Howell Woods
Wetland Restoration Site
Johnston County, North Carolina

Year 4 Annual Monitoring Report
2005

Prepared for: NCDEHNR/Ecosystem Enhancement Program
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Site Design: EcoScience Corporation
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December 2005

Ecosystem Enhancement PROGRAM

NCDENR

NC STATE UNIVERSITY

Howell Woods Wetland Restoration Site
Fall 2005 Monitoring Summary

A wetland enhancement and restoration project was funded through the North Carolina Wetlands Restoration Program (NCWRP). The goals of the project are to:

1) Maximize the area returned to historic wetland function
2) Enhance water quality functions in Gar Gut Creek and Mill Creek.
3) Re-establish a functioning backwater slough system, which extends through developing bottomland hardwood forests.

This is the 4th year of the 5-year monitoring plan for the completed Howell Woods Site.

Table 1. Background information

Project Name	Howell Woods Wetland Restoration
Designer's Name	EcoScience Corporation 1101 Haynes Street, Suite 101 Raleigh, NC 27604
Contractor's Name	Backwater Environmental 2312 New Bern Avenue Raleigh, NC 27610
Directions to Project Site	From Highway 70 Business in Smithfield, travel south 15 miles on Route 701. Turn onto Racetrack Road heading southeast. Turn left into Howell Woods Environmental Learning Center after approximately 10 miles. See Jaime Sasser or Kinchon Taylor at the Center office for a gate key and directions back to the site.
Drainage Area	6300 acres
USGS Hydro Unit	03020201
NCDWQ Subbasin	03-04-04
Project Size	32 acres riverine wetland restoration 74 acres riverine wetland enhancement 4 acres wetland creation
Restoration Approach	Channel plugs on main canal and tributaries. Creation of a floodplain slough and isolated depressions. Littoral shelf grading adjacent to existing ponds. Wetland grading and planting.
Date of Completion	Initial Planting Spring 2000.
	Construction and Planting Summer 2002.
Monitoring Dates	Sep 2001, Dec 2002, Nov 2003,2004,2005

Table 2. Vegetation Plots Summary

Howell Woods Wetland Restoration Vegetative Plots Summary Fall 2005					
	planted tree stems	Total tree stems	Total Tree Species	Extrapolated planted stems/acre	Extrapolated total stems/acre
Quad 1	11	138	8	440	5520
Quad 2	4	21	4	160	840
Quad 3	7	24	6	280	960
Quad 4	15	104	6	600	4160
Quad 5	2	35	4	80	1400
Average	**7.8**	**64.4**	**5.6**	**312**	**2576**

Results Summary

Table 2 summarizes the stem counts for planted and volunteer trees in each of the monitoring plots. A more detailed summary, and the full results are presented in the report. Restoration areas at the site, on average, are currently meeting the proposed mitigation success criteria. However, planted stem totals in stream side zones (Quads 2 and 5) were low. Volunteer recruitment in all quads has increased the overall stem density and development should continue.

The conditions in the wetland creation areas (littoral shelves) are supporting a herbaceous wetland community. The density of herbaceous species also appears to have improved each monitoring trip. However, the difference between the targeted, planted species composition and the current species composition is not known. A more detailed assessment of this area and acreage measurement should help with determination for wetland creation credits.

Groundwater gage data has indicated that flooding is a frequent occurrence, especially in areas near the plugged and created channels. However, it seems that some areas may actually be too wet for existing large trees. Since 2003, a line of mature trees at the edge of the channel has exhibited high mortality. It has been difficult to assess enhancement areas some distance from surface waters. It is clear that the site activities should have restored a more natural hydrologic regime, however, it is difficult to determine the actual extent of enhancement.

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1.0 PROJECT BACKGROUND

1.1 Location and Setting

The project site is located on the grounds of the Howell Woods Environmental Learning Center southeast of Smithfield, NC. The site is approximately 25 miles south of Smithfield in southeastern Johnston County. From Highway 70 Business in Smithfield, travel south 15 miles on Route 701. Turn left onto Devil's Racetrack Road heading southeast. Turn left into Howell Woods Environmental Learning Center after approximately 10 miles. See Jaime Sasser or Kinchon Taylor at the Center office for a gate key and directions back to the site.

1.2 Structure and Objectives

The site was identified for its potential as a wetland restoration site partially due to its location near the lower floodplain of the Neuse River. A network of drainage canals and ditches had been installed, primarily for agricultural purposes. The drainage system had exhibited limited effectiveness for improving agricultural production, also making the site conducive for a restoration project. Background information provided in this report was first published in the document "Howell Woods Wetland Restoration Site As-Built Construction Report", which was prepared by EcoScience Corporation in December of 2002. The primary goals as stated in the As-Built Construction Report include:

1) Maximize the area returned to historic wetland function.
2) Enhance water quality functions in Gar Gut Creek and Mill Creek.
3) Re-establish a functioning backwater slough system which extends through developing bottomland hardwood forests.

Site investigation and design services were provided between 1998 and 2002 by EcoScience Corporation. The final plan estimated 32 acres of riverine wetland restoration, 74 acres of wetland enhancement, and 4 acres of wetland creation. The primary construction plan included the targeted blocking of a major drainage canal and grading of littoral shelves and canal side areas. Construction activities at the site began in June of 2002 and were completed in July of 2002. Planting at the site was completed in two phases. The first phase included the planting of bottomland forest tree species in areas that would not be disturbed by construction activities. This phase of the planting was completed in the spring of 2000. The second phase of planting included freshwater herbaceous sprigs in littoral shelf areas in addition to bottomland hardwood species. The majority of the planting occurred during this phase, which was completed in December of 2002. The As Built Construction Report indicates an initial approximate planting area of 20 acres and Figure 8 reports initial planting areas of 12.5 acres of floodplain bottomland hardwood and 4.1 acres of mesic upland slope. After construction was completed in 2002, an additional 4 acres of littoral shelf areas were planted along with the re-planting and added planting of some additional bottomland hardwood areas. This results in a total of 20.6 acres of planting. Additional planting associated with construction activities at several tributaries may have increased the total planting area. A plan view of the site which shows the final community types based on several figures and data provided by EcoScience Corporation is included with this report.

Table 3. Project Structure Table Project: Howell Woods	
Segment/Reach ID	**Acreage**
Wetland Restoration Area	32 acres
Wetland Enhancement Area	74 acres
Wetland Creation	4 acres

Table 4. Project Objectives Table Project: Howell Woods			
Segment/Reach ID	**Objectives**	**Acreage**	**Comment**
Wetland Restoration Area	Restoration	32	Maximize the area returned to historic wetland function
Wetland Enhancement Area	Enhancement	74	Enhance water quality functions in Gar Gut Creek and Mill Creek. Re-establish a functioning backwater slough system, which extends through developing bottomland hardwood forests.
Wetland Creation Area	Creation	4	Not documented. Establish herbaceous community.

