

Carteret-Craven Electrical Cooperative
Wetland Restoration
Morehead City, Onslow County, North Carolina
2004 Annual Monitoring Report



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NC STATE UNIVERSITY

**Carteret-Craven Electrical Cooperative (CCEC)
Wetlands Restoration Site (Jumping Run Creek)
Fall 2004 Monitoring Summary**

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

- 1) Reduce nutrient inputs to estuarine system.
- 2) Contribute to effort to reopen closed shellfish waters.
- 3) Provide educational opportunities to show the importance of wetlands for water quality.

This is the 3rd year of the 5-year monitoring plan for the completed CCEC Site.

Table 1. Background Information

Project Name	Carteret-Craven Electrical Cooperative Wetlands Restoration Site (Jumping Run Creek)
Designer's Name	Soil and Environmental Consultants, PA. 11010 Raven Ridge Rd. Raleigh, NC 27614
Contractor's Name	East Cell – NC Department of Transportation West Cell - unreported
Directions to Project Site	The site is located at the Carteret-Craven Electrical Cooperative offices. The offices are located on the north side of NC-24, near Morehead City, NC.
Drainage Area	1.25 square miles
USGS Hydro Unit	03020106
NCDWQ Subbasin	03-05-03
Project Size	2.64 acres freshwater wetland restoration
Restoration Approach	Expand existing road ditches. Grade areas to improve hydrology. Utilize water control structure to improve storage in upper West Cell.
Date of Completion	East Cell - Fall 2000, West Cell – Winter 2001
Monitoring Dates	November 2002, November 2003

Results Summary

Overall, this site is currently meeting the proposed mitigation success criteria. However, there is some concern over the vegetative community development in the West Cell of the site. An additional planting was completed in the spring of 2004 which may improve plant growth. Continued monitoring in this cell should determine if corrective actions are needed.

Table 2. Summary Table of Results

Carteret-Craven Electrical Coop. Wetland									
Morehead City, Onslow County, NC									
Fall 2004 Monitoring Data Summary									
10/19/2004									
East Cell Quad 1									
Tree Stratum									
Species	Stems	Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	10	124.7	26.7	13.35	6634.3	58.1	10	58.8	1
<i>Nyssa biflora</i>	1	90	24	12	452.4	4.0	1	5.9	3
<i>Taxodium distichum</i>	6	109	28.7	14.3	4340.1	38.0	6.0	35.3	2
Planted Trees per acre	680								
East Cell Quad 2									
Tree Stratum									
Species		Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	11	145.2	29.4	14.7	7873.6	50.7	11.0	39.3	3
<i>Pinus serotina</i>	4	40.8	10.3	5.1	332.2	2.1	4.0	14.3	2
<i>Taxodium distichum</i>	13	111.9	25.7	12.8	7323.1	47.2	13.0	46.4	1
Planted Trees per acre	1120								
West Cell Quad 1									
Tree Stratum									
Species		Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	3	76.0	13.7	6.8	442.2	9.6	3.0	6.5	3
<i>Pinus taeda</i>	34	26.2	8.3	4.1	1905.4	41.5	34.0	73.9	1
<i>Taxodium distichum</i>	8	98.9	18.1	9.1	2111.9	46.0	8.0	17.4	2
<i>Fraxinus sp.</i>	1	82.0	13.0	6.5	132.7	2.9	1.0	2.2	4
Total Trees per acre	1840								
Planted trees per acre	480								
Nat. regen. trees per acre	1360								
West Cell Quad 2									
Tree Stratum									
Species		Height (cm)	Diameter (mm)	Radius (mm)	Σ X-sec. (mm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
<i>Nyssa aquatica</i>	1	77.0	12.0	6.0	113.1	2.9	1.0	8.3	3
<i>Pinus taeda</i>	1	68.0	15.0	7.5	176.7	4.5	1.0	8.3	2
<i>Taxodium distichum</i>	10	94.2	20.9	10.5	3601.1	92.6	10.0	83.3	1
Planted trees per acre	480								
Trees per acre	480								
Nat. regen. trees per acre	0								

