

ANNUAL REPORT FOR 2004



**U. S. Marine Corps Mitigation Site
Onslow County
Project No. 6.269010T
TIP No. U-2107 WM**



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

 1.4 Permit Related Requirements..... 4

2.0 HYDROLOGY..... 5

 2.1 Success Criteria..... 5

 2.2 Hydrologic Description..... 5

 2.3 Results of Hydrologic Monitoring..... 7

 2.3.1 Site Data..... 7

 2.3.2 Climatic Data..... 7

 2.4 Conclusions..... 9

3.0 VEGETATION..... 11

 3.1A Success Criteria (Shrub Area)..... 11

 3.1B Success Criteria (Marsh Grass Area)..... 11

 3.2A Description of Planted Areas (Shrub Area)..... 11

 3.2B Description of Planted Areas (Marsh Grass Area)..... 11

 3.3A Results of Vegetation Monitoring (Shrub Area)..... 12

 3.3B Results of Vegetation Monitoring (Marsh Grass Area)..... 13

 3.4A Conclusions (Shrub Area)..... 14

 3.4B Conclusions (Marsh Grass Area)..... 14

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS..... 15

TABLES

TABLE 1 – 2004 Groundwater Gauge Hydrologic Monitoring Results..... 7

TABLE 2 – 2004 VEGETATIVE MONITORING RESULTS..... 12
(SHRUB AREA)

TABLE 3 – 2004 VEGETATIVE MONITORING RESULTS..... 13
(MARSH GRASS AREA)

FIGURES

FIGURE 1 – SITE LOCATION MAP.....	3
FIGURE 2 – MONITORING GAUGE LOCATION MAP.....	6
FIGURE 3 – 2004 HYDROLOGIC MONITORING GAUGE RESULTS.....	8
FIGURE 4 – USMC 30-70 PERCENTILE GRAPH, WILMINGTON, NC....	10

APPENDICES

APPENDIX A – GAUGE DATA GRAPHS	
APPENDIX B – SITE PHOTOGRAPHS	
APPENDIX C – VEGETATION PLANTING PLAN AND PHOTO AND VEGETATION PLOT LOCATIONS	

SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year on the U.S. Marine Corps Mitigation Site. This site was constructed in 1999. The site was regraded in 2002 after portions of the site did not meet the hydrology success criteria. During the grading, all monitoring gauges were removed. Following grading, one tidal gauge and two surface water gauges were installed in the restoration area. In May 2003, additional gauges were installed in the reference and restoration areas. Two groundwater gauges (including one reference), three surface water gauges (including two reference), and one onsite rain gauge. Currently, there is one tidal gauge, five surface water gauges, two groundwater gauges, and one rain gauge.

During the 2004 growing season, both groundwater gauges demonstrated successful hydrologic results, with GW-1 (reference) indicating saturation for 40.1% and GW-2 indicating saturation for 20.8% of the growing season, respectively. All five surface gauges and the tidal gauge indicated inundation throughout the growing season.

Historical rainfall data used for the 30-70 percentile was recorded at the Wilmington (New Hanover County) Weather Station, maintained by the NC State Climate Office.

Approximately 0.56 acres involved shrub planting. The one test plot yielded an average density of 560 shrubs per acre. Approximately 2.93 acres were planted in the marsh grass area. For the third year of monitoring, the percent frequency yielded 76.2% while the cover scale value was 4.12%. These results do not currently meet the success criteria, but both have improved in the third year of monitoring.

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 U.S. Marine Corps Mitigation Site encompasses 3.5 acres and is located in Onslow County on the Intracoastal Waterway, southeast of Onslow Beach on the Camp Lejeune Marine Corps Base (Figure 1). Designed as a salt marsh, the site provides compensatory mitigation for the US 17 Bypass of Jacksonville, TIP Project U-2107A, B, BA, C, and D (USACE Action ID No. 199402926).

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for five years (for vegetation) and until success is shown (hydrologic). 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 2004 at the USMC Mitigation Site.

Activities in 2004 reflect the third year of hydrologic and vegetation monitoring following regrading and replanting of the site in Spring 2002. Included in this report are analyses of both hydrologic and vegetative monitoring results, as well as local climate conditions throughout the growing season.

