Year Four Monitoring Report

for

Deep Creek Mitigation Bank

Yadkin County, North Carolina

S&EC Project No. 6170

Prepared for

American Wetlands & Natural Resources Exchange Corporation

January 2007

S&EC

Soil & Environmental Consultants, PA

11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467

www.SandEC.com

1.0 INTRODUCTION

1.1 Introduction

This monitoring report has been prepared by Soil & Environmental Consultants, PA (S&EC) in order to present and evaluate site monitoring data for the period January 1st, 2006 through December 15th, 2006, for the Deep Creek Wetlands & Stream Mitigation Bank in Yadkin County, North Carolina. This report includes the following:

Project History

Mitigation Components

Hydrologic Monitoring

Vegetation Monitoring

Benthic Monitoring

Credit Ledger

Site Maintenance

Appendix A – Site Figures

Appendix B – MBRT Response

Appendix C – Hydrologic Data

Appendix D – Site Photos

Appendix E – Benthic Data

1.2 Project History

The Deep Creek Wetland Mitigation Bank is a Private-Commercial Bank, which will be operated as a Debit Bank and will offer wetland and stream impact credits, solely for wetland and stream impacts by the North Carolina Department of Transportation (NCDOT) in the upper Yadkin River basin (Cataloging Unit # 03040101). A perpetual conservation easement on the site has been conveyed to Piedmont Land Conservancy.

The mitigation effort involves approximately 46.41 acres of restored and created wetlands, and 5,733 linear feet of stream restoration within a larger tract of approximately 70.745 acres.

Construction took place during the period January 21st, 2003 to April 14th, 2003, and was performed by North State Environmental, Inc., of Winston-Salem, NC. During April 3-4,

2003 the site was planted to bottomland hardwood seedlings by Carolina Silvics of Edenton, NC, a forestry consulting firm.

The intent of the mitigation effort is to develop a Palustrine Forested Wetland (Cowardin), further classified as Bottomland Hardwood Forest Wetland (NCDEHNR 1996 Field Guide Report No. 96-01). This is being done by restoring wetland hydrology to the hydric soil, developing wetland hydrology in the near-hydric areas, and planting Bottomland Hardwood Forest Wetland species.

Restoration of wetland hydrology to the hydric soil (restoration) area of the site was accomplished by reversing the effect of the existing drainage system and restoring the stream channels through the site, thereby returning near-original wetland hydrology to the restoration portion of the site. Wetland hydrologic conditions were created on site, within select areas by lowering the land surface and raising the elevation of the seasonal water table. Stream restoration was performed by filling ditches to grade and modifying the dimension, pattern, and profile of the channelized streams to restore natural stream morphology.

1.3 Mitigation Components

The following table lists the actual acreage and potential credits, which were developed as a result of implementation of the mitigation plan.

Wetland Restoration	**(1:1)**	**30.40 acres**	**30.40 credits**
Wetland Creation	**(3:1)**	**16.01 acres**	**5.34 credits**
Total		**46.41 acres**	**35.74 credits**
Stream Restoration			**5,733 linear feet**

1.4 Response to MBRT Comments

After completion and submittal of Year 3 Monitoring Report, a letter was received from the MBRT summarizing comments and concerns in response to the Report. These comments and concerns addressed several areas, to include site hydrology, site vegetation, biological monitoring, and stream stability. A response was complied to address those concerns. This response is included as Appendix B and is summarized below:

While gauges D3 and D9 did not meet hydrologic success criteria for 2005, two gauges have been installed to replace these gauges. The replacement gauges (D3A and D9A) exceeded success criteria in 2005 and continue to in 2006.

Concerns were raised regarding the inclusion of volunteers in stem counts for 2005. These volunteers were removed from stem counts, and were not included in the counts. Planted stem densities without the inclusion of the volunteers remained above acceptable levels.

Benthic sampling results have shown steady increases in water quality through 2005, as was indicated by more intolerant species being collected in the stream. All post-construction sampling events have occurred each spring, as advised by the Division of Water Quality (DWQ). Pre-construction baseline samples, due to construction schedules, were not taken at the time suggested by some MBRT Members. In order to collect the most comparative data of the post-restoration condition, sampling will continue each spring.

The stability of the stream, as shown by an apparent deepening of the thalweg in select locations, has also been addressed in Appendix B. While the cross-sections and longitudinal profiles appear to show a deepening thalweg, when the bankfull dimensions of the channel are analyzed, the changes appear to be natural channel adjustment and are not of concern at this time.

2.0 MONITORING

This section includes information concerning; 1) hydrologic monitoring, 2) vegetative monitoring and 3) benthic macroinvertebrate monitoring.

2.1 Hydrologic Monitoring

Hydrologic monitoring data (shallow groundwater levels) for the 2006 monitoring year indicates that the site is successfully experiencing conditions consistent with local jurisdictional wetlands as all twelve gauges met hydrology. Data collected for the monitoring period are presented in graphical format in attachments to this report (Appendix C).

Data collected on this and other sites over the past several years indicates that the most likely times of the year in which soil saturation occurs in wetlands is during the winter and early spring months. The growing season in this area normally begins in late March. Rainfall patterns during the preceding winter and early spring months are the most critical of the year relative to successful wetland hydrology for that year. Typically, once the growing season enters late spring through summer, shallow groundwater levels begin to fall and also fluctuate rapidly due to high evapotranspiration rates and summer rainfall patterns. Fall is normally the driest portion of the year.

To achieve wetland hydrology, it is desired that saturation occurs to within 12 inches of the ground surface for approximately 18 or more consecutive days during the growing season, which is the equivalent of roughly 8.5% of the growing season. This duration is selected as the mean and generally desired percentage, however, an individual gauge is

deemed successful if it falls within the range of 5 to 12% of the growing season or approximately 10 to 25 days.

Despite the drier than normal conditions, (19.61" of rainfall during the growing season as compared to normal rainfall of 27.61" from the State Climate Office Yadkinville Gauge) data from twelve (12) of the twelve (12) ground monitoring gauges at the Deep Creek site clearly met the hydrologic monitoring requirement. These gauges (D1, D2, D3A, D4 through D8, D9A and D10 through D12) indicated saturation levels that ranged from 22 to 106 consecutive days within the growing season. This represents stronger and more uniform hydrologic success during the fourth year of monitoring.

As in Years One through Three, the site has continued to perform successfully during Year Four (2006) of monitoring with respect to hydrologic success.

2.2 Vegetation Monitoring

Success criteria for vegetation are based on the average number of live stems per acre across the site as described in the *Success Criteria* portion of the Mitigation Plan. As described in the Mitigation Plan, a mean density of 260 stems per acre is required at the end of the five-year monitoring period. Additionally, it was desired that no single planted species comprise greater than twenty percent (20%) of the surviving stems at the end of the monitoring period.

Twelve (12) sample plots are located across the site adjacent to the groundwater monitoring devices. For simplification of records the sample plots are numbered the same as the monitoring gauges. Each plot is a square, 10 meters (32.8 feet) on each side (100 square meters, or approximately 1075 square feet). The locations of sample vegetation plots are identified on the As-built Plans.

The following table indicates the total number of live stems in each sample plot as of May 18, 2006:

Plot Numbers	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	T
Total Woody Stems	16	6	15	6	23	14	4	13	10	15	12	6	140

The average stems per sample plot is 11.67 stems. The sample plot median is 12.5 stems. A review of the sample plots (averaging 11.67 stems per plot) reveals a **current (2006 – Year Four) site survival density of approximately 473 stems per acre.** Plot photographs are attached as Appendix D.

Species diversity is described in the following table:

Plot Number

Species	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	T	%
American	9	3	2	2	14	5	2	9	5	12	1	1	65	46%

Sycamore														
River Birch	-	2	-	-	5	-	-	-	2	2	3	1	15	11%
Green Ash	2	-	5	2	2	4	-	2	1	-	-	3	21	15%
Box-elder	1	-	4	-	-	2	-	2	-	-	-	-	9	6%
Oak, Cherrybark	-	-	-	-	-	-	-	-	-	-	-	-	0	0%
Oak, Water	-	-	-	1	-	-	1	-	1	-	-	-	3	2%
Oak, Willow	-	1	3	-	-	-	-	-	-	1	1	1	7	5%
Black Gum	-	-	1	1	1	-	-	-	-	-	-	-	3	2%
Yellow Poplar	-	-	-	-	-	-	-	-	-	-	-	-	0	0%
Black Willow	4	-	-	-	-	3	-	-	-	-	-	-	7	5%
Winged Elm	-	-	-	-	-	-	-	-	-	-	1	-	1	1%
Red Maple	-	-	-	-	1	-	-	-	1	-	6	-	8	6%
Silky Dogwood	-	-	-	-	-	-	1	-	-	-	-	-	1	1%
Loblolly Pine	-	-	-	-	-	-	-	-	-	-	-	-	0	0%
Totals	16	6	15	6	23	14	4	13	10	15	12	6	140	100%

There are fourteen (14) different woody species represented within the twelve (12) sample plots. Other than American Sycamore, no single species comprises more than 20% of the total stand.

Stem count will most likely vary in future years. There can be both an increase in total stem count as well as species diversity. There may some decrease in the number of stems due to mortality, but there is likelihood that there will be an increase. The increase could come about because at the time the stem counts were made some of the trees were small and still competing with other vegetation, thus making it difficult to determine if all stems were counted early in the monitoring period.

In summary, the vegetative component of the mitigation effort meets total stem and diversity criteria in Year Four (2006) and can be expected throughout the five-year monitoring period.

