

# Prime Hook National Wildlife Refuge: Providing Science for Management

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# Prime Hook NWR



- Established in 1963
- ~10,000 acres
- 4200 acres of impounded marsh
- 2300 acres of tidal marsh
- 100,000 Snow Geese
- 80,000 Ducks







2  
0  
0  
6

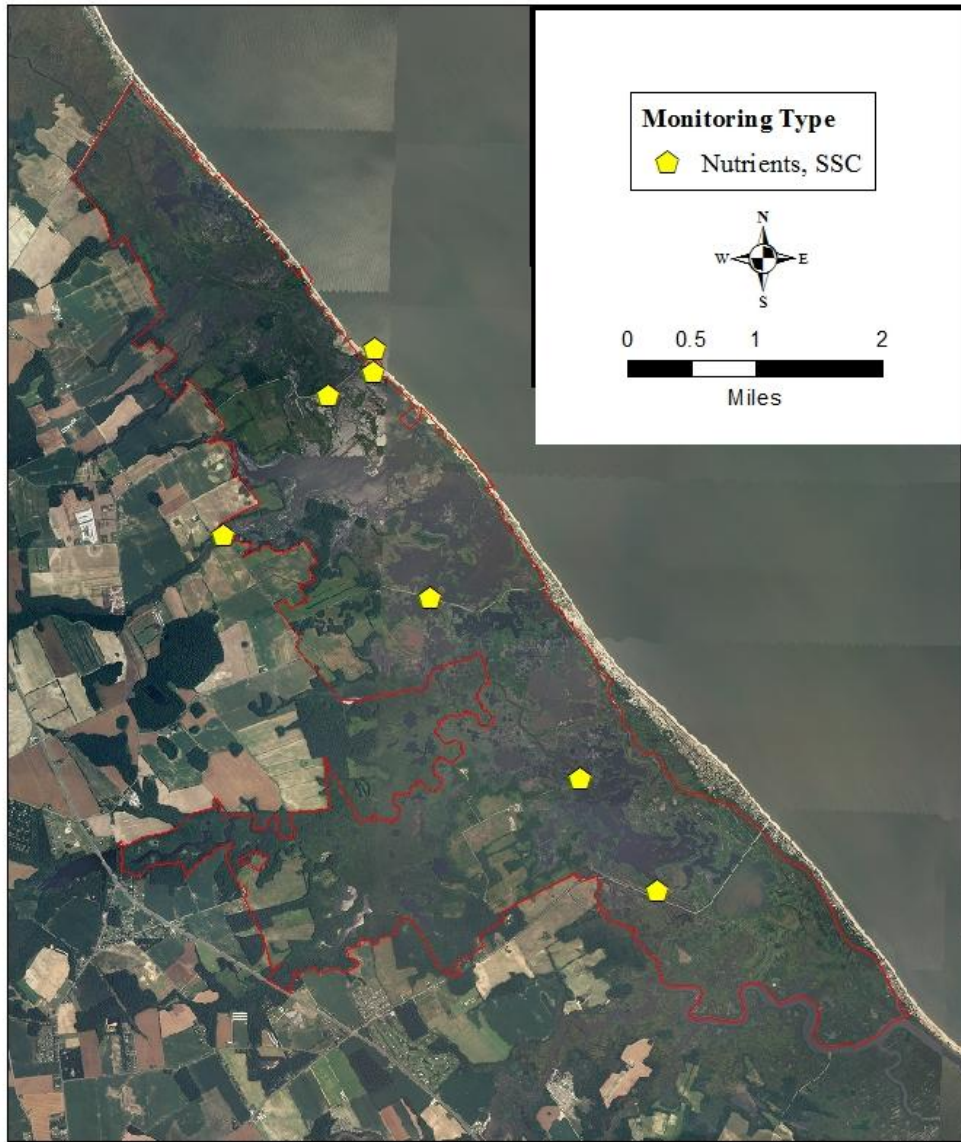


# Nutrient Monitoring





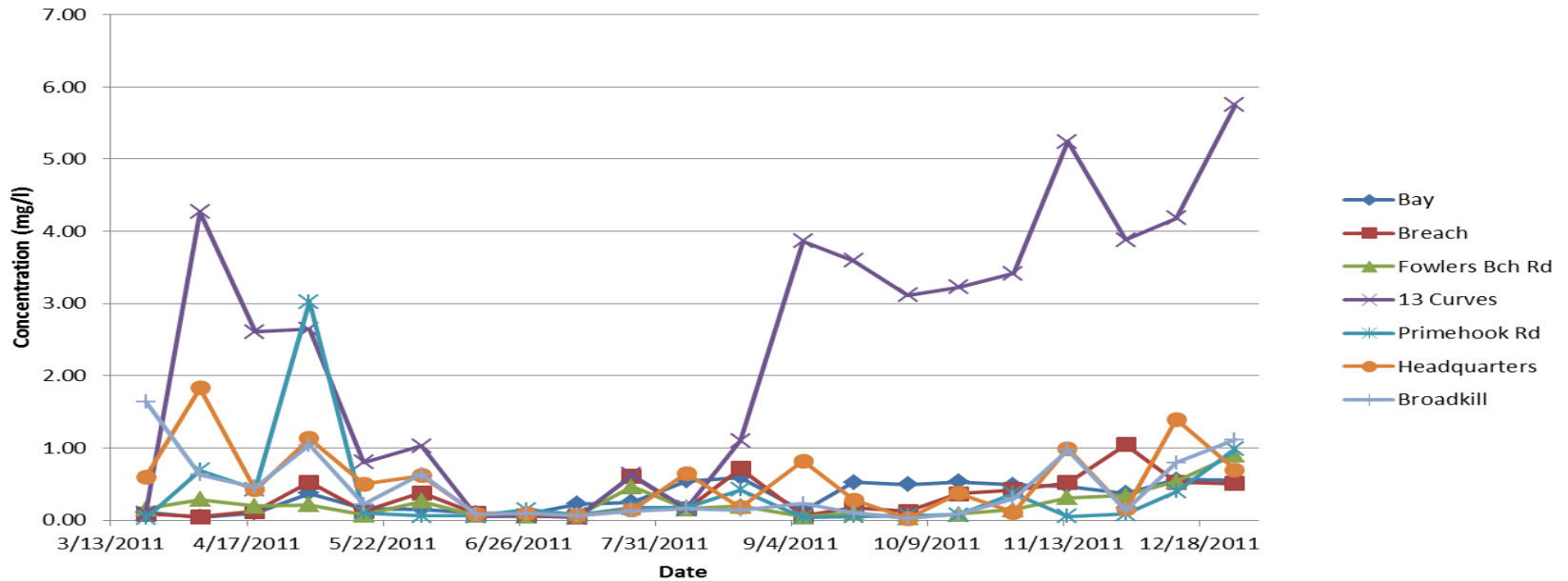
# Semi-Monthly Nutrient Sampling



## Parameters:

- Chlorophyll-a
- Pheophytin
- Ammonia (NH<sub>3</sub>)
- Nitrite (NO<sub>2</sub>)
- Nitrate/Nitrite (NO<sub>x</sub>)
- Ortho-phosphate (O-PO<sub>4</sub>) (DIP)
- Dissolved Inorganic N (DIN) (calculated)
- Total Dissolved N
- Total Dissolved P
- Silicate
- Total Suspended Solids (TSS)
- Suspended Solids Concentration (SSC)

# DIN



Date	Location						
	Bay	Breach	Fowlers Bch Rd	13 Curves	Primehook Rd	Headquarters	Broadkill
3/22/2011	0.1106	0.0849	0.1548	0.0971	0.0289	0.5986	1.6403
4/5/2011	<i>0.0411</i>	<i>0.0453</i>	0.2838	4.2666	0.6883	1.832	0.6304
4/19/2011	0.1001	0.1233	0.1938	2.6057	0.4293	0.4195	0.4593
5/3/2011	0.3721	0.5258	0.2151	2.6427	3.024	1.1308	1.0402
5/17/2011	0.1604	0.1224	0.0698	0.7978	0.1045	0.4975	0.2203
6/1/2011	0.1509	0.379	0.2612	1.028	0.0611	0.6142	0.6324
6/15/2011	0.0959	0.0899	0.068	0.0505	0.0594	0.0824	0.0754
6/28/2011	0.0911	0.0528	0.056	0.0572	0.1441	0.0907	0.0974
7/11/2011	0.2269	0.0492	0.0602	0.0357	0.0801	0.0682	0.0686
7/25/2011	0.2475	0.6088	0.4661	0.6266	0.1711	0.1385	0.1271
8/8/2011	0.5463	0.1525	0.1603	0.1588	0.178	0.6454	0.1624
8/22/2011	0.5912	0.7164	0.195	1.1013	0.4217	0.1781	0.1374
9/7/2011	0.127	0.0564	0.0446	3.862	0.039	0.8172	0.2316
9/20/2011	0.5279	0.1689	0.095	3.594	0.0557	0.2779	0.1027
10/4/2011	0.4952	0.1214	0.0335	3.116	0.0656	0.0253	0.0211
10/17/2011	0.533	0.3654	0.0827	3.224	0.0724	0.3726	0.0848
10/31/2011	0.4912	0.4229	0.1430	3.4160	0.3729	0.1081	0.2987
11/14/2011	0.4727	0.5207	0.3106	5.2430	0.0510	0.9919	0.9709
11/29/2011	0.3693	1.0482	0.3389	3.8788	0.0826	0.1488	0.1402
12/12/2011	0.5641	0.5235	0.5396	4.1840	0.3968	1.3935	0.7917
12/27/2011	0.5554	0.5042	0.9058	5.7464	0.987	0.6939	1.1156

