SUCK CREEK STREAM RESTORATION
(Project No. 368)
FINAL

MONITORING YEAR 4 of 5 (2007)

Submitted
October 2007

Submitted to:

North Carolina Department of Environment and Natural Resources
Ecosystem Enhancement Program
Raleigh, North Carolina

TABLE OF CONTENTS

Table of Figures

Table of Tables

TABLE OF CONTENTS (continued)

Appendices

I. Executive Summary

The 2003 objective of the Suck Creek stream restoration project was to restore an unstable, degraded stream corridor and adjacent riparian zones to a stable condition that supported high quality in-stream and riparian habitat. The design integrated design goals with site constraints, such as the need to maintain access to surrounding cattle pastures. Design elements included: (1) constructing 3,260 feet of channel with a stable dimension, pattern and profile; (2) installing in-stream structures such as log vanes, J-hook vanes, cross vanes, root wads, and boulder clusters; (3) planting the stream banks and adjacent 7.8 acres of riparian buffer with native plant species; (4) installing fencing to exclude cattle from the restored area; and (5) creating stable road crossings to allow access to adjacent pasture lands. Construction was completed in April 2003, the as-built survey was completed June 2003, and the riparian buffer was planted in February 2004. Year 1 Geomorphologic Monitoring was conducted in October 2004, Year 2 in September 2005, and Year 3 monitoring in August 2006. The Year 4 monitoring provided in this report was conducted in July 2007.

The stream restoration component of the project involved implementing a Priority I Restoration method to create a more stable C4 stream type. Based on the findings of the 2007 monitoring effort summarized in this report, the restored reaches are predominantly stable. Four maintenance actions are recommended at this time. On the upper reach where cattle have entered the stream and caused bank destabilization at a cattle crossing, replacement of fencing is recommended. The removal of a beaver dam/debris dam at station 11+30 is recommended to restore flow and water surface levels. Maintenance should be considered on the cross vanes at Stations 18+00, 21+60, 25+70 and 26+60 since scour between and around individual rocks in the arm is extensive and the arm of the structure is not creating a bar behind the structure of any kind. Piping between vane rocks still continues. Additional maintenance at Station 25+50 to reposition the log vane structure is suggested.

The mean particle size of mobile sediment in the upper reach fluctuated within the sand range (from $D_{50\ (2005)}$ = 15mm. to $D_{50\ (2006)}$ = 0.7 mm. to $D_{50\ (2007)}$ = 6 mm). The mean particle size of mobile sediment in the lower reach has not significantly changed. An extensive mid-channel bar has continued to form just downstream of the boulder field in the upper reach.

Vegetation representing local riparian communities was planted to provide additional stability to the stream banks and establish a riparian buffer. The planted riparian vegetation onsite is well established on the stream banks and less established at the outer limits of the riparian corridor. Within Suck Creek vegetation plots the most common species found are river birch (*Betula nigra*), black willow (*Salix nigra*), sycamore (*Platanus occidentalis*), and green ash (*Fraxinus pennsylvanica*) (Weakley, 2006). A total of 12 species are present, and this is consistent with last years report. The taxonomic standard utilized for this assessment was Flora of the Carolinas, Virginia, Georgia and surrounding areas by: Alan S. Weakley. This is the second year vegetation was

monitored using the CVS-EEP Protocol for Recording Vegetation (Lee et al. 2006). Vegetation reports (Appendix A) from Monitoring Year 3 will be greater in total woody stems due to several *Betula nigra* individuals that were inaccurately reported as planted stems. These individuals were subsequently identified as root suckers from parent trees.

In analyzing Monitoring Year 3 CVS reports versus Monitoring Year 4 reports one notable change is in the Vigor category, more entries for the lower vigor scores 2, 1, 0 and Missing were reported for 2007 than for 2006. The likely reason is the severe drought that Moore County is experiencing. Drought as a cause for damage increased somewhat from MY3 to MY4; however, the increase from insect damage was more robust. Two new entries to the damage category at Suck Creek are Livestock and Beaver. Livestock graze the neighboring fields, and evidence was found indicating they pushed through fencing at the stream crossing. This affected Plot 6 and Plot 7 the most; little or no livestock damage was observed in other plots.

There is no wetland component to this mitigation site.

II. Project Background

1. Project Objectives

The goal of the project was to transform the pre-existing altered stream corridor to a more stable and biologically active form through the following objectives:

- Restore 3,260-linear feet of Suck Creek through geomorphic modification through dimension, pattern and profile adjustments, and cattle exclusion;
- Establish a riparian zone (7.8 acres) surrounding restored sections of Suck Creek;
- Provide cattle exclusion fencing and controlled crossings to protect restoration effort; and
- Provide perpetual protection of the riparian area and stream with a conservation easement.

2. Project Structure, Restoration Type, and Approach

The pre-restoration channel was incised with unstable banks. Using reference data from regional curves and appropriate reference reaches, the channel geometry was modified to produce a more stable C4 stream type, as defined by Rosgen (Rosgen 1994). In accordance with the Priority 1 Restoration method, the stream bed was elevated to reconnect it to its abandoned terrace, increasing available flood prone area to near pre-existing conditions. The result of the restoration effort is an increase in the width to depth ratio and reduced bank height ratios, thus improving channel stability. The sinuosity of the reach was also increased which resulted in a decreased mean slope. The decreased mean slope reduces the stream velocities of bankfull events that should also increase stream stability. In-stream structures including rock cross vanes, root wads and log vanes were incorporated into the channel. A vegetative buffer was planted along the stream corridor to further stabilize the stream banks, improve habitat conditions, and reduce ambient water temperature. Stream channel construction was completed in April of 2003 and the vegetated buffers were planted in February 2004. Stream and buffer restoration areas are surrounded by fencing and are protected by a conservation easement.

Suck Creek was restored through the North Carolina Ecosystem Enhancement Program (EEP). This is the Year 4 monitoring report for Suck Creek.

Table I provides information on the project structure and objectives.

Table I: Project Mitigation Objectives Table Suck Creek Stream Restoration: Project No. 368						
Project Segment or Reach ID	**Existing Feet/Acres**	**Type**	**Approach**	**Footage or Acreage**	**Stationing**	**Comments**
Upper Reach	NA	R	P1	875 Lf	0+00 – 08+75	Restore dimension, pattern, and profile
Lower Reach	NA	R	P1	2,088 Lf	08+75 – 29+63	Restore dimension, pattern, and profile
Riparian Buffer Area	NA	R	SS	7.8 Ac.	NA	Restore riparian wetland community
R= Restoration		EII = Enhancement II		P1 = Priority I		P3 = Priority III
EI = Enhancement I		S = Stabilization		P2 = Priority II		SS = Stream Bank stabilization

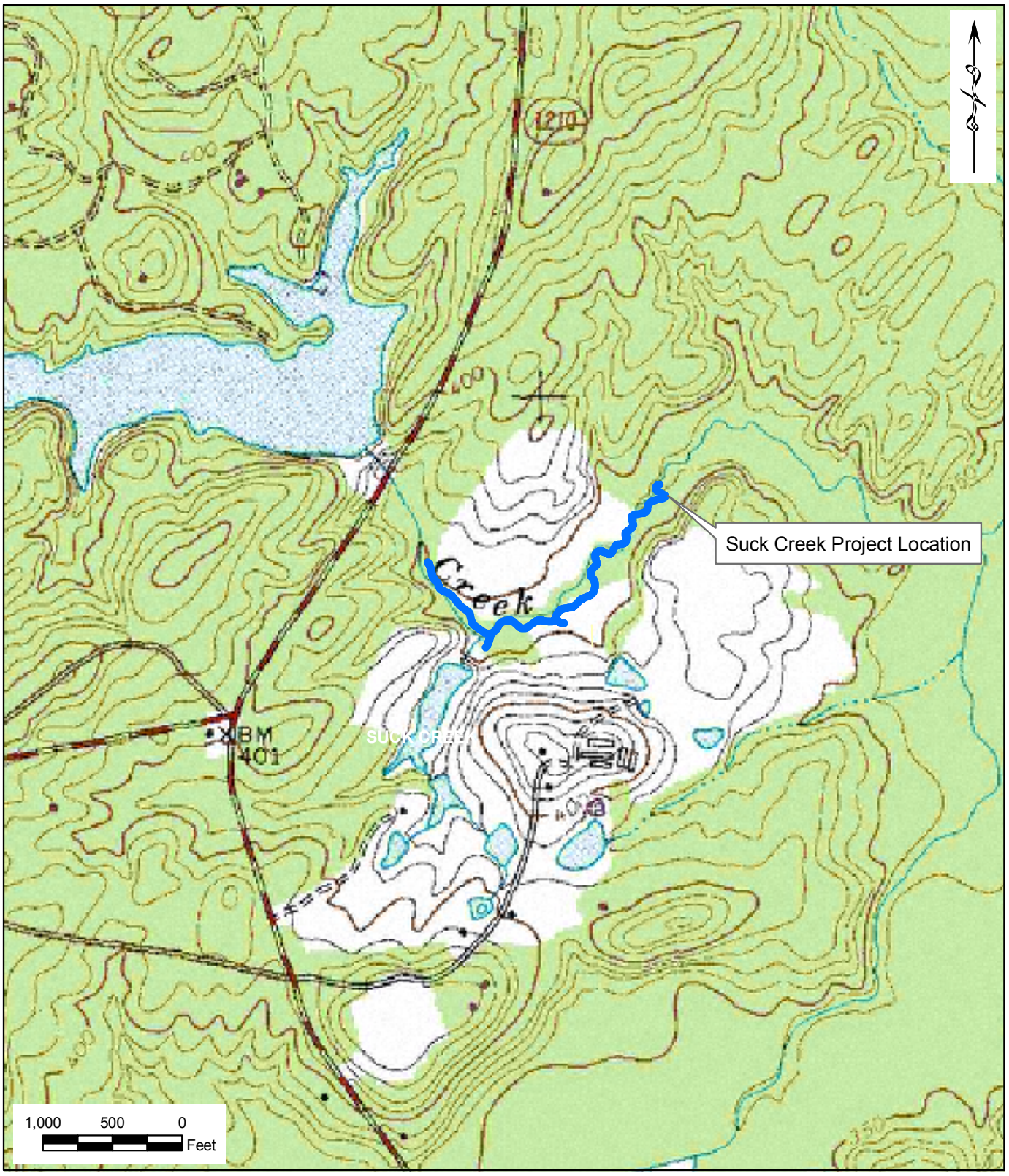
3. Location and Setting

The Suck Creek Stream Restoration Project site lies within the Richardson Farm in Moore County, North Carolina. The stream drains a portion of the Deep River Subbasin (USGS Hydrologic Unit 03030003) and North Carolina Department of Water Quality (NCDWQ) Subbasin 03-06-10 of the Cape Fear River Basin. The project watershed consists of mainly of agricultural lands.

The Suck Creek site is located south of SR1261 and east of SR1210. Access to the site is provided via an access road on Richardson Farm. At the downstream terminus, the stream drains a 4.8 mile watershed that includes several impoundments. A vicinity map with directions to the site is provided in Figure 1.

4. Project History and Background

Project activity and reporting history are provided in Table II. Project contact information in Table III and project background history is provided in Table IV.



Source: NCDOT USGS Topographic Quadrangle No. 105

Ecosystem Enhancement Program

FIGURE 1
PROJECT VICINITY MAP

Suck Creek Stream Restoration
Project No. 368
Monitoring Year 4 of 5
Moore County, North Carolina

THE LOUIS BERGER GROUP, INC
30A Vreeland Road
Florham Park, NJ 07932

October 2007

Table II. Project Activity and Reporting History Suck Creek Stream Restoration: Project No. 0117950008		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	N/A	N/A
Final Design - 90%	N/A	2002
Construction	N/A	Apr-03
Temporary S&E mix applied to entire project area	N/A	N/A
Permanent seed mix applied to reach/segments 1 & 2	N/A	Apr-03
Containerized and B&B plantings for reach/segments 1 & 2	N/A	Feb-04
Mitigation Plan / As-built (Year 0 Monitoring - Baseline)	Mar-04	Jul-04
Year 1 Monitoring	Oct-04	Dec-04
Year 2 Monitoring	Sep-05	Dec-05
Year 3 Monitoring	Sep-06	Dec-06
Year 4 Monitoring	July-07	Oct-07

N/A: Historical project documents necessary to provide this data were unavailable.

Table III. Project Contact Table Suck Creek Stream Restoration: Project No. 0117950008	
Designer: Kimley-Horn and Associates, Inc.	P.O. Box 33068, Raleigh, NC, 27636 Mr. Will Wileham, Phone: (919) 677-2000
Construction Contractor: Shamrock Environmental Corporation	PO Box 14987, Greensboro NC 27415 Mr. Bill Wright
Planting Contractor: Shamrock Environmental Corporation	PO Box 14987, Greensboro NC 27415 Mr. Bill Wright
Seeding Contractor: Shamrock Environmental Corporation	PO Box 14987, Greensboro NC 27415 Mr. Bill Wright
Seedmix Sources: Ernst Crownvetch Farms	9006 Mercer Pike, Meadville, PA 16335 (814) 336-2404
Nursery Stock Suppliers: Hillis Nursery Company	92 Gardner Rd., McMinnville, TN 37110 (931) 668-9125
Monitoring Performers:	
Year 1 Monitoring (stream and vegetation): Kimley-Horn and Associates, Inc.	P.O. Box 33068, Raleigh, NC, 27636 Mr. Will Wileham, Phone: (919) 677-2000
Year 4 Monitoring (stream and vegetation): The Louis Berger Group, Inc.	1001 Wade Avenue Ste. 400, Raleigh, NC 27605 Mr. Ed Samanns, Phone: (973) 407-1468

Table IV. Project Background Table Suck Creek Stream Restoration: Project No. 0117950008	
Project County	Moore
Drainage Area of Upper Reach	4.7 sq. miles
Drainage Area of Lower Reach	4.8 sq. miles
Drainage Area Impervious Cover Estimate (%)	<2 percent
Stream Order	2
Physiographic Region	Piedmont
Ecoregion	Sand Hills
Rosgen Classification of As-built	C4
Cowardin Classification	Riverine Upper Perennial Stream Bed Sand Substrate (R3SB2) Lotic System
Dominant Soil Types	Chewacla silt loam, Tetotum silt loam
Reference Site ID	Upstream of project site and Richland Creek
USGS HUC for Project and Reference	3030003
NCDWQ Sub-Basin for Project and Reference	03-06-10
NCDWQ Classification for Project and Reference	C
NCDWQ Classification of Reach 1	C
NCDWQ Classification of Reach 2	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	--
% of project easement fenced	100%

5. Monitoring Plan View

The monitoring plan view is included as Figures 2a-2c.

