

ANNUAL REPORT FOR 2002



Dismal Swamp Mitigation Site
Gates / Perquimans County
Project No. 6.129003T
TIP No. R-2208 WM



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December 2002

TABLE OF CONTENTS

2002 REPORT – EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	2
1.1 Project Description	2
1.2 Purpose.....	2
1.3 Project History	3
1.4 Debit Ledger.....	5
1.5 Permit Related Requirements	5
2.0 HYDROLOGY	6
2.1 Success Criteria	6
2.2 Hydrologic Description	6
2.3 Results of Hydrologic Monitoring.....	8
2.3.1 Site Data	8
2.3.2 Climatic Data	11
2.4 Conclusions.....	11
3.0 VEGETATION: DISMAL SWAMP MITIGATION SITE	13
3.1 Success Criteria	13
3.2 Description of Species.....	13
3.3 Results of Vegetation Monitoring	15
3.4 Conclusions.....	17
4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS	17

FIGURES

Figure 1. SITE LOCATION MAP 4
Figure 2. GAUGE LOCATION MAP 7
Figure 3. 2002 HYDROLOGIC MONITORING RESULTS 10
Figure 4. DISMAL SWAMP 30-70 PERCENTILE GRAPH..... 12

TABLES

Table 1. DISMAL SWAMP DEBIT LEDGER..... 5
Table 2. 2002 HYDROLOGIC MONITORING RESULTS 8
Table 3. VEGETATION MONITORING RESULTS 15

APPENDICES

APPENDIX A. DEPTH TO GROUNDWATER & SURFACE WATER GRAPHS
APPENDIX B. SITE PHOTOS
APPENDIX C. VEGETATIVE MONITORING PLAN

DISMAL SWAMP MITIGATION SITE

2002 REPORT – EXECUTIVE SUMMARY

The following report summarizes the monitoring activities that have occurred in the past year at the Dismal Swamp Mitigation Site. Phase 1 of this site was constructed in 1996 and Phase 2 was constructed in 1998. Monitoring activities in 2002 represent the fourth year of monitoring. The site must demonstrate vegetation and hydrological success for a minimum of five years.

The site is monitored with forty-eight vegetation plots, twenty-eight groundwater gauges, six surface gauges and two rain gauges. Data recorded by the rain gauge will be used for comparison to the daily groundwater readings. Daily rainfall recorded at a rain gauge in Elizabeth City, maintained by the NC State Climate Office, was obtained to produce the 30-70 percentile graph.

Hydrologic monitoring indicates that more than half of the entire site has met success criteria during the 2002-monitoring year. Nineteen of the 23 gauges met or exceeded the expected 12.5% jurisdictional wetland criteria for the growing season. All 4 gauges met the expected success criteria of 5%-12.5%, while the 1 gauge in the upland area met the expected hydrology less than 5% of the growing season. Overall only 4 gauges did not meet the expected wetland success criteria for the growing season.

The previous existing surface gauge indicated surface water throughout the growing season, while the 5 new Infinity surface gauges indicated surface water at the beginning and end of the growing season.

Rainfall data has been acquired from an onsite rain gauge. Also monthly rainfall data recorded from a rain gauge maintained by the NC State Climate Office in Elizabeth City was used for historical data. The 30-70-percentile graph indicates an average rainfall for the 2002-growing season.

Vegetation monitoring yielded a successful total average tree density of 482 trees per acre across the four-planted zones, which is well above the success criteria of 320 trees per acre.

Based on the monitoring results from the 2002 growing season, NCDOT recommends that hydrologic and vegetation monitoring continue.

1.0 INTRODUCTION

1.1 Project Description

The Dismal Swamp Mitigation Site is located along the Gates and Perquimans County line (COE ID # 199401492). It is 1.2 miles east of Sandycross on SR 1002 (Folly Road) (Figure 1). The site encompasses approximately 612 acres of farm and forest communities.

1.2 Purpose

In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five 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 2002 at the Dismal Swamp Mitigation Site as well as local climate conditions throughout the growing season.

