Eagle Brunswick Tract
Year Three Monitoring Report

Brunswick County, NC

Prepared for:
ECOBANK
Winter Park, FL

Prepared by:
Land Management Group, Inc.
Wilmington, NC

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1.0 Introduction

As part of mitigation for unavoidable wetland impacts associated with the construction of the Wilmington Bypass by the North Carolina Department of Transportation, ECOBANK proposed to utilize restoration, enhancement, and preservation mitigation at the 451-acre Eagle Brunswick tract, located in Brunswick County, North Carolina (Figure 1) as described in Revised Compensatory Mitigation Plan for the Eagle Brunswick Tract dated July 21, 2000. This tract historically consisted of pine flat and pocosin habitats, much of which was ditched and drained due to silvicultural purposes.

In order to restore wetland hydrology at the Eagle Brunsick tract, all on-site ditches were filled in December of 1999. Automated groundwater monitoring gauges were then placed in transects throughout the site to collect hydrology data. Although the mitigation efforts did not include planting wetland vegetation within the pocosin and pine flats, six monitoring plots were located within the site and existing vegetation was analyzed to verify that the ditch-filling has not negatively affected species composition or numbers.

In addition to the pocosin and pine flats mitigation, approximately four acres (~1700 linear feet of stream) of stream/headwater riverine wetlands were restored at the northern end of the tract by filling a ditch, reestablishing wider slopes and natural sinuosity, and planting 2000 seedlings along the bank. Because this area was not counted towards the mitigation credits, neither hydrologic nor vegetation monitoring were conducted here.

The hydrology and vegetation data collected throughout the past twelve months are presented in this document and will be monitored for at least a total of five years, or until the project is deemed successful.

The two previous monitoring reports for this site determined that Eagle Brunswick has achieved both the vegetative and hydrological success criteria and the site is thus far a mitigation success.

2.0 Hydrology

2.1 Success Criteria

According to the Eagle Brunswick Tract Mitigation Plan, the wetland hydrology success criterion for this site is the establishment of a static water table at or within 12" of the soil surface, ponded or flooded for 12.5% of the growing season during normal precipitation conditions. The growing season in Brunswick County extends 265 days, between March 7 and November 28. Normal precipitation is defined as total monthly precipitation falling within the 30th and 70th percentiles of a 30-year period. Therefore, to meet the success criterion, the water table should remain at or within 12" of the soil surface for at least 33 consecutive days between March 7 and November 28. However, because of awareness in the scientific community that undisturbed pocosin/pine flat wetlands do not always meet this 12.5% threshold, this criterion is subject to redefinition based on groundwater results from the reference gauges, as stated on page 16 of the mitigation plan. A redefinition of the hydrological success criterion is not requested in this monitoring report.

2.2 Methods

In December of 1999, several ditches that transected the Eagle Brunswick Tract were filled to restore wetland hydrology to the 451-acre site. As stated in the mitigation plan, a total of 23 automated groundwater monitoring gauges were installed throughout the site to monitor groundwater hydrology for at least five years. Fifteen of these gauges were located in restored wetlands, six gauges were

installed in enhanced wetlands, and two gauges were placed in reference wetlands located on site (Figure 2). Hydrology data from the gauges located in restored and enhanced areas have been compared to data from the two reference gauges.

At the Eagle Brunswick site, four gauges were installed within restored wetlands at the end of 1999. The remaining gauges in restored areas and reference areas were installed in the summer of 2000. Finally, six gauges were installed within enhancement areas at the end of October, 2000.

2.3 Results

Of the 21 gauges located within the restored and enhanced wetlands, 20 met the hydrology success criterion for the year 2003 (Table 1), which is a water table within 12" of the soil surface for 12.5% of the growing season (33 days). In fact, most gauges documented wetland hydrology for significantly longer than 33 days. One gauge, F3, had a dead battery during portions of the growing season and was unable to document wetland hydrology for at least 33 continuous days during the growing season. The reference gauges (R1 and R2) located within the tract reflected the same patterns as the other gauges, and documented wetland hydrology for 124 and 75 days, respectively.

Most gauges documented wetter hydrology patterns than recorded in 2001 or 2002 (Table 1). Unlike 2002, which experienced very dry conditions, the 30-day running total for 2003 shows normal or above normal rainfall for most of the year (Appendix A).

Table 1. Groundwater monitoring results for gauges located within the Eagle Brunswick Tract.

Type	Gauge Number	Serial Number	2001 # of Consecutive Days above 12"	2002 # of Consecutive Days above 12"	2003 # of Consecutive Days above 12"
Restoration	A1	S320479	89	35	123
	A2	S342F37	89	*	123
	A3	S353973	89	35	123
	B1	S35398E	90	36	123
	B2	S2C7D36	89	24*	122
	B3	S37851A	91	35	124
	C1	S2C7EE9	128	16*	193
	C2	S213C85	57	35	190
	C3	S353B90	128	35	193
	E1	S126F5F	85	25	71
	E2	S2EACFA	85	25	48
	E3	S214018	83	19	68
	F1	S2D44E2	98	35	114
	F2	S2EA974	gauge stolen	35	124
	F3	S353A85	77	*	26*
Enhancement	A4	S353A2C		35	123
	A5	S353ADE		35	77
	A6	S144FBA		*	39
	D1	S3697DA	53	39	125
	D2	S3783F2		39	189
	D3	S1271FD	28	39	190
Reference	R1	S378395	9	36	124
	R2	S317403	11	35	75

* Gauge stopped reading during growing season.