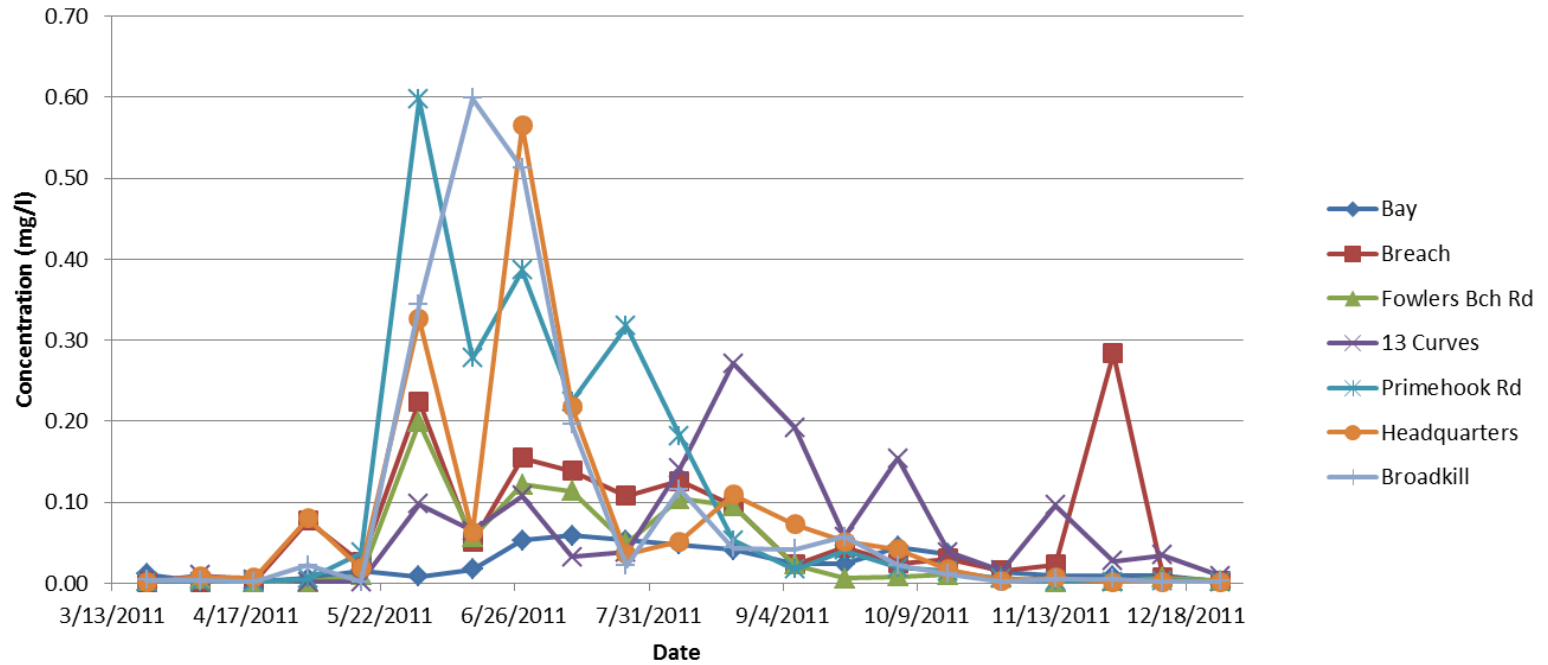
## EPA National Coastal Condition Guidelines for Northeast Coast

DIN	Condition
<0.1 mg/L	Good
0.1-0.5 mg/L	Fair
>0.5 mg/L	Poor

Black Italic - NOx component below MDL

Blue Italic - NH3 component below MDL

# O-PO4 (DIP)



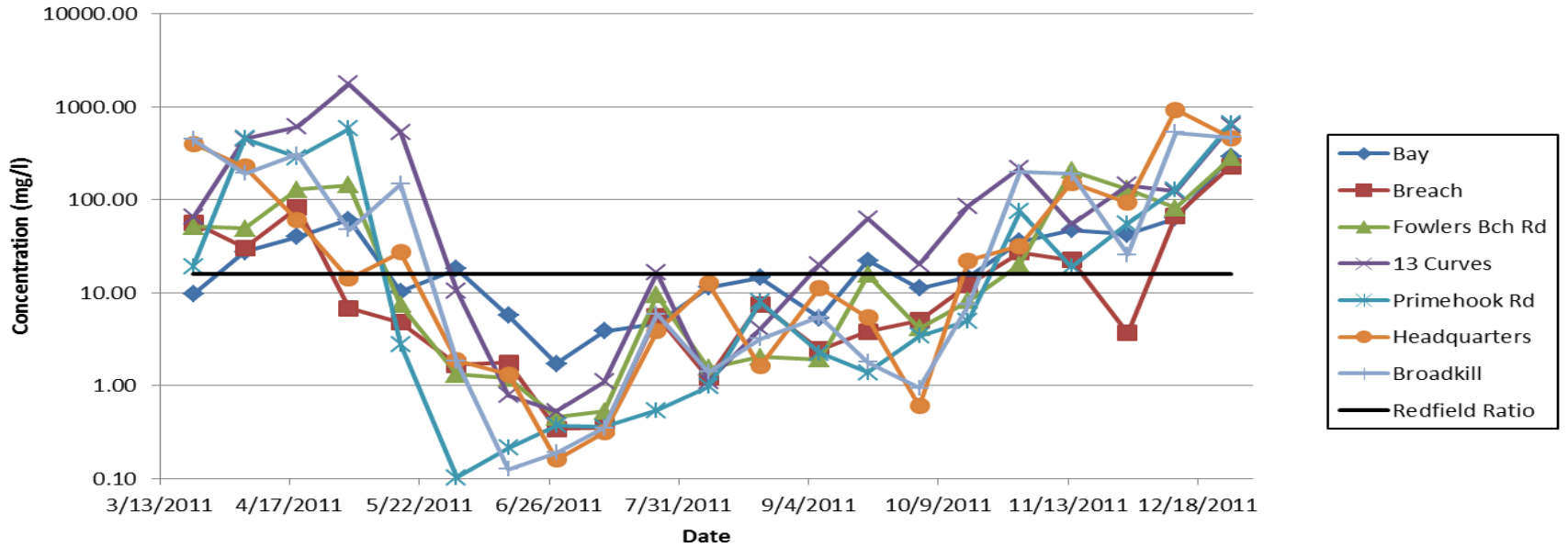
Date	Location						
	Bay	Breach	Fowlers Bch Rd	13 Curves	Primehook Rd	Headquarters	Broadkill
3/22/2011	0.0114	0.0015	0.003	0.0015	0.0015	0.0015	0.0037
4/5/2011	0.0015	0.0015	0.0058	0.0095	0.0015	0.0081	0.0033
4/19/2011	0.0025	0.0015	0.0015	0.0043	0.0015	0.007	0.0015
5/3/2011	0.0061	0.0772	0.0015	0.0015	0.0052	0.0799	0.0219
5/17/2011	0.0156	0.0255	0.0094	0.0015	0.0374	0.0182	0.0015
6/1/2011	0.0084	0.2244	0.1986	0.0975	0.597	0.3265	0.344
6/15/2011	0.0169	0.051	0.0565	0.0644	0.2782	0.0625	0.599
6/28/2011	0.0529	0.1546	0.1219	0.1082	0.386	0.565	0.512
7/11/2011	0.0588	0.1383	0.114	0.0323	0.224	0.2174	0.196
7/25/2011	0.0531	0.108	0.0494	0.038	0.3174	0.036	0.0216
8/8/2011	0.048	0.126	0.1043	0.1416	0.1815	0.0512	0.116
8/22/2011	0.0409	0.0955	0.0951	0.271	0.0532	0.1095	0.0434
9/7/2011	0.0238	0.0232	0.0231	0.1921	0.0173	0.0724	0.0421
9/20/2011	0.0237	0.0442	0.0061	0.0575	0.0401	0.0513	0.0575
10/4/2011	0.0445	0.0241	0.0081	0.154	0.0192	0.0417	0.0224
10/17/2011	0.0364	0.03	0.0102	0.0379	0.0146	0.0168	0.0115
10/31/2011	0.0138	0.0156	0.0071	0.0157	0.0050	0.0034	0.0015
11/14/2011	0.0100	0.0231	0.0015	0.0960	0.0027	0.0065	0.0051
11/29/2011	0.0087	0.2840	0.0026	0.0270	0.0015	0.0016	0.0055
12/12/2011	0.0089	0.0078	0.0066	0.0343	0.0031	0.0015	0.0015
12/27/2011	0.0019	0.0022	0.0032	0.0092	0.0015	0.0015	0.0024

