ANNUAL REPORT FOR 2003

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

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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……. 3
- 1.4 Permit Related Requirements…….. 5

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 – 2003 Groundwater Gauge Hydrologic Monitoring Results….. 7

TABLE 2 – 2003 VEGETATIVE MONITORING RESULTS……. 12
(SHRUB AREA)

TABLE 3 – 2003 VEGETATIVE MONITORING RESULTS……. 13
(MARSH GRASS AREA)

FIGURES

FIGURE 1 – SITE LOCATION MAP…….. 4

FIGURE 2 – MONITORING GAUGE LOCATION MAP…….. 6

FIGURE 3 – 2003 HYDROLOGIC MONITORING GAUGE RESULTS…… 8

FIGURE 4 – USMC 30-70 PERCENTILE GRAPH, WILMINGTON, NC…. 10

APPENDICES

APPENDIX A – GAUGE DATA GRAPHS

APPENDIX B – SITE PHOTOS

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 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 2003 growing season, both groundwater gauges demonstrated successful hydrologic results, with GW-1(reference) indicating saturation for 23.6% and GW-2 indicating saturation for 53.3% 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) rain gauge, maintained by the NC State Climate Office.

Approximately 0.56 acres involved shrub planting. The one test plot yielded an average density of 640 shrubs per acre. Approximately 2.93 acres were planted in the marsh grass area. For the second year of monitoring, the percent frequency yielded 68.4% while the cover scale value was 3.45. These results do not currently meet the success criteria, but both have improved in the second year of monitoring.

Based on the results from the 2003 growing season, NCDOT will continue to monitor the USMC Mitigation Site for hydrology and vegetation.

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 2003 at the USMC Mitigation Site.

Activities in 2003 reflect the second 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.

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)

