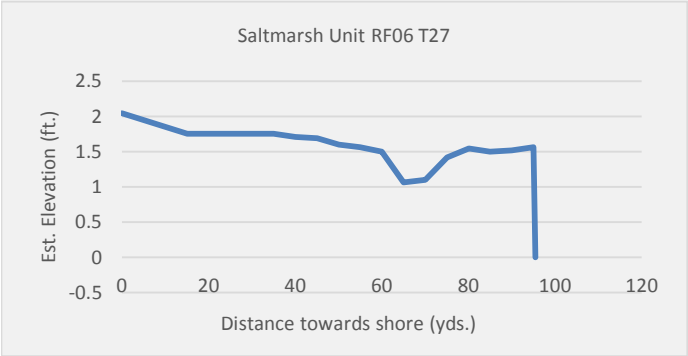

Saltmarsh Unit RF04, T23
Est. Elevation (ft.)
2
1
0
0
50
100
150
Distance towards shore (yds.)


Saltmarsh Unit RF04 T21
Est. Elevation (ft.)
3
2
1
0
0
20
40
60
80
100
120
Distance towards shore (yds.)


Saltmarsh Unit RF05 T24
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
50
100
150
200
Distance towards shore (yds.)


Saltmarsh Unit RF05, T25
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
50
100
150
Distance towards shore (yds.)


Saltmarsh Unit RF05, T26
Est. Elevation (ft.)
2
1.5
1
0.5
0
0
50
100
150
Distance towards shore (yds.)


Saltmarsh Unit RF06 T27
Est. Elevation (ft.)
2.5
2
1.5
1
0.5
0
-0.5
0
20
40
60
80
100
120
Distance towards shore (yds.)

SPRF01
SPRF02
SPRF03
SPRF04
SPRF05
SPRF17
SPRF18
SPRF19
SPRF20
SPRF21
SPRF22
SPRF23
SPRF24

Pettaquamscutt Cove

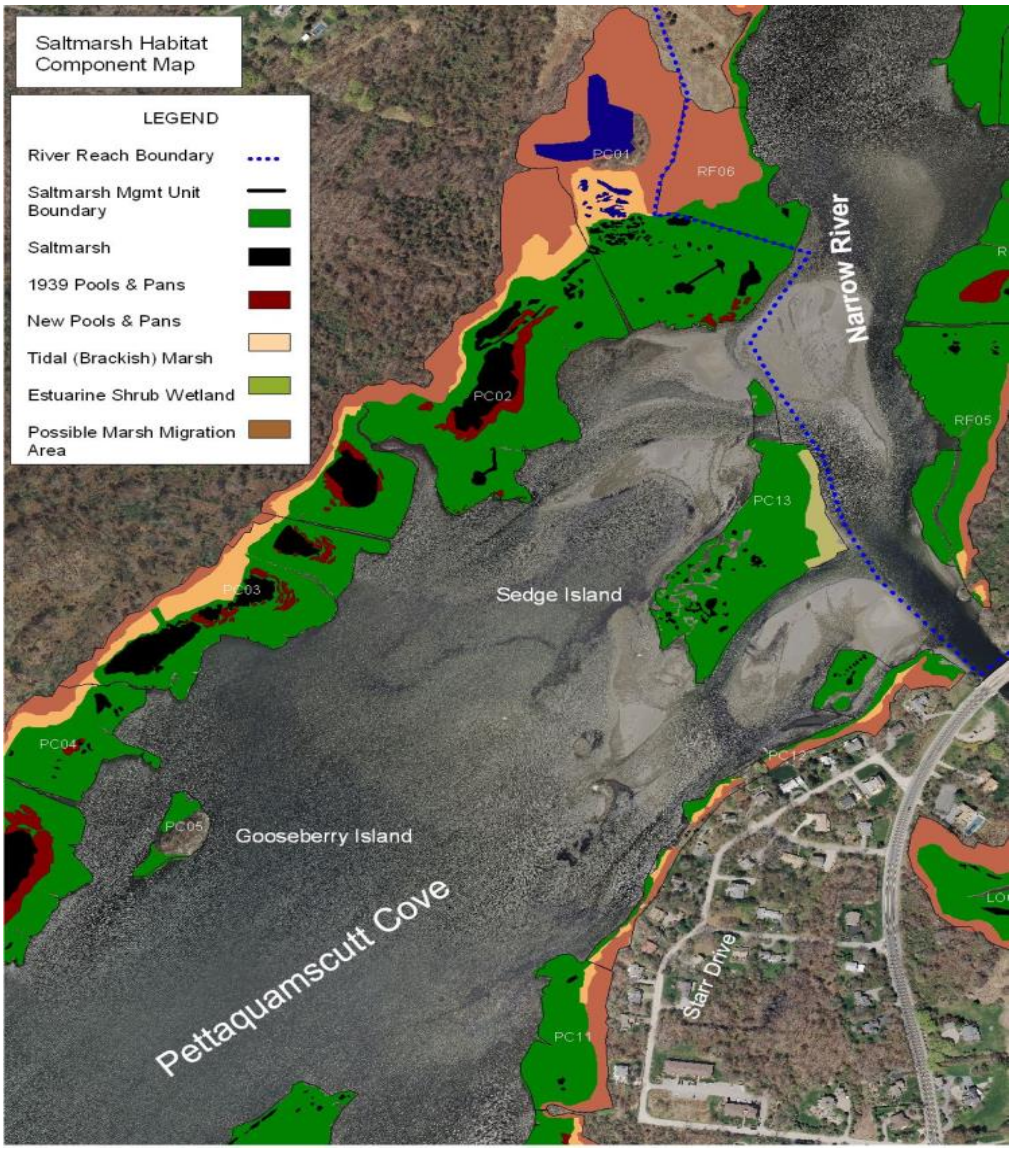
I. Overview

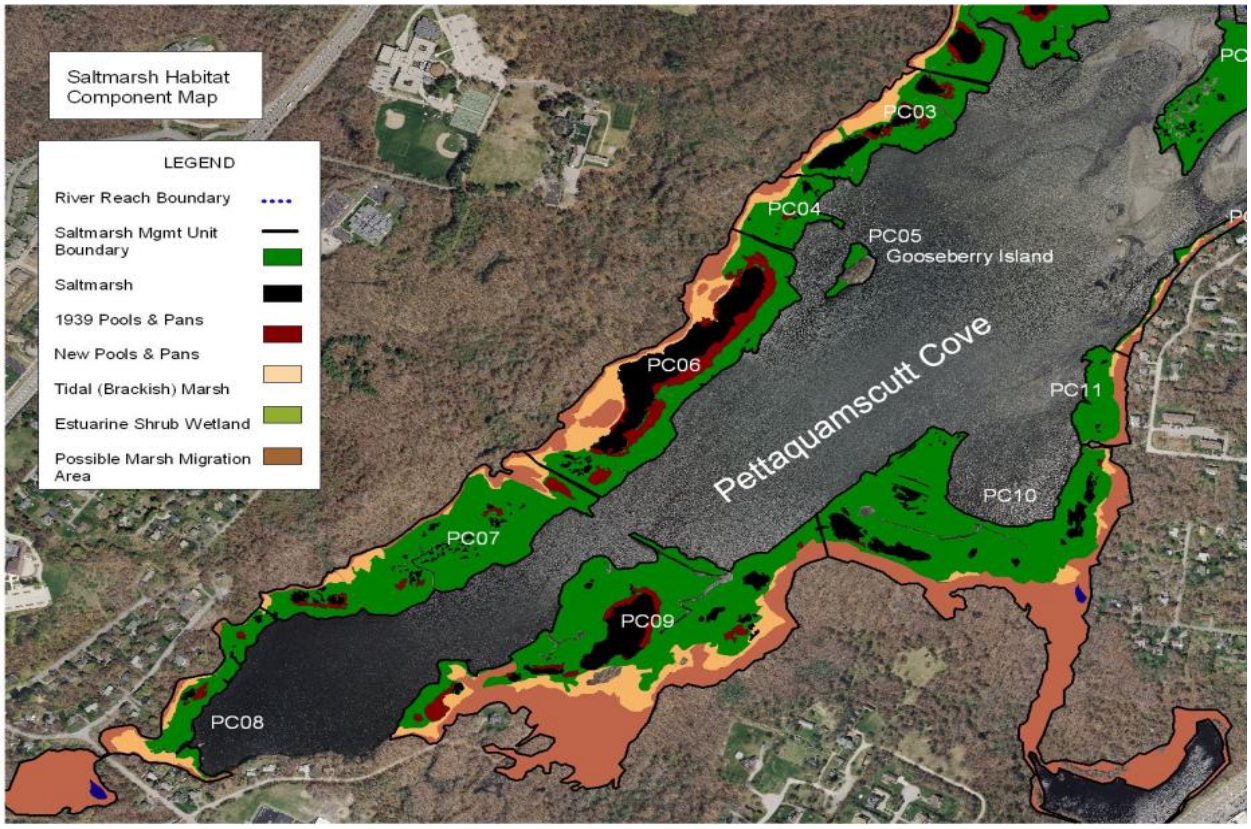
This reach contains the bulk of current saltmarsh habitat in the estuary. Brackish marsh dominated variably by phragmites, cattail, sciurpus. Stone walls along the side of the marshes either focus freshwater into channels, or disperse the water into tidal wetlands directly onto saltmarshes. Most pre-1939 ditches nonfunctional. Possible migration areas on NRLT and Audubon Society lands, Town of Narragansett lands at Canonchet farms, and the Mumford drainage on the Refuge. Boat wake impacts low in the cove, but wind driven waves of concern. Bank stability rated moderate in most areas, but low in vicinity of Gooseberry Island and the Starr Drive Cove.