EPA National Coastal Condition Guidelines for Northeast Coast

DIP <0.01 mg/L Good  
0.01-0.05 mg/L Fair  
>0.05 mg/L Poor

Black Italic - Below Minimum Detection Limit 0.0015 mg/L

## N:P Ratio



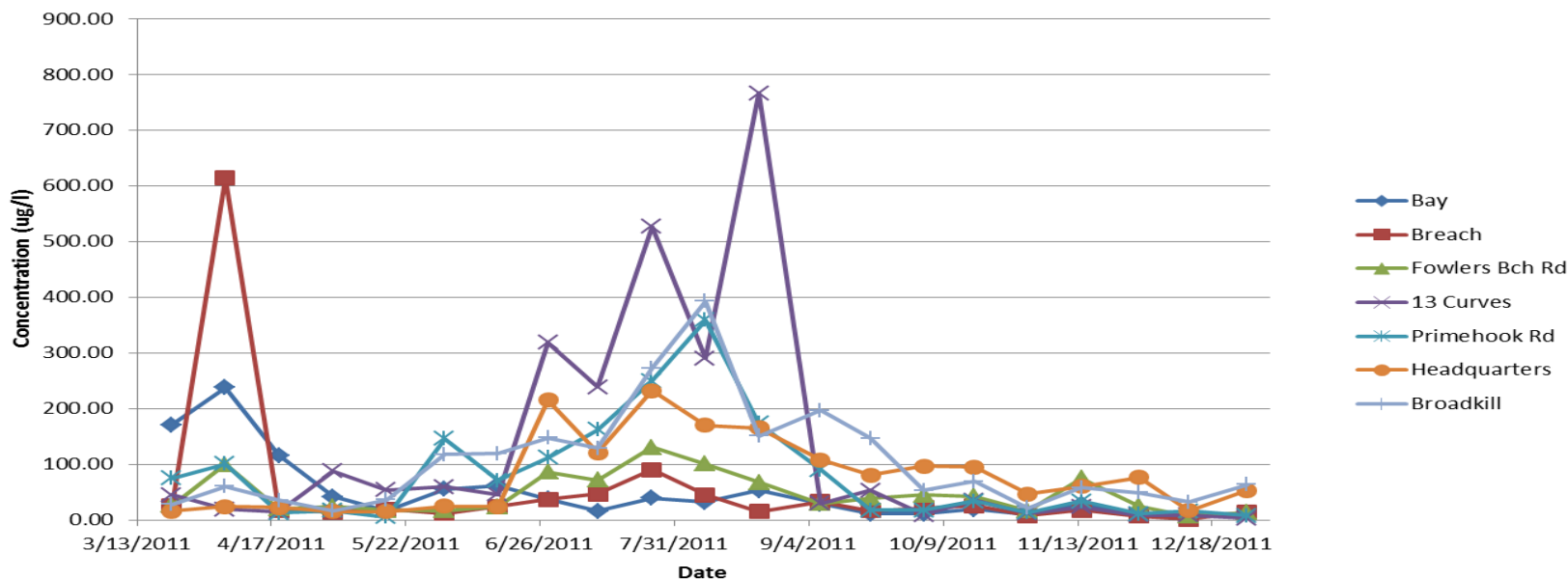
Date	Location						
	Bay	Breach	Fowlers Bch Rd	13 Curves	Primehook Rd	Headquarters	Broadkill
3/22/2011	9.7	56.6	51.6	64.7	19.3	399.1	443.3
4/5/2011	27.4	30.2	48.9	449.1	458.9	226.2	191.0
4/19/2011	40.0	82.2	129.2	606.0	286.2	59.9	306.2
5/3/2011	61.0	6.8	143.4	1761.8	581.5	14.2	47.5
5/17/2011	10.3	4.8	7.4	531.9	2.8	27.3	146.9
6/1/2011	18.0	1.7	1.3	10.5	0.1	1.9	1.8
6/15/2011	5.7	1.8	1.2	0.8	0.2	1.3	0.1
6/28/2011	1.7	0.3	0.5	0.5	0.4	0.2	0.2
7/11/2011	3.9	0.4	0.5	1.1	0.4	0.3	0.4
7/25/2011	4.7	5.6	9.4	16.5	0.5	3.8	5.9
8/8/2011	11.4	1.2	1.5	1.1	1.0	12.6	1.4
8/22/2011	14.5	7.5	2.1	4.1	7.9	1.6	3.2
9/7/2011	5.3	2.4	1.9	20.1	2.3	11.3	5.5
9/20/2011	22.3	3.8	15.6	62.5	1.4	5.4	1.8
10/4/2011	11.1	5.0	4.1	20.2	3.4	0.6	0.9
10/17/2011	14.6	12.2	8.1	85.1	5.0	22.2	7.4
10/31/2011	35.6	27.1	20.1	217.6	74.6	31.8	199.1
11/14/2011	47.3	22.5	207.1	54.6	18.9	152.6	190.4
11/29/2011	42.4	3.7	130.3	143.7	55.1	93.0	25.5
12/12/2011	63.4	67.1	81.8	122.0	128.0	929.0	527.8
12/27/2011	292.3	229.2	283.1	624.6	658.0	462.6	464.8

Green: P Limited

Red: N Limited



## Chlorophyll - A



Date	Location						
	Bay	Breach	Fowlers Bch Rd	13 Curves	Primehook Rd	Headquarters	Broadkill
3/22/2011	171.22	24.43	26.33	45.16	74.35	15.96	27.76
4/5/2011	237.78	614.04	100.05	19.37	100.93	23.84	60.18
4/19/2011	115.99	17.60	19.81	13.91	12.52	22.36	35.34
5/3/2011	41.30	14.01	23.77	87.52	16.43	15.19	16.98
5/17/2011	15.47	18.98	17.45	53.39	5.33	15.14	36.15
6/1/2011	55.76	11.89	16.27	59.63	145.85	24.35	117.86
6/15/2011	61.85	24.01	23.91	45.88	70.66	24.17	118.94
6/28/2011	37.57	37.19	86.33	318.52	112.00	215.24	147.79
7/11/2011	16.17	46.82	71.90	238.38	161.72	120.82	128.64
7/25/2011	39.24	90.18	130.29	526.50	250.10	231.80	272.80
8/8/2011	31.90	44.87	100.27	290.40	358.55	170.11	392.49
8/22/2011	53.30	15.34	67.65	766.50	173.64	165.30	150.39
9/7/2011	28.97	32.84	29.54	29.48	90.10	107.49	196.67
9/20/2011	11.34	16.50	39.08	53.07	17.26	80.04	146.74
10/4/2011	11.03	21.38	45.06	9.18	17.69	96.53	52.60
10/17/2011	19.04	25.56	42.59	35.31	33.41	95.16	69.17
10/31/2011	9.51	7.82	16.87	11.51	13.19	46.11	21.26
11/14/2011	29.05	17.38	75.12	22.98	33.89	60.32	57.78
11/29/2011	8.91	7.03	24.64	8.48	11.24	76.05	48.72
12/12/2011	8.80	1.62	7.18	8.84	16.20	16.39	31.67
12/27/2011	11.25	14.07	13.47	3.29	8.04	52.92	63.65

