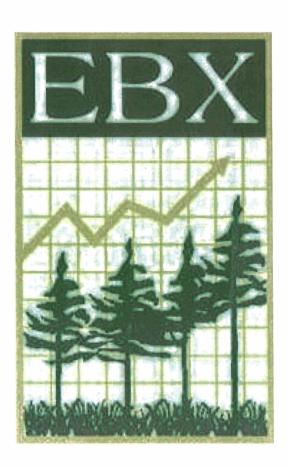
# **NEU-CON UMBRELLA** WETLAND AND STREAM MITIGATION BANK

# **CASEY/KING WETLAND MITIGATION SITE Annual Monitoring Report for 2005 (Year 4)**



# Environmental Banc & Exchange, LLC Managers, Bankers, and Traders of Environmental Rights

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# **ANNUAL MONITORING REPORT FOR 2005 (YEAR 4)**

# Casey/King Wetland Mitigation Site November 2005

## 1.0 SUMMARY

In March 2002, construction was completed to restore a wetland ecosystem throughout the Casey/King Mitigation Site. The targeted wetland system for the restored site was a "non-riverine, wet hardwood forest" with a small component of "Coastal Plain, small stream swamp", as described by Schafale and Weakley, 1990. Though the site's restoration plan anticipated restoration of 28 acres of wetland system, post construction survey revealed up to 37.3 acres of wetland conditions were restored (a 9.3-acre increase in wetland area restored). Monitoring of this restoration project is to take place during the five growing seasons subsequent to construction completion. This Annual Report summarizes the groundwater and vegetation monitoring activities performed on the Casey/King Wetland Mitigation Site during the fourth year after construction completion. All data included in this report correspond to results obtained from monitoring during the year 2005 growing season.

This Annual Report documents vegetation survivability throughout the restored site during the fourth growing season of the project. Data on average survival success of all woody vegetation planted on site is based on sampling from five vegetation monitoring plots placed at random locations onsite. Each monitoring plot is 0.1 acre in size. Additional planting was done on site after the first growing season due to low survivability. The Casey/King site is overall in its fourth growing season, however, supplemental planting took place after the first growing season.

Although the approved Mitigation Plan calls for only three vegetation monitoring plots, it was deemed necessary to increase the vegetation sample size based on the increase in restored wetland area (as compared to its predicted extent). The two additional vegetation monitoring plots are located within these additional 9.3 acres of restored wetland planted with non-riverine forest vegetation. This additional area is located outside the original project mitigation boundary.

This Annual Report presents data from five wetland hydrology monitoring stations. Each station is equipped with a manual groundwater gauge. Four of these stations are equipped with automated groundwater gauges. The location of each station coincides with the location of one of the five 0.1 acre vegetation-monitoring plots on site (gauge stations are located just outside one of the corners of the vegetation plot). Each groundwater gauge location also serves as a base point from which photographs are taken and referenced.

Part of the monitoring effort for this project includes observation of the relationship between local climatic conditions and site groundwater levels. Weather data from the Kingston Weather Station are used in conjunction with data collected from an onsite, manual rain gauge to document climatic conditions.

The fourth post-construction growing season at the Casey/King Wetland Mitigation Site was a successful one. Data collected from the onsite, groundwater monitoring wells showed all five wetland hydrology monitoring stations met the hydrologic success criteria established in the monitoring plan. Based on vegetation monitoring, survivability rates ranged from 320 and 590 stems per acre, demonstrating that the site met the initial vegetation survival criteria of 320 stems

per acre surviving after the third growing season and is on track for meeting the final vegetation survival criteria of 260 stems per acre surviving after the fifth growing season.