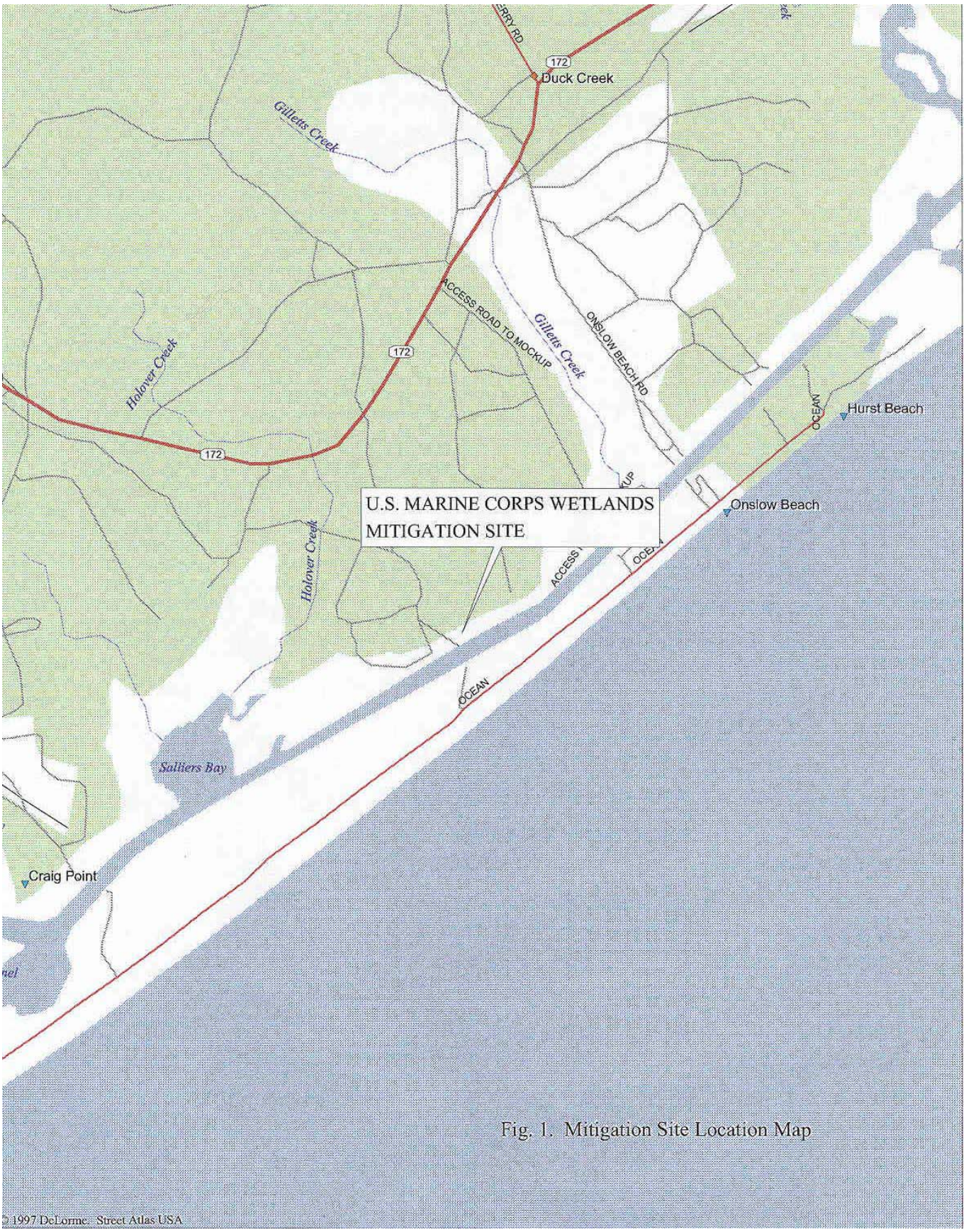

Fig. 1. Mitigation Site Location Map

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.

Marsh area

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

According to the September 1997 mitigation plan, this is defined as "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".

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. Also, local climate conditions must represent average conditions for the area.

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 second year of hydrologic monitoring for the site, following the regrading activities.

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

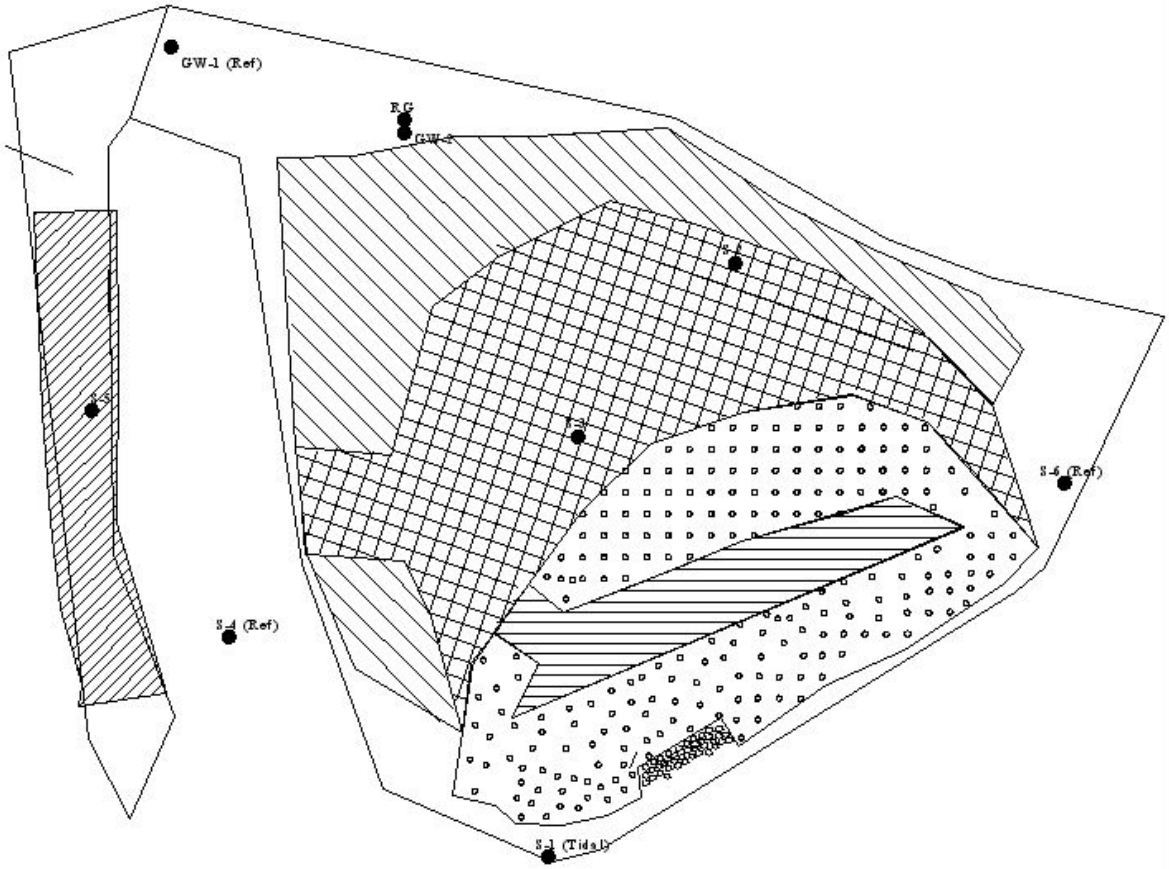


Figure 2. Gauge Location Map

N

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. 2003 Groundwater Gauge Hydrologic Monitoring Results

