

# ANNUAL REPORT FOR 2005



**Roanoke Island Mitigation Site  
Dare County  
Project No. 8.1052501  
TIP No. K-4003**



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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..... 4

    2.1 Success Criteria..... 4

    2.2 Hydrologic Description..... 5

    2.3 Results of Hydrologic Monitoring..... 5

        2.3.1 Site Data..... 5

        2.3.2 Climatic Data..... 11

    2.4 Conclusions..... 11

3.0 VEGETATION..... 13

    3.1 Success Criteria..... 13

    3.2 Description of Species..... 13

    3.3 Results of Vegetation Monitoring..... 13

    3.4 Conclusions..... 14

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS..... 14

## TABLES

TABLE 1 – 2005 HYDROLOGIC MONITORING RESULTS.....	8
TABLE 2 – 2005 VEGETATIVE MONITORING RESULTS .....	13

## FIGURES

FIGURE 1 – SITE LOCATION MAP.....	3
FIGURE 2 – MONITORING GAUGE LOCATION MAP- NORTH TRACT.....	6
FIGURE 3 – MONITORING GAUGE LOCATION MAP- SOUTH TRACT.....	7
FIGURE 4 – 2005 HYDROLOGIC MONITORING RESULTS- NORTH .....	9
FIGURE 5 – 2005 HYDROLOGIC MONITORING RESULTS- SOUTH.....	10
FIGURE 6 – 30-70 PERCENTILE GRAPH.....	12

## APPENDICES

APPENDIX A – GAUGE DATA GRAPHS

APPENDIX B – PHOTO AND VEGETATION PLOT LOCATIONS,  
SITE PHOTOS

## SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Roanoke Island Mitigation Site. The site was constructed to serve as mitigation for the Roanoke Island Visitor Center/ Rest Area; approximately 1.77 acres of impacts are mitigated for onsite and the remaining 1.36 acres of preservation were debited from the Mashoes Road Mitigation Site. The Roanoke Island Site was constructed in 2002 and this report details the fourth year of hydrology monitoring and first year (restart) of vegetation monitoring following construction.

Data from the fourth year of hydrologic monitoring indicates that ten of the eleven monitoring gauges are meeting jurisdictional success by showing saturation within 12 inches of the surface for at least 12.5% of the growing season, and are within 20% of the saturation period for their respective reference gauges. Non-reference Gauge RINT-2 was saturated within 12 inches of the surface for 70.5% of the growing season. This was well above 12.5% of the growing season, but not within 20% of the saturation period for the reference gauge in that area.

As recommended last year, Gauge RIST-7 (ref) was moved to a more suitable location on August 10, 2005, based on a more representative elevation with nearby Gauge RIST-8.

This site was replanted in March 2005 with containerized baldcypress and swamp blackgum and bareroot Atlantic white cedar. Soil samples were taken on site. Soluble salt levels are very high at this site, which is making it very difficult to get hardwood vegetation to live. Compaction on site may also be an issue. In an attempt to get more trees to survive, NCDOT is going to apply calcitic limestone, hand till the site, and replant bareroot trees on 4-ft. centers.

NCDOT will continue to monitor vegetation and hydrology at the Roanoke Island Mitigation Site.

## **1.0 INTRODUCTION**

### **1.1 Project Description**

The Roanoke Island Site serves as onsite mitigation for the Roanoke Island Visitor Center/Rest Area, located adjacent to the new US 64-264 Manteo Bypass. The site is divided into two tracts; the “south” tract is on the same property as the Visitor Center and the “north” tract is located approximately 600 feet north of the Visitor Center (Figure 1). The mitigation is associated with Project 8.1052501, TIP Numbers K-4003 and R-2551.

The site is designed to provide 0.11 acres of restoration (1:1) and 1.66 acres of creation (1:1) of Estuarine Fringe wetlands. The site also includes 1.29 acres (5:1) of estuarine preservation. In addition, approximately 1,004 feet of riparian buffer was planted with the same vegetation mix as that used in the wetland zones. The width of the buffer zone varies between 9 and 65 feet based on NCDOT property limits. The construction plan for the wetland sites involved grading the former borrow pit areas to meet the elevations of adjacent jurisdictional wetlands.

### **1.2 Purpose**

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five years or until success criteria are fulfilled. Success criteria are based on federal guidelines for wetland mitigation and are stipulated in the “Roanoke Island Visitor Center/ Rest Area Mitigation Plan” dated May 2001 (revised July 2001). These guidelines stipulate criteria for both hydrologic conditions and vegetation survival. The following report details the results of hydrologic and vegetative monitoring during 2005 at the Roanoke Island Mitigation Site.

