Libertyville Wetland Mitigation Bank

Third Annual Monitoring Report

2008

Prepared for:

Chesapeake Land Development LLC

By

Walter I. Priest, III
Wetland Design
P. O. Box 69
Bena, VA 23018

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2008 Monitoring Report
Libertyville Tidal Wetland Bank

Introduction

This report constitutes the third year monitoring report for the Chesapeake Land Development Tidal Wetland Mitigation Bank LLC (Bank). It is intended to document the progress of the project and validate the credits authorized. The Bank was designed to be a tidal wetland bank to offset unavoidable wetland losses where on-site compensation was not possible or practical.

Construction Summary

The site is located on Libertyville Road in Chesapeake, VA adjacent to Mains Creek, a tributary of the Southern Branch of the Elizabeth River (Fig. 1). The closest tide station to the site is Money Point where the tide range is 2.8' (Fig. 2).

The site was cleared, graded and regraded to intertidal elevations at or below mean high water (MHW), approximately +1.2' NAVD 88. This effectively established tidal hydrology at the site. It was planted in the spring of 2006 with over 20,000 plants primarily *Spartina alterniflora* in the main portion of the marsh with *Spartina patens*, *Iva frutescens*, *Baccharis halimifolia*, and *Morella cerifera* around the perimeter in the areas above mean high water. The herbaceous plants were planted on 3' centers.

Details of the construction process can be found in the first year's Monitoring Report.

The as-built survey indicated there was a total of 262,388 SF or 6.0236 acres of wetlands on the site (Fig. 3).

Additional plantings of *Spartina patens*, switch grass, saltbushes, wax myrtle and pine trees have also occurred around the perimeter subsequent to the final excavation. This was done to help ensure the effective establishment of the high marsh communities and buffer areas around the Bank. The developer has also embarked on a diligent *Phragmites* control program with routine spraying. Supplemental plantings of saltgrass, *Distichlis spicata* and black needlerush, *Juncus roemerianus*, were made during the Spring of 2008 in a few areas where plant survival and growth have been less than optimal.

Monitoring Requirements

A careful review of the Libertyville Mitigation Banking Instrument indicated two separate sets of criteria that needed to be satisfied. The first is the success criteria and the second is the formal monitoring requirements.

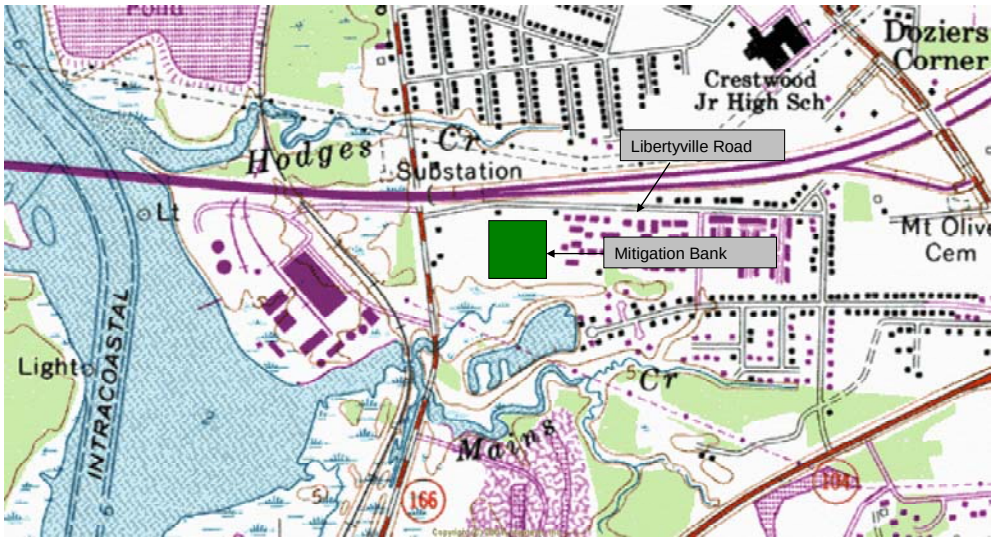
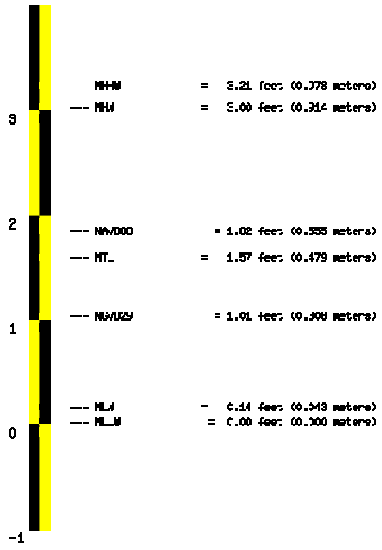