1.3 Project History

Summer 1996	Grading Construction - Majority of Ditches Filled; Mowing; Discing (Phase 1)
January -February 1997	Tree Planting
February 1997	Monitoring Gauges Installed
March – November 1997	Hydrologic Monitoring (1 Year)
July 1997	Stake Test Plots & Initial Vegetation Monitoring
November 1997	Vegetation Monitoring (1 Year)
March – November 1998	Hydrologic Monitoring (2 Year)
October 1998	Vegetation Monitoring (2 Year)
November 1998	Grading Construction - Main Canal Ditch (Phase 2)
February 1999	Tree Planting (Phase 2)
March – November 1999	Hydrologic Monitoring (Restart 1 Year)
November 1999	Vegetation Monitoring (Restart 1 Year)
March 2000	Herbicide Treatment
March – November 2000	Hydrologic Monitoring (2 Year)
October 2000	Vegetation Monitoring (2 Year)
March – November 2001	Hydrologic Monitoring (3 Year)
September 2001	Vegetation Monitoring (3 Year)
March-November 2002	Hydrologic Monitoring (4 Year)
September 2002	Vegetation Monitoring (4 Year)

Figure 1. SITE LOCATION MAP

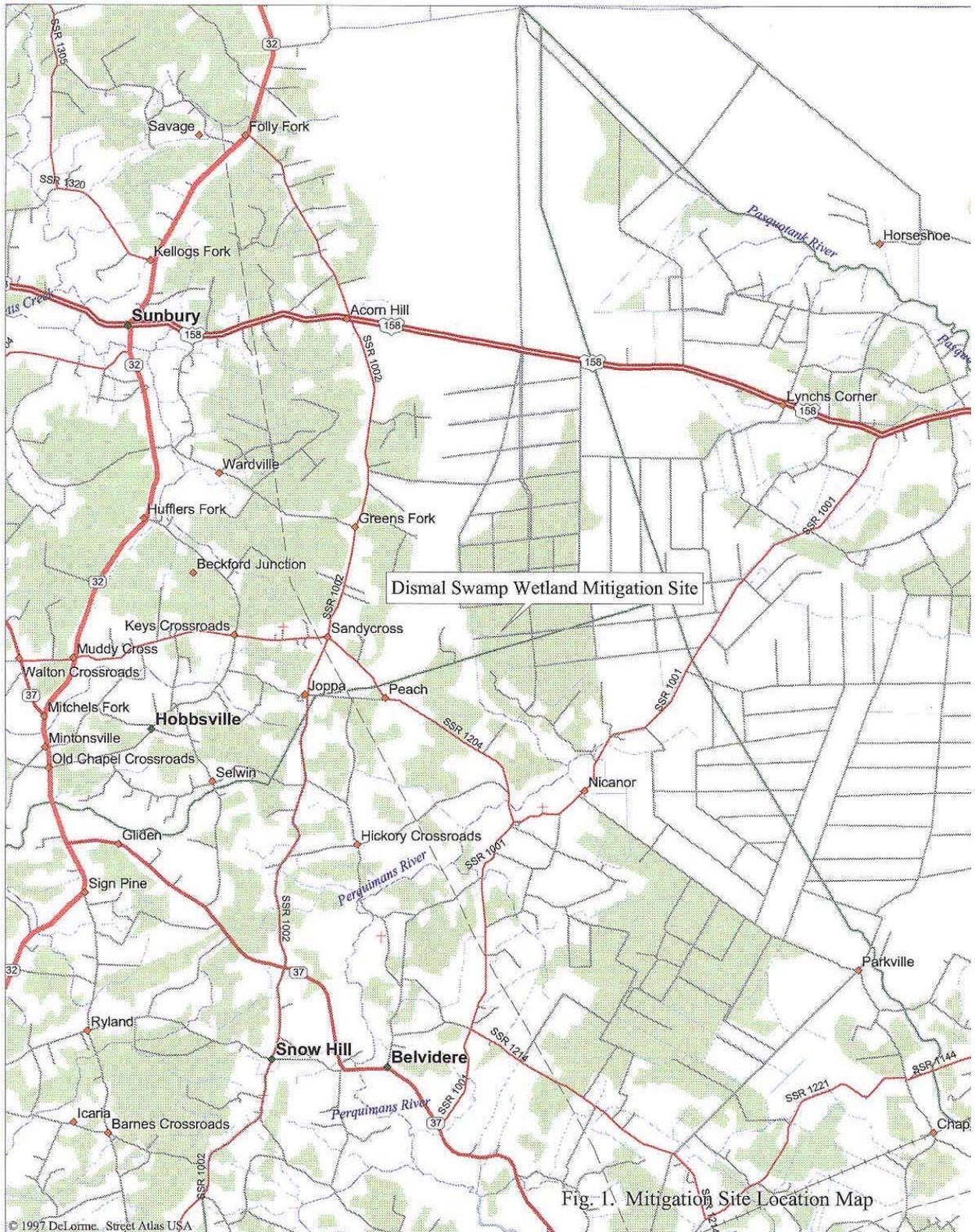


Fig. 1. Mitigation Site Location Map

1.4 Debit Ledger

Because of its size, Dismal Swamp Mitigation Site will provide mitigation for several highway projects. Table 1 shows the projects that this site is providing mitigation for through November 2002.

