ANNUAL REPORT FOR 2002

Ballance Farm Mitigation Site
Currituck County
Project No. 6.049008T
TIP No. R-2228WM

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SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Ballance Farm Mitigation Site. This is the fourth year the site has been monitored for vegetation and hydrologic success. The site must demonstrate both hydrologic and vegetation success for a minimum of five years.

The Ballance Farm site contains 28 groundwater monitoring gauges and 12 surface gauges. The original 17 gauges were placed soon after the site was constructed. The site was extremely wet and gauges were installed in the drier, and therefore higher, locations across the site. NCDOT installed an additional 11 groundwater gauges across the site at more elevation-representative locations. The site also contains 21 plots monitoring trees and 500 plots monitoring the marsh area.

In May 2002 during an on-site field visit, state and federal agencies requested that NCDOT delineate the marsh areas that received routine tidal flooding. In July 2002, NCDOT performed a marsh delineation, which was done at a time just after a wind tide event. According to the delineation, the creation areas are functioning as a brackish water marsh very similar to the reference marsh system.

Success criteria are based on federal guidelines for wetland mitigation (as well as a comparison to the hydrology of an undisturbed coastal marsh reference ecosystem located along Tull Creek and an undisturbed forested wetland reference ecosystem referred to as the Richard's property). These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. Gauges were not installed on the Richard's property for the first two years of monitoring; the groundwater gauges were later installed in early 2001. The 3 reference gauges indicated that the reference-forested wetland had groundwater within 12 inches of the surface for the entire growing season.

Hydrologic monitoring indicated that of the 28 groundwater gauges on site, 26 showed saturation for over 12.5% of the growing season, 1 gauge showed saturation between 8 – 12.5% of the growing season, and only 1 gauge indicated less than 5%. All 12 surface water gauges have shown surface water throughout the entire growing season.

The daily rainfall data depicted on the monitoring gauge graphs is recorded from an on-site rain gauge. Historical rainfall data used for the 30-70 percentile was recorded at the Elizabeth City rain gauge, maintained by the NC State Climate Office.

This is the fourth year of vegetative monitoring for the forested restoration areas. Of the 430 acres of this site, approximately 223 involved tree planting. There were 21 (50' x 50') plots established throughout the planting areas,

encompassing all plant communities. The vegetation monitoring of the planted area revealed the average density to be 436 trees per acre, which is well above the 320 trees per acre required by the minimum success criteria for three years.

This year was the third vegetative monitoring year for the marsh area since the area was re-planted in June 2000. Success will be determined in accordance with NMFS Guidelines. Of the 430 acres of this site, approximately 48 acres involved marsh grass planting. There were 500 random (1m x 1m) plots established throughout the planting areas, encompassing all plant communities. These plots were located with GPS. At year 5, the average of all plots should have a scale value of 5 (75% vegetative cover) consisting of herbaceous species, not including invasive species. A minimum of 70% of the plots should contain the target (planted) species. This year the vegetative cover scale value is 3.03, and the vegetative frequency of target species is well above the success criteria of 70%. The coverage has increased since planting. The percent frequency of target species (planted species) is 73.6% as monitored.

Based on the hydrologic and vegetation monitoring, the Ballance Farm Mitigation Site met success criteria across the majority of the site during the 2002-growing season. NCDOT recommends that monitoring continue.

1.0 INTRODUCTION

1.1 Project Description

The Ballance Farm Mitigation Site is located in Currituck County (Figure 1). The property was originally a 469-acre site out of which NCDOT purchased 430 acres. The mitigation site consisted of 297 acres of agricultural fields, 50 acres of tidal freshwater marsh, 51 acres of forested wetland, 5.3 acres of forested uplands, and 26 acres of roads, ditches and so on. It was designed to mitigate for the widening of NC 168 (TIP Project R-2228); the project includes the creation of coastal marsh wetland and the preservation of forested wetlands and forested upland areas. According to the Ballance Farm Mitigation Plan, implementation of the site was to provide 61 acres of marsh creation, 236 acres of forested wetland restoration, 51 acres of forested wetland preservation, 50 acres of coastal marsh preservation, and 5.3 acres of upland habitat preservation. However, based on recent GPS data and ground observation, approximately 13 acres of the zone C1 marsh creation area appears to have been graded incorrectly. NCDOT obtained controlled aerial photography of the mitigation site to determine the as-built condition of the site.

The Final Mitigation Plan for this site was issued on April 1, 1996. Construction was completed in December 1998. The site was planted and monitoring gauges installed in February 1999. This monitoring report presents the fourth year results of hydrologic monitoring and vegetation monitoring.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria are based on federal guidelines for wetland mitigation (as well as a comparison to the hydrology of an undisturbed coastal marsh reference ecosystem and an undisturbed-forested wetland reference ecosystem). These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during the year 2002 at the Ballance Farm Mitigation Site as well as local climate conditions throughout the growing season.

1.3 Project History

December 1998	Site Constructed
February 1999	Site Planted
March-November 1999	Hydrology Monitoring (YEAR 1)
November 1999	Vegetation Monitoring (YEAR 1)
March-November 2000	Hydrology Monitoring (YEAR 2)
March 2000	Hardwood Herbicide Treatment
June 2000	Marsh Re-planted
October 2000	Hardwood Vegetation Monitoring (YEAR 2)
October-November 2000	Marsh Vegetation Monitoring (YEAR 1)
March-November 2001	Hydrology Monitoring (YEAR 3)
July 2001	Hardwood Vegetation Monitoring (YEAR 3)
July 2001	Marsh Vegetation Monitoring (YEAR 2)
March-November 2002	Hydrology Monitoring (YEAR 4)
May 2002	On-site Agency Meeting
July 2002	Marsh Delineation
July 2002	Hardwood Vegetation Monitoring (YEAR 4)
July 2002	Marsh Vegetation Monitoring (YEAR 3)

FIGURE 1: VICINITY MAP

1.4 Debit Ledger

Ballance Farm	Mit. Plan			Ratios	TIP DEBIT	TIP DEBIT	TIP DEBIT	TIP DEBIT	TIP DEBIT
Currituck Co. Habitat	Acres at Start:	Acres Remaining	Percent Remaining		R-2228BA & A	R-2228 mod.	Div. 1	Div. 1	B-3445
FWM Creation	48	37.25	77.60			10.65			0.1
FWM Preservation	50	50	100.00						
BLH Restoration	225	195.63	86.95		17.5	10.6	0.27	1	
BLH Preservation	51	49.65	97.35				1.35		
Upland Mgmnt.	5.3	5.3	100.00						
TOTAL	379.3	337.83	89.07						

2.0 HYDROLOGY

2.1 Success Criteria

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology states that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive day percentage of 12.5% of the growing season. Areas inundated or saturated for less than 5% of the growing season are always classified as non-wetlands. Areas inundated or saturated between 5% - 12.5% of the growing season can be classified as wetlands depending upon factors such as the presence of wetland vegetation and hydric soils.

The growing season in Currituck County begins March 20 and ends November 13. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after March 20 and before November 13.[1] The growing season is 239 days; therefore, optimum hydrology requires 12.5% of this season, or at least 30 consecutive days. Local climate must also represent average conditions for the area.

Based on the Ballance Farm Mitigation Plan, hydrologic success of the created coastal marsh is dependent on the groundwater levels occurring at depths concluded in the water budget analysis and similar to those in the adjoining reference coastal marsh. Success will also be determined by comparison of hydrology with the reference coastal marsh.

Based on coordination with the Corps of Engineers after completion of the Ballance Farm Mitigation Plan, the created forested wetland will be considered successful if hydrology on-site is consistent with reference ecosystem referred to as the Richards' property. The plan also states that hydrologic success of the created-forested wetland is dependent on the groundwater levels occurring at depths concluded in the water budget analysis and similar to those in the reference forested wetland.

2.2 Hydrologic Description

In early 1999, seventeen monitoring gauges, one rain gauge, and fourteen surface water gauges were installed. In early 2000, eleven additional groundwater-monitoring gauges were installed, and seven surface water gauges were either removed or relocated to more adequately monitor the marsh area. There are currently 12 surface water gauges on-site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth and the surface gauges record daily readings of surface water depth.

