

**HAW RIVER SWAMP WETLAND RESTORATION SITE  
ANNUAL WETLAND MONITORING REPORT  
YEAR 2 (YEAR 2006)  
GUILFORD AND ROCKINGHAM COUNTIES, NORTH CAROLINA**



Natural Resources  
Restoration & Conservation

**RESTORATION SYSTEMS, LLC  
1101 Haynes Street, Suite 107  
Raleigh, North Carolina 27604  
restorationsystems.com  
(919) 755-9490**

**November 2006**

## EXECUTIVE SUMMARY

Restoration Systems, LLC, a private environmental restoration company, has completed the restoration of wetlands at the Haw River Swamp Wetland Restoration Site (hereafter referred to as the "Site") to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located in the Cape Fear River basin (United States Geological Survey Hydrologic Unit 03030002) approximately 8 miles north of the Greensboro city limits on the Guilford and Rockingham county line. The Site encompasses 60 acres within the Haw River floodplain and as constructed offers riverine wetland restoration, enhancement, and preservation, with benefits to water quality and wildlife in a rapidly developing watershed.

A Detailed Wetland Restoration Plan outlined methods to restore prior-converted (PC) agricultural fields that had been ditched, drained, and cleared for row crop production to pristine riverine wetlands. The plan outlined restoration procedures including 1) the excavation of a floodplain adjacent to the southern bank of Midway Creek in order to reestablish over-bank flooding, 2) plugging and filling sections of an existing canal/ditch system, and 3) diverting a secondary tributary to force discharge down the Haw River floodplain.

The objectives of the Site include the following:

1. Remove agricultural activities from the floodplain and banks of the Haw River.
2. Remove the Site from potential land uses associated with encroaching urbanization.
3. Increase flood storage potential within the Cape Fear Basin.
4. Provide floodplain surfaces to the Haw River for natural redevelopment of geomorphological processes.
5. Re-establish anastomosed stream channels and Piedmont swamp and bottomland forest communities within the floodplain ecosystem.
6. Intercept and assimilate nutrient and sediment-laden run-off from adjacent and upstream watersheds.
7. Assist in establishing a continuous wetland bio-reserve (corridor) between Cone and Benaja Swamps and the adjacent bottomland ecosystems.

The monitoring protocol for the Site consists of an analysis of two primary parameters: hydrology and vegetation. Monitoring of restoration efforts will be performed for a minimum of 5 years or until success criteria are fulfilled. Eight groundwater monitoring gauges and eight 0.11-acre vegetation plots were installed in wetland restoration areas to provide representative coverage across the Site.

The Site achieved defined (or targeted) success criteria for hydrology at all eight restoration area groundwater gauges in the Second Monitoring Year (Year 2006), with greater than 28 consecutive days (12.5 percent) of saturation during the growing season.

As a whole, vegetation plots across the Site were well-above the required 320 stems/acre with an average of 962 stems per acre in the Second Monitoring Year (Year 2006).

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**1.0 INTRODUCTION**

Restoration Systems, LLC, a private environmental restoration company, has completed the restoration of wetlands at the Haw River Swamp Wetland Restoration Site (hereafter referred to as the “Site”) to assist the North Carolina Ecosystem Enhancement Program (EEP) in fulfilling restoration goals in the region. The Site is located in the Cape Fear River basin (United States Geological Survey Hydrologic Unit 03030002) approximately 8 miles north of the Greensboro city limits on the Guilford and Rockingham county line (Figure 1). The Site encompasses 60 acres within the Haw River floodplain and as constructed offers riverine wetland restoration, enhancement, and preservation as presented in the following table, with benefits to water quality and wildlife in a rapidly developing watershed.

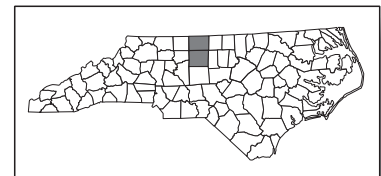
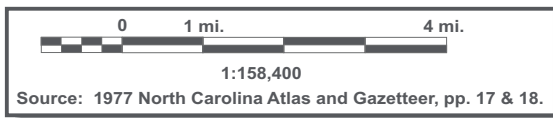
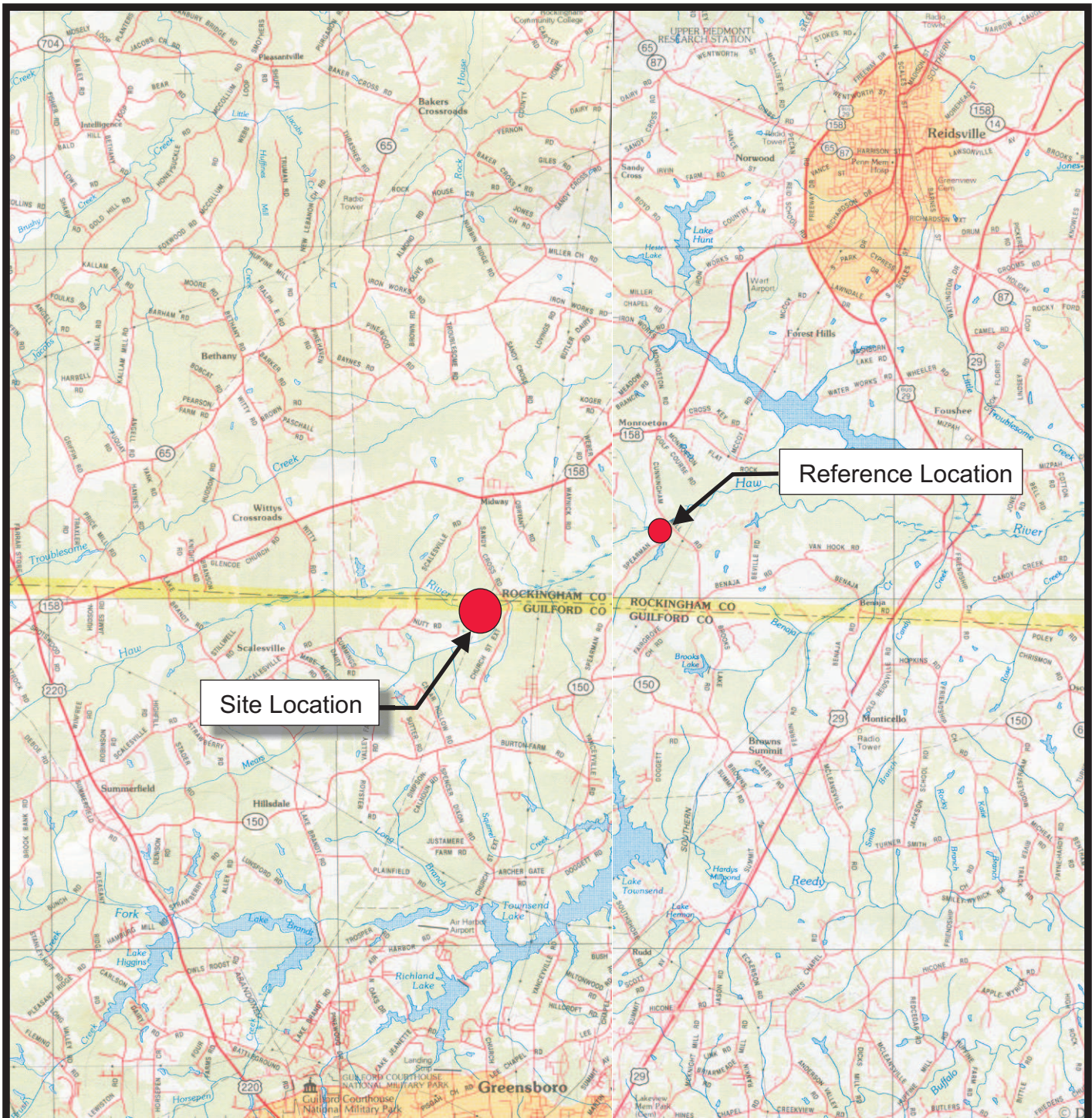
**Table 1. Site Acreage as Constructed**

<b>Type</b>	<b>Acreage</b>
Riverine Wetland Restoration	26.7
Riverine Wetland Enhancement	2.5
Riverine Wetland Preservation	18.0
Forested Upland Buffer	12.8
<b>TOTAL</b>	<b>60.0</b>

The Detailed Wetland Restoration Plan outlined methods designed to restore prior-converted (PC) agricultural fields that had been ditched, drained, and cleared for row crop production to pristine riverine wetlands. The plan outlined restoration procedures including 1) the excavation of a floodplain adjacent to the southern bank of Midway Creek in order to reestablish over-bank flooding, 2) plugging and filling sections of an existing canal/ditch system, and 3) diverting a secondary tributary to force discharge down the Haw River floodplain.

The objectives of the Site include the following:

1. Remove agricultural activities from the floodplain and banks of the Haw River.
2. Remove Site from potential land uses associated with encroaching urbanization.
3. Increase flood storage potential within the Cape Fear Basin.
4. Provide floodplain surfaces to the Haw River for natural redevelopment of geomorphological processes.
5. Re-establish anastomosed stream channels and Piedmont swamp and bottomland forest communities within the floodplain ecosystem.
6. Intercept and assimilate nutrient and sediment-laden run-off from adjacent and upstream watersheds.
7. Assist in establishing a continuous wetland bio-reserve (corridor) between Cone and Benaja Swamps and the adjacent bottomland ecosystems.



2126 Rowland Pond Dr.  
Willow Spring, NC 27592  
(919) 215-1693  
(919) 341-3839 fax

Axiom Environmental, Inc.

**SITE LOCATION MAP**  
**HAW RIVER WETLAND RESTORATION SITE**  
 Guilford and Rockingham Counties, North Carolina

Dwn. by:	WGL
Ckd by:	WGL
Date:	May 2005
Project:	05-005

**FIGURE**  
**1**

In February 2003, EEP contracted with Restoration Systems, LLC to complete Phase I (northern half) of the Site. Subsequently, in August 2004, EEP contracted Restoration Systems to complete Phase II (southern half), the remainder of the Site. A combined Detailed Wetland Restoration Plan was completed for both phases of the project with final permits issued in September 2004. Upon completion of the detailed plan and issuance of permits, construction plans were developed and construction was initiated in February 2005. Backwater Environmental, a subsidiary of Osborne Co. Inc., completed earthwork and grading at the Site and as-built construction drawings in late winter/early spring of 2005. Carolina Silvics completed planting of the Site in April 2005. Axiom Environmental, Inc. completed an as-built mitigation plan in June 2005.

Information on project managers, owners, and contractors follows:

Owner Information

Restoration Systems, LLC  
George Howard and John Preyer  
1101 Haynes Street, Suite 107  
Raleigh, North Carolina 27604  
(919) 755-9490

Monitoring Performer Information

Axiom Environmental, Inc.  
Grant Lewis and Corri Faquin  
2126 Rowland Pond Drive  
Willow Spring, North Carolina 27529  
(919)215-1693

Earthwork Contractor Information

Backwater Environmental, Inc.  
Wes Newell  
P.O. Box 1654  
Pittsboro, North Carolina 27312  
(919) 523-4375

Designer Information

EcoScience Corporation  
Jens Geratz and Jerry McCrain  
1101 Haynes Street, Suite 101  
Raleigh, North Carolina 27604  
(919) 828-3433

Planting Contractor Information

Carolina Silvics  
Dwight McKinney  
908 Indian Trail Road  
Edenton, North Carolina 27932  
(252) 482-8491

As outlined in the Detailed Wetland Restoration Plan, this project was designed and constructed based upon reference (relatively undisturbed) wetlands downstream of the Site (Figure 1). As-Built construction drawings dated May 2005 include Site alterations designed to restore groundwater, surface flow dynamics, and wetland hydrology as follows 1) installation of ditch plugs, 2) ditch and canal backfilling, 3) wetland depression excavation, 4) installation of log weir outfall structures at outfall points, 5) river levee removal, 6) Midway Creek alterations, 8) unnamed tributary diversion, and 9) planting of 24,950 seedlings.

This report represents the Second Year Annual Monitoring Report. Monitoring activities were performed throughout Year 2006, including recording groundwater table elevations and plant species densities.

## 2.0 MONITORING PROGRAM

The Site monitoring protocol consists of a comparison between reference and restoration areas along with evaluation of jurisdictional wetland criteria (Environmental Laboratory 1987). Monitoring will entail analysis of two primary parameters: hydrology and vegetation. Monitoring of restoration efforts will be performed for a minimum of 5 years or until success criteria are fulfilled. The monitoring program is described below.

The restoration area has been subdivided into swamp forest, bottomland hardwood forest, and mesic forest based on Site construction as depicted in Figure 2. Community patterns continue to develop, with a variety of tree seedlings surviving in local niches along the hydrology gradient. The initial plan was to classify Site vegetation into three broad plant community assemblages based on hydroperiod, primarily as a function of floodplain location. Community classifications included: 1) bottomland hardwood forest on floodplain flats, 2) swamp forest in floodplain depressions, and 3) mesic forest on upper floodplain slopes. However, the landscape diversity suggests that the bottomland hardwood forest and swamp forest will be well intermixed across the Site in the future. Therefore, these communities may need to be combined into one group: bottomland hardwood/swamp forest. In addition, several emergent areas may remain permanently inundated and may need to be reclassified. However, this annual monitoring report continues to differentiate between the three community classifications stated above.

