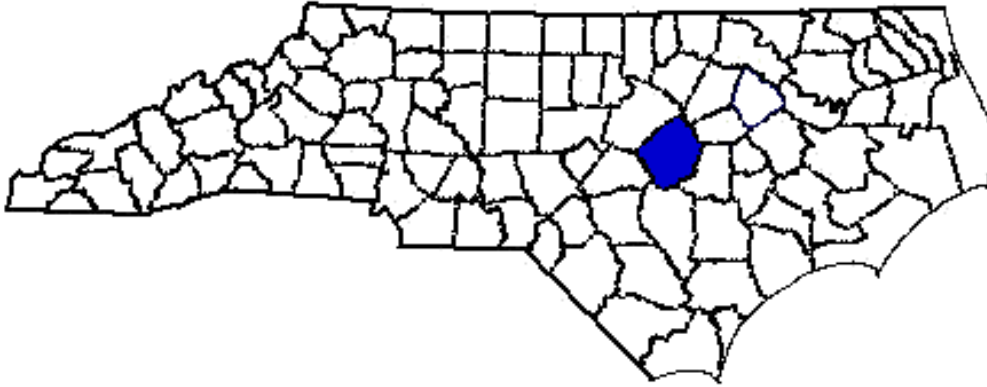


ANNUAL REPORT FOR 2004



**Benson Grove Mitigation Site
Johnston County
Project No. 8.1402211
TIP No. R-2547WM**



Prepared By:
Office of Natural Environment & Roadside Environmental Unit
North Carolina Department of Transportation
December 2004

TABLE OF CONTENTS

| | |
|---|----|
| SUMMARY | 1 |
| 1.0 INTRODUCTION | 2 |
| 1.1 PROJECT DESCRIPTION..... | 2 |
| 1.2 PURPOSE | 2 |
| 1.3 PROJECT HISTORY | 4 |
| 2.0 HYDROLOGY..... | 5 |
| 2.1 SUCCESS CRITERIA..... | 5 |
| 2.2 HYDROLOGIC DESCRIPTION | 5 |
| 2.3 RESULTS OF HYDROLOGIC MONITORING | 5 |
| 2.3.1 Site Data | 5 |
| 2.3.2 Climatic Data..... | 9 |
| 2.4 CONCLUSIONS | 9 |
| 3.0 VEGETATION: BENSON GROVE MITIGATION SITE..... | 11 |
| 3.1 SUCCESS CRITERIA..... | 11 |
| 3.2 DESCRIPTION OF SPECIES..... | 11 |
| 3.3 RESULTS OF VEGETATION MONITORING | 12 |
| 3.4 CONCLUSIONS | 12 |
| 4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS..... | 13 |

LIST OF TABLES

| | | |
|----------|--|----|
| Table 1. | Benson Grove Hydrologic Monitoring Results | 7 |
| Table 2. | Vegetation Monitoring Statistics..... | 12 |

LIST OF FIGURES

| | | |
|------------|--|----|
| Figure 1. | Site Location Map | 3 |
| Figure 2. | Monitoring Gauge Location Map..... | 6 |
| Figure 3 . | Monitoring Gauge Hydrologic Results..... | 8 |
| Figure 4. | 30-70 Percentile Graph..... | 10 |

APPENDICES

APPENDIX A - GAUGE DATA GRAPHS

APPENDIX B - SITE PHOTOS & PLANTING PLAN

Summary

The following report summarizes the monitoring activities that have occurred in the past year at the Benson Grove Mitigation Site. Site construction was completed in March 2002. The 2004-year represents the third year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years or until the site is deemed successful.

Site hydrology is being monitored with eleven groundwater monitoring gauges, three surface water gauges, and one onsite rain gauge. Ten vegetation plots are used to monitor the 31.5 acres planted in trees on the site.

This report utilizes rainfall data from both an onsite rain gauge and a local weather station. The NC State Climate Office provided the historical data for the Smithfield weather station.

Nine of the eleven-groundwater gauges indicated saturation levels exceeding the 12.5% criterion for the growing season. The three surface gauges revealed varying levels of inundation throughout the growing season. Surface gauges BGS-2 and BGS-3 malfunctioned during the growing season, however the gauge did exhibit periods of inundation prior to and after the malfunction.