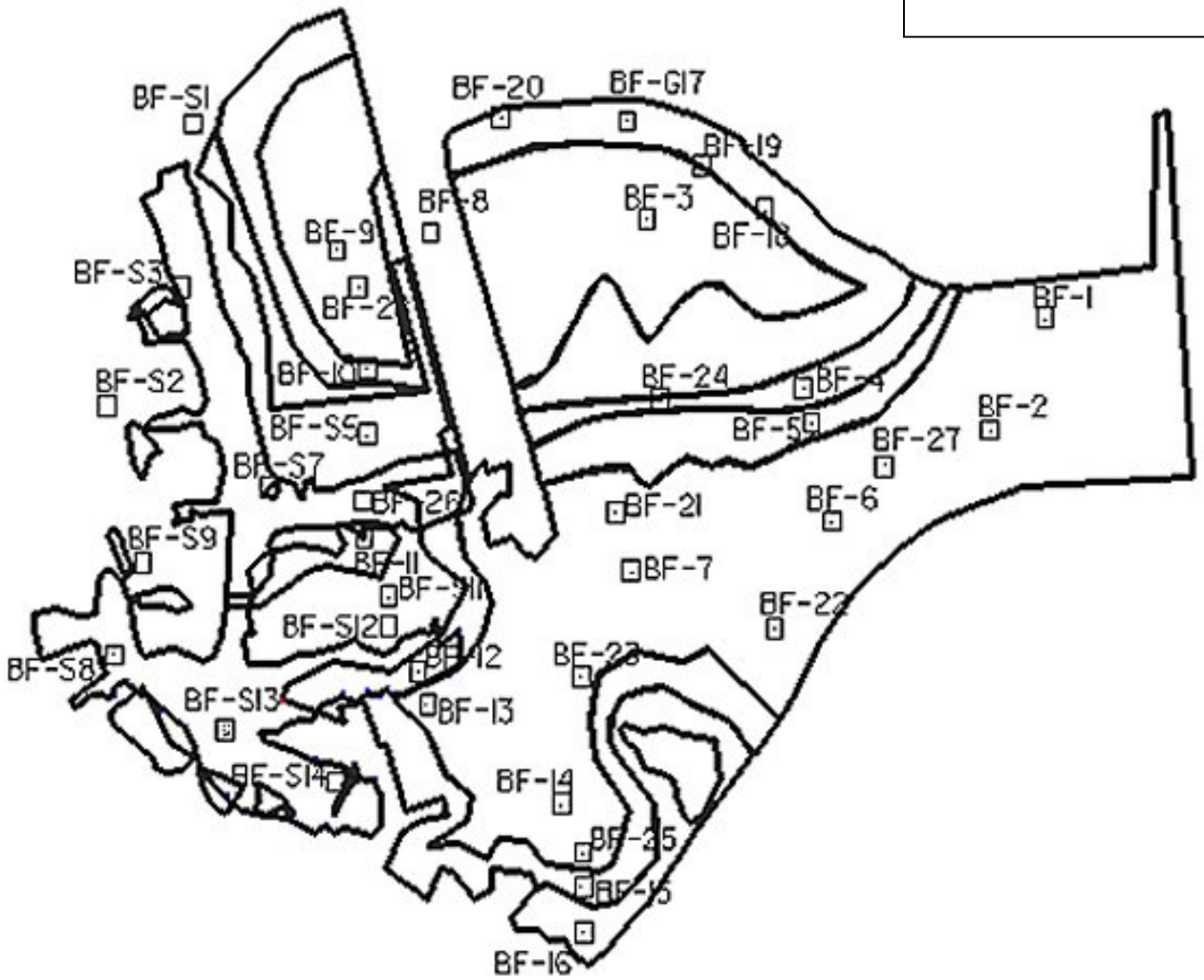
The Ballance Farm site involved the construction and planting of a tidal marsh system by grading the site to match the topography of the existing system located along Tull Creek and by constructing large channels connecting Roland

[1] Natural Resources Conservation Service, Soil Survey of Currituck County, North Carolina, p.71.

Creek, Tull Creek, and a tributary to Tull Creek. This connectivity will allow for tidal flushing of the constructed coastal marsh. This work created a 400-foot wide band of coastal marsh area that resulted in approximately 61 acres of coastal marsh created. In the existing agricultural fields, the field crowns were graded down, the field ditches were filled and plugged, and this area planted resulting in the restoration of approximately 236 acres of forested wetlands.

This should provide adequate hydrologic input from the adjacent creeks and rainfall to sustain the necessary hydrology for this site. The hydrologic monitoring should show the reaction of the groundwater level to specific tidal and rainfall events.

Figure 2: Gauge Location Map



2.3 Results of Hydrologic Monitoring

2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 239-day growing season. The results are presented in Table 1. Appendix A contains a plot of the groundwater depth for each monitoring gauge and the surface water depth recorded by the surface gauge. The maximum number of consecutive days is noted on each graph. The Infinities rain gauge that is currently located on the site was utilized for the 2002 monitoring season, thus eliminating the need to use official rainfall information on the monitoring gauge graphs. Historical rainfall data was obtained from the North Carolina State Climatic Office. Figure 3 is a graphical representation of the hydrologic monitoring results.

Table 1
HYDROLOGIC MONITORING RESULTS (GROUNDWATER GAUGES)

Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %	Success Dates
BF-1				✓	32.2	March 20-June 4
BF-2*				✓	25.5	March 20-May 19 Oct. 12-Nov 13
BF-3				✓	17.9	March 20-May 1
BF-4*				✓	40.2	March 20-June 23 Oct 12-Nov 13
BF-5*				✓	24.7	March 20-May 17 Oct 12-Nov 13
BF-6				✓	25.5	March 20-May 19
BF-7*				✓	24.7	March 20-May 17 Oct 12-Nov 13
BF-8				✓	24.3	March 20-May 16
BF-9*				✓	23.9	March 20-May 15 Oct 12-Nov 13
BF-10*				✓	15.9	April 18-May 19 Aug 29-Oct 5 Oct 12-Nov 13
BF-11				✓	25.1	March 20-May 18
BF-12			✓		10.0	
BF-13*				✓	27.2	March 20-May 23 Oct 12- Nov 13
BF-14*				✓	29.7	March 20-May 27 Sept 5-Oct 7 Oct 12- Nov 13
BF-15				✓	31.4	March 20-June 2 Sept 1-Nov 13
BF-16	✓				1.3	
BF-17*				✓	26.0	March 20-May 20 Oct 12-Nov 13
BF-18				✓	32.6	March 20-May 29

						Aug 28-Nov 13
BF-19*				✓	13.8	Oct 11-Nov 13
BF-20*				✓	28.5	March 20-May 26 Oct 12-Nov 13
BF-21*				✓	28.0	March 20-May 25 Aug 29-Oct 5 Oct 12-Nov 13
BF-22*				✓	27.2	March 20-May 23 Oct 12-Nov 13
BF-23*				✓	32.2	March 20-June 4 Oct 12-Nov 13
BF-24*				✓	30.1	March 20-May 30 Oct 12-Nov 13
BF-25*				✓	28.0	March 20-May 25 Sept 6-Oct 9 Oct 12-Nov 13
BF-26				✓	100.0	March 20-November 13
BF-27*				✓	28.9	March 20-May 27 Oct 12-Nov 13
BF-28*				✓	30.1	March 20-May 30 Oct 12-Nov 13
BF-REF1				✓	100	March 20-Nov 13
BF-REF 2				✓	100	March 20-Nov 13
BF-REF 3				✓	100	March 20-Nov 13

* Gauges met the criteria success during an above average rainfall for the month of October.

The following gauges (BF-2, BF-3, BF-7, BF-10, BF-11, BF-12, BF-18, BF-19, BF-25) all improved hydraulically from the 2001-monitoring year.

Of the 28 gauges installed, 26 gauges showed saturation for at least 12.5% of the growing season, 1 gauge showed saturation for at least 10% of the growing season, and only 1gauge (BF-16) showed saturation less than 5% of the surface.