MONITORING LEGEND

- CVS VEGETATION PLOT
- CROSS SECTION
- PHOTO POINT

LEGEND

- BOULDER CLUSTER
- ROOT WAD
- BOULDER
- ROCK CROSS VANE
- J-HOOK VANE
- LOG VANE
- PROJECT FENCING/EASEMENT BOUNDARY
- EDGE OF WATER
- ℄ OF SUCK CREEK
- WETLAND

BEGIN LONG PROFILE UPPER REACH

PHOTO 1

PLOT7NE

PLOT7NW

UPPER REACH POOL CROSS SECTION

PLOT7SE

PLOT7SW

UPPER RIFFLE PEBBLE COUNT

PHOTO 2

PROJECT FENCING/EASEMENT BOUNDARY

WETLAND (FORMER CHANNEL)

UPPER REACH RIFFLE CROSS SECTION

UPPER POOL PEBBLE COUNT

PHOTO 3

PLOT8NE

PLOT8NW

PLOT8SE

PLOT8SW

END LONG PROFILE UPPER REACH

WETLAND (FORMER CHANNEL)

PLOT6NE

TRIBUTARY

MATCH SHEET 2
MATCH SHEET 3

N

Point	Northing	Easting
Vegetation Plot 1	576043.96	1839368.01
Vegetation Plot 2	576019.30	1839391.38
Vegetation Plot 3	575705.10	1839195.23
Vegetation Plot 4	575670.64	1839195.76
Vegetation Plot 5	575399.70	1838911.21
Vegetation Plot 6	575242.56	1838843.48
Vegetation Plot 7	575223.77	1838820.29
Vegetation Plot 8	575067.05	1838403.48
Vegetation Plot 9	575120.55	1838565.85
Vegetation Plot 10	575043.36	1838193.48
Vegetation Plot 11	575205.99	1837994.38
Vegetation Plot 12	575227.43	1837969.85
Vegetation Plot 13	575441.64	1837796.88
Begin lower Long Profile	575429.88	1838894.84
End lower Long Profile	575714.29	1839149.08
End upper Long Profile	575199.03	1837983.42
Begin upper Long Profile	575500.62	1837736.10
Cross section pool upper rb	575376.79	1837755.68
Cross section pool upper lb	575399.15	1837817.16
Cross section riffle upper rb	575277.86	1837865.67
Cross section riffle upper lb	575317.97	1837891.83
Cross section pool lower lb	575556.65	1838893.48
Cross section pool lower rb	575556.90	1838859.02
Cross section riffle lower lb	575622.50	1838996.76
Cross section riffle lower rb	575578.60	1838971.31
Photo 1	575376.68	1837774.36
Photo 2	575256.24	1837906.95
Photo 3	575512.81	1838927.71
Photo 4	575645.80	1838921.04
Photo 5	575583.03	1839062.27
Photo 6	575444.94	1837767.29
Lower Riffle Pebble Count	575603.43	1838985.77
Lower Pool Pebble Count	575556.35	1838925.75
Upper Riffle Pebble Count	575388.06	1837787.69
Upper Pool Pebble Count	575290.79	1837879.88
CVS Vegetation Plot 1sw	576058.6991	1839356.661
CVS Vegetation Plot 1se	576045.5053	1839325.888
CVS Vegetation Plot 1se	576046.0389	1839325.961
CVS Vegetation Plot 1ne	576015.9035	1839341.033
CVS Vegetation Plot 1nv	576031.1477	1839372.124
CVS Vegetation Plot 2nw	576001.0681	1839386.763
CVS Vegetation Plot 2ne	575987.1485	1839359.269
CVS Vegetation Plot 3sw	575704.0179	1839195.395
CVS Vegetation Plot 3se	575705.9372	1839163.274
CVS Vegetation Plot 3ne	575673.4526	1839162.986
CVS Vegetation Plot 3nw	575671.8718	1839195.902
CVS Vegetation Plot 4nw	575639.496	1839194.039
CVS Vegetation Plot 4ne	575640.206	1839161.685
CVS Vegetation Plot 9sw	575561.2585	1838989.203
CVS Vegetation Plot 9se	575551.9948	1838957.108
CVS Vegetation Plot 9ne	575518.9143	1838963.104
CVS Vegetation Plot 9nw	575527.8744	1838995.987
CVS Vegetation Plot 5sw	575425.219	1838891.809
CVS Vegetation Plot 5se	575411.0425	1838862.195
CVS Vegetation Plot 5ne	575374.9813	1838883.694
CVS Vegetation Plot 5nw	575393.0617	1838906.897
CVS Vegetation Plot 6sw	575064.3144	1838213.632
CVS Vegetation Plot 6se	575089.2387	1838190.699
CVS Vegetation Plot 6ne	575061.8241	1838168.59
CVS Vegetation Plot 6nw	575039.6516	1838195.346
CVS Vegetation Plot 7sw	575382.2513	1837819.244
CVS Vegetation Plot 7se	575387.3783	1837833.186
CVS Vegetation Plot 7ne	575446.0278	1837801.193
CVS Vegetation Plot 7nw	575437.3305	1837783.794
CVS Vegetation Plot 8sw	575224.3318	1837969.265
CVS Vegetation Plot 8se	575240.1652	1837992.754
CVS Vegetation Plot 8ne	575262.6698	1837972.458
CVS Vegetation Plot 8nw	575246.0297	1837945.68

SCALE IN FEET
25 0 50

ECOSYSTEM ENHANCEMENT PROGRAM

FIGURE 2A
MONITORING PLAN VIEW
SUCK CREEK STREAM RESTORATION
PROJECT NO. 011795008
MONITORING YEAR 4 OF 5
MOORE COUNTY, NORTH CAROLINA

THE LOUIS BERGER GROUP, INC
30A VREELAND ROAD
FLORHAM PARK, NJ 07932

NOVEMBER 2007

Point	Northing	Easting
Vegetation Plot 1	576043.96	1839368.01
Vegetation Plot 2	576019.30	1839391.38
Vegetation Plot 3	575705.10	1839195.23
Vegetation Plot 4	575670.64	1839195.76
Vegetation Plot 5	575399.70	1838911.21
Vegetation Plot 6	575242.56	1838843.48
Vegetation Plot 7	575223.77	1838820.29
Vegetation Plot 8	575067.05	1838403.48
Vegetation Plot 9	575120.55	1838565.85
Vegetation Plot 10	575043.36	1838193.48
Vegetation Plot 11	575205.99	1837994.38
Vegetation Plot 12	575227.43	1837969.85
Vegetation Plot 13	575441.64	1837796.88
Begin lower Long Profile	575428.88	1838894.84
End lower Long Profile	575714.29	1839149.08
End upper Long Profile	575199.03	1837983.42
Begin upper Long Profile	575500.62	1837736.10
Cross section pool upper rb	575376.79	1837755.68
Cross section pool upper lb	575399.15	1837817.16
Cross section riffle upper rb	575277.86	1837865.67
Cross section riffle upper lb	575317.97	1837891.83
Cross section pool lower lb	575556.65	1838893.48
Cross section pool lower rb	575556.90	1838959.02
Cross section riffle lower lb	575622.50	1838996.76
Cross section riffle lower rb	575578.60	1838971.31
Photo 1	575376.68	1837774.36
Photo 2	575256.24	1837906.95
Photo 3	575512.81	1838927.71
Photo 4	575645.80	1838921.04
Photo 5	575583.03	1839062.27
Photo 6	575444.94	1837767.29
Lower Riffle Pebble Count	575603.43	1838985.77
Lower Pool Pebble Count	575556.35	1838925.75
Upper Riffle Pebble Count	575388.06	1837787.69
Upper Pool Pebble Count	575299.79	1837879.88
CVS Vegetation Plot 1sw	576058.6991	1839356.661
CVS Vegetation Plot 1se	576045.5053	1839325.888
CVS Vegetation Plot 1se	576046.0389	1839325.961
CVS Vegetation Plot 1ne	576015.9035	1839341.033
CVS Vegetation Plot 1nv	576031.1477	1839372.124
CVS Vegetation Plot 2nw	576001.0681	1839386.763
CVS Vegetation Plot 2ne	575987.1485	1839359.269
CVS Vegetation Plot 3sw	575704.0179	1839195.395
CVS Vegetation Plot 3se	575705.9372	1839163.274
CVS Vegetation Plot 3ne	575673.4526	1839162.986
CVS Vegetation Plot 3nw	575671.8718	1839195.902
CVS Vegetation Plot 4nw	575639.496	1839194.039
CVS Vegetation Plot 4ne	575640.208	1839161.685
CVS Vegetation Plot 9sw	575561.2585	1838989.203
CVS Vegetation Plot 9se	575551.9948	1838957.108
CVS Vegetation Plot 9ne	575518.9143	1838963.104
CVS Vegetation Plot 9nw	575527.8744	1838995.987
CVS Vegetation Plot 5sw	575425.219	1838891.809
CVS Vegetation Plot 5se	575411.0425	1838862.195
CVS Vegetation Plot 5ne	575374.9813	1838883.694
CVS Vegetation Plot 5nw	575393.0617	1838906.897
CVS Vegetation Plot 6sw	575064.3144	1838213.632
CVS Vegetation Plot 6se	575089.2387	1838190.699
CVS Vegetation Plot 6ne	575061.8241	1838168.59
CVS Vegetation Plot 6nw	575039.6516	1838195.346
CVS Vegetation Plot 7sw	575382.2513	1837819.244
CVS Vegetation Plot 7se	575387.3783	1837833.186
CVS Vegetation Plot 7ne	575446.0278	1837801.193
CVS Vegetation Plot 7nw	575437.3305	1837783.794
CVS Vegetation Plot 8sw	575224.3318	1837969.265
CVS Vegetation Plot 8se	575240.1652	1837992.754
CVS Vegetation Plot 8ne	575262.6698	1837972.458
CVS Vegetation Plot 8nw	575246.0297	1837945.68

N

MATCH SHEET 1

MATCH SHEET 2

MATCH SHEET 3

PHOTO 4

PLOT9NW

PLOT9NE

PLOT5NE

PLOT5SE

BEGIN LONG PROFILE LOWER REACH

RIP RAP OUTLET

BENCH MARK NAIL IN FENCE POST ELEV. = 347.46'

SURFACE WATER WETLAND

POND

PROJECT FENCING/ EASEMENT BOUNDARY

PLOT6SE

PLOT6SW

PLOT6NW

18" MAPLE

STREAM CROSSING/FORD

SCALE IN FEET

25 0 50

MONITORING LEGEND

CVS VEGETATION PLOT

CROSS SECTION

PHOTO POINT

LEGEND

BOULDER CLUSTER

ROOT WAD

BOULDER

ROCK CROSS VANE

J-HOOK VANE

LOG VANE

PROJECT FENCING/EASEMENT BOUNDARY

EDGE OF WATER

℄ OF SUCK CREEK

WETLAND

ECOSYSTEM ENHANCEMENT PROGRAM

FIGURE 2B
MONITORING PLAN VIEW
SUCK CREEK STREAM RESTORATION
PROJECT NO. 011795008
MONITORING YEAR 4 OF 5
MOORE COUNTY, NORTH CAROLINA