## 2.0 INTRODUCTION

## 2.1 Project Description

Located in Lenoir County, North Carolina, the Casey/King Wetland Mitigation Site encompasses a total restored area of approximately 37.3 acres. It is situated off of British Road (State Road 1803) several miles east of Kinston (Figure 1). This project provides compensatory mitigation for wetland impacts associated with North Carolina Department of Transportation (NCDOT) projects within the resident hydrologic unit. The Casey/King Site was designed to restore a non-riverine, wet hardwood forest ecosystem and a Coastal Plain, small stream swamp ecosystem. It was constructed between December 2001 and February 2002, with 37.3 acres of planting completed on March 19, 2002. Groundwater and rain gauges became functional on March 20, 2002. The site is now in its fourth year of monitoring.

## 2.2 Purpose

Monitoring of the Casey/King Site is required to demonstrate successful mitigation based on the criteria described in both the Site Specific Mitigation Plan and the Neu-Con Umbrella Stream and Wetland Mitigation Bank Instrument, as well as through comparison to conditions at a selected reference site. Both hydrologic and vegetation monitoring are conducted throughout the growing season. Success criteria must be met for five consecutive years. This Annual Report details the results of the hydrologic and vegetation monitoring for 2005 at the Casey/King Wetland Mitigation Site.

## 2.3 Project History and Schedule

May 2000	Pre-restoration Monitoring Gauges Installed			
Fall 2001	Approved Mitigation Plan			
December 17, 2001	Construction Began			
March 7, 2002	Construction Completed			
March 19, 2002	Planting Completed			
March 19, 2002	Post Construction Monitoring Gauges Installed			
April 2002	As-Built Report Submitted			
October / November 2002	Supplemental Vegetative Monitoring			
November 30, 2002	1 <sup>st</sup> Annual Monitoring Report			
November 2003	2 <sup>nd</sup> Annual Monitoring Report			
November 2004	3 <sup>rd</sup> Annual Monitoring Report			
November 2005	4 <sup>th</sup> Annual Monitoring Report			
November 2006 (scheduled)	5 <sup>th</sup> Annual Monitoring Report			

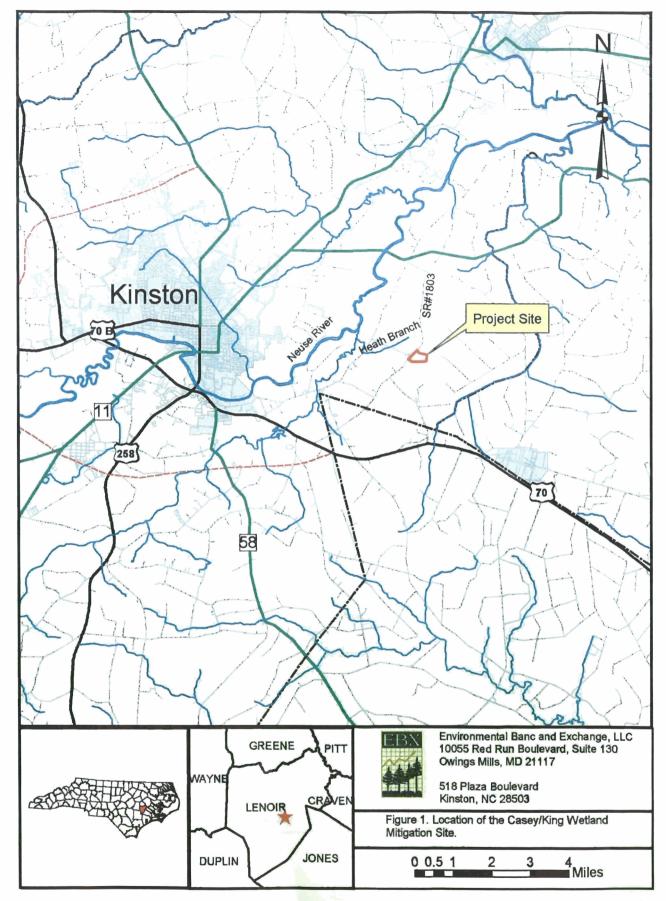


Figure 1. Location of the Casey/King Wetland Mitigation Site.