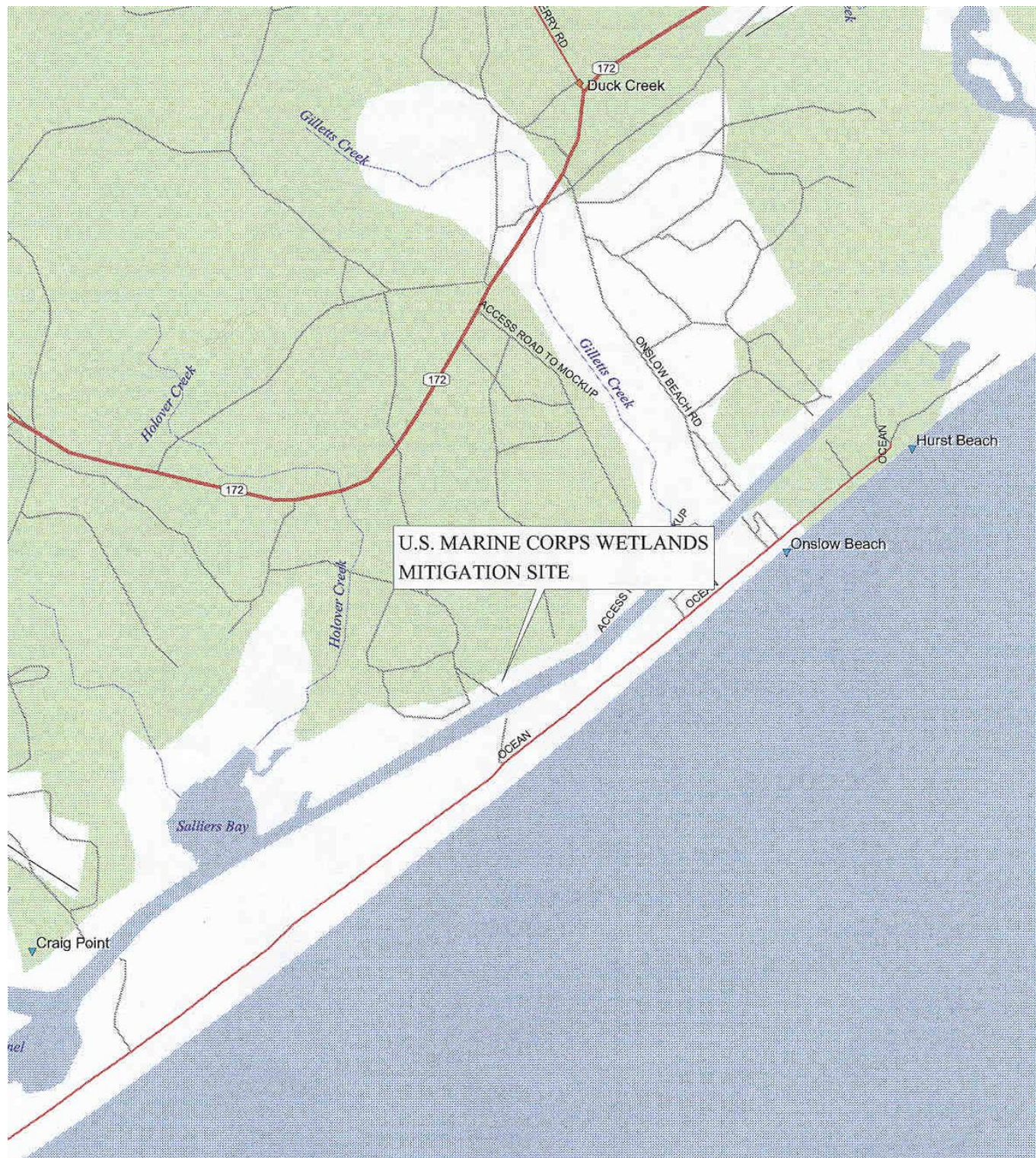


Fig. 1. Mitigation Site Location Map

1.3 Project History

March 1999	Grading Construction
April 1999	Site Planted
May 1999	Monitoring Gauges Installed
May- November 1999	Hydrologic Monitoring (Year 1)
October 1999	Vegetation Monitoring (Year 1)
March-November 2000	Hydrologic Monitoring (Year 2)
August 2000	Vegetation Monitoring (Year 2)
March – November 2001	Hydrologic Monitoring (Year 3)
October 2001	Vegetation Monitoring (Year 3)
April 2002	Site Regraded
May 2002	Site Replanted
August 2002	Vegetation Monitoring (Restart Year 1)
March-November 2002	Hydrologic Monitoring (Restart Year 1)
May 2003	Supplemental Planting
August 2003	Site Treated for Phragmites
August 2003	Vegetation Monitoring (Year 2)
March-November 2003	Hydrologic Monitoring (Year 2)
June 2004	Site Treated for Phragmites
August 2004	Site Visit with Regulatory Agencies
August 2004	Vegetation Monitoring (Year 3)
March-November 2004	Hydrologic Monitoring (Year 3)