II. Saltmarsh Management Units:

III. Habitat Components:

UNIT	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								POSSIBLE FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTURINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
ALL	169.0	86.8	5.7	14.2	20.0	23.0	12.6	0.6	119.9	49.1	56.5
PC01	13.2	4.9	0.1	0.4	0.5	10.7	1.1		6.5	6.7	137.5
PC02	16.4	9.2	0.9	1.9	2.8	30.5	1.2		13.1	3.2	34.9
PC03	9.0	5.3	0.3	1.3	1.6	30.8	1.3		8.2	0.8	15.6
PC04	3.8	2.8	0.0	0.1	0.1	4.8	0.4		3.3	0.4	15.5
PC05	0.4	0.4				0.0			0.4		0.0
PC06	18.2	6.8	2.6	4.9	7.5	110.4	1.0		15.3	2.9	41.8
PC07	16.5	13.0	0.5	0.5	1.0	7.6	1.2		15.2	1.3	10.3
PC08	10.0	3.1	0.1	0.1	0.2	7.4	1.1		4.5	5.6	179.5
PC09	36.8	15.8	1.2	2.9	4.1	25.6	4.2		24.1	12.7	80.4
PC10	31.8	16.0	0.0	1.8	1.9	11.6	0.7		18.5	13.2	82.8
PC11	3.7	2.6		0.0	0.0	0.8	0.1		2.7	0.9	36.2
PC12	2.9	1.4		0.0	0.0	1.9	0.3		1.7	1.2	86.6
PC13	6.3	5.5		0.2	0.2	2.9		0.6	6.3		0.0





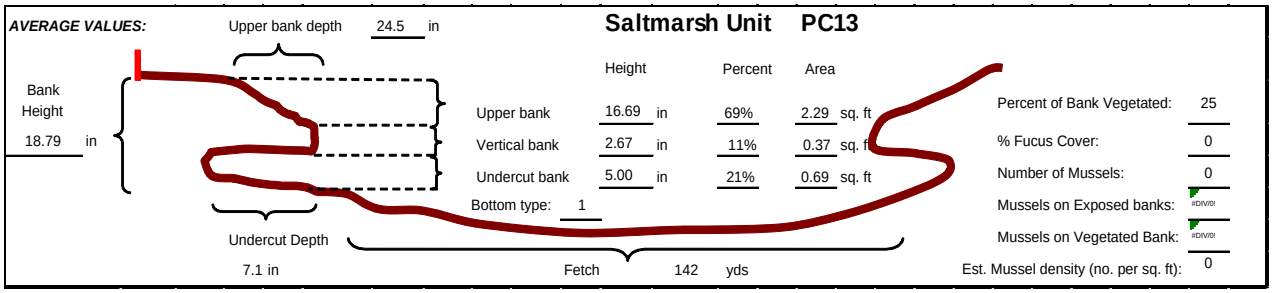
IV. Marsh Surface Conditions and Drainage (NOTE MAPS SHOWN IN APPENDIX G)

UNIT	MARSH SURFACE DRAINS						CONDITION OF MARSH SURFACE				
	FUNCTIONAL DRAINAGE (FT)				NONFUNCTIONAL (FT)		CURRENT WELL DRAINED MARSH SURFACE		WELL DRAINED MARSH W/ DITCH REPAIR		
	DITCH / SLOUGH	SHORELINE	TOTAL	DENSITY	TOTAL	DENSITY	ACRES	PERCENT	NEW AC	TOTAL	PERCENT
ALL	18427.0	27497.0	45924.0	430.3	3984.0	37.3	54.6	51.2	7.9	62.5	58.6
PC01		860.0	860.0	158.7		0.0	0.9	16.4	0.1	0.9	17.5
PC02	1431.0	2568.0	3999.0	333.5	38.0	3.2	3.7	31.1	0.1	3.8	31.6
PC03	1540.0	1454.0	2994.0	433.7	117.0	16.9	2.7	39.0	0.9	3.6	52.1
PC04	973.0	969.0	1942.0	668.3		0.0	1.6	53.7		1.6	53.7
PC05		590.0	590.0	1362.6		0.0	0.4	87.8		0.4	87.8
PC06	1575.0	2279.0	3854.0	268.9	210.0	14.7	8.0	56.0	1.5	9.6	66.6
PC07	4202.0	2602.0	6804.0	485.4		0.0	7.4	52.6		7.4	52.6
PC08	933.0	1480.0	2413.0	724.6		0.0	1.9	57.4		1.9	57.4
PC09	3649.0	5028.0	8677.0	436.3	2753.0	138.4	16.4	82.2	3.6	20.0	100.4
PC10	2780.0	2757.0	5537.0	310.0	866.0	48.5	6.7	37.3	1.8	8.4	47.2
PC11	150.0	887.0	1037.0	395.2		0.0	1.1	41.5		1.1	41.5
PC12		2700.0	2700.0	1920.3		0.0	1.4	100.3		1.4	100.3
PC13	1194.0	3323.0	4517.0	803.3		0.0	2.5	45.0		2.5	45.0

V. Saltmarsh Shoreline Conditions

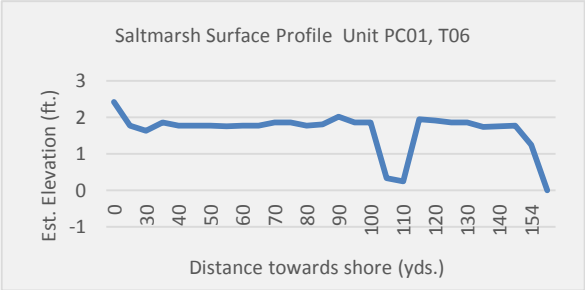
Data summarized by saltmarsh management unit from shoreline stability surveys completed in 2012. Data only available for Sedge Island North shore.

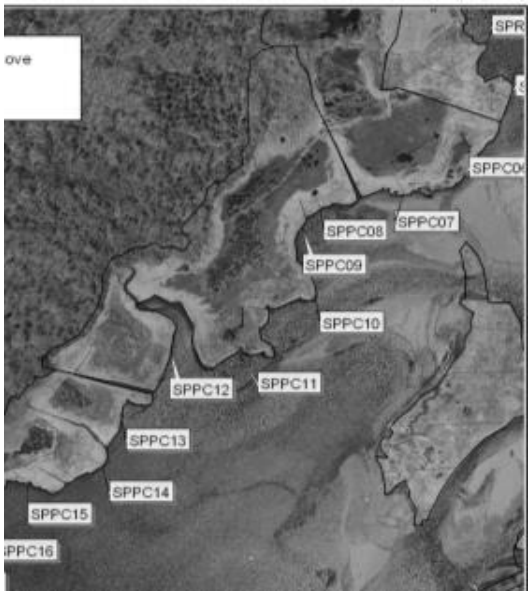
Susceptibilty to boat wake impacts: High on North Shore; low in remaining areas. High susceptibility to wind driven waves west and south; high erosion east side from river channel.

