

Factors Governing Successful Tidal Wetland Mitigation

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Wetland Design and Restoration
ASWM Webinar
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Goals and Objectives

- **Successful Tidal Wetland Mitigation**
 - Primary production and detrital export
 - Fish, shellfish and wildlife habitat
 - Water quality enhancement
 - Shoreline erosion protection
 - Flood buffering

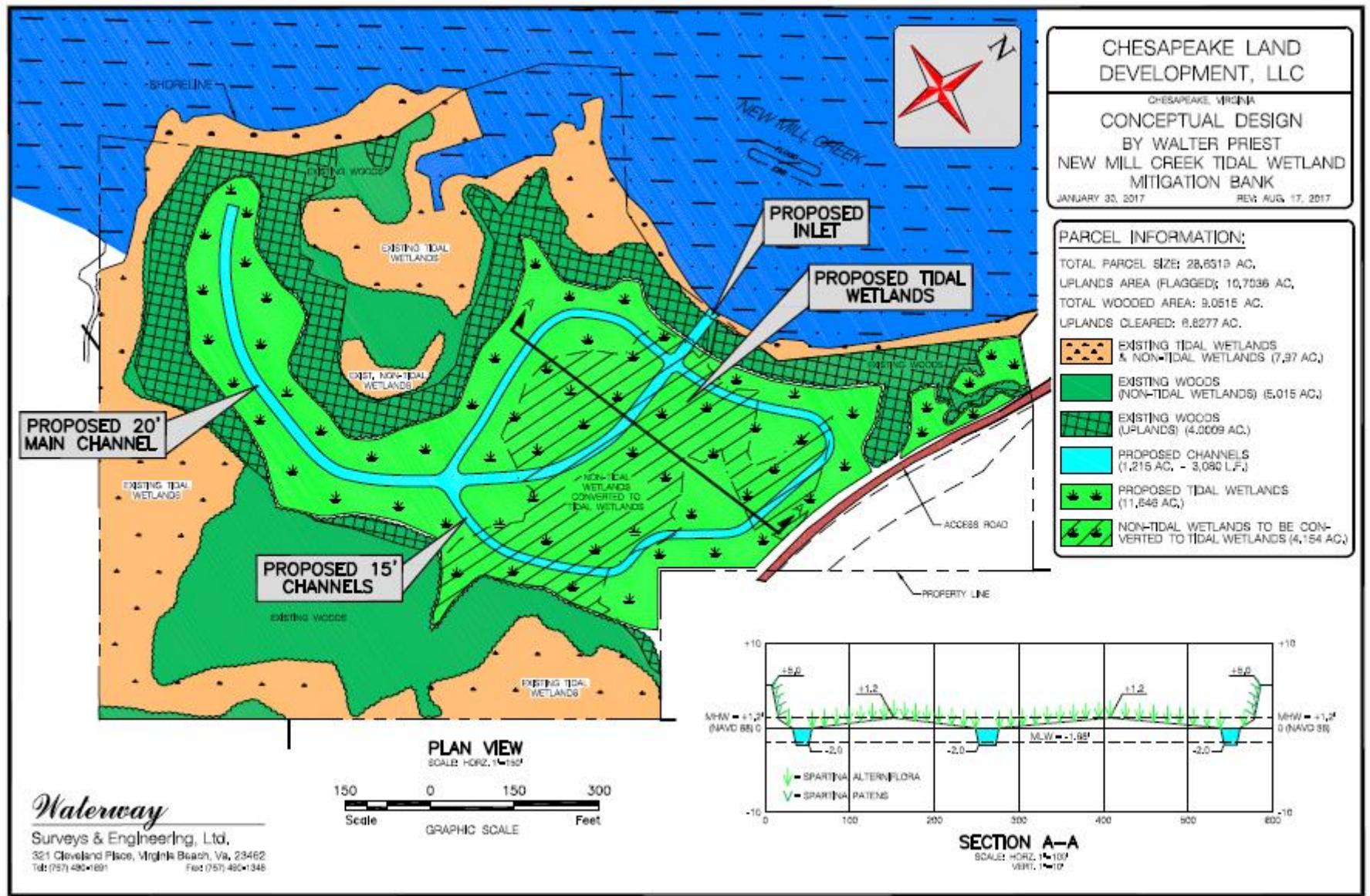
Site Selection

- **No contamination**
- **Diminished ecological value**
- **Access to tidal hydrology**
 - No plumbing
- **Landscape position**
 - Targets of opportunity
 - Connection to watershed
 - Adjacent habitats – forest or wetlands
 - Wildlife corridors
- **Is the proposal realistic for the site?**