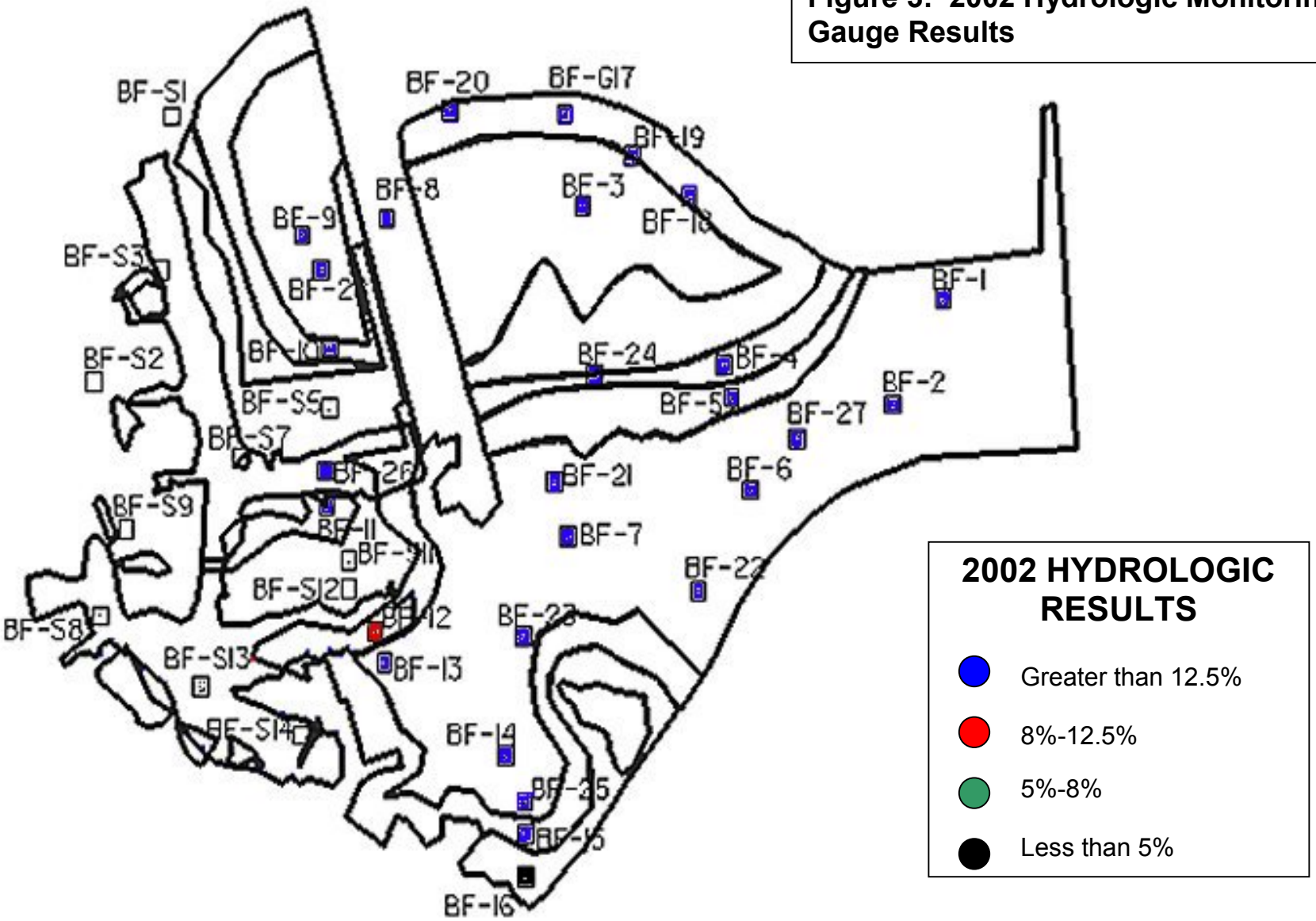
As noted previously, the reference forested wetland (the Richards' property) for the created-forested wetland had gauges installed prior to the 2001-monitoring season. These gauges showed hydrology within twelve inches of the surface for 100% of the 2002-growing season during an average-rainfall-year. On two trips to the property, the site has exhibited evidence of soil saturation over an extended period of time in excess of the 12.5% of the growing season standard.

The surface gauges are located in the existing and created coastal marsh. The surface gauges in the created marsh show the hydrology is consistent with the reference marsh.

Specific gauge problems:

- Gauges BF-16 stopped recording data (April 16-June 19) due to a dead battery.

Figure 3: 2002 Hydrologic Monitoring Gauge Results



2.3.2 Climatic Data

Figure 5 is a comparison of monthly rainfall for the period of November 2001 through October 2002 to historical precipitation (collected between 1971 and 2002) for Elizabeth City, North Carolina. This comparison gives an indication of how 2002 relates to historical data in terms of climate conditions. The NC State Climate Office provided all off-site data. February and May experienced below average rainfall. The months of April and September all recorded average rainfall for the site. January, March, June, July, August, and October experienced above average rainfall. No data is available for November or December however; the site meets hydrologic success criteria without these data. Overall 2002 experienced an average rainfall year.

2.3.3 Marsh Delineation

In May 2002, NCDOT, along with state and federal agencies, held an on-site meeting to discuss the marsh portion of Ballance Farm. During the meeting, the agencies requested that NCDOT GPS the marsh areas that were receiving routine wind tide flooding. In July 2002, NCDOT delineated the marsh areas that appeared to be receiving tidal flooding. This delineation was performed after a wind tide even in the marsh portion of the site. The GPS results indicated that the marsh areas appeared to be flooding similarly to the predictions in the mitigation plan. The creation areas are functioning as a brackish water marsh with a higher marsh component at the upper elevations. The marsh GPS results are detailed in (Figure 4).

2.3.4 Forested Wetland Reference Ecosystem Comparison to Restoration Site (Richards' Property)

The average elevation of the monitoring gauge locations on this reference site is at 1.53 feet. The elevation in the restored forested wetland ranges from 3.4 feet to well over 6 feet based on survey data. Therefore, the reference-forested wetland will always be wetter than the restored-forested wetland. The reference and restored-forested wetlands reacted similarly to the periods of drought this monitoring year. However, the lower elevation of the reference site lessened the effect to groundwater elevations that the lack of rainfall had. The restored-forested wetland located at a higher elevation showed a greater response to the lack of rainfall in its groundwater elevations.