The 2004 vegetation monitoring of the site revealed an average tree density of 510 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

Per the letter from the Ecosystem Enhancement Program (EEP) to NCDOT dated August 25, 2004, the EEP has accepted the transfer of all off-site mitigation projects. The EEP will be responsible for fulfilling the remaining monitoring requirements and future remediation for this project.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Benson Grove Site is located just west of NC 50 on SR 1319 (Zacks Mill Rd) in Johnston County. The site is situated in the Neuse River Basin, in the Black Creek Sub-basin. This site mitigates for wetland impacts associated with transportation improvement projects R-2000 (Raleigh Outer Loop), R-2541 (Holly Springs Bypass), and R-2552 (Clayton Bypass).

The site will provide 31.41 acres of SPH/BLH restoration and 50.5 acres of preservation.

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. These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during the 2004-growing season at the Benson Grove Mitigation Site.

Activities in 2004 reflect the third year of monitoring following the restoration efforts. Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season, and site photographs.

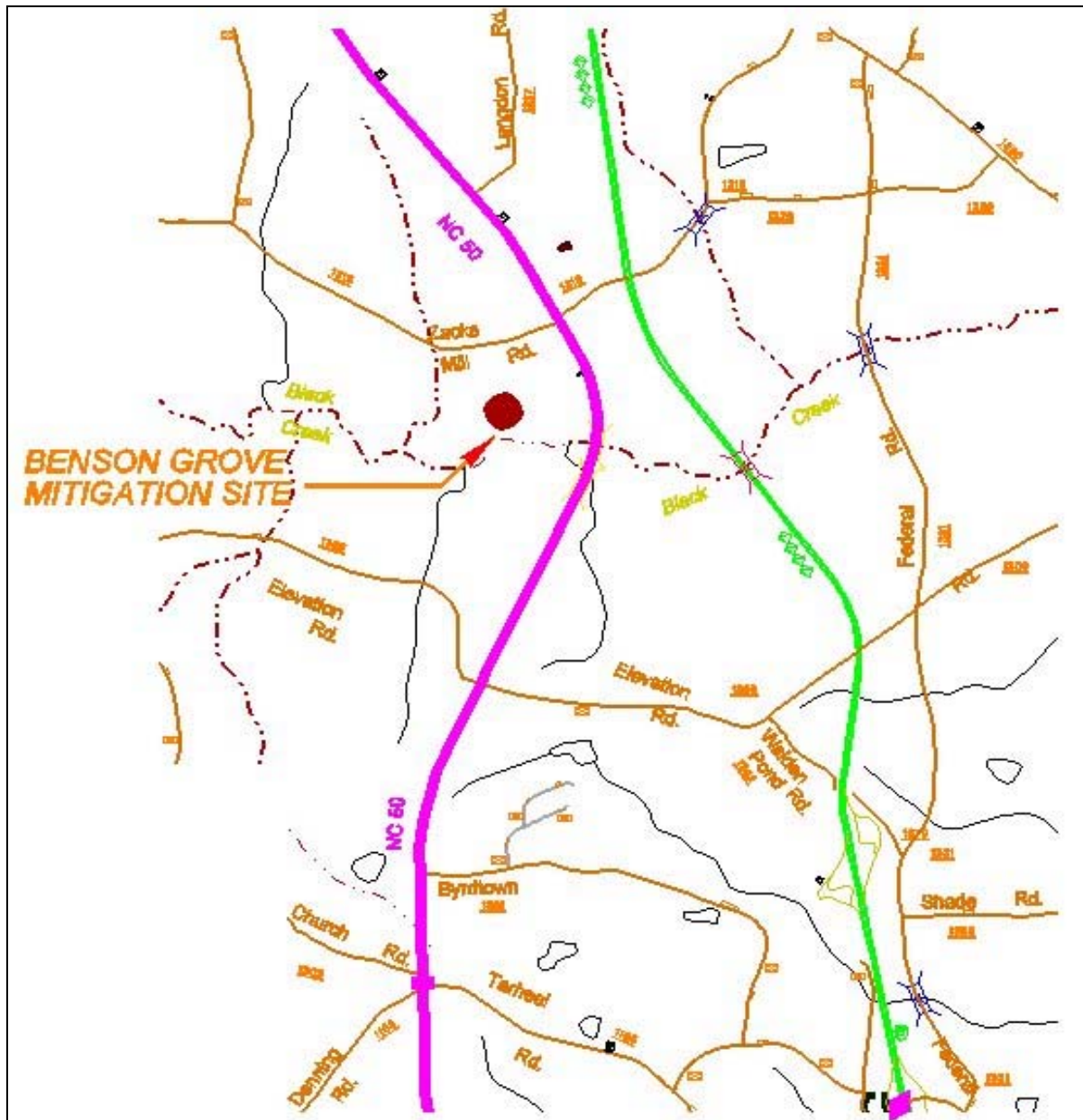


Figure 1. Site Location Map

1.3 PROJECT HISTORY

| | |
|-----------------------|--|
| December 2001 | Herbicide Application I |
| January 2002 | Site Constructed |
| February 2002 | Herbicide Application II |
| March 2002 | Site Planted |
| June 2002 | Vegetation Monitoring (1 yr.) |
| March – November 2002 | Hydrologic Monitoring (1yr.) |
| February 2003 | Site Supplementary Planted |
| July 2003 | Vegetation Monitoring (2 yr.) |
| July 2003 | Onsite agency meeting to discuss nuisance species. |
| March – November 2003 | Hydrologic Monitoring (2yr.) |
| June 2004 | Vegetation Monitoring (3 yr.) |