2.3 Benthic Monitoring

The Year Four macroinvertebrate survey was completed on May 18, 2006, by S&EC. This sampling event replicated a baseline benthos survey was performed by S&EC in February 6, 2003, before construction commenced. This sampling event was conducted according to protocol specified by the NCDENR-DWQ Standard Operating Procedures for Benthic Macroinvertebrates. Samples were taxonomically identified by EcoAnalysts of Moscow, ID. Results of the Year Four sampling event are shown in the following table and attached as Appendix E.

The Year Four monitoring shows an increase in two metrics and a decrease in two metrics. We have seen increases in the total number of organisms as well as the total

number of taxa. EPT taxa richness and abundance have both seen decreases. This indicates a shift away from less tolerant organisms, which are represented by the EPT (Ephemeroptera, Plecoptera, and Trichoptera) families. We believe this shift is primarily due to the negative impacts several beaver impoundments have had on the stream channel water quality. These beaver impoundments slow water flow and inundate riffles, where most EPT taxa thrive. Without running water, these organisms cannot obtain the levels of oxygen necessary, so they are forced to migrate to a more suitable area in the stream.

The Average EPT taxa richness has decreased from 14 species to 8. However, Year 4 EPT taxa richness is still greater than was found in pre-construction monitoring. This slightly lowers the classification of the stream from Good-Fair to Fair. Significant effort was exerted this year to remove beavers and their dams from the site. It is expected that as beavers continue to be trapped and removed from the system, we will continue to see increased numbers of EPT taxa.

The following results summary is provided:

	Pre 2003	**Year 3 2005**	**Year 4 2006**
Total No. Of Organisms	35	81	91
Total No. Of Taxa	9	31	33
EPT Taxa Richness	1	14	8
EPT Abundance	2	50	27
NC Biotic Index	**7.23**	**5.37**	**6.6**

Overall, in Year Four we see an increase in the total number of organisms. This is coupled with an increase in the number of different species in all stations, with the exception of Station 3, which was directly upstream of the largest beaver dam (since removed). The richness and abundance of EPT taxa showed decreases in all sampling stations. This shift back towards more tolerant species is indicative of changes in water quality due to the impounding of a large portion of the stream due to beaver activity.

	Station 1			**Station 2**			**Station 3**			**Station 4**		
	Pre 2003	**Year 3 2005**	**Year 4 2006**	**Pre 2003**	**Year 3 2005**	**Year 4 2006**	**Pre 2003**	**Year 3 2005**	**Year 4 2006**	**Pre 2003**	**Year 3 2005**	**Year 4 2006**
TOTAL NO. OF ORGANISMS	20	84	102	45	62	93	25	123	93	48	53	75
TOTAL NO. OF TAXA	7	29	41	9	30	36	8	40	30	10	25	26
EPT TAXA RICHNESS	1	18	10	1	17	6	1	20	6	1	9	8
EPT ABUNDANCE	1	52	21	1	47	30	3	88	28	1	26	28
NC BIOTIC INDEX	**7.85**	**4.86**	**5.4**	**7.91**	**4.85**	**6.5**	**6.67**	**4.62**	**7.2**	**6.5**	**7.13**	**7.1**

Based on the benthic data collected to date, the site continues to show indications of a more diverse benthic population. As the stream returns to its state prior to the

introduction of beaver impoundments, we expect to see improvement in overall water quality again.

2.4 Future Monitoring

Physical stream channel monitoring (cross-sections and longitudinal profiles), as outlined in the approved mitigation plan, is to be performed every other year for five consecutive years starting one year after the completion of construction. Physical stream monitoring will be conducted again in Year Five (2007). Benthic Monitoring was initiated in Year Three (2005) and will continue until Year Five (2007), for three consecutive years.

2.5 Monitoring Success – Year Four (2006)

Based on vegetation data collected within the sample plots, existing groundwater gauge and rainfall data, the site has met the success criteria as set forth in the Mitigation Banking Instrument for Year Four (2006).

2.5 Credit Ledger

The Credit/Debit Ledger that follows indicates the number of credits that were granted for Deep Creek Wetlands Mitigation Bank. The ledger also indicates the number of credits that have been released to mitigate for wetland and stream impacts, subject to permit approval by the US Army Corps of Engineers. Forty-five percent (45%) of both wetlands and stream have been released. The releases were based on the approval of the Banking Easement and the recording of a perpetual conservation easement, of which have been accomplished.

By meeting the success criteria as documented in this report, an additional fifteen percent (15%) should be released.

LEDGER

DEEP CREEK STREAM & WETLANDS MITIGATION BANK

	CREDIT TYPE			
	WETLANDS			STREAM
	Restoration	Creation	Total	Total Feet
TOTAL APPROVED CREDITS FOR PROJECT	30.40	5.34	35.74	5,733.00

APPROVED CREDITS						
Date Issued	Released Credits	Percent				
10/9/2003	Easement Recorded	15.0	4.56	0.80	5.36	859.95
8/6/2004	1st Year Monitoring	10	3.04	0.53	3.57	573.30
9/19/2005	2nd Year Monitoring	10	3.04	0.53	3.57	573.30
8/3/2006	3rd Year Monitoring	10	3.04	0.53	3.57	573.00

					0.00	
					0.00	
					0.00	
	Total	45.0	13.68	2.39	16.07	2579.85

PROJECT DEBITS						
Date Issued	Project	USACE ID				
			0.00	0.00	0.00	0.00

UNUSED CREDIT BALANCE (DEFICIT)					
Date	8/3/2006	13.68	2.39	16.07	2,579.9

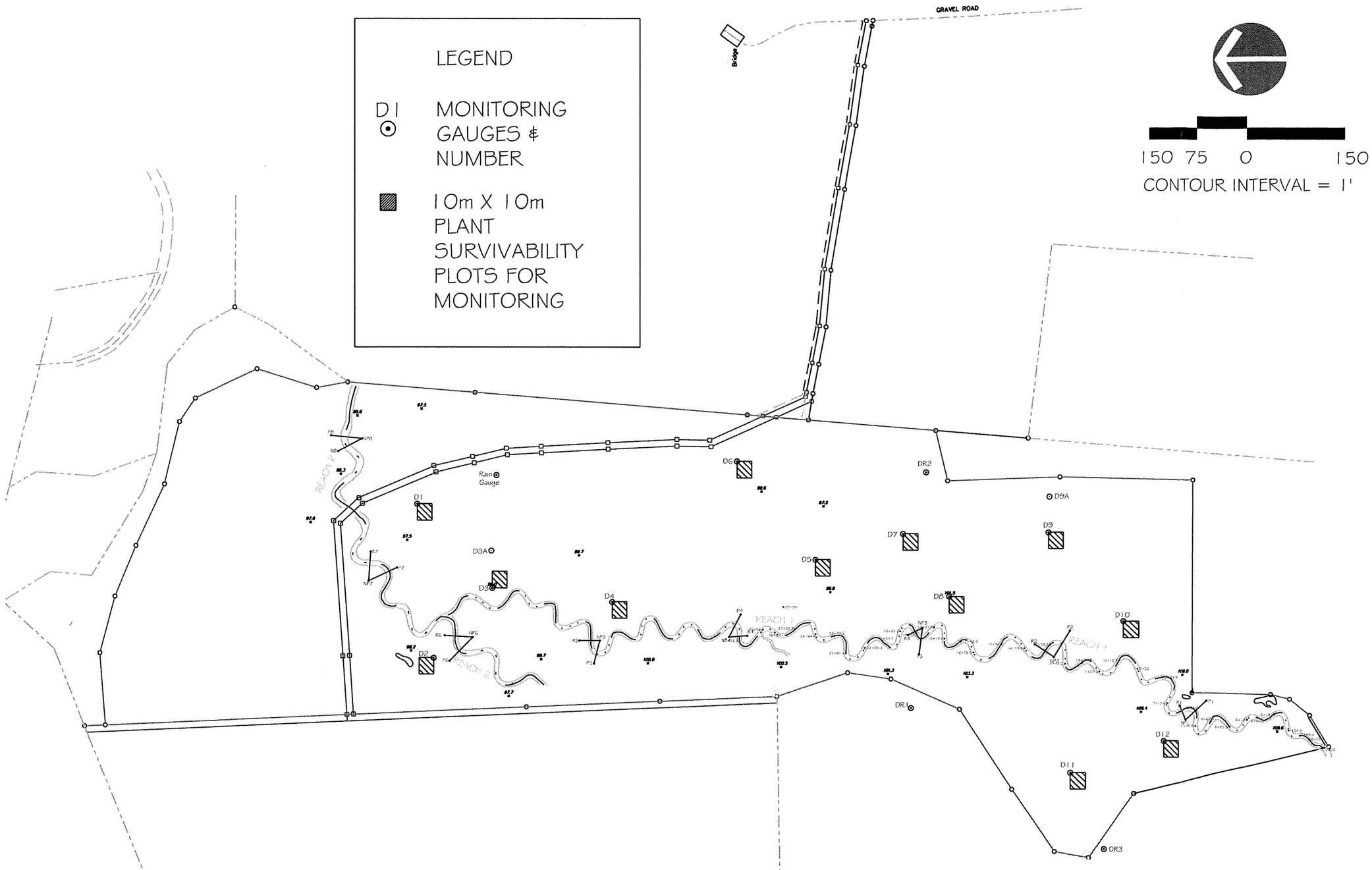
3.0 SITE MAINTENANCE

This section includes information concerning repairs made onsite in response to comments provided by the MBRT in August of 2006.