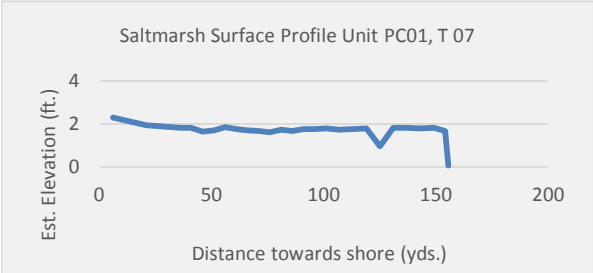


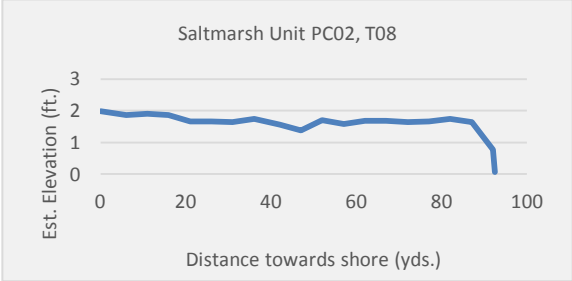
VI. Saltmarsh Surface Profiles

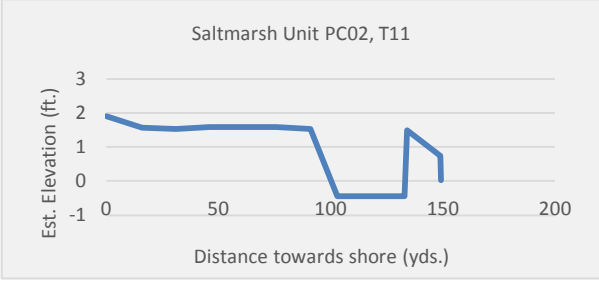
NOTE: All elevations tied to field elevation at Refuge Survey marker established in 2008. Reference elevation is 1.54' NGVD88.











Lower Narrow River Reach

I. Overview

Saltmarsh in this reach is typified by very high (1 meter +) banks with deep undercuts which appear relatively stable. The marsh surface is typically coated with algae. Shallow tidal flats limit wave action on saltmarsh shorelines, although the shore at LO02 is failing. Heavily used fishing trail on LO04. Fringe marsh on Northern shore moves up and down with wave action.

II. Saltmarsh Management Units

III. Habitat Components:

UNIT	TOTAL ACRES	CURRENT HABITAT AVAILABILITY (AC.)								POSSIBLE FUTURE HABITAT	
		SALT MARSH	POOLS AND PANS				TIDAL (BRACKISH) MARSH	ESTURINE SHRUB WETLAND	TOTAL ALL HABITATS	MARSH MIGRATION AREA	% OF EXIST. MARSH
			NEW POOLS & PANS	OLD POOLS & PANS	ALL POOLS & PANS	PERCENT POOLS & PANS					
ALL	21.4	14.0	0.0	0.5	0.5	3.7	0.0	0.0	14.5	6.8	48.8
LO01	5.6	3.6		0.1	0.1	1.5			3.6	2.0	55.4
LO02	6.9	4.2		0.2	0.2	5.2			4.4	2.5	59.8
LO03	2.4	1.8		0.0	0.0	1.8			1.9	0.5	26.8
LO04	6.5	4.4		0.2	0.2	4.9			4.6	1.9	42.3

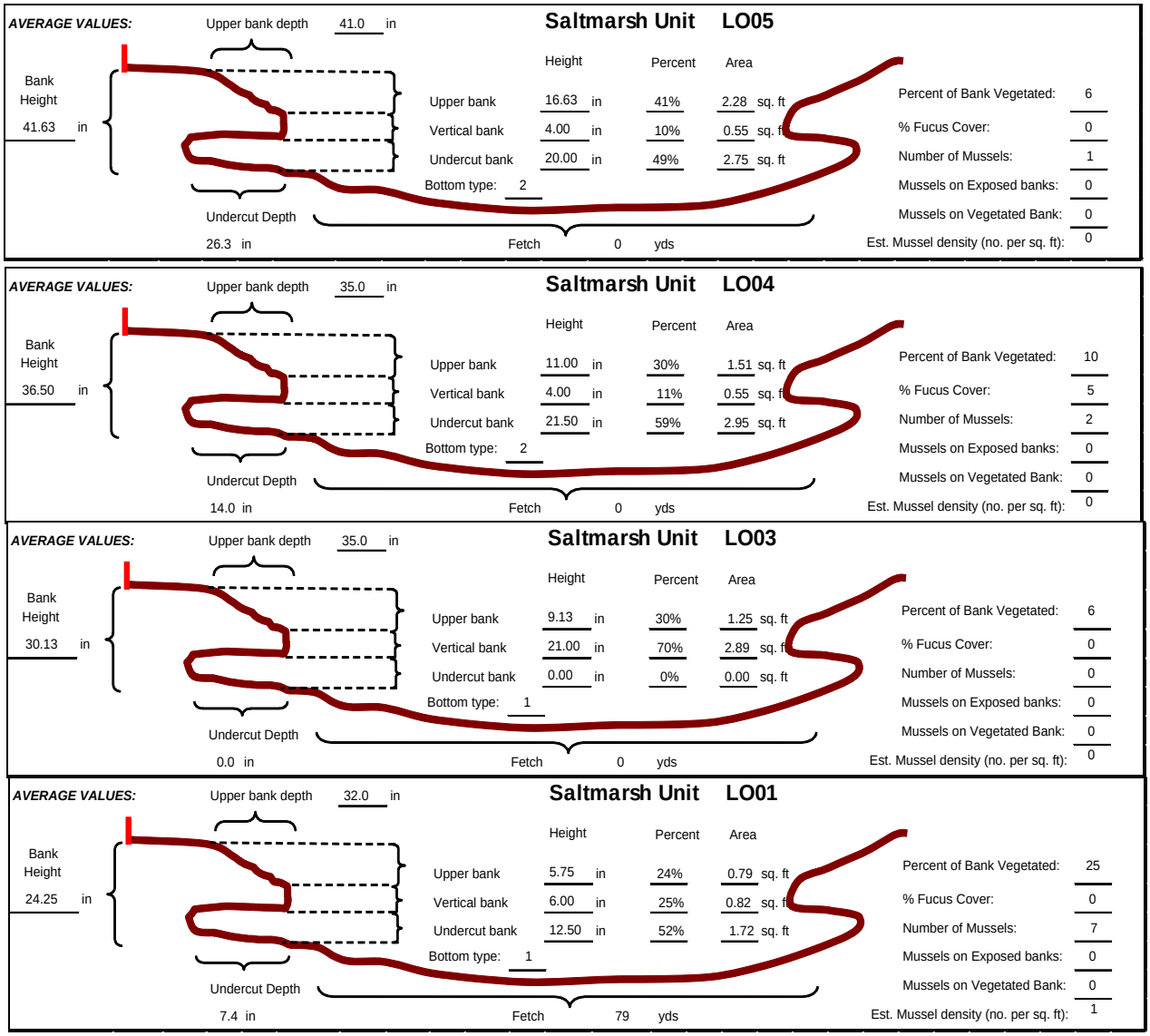
IV. Marsh Surface Conditions and Drainage (NOTE MAP SHOWN IN APPENDIX G)

UNIT	MARSH SURFACE DRAINS						CONDITION OF MARSH SURFACE				
	FUNCTIONAL DRAINAGE (FT)				NONFUNCTIONAL (FT)		CURRENT WELL DRAINED MARSH SURFACE		WELL DRAINED MARSH W/ DITCH REPAIR		
	DITCH / SLOUGH	SHORELINE	TOTAL	DENSITY	TOTAL	DENSITY	ACRES	PERCENT	NEW AC	TOTAL	PERCENT
ALL	7972.0	6414.0	14386.0	989.5	58.0	4.0	11.7	80.5	0.1	11.8	81.1
LO01	2240.0	3750.0	5990.0	1652.4		0.0	3.2	88.8		3.2	88.8
LO02	2423.0	630.0	3053.0	695.6		0.0	4.4	100.0		4.4	100.0
LO03	2356.0	752.0	3108.0	1650.6	58.0	30.8	1.8	95.6	0.1	1.9	99.9
LO04	953.0	1282.0	2235.0	481.6		0.0	2.3	49.6		2.3	49.6

V. Saltmarsh Shoreline Conditions.

Data summarized by saltmarsh management unit from shoreline stability surveys completed in 2012.