THE LOUIS BERGER GROUP, INC
30A VREELAND ROAD
FLORHAM PARK, NJ 07932

NOVEMBER 2007

MONITORING LEGEND

CVS VEGETATION PLOT

CROSS SECTION

PHOTO POINT

LEGEND

BOULDER CLUSTER

ROOT WAD

BOULDER

ROCK CROSS VANE

J-HOOK VANE

LOG VANE

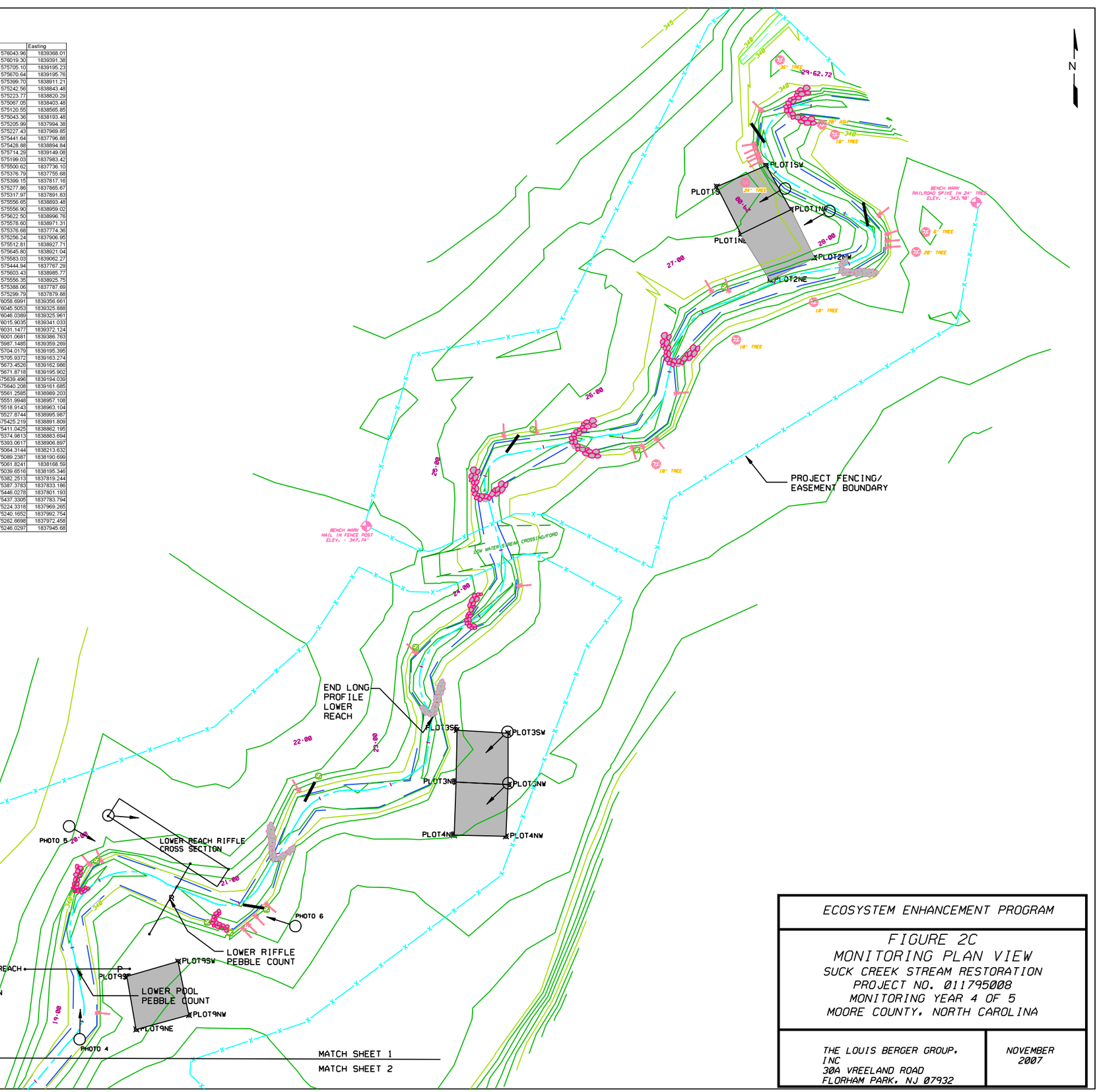
PROJECT FENCING/EASEMENT BOUNDARY

EDGE OF WATER

℄ OF SUCK CREEK

WETLAND

Point	Northing	Easting
Vegetation Plot 1	576043.96	1839368.01
Vegetation Plot 2	576019.30	1839391.38
Vegetation Plot 3	575705.10	1839195.23
Vegetation Plot 4	575670.64	1839195.76
Vegetation Plot 5	575399.70	1838911.21
Vegetation Plot 6	575242.56	1838843.48
Vegetation Plot 7	575223.77	1838820.29
Vegetation Plot 8	575067.05	1838403.48
Vegetation Plot 9	575120.55	1838565.85
Vegetation Plot 10	575043.36	1838193.48
Vegetation Plot 11	575205.99	1837994.38
Vegetation Plot 12	575227.43	1837969.85
Vegetation Plot 13	575441.64	1837796.88
Begin lower Long Profile	575428.88	1838894.84
End lower Long Profile	575714.29	1839149.08
End upper Long Profile	575199.03	1837983.42
Begin upper Long Profile	575500.62	1837736.10
Cross section pool upper rb	575376.79	1837755.68
Cross section pool upper lb	575399.15	1837817.16
Cross section riffle upper rb	575277.86	1837865.67
Cross section riffle upper lb	575317.97	1837891.83
Cross section pool lower lb	575556.65	1838893.48
Cross section pool lower rb	575556.90	1838959.02
Cross section riffle lower lb	575622.50	1838996.76
Cross section riffle lower rb	575578.60	1838971.31
Photo 1	575376.68	1837774.36
Photo 2	575256.24	1837906.95
Photo 3	575512.81	1838927.71
Photo 4	575645.80	1838921.04
Photo 5	575583.03	1839062.27
Photo 6	575444.94	1837767.29
Lower Riffle Pebble Count	575603.43	1838985.77
Lower Pool Pebble Count	575556.35	1838925.75
Upper Riffle Pebble Count	575388.06	1837787.69
Upper Pool Pebble Count	575299.79	1837879.88
CVS Vegetation Plot 1sw	576058.6991	1839356.661
CVS Vegetation Plot 1se	576045.5053	1839325.888
CVS Vegetation Plot 1se	576046.0389	1839325.961
CVS Vegetation Plot 1ne	576015.9035	1839341.033
CVS Vegetation Plot 1nv	576031.1477	1839372.124
CVS Vegetation Plot 2nw	576001.0681	1839386.763
CVS Vegetation Plot 2ne	575987.1485	1839359.269
CVS Vegetation Plot 3sw	575704.0179	1839195.395
CVS Vegetation Plot 3se	575705.9372	1839163.274
CVS Vegetation Plot 3ne	575673.4526	1839162.986
CVS Vegetation Plot 3nw	575671.8718	1839195.902
CVS Vegetation Plot 4nw	575639.496	1839194.039
CVS Vegetation Plot 4ne	575640.208	1839161.685
CVS Vegetation Plot 9sw	575561.2585	1838989.203
CVS Vegetation Plot 9se	575551.9948	1838957.106
CVS Vegetation Plot 9ne	575518.9143	1838963.104
CVS Vegetation Plot 9nw	575527.8744	1838995.987
CVS Vegetation Plot 5sw	575425.219	1838891.809
CVS Vegetation Plot 5se	575411.0425	1838862.195
CVS Vegetation Plot 5ne	575374.9813	1838883.694
CVS Vegetation Plot 5nw	575393.0617	1838906.897
CVS Vegetation Plot 6sw	575064.3144	1838213.632
CVS Vegetation Plot 6se	575089.2387	1838190.699
CVS Vegetation Plot 6ne	575061.8241	1838168.59
CVS Vegetation Plot 6nw	575039.6516	1838195.346
CVS Vegetation Plot 7sw	575382.2513	1837819.244
CVS Vegetation Plot 7se	575387.3783	1837833.186
CVS Vegetation Plot 7ne	575446.0278	1837801.193
CVS Vegetation Plot 7nw	575437.3305	1837783.794
CVS Vegetation Plot 8sw	575224.3318	1837969.265
CVS Vegetation Plot 8se	575240.1652	1837992.754
CVS Vegetation Plot 8ne	575262.6698	1837972.458
CVS Vegetation Plot 8nw	575246.0297	1837945.68



ECOSYSTEM ENHANCEMENT PROGRAM

FIGURE 2C
MONITORING PLAN VIEW
SUCK CREEK STREAM RESTORATION
PROJECT NO. 011795008
MONITORING YEAR 4 OF 5
MOORE COUNTY, NORTH CAROLINA

THE LOUIS BERGER GROUP, INC
30A VREELAND ROAD
FLORHAM PARK, NJ 07932

NOVEMBER 2007

III. Project Condition and Monitoring Results

A. Vegetation Assessment

1. Vegetative Problem Areas

Vegetative Problem Areas are defined as either lacking vegetation or containing exotic vegetation. One problem area was identified where vegetation was lacking during Monitoring Year 4.

2. Vegetative Problem Area Plan View

The location of the vegetative problem area is shown in Appendix A.

B. Stream Assessment

1. Procedural Items

During the Year 2 (2005) field sampling effort at the lower pool cross section, the right bank stake could not be found. The field crew used a sub-meter accurate GPS unit to locate to the approximate coordinates of the previous year's location. When the stake location could not be located, a new end point was created. Conduit was driven into the ground to mark the location, GPS coordinates were established at the location of the installed conduit, the elevation of the top of conduit was established using a laser level and rod (tied into the permanent benchmark located on-site) and the cross section was surveyed. This cross section location was used during Year 3 and Year 4 monitoring.

Hydrologic Criteria

A stream gauge was installed the first week in August 2006. During the period of available data (January – October 2007) 7 bankfull events were recorded. A graphic of the data collected is provided in Appendix B.

Bank Stability Assessments

The revised EEP monitoring report guidelines do not require bank stability assessments until year 5, post-construction. Therefore, sediment export evaluations are not required for the year 4 monitoring period.

2. Stream Problem Areas Plan View

The position of each structural problem area is shown in Appendix B.

3. Stream Problem Areas Table

There were four new problem areas identified during Year 4 monitoring, two of which resulted from beaver, one from livestock and one from a dislodged root wad. Year 3 problem areas had degraded further with obvious scour on the left bank at stations 18+00 and 26+60. The root wad failure at Station 19+10 has not entirely stabilized, minor scouring occurring behind it, no maintenance recommended. There is scour underneath the root wad that is eroding the bank; however it is vegetated and not likely to require maintenance. A summary of the problem structures observed during Year 4 monitoring with notes about each structures status is provided in Appendix B.

Four maintenance actions are recommended at this time. Where cattle have entered the stream and caused bank destabilization, replacement and strengthening of fencing at the first cattle crossing on the upper reach is recommended. The removal of a beaver dam/debris dam at station 11+30 is recommended to disrupt ponding upstream and restore appropriate flow and water surface levels. Maintenance should be considered on the cross vanes at Stations 18+00, 21+60, 25+70 and 26+60 since scour between and around individual rocks in the arm is extensive and the arm of the structure is not creating a bar behind the structure of any kind. Piping between vane rocks still continues. Additional maintenance at Station 25+50 to reposition the log vane structure is suggested.

The mid-channel bars noted as problem areas (Stations 4+00 to 4+60 and Station 19+10) have become vegetated with rice cutgrass (*Leersia oryzoides*). This feature likely occurs because of unfocused velocity and too slight a water surface slope. Low water levels due to the late summer drought may have also created shallow water conditions conducive for the germination and establishment of rice-cut grass.

4. Number Issue Photos Section

A photograph of each structural problem area is provided in Appendix B.

5. Fixed Station Photos

Photographs taken at each established photograph station are provided in Appendix B.

6. Stability Assessment

A semi-qualitative summary of results from the visual inspection is proved in Table VIIa for the Upper Reach and Table VIIb for the Lower Reach.

Table VIIa. Categorical Stream Feature Visual Stability Assessment – Upper Reach
Suck Creek Stream Restoration: Project No. 0117950008
Segment/Reach: Upper Reach

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	N/A	N/A	88	88	88	
B. Pools	N/A	N/A	88	88	88	
C. Thalweg	N/A	N/A	100	100	100	
D. Meanders	N/A	N/A	100	100	100	
E. Bed General	N/A	N/A	99	99	94	
F. Bank Condition	N/A	N/A	96	96	94	
G. Vanes / J Hooks etc.	N/A	N/A	100	100	100	
H. Wads and Boulders	N/A	N/A	100	100	100	

N/A: Historical project documents necessary to provide this data were unavailable at the time of this report submission.

Table VIIb. Categorical Stream Feature Visual Stability Assessment – Lower Reach
Suck Creek Stream Restoration: Project No. 0117950008
Segment/Reach: Lower Reach

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	N/A	N/A	93.5	93.5	93.5	
B. Pools	N/A	N/A	100	100	100	
C. Thalweg	N/A	N/A	100	100	100	
D. Meanders	N/A	N/A	99	99	99	
E. Bed General	N/A	N/A	100	100	96	
F. Bank Condition	N/A	N/A	100	100	96	
G. Vanes / J Hooks etc.	N/A	N/A	85	85	84	
H. Wads and Boulders	N/A	N/A	96	96	96	

N/A: Historical project documents necessary to provide this data were unavailable at the time of this report submission.

7. Quantitative Measures Summary Tables

Graphic interpretations of cross sections, profiles and sediment distributions are shown in Appendix B. A summary of geomorphic measurements is shown in Table VIII and Table IX.

Table VIII. Baseline Morphology and Hydraulic Summary
Suck Creek Stream Restoration: Project No. 0117950008
Segment/Reach: Entire Reach

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)													15	20	N/A	N/A	N/A	21.2
Floodprone Width (ft)																		
BF Cross Sectional Area (ft^2)													18	36	N/A	N/A	N/A	18.1
BF Mean Depth (ft)													1.2	1.8	N/A	N/A	N/A	1.3
BF Max Depth (ft)													1.8	2.9	N/A	N/A	N/A	2.2
Width/Depth Ratio													12.5	11.1	N/A	N/A	N/A	16.3
Entrenchment Ratio													N/A	N/A	N/A	N/A	N/A	N/A
Bank Height Ratio													N/A	N/A	N/A	N/A	N/A	N/A
Wetted Perimeter (ft)													N/A	N/A	N/A	N/A	N/A	N/A
Hydraulic Radius (ft)													N/A	N/A	N/A	N/A	N/A	N/A
Pattern																		
Channel Beltwidth (ft)													21	99	N/A	20	104	N/A
Radius of Curvature (ft)													32	69	N/A	35	55	N/A
Meander Wavelength (ft)													130	265	N/A	120	265	N/A
Meander Width ratio																		
Profile																		
Riffle length (ft)													N/A	N/A	N/A	10	42	N/A
Riffle slope (ft/ft)													.45	1.0	N/A	0.5	1.0	N/A
Pool length (ft)													N/A	N/A	N/A	20	128	N/A
Pool spacing (ft)													60	140	N/A	54	171	N/A
Substrate																		
d50 (mm)													N/A	N/A	N/A	0.8	20	N/A
d84 (mm)													N/A	N/A	N/A	10	34	N/A
Additional Reach Parameters																		
Valley Length (ft)																		
Channel Length (ft)																		
Sinuosity																		
Water Surface Slope (ft/ft)																		
BF slope (ft)																		
Rosgen Classification																		
*Habitat Index																		
*Macrobenthos																		

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria
N/A: Historical project documents necessary to provide this data were unavailable.

Table IX. Morphology and Hydraulic Monitoring Summary
Suck Creek Stream Restoration: Project No. 0117950008
Segment/Reach:

Parameter	Cross Section 1 Upper Pool						Cross Section 2 Upper Riffle						Cross Section 3 Lower Pool						Cross Section 4 Lower Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	27.3	26.2	24.7	26.4			21.2	19.2	17.0	20.2			31	9.9	10.5	11.2			20.7	16.6	16.6	16.4		
Floodprone Width (ft)	N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A			N/A	N/A	N/A	N/A		
BF Cross Sectional Area (ft^2)	34.3	32.5	28.8	33.2			18.1	15.2	15.7	17.0			33	13.4	11.4	19.6			27.4	20.9	20.5	22.3		
BF Mean Depth (ft)	1.8	1.2	1.2	1.3			0.9	0.8	0.9	0.8			1.1	1.4	1.1	1.8			1.3	1.3	1.2	1.4		
BF Max Depth (ft)	2.8	2.7	2.7	2.8			1.6	1.6	1.6	1.7			2.8	1.6	1.4	2.1			2.2	2	1.9	2.1		
Width/Depth Ratio	7.4	21.1	21.1	20.9			25	24.2	18.5	23.9			29.2	7.3	9.7	6.4			15.6	13.2	13.4	12.1		
Entrenchment Ratio	2.1	N/A	N/A	N/A			2.8	N/A	N/A	N/A			2.5	N/A	N/A	N/A			3.2	N/A	N/A	N/A		
Bank Height Ratio																								
Wetted Perimeter (ft)	N/A	27.3	25.8	27.5			N/A	19.7	17.6	21.0			N/A	11.7	12	13.3			N/A	13.2	17.7	17.9		
Hydraulic Radius (ft)	N/A	1.2	1.1	1.2			N/A	0.8	0.9	0.8			N/A	1.1	0.9	1.5			N/A	1.2	1.2	1.2		
Substrate																								
d50 (mm)	17.9	14.8	N/A	6			13.2	7.3	0.7	6.0			0.8	0.8	N/A	4			20	0.7	0.5	4.0		
d84 (mm)	32	32	N/A	16			30.8	34	23	16			10	9	N/A	11			33.4	5	133	11		