1.4 Permit Related Requirements

Special conditions of the permit for U-2107 required that NCDOT:

“3.5 acres of *Spartina alterniflora* and *Juncus roemerianus* marsh shall be restored as described in the Onslow County Marsh Mitigation Plan dated September 1997. All grading and planting on the site shall be completed no later than June 1, 1999.” This site was initially completed in March 1999. Remediation activities occurred in Spring 2002.

2.0 HYDROLOGY

2.1 Success Criteria

Shrub area

Project specifications require saturation or inundation (within 12 inches of the surface) for at least 12.5% of the growing season for one year under average climatic conditions. However, areas may still be classified as wetlands even though the hydrology does not meet optimum wetland criteria.

The growing season in Onslow County begins April 8 and ends November 5. These dates correspond to a 50% probability that air temperatures will drop to 28° F or lower after April 8 and before November 5.¹ The growing season is 212 days; therefore, optimum duration for wetland hydrology is 27 days.

Marsh area

For the lower marsh area, the success criteria require daily tidal flooding.

According to the September 1997 mitigation plan, this is defined by “Hydrological success criteria will include the recorded presence of similar water level elevations and flood durations within the mitigation area as compared with the RME”.

2.2 Hydrologic Description

There is one tidal gauge, five surface water-monitoring gauges, two groundwater gauges, and one rain gauge installed onsite (Figure 2). The tidal gauge measures water elevation every three hours, while the surface water gauges record every hour. The automatic monitoring gauges record daily readings of groundwater depth. This is the third year of hydrologic monitoring for the site, following the regrading activities.

¹ Soil Conservation Service, Soil Survey of Johnston County, North Carolina, 1994.

