UT to Rocky River (Smith Tract) Stream and Buffer Restoration, Enhancement, and Preservation
Chatham County, North Carolina
CU: 03030003 SCO# 402

Final Monitoring Report
(Year 1 of 5)
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Submitted to:

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Ecosystem Enhancement Program
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Chatham County, North Carolina

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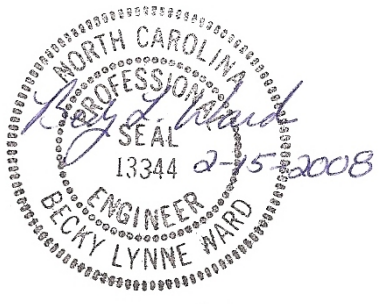

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III. Executive Summary

In October of 2006 NCEEP completed 1111 linear feet of stream restoration and 1095 linear feet of stream enhancement on two unnamed tributaries to Rocky River on the Smith property in Chatham County. The streams on both Reach 1 and 2 classify as C4 stream types. The priority one restoration of Reach 2 has constructed riffles that establish grade control with single wing rock vanes to provide additional stability. The enhancement of Reach 1 was accomplished with bank stabilization along with a short segment of stream realignment that accommodates a new livestock crossing.

The UT Rocky River (Smith Tract) restoration project is functioning well. The reach one bank repairs and channel restoration are stable. There are a few areas in reach one that were identified as potential problems due to minor toe erosion and sparse bank vegetation that require further monitoring during year two. Reach 2's pattern, profile, and sections have not changed significantly as compared to the as-built conditions. There are some areas in Reach 2 experiencing toe erosion at riffles and bare banks due to the loss of the erosion control fabric along with the seed placed underneath. Two significant stream problem areas exist on Reach 2. These two areas are both located below the tributary that enters Reach 2 from the west and occurred shortly after construction when the adjacent wooded property was cleared. Incision of the channel has occurred at two locations. This incision is currently isolated to these two segments, no incision is progressing upstream. The second area is at the end of the stream where aggradation has occurred. A farm road crossing just below the project with a small pipe caused a backup of storm water and deposition of sediment washed off the newly graded floodplain. The EEP project manager is currently pursuing replacement of the existing pipe with a larger size. At the time of this pipe replacement the incised areas will also be repaired.

Overall, planted vegetation of both Reach 1 and 2 is in excellent condition. However, there are some areas of minor invasive/exotic vegetation encroachment. The vegetation plots themselves appear to be in excellent condition, and sampling results indicate low planted stem mortality rates and limited invasive/exotic encroachment. It is not recommended that invasive/exotic vegetation eradication activities take place at this time, but that abundance and densities be monitored annually and eradication initiated when a significant threat, if at all, develops. The most significant problem area on the site is in Reach 2 where the loss of erosion control fabric and support vegetation prior to plant establishment and growth led to exposed and eroding banks.

IV. Project Background

1. Location and Setting

From U.S. Highway 64 just east of Siler City, head north on Silk Hope Road, then turn left onto Rufus Brewer Road, and take the next left onto Smith Hudson Road. The property is in Chatham County (Figure 1). The construction entrance is off of Smith Hudson Road, just east of the house, and provides access to Reach 1 (Latitude 35°45'56" and Longitude 79°24'57") and Reach 2 (Latitude 35°45'57" and Longitude 79°25'9"). The site is in the Cape Fear River Basin in Cataloging Unit 03030003. See the vicinity map below:

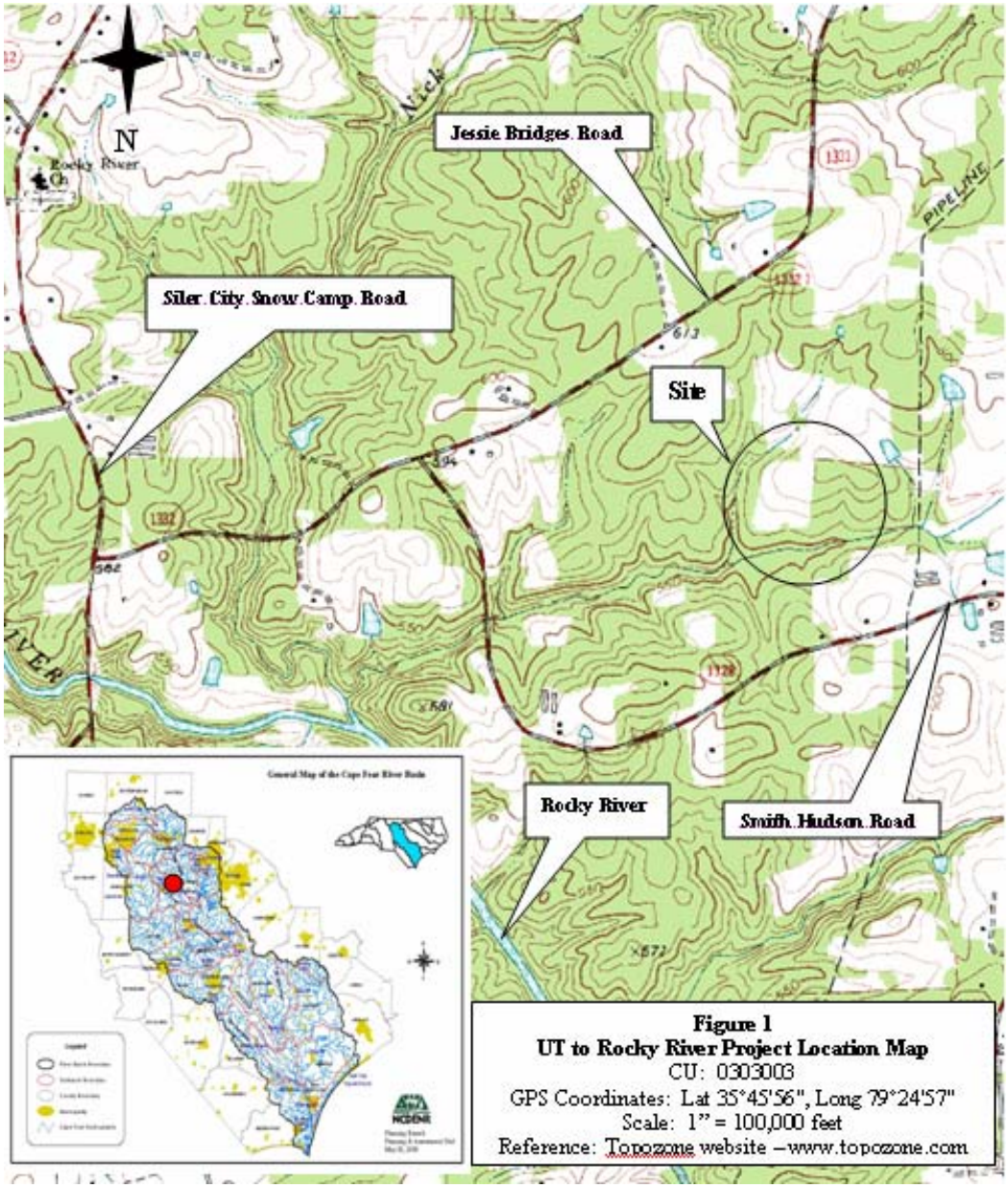

Figure 1
UT to Rocky River Project Location Map
CU: 0303003
GPS Coordinates: Lat 35°45'56", Long 79°24'57"
Scale: 1" = 100,000 feet
Reference: Topozone website –www.topozone.com

The drainage area for Reach 1 is approximately 1.28 square miles and Reach 2 is approximately 0.21 square miles. The watershed contributing to Reach 1 is currently developed with rural agricultural usage. The watershed for Reach 2 has less agriculturally developed land. The property falls under the planning and zoning restrictions of Chatham County.

2. Poject Structure, Mitigation Type, Approach and Objective

The project involves the improvement of water quality and the control of sediment transport with stream restoration and enhancement, and riparian buffer restoration, enhancement, and preservation. Reach 1 has a total stream length of 1095 linear feet. Stream Enhancement I was performed on 208 linear feet of stream. The stream pattern and profile was restored throughout this stream segment to improve the channel stability and provide for a permanent livestock crossing. The remaining length of Reach I includes 887 linear feet of Enhancement II, stream bank stabilization, to reduce sediment export from prior cattle access to the stream. On Reach 2 a priority-one stream restoration was preformed for the entire reach length of 1111 linear feet. The channel long-term stability was returned with the restoration of channel pattern, profile, and dimension.