Activities in 2005 reflect the fourth year of hydrology monitoring and the first year (restart) of vegetation monitoring at the mitigation site. Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season.



**Figure 1.** Location Map- Roanoke Island Mitigation Site

### 1.3 Project History

March 2002	Construction Completed
March 2002	Monitoring Gauges Installed
March 2002	Site Planted
March- November 2002	Hydrologic Monitoring (Year 1)
June 2002	Vegetation Monitoring (Year 1)
March- November 2003	Hydrologic Monitoring (Year 2)
September 2003	Vegetation Monitoring (Year 2)
February 2004	Site Replanted
July 2004	Vegetation Monitoring (Year 1 Restart)
March- November 2004	Hydrologic Monitoring (Year 3)
March- November 2005	Hydrologic Monitoring (Year 4)
August 2005	Vegetation Monitoring (Year 1 Restart)

## 2.0 HYDROLOGY

### 2.1 Success Criteria

While a constructed site must typically meet jurisdictional criteria of inundation or saturation within 12 inches of the surface for at least 12.5% of the growing season, NCDOT and consulting agencies agreed that other criteria might be the best indicator of hydrologic success on this particular site. In accordance with the guidelines set forth by the approved mitigation plans, hydrologic success is dictated by the hydrologic condition of the reference wetlands adjacent to the sites. Monitoring gauges are located in both the constructed and reference areas. The site is considered a hydrologic success if the hydrologic frequency, duration and depth are within 20% of its respective reference wetland.

The growing season in Dare County begins March 13 and ends November 25. The dates correspond to a 50% probability that temperatures will drop to 28° F or lower after March 13 and before November 25.<sup>1</sup> The growing season is 258 days; therefore the optimum duration for wetland hydrology is 32 days. While the monitoring gauges record ground/surface water levels throughout the year, special attention is placed on water levels during the 258-day growing season. In addition, local rainfall totals are monitored to ensure that the site is functioning in normal climatic conditions.

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<sup>1</sup> Natural Resources Conservation Service, Soil Survey of Dare County, North Carolina, p.69.

## **2.2 Hydrologic Description**

The site was constructed by grading the existing fill material down to meet the elevations of existing reference wetlands. The removed fill material is associated with borrow pit/ spoil basins that were previously onsite. Eleven monitoring gauges were installed on the site in order to monitor the new hydrologic conditions. Three gauges were located on the north tract and eight gauges were located on the south tract. Of these, one gauge is located within the north tract reference wetland, while four gauges are located within reference areas in the south tract. The success of the site is determined by comparing the groundwater levels in the reference areas with those in the constructed zones.

Site rainfall is monitored with a rainfall gauge located onsite. In addition, the recorded data is compared to rainfall data at the Manteo Airport gauge in order to check the accuracy of the measured data. The NC State Climate Office provided the Manteo data. Figures 2 and 3 are monitoring gauge maps of the north and south tracts, respectively.