#### 3.0 HYDROLOGIC MONITORING

## 3.1 Success Criteria

The hydrologic success criteria for this site requires the groundwater table remain within 12 inches of the soil surface for at least 5 percent of the growing season continuously, or for at least 12.5 percent of the growing season cumulatively. The National Weather Service Wetlands Determination Tables (WETS) for the for Kinston NNE, NC4689 weather station defines the growing season for Lenoir County as a 238-day long period extending from March 20 to November 12 of each year. Using this data as base, the time period for which hydrologic success criteria must be met translates to 12 consecutive days or 30 cumulative days.

The Mitigation Plan specifies that groundwater data is to be collected from manual groundwater gauges. This Plan further specifies that successful hydrologic data must demonstrate wetland conditions are present in normal or dryer than normal conditions. Monitoring data collected from the reference wetland system identified in the Mitigation Plan (Webb reference site) is included here to demonstrate the positive correlation existing between the sites's restored hydrology and the natural hydrology of the target system.

## 3.2 Description of Hydrologic Monitoring Efforts

Five manual groundwater gauges, four automated groundwater gauges (Remote Data Systems model WL 40), and one manual rain gauge were installed onsite during the first growing season (Figure 2). Groundwater gauges, both manual and automated, were installed to a minimum depth of at least 32 inches below the ground surface. The monitoring protocol for the site specifies that automated monitoring stations must be downloaded and checked for malfunctions on a monthly basis. During monthly site visits, manual groundwater gauges are read and rainfall totals are collected from the on-site rain gauge. Raw hydrograph data from the monitoring gauges are presented in Appendix A.

Prior to the start of the 2004 growing season, one of the RDS loggers (CK1) failed and was replaced by a logger manufactured by Infinities USA, Inc. Based on past monitoring experience, the Infinities loggers have proven to be more reliable than those manufactured by RDS, and provide the same level of accuracy. Therefore, any RDS loggers that fail will be replaced by Infinities loggers.

Well (CK5) was damaged in early October 2004, and well (CK1) was damaged in early November 2004. The well casings for the Infinity loggers and the manual calibration wells were damaged and had to be reinstalled. The old wells were removed and new well casings were relocated within inches of the previous well location.

Each monitoring station is located within a particular wetness zone at the restoration site. Plots CK#1, CK#3, CK#4 and CK#5 contain both manual and automated groundwater gauges and are positioned to determine the success of restoring a non-riverine, wet hardwood forest on the site. Plot CK#2 is accessed to determine the success of the small stream swamp ecosystem, with the success being determined by a single manual gauging station. Automated and manual gauges within a plot are separated by no more than three feet.