Table 1. DISMAL SWAMP DEBIT LEDGER

	BLH Non-Riverine	SPH Riverine	Total Acres
Total Acres at Site	485	58	543
TIP Project Debits			
R-2208A	39.71	6.09	45.8
R-2512A&B	2.69	8.06	10.75
R-2515A	20.6	-	20.6
R-2228A	-	0.88	0.88
R-2512A&B	1.93	-	1.93
R-2404B&C	52.66	4.26	56.92
R-2208A mod	14.93	-	14.93
R-2512B mod	2.39	-	2.39
R-2512A/B mod	3.89	-	3.89
R-2551	-	1.5	1.5
R-2515A	0.46	-	0.46
Division Project Debits			
Unnamed project	0.34	-	0.34
SR-1180	0.22	-	0.22
SR-1135	1.4	-	1.4
Remaining Acres at Site	343.78	37.21	380.99

69 acres of upland on debit ledger

1.5 Permit Related Requirements

There are no additional permit special conditions pertaining to the success criteria of the site that must be met in order for the site to be deemed successful.

2.0 HYDROLOGY

2.1 Success Criteria

Target hydrological characteristics include saturation or inundation within 12 inches of the surface for at least 12.5% of the growing season at lower landscape positions, during average climatic conditions. Upper landscape reaches and areas near perimeter canals may exhibit surface saturation/inundation for between 5% and 12.5% of the growing season based on gauge data. These 5%-12.5% areas are expected to support hydrophytic vegetation within organic soils of low permeability. If wetland parameters are marginal as indicated by vegetation and hydrology monitoring, consultation with COE personnel will be undertaken to determine jurisdictional extent in these transitional areas. One gauge was placed in an upland area where saturation is expected to be less than 5% of the growing season, in order to aid future delineation of true wetland area. Table 1 summarizes the wetland criteria expected for each monitoring gauge.

The growing season in Gates County begins March 25 and ends November 11. The dates correspond to a 50% probability that temperatures will drop to 28° F or lower after March 25 and before November 11.¹ The growing season is 232 days; the optimum duration for wetland hydrology is 29 consecutive days. Local climate must represent average conditions for the area in order for the hydrologic data to be considered valid.

2.2 Hydrologic Description

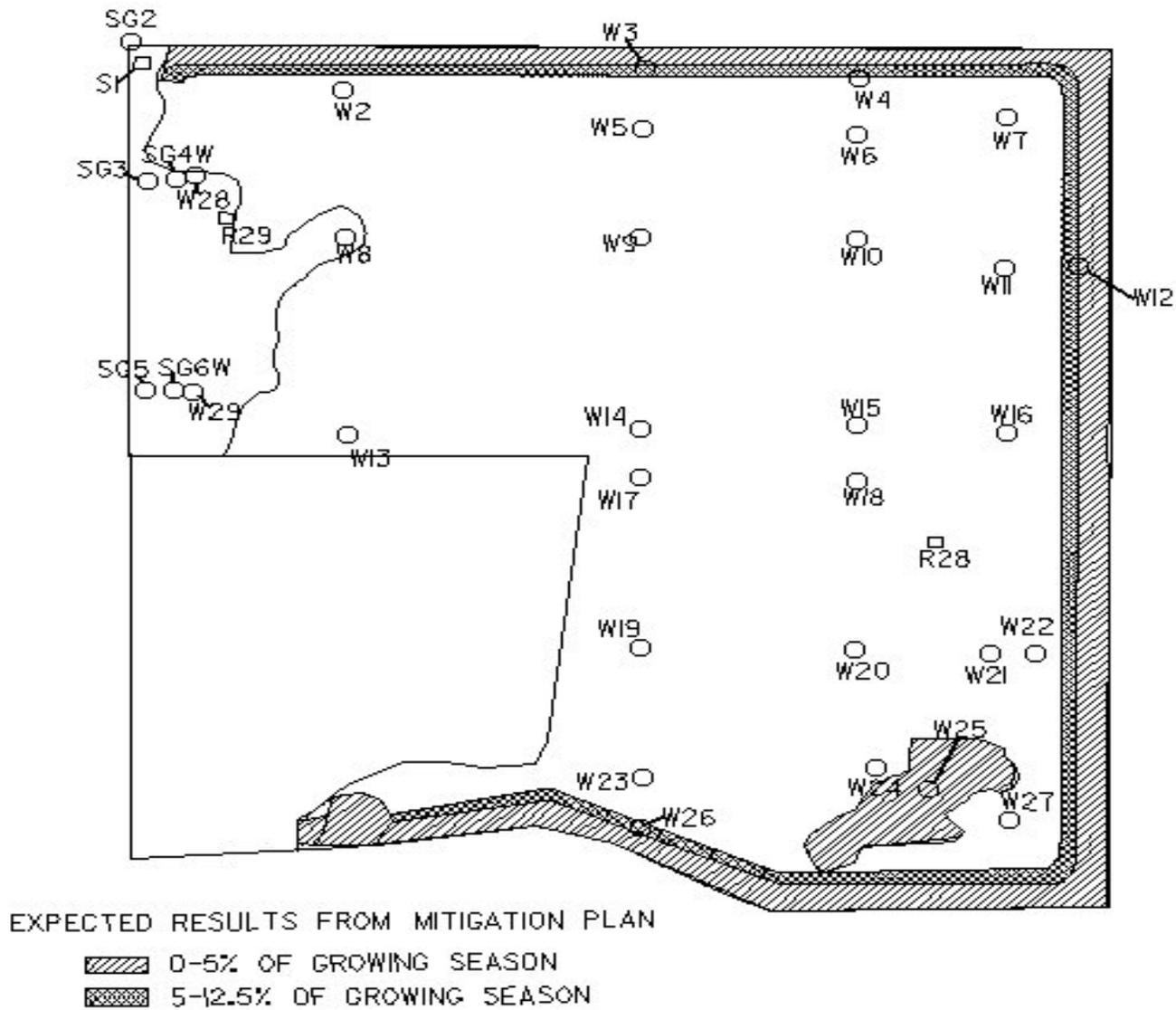
Twenty-eight groundwater-monitoring gauges, two rain gauges, and six surface gauges are currently in use at Dismal Swamp. One surface water gauge was installed on site in 1997 while 5 Infinity surface gauges and 2 groundwater gauges were recently installed in spring 2002. (Figure 2). The 5 Infinity gauges were installed to illustrate surface water levels in the riverine area. The 2 groundwater gauges were installed adjacent to the surface gauges to show groundwater in the absence of surface water. The monitoring gauges record daily readings of groundwater depth. The rain gauges were replaced in spring 2000 with Infinity rain gauges.