In December 2006, repairs were made to the stream channel in two areas, as recommended by the MBRT. Upstream of the culverted crossing, an outer bend that had suffered some erosion was stabilized with coir matting and over-planted with livestakes. Downstream of the culverted crossing, an outer bend had similarly eroded. This bend was regraded, stabilized with coir matting, and over-planted with livestakes. All work was performed by North State Environmental, Inc. of Winston Salem, NC (the original construction contractor). Those areas will be closely monitored over the upcoming monitoring year.

As referenced earlier in the Report, beaver activity continues at certain locations in the stream. American Wetlands has a multi-year agreement with a local beaver trapper to remove as many beaver as possible and clear the channels of dam material. Several beaver have been trapped and removed throughout the year. The trapping will continue throughout 2007. Dam debris has also been removed several times during the year. At the present time, all existing dams have been breached and the new debris will be removed as soon as the ground is dry enough to enter with a small piece of mechanized equipment.

Appendix A



MONITORING SYSTEMS

File: S:\Jobs\4-6\4517\01\As-Built Drawings\DEEP CREEK

Project: DEEP CREEK WETLAND MITIGATION BANK
Location: ADKIN CO., NC
Type: AMERICAN WETLANDS
Sheet Title: MONITORING SYSTEMS
Project No.: 4170.01
Drawn: DT
Scale: 1" = 150'
Sheet No.: 1 OF 1

Soil & Environmental Consultants, PA
11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
www.SandEC.com

REV.	DESCRIPTION:	DATE	APPROVED
0	AS-BUILT DRAWINGS	3/24/03	PKS

REVISIONS

Appendix B

Hydrology Monitoring

While 2005 was a relatively dry year, overall site hydrology was successful, with the exception of two gauges, D3 and D9. Hydrologic success criteria for the site are based on soil saturation within 12 inches of the ground surface for 18 or more consecutive days (8.5%) during the growing season. It should be noted that guidance specifies that this period of consecutive saturation should be between 5% and 12% of the growing season for an area to be considered a jurisdictional wetland. The prescribed 8.5% value represents the mean value of percentage of the growing season experiencing consecutive saturation.

Groundwater Monitoring

Gauge D3 has consistently varied from observed conditions across the remainder of the site. Due to its close proximity to the restored channel, it is our opinion that the reading depth of this gauge may have intersected a subsoil layer of higher permeability (typical of fluvial deposits) which is sub-draining groundwater from the annular space around the gauge. Due to this anomaly, in 2005 an additional gauge (Gauge D3A) was installed adjacent to D3 in order to collect additional data so that a more accurate assessment could be made of hydrology in the area. In 2005, Gauge D3A met success criteria while Gauge D3 did not. Data collected in 2006 have also shown D3A to be meeting success criteria while D3 does not. Visual observations of the area surrounding these gauges indicate similar surface conditions to those seen elsewhere on site where hydrology success criteria were met.

Gauge D9 also seems to be a statistical anomaly, as it met success criteria in 2003, but did not in 2004 and 2005. Since there have been no changes on the site or in the vicinity of the gauge that would have caused this, an additional gauge was installed in 2006 adjacent to D9 (D9A). Data collected from 2006 has shown gauge D9A is currently meeting hydrology, while D9 is not.

Vegetation Monitoring

Vegetation onsite in 2005 was successful with a mean live stem density of 566 stems per acre. While numerous volunteers were found in several of the plots, once those volunteers were removed from stem counts, densities remain higher than the desired success criteria, of 290 stems per acre expected in Year Three of Monitoring. While the removal of the volunteer species shows marginal success in several plots, (D2, D4, D7, and D12 of 242, 242, 202, and 242 stems per acre respectively), the mean density over the entire site is well above required success criteria with 495 stems per acre. Recent data collected for the 2006 (Year 4) Monitoring Year show similar trends. While several individual plots show marginal success, over the entire site, densities are well above the 260 stems per acre minimum (see attached vegetation summary tables).

Biological Monitoring

The Year Three benthic survey was completed on April 11, 2005, by S&EC. This sampling event replicated a baseline benthos survey which was performed by S&EC in February 6, 2003, before construction commenced. While it would have been ideal to continue sampling in February, based on correspondence with Dave Penrose (during his tenure at the Division of Water Quality), S&EC adjusted the sampling date to the Spring of all subsequent monitoring years. If construction scheduling would have allowed, the pre-construction sampling would have occurred in April/May, not February for the most representative results. In order to collect the most comparative data of the post-restoration condition, sampling was performed during the Spring. Sampling for Year Four (2006) occurred in May 2006. While lab results have not been received, we expect to see similar improvement in 2006 as was seen in 2005. The third and final benthic sampling (Year 5) will be performed in the Spring of 2007. Results from this sampling event will be incorporated into the Year Five Monitoring Report.

Data collected in 2005 shows an increase in water quality, as more intolerant species, which require higher water quality, are being seen in the stream. The Year Three monitoring has shown an increase in all four metrics reported, including EPT Taxa Richness. The Average EPT Taxa Richness has increased from 1 species to 16. This raises the classification of the stream from Poor to Good-Fair. It is expected that as the system progresses, we will continue to see increased numbers of EPT taxa.

While a general increase in organisms is not always a positive indicator, a shift towards more intolerant species has been observed, as is shown in the NC Biotic Index. Tolerance Values range from 0 for organisms very intolerant of organic wastes to 10 for organisms very tolerant of organic wastes. As this index decreased (from 7.23 to 5.37), we are seeing more organisms that require higher quality waters in the system.

Stream Stability Monitoring

As noted in your comments 5 of the collected stream cross-sections show the thalweg deepening. Based on our experience with similar restoration projects this is a normal stream adjustment, and in the case of this stream, it does not affect the bankfull dimensions of the channel. By comparing the as-built cross-sections and the Year 3 cross-sections (using the same bankfull elevation for both years) it is seen that the mean bankfull depths have not experienced a significant deviation from the as-built conditions (see attached table "Deep Creek Cross-Section Summary"). The cross-sectional areas and bankfull widths are also generally consistent illustrating that the channel does have a stable and appropriate dimension. And while there has been some deposition in pools, this is a natural occurrence until such a time as a bankfull flow scours the pool to its maximum depth. These cross-sections in addition to the longitudinal profile also show that there is no consistent depth of scour or headcut within the restoration reach. Areas of scour and deposition are isolated and innocuous, and can be attributed to normal stream adjustments and processes.

Riffle 8 and Pool 8 cross-sections are not maintaining their as-built dimension. These cross-sections are in an area currently experiencing accelerated local scour, and this area is scheduled to be re-graded and planted. We visited the site on April 25, 2006 as part of our Year 4 site evaluation. During this visit we observed site conditions including select areas of localized bank erosion. These areas are scheduled to be re-graded stabilized using temporary seeding measures and erosion control matting, and re-planted. These isolated sections of repair will be closely monitored for success over the upcoming monitoring year.

Deep Creek Cross-Section Summary

Pool 1			
	Asbuilt	Year 1	Year 3
W_{bkf}	18.9	22.6	18.7
D_{bkf}	1.7	1.2	1.5
A_{bkf}	31.2	27.4	27.7

Riffle 1			
	Asbuilt	Year 1	Year 3
W_{bkf}	12.3	12.4	13.1
D_{bkf}	1.3	1.3	1.3
A_{bkf}	16.4	16.3	17.1

Pool 2			
	Asbuilt	Year 1	Year 3
W_{bkf}	20.7	33.8	28.3
D_{bkf}	1.5	1	1.2
A_{bkf}	31.5	32.2	34.6

Riffle 2			
	Asbuilt	Year 1	Year 3
W_{bkf}	14.7	14.9	20.1
D_{bkf}	1	0.9	0.9
A_{bkf}	14.2	13.8	17.5

Pool 3			
	Asbuilt	Year 1	Year 3
W_{bkf}	17.8	16.9	17.8
D_{bkf}	1.3	1.3	1.4
A_{bkf}	23.2	22.7	24.3

Riffle 3			
	Asbuilt	Year 1	Year 3
W_{bkf}	30.4	30.3	31.4
D_{bkf}	0.6	0.6	0.5
A_{bkf}	17.6	17.7	17

Pool 4			
	Asbuilt	Year 1	Year 3
W_{bkf}	19.9	16.9	21.7
D_{bkf}	1.5	1.7	1.5
A_{bkf}	30	29.4	32.4

Riffle 4			
	Asbuilt	Year 1	Year 3
W_{bkf}	13.5	14.3	16.1
D_{bkf}	1.2	1.2	1.2
A_{bkf}	16.4	16.8	19.5

Pool 5			
	Asbuilt	Year 1	Year 3
W_{bkf}	17.6	17.5	19.5
D_{bkf}	1.6	1.7	1.7
A_{bkf}	28.4	29.3	32.1

Riffle 5			
	Asbuilt	Year 1	Year 3
W_{bkf}	13.1	13.5	16.6
D_{bkf}	1.5	1.4	1.3
A_{bkf}	19.4	18.6	21.2

Pool 6			
	Asbuilt	Year 1	Year 3
W_{bkf}	18.9	21.2	17.4
D_{bkf}	2.1	1.8	1.5
A_{bkf}	40.2	37.4	25.2

Riffle 6			
	Asbuilt	Year 1	Year 3
W_{bkf}	17.8	21.5	20.8
D_{bkf}	1.3	1.1	1.2
A_{bkf}	22.7	23.2	24.7

Pool 7			
	Asbuilt	Year 1	Year 3
W_{bkf}	17.2	23.8	22.1
D_{bkf}	2.4	2	2.1
A_{bkf}	40.8	47.1	45.9

Riffle 7			
	Asbuilt	Year 1	Year 3
W_{bkf}	22.9	24.4	24.4
D_{bkf}	1.1	1.1	1.1
A_{bkf}	24.2	27.9	27.9