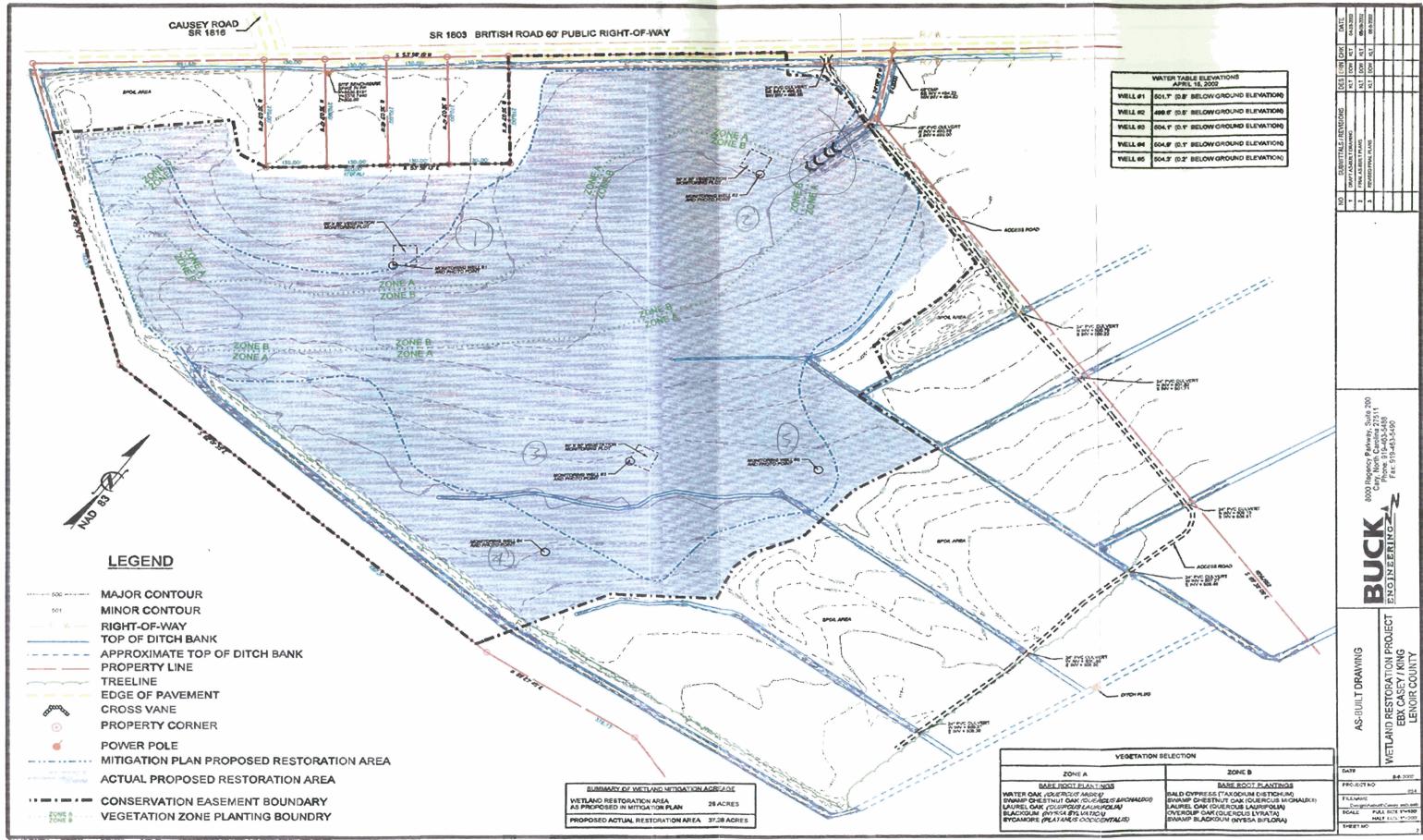


Figure 2. Casey/King As-Built Drawing.

## 3.3 Results of Hydrologic Monitoring

#### 3.3.1 Site Data

The following hydroperiod statistics were calculated for each monitoring station during the growing season: 1) most consecutive days that the water table was within twelve inches of the soil surface; 2) cumulative number of days that the water table was within twelve inches of the soil surface; and 3) number of times that the water table rose to within twelve inches of the soil surface. The results of these calculations are presented in Table 1. Figure 3 provides a chart of the water depth for each of the onsite, groundwater monitoring gauges. The locations of each gauge are shown in Figure 2.

Groundwater levels are closely related to neighboring climatic conditions. A precipitation graph is shown at the top of the hydrograph in Figure 3 to demonstrate the reaction of groundwater level at each monitoring location to specific rainfall events. More detailed information on precipitation data is included in Section 3.3.2 of this report.

Gauges located at CK4 and CK5 experienced brief periods of missing data due false readings. Data collection returned to normal and the wells were left in place.

The site was designed to function with rainfall as its primary hydrologic influence. Monitoring has shown the influence of rainfall on site hydrology. During most site visits in the 2005 monitoring season, evidence of surface inundation was observed across the monitored restoration area.