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.

¹ Soil Survey of Gates County, North Carolina, Soil Conservation Service, p.93.

Figure 2: Gauge Location Map



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 232-day growing season. Table 2 shows the hydrologic results for the 2002-growing season, along with the expected success criteria for each gauge.

Table 2. 2002 HYDROLOGIC MONITORING RESULTS

Monitoring Gauge	Expected %	< 5%	5% - 12.5%	≥ 12.5%	Actual %	Date
DS-2	> 12.5%			✓	25.0	March 25-May 21
DS-3	5%-12%			✓	20.7	March 25-May 11
DS-4	5%-12%		✓		6.5	April 2-April 15
DS-5	> 12.5%			✓	23.7	March 25-May 18
DS-6	> 12.5%			✓	21.1	March 25-May 12
DS-7	> 12.5%	✓			.43	
DS-8	> 12.5%	✓			3.0	
DS-9	> 12.5%			✓	18.1	April 16-May 27
DS-10	> 12.5%			✓	22.8	March 25-May 16
DS-11	> 12.5%			✓	24.6	March 25-May 20
DS-12	5%-12%		✓		6.5	April 2-April 15
DS-13	> 12.5%			✓	15.6	March 25-April 30
DS-14	> 12.5%			✓	20.3	March 25-May 10
DS-15	> 12.5%			✓	27.2	March 25-May 26
DS-16	> 12.5%			✓	20.7	March 25-May 11
DS-17	> 12.5%			✓	31.0	March 25-June 4
DS-18	> 12.5%			✓	30.2	March 25-June 2
DS-19	> 12.5%			✓	27.6	March 25-May 27
DS-20	> 12.5%			✓	21.1	March 25-May 12
DS-21	> 12.5%			✓	24.1	March 25-May 19
DS-22	> 12.5%		✓		10.3	April 16-May 9
DS-23	> 12.5%			✓	25.4	March 25-May 22
DS-24	> 12.5%		✓		9.5	March 25-April 15
DS-25	0%-5%	✓			1.3	
DS-26	5%-12%			✓	15.5	March 25-April 29
DS-27	> 12.5%			✓	12.5	March 25-April 22
DS-28	> 12.5%			✓	23.3	March 25-May 17
DS-29	> 12.5%			✓	25.4	March 25-May 22

Specific Gauge Problems:

- DS-22 lost data at the beginning of the growing season; the gauge was programmed to begin recording data on April 16.
- DS-7 experienced battery failure twice during the growing season (February 17-April 14), (May 20-June 4)
- DS-9 failed to record data (February 22-April 14), the battery was replaced.
- DS-8 experienced gauge malfunctions throughout the growing season (March 11-April 14), (April 23-June 4), (July 3-July 16), (July 27-September 4)
- DS-24 experienced gauge malfunctions (April 16-June 4)
- DS-2 experienced gauge malfunctions during (July 17-October 8)
- DS-15 failed to record data (August 10-September 5)
- DS-18 experienced battery failure at the end of the growing season (September 4-end of growing season)

Figure 3: 2002 Hydrologic Monitoring Results

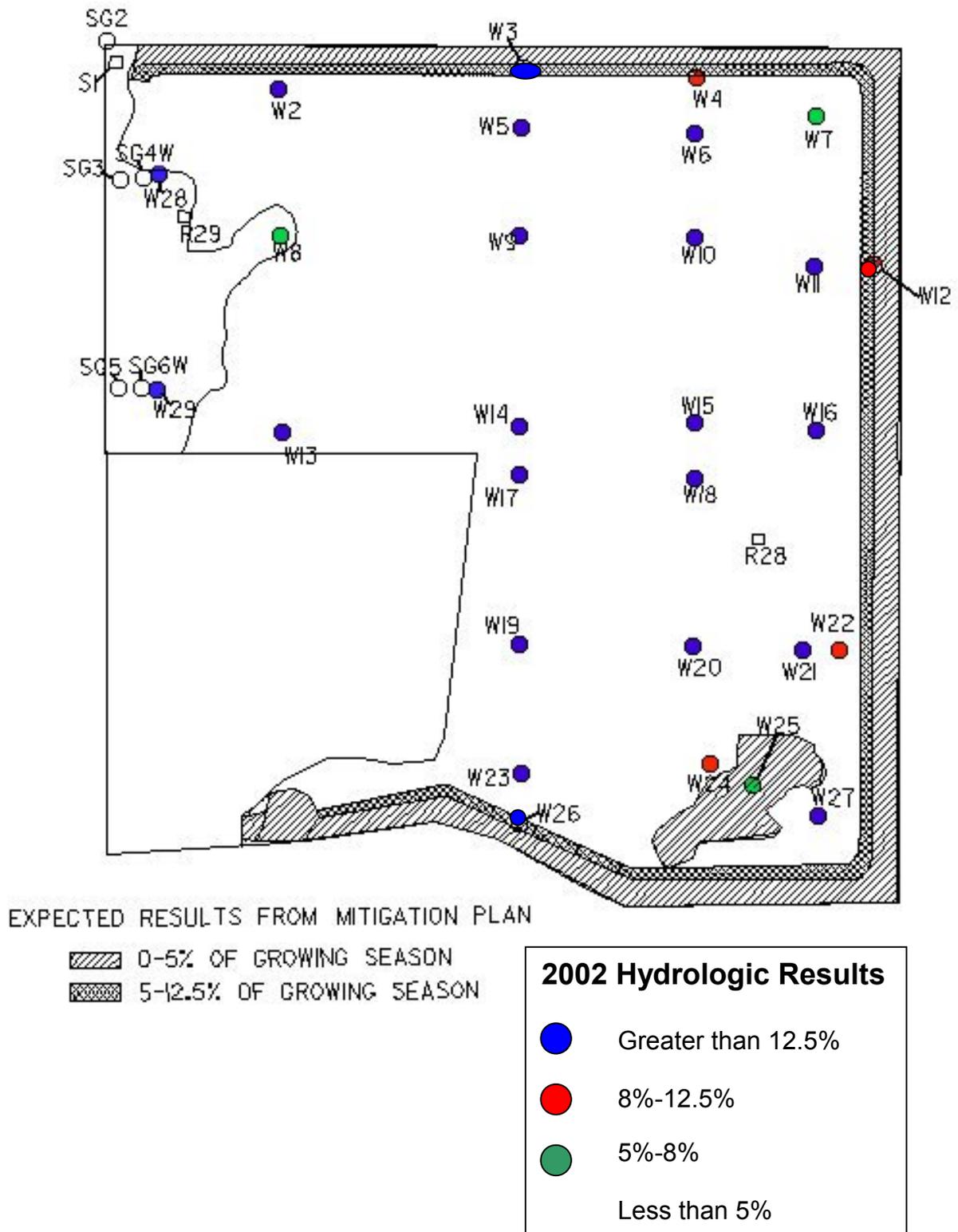


Figure 3 is an illustration of the 2002 hydrologic results. A blue square indicates hydrology for greater than 12.5% of the growing season; a red square means the gauge showed between 5% and 12.5%. A black square indicates hydrology less than 5% of the season. It is this hydrologic data which will determine the success of the site. The surface water gauges have recorded appreciable surface water throughout the growing season. Refer to Appendix A for the groundwater and surface water graphs.