| March – November 2004 | Hydrologic Monitoring (3yr.) |

2.0 HYDROLOGY

2.1 SUCCESS CRITERIA

In accordance with federal guidelines for wetland mitigation, the success criteria for hydrology state that the area must be inundated or saturated (within 12" of the surface) by surface or groundwater for at least a consecutive 12.5% of the growing season during a normal precipitation year.

The growing season in Johnston County begins March 26 and ends November 10. These dates correspond to a 50% probability that temperatures will not drop to 28°F or lower after March 26 and before November 10.¹ The growing season is 229 days; therefore, optimum hydrology requires 12.5% of this season, or at least 29 consecutive days. Local climate must also represent average conditions for the area.

2.2 HYDROLOGIC DESCRIPTION

In March 2002, eleven groundwater gauges, three surface water gauges, and one onsite rain gauge were installed throughout the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This represents the third full growing season that the monitoring gauges have been in place.

The Benson Grove site was designed to receive hydrologic input from rainfall and surface water accessing the floodplain. The hydrologic monitoring also shows the reaction of the groundwater level to specific rainfall events.

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 well. This number was converted into a percentage of the 229-day growing season (March 26 – November 10). The results are presented in Table 1.

Appendix A contains charts of the groundwater depth for each monitoring gauge during 2004. The maximum number of consecutive days is noted on each graph.

Figure 3 provides a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in red show hydrology between 8% and 12.5% of the season, while those in green indicate hydrology between 5% and 8% of the growing season.

¹ Natural Resources Conservation Service, Soil Survey of Wake County, North Carolina, p. 79.