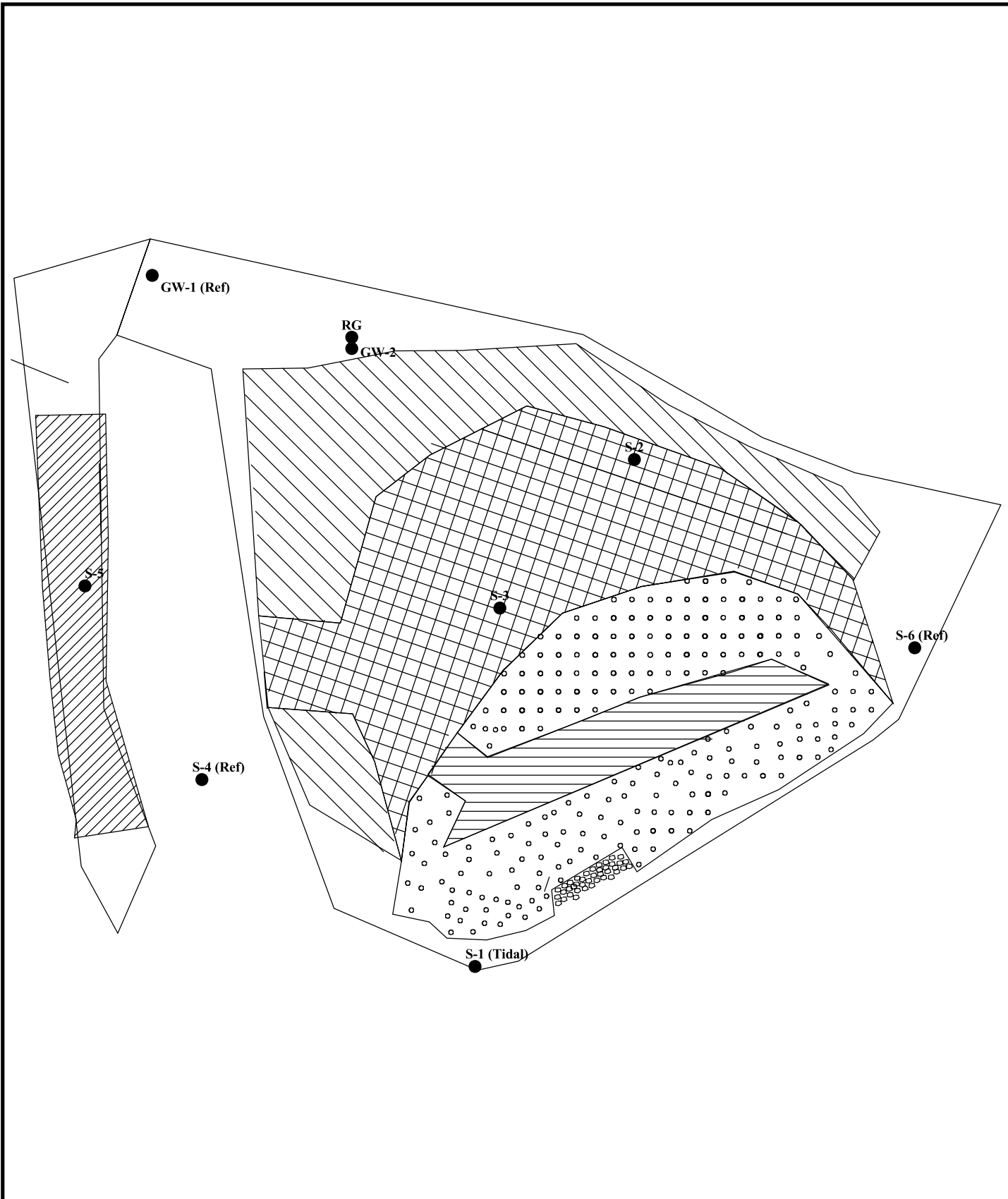


Figure 2. Gauge Location Map



Not to Scale

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 212-day growing season. The results are presented in Table 1.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days is noted on each graph. An onsite rain gauge was used to obtain rainfall data from the site. It has been compared with rainfall data obtained from the State Climate Office Local Weather Station in Wilmington.

Table 1. 2004 Groundwater Gauge Hydrologic Monitoring Results

Monitoring Gauge	<5%	5%-8%	8%-12.5%	>12.5%	Actual %	Success Dates
GW-1 (Ref)+				X	40.1	April 8-May 18 Aug 13-Nov 5
GW-2+				X	20.8	April 8-May 4 July 21-Aug 19 Sept 23- Nov 5

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

All five surface gauges (including both reference gauges) and the tidal gauge indicated inundation throughout the growing season. This is consistent with the hydrology success criteria outlined for the marsh restoration area.

2.3.2 Climatic Data

Figure 3 is a comparison of monthly rainfall for the period of November 2003 through October 2004 to historical precipitation (collected between 1973 and 2004) for Wilmington, North Carolina. This comparison gives an indication of how 2004 relates to historical data in terms of climate conditions. The NC State Climate Office provided all offsite data.

For the 2004-year, February and August experienced above average rainfall. The months of March and October recorded below average rainfall for the site. November (03'), December (03'), January, April, May, June, July, September, and November experienced average rainfall. Overall, 2004 experienced an average rainfall year.