Figure 1. Location of Libertyville Tidal Wetland Mitigation Bank.



The NAVD 88 and the NGVD 29 elevations related to MLLW were computed from Bench Mark, DRAW RM 1, 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

Fig. 2 Tidal Datum Conversion for Money Point

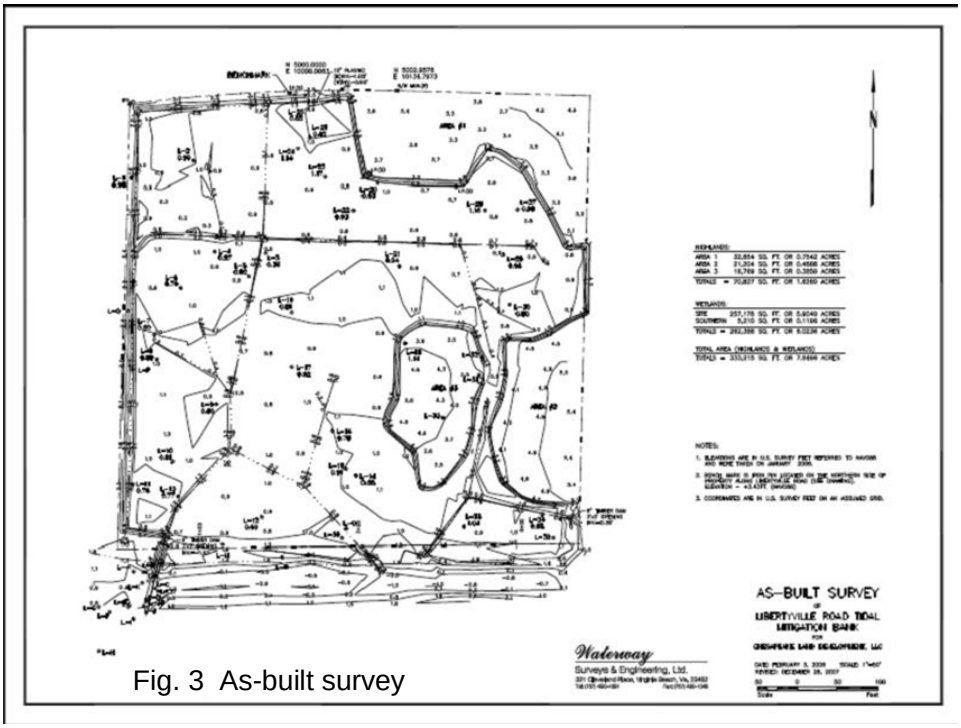


Fig. 3 As-built survey

The success criteria are summarized as follows:

1. Presence of wetland hydrology indicators such as tidal inundation and salinity.
2. Presence of soils under hydric condition.
3. Presence of more than 50% hydrophytic vegetation.
4. First year survival of 80% of the planted vegetation.
5. After five years:
    a. 70% vegetation cover
    b. Minimum of 35% cover of *Spartina alterniflora*
    c. Maximum of 5% cover of *Phragmites australis.*

Monitoring requirements:

1. Establishment of a reference site of similar soils, hydrology and vegetation.
2. Vegetation survey
3. Wildlife survey
4. Hydrologic monitoring
5. Photographic monitoring.

