ANNUAL REPORT FOR 2002

ABC WETLAND MITIGATION SITE
BEAUFORT COUNTY
PROJECT NO. 8.T221801
TIP No. R-2510WM

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North Carolina Department of Transportation
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ABC MITIGATION SITE

2002 REPORT – EXECUTIVE SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at ABC Mitigation Site. The site was constructed during the months of September 2000-January 2001. Monitoring activities in 2002 represent the second year of monitoring. The site must demonstrate vegetation and hydrological success for a minimum of five years.

The ABC site contains 29 groundwater monitoring gauges (21 on-site & 8 reference gauges) and 1 on-site rain gauge. Following site construction 21 groundwater gauges were installed throughout the site. Six additional groundwater gauges were recently installed in March and April 2002.

Hydrologic monitoring indicated that of the 29 groundwater gauges on-site, 25 showed saturation for over 12.5% of the growing season, 2 gauges showed saturation levels between 8 %– 12.5%, and only 2 gauges indicated less than 5% of the 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 Washington rain gauge, maintained by the NC State Climate Office.

Of the 187 acres of this site, approximately 140.7 acres involved tree planting. There were 13 vegetation-monitoring plots established throughout the planting areas. The 2002 vegetation monitoring of the planted areas revealed an average density of 550 trees per acre. This is above the minimum 320 trees per acre.

Based on the hydrologic and vegetation monitoring, the ABC 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 North Carolina Department of Transportation (NCDOT) established the ABC Wetland Mitigation Site (hereinafter referred to as the Site) to provide up-front, wetland replacement for unavoidable highway related wetland impacts in the region. The 75-hectare (184-acre) tract is situated approximately 18 kilometers (11 miles) northeast of Washington and approximately 77 kilometers (48 miles) west of Beaufort County, North Carolina (Figure 1).

The Site had been cleared, ditched, and drained, with wetlands effectively removed to facilitate agricultural production and to convey runoff into Acre Swamp located along the southeastern border of the Site. Wetland mitigation activities were designed to restore wetland features and functions similar to those exhibited by reference wetlands in the region. Site alterations designed to restore characteristic wetland soil features and groundwater wetland hydrology include depression construction (B-horizon contouring), impervious ditch plug construction, ditch backfilling, field crown removal, and harrowing/scarification of wetland soil surfaces. Following construction the Site was planted with native vegetation characteristic of the target ecosystem.

Pre-construction investigations suggested that the Site would support the following communities: 37 hectares (92 acres) of restored non-riverine forested wetlands; 7 hectares (19 acres) of enhanced non-riverine wetland systems; and approximately 1252 meters (4107 feet) of stream enhancement (including streamside plantings and riparian forest buffer restoration). In addition, groundwater recharge was expected to improve within the remaining 31 hectares (76 acres) of uplands and streamside management areas. These areas were estimated based on soil types, local topographic features, elevation and slope, landscape position, and groundwater model forecast (DRAINMOD).

1.2 Purpose

The purpose of this project is to provide mitigation for impacts to forested wetlands caused by Transportation Improvement Projects (TIPs) in the region. A monitoring program must be conducted in order to demonstrate successful mitigation. This program includes installation of groundwater gauges to establish a hydrologic record, placement of permanent vegetation sampling plots to record establishment of woody vegetation, and visual documentation of the Site through development of a photographic record. This document summarizes the results of the monitoring program activities at the ABC Wetland Mitigation Site for the 2002 year.

1.3 Project History

January 1997	Site Identification
June 1999	Detailed Mitigation Design Study
September 2000-January 2001	Site Construction
March 2001	Site Planted
March 2001	Initiated Hydrology Monitoring Stages
August, November 2001	Vegetation Monitoring (1 yr.)
August, November 2001	Vegetation Monitoring (1 yr.)
August 2002	Vegetation Monitoring (2 yr.)
March – November 2002	Hydrologic Monitoring (2 yr