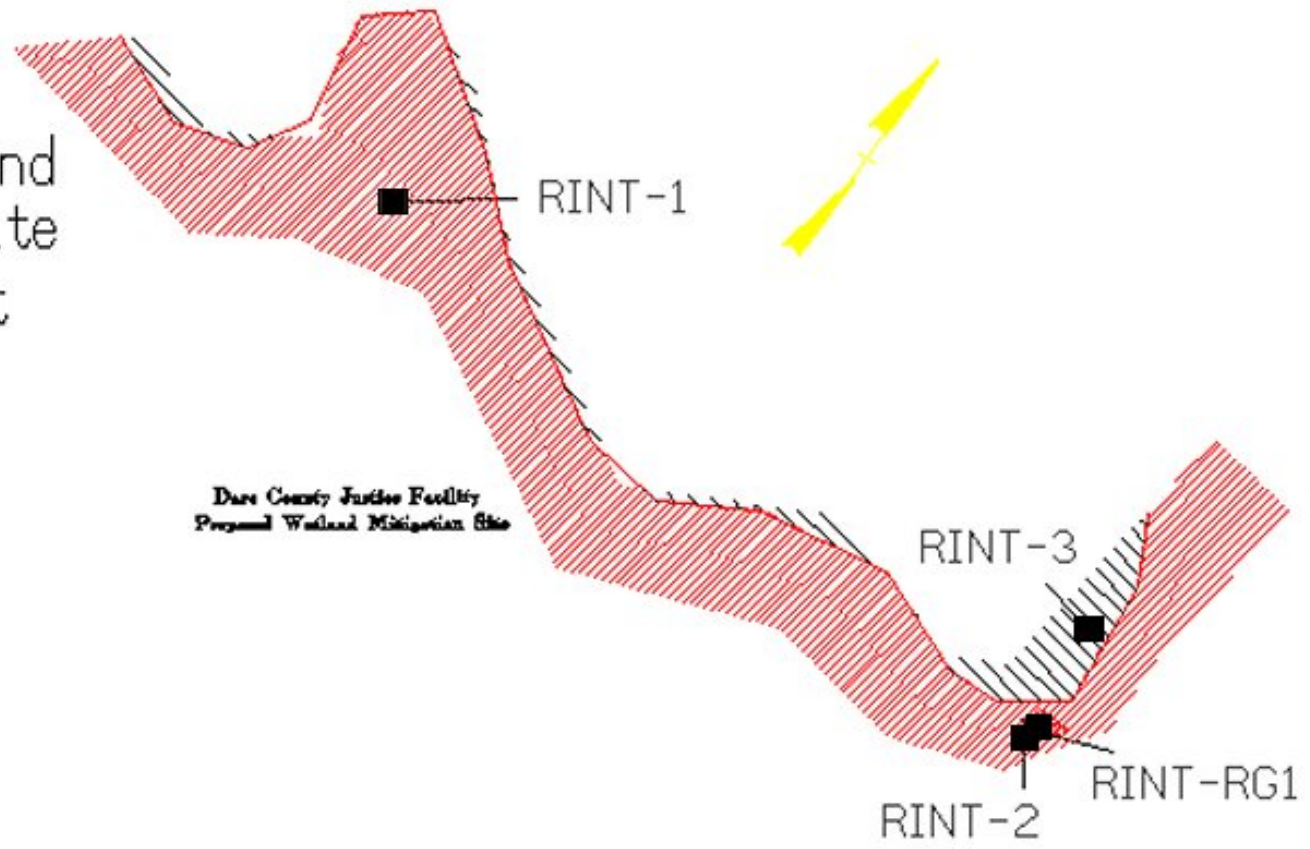
## **2.3 Results of Hydrologic Monitoring**

### **2.3.1 Site Data**

Table 1 is a summary of the hydrologic monitoring results for both the north and south tracts. The mitigation plan states that the hydrologic conditions of the constructed areas must be within 20% of those in the reference areas. Figures 4 and 5 are representations of the hydrologic monitoring results.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. While success of the site is based on reference wetlands and not the percentage of the growing season that the groundwater is within 12 inches of the surface, the 12-inch line is provided for reference. The number of days the water level was above this line is also provided on each graph. Precipitation events, as recorded by the onsite rain gauge, are included on each graph as bars.