**EPA National Coastal Condition Guidelines for Northeast Coast**

**CHLA** <5 ug/L Good  
 5-20 ug/L Fair  
 >20 ug/L Poor

# Coastal Erosion







2  
0  
0  
6



2  
0  
0  
6



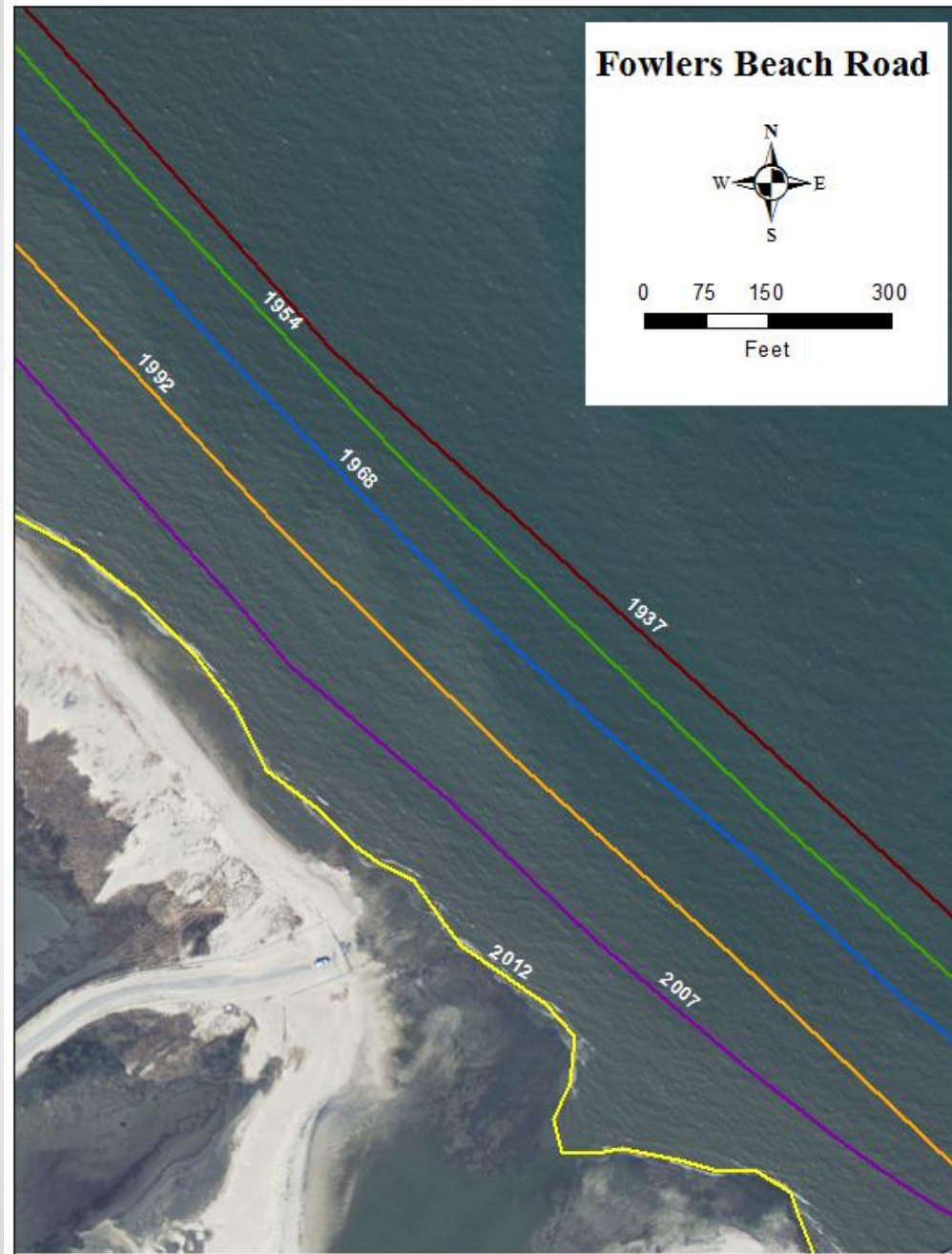


2009



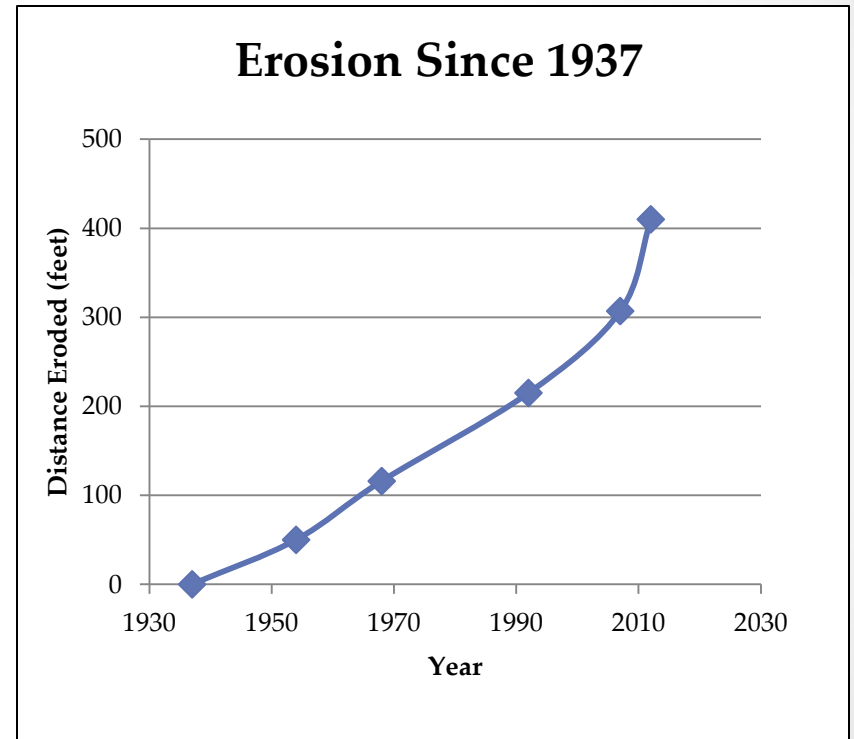
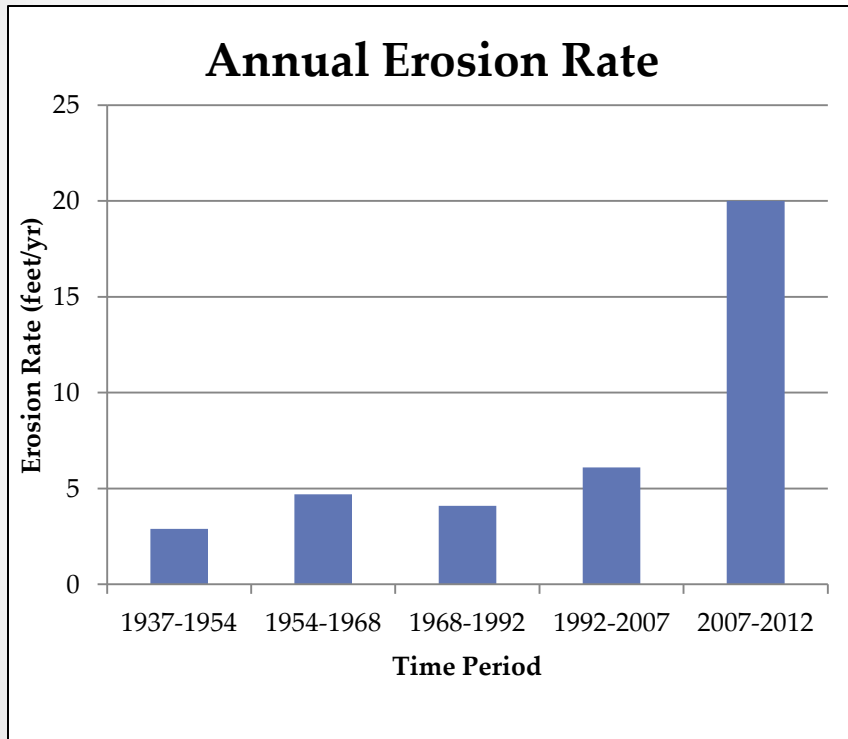
2012