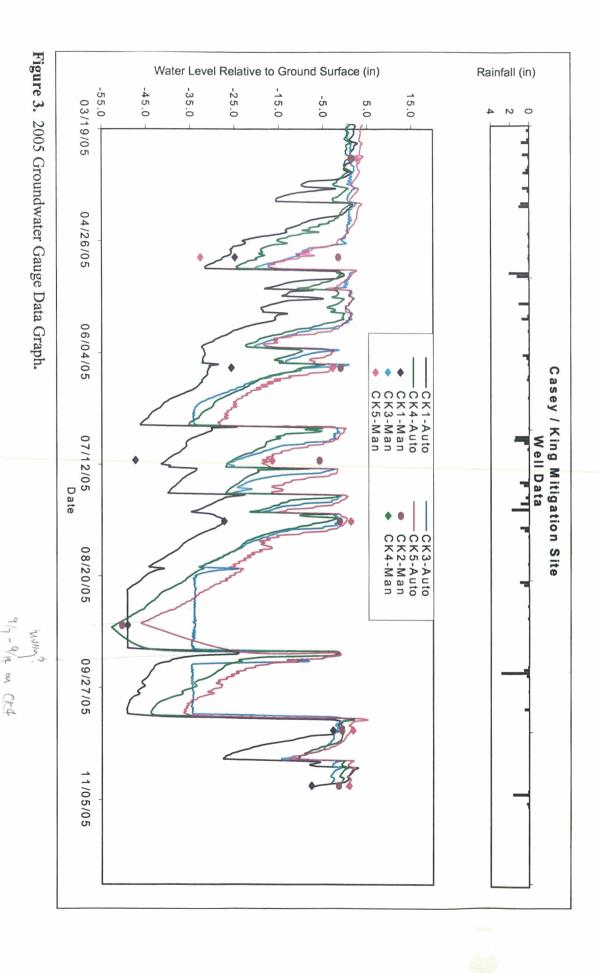
Table 1.	Hydrologic	Monitoring	Results	for 200	5.
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Monitoring Station	Most Consecutive Days Meeting Criteria <sup>1</sup>	Cumulative Days Meeting Criteria <sup>2</sup>	Number of Instances Meeting Criteria <sup>3</sup>
CK1	21 (9%)	40 (17%)	5
CK2 <sup>4</sup>	~ 43 (18%)	~ 99 (41%)	~ 10
CK3	43 (18%)	99 (41%)	10
CK4 <sup>5</sup>	36 (15%)	79 (33%)	9
CK5 <sup>5</sup>	44 (18%)	108(45%)	9

## **Notes:**

Percentage indicates percent of the growing season.

- 1. Indicates the most consecutive number of days within the monitored growing season with a water table less than 12 inches from the soil surface.
- 2. Indicates the cumulative number of days within the monitored growing season with a water table less than 12 inches from the soil surface.
- 3. Indicates the number of instances within the monitored growing season when the water table rose to less than 12 inches from the soil surface.
- 4. Groundwater gauge CK2 is a manual gauge. Hydrologic parameters are estimated based on data from gauge CK3, which most closely matches the data from CK2.
- 5. Monitoring station experienced a brief period of missing data.



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#### 3.3.2 Climatic Data

Table 2 is a comparison of the 2005 monthly rainfall to historical precipitation data collected between 1948 and 2002 for the Lenoir County area. Observed data presented were collected from an automated weather station in Kinston. Monthly rainfall for the months of November and December 2005 were not available at the time this report was compiled. Monthly rainfall for October, November, and December 2004 became available subsequent to preparation of the year 2004 monitoring report, and are included here as supplemental information.

Data from the manual onsite rain gauge was used to determine how rain data from the Kinston automated weather station correlates with rainfall at the site. For the period when rainfall measurements were collected on-site (March 10 through September 6), the rainfall total from the Kinston gauge (24.5 inches) correlates well with data from the onsite manual rain gauge (24.3 inches). This comparison indicates that 2005 rain data from the Kinston gauge approximates onsite rainfall.

For the 2005 period of record between January and September 2005, total rainfall was approximately ten inches below the long-term average.

Table 2. Comparison of Historic Average Rainfall to Observed Rainfall (Inches).