Monitoring Gauge	<5%	5%-8%	8%-12.5%	>12.5%	Actual %	Success Dates
GW-1 (Ref)+				**X**	**23.6**	May 21-June 29 July 12-August 30 Sept 18-Nov 5
GW-2+				**X**	**53.3**	May 21-July 9 July 16- Nov 5

+ Gauge met the success criterion during an average rainfall month (May, June, August, and November).

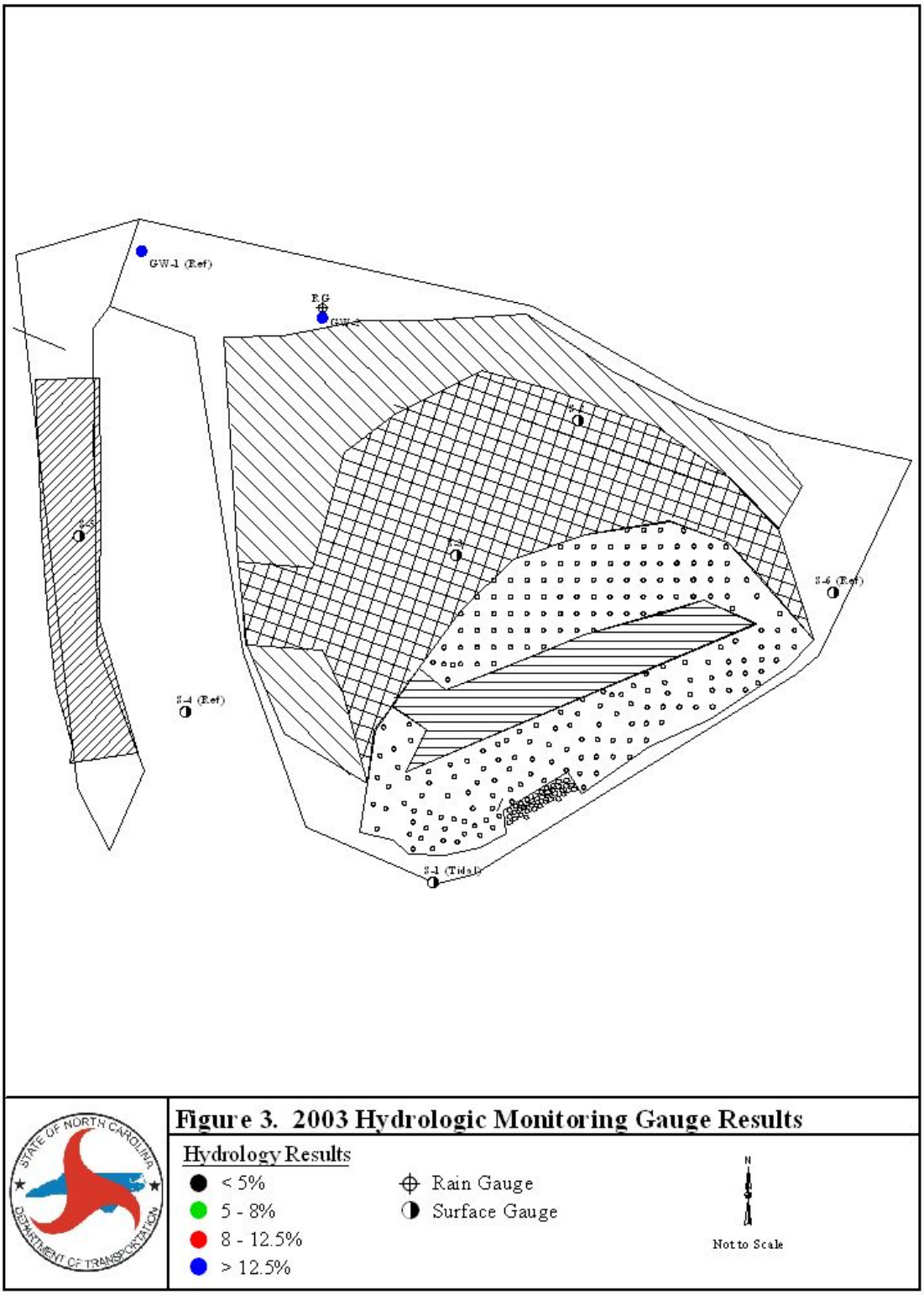
All five surface gauges (including both reference gauges) and the tidal gauge indicated inundation throughout the growing season. This is consistent with the hydrology success criteria outlined for the marsh restoration area.

