

Wilson Bay Wetland Restoration  
Phase I  
Jacksonville, Onslow County, North Carolina

2003 Annual Monitoring Report



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**NC STATE UNIVERSITY**

**Wilson Bay Wetland Restoration Site – Phase I  
Fall 2003 Monitoring Summary**

A wetland restoration project was funded through the North Carolina Wetlands Restoration Program (NCWRP). The goals of the project are to:

- 1) Reduce nutrient and stormwater inputs to estuarine waters.
- 2) Stabilize shoreline through restoration of native vegetation.
- 3) Improve natural aesthetics of estuarine marsh.
- 4) Enhance wildlife habitat.
- 5) Educate visitors about the importance of coastal wetlands.

This is the 2nd year of the 5-year monitoring plan for the completed Wilson Bay Site.

**Table 1. Background Information**

<b>Project Name</b>	<b>Wilson Bay Wetland Restoration, Phase I</b>
<b>Designer's Name</b>	BLUE: Land, Water, Infrastructure, PA 1271 Old Highway #1 South Southern Pines, NC
<b>Contractor's Name</b>	Eastern Excavating, Inc. Jacksonville, NC
<b>Directions to Project Site</b>	Traveling east on Highway into Jacksonville, exist right to cross the old bridge into downtown. Turn right just past the courthouse. Drive south approximately one mile and turn left into the site at the old wastewater treatment plant.
<b>Drainage Area</b>	Not applicable
<b>USGS Hydro Unit</b>	03030001
<b>NCDWQ Subbasin</b>	03-05-02
<b>Project Size</b>	3 acres brackish marsh and transitional freshwater wetland restoration
<b>Restoration Approach</b>	Remove trash and debris. Mass earthwork, grading of wetland areas Creation of a tidal creek.
<b>Date of Completion</b>	Spring 2001
<b>Monitoring Dates</b>	November 2001, November 2003

**Results Summary**

The site was found to be stable, ecologic communities developing, and vegetation healthy. Survivability and coverage is exceeding the success criteria for the site. The density and development of the marsh areas is substantial. Survivability and coverage of plants in the bay forest was meeting requirements. Further development of communities at the site is expected and it appears that the goals of the site will be met without further work. Recommendations for the site include:

- 1) Continued monitoring of invasive and undesirable vegetation.
- 2) Potential addition of more tree species.
- 3) Possible maintenance of invasive vegetation if competition appears to limit site development.

**Table 2. Monitoring Results Summary Table**

<b>Wilson Bay Wetland Restoration - Phase I</b>							
Jacksonville, Onslow County, NC							
Fall 2003 Monitoring Data							
10/1/2003							
<b>Bay Forest Quad 1</b>							
<b>Tree Stratum</b>							
<b>Species</b>	<b>Height (cm)</b>	<b>Diameter (mm)</b>	<b>Σ X-sec. (cm<sup>2</sup>)</b>	<b>Rel. x-sec (%)</b>	<b>Density</b>	<b>Rel. Density (%)</b>	<b>Rank (Importance)</b>
<i>Pinus serotina</i>	252	45			3		1
<i>Pinus serotina</i>	151	15					
<i>Pinus serotina</i>	129	30					
<b>Shrub Stratum</b>							
<b>Species</b>	<b>Cover (%)</b>	<b>Rel. cover (%)</b>	<b>Density</b>	<b>Rel. Density (%)</b>	<b>Rank (Importance)</b>		
<i>Magnolia virginiana</i>	0.5	33.3	1	16.7	2		
<i>Ilex coriacea</i>	1	66.7	5	83.3	1		
<b>Total</b>	<b>1.5</b>	<b>100.0</b>	<b>6</b>	<b>100.0</b>			
<b>Herb Stratum</b>							
<b>Species</b>	<b>Cover (%)</b>	<b>Rel. cover (%)</b>	<b>Rank (Importance)</b>				
<i>Ambrosia artemisiifolia</i>	0.5	0.3	5				
<i>Aster sp.</i>	20	12.8	4				
<i>Digitaria sp.</i>	70	44.9	1				
<i>Festuca sp.</i>	35	22.4	2				
<i>Ipomea sp.</i>	0.5	0.3	5				
<i>Panicum sp.</i>	30	19.2	3				
<b>Total</b>	<b>156</b>	<b>100.0</b>					
<b>Marsh Transect Data</b>							
<b>Transect 1</b>							
<b>Species</b>	<b>Plot No.</b>	<b>Count</b>	<b>Height (m)</b>	<b>Cover (%)</b>			
<i>Spartina Cynosuroides</i>	1	87	2.5	60			
	2	62	2-2.5	50			
	3	57	2-2.5	45			
<i>Spartina Patens</i>	4	na	0.75	100			
<b>Transect 2</b>							
<b>Species</b>	<b>Plot No.</b>	<b>Count</b>	<b>Height (m)</b>	<b>Cover (%)</b>			
<i>Spartina Cynosuroides</i>	1	65	2-2.5	50			
	2	55	2.5	35-40			
	3	66	2.5	40-45			
<i>Spartina Patens</i>	4	na	0.75-1	100			