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1.0 BACKGROUND DATA

1.1 Introduction

The project site is located on the grounds of the Carteret Craven Electrical Cooperative offices. There are two main areas of the site. One is located on the east side of the building and a larger area is to the west of the building. Background data provided in this report was provided in a report entitled "Monitoring Report for Carteret-Craven Electrical Cooperative Wetlands". The report was prepared by Soil and Environmental Consultants, PA (S&EC) and submitted on January 2, 2003. The primary goals of the project, as included in the report, were to restore freshwater wetlands on the site that had been destroyed by filling and drainage activities. The wetlands would provide water quality improvements and augment habitat in the area. The goals of the project as listed by the NCWRP on their website include:

- 1) Reduce nutrient inputs to estuarine system.
- 2) Contribute to effort to reopen closed shellfish waters.
- 3) Provide educational opportunities to show the importance of wetlands for water quality.

1.2 Design and Construction Background

Site design services were provided by S&EC. The site was constructed in two phases. The first phase consisted of construction on the eastern portion of the site. Grading for phase I was done by the North Carolina Department of Transportation (NCDOT). Construction at the site began in February of 2000 and planting was completed that summer. The second phase of construction on the site began in December of 2000. This phase of the construction was completed by a private contractor. This phase included the construction of a low head weir/bulkhead structure to control hydrology in the upper area of the site. The weir was installed during February of 2001. The west cell was planted in March and April of 2001. Some additional work was undertaken to improve conditions in the western cell in December of 2001. This work included plugging portions of the ditch, repair of erosion near the weir, and repair of damage caused by surface water flow down the banks of the wetland.

1.3 Monitoring Background

The first monitoring trip made to the site was on November 21, 2002 by S&EC. Three 10 meter X 10 meter plots were set up for vegetative sampling. One plot was set up in the eastern cell and two were installed in the west cell. In the west cell, one of the plots was set up above the weir and one between the weir and the road. Woody vegetation was identified and counted in each of the cells. No effort was made to distinguish between planted and volunteer vegetation. The presence and percent coverage of herbaceous vegetation was also noted in the plots. The results presented in the monitoring report indicate an average density of 946 stems/acre. This number reflects the total of all of the plots. Observations report 80% cover in the eastern cell, with much lower coverages in the western cell at 20% and 30%. The results of this vegetative survey indicate survival well above the required minimums.

Three groundwater gages had been installed to monitor hydrology at the site. The report determined that groundwater levels during the growing season of 2002 were within 12 inches of the surface for sufficient continuous periods. The report also states that drought conditions occurred in this year, indicating that longer periods of saturation should be expected in years with normal rainfall.

NCSU staff made our initial monitoring visit on October 2, 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. The plan involved vegetative plots, analysis of hydrologic data, and revised success criteria. Photographs and

observations were also be a part of the new monitoring agenda. The full monitoring plan is explained in detail in this report

1.4 Current Monitoring

NCSU has continued monitoring throughout 2004. The monitoring methodology was kept the same as in 2003. Two site visits were conducted in 2004. The first, a spring visit, was made to collect water table data and make observations during the growing season. The second visit was conducted in the fall and involved the vegetative monitoring protocols.

Location Map



CCEC
Jumping Run Creek
Wetlands Restoration



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2.0 MONITORING PLAN AND RESULTS

2.1 Vegetation Monitoring Set up

As described in the “Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects” document, the monitoring set up for this site was a series of nested plots. Two 1 meter X 1 meter plots were set up in each of the wetland cells. The plots were permanently marked with pipe so measurements can be replicated in subsequent years. Smaller nested plots were set up to record shrub and herbaceous cover. The attached Vegetation Monitoring map shows the locations of the vegetation transects and plots.