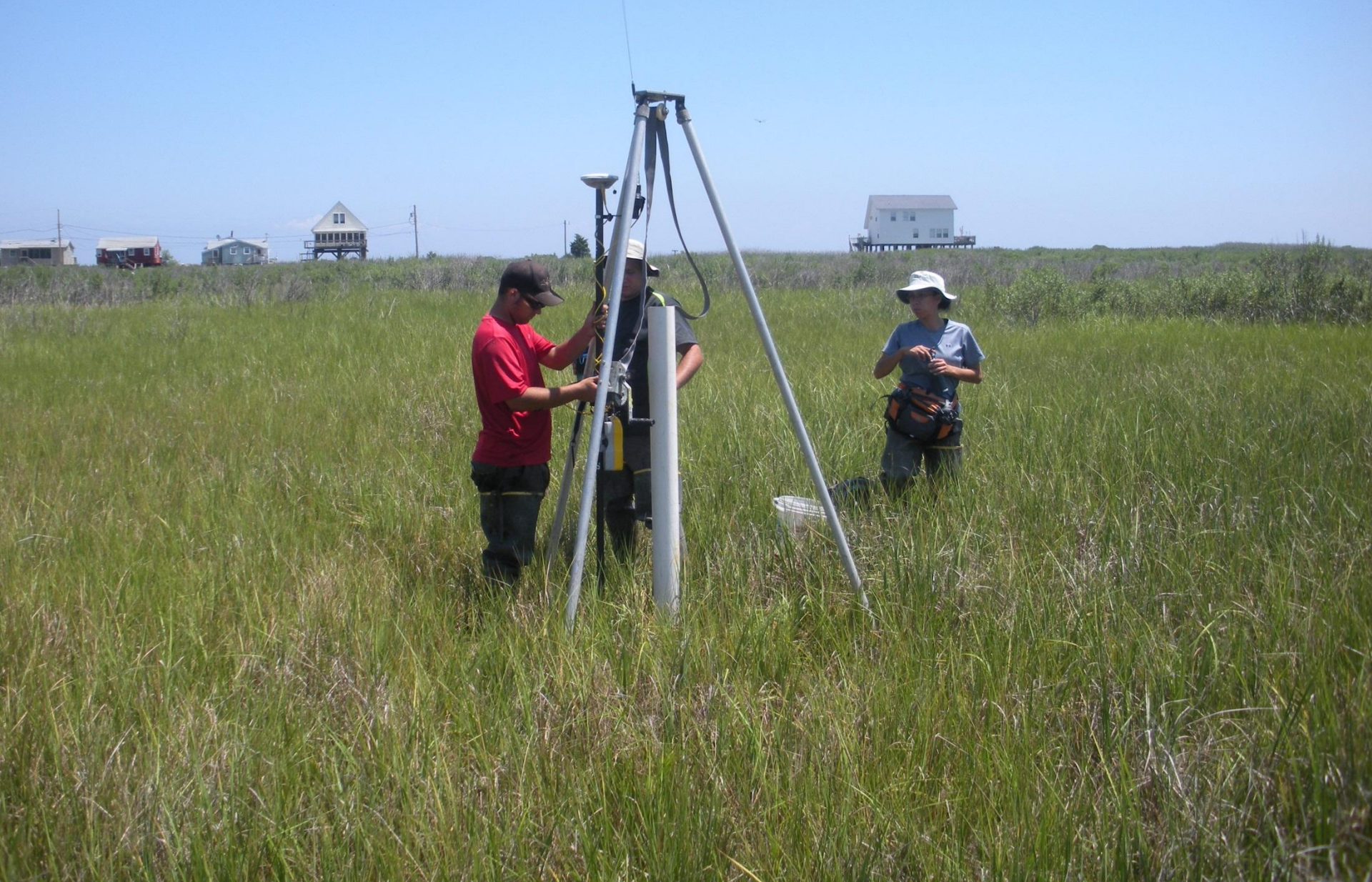
Date	Shoreline Movement (ft)
1937	0
1954	50
1968	116
1992	215
2007	307
2012	410

# Coastal Erosion Rates





# Accretion Rate









# Historic Accretion Rates

## Primehook National Wildlife Refuge



### Legend

-  Radiometric Core
-  Future Core Location
-  Tidal Units 1 and 4
-  Impounded Unit 2 and 3



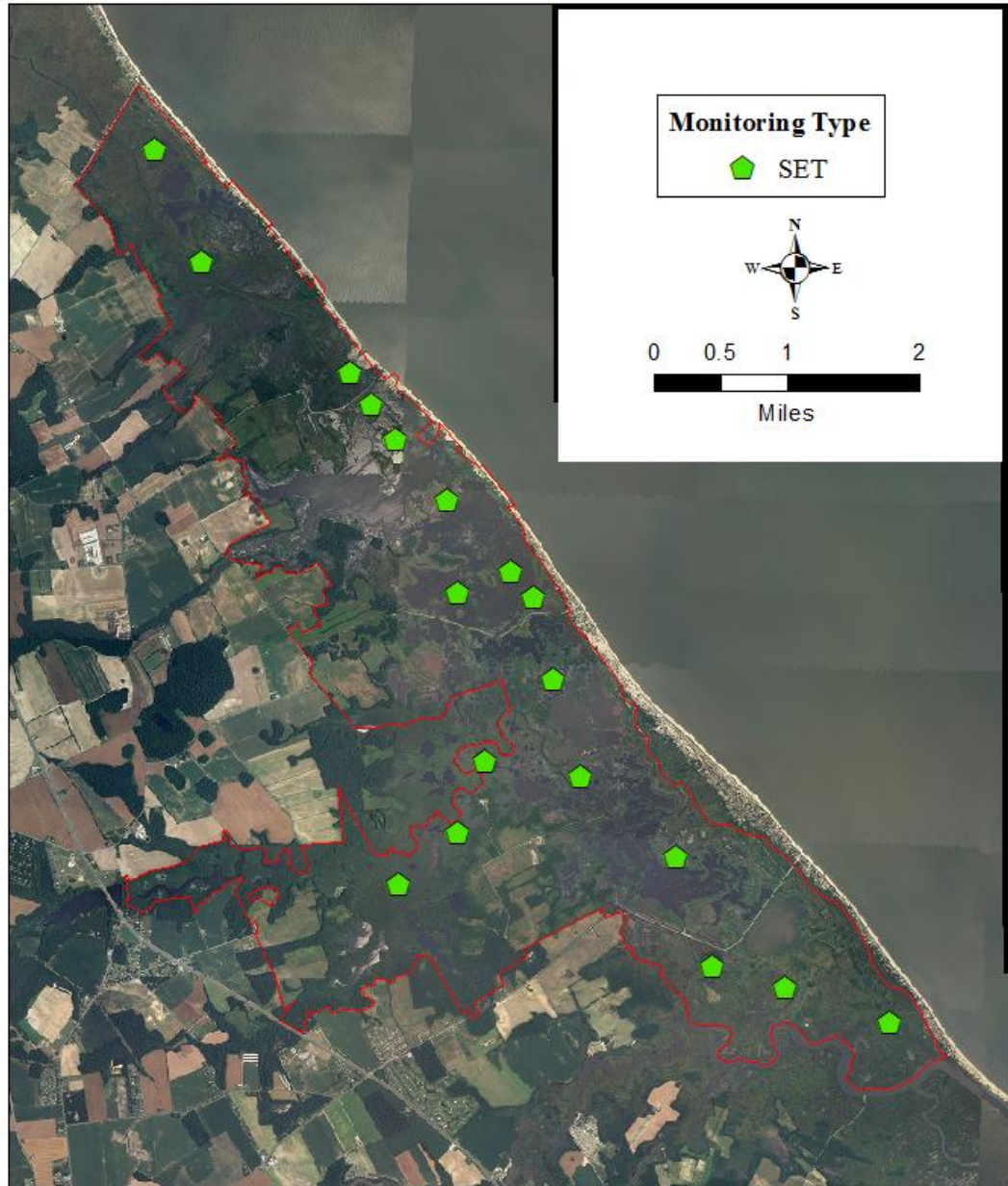
### Determined by Cs<sup>137</sup> Content

	Post 1954 Accretion Rate: (cm/yr)	Mineral Mass Accumulation Rate: (g/cm <sup>2</sup> /yr)	Organic Mass Accumulation Rate: (g/cm <sup>2</sup> /yr)
PM2	0.31	0.09	0.04
PM7	0.45		
<u>PM1</u>	<u>0.69</u>	<u>0.20</u>	<u>0.05</u>
PM3	0.17	0.04	0.01
PM8	0.23		
<u>PM4</u>	<u>0.17</u>	<u>0.01</u>	<u>0.02</u>
PM9	0.16		
PM6	0.39	0.06	0.06
PM5	0.38	0.09	0.04