Susceptibility to boat wake impacts: Moderate to high all areas except for lower half of LO01. Overall stability of saltmarsh shorelines is moderate except RF02 which is actively eroding, large blocks coming off of shoreline. Shoals along RF04 and 05 provide wave abatement.



APPENDIX C

Change in Saltmarsh Abundance in the Narrow River Estuary

SALTMARSH HABITAT - LOSS OVER TIME

PRIMARILY RESULT OF CHANGES IN CHANNELS/DRAINAGE AND POOR TO NO RECRUITMENT

ESTIMATED LOSS FROM HISTORICAL LEVEL: 12 ACRES

APPENDIX D

Mean High Tide Line Survey in 2009

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
JOHN H. CHAFEE NATIONAL WILDLIFE REFUGE
UNITED STATES
(TRACTS 11b,31,36,45,58)
TIDAL STUDY AT PETTAQUAMSCUTT COVE
Washington County, Rhode Island

0 100 200 400 600 800

See Note #1

NOTES:

1. This plat is based on the Rhode Island State Plane Coordinate System (N.A.D. 83/96).
2. Vertical Datum is based on N.A.V.D. 1988. Benchmark 398, PID LW0648 was used as base elevation.
3. A Tidal Study was done to determine the Mean High Water Line (MHWL) of Pettaquamscutt Cove at Middle Bridge by using the "Range Ratio Method". This was done from August 4-5, 2009. Tidal Benchmark 945 4341 A Tidal was used as the Control Tide Station.
4. Three (3) Tidal Benchmarks were set on UNITED STATES (TRACT 36), in concrete. They are known as: Tidal Benchmarks "A", point number 10143, with being 0.736 feet above mean high water; Tidal Benchmark "B", point number 10142, being 0.756 feet above mean high water; and Tidal Benchmark "C", point number 10139, being 0.776 feet above mean high water.
5. N.A.V.D. 1988 elevations were established by running level loops from Benchmark 398 to Tidal Benchmark 4341 A, N.A.V.D. elevation of 18.02 feet and Tidal Benchmark 4341 D, N.A.V.D. elevation 27.39 feet and and from Benchmark 398 to Tidal Benchmark "C", N.A.V.D. elevation of 1.58 feet. The MHWL N.A.V.D. 1988 elevation is 0.804 feet.
6. Horizontal Control was established on Tidal Benchmark "C" by OPUS.
7. The ortho imagery was downloaded from Rhode Island GIS and was produced by Chas H. Sells under contract for Rhode Island DOT. The imagery has 2 foot pixel resolution and is referenced to Rhode Island State Plane Coordinate System (N.A.D 1983) U. S. Survey Feet.
8. The MHWL of UNITED STATES (TRACTS 11b,31,36,45,58) was located using GPS/RTK technology on August 11, 2009.

Tidal Benchmark Set in Concrete

Iron Rod set on MHWL

Mean High Water Line

POINT	NORTHING	EASTING
10013	136051.031	341700.364
10015	135871.802	341705.171
10017	135698.349	341598.105
10019	135616.732	341658.502
10021	135525.669	341718.774
10023	135448.503	341779.782
10025	135451.959	341871.346
10027	135285.487	341942.093
10029	135212.158	341853.817
10031	135092.986	341808.72
10033	135002.502	341774.116
10035	134922.405	341677.793
10037	134846.077	341580.438
10039	134748.691	341545.765
10041	134669.047	341515.721
10043	134520.586	341470.445
10045	134410.912	341523.722
10047	134321.992	341574.188
10049	134236.931	341640.568
10051	134139.68	341635.624
10053	134068.813	341566.381
10055	133980.604	341526.981
10057	133886.887	341556.248
10059	133789.985	341577.67
10061	133697.561	341635.916
10063	133547.31	341760.546
10065	133387.711	341821.533
10067	133715.576	341228.233
10069	133653.728	341158.25
10071	133599.748	341077.377
10073	133519.737	341004.45
10075	133444.822	340945.303
10077	133361.724	340894.745
10079	133261.499	340831.022
10081	133342.406	340766.279
10083	133407.846	340674.003
10085	133548.156	340682.734
10087	133823.751	340891.264
10089	133927.464	340957.306
10091	133998.459	340996.226
10093	134183.373	340967.15
10095	134173.639	341072.218
10097	134155.592	341168.392
10099	134056.892	341208.368
10101	133952.995	341218.486
10103	133851.09	341252.074
10105	133761.183	341300.531
10107	134949.417	341124.114
10109	134962.043	341133.426
10111	137063.174	341819.81
10113	137167.199	341832.893
10115	137305.863	341865.34
10117	137393.873	341871.292
10119	137459.784	341945.504
10121	137558.138	341996.59
10123	137645.755	342038.89
10125	137733.798	342004.945
10127	137810.323	341950.181
10129	137869.573	341881.522
10131	137966.116	341796.742
10133	138148.355	341683.389
10135	138186.511	341706.457
10137	138192.777	342311.891

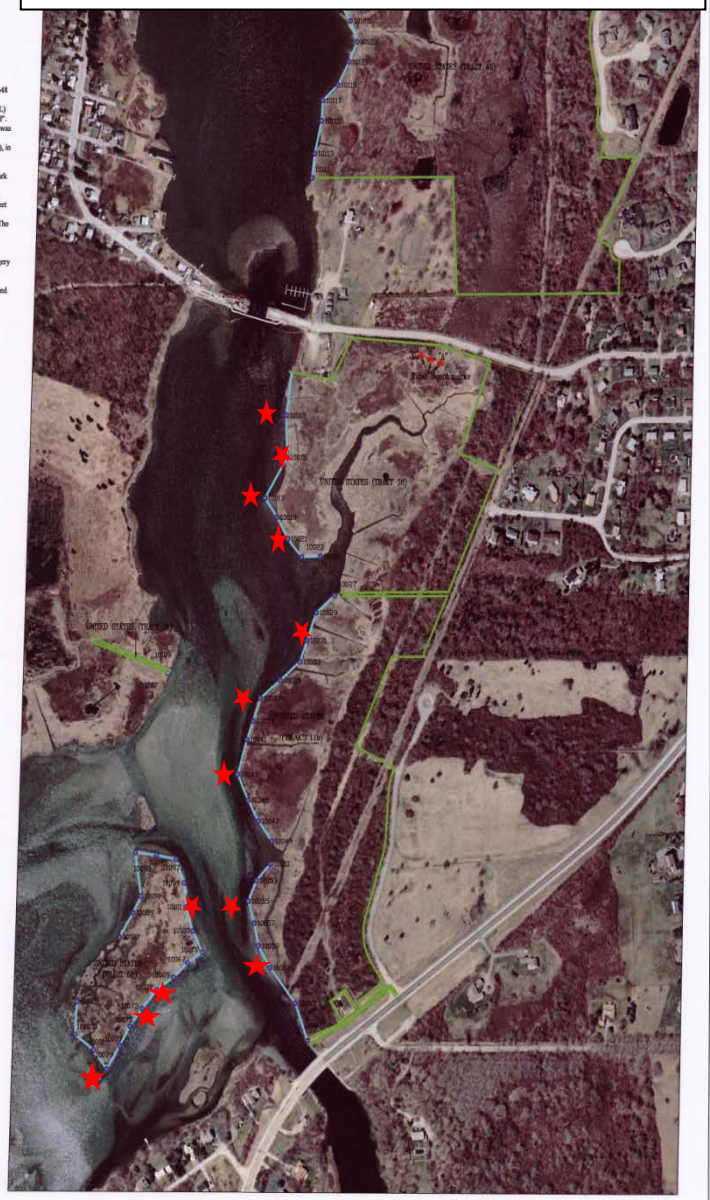
THIS MAP was compiled from surveys of the United States Fish and Wildlife Service made from August 3-6 and 10, 2009 and from records in the files thereof.