Parameter	MY-01 (2004)			MY-02 (2005)			MY-03 (2006)			MY-04 (2007)			MY-05 (2008)			MY+ (XXXX)		
Upper Reach																		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel beltwidth (ft)	21	99	N/A	27	13	20	27	13	20	13	27	20						
Radius of curvature (ft)	32	69	N/A	30	33	31.5	30	33	31.5	30	33	31.5						
Meander wavelength (ft)	130	265	N/A	160	141	150	160	141	150	141	160	150						
Meander width ratio	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Profile																		
Riffle length (ft)	10	42	N/A	75	32	30	26	11	3	8	17	13						
Riffle slope (ft/ft)	0.5%	1.0%	N/A	0.1	0.09	0.01	0.41	0.38	0.05	.012	.060	.031						
Pool length (ft)	20	128	N/A	45	18	7	86	56	12	9	27	18						
Pool spacing (ft)	54	171	N/A	88	68	53	99	64	51	9	122	52						
Lower Reach																		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel beltwidth (ft)	21	99	N/A	27	13	20	27	13	20	13	27	20						
Radius of curvature (ft)	32	69	N/A	30	33	31.5	30	33	31.5	30	33	31.5						
Meander wavelength (ft)	130	265	N/A	160	141	150	160	141	150	141	160	150						
Meander width ratio	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A						
Profile																		
Riffle length (ft)	10	42	N/A	56	26	8	27	21	8	8	31	19						
Riffle slope (ft/ft)	0.5%	1.0%	N/A	0.08	0.03	0.006	0.07	0.021	0.013	.005	.048	.024						
Pool length (ft)	20	128	N/A	34	20	10	77	35	19	19	66	40						
Pool spacing (ft)	54	171	N/A	123	83	77	119	84	23	21	126	67						

Table IX. Morphology and Hydraulic Monitoring Summary – Continued						
Suck Creek Stream Restoration: Project No. 0117950008						
Segment/Reach:						
	MY-01 (2004)	**MY-02 (2005)**	**MY-03 (2006)**	**MY-04 (2007)**	**MY-05 (2008)**	**MY+ (XXXX)**
Additional Reach Parameters		Lower/Upper	Lower/Upper	Lower/Upper		
Valley length (ft)	N/A	411/386	411/386	411/386		
Channel length (ft)	N/A	515/408	515/408	515/408		
Sinuosity	N/A	1.25/1.05	1.25/1.05	1.25/1.05		
Water surface slope (ft/ft)	N/A	0.0022/0.0017	0.0020/0.0021	0.0019/0.00009		
Bankfull slope (ft)	N/A	0.0023/0.0029	0.0054/0.0035	0.0080/0.0008		
Rosgen Classification	C5	C5	C5	C5		
*Habitat Index	N/A	N/A	N/A	N/A		
*Macrobenthos	N/A	N/A	N/A	N/A		

* Inclusion will be project specific and determined primarily by As-built monitoring plan/success criteria
N/A: Historical project documents necessary to provide this data were unavailable at the time of this report submission.

IV. Methodology Section

No unavoidable deviations from established protocols occurred during year 4 monitoring. The taxonomic standard that was applied for vegetation data collection was Flora of the Carolinas, Virginia, Georgia, and surrounding areas by: Alan S. Weakley. CVS-EEP Protocol for Recording Vegetation Version 4.0 http://cvs.bio.unc.edu/methods.htm was used for collecting vegetation data, and this was the second year using this method for the Suck Creek Stream Restoration Project (Lee, et al. 2006).

V. References

Lee, Michael T., R. K. Peet, S. D. Roberts, and T. R. Wentworth. 2006. CVS-EEP Protocol for Recording Vegetation, Version 4.0 (http://cvs.bio.unc.edu/methods.htm)

Weakley, Alan S., *Flora of the Carolinas, Virginia, Georgia, and surrounding area*, working draft of January 2006. University of NC Herbarium, N.C. Botanical Garden, Chapel Hill, NC. http://www.herbarium.unc.edu/. Accessed August 2007.

APPENDICES

Click on the Desired Link Below

Appendix A
(Veg. Data & Photos)

Appendix B
(Stream Data & Photos)

APPENDIX A

1. VEGETATION DATA TABLES

1. Vegetation Data Tables

Table 1. Vegetation Metadata	
Report Prepared By	Tisha Johnson
Date Prepared	8/13/2007
Database name	CVS_EEP_DataEntry_v202.mdb
Database location	C:/work/CVS-EEP
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	This worksheet, which is a summary of the project and the project data.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Stem Count by Plot and Spp	Count of living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	EEP Project Number .00012
Project Name	Suck Creek
Description	Stream Restoration
Length (ft)	
Stream-to-edge width (ft)	
Area (sq m)	
Required Plots (calculated)	
Sampled Plots	

Table 2. Plots				
plot	**Date Sampled**	**Living Stems**	**Dead Or Missing Stems**	**# species**
79-1-8-year:1	7/18/2007	10	1	3
79-1-9-year:1	7/5/2007	1	0	1
79-1-4-year:1	7/5/2007	7	2	5
79-1-5-year:1	7/5/2007	6	1	4
79-1-6-year:1	7/18/2007	24	2	6
79-1-7-year:1	7/18/2007	15	3	4
79-1-1-year:1	7/5/2007	5	1	3
79-1-2-year:1	7/5/2007	14	1	3
79-1-3-year:1	7/5/2007	12	1	5

Table 3. Vigor		
Vigor	**Count**	**Percent**
	24	22.6
0	4	3.8
1	1	0.9
2	13	12.3
3	36	34
4	44	41.5
Missing	8	7.5

Table 3. Vegetation Vigor by Species							
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**
	Alnus serrulata	1	1	1			1
	Betula nigra	20	17	2		3	
	Celtis occidentalis			1			1
	Cornus amomum		1				1
	Diospyros virgininana	1					
	Fraxinus pennsylvanica	6			1		
	Liquidambar styraciflua	16		1			
	Pinus taeda	1	1	3			2
	Quercus phellos	1	1				
	Salix nigra	7	8	5		1	1
	Platanus occidentalis	5	5				
	Acer rubrum	1	2				1
TOT:	**12**	**44**	**36**	**13**	**1**	**4**	7

Table 4. Damage		
Damage	**Count**	**Percent Of Stems**
(no damage)	86	66.2
Livestock	19	14.6
Insects	11	8.5
Beaver	6	4.6
Unknown	4	3.1
Drought	2	1.5
(other damage)	2	1.5

Table 5. Vegetation Damage by Species									
	Species	**Total Stems**	**# plots**	**avg# stems**	**plot 79-1-1-year:1**	**plot 79-1-2-year:1**	**plot 79-1-3-year:1**	**plot 79-1-4-year:1**	**plot 79-1-5-year:1**
	Acer rubrum	4	4						
	Alnus serrulata	4	3				1		
	Betula nigra	66	47	2	1	5	11		
	Celtis occidentalis	2	1				1		
	Cornus amomum	2	2						
	Diospyros virginiana	1	1						
	Fraxinus pennsylvanica	8	5				3		
	Liquidambar styraciflua	1	1						
	Pinus taeda	7	3			2	1	1	
	Platanus occidentalis	10	4	4		2			
	Quercus phellos	2	2						
	Salix nigra	22	12		1	2	2	3	2
TOT:		**130**	**86**	**6**	**2**	**11**	**19**	**4**	**2**

Table 6. Damage by Plot									
	Year 1 plots	**All Damage Categories**	**(no damage)**	**Beaver**	**Drought**	**Insects**	**Livestock**	**Unknown**	**(other damage)**
	79-1-1	6	4					1	1
	79-1-2	15	8			7			
	79-1-3	13	10			3			
	79-1-4	9	8			1			
	79-1-5	7	5					2	
	79-1-6	33	20	6	2		4	1	
	79-1-7	18	3				14		1
	79-1-8	28	27				1		
	79-1-9	1	1						
TOT:	**9**	**130**	**86**	**6**	**2**	**11**	**19**	**4**	**2**

Table 7. Stem count by plot and species													
	Species	**Total Stems**	**# plots**	**Average # stems**	**plot 79-1-1-year:1**	**plot 79-1-2-year:1**	**plot 79-1-3-year:1**	**plot 79-1-4-year:1**	**plot 79-1-5-year:1**	**plot 79-1-6-year:1**	**plot 79-1-7-year:1**	**plot 79-1-8-year:1**	**plot 79-1-9-year:1**
	Acer rubrum	3	2	1.5				2		1			
	Alnus serrulata	3	2	1.5						2		1	
	Betula nigra	39	6	6.5	1	9	1			9	11	8	
	Celtis occidentalis	1	1	1							1		
	Cornus amomum	1	1	1					1				
	Diospyros virginiana	1	1	1					1				
	Fraxinus pennsylvanica	8	5	1.6			1		3		2	1	1
	Liquidambar styraciflua	1	1	1				1					
	Pinus taeda	5	3	1.67			2	2		1			
	Platanus occidentalis	10	4	2.5	2	2		1		5			
	Quercus phellos	2	2	1			1	1					
	Salix nigra	20	6	3.33	2	3	7		1	6	1		
TOT:	**12**	**94**	**12**		**5**	**14**	**12**	**7**	**6**	**24**	**15**	**10**	**1**

APPENDIX A

2. VEGETATION PROBLEM AREA PHOTOS

4.0 Vegetation Problem Area Photos

View of bare floodplain looking east near vegetation plot 3 – 7/18/2007

View of bare floodplain looking west, Stations 23+40 thru 23+70 – 7/18/2007

APPENDIX A

3. VEGETATION MONITORING PLOT PHOTOS

3. Vegetation Monitoring Plot Photos

Taken on 7/18/2007, a representative photo of each vegetation plot is provided below.

CVS Plot 1 (Formerly Plot 2 in 2006 report)

CVS Plot 2 (Formerly Plot 1 in 2006 report)

CVS Vegetation Plot 3

CVS Vegetation Plot 4

CVS Vegetation Plot 5

CVS Vegetation Plot 6

CVS Vegetation Plot 7

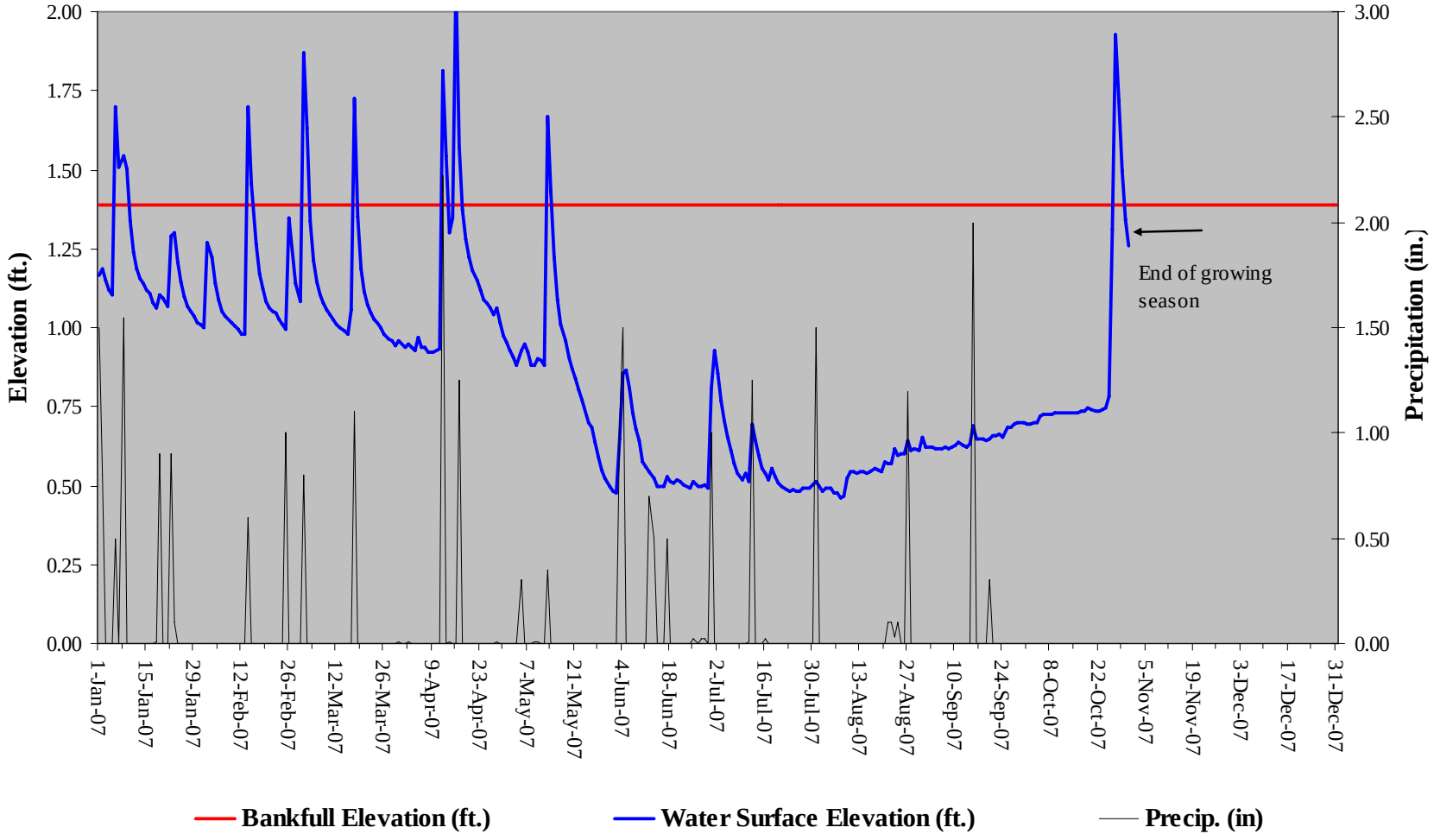
CVS Plot 8 (formerly Plot 7 in 2006 report)

CVS Vegetation Plot 9

APPENDIX B

1. STREAM GAUGE DATA

Suck Creek Mitigation Site
Stream Gauge ASSG-1 (Serial No.N4497E95)



APPENDIX B

2. PROBLEM AREAS PLAN VIEW

MONITORING LEGEND

CROSS SECTION

PHOTO POINT

LEGEND

BOULDER CLUSTER

ROOT WAD

BOULDER

ROCK CROSS VANE

J-HOOK VANE

LOG VANE

PROJECT FENCING/EASEMENT BOUNDARY

EDGE OF WATER

℄ OF SUCK CREEK

WETLAND

STREAM PROBLEM AREA

BEGIN LONG PROFILE UPPER REACH

UPPER REACH POOL CROSS SECTION

UPPER RIFFLE PEBBLE COUNT

PROJECT FENCING/EASEMENT BOUNDARY

WETLAND (FORMER CHANNEL)

UPPER REACH RIFFLE CROSS SECTION

VEGETATION PLOT A

UPPER POOL PEBBLE COUNT

END LONG PROFILE UPPER REACH

WETLAND (FORMER CHANNEL)

MID CHANNEL BAR

TRIBUTARY

MATCH SHEET 2
MATCH SHEET 3

N

SCALE IN FEET
25 0 50

ECOSYSTEM ENHANCEMENT PROGRAM

EXHIBIT B-1A
STREAM PROBLEM AREA PLAN VIEW
SUCK CREEK STREAM RESTORATION
PROJECT NO. 011795008
MONITORING YEAR 4 OF 5
MOORE COUNTY, NORTH CAROLINA