Figure 1: SITE LOCATION MAP

2.0 HYDROLOGY

2.1 Success Criteria

Hydrologic success criteria for the Site is based on federal guidelines for wetlands as described in the 1987 U.S. Army Corp of Engineers (COE) Wetlands Delineation manual. These guidelines suggest that an area must be inundated or saturated (within 12 inches of the surface) by surface or groundwater for 12.5% of the growing season (consecutive days). However, areas inundated between 5% and 12.5% of the growing season may warrant jurisdictional classification depending upon factors such as the presence of hydrophytic vegetation and hydric soils. For example, reference groundwater models (DRAINMOD) predict that wetland hydroperiod during early successional phases in restoration areas will average 8 % of the growing season for 55 % of the years and at least 5 % of the growing season for 82 % of the monitoring years. As these sites approach steady state conditions, water storage capacity increases through the improvement of rooting functions, organic material/debris accumulation, and increase in micro-topography. Based on the groundwater model, hydrology success criteria for the five-year monitoring period will include a minimum regulatory criteria, comprising saturation (free water) within one-foot of the soil surface for 5% of the growing season.

The average wetland hydroperiod for this Site is expected to exhibit a gradual increase from 8% of the growing season, immediately after farm land is abandoned and drainage structures are removed, to as much as 20% under steady state forest conditions. Evaluation of success criteria will be supplemented by sampling and data comparison between reference wetland sites. One reference community was monitored for 2002 and is located approximately 0.20 mile north of the Site. Other reference communities are currently being evaluated for the 2002 monitoring period.

The growing season for Beaufort County is defined in the Beaufort County soil survey as the period between March 13 and November 25 (256 days, USDA 1995). In order to meet minimum hydrologic regulatory success as outlined in the Mitigation Plan (5% of the growing season), the groundwater table must remain within 12 inches of the surface for 13 days. Based on the hydrologic forecast average of 8% of the growing season for the first year, wetland hydrology will be met if the groundwater table remains within 12 inches of the surface for at least 20 consecutive days during the growing season. As the Site continues to develop, wetland hydroperiods of 32 consecutive days (12.5%) and possibly 51 consecutive days (20%) are anticipated.'

2.2 Hydrologic Description

Following construction, 21 continuously monitored, groundwater gauges were placed in accordance with specifications in U.S. Corps of Engineers', Installing Monitoring Recorders/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1, August 1993). Sixteen monitoring gauges were installed to provide representative coverage within each of the wetland physiographic landscape areas on the Site. In March and April 2002, 8 additional groundwater gauges were installed on site, 3 of those gauges were installed in the reference site. In addition, five monitoring gauges were placed within the reference wetland community located approximately 0.20 mile north of the Site.
(Figure 2)

Micro-topographical features, such as semi-permanently inundated/saturated depressions and swales of various sizes, were created for the purpose of water storage as well as habitat diversity. Eleven gauges (D1, D2, D4, D6, D7, D8, D9, D10, S1, S2, and S3,) were placed within saturated depressions, while nine gauges (F1, F2, F3, F4, F5, F6, F7, F8, and F9) were placed in non-depressional areas throughout the Site at base elevation. Eight gauges were placed in similar landscape positions within the reference community.

Gauges RD1, RD2, RD3, RD4, and RD5 were placed in depressions while gauges RF1, RF2, and RF3 were placed at base elevation.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days that the gauge met success above this 12-inch depth is noted on each graph. Data determined to be erroneous was omitted; therefore, some gaps appear in the plots.

Precipitation events are included on each graph as bars. The rainfall plotted was obtained from the on-site Infinity rain gauge.

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 256-day growing season. Table 1 shows the hydrologic results for the 2002-growing season.