October 29, 2009

Michael J. Hayden, PLS, Supervisory Land Surveyor
Office of Realty
300 Westgate Center Drive
Hadley, MA 01035

SALTMARSH SHORELINE EROSION
MASS BANK FAILURE MORE THAN HOMOGENEOUS EROSION
.DELINIATION OF MEAN HIGH WATER LINE (0.805 FT.) IN 2009.

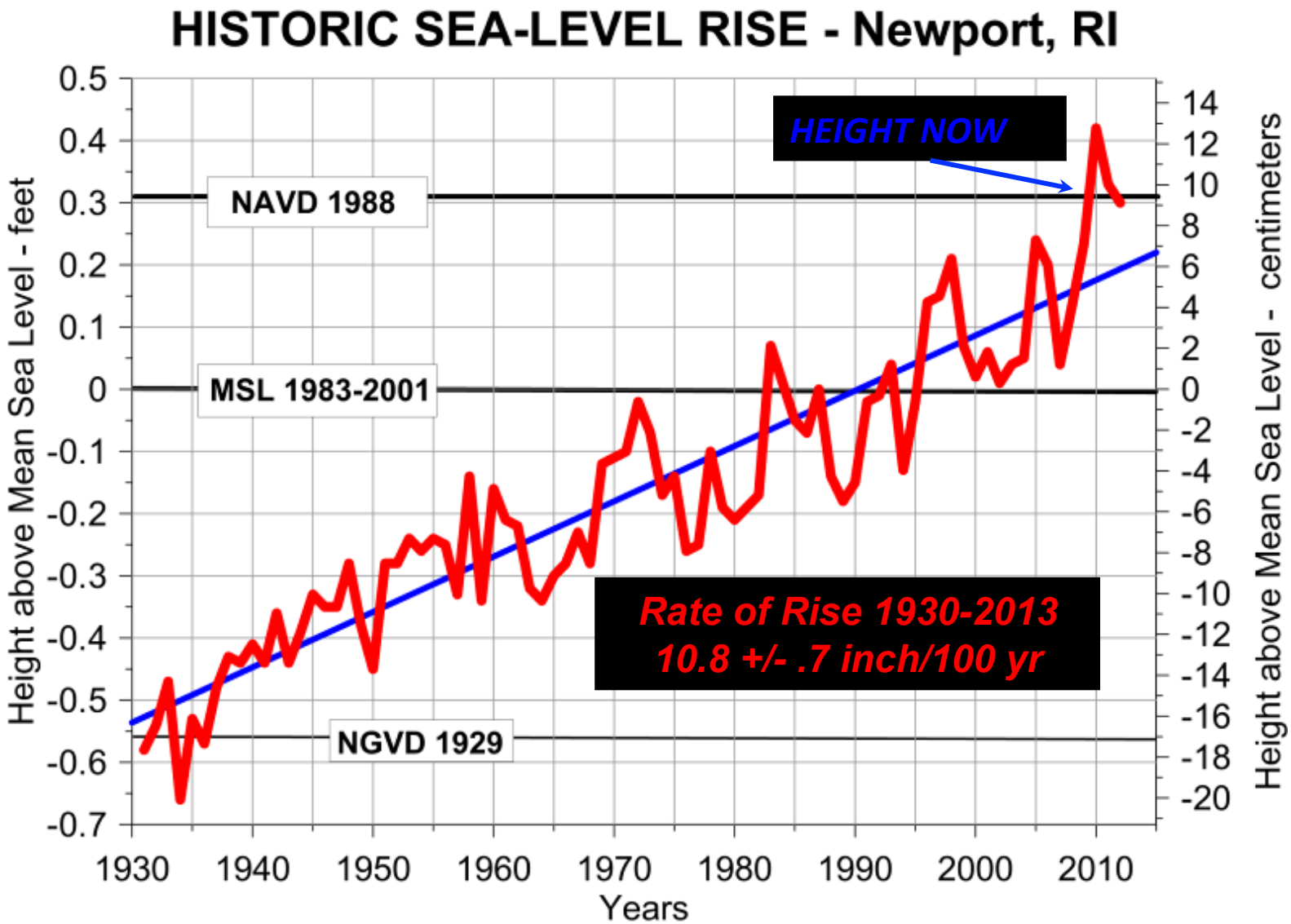
Blue circle: Metal rod placed at elevation in 2009, typically top of bank.
Red Star: Metal rods lost (in water) or below MHWL in 2013 (20% loss).



APPENDIX E

Sea Level Rise Projection in the Narrow River Estuary

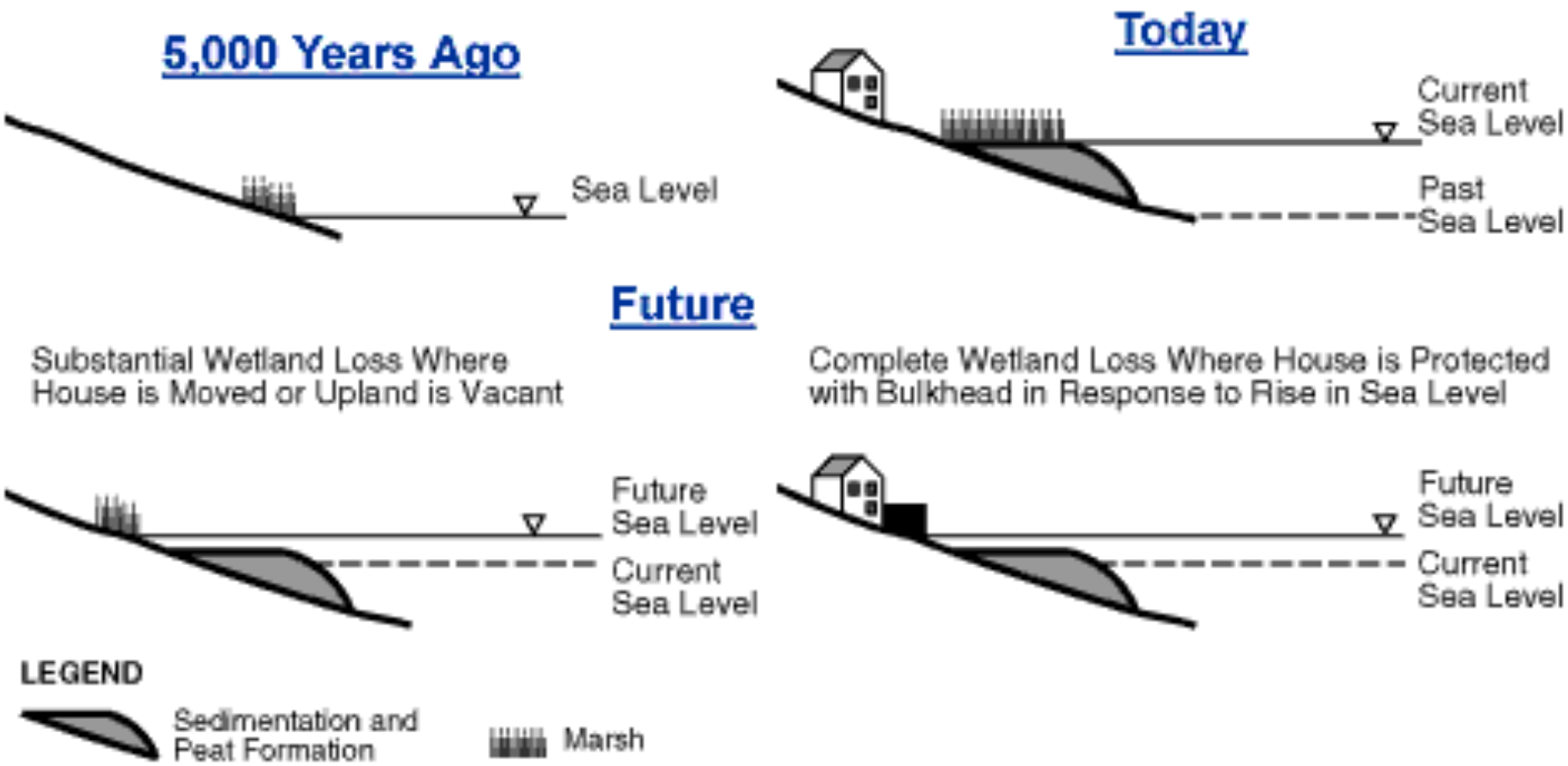
This Appendix presents the sea level rise at the Newport Gauge, and SLAMM modelling data showing changes in the Narrow River Estuary (RICRMC 2014)