Table 2. Comparison of Historic Average Rainfall to Observed Rainfall (Inches).									
				Observed Precipitation, P (in)					
Month	Average	30%	70%	Month	P				
October	2.96	1.77	3.66	October 2004	0.86				
November	2.83	1.86	3.4	November 2004	4.05				
December	3.54	2.11	4.29	December 2004	2.62				
January	4.05	3.08	4.71	January 2005	2.58				
February	3.73	2.41	4.49	February 2005	2.05				
March	3.97	2.71	4.74	March 2005	3.57				
April	3.16	1.95	3.82	April 2005	3.73				
May $\mathcal{E}_{i}$	4.26	2.79	5.12	May 2005	5.27				
June 36,37	4.04	2.76	4.82	June 2005	4.11				
July ઉપયા	5.29	3.78	6.26	July 2005	6.21				
August	5.48	3.73	6.55	August 2005	1.61				
September	4.29	2.3	5.24	September 2005	4.12				
October	<b>₹2.96</b>	1.77	3.66	October 2005 *	1.94*				
November	2.83	1.86	3.4	November 2005	N/A				
December	3.54	2.11	4.29	December 2005	N/A				

## **Notes:**

<sup>\*</sup> Rainfall data for dates of October 3-21, 2005 were unavailable at the time of preparation of this report.

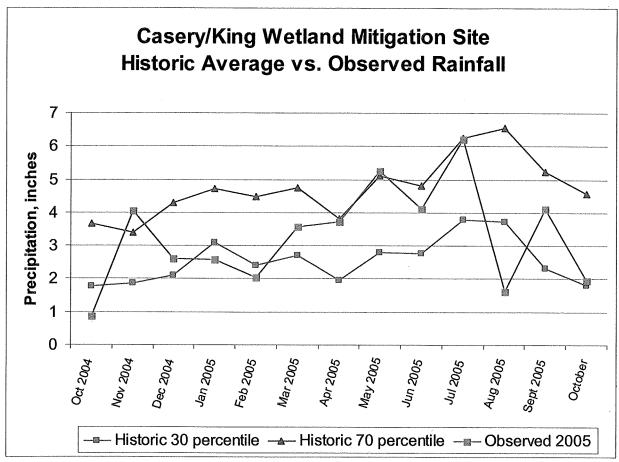


Figure 4. Historic Averages vs. Observed Rainfall.

# 3.4 Hydrologic Conclusions

Data collected from all the groundwater monitoring gauges on the Casey/King Wetland Mitigation Site indicate that hydrologic success criteria have been met during the 2005 growing season. All gauges demonstrated consecutive saturated conditions within the 12 inches below soil surface for at least five percent of the growing season (12 consecutive days), and cumulative soil saturation within 12 inches of the ground surface for over 12.5 percent of the growing season (30 days of the entire season).

This data together with the corresponding climatic data for the area show the site was able to meet the hydrologic success criteria for the 2005 growing season, despite receiving notably less rainfall than the long-term yearly average.

#### 4.0 VEGETATION

#### 4.1 Success Criteria

The interim measure of vegetative success identified in the Casey/King Mitigation Plan has been met (survival of at least 320 3-year old trees per acre at the end of Year 3 of the monitoring period). The final vegetative success criteria will be the survival of 260 5-year old trees per acre at the end of the five-year monitoring period. In addition, at the end of the five-year monitoring period, the presence of volunteer facultative softwood species such as red maple, sweet gum, and loblolly pine shall be limited to less than 10 percent each of the total number of trees utilized to determine success. These trees may contribute more than 10 percent of the total trees on the site, but they will not constitute more than 10 percent each of the 260 trees per acre count required to meet vegetation success criteria.

Construction was completed on March 7, 2002. Planting of bare root trees and spreading of the permanent seed mixture was completed on March 19, 2002. Approximately 21,900 trees were planted over 37.3 acres. Supplemental planning occurred in the spring of 2003 on selected areas of the site, consistent with the recommendations given in the 2002 monitoring report.