Figure 2: Monitoring Gauge Location Map

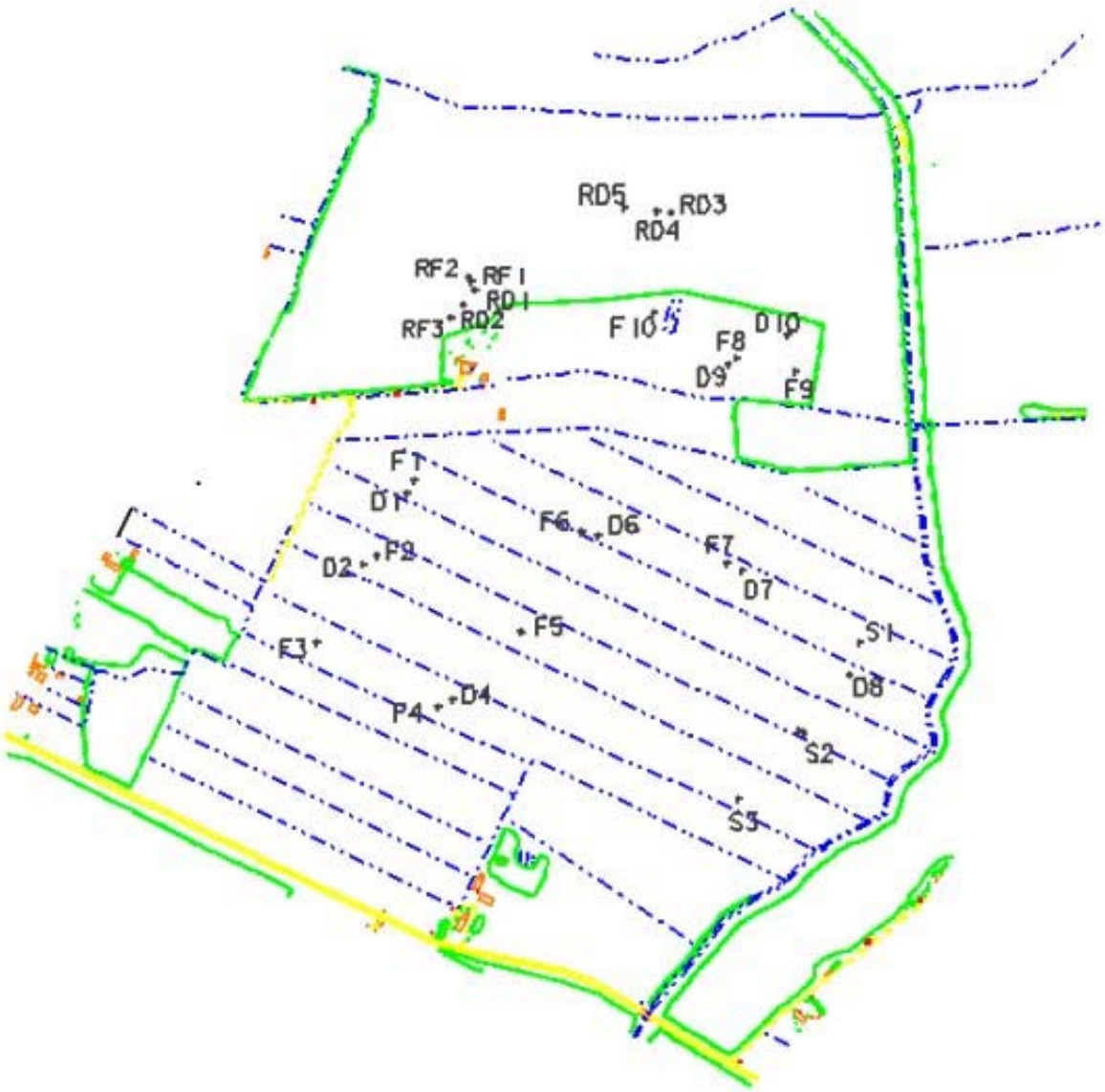


Table 1 A comparison between on-site and reference wetland hydroperiod for the 2002 Monitoring

Monitoring Gauges		<5%	5%-8%	8%-12.5%	> 12.5%	Actual %	Success Dates
Depressions	D1				✓	28.9	3/13-5/25 11/7-11/25
	D2				✓	28.5	3/13-5/24 11/7-11/25
	D4				✓	28.1	3/13-5/23
	D6				✓	25.8	3/13-5/17 11/6-11/25
	D7				✓	33.2	3/13-6/5
	D8				✓	23.4	3/13-5/11
	D9				✓	24.6	3/13-5/14
	D10	✓				2.0	
	S1				✓	35.2	3/13-6/10 11/6-11/25
	S2				✓	25	3/13-5/15 11/6-11/25
	S3				✓	30.1	3/13-5/28
Base Elevation	F1				✓	29.7	3/13-5/27 10/30-11/25
	F2				✓	30.5	3/13-5/29 10/30-11/25
	F3				✓	23.4	3/13-5/11 11/7-11/25
	F4				✓	36.3	3/13-6/13 11/7-11/25
	F5				✓	31.3	3/13-5/31 10/30-11/25
	F6				✓	25.8	3/13-5/17 10/30-11/25
	F7				✓	31.3	3/13-5/31 11/6-11/25
	F8				✓	18.8	3/14-4/30
	F9				✓	14.1	3/14-4/18
	F10				✓	14.5	4/9-5/15
Reference	RD1				✓	19.9	3/13-5/2
	RD2				✓	18.8	3/13-4/29
	RD3	✓				3.9	
	RD4			✓		8.6	4/8-4/28
	RD5			✓		8.6	4/8-4/28
	RF1				✓	22.7	3/13-5/9
	RF2				✓	22.3	3/13-5/8
	RF3				✓	22.7	3/13-5/9

