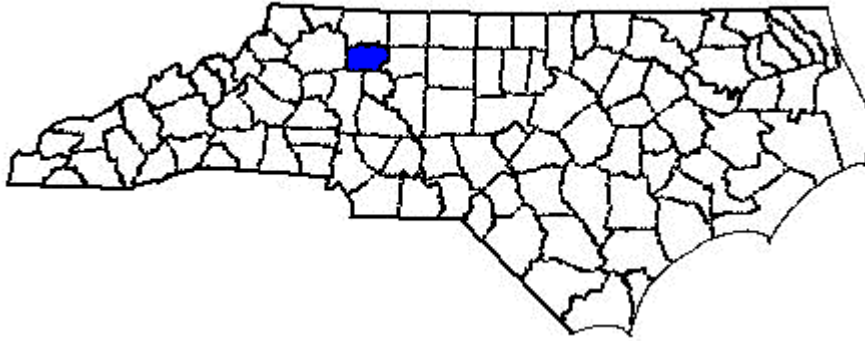


# ANNUAL REPORT FOR 2001



**Bethel Church Mitigation Site**

**Yadkin County**

**Project No. 6.779004T**

**TIP No. R-2120WM**



Prepared By:  
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## **SUMMARY**

The following report summarizes the monitoring activities that have occurred in the past year at the Bethel Church Mitigation Site. Site construction began in December 2000 and was completed in February 2001. Monitoring activities in 2001 represent the first year of monitoring for the site. The site must demonstrate both hydrologic and vegetation success for a minimum of five years.

The site contains six monitoring gauges (5 in the restoration areas, 1 in the existing wetland area), one rain gauge and four vegetation plots. Due to problems with the late installation and problems programming the rain gauge, this report utilizes rainfall data from the State Climate Office's Yadkinville weather station.

According to the Mitigation Plan dated August 1998, hydrologic success is based on saturated conditions within the upper twelve inches of soil for 5-12% of the growing season, which is 202 days. All of the six gauges met or exceeded this requirement for the first growing season.

Vegetation success requires 320 trees/acre of the target species surviving at the end of the first three years. The entire site does not currently meet vegetative success criteria. NCDOT will replant the site in the winter, 2002.

Based on the monitoring results from the 2001 growing season, NCDOT recommends that monitoring continue. Vegetation monitoring will resume upon completion of replanting the site in winter, 2002

## **1.0 Introduction**

### **1.1 Project Description**

The Bethel Church Mitigation Site is located on US 421 east of Yadkinville adjacent to an unnamed tributary of South Deep Creek in Yadkin County (Figure 1). This site mitigates for wetland impacts associated with the improvements to US 421 New Location (R-2120AB).

The Bethel Church Mitigation Site is divided into two parcels (North and South), totaling approximately 8.0 acres (ac) in size. The site consists of 3.03 ac of the restoration of a bottomland hardwood wetland restoration, 0.8 ac of wetland enhancement, 850 feet of stream restoration and 4.2 ac of upland buffer. Site construction began in December 2000 and was completed in February 2001. The site was initially planted in March of 2001.

In addition to the original mitigation plan, the Department purchased Lots 1-20, which are adjacent parcels of land to the west of Fox Drive between the unnamed tributary and extend to the north up to the Control Access along US 421. These parcels are completely wooded, consisting of upland forest and bottomland hardwood floodplain sections adjacent to the stream. By acquiring these parcels, the fill material associated with Fox Drive was completely removed to match the wetland mitigation site contours. The in-stream culvert was also removed during construction.

### **1.2 Purpose**

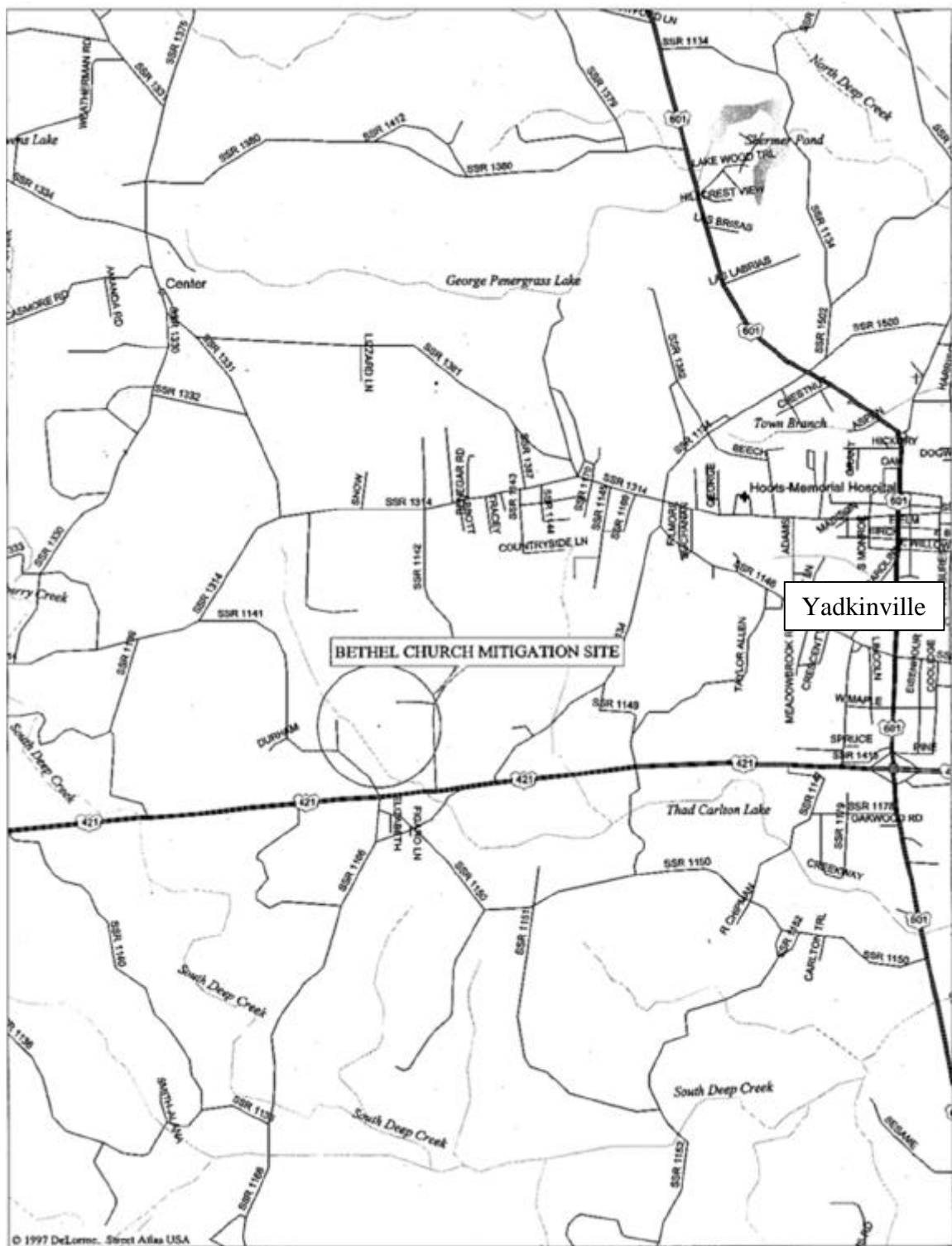
In order to demonstrate successful mitigation, hydrologic and vegetative monitoring must be conducted for a minimum of five consecutive years. Success criteria for hydrology and vegetation are based on the approved mitigation plan dated August 1998. The following report details the results of hydrologic and vegetative monitoring activities that were performed during the 2001-growing season at the Bethel Church Mitigation Site.