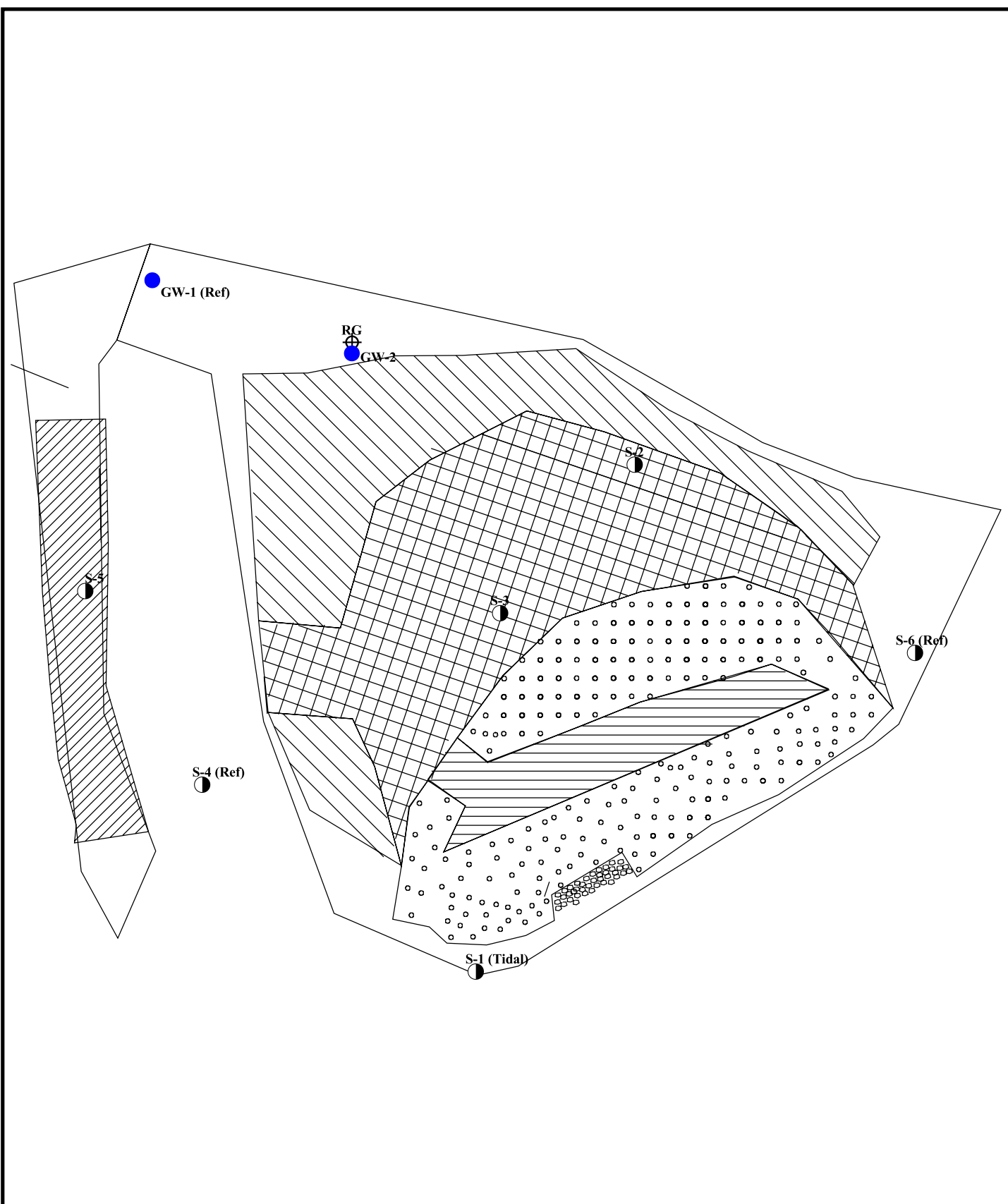


Figure 3. 2004 Hydrologic Monitoring Gauge Results



Hydrology Results

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

- ⊕ Rain Gauge
- Surface Gauge



2.4 Conclusions

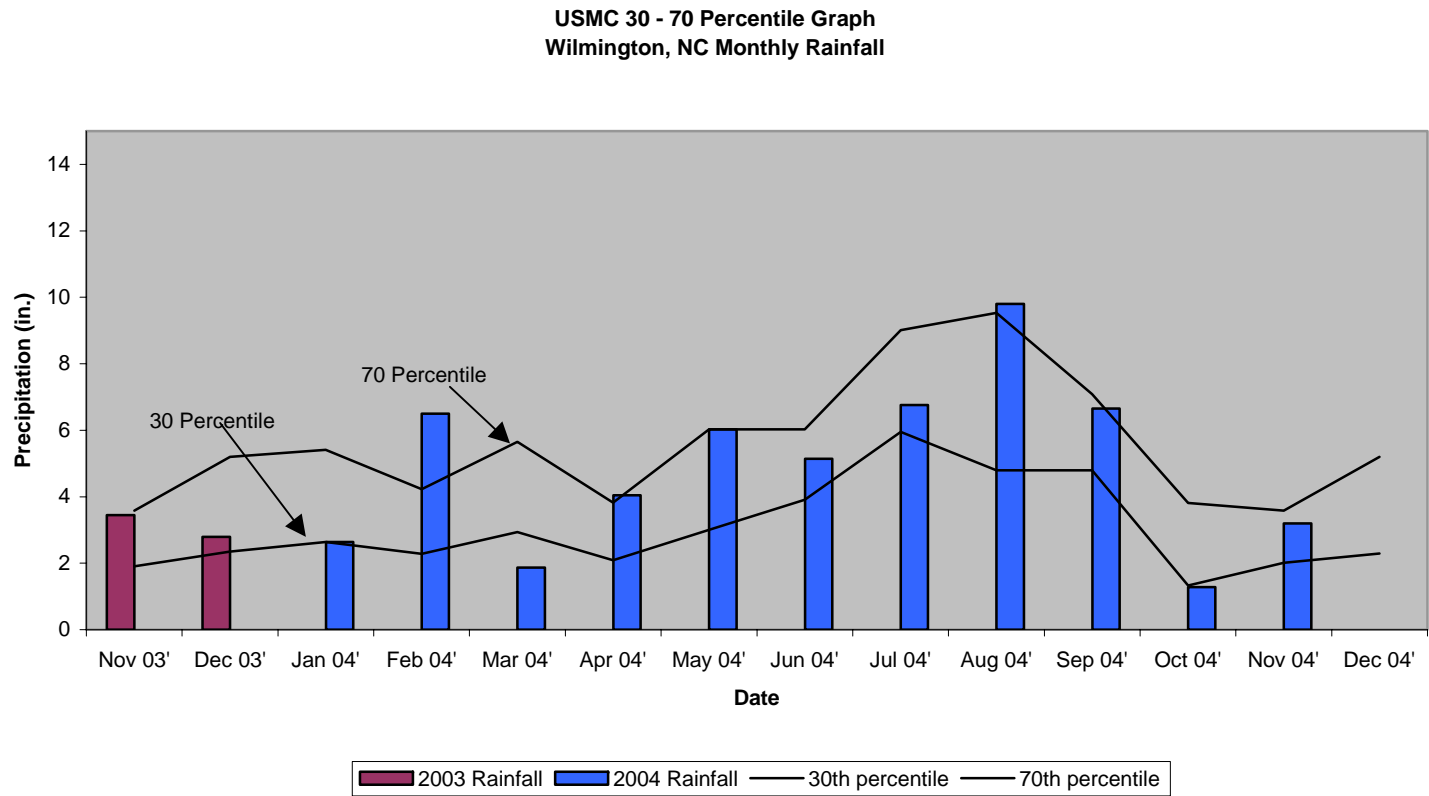
Currently, there is one tidal gauge, five surface water gauges, two groundwater gauges, and one rain gauge being used to monitor hydrology on the USMC Mitigation Site.

The two groundwater gauges demonstrated successful hydrologic results, with GW-1 (reference) indicating 40.1% and GW-2 indicating 20.8% saturation periods during the growing season, respectively.

All five surface gauges (including both reference gauges) and the tidal gauge indicated inundation throughout the growing season. This is consistent with the hydrology success criteria outlined for the marsh restoration area.

EEP will begin monitoring hydrology at the USMC Mitigation Site for the 2005 monitoring year.

FIGURE 4. 30-70 Percentile Graph



VEGETATION: USMC MITIGATION SITE (YEAR 3 MONITORING)

3.1A Success Criteria (Shrub Area)

The success criteria state that there must be a minimum mean density of 320 trees per acre of approved target species surviving for at least three years.

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 in 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 (Shrub Area)

The following plant communities were planted in the Shrub Area:

Zone 1: (approximately 0.56 acres)

Myrica cerifera, Wax Myrtle

Baccharis halimifolia, False Willow

Iva frutescens, Marsh Elder

3.2B Description of Planted Areas (Marsh Grass Area)

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

Zone 1: (approximately 0.7 acres)

Juncus roemerianus, Black Needle Rush

Zone 2: (approximately 2.23 acres)

Spartina alterniflora, Smooth Cordgrass

3.3A Results of Vegetation Monitoring (3 year) (Shrub Area)

Plot #	Wax Myrtle	False Willow	Marsh Elder	Total (3 year)	Total (at planting)	Density (Shrubs/Acre)
1	22	9	11	42	51	560
TOTAL DENSITY						560

Site Notes: Natural propagation seen in marsh elder and false willow species. Phragmites on the outer fringe of the site were treated in June 2004 and will continue to be evaluated throughout the monitoring period.