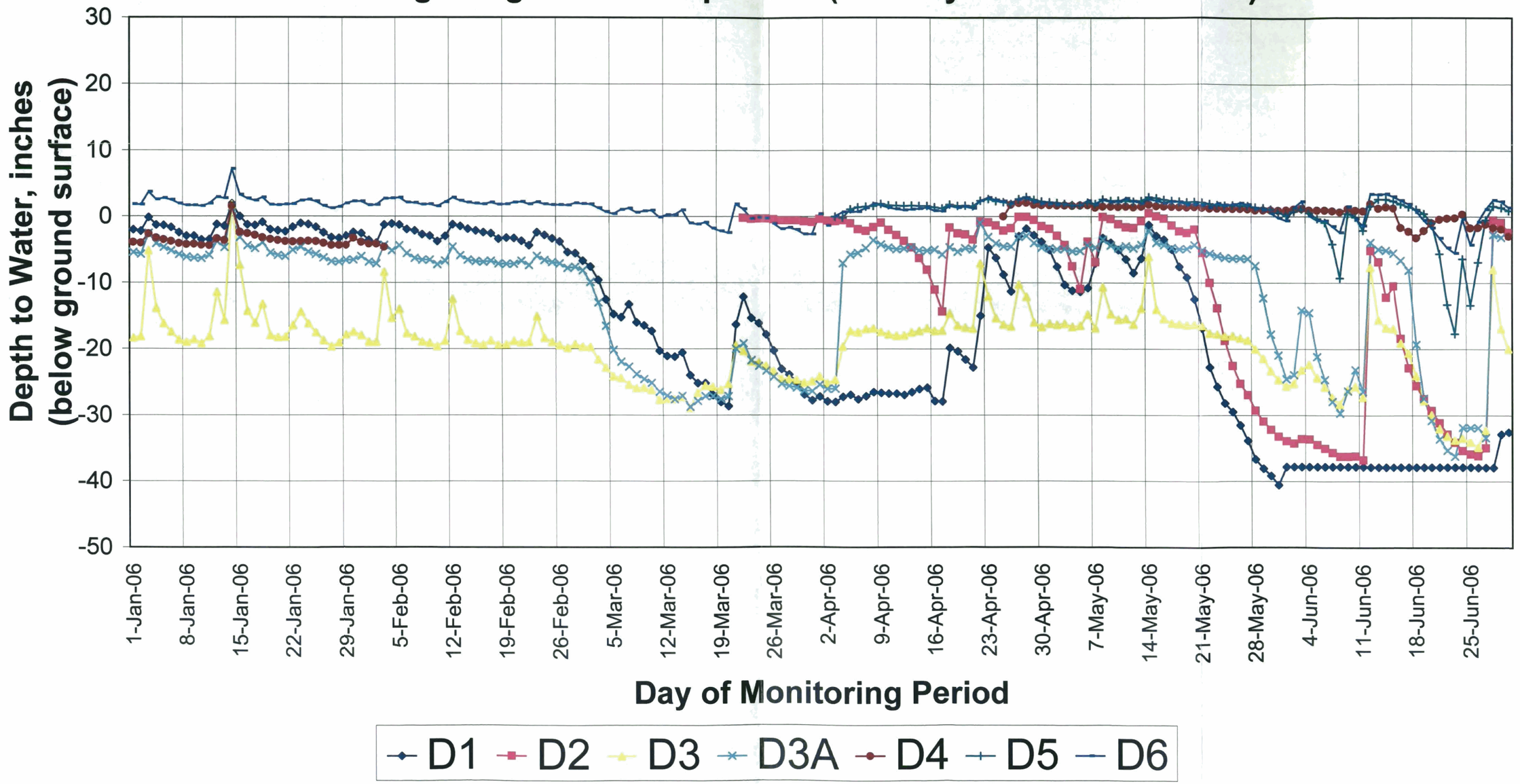
Pool 8			
	Asbuilt	Year 1	Year 3
W_{bkf}	21.5	22.2	26.1
D_{bkf}	2.2	2.7	2.8
A_{bkf}	46.9	59.2	73

Riffle 8			
	Asbuilt	Year 1	Year 3
W_{bkf}	17.6	17.7	19.7
D_{bkf}	1.6	1.7	2
A_{bkf}	28.8	30.6	38.5

Appendix C

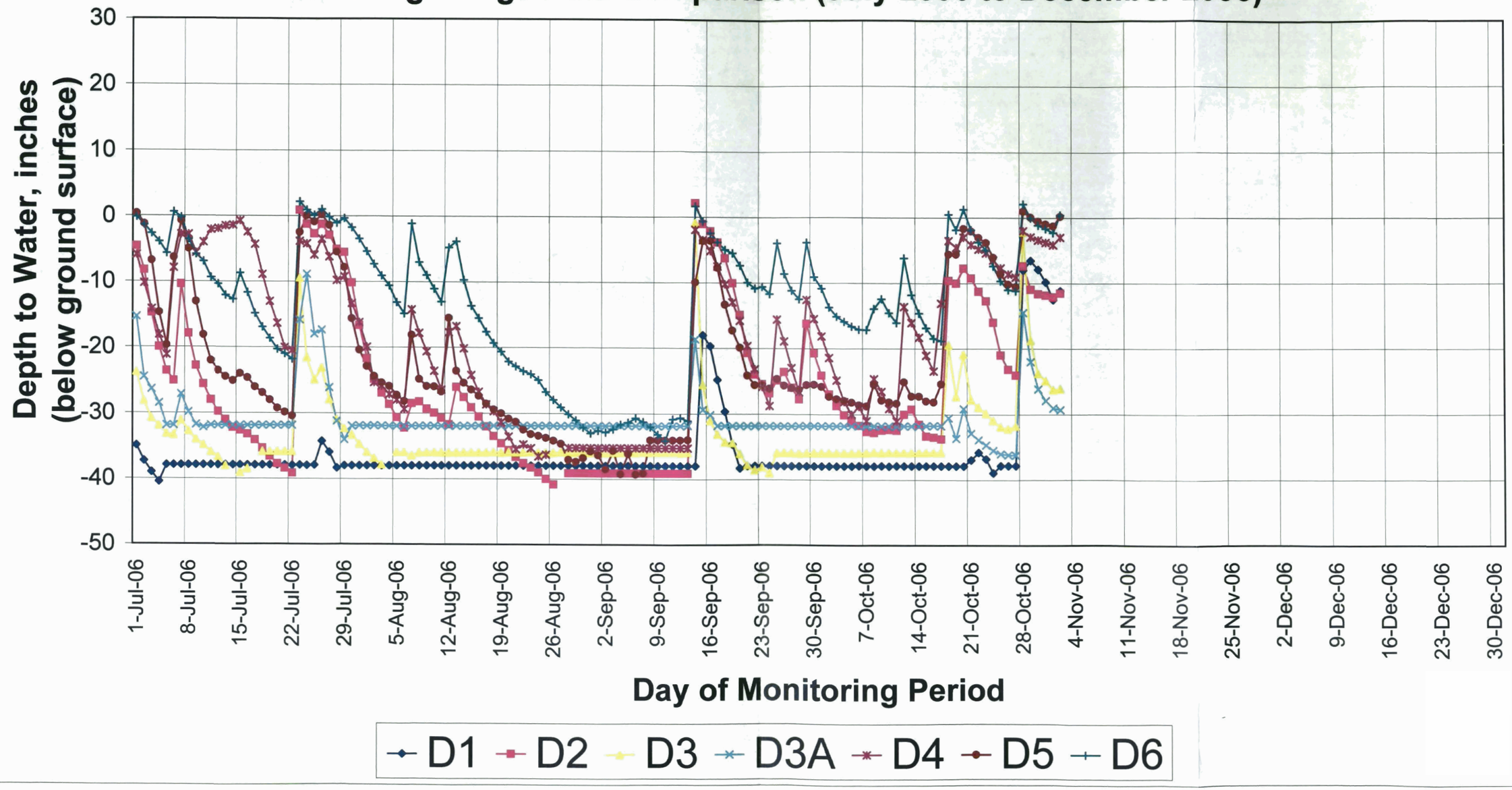
Deep Creek Wetland Mitigation Bank

Monitoring Gauge Data Comparison (January 2006 to June 2006)