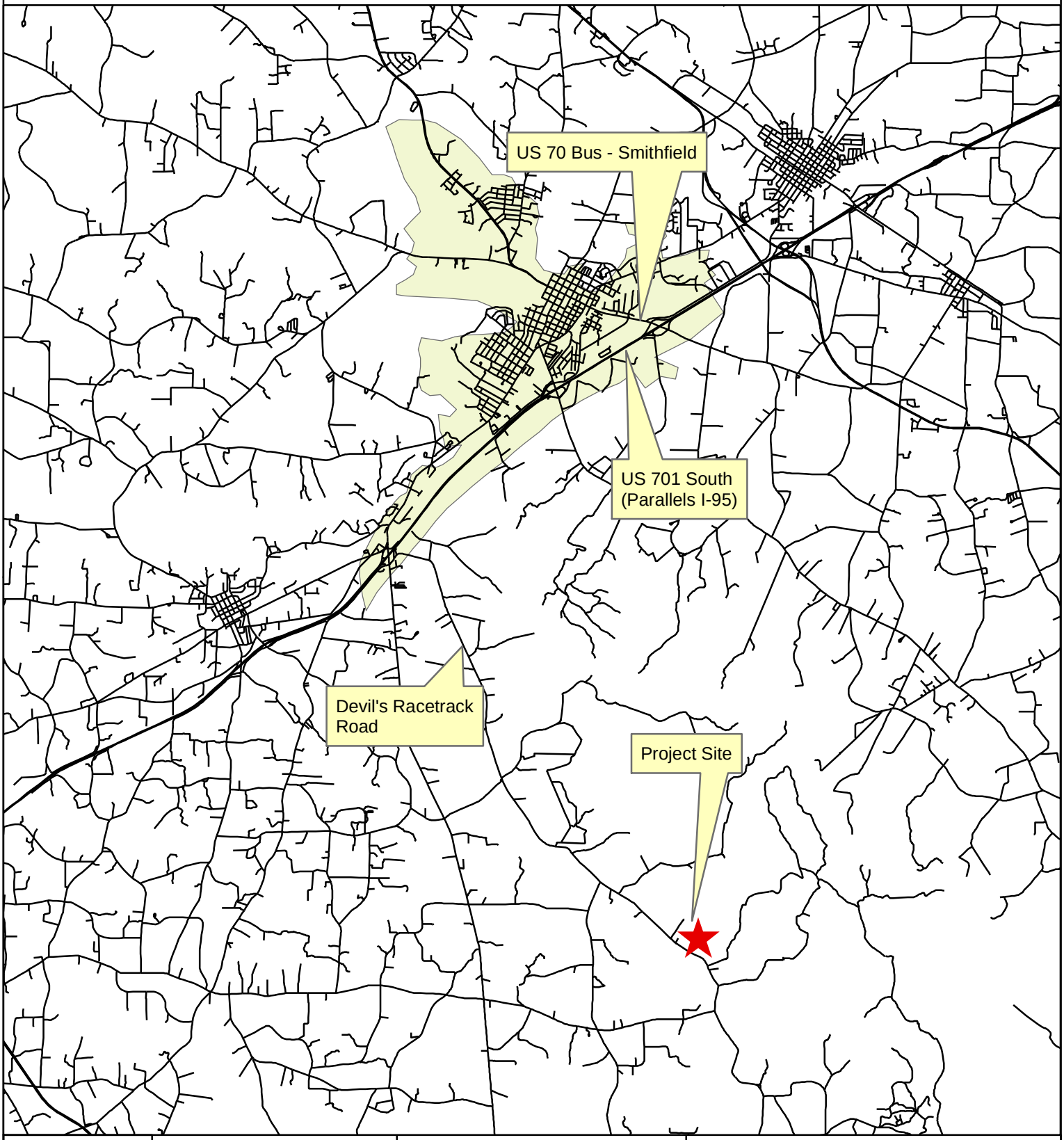
1.3 Project History and Background

Table 5. Project Activity and Reporting History Project: Howell Woods		
Activity or Report	**Calendar Year of Completion or Planned Completion**	**Actual Completion Date**
Restoration Plan	Oct 2001	Oct 2001
Mitigation Plan	Oct 2001	Oct 2001
Construction	Spring 2000, Fall 2002	Spring 2000, Fall 2002
Initial Planting	Spring 2000	Spring 2000
As-Built report	Dec 2002	Dec 2002
Final Planting	Dec 2002	Dec 2002
Initial – Year 1 monitoring	2002	2002
Year 2 Monitoring	2003	2003
Year 3 Monitoring	2004	2004
Year 4 Monitoring	2005	2005

Table 6. Project Contact Table Project: Howell Woods	
Designer Primary project design POC	EcoScience Corporation 1101 Haynes Street, Suite 101 Raleigh, NC 27604 Grant Lewis 919.828.3433
Construction Contractor Construction contractor POC	Backwater Environmental 2312 New Bern Avenue Raleigh, NC 27610 Wes Newell 919.523.4375
Monitoring Performers 	Biological and Agricultural Engineering North Carolina State University Campus Box 7625 Raleigh, NC 27695
Vegetation Monitoring POC	Karen Hall 919.515.8242
Wetland Monitoring POC	Kris Bass 919.515.8245

Table 7. Project Background Table Project: Howell Woods	
Project County	Johnston
Drainage Area	6300 acres
Drainage impervious cover estimate (%)	<10%
Stream Order	1-2
Physiographic Region	Coastal Plain
Ecoregion	Rolling Coastal Plain or Southeastern Floodplains and Terraces
Cowardin Classification	PFO2
Dominant soil types	Wehadkee
USGS HUC for Project and Reference	03020201
NCDWQ Sub-basin for Project and Reference	03-04-04
NCDWQ classification for Project and Reference	C, NSW
% of project easement fenced	0, but there are several gates along the road

Location Map



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Howell Woods
Wetlands Restoration

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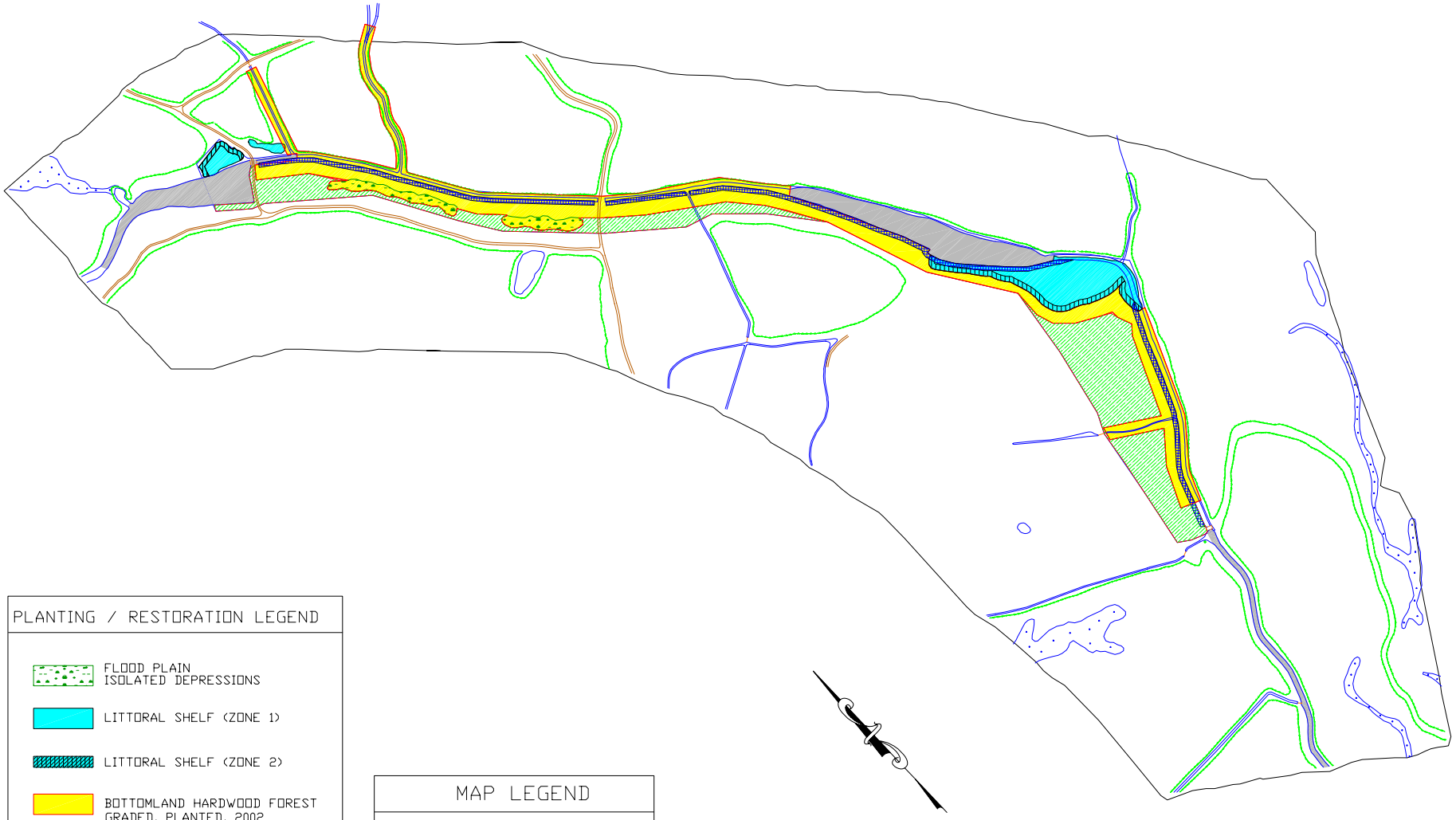