Table 3. Vegetation Plots

<i>Community Type</i>	<i>Total Area (acres)</i>	<i>Setup</i>	<i>Plots</i>	<i>Size (sq. meters)</i>
East Cell	0.82	Nested Plots	2	10m, 5m, 1m
West Cell	1.82	Nested Plots	2	10m, 5m, 1m

2.2 Vegetation Monitoring Results

2.2.1 East Cell

Vegetation throughout the East Cell appeared healthy and consisted of a combination of both planted trees and shrubs and volunteer shrubs and herbaceous plants. The herbaceous plants were widely diverse and thick throughout. A variety of algae was found in areas of standing water. Microtopography was heterogeneous in most areas.

Herbaceous vegetation consisted of a variety of emergent and terrestrial plants. *Hydrocotyle* spp. (Pennywort) and *Diodia virginiana* were dominant emergents. Rushes and sedges were common, but nowhere dominant. Few shrubs existed and those that were noted were small species of *Myrica cerifera* (wax myrtle), *Rosa palustris* (swamp rose) and *Cephalanthus occidentalis* (button bush).

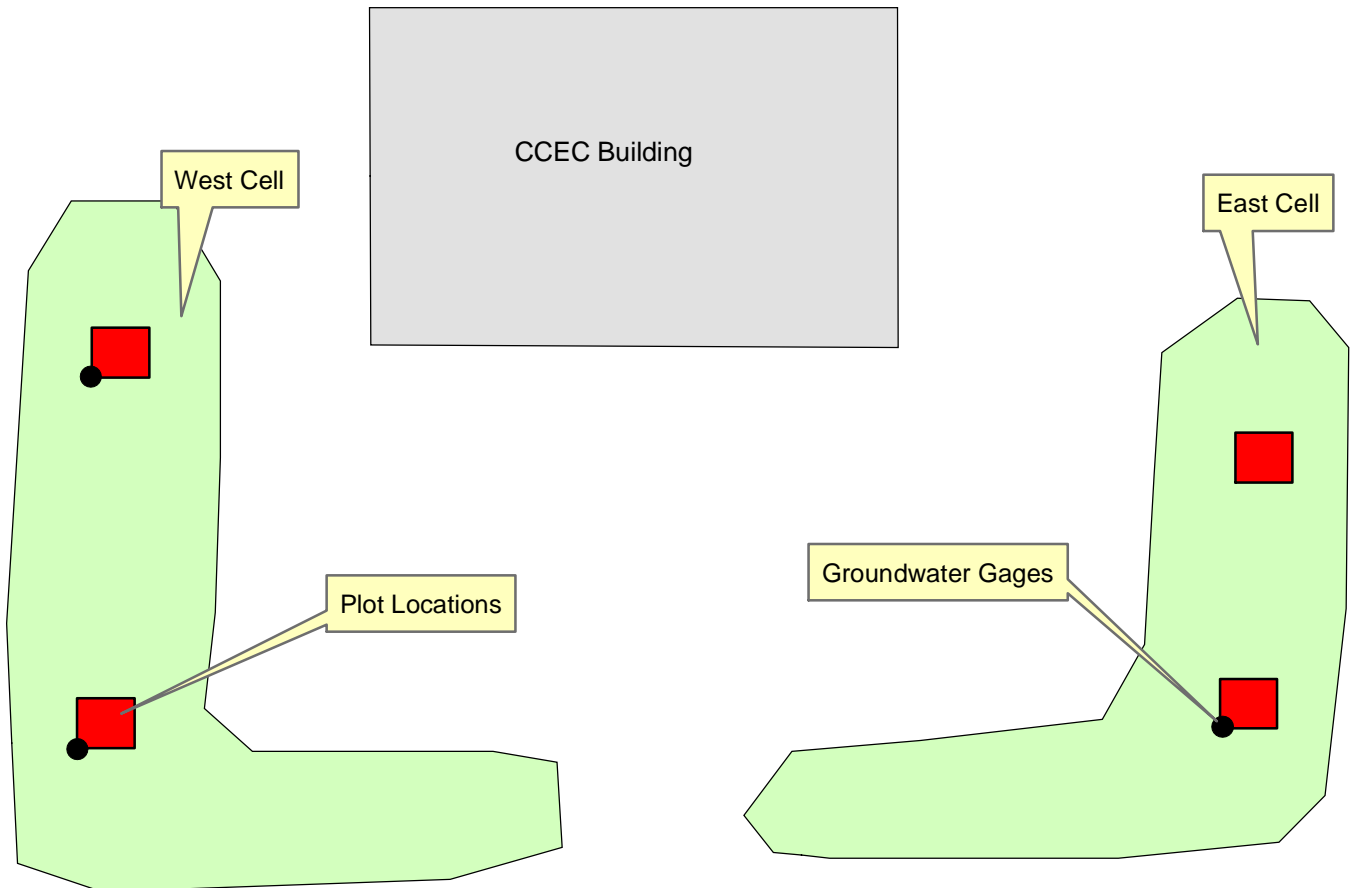
Planted trees were prevalent on this site. *Taxodium distichum* (bald cypress) and *Nyssa aquatica* (water tupelo) were the dominate trees. Planted trees were largely healthy and appeared vigorous. *Pinus serotina* (pond pine) was present, although unhealthy in appearance. Some tree mortality was noticed. Extrapolation from two plots in the East Cell resulted in an average of 900 trees per acre for this area. This number is generated from planted trees only with no naturally regenerated trees noted.