Roanoke Island  
Mitigation Site  
North Tract



**Figure 2.** Monitoring Gauge Location Map - North Tract

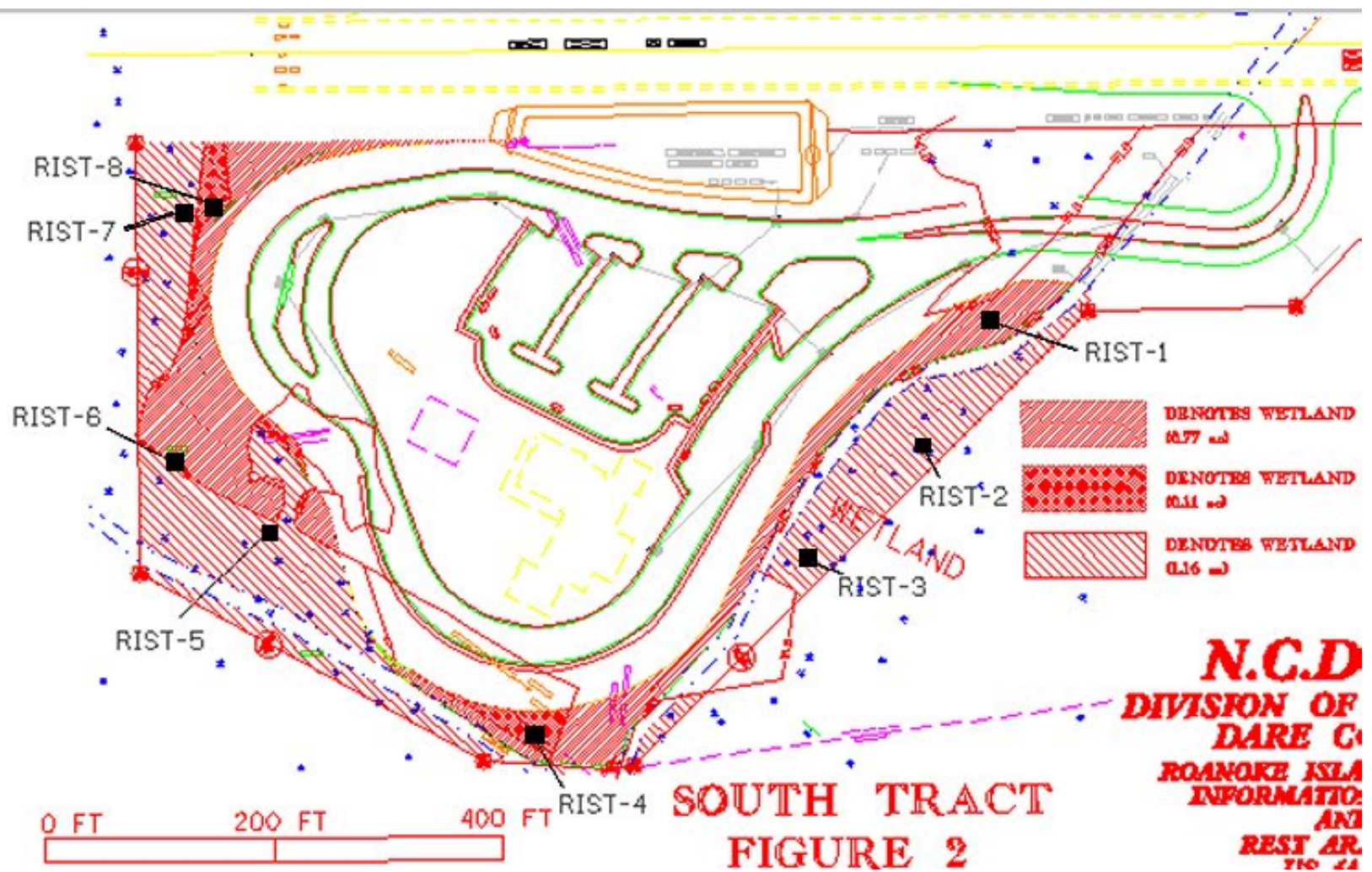


Figure 3. Monitoring Gauge Location Map - South Tract

**Table 1. 2005 Hydrologic Monitoring Results (March 13 – November 25)**

Monitoring Gauge	< 5%	5 - 12%	> 12.5%	Actual Consecutive %	Dates Meeting Success
<b>NORTH TRACT</b>					
RINT-1			×	85.7 (100) <sup>a</sup>	April 19-Nov 25
RINT-2			×	70.5	March 13-Sep 10 Sep 13-Nov 25
RINT-3 (ref)			×	100	March 13-Nov 25
<b>SOUTH TRACT</b>					
RIST-1			×	100	March 13-Nov 25
RIST-2 (ref)			×	100	March 13-Nov 25
RIST-3 (ref)			×	50 (100) <sup>a</sup>	March 13-July 19 August 30-Nov 25
RIST-4			×	72.9 (100) <sup>a</sup>	March 13- April 24 May 22-Nov 25
RIST-5 (ref)			×	100	March 13-Nov 25
RIST-6			×	100	March 13-Nov 25
RIST-7 (ref)			×	100	March 13-Nov 25
RIST-8			×	100	March 13-Nov 25

a- These monitoring gauges have missing data due to gauge malfunction. ESI analyzed the hydrographic response to rainfall events prior to and subsequent to the missing data gap and then extrapolated the missing data based on comparison to data for a comparable gauge that exhibited similar groundwater levels and hydrographic responses to precipitation events.

Notes: "RINT" denotes gauges on the northern tract.

"RIST" denotes gauges on the southern tract.

"ref" denotes gauges in preservation areas of the site, used as reference wetlands.