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## **1.0 BACKGROUND DATA**

### **1.1 Introduction**

The Wilson Bay Wetland Restoration Project involved the restoration of brackish marsh and transitional freshwater wetlands. The site is located at the old wastewater treatment plant in Jacksonville, North Carolina. The plant is currently the site of an extensive retrofit/reuse project for the City of Jacksonville. The City plans to turn the plant into a museum, park, and educational center. Efforts at the site also include ecosystems restoration and research efforts in the surrounding watershed and in the adjacent Wilson Bay.

### **1.2 Goals and Objectives**

The primary goals of the project were to:

- 1) Reduce nutrient and stormwater inputs to estuarine waters.
- 2) Stabilize shoreline through restoration of native vegetation.
- 3) Improve natural aesthetics of estuarine marsh.
- 4) Enhance wildlife habitat.
- 5) Educate visitors about the importance of coastal wetlands.

### **1.3 Design and Construction Background**

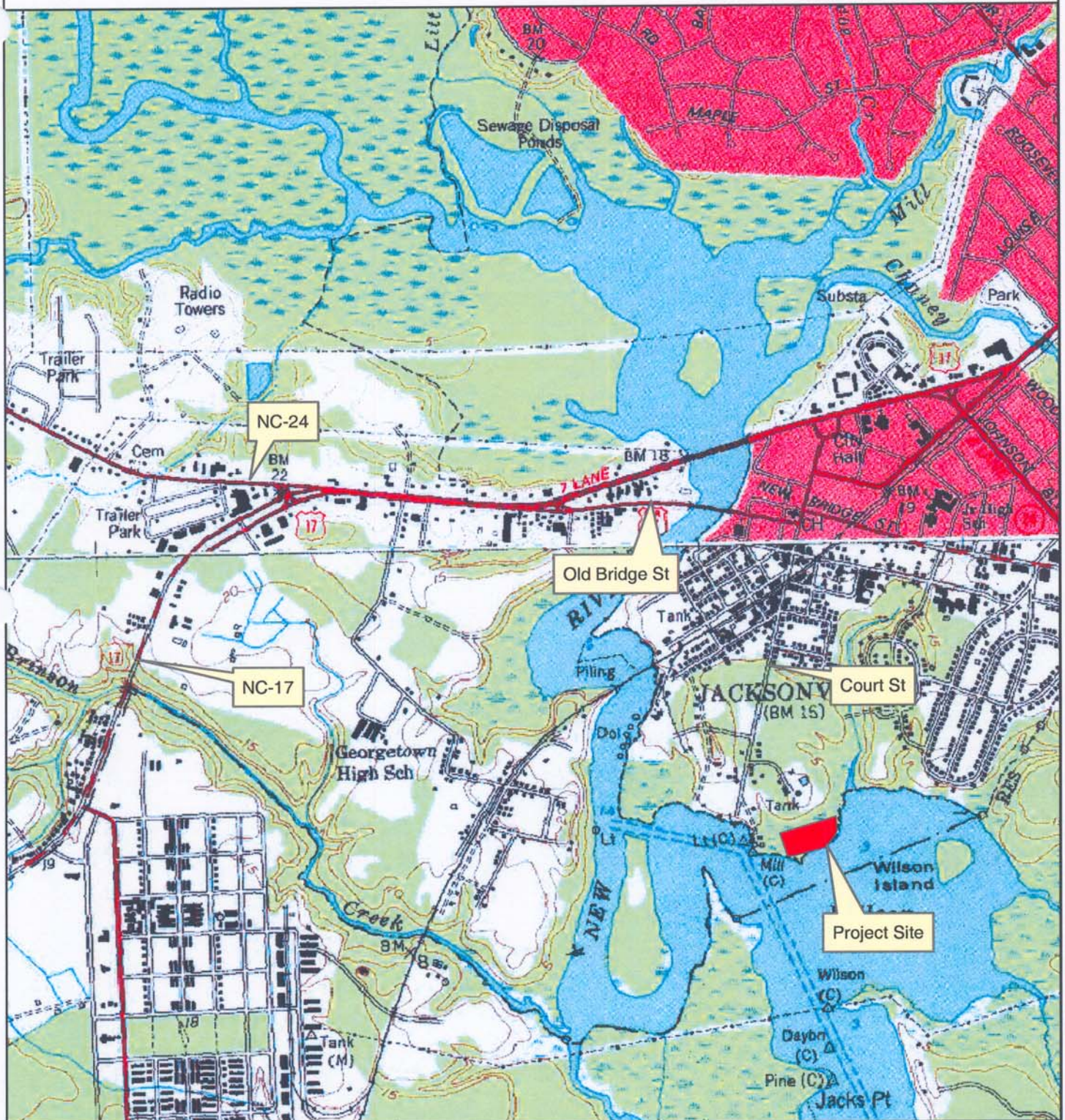
Design and construction oversight services for this project were provided by Blue: Land, Water, Infrastructure, PA (BLWI). The construction bid was won by Eastern Excavating Inc., out of Jacksonville. The planting contract was awarded to Southern Landscaping, also from Jacksonville. Construction at the site began in early 2001 and planting of the site was completed later that spring. A number of wetland community types were planted including brackish marsh, salt shrub, gum-cypress swamp, and bay forest. Brackish marsh areas were planted primarily with *Spartina cynosuroides* (Giant Cordgrass) and *Spartina patens* (Saltmeadow Cordgrass). Other communities included a variety of native plantings appropriate for design elevation and water chemistry conditions.