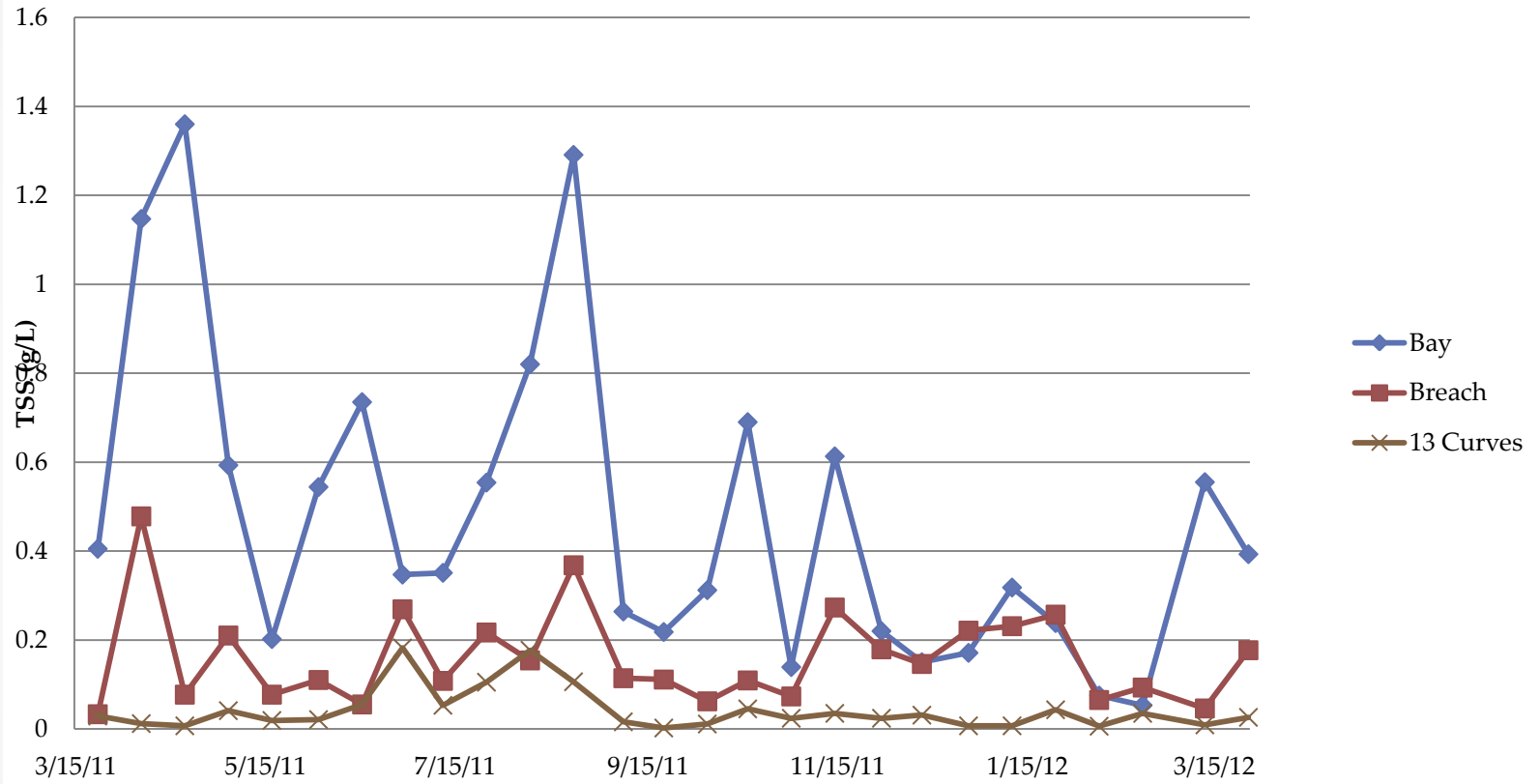
1,600 800 0 1,600 Meters







# Total Suspended Solids



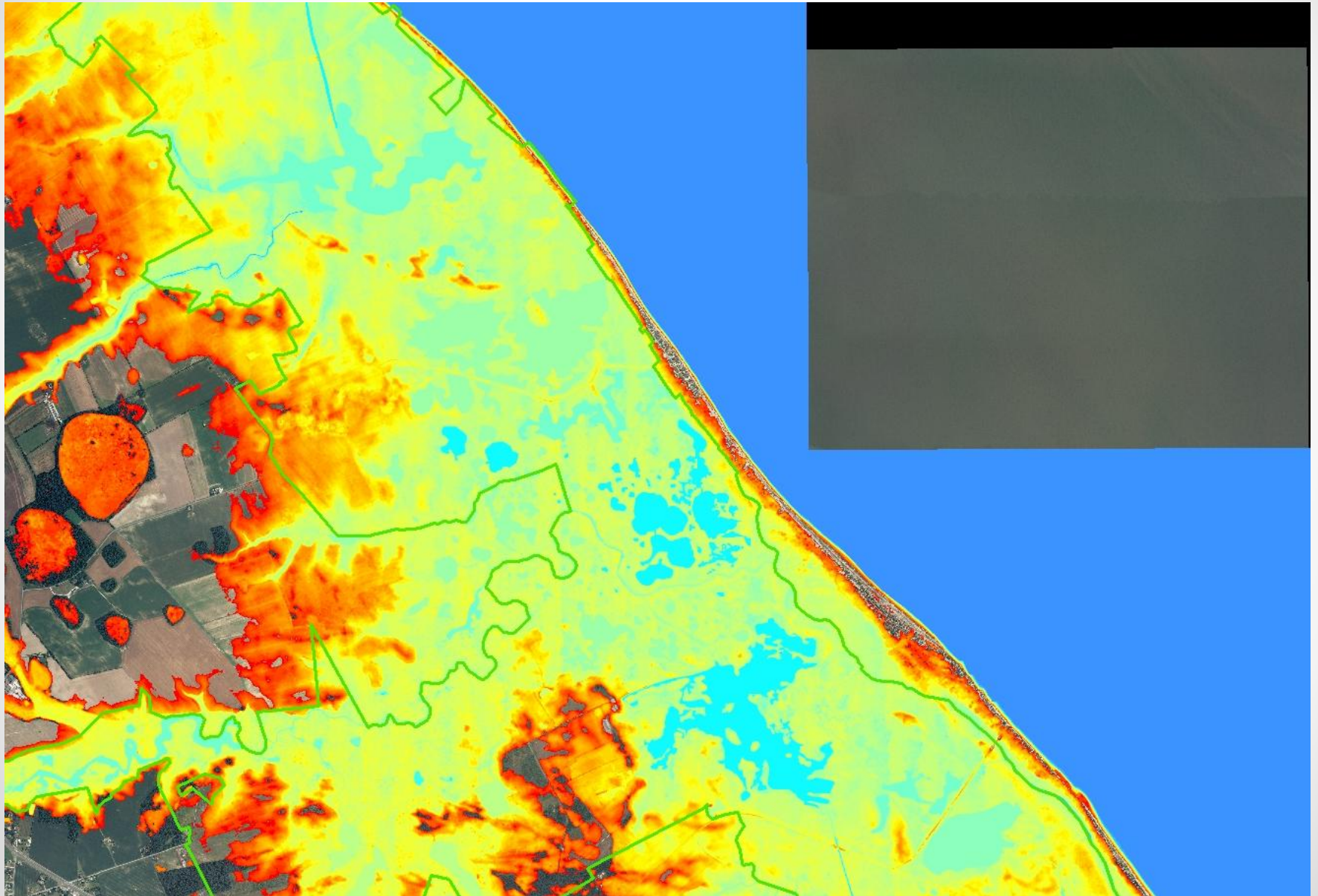


# Surface Elevation & Bathymetry





# 2006 LiDAR





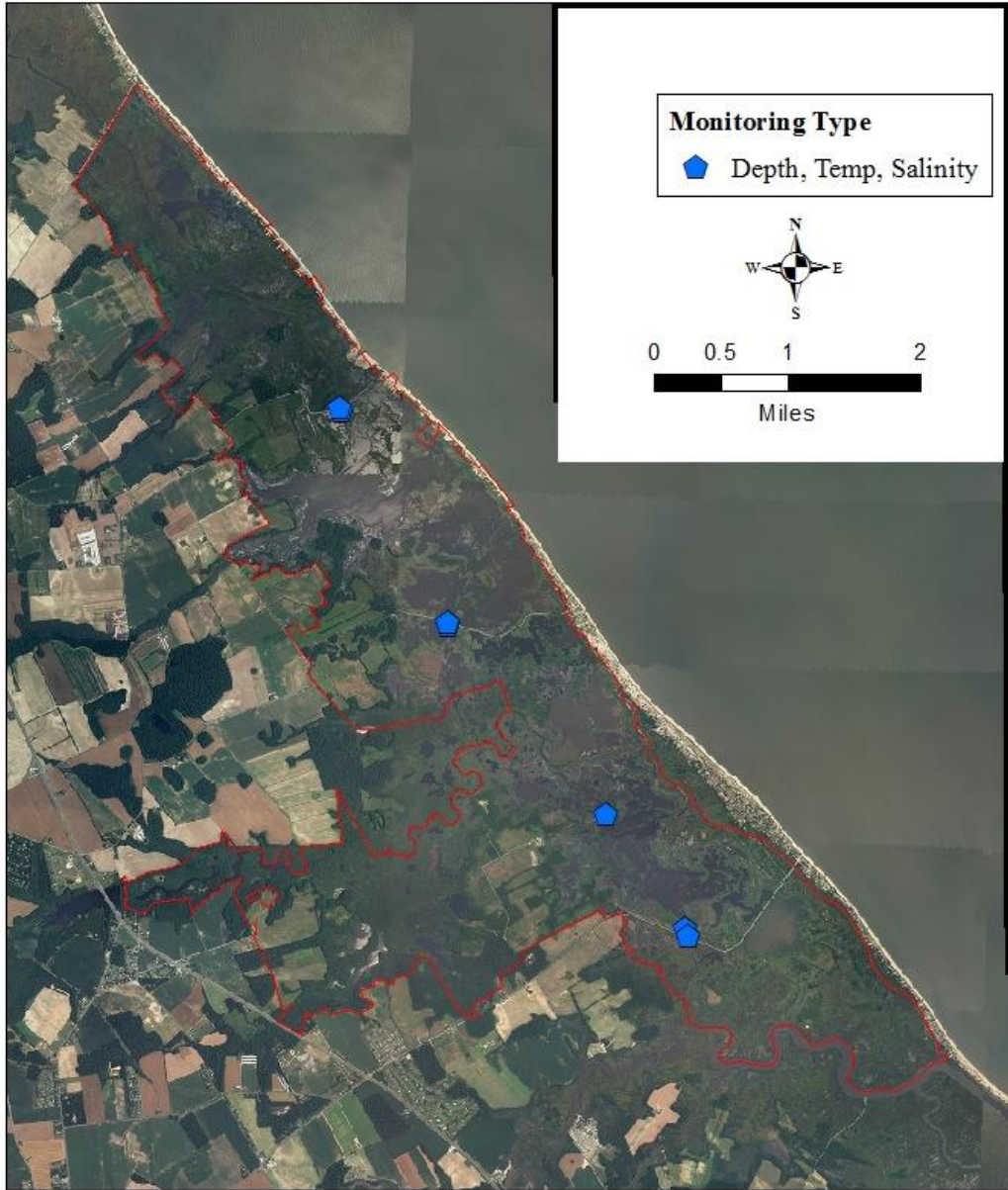
# 2012 Bathymetry Surveys



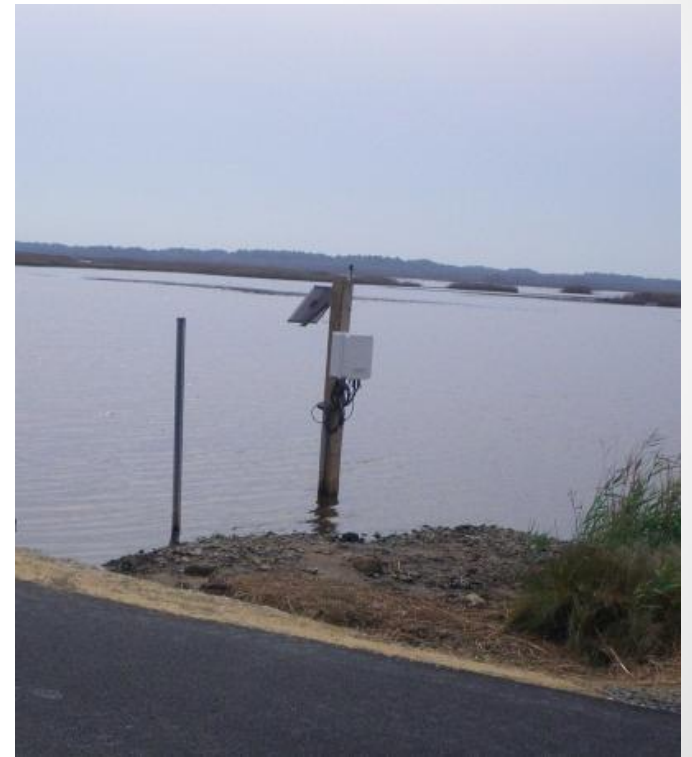
# Water Levels & Salinity



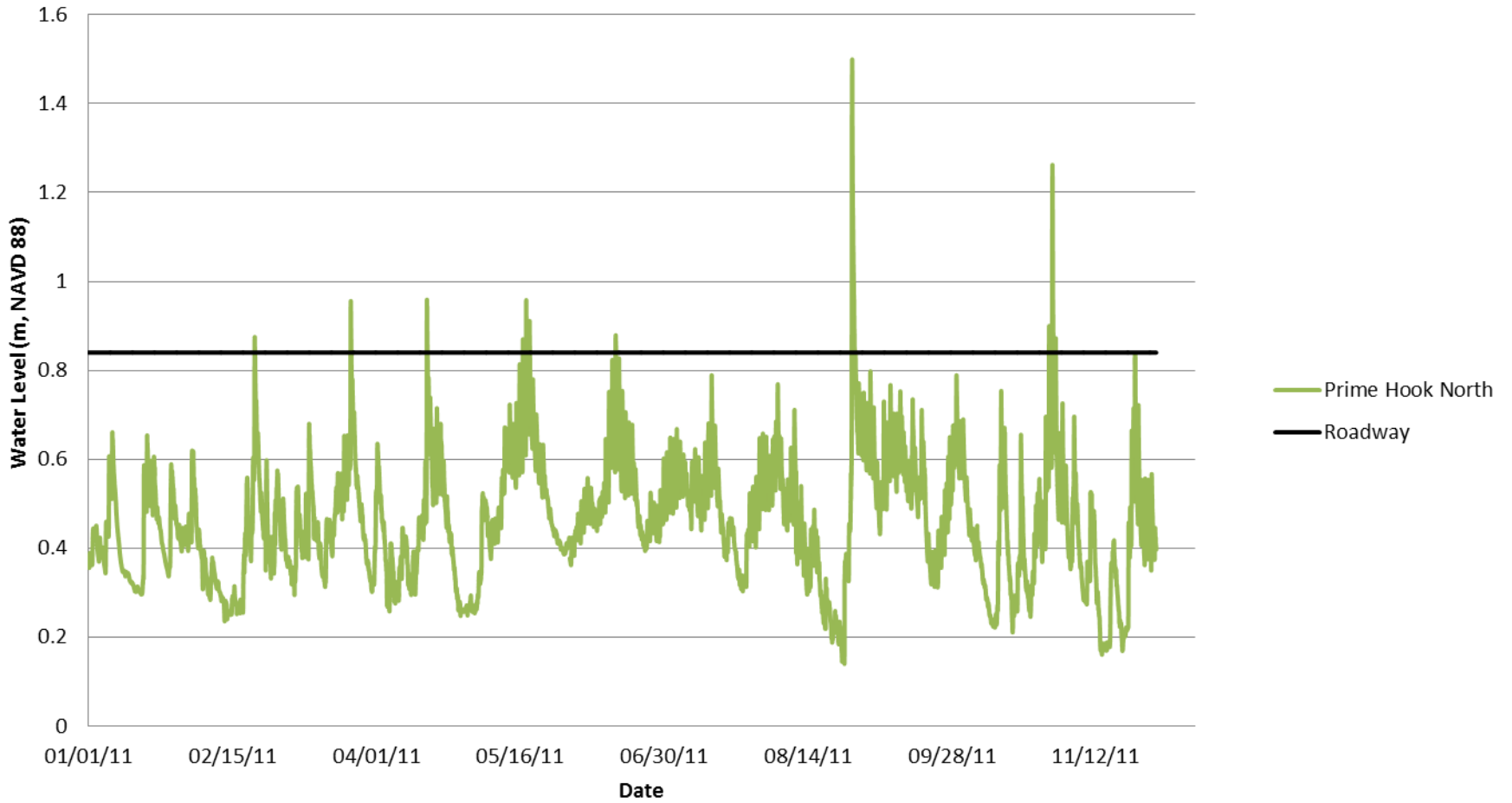




## Continuous Real-time Salinity & Water Level Monitoring

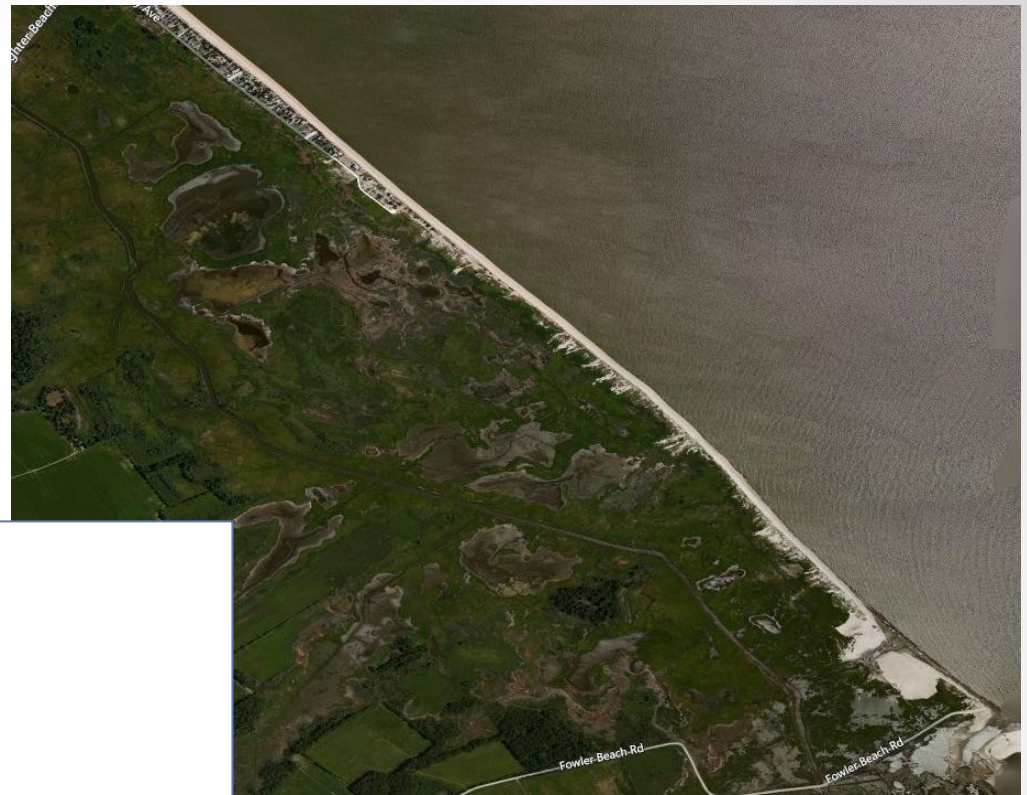


# Water Level

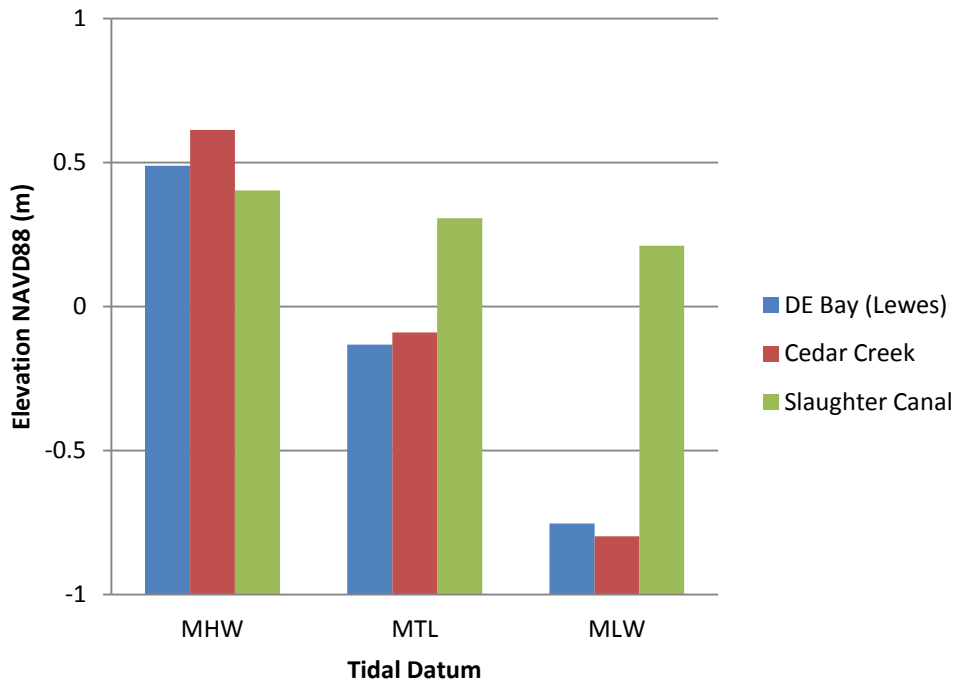




# Altered Tidal Regime



### Tidal Datums



Unit 1