Mitigation Design

- **Tidal Hydrology**
 - Tide range
 - Salinity
 - Channel size and configuration
 - Drainage
 - Perimeter ditches

New Mill Creek Tidal Wetland Mitigation Bank



Mitigation Design

- **Elevation – The Critical Element**
 - Topographic survey
 - Datum
 - NAVD88 – Geodetic datum
 - NOAA Mean low water
 - Tidal epoch
 - Side slopes
 - Transition areas
 - Biological bench marks
 - Habitat complexity - microtopography

Tidal Datums

- Tidal datum information available at:
- <https://tidesandcurrents.noaa.gov/stations.html?type=Bench+Mark+Data+Sheets>

Station ID: 8638610 PUBLICATION DATE: 08/07/2013
Name: SEWELLS POINT, HAMPTON ROADS
VA
NOAA Chart: 12245 Latitude: 36° 56.8' N (36.94667)
USGS Quad: NORFOLK NORTH Longitude: 76° 19.8' W (-76.33000)

T I D A L D A T U M S

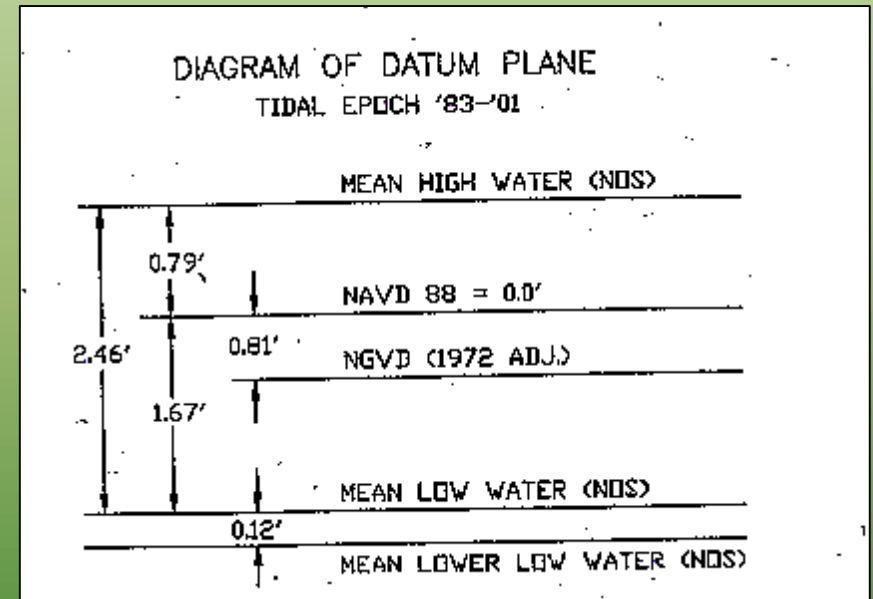
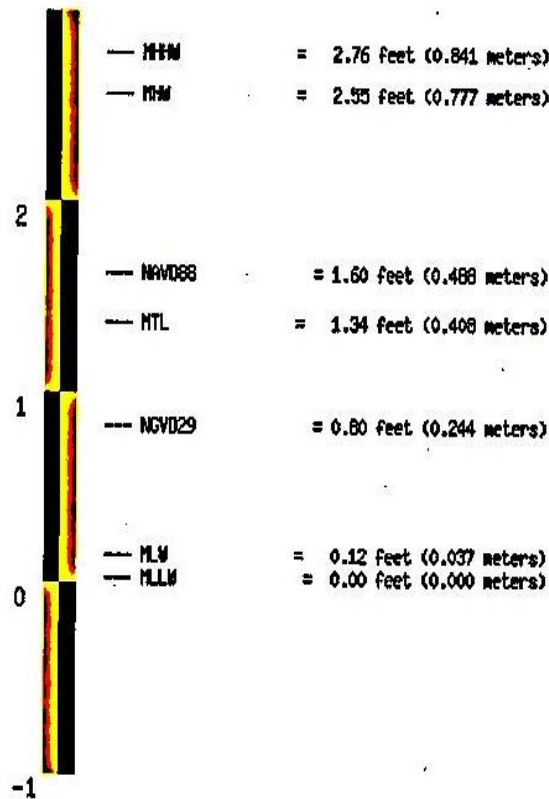
Tidal datums at SEWELLS POINT, HAMPTON ROADS based on:

LENGTH OF SERIES: 19 YEARS
TIME PERIOD: January 1983 - December 2001
TIDAL EPOCH: 1983-2001
CONTROL TIDE STATION:

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in METERS:

HIGHEST OBSERVED WATER LEVEL (08/23/1933)	=	2.444
MEAN HIGHER HIGH WATER	<u>MHHW</u>	= 0.840
MEAN HIGH WATER	<u>MHW</u>	= 0.778
North American Vertical Datum	<u>NAVD88</u>	= 0.491
MEAN SEA LEVEL	<u>MSL</u>	= 0.412
MEAN TIDE LEVEL	<u>MTL</u>	= 0.408
MEAN LOW WATER	<u>MLW</u>	= 0.038
MEAN LOWER LOW WATER	<u>MLLW</u>	= 0.000
LOWEST OBSERVED WATER LEVEL (01/31/1966)	=	-1.092

Tidal Datum Conversion



The NAVD 88 and the NGVD 29 elevations related to MLLW were computed from Bench Mark, TIDAL 6 STA 97, at the station.

Displayed tidal datums are Mean Higher High Water (MHHW), Mean High Water (MHW), Mean Tide Level (MTL), Mean Low Water (MLW), and Mean Lower Low Water (MLLW) referenced on 1983-2001 Epoch