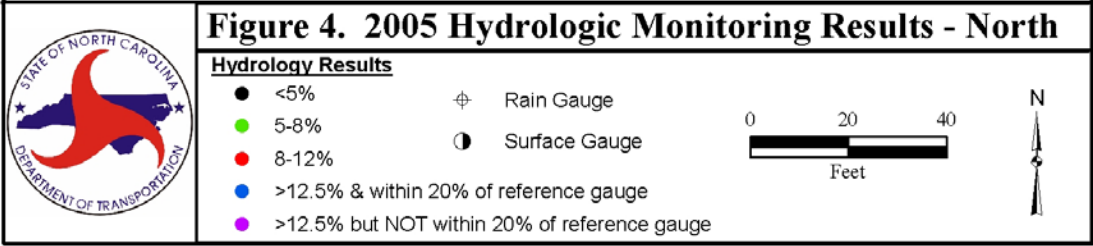
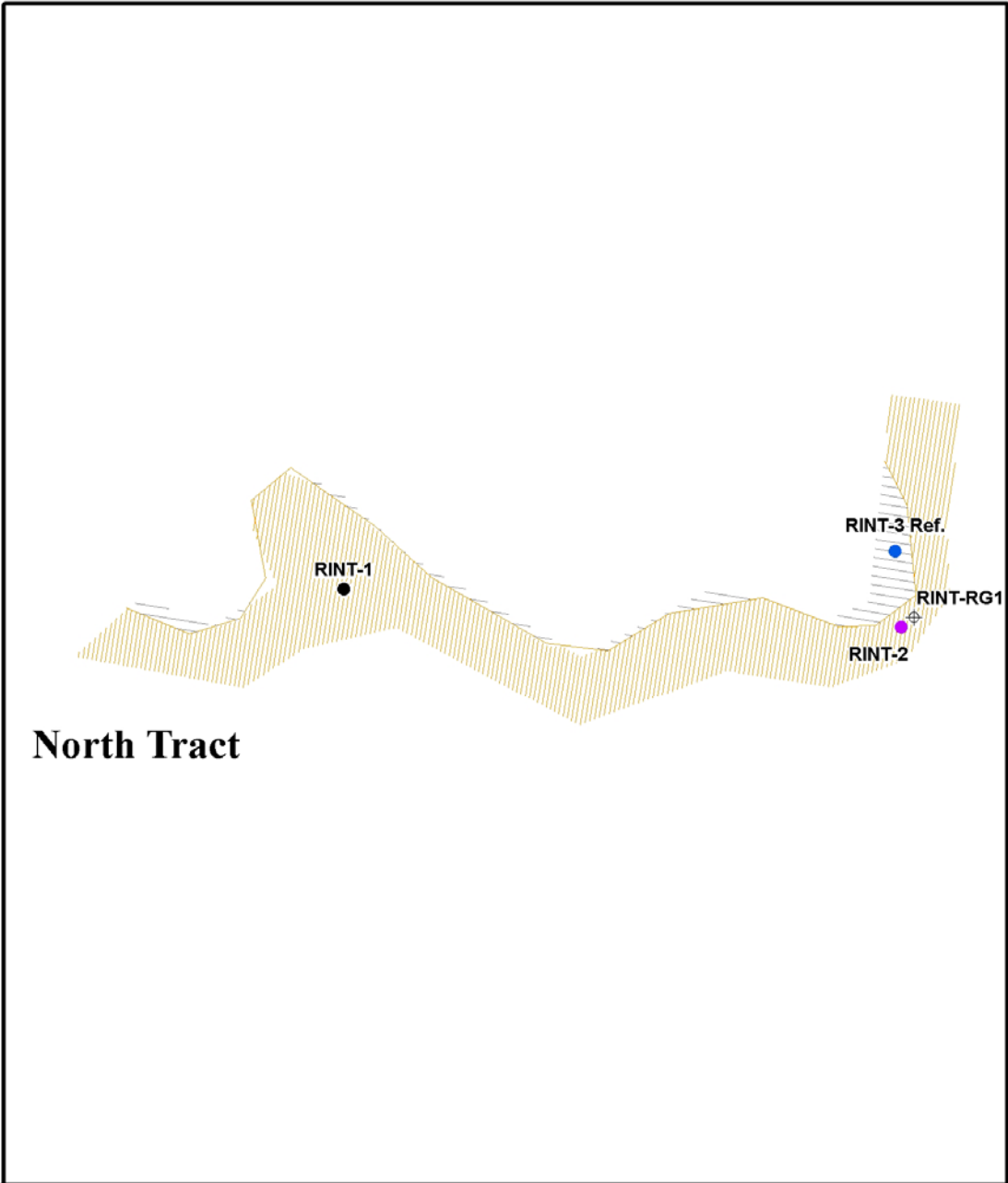
**Specific Gauge Problems:**