### **1.4 Monitoring Background**

A monitoring plan for the site including vegetative and hydrologic success criteria was prepared by BLWI. The plan submits vegetative criteria, which requires increasing percent coverage (based on plant spacing) over a 5 year period. Proposed minimums included 25% after the first year, 50% after the third year, and 75% after the fifth year. The hydrologic monitoring plan included analysis of groundwater levels and temperature to meet regulatory minimums.

The first monitoring visit was completed by Soil and Environmental Consultants, PA. The visit occurred on November 26, 2001 and monitoring focused on vegetative plots where survivability and height were measured. Plots were set up in a marsh reference area and the brackish marsh areas. A transect was set up in the bay forest. The report indicated that the site was meeting survivability requirements and stated that diversity and density at the site should continue to improve. However, the report noted several plots with low stem counts and some concern was mentioned about areas where crabgrass was growing. No other monitoring reports were provided prior to this study.

# Location Map



Wilson Bay  
Wetland Restoration  
Phase I



**NCSU Water  
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**Water Resources  
Research Institute**

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### **1.5 Current Monitoring**

NCSU staff made our initial monitoring visit on October 1, 2003. This visit occurred 2 years after the first monitoring trip for the site. Our staff planned to implement a revised monitoring procedure developed based on the document "Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects" provided by the North Carolina Wetlands Restoration Program. The new vegetation monitoring plan involves belted transects in the marsh areas and a plot in the bay forest area. The plan also involves analysis of hydrologic data recorded by a single groundwater gage in the bay forest area. Photographs and observations will also be a part of the new monitoring agenda. The full monitoring plan is explained in detail in this report.

## 2.0 MONITORING PLAN AND RESULTS

### 2.1 Vegetation Monitoring Set up

As described in the “Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects” document, belted transects were set up for recording vegetation density and survivability in the marsh areas. A total of two (2) transects were set up that run perpendicular to the shoreline from the water edge to the upper limit of the restored marsh. 1 meter x 1 meter plots were set up at various intervals along the transects. Measurements were made in three (3) plots in the *Spartina cynosuroides* areas and 1 plot in the *Spartina patens* area for each transect. A single 10 meter x 10 meter plot was set up for measuring survivability of trees in the bay forest area. Smaller nested plots were set up within this plot. A 5 meter plot was set up for recording shrubs and a 1 meter plot was set up for herbaceous measurements. Other vegetative communities at the site were found to be too small to justify additional plots. However, our staff visited each area to make observations on the health and development of those communities.

**Table 3. Vegetation Plots**

<i>Community Type</i>	<i>Total Area (acres)</i>	<i>Setup</i>	<i>Plots</i>	<i>Size (sq. meters)</i>
Brackish Marsh	1.87	Transects	6	1m
Bay Forest	0.28	Nested Plots	1	10m, 5m, 1m

Construction of Phase II of the project was underway during our monitoring visit. Due to construction activities, access to the reference marsh site was limited. No transects or plots were placed in the reference site during our visit. Reference site data from the previous monitoring report will be used for comparison purposes in this report.