PLANTING / RESTORATION LEGEND

- FLOOD PLAIN ISOLATED DEPRESSIONS
- LITTORAL SHELF (ZONE 1)
- LITTORAL SHELF (ZONE 2)
- BOTTOMLAND HARDWOOD FOREST GRADED, PLANTED, 2002
- OPEN WATER
- STREAM SIDE ZONES
- BOTTOMLAND HARDWOOD FOREST AND MESIC UPLAND SLOPE PLANTED, 2000

MAP LEGEND

- PROJECT BOUNDARY
- EXISTING ROADS
- APPROX. MINOR CONTOUR
- APPROX. MAJOR CONTOUR
- WOODS

CAD data provided by:

EcoScience Corporation

Raleigh, North Carolina

Vegetative Communities Map

Howell Woods Wetland Restoration
Johnston County, North Carolina

Note: Map data provided by EcoScience Corporation. Data has been compiled and edited for use with this report.

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1.4 Monitoring Plan

A monitoring plan for the site was prepared by EcoScience Corporation. The plan included monitoring for vegetative and hydrologic success criteria. The initial plan was implemented on the partially completed site in 2001 and fully in 2002.

NCSU staff made our initial monitoring visit on October 9-10, 2003. Our staff implemented a revised monitoring procedure developed based on the document "Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects" provided by the North Carolina Wetlands Restoration Program. Our staff continued hydrologic monitoring as directed using the existing gages installed at the site. Photographs and observations were also a part of the new monitoring agenda. The full monitoring plan is explained in detail in this report.

1.4.1Previous Vegetative Results

The 2002 vegetative sampling was completed immediately following the final planting at the site. Although this monitoring visit occurred shortly after planting, the site was found above the success criteria set forth in the initial monitoring plan. The 2003 and 2004 monitoring found that the site was meeting the vegetative success criteria on average. However, some individual areas were not found to be meeting the criteria on their own. Detailed descriptions, including the data from each of the previous monitoring are included in the reports from those years.

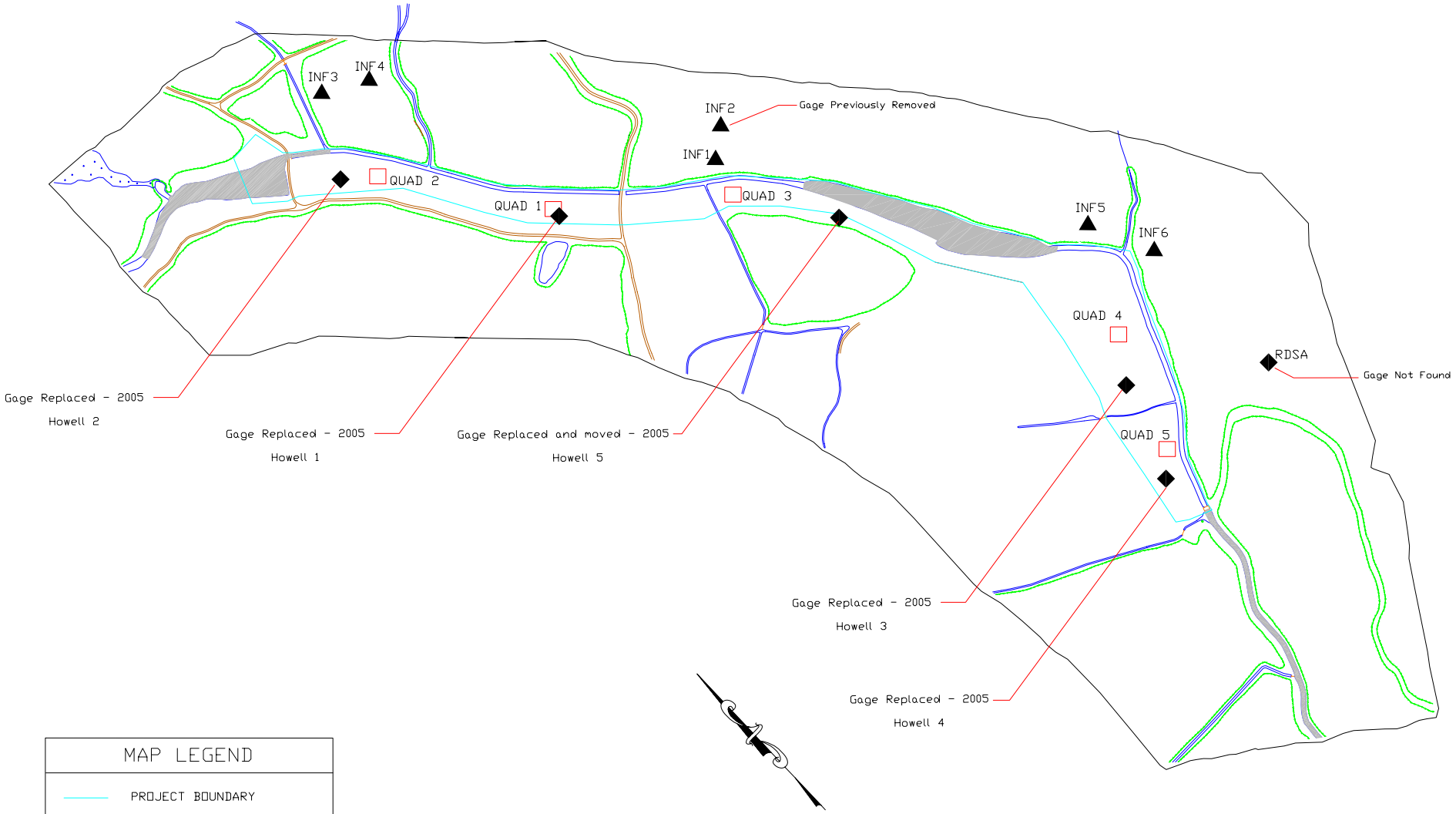
1.4.2 Previous Hydrologic Results

A network of groundwater gages was set up throughout the site and in reference areas to gather pre and post construction water table data. The data collected and presented in the previous monitoring reports indicated that water tables have risen since the 2002 restoration work. Hydrology was in excess of targeted regulatory minimums in 2003. The full data and analysis can be reviewed in the prior reports.