THE LOUIS BERGER GROUP, INC
30A VREELAND ROAD
FLORHAM PARK, NJ 07932

NOVEMBER 2007

N

MATCH SHEET 1

MATCH SHEET 2

BEGIN LONG PROFILE LOWER REACH

ARM SCOUR

SURFACE WATER WETLAND

PROJECT FENCING/ EASEMENT BOUNDARY

DAMAGED BANK

BEAVER DAM

FLOW BACKUP

MATCH SHEET 3

MATCH SHEET 2

SCALE IN FEET

25 0 50

MONITORING LEGEND

- CROSS SECTION
- PHOTO POINT

LEGEND

- BOULDER CLUSTER
- ROOT WAD
- BOULDER
- ROCK CROSS VANE
- J-HOOK VANE
- LOG VANE
- PROJECT FENCING/EASEMENT BOUNDARY
- EDGE OF WATER
- ℄ OF SUCK CREEK
- WETLAND
- STREAM PROBLEM AREA

ECOSYSTEM ENHANCEMENT PROGRAM

EXHIBIT B-1B
STREAM PROBLEM AREA PLAN VIEW
SUCK CREEK STREAM RESTORATION
PROJECT NO. 011795008
MONITORING YEAR 4 OF 5
MOORE COUNTY, NORTH CAROLINA

THE LOUIS BERGER GROUP, INC
30A VREELAND ROAD
FLORHAM PARK, NJ 07932

NOVEMBER 2007

MONITORING LEGEND

CROSS SECTION

PHOTO POINT

LEGEND

BOULDER CLUSTER

ROOT WAD

BOULDER

ROCK CROSS VANE

J-HOOK VANE

LOG VANE

PROJECT FENCING/EASEMENT BOUNDARY

EDGE OF WATER

℄ OF SUCK CREEK

WETLAND

STREAM PROBLEM AREA

N

ARM SCOUR

CROSS VANE

ROOT WAD FAILURE

PROJECT FENCING/
EASEMENT BOUNDARY

END LONG
PROFILE
LOWER
REACH

LOWER REACH RIFFLE
CROSS SECTION

ARM SCOUR

LOWER RIFFLE
PEBBLE COUNT

LOWER REACH
POOL
CROSS
SECTION

LOWER POOL
PEBBLE COUNT

MID CHANNEL BAR

MATCH SHEET 1

MATCH SHEET 2

SCALE IN FEET
25 0 50

ECOSYSTEM ENHANCEMENT PROGRAM

EXHIBIT B-1C
STREAM PROBLEM AREA PLAN VIEW
SUCK CREEK STREAM RESTORATION
PROJECT NO. 011795008
MONITORING YEAR 4 OF 5
MOORE COUNTY, NORTH CAROLINA

THE LOUIS BERGER GROUP, INC
30A VREELAND ROAD
FLORHAM PARK, NJ 07932

NOVEMBER
2007

APPENDIX B

3. TABLE B.2. STREAM PROBLEM AREAS

Table B.1. Stream Problem Areas **Suck Creek Stream Restoration: Project No. 0117950008**			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number /ID**
Mid channel bar	4+00 to 4+60	Slope too slight to move sediment. More sediment has deposited and vegetation has established.	Station 4+00
Damaged bank	6+40	Cows trampled when entering stream.	Station 6+40
Flow backup	8+75 – 11+30	Beaver dam/debris dam at cross vane structure at 11+30	Station 8+75, 9+00-11+30
Cross Vane blockage	11+30	Beaver dam/debris dam	Station 11+30
Cross Vane, LB arm scour	18+00	Cross Vane failure, flow undermined left bank and now water flows around the vane instead of through it.	Station 18+00
Mid channel bar	19+00	Sediment has deposited and vegetation has established.	Station 19+10
Cross Vane, arm scour	21+60	Large voids between rocks in vane. No change from prior year.	Station 21+60
Log vane failure	25+50	Log vane has separated from bank, altering channel flow.	Station 25+50
Cross Vane	25+70	Large voids between rocks in vane. No change from prior year.	Station 25+70
Cross Vane, LB arm scour	26+60	Large voids between rocks, Scour of left bank worsening.	Station 26+60

APPENDIX B

4. STREAM PROBLEM AREA PHOTOS

4. Representative Stream Problem Area Photos

Taken on 7/18/2007, a photo of each structural problem area with corresponding stationing.

Station 4+00

Station 6+40 Right Bank

Station 6+40 Left Bank

Station 8+75

Station 9+00-11+30

Station 11+30 looking upstream

Station 11+30 1 month earlier looking downstream

Station 18+00

Station 19+00

Station 21+60

Station 25+50

Station 25+70

Station 26+60, left bank arm scour

APPENDIX B

5. STREAM PHOTO-STATION PHOTOS

Stream Photo-Station Photos

Photo Station 1 – 7/18/2007

Photo Station 2 – 7/18/2007

Photo Station 3 – 7/18/2007

Photo Station 4 – 7/18/2007

Photo Station 5 – 7/18/2007

Photo Station 6 – 7/18/2007

APPENDIX B

6. TABLE B.2. QUALITATIVE VISUAL STABILITY ASSESSMENT

6. Table B.2. Qualitative Visual Stability Assessment

Table B.2.a. Visual Morphological Stability Assessment Suck Creek Stream Restoration - Upper Reach: 2,088 feet

Feature Category	Metric (per As-Built and reference baseline)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	7	8	8	88	
	2. Armor Stable?		0			
	3. Facet grade appears stable?	7	8	8	88	
	4. Minimal evidence of embedding / fining?	7	8	8	88	
	5. Length appropriate?	7	8	8	88	88
B. Pools	1. Present?	7	8	7	88	
	2. Sufficient depth?	7	8	7	88	
	3. Length appropriate?	7	8	7	88	88
C. Thalweg	1. Upstream of meander bend centering?	8	8	8	100	
	2. Downstream of meander bend centering?	8	8	8	100	100
D. Meanders	1. Outer bend in state of limited / controlled erosion	7	7	7	100	
	2. Of those eroding, # w/concomitant point bar formation?					
	3. Apparent Rc within spec?	7	7	7	100	
	4. Sufficient Floodplain Access and Relief?	7	7	7	100	100
E. Bed General	1. General channel bed aggradation areas?			90/2088	96	
	2. Channel bed degradation?			25/2088	99	94
F. Vanes	1. Free of back or arm scour?	7	7	7	100	
	2. Height appropriate?	7	7	7	100	
	3. Angle and geometry appear appropriate?	7	7	7	100	
	4. Free of piping or other structural failures?	7	7	7	100	100
G. Wads / Boulders	1. Free of Scour?	7	7	7	100	
	2. Footing Stable?	7	7	7	100	100

Table B.2.b. Visual Morphological Stability Assessment Suck Creek Stream Restoration - Lower Reach: 875 feet

Feature Category	Metric (per As-Built and reference baselines)	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	23	23	23	100	
	2. Armor Stable?		0			
	3. Facet grade appears stable?	20	23	21	87	
	4. Minimal evidence of embedding / fining?	20	23	23	87	
	5. Length appropriate?	23	23	23	100	93.5
B. Pools	1. Present?	24	24	24	100	
	2. Sufficient depth?	24	24	24	100	
	3. Length appropriate?	24	24	24	100	100
C. Thalweg	1. Upstream of meander bend centering?	21	21	21	100	
	2. Downstream of meander bend centering?	21	21	21	100	100
D. Meanders	1. Outer bend in state of limited / controlled erosion	20	21	20	95	
	2. Of those eroding, # w/concomitant point bar formation?	21	21	21	100	
	3. Apparent Rc within spec?	21	21	21	100	
	4. Sufficient Floodplain Access and Relief?	21	21	21	100	99
E. Bed General	1. General channel bed aggradation areas?			0/875	100	
	2. Channel bed degradation?			35/875	96	96
F. Vanes	1. Free of back or arm scour?	15	19	15	79	
	2. Height appropriate?	17	19	17	90	
	3. Angle and geometry appear appropriate?	19	19	19	100	
	4. Free of piping or other structural failures?	14	19	14	73	84
G. Wads / Boulders	1. Free of Scour?	25	26	24	96	
	2. Footing Stable?	25	26	25	96	96

APPENDIX B

7. CROSS SECTION PLOTS AND RAW DATA TABLES

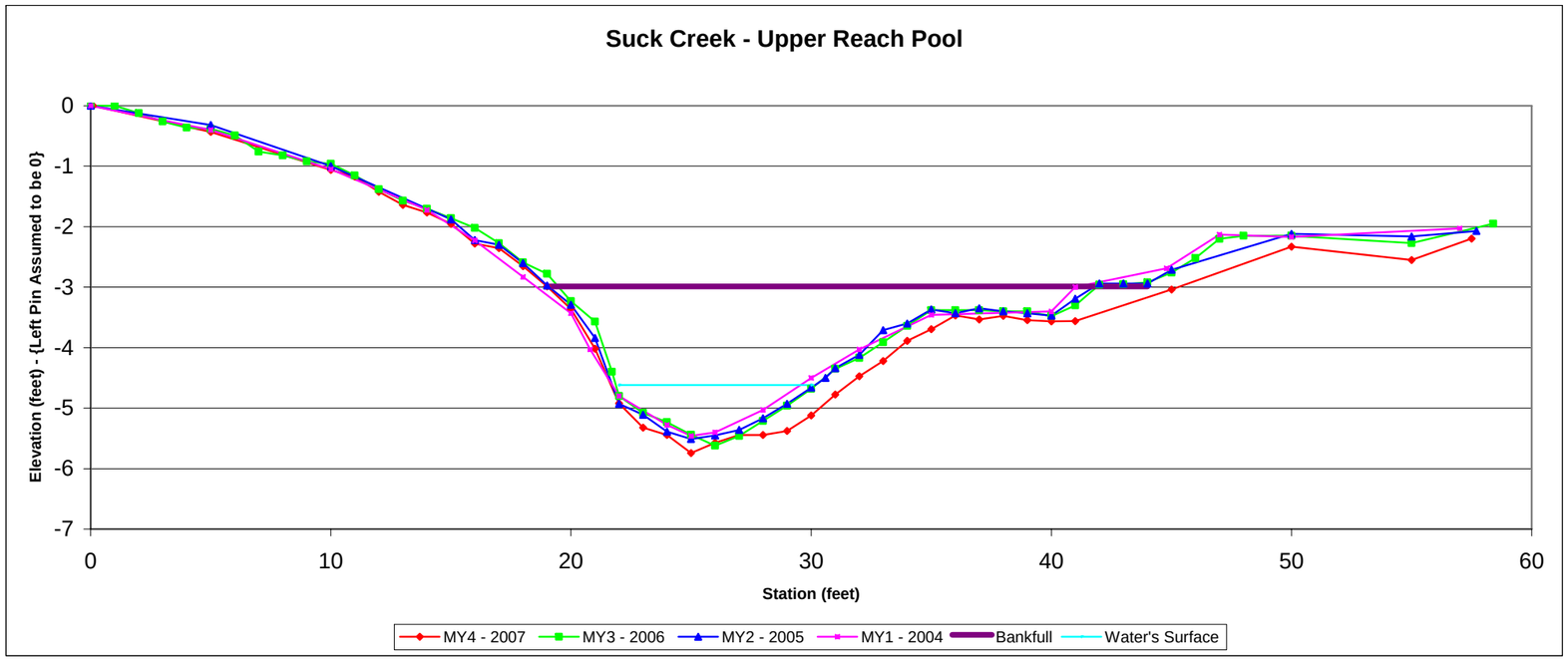
Project Name:	Suck Creek	**Cross Section:**	Upper reach
Project Number:	11795008	**Feature:**	Pool
Date:	06/21/07	**Crew:**	RB, TJ, & MO

MY4 - 2007 2007 Survey		MY3 - 2006 2006 Survey		MY2 - 2005 2005 Survey		MY1 - 2004 2004 Survey	
STA	ELEV	STA	ELEV	STA	ELEV	STA	ELEV
0.1	0.00	0.0	0.00	0.0	0.00	0.0	0.00
5.0	-0.43	1.0	0.00	5.0	-0.32	5.0	-0.40
10.0	-1.06	2.0	-0.12	10.0	-1.00	10.0	-1.05
11.0	-1.17	3.0	-0.26	15.0	-1.88	14.0	-1.72
12.0	-1.42	4.0	-0.36	16.0	-2.22	16.0	-2.23
13.0	-1.64	5.0	-0.38	17.0	-2.30	18.0	-2.83
14.0	-1.77	6.0	-0.49	18.0	-2.60	20.0	-3.43
15.0	-1.95	7.0	-0.76	19.0	-2.97	20.8	-4.03
16.0	-2.28	8.0	-0.82	20.0	-3.29	22.0	-4.80
17.0	-2.36	9.0	-0.92	21.0	-3.84	24.0	-5.28
18.0	-2.65	10.0	-0.96	22.0	-4.93	25.0	-5.46
19.0	-2.99	11.0	-1.15	23.0	-5.11	26.0	-5.40
20.0	-3.36	12.0	-1.38	24.0	-5.39	28.0	-5.03
21.0	-4.02	13.0	-1.57	25.0	-5.51	30.0	-4.50
22.0	-4.92	14.0	-1.70	26.0	-5.45	32.0	-4.03
23.0	-5.32	15.0	-1.86	27.0	-5.36	35.0	-3.46
24.0	-5.44	16.0	-2.02	28.0	-5.17	40.0	-3.40
25.0	-5.74	17.0	-2.27	29.0	-4.93	41.0	-3.00
26.0	-5.57	18.0	-2.59	30.0	-4.66	44.8	-2.69
27.0	-5.44	19.0	-2.78	30.6	-4.50	47.0	-2.13
28.0	-5.44	20.0	-3.23	31.0	-4.34	50.0	-2.17
29.0	-5.38	21.0	-3.57	32.0	-4.12	57.0	-2.03
30.0	-5.12	21.7	-4.40	33.0	-3.71		
31.0	-4.77	22.0	-4.80	34.0	-3.60		
32.0	-4.47	23.0	-5.08	35.0	-3.37		
33.0	-4.22	24.0	-5.23	36.0	-3.43		
34.0	-3.89	25.0	-5.44	37.0	-3.35		
35.0	-3.69	26.0	-5.62	38.0	-3.40		
36.0	-3.47	27.0	-5.46	39.0	-3.43		
37.0	-3.53	28.0	-5.21	40.0	-3.47		
38.0	-3.47	29.0	-4.96	41.0	-3.19		
39.0	-3.55	30.0	-4.68	42.0	-2.94		
40.0	-3.57	31.0	-4.35	43.0	-2.94		
41.0	-3.56	32.0	-4.17	44.0	-2.94		
45.0	-3.04	33.0	-3.91	45.0	-2.71		
50.0	-2.33	34.0	-3.64	50.0	-2.12		
55.0	-2.55	35.0	-3.38	55.0	-2.16		
57.5	-2.20	36.0	-3.38	57.7	-2.07		
		37.0	-3.38				
		38.0	-3.40	43.0	-2.95	48.0	-2.15
		39.0	-3.40	44.0	-2.92	50.0	-2.15
		40.0	-3.48	45.0	-2.76	55.0	-2.27
		41.0	-3.30	46.0	-2.52	58.4	-1.95
		42.0	-2.96	47.0	-2.20		