Activities in 2001 reflect the first year of monitoring following the restoration efforts. This document includes analyses of both hydrologic and vegetative monitoring throughout the growing season.

### 1.3 Project History

August 1998	Mitigation Plan
December 2000 -	
February 2001	Site Construction
March 2001	Site Planted
March 2001	Monitoring Gauges Installed
April 2001-	
October 2001	Hydrologic Monitoring
July 2001	Vegetation Monitoring (1 yr.)

Figure 1. Site Location Map



## **2.0 HYDROLOGY**

### **2.1 Success Criteria**

Per the mitigation plan dated August, 1998, Surface and groundwater hydrology of the Bethel Church mitigation site will be monitored for five years following the completion of all implementation activities, or until hydrologic success criteria are met. Hydrologic success for this site is defined as the presence of the water table within 12 inches of the soil surface for 5-12 % of the growing season during a normal rainfall year.

The growing season in Yadkin County begins April 9 and ends October 28. These dates correspond to a 50% probability that temperatures will drop to 28°F or lower after April 9 and before October 28.<sup>1</sup> The growing season is 202 days; therefore, optimum hydrology requires 12.5% of this season, or at least 25 consecutive days. Local climate must also represent average/normal conditions for the area.

### **2.2 Hydrologic Description**

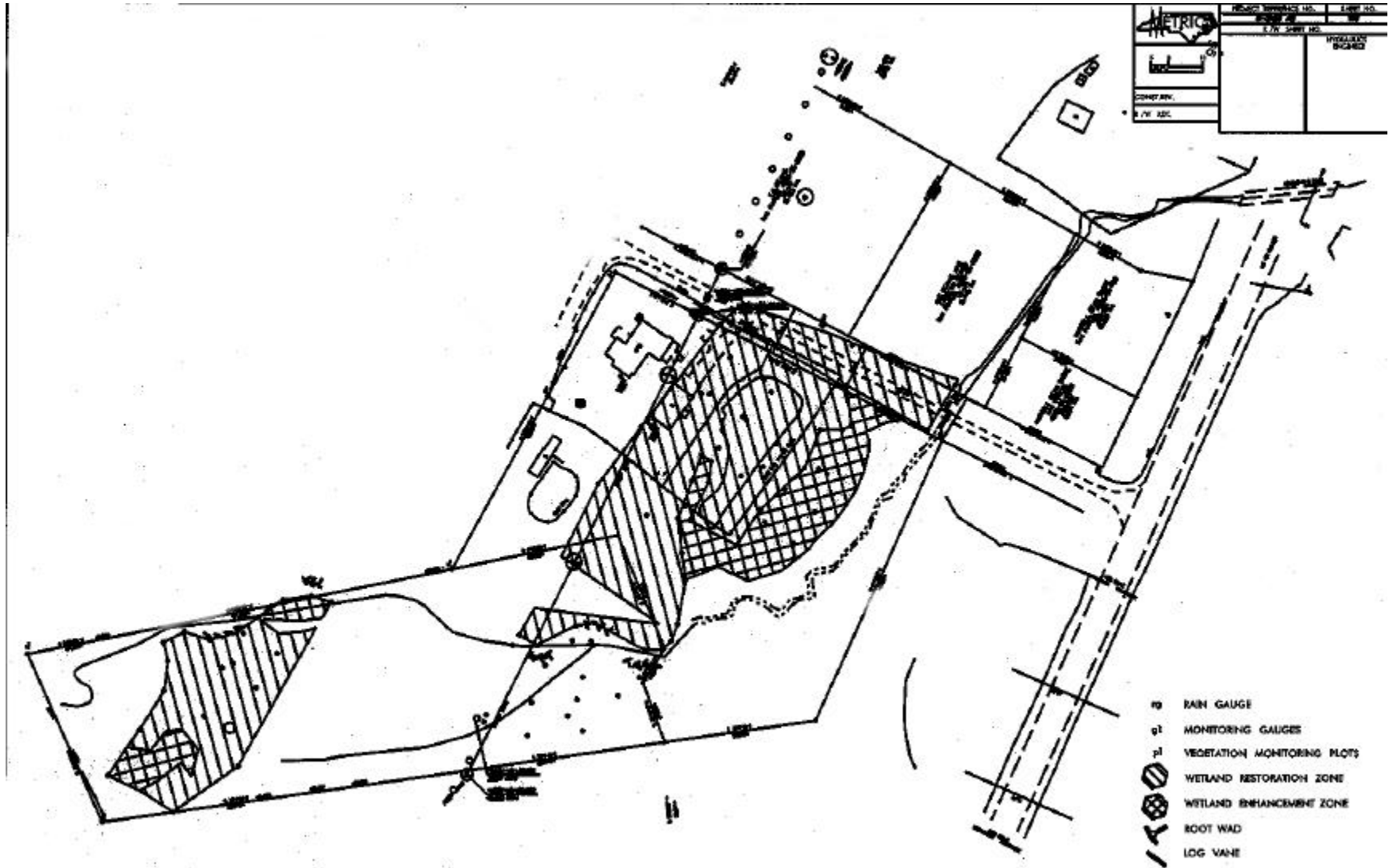
In March 2001, six monitoring gauges were installed across the site (Figure 2). The automatic monitoring gauges record daily readings of groundwater depth. This represents the first growing season that the monitoring gauges have been in place since construction of the site.