2.3.2 Climatic Data

Figure 3 is a comparison of monthly rainfall for the period of November 2002 through October 2003 to historical precipitation (collected between 1972 and 2003) for Wilmington, North Carolina. This comparison gives an indication of how 2003 relates to historical data in terms of climate conditions. The NC State Climate Office provided all offsite data.

For the 2003-year, March, April, July, September, and October experienced above average rainfall. The month of January recorded below average rainfall for the site. November (02'), December (02'), February, May, June, August, and November experienced average rainfall. Overall, 2003 experienced an average rainfall year.

Figure 3. Hydrologic Monitoring Gauge Results



2.4 Conclusions

In May 2003, two groundwater gauges and three (additional) surface water gauges were installed on the site. 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.

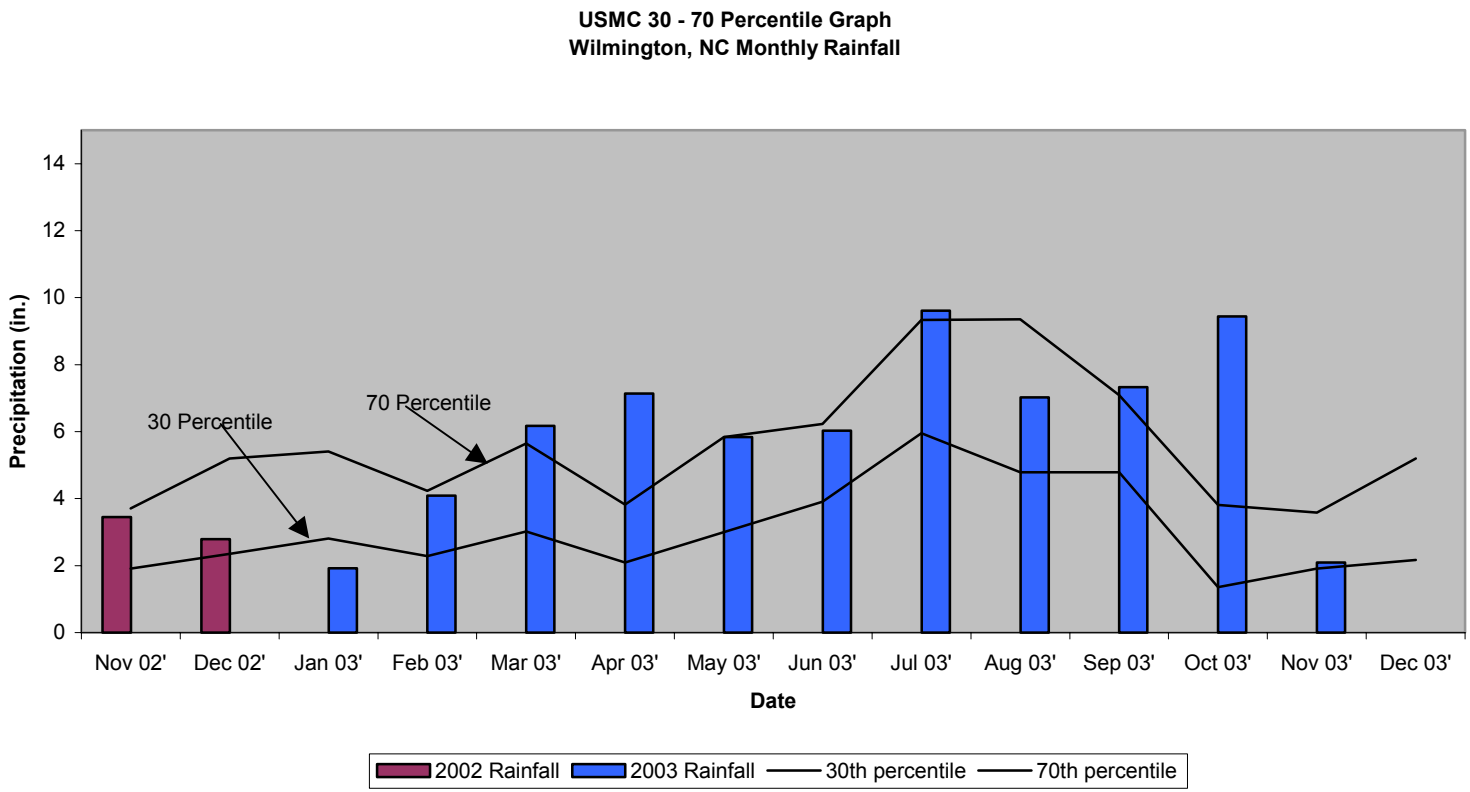
All five surface gauges (including both reference gauges) and the tidal gauge indicated inundation throughout the growing season. This is consistent with the hydrology success criteria outlined for the marsh restoration area.