Figure 2. Monitoring Gauge Location Map

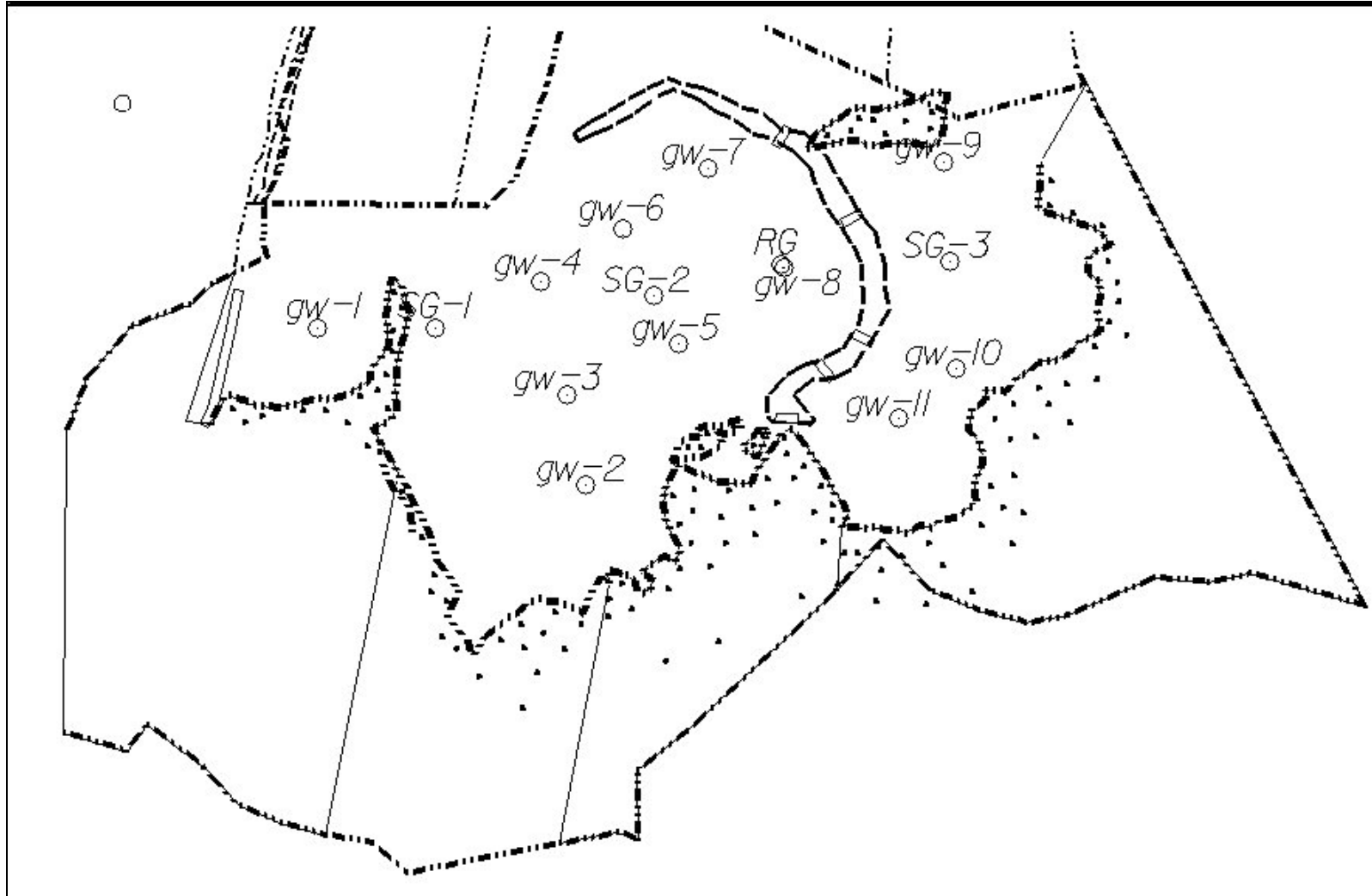


Table 1. Benson Grove Hydrologic Monitoring Results

| Monitoring Well | <5% | 5-8% | 8-12.5% | >12.5% | Actual % | Success Dates |
|-----------------|-----|------|---------|--------|----------|---|
| BGGW-1+ | | | | ✘ | 25.3 | March 26-May 17 May 20-July 16 |
| BGGW-2 | | | ✘ | | 12.2 | March 26-April 8 May 23-June 19 |
| BGGW-3+ | | | | ✘ | 53.3 | March 26-July 25 July 30-Oct 26 |
| BGGW-4+ | | | | ✘ | 44.1 | March 26-April 23 July 30-Nov 7 |
| BGGW-5+ | | | | ✘ | 16.2 | Aug 13-Aug 26 Aug 30-Oct 5 |
| BGGW-6+ | | | | ✘ | 45.4 | March 26-May 17 May 23-July 15 July 30-Nov 10 |
| BGGW-7+ | | | | ✘ | 50.7 | March 26-May 17 May 23-July 15 July 30-Nov 10 |
| BGGW-8+ | | | | ✘ | 44.5 | March 26-May 16 May 23-June 24 July 30-Nov 8 |
| BGGW-9+ | | | | ✘ | 45.4 | March 26-May 18 May 20-July 14 July 30-Nov 10 |
| BGGW-10+ | | | | ✘ | 45.4 | March 26-May 13 May 23-June 19 July 30-Nov 10 |
| BGGW-11 | | | ✘ | | 10.0 | July 30-Aug 21 Oct 26-Nov 10 |

+ Gauge met the success criterion during an average rainfall month (April, September and November).

Specific Gauge Problems:

- BGGW-11 malfunctioned during the beginning and the end of the growing season.