The Bethel Church site was designed to restore the natural flooding regime of the headwater stream. Hydrology for the site is naturally dominated by over-bank flooding of the small unnamed tributary of South Deep Creek. The hydrologic monitoring should show the reaction of the groundwater level to specific rainfall events and the extent of ponding that may be attributed to over-bank flooding.

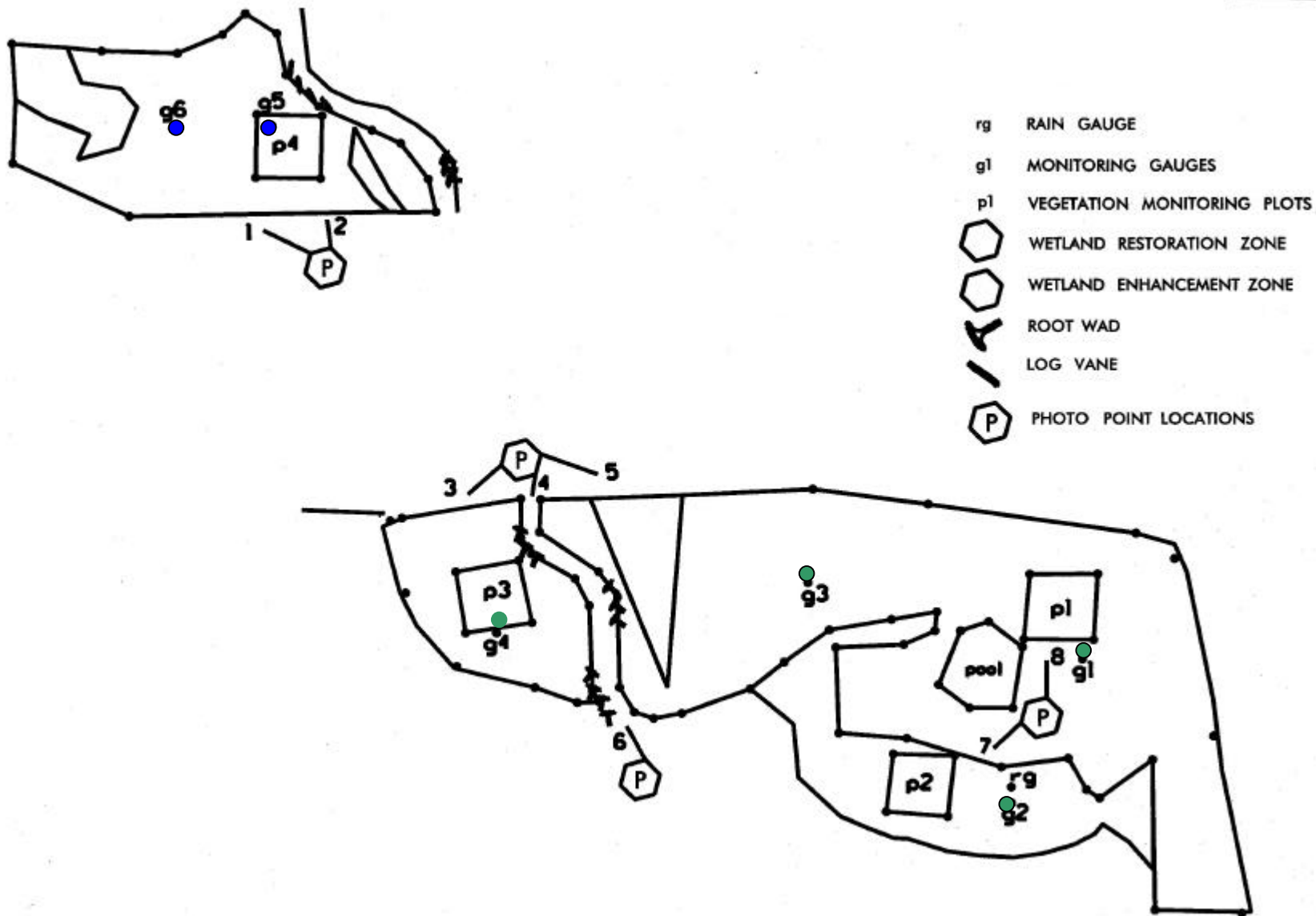
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<sup>1</sup> Soil Conservation Service, Soil Survey of Yadkin County, North Carolina.

**FIGURE 1: BETHEL CHURCH MITIGATION PLAN**



**FIGURE 2: BETHEL CHURCH MONITORING PLAN  
& 2001 GAUGE RESULTS**



## 2.3 Results of Hydrologic Monitoring

### 2.3.1 Site Data

The maximum number of consecutive days that the groundwater was within twelve inches of the surface was determined for each gauge. This number was converted into a percentage of the 202-day growing season. The results are presented in Table 1.

Appendix A contains a plot of the groundwater depth for each monitoring gauge. The maximum number of consecutive days is noted on each graph. The onsite rain gauge malfunctioned was installed after the beginning of the growing season and then was not functionally, due to programming errors until August 2001. Therefore, rainfall data was obtained from the State Climate Office Local Weather Station in Yadkinville, which is approximately 2 miles from the mitigation site.

**Table 1. Bethel Church Hydrologic Monitoring Results.**

Monitoring Gauge	< 5%	5% - 8%	8% - 12.5%	> 12.5%	Actual %*	Success Dates
GW-1			X		11.4	May 17-June 8
GW-2 (Existing Wetland)			X		11.9	Apr. 9-May 2
GW-3			X		11.4	May 17 –June 8
GW-4				X	65.4	Jun 19-Oct 28
GW-5				X	34.7	Apr. 9-Jun 17
GW-6				X	25.7	Apr. 26-Jun 16

\*Gauges were installed March 2001.

Figure 2 represents a graphical representation of the hydrologic results. Gauges highlighted in blue indicate wetland hydrology for more than 12.5% of the growing season. Gauges highlighted in green show hydrology between 8% and 12.5% of the season.