The Monitoring Report requirements are summarized as follows:

1. Bank location on USGS topographic map.
2. Detailed narrative summarizing condition of Bank and maintenance activities.
3. Topographic survey showing transect and quadrat locations and permanent photographic points.

4. Photographs of the site.
5. Results of hydrologic survey, hydroperiod, extent of inundation and depth.

6. Results of vegetation survey:
    a. Percent cover
    b. Species diversity
    c. Percent exotic vegetation
    d. Percent facultative and upland species
    e. Survival rate of planted vegetation
    f. Natural vegetation recruitment
    g. Plant vigor as measured by evidence of reproduction.
7. Results of wildlife observations.

Methodology

The following methodologies and sampling regimes were developed in an effort to satisfy the success criteria and monitoring requirements outlined above.

Photo points were established at the northwest, southwest, northeast and southeast corners of the site. Three wide angle photos were taken at each point to provide a panorama of the site (See Appendix). Photographs were taken on 22 October 2008.

Cover estimates were based on meter square quadrats randomly selected along transects across the site. Three transects were established at 100', 300' and 500' parallel to the western property line. Quadrats along these transects were selected using a table of random numbers from 1-100 to dictate the distance along the transect and the distance to left or right (Fig. 4). This resulted in 29 quadrats being sampled for percent cover, percent no cover, flowering stems, plant height and substrate condition.

Percent cover is defined as the percentage of the area of a meter square rectangular quadrat that is shaded or covered by each species present. The percent no cover was treated as a separate species, i.e. total percent cover plus the percent no cover equals 100%.

Individual planting units were no longer readily discernable due to the considerable growth and lateral expansion that have occurred. According to the first year's Monitoring Report, plant survival exceeded the required 80% survival success criterion. Consequently, additional data on plant survival per se were not collected.

The number of flowering stems and height of the tallest plant occurring in each quadrat were recorded as a measures of plant vigor.

All additional wetland plant species encountered during the survey were also recorded as was animal usage identified by observation, tracks, scat and other sign.