Tidal Epoch



Libertyville Tidal Wetland Bank - 2018

Legend

Route



Google Earth

© 2018 Google

500 ft



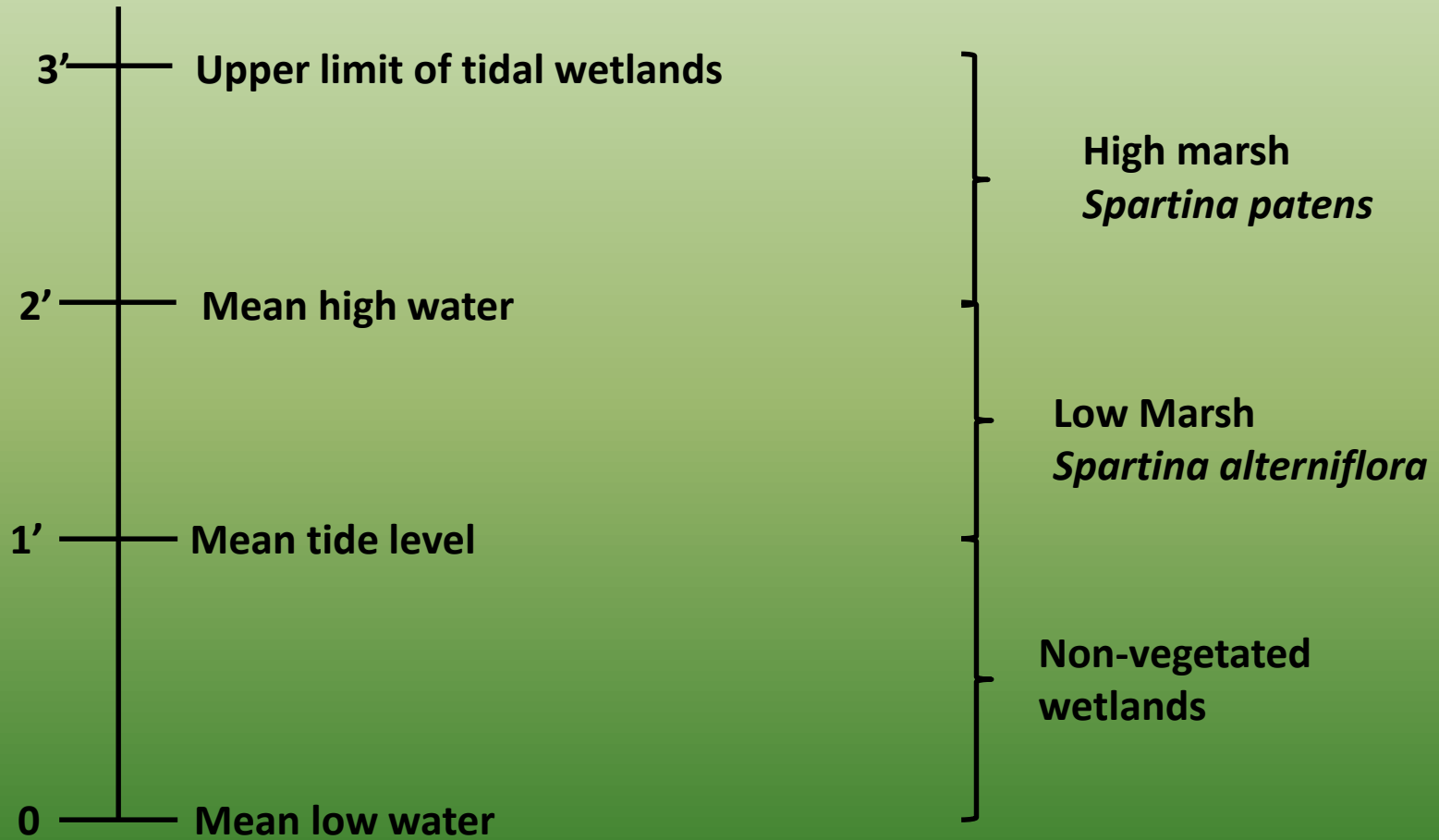
Biological Bench Mark

BIOLOGICAL BENCH MARK FORM								
Site:	Libertyville Wetland Bank							
Date:	17-Aug-05							
Investigator:	W. I. Priest							
Datum:	NAVD 88							
	Lower Limit Spartina alterniflora	Upper Limit Spartina alterniflora	Lower Limit Phragmites australis	Upper Limit Phragmites australis	Juncus roemarianus	Saltbush	Misc. Species	Note
	1.12	2.45	2.45		2.73	3.8	0.65	Creek bottom
	0.93	2.8	2.17		2.48	3.86	1.36	Ditch bottom
	0.8	2.77	2.1		2.83	3.61	2.58	Panne
	0.91	2.65	2.65		3.03	3.59	3.3	Existing Grade
	0.82	2.81	2.82	3.43	2.93	3.46		
	1.24	3.04	2.83		2.9		2.81	S.r.
		2.93	2.97		2.7		2.86	S.cyno.
		2.89	3.03				3.04	D.s.
			2.9				3.22	D.s.
Mean	0.97	2.79	2.66		2.80	3.66		
Max	1.24	3.04	3.03		3.03	3.86		
Min	0.80	2.45	2.10		2.48	3.46		
N	6	8	9		7	5		
Ave Dev	0.14	0.13	0.28		0.14	0.13		
Std Dev	0.17	0.18	0.34		0.18	0.16		

Mitigation Design

- **Plants – Reflection of Hydrology**
 - Planting zones
 - Species
 - Habitat complexity
- **Invasive Species – *Phragmites australis***
 - Spray and remove during construction
 - Mean high water limit
 - Perimeter ditches

Wetlands Zonation- Virginia Model



Plant Selection

<u>Species</u>	<u>Inundation Zone</u>	<u>Salinity Range</u>
<i>Spartina alterniflora</i>	MTL – MHW	5 – 30 ppt
<i>Spartina patens</i>	MHW – ULW	5 – 30 ppt
<i>Spartina cynosuroides</i>	MHW – ULW	0 – 5 ppt
<i>Distichlis spicata</i>	MHW – ULW	10 – 30 ppt
<i>Scirpus pungens</i>	MHW – ULW	0 – 15 ppt
<i>Juncus roemarianus</i>	above MHW	10 – 25 ppt
<i>Iva frutescens</i>	near ULW	5 – 30 ppt
<i>Baccharis halimifolia</i>	near ULW	0 – 30 ppt
<i>Panicum virgatum</i>	above ULW	0 – 25 ppt