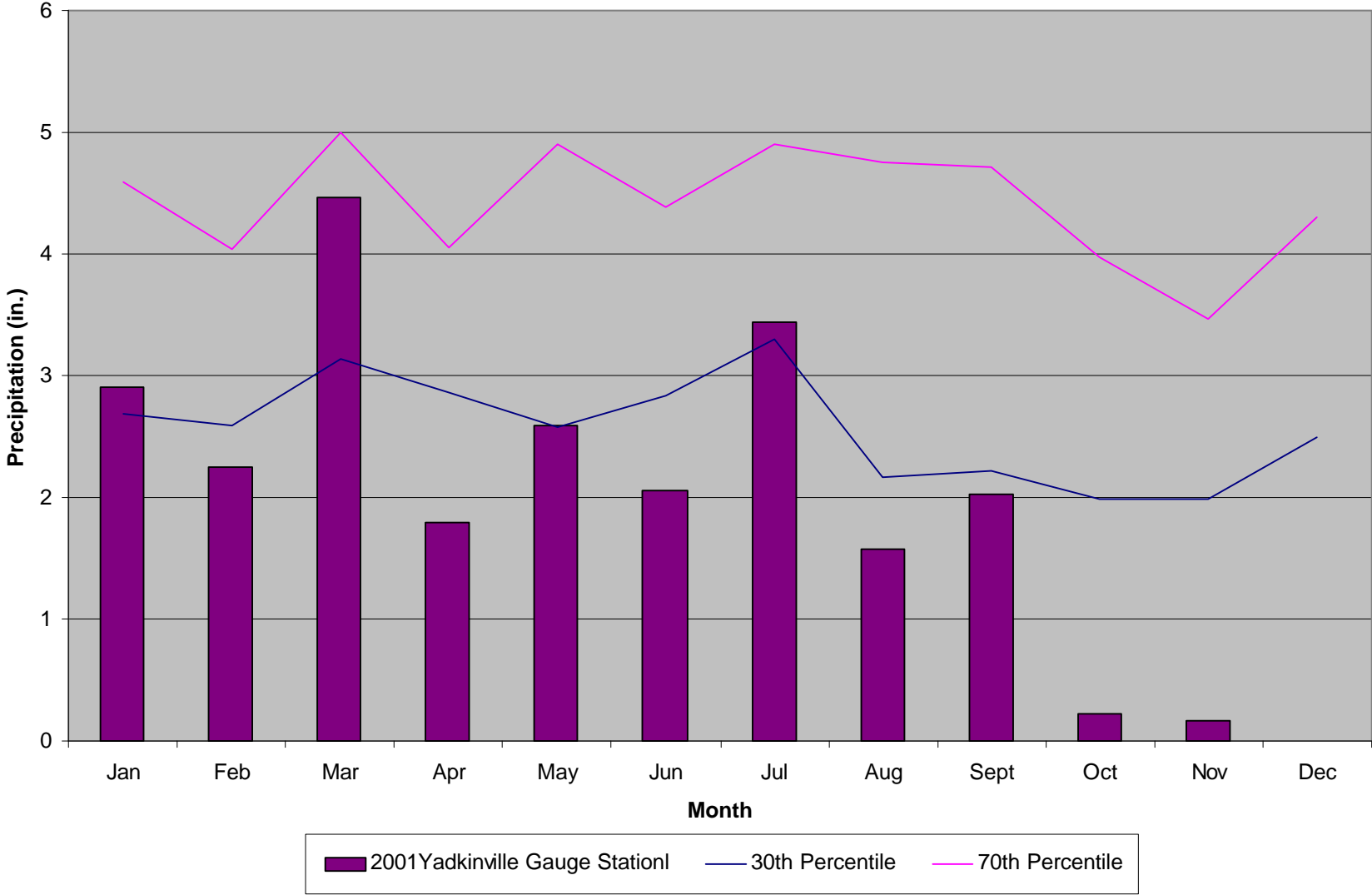
### 2.3.2 Climatic Data

Figure 4 represents an examination of the local climate in comparison with historical data in order to determine whether 2001 was “average” in terms of precipitation. The two lines represent the 30<sup>th</sup> and 70<sup>th</sup> percentiles of monthly historical precipitation at the Yadkinville Station. The bars represent the monthly rainfall totals for 2001. The historical data was also collected from the State Climatic Office for the Yadkinville weather station. With exception of January, March and July, monthly rainfall results for 2001 were below normal.

## **2.4 Conclusions**

The 2001 growing season represents the first monitoring assessment period for the Bethel Church mitigation site since construction. It is concluded that the overall rainfall for 2001 was below.

**FIGURE 4: Bethel Church 30-70 Percentile Graph  
Yadkin County**



### 3.0 VEGETATION: BETHEL CHURCH MITIGATION SITE (YEAR 1)

#### 3.1 Success Criteria

Success criteria are defined as 320 trees/acre of the target species surviving at the end of three years, and 260 trees/acre of the target species surviving at the end of five years.

#### 3.2 Description of Species

The following species were planted in the Wetland Restoration Area:

*Carya cordiformis*, Bitternut Hickory

*Fraxinus pennsylvanica*, Green Ash

*Platanus occidentalis*, Sycamore

*Quercus nigra*, Water Oak

*Quercus palustris*, Pin Oak

*Quercus phellos*, Willow Oak

*Quercus rubra*, Northern Red Oak

#### 3.3 Results of Vegetation Monitoring

Plot #	Bitternut Hickory	Green Ash	Sycamore	Water Oak	Pin Oak	Willow Oak	Northern Red Oak	Total (1 year)	Total (at planting)	Density (Tree/Acre)
1		1				5	2	8	36	151
2		7						7	42	113
3		12			1	14	7	34	51	453
4		12		1		14	2	29	45	438
<b>AVERAGE DENSITY</b>										<b>289</b>

**Site Notes:** Other species noted: foxtail, ragweed, red maple, *Juncus* sp., *Sagittaria* sp., smartweed, *Carex* sp., cattail, and alder. Plot 2 had heavy growth competition and the only trees noted planted were green ash and black willow.

### **3.4 Conclusions**

The site does not currently meet vegetative success criteria. It is believed that this is due to a combination of poor planting procedures by contractor, poor plant material supplied by contractor, late growing season installation of plant material, heavy competition in the enhancement area and below average precipitation in the spring. NCDOT will replant the site in Winter, 2002 and take measures to reduce competition.