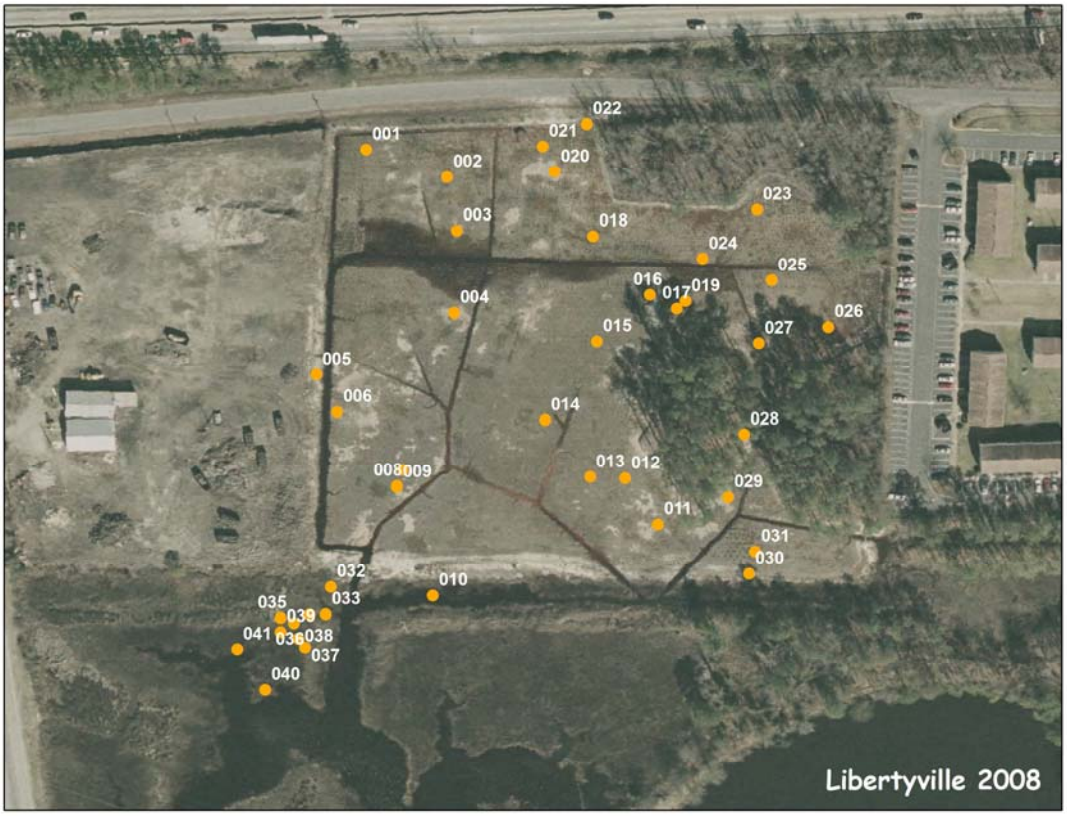


Fig. 4 Quadrat locations

Ten quadrats in the adjacent reference natural marsh were selected by random tosses of meter square frame. Percent cover for each species present as well as percent no cover were recorded for each reference quadrat.

GPS points and spot elevations were collected for each of the quadrats sampled and are presented in Figure 4.

Fish utilization was determined by deploying a block net across the outlet in the southwestern corner of the site during an ebb tide. Species caught were counted and a representative sample for each species was measured for total length.

Results

Spartina alterniflora was by far the dominant species in the quadrats sampled making up 58.21% of the cover at the site (Table 1). It was present in all of the quadrats but one that was on the perimeter berm. *Spartina patens* was limited to two quadrats on the perimeter. The next most frequent occurrence, four quadrats, was *Salicornia europea*, that has colonized the site from seed. The supplemental plantings of *Distichlis spicata* and *Juncus roemerianus* appeared in one quadrat each (Table 1). *Phragmites australis* was present in one quadrat, but it had been sprayed with herbicide and was not vigorous.

The increasing trend in percent cover at the site over the last three years is given in Figure 5. It has increased from 11.84% in 2006 to 62.34% in 2008.

This year the number of flowering shoots, a measure of plant vitality, of *Spartina alterniflora* increased to 14.97/m^2 an order of magnitude increase over the initial value of 3.76 in 2006 (Fig. 6)