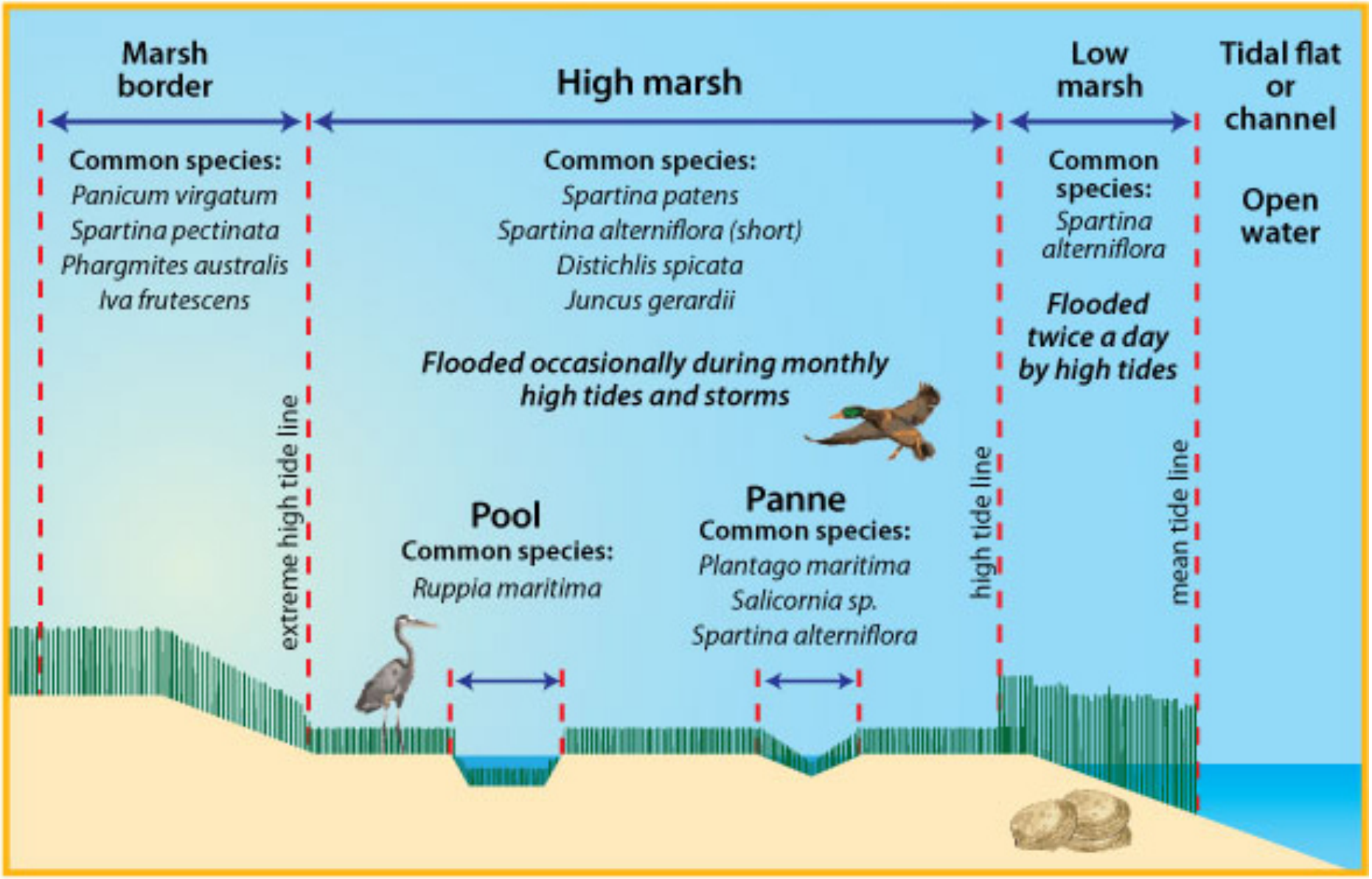


Adapted from:
http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8452660%20Newport,%20RI