1.4.3 Current Monitoring

NCSU has continued monitoring throughout 2005. The monitoring methodology was kept the same as in 2003 and 2004. Two site visits were conducted in 2005. The first, a summer visit, was made to install new monitoring gages and make observations during the growing season. The second visit was conducted in the fall and involved data collection and the vegetative monitoring protocols.

As described in the "Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects" document, plots were set up for recording vegetation density and survivability in the restored wetland areas. Plots were set up in various areas throughout the site to represent the range of conditions and treatments. A total of five (5) plots were set up throughout the site. Three plots were set up in the upper bottomland floodplain forest area along the main drainage canal. One plot was set up in the main area that was part of the initial planting in 2000. One plot was set up near the lower portion of the site in an area adjacent to the canal where the 2002 construction had occurred. The plots were 10 meters x 10 meters with nested plots of 5 meters X 5 meters and 1 meter X 1 meter. All planted trees were counted, identified, and measured for diameter breast height (dbh) throughout the entire plot. Due to the large number of volunteer tree species, quantities were estimated based on observations and average heights measured. Shrub data was recorded in the nested 5 meter plot and herbaceous material was estimated in the 1 meter plot. Although plots could not be set up in all areas of the site, our staff visited each area to make observations on the health and development of varying areas. The Monitoring Map shows the locations of the quads/plots and other monitoring activities.



MAP LEGEND

- PROJECT BOUNDARY
- EXISTING ROADS
- MONITORING PLOTS/QUADS
- INFINITY GROUNDWATER GAGE
- RDS GROUNDWATER GAGE
- WOODS

CAD data provided by:

EcoScience Corporation

Raleigh, North Carolina

2005 Monitoring Map

Howell Woods Wetland Restoration
Johnston County, North Carolina

Note: Map data provided by EcoScience Corporation. Data has been compiled and edited for use with this report.

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2.0 PROJECT CONDITION AND MONITORING RESULTS

2.1 Vegetation Monitoring Results

2.1.1 Wetland Restoration

Vegetation throughout this wetland area consists of a combination of both planted and volunteer trees, shrubs and herbaceous plants. The herbaceous plants species are diverse, with an evident gradation of species from drier to wetter areas. Further inspection revealed the continued growth of a significant number of volunteers. Much of the site is bordered by young forest on one side, and bottomland hardwood forest on the other side of the main canal, which likely serve as seed sources for volunteer growth. *Ulmus* spp. (elms), *Acer* spp. (maples), and *Fraxinus* spp. (ashes) are the most prolific volunteers. Because there had been two previous planting events of bare root seedlings, some of the planted species were difficult to differentiate between volunteer trees based on size. Therefore, when calculating planted trees per acre at this site, the "planted" species is an approximation.

Randomly located plots were generally positioned on a grade from dry to wet areas due to linearity of the wetlands. The drier areas of all plots were in early to mid-successional states. *Rubus* spp. (blackberry and dewberry), *Andropogon* spp. (broomsedge, etc.), *Aster* spp., and numerous stems of *Liquidambar styraciflua* (sweet gum), elms, maples, and ashes resulted in a thick coverage in most plots. A few plots were less diverse in trees and contained an abundance of various grass species. *Hibiscus moscheutos* (marsh mallow) and *Cephalanthus occidentalis* (button bush) were commonly occurring shrubs. These species appear to have been planted in wetter areas, but are not abundant in numbers of stems. *Carex* spp. (sedges), *Juncus* spp. (rushes), and *Diodia virginiana* were located throughout the wetter areas.

Planted trees on this site were healthy and exhibited growth in the past year. *Quercus* spp. (oaks) were well represented planted species. *Platanus occidentalis* (sycamore) and maples were also noted planted trees. *Taxodium distichum* (bald cypress) and *Nyssa* spp. (tupelos) were the predominately planted trees in the wet areas. Some tree mortality was noticed. Extrapolation from the plots resulted in an overall average of approximately 312 planted trees per acre for this wetland. If natural regeneration is included with planted trees, the number is increased to an average of approximately 2,576 trees per acre. Both of these estimates are based on a diverse mix of species as well. The total number of stems (planted + volunteer) far exceeded requirements for every plot (100% attainment). However, two plots resulted in planted stem counts less than requirements. Quads 2 and 5 (160 and 80 stems/acre) were representative of lower, wetter areas of the site and the stream side zones shown on the Vegetative Communities Map. Totaling numbers of only planted stems would result in a 60% vegetative attainment for the site. This difference in planted and total stems per acre illustrates the importance of natural regeneration in the restoration of this site.

Invasive plant species on the site included *Lonicera japonica* (Japanese honeysuckle) and *Typha* spp. (cattails). Although the honeysuckle was in most plots and entangles many trees and shrubs, it does not appear to be prohibiting growth or survival.

The phased planting schedule at the site made it challenging to differentiate between planted and volunteer trees based on size. Therefore, when calculating planted trees per acre at this site, the number of "planted" species was based on the experience and judgment of the monitoring team. A detailed summary listing species found and stem counts is presented in Table 2. The full data, including average heights of each species is included in the Appendix. A table is presented below showing the survival of planted species from our first monitoring visit to 2005. Green ash was the only planted species that has been found to increase in population so far. Sycamore and willow oak have had the lowest survival.

Table 8. Species Survival.

Howell Woods
2005 Species Survival

	Plot							
Species	1	2	3	4	5	**2003 total**	**2005 total**	**Survival %**
Shrubs								*
Cephalanthus occidentalis						6	0	0%
Trees								
Fraxinus pennsylvanica	2	16	0	10	0	22	28	127%
Platanus occidentalis	1	0	0	0	2	4	3	75%
Quercus nigra	0	0	0	1	0	1	1	100%
Quercus pagoda	2	1	1	0	0	4	4	100%
Quercus phellos	2	2	1	1	0	7	6	86%
Taxodium distichum	0	0	1	0	0	1	1	100%

* Stem count is influenced by naturally regenerated trees.

2.1.2 Wetland Creation/Littoral Shelves

Each of the littoral shelf areas were examined by our staff. Herbaceous plant populations continue to increase in density each year based on visual observation. However, it is unclear whether desired species have survived or expected communities are developing. It does appear that a herbaceous community of wetland plants is developing. It is also expected that these areas will continue to improve in density over time. A more detailed assessment of these areas will help make final determinations on them.

2.1.3 Wetland Enhancement

It appears, based on the As-Built Construction Report, that a large portion of the project site where no construction activities took place was planned as the enhancement area. However, it is unknown how the extent of this enhancement was determined and is unclear how this might be assessed. During our visit, it appeared that a large portion of the areas likely designated for enhancement had been actively flooded during the growing season. It is clear that the site work has decreased drainage and restored a more natural hydrologic regime to most of the area. Trees in the enhancement area, that used to be near the banks of the newly plugged channel, are now in almost constant contact with surface waters. It appears that these trees have been adversely effected and that an increasing number will likely die due to excessive saturation.