Soils

- **Composition at planting elevations**
 - **Over excavation and backfill?**
- **Sand is best for planting and growth**
- **Avoid heavy clay and peat**
- **Organic matter will increase over time**
- **Fine-grained sediment deposition**
- **Benthic algal mats**

Soil at depth



Success Criteria

- **As-built survey**
- **Tidal inundation**
 - Tide staff
- **Plant survival**
 - First year
- **Plant cover – 70%**
- **Soil development**

Monitoring

- **Vegetation**
 - Early fall – peak production
 - Random m² quadrats
 - Percent cover by species
 - Percent no cover
 - Quadrat elevation
 - Algal mat
 - Volunteer species
 - Invasive species occurrence
 - Reference area data

Monitoring

- **Soils**
 - Algal mats
 - Sediment accumulation
- **Animals**
 - Macrobenthic invertebrates
 - Wildlife
- **Photographic stations**
 - Perimeter locations that indicate representative views of site development
- **Physiography**
 - Signs of excessive erosion or deposition
 - Tide staff elevations as necessary

Channel Monitoring

- **Fishes – Qualitative Evaluation**
 - Block net at high tide in the Fall
 - Count and measure each species
 - Trophic groups
 - Forage fishes
 - Juvenile nursery species
 - Piscivorous
 - Diversity
 - 1 – 3 species: Fair
 - 4 – 7 species: Good
 - 8 - >10 species: Excellent



Table 6. Libertyville fish utilization block net data.

25-Sep-07							
				<u>Length (mm)</u>			
<u>Common Name</u>			<u>Scientific Name</u>	<u>Number</u>	<u>Mean</u>	<u>Max</u>	<u>Min</u>
Mummichog			<i>Fundulus heteroclitus</i>	3005	61	89	23
Striped killifish			<i>Fundulus majalis</i>	202	84	118	49
Sheepshead minnow			<i>Cyprinodon variegatus</i>	167	51	60	40
Blue crab			<i>Callinectes sapidus</i>	27	62	140	36
Spot			<i>Leiostomus xanthurus</i>	15	147	178	125
Atlantic silverside			<i>Menidia menidia</i>	4	75	78	68
White perch			<i>Morone americana</i>	4	99	115	83