The two groundwater gauges demonstrated successful hydrologic results, with GW-1 (reference) indicating 23.6% and GW-2 53.3% saturation periods during the growing season, respectively.

For the 2003-year, March, April, July, September, and October experienced above average rainfall. The month of January recorded below average rainfall for the site. November (02'), December (02'), February, May, June, August, and November experienced average rainfall. Overall, 2003 experienced an average rainfall year.

NCDOT will continue to monitor the USMC Mitigation Site for hydrology.

FIGURE 4. 30-70 Percentile Graph



3.0 VEGETATION: USMC MITIGATION SITE (YEAR 2 MONITORING)

3.1A Success Criteria (Shrub Area)

Success criteria states 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 to 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 (Year 2) (Shrub Area)

TABLE 2: 2003 VEGETATIVE MONITORING RESULTS (SHRUB AREA)

Plot #	Wax Myrtle	False Willow	Marsh Elder	Total (2 year)	Total (at planting)	Density (Shrubs/Acre)
1	26	8	14	48	51	640
TOTAL DENSITY						**640**

Site Notes: Natural propagation seen in marsh elder and false willow species. Phragmites on the outer fringe of the site were treated in August 2003 and will continue to be evaluated throughout the monitoring period.

3.3B Results of Vegetation Monitoring (Year 2) (Marsh Grass Area)

TABLE 3: 2003 VEGETATIVE MONITORING RESULTS (MARSH AREA)

	Plot #	Scale Factor	*Juncus roemerianus*	*Spartina alterniflora*	Frequency	Notes
	1	4.0				*Spartina patens*
	2					Open Water
	3	4.0				*Spartina patens,* Phragmites, Cattails
	4	4.0				*Spartina patens,* Phragmites, Cattails
	5					Open Water
	6	5.0				Glasswort
	7	2.0				
	8	2.0				
	9	5.0				*Spartina patens*
	10	5.0				*Spartina patens,* Wire Grass
	11	0.0				Bare Ground
	12	5.0				*Spartina patens,* Wire Grass, Glasswort
	13					Out of Bounds
	14	0.0				Bare Ground
	15	0.0				Bare Ground
	16					Open Water
	17	5.0				*Spartina patens,* Wire Grass, Glasswort
	18					Open Water
	19					Open Water
	20	5.0				*Spartina patens,* Wire Grass, Glasswort
	21	0.0				Bare Ground
	22	4.0				
	23	5.0				*Baccharis halimifolia, Spartina patens*
	24	1.0				
	25	5.0				
	26	4.0				Glasswort
	27	5.0				*Spartina patens, Baccharis halimifolia*
	28	5.0				
	29	5.0				*Spartina patens, Baccharis halimifolia*
	30	2.0				
	31	5.0				Glasswort
	32					Out of Bounds
	33					Out of Bounds
	34					Out of Bounds
	35	2.0				
	36	5.0				*Spartina patens*
	37					Out of Bounds
	38					Open Water
	39	5.0				
	40	1.0				
	41	1.0				
	42	4.0				
	43	5.0				Glasswort
	44	4.0				*Spartina patens,* Wire Grass
	45	5.0				
	46					Out of Bounds
	47	0.0				Bare Ground
	48	5.0				
	49	1.0				
	50	5.0				Glasswort

Site Notes: Marsh area has grasses present throughout portions of the site, and coverage is increasing in these areas.

3.4A Conclusions (Shrub Area)

Of the 3.5 acres on this site, approximately 0.56 acres involved shrub planting. There was one test plot established in the planting area. The 2003 vegetation monitoring of the planted area revealed an average density of 640 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) **68.4%**
  Frequency of 70% required.
- Vegetative Cover Scale Value **3.45**
  Scale Value of 5 required for year 5.