2.3.2 Climatic Data

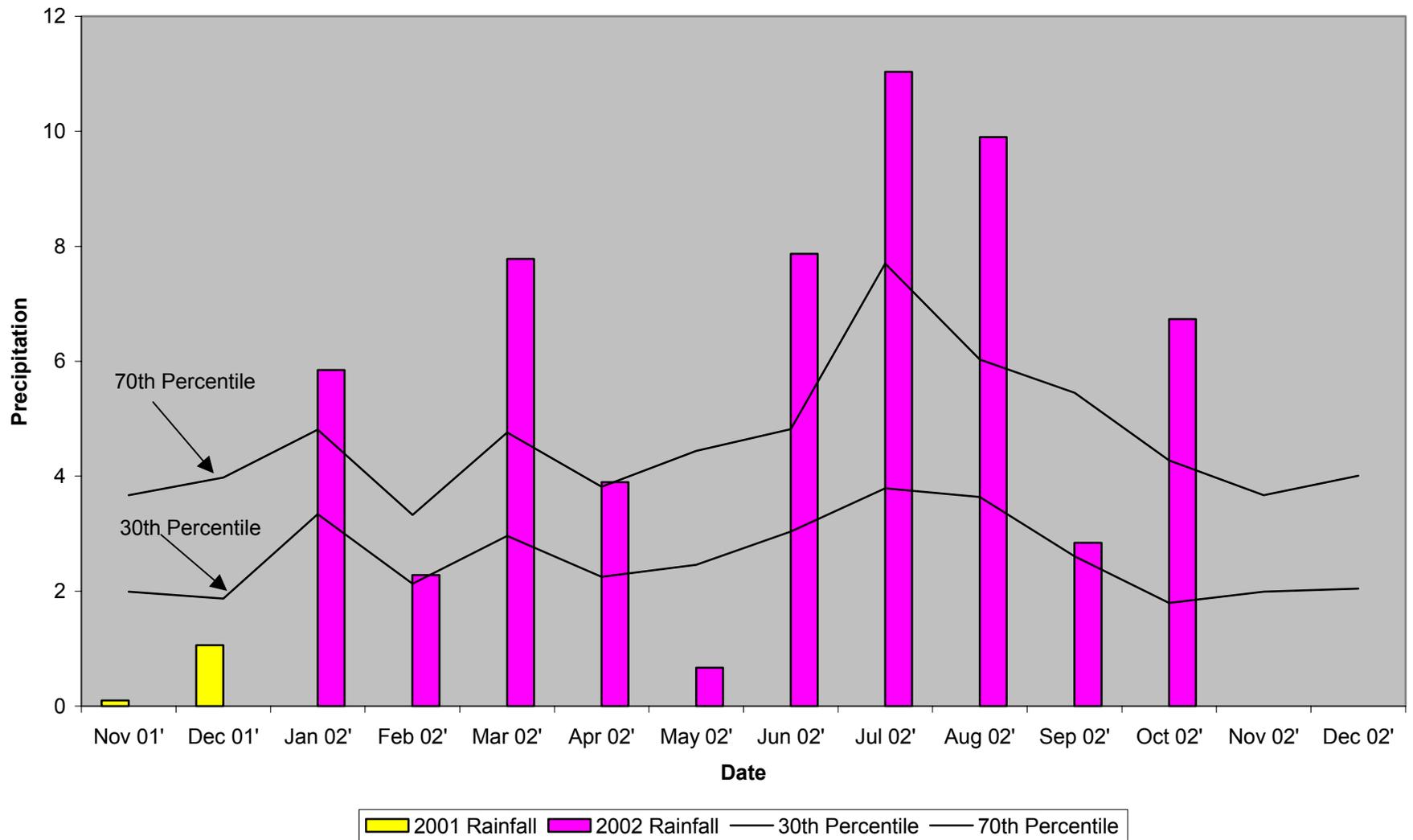
Figure 4 is a comparison of monthly rainfall for the period of November 2001 through October 2002 to historical precipitation (collected between 1971 and 2002) for Elizabeth City, North Carolina. This comparison gives an indication of how 2002 relates to historical data in terms of climate conditions. All off-site data was provided by the NC State Climate Office. February and May experienced below average rainfall. The months of April and September all recorded average rainfall for the site. January, March, June, July, August, and October experienced above average rainfall. No data is available for November or December however; the site meets hydrologic success criteria without these data. Overall 2002 experienced an average to below average rainfall year.