Table I. Project Mitigation Structure and Objectives Table
Smith Tract / Number 046107

Project segment or Reach ID	Mitigation Type	Approach	Linear Footage or Acreage	Stationing	Comment
Reach 1	EII	SS	887	00+00 - 08+87	Bank stabilization, fence out cattle
Reach 1	EI	P1	208	08+87 - 10+95	Relocation, improve cattle/equipment crossing, reestablish stream pattern and dimension
Reach 2	R	P1	1111	-00+03 - 11+08	Reconnect to floodplain, adjust stream pattern, profile and dimension, install structures and vegetation

R= Restoration
EI= Enhancement
EII= Enhancement II
S= Stabilization

P1= Priority I
P2= Priority II
P3= Priority III
SS = Stream bank stabilizations

3. Project History and Background

In 2001, the North Carolina Department of Transportation (NCDOT) identified two unnamed tributaries to Nick Creek in Chatham County, North Carolina, as stream mitigation sites. The tributaries are on a tract that was referred to as the Smith Tract Mitigation Site. The two unnamed tributaries have been designated Reach 1 and Reach 2. Reach 1 is located in the approximate middle of the property and flows from the property's eastern boundary line with Mr. John R. Fox to the western property line with Mr. George Edward Pike. Reach 2 is located in the western most portion of the property and flows from the northern property boundary line with Ms. Julia B. Howard to the southern property boundary line with Mr. George Edward Pike. These two streams join just south of the Smith property boundary line on Mr. Pike's property, and then discharge into Nick Creek approximately 6,000 linear feet west of the Smith Property, just above the confluence of Nick Creek and the Rocky River.

The goals of the enhancement on Reach 1 were to remove cattle access to the stream, restore damaged banks to prevent further sediment input, and to restore a section of the stream with a realignment and incorporation of a stable livestock crossing. Reach 2 goals consisted of reconnecting the incised channel to the floodplain and permanent stabilization with a corrected pattern, profile, and dimension.

The construction of the stream restoration and enhancement for the project was completed in October of 2007. The planting of the woody species was delayed until late November and was completed in Early December.

Table II. Project Activity and Reporting History UT Rocky River Smith Tract / Number 046107			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	1/31/2005	8/20/2003	4/26/2005
Final Design - 90%	2/28/2005	NA	8/4/2005
Construction	9/25/2006	NA	10/13/2006
Temporary S&E mix applied to entire project area - Reach 1	9/9/2006	NA	7/27/2006
Temporary S&E mix applied to entire project area - Reach 2	8/5/2006	NA	9/29/2006
Permanent seed mix applied to reach segments - Reach 1	9/9/2006	NA	7/27/2006
Permanent seed mix applied to reach segments - Reach 2	8/5/2006	NA	9/29/2006
Containerized and B&B plantings for reach/segments - Reach 1	12/31/2006	NA	12/12/2006
Containerized and B&B plantings for reach/segments - Reach 2	12/31/2006	NA	12/12/2006
Mitigation Plan/ As-built (Year 0 Monitoring - baseline)	12/1/2006	1/15/2007	3/20/2007
Year 1 Monitoring	12/1/2007	11/14/2007	12/3/2007
Year 2 Monitoring			
Structural maintenance (bench expansion, vane adjustment)			
Year 3 Monitoring			
Supplemental planting of containerized material			
Year 4 Monitoring			
Year 5 Monitoring			
Years 5+ Monitoring			

Bolded items represent those events or deliverables that are variable. Non-bolded items represent events that are standard components over the course of a typical project.

NOTE: Temporary and permanent seed placed at same time as construction progressed from upstream to downstream for each reach

Table III. Project Contact Table UT Rocky River Smith Tract / Number 046107	
Designer Ward Consulting Engineers	**Firm information/Address** Becky Ward (919) 870-0526 8386 Six Forks Road, Suite 101, Raleigh, NC 27615-5088
Construction Contractor McQueen Construction	**Firm information/Address** Harvey McQueen (919) 697-0614 619 Patrick Road, Bahama, NC 27503
Planting Contractor Southern Garden Inc.	**Firm information/Address** P.O. Box 808, Apex, NC 27502 (919) 362-1050
Seed Contractor McQueen Construction	**Company information/Address** Harvey McQueen (919) 697-0614 619 Patrick Road, Bahama, NC 27503
Seed Mix Sources Evergreen Seed	**Company and Contact Phone** (919) 567-1333
Nursery Stock Suppliers Coastal Plain Conservation Nursery, Inc. (Edenton, NC) Cure Nursery (Pittsboro, NC) Brook Run Nursery (Blackstone, VA)	**Company and Contact Phone** Ellen Colodney (252) 482-5707 Bill and Jennifer Cure (919) 542-6186 Howard Malinski (919) 422-8727
Monitoring Performers Ward Consulting Engineers & The Catena Group	**Firm information/Address** Ward Consulting Engineers: 8386 Six Forks Road, Suite 101, Raleigh, NC 27615-5088 The Catena Group: 410-B Millstone Drive, Hillsborough, NC 27278
Stream Monitoring POC - Ward Consulting Engineers	Becky Ward (919) 870-0526
Vegetation Monitoring POC - The Catena Group	Kate Montieth (919) 732-1300
Wetland Monitoring POC - NA	NA