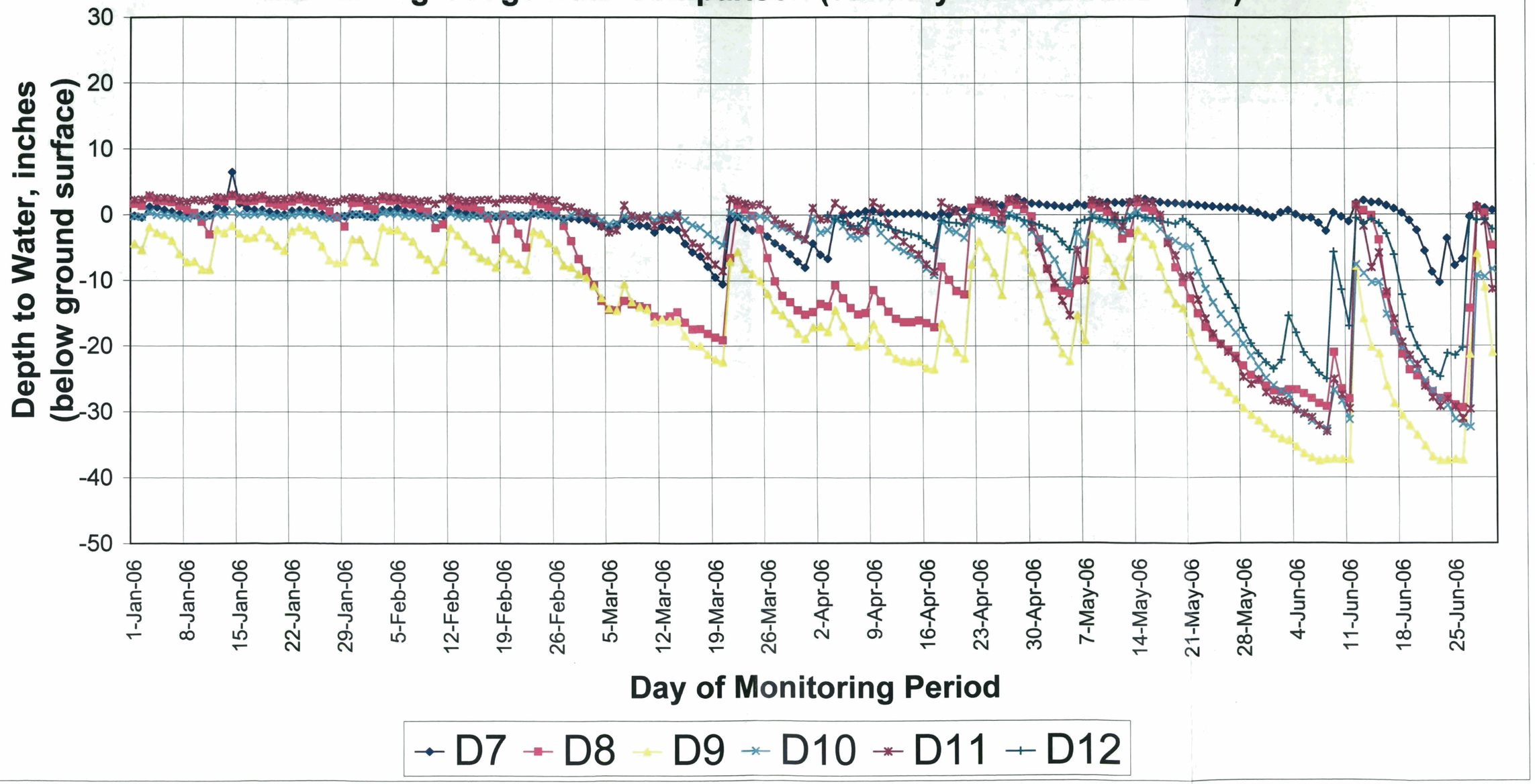
Deep Creek Wetland Mitigation Bank

Monitoring Gauge Data Comparison (July 2006 to December 2006)



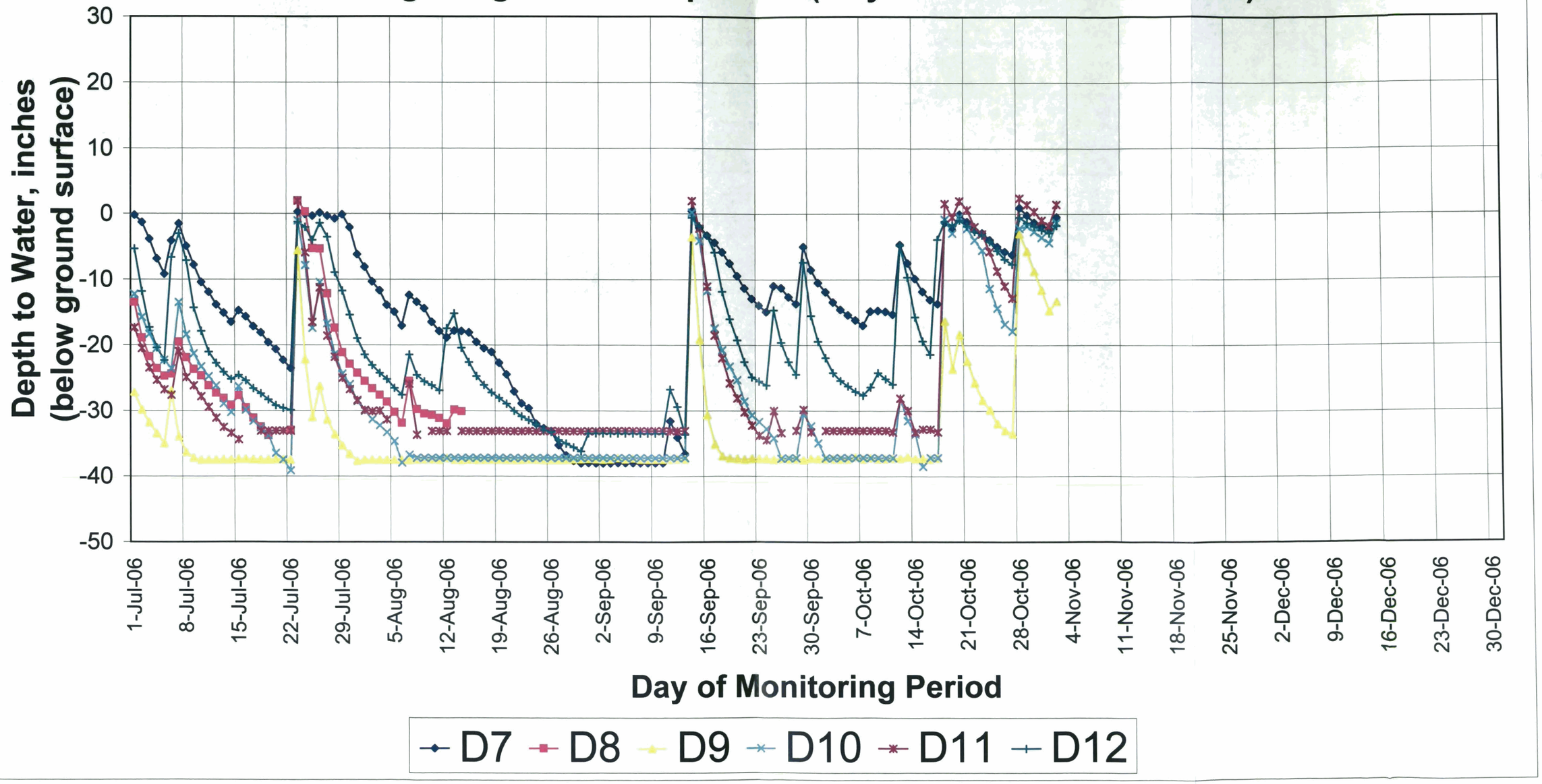
Deep Creek Wetland Mitigation Bank

Monitoring Gauge Data Comparison (January 2006 to June 2006)



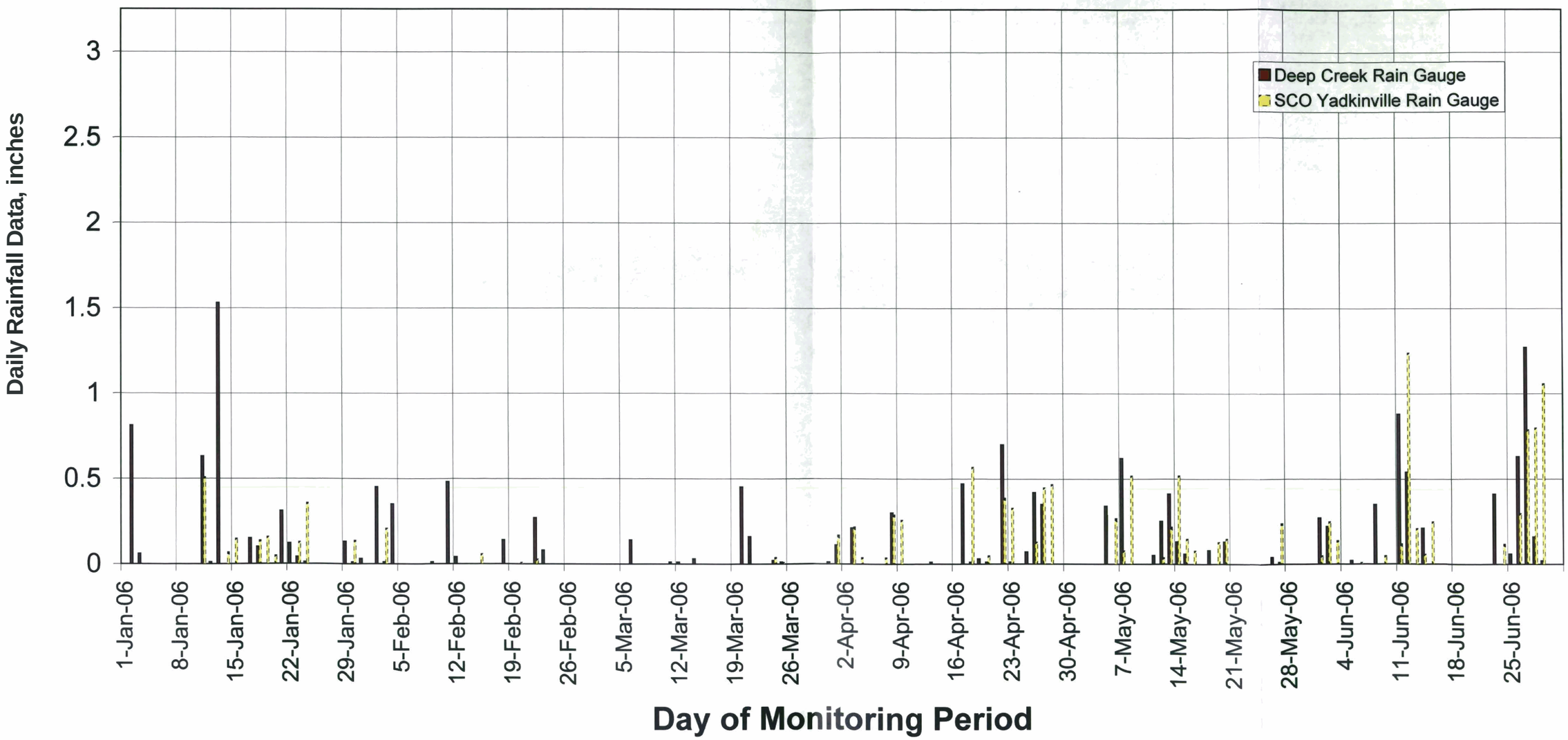
Deep Creek Wetland Mitigation Bank

Monitoring Gauge Data Comparison (July 2006 to December 2006)