2.4 Conclusions

For the 2002-year, 12 gauges improved from 2001. Nineteen of the 23 gauges met or exceeded the expected 12.5% jurisdictional wetland criteria for the growing season. All 4 gauges met the expected success criteria of 5%-12.5%, while 1 gauge in the upland area met the expected hydrology less than 5% of the growing season. Overall only 4 gauges did not meet the expected wetland success criteria for the growing season. The previous existing surface gauge indicated surface water throughout the growing season, while the 5 new Infinity surface gauges indicated surface water at the beginning and end of the growing season.

Hydrologic monitoring will continue for 2003 at the Dismal Swamp Mitigation Site

Figure 4
Dismal Swamp 30-70 Percentile Graph 2002
Elizabeth City, NC



3.0 VEGETATION: DISMAL SWAMP MITIGATION SITE (YEAR 4 MONITORING)

3.1 Success Criteria

NCDOT will monitor the site for five years. A 320 stems per acre survival criterion for planted seedlings will be used to determine success for the first three years. The required survival criterion will decrease by 10% per year after the third year of vegetation monitoring (i.e., for an expected 290 stems per acre for year 4, and 260 stems per acre for year 5). The number of plants of one species will not exceed 20% of the total number of plants of all species planted.

3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

Zone 1: Non-riverine Swamp Forest / Atlantic White Cedar (136 acres)

Taxodium distichum, Baldcypress
Nyssa aquatica, Tupelo Gum
Nyssa sylvatica var. *biflora*, Swamp Blackgum
Chamaecyparis thyoides, Atlantic White Cedar
Fraxinus pennsylvanica, Green Ash
Quercus laurifolia, Laurel Oak
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus phellos, Willow Oak
Quercus lyrata, Overcup Oak

Zone 2: Coastal Fringe Sandhill Forest (12 acres)

Nyssa sylvatica var. *sylvatica*, Blackgum
Quercus marilandica, Blackjack Oak
Quercus virginiana, Live Oak
Pinus palustris, Longleaf Pine
Quercus coccinea, Scarlet Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus laevis, Turkey Oak
Quercus laurifolia, Laurel Oak
Quercus phellos, Willow Oak

**Zone 3: Non-riverine Swamp Forest Mineral Soil Subtype
(315 acres)**

Taxodium distichum, Baldcypress
Nyssa sylvatica var. *biflora*, Swamp Blackgum
Chamaecyparis thyoides, Atlantic White Cedar
Fraxinus pennsylvanica, Green Ash
Quercus laurifolia, Laurel Oak
Quercus falcata var. *pagodaefolia*, Cherrybark Oak
Quercus michauxii, Swamp Chestnut Oak
Quercus phellos, Willow Oak
Liriodendron tulipifera, Yellow Poplar

Zone 4: Riverine Swamp Forest (34 acres)

Taxodium distichum, Baldcypress
Nyssa aquatica, Tupelo Gum
Nyssa sylvatica var. *biflora*, Swamp Blackgum
Quercus lyrata, Overcup Oak
Chamaecyparis thyoides, Atlantic White Cedar
Fraxinus pennsylvanica, Green Ash
Quercus laurifolia, Laurel Oak
Quercus falcata var. *pagodaefolia*, Cherrybark Oak

3.3 Results of Vegetation Monitoring

Table 3. Vegetation Monitoring Results

	Plot #	Green Ash	Willow Oak	Laurel Oak	Cherrybark Oak	Tulip Poplar	Baldcypress	Tupelo Gum	Atlantic White Cedar	Swamp Blackgum	Southern Red Oak	Swp. Chestnut Oak	Longleaf Pine	Scarlet Oak	Blackgum	Turkey Oak	Overcup Oak	Blackjack Oak	Live Oak	Total (4 year)	Total (at planting)	Density (Trees/Acre)	
ZONE 1	13	6		3	1		11		2	3										26	34	520	
	14			2			8	2				4								16	30	363	
	15	2	1	10	1		6		5											25	35	486	
	16	5	4	4	1		8		4	2										28	37	515	
	23	5		3			10		2											20	28	486	
	24		5				14		5	3										27	32	574	
	26	1	1		1		16		4			2								25	28	607	
	31	2	3				14													19	34	380	
	32	1					21	2		2		1								27	41	448	
	33	2	1	3	2		7		12	1								2		30	33	618	
	42	9		7	1		4		1	4										26	28	631	
	43	8					19													27	38	483	
	47	5		6																11	25	299	
ZONE 1 AVERAGE DENSITY																							493
ZONE 2	12											17	2		2			1		22	24	623	
	29		2	6							1	3			6			1		19	24	538	
ZONE 2 AVERAGE DENSITY																							581