# Prime Hook NWR

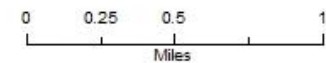
5/3/2011

Salinity Transect



## Salinity Levels (PSU)

- ◆ 0.0 - 1.0
- ◆ 1.1 - 2.0
- ◆ 2.1 - 3.0
- ◆ 3.1 - 4.0
- ◆ 4.1 - 5.0
- ◆ 5.1 - 6.0
- ◆ 6.1 - 8.0
- ◆ 8.1 - 10.0
- ◆ 10.1 - 12.0
- ◆ 12.1 - 14.0
- ◆ 14.1 - 16.0
- ◆ 16.1 - 18.0
- ◆ 18.1 - 20.0
- ◆ 20.1 - 24.0
- ◆ 24.1 - 28.0
- ◆ 28.1 - 36.0





# Prime Hook NWR

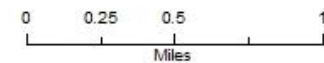
7/12/2011

Salinity Transect



## Salinity Levels (PSU)

- ◆ 0.0 - 1.0
- ◆ 1.1 - 2.0
- ◆ 2.1 - 3.0
- ◆ 3.1 - 4.0
- ◆ 4.1 - 5.0
- ◆ 5.1 - 6.0
- ◆ 6.1 - 8.0
- ◆ 8.1 - 10.0
- ◆ 10.1 - 12.0
- ◆ 12.1 - 14.0