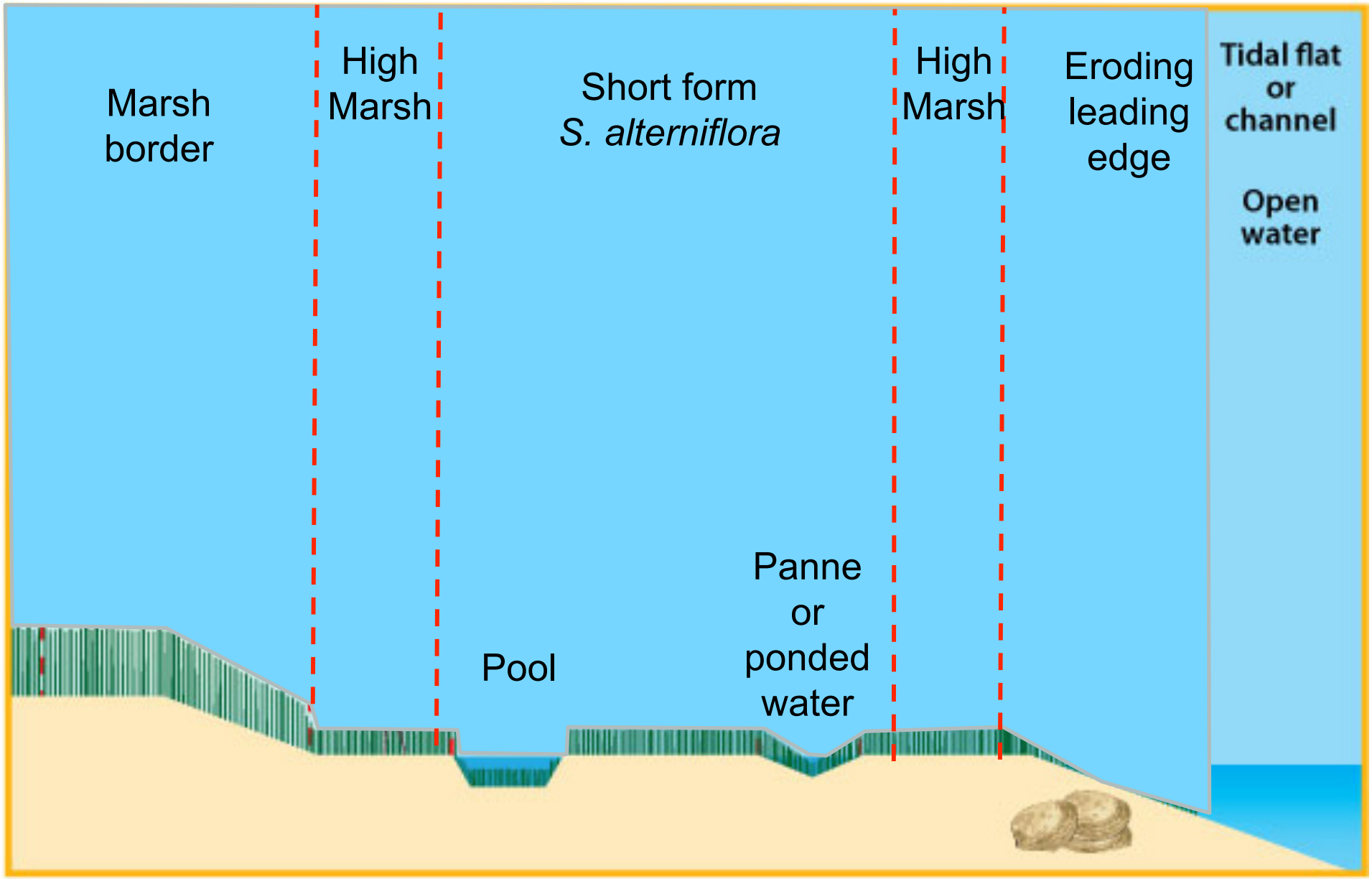
Boothroyd 2013

Evolution of a Marsh as Sea Level Rises





Source: Maine SeaGrant

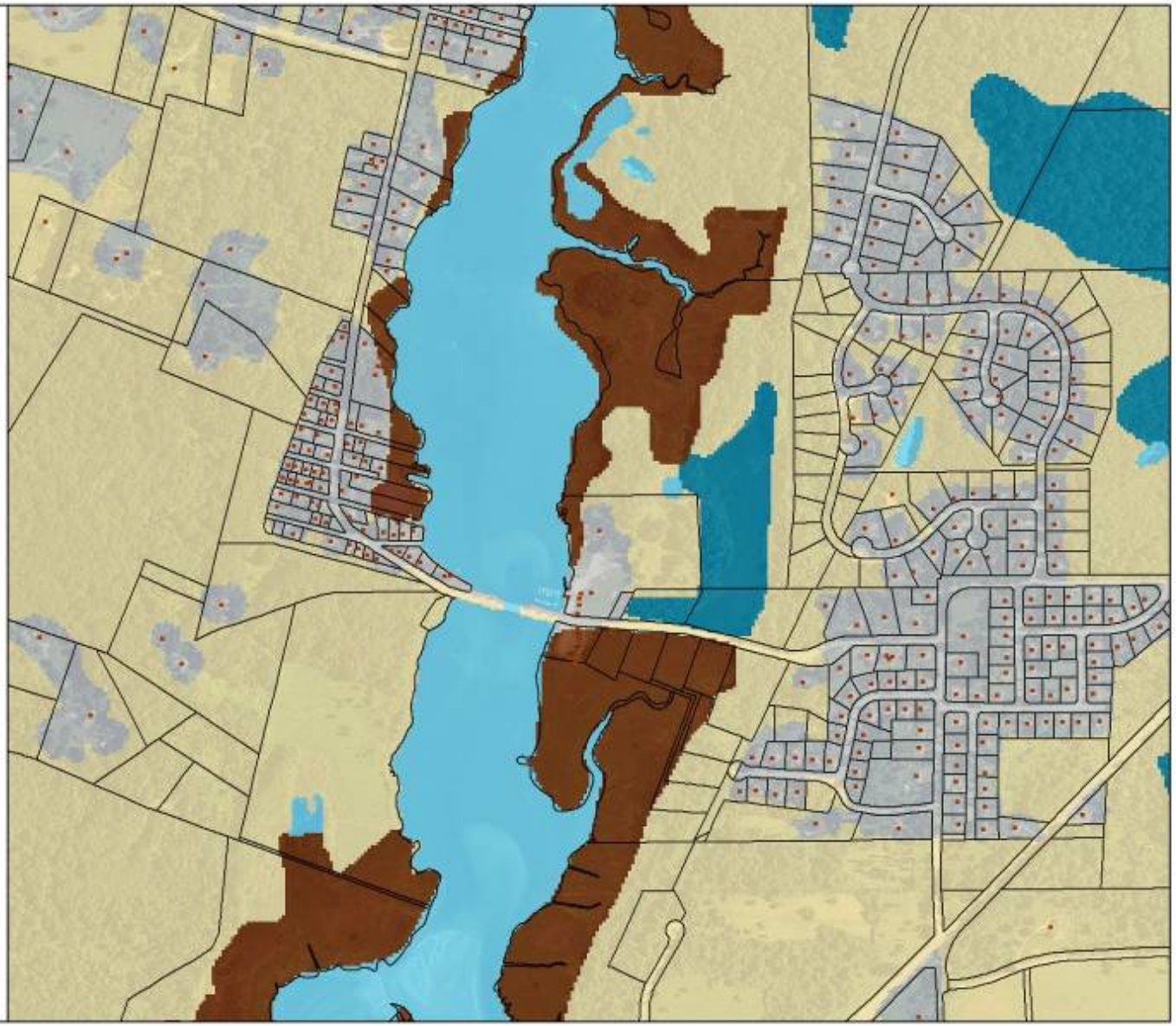


Source: Save The Bay

Middlebridge

Current Condition

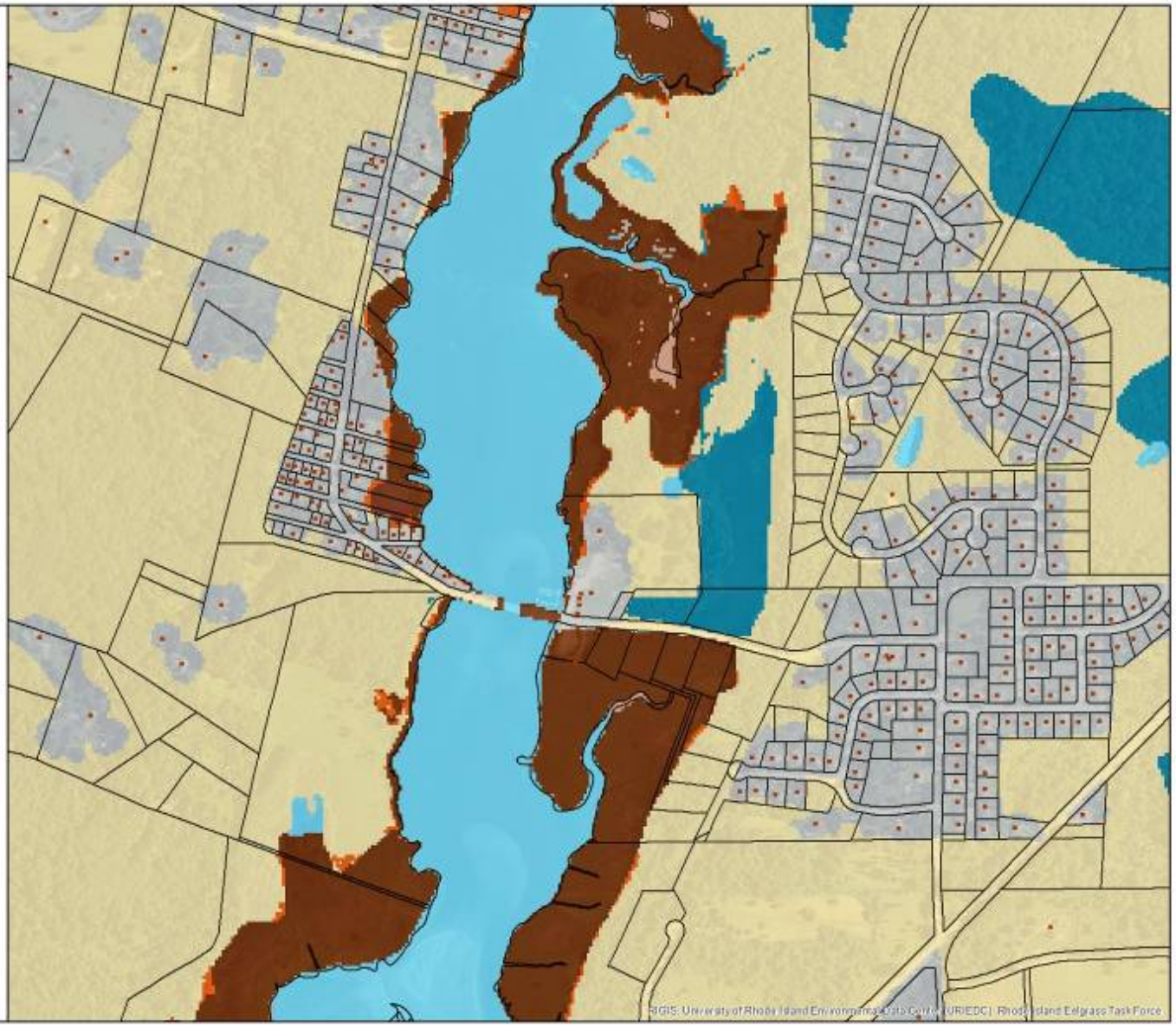
- Developed Upland
- Undeveloped Upland
- Salt Marsh
- Brackish Marsh
- Scrub/Shrub Transitional Marsh
- Tidal Flat
- Swamp
- Fresh Marsh
- Open Water
- Beach
- Rocky Intertidal