	Plot #	Green Ash	Willow Oak	Laurel Oak	Cherrybark Oak	Tulip Poplar	Baldypress	Tupelo Gum	Atlantic White Cedar	Swamp Blackgum	Southern Red Oak	Swp. Chestnut Oak	Longleaf Pine	Scarlet Oak	Blackgum	Turkey Oak	Overcup Oak	Blackjack Oak	Total (4 year)	Total (at planting)	Density (Trees/Acre)
ZONE 3	1	3	2	12			6			8		1							32	32	680
	2		2	3			12												17	29	399
	3		3	8			7												18	21	583
	4		1	8			8												17	24	482
	5	6		4	8		1			1		3							23	31	505
	6			1			4					1							6	28	146
	7	1	6	8	2		5												22	31	483
	8	4	2	1	1		22			1									31	39	541
	9				2		2												4	20	136
	10		2	5	1	1	4												13	28	316
	11				5														5	19	179
	17	1	13	1		1	8						1						25	29	586
	18		2	2	13		7						5						29	35	563
	19		3	1	8		5		2				1						20	32	425
	20	2	5	3	4		3						1						18	25	490
	21	3	4	8			16			1			2						34	34	680
	22	2		1	2		11												16	34	320
	25	3	6		8	2	2						1						22	23	650
	27	3	3	2	3		3		5										19	25	517
	28		1				2	8		1	2								14	22	433
	30	2	5		6		3		6	1									23	27	579
	34		2	1	1		1		3										8	36	151
	35		2	8	14		1		1										26	27	655
	36		5	1	6		15						2						29	42	470
37	5		3	5	2	22												37	38	662	
38		4	7	7		8						1						27	30	612	
39	4	4	1	1		5			1			4						20	22	618	
40		7		10		1			2									20	30	453	
41	3	5	11			2		6										27	30	612	
48	5	5	2	10	1													23	30	521	

ZONE 3 AVERAGE DENSITY 481

ZONE 4	44					24													24	40	408
	45				1	17	2										1		21	36	397
	46			1		19													20	39	349

ZONE 4 AVERAGE DENSITY 384

TOTAL AVERAGE DENSITY 482

Site Notes:

Zone 1: Other species noted: smartweed, fennel, foxtail, ragweed, goldenrod, red maple, *Juncus* sp., switchgrass, cattail, volunteer pine, and bermuda grass. Evidence of deer browsing.

Zone 2: Other species noted: sweetgum, goldenrod, and volunteer pine. Evidence of deer browsing.

Zone 3: Other species noted: volunteer pine, fennel, broomsedge, sweet gum, *Carex* sp., woolgrass, goldenrod, smartweed, foxtail, red maple, ragweed, various grasses, *Baccharis halimifolia*, *Panicum* sp., *Juncus* sp., switchgrass, *Aster* sp., pokeberry, Bermuda grass, and grapevine. Evidence of deer browsing.

Zone 4: Other species noted: switchgrass and smartweed. Evidence of deer browsing.

3.4 Conclusions

Of the 612 acres on this site, approximately 576 involved tree planting. There were 48 plots established throughout the planting areas, encompassing all plant communities. The 2002 vegetation monitoring revealed average densities of 493 trees per acre for Zone 1, 581 trees per acre for Zone 2, 481 trees per acre for Zone 3, and 384 trees per acre for Zone 4. The total density average is 482 trees per acre, which is well above the success criteria of 320 trees per acre.

NCDOT will continue vegetation monitoring at the Dismal Swamp Mitigation Site.

4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS

This site has shown success for the 2002-growing season. Vegetation Plots located in both phases of the planting show high tree survival. The total density average is 482 trees per acre, which is well above the success criteria of 320 trees per acre.

Hydrologic monitoring for 2002, 19 of the 23 gauges met or exceeded the expected 12.5% jurisdictional wetland criteria for the growing season. All 4 gauges met the expected success criteria of 5%-12.5%, while the 1 gauge in the upland area met the expected hydrology less than 5% of the growing season. Overall only 4 gauges did not meet the expected wetland success criteria for the growing season.

NCDOT proposes to continue hydrologic and vegetation monitoring at Dismal Swamp Mitigation Site for the 2003-growing season.

***APPENDIX A: DEPTH TO GROUNDWATER
&
SURFACE WATER GRAPHS***

APPENDIX B: SITE PHOTOS

Dismal Swamp



Photo 1



Photo 2



Photo 3



Photo 4

Dismal Swamp



Photo 5



Photo 6



Photo 7



Photo 8

Dismal Swamp



Photo 9



Photo 10



Photo 11

APPENDIX C: VEGETATIVE MONITORING PLAN

DISMAL SWAMP MITIGATION SITE PHOTO AND PLOT LOCATIONS