### 2.1 Wetland Hydrology

#### 2.1.1 Hydrology Monitoring Procedure

After hydrological modifications were completed at the Site, continuous recording, groundwater monitoring gauges were installed in accordance with specifications in *Installing Monitoring Wells/Piezometers in Wetlands* (NCWRP 1993). Monitoring gauges were set to a depth of approximately 24 inches below the soil surface. Screened portions of each gauge were surrounded by filter fabric, buried in a sand screen, and sealed with a bentonite cap to prevent siltation and surface flow infiltration during floods.

Eight monitoring gauges were installed in wetland restoration areas to provide representative coverage within each community (Figure 2). Hydrologic sampling will be carried out in restoration areas during the growing season (March 26 to November 6) at daily intervals necessary to satisfy the hydrology success criteria.

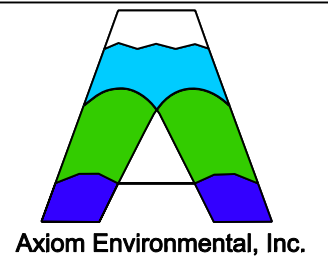
#### 2.1.2 Hydrologic Success Criteria

Target hydrological goals have been developed using regulatory wetland hydrology criteria and reference wetland sites.

##### Regulatory Wetland Hydrology Criteria

The regulatory wetland hydrology criteria require saturation (free water) within 1 foot of the soil surface for 5 percent of the growing season under normal climatic conditions. In some instances, the regulatory wetland hydroperiod may range from 5 and 12.5 percent of the growing season.

Restoration Systems  
 1101 Haynes Street  
 Suite 107  
 Raleigh N.C. 27604  
 (919) 755-9490  
 restorationsystems.com



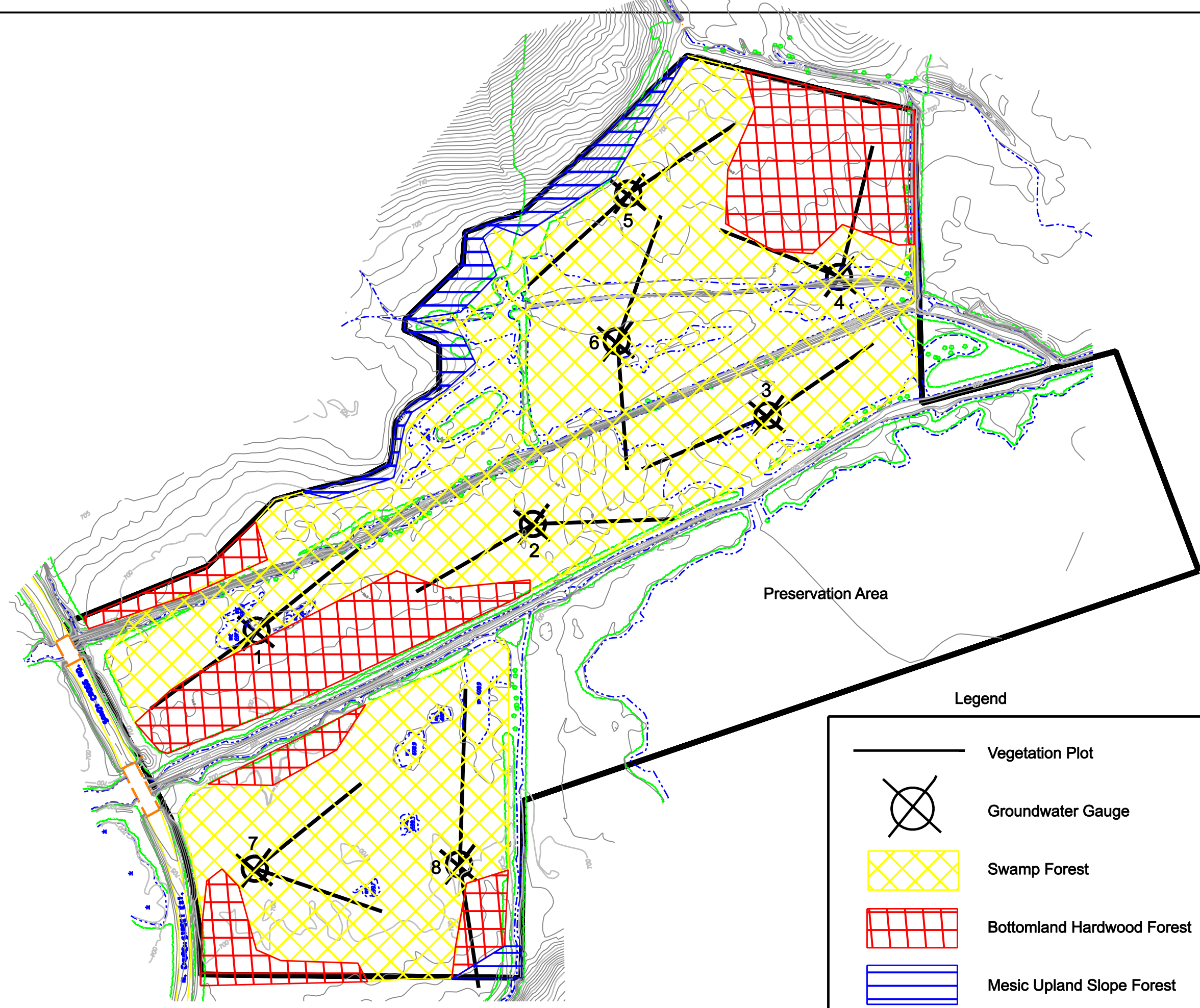
NOTES/REVISIONS


Project:  
**Haw River Swamp  
 Wetland Restoration  
 Site**  
 Guilford and Rockingham  
 Counties  
 North Carolina

Title:  
**Monitoring  
 Plan**

Scale:  
 1 inch = 220 feet  
 Date:  
 November 2005  
 Project No.:  
 05-002.17

Figure  
**2**



**Legend**

	Vegetation Plot
	Groundwater Gauge
	Swamp Forest
	Bottomland Hardwood Forest
	Mesic Upland Slope Forest



Based on the Detailed Wetland Restoration Plan, under normal climatic conditions, the hydrologic success criterion requires saturation (free water) within 1 foot of the soil surface for a minimum of 5 percent of the growing season for the floodplain flats (bottomland hardwood forest) areas depicted in Figure 2. The floodplain depressions (swamp forest) must support saturation (free water) within 1 foot of the soil surface for a minimum of 12.5 percent of the growing season. This hydroperiod translates to saturation for a minimum 12-day (5 percent) to 28-day (12.5 percent) consecutive period during the growing season, which extends from March 26 to November 6 (USDA 1977).

### **2.1.3 Hydrological Monitoring Results and Comparison with Success Criteria**

Hydrographs for each monitoring location are provided in Appendix A along with daily rainfall totals for 2006 collected at the Piedmont Triad International Airport, located approximately 12 miles southwest of the Site. All gauges achieved hydrology success criteria for the Second Year (Year 2006) of annual monitoring with greater than 28 consecutive days (12.5 percent) of saturation during the growing season, as required for swamp forest hydrology (Table 2).

**Table 2. 2006 (Year 1) Groundwater Gauge Results**

<b>Gauge</b>	<b>Community</b>	<b>Max Consecutive Days Saturated During Growing Season (Percent)</b>	<b>Defined (or Targeted) Success Criteria Achieved</b>
1	swamp forest	74 days (32.7 %)	Yes
2	swamp forest	55 days (24.3 %)	Yes
3	swamp forest	226 days (100 %)	Yes
4	swamp forest	154 days (68.1 %)	Yes
5	swamp forest	66 days (29.2 %)	Yes
6	swamp forest	226 days (100 %)	Yes
7	swamp forest	55 days (24.3 %)	Yes
8	swamp forest	159 days (70.4 %)	Yes
BH Ref	bottomland hardwoods	22 days (9.7%)	Yes
SF Ref	swamp forest	226 days (100 %)	Yes

## **2.2 Vegetation**

### **2.2.1 Vegetation Monitoring Procedure**

Restoration monitoring procedures for vegetation are designed in accordance with guidelines presented in *Mitigation Site Classification* (MiST) documentation (USEPA 1990) and *Compensatory Hardwood Mitigation Guidelines* (USDOA 1993). The following presents a general discussion of the monitoring protocol.

Vegetation will receive visual evaluations during the periodic reading of monitoring gauges to ascertain the general conditions and degree of overtopping of planted elements by weeds. Subsequently, quantitative sampling of vegetation will be performed once annually during the fall for a minimum of 5 years or until vegetation success criteria are achieved. Sampling dates may be modified to accommodate river flood events and plot inundation, if needed.

Sixteen sample transects (8 plots) were installed within planted areas of the Site to represent the various hydrologic regimes and plant communities (Figure 2). Each transect is 300 feet long and 8 feet wide (0.055

acre). Two transects were set up on each of the eight groundwater monitoring gauges for a total of eight, 0.11-acre plots. In each sample plot, monitored vegetation parameters include species composition and density. Visual observations of the percent cover of shrub and herbaceous species will be recorded but not used for vegetative success criteria. Photographs of the 8 vegetation plots are included in Appendix B.

### **2.2.2 Vegetation Success Criteria**

Success criteria have been established to verify that the vegetation component supports community elements necessary for floodplain forest development. Success criteria are dependent upon the density and growth of characteristic forest species. Additional success criteria are dependent upon density and growth of "Character Tree Species," which include planted species, species listed by Schafale and Weakley (1990) as occurring in Piedmont bottomland and swamp forests, and species identified in the reference forest ecosystems (RFE's). Planted tree species and those identified in the reference forest ecosystem will be used to define "Character Tree Species" as termed in the success criteria (Tables 3 and 4).

**Table 3. Reference Forest Plot Summary**

<b>Species</b>	<b>Number of Individuals*</b>	<b>Relative Density (Percent)</b>	<b>Relative Basal Area (Percent)</b>	<b>Importance Value</b>
<i>Acer rubrum</i> (red maple)	10	31.3	35.4	0.21
<i>Fraxinus pennsylvanica</i> (green ash)	10	31.3	28.0	0.20
<i>Platanus occidentalis</i> (American sycamore)	2	6.3	11.0	0.07
<i>Quercus lyrata</i> (overcup oak)	2	6.3	7.3	0.06
<i>Quercus rubra</i> (northern red oak)	1	3.1	6.9	0.04
<i>Salix nigra</i> (black willow)	1	3.1	6.0	0.04
<i>Acer negundo</i> (box elder)	2	6.3	0.5	0.03
<i>Carya ovata</i> (pignut hickory)	1	3.1	2.4	0.03
<i>Celtis laevigata</i> (hackberry)	1	3.1	1.5	0.03
<i>Fagus grandifolia</i> (American beech)	1	3.1	0.7	0.02
<i>Ulmus americana</i> (American elm)	1	3.1	0.3	0.02
<b>Total</b>	<b>32</b>	<b>100</b>	<b>100</b>	<b>1</b>

\* Summary of four 0.1-acre plots.

An average density of 320 stems per acre over all sampling transects of Character Tree Species must be surviving at the end of three monitoring years. Subsequently, 290 character tree stems per acre must be surviving in year 4, and 260 character tree stems per acre must be surviving in year 5. Planted species must represent a minimum of 30 percent of the required stem per acre total (96 stems per acre). A total of 24,950 bare root seedlings of 17 species were planted on the Site at a density of 680 trees per acre (Table 4). Each naturally recruited character species may represent up to 10 percent of the required stem per acre total. In essence, seven naturally recruited character species may represent a maximum of 70 percent of the required stem/acre total. Additional stems of naturally recruited species above the 70 percent threshold are discarded from the statistical analysis. The remaining 30 percent are not necessarily removed from the Site, but will be left as a reserve and future seed source for species maintenance during mid-succession phases of forest development.