Gauges F8, F9, F10, D9, D10, RD3, RD4, and RD5 were installed this year (2002).

Specific Gauge Problems:

- F10 experienced gauge malfunctions during installation of the gauge (March 13-April 8)
- RF2 stopped recording data (May 9-July 11)
- RD2 stopped recording data (May 18-July 11)
- RD1, RD3 experienced gauge malfunctions at the end of the growing season from (November 1-December)
- RD3, RD4, RD5 were all installed April 3, therefore no data was recorded for these gauges until after installation.
- RD5 stopped recording data (June 19-July 11)

For the 2002 monitoring year, groundwater data indicates that the average wetland hydroperiod (for consecutive days) 25 of the 29 gauges (on-site and reference) exceeds the success criteria of 12.5%. Of these 29 gauges, 21 on-site groundwater gauges indicate that wetland hydroperiod exceeded the 12.5% jurisdictional threshold. Five of the 8 reference groundwater gauges exceeded the success criteria of 12.5%. Overall, on-site gauges exhibited similar results or exceed saturation periods with gauges in the reference community.

2.3.2 Climatic Data

The majority of this Site is characterized as a precipitation driven system and wetland hydroperiod is completely dependent upon local weather patterns. Figure 4 is a comparison of monthly rainfall for the period of November 2001 through November 2002 to historical precipitation (collected between 1971 and 2002) for Washington, North Carolina. Rainfall data from the Washington rain gauge was not available for months of August-November. For these particular months, the onsite rain gauge at ABC site was used for the monthly rainfall. 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.

For the 2002-year, November 01, February, April, May, July, and August experienced below average rainfall. The months of December 01 and June all recorded average rainfall for the site. January, March, October, and November experienced above average rainfall. No data is available for the month of September. Overall, 2002 experienced a below average rainfall year.

2.4 Conclusions

Hydrologic data indicate that the Site met or exceeded wetland jurisdictional status for the 2002-monitoring year. Twenty-five of the 29 gauges (both on-site and reference) exceeded 12.5% of the growing season. Gauges RD4 and RD5 exceeded the forecast 8% of the growing season and gauges D10 and RD3 fell below the 5% saturation. In addition, rainfall amounts were below average for the 2002-growing season. A good indication that the Site should be considered successful is that wetland hydroperiod for the Site is similar or exceeds that of reference wetland.