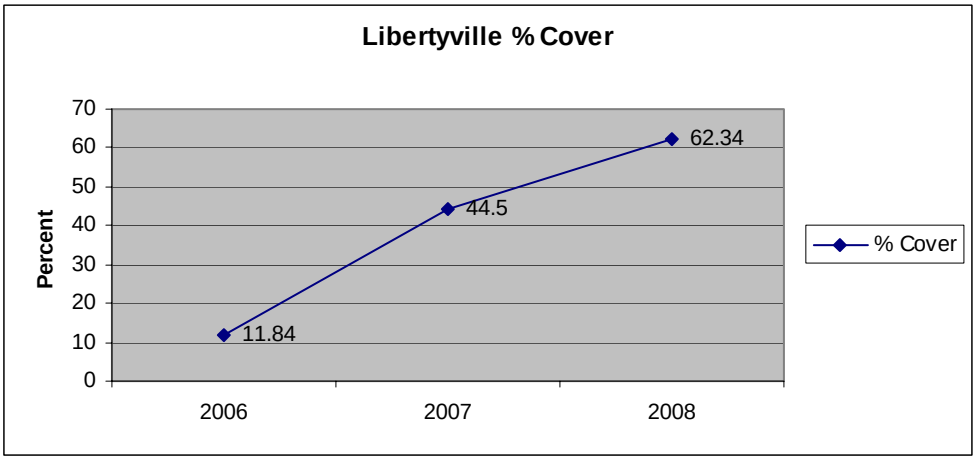


Figure 5. Mean percent vegetative cover 2006-2008

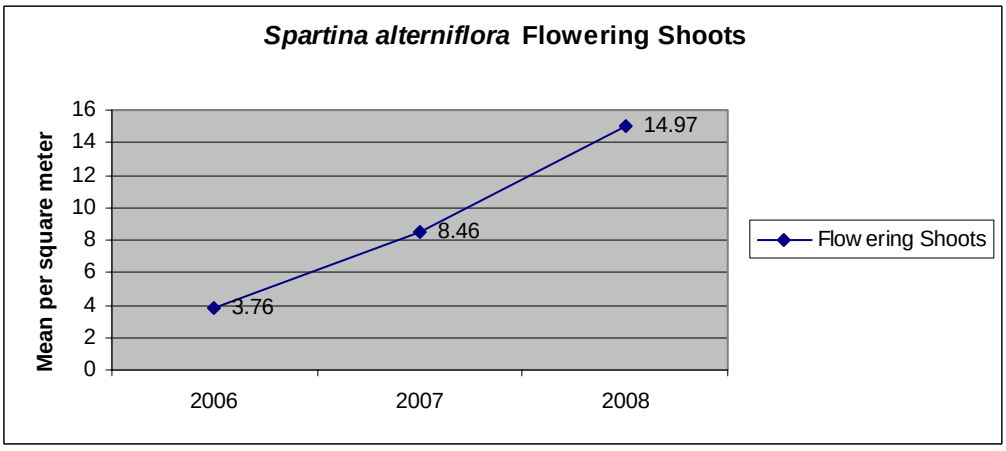


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Figure 6. Mean number of *Spartina alterniflora* flowering shoots per m^2.

Another measure of plant vigor, plant height, was measured in 2007 and 2008. The average height of the tallest plant in each quadrat increased almost a foot from 3.02 ft last year to 3.93 ft in 2008.

The elevations of all of the quadrats were below the 1.2' NAVD 88 mean high water except two. One was on the perimeter berm and one in the interior of the marsh (Table 2). Qualitative observations of the substrate indicated it was typically saturated mud or sand often covered with an algal mat.

Table 1. Libertyville Wetland Mitigation Bank vegetation survey data
Sampling Dates 22-Oct-08

	% Cover									
Quadrat#	No Cover	*Spartina alterniflora*	*Spartina patens*	*Juncus roemerianus*	*Atriplex patula*	*Salicornia europea*	*Distichlis spicata*	*Phragmites australis*	*Iva frutescens*	**Total cover**
1	40	44		15		1				60
2	25	75								75
3	15	85								85
4	15	85								85
5	20	10	70							80
6	80	10				10				20
7	85	15								15
8	95	4					1			5
9	35	63				2				65
10	85	0	15							15
11	5	95								95
12	20	80								80
13	25	75								75
14	25	75								75
15	25	75								75
16	45	55								55
17	15	85								85
18	50	50								50
19	25	75								75
20	50	47			1	1			1	50
21	15	85								85
22	15	85								85
23	43	55						2		57
24	60	40								40
25	35	65								65
26	30	70								70
27	50	50								50
28	30	70								70
29	35	65			1					66
Mean	37.69	58.21	42.50	15.00	1.00	3.50	1.00	2.00	1.00	**62.34**
N	29.00	29.00	2.00	1.00	2.00	4.00	1.00	1.00	1.00	**29.00**
Max	95.00	95.00	70.00	15.00	1.00	10.00	1.00	2.00	1.00	**95.00**
Min	5.00	0.00	15.00	15.00	1.00	1.00	1.00	2.00	1.00	**5.00**
Ave. Dev.	18.51	21.96	27.50	0.00	0.00	3.25	0.00	0.00	0.00	**18.54**