**Table 4. Planted Species and Densities**

<b>Species</b>	<b>Number Planted</b>
<i>Ulmus americana</i> (American elm)	2300
<i>Nyssa sylvatica</i> (black gum)	150
<i>Salix nigra</i> (black willow)	1000
<i>Quercus pagoda</i> (cherrybark oak)	3500
<i>Fraxinus pennsylvanica</i> (green ash)	1500
<i>Pinus taeda</i> (loblolly pine)	1200
<i>Carya tomentosa</i> (mockernut hickory)	300
<i>Quercus rubra</i> (northern red oak)	300
<i>Quercus lyrata</i> (overcup oak)	3000
<i>Betula nigra</i> (river birch)	100
<i>Quercus falcata</i> (southern red oak)	400
<i>Celtis laevigata</i> (sugarberry)	1200
<i>Quercus michauxii</i> (swamp chestnut oak)	4800
<i>Platanus occidentalis</i> (American sycamore)	200
<i>Quercus alba</i> (white oak)	400
<i>Quercus phellos</i> (willow oak)	2500
<i>Liriodendron tulipifera</i> (yellow poplar)	2100
<b>Total</b>	<b>24,950</b>

### **2.2.3 Vegetation Sampling Results and Comparison to Success Criteria**

Quantitative sampling of vegetation was conducted in August 2006. Results are provided in Table 5. Vegetation success criteria for year 2 (320 tree stems per acre) were exceeded for the 2006 annual monitoring year with 962 stems per acre across the Site. In addition, each individual vegetation plot met success criteria with the exception of plot numbers 3 and 6. Plot number 3 occurs in one of the wettest locations of the Site that is inundated for much of the growing season as evidenced by groundwater gauge data (Appendix A). This plot is primarily characterized by herbaceous freshwater emergent vegetation including swamp rosemallow (*Hibiscus moscheutos*), arrowhead (*Sagittaria* sp.), toothcup (*Rotala ramosior*), Pennsylvania smartweed (*Polygonum pensylvanicum*), and various other smartweeds (*Polygonum* spp.). Community boundaries may need to be adjusted or redefined during the 5-year monitoring period due to the intermixing of herbaceous freshwater emergent communities with the bottomland and swamp forest communities.

**TABLE 5**  
**2006 VEGETATION MONITORING DATA AND RESULTS**

Note: Each plot totals 0.11 acre in size.

Species**	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8	Totals	Total/Acre	Total Tree Stems/Acre Counting Towards Success Criteria*
<i>Acer rubrum</i> (red maple)	314	582		90	65	29	13	73	1166	1325	32
<i>Acer negundo</i> (box elder)	21						10	14	45	51	32
<i>Alnus serrulata</i> (tag alder)							9		9	10	10
<i>Cornus amomum</i> (silky dogwood)				2			6	8	16	18	18
<i>Diospyros virginiana</i> (persimmon)					2			2	4	5	5
<i>Fraxinus pennsylvanica</i> (green ash)	67	103		79	51	3	94	31	428	486	486
<i>Liquidambar styraciflua</i> (sweetgum)	67	12		5			72	19	175	199	32
<i>Liriodendron tulipifera</i> (tulip poplar)				15	1			1	17	19	19
<i>Platanus occidentalis</i> (American sycamore)	25	3		1			6	39	74	84	84
<i>Quercus lyrata</i> (overcup oak)	4	17	8	8	5	5	1		48	55	55
<i>Quercus michauxii</i> (swamp chestnut oak)	13	7		5	9	2	2	3	41	47	47
<i>Quercus pagoda</i> (cherrybark oak)		4		3	2		1	1	11	13	13
<i>Quercus phellos</i> (willow oak)	2	8		1	4	2	1		18	20	20
<i>Salix nigra</i> (black willow)									6	7	7
<i>Sambucus canadensis</i> (elderberry)		1		2					3	3	3
<i>Ulmus</i> sp. (elm)	36	117	3	20	32	18			226	257	32
<i>Ulmus alata</i> (winged elm)	19	3		1	1				24	27	27
<i>Ulmus rubra</i> (slippery elm)	7	28		22	46	11		2	116	132	32
<i>Ulmus americana</i> (American elm)	3							4	7	8	8
<b>TOTAL</b>	<b>578</b>	<b>885</b>	<b>11</b>	<b>254</b>	<b>224</b>	<b>70</b>	<b>215</b>	<b>197</b>	<b>2434</b>	<b>2766</b>	<b>962</b>
<b>TOTAL COUNTING TOWARDS SUCCESS CRITERIA</b>	<b>135</b>	<b>160</b>	<b>8</b>	<b>131</b>	<b>87</b>	<b>23</b>	<b>119</b>	<b>93</b>			
<b>TOTAL/ACRE COUNTING TOWARDS SUCCESS CRITERIA</b>	<b>1227</b>	<b>1455</b>	<b>73</b>	<b>1191</b>	<b>791</b>	<b>209</b>	<b>1082</b>	<b>845</b>			

\* Success criteria requires that each naturally recruited species make up no more than 10 percent of the 320 stem/acre total. Using this criteria, no naturally recruited species can provide more than 32 stems/acre towards success criteria (or 3.53 stems/0.11 acre plot).

\*\* Planted species are in bold font.

### 3.0 CONCLUSIONS

In summary, the Site achieved defined (or targeted) success criteria for hydrology at all eight restoration area groundwater gauges in the Second Monitoring Year (Year 2006), with greater than 28 consecutive days (12.5 percent) of saturation during the growing season.

As a whole, vegetation plots across the Site were well-above the required 320 stems/acre with an average of 962 stems per acre in the Second Monitoring Year (Year 2006).

Community boundaries may need to be redefined or combined during the 5-year monitoring period due to the intermixing of bottomland hardwoods forest with swamp forest across the Site. In addition, an herbaceous freshwater emergent community may need to be separated from the bottomland and swamp forest communities.

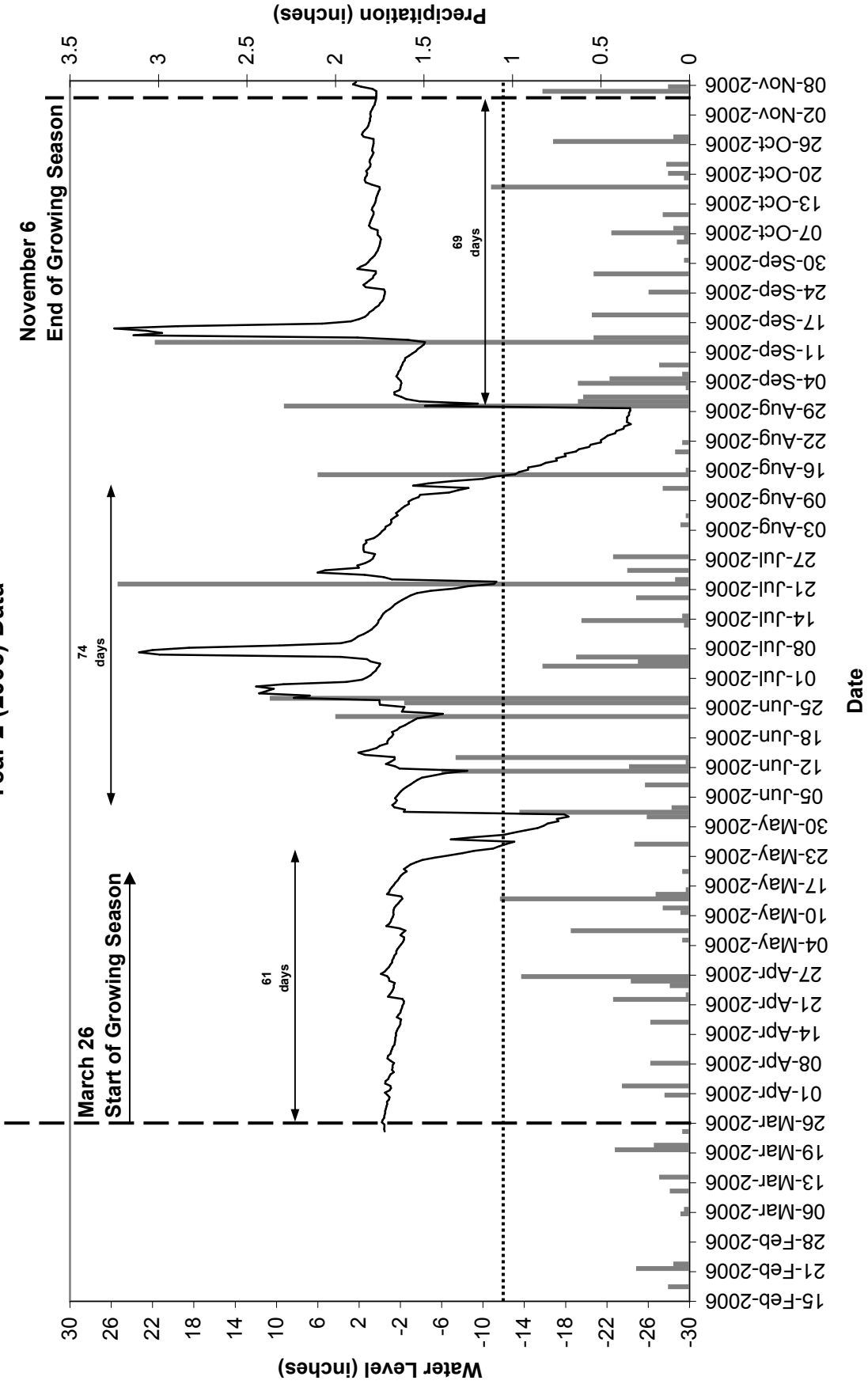
Documented animal species that utilize the developing wetland ecosystem are listed in Appendix C.

#### 4.0 REFERENCES

- Environmental Laboratory. 1987. Corps of Engineers Wetland Delineation Manual. Technical Report Y-87-1. United States Army Corps of Engineers Waterways Experiment Station, Vicksburg, MS.
- North Carolina Wetlands Restoration Program (NCWRP). 1993. Installing Monitoring Wells/Piezometers in Wetlands (WRP Technical Note HY-IA-3.1). North Carolina Department of Environment, Health, and Natural Resources, Raleigh, North Carolina.
- Schafale, M. P and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation, NC Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources, Raleigh, North Carolina.
- United States. Department of Agriculture (USDA). 1977. Soil Survey of Guilford County, North Carolina. United States Department of Agriculture.
- United States Department of the Army (USDOA). 1993 (unpublished). Compensatory Hardwood Mitigation Guidelines. United States Army Corps of Engineers, Wilmington District.
- United States Environmental Protection Agency (USEPA). 1990. Mitigation Site Classification (MiST). A Methodology to Classify Pre-Project Mitigation Sites and Develop Performance Standards for Construction and Restoration of Forested Wetlands. USEPA Workshop, August 13-15, 1989. USEPA Region IV and Hardwood Research Cooperative, North Carolina State University, Raleigh, NC.