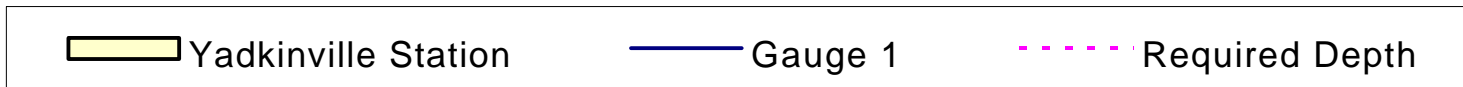
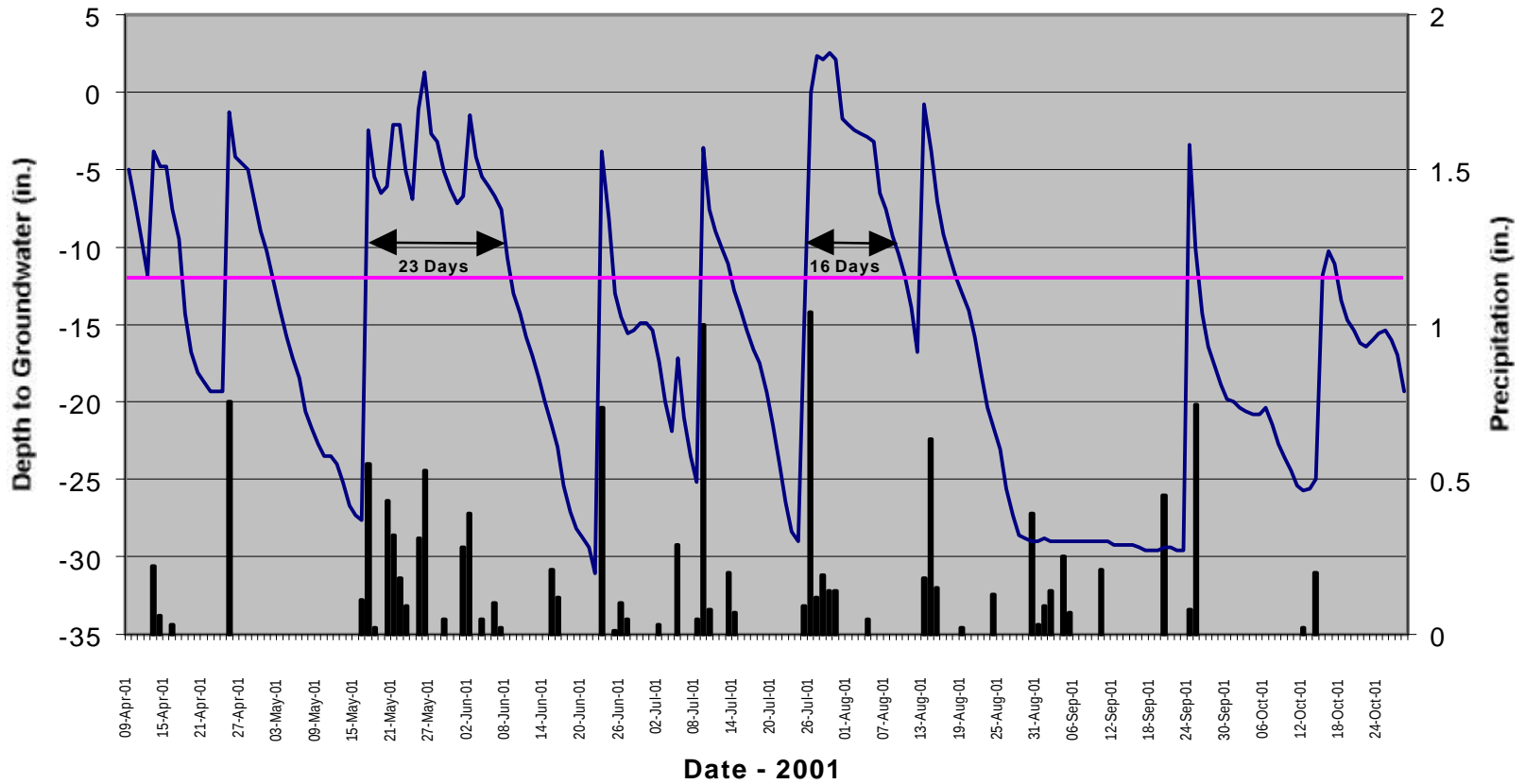
#### **4.0 OVERALL CONCLUSIONS/ RECOMMENDATIONS**

The Bethel Church Mitigation Site has met the success criteria prescribed in the mitigation plan for the site, even though rainfall for the entire growing season was below normal. All gauges on-site met or exceeded the gauge installed in the existing wetland. It is recommended that hydrologic monitoring continue in order to determine whether the site will continue to improve over time.