Figure 3: 2002 Hydrologic Monitoring Results

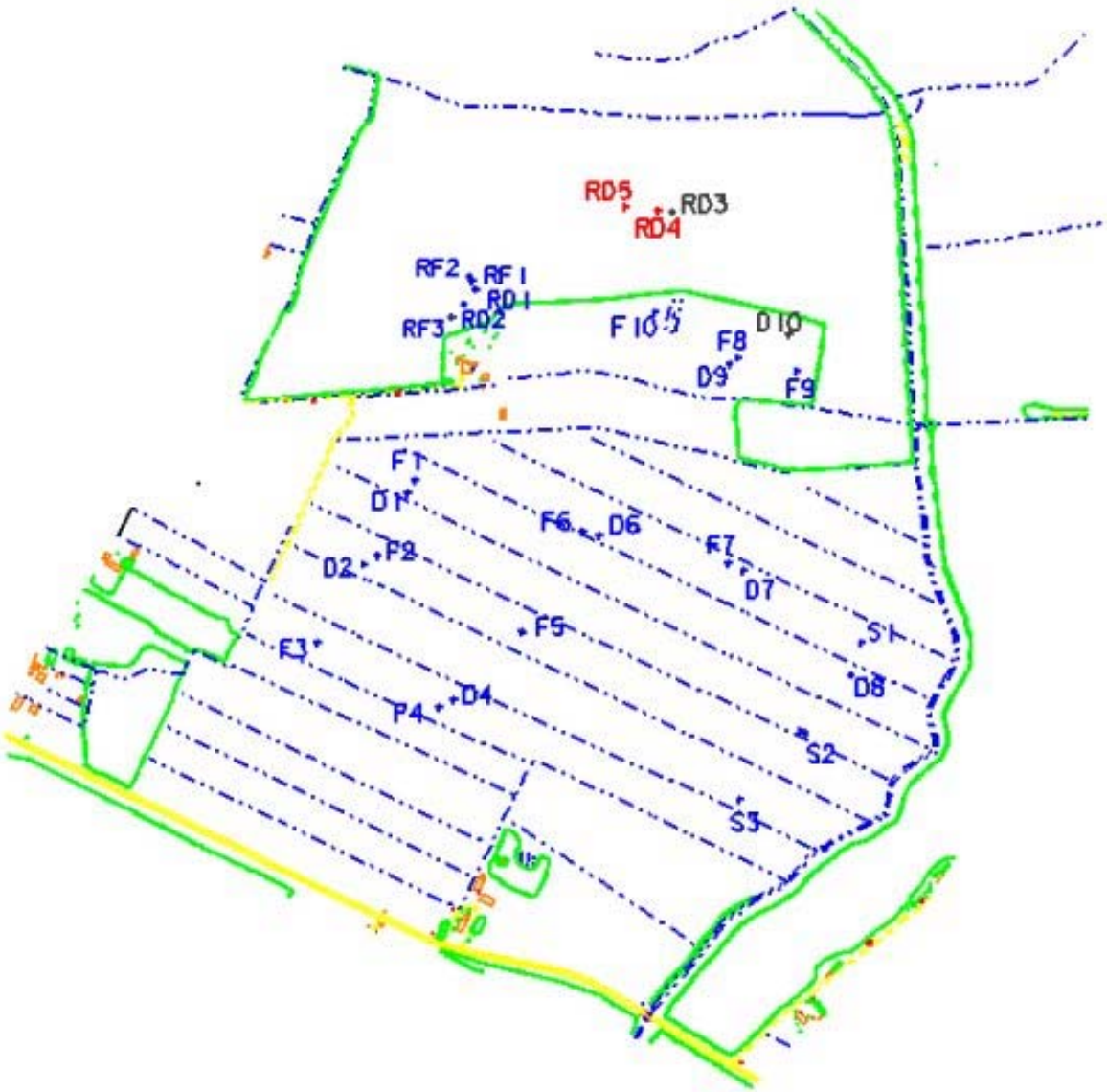
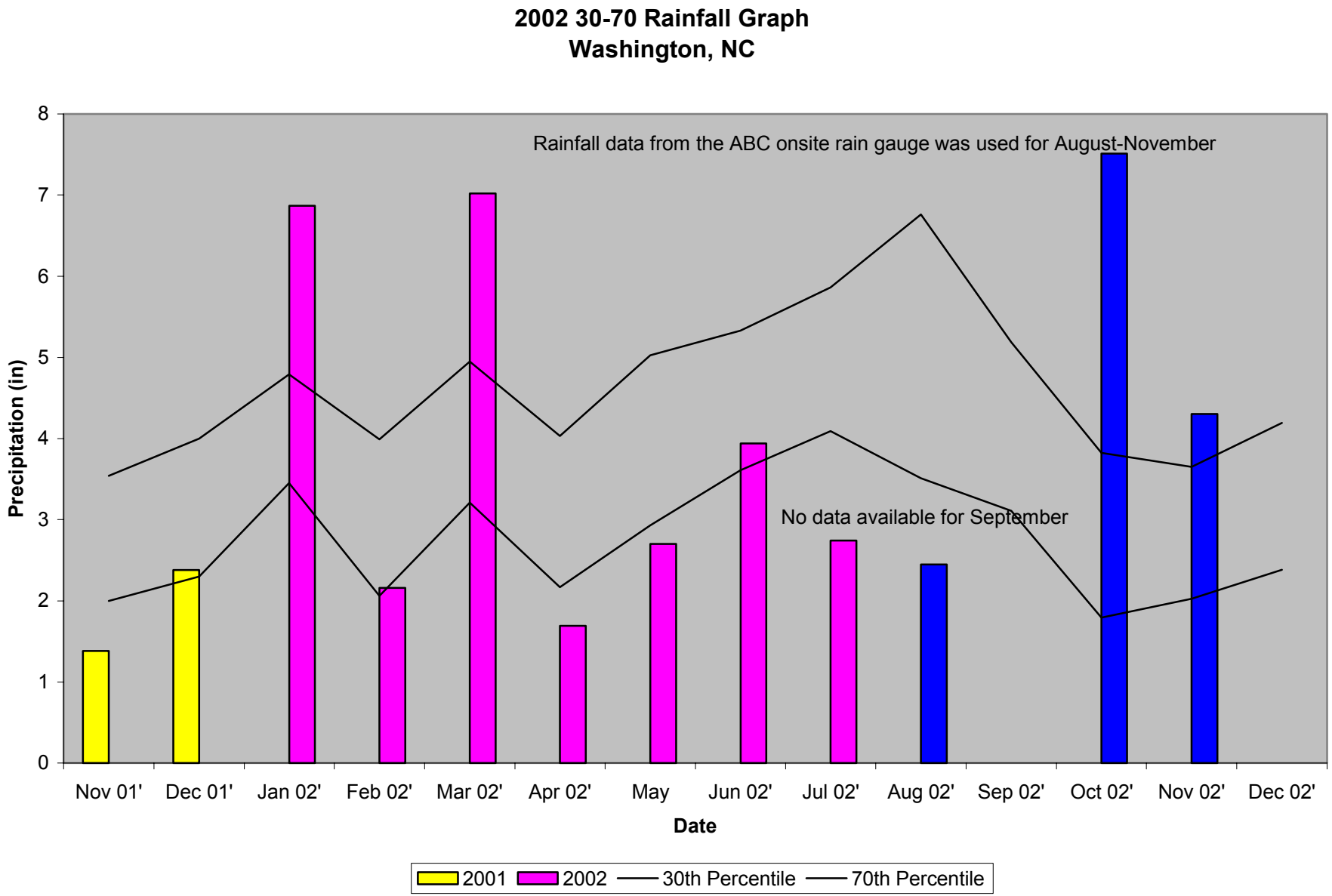