3.3B Results of Vegetation Monitoring (Marsh Grass Area)

	Plot #	Scale Factor	<i>Juncus roemerianus</i>	<i>Spartina alterniflora</i>	Frequency	Notes
	1	4.0	☐	☐	☐	
	2					open water
	3	2.0		☐	☐	
	4	3.0		☐	☐	
	5	3.0		☐	☐	
	6	0.0				bare ground
	7	5.0		☐	☐	
	8	5.0				
	9					open water
	10	5.0		☐	☐	
	11	5.0				
	12	0.0				bare ground
	13	5.0		☐	☐	
	14	5.0	☐		☐	
	15	0.0				bare ground
	16	5.0		☐	☐	
	17	5.0		☐	☐	
	18	5.0				
	19	5.0		☐	☐	
	20	5.0		☐	☐	
	21	3.0		☐	☐	
	22	4.0		☐	☐	
	23	5.0		☐	☐	
	24					out of bounds
	25					out of bounds
	26	0.0				bare ground
	27	5.0				
	28					out of bounds
	29	5.0		☐	☐	
	30	5.0		☐	☐	
	31	4.0		☐	☐	
	32	5.0		☐	☐	
	33	5.0		☐	☐	
	34	5.0		☐	☐	
	35	5.0		☐	☐	
	36	5.0		☐	☐	
	37					out of bounds
	38	5.0		☐	☐	
	39	5.0		☐	☐	
	40	0.0				bare ground
	41	5.0		☐	☐	
	42	5.0		☐	☐	
	43	5.0		☐	☐	
	44	5.0	☐	☐	☐	
	45					out of bounds
	46	5.0				
	47	5.0		☐	☐	
	48	5.0	☐		☐	
	49					open water
	50	5.0		☐	☐	

Frequency/Percentage of			
Plots with Desired Species		76.2%	
Sum Scale Value		173.0	
Total # of Plots Counted		42	
Vegetative Cover (Scale Value)		4.12	

Site Notes: The marsh area has grasses present throughout the majority of the site, and coverage is increasing in these areas. The following species were also noted in the monitoring plots. The percentage of plots that the species were found follows in parentheses (i.e. 10% of the plots contain *Spartina patens*)

Spartina patens (10), lespedeza (1), *Baccharis* sp. (4), wire grass (3), and barnyard grass (2)

3.4A Conclusions (Shrub Area)

Of the 3.5 acres that comprise this site, approximately 0.56 acres involved shrub planting. There was one test plot established in the planting area. The 2004 vegetation monitoring of the planted area revealed an average density of 560 shrubs per acre, which is well above the minimum requirement of 320 shrubs per acre. The marsh elder and false willow shrubs are spreading by natural propagation throughout the shrub area.

3.4B Conclusions (Marsh Grass Area)

- Percent Frequency of Target Species (Black Needle Rush and Smooth Cordgrass)
Frequency of 70% required. **76.2%**
- Vegetative Cover Scale Value
Scale Value of 5 required for year 5. **4.12**

Approximately 2.93 acres (of the 3.5 acres) involved marsh grass planting. There were 50 random plots established throughout the planting area that were located using GPS. Five of the sample plots were located as outside of the planted area. This is due to variances involved with the GPS system and the random point-generating program used to establish sample plot locations. These plots are labeled out of bounds and are not used in the calculations of the percent frequency and scale value. The vegetative coverage and frequency do not currently meet the success criteria. Based on the percent frequency and scale value, the marsh grass area is on track for year 3.

NCDOT regraded portions of the site in 2002. The marsh portion of the site was replanted in April 2002 and supplemental planted in May 2003. The site was treated for phragmites in June 2004. Photographs 9 through 12 show that the rock structure on the shoreline has stabilized and *Spartina alterniflora* is coming in naturally.

EEP will begin monitoring vegetation at the USMC Mitigation Site for the 2005 monitoring year.

4.0 OVERALL CONCLUSIONS AND RECOMMENDATIONS

One tidal gauge, five surface water gauges, two groundwater gauges, and one rain gauge are being used to monitor hydrology on the USMC Mitigation Site. All five surface gauges (including both reference gauges) and the tidal gauge indicated inundation throughout the growing season. This is consistent with the hydrology success criteria outlined for the marsh restoration area. The two groundwater gauges demonstrated successful hydrologic results, with GW-1 (reference) indicating 40.1% and GW-2 indicating 20.8% saturation periods during the growing season, respectively.