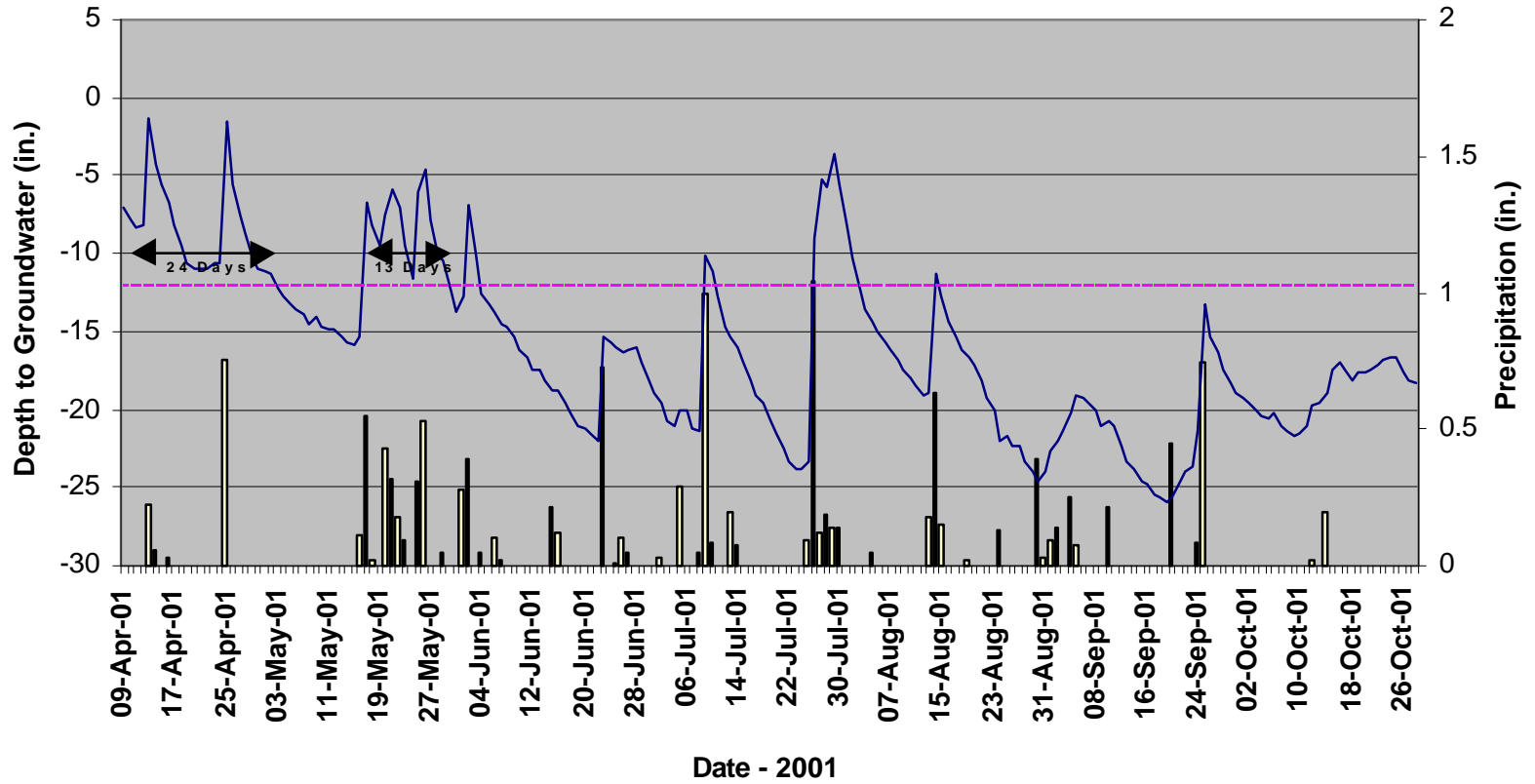
The site does not currently meet vegetative success criteria. NCDOT will replant the site in the winter of 2002 and take measures to reduce competition. Vegetation monitoring will resume after replanting Winter, 2002.

**APPENDIX A**  
**DEPTH TO GROUNDWATER GRAPH**

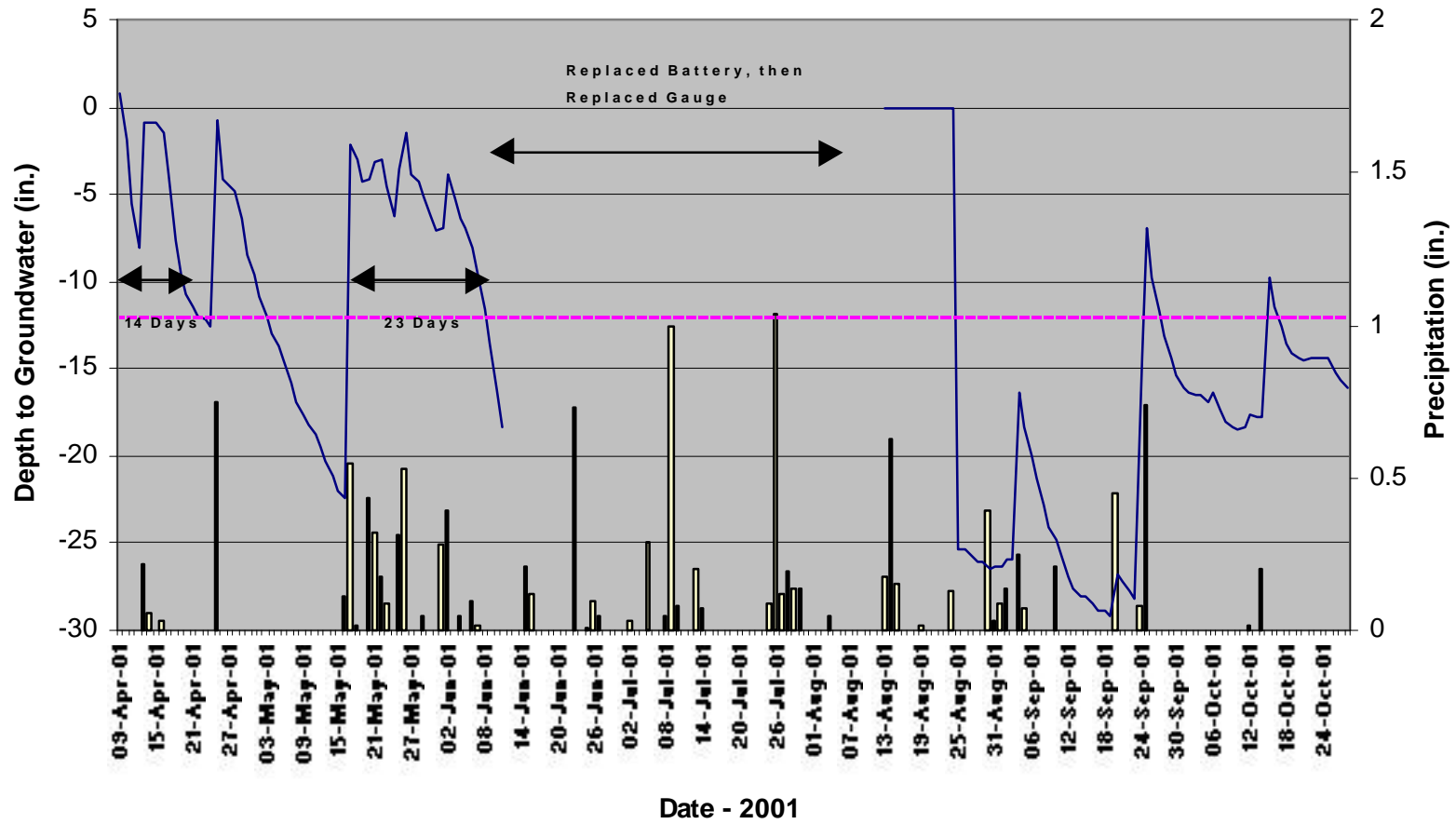
### BETHEL CHURCH GAUGE 1 (S49414C)