Natural regeneration included only herbaceous and shrub species. Surviving trees had been planted. Planted wax myrtles along the wetland appeared to be an abundant seed source of these species.

Invasive plant species on the site included *Mikania scandens* (climbing hempweed) and *Typha* spp. (cattails). Although not exotic, these plants were present in the wetland. The climbing hempweed covered nearly every shrub and tree. This vine appeared to strangle smaller shrubs and cause irregular growth in the trees. Cattails were located in an isolated area along an outfall area near the road.

The east cell is currently meeting the requirements of vegetative success at this site. Recommendations for this site are to monitor the invasive plants over time and maintain them if needed. Overall, this portion of the site has a healthy, diverse vegetative population.

Monitoring Map



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2.2.2 West Cell

Vegetation throughout this wetland area consisted of a combination of both planted and volunteer trees, shrubs and herbaceous plants. Trees and shrubs were planted within this cell during the spring of 2004.

Herbaceous vegetation consisted of a variety of emergent and terrestrial plants. *Hydrocotyle* spp. and *Diodia virginiana* were dominant emergents in the area below the weir. The plot above the weir was very sparse in herbaceous vegetation. Compared to the East Cell, however, diversity of herbs was low in the West Cell. Only small species of wax myrtle represented the shrub layer. These appeared to be volunteers from a nearby hedgerow. In both areas, the shrub and herb layers were more abundant in the drier areas than the wetter areas. The herbs in the drier areas represented commonly occurring early successional species such as *Andropogon* spp. and *Panicum* spp.

Planted trees on this site included predominantly bald cypress, water tupelo, and *Fraxinus pennsylvanica* (green ash). The overall health of these trees was average. The recently planted trees appeared to be in good shape, however, older trees were struggling. Mortality of older trees was noted. The area below the weir was abundant in *Pinus* spp. volunteers, which were healthy and vigorous. Extrapolation from two plots in the West Cell resulted in an average of 480 planted trees per acre for this area. Planted trees and volunteer trees resulted in an extrapolated average of 1160 trees per acre.

Invasive plant species on the site included climbing hempweed. These plants were present in the drier areas of this wetland. This vine appeared to strangle smaller shrubs and cause irregular growth in the trees in the drier areas. It is not nearly as prevalent as it is in the East Cell.

Recommendations for this site are to monitor the invasive plants over time and maintain them if needed. Secondly, a soil fertility test is recommended. The substrate appeared to be quite sandy with no nutrients; a possible explanation for poor health of the planted trees, particularly in the area above the weir.