Of the 3.5 acres on this site, approximately 2.93 acres involved marsh grass planting. There were 50 random plots established throughout the planting area and they were located using GPS. The vegetative coverage and frequency do not currently meet the success criteria. However, vegetation coverage and frequency appear to be improving in the second year of monitoring.

NCDOT regraded portions of the site in 2002. The marsh portion of the site was replanted in April 2002 and supplemental planting occurred in May 2003. The site was treated for phragmites in August 2003 and will be re-evaluated throughout the monitoring period.

NCDOT will continue vegetation monitoring at the USMC Mitigation Site.

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 23.6% and GW-2 53.3% saturation periods during the growing season, respectively.

For the second year of monitoring, the one test plot in the shrub area yielded an average density of 640 shrubs per acre. This is above the minimum success criterion for the shrub area. The percent frequency in the marsh grass area yielded 68.4% and the cover scale value was 3.45. These results do not currently meet the success criteria, but both have improved in the second year of monitoring.

Based on results from the 2003 growing season, NCDOT will continue to monitor USMC for hydrology and vegetation.

APPENDIX A

GAUGE DATA GRAPHS

APPENDIX B

SITE PHOTOS

USMC

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

2003

Photo 7

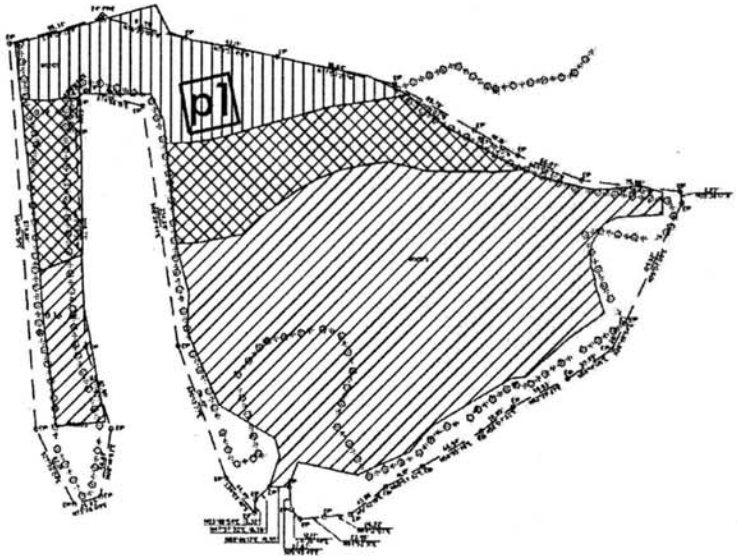
Photo 8

Photo 9

2003

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-2107WM	WM-1
S.R. SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

N
NC GRID NAD 83

LEGEND

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

PROJECT REFERENCE NO.	SHEET NO.
U-2107WM	map 1
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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

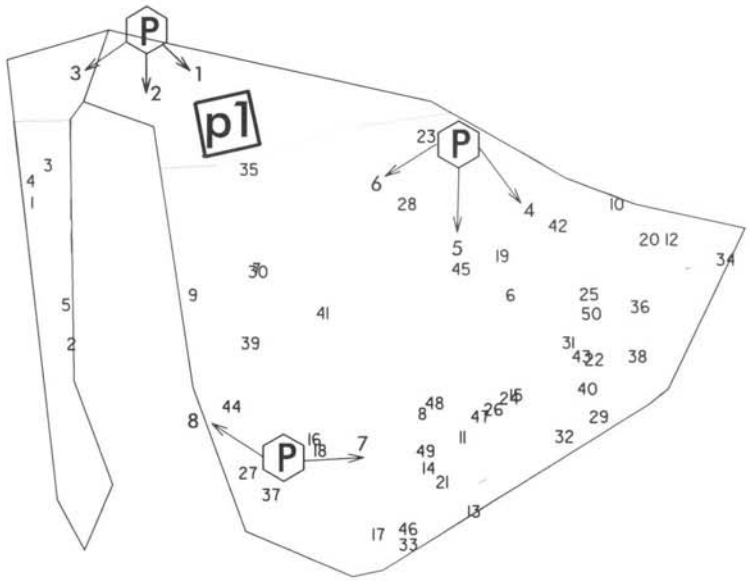


PHOTO AND VEGETATION PLOT LOCATIONS

- Random Plots
- Photograph Locations
- Vegetation Monitoring Plot (50 ft. X 50 ft.)