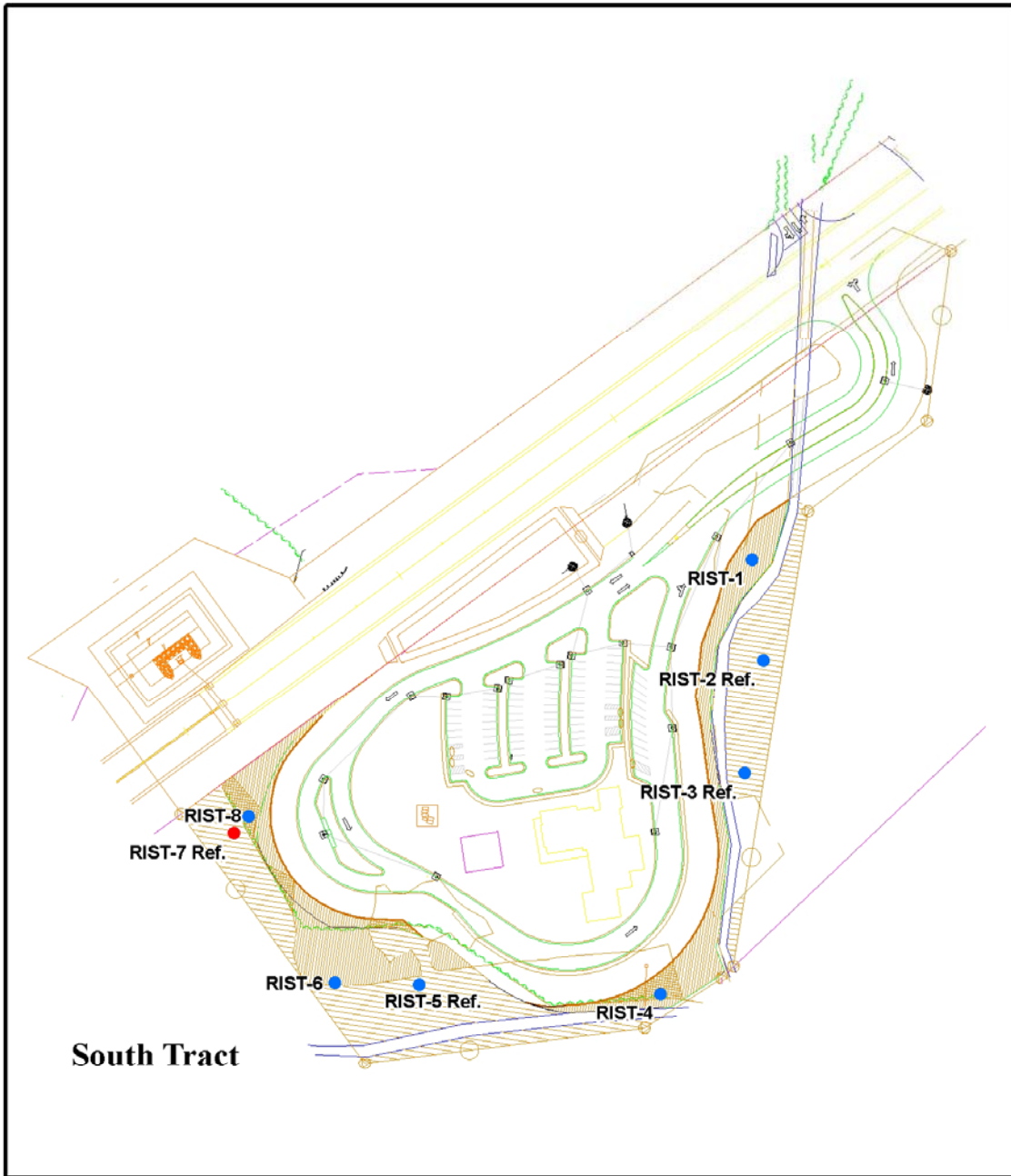
Gauge RINT-1 has recorded data for 221 consecutive days (85.7% of the growing season) and one data gap from March 16 through April 18. Using nearby gauges and adjacent data points to extrapolate missing data, it can be assumed that Gauge RINT-1 would have made jurisdictional hydrology for approximately 100% of the growing season.

Gauge RIST-3 has recorded data for 129 consecutive days (50% of the growing season) and one data gap from July 20 through August 28. Using nearby gauges and adjacent data points to extrapolate missing data, it can be assumed that Gauge RIST-3 would have made jurisdictional hydrology for approximately 100% of the growing season.

Gauge RIST-4 has recorded data for 188 consecutive days (72.9% of the growing season) and one data gap from April 25 through May 21. Using nearby gauges and adjacent data points to extrapolate missing data, it can be assumed that Gauge RIST-4 would have made jurisdictional hydrology for approximately 100% of the growing season.

As recommended last year, Gauge RIST-7 (ref) was moved to a more suitable location on August 10, 2005, based on a more representative elevation with nearby Gauge RIST-8.