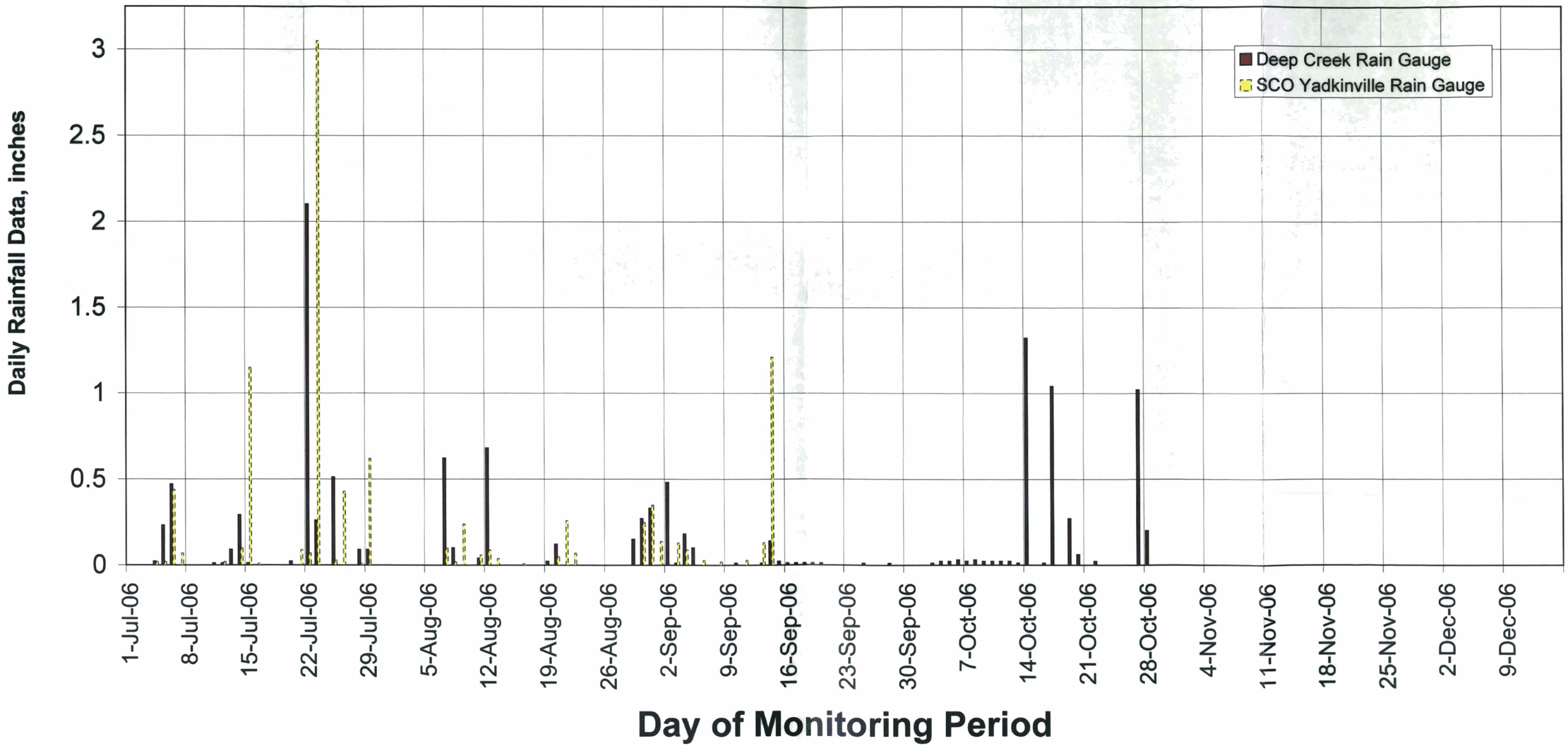
Deep Creek Wetland Mitigation Bank

Site Rainfall Data (January 2006 to June 2006)



Deep Creek Wetland Mitigation Bank

Site Rainfall Data (July 2006 to December 2006)

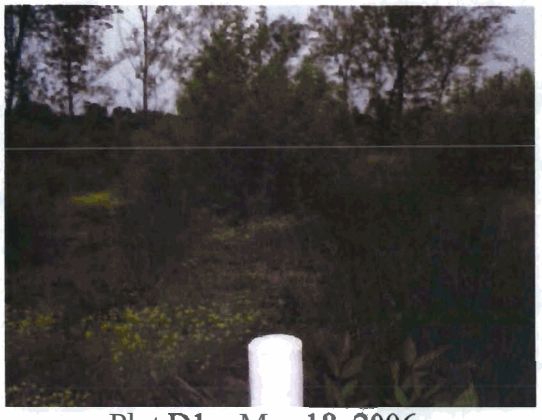


Appendix D

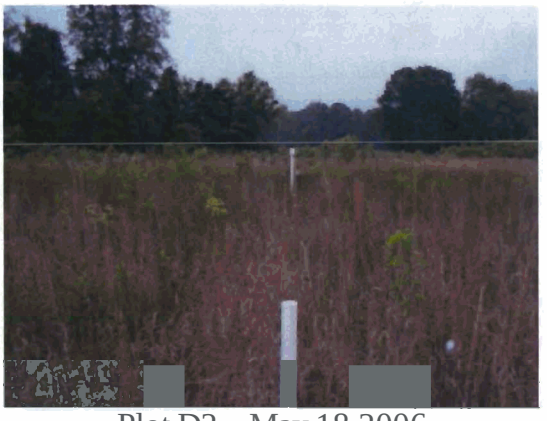
Appendix D

Site Photos

A photograph of each of the ten (10) sample plots is included below. Each view is from the southeast comer of the plot toward the northwest comer where the groundwater monitoring gauge is located. The photos were taken in the 2006 growing season.