FIGURE 4: MARSH DELINEATION

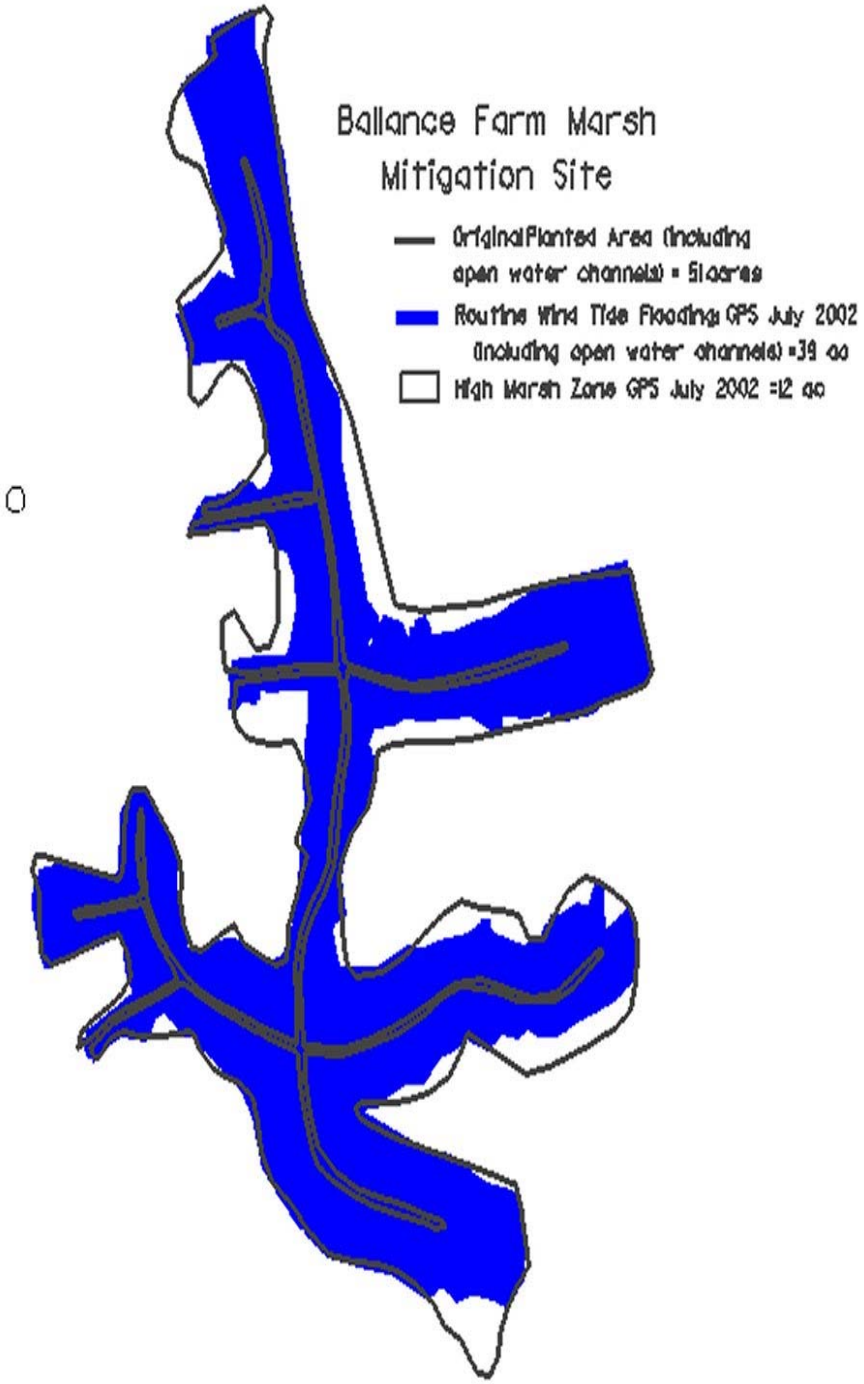
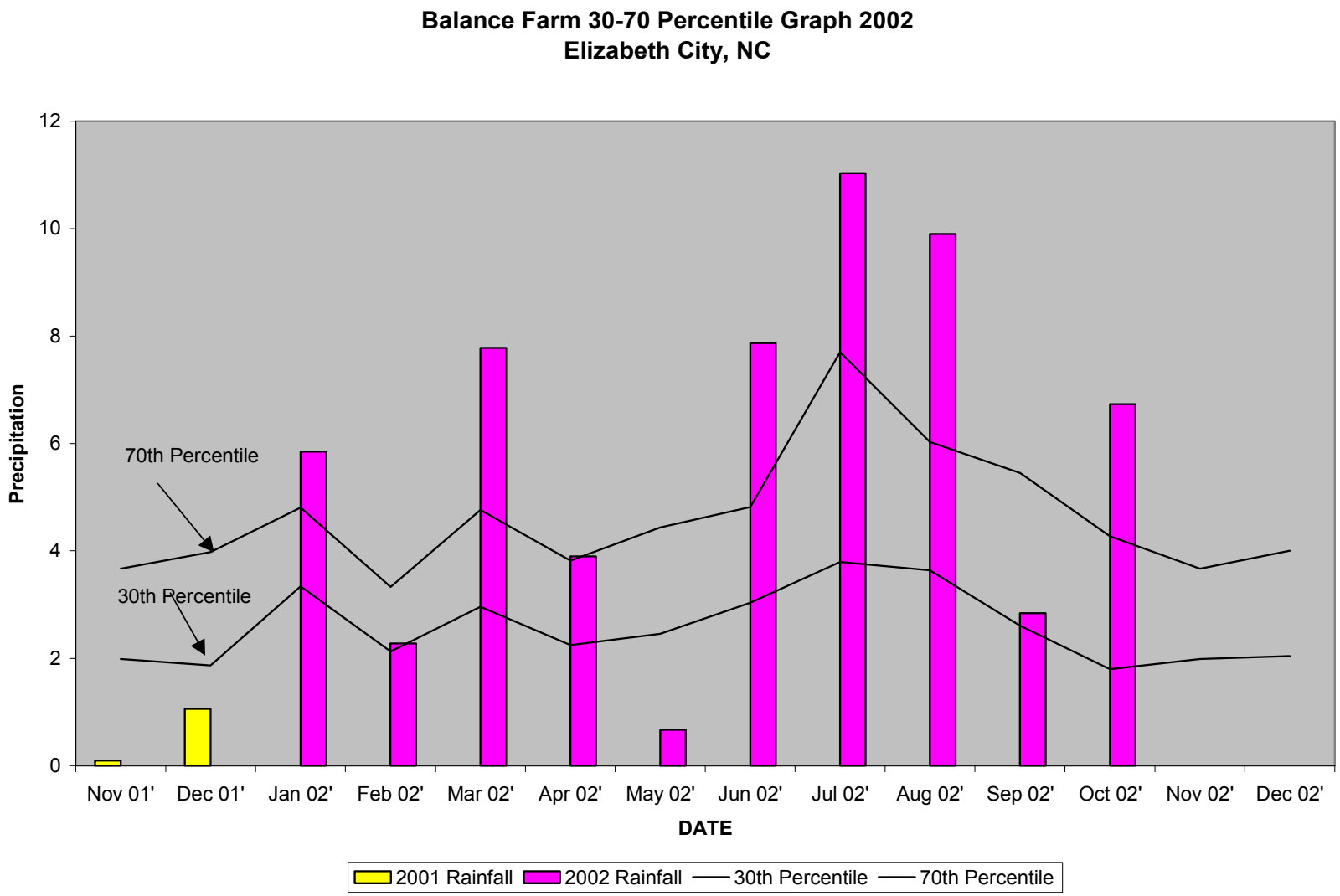


FIGURE 5


Balance Farm 30-70 Percentile Graph 2002
Elizabeth City, NC
Precipitation
12
10
8
6
4
2
0
70th Percentile
30th Percentile
Nov 01'
Dec 01'
Jan 02'
Feb 02'
Mar 02'
Apr 02'
May 02'
Jun 02'
Jul 02'
Aug 02'
Sep 02'
Oct 02'
Nov 02'
Dec 02'
DATE
2001 Rainfall
2002 Rainfall
30th Percentile
70th Percentile

2.4 Conclusions

The year 2002 represents the fourth growing season that the hydrologic data has been examined. The majority of the monitoring gauges on site have shown saturation and inundation for long periods of time. Compared to 2001 gauge data, 9 groundwater gauges improved hydraulically for the 2002-year. Hydrologic monitoring data in 2002 met or exceeded the success criteria for jurisdictional wetland hydrology. The hydrology in the created coastal marsh is consistent with the hydrology in the coastal marsh reference ecosystem. Jurisdictional hydrology was achieved in the created-forested wetland at 26 of the 28-groundwater gauge locations during an average rainfall year.

3.0 VEGETATION: BALLANCE FARM MITIGATION SITE HARDWOOD (YEAR 4 MONITORING) MARSH (YEAR 3 MONITORING)

3.1A Success Criteria

(Bottomland Hardwood Area)

NCDOT will monitor the site for five years. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required survival criterion will decrease by 10% per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for year 4, and 260 stems per acre for year 5). The number of plants of one species will not exceed 20% of the total number of plants of all species planted.

3.1B Success Criteria

(Marsh Grass Area)

The vegetative marsh success of the wetland site will be determined in accordance with NMFS Guidelines. Monitoring plots found to be located within the open water channel will not be evaluated, and will not count toward the final count of plots. The vegetation component of the wetland site will be deemed successful if the following criteria are met.

1. At year five, the average of all plots should have a scale value of 5 (75% vegetative cover) consisting of wetland herbaceous species, not including any invasive species.
2. A minimum of 70% of the plots shall contain the target (planted) species.

3.2A Description of Planted Areas

The following plant communities were planted in the Bottomland Hardwood Area:

Zone 1: (approximately 44 acres)

Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Fraxinus pennsylvanica, Green Ash
Quercus lyrata, Overcup Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus nigra, Water Oak
Quercus phellos, Willow Oak

Zone 2: (approximately 67 acres)

Fraxinus pennsylvanica, Green Ash
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus phellos, Willow Oak
Quercus nigra, Water Oak
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak

Zone 3: (approximately 27 acres)

Taxodium distichum, Baldcypress
Fraxinus pennsylvanica, Green Ash
Quercus lyrata, Overcup Oak
Nyssa aquatica, Water Tupelo

3.2B Description of Planted Areas

The following plant communities were planted in the Marsh Grass Area:

Zone 1: (approximately 44 acres in zone 1 and 2)

Scirpus cyperinus, Woolgrass
Juncus effusus, Soft rush

Zone 2:

Cladium jamaicense, Sawgrass
Juncus roemerianus, Black Needle Rush
Scirpus americanus
Scirpus atrovirens
Carex lurida, Shallow Sedge
Carex vulpinoidea, Fox Sedge
Scirpus robustus
Scirpus pugens
Juncus gerardi, Blackgrass
Distichlis spicata, Spikegrass

Zone 3: (approximately 4 acres)

Spartina cynosuroides, Big Cordgras

3.3A Results of Vegetation Monitoring

(Bottomland Hardwood Area)