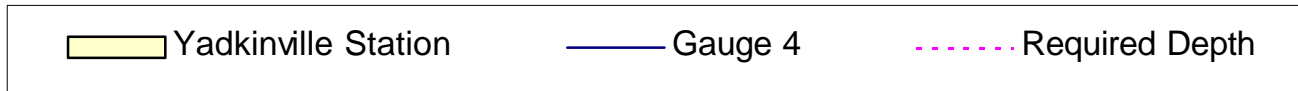
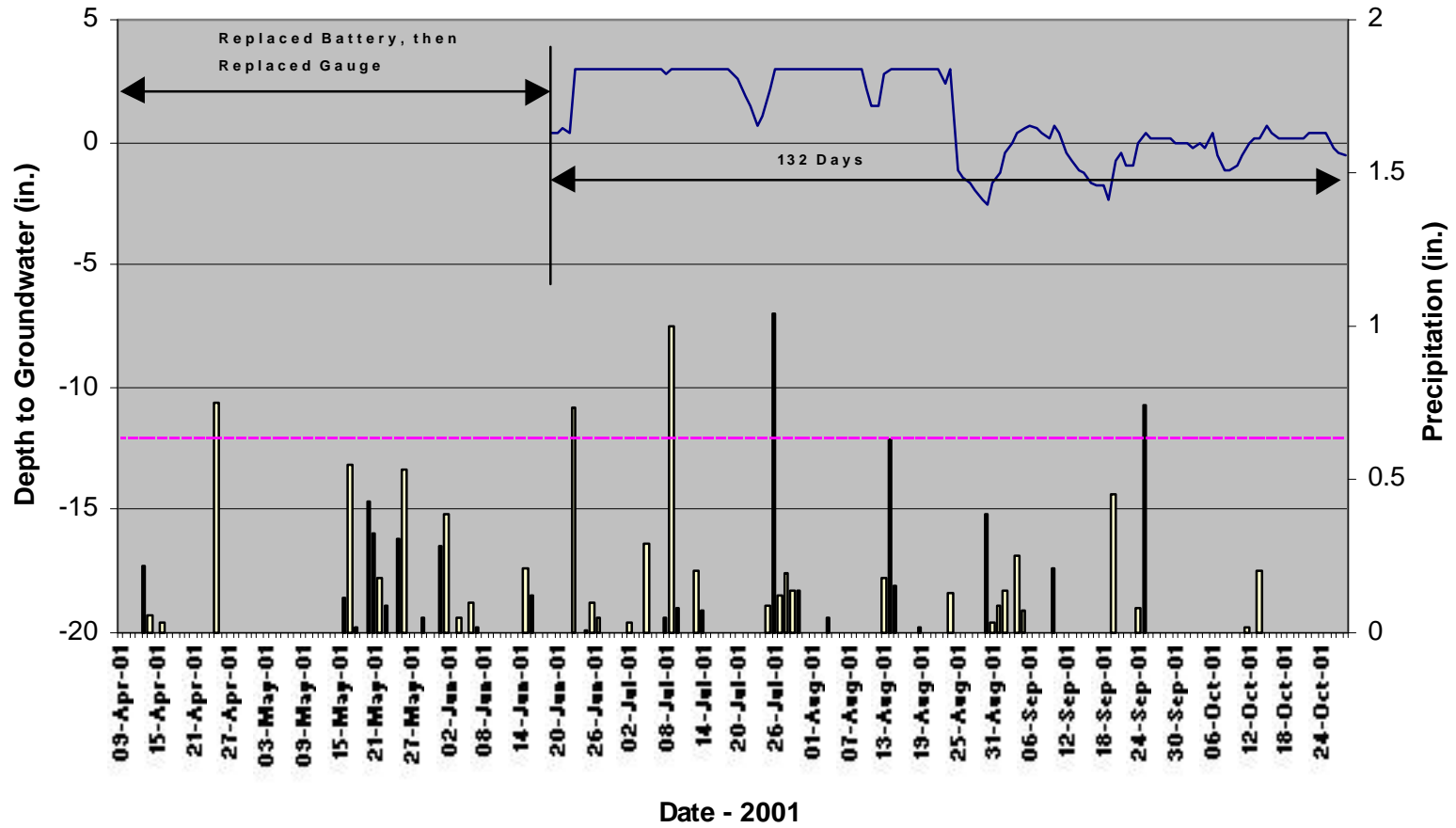
BETHEL CHURCH GAUGE 2 (S4942DB)