### 2.2 Vegetation Monitoring Results

#### 2.2.1 Brackish Marsh

Observations in the restored marsh areas revealed a dense, healthy stand of the primary planted species. The density of *Spartina cynosuroides* made walking difficult and the average plant height was several feet above the researcher’s heads. Plot data in the *S. cynosuroides* areas resulted in a total of 392 stems in 6 plots for an average of 65 stems per plot. With an initial planting density of approximately 10,000 plants/acre (2.5 stems/plot), this indicates excellent development of the lower marsh. *Spartina cynosuroides* ranged between 6 to over 7 feet in height and covered between 35-60% of the plot surface area. Organic material buildup in most of the plots was around 0.5 inches. Old growth organic buildup, percent coverage, and general development in plots nearer the water and in the middle of the marsh was better than in plots on the upper edges.

Development in the upper marsh areas planted with *Spartina patens* was even more substantial than in the main marsh. Populations of *S. patens* were too dense to count every stem in the 1 meter plots. Plots in these areas were composed entirely of the desired species with no encroaching species found. A mat of old growth organic material between 6-8 inches thick covered the ground. New growth 2-2.5 feet in height covered 100% of the plot area.

Marsh areas throughout the site have exceeded survivability requirements as proposed in the monitoring plan for the site. Based on observations, the site is developing similarly to reference marsh area, although no reference measurements were made.



# Monitoring Map



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Phase I



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### 2.2.2 Bay Forest

A single monitoring plot was randomly located within the "Bay Forest" area. No reference area was studied; therefore no comparisons could be made to reference conditions. It should be noted that this area graded from drier, sandier conditions to wetter conditions toward the marsh.

Vegetation throughout the Bay Forest appeared healthy and consisted of a combination of both planted trees and shrubs and volunteer shrubs and herbaceous plants. The wetland appeared to be going through an early successional stage despite the numerous planted shrubs and trees. This was evidenced by an abundance of *Andropogon glomeratus* throughout the area. Additionally, *Ambrosia artemisiifolia* (ragweed), *Aster* spp., and *Panicum* spp. were abundantly present within the plot, signifying early succession. *Magnolia virginiana* (sweetbay) and *Ilex coriacea* (gallberry) were the only shrubs recorded in the plot, although *Ilex glabra* (inkberry) and *Alnus serrulata* (tag alder) was located throughout the bay forest. *I. coriacea* was the dominant shrub and appeared to be thriving in transitional and freshwater wetland areas of the site. Planted trees, including *Pinus serotina* (pond pine) and *P. palustris* (longleaf pine), were the only trees located in the plot vicinity. *P. serotina* was the dominant tree in the plot, with only three stems counted. This translates into a density of 120 stems/acre. Little tree mortality was noted within the plot.

Natural regeneration included only herbaceous and shrub species. All surviving tree species had been planted. However, a nearby seed source for pines will likely supply the site with volunteers over time. As stated, this site appears to be in an early successional state with shrub and herbaceous species thriving.