Table 2. Libertyville quadrat characteristics - 2008

Quadrat #	Total cover	Elevation NAVD 88	Flowering shoots	Tallest Plant (ft)	Comments
1	60	0.98	2	2.8	
2	75	0.69	21	3.8	
3	85	0.44	24	4.7	
4	85	0.76	3	3.1	
5	80	0.46	15	3.4	
6	20	0.74	9	2.1	
7	15	0.62	0	1.4	high & bare
8	5	0.64	0	1	raccoon tracks
9	65	0.43	19	4.1	
10	15	1.45	0	n/a	All *S.patens* on berm
11	95	0.52	27	5.6	
12	80	0.54	7	4.2	
13	75	0.55	20	2.9	
14	75	0.52	44	5.4	small creek
15	75	0.67	7	4.7	
16	55	0.68	3	3.3	
17	85	0.62	32	3	
18	50	0.75	29	3.9	
19	75	0.71	27	2.9	
20	50	1.51	12	5.2	
21	85	0.48	4	4.3	
22	85	0.5	19	3.9	
23	57	0.64	10	2.1	
24	40	0.39	18	7.1	shade
25	65	0.21	49	6.6	shade
26	70	n/a	18	7.8	
27	50	n/a	6	3.5	
28	70	0.43	0	3.7	
29	66	1.06	9	3.4	
Mean	**62.34**	**0.67**	**14.97**	**3.93**	
N	**29.00**	**27.00**	**29.00**	**28.00**	
Max	**95.00**	**1.51**	**49.00**	**7.80**	
Min	**5.00**	**0.21**	**0.00**	**1.00**	
Ave. Dev.	**18.54**	**0.20**	**10.52**	**1.18**	

The percent cover at the reference site averaged 58.5% down from 79.9% in 2007. The primary species was *Spartina alterniflora* with small percentages of *Distichlis spicata* and *Aster tenuifolius* (Table 3). There is no apparent reason for this decline in cover. The same general area has been randomly sampled each year of the monitoring. Elevations of the sample quadrats were determined this year and are somewhat lower the mitigation bank (Table 3).

Additional plant species that have been observed within the bank are given in Table 4. The presence of most of these species is the result of natural recruitment.

Table 3. Reference area cover data for Libertyville Mitigation Bank.
Sampled 22 October 2008.

Quadrat	No Cover	*Spartina alterniflora*	*Distichlis spicata*	*Aster tenuifolius*	Total cover	Elavation
A	60	40			40	0.35
B	40	58		2	60	1.05
C	50	50			50	0.05
D	55	45			45	-0.12
E	45	55			55	-0.11
F	45	55			55	-0.5
G	10	20	70		90	0.92
H	60	40			40	-0.28
I	15	85			85	-0.68
J	35	65			65	-0.28
Mean	**41.50**	**51.30**	**70.00**	**2.00**	**58.50**	**0.04**
N	**10.00**	**10.00**	**1.00**	**1.00**	**10.00**	**10.00**
Max	**60.00**	**85.00**	**70.00**	**2.00**	**90.00**	**1.05**
Min	**10.00**	**20.00**	**70.00**	**2.00**	**40.00**	**-0.68**
Ave. Dev.	**13.20**	**12.30**	**0.00**	**0.00**	**13.20**	**0.44**

Table 4. Wetland plants observed at Libertyville Wetland Mitigation Bank.

Scientific name	Common name	Abbreviation
Spartina alterniflora	Smooth cordgrass	Sa
Spartina patens	Saltmeadow hay	Sp
Distichlis spicata	Saltgrass	Ds
Pluchea purprescens	Saltmarsh fleabane	Pp
Aster tenuifolius	Perennial saltmarsh aster	At
Aster subulatus	Annual saltmarsh aster	As
Atriplex patula	Orach	Ap
Eleocharis parvula	Dwarf spikerush	Ep
Solidago sempervirens	Seaside goldenrod	Ss
Panicum virgatum	Switchgrass	Pv
Ruppia maritima	Widgeongrass	Rm
Cyperus sp.	Nut sedge	Cy
Iva frutescens	Marsh elder	If
Baccharis halimifolia	Groundsel tree	Bh
Morella cerifera	Wax myrtle	Mc
Salicornia europea	Glasswort	Se

Fish captured in the block net exiting the marsh on the ebb tide are listed in Table 5. The majority of the fish are marsh resident killifishes. Also captured were juvenile spot and blue crabs using the marsh as a forage and refuge area. Piscivorous white perch and American eel were also using the marsh.