Table 9. Vegetative Problem Areas			
Location/Issue	**Location**	**Probable Causes**	**Photo #**
Low Tree Stem Counts in Stream Side Zones	See Plan View	Compacted soil Lower planted quantities Proximity of surface water	1,2,3,5
Littoral Shelf	See Plan View	Compacted soil Improper hydrologic conditions	5
Mature trees stressed in enhancement area	See Photos	Proximity of surface waters	4,5

2.2 Hydrologic Monitoring Results

Each of the existing gages at the site were visited and a data download was attempted. Downloads of Infinity type gages were mostly successful. However, several of the gages recorded values outside the range of the equipment for the entire year. Other gages began recording obviously erroneous values.

The Infinity gages are located primarily in the enhancement areas of the site and most are in close proximity to surface waters. The data acquired from these gages in 2003 showed that the hydrologic success criteria were exceeded over almost the entire growing season. Accurate data was only acquired from one recorder in 2004. The water table depth measured only dipped below 12 inches for a brief time during 2004.

The main restoration areas of the site are outfitted with RDS gages. In 2004, downloads for the RDS type recorders were entirely unsuccessful. Some data was eventually recovered, however, the gages would not collect additional data. At the request of EEP staff, 5 new RDS gages were installed in the summer of 2005.

The data recorded from the operating Infinity recorders is presented in Appendix B. The recorder is located in one of the enhancement areas. The water table depth stays well above 12 inches for the first few months of the growing season, only approaching that depth near the end of the period shown. The data jumps right back up to the surface, presumably due to a rain event. However, data collected after this point and over the summer exhibited errors, possibly due to some equipment malfunction. Although we could not record the full growing season of data, it is clear that this area remains wet a large part of the year, and that it will continue to meet wetness criteria for the site.

Data collected by a few of the newly installed RDS gages is also presented in Appendix B. The gages were installed in the beginning of August and in the middle of a severe drought in the area. Two of the gages show the site to wet up quite easily, and the base groundwater level to be steadily rising with subsequent rainfalls. However, during this time there where no periods meeting the wetness criteria. The longest period with water table depths within the first 12 inches was 4 days. Data shown from one of these gages exhibited only small changes in water table depths. This may be because the depth was initially below the maximum that can be read by these gages (41 inches).

2.3 Results Discussion

Based on vegetative survival totals from all plots, restored areas at this site are currently meeting the mitigation requirements as stated in the As-Built Construction Report. There were several plots which are exhibiting minimal stem counts. It appears that the continued development of adjacent vegetative communities and the proliferation of volunteers will populate these areas over time. Although water table data from this year was minimal, the site also seems to be exceeding wetness hydrologic criteria. The data collected in the next year of monitoring should be able to confirm this.

Vegetation on the wetland creation (littoral shelf) areas of the site appeared to improve this year. The herbaceous community is comprised of primarily obligatory wetland plants. However, the extents of the desired community has not been determined. If a more quantitative method is needed to determine mitigation credit in these areas, adjustments should be considered to the monitoring procedure.

It has also been difficult to assess enhancement areas with the current monitoring protocol. Data collected near the channel has shown high water tables and frequent flooding. This may be the intended effect, but it also appears to be causing stress on some of the mature trees along the channel banks. Gages installed farther from the channels have been prone to errors and water tables have been mostly below the reading limits of the equipment.

3.0 PHOTOGRAPHS

Photo 1. Fall 2005. Wetland Restoration Area.

Photo 2. Fall 2005

Photo 3. Fall 2005

Photo 4. Fall 2005. Stressed trees along plugged channel.

Photo 5. Fall 2005.

APPENDIX A

Vegetative Data Summary

Howell Woods Wetland Restoration
Johnston County, NC
Fall 2005 Monitoring Data Summary
11/9/2005

Quad 1

Tree Stratum

Species	Height (cm)	Density	Rel. Density (%)
Acer rubrum	78	40	29.0
Platanus occidentalis	417	1	0.7
Quercus phellos	258	2	0.7
Quercus pagoda	111	2	1.4
Ulmus spp.	46	50	36.2
Pinus taeda	162	3	2.2
Fraxinus spp.	134	2	1.4
Liquidambar styraciflua	89	39	28.3

Total Trees per acre	5520
Planted trees per acre	440
Natural regen trees per acre	5080

Quad 2

Tree Stratum

Species	Height (cm)	Density	Rel. Density (%)
Fraxinus sp.	83	16	76.2
Liquidambar styraciflua	105	2	9.5
Quercus pagodifolia	115	1	4.8
Quercus phellos	113	2	9.5

Total Trees per acre	840
Planted trees per acre	160
Natural regen trees per acre	680

Quad 3

Tree Stratum

Species	Height (cm)	Density	Rel. Density (%)
Ulmus sp.	95	10	41.7
Quercus phellos	178	1	4.2
Taxodium distichum	168	1	4.2
Quercus pagoda	175	1	4.2
Liquidambar styraciflua	142	2	4.2
Acer rubrum	220	10	41.7

Total Trees per acre	960
Planted trees per acre	280
Natural regen trees per acre	680

Quad 4

Tree Stratum

Species	Height (cm)	Density	Rel. Density (%)
Ulmus sp.	106	65	63
Quercus phellos	295	1	1
Quercus nigra	380	1	1
Fraxinus sp.	191	10	10
Liquidambar styraciflua	223	9	9
Acer rubrum	200	18	17

Total Trees per acre	4160
Planted trees per acre	600
Natural regen trees per acre	3560