Table IV. Project Background Table UT Rocky River Smith Tract / Number 046107	
Project County	Chatham
Drainage Area - Reach 1	1.28 mi^2
Drainage Area - Reach 2	0.21 mi^2
Drainage impervious cover estimate (%)	Reach 1 (2%) Reach 2 (1%)
Stream Order - Reach 1	2
Stream Order - Reach 2	2
Physiographic Region	Piedmont
Ecoregion	45c Carolina Slate Belt
Rosgen Classification of As-built - Reach 1	C4 / E4
Rosgen Classification of As-built - Reach 2	C4
Cowardin Classification	NA
Dominant soil types - Reach 1	Cid-Lignum Complex, Nanford-Baden Complex
Dominant soil types - Reach 2	Riverview Silt Loam
USGS HUC for Project and reference	03030003
NCDWQ Sub-basin for Project and reference	Cape Fear River Subbasin 03-06-12
NCDWQ classification for Project and Reference - Reach 1	C
NCDWQ classification for Project and Reference - Reach 2	C
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	
% Of project easement fenced - Reach 1	13%
% Of project easement fenced - Reach 2	41%

Note: The cattle are currently fenced out of the stream. Mr. Smith has set a pasture fence closer to the house.

4. **Monitoring Plan View**

The plan view for the site is shown in Appendix B, Section 1, Figures 2 & 3. This plan view is at a 1" to 30' scale that shows the as-built topographic information, stream, and vegetation locations. No current photographic information was available to reflect a clear image of the repaired channel and therefore the as-built drawings were utilized as the base plan for the figures submitted with this report. Reach 1 in shown on Figure 2 and Reach 2 is shown on Figure 3.

V. Project Condition and Monitoring Results

A. Vegetation Assessment

Reach 1: Overall, planted vegetation is in excellent condition. However, there are some areas of minor invasive/exotic vegetation encroachment. There is minor development of privet (*Ligustrum sinense*) along entire reach, mostly along stream banks. Japanese grass (*Microstegium vimineum*) is dense in some areas of the

floodplain. The vegetation plots themselves appear to be in excellent condition, and sampling results indicate low planted stem mortality rates and limited invasive/exotic encroachment.

Reach 2: Overall, planted vegetation is in excellent condition. Invasive/exotic vegetation encroachment is minimal for the entire reach, although forested slope areas that were not planted have some mature growth of privet and autumn olive (*Elaeagnus umbellata*), which increases the risk of exotic plant invasion into the floodplain. The vegetation plots themselves appear to be in excellent condition, and sampling results indicate low planted stem mortality rates and limited invasive/exotic encroachment.

1. Soil Data

Table V. Preliminary Soil Data

Series	Max. Depth (in)	% Clay on Surface	K_w	K_f	T	%OM
Cid-Lignum complex (CmB)						
Cid	40	10-25	0.4	0.49	2	0.5-2
Lignum	40-60	10-25	0.3	0.43	4	0.5-2
Nanford-Badin complex (NaC)						
Nanford	>60	10-27	0.2	0.37	5	1-3
Badin	>40	10-27	0.2	0.37	3	1-3
Riverview silt loam (RvA)	>60	10-27	0.3	0.37	5	0.5-2