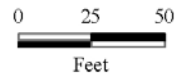


**Figure 5. 2005 Hydrologic Monitoring Results - South**



**Hydrology Results**

- <5%
- 5-8%
- 8-12%
- >12.5%
- ⊕ Rain Gauge
- ⊙ Surface Gauge



### **2.3.2 Climatic Data**

Figure 6 provides an evaluation of the local climate in comparison with historical data in order to determine whether 2005 was “normal” in terms of climate conditions. The two lines represent the 30<sup>th</sup> and 70<sup>th</sup> percentiles of monthly precipitation for Manteo, NC. The bars are monthly rainfall totals for 2005. The historical data was collected from the State Climate Office of North Carolina. The rainfall data for the Roanoke Island Site is incomplete and can not be used to determine normalcy of rainfall. The rainfall data from the Manteo Airport is incomplete for April and August and there was no data collected in June or September. The onsite rain gauge malfunctioned during the beginning of the growing season and the data collected through June is unreliable. The gauge was replaced in June.

Due to the incomplete rainfall data both onsite and offsite only broad generalization can be made for the rainfall in 2005. Based on the available data from the Manteo Airport, it appears that the rainfall going in to the 2005 growing season (January through May) was below normal, June was normal, and November was below normal. The on-site rainfall data shows August, September, and November were below normal. There is a discrepancy between the onsite and offsite data for July.