Figure 4: 30-70 Percentile Graph



3.0 VEGETATION: ABC MITIGATION SITE (YEAR 2 MONITORING)

3.1 Success Criteria

Success Criteria states that there must be a minimum of 320 trees per acre living for at least three consecutive years. A minimum of 290 trees per acre living at year 4 and a minimum of 260 trees per acre living at year 5.

3.2 Description of Species

The following tree species were planted in the Wetland Restoration Area:

Zone 1: Levee/Streambank Forest

Taxodium distichum, Baldcypress
Nyssa sylvatica var. *biflora*, Swamp Blackgum
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak
Quercus phellos, Willow Oak
Betula nigra, River Birch

Zone 2: Riverine Swamp Forest

Taxodium distichum, Baldcypress
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak
Quercus phellos, Willow Oak
Fraxinus pennsylvanica, Green Ash
Quercus michauxii, Swamp Chestnut Oak

Zone 3: Mesic Hardwood Forest

Fraxinus pennsylvanica, Green Ash
Quercus michauxii, Swamp Chestnut Oak
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Liriodendron tulipifera, Tulip Poplar
Quercus rubra, Northern Red Oak
Quercus alba, White Oak

Zone 4: Non-Riverine Wet Hardwood Forest

Nyssa sylvatica var. *biflora*, Swamp Blackgum
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak
Quercus phellos, Willow Oak
Fraxinus pennsylvanica, Green Ash
Quercus michauxii, Swamp Chestnut Oak

Zone 5: Dry Mesic Oak/Hickory Forest

Quercus rubra, Northern Red Oak
Quercus alba, White Oak
Carya tomentosa, Mockernut Hickory
Nyssa sylvatica, Blackgum
Carya glabra, Pignut Hickory
Quercus falcata, Southern Red Oak