Quad 5

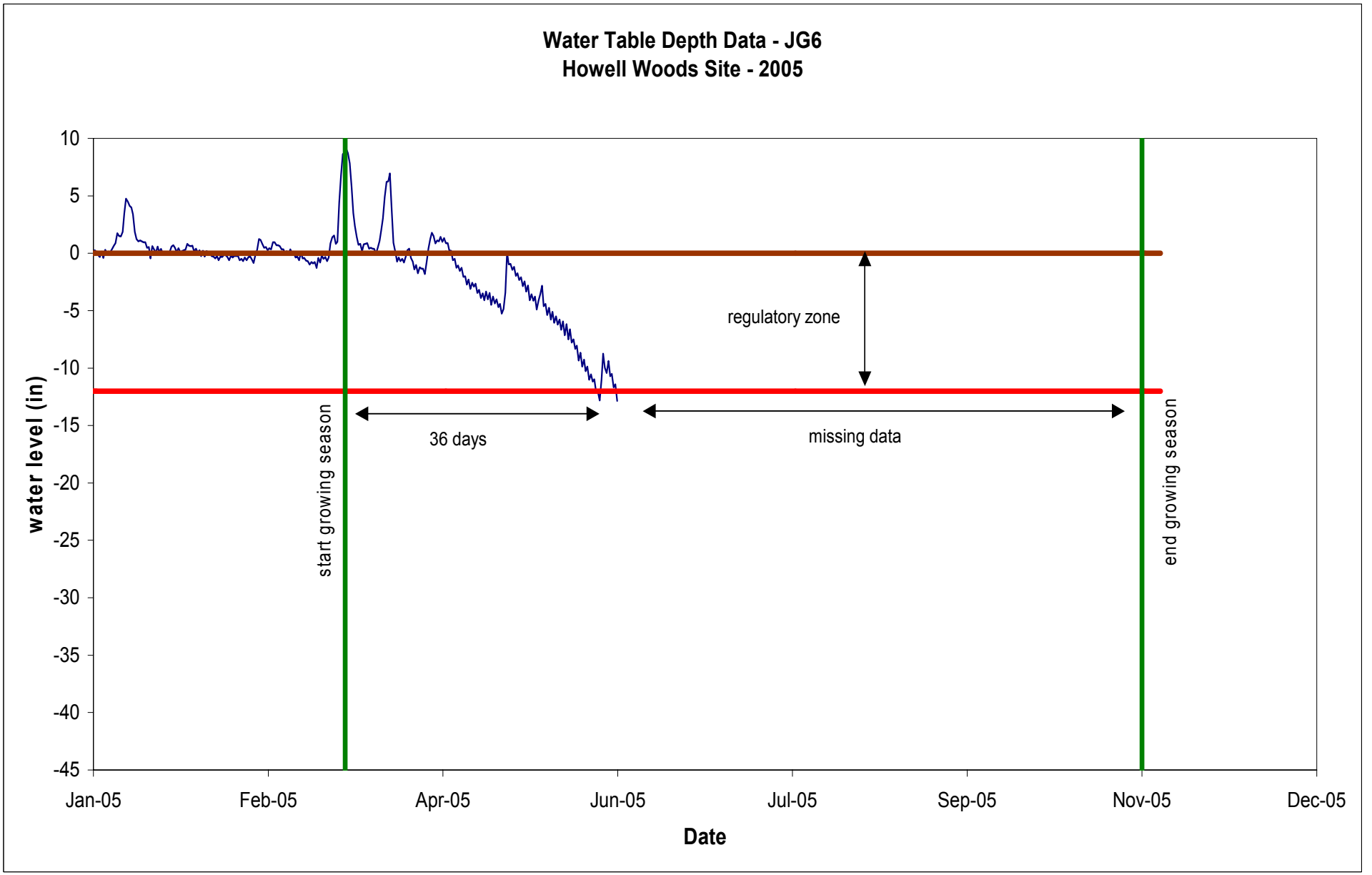
Tree Stratum

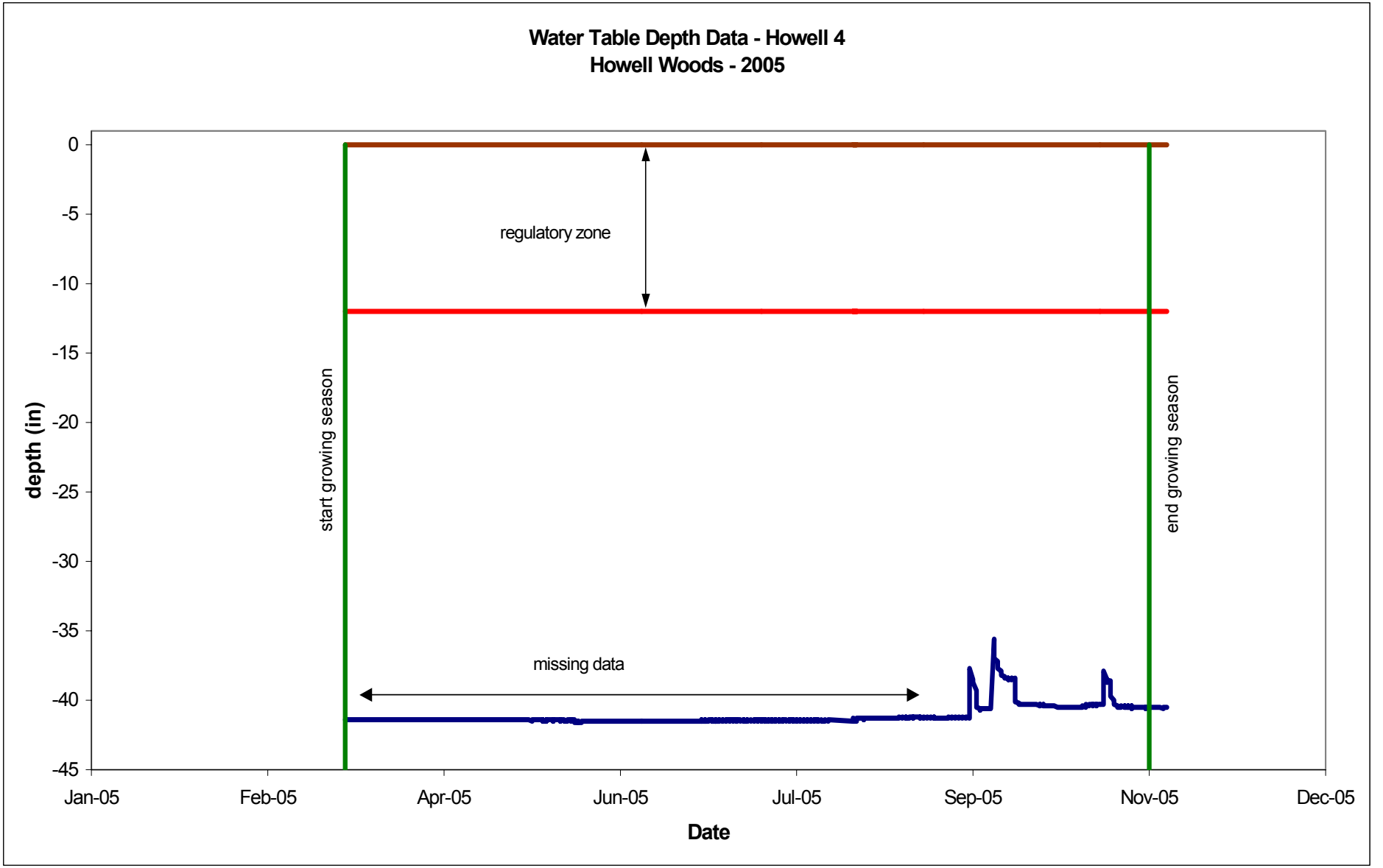
Species	Height (cm)	Density	Rel. Density (%)
Ulmus sp.	47	5	14.3
Acer rubrum	22	4	11.4
Platanus occidentalis	154	2	5.7
Liquidambar styraciflua	35	24	68.6