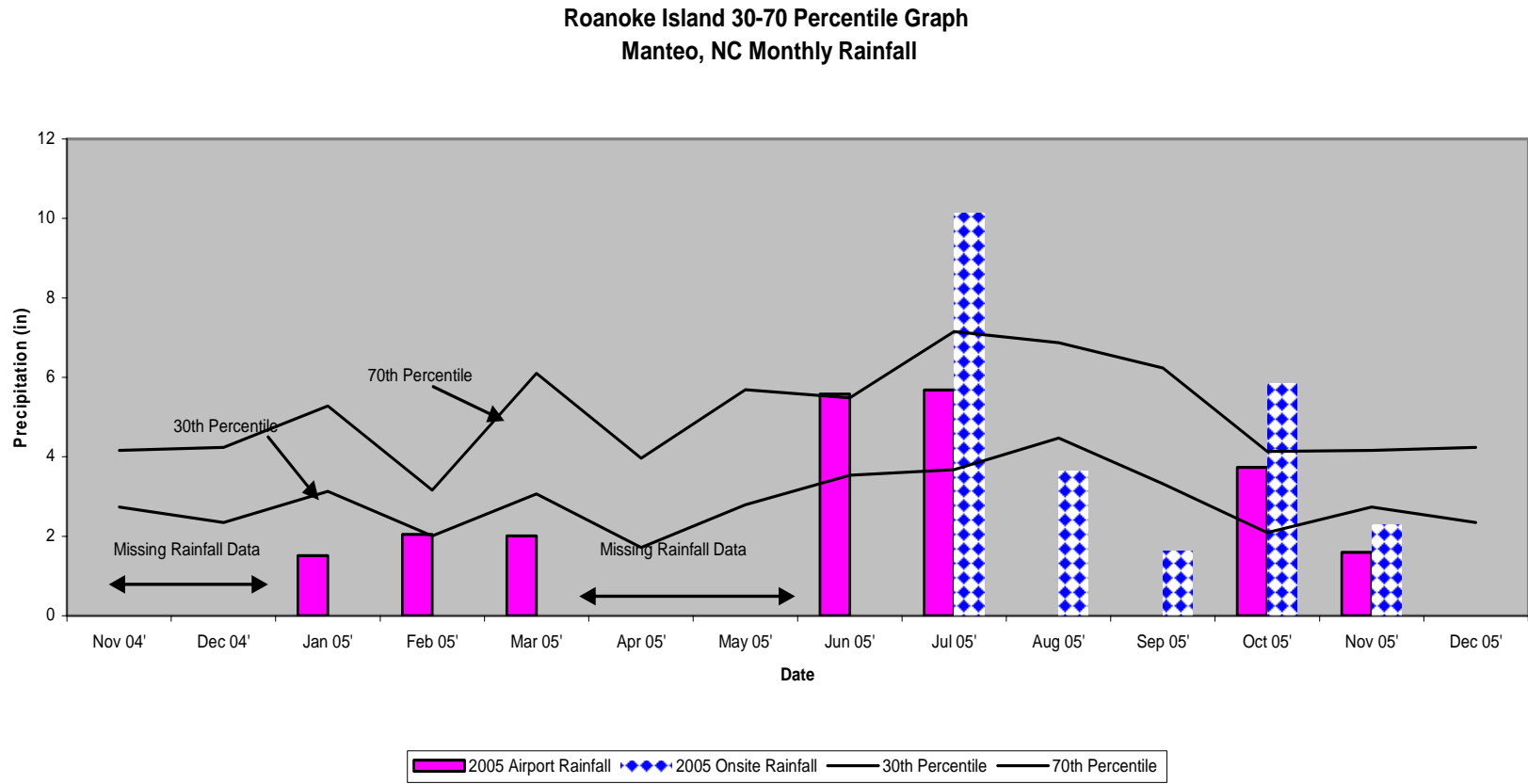
## **2.4 Conclusions**

Data from the fourth year of hydrologic monitoring indicates that ten of the eleven monitoring gauges are meeting jurisdictional success by showing saturation within 12 inches of the surface for at least 12.5% of the growing season, and are within 20% of the saturation period for their respective reference gauges. Non-reference Gauge RINT-2 was saturated within 12 inches of the surface for 70.5% of the growing season. This was well above 12.5% of the growing season, but not within 20% of the saturation period for the reference gauge in that area.

As recommended last year, Gauge RIST-7 (ref) was moved to a more suitable location on August 10, 2005, based on a more representative elevation with nearby Gauge RIST-8. Gauge RIST-7 (ref) was meeting success criteria for 2005 in its original location and met success criteria for the remainder of the season in its new location/elevation.

NCDOT recommends that hydrologic monitoring continue on the Roanoke Island Mitigation Site.

**Figure 6. 30-70 Percentile Graph: Manteo, NC**



### 3.0 VEGETATION: ROANOKE ISLAND VISITOR CENTER (YEAR 1 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/Creation Area:

*Taxodium distichum*, Bald cypress

*Myrica cerifera*, Wax Myrtle

*Persea palustris*, Swamp Redbay

*Nyssa sylvatica* var. *biflora*, Swamp Blackgum

*Gordonia lasianthus*, Loblolly Bay

*Chamaecyparis thyoides*, Atlantic White Cedar

#### 3.3 Results of Vegetation Monitoring

Plot #	Baldcypress	Wax Myrtle	Swamp Redbay	Loblolly Bay	Swamp Blackgum	Atlantic White Cedar	Total (1 year)	Total (at planting)	Density (Trees/Acre)
1	3				5		8	27	201
2	2	1			6	2	11	29	258
3	4	9					13	40	221
4	3	1			4		8	34	160
<b>Average Tree Density</b>									<b>210</b>

**Site Notes:** Other species noted: *Juncus* sp., *Typha latifolia*, *Luziola* sp., *Scripus* sp., *Pluchea* sp., *Cladium* sp., *Phragmites* sp., *Pinus* sp., and *Baccharis halimifolia*.

### **3.4 Conclusions**

Approximately 1.77 acres of this site were planted as wetland restoration and creation areas in March 2002. The site has been replanted in February 2004 and March 2005.

This site was replanted in March 2005 with containerized baldcypress and swamp blackgum and bareroot Atlantic white cedar. The 2005 vegetation monitoring revealed an average density of 210 trees per acre for year 1, which is below the 320 trees per acre minimum requirement. Soil samples were taken on site. Soluble salt levels are very high at this site which is making it very difficult to get hardwood vegetation to live. Compaction on the site may also be an issue. In an attempt to get more trees to survive NCDOT is going to apply calcitic limestone, hand till the site, and replant bareroot trees on 4-foot centers.

### **4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS**

Data from the fourth year of hydrologic monitoring indicates that ten of the eleven monitoring gauges are meeting jurisdictional success by showing saturation within 12 inches of the surface for at least 12.5% of the growing season, and are within 20% of the saturation period for their respective reference gauges. Non-reference Gauge RINT-2 was saturated within 12 inches of the surface for 70.5% of the growing season. This was well above 12.5% of the growing season, but not within 20% of the saturation period for the reference gauge in that area.

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NCDOT will continue to monitor the Roanoke Island Mitigation Site for hydrology and vegetation.

**APPENDIX A**

**GAUGE DATA GRAPHS**

## **APPENDIX B**

### **PHOTO AND VEGETATION PLOT LOCATIONS/ SITE PHOTOGRAPHS**

# ROANOKE ISLAND VISITOR CENTER



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6

August 2005

# ROANOKE ISLAND VISITOR CENTER



Photo 7

# ROANOKE ISLAND VISITOR CENTER

## PHOTO AND VEGETATION PLOT LOCATIONS