3.3 Results of Vegetation Monitoring

ZONE	Plot #	Baldcypress	Swp. Blackgum	Laurel Oak	Overcup Oak	Willow Oak	River Birch	Green Ash	Swp. Chestnut Oak	Cherrybark Oak	Tulip Poplar	Northern Red Oak	White Oak	Mockernut Hickory	Blackgum	Pignut Hickory	Southern Red Oak	Total (2 year)	Total (at planting)	Density (Tree/Acre)
1	12	12			1				16			3						32	32	680
	13		1	6	13	4	3		4									31	35	602
									ZONE 1 AVERAGE DENSITY											641
2	10	1			8	5				2								16	32	340
	11	17			7			9										33	33	680
									ZONE 2 AVERAGE DENSITY											510
3	8							7		4		5	9					25	33	515
	9									13	1	6	1					21	31	461
									ZONE 3 AVERAGE DENSITY											488
4	1		1	2	6	21		1										31	31	680
	2		2			7		2	16									27	34	540
	3	5			8	5		1	7									26	31	570
	4	1	1		19	3		14	1									39	39	680
	5		1		9	1		19										30	35	583
									ZONE 4 AVERAGE DENSITY											611
5	6											5		1	4			10	31	219
	7				2	4						1	3		1		17	28	32	595
									ZONE 5 AVERAGE DENSITY											407
									TOTAL AVERAGE DENSITY											550

Site Notes:
Zone 1: Other species noted: Goldenrod, *Aster* sp. and fennel. Plots 12 and 13 are 100' x 25' due to the size of the zone.
Zone 2: Other species noted: smartweed, foxtail, fennel, *Aster* sp., ragweed, *Juncus* sp., and *Scirpus* sp. Cattails and standing water were noted in the swales.
Zone 3: Other species noted: volunteer pine, lespedeza, fennel, foxtail, briars, and broomsedge.
Zone 4: Other species noted: foxtail, black willow, smartweed, lespedeza, blackberry, fennel, ragweed, *Juncus* sp., *Carex* sp., *Aster* sp., *Baccharis* sp., *Panicum* sp., and *Eleocharis* sp.
Zone 5: Other species noted: volunteer overcup oak, heavy fennel, and ragweed.

3.4 Conclusions

Of the 187 acres of this site, approximately 140.7 acres involved tree planting. There were 13 vegetation monitoring plots established throughout the planting areas. The 2002 vegetation monitoring of the planted areas revealed an average density of 550 trees per acre. This is above the minimum 320 trees per acre. NCDOT will continue vegetation monitoring at the ABC Mitigation Site.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the initial mitigation design plan, expectations were that the Site would support 37 hectares (92 acres) of restored non-riverine forested wetlands and 7 hectares (19 acres) of enhanced non-riverine wetland systems. Groundwater recharge potential was proposed for restoration or enhancement within the remaining 31 hectares (76 acres) of uplands and stream-side management areas. These estimates were based on landscape position and soil types.

Following the 2002 monitoring season, gauge data indicates that additional areas of the site exhibit wetland hydrology than was predicted in the original mitigation plan. In spite of a decrease in precipitation 25 of the 29 gauges (both on-site and reference) exceeded 12.5% of the growing season. Two gauges met the hydrologic success of 8%-12.5% of the growing season. And only 2 gauges met hydrology less than 5% of the growing season.
Overall, on-site gauges exhibit similar results with gauges in the reference community.

For the 2002 vegetation monitoring year, there were 13 vegetation plots established throughout the planting areas. The 2002 vegetation monitoring of the planted areas revealed an average density of 550 trees per acre. This is above the minimum 320 trees per acre.

Vegetative data also indicate that the entire Site may support species typical of mesic and bottomland hardwood communities, which meets jurisdictional standards. All soils within the Site were mapped as either Type A (hydric soils) or Type B (containing inclusions of hydric soils) which meet jurisdictional standards for soils.

In summary, the Site met success criteria for hydrology and vegetation in the 2002 Monitoring Year and more importantly, the Site exhibits wetland characteristics similar to reference. In addition, jurisdictional wetland criteria have been met throughout a much greater area than originally predicted.