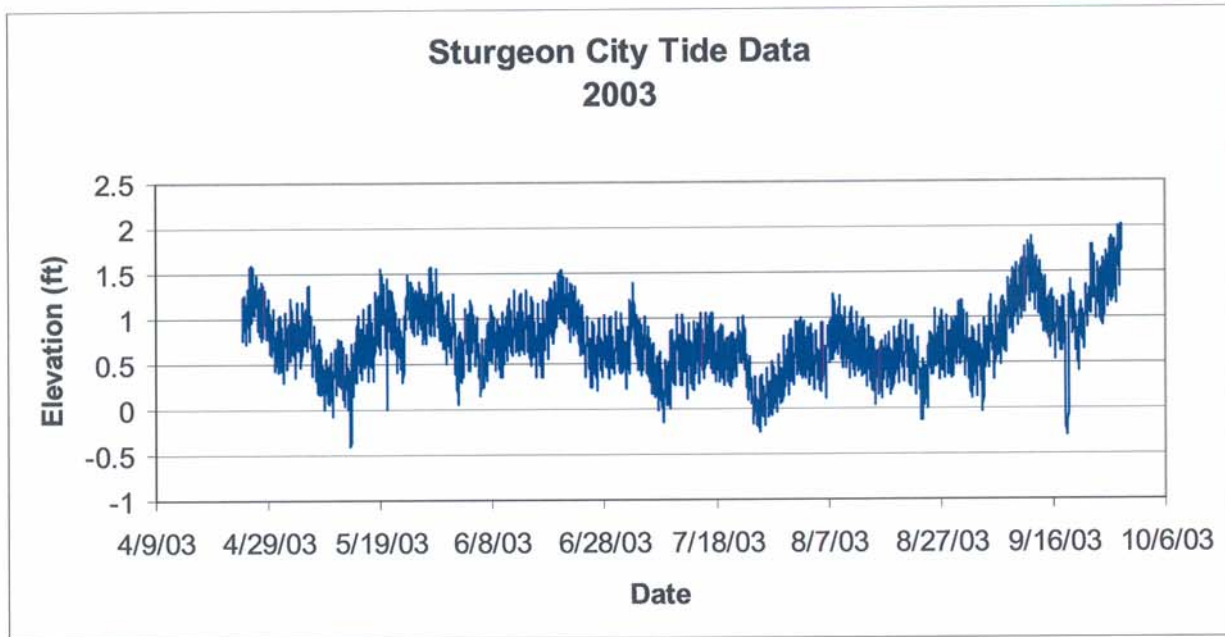
Invasive plant species on the site included a type of crabgrass as well as a *Festuca* (fescue) species. *Festuca* sp. had been planted during the restoration phase for erosion control. The grass was quite healthy in areas where it was growing. The crabgrass was scattered throughout the area. Neither plant seemed to be out-competing native vegetation.

It appears that the vegetative success criteria, as proposed in the monitoring plan, for the freshwater wetland areas of the site are being met. As few tree species were planted, standard criteria based on stem counts per acre may not be met. However, it appears that most planted trees are surviving and a diverse population of shrubs and herbaceous plants is developing. Few of the smaller herbaceous plants planted at the site were found to have survived.

### 2.3 Hydrologic Monitoring Set up

A groundwater gage was installed in the bay forest area of the site. The gage was installed soon after construction activities were completed at the site. The gage is made by Remote Data Systems (RDS). The gage is set to record the water table depth once each day. During the site visit, NCSU staff downloaded the data using one of our data collectors. It is unknown when the last download had occurred, but the gage memory was full. The collected data shows a constant water surface elevation 44 inches below the ground surface, which is at the limit of the gage. As the ground surface is only 2.5-3 feet above sea level at the gage, it is likely that the gage data became compromised either due to an error in the gage or because the memory capacity had been exceeded. The gage will be downloaded again during the spring visit. The gage may need to be replaced if it still does not seem to be operating properly and groundwater monitoring is still desired.

Additional tide level data is also being recorded. This data can be used to verify and support the marsh design and development. The tide data for 2003 is shown below and was provided by the design consultant, BLUE: Land, Water, Infrastructure, PA (BLWI). The data confirms tidal fluctuations are sufficient to initiate regular overflow into the tidal marsh. Regular surface inundation of brackish water and subsequent drainage and flushing are integral to the survival and development of the designated marsh community. This type of information helps confirm hydrologic conditions in the marsh, and will be especially valuable if any problems ever develop.



**Figure 3. Sturgeon City Tide Data**

#### **2.4 Results Discussion**

Vegetation survivability and coverage is exceeding the success criteria at this site. The density and development of the marsh areas was very impressive. Survivability and coverage of plants in the bay forest was meeting requirements. However, few of the smaller plants and herbs that were planted in this area were found to have survived. If a more diverse population of trees is desired, introduction of a few more species of trees may be recommended. Although the existing trees will soon shade out most undesirable vegetation, the bay forest area should be watched to ensure that grasses and weeds do not out-compete the trees for nutrients. If invasive plant populations become too competitive, some maintenance may be required. A small area where concentrated stormwater enters the site is developing as a freshwater wetland. The area is partly vegetated with what might be considered undesirable species such as cattails. Although this is not part of the success criteria, it may be advisable to watch this area to make sure it does not expand. Observations in the salt shrub and gum-cypress swamp areas found the plants to appear healthy.

### 3.0 PHOTOGRAPHS



Photo 1. Marsh view from drying beds.



Photo 2. Marsh and Wilson Bay



Photo 3. Close up of Big Cordgrass and Saltmeadow Cordgrass



Photo 4. Transition between upper and lower marsh.



Photo 5. Bay Forest





Photo 6. Overview of Bay Forest Area.