**APPENDIX A**  
**GAUGE DATA**

# Haw River Gauge 1 Year 2 (2006) Data



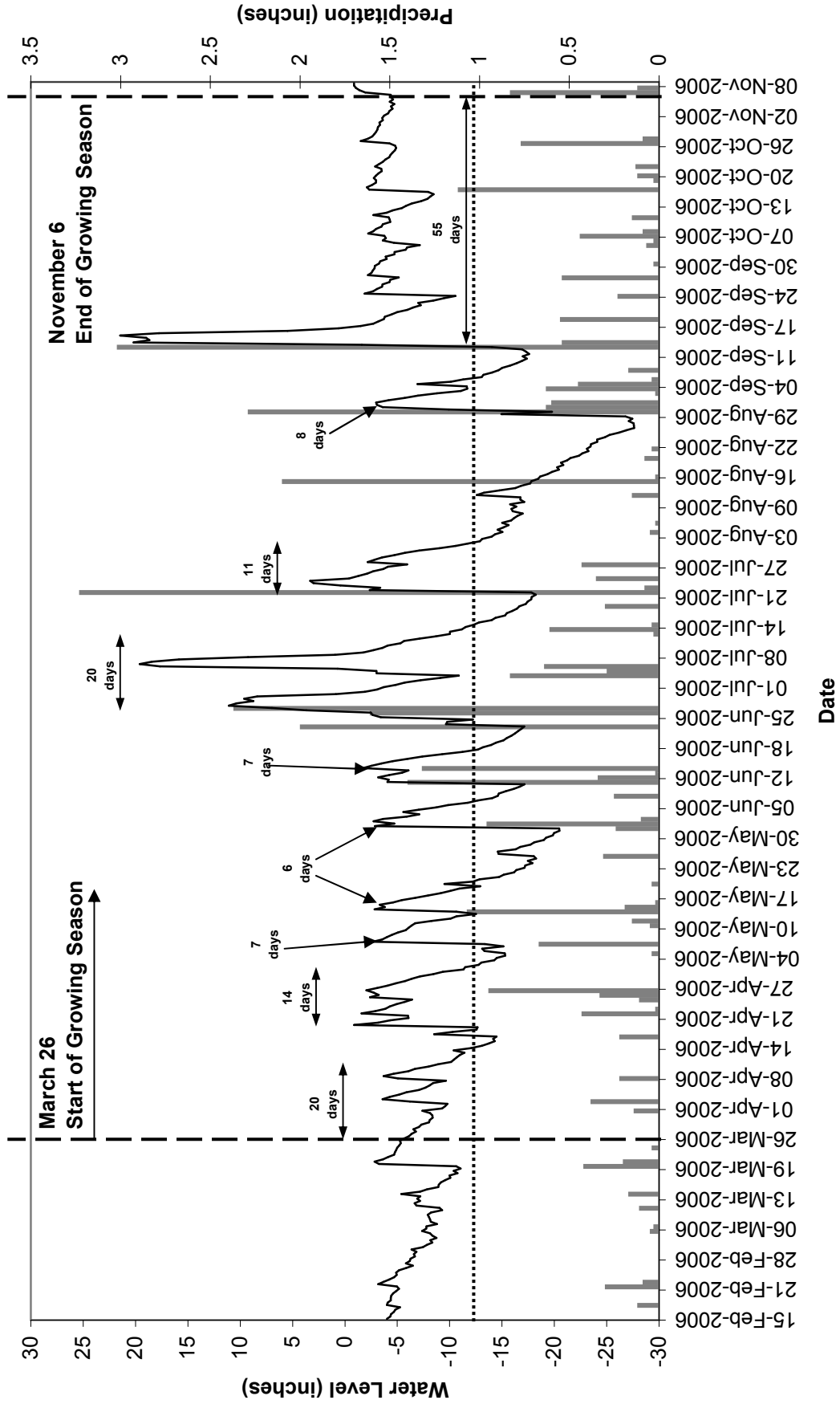








# Haw River Gauge 2 Year 2 (2006) Data

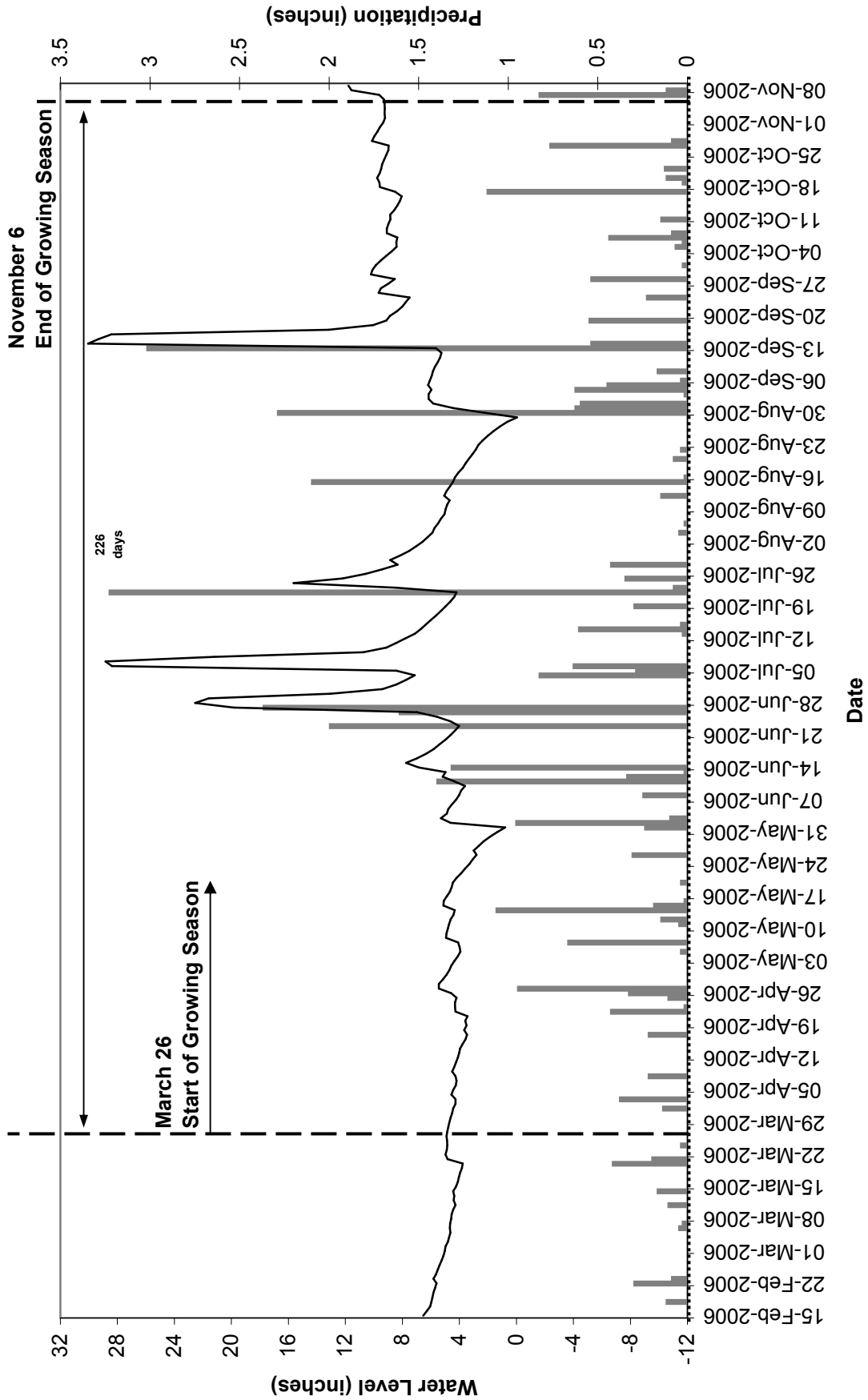








# Haw River Gauge 3 Year 2 (2006) Data

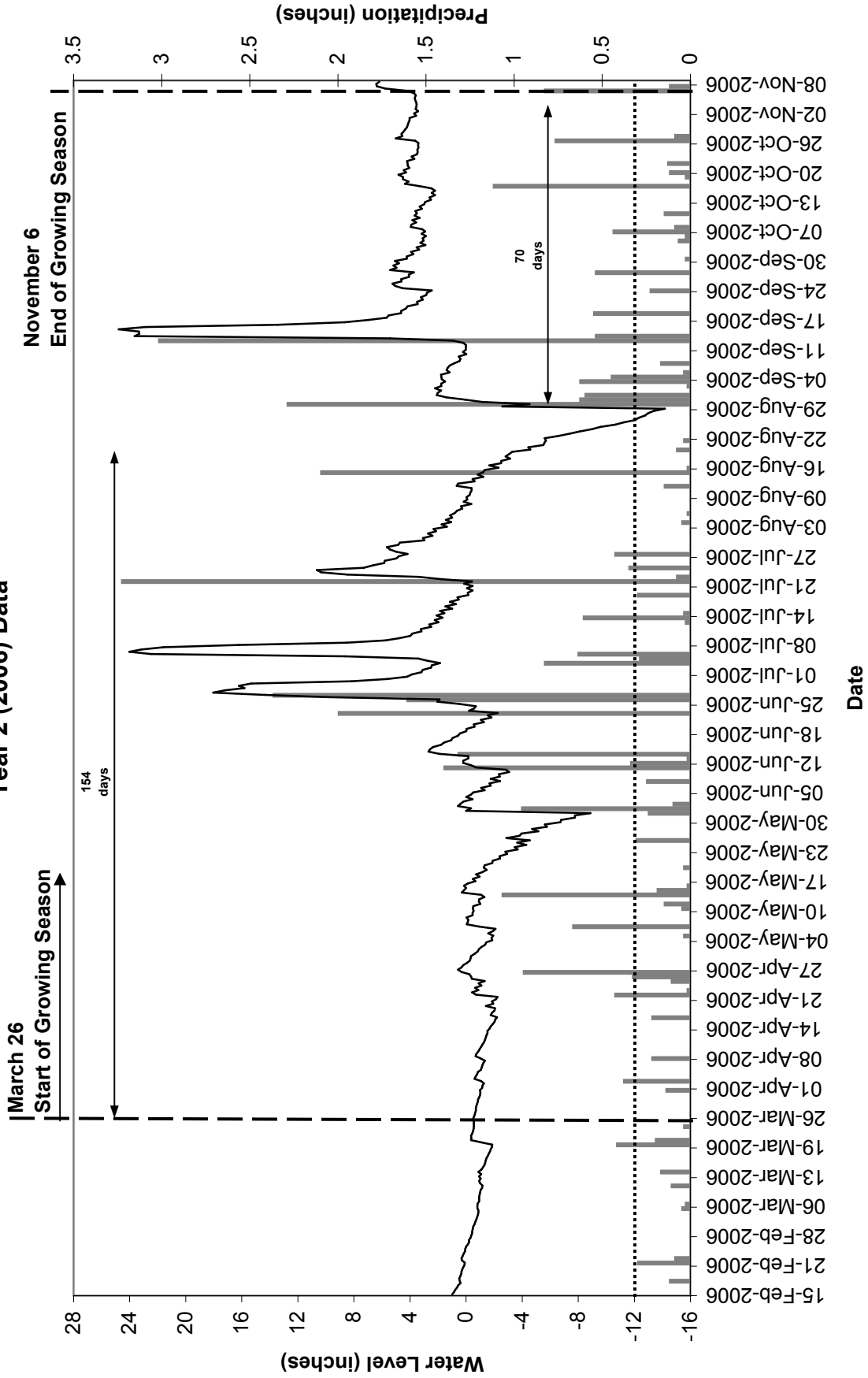








# Haw River Gauge 4 Year 2 (2006) Data



Gauge: 4

Data Acquired: November 9, 2006

Serial Number: N4241D5C

CD: Consecutive Days Saturation (within 12 inches of the soil surface) During the Growing Season