Vegetation and Hydrologic monitoring activities will continue for another year at the ABC Mitigation site

APPENDIX A

Groundwater Gauge Graphs

APPENDIX B

SITE PHOTOS & Vegetation Plant Communities

ABC

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

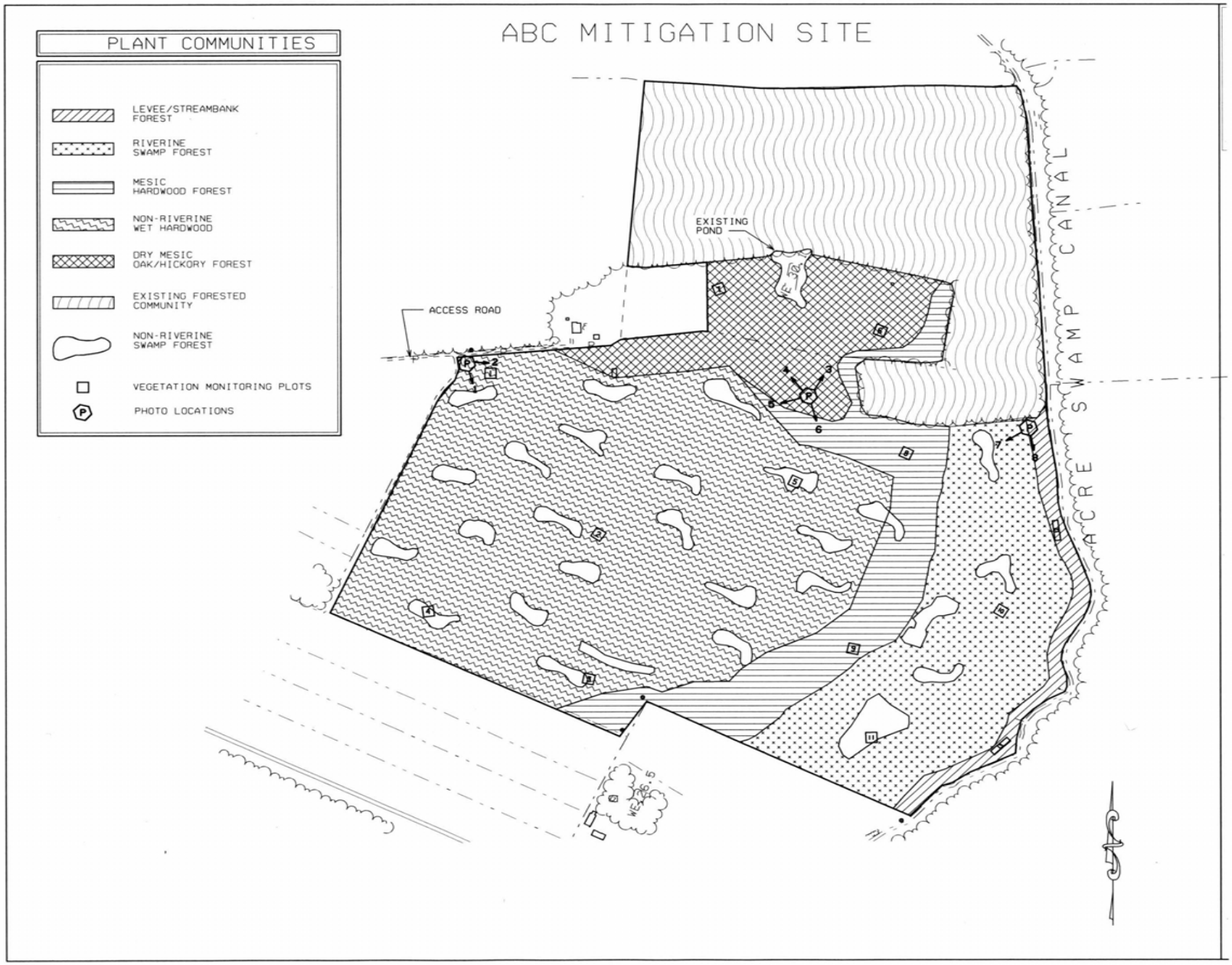
2002

ABC

Photo 7

Photo 8

Photo 9 (Swale)

Photo 10 (Swale)

ABC MITIGATION SITE