## 4.2 Description of Species

Table 3 shows the tree species planted in the Wetland Restoration Area:

ID	Common Name	Scientific Name	FAC Status	Year planted
1	Sugarberry	Celtis laevigata	FACW	2003
2	Swamp Tupelo	Nyssa biflora	OBL	2003
3	Blackgum	Nyssa sylvatica	FAC	2002 & 2003
4	Sycamore	Platanus occidentalis	FACW-	2002
5	Laurel Oak	Quercus laurifolia	FACW	2002 & 2003
6	Swamp White Oak	Quercus lyrata	OBL	2003
7	Swamp Chestnut Oak	Quercus michauxii	FACW-	2002 & 2003
8	Water Oak	Quercus nigra	FACW-	2003
9	Cherrybark Oak	Quercus pagoda	FAC	2002 & 2003
10	Coastal Willow Oak	Quercus phellos	FACW-	2002 & 2003
11	Shumard Oak	Quercus shumardii	FACW-	2003
12	Bald Cypress	Taxodium distichum	OBL	2002 & 2003

Table 3. Tree Species Planted in the Casey/King Wetland Restoration Area.

# 4.3 Results of Vegetation Monitoring

Table 4 shows stem counts for each of the monitoring stations. Numbers identify planted tree species and letters identify volunteer tree species at the top row, and each plot is identified down the left column. To match the numeric Species ID with the species name, please refer to the previous table. Volunteer Species are shown in the footnotes for Table 4. Trees are flagged in the field on a quarterly basis before the flags degrade. Flags are utilized because they will not interfere with the growth of the tree. Volunteers are also flagged during this process.

hunitellicus 590 320 320 740

319

Table 4. 2005 Vegetation Monitoring Statistics by Plot.

Plot	1	2	3	4	5	6	7	8	9	10	11	12	A	В	C	D	E	F & St	em/ac
CK1	0	5	2	3	5	0	3	7	0	16	8	5	1	0	0	4	0	0 <	590
CK2	0	1	0	2	0	2	1	3	0	13	4	6	0	0	0	0	0	0 0	320
СКЗ	0	10	2	3	2	0	5	1	0	0	10	1	0	0	0	3	0	0 3	370
CK4	0	2	0	3	1	12	3	0	0	0	8	0	1	4	10	5	1	0 2)	500
CK5	0	0	0	18	4	0	2	0	0	3	1	1	0	0	0	3	1	<b>4</b> %	370

Volunteer individuals are also flagged during the tree count process. Volunteer tree species found within the Casey/King Wetland Restoration Area are described in Table 5.

Table 5. Volunteer Tree Species Identified at the Casey/King Wetland Restoration Area.

ID	Species	Common Name	FAC Status						
A	Acer rubrum	Red Maple	FAC						
В	Liquidambar styraciflua	Sweetgum	FAC+						
C	Nyssa sylvatica	Blackgum	FAC						
D	Platanus occidentalis	Sycamore	FACW-						
E	Salix nigra	Black Willow	OBL						
F	Taxodium distichum	Bald Cypress	OBL						
G	Carya sp. *	Hickory							
H Fraxinus sp. * Ash									
Not	Notes:								
*	* Sapling; positive ID not possible.								

Range of Stems/Acre: 320-590

volunteur fran 0-4270; 2 plots > 10% voluntees

Differences between species composition and plot statistics presented in 2003 and 2004 reports are attributed to a number of factors, and therefore, the monitoring protocol has been modified to create more consistent data. Variability in the statistics resulted from an inability to locate trees from one year to the next, but the overwhelming factor is that tree counts are performed after planting or near leaf drop when identification of leafless sapling oaks and gums is almost impossible. In order increase consistency, we have erected PVC stakes adjacent to trees within the plots since the lack of forest cover allows the flags to photo-degrade. Changes in data also results because some saplings appear dead in one year when they may in fact be dormant or have a dead terminal bud and will re-sprout in the following spring.

#### 4.4 **Vegetation Monitoring Conclusions**

Approximately 37.3 acres of this site was planted in non-riverine hardwoods and Coastal Plain, swamp species. There were five 0.1 acre vegetation monitoring plots established throughout the planting areas. The 2005 vegetation monitoring indicated a tree density of 320 to 590 stems per acre, meeting the minimum success interim criteria of 320 trees per acre by Year 3. This

indicates that it is very likely that the success criteria of 260 stems per acre will be met at the end of the 5-year monitoring period.