JD: Days During the Growing Season

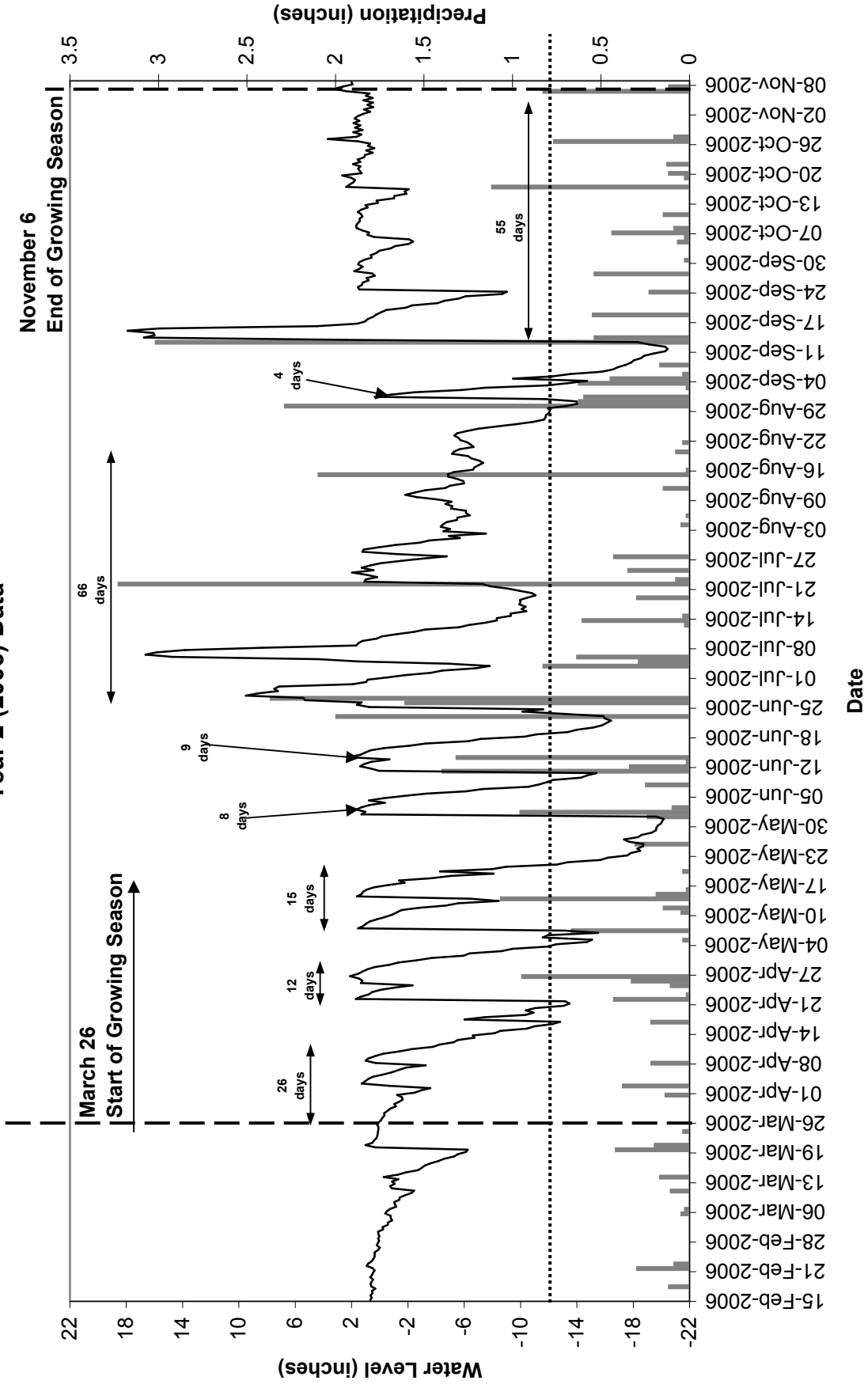
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Date	Time	Water Level (inches)	CD	JD	Date	Time	Water Level (inches)	CD	JD	Date	Time	Water Level (inches)	CD	JD		
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01-Jan-2006	23:59:19	0.95			06-Feb-2006	23:59:19	0.81			14-Mar-2006	23:59:19	-1.09				
02-Jan-2006	11:59:19	0.94			07-Feb-2006	11:59:19	0.71			15-Mar-2006	11:59:19	-1.2				
02-Jan-2006	23:59:19	2.8			07-Feb-2006	23:59:19	0.62			15-Mar-2006	23:59:19	-1.31				
03-Jan-2006	11:59:19	6.86			08-Feb-2006	11:59:19	0.53			16-Mar-2006	11:59:19	-1.37				
03-Jan-2006	23:59:19	6.77			08-Feb-2006	23:59:19	0.45			16-Mar-2006	23:59:19	-1.4				
04-Jan-2006	11:59:19	4.89			09-Feb-2006	11:59:19	0.35			17-Mar-2006	11:59:19	-1.45				
04-Jan-2006	23:59:19	3.51			09-Feb-2006	23:59:19	0.29			17-Mar-2006	23:59:19	-1.55				
05-Jan-2006	11:59:19	2.86			10-Feb-2006	11:59:19	0.22			18-Mar-2006	11:59:19	-1.62				
05-Jan-2006	23:59:19	2.5			10-Feb-2006	23:59:19	0.15			18-Mar-2006	23:59:19	-1.71				
06-Jan-2006	11:59:19	2.22			11-Feb-2006	11:59:19	0.55			19-Mar-2006	11:59:19	-1.76				
06-Jan-2006	23:59:19	1.96			11-Feb-2006	23:59:19	1.26			19-Mar-2006	23:59:19	-1.85				
07-Jan-2006	11:59:19	1.77			12-Feb-2006	11:59:19	1.47			20-Mar-2006	11:59:19	-1.86				
07-Jan-2006	23:59:19	1.62			12-Feb-2006	23:59:19	1.53			20-Mar-2006	23:59:19	-1.1				
08-Jan-2006	11:59:19	1.47			13-Feb-2006	11:59:19	1.48			21-Mar-2006	11:59:19	-0.36				
08-Jan-2006	23:59:19	1.34			13-Feb-2006	23:59:19	1.37			21-Mar-2006	23:59:19	-0.38				
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11-Jan-2006	11:59:19	0.94			16-Feb-2006	11:59:19	0.78			24-Mar-2006	11:59:19	-0.55				
11-Jan-2006	23:59:19	1.66			16-Feb-2006	23:59:19	0.65			24-Mar-2006	23:59:19	-0.55				
12-Jan-2006	11:59:19	1.71			17-Feb-2006	11:59:19	0.56			25-Mar-2006	11:59:19	-0.55				
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13-Jan-2006	11:59:19	1.74			18-Feb-2006	11:59:19	0.46			26-Mar-2006	11:59:19	-0.53	1	1		
13-Jan-2006	23:59:19	2.14			18-Feb-2006	23:59:19	0.48			26-Mar-2006	23:59:19	-0.6	1	1		
14-Jan-2006	11:59:19	2.19			19-Feb-2006	11:59:19	0.41			27-Mar-2006	11:59:19	-0.65	2	2		
14-Jan-2006	23:59:19	2.06			19-Feb-2006	23:59:19	0.34			27-Mar-2006	23:59:19	-0.7	2	2		
15-Jan-2006	11:59:19	1.9			20-Feb-2006	11:59:19	0.33			28-Mar-2006	11:59:19	-0.7	3	3		
15-Jan-2006	23:59:19	1.8			20-Feb-2006	23:59:19	0.27			28-Mar-2006	23:59:19	-0.74	3	3		
16-Jan-2006	11:59:19	1.7			21-Feb-2006	11:59:19	0.2			29-Mar-2006	11:59:19	-0.79	4	4		
16-Jan-2006	23:59:19	1.57			21-Feb-2006	23:59:19	0.11			29-Mar-2006	23:59:19	-0.84	4	4		
17-Jan-2006	11:59:19	1.46			22-Feb-2006	11:59:19	0.09			30-Mar-2006	11:59:19	-0.86	5	5		
17-Jan-2006	23:59:19	1.53			22-Feb-2006	23:59:19	0.29			30-Mar-2006	23:59:19	-0.95	5	5		
18-Jan-2006	11:59:19	1.94			23-Feb-2006	11:59:19	0.33			31-Mar-2006	11:59:19	-1	6	6		
18-Jan-2006	23:59:19	1.81			23-Feb-2006	23:59:19	0.24			31-Mar-2006	23:59:19	-1.03	6	6		
19-Jan-2006	11:59:19	1.73			24-Feb-2006	11:59:19	0.16			01-Apr-2006	11:59:19	-0.98	7	7		
19-Jan-2006	23:59:19	1.66			24-Feb-2006	23:59:19	0.08			01-Apr-2006	23:59:19	-1.15	7	7		
20-Jan-2006	11:59:19	1.54			25-Feb-2006	11:59:19	0.05			02-Apr-2006	11:59:19	-1.16	8	8		
20-Jan-2006	23:59:19	1.44			25-Feb-2006	23:59:19	0			02-Apr-2006	23:59:19	-1.28	8	8		
21-Jan-2006	11:59:19	1.73			26-Feb-2006	11:59:19	-0.12			03-Apr-2006	11:59:19	-1.08	9	9		
21-Jan-2006	23:59:19	1.71			26-Feb-2006	23:59:19	-0.22			03-Apr-2006	23:59:19	-0.6	9	9		
22-Jan-2006	11:59:19	1.64			27-Feb-2006	11:59:19	-0.21			04-Apr-2006	11:59:19	-0.68	10	10		
22-Jan-2006	23:59:19	1.6			27-Feb-2006	23:59:19	-0.32			04-Apr-2006	23:59:19	-0.79	10	10		
23-Jan-2006	11:59:19	1.67			28-Feb-2006	11:59:19	-0.38			05-Apr-2006	11:59:19	-0.85	11	11		
23-Jan-2006	23:59:19	1.64			28-Feb-2006	23:59:19	-0.43			05-Apr-2006	23:59:19	-1.05	11	11		
24-Jan-2006	11:59:19	1.56			01-Mar-2006	11:59:19	-0.45			06-Apr-2006	11:59:19	-1.12	12	12		
24-Jan-2006	23:59:19	1.48			01-Mar-2006	23:59:19	-0.49			06-Apr-2006	23:59:19	-1.17	12	12		
25-Jan-2006	11:59:19	1.35			02-Mar-2006	11:59:19	-0.51			07-Apr-2006	11:59:19	-1.23	13	13		
25-Jan-2006	23:59:19	1.13			02-Mar-2006	23:59:19	-0.61			07-Apr-2006	23:59:19	-1.35	13	13		
26-Jan-2006	11:59:19	1.02			03-Mar-2006	11:59:19	-0.67			08-Apr-2006	11:59:19	-1.04	14	14		
26-Jan-2006	23:59:19	0.88			03-Mar-2006	23:59:19	-0.73			08-Apr-2006	23:59:19	-0.68	14	14		
27-Jan-2006	11:59:19	0.76			04-Mar-2006	11:59:19	-0.78			09-Apr-2006	11:59:19	-0.73	15	15		
27-Jan-2006	23:59:19	0.7			04-Mar-2006	23:59:19	-0.84			09-Apr-2006	23:59:19	-0.87	15	15		
28-Jan-2006	11:59:19	0.64			05-Mar-2006	11:59:19	-0.87			10-Apr-2006	11:59:19	-0.96	16	16		
28-Jan-2006	23:59:19	0.56			05-Mar-2006	23:59:19	-0.88			10-Apr-2006	23:59:19	-1.07	16	16		
29-Jan-2006	11:59:19	0.5			06-Mar-2006	11:59:19	-0.8			11-Apr-2006	11:59:19	-1.17	17	17		
29-Jan-2006	23:59:19	0.52			06-Mar-2006	23:59:19	-0.81			11-Apr-2006	23:59:19	-1.28	17	17		
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31-Jan-2006	11:59:19	0.36			08-Mar-2006	11:59:19	-0.94			13-Apr-2006	11:59:19	-1.45	19	19		
31-Jan-2006	23:59:19	0.28			08-Mar-2006	23:59:19	-0.94			13-Apr-2006	23:59:19	-1.53	19	19		
01-Feb-2006	11:59:19	0.2			09-Mar-2006	11:59:19	-0.97			14-Apr-2006	11:59:19	-1.52	20	20		
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02-Feb-2006	11:59:19	0.11			10-Mar-2006	11:59:19	-1.04			15-Apr-2006	11:59:19	-1.76	21	21		
02-Feb-2006	23:59:19	0.64			10-Mar-2006	23:59:19	-1.15			15-Apr-2006	23:59:19	-1.91	21	21		
03-Feb-2006	11:59:19	0.86			11-Mar-2006	11:59:19	-1.17			16-Apr-2006	11:59:19	-2.02	22	22		
03-Feb-2006	23:59:19	0.94			11-Mar-2006	23:59:19	-1.01			16-Apr-2006	23:59:19	-2.09	22	22		
04-Feb-2006	11:59:19	1.07			12-Mar-2006	11:59:19	-0.93			17-Apr-2006	11:59:19	-2.2	23	23		
04-Feb-2006	23:59:19	1.17			12-Mar-2006	23:59:19	-1.04			17-Apr-2006	23:59:19	-1.75	23	23		
05-Feb-2006	11:59:19	1.19			13-Mar-2006	11:59:19	-0.94			18-Apr-2006	11:59:19	-1.85	24	24		
05-Feb-2006	23:59:19	1			13-Mar-2006	23:59:19	-1.07			18-Apr-2006	23:59:19	-2.02	24	24		