ZONE	Plot #	Overcup Oak	Water Tupelo	Green Ash	Baldcypress	Willow Oak	Laurel Oak	Cherrybark Oak	Swp. Chestnut Oak	Water Oak	Total (4 year)	Total (at planting)	Density (Trees/Acre)
1	4	9		7		4		5			25	39	436
	5	10		4		7		6	1	1	29	40	493
	8			13					4		17	44	263
	9	17		4		2		5	1		29	39	506
	11	5				1		7	7		20	38	358
	12	3		1		7		7	7	1	26	42	421
	15			3		4	1	8	8		24	37	441
	16	3		1		13		5	13		35	41	580
	17	11				9		8	10	1	39	41	647
	20	3		2				2			7	45	106
	21	6		2		2		2	4		16	39	279
								ZONE 1 AVG.					**412**
2	3	17		3		3	2		4		29	39	506
	6			8		4		1		1	14	38	251
	10			5		1	2	2	16		26	36	491
	13	1				11	3	3	5	1	24	41	398
	14	1				8	3	1	7		20	37	368
	18	1		10		3		1	11		26	39	453
								ZONE 2 AVG.					**411**
3	1		6	4	19						29	40	493
	2		8	13	14						35	36	661
	7	4		27		6					37	37	680
	19	9		2							11	23	325
								ZONE 3 AVG.					**540**
								TOTAL AVG.					**436**

Site Notes:

Zone 1: Other species noted: sedges, broomsedge, various grasses, cattails, *Juncus* sp., trumpet creeper, fennel, briars, *Baccharis halimifolia*, Queen-Anne's-lace, ragweed, *Aster* sp., *Sesbania* sp., horse-neetle, redbay, red maple, volunteer hickory, and sweetgum. Plot 4 is overgrown with heavy trumpet creeper and broomsedge making trees difficult to find.

Zone 2: Other species noted: sedges, *Baccharis halimifolia*, various grasses, few volunteer hickory, pine, red maple, sweetgum, trumpet creeper, panic grass, broomsedge, *Juncus* sp., briars, *Sesbania* sp., fennel, Queen-Anne's-lace, redbay, ragweed, volunteer tulip poplar, horse-nettle, and *Aster* sp. Half of plot 6 had standing water.

Zone 3: Other species noted: broomsedge, various grasses and sedges, cattails, *Juncus* sp., *Baccharis halimifolia*, switch grass, Queen-Anne's-lace, black willow, volunteer pine, fennel, wax myrtle and few red maple. Plot 19 has heavy switch grass.

3.3B Results of Vegetation Monitoring (3 year)

(Marsh Grass Area)

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pugens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex valpinoidea*	*Spartina cynosuroides*	Frequency
1	2.0														
2	3.0														
3	2.0									✓					✓
4	0.0														ow
5	5.0														
6	2.0														
7	0.0														ow
8	2.0														
9	3.0		✓							✓					✓
10	5.0	✓													✓
11	2.0														
12	2.0									✓					✓
13	5.0	✓													✓
14	2.0	✓													✓
15	4.0									✓					✓
16	5.0	✓													✓
17	4.0	✓													✓
18	4.0														
19	3.0									✓					✓
20	5.0														
21	2.0														
22	4.0									✓					✓
23	3.0	✓								✓					✓
24	5.0									✓					✓
25	2.0														
26	2.0														
27	4.0									✓					✓
28	4.0														
29	3.0	✓													✓
30	2.0														
31	2.0	✓													✓
32	4.0								✓						✓
33	2.0									✓					✓
34	5.0	✓													✓
35	2.0									✓					✓
36	3.0														
37	2.0														
38	3.0		✓						✓						✓
39	2.0									✓					✓
40	2.0									✓					✓
41	0.0														ow
42	3.0	✓													✓
43	3.0														
44	5.0	✓													✓
45	5.0	✓							✓						✓
46	5.0														
47	2.0														
48	5.0	✓	✓												✓
49	3.0									✓					✓
50	3.0														
51	4.0														
52	5.0								✓						✓
53	2.0														
54	3.0	✓													✓
55	3.0	✓													✓
56	4.0									✓					✓
57	3.0									✓					✓
58	4.0									✓					✓
59	4.0														
60	5.0														

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pungens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroides*	Frequency
61	3.0														
62	0.0														ow
63	5.0									✓					✓
64	5.0	✓													✓
65	5.0	✓													✓
66	2.0									✓					✓
67	3.0	✓													✓
68	5.0									✓	✓				✓
69	5.0									✓					✓
70	2.0														
71	0.0														ow
72	2.0														
73	5.0	✓													✓
74	2.0														
75	3.0								✓						✓
76	2.0														
77	2.0									✓					✓
78	3.0														
79	5.0	✓													
80	5.0														
81	2.0								✓	✓					✓
82	3.0													✓	✓
83	2.0								✓	✓					✓
84	5.0	✓												✓	✓
85	4.0													✓	✓
86	3.0									✓					✓
87	2.0	✓													✓
88	2.0														
89	3.0													✓	✓
90	2.0														
91	2.0		✓												✓
92	5.0	✓													✓
93	5.0	✓													✓
94	5.0	✓	✓												✓
95	1.0									✓					✓
96	3.0									✓					✓
97	5.0								✓						✓
98	5.0	✓													✓
99	4.0						✓		✓						✓
100	5.0	✓													✓
101	2.0									✓					✓
102	3.0									✓					✓
103	2.0				✓										✓
104	5.0	✓					✓								✓
105	2.0													✓	✓
106	4.0														
107	2.0														
108	2.0							✓		✓					✓
109	3.0		✓												✓
110	3.0							✓		✓					✓
111	2.0	✓													✓
112															ow
113	5.0	✓				✓									✓
114	2.0														
115	2.0		✓												✓
116	2.0	✓								✓					✓
117	4.0													✓	✓
118	2.0	✓													✓
119	2.0														
120	5.0	✓													✓

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pungens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroide*	Frequency
121	2.0	✓								✓					✓
122	3.0			✓						✓					✓
123	4.0			✓											✓
124															ow
125	3.0	✓													✓
126	4.0			✓						✓					✓
127	0.0														ow
128	0.0														ow
129	2.0														
130	2.0	✓													✓
131	5.0									✓					✓
132	5.0														
133	5.0	✓													✓
134	3.0	✓								✓					✓
135	3.0								✓	✓					✓
136	3.0														
137	4.0	✓													✓
138	3.0	✓					✓								✓
139	2.0									✓					✓
140	3.0	✓												✓	✓
141	2.0									✓					✓
142	3.0		✓												✓
143	4.0		✓												✓
144	2.0	✓													✓
145	1.0								✓						✓
146	3.0														
147	2.0		✓							✓					✓
148	2.0		✓												✓
149	5.0		✓												✓
150	4.0									✓					✓
151	5.0														
152	2.0														
153	2.0		✓												✓
154	3.0									✓					✓
155	3.0														
156	3.0									✓					✓
157	5.0														
158	2.0		✓												✓
159	5.0	✓													✓
160	5.0														
161	2.0				✓										✓
162	3.0	✓													✓
163	3.0														
164	2.0														
165	5.0	✓													✓
166	5.0	✓													✓
167	2.0														
168	5.0	✓					✓								✓
169	2.0	✓													✓
170	2.0									✓					✓
171	2.0									✓					✓
172	2.0														
173	5.0														
174															ow
175	3.0				✓										✓
176	3.0		✓												✓
177	3.0														
178	3.0	✓													✓
179	3.0									✓					✓
180	2.0														

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pugens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroides*	Frequency
181	3.0	✓													✓
182	5.0	✓													✓
183	2.0														
184	2.0									✓					✓
185	1.0														
186	5.0	✓	✓												✓
187	3.0	✓													✓
188	0.0														ow
189	5.0	✓													✓
190	3.0			✓											✓
191	2.0														
192	2.0	✓							✓	✓					✓
193	0.0														ow
194	2.0								✓						✓
195	0.0														ow
196	3.0			✓											✓
197	2.0									✓					
198	5.0	✓													✓
199	2.0														
200	2.0									✓					
201	5.0	✓													✓
202	2.0									✓					✓
203	5.0	✓													✓
204	5.0														
205	0.0														OW
206	2.0														
207	2.0									✓					✓
208	2.0									✓					✓
209	2.0						✓			✓					✓
210	5.0	✓	✓												✓
211	3.0				✓										✓
212	5.0	✓													✓
213	5.0		✓	✓							✓				✓
214	2.0	✓								✓					✓
215	3.0	✓													✓
216	5.0						✓		✓						✓
217	2.0									✓				✓	✓
218	5.0	✓													✓
219	5.0						✓							✓	✓
220	2.0									✓					✓
221	3.0														
222	2.0														
223	3.0				✓					✓					✓
224	5.0	✓													✓
225	2.0									✓					
226	3.0		✓												✓
227	2.0								✓	✓					✓
228	2.0	✓													✓
229	3.0									✓					
230	2.0														
231	3.0									✓					✓
232	2.0	✓													✓
233	2.0									✓					✓
234	2.0		✓							✓					✓
235	2.0							✓		✓					✓
236	2.0									✓					✓
237	3.0									✓					✓
238	2.0		✓												✓
239	3.0														
240	5.0	✓					✓								✓