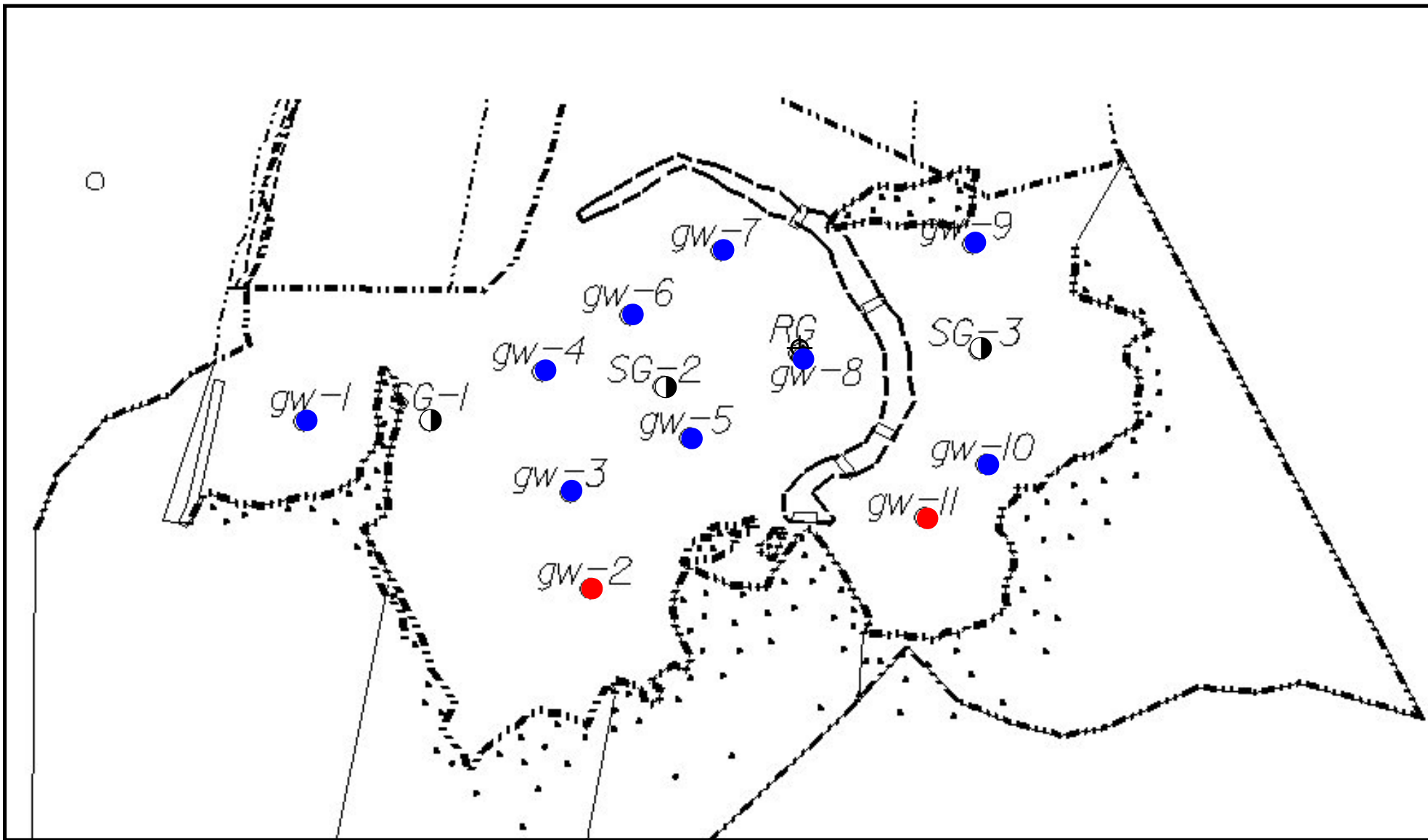


Figure 3. 2004 Hydrologic Monitoring Gauge Results



Hydrology Results

- < 5%
- 5 - 8%
- 8 - 12.5%
- > 12.5%

- ⊕ Rain Gauge
- ◐ Surface Gauge


 Not to Scale

2.3.2 Climatic Data

Figure 4 provides an evaluation of the local climate in comparison with historical data in order to determine whether 2004 was “average” in terms of rainfall. The two lines represent the 30th and 70th percentiles of monthly precipitation for Smithfield. The bars are the monthly rainfall totals for the 2003 and 2004 hydrologic year. The historical data and monthly rainfall was collected by the National Climatic Data Center.