	2007	2006	2005	2004
X-Sectional Area	33.2	28.8	32.5	34.3
Width	26.4	24.7	26.2	27.3
Mean Depth	1.3	1.2	1.2	1.8
Max Depth	2.8	2.7	2.7	2.8
W/D	20.9	21.8	21.1	7.4

Suck Creek - Upper Reach Pool
Photo Looking Upstream

Suck Creek - Upper Reach Pool
Photo Looking Downstream



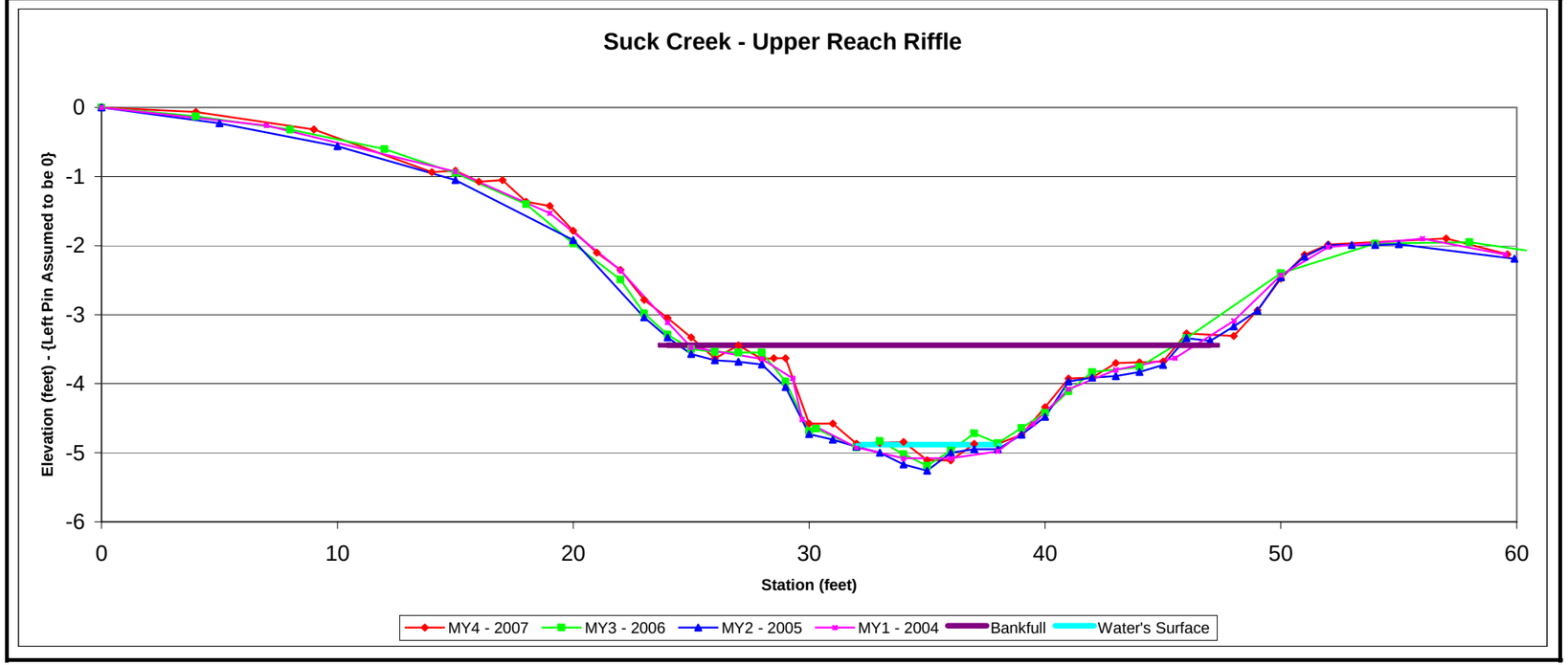
Project Name:	Suck Creek	**Cross Section:**	Upstream Riffle
Project Number:	11795008	**Feature:**	Riffle
Date:	06/21/07	**Crew:**	RB, TJ, & MO

MY4 - 2007 2007 Survey		MY3 - 2006 2006 Survey		MY2 - 2005 2005 Survey		MY1 - 2004 2004 Survey	
STA	**ELEV**	**STA**	**ELEV**	**STA**	**ELEV**	**STA**	**ELEV**
0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
4.0	-0.06	4.0	-0.13	5.0	-0.23	7.0	-0.26
9.0	-0.32	8.0	-0.32	10.0	-0.56	15.0	-0.93
14.0	-0.94	12.0	-0.60	15.0	-1.05	19.0	-1.53
15.0	-0.92	15.0	-0.95	20.0	-1.92	22.0	-2.36
16.0	-1.07	18.0	-1.40	23.0	-3.04	24.0	-3.11
17.0	-1.05	20.0	-1.97	24.0	-3.33	25.0	-3.47
18.0	-1.36	22.0	-2.49	25.0	-3.57	28.0	-3.64
19.0	-1.43	23.0	-2.98	26.0	-3.66	29.3	-3.92
20.0	-1.78	24.0	-3.29	27.0	-3.68	29.7	-4.52
21.0	-2.10	25.0	-3.50	28.0	-3.72	32.0	-4.92
22.0	-2.35	26.0	-3.54	29.0	-4.05	34.0	-5.08
23.0	-2.78	27.0	-3.55	30.0	-4.73	36.0	-5.08
24.0	-3.05	28.0	-3.55	31.0	-4.81	38.0	-4.98
25.0	-3.33	29.0	-3.97	32.0	-4.91	39.5	-4.58
26.0	-3.63	30.0	-4.69	33.0	-5.00	41.0	-4.08
27.0	-3.44	30.3	-4.65	34.0	-5.17	43.0	-3.80
28.0	-3.64	32.0	-4.92	35.0	-5.26	45.5	-3.63
28.5	-3.63	33.0	-4.83	36.0	-5.00	48.0	-3.09
29.0	-3.63	34.0	-5.02	37.0	-4.95	50.0	-2.43
30.0	-4.58	35.0	-5.19	38.0	-4.95	52.0	-2.02
31.0	-4.58	36.0	-4.97	39.0	-4.74	56.0	-1.90
32.0	-4.87	37.0	-4.72	40.0	-4.48	59.5	-2.13
33.0	-4.86	38.0	-4.86	41.0	-3.97		
34.0	-4.84	39.0	-4.64	42.0	-3.91		
35.0	-5.11	40.0	-4.42	43.0	-3.89		
36.0	-5.11	41.0	-4.11	44.0	-3.83		
37.0	-4.87	42.0	-3.83	45.0	-3.73		
38.0	-4.87	44.0	-3.76	46.0	-3.34		
39.0	-4.74	46.0	-3.34	47.0	-3.38		
40.0	-4.34	50.0	-2.40	48.0	-3.17		
41.0	-3.92	54.0	-1.97	49.0	-2.94		
42.0	-3.91	58.0	-1.95	50.0	-2.46		
43.0	-3.70	61.0	-2.10	51.0	-2.16		
44.0	-3.69			52.0	-1.99		
45.0	-3.68			53.0	-1.99		
46.0	-3.27			54.0	-1.99		
48.0	-3.31			55.0	-1.98		
49.0	-2.94			59.9	-2.19		
50.0	-2.48						
51.0	-2.13						
52.0	-1.98						
57.0	-1.90						
59.6	-2.13						

	2007	2006	2005	2004
X-Sectional Area	17.0	15.7	15.2	18.1
Width	20.2	17.0	19.2	21.2
Mean Depth	1.7	0.9	0.8	0.9
Max Depth	0.8	1.6	1.6	1.6
W/D	23.9	18.5	24.2	25.0

Suck Creek - Upper reach Riffle
Photo Looking Upstream

Suck Creek - Uppper Reach Riffle
Photo Looking Downstream



Project Name:	Suck Creek	**Cross Section:**	Lower Reach
Project Number:	11795008	**Feature:**	Pool
Date:	06/28/07	**Crew:**	RB & TJ

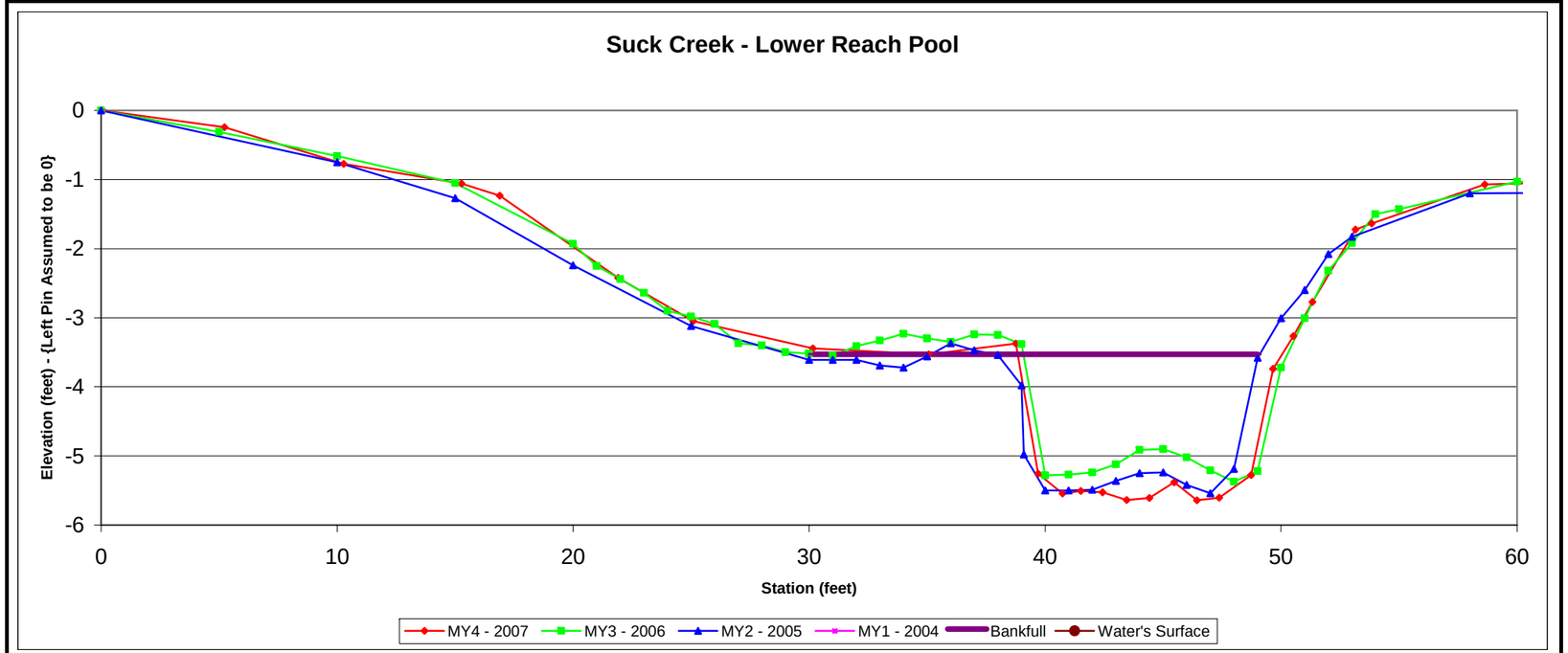
MY4 - 2007 2007 Survey		MY3 - 2006 2006 Survey		MY2 - 2005 2005 Survey		MY1 - 2004 2004 Survey	
STA	**ELEV**	**STA**	**ELEV**	**STA**	**ELEV**	**STA**	**ELEV**
0.1	0.00	0.0	0.00	0.0	0.00		
5.2	-0.25	5.0	-0.31	10.0	-0.75		
10.3	-0.77	10.0	-0.66	15.0	-1.27		
15.3	-1.06	15.0	-1.05	20.0	-2.24		
16.9	-1.24	20.0	-1.93	25.0	-3.12		
21.9	-2.42	21.0	-2.25	30.0	-3.61		
25.1	-3.05	22.0	-2.44	31.0	-3.61		
30.2	-3.44	23.0	-2.64	32.0	-3.61		
35.1	-3.53	24.0	-2.90	33.0	-3.69		
38.8	-3.37	25.0	-2.98	34.0	-3.72		
39.7	-5.26	26.0	-3.09	35.0	-3.56		
40.7	-5.54	27.0	-3.37	36.0	-3.37		
41.5	-5.51	28.0	-3.40	37.0	-3.47		
42.4	-5.53	29.0	-3.50	38.0	-3.54		
43.5	-5.64	30.0	-3.52	39.0	-3.98		
44.4	-5.61	31.0	-3.55	39.1	-4.98		
45.5	-5.38	32.0	-3.41	40.0	-5.50		
46.4	-5.64	33.0	-3.33	41.0	-5.50		
47.4	-5.61	34.0	-3.23	42.0	-5.49		
48.7	-5.27	35.0	-3.30	43.0	-5.36		
49.7	-3.74	36.0	-3.35	44.0	-5.25		
50.5	-3.27	37.0	-3.24	45.0	-5.24		
51.3	-2.77	38.0	-3.25	46.0	-5.42		
53.1	-1.72	39.0	-3.38	47.0	-5.54		
53.8	-1.64	40.0	-5.28	48.0	-5.19		
58.6	-1.07	41.0	-5.27	49.0	-3.58		
63.6	-1.02	42.0	-5.24	50.0	-3.01		
68.0	-1.06	43.0	-5.12	51.0	-2.60		
		44.0	-4.91	52.0	-2.08		
		45.0	-4.90	53.0	-1.83		
		46.0	-5.02	58.0	-1.20		
		47.0	-5.21	63.0	-1.19		
		48.0	-5.37	67.2	-1.26		
		49.0	-5.22				
		50.0	-3.72				
		51.0	-3.01				
		52.0	-2.32				
		53.0	-1.92				
		54.0	-1.50				
		55.0	-1.43				
		60.0	-1.03				
		65.0	-1.03				
		67.9	-1.08				

The Pool Cross-Section for the Lower Reach of 2004 is not shown because it was taken in a different location.