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pungens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroides*	Frequency
241	3.0	✓													✓
242	2.0									✓					✓
243	2.0														
244	2.0														
245	2.0														
246	2.0									✓					✓
247	2.0														
248	2.0													✓	✓
249	2.0	✓													
250	0.0														OW
251	4.0									✓				✓	✓
252	0.0														OW
253	2.0						✓			✓					✓
254	2.0	✓							✓						✓
255	2.0								✓						✓
256	3.0									✓					✓
257	2.0									✓					✓
258	4.0	✓		✓											✓
259	2.0									✓					✓
260	3.0	✓	✓												✓
261	2.0		✓							✓					✓
262	1.0														
263	0.0														OW
264	2.0									✓					✓
265	3.0														
266	3.0		✓							✓					✓
267	3.0	✓													✓
268	3.0	✓													✓
269	3.0									✓					✓
270	0.0														OW
271	2.0		✓												✓
272	2.0														
273	3.0	✓													✓
274	0.0														OW
275	3.0									✓					✓
276	2.0									✓					✓
277	2.0														
278	3.0				✓										✓
279	2.0														
280	3.0									✓					✓
281	2.0								✓	✓					✓
282	2.0														
283	5.0			✓											✓
284	3.0									✓					✓
285	0.0														OW
286	2.0									✓					✓
287	2.0									✓					✓
288	2.0		✓												✓
289	4.0									✓					✓
290	2.0														
291	3.0	✓													✓
292	4.0	✓													
293	0.0														OW
294	4.0														
295	2.0								✓	✓					✓
296	2.0									✓					✓
297	2.0														
298	5.0														
299	2.0														
300	2.0									✓					✓

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pungens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroides*	Frequency
301	2.0	✓													✓
302	0.0														OW
303	4.0									✓					✓
304	4.0														
305	3.0														
306	3.0							✓		✓					✓
307	5.0													✓	✓
308	3.0									✓					✓
309	3.0									✓					✓
310	2.0									✓					✓
311	2.0														
312	0.0														OW
313	2.0														
314	0.0														OW
315	2.0	✓													✓
316	3.0									✓					✓
317	3.0														
318	5.0	✓													✓
319	2.0									✓					✓
320	4.0	✓		✓						✓					✓
321	2.0														
322	5.0	✓	✓												✓
323	2.0									✓					✓
324	4.0						✓								✓
325	5.0									✓					✓
326	3.0														
327	2.0	✓													✓
328	3.0									✓					✓
329	2.0														
330	2.0									✓					✓
331	2.0									✓					✓
332	3.0	✓													✓
333	3.0	✓													✓
334	4.0	✓							✓						✓
335	2.0														OW
336	3.0	✓													✓
337	2.0									✓					✓
338	3.0		✓		✓					✓					✓
339	5.0	✓													✓
340	4.0		✓	✓											✓
341	2.0									✓					✓
342	4.0			✓						✓					✓
343	2.0														
344	3.0	✓													✓
345	4.0	✓													✓
346	2.0					✓									✓
347	3.0									✓					✓
348	2.0	✓													✓
349	2.0														
350	2.0									✓					✓
351	4.0			✓											✓
352	2.0														
353	2.0									✓					✓
354	0.0														OW
355	0.0														OW
356	4.0									✓					✓
357	2.0									✓					✓
358	2.0									✓					✓
359	3.0	✓													✓
360	2.0	✓													✓

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pugens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroides*	Frequency
361	4.0		✓												✓
362	5.0	✓													✓
363	5.0	✓													✓
364	3.0								✓	✓					✓
365	2.0			✓						✓					✓
366	2.0									✓					✓
367	0.0														OW
368	2.0	✓								✓					✓
369	3.0	✓	✓												✓
370	3.0														
371	2.0									✓					✓
372	2.0									✓					✓
373	5.0	✓													✓
374	3.0	✓							✓	✓					✓
375	2.0									✓					✓
376	2.0														
377	3.0	✓													
378	2.0														
379	3.0			✓						✓					✓
380	3.0	✓								✓					✓
381	3.0														
382	3.0	✓								✓					✓
383	2.0														
384	3.0				✓										✓
385	4.0	✓													✓
386	3.0		✓												✓
387	4.0				✓					✓					✓
388	0.0														OW
389	3.0								✓	✓					✓
390	2.0									✓					✓
391	3.0		✓												✓
392	2.0						✓			✓					✓
393	2.0								✓						✓
394	2.0	✓											✓	✓	✓
395	2.0														
396	5.0	✓													✓
397	3.0	✓													✓
398	4.0					✓									✓
399	3.0	✓													✓
400	4.0	✓													✓
401															
402	3.0														
403	5.0	✓													✓
404	4.0		✓												✓
405	0.0														OW
406	2.0									✓					✓
407	4.0														
408	0.0														OW
409	2.0				✓					✓					✓
410	5.0	✓													✓
411	0.0														OW
412	2.0									✓					✓
413	3.0		✓							✓					✓
414	5.0	✓								✓				✓	✓
415	3.0	✓													✓
416	2.0	✓								✓					✓
417	3.0	✓	✓							✓					✓
418	2.0									✓					✓
419	4.0			✓	✓				✓	✓					✓
420	2.0														

Plot #	Scale Factor	*Juncus effusus*	*Scirpus cyperinus*	*Juncus roemerianus*	*Scirpus robustus*	*Scirpus pungens*	*Scirpus americanus*	*Scirpus atrovirens*	*Cladium jamaicense*	*Juncus gerardii*	*Distichlis spicata*	*Carex lupida*	*Carex vulpinoidea*	*Spartina cynosuroide*	Frequency
421	3.0														
422	0.0														OW
423	5.0	✓													✓
424	2.0									✓					✓
425	3.0	✓								✓					✓
426	3.0								✓						✓
427	2.0									✓					✓
428	2.0									✓					✓
429	2.0									✓					✓
430	3.0			✓											
431	2.0														
432	3.0		✓	✓											✓
433	3.0	✓													✓
434	0.0														OW
435	2.0	✓													✓
436	5.0														
437	2.0									✓					✓
438	3.0		✓												✓
439	3.0		✓												✓
440	2.0									✓					✓
441	3.0	✓													✓
442	3.0														
443	0.0														OW
444	2.0	✓								✓					✓
445	3.0		✓												✓
446	2.0														
447	4.0									✓					✓
448	2.0										✓				✓
449	2.0														
450	3.0														
451	4.0			✓											✓
452	3.0									✓					✓
453	5.0	✓								✓					✓
454	3.0														
455	0.0														OW
456	3.0									✓					✓
457	0.0														OW
458	0.0														OW
459	4.0	✓													✓
460	0.0														OW
461	2.0									✓					✓
462	2.0									✓					✓
463	2.0									✓					✓
464	4.0	✓	✓												✓
465	3.0			✓											✓
466	5.0	✓								✓					✓
467	2.0	✓													✓
468	3.0									✓					✓
469	5.0														
470	3.0									✓					✓
471	2.0														
472	2.0									✓					✓
473	0.0														OW
474	2.0									✓					✓
475	3.0		✓												✓
476	3.0								✓	✓					✓
477	2.0									✓					✓
478	0.0														OW
479	2.0									✓					✓
480	3.0		✓												✓

481	5.0	✓													✓
482	2.0									✓					✓
483	5.0	✓													✓
484	2.0									✓					✓
485	2.0								✓	✓					✓
486	4.0	✓													✓
487	4.0														
488	2.0				✓					✓					✓
489	0.0														**OW**
490	2.0														
491	5.0									✓					✓
492	5.0						✓								✓
493	5.0	✓								✓					✓
494	3.0					✓									✓
495	2.0	✓								✓					✓
496	3.0	✓													✓
497	3.0														
498	3.0				✓					✓					✓
499	3.0														
500	2.0								✓	✓					✓
Frequency/Percentage Plots		28.6	9.4	4.1	2.8	0.9	2.6	0.9	6.3	36.9	0.4	0.0	0.2	3.1	73.6
with Desired Species															
Sum Scale Value															1387
Total Number of Plots															458
Vegetative Cover (Scale Value)															3.03

Site Notes: The following species were also noted in the monitoring plots. The number of plots the species was found in is following the species in parentheses (i.e. goldenrod was noted in 207 plots).