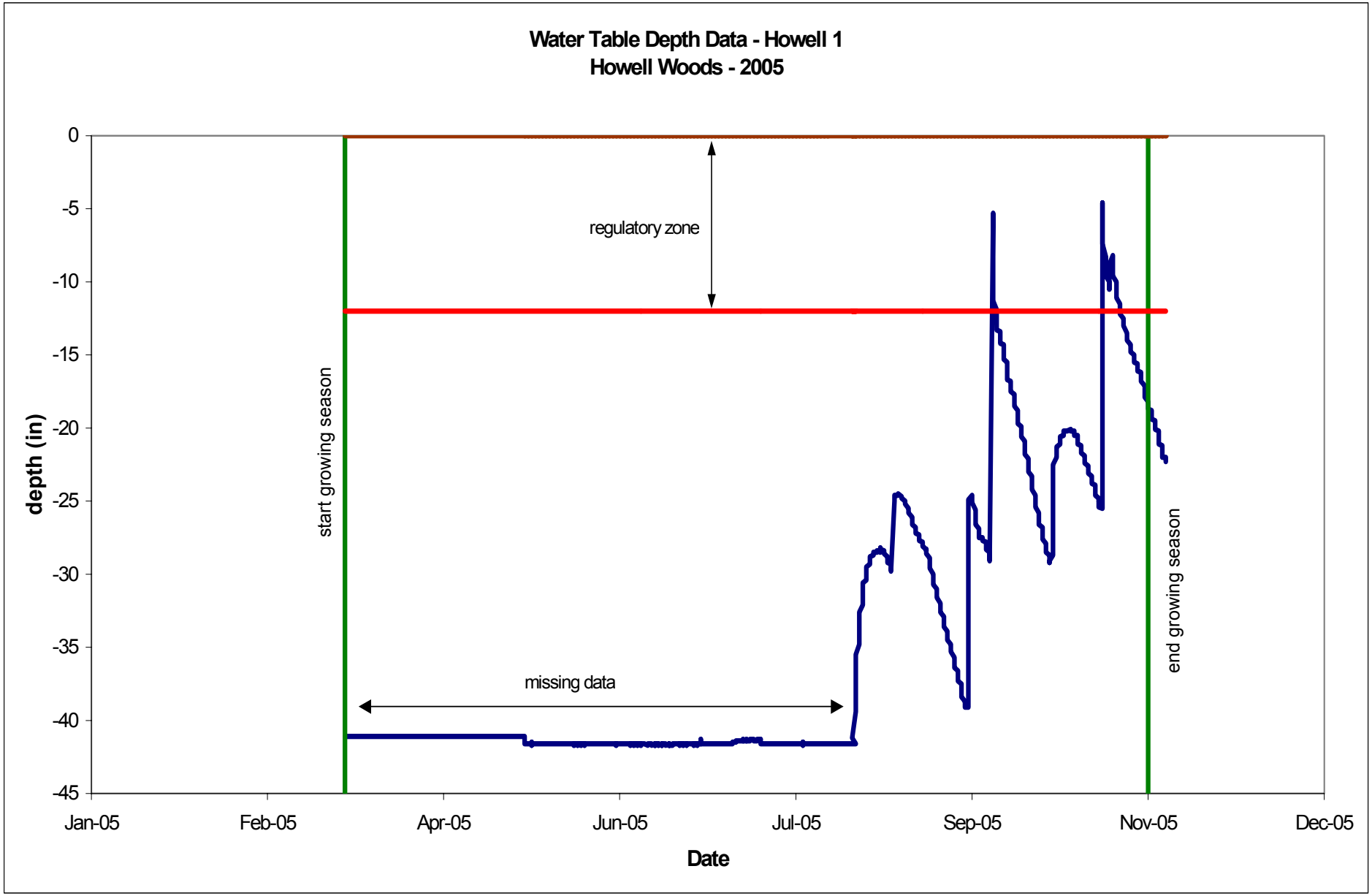
Total Trees per acre	1400
Planted trees per acre	80
Natural regen trees per acre	1320