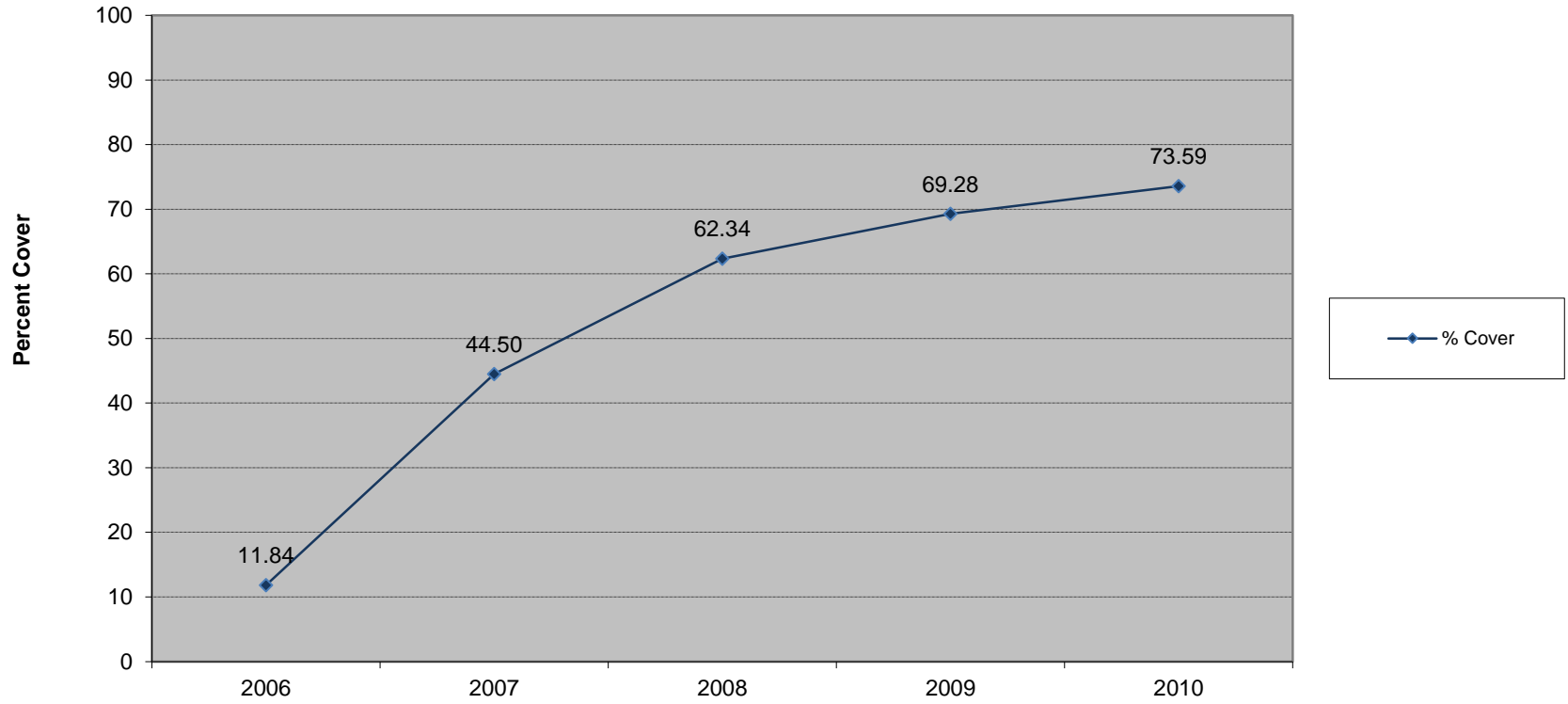
Monitoring Report

- **Project description**
- **Sampling design – quadrat locations**
- **Presentation of data**
- **Analysis**
 - **Trajectory**
 - **Problem areas**
 - **Plant survival**
 - **Inundation or drainage issues**
 - **Invasive species**
- **Recommendations**
 - **Remedial planting**
 - **Correct elevation issues**
 - **Invasive species control**

Table 1. Libertyville Wetland Mitigation Bank Vegetation Survey Data

Sampling Date	24-Sep-10								
	% Cover								
Quadrat#	No Cover	<i>Spartina alterniflora</i>	<i>Spartina patens</i>	<i>Distichlis spicata</i>	<i>Salicornia europaea</i>	<i>Aster sp.</i>	<i>Juncus</i>	<i>Atriplex patula</i>	Total cover
1	15	85							85
2	20	80							80
3	35	65							65
4	15	85							85
5	24	75				1			76
6	24	75				1			76
7	20	30		45			5		80
8	29	70			1				71
9	34	20		30		1	15		66
10	22	75				3			78
11	30	60				10			70
12	60	40							40
13	25	75							75
14	20	80							80
15	25	75							75
16	20	80							80
17	30	68		10	2				80
18	20	80							80
19	20	80							80
20	15	85							85
21	20	80							80
22	15	85							85
23	30	70							70
24	30	68					2		70
25	35	65							65
26	35	65							65
27	30	70							70
28	35	65							65
29	55	45							45
30	30	45						25	70
31	25	75							75
32	30	70							70
33	30	70							70
34	5	20	75						95
Mean	26.71	66.94	75.00	28.33	1.50	3.20	7.33	25.00	73.59
N	34.00	34.00	1.00	3.00	2.00	5.00	3.00	1.00	34.00
Max	60.00	85.00	75.00	45.00	2.00	10.00	15.00	25.00	95.00
Min	5.00	20.00	75.00	10.00	1.00	1.00	2.00	25.00	40.00
Ave. Dev.	7.69	12.73	0.00	12.22	0.50	2.72	5.11	0.00	7.75

Libertyville % Cover - 2010





Questions?

Photo credit: John Evans , Norfolk Corps

7/21/2002