A cumulative list of wildlife observed at the site is provided in Table 6.

Table 5. Fish utilization of the Libertyville Mitigation Bank.

Site description Libertyville **Gear type-**Block net
Date 16-Oct-08
Temperature 26°C
Salinity 14 ppt
Time 1130 hi slack

			Length (mm)		
Common Name	**Scientific Name**	**Number**	**Mean**	**Max**	**Min**
Mummichog	*Fundulus heteroclitus*	282	67.37	88	48
Striped killifish	*Fundulus majalis*	126	81.17	113	51
Sheepshead minnow	*Cyprinodon variegatus*	56	49.2	60	38
Blue crab	*Callinectes sapidus*	27	59.74	150	27
Atlantic silverside	*Menidia menidia*	8	74.88	79	69
Spot	*Leiostomus xanthurus*	5	126.2	147	109
White perch	*Morone americana*	1	124	124	124
American eel	*Anguilla rostrata*	1	610	610	610

Table 6. Wildlife observed at Libertyville Wetland Mitigation Bank

Scientific name	Common name
Ardea alba	Great egret
Ceryle alcyon	Kingfisher
Branta canadensis	Canada goose
Charadrius vociferus	Killdeer
Actitis macularia	Spotted sandpiper
Nyctanassa violacea	Yellow-crowned night-heron
Procyon lotor	Raccoon
Ondatra zibethica	Muskrat
Urocyon cinereoargenteus	Gray fox
Didelphis marsupialis	Opossum

Discussion

Tidal hydrology continues to be well maintained with no problems with tidal flooding or drainage. Minor shifts in creek channel morphology continue to occur as the system works to achieve equilibrium.

The mean high water elevation of 1.2' NAVD 88 effectively dictates the hydroperiod criterion for the marsh. Most of the bank is below this elevation, but there are a few isolated higher areas as indicated by some of the quadrat elevations. This situation has resulted in a few areas where the *Spartina alterniflora* has been slow to spread. The 2007 Monitoring Report recommended supplemental plantings with *Distichlis spicata* and *Juncus roemerianus*. These are typical high marsh species that might be better adapted to the higher elevations. Supplemental plantings of several hundred plugs of each species were made in selected areas in the Spring of 2008. These plantings were only minor constituents of the cover estimates, but observations in the marsh as a whole indicated good rhizome growth in the *Distichlis spicata* plantings (See Photo Appendix). *Juncus roemerianus* plantings appeared to survive well but showed little lateral growth. Additional plantings are planned for the Spring of 2009. It is anticipated that these species will be an increasing component of the vegetative cover.

All of the 2008 vegetation parameters showed substantially increased values compared to 2007. Total cover increased by almost 50% of the 2007 cover estimate from 44.5% to 62.3%. The number of *Spartina alterniflora* flowering shoots has increased by an order of magnitude from 8.2 to 15/m^2. The height of the tallest plant in each quadrat increased by almost a foot. The increase in each of these elements is indicative of a maturing plant community within the bank.

Fish utilization monitoring provides a good functional component that indicates the marsh is providing habitat for resident marsh killifishes, a nursery area for commercially important species, spot and blue crabs and a foraging area for predatory fish like white perch and eels.

Problem areas were very limited. The supplemental plantings appear to be addressing plant colonization issues in the isolated high areas within the marsh. The *Phragmites* control program also appears to be having its desired effect. No herbivory problems were noted. The bank owner has indicated there is on deposit maintenance fees in the amount of $7,566.45 set aside from credit purchases to address any future problems.

Conclusion

The 2008 monitoring of the Libertyville Wetland Bank indicates that the wetland is a healthy, productive system that is maturing on a trajectory that should meet its success criteria well within the allotted time frame.