Page 3 Gauge 4

(continued)					(continued)					(continued)				
Date	Time	Water Level (inches)	CD	JD	Date	Time	Water Level (inches)	CD	JD	Date	Time	Water Level (inches)	CD	JD
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16-Aug-2006	11:59:19	-2.31	144	144	24-Sep-2006	23:59:19	4.54	27	183	03-Nov-2006	11:59:19	3.6	67	223
16-Aug-2006	23:59:19	-1.65	144	144	25-Sep-2006	11:59:19	5.05	28	184	03-Nov-2006	23:59:19	3.54	67	223
17-Aug-2006	11:59:19	-2.49	145	145	25-Sep-2006	23:59:19	5.26	28	184	04-Nov-2006	11:59:19	3.52	68	224
17-Aug-2006	23:59:19	-2.51	145	145	26-Sep-2006	11:59:19	4.6	29	185	04-Nov-2006	23:59:19	3.57	68	224
18-Aug-2006	11:59:19	-3.14	146	146	26-Sep-2006	23:59:19	4.63	29	185	05-Nov-2006	11:59:19	3.63	69	225
18-Aug-2006	23:59:19	-2.82	146	146	27-Sep-2006	11:59:19	4.07	30	186	05-Nov-2006	23:59:19	3.66	69	225
19-Aug-2006	11:59:19	-3.08	147	147	27-Sep-2006	23:59:19	4.09	30	186	06-Nov-2006	11:59:19	3.59	70	226
19-Aug-2006	23:59:19	-3.28	147	147	28-Sep-2006	11:59:19	3.73	31	187	06-Nov-2006	23:59:19	3.72	70	226
20-Aug-2006	11:59:19	-4.58	148	148	28-Sep-2006	23:59:19	5.41	31	187	07-Nov-2006	11:59:19	4.26		
20-Aug-2006	23:59:19	-4.43	148	148	29-Sep-2006	11:59:19	4.97	32	188	07-Nov-2006	23:59:19	5.77		
21-Aug-2006	11:59:19	-5.52	149	149	29-Sep-2006	23:59:19	5.18	32	188	08-Nov-2006	11:59:19	6.37		
21-Aug-2006	23:59:19	-5.59	149	149	30-Sep-2006	11:59:19	4.79	33	189	08-Nov-2006	23:59:19	6.4		
22-Aug-2006	11:59:19	-5.7	150	150	30-Sep-2006	23:59:19	5.07	33	189	09-Nov-2006	11:59:19	6.18		
22-Aug-2006	23:59:19	-5.61	150	150	01-Oct-2006	11:59:19	4.22	34	190					
23-Aug-2006	11:59:19	-6.59	151	151	01-Oct-2006	23:59:19	4.22	34	190					
23-Aug-2006	23:59:19	-7.39	151	151	02-Oct-2006	11:59:19	3.76	35	191					
24-Aug-2006	11:59:19	-8.13	152	152	02-Oct-2006	23:59:19	3.93	35	191					
24-Aug-2006	23:59:19	-8.98	152	152	03-Oct-2006	11:59:19	3.34	36	192					
25-Aug-2006	11:59:19	-9.59	153	153	03-Oct-2006	23:59:19	3.53	36	192					
25-Aug-2006	23:59:19	-10.66	153	153	04-Oct-2006	11:59:19	2.89	37	193					
26-Aug-2006	11:59:19	-11.26	154	154	04-Oct-2006	23:59:19	3.25	37	193					
26-Aug-2006	23:59:19	-12.06	154	154	05-Oct-2006	11:59:19	3.02	38	194					
27-Aug-2006	11:59:19	-12.31	155	155	05-Oct-2006	23:59:19	3.09	38	194					
27-Aug-2006	23:59:19	-12.76	155	155	06-Oct-2006	11:59:19	2.87	39	195					
28-Aug-2006	11:59:19	-12.98	156	156	06-Oct-2006	23:59:19	3.17	39	195					
28-Aug-2006	23:59:19	-13.37	156	156	07-Oct-2006	11:59:19	2.91	40	196					
29-Aug-2006	11:59:19	-14.19	157	157	07-Oct-2006	23:59:19	3.13	40	196					
29-Aug-2006	23:59:19	-2.58	1	157	08-Oct-2006	11:59:19	3.95	41	197					
30-Aug-2006	11:59:19	-4.53	2	158	08-Oct-2006	23:59:19	3.91	41	197					
30-Aug-2006	23:59:19	-1.13	2	158	09-Oct-2006	11:59:19	3.57	42	198					
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03-Sep-2006	11:59:19	1.76	6	162	12-Oct-2006	23:59:19	3.32	45	201					
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04-Sep-2006	11:59:19	1.49	7	163	13-Oct-2006	23:59:19	2.92	46	202					
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05-Sep-2006	11:59:19	1.77	8	164	14-Oct-2006	23:59:19	2.61	47	203					
05-Sep-2006	23:59:19	1.79	8	164	15-Oct-2006	11:59:19	2.21	48	204					
06-Sep-2006	11:59:19	1.18	9	165	15-Oct-2006	23:59:19	2.45	48	204					
06-Sep-2006	23:59:19	1.39	9	165	16-Oct-2006	11:59:19	2.21	49	205					
07-Sep-2006	11:59:19	1.31	10	166	16-Oct-2006	23:59:19	2.46	49	205					
07-Sep-2006	23:59:19	1.18	10	166	17-Oct-2006	11:59:19	3.33	50	206					
08-Sep-2006	11:59:19	0.84	11	167	17-Oct-2006	23:59:19	4.35	50	206					
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09-Sep-2006	11:59:19	0.4	12	168	18-Oct-2006	23:59:19	4.49	51	207					
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10-Sep-2006	11:59:19	-0.02	13	169	19-Oct-2006	23:59:19	4.82	52	208					
10-Sep-2006	23:59:19	0.22	13	169	20-Oct-2006	11:59:19	4.28	53	209					
11-Sep-2006	11:59:19	0.02	14	170	20-Oct-2006	23:59:19	4.44	53	209					
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12-Sep-2006	11:59:19	0	15	171	21-Oct-2006	23:59:19	4.15	54	210					
12-Sep-2006	23:59:19	0.18	15	171	22-Oct-2006	11:59:19	4.18	55	211					
13-Sep-2006	11:59:19	0.93	16	172	22-Oct-2006	23:59:19	4.21	55	211					
13-Sep-2006	23:59:19	5.43	16	172	23-Oct-2006	11:59:19	3.69	56	212					
14-Sep-2006	11:59:19	23.65	17	173	23-Oct-2006	23:59:19	3.89	56	212					
14-Sep-2006	23:59:19	23.31	17	173	24-Oct-2006	11:59:19	3.51	57	213					
15-Sep-2006	11:59:19	23.35	18	174	24-Oct-2006	23:59:19	3.45	57	213					
15-Sep-2006	23:59:19	24.78	18	174	25-Oct-2006	11:59:19	3.47	58	214					
16-Sep-2006	11:59:19	22.87	19	175	25-Oct-2006	23:59:19	3.4	58	214					
16-Sep-2006	23:59:19	13.42	19	175	26-Oct-2006	11:59:19	3.42	59	215					
17-Sep-2006	11:59:19	8.66	20	176	26-Oct-2006	23:59:19	3.4	59	215					
17-Sep-2006	23:59:19	6.98	20	176	27-Oct-2006	11:59:19	3.63	60	216					
18-Sep-2006	11:59:19	5.67	21	177	27-Oct-2006	23:59:19	5.02	60	216					
18-Sep-2006	23:59:19	5.53	21	177	28-Oct-2006	11:59:19	4.56	61	217					
19-Sep-2006	11:59:19	4.65	22	178	28-Oct-2006	23:59:19	4.61	61	217					
19-Sep-2006	23:59:19	4.63	22	178	29-Oct-2006	11:59:19	4.46	62	218					
20-Sep-2006	11:59:19	4.3	23	179	29-Oct-2006	23:59:19	4.33	62	218					
20-Sep-2006	23:59:19	4.17	23	179	30-Oct-2006	11:59:19	4.21	63	219					
21-Sep-2006	11:59:19	3.45	24	180	30-Oct-2006	23:59:19	4.15	63	219					
21-Sep-2006	23:59:19	3.49	24	180	31-Oct-2006	11:59:19	4.11	64	220					
22-Sep-2006	11:59:19	3.07	25	181	31-Oct-2006	23:59:19	4.03	64	220					
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23-Sep-2006	11:59:19	2.85	26	182	01-Nov-2006	23:59:19	3.57	65	221					
23-Sep-2006	23:59:19	2.79	26	182	02-Nov-2006	11:59:19	3.71	66	222					

# Haw River Gauge 5 Year 2 (2006) Data



Gauge: 5

Data Acquired: November 9, 2006

Serial Number: N3ECD4F3

CD: Consecutive Days Saturation (within 12 inches of the soil surface) During the Growing Season

JD: Days During the Growing Season

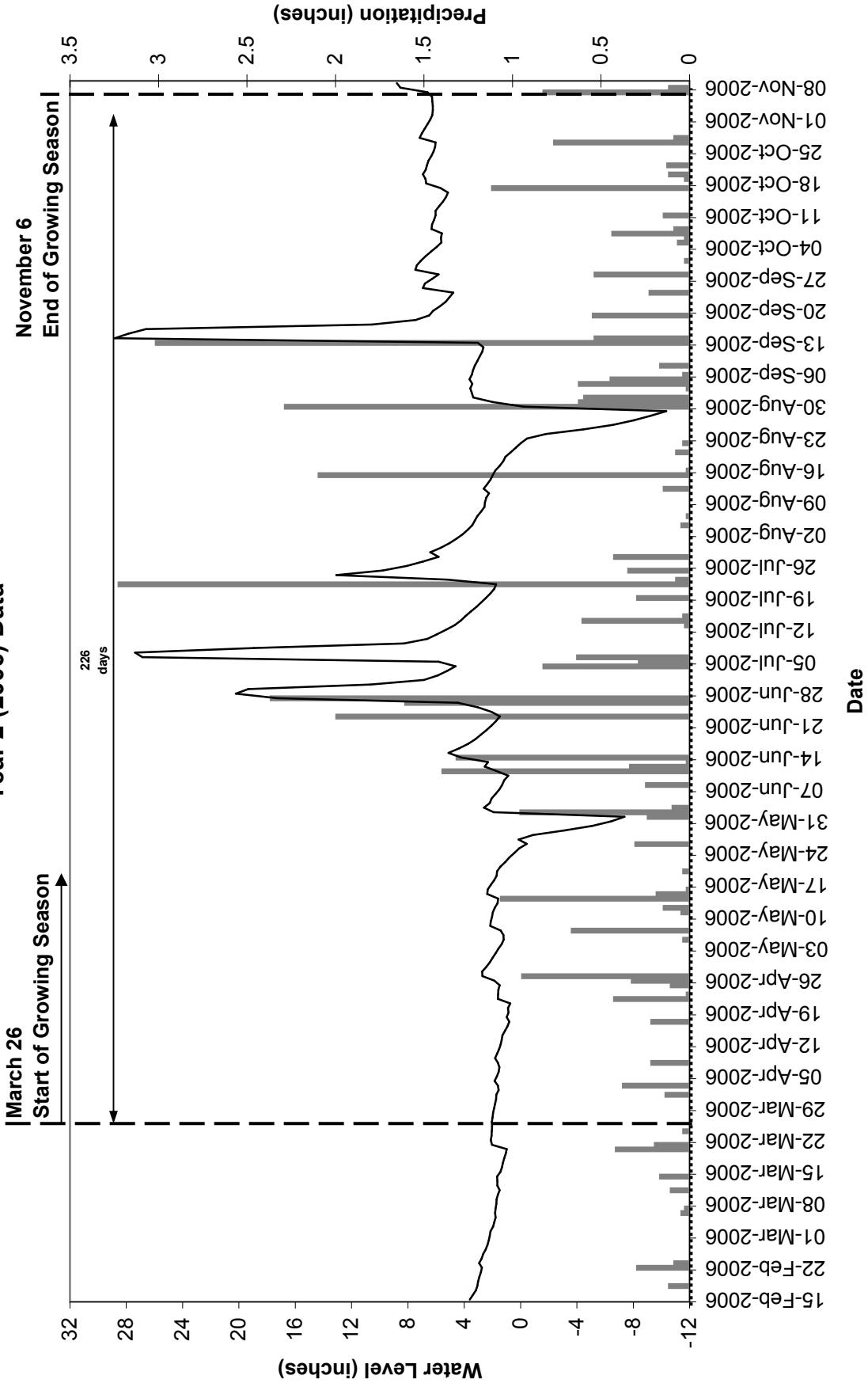