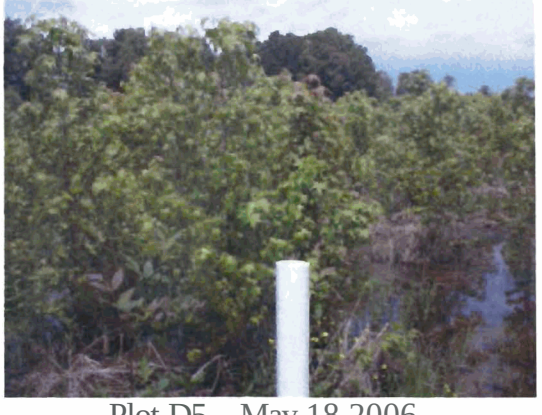
Plot D1 – May 18, 2006



Plot D2 – May 18,2006

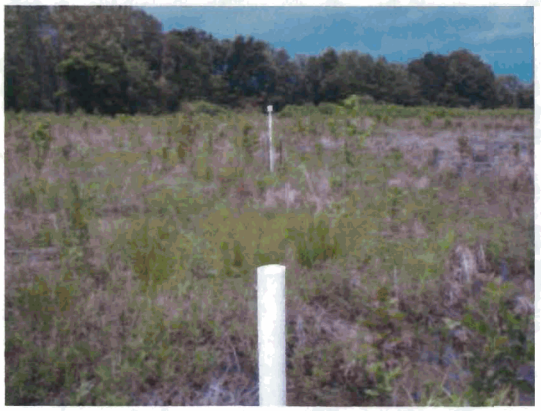
Plot D3 – May 18, 2006

Plot D4 – May 18, 2006



Plot D5 – May 18,2006

Plot D6 – May 18,2006



Plot D7 – May 18, 2006

Plot D8 – May 18, 2006

Plot D9 – May 18, 2006

Plot D10 – May 18, 2006

Plot D11 – May 18, 2006

Plot D12 – May 18, 2006

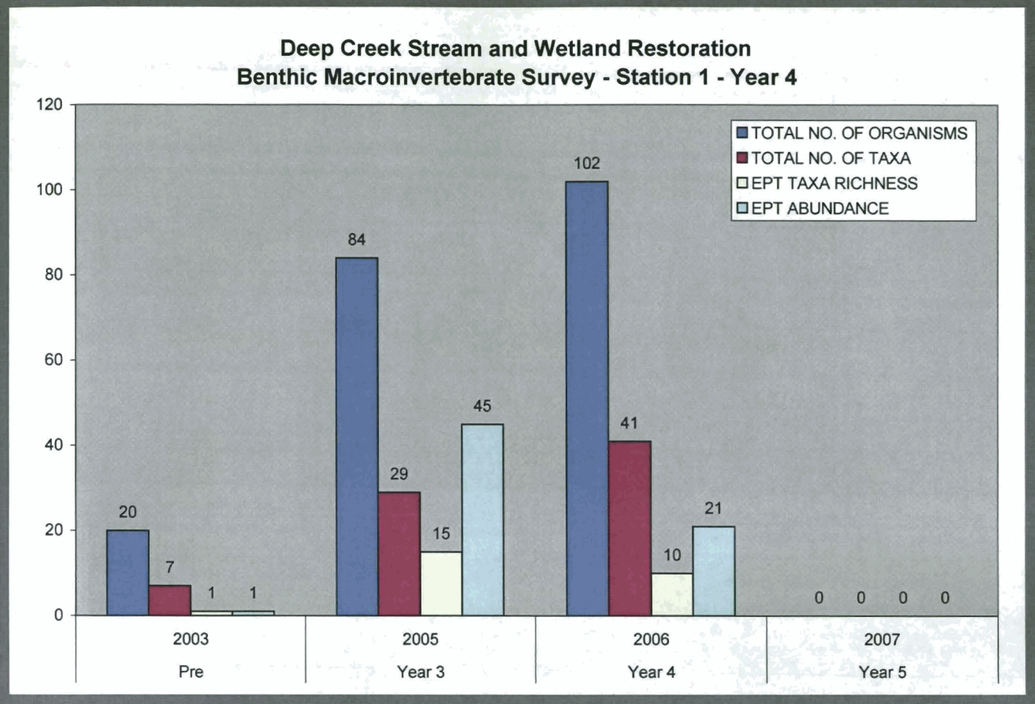
Appendix E

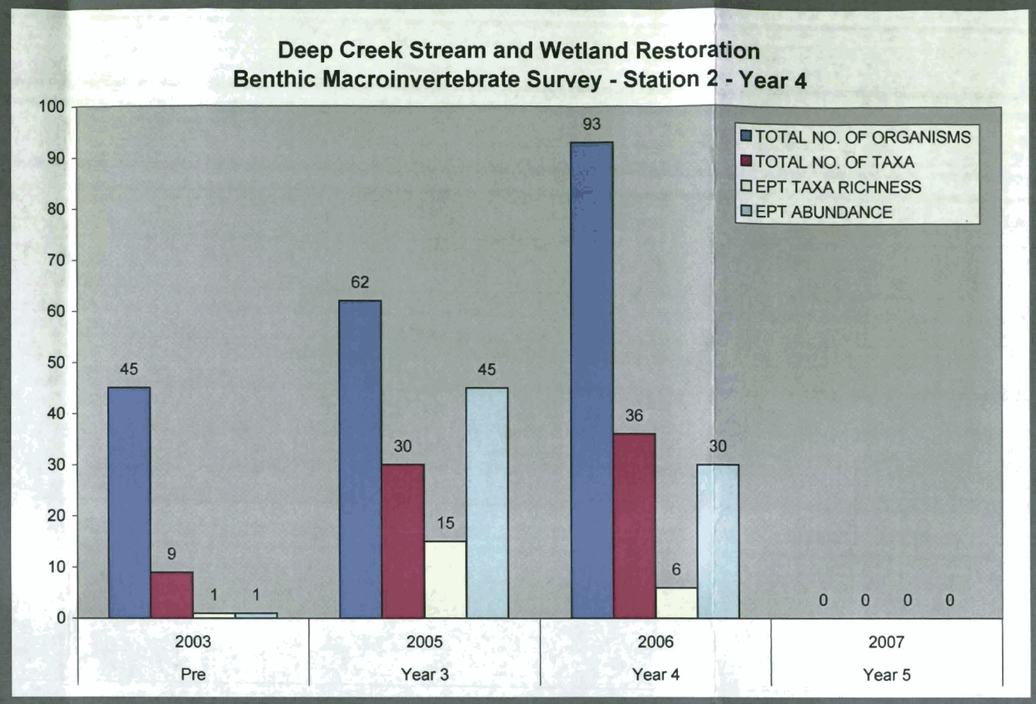
DEEP CREEK
Aquatic Macroinvertebrate Monitoring

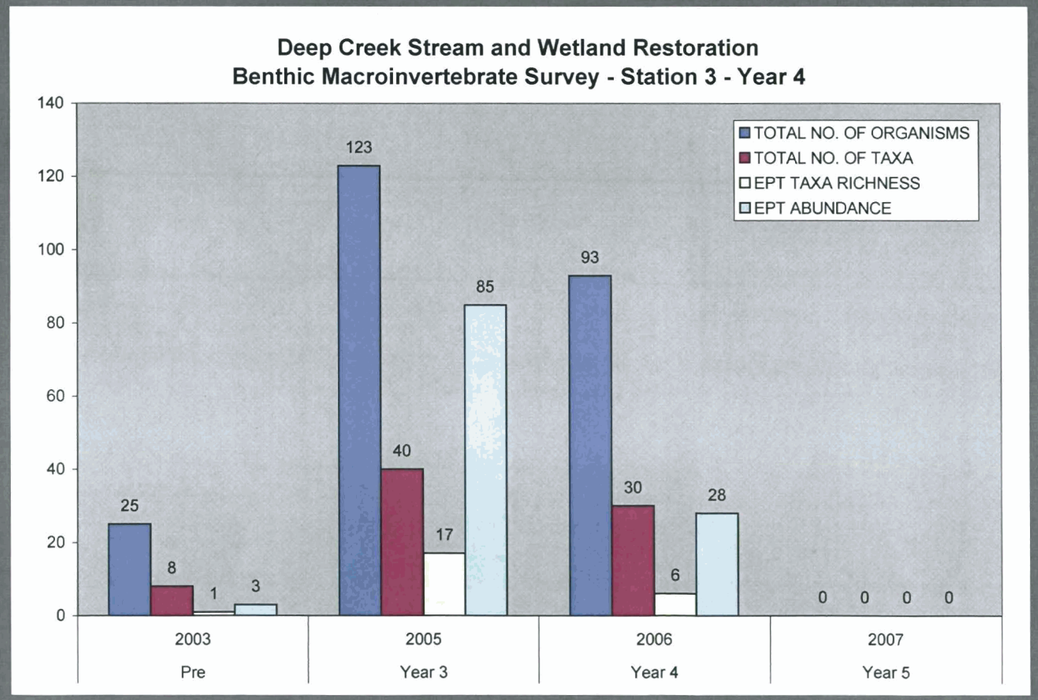
S&EC Job # 6170

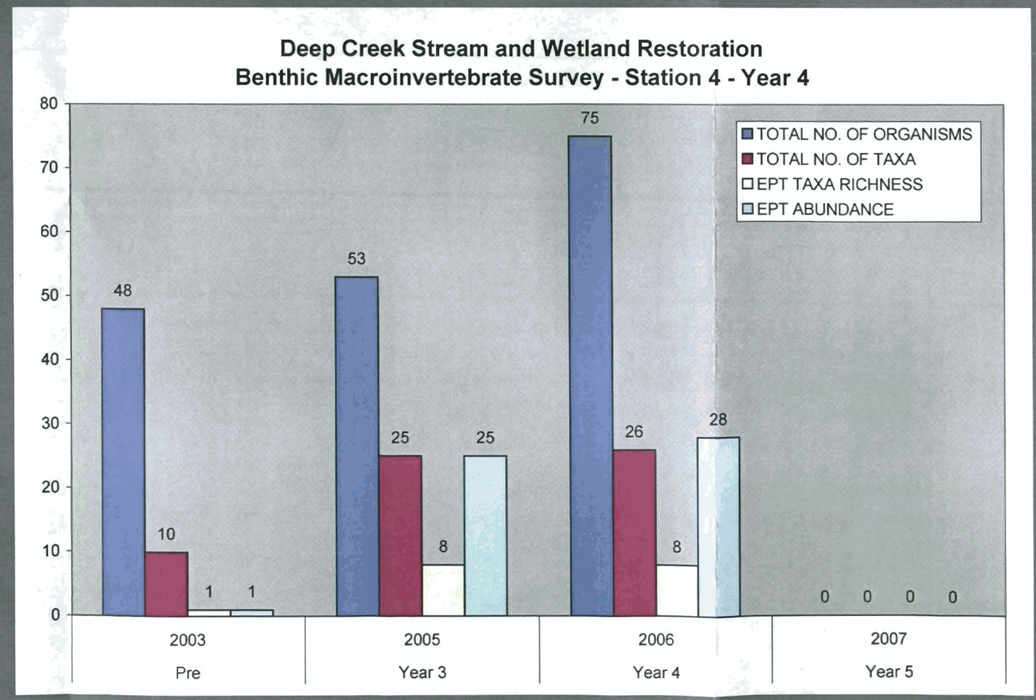
SPECIES	T.V.	FFG	Station 1 Pre 2003	Station 1 Year 3 2005	Station 1 Year 4 2006	Station 1 Year 5 2007	Station 2 Pre 2003	Station 2 Year 3 2005	Station 2 Year 4 2006	Station 2 Year 5 2007	Station 3 Pre 2003	Station 3 Year 3 2005	Station 3 Year 4 2006	Station 3 Year 5 2007	Station 4 Pre 2003	Station 4 Year 3 2005	Station 4 Year 4 2006	Station 4 Year 5 2007
MOLLUSCA																		
Bivalvia																		
Veneroida																		
Sphaeriidae		FC																
Pisidium sp.	6.48	FC	3								1				10			
Sphaerium sp.													1					
Gastropoda																		
Basommatophora																		
Lymnaeidae		SC										1						
Fossaria sp.		SC																
Physidae																		
Physa sp.					1				1								3	
Physella sp.	8.84	CG	1				1		1			1						
ANNELIDA																		
Oligochaeta		CG																
Haplotaxida																		
Enchytraidae	9.84	CG	10				10				1				1	1	3	
Lumbricidae		CG					10				3				1			
Tubificidae w.h.c.	7.11	CG			3						10				10			
Tubificidae w.o.h.c.	7.11	CG							3						3	1		
Tubificidae																		
Aulodrilus					1				3				1					
Limnodrilus																	3	
Naididae																		
Nais													1					
Stylaria																	3	
Lumbriculida																		
Lumbriculidae	7.03	CG					10				3				10			
Eclipidrilus sp.		CG					10				3				10			
ARTHROPODA																		
Crustacea																		
Amphipoda																		
Synurella					10								1					
Cladocera																		
Daphnidae																		
Ceriodaphnia sp.																1		
Isopoda																		
Asellidae		SH																
Caecidotea sp.	9.1	CG														1		
Insecta																		
Ephemeroptera																		
Ameletidae		CG																
Ameletus lineatus	2.4	CG		3				10				10						
Baetidae		CG			1													
Acerpenna macdunnoughi				3				3				10				1		
Baetis sp.		CG										1					10	
Callibaetis sp.	9.8	CG														3		
Centroptilum sp.	6.6	CG						1	10			3	10			3	1	
Diphetor hageni	1.6											1						
Paracloeodes minutus													1					
Plauditus sp.		CG						10				10						
Caenidae		CG																
Caenis latipennis					1				10				3				10	
Caenis sp.	7.4	CG						3				3				10		
Ephemerellidae		SC																
Eurylophella sp.	4.3	SC										1						
Eurylophella doris	4.3															3	1	
Heptageniidae		SC																
Maccaffertium (Stenonema) modes	5.5	SC		10				3	3			10	10				1	
Stenacron interpunctatum													3				1	
Stenonema sp.					10													
Leptophlebiidae		CG																
Leptophlebia sp.	6.2	CG		1				3				3				3		
Paraleptophlebia sp.					3				3									
Odonata																		
Aeshnidae																		
Boyeria vinosa					1								1					
Calopterygidae		P																
Calopteryx sp.	7.8	P		3									1					
Coenagrionidae		P															1	
Argia sp.	8.2	P										1						
Cordulegastridae		P																
Cordulegaster maculata													1					
Cordulegaster sp.	5.7	P		3	1							1						
Corduliidae		P										1						
Gomphidae		P														1		
Gomphus sp.	5.8	P		1														
Ophiogomphus sp.	5.5	P						1										
Progomphus obscurus	8.2	P						1										
Plecoptera																		
Nemouridae		SH																
Amphinemura sp.	3.3	SH		3	1			3				1						
Perlidae		P																
Perlesta sp.				3	1			1	3			3	1				1	
Perlesta placida sp. gp.	4.7	P																
Perlodidae		P																
Isoperla sp.				1				1				10						
Hemiptera																		
Gerridae		P			1				1									
Aquarius sp.		P										1					1	
Trepobates sp.		P										1						
Megaloptera																		
Corydalidae																		
Nigronia serricornis					1													
Sialidae																		
Sialis sp.					1				3									
Trichoptera																		
Hydropsychidae		FC						1	1									
Cheumatopsyche sp.	6.2	FC		1	1			3				3					3	
Diplectrona modesta	2.2	FC		3														
Hydropsyche betteni gp.	7.8	FC		1				1										
Philopotamidae		FC																
Chimarra aterrima	2.8	FC		3														
Lepidostomatidae		SH																
Lepidostoma sp.	0.9	FC		1														
Limnephilidae		SH																
Ironoquia sp.		-		10	1		1					10				1		
Pycnopsyche sp.	2.5	SH		1	1							3				1		