Goldenrod (207), arrowhead (7), silver bunchgrass (2), red maple (10), *Baccharis halimifolia* (45), *Aster* sp. (219), *Juncus acuminatus* (161), Smartweed (101), *Pluchea* sp. (139), lizard tail (4), *Panicum* sp. (26), ragweed (25), broomsedge (49), *Scirpus* sp. (25), barnyard grass (29), pennywort (34), iris (1), pea (8), *Cyperus* sp. (33), horseweed (23), cattail (9), fennel (2), bulrush (1), thistle (1), baldcypress (6), phragmites (2), foxtail (6), water grass (5), pine (7), *Eleocharis* sp. (14), *Ptilimnium* sp. (23), *Hypericum drummondii* (24), *Echinochloa crusgalli* (12), *Linum striatum* (5), *Eryngium aquaticum* (27), duck potato (6), *Juncus* sp. (66), and *Typha* sp. (12).

3.4A Conclusions

Of the 430 acres of this site, approximately 223 involved tree planting. There were 21 plots established throughout the planting areas, encompassing all plant communities. The 2002 vegetation monitoring of the planted area revealed an average density of 436 trees per acre, which is well above the 290 trees per acre required by the minimum success criteria.

3.4B Conclusions

- Percent Frequency of Target Species (planted species) **73.6%**
  Frequency of 70% required.
- Vegetative Cover Scale Value **3.03**
  Scale Value of 5 required for year 5.

Of the 430 acres of this site, approximately 48 acres involved marsh grass planting. There were 500 random plots established throughout the planting areas, encompassing all plant communities. These plots were located with GPS. The marsh was replanted in June of 2000. The plantings are continuing to increase in cover.

NCDOT will continue vegetation monitoring at the Ballance Farm Mitigation Site.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

The year 2002 represents the fourth growing season that the hydrologic data has been examined. The majority of the monitoring gauges on site have shown saturation and inundation for long periods of time. Hydrologic monitoring data in 2002 met or exceeded the success criteria for jurisdictional wetland hydrology. The hydrology in the created coastal marsh is consistent with the hydrology in the coastal marsh reference ecosystem. Jurisdictional hydrology (greater than 12.5%) was achieved in the created forested wetland at 26 of the 28 groundwater gauge locations. Groundwater monitoring gauges installed at the forested wetland reference ecosystem located on the Richards' property prior to the 2001 monitoring period showed hydrology at 100% of the growing season during an average rainfall year.

Of the 430 acres of this site, approximately 223 involved tree planting. There were 21 plots established throughout the planting areas, encompassing all plant communities. The vegetation monitoring of the planted area revealed the average density to be 436 trees per acre, which is well above the 290 trees per acre required by the minimum success criteria after 4 years.

Of the 430 acres of this site, approximately 48 acres involved coastal marsh grass planting. There were 500 random plots established throughout the planting areas, encompassing all plant communities. These plots were located with GPS. The marsh was replanted in June. The percent frequency of target specie (planted species) is 73.6% as monitored. The success criteria requirement is 70%. The initial plantings are continuing to increase in cover. The vegetative cover scale value is 3.03, and the required vegetative scale value for year 5 is 5.

Vegetation and Hydrologic monitoring activities will continue for another year at the Ballance Farm Mitigation site.

APPENDIX A

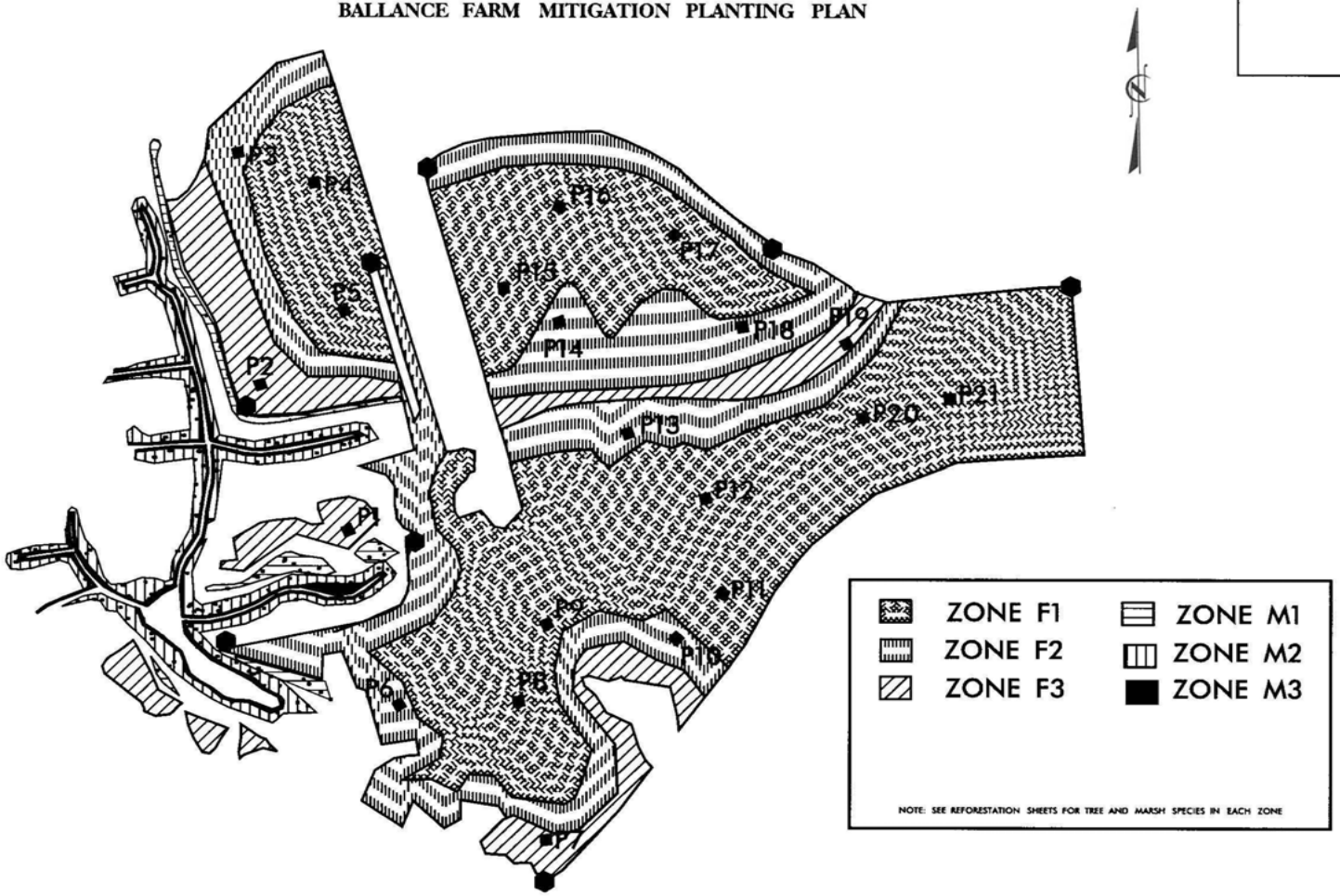
DEPTH TO GROUNDWATER
And
SURFACE GAUGE PLOTS