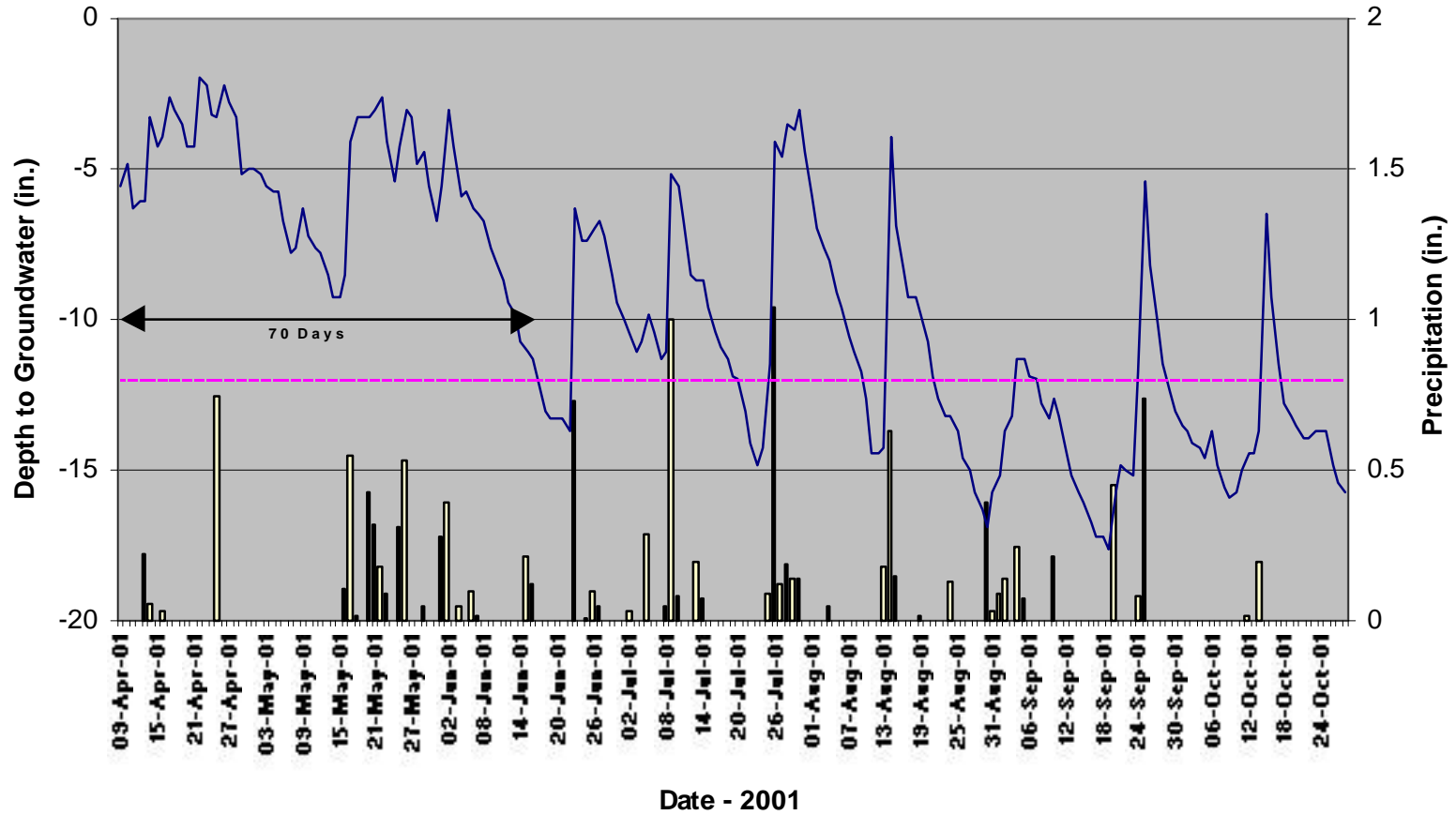
### BETHEL CHURCH GAUGE 3 (S494208)



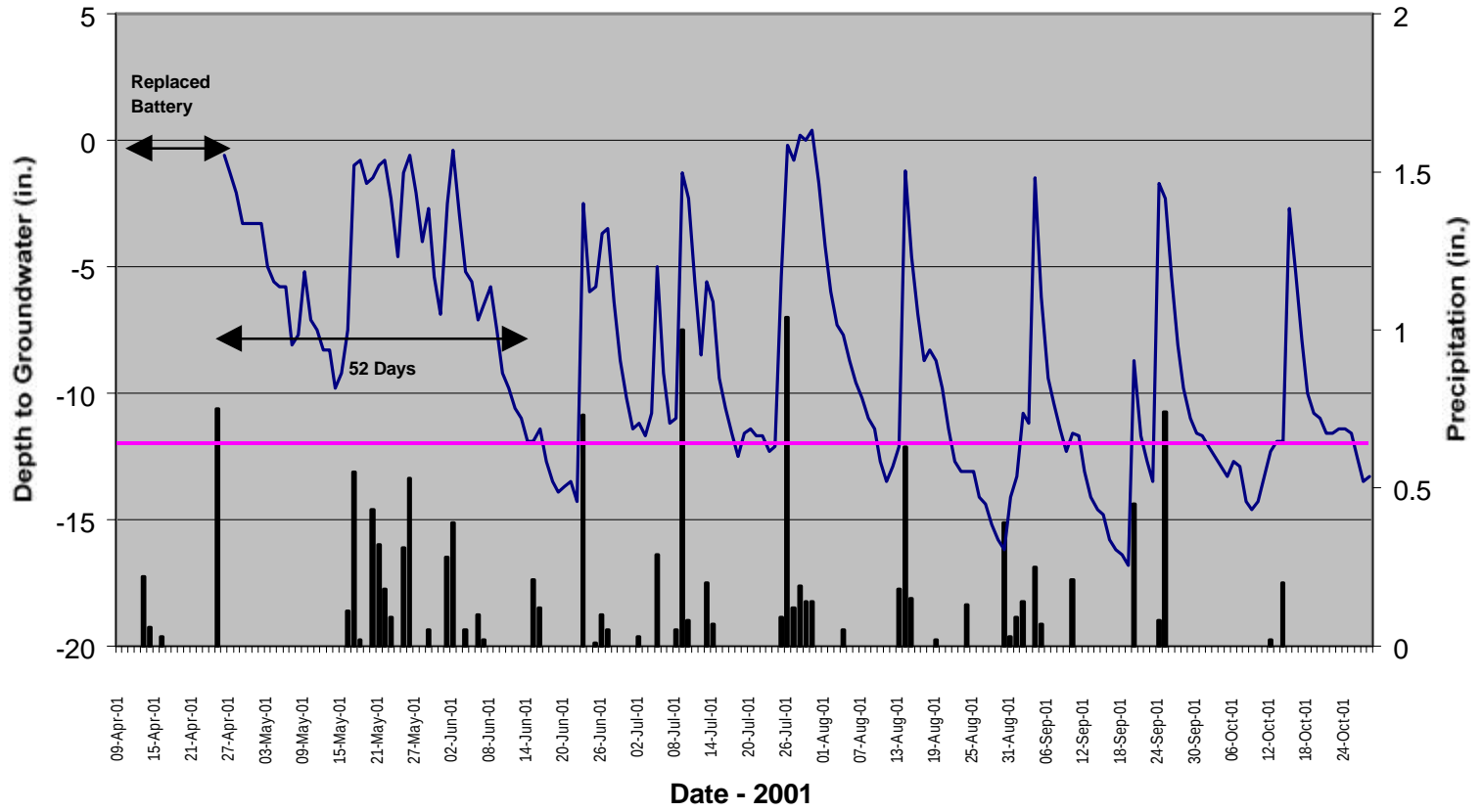
### BETHEL CHURCH GAUGE 4 (S497F51)



### BETHEL CHURCH GAUGE 5 (S493FC7)



### BETHEL CHURCH GAUGE 6 (S213A85)



**APPENDIX B**  
**SITE PHOTOS**

# BETHEL CHURCH PHOTOS



Photo 1



Photo 2



Photo 3



Photo 4



Photo 5



Photo 6

## BETHEL CHURCH PHOTOS



Photo 7



Photo 8