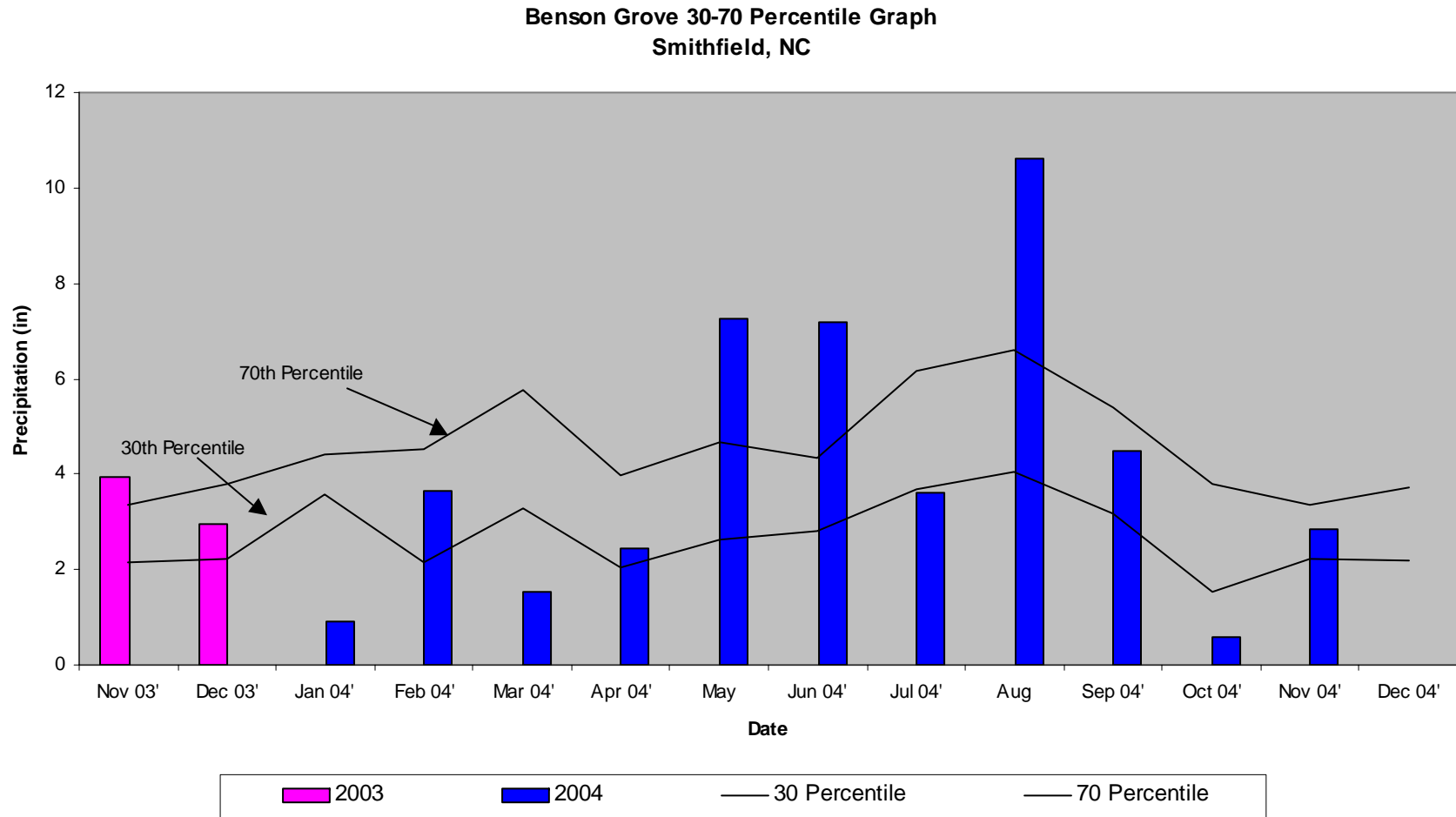
Months with below average rainfall include: January, March, July, and October. The months of December (03'), February, April, September and November experienced average rainfall. November (03'), May, June, and August experienced above average rainfall. Overall, the site experienced average rainfall in 2004.