	2007	2006	2005	2004
X-Sectional Area	19.6	11.4	13.4	NA
Width	11.2	10.5	9.9	NA
Mean Depth	1.8	1.1	1.4	NA
Max Depth	2.1	1.4	1.6	NA
W/D	6.4	9.7	7.3	NA

Suck Creek - Lower Reach Pool
Photo Looking Upstream

Suck Creek - Lower Reach Pool
Photo Looking Downstream



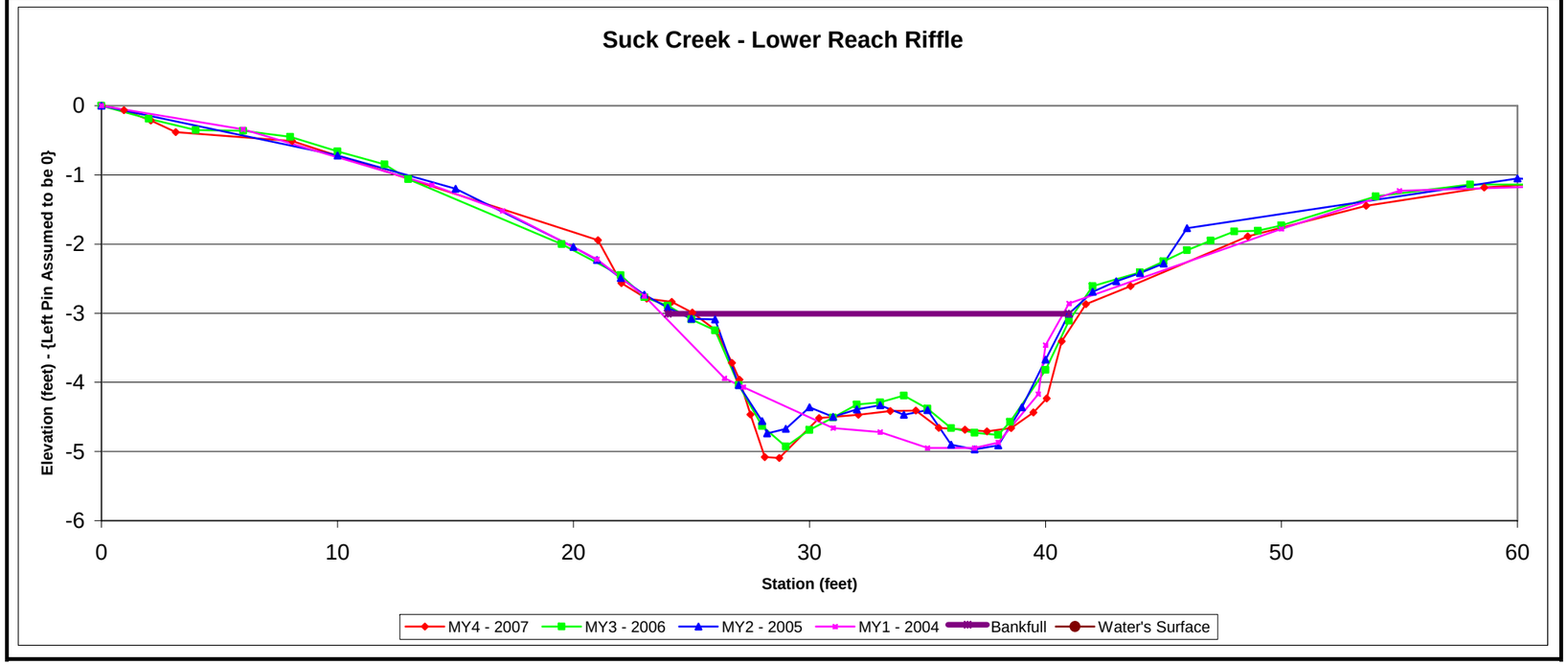
Project Name:	Suck Creek	**Cross Section:**	Lower Reach
Project Number:	11795008	**Feature:**	Riffle
Date:	06/28/07	**Crew:**	RB & TJ

MY4 - 2007 2007 Survey		MY3 - 2006 2006 Survey		MY2 - 2005 2005 Survey		MY1 - 2004 2004 Survey	
STA	**ELEV**	**STA**	**ELEV**	**STA**	**ELEV**	**STA**	**ELEV**
0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
1.0	-0.06	2.0	-0.19	10.0	-0.72	6.0	-0.34
2.1	-0.21	4.0	-0.35	15.0	-1.20	14.0	-1.15
3.1	-0.38	6.0	-0.36	20.0	-2.04	17.0	-1.52
8.1	-0.51	8.0	-0.45	21.0	-2.23	21.0	-2.22
21.0	-1.94	10.0	-0.66	22.0	-2.49	23.0	-2.75
22.0	-2.56	12.0	-0.85	23.0	-2.73	26.4	-3.94
23.1	-2.79	13.0	-1.06	24.0	-2.92	27.2	-4.07
24.2	-2.84	19.5	-2.00	25.0	-3.08	31.0	-4.66
25.0	-2.99	22.0	-2.45	26.0	-3.09	33.0	-4.72
26.1	-3.26	23.0	-2.77	27.0	-4.04	35.0	-4.95
26.7	-3.72	24.0	-2.89	28.0	-4.56	37.0	-4.95
27.0	-3.96	25.0	-3.09	28.2	-4.74	38.0	-4.87
27.5	-4.46	26.0	-3.25	29.0	-4.67	39.7	-4.17
28.1	-5.08	27.0	-4.04	30.0	-4.36	40.0	-3.46
28.7	-5.09	28.0	-4.63	31.0	-4.50	41.0	-2.86
30.4	-4.52	29.0	-4.93	32.0	-4.39	50.0	-1.78
32.1	-4.47	30.0	-4.69	33.0	-4.33	55.0	-1.23
33.4	-4.42	31.0	-4.51	34.0	-4.47	66.0	-1.12
34.5	-4.41	32.0	-4.32	35.0	-4.40		
35.5	-4.66	33.0	-4.29	36.0	-4.90		
36.6	-4.68	34.0	-4.19	37.0	-4.97		
37.5	-4.71	35.0	-4.38	38.0	-4.91		
38.5	-4.66	36.0	-4.66	39.0	-4.36		
39.5	-4.43	37.0	-4.73	40.0	-3.67		
40.1	-4.23	38.0	-4.76	41.0	-3.01		
40.7	-3.41	38.5	-4.57	42.0	-2.69		
41.7	-2.87	40.0	-3.82	43.0	-2.54		
43.6	-2.61	41.0	-3.11	44.0	-2.42		
48.6	-1.89	42.0	-2.61	45.0	-2.28		
53.6	-1.45	44.0	-2.41	46.0	-1.77		
58.6	-1.18	45.0	-2.25	60.0	-1.05		
63.4	-1.07	46.0	-2.09	65.6	-1.16		
66.4	-1.15	47.0	-1.95				
		48.0	-1.82				
		49.0	-1.81				
		50.0	-1.73				
		54.0	-1.31				
		58.0	-1.14				
		62.0	-1.14				
		66.0	-1.10				

	2007	2006	2005	2004
X-Sectional Area	22.3	20.5	20.9	27.4
Width	16.4	16.6	16.6	20.7
Mean Depth	1.4	1.2	1.3	1.3
Max Depth	2.1	1.9	2.0	2.2
W/D	12.1	13.4	13.2	15.6

Suck Creek - Lower Reach Riffle
Photo Looking Upstream

Suck Creek - Lower Reach Riffle
Photo Looking Downstream

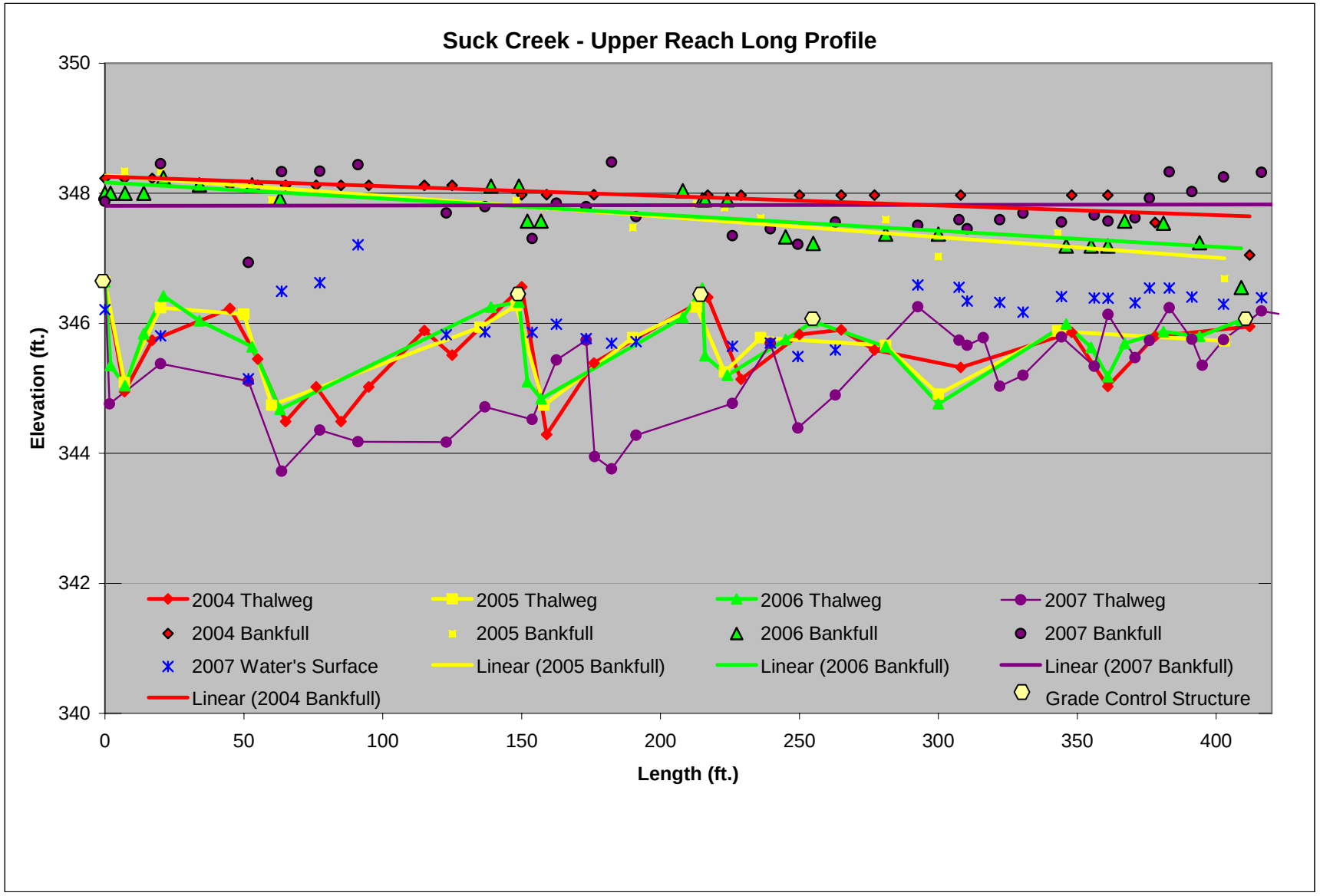


APPENDIX B

8. LONGITUDINAL PLOTS AND RAW DATA TABLES

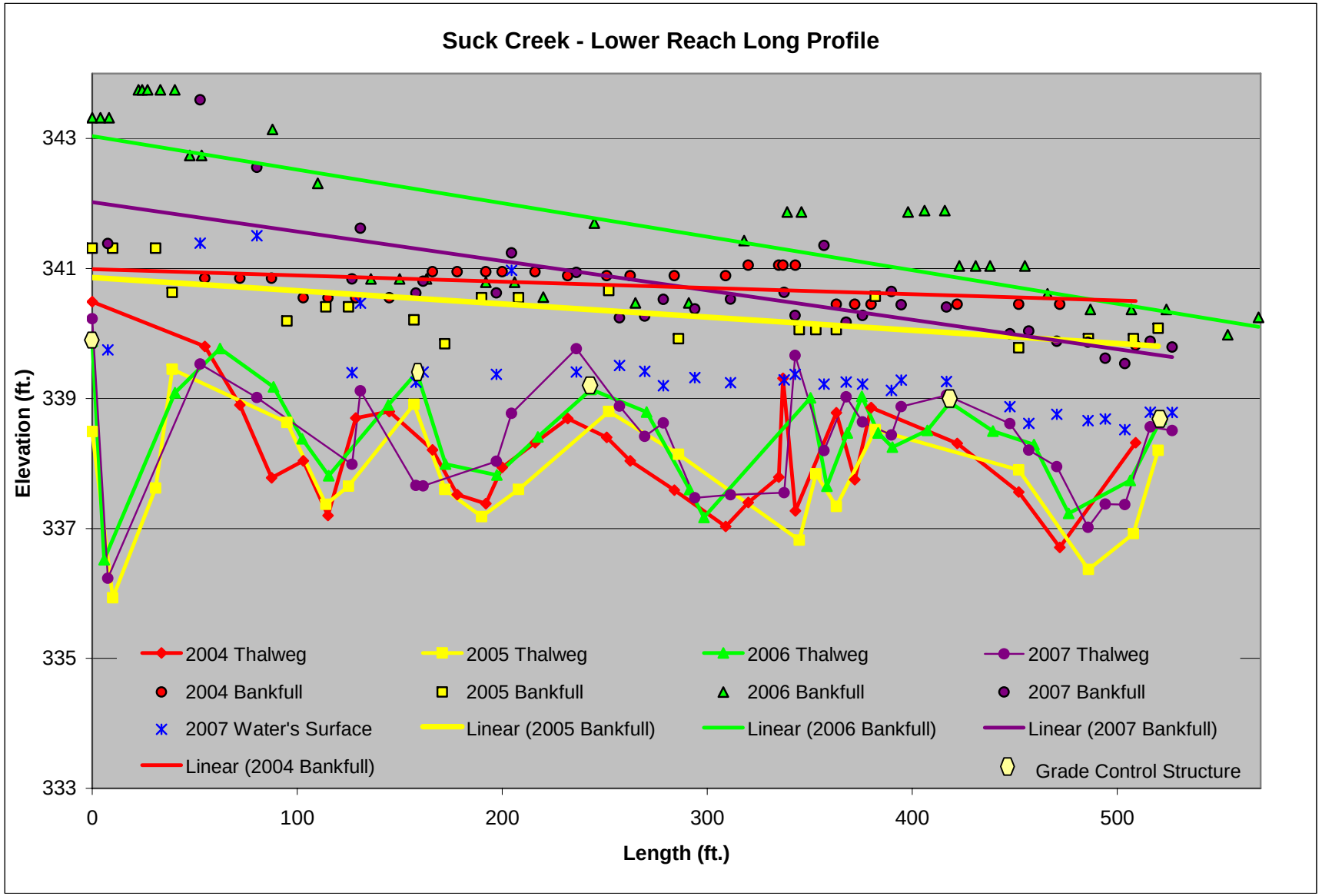
Raw Longitudinal Profile - Upper Reach

Long Profile - Upper Reach		Thalweg	Water Surface	Bankfull
Note	Station	Elevations	Elevations	Elevations
Top of Rock	0.000	346.650	346.210	347.876
TW	1.659	344.760		
TW	20.031	345.378	345.808	348.452
TW	51.616	345.112	345.146	346.934
TW	63.578	343.724	346.494	348.332
TW	77.386	344.358	346.626	348.338
TW	91.104	344.178	347.206	348.438
TW	122.863	344.172	345.826	347.698
TW	136.767	344.716	345.868	347.792
TW	153.790	344.520	345.860	347.304
TW	162.534	345.434	345.984	347.848
TW	173.214	345.740	345.766	347.794
TW	176.276	343.950		
TW	182.365	343.762	345.692	348.480
TW	191.203	344.278	345.718	347.638
TW	225.911	344.768	345.647	347.348
TW	239.582	345.694	345.698	347.454
TW	249.395	344.388	345.488	347.216
TW	262.951	344.896	345.590	347.558
TW.G	292.561	346.254	346.590	347.506
TW.P	307.444	345.740	346.554	347.592
DMA.P	310.362	345.660	346.344	347.454
TW.RU	316.132	345.778		
TW.P	322.130	345.032	346.320	347.592
TW.G	330.477	345.200	346.172	347.694
TW.RU	344.299	345.788	346.412	347.558
TW.BOULDERS	356.147	345.338	346.388	347.664
TW.RI	361.066	346.134	346.384	347.572
TW.P	370.841	345.472	346.314	347.620
TW	375.962	345.734	346.544	347.924
TW.R	383.153	346.238	346.542	348.328
TW	391.277	345.754	346.404	348.026
TW.D	394.984	345.354		
TW.G	402.679	345.746	346.292	348.250
TW.P	416.337	346.190	346.392	348.320
TW.R	429.490	346.098	346.350	348.256
TW.ROK	443.315	346.238	346.248	348.222