Phryganeidae		SH																	
Ptilostomis sp.		SH	1									3				1			
Rhyacophilidae		P																	
Rhyacophila fenestrata/ledra		P					1												
Uenoidae																			
Neophylax sp.	2.2	SC		1	1		1					3							
Coleoptera																			
Dryopidae			3																
Helichus basalis		SC																	
Helichus sp.	4.6	SC		3	3				3										
Dytiscidae		P		1															
Coptotomus sp.	9.3															1			
Hydaticus sp.							1												
Neoporus sp.					3								1						
Elmidae		CG							1										
Ancyronyx variegata									1				1						
Dubiraphia sp.																1			
Dubiraphia vittata	4.1	SC			1				1			1							
Macronychus glabratus					3														
Stenelmis sp.	5.1	SC							3			1							
Gyrinidae		P			3							1							
Dineutus sp.	5.5	P							3										
Gyrinus sp.	6.2	P														1			
Haliplidae							1		3										
Peltodytes sp.	8.7	SH																	
Hydrophilidae		P		3															
Hydrobius sp.		P					1												
Sperchopsis tesselatus	6.1	CG														1			
Staphylinidae		P					1					1							
Diptera									3				10			1			
Chironomidae					1														
Ablabesmyia mallochi	7.2	P							1				10						
Ablabesmyia sp.																1			
Apsectrotanypus johnsoni	0.1								1										
Brillia sp.									1				10						
Chironomus sp.									1							1			
Cladotanytarsus sp.	4.1	FC					1					3				1			
Clinotanypus pinguis	8.7	P		3								1						3	
Conchapelopia sp.	8.4	P					1		3										
Cricotopus bicinctus	8.5	CG							1										
Cryptochironomus sp.	6.4	P					1												
Cryptotendipes sp.																		1	
Endochironomus sp.		SH							1				1						
Microtendipes pedellus gp.	5.5	CG					1					1				1			
Natarsia sp.									1									3	
Odontomesa sp.							1		1			1							
Parakiefferiella sp.																		1	
Paracladopelma sp.	5.5	CG							3				3						
Parametriocnemus sp.		CG			3		1					1				3			
Paratanytarsus sp.					1				3									1	
Paratendipes sp.	5.1	CG			10							10							
Phaenopsectra sp.									1			3							
Polypedilum aviceps					13							3							
Polypedilum fallax	6.4	SH		3															
Polypedilum flavum (convictum)	4.9	SH		10			3												
Polypedilum halterale	7.3	SH			1				1			10							
Polypedilum illinoense	9	SH			3							3							
Polypedilum scalaenum									1			3							
Potthastia longimana gr.					1														
Procladius sp.					1				3										
Rheotanytarsus exiguus gr.					1														
Stictochironomus sp.																			
Tanytarsus sp.	6.8	FC			3				10										
Thienemanniella sp.									1										
Thienemannimyia gr. sp.					3														
Tvetenia bavarica gr.					1														
Xylotopus par																			
Zavrelia sp.	5.3	CG																	
Zavrelimyia sp.																			
Ceratopogoninae																			
Bezzia sp.																			
Ceratopogonidae					1				1										
Probezzia sp.									3										
Dixidae		CG																	
Dixa sp.	2.6	CG																	
Dixella sp.		CG																	
Forcipomyiinae																			
Atrichopogon sp.									1										
Simuliidae		FC																	
Simulium sp.	6	FC		1															
Tabanidae		PI																	
Chrysops sp.	6.7	PI		1			1												
Hybomitra sp.					1														
Tabanus sp.	9.22	PI	1				1					1							
Tipulidae		SH	1	1															
Dicranota sp.					3														
Hexatoma sp.	4.3	P										1							
Ormosia sp.		CG					1									1			
Pseudolimnophila sp.	7.2	P		3	1														
Tipula sp.	7.3	SH		3			1					1						3	
TOTAL NO. OF ORGANISMS			20	84	102	0	45	62	93	0	25	123	93	0	48	53	75	0	
TOTAL NO. OF TAXA			7	29	41	0	9	30	36	0	8	40	30	0	10	25	26	0	
EPT TAXA RICHNESS			1	15	10	0	1	15	6	0	1	17	6	0	1	8	8	0	
EPT ABUNDANCE			1	45	21	0	1	45	30	0	3	85	28	0	1	25	28	0	
NC BIOTIC INDEX			7.85	4.86	5.4		7.91	4.85	6.5		6.67	4.62	7.2		6.5	7.13	7.1		


Deep Creek Stream and Wetland Restoration
Benthic Macroinvertebrate Survey - Station 1 - Year 4
TOTAL NO. OF ORGANISMS
TOTAL NO. OF TAXA
EPT TAXA RICHNESS
EPT ABUNDANCE
120
100
80
60
40
20
0
20
7
1
1
84
29
15
45
102
41
10
21
0 0 0 0
2003
Pre
2005
Year 3
2006
Year 4
2007
Year 5


Deep Creek Stream and Wetland Restoration
Benthic Macroinvertebrate Survey - Station 2 - Year 4
TOTAL NO. OF ORGANISMS
TOTAL NO. OF TAXA
EPT TAXA RICHNESS
EPT ABUNDANCE
100
90
80
70
60
50
40
30
20
10
0
45
9
1
1
62
30
15
45
93
36
6
30
0 0 0 0
2003
Pre
2005
Year 3
2006
Year 4
2007
Year 5


Deep Creek Stream and Wetland Restoration
Benthic Macroinvertebrate Survey - Station 3 - Year 4
TOTAL NO. OF ORGANISMS
TOTAL NO. OF TAXA
EPT TAXA RICHNESS
EPT ABUNDANCE
140
120
100
80
60
40
20
0
25
8
1
3
123
40
17
85
93
30
6
28
0 0 0 0
2003
Pre
2005
Year 3
2006
Year 4
2007
Year 5


Deep Creek Stream and Wetland Restoration
Benthic Macroinvertebrate Survey - Station 4 - Year 4
TOTAL NO. OF ORGANISMS
TOTAL NO. OF TAXA
EPT TAXA RICHNESS
EPT ABUNDANCE
80
70
60
50
40
30
20
10
0
48
10
1
1
53
25
8
25
75
26
8
28
0 0 0 0
2003
Pre
2005
Year 3
2006
Year 4
2007
Year 5