For the third year of monitoring, the one test plot in the shrub area yielded an average density of 560 shrubs per acre. This is above the minimum success criterion for the shrub area. For the third year of monitoring, the percent frequency yielded 76.2% while the cover scale value was 4.12%. These results do not currently meet the success criteria, but both have improved in the third year of monitoring.

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 PHOTOGRAPHS

USMC



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6

2004



Photo 7



Photo 8



Photo 9 (Shoreline)



Photo 10 (Shoreline)



Photo 11 (Shoreline)

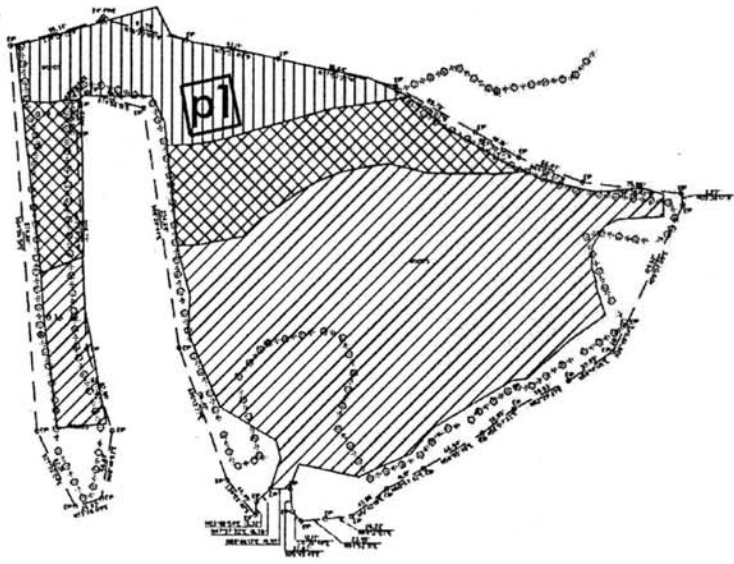


Photo 12 (Channel)





APPENDIX C
VEGETATION PLANTING PLAN AND
PHOTO AND VEGETATION PLOT LOCATIONS

USMC Marsh/Shrub Site Onslow County, U-2107 WM PLANTING PLAN

PROJECT REFERENCE NO.	SHEET NO.
U-2107 WM	WM-1
ROADWAY DESIGN PROJECTS	VEGETATION PROJECTS



LEGEND

-  Wax Myrtle
False Willow
Marsh Elder
-  Blackneedle Rush
-  Smooth Cordgrass
-  Vegetation Monitoring Plot (50 ft. X 50 ft.)

DATE PLOTTED: 11/11/2011 10:58:11 AM

USMC Marsh/Shrub Site
Onslow County, U-2107 WM

PROJECT REFERENCE NO.	SHEET NO.
U-2107 WM	0001 /
BY SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

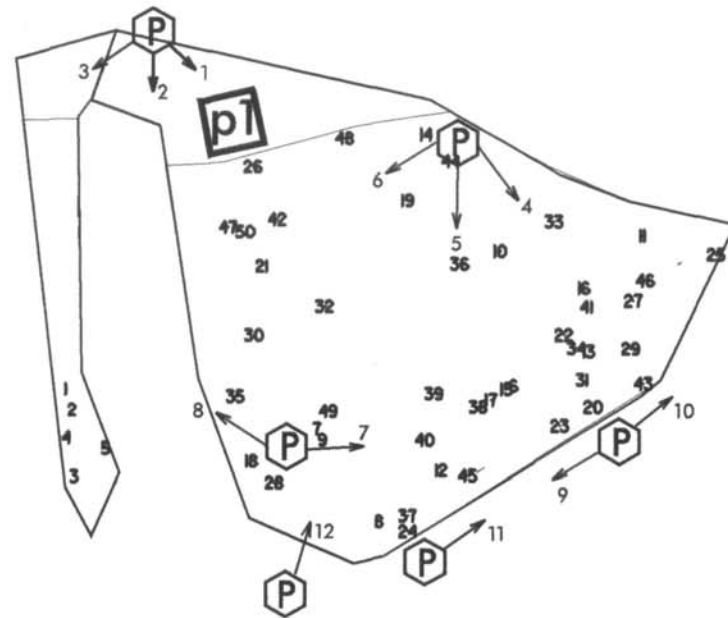


PHOTO AND VEGETATION PLOT LOCATIONS

□	Random Plots
⬡ P	Photograph Locations
□	Vegetation Monitoring Plot (50 ft. X 50 ft.)