Suck Creek - Upper Reach Long Profile
Elevation (ft.)
350
348
346
344
342
340
0
50
100
150
200
250
300
350
400
Length (ft.)
2004 Thalweg
2005 Thalweg
2006 Thalweg
2007 Thalweg
2004 Bankfull
2005 Bankfull
2006 Bankfull
2007 Bankfull
2007 Water's Surface
Linear (2005 Bankfull)
Linear (2006 Bankfull)
Linear (2007 Bankfull)
Linear (2004 Bankfull)
Grade Control Structure

Raw Longitudinal Profile Data – Lower Reach

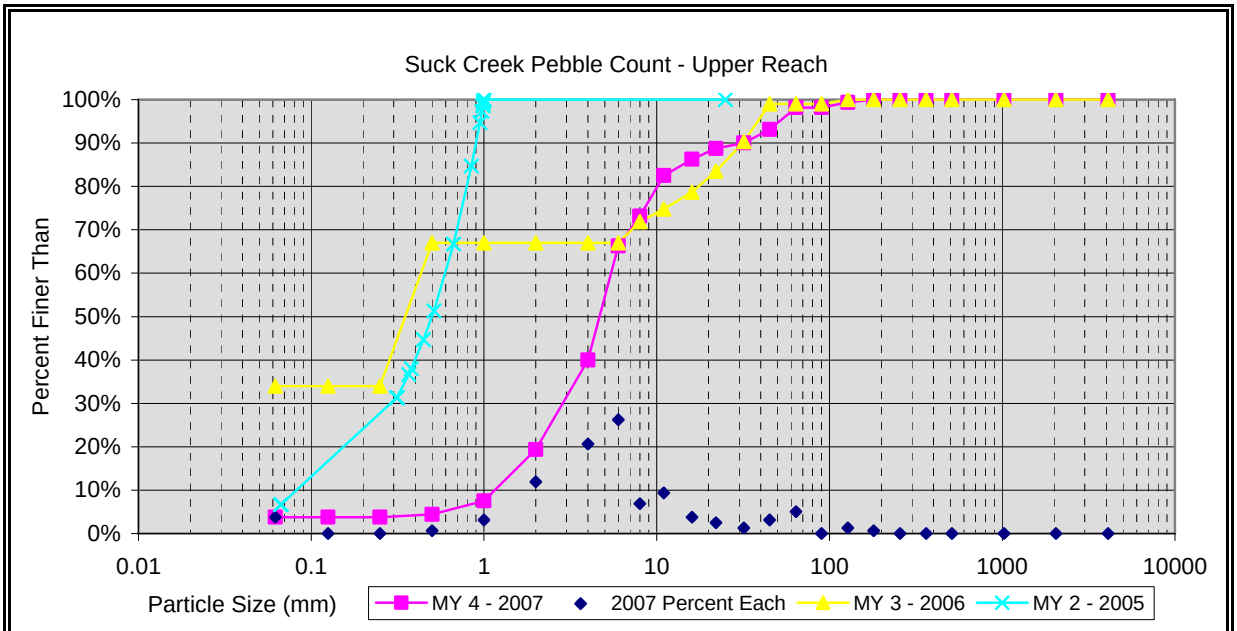
Long Profile - Lower Reach		Thalweg	Water Surface	Bankfull
Note	Station	Elevations	Elevations	Elevations
TOPROC	0.000	340.226		
DMAX	7.570	336.234	339.746	341.382
TW	52.626	339.528	341.392	343.594
TW.P	80.308	339.012	341.504	342.558
TW.G	126.798	337.988	339.398	340.838
TW	130.853	339.118	340.468	341.618
DMAX	157.877	337.662	339.250	340.620
TW.STRU	161.394	337.652	339.406	340.804
TW.G	197.204	338.032	339.370	340.624
TW.P	204.597	338.772	340.970	341.240
TOP.ROCK	236.173	339.764	339.406	340.938
T.RU	257.253	338.882	339.507	340.242
T.P	269.472	338.416	339.417	340.266
TOP.ROCK	278.669	338.623	339.195	340.525
T.G	293.985	337.472	339.320	340.378
T.P	311.380	337.517	339.243	340.529
T.G	337.576	337.549	339.284	340.631
T.ROCK	342.954	339.662	339.373	340.276
T.G	357.032	338.197	339.223	341.354
T.RI	367.810	339.023	339.253	340.174
T.P	375.769	338.637	339.221	340.276
T.G	389.906	338.439	339.126	340.647
T.RI	394.637	338.873	339.281	340.443
T.RI	416.738	339.048	339.260	340.407
T.P	447.656	338.613	338.875	339.995
T.RUN	456.939	338.206	338.616	340.038
T.P	470.604	337.949	338.757	339.880
T.G	485.783	337.017	338.661	339.866
T.P	494.199	337.375	338.685	339.617
T.G	503.729	337.367	338.520	339.536
T.RI	516.164	338.561	338.788	339.881
T.ROCK	526.914	338.507	338.785	339.791


Suck Creek - Lower Reach Long Profile
Elevation (ft.)
343
341
339
337
335
333
0
100
200
300
400
500
Length (ft.)
2004 Thalweg
2005 Thalweg
2006 Thalweg
2007 Thalweg
2004 Bankfull
2005 Bankfull
2006 Bankfull
2007 Bankfull
2007 Water's Surface
Linear (2005 Bankfull)
Linear (2006 Bankfull)
Linear (2007 Bankfull)
Linear (2004 Bankfull)
Grade Control Structure

APPENDIX B

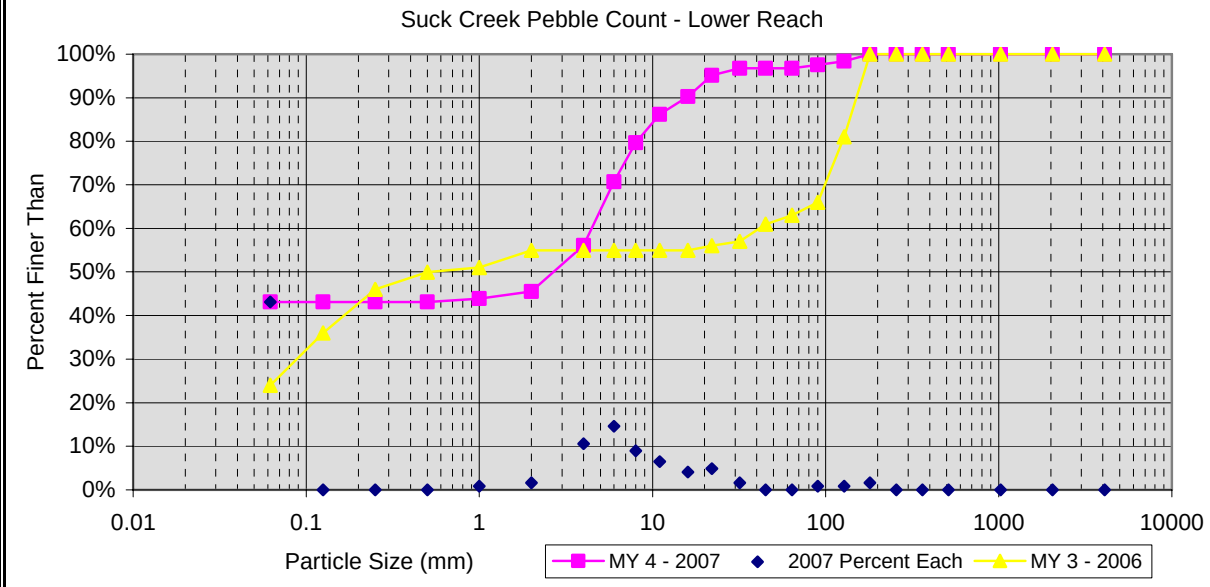
9. PEBBLE COUNT PLOTS AND RAW DATA TABLES

Pebble Count Data				Raw Data			Individual Percentage			Cumulative Percentage		
Material	Size Range (mm)			2005	2006	2007	2005	2006	2007	2005	2006	2007
silt/clay	0	-	0.062	10	35	6	7%	34%	4%	7%	34%	4%
very fine sand	0.062	-	0.13	0	0	0	0%	0%	0%	7%	34%	4%
fine sand	0.13	-	0.25	0	0	0	0%	0%	0%	7%	34%	4%
medium sand	0.25	-	0.5	37	34	1	25%	33%	1%	31%	67%	4%
coarse sand	0.5	-	1	0	0	5	0%	0%	3%	31%	67%	8%
very coarse sand	1	-	2	0	0	19	0%	0%	12%	31%	67%	19%
very fine gravel	2	-	4	0	0	33	0%	0%	21%	31%	67%	40%
fine gravel	4	-	6	8	0	42	5%	0%	26%	37%	67%	66%
fine gravel	6	-	8	2	5	11	1%	5%	7%	38%	72%	73%
medium gravel	8	-	11	10	3	15	7%	3%	9%	45%	75%	83%
medium gravel	11	-	16	10	4	6	7%	4%	4%	51%	79%	86%
coarse gravel	16	-	22	23	5	4	15%	5%	3%	67%	83%	89%
coarse gravel	22	-	32	27	7	2	18%	7%	1%	85%	90%	90%
very coarse gravel	32	-	45	15	9	5	10%	9%	3%	95%	99%	93%
very coarse gravel	45	-	64	4	0	8	3%	0%	5%	97%	99%	98%
small cobble	64	-	90	2	0	0	1%	0%	0%	99%	99%	98%
medium cobble	90	-	128	0	1	2	0%	1%	1%	99%	100%	99%
large cobble	128	-	180	1	0	1	1%	0%	1%	99%	100%	100%
very large cobble	180	-	256	1	0	0	1%	0%	0%	100%	100%	100%
small boulder	256	-	362	0	0	0	0%	0%	0%	100%	100%	100%
small boulder	362	-	512	0	0	0	0%	0%	0%	100%	100%	100%
medium boulder	512	-	1024	0	0	0	0%	0%	0%	100%	100%	100%
large boulder	1024	-	2048	0	0	0	0%	0%	0%	100%	100%	100%
very large boulder	2048	-	4096	0	0	0	0%	0%	0%	100%	100%	100%
bedrock				0	0	0	0%	0%	0%	100%	100%	100%
			Total Particle Count:	150	103	160						



Size percent less than (mm)						Percent by substrate type					
Year	D16	D35	D50	D84	D95	silt/clay	sand	gravel	cobble	boulder	bedrock
2005	0.5	6.0	16.0	32	45	7%	25%	66%	3%	0%	0%
2006	SC	0.25	0.5	32	45	34%	33%	32%	1%	0%	0%
2007	1.0	4.0	6.0	16	64	4%	16%	79%	2%	0%	0%

Pebble Count Data				**Raw Data**			**Individual Percentage**			**Cumulative Percentage**		
Material	**Size Range (mm)**			**2005**	**2006**	**2007**	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**
silt/clay	0	-	0.062		24	53		24%	43%		24%	43%
very fine sand	0.062	-	0.13		12	0		12%	0%		36%	43%
fine sand	0.13	-	0.25		10	0		10%	0%		46%	43%
medium sand	0.25	-	0.5		4	0		4%	0%		50%	43%
coarse sand	0.5	-	1		1	1		1%	1%		51%	44%
very coarse sand	1	-	2		4	2		4%	2%		55%	46%
very fine gravel	2	-	4		0	13		0%	11%		55%	56%
fine gravel	4	-	6		0	18		0%	15%		55%	71%
fine gravel	6	-	8		0	11		0%	9%		55%	80%
medium gravel	8	-	11		0	8		0%	7%		55%	86%
medium gravel	11	-	16		0	5		0%	4%		55%	90%
coarse gravel	16	-	22		1	6		1%	5%		56%	95%
coarse gravel	22	-	32		1	2		1%	2%		57%	97%
very coarse gravel	32	-	45		4	0		4%	0%		61%	97%
very coarse gravel	45	-	64		2	0		2%	0%		63%	97%
small cobble	64	-	90		3	1		3%	1%		66%	98%
medium cobble	90	-	128		15	1		15%	1%		81%	98%
large cobble	128	-	180		19	2		19%	2%		100%	100%
very large cobble	180	-	256		0	0		0%	0%		100%	100%
small boulder	256	-	362		0	0		0%	0%		100%	100%
small boulder	362	-	512		0	0		0%	0%		100%	100%
medium boulder	512	-	1024		0	0		0%	0%		100%	100%
large boulder	1024	-	2048		0	0		0%	0%		100%	100%
very large boulder	2048	-	4096		0	0		0%	0%		100%	100%
bedrock					0	0		0%	0%		100%	100%
			Total Particle Count:	**0**	**100**	**123**						



	Size percent less than (mm)					Percent by substrate type					
Year	**D16**	**D35**	**D50**	**D84**	**D95**	**silt/clay**	**sand**	**gravel**	**cobble**	**boulder**	**bedrock**
2005											
2006	SC	0.13	0.5	180	180	24%	31%	8%	37%	0%	0%
2007	SC	SC	4.0	11	22	43%	2%	51%	3%	0%	0%