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Date	Time	Water Level (inches)	CD	JD	Date	Time	Water Level (inches)	CD	JD	Date	Time	Water Level (inches)	CD	JD		
01-Jan-2006	11:59:19	0.25			06-Feb-2006	11:59:19	0.56			14-Mar-2006	11:59:19	-0.27				
01-Jan-2006	23:59:19	0.45			06-Feb-2006	23:59:19	0.47			14-Mar-2006	23:59:19	-1.28				
02-Jan-2006	11:59:19	0.76			07-Feb-2006	11:59:19	0.47			15-Mar-2006	11:59:19	-1.85				
02-Jan-2006	23:59:19	1.71			07-Feb-2006	23:59:19	0.37			15-Mar-2006	23:59:19	-2.72				
03-Jan-2006	11:59:19	1.22			08-Feb-2006	11:59:19	0.48			16-Mar-2006	11:59:19	-2.97				
03-Jan-2006	23:59:19	0.87			08-Feb-2006	23:59:19	0.4			16-Mar-2006	23:59:19	-3.2				
04-Jan-2006	11:59:19	0.87			09-Feb-2006	11:59:19	0.4			17-Mar-2006	11:59:19	-3.61				
04-Jan-2006	23:59:19	0.87			09-Feb-2006	23:59:19	0.21			17-Mar-2006	23:59:19	-4.16				
05-Jan-2006	11:59:19	0.82			10-Feb-2006	11:59:19	0.45			18-Mar-2006	11:59:19	-4.58				
05-Jan-2006	23:59:19	0.71			10-Feb-2006	23:59:19	0.41			18-Mar-2006	23:59:19	-5.28				
06-Jan-2006	11:59:19	0.55			11-Feb-2006	11:59:19	1.49			19-Mar-2006	11:59:19	-5.54				
06-Jan-2006	23:59:19	0.33			11-Feb-2006	23:59:19	1.3			19-Mar-2006	23:59:19	-6.13				
07-Jan-2006	11:59:19	0.43			12-Feb-2006	11:59:19	1.16			20-Mar-2006	11:59:19	-6.24				
07-Jan-2006	23:59:19	0.56			12-Feb-2006	23:59:19	0.9			20-Mar-2006	23:59:19	0.32				
08-Jan-2006	11:59:19	0.5			13-Feb-2006	11:59:19	0.83			21-Mar-2006	11:59:19	1.01				
08-Jan-2006	23:59:19	0.49			13-Feb-2006	23:59:19	0.76			21-Mar-2006	23:59:19	0.53				
09-Jan-2006	11:59:19	0.36			14-Feb-2006	11:59:19	0.75			22-Mar-2006	11:59:19	0.4				
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10-Jan-2006	23:59:19	0.11			15-Feb-2006	23:59:19	0.57			23-Mar-2006	23:59:19	0.16				
11-Jan-2006	11:59:19	0.39			16-Feb-2006	11:59:19	0.65			24-Mar-2006	11:59:19	0.11				
11-Jan-2006	23:59:19	0.75			16-Feb-2006	23:59:19	0.52			24-Mar-2006	23:59:19	0.1				
12-Jan-2006	11:59:19	0.63			17-Feb-2006	11:59:19	0.55			25-Mar-2006	11:59:19	0.09				
12-Jan-2006	23:59:19	0.51			17-Feb-2006	23:59:19	0.32			25-Mar-2006	23:59:19	0.18				
13-Jan-2006	11:59:19	0.63			18-Feb-2006	11:59:19	0.61			26-Mar-2006	11:59:19	0.07	1	1		
13-Jan-2006	23:59:19	1.42			18-Feb-2006	23:59:19	0.65			26-Mar-2006	23:59:19	-0.09	1	1		
14-Jan-2006	11:59:19	0.96			19-Feb-2006	11:59:19	0.59			27-Mar-2006	11:59:19	-0.19	2	2		
14-Jan-2006	23:59:19	0.47			19-Feb-2006	23:59:19	0.47			27-Mar-2006	23:59:19	-0.34	2	2		
15-Jan-2006	11:59:19	0.37			20-Feb-2006	11:59:19	0.67			28-Mar-2006	11:59:19	-0.31	3	3		
15-Jan-2006	23:59:19	0.26			20-Feb-2006	23:59:19	0.55			28-Mar-2006	23:59:19	-0.54	3	3		
16-Jan-2006	11:59:19	0.26			21-Feb-2006	11:59:19	0.48			29-Mar-2006	11:59:19	-0.74	4	4		
16-Jan-2006	23:59:19	0.1			21-Feb-2006	23:59:19	0.37			29-Mar-2006	23:59:19	-1.14	4	4		
17-Jan-2006	11:59:19	0.24			22-Feb-2006	11:59:19	0.52			30-Mar-2006	11:59:19	-1.03	5	5		
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18-Jan-2006	11:59:19	0.55			23-Feb-2006	11:59:19	0.82			31-Mar-2006	11:59:19	-1.62	6	6		
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21-Jan-2006	11:59:19	0.81			26-Feb-2006	11:59:19	0.12			03-Apr-2006	11:59:19	-0.71	9	9		
21-Jan-2006	23:59:19	0.37			26-Feb-2006	23:59:19	-0.01			03-Apr-2006	23:59:19	1.28	9	9		
22-Jan-2006	11:59:19	0.41			27-Feb-2006	11:59:19	0.2			04-Apr-2006	11:59:19	1.04	10	10		
22-Jan-2006	23:59:19	0.43			27-Feb-2006	23:59:19	0.14			04-Apr-2006	23:59:19	0.81	10	10		
23-Jan-2006	11:59:19	0.8			28-Feb-2006	11:59:19	0.05			05-Apr-2006	11:59:19	0.48	11	11		
23-Jan-2006	23:59:19	0.6			28-Feb-2006	23:59:19	0.12			05-Apr-2006	23:59:19	-0.28	11	11		
24-Jan-2006	11:59:19	0.58			01-Mar-2006	11:59:19	0.03			06-Apr-2006	11:59:19	-0.89	12	12		
24-Jan-2006	23:59:19	0.45			01-Mar-2006	23:59:19	0.09			06-Apr-2006	23:59:19	-1.36	12	12		
25-Jan-2006	11:59:19	0.19			02-Mar-2006	11:59:19	0.12			07-Apr-2006	11:59:19	-1.87	13	13		
25-Jan-2006	23:59:19	-0.03			02-Mar-2006	23:59:19	-0.24			07-Apr-2006	23:59:19	-3.27	13	13		
26-Jan-2006	11:59:19	-0.16			03-Mar-2006	11:59:19	-0.2			08-Apr-2006	11:59:19	0.28	14	14		
26-Jan-2006	23:59:19	-0.23			03-Mar-2006	23:59:19	-0.56			08-Apr-2006	23:59:19	0.99	14	14		
27-Jan-2006	11:59:19	-0.11			04-Mar-2006	11:59:19	-0.58			09-Apr-2006	11:59:19	0.82	15	15		
27-Jan-2006	23:59:19	-0.13			04-Mar-2006	23:59:19	-0.87			09-Apr-2006	23:59:19	0.29	15	15		
28-Jan-2006	11:59:19	0.03			05-Mar-2006	11:59:19	-0.78			10-Apr-2006	11:59:19	-0.26	16	16		
28-Jan-2006	23:59:19	0.13			05-Mar-2006	23:59:19	-0.76			10-Apr-2006	23:59:19	-1.4	16	16		
29-Jan-2006	11:59:19	0.53			06-Mar-2006	11:59:19	-0.38			11-Apr-2006	11:59:19	-2.27	17	17		
29-Jan-2006	23:59:19	0.43			06-Mar-2006	23:59:19	-0.52			11-Apr-2006	23:59:19	-3.79	17	17		
30-Jan-2006	11:59:19	0.47			07-Mar-2006	11:59:19	-0.74			12-Apr-2006	11:59:19	-4.26	18	18		
30-Jan-2006	23:59:19	0.49			07-Mar-2006	23:59:19	-1.18			12-Apr-2006	23:59:19	-5.25	18	18		
31-Jan-2006	11:59:19	0.15			08-Mar-2006	11:59:19	-1.07			13-Apr-2006	11:59:19	-5.54	19	19		
31-Jan-2006	23:59:19	-0.1			08-Mar-2006	23:59:19	-1.04			13-Apr-2006	23:59:19	-6.71	19	19		
01-Feb-2006	11:59:19	-0.11			09-Mar-2006	11:59:19	-1.4			14-Apr-2006	11:59:19	-6.6	20	20		
01-Feb-2006	23:59:19	-0.2			09-Mar-2006	23:59:19	-1.41			14-Apr-2006	23:59:19	-8.17	20	20		
02-Feb-2006	11:59:19	-0.07			10-Mar-2006	11:59:19	-1.8			15-Apr-2006	11:59:19	-8.57	21	21		
02-Feb-2006	23:59:19	1.11			10-Mar-2006	23:59:19	-2.26			15-Apr-2006	23:59:19	-10.46	21	21		
03-Feb-2006	11:59:19	0.47			11-Mar-2006	11:59:19	-2.43			16-Apr-2006	11:59:19	-10.97	22	22		
03-Feb-2006	23:59:19	0.36			11-Mar-2006	23:59:19	-0.88			16-Apr-2006	23:59:19	-12.27	22	22		
04-Feb-2006	11:59:19	0.74			12-Mar-2006	11:59:19	-0.72			17-Apr-2006	11:59:19	-12.82	23	23		
04-Feb-2006	23:59:19	0.37			12-Mar-2006	23:59:19	-1.07			17-Apr-2006	23:59:19	-6.01	23	23		
05-Feb-2006	11:59:19	0.14			13-Mar-2006	11:59:19	-0.88			18-Apr-2006	11:59:19	-7.43	24	24		
05-Feb-2006	23:59:19	0.57			13-Mar-2006	23:59:19	-1.33			18-Apr-2006	23:59:19	-10.35	24	24		