Middlebridge

One Foot
Sea Level Rise Model

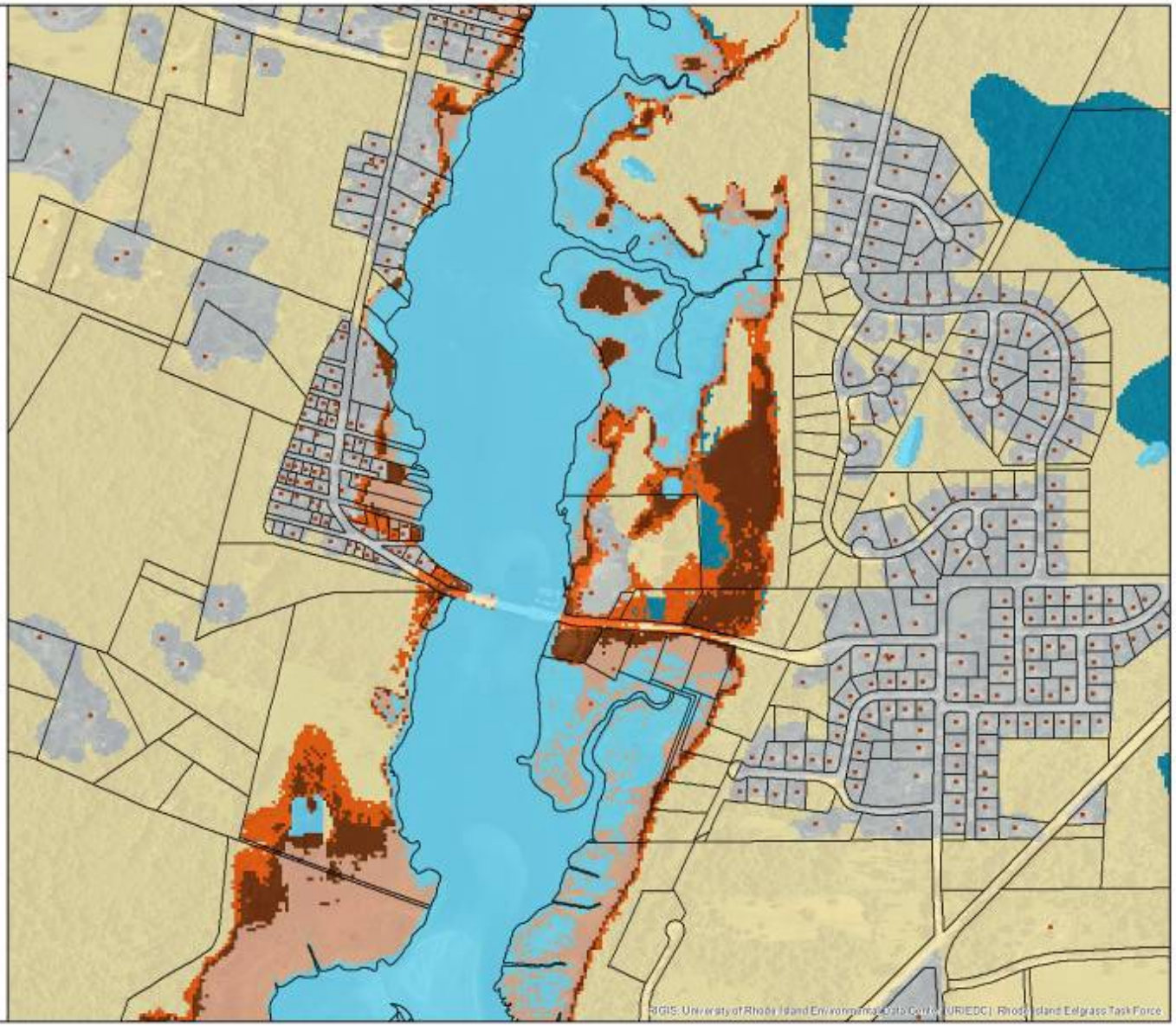
- Developed Upland
- Undeveloped Upland
- Salt Marsh
- Brackish Marsh
- Scrub/Shrub Transitional Marsh
- Tidal Flat
- Swamp
- Fresh Marsh
- Open Water
- Beach
- Rocky Intertidal



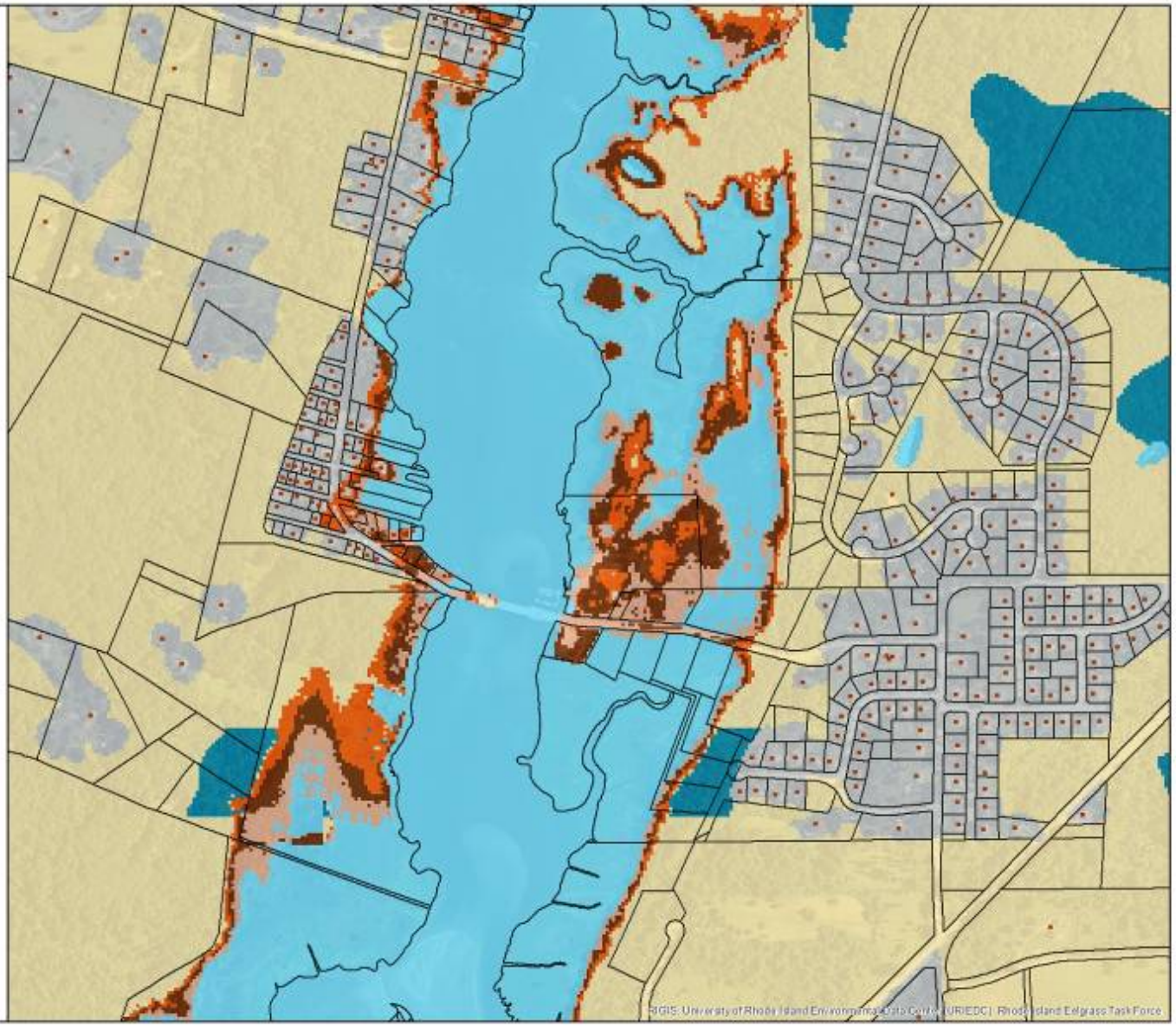
Middlebridge

Three Foot Sea Level Rise Model

- Developed Upland
- Undeveloped Upland
- Salt Marsh
- Brackish Marsh
- Scrub/Shrub Transitional Marsh
- Tidal Flat
- Swamp
- Fresh Marsh
- Open Water
- Beach
- Rocky Intertidal



Middlebridge

Five Foot
Sea Level Rise Model

- Developed Upland
- Undeveloped Upland
- Salt Marsh
- Brackish Marsh
- Scrub/Shrub Transitional Marsh
- Tidal Flat
- Swamp
- Fresh Marsh
- Open Water
- Beach
- Rocky Intertidal