2.3 Hydrologic Monitoring Setup

Three ground water gages were set up at the site for the purposes of hydrologic monitoring after the project construction was completed. No revisions to the current hydrologic monitoring plan were proposed for this site. The data from each of the devices was downloaded during the monitoring visit. Analysis and overlay of the data showed that saturation levels well exceeded the mitigation requirements. Water levels in each area were recorded within 12 inches of the surface for a large portion of the growing season (Figure 3).

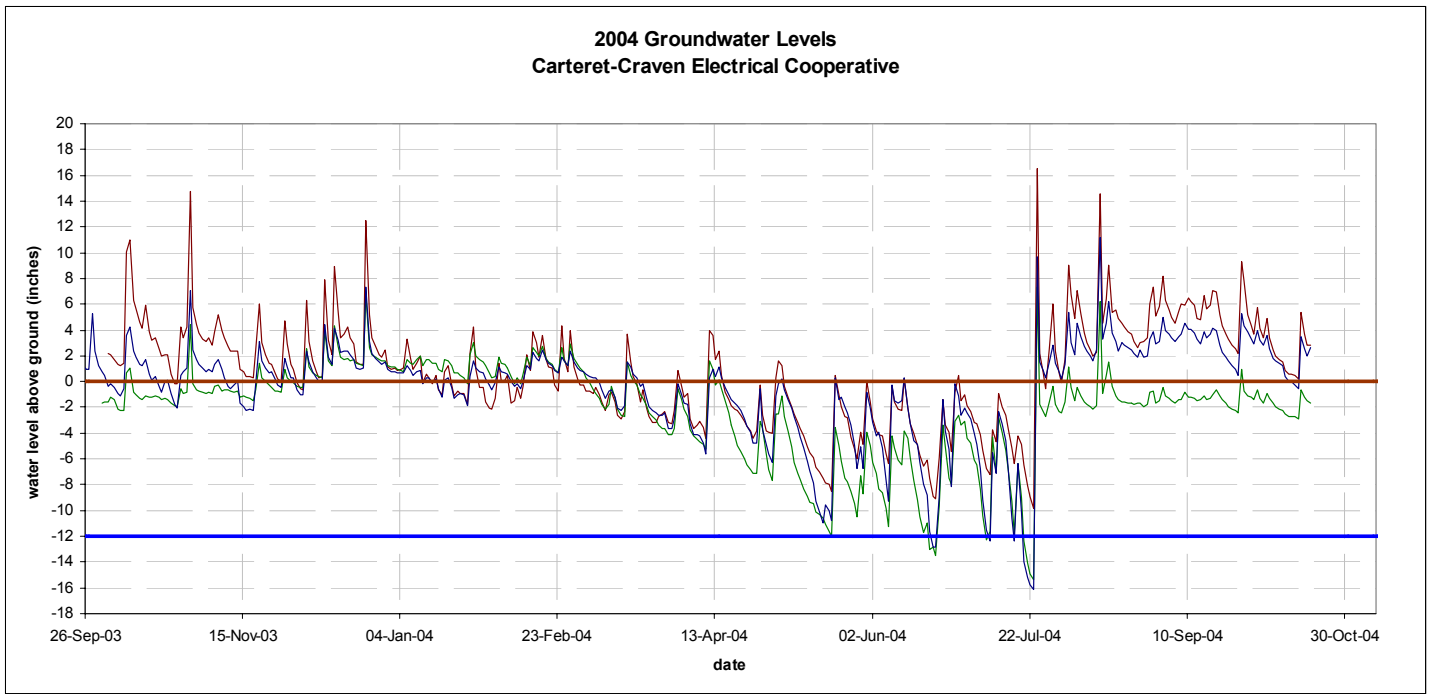


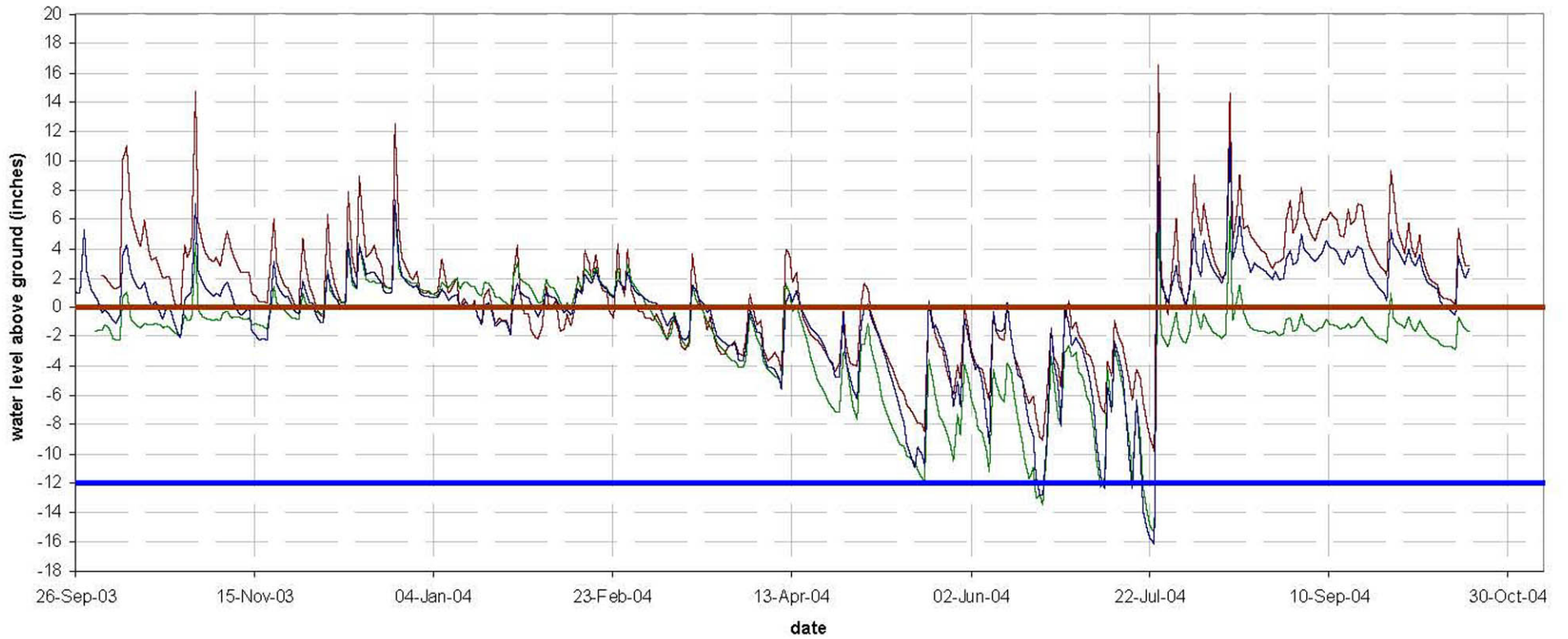
Figure 3. 2004 Groundwater Levels

2.4 Results Discussion

The Carteret-Craven Electrical Cooperative is currently meeting the vegetative and hydrologic success criteria for the project. Stem counts and saturation levels are well above the proposed criteria. Continued monitoring is recommended to further assess whether actions will be needed to ensure future vegetative criteria will be met and that invasives will not negatively impact the area. A soil fertility test could help determine if nutrient deficiencies are a problem in the West Cell.

The continued level of surface inundation may also be causing stress and contributing to the poor health and propagation of the trees. This type of hydroperiod, which is more similar to a constructed wetland than a natural one, may be more suitable for herbaceous wetland plants. If maximizing water quality benefits is a primary goal of the project, it may be recommended to compliment the Western Cell with a herbaceous planting.

2004 Groundwater Levels Carteret-Craven Electrical Cooperative



3.0 PHOTOGRAPHS



Photo 1. East Cell



Photo 2. East Cell Vegetation Plot



Photo 3. West Cell - above weir



Photo 4. West Cell - groundwater gage