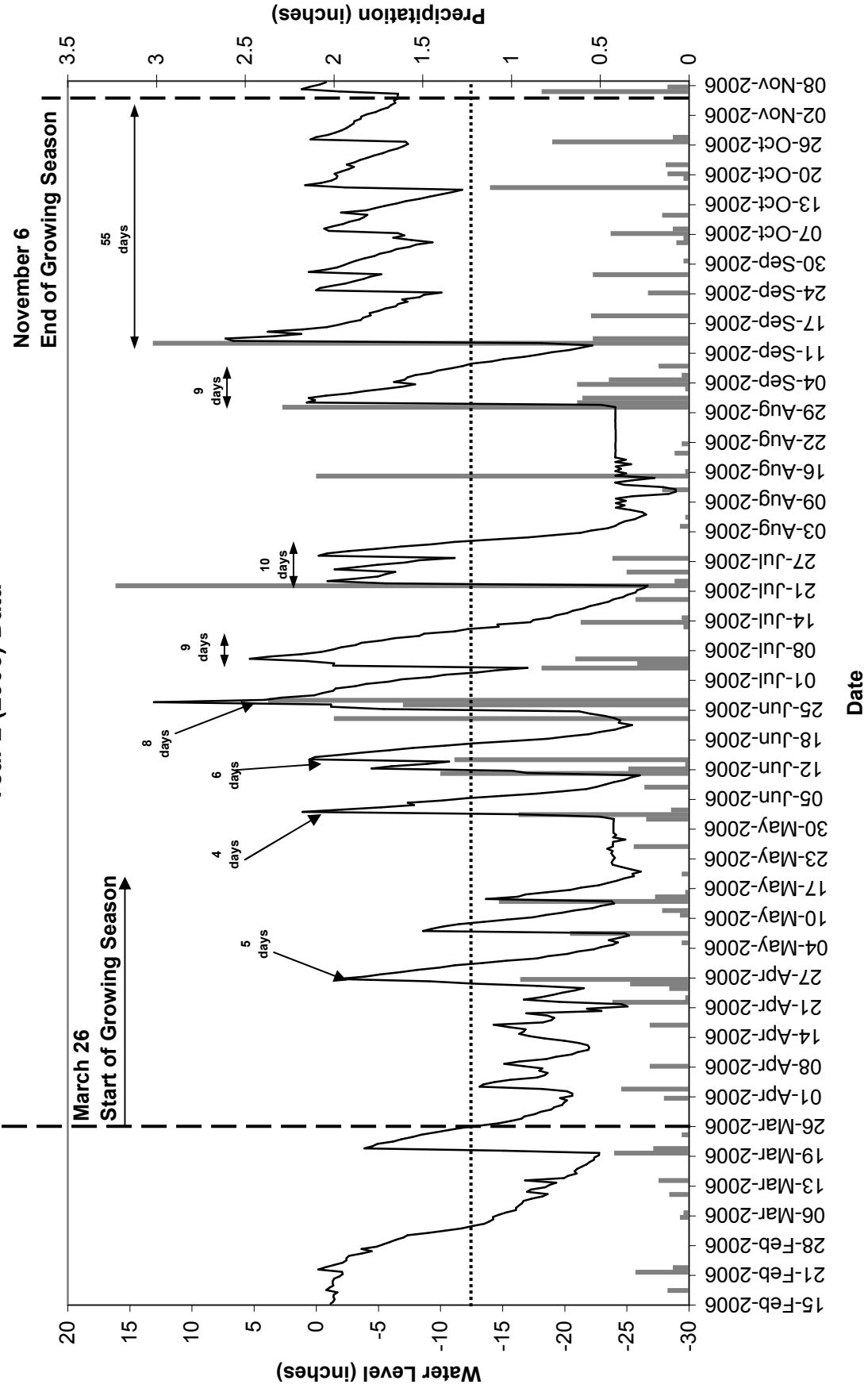
# Haw River Gauge 6 Year 2 (2006) Data







# Haw River Gauge 7 Year 2 (2006) Data



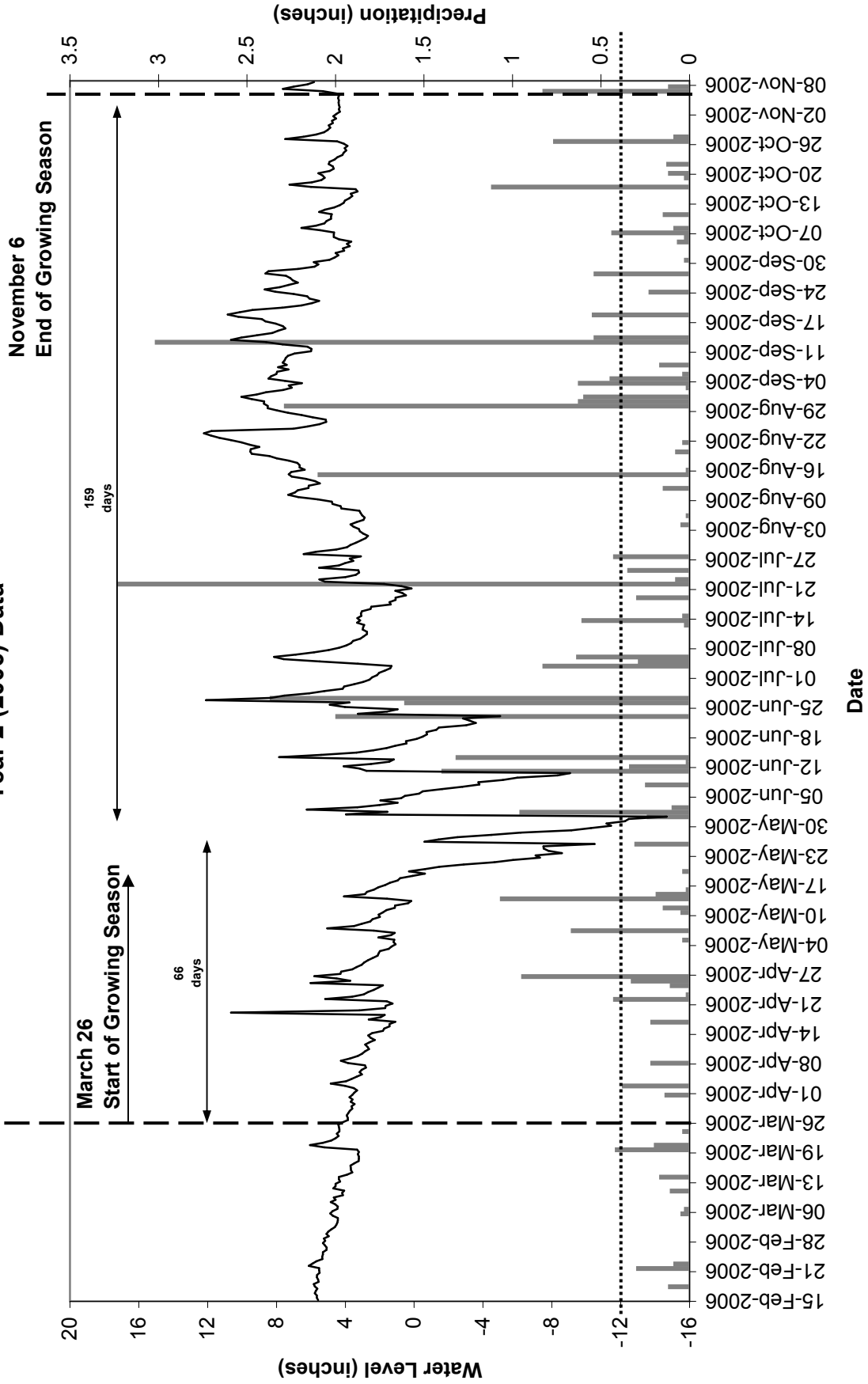








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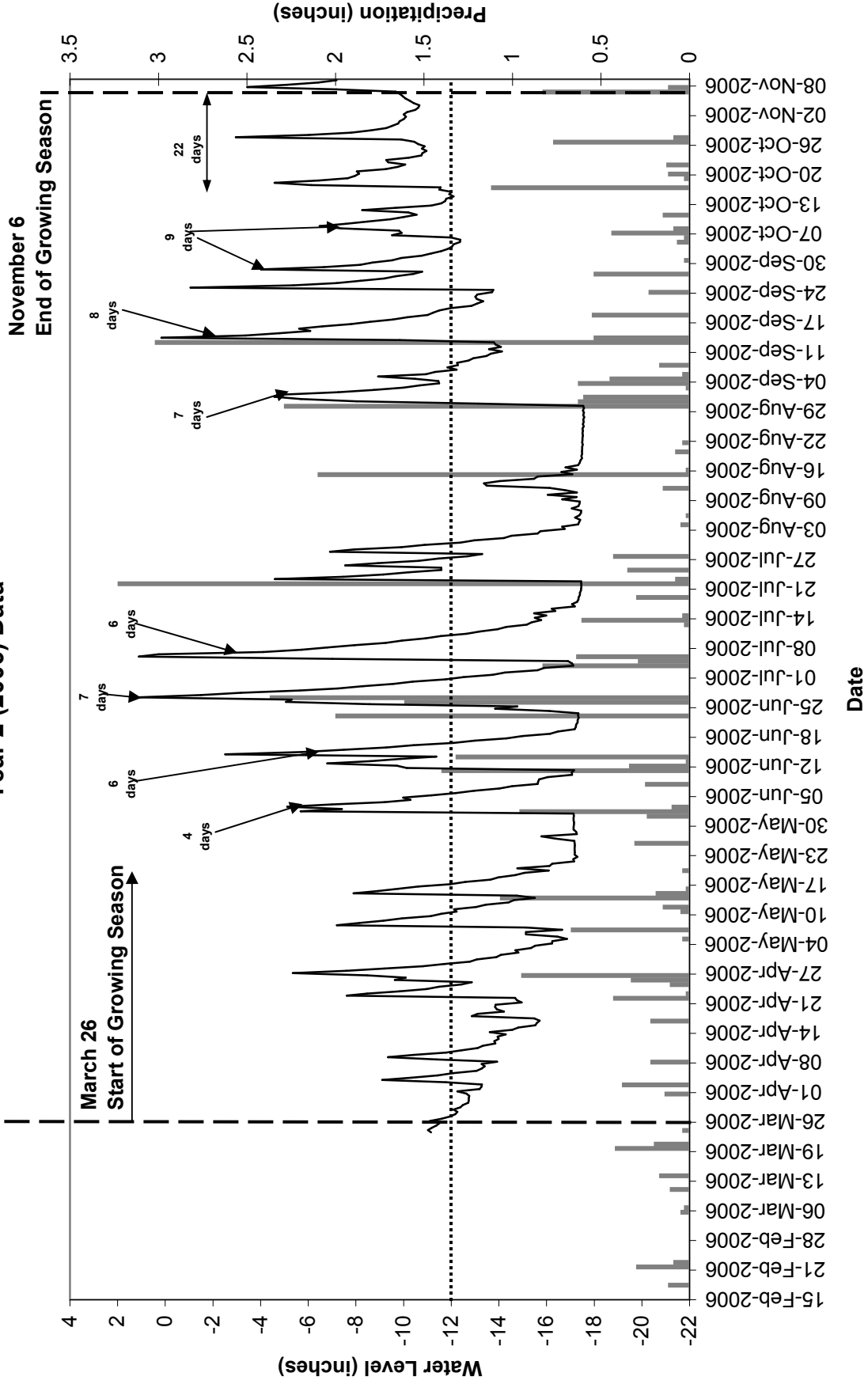








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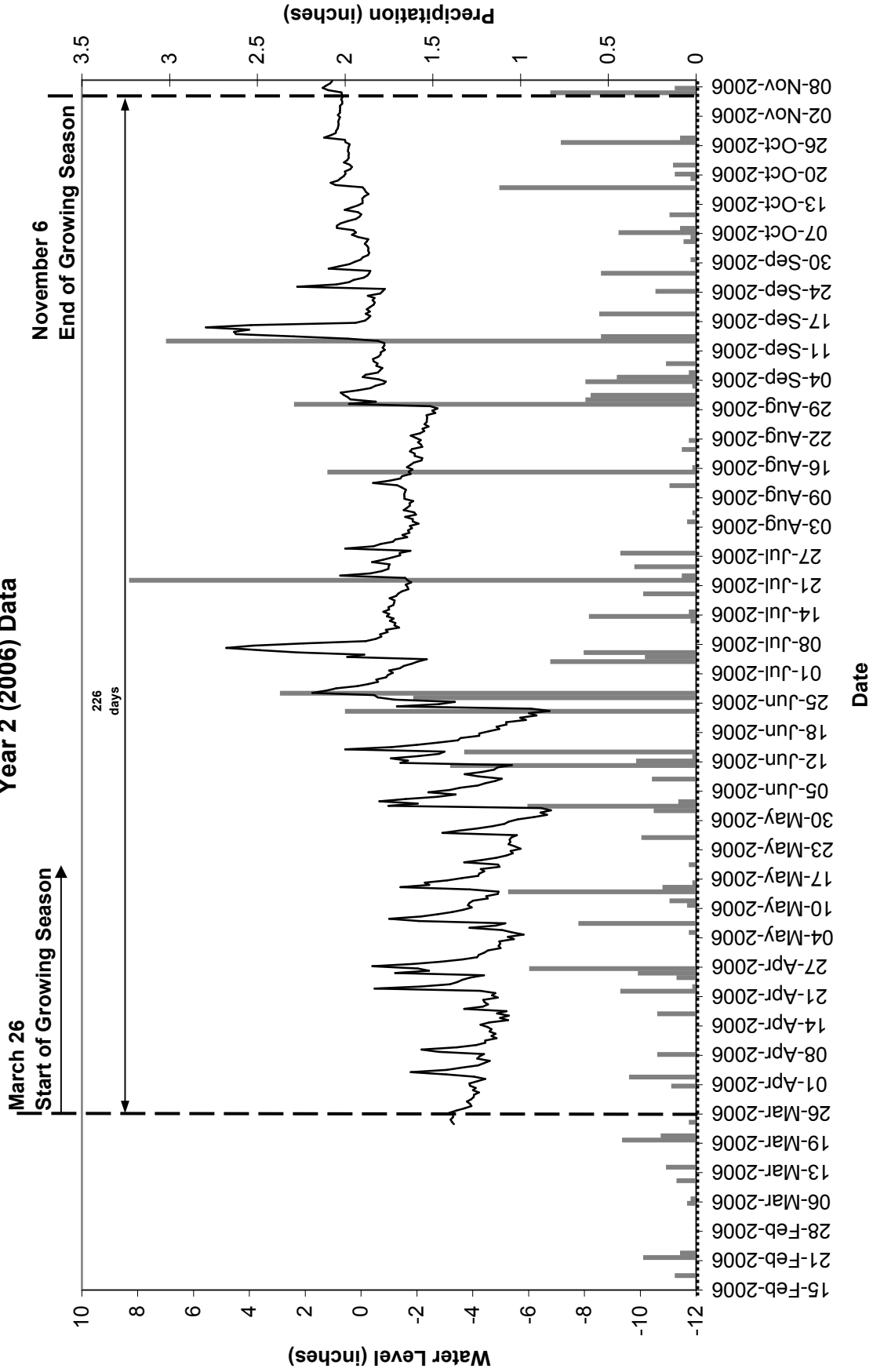








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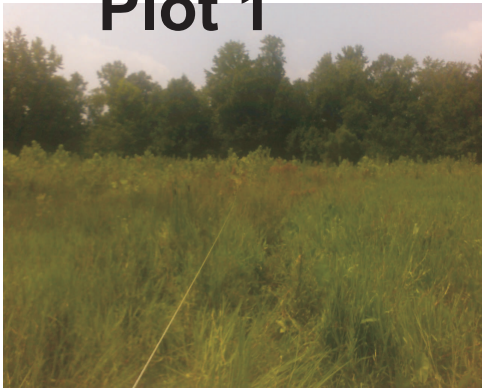




**APPENDIX B**  
**VEGETATION PLOT PHOTOGRAPHS**

Haw River Swamp Wetland Restoration Site  
Year 2 (2006) Annual Monitoring Report  
Vegetation Plot Photographs Taken August 2006

**Plot 1**



**Plot 2**



**Plot 3**



**Plot 4**



**Plot 5**



**Plot 6**



**Plot 7**



**Plot 8**



**APPENDIX C**  
**WILDLIFE OBSERVATIONS**



WILDLIFE OBSERVED AT			
HAW RIVER SWAMP WETLAND RESTORATION SITE			
BIRDS*:		September	August
		2005	2006
Great Egret	<i>Ardea alba</i>	x	x
Great Blue Heron	<i>Ardea herodias</i>	x	x
Green Heron	<i>Butorides virescens</i>		x
Canada Goose	<i>Branta canadensis</i>	x	x
Mallard	<i>Anas platyrhynchos</i>	x	
Turkey Vulture	<i>Cathartes aura</i>	x	x
Red-tailed Hawk	<i>Buteo jamaicensis</i>	x	x
Red-shouldered Hawk	<i>Buteo lineatus</i>		x
Killdeer	<i>Charadrius vociferus</i>	x	x
American Woodcock	<i>Scolopax minor</i>	x	
Mourning Dove	<i>Zenaida macroura</i>		x
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>		x
Chimney Swift	<i>Chaetura pelagica</i>	x	
Ruby-throated Hummingbird	<i>Archilochus colubris</i>		x
Belted Kingfisher	<i>Ceryle alcyon</i>		x
Pileated Woodpecker	<i>Dryocopus pileatus</i>	x	
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	x	x
Downy Woodpecker	<i>Picoides pubescens</i>	x	
Northern Flicker	<i>Colaptes auratus</i>		x
Eastern Wood-Pewee	<i>Contopus virens</i>	x	x
Eastern Phoebe	<i>Sayornis phoebe</i>		x
Blue Jay	<i>Cyanocitta cristata</i>	x	
American Crow	<i>Corvus brachyrhynchos</i>	x	x
Red-eyed Vireo	<i>Vireo olivaceus</i>	x	
Barn Swallow	<i>Hirundo rustica</i>	x	
Carolina Chickadee	<i>Poecile carolinensis</i>		x
Tufted Titmouse	<i>Baeolophus bicolor</i>	x	x
White-breasted Nuthatch	<i>Sitta carolinensis</i>		x
Carolina Wren	<i>Thryothorus ludovicianus</i>	x	x
Blue-gray Gnatcatcher	<i>Polioptila caerulea</i>		x
Eastern Bluebird	<i>Sialia sialis</i>	x	
American Robin	<i>Turdus migratorius</i>		x
Common Yellow-throat	<i>Geothlypis trichas</i>		x
Summer Tanager	<i>Piranga rubra</i>		x
Northern Cardinal	<i>Cardinalis cardinalis</i>	x	x
Indigo Bunting	<i>Passerina cyanea</i>	x	x
Field Sparrow	<i>Spizella pusilla</i>		x
Red-winged Blackbird	<i>Agelaius phoeniceus</i>		x
American Goldfinch	<i>Carduelis tristis</i>	x	x

MAMMALS:		September	August
		2005	2006
Beaver	<i>Castor canadensis</i>	x	x
Virginia Opossum	<i>Didelphis virginiana</i>	x	
Woodchuck	<i>Marmota monax</i>		x
Striped Skunk	<i>Mephitis mephitis</i>	x	
Muskrat	<i>Ondatra zibethicus</i>	x	
Raccoon	<i>Procyon lotor</i>	x	
White-tailed Deer	<i>Odocoileus virginianus</i>		x
Mouse Nest			x
REPTILES and AMPHIBIANS:		September	August
		2005	2006
Eastern Mud Turtle	<i>Kinosternon subrubrum</i>	x	
Rough Green Snake	<i>Opheodrys aestivus</i>		x
Green Frog	<i>Rana clamitans</i>		x
September 2005 – these were observations made incidental to other work.			
August 2006 – these were observations made incidental to other work.			
*Sibley, D.A. 2000. The Sibley Guide to Birds. National Audobon Society.			