3.0 Vegetation

3.1 Success Criterion

As established in the mitigation plan, the vegetation success criterion for the Eagle Brunswick site was a minimum of 320 trees per acre, specifically of pond pine (*Pinus serotina*) and loblolly bay (*Gordonia lasianthus*).

3.2 Methods

Although no wetland vegetation was planted within the pocosin or pine flats restoration and enhancement areas at Eagle Brunswick, vegetation monitoring was included as a part of the mitigation plan in order to evaluate whether the ditch-filling activities had any negative consequences on existing vegetation and if vegetation within these restored and enhanced areas resembled the wet pine flat reference area (Table 2).

Table 2. Dominant vegetation at the pine flat reference area of the Eagle Brunswick Tract.

Dominant Overstory	Dominant Shrub/Sapling	Dominant Herbaceous
Pinus serotina	*Gordonia lasianthus* *Lyonia lucida* *Cyrilla racemiflora* *Ilex glabra*	*Ilex glabra* *Lyonia lucida*

Six circular plots were randomly located within restoration and enhancement areas throughout the site (Figure 2). All species within these plots were noted, however only pond pine and loblolly bay stems were counted towards the total. Each plot surveyed had a 10' radius and, therefore, contained 314 ft^2. Because six plots were counted, the total area surveyed was 1884 ft^2. To extrapolate the vegetation to one acre, the total number of pond pine and loblolly bay trees in the six plots was multiplied by 23.1.

3.3 Results

Based on data from the six vegetation plots, the Eagle Brunswick site contained an average of 646.8 pond pine and loblolly bay trees per acre. This is greater than results from 2001 (462 trees/acre) and 2002 (508.2 trees/acre) and well above the 320 trees per acre criterion established in the mitigation plan. Therefore, the vegetation criterion for 2003 was fulfilled.

Table 3. Number of pond pine and loblolly bay trees found in each plot at the Eagle Brunswick Tract in 2003.

Plot #	**Pond Pine** *(Pinus serotina)*	**Loblolly Bay** *(Gordonia lasianthus)*
1		6
2	2	5
3	4	2
4	2	
5	3	1
6	2	1
Total	**13**	**15**

As in previous years, other vegetation observed at Eagle Brunswick included titi (*Cyrilla racemiflora*), sweet pepperbush (*Clethra alnifolia*), fetterbush (*Lyonia lucida*), gallberry (*Ilex glabra*), and catbrier (*Smilax spp*.), which were mainly found in the shrub and herbaceous layers. Exact counts of these species were not made since they did not factor into the vegetation criterion.

4.0 Conclusions

Hydrology data from 2003 revealed that 20 of 21 monitoring gauges throughout the restored and enhanced areas of Eagle Brunswick met the 12.5% wetland hydrology criterion established in the mitigation plan. One gauge, F3, had a dead battery during portions of the growing season and was unable to document wetland hydrology for at least 33 continuous days during the growing season. Based on data from previous years, however, it is felt that this gauge would have recorded wetland hydrology had it been functioning properly.

As stated on page 10 of the mitigation plan, several gauges were installed throughout the tract in 1997 to evaluate the effects of the ditches on hydrology (Figure 2).

It was determined from these data that the ditches had a 300' drainage effect, which was used to establish restoration and enhancement boundaries. The mitigation plan did not require a direct comparison of pre-project and post-project data and all but two of the gauges (D1 and D2; see Figure 2) were in different locations. However, a general comparison of data from these gauges revealed that the ditches had a considerable drainage effect. Gauges as far as 500' away from a ditch measured water levels that were routinely 2-3' below the surface (Appendix A: Figures A.11 & A.12). After the ditches were filled, groundwater levels rose to within 12" of the soil surface for most of the growing season and reflected wetland hydrology. Even gauges located in enhanced areas resulted in wetter hydrology after the ditches were filled (Gauges F & H compared to Gauges D1-D3 and A4-A6).

Vegetation monitoring found the Eagle Brunswick Tract to contain thick stands of wet pine flat plant species such as gallberry, fetterbush, and sweet pepperbush (Appendix B). In addition, an average of 646.8 trees per acre of pond pine and loblolly bay were observed in the canopy and shrub layer throughout the tract. This value greatly exceeded the vegetation criterion of 320 trees per acre of these two species.

Because both hydrology and vegetation criteria were achieved during the first three years of monitoring, wetland mitigation at the Eagle Brunswick site can be considered a success thus far.