2.4 CONCLUSIONS

The 2004-year represents the third year for hydrologic monitoring. Nine of the eleven gauges indicated saturation within 12” of the ground for greater than 12.5% of the growing season. The three surface gauges revealed varying levels of inundation throughout the growing season. Surface gauges BGSG-2 and BGSG-3 malfunctioned during the growing season, however the gauges did exhibit periods of inundation prior to and after the malfunction.

The EEP will begin monitoring the hydrology at the Benson Grove Mitigation Site in 2005.

Figure 4: 30-70 Percentile Graph



3.0 VEGETATION: BENSON GROVE MITIGATION SITE (YEAR 3 MONITORING)

3.1 SUCCESS CRITERIA

The success criteria state that at least 320 stems per acre must survive after the completion of the third growing season and 240 stems per acre after the fifth growing season. If desired vegetation has not been established, NCDOT will notify the appropriate agencies and will implement corrective measures.

3.2 DESCRIPTION OF SPECIES

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

Fraxinus pennsylvanica, Green Ash
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Quercus laurifolia, Laurel Oak
Quercus lyrata, Overcup Oak
Quercus nigra, Water Oak
Liriodendron tulipifera, Tulip Poplar
Quercus phellos, Willow Oak
Taxodium distichum, Baldcypress
Nyssa aquatica, Water Tupelo

3.3 RESULTS OF VEGETATION MONITORING

TABLE 2: Vegetation Monitoring Statistics

| Plot # | Green Ash | Cherrybark Oak | Laurel Oak | Overcup Oak | Water Oak | Tulip Poplar | Willow Oak | Baldcypress | Water Tupelo | Total (3 year) | Total (at planting) | Density (Trees/Acre) |
|-----------------------|-----------|----------------|------------|-------------|-----------|--------------|------------|-------------|--------------|----------------|---------------------|----------------------|
| 1 | | | | 4 | | | 2 | 2 | | 8 | 28 | 194 |
| 2 | 6 | 6 | 2 | 4 | | 1 | 2 | 1 | | 22 | 23 | 650 |
| 3 | 5 | 1 | | | | | 1 | 1 | 1 | 9 | 31 | 197 |
| 4 | 7 | | | 2 | | | 4 | 10 | | 23 | 23 | 680 |
| 5 | 7 | 4 | | 6 | | | 6 | | 1 | 24 | 35 | 466 |
| 6 | 4 | 2 | | | 1 | | | 8 | | 15 | 32 | 319 |
| 7 | 4 | | | | | | | 12 | 3 | 19 | 20 | 646 |
| 8 | 1 | | 2 | 9 | | | 9 | 5 | 2 | 28 | 31 | 614 |
| 9 | 8 | 2 | 1 | 5 | | | 1 | 25 | 2 | 44 | 46 | 650 |
| 10 | 11 | 2 | 2 | 10 | 1 | | 9 | 3 | 1 | 39 | 39 | 680 |
| Total Density Average | | | | | | | | | | | 510 | |

Site Notes: Other species noted: sweetgum, red maple, *Baccharis halimifolia*, ragweed, thistle, Queen Ann's Lace, broomsedge, morning glory, fennel, *Juncus* sp., *Polygonum* sp., black willow, cattail, *Pluchea* sp., and horse-nettle. Red maple and sweetgum were very thick in the areas in and around plots 1, 2, and 3. Red maple and sweetgum were moving into the areas around plots 8 and 9.

3.4 CONCLUSIONS

Of the 81.9 acres on this site, approximately 31.5 acres involved tree planting. There were ten vegetation-monitoring plots established throughout the planting areas. The 2004 vegetation monitoring of the site revealed an average tree density of 510 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

The Roadside Environmental Unit and the Corps of Engineers met on site to evaluate the nuisance tree issue on July 15, 2003. After evaluating the problem it was determined that the nuisance tree issue may need to be addressed in the future.

The EEP will begin monitoring the vegetation at the Benson Grove Mitigation Site in 2005.

4.0 OVERALL CONCLUSIONS/RECOMMENDATIONS

For 2004, nine of the eleven groundwater gauges indicated saturation within 12" of the ground for greater than 12.5% of the growing season. The three surface gauges revealed varying levels of inundation throughout the growing season. Surface gauges BGS-2 and BGS-3 malfunctioned during the growing season, however the gauges did exhibit periods of inundation prior to and after the malfunction.