- ◆ 14.1 - 16.0
- ◆ 16.1 - 18.0
- ◆ 18.1 - 20.0
- ◆ 20.1 - 24.0
- ◆ 24.1 - 28.0
- ◆ 28.1 - 36.0



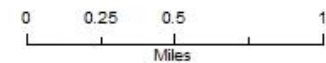
# Prime Hook NWR

10/25/2011  
Salinity Transect



## Salinity Levels (PSU)

- ◆ 0.0 - 1.0
- ◆ 1.1 - 2.0
- ◆ 2.1 - 3.0
- ◆ 3.1 - 4.0
- ◆ 4.1 - 5.0
- ◆ 5.1 - 6.0
- ◆ 6.1 - 8.0
- ◆ 8.1 - 10.0
- ◆ 10.1 - 12.0
- ◆ 12.1 - 14.0
- ◆ 14.1 - 16.0
- ◆ 16.1 - 18.0
- ◆ 18.1 - 20.0
- ◆ 20.1 - 24.0
- ◆ 24.1 - 28.0
- ◆ 28.1 - 36.0

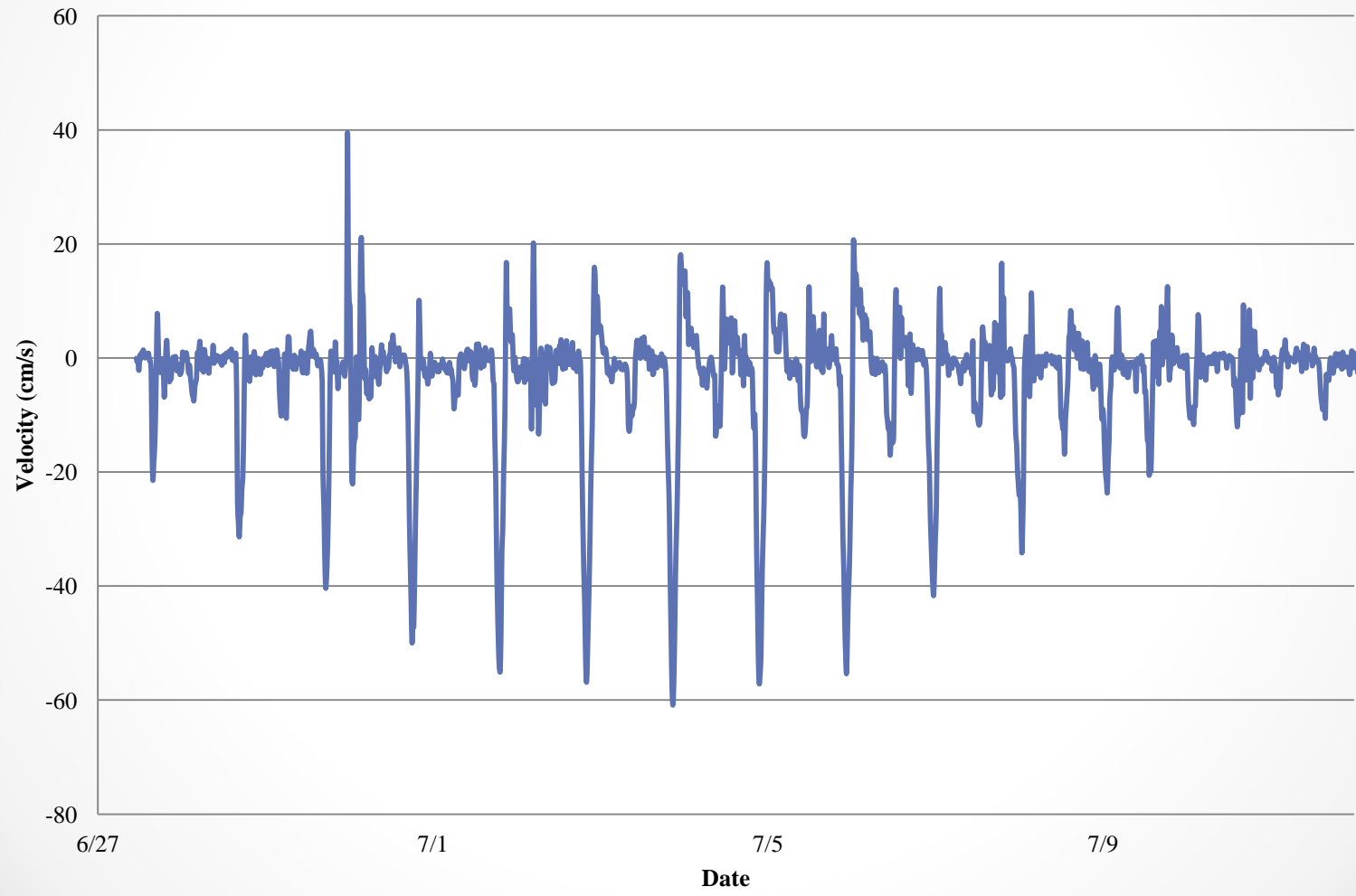




# Flow Monitoring



# Slaughter Creek at Cods Rd





July 2008



August 2010





January 2013





The End?