Hydrophytic herbaceous vegetation including rush (Juncus effusus), spike-rush (Eleocharis obtusa), Boxseed (Ludwigia sp.), and sedge (Carex sp.) are frequently observed across the site, particularly in areas of inundation. Cat-tail (Typha latifolia) and knotweed (Polygonum persicaria) are also found on site. The presence of these herbaceous wetland plants helps to confirm the presence of wetland hydrology on the site.

Weedy vegetation is also present on the site in some localized areas. The majority of the weedy species is annuals and believed to pose very little threat to survivability in site. Thickets of partridge pea (Cassia fasciculata) are no longer present on the site and the fennel (Foeniculum vulgare) has become even more localized; these don't seem to be affecting the survivability of the planted vegetation. Other weedy vegetation including ragweed (Ambrosia artemisiifolia) is present on site. Some patches of Johnson grass (Sorghum halepense), which were previously noted in scattered portions of the site, are noted along the entrance road to the site. Control measures could be deemed necessary to prevent reinvasion of this species should it be noted in future quarterly evaluations.

## 5.0 REFERENCE SITE CONDITIONS

The approved Mitigation Plan states that if the rainfall data for any given year during the monitoring period substantially differs from the historic average for the area, the reference wetland data can be accessed to determine if there is a positive correlation between the performance of the restoration site and the natural hydrology of the reference site.

Data **from** the reference site are compared to restoration site data in Figure 5. Data from the reference wetland groundwater gauge show a positive correlation with the automated and manual groundwater gauges located across the restoration site for the months of March to October 2005. The **onsite** groundwater gauge **CK#4** and **CK#5 malfunctioned** during the first half of the month of September 2005, thus comparison of groundwater level at the two sites should disregard data from these two gauges for that specified period.

The automated gauges from both the restoration site and the reference wetland show the similarity of the natural hydrology of the reference site and the restored hydrology of the Casey/King Mitigation Site. Rainfall amounts during the monitoring period at the Webb Reference Site and the mitigation site were very similar.

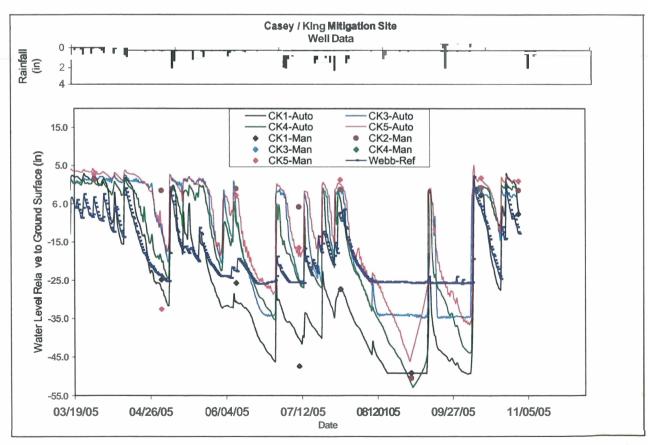


Figure 5. Comparison of Reference Site Data to Data from Stations Onsite.

## 6.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

- Fourth year hydrologic monitoring has shown that wetland hydrologic success criteria have been met and that the site is performing as designed.
- Vegetation monitoring efforts indicate that the number of stems per acre on the site range from 320 to 590, which meets the interim trajectory of 320 trees per acre in Year 3. This indicates that it is very likely that the success criteria of 260 stems per acre will be met at the end of the 5-year monitoring period.
- Monitoring of vegetation and hydrology will continue in 2006.

# 7.0 WILDLIFE OBSERVATIONS

Deer and raccoon tracks are common observations during site visits. Rabbit tracks and skat are also common. Leopard frogs can be found in the areas of the site that exhibit surface ponding for extensive periods. Tree frogs have also been observed from time to time on tall vegetation. Mosquito fish can be observed in all open and flowing water areas.