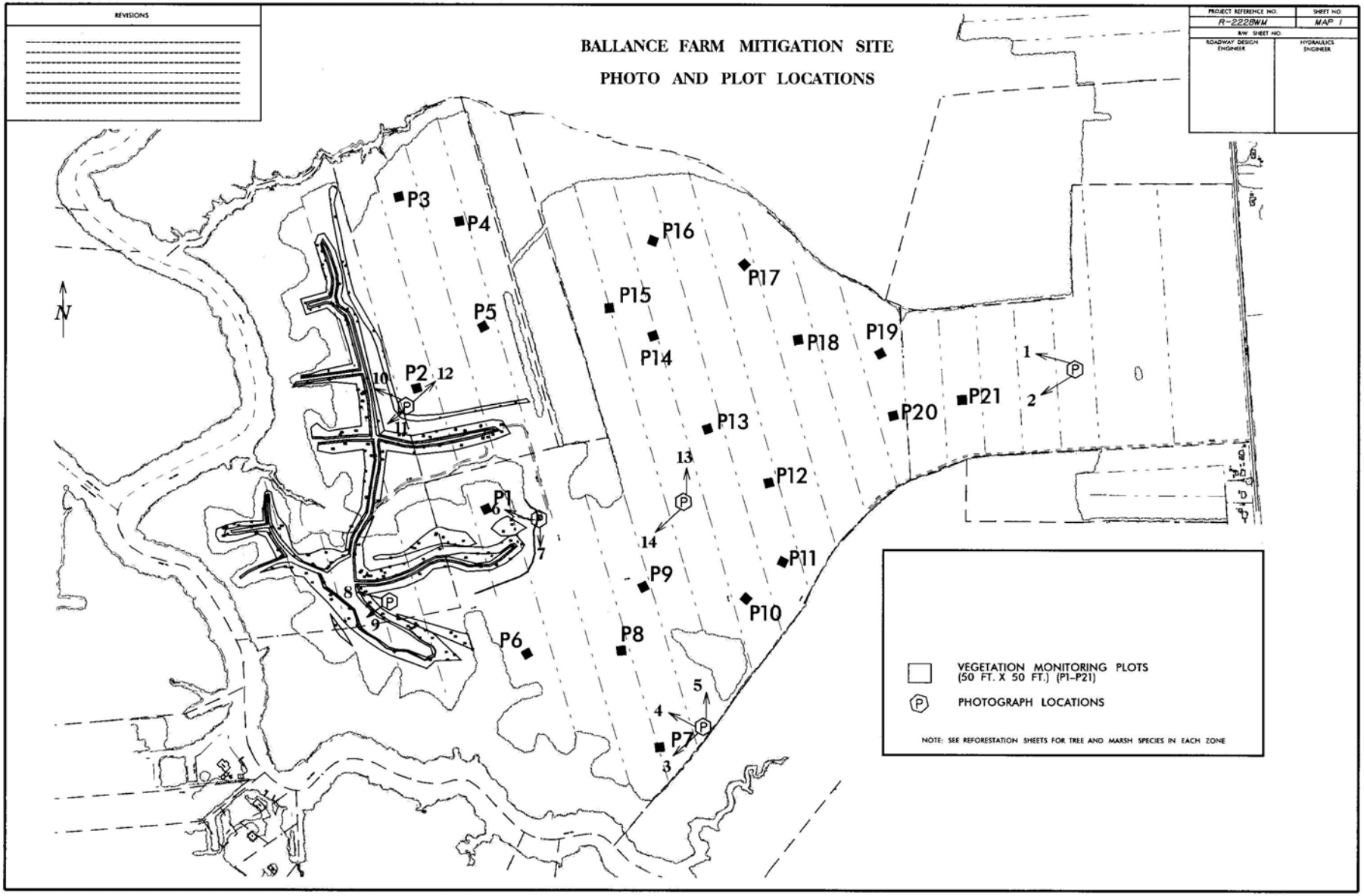
Planting Plan
Photo & Plot Locations
Marsh Grass Random Plot Location

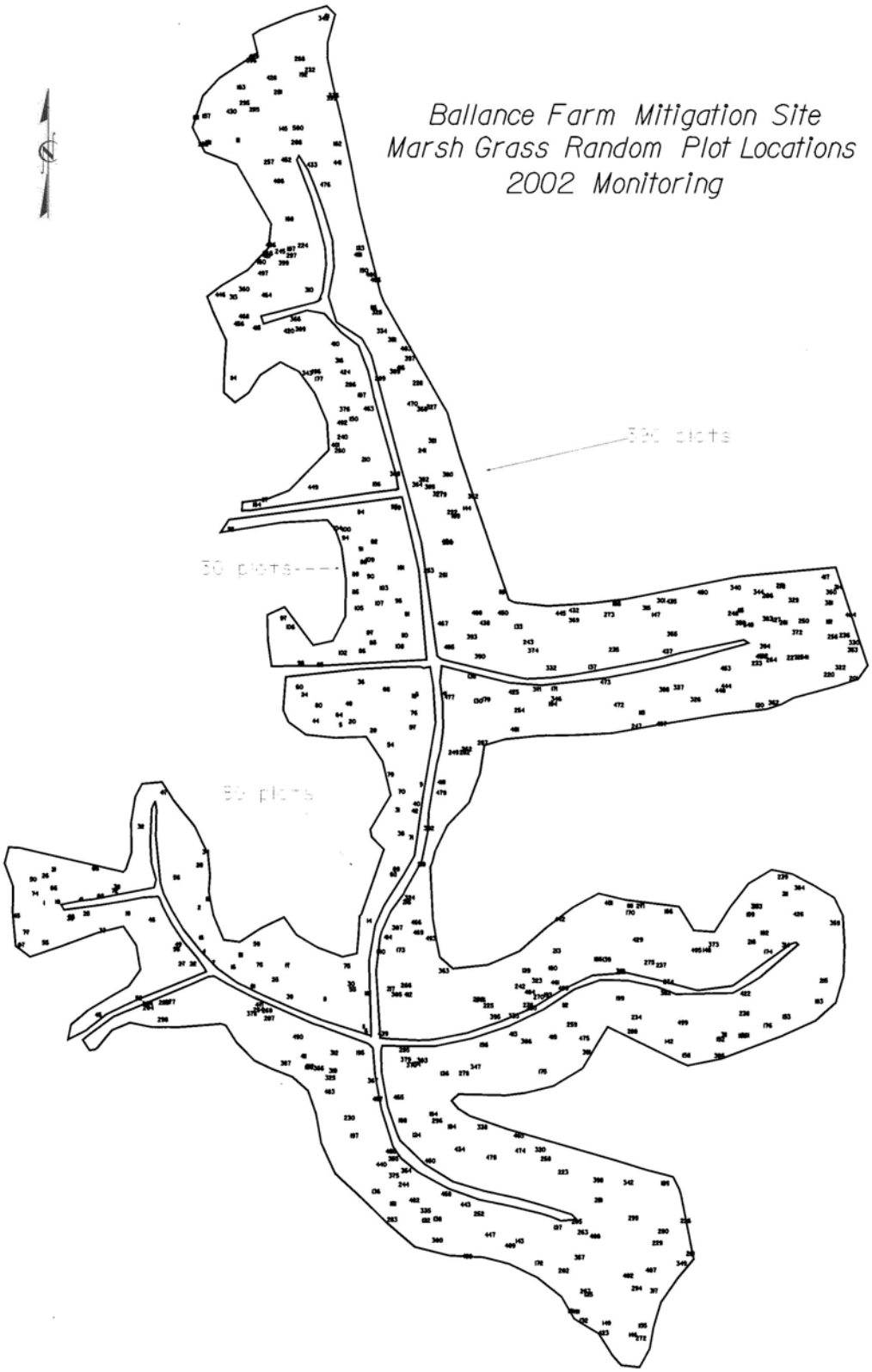
PROJECT REFERENCE NO.	SHEET NO.
R-2228WM	WM-1
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

CURRITUCK COUNTY, NORTH CAROLINA

BALLANCE FARM MITIGATION PLANTING PLAN




BALLANCE FARM MITIGATION SITE
PHOTO AND PLOT LOCATIONS
REVISIONS
PROJECT REFERENCE NO.
R-2228WM
SHEET NO.
MAP 1
R/W SHEET NO.
ROADWAY DESIGN ENGINEER
HYDRAULICS ENGINEER
N
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
P17
P18
P19
P20
P21
1
2
3
4
5
6
7
8
9
10
11
12
13
14
VEGETATION MONITORING PLOTS (50 FT. X 50 FT.) (P1-P21)
PHOTOGRAPH LOCATIONS
NOTE: SEE REFORESTATION SHEETS FOR TREE AND MARSH SPECIES IN EACH ZONE


Ballance Farm Mitigation Site
Marsh Grass Random Plot Locations
2002 Monitoring
330 plots
30 plots
90 plots

APPENDIX C

SITE PHOTOS

BALLANCE FARM

Photo 1

Photo 2

Photo 3

Photo 4

BALLANCE FARM

Photo 5

Photo 6

Photo 7

Photo 8

BALLANCE FARM

Photo 9

Photo 10

Photo 11

Photo 12

BALLANCE FARM

Photo 13

Photo 14