The 2004 vegetation monitoring of the site revealed an average tree density of 510 trees per acre. This average is above the minimum success criteria of 320 trees per acre.

Per the letter from the Ecosystem Enhancement Program (EEP) to NCDOT dated August 25, 2004, the EEP has accepted the transfer of all off-site mitigation projects. The EEP will be responsible for fulfilling the remaining monitoring requirements and future remediation for this project.

APPENDIX A

GAUGE DATA GRAPHS

APPENDIX B

SITE PHOTOS & PLANTING PLAN

Benson Grove



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6



Photo 7



Photo 8



Photo 9



Photo 10



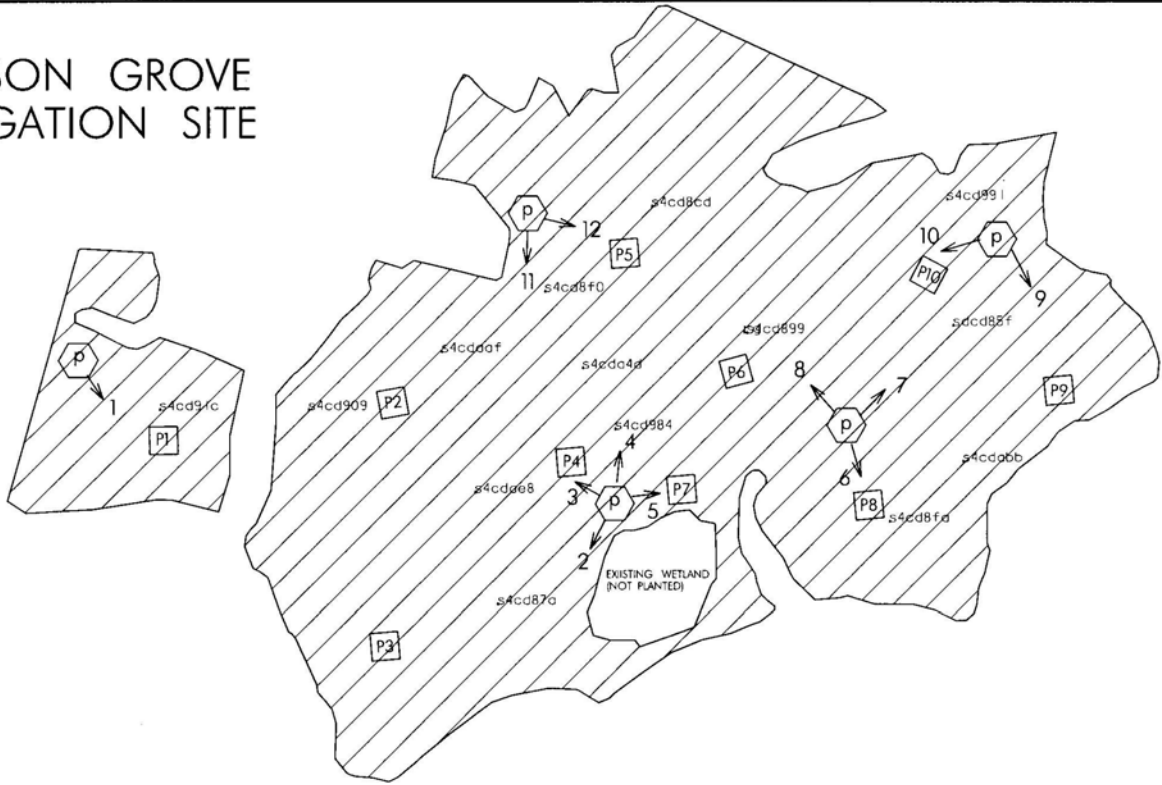
Photo 11



Photo 12

BENSON GROVE MITIGATION SITE

| | |
|--|------------------------|
| PROJECT REFERENCE NO. <i>R-2541</i> | SHEET NO. |
| RW SHEET NO. | |
| ROADWAY DESIGN ENGINEER | HYDRAULICS ENGINEER |



□ VEGETATION MONITORING PLOTS

⬡ PHOTOGRAPH LOCATIONS

11/11/2011 10:00 AM