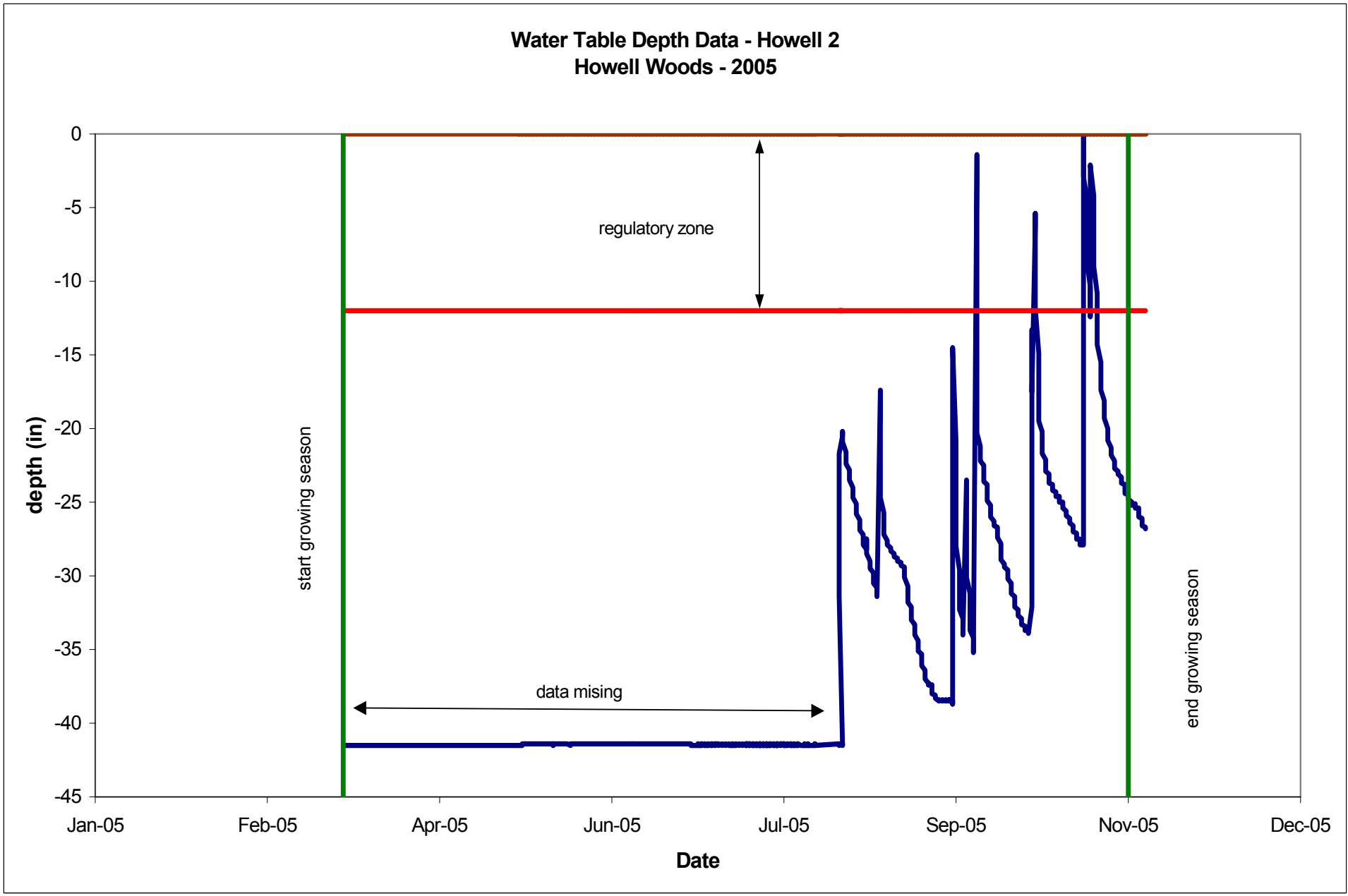
APPENDIX B

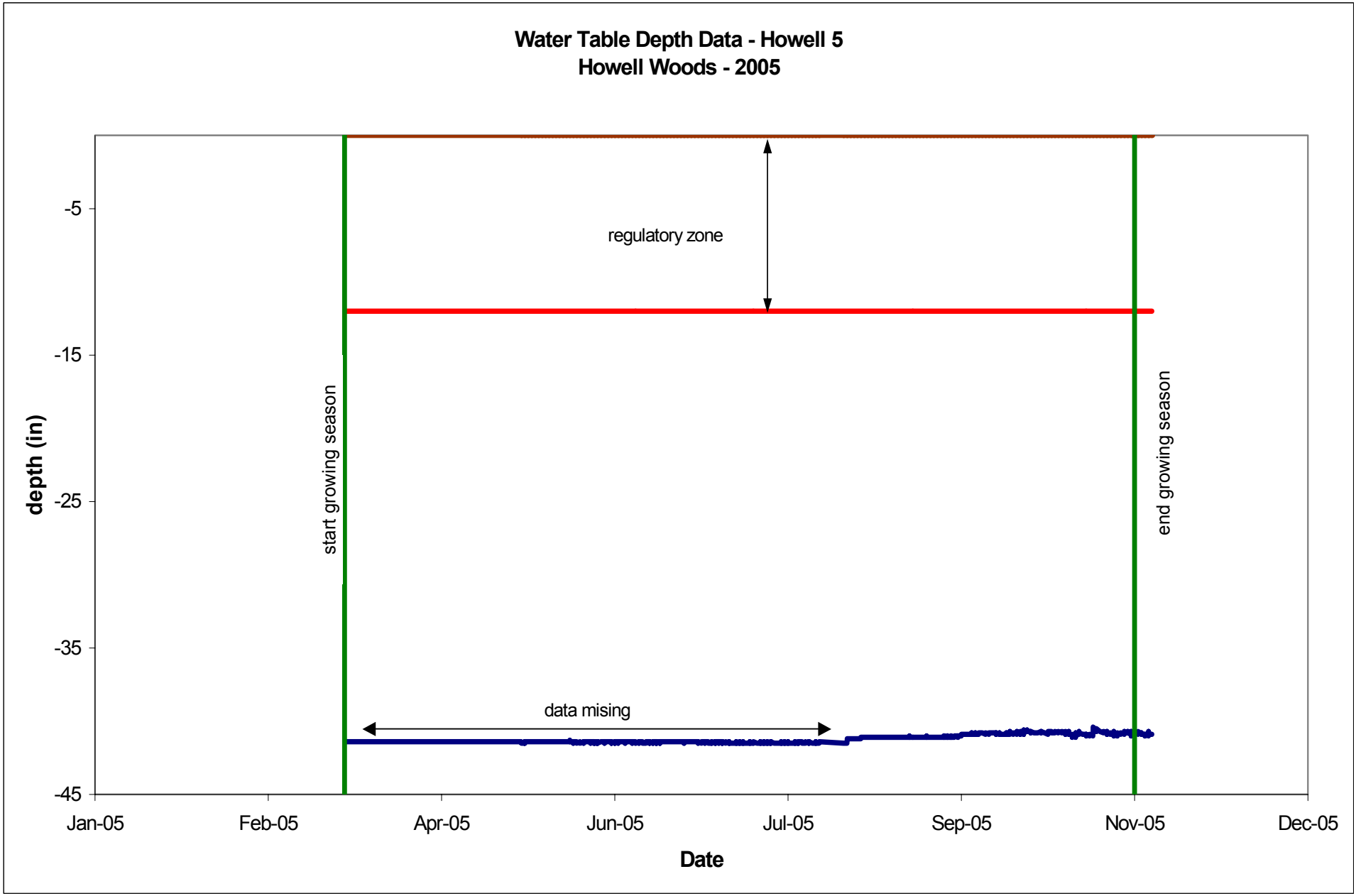
Hydrology Data Charts

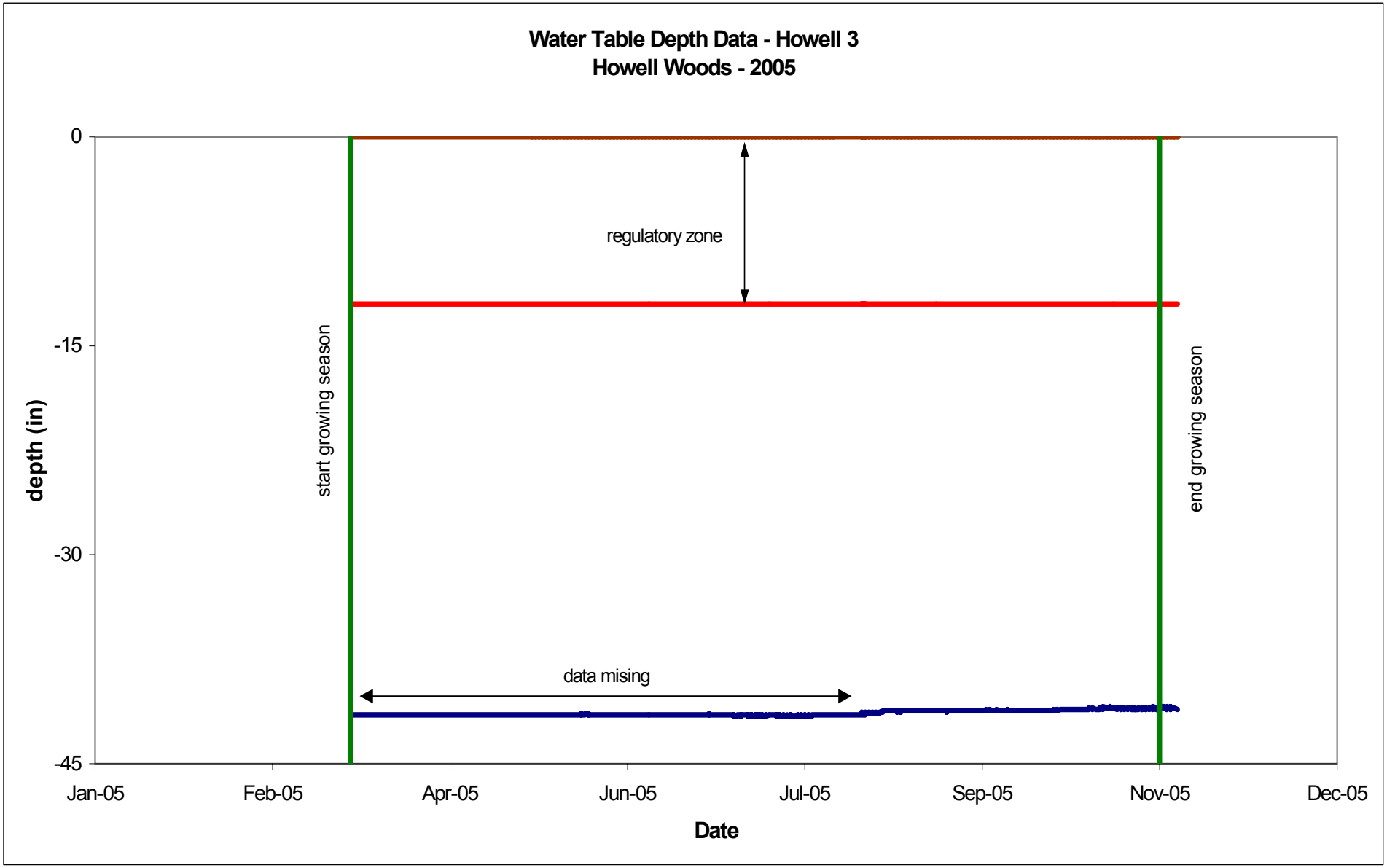

Water Table Depth Data - JG6
Howell Woods Site - 2005
water level (in)
10
5
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
regulatory zone
start growing season
36 days
missing data
end growing season
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date


Water Table Depth Data - Howell 4
Howell Woods - 2005
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
depth (in)
regulatory zone
start growing season
end growing season
missing data
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date


Water Table Depth Data - Howell 1
Howell Woods - 2005
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
depth (in)
regulatory zone
start growing season
end growing season
missing data
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date


Water Table Depth Data - Howell 2
Howell Woods - 2005
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
depth (in)
regulatory zone
start growing season
end growing season
data mising
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date


Water Table Depth Data - Howell 5
Howell Woods - 2005
-5
-15
-25
-35
-45
depth (in)
regulatory zone
start growing season
end growing season
data mising
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date


Water Table Depth Data - Howell 3
Howell Woods - 2005
0
-15
-30
-45
depth (in)
regulatory zone
start growing season
end growing season
data mising
Jan-05
Feb-05
Apr-05
Jun-05
Jul-05
Sep-05
Nov-05
Dec-05
Date