2. Vegetative Problem Areas

Table VI. Vegetative Problem Areas

Feature/Issue	Station #/Range	Probable Cause	Photo #
Bare Bank	Site 4	Existing bank not in original repair area, bank stable	8
	Site 10a-d	Loss of fabric & seed, soils not conducive to plant growth	18-20
Bare Flood Plain	Site 2	Unknown	3-4
	Site 11	Unknown	21
Invasive/Exotic Populations	Site 1	Privet: encroachment from outside; volunteer	1-2
	Site 3	Microstegium: upstream seed source	5-7
	Site 4	Multiflora rose: encroachment from outside; volunteer	8
	Site 5	Privet: encroachment from outside; volunteer; Microstegium: upstream seed source	9-11
	Site 6	Privet and blackberry: encroachment from outside; volunteer	12
	Site 7	Privet: encroachment from outside; volunteer	13
	Site 8	Privet: encroachment from outside; volunteer	14
	Site 9	Privet: encroachment from outside; volunteer; Microstegium: upstream seed source; Japanese honeysuckle: encroachment from outside; volunteer	15-17
	Site 12	Privet and blackberry: encroachment from outside; volunteer; Autumn olive: encroachment from outside; volunteer, upstream seed source	22-23
	Stream Station 4+00	Fescue in channel from upstream seed source	444

3. Vegetative Current Conditions Plan View

The most significant needs for vegetation repair are on the exposed and eroding banks of Reach 2 (Sites 10a -10d), most likely caused by loss of erosion control fabric and support vegetation prior to plant establishment and growth in early 2007. Of less concern, but as a potential erosion risk, Site 11 is a fairly large area of exposed soil that should be reseeded to prevent: 1) soil loss during flooding events and 2) development of exotics and weedy vegetation. The abundance of autumn olive and Chinese privet is relatively low and does not yet present a threat to planted, volunteer, or pre-existing native vegetation. It may be expected, however, that these species will increase in abundance over time from on and off site seed and vegetative sources. There is a small amount of Fescue growing in the channel of Reach 2. This originated from an upstream seed source.

See Appendix B, Section 1, Figures 2 & 3: Problem Areas Plan View for Reach 1 and Reach 2.

4. Stem Counts

Table VII. Stem counts for each species arranged by plot.

Species	Plots 1	2	3	4	5	6	Initial Totals	Year-1 Totals	Survival %
Shrubs									
Alnus serrulata	1	2		2		5	10	7	70[b]
Ilex verticillata				2		4	6	5	83
Lindera benzoin	1			2		5	8	6	75[b]
Sambucus canadensis				2		6	8	5	63[b]
Viburnum nudum						2	2	2	100
Trees									
Betula nigra		1		4	5		10	11[a]	110
Carpinus caroliniana	1						1	0	0
Carya cordiformis	8	3	2	5	3	6	27	23	85
Celtis laevigata	1	4		5			10	9	90
Fraxinus pennsylvanica	2	4		5	5	1	17	17	100
Liriodendron tulipifera	3	2	4	4	3		16	8	50[c]
Nyssa sylvatica			6				6	6	100
Platanus occidentalis	3				2	1	6	6	100
Quercus alba			7				7	7	100
Quercus pagoda	2	2		2	2		8	8	100
Quercus phellos		3		1	5	1	10	9	90
Quercus rubra			4				4	4	100
Ulmus Americana				4	1	2	7	6	86

a: Includes one stem that was missed during Year-0 monitoring

b: *Alnus serrulata*, *Lindera benzoin*, and *Sambucus canadensis* are all shrubs that were planted at the top-of-bank which is eroding in some places. This has caused the less than 80% survival rate for these three species as they have washed away.

c: A variety of grassy, herbaceous species were growing in the plots. Their dead stems created a mat of vegetation that surrounded the planted stems. It is possible that this mat captured water and led to the rotting of some stems of *Liriodendron tulipifera*. Additionally, a few stems were knocked over during flood events and died.

5. Vegetation Plot Photos

See Appendix 1 Section 3: Vegetation Monitoring Plot Photos

B. Stream Assessment

1. Procedural Items

a. Morphometric Criteria

Dimension: One (1) established permanent cross section was monitored on Reach 1 within the 208 linear foot stream Enhancement I segment of the stream. Five (5) established cross sections were monitored on Reach 2 three of which are in riffles and two are in pool locations.

Profile: Profile data was collected on 1111 linear feet of Reach 1 and 208 linear feet of stream profile on Reach 2 throughout the Enhancement I stream segment.

b. Hydrologic Criteria

One verified stream bankfull event occurred in October of 2007 on Reach 2. A stream flow level recorder is located on Reach 2 at stream station 2+90, which shows the highest level of water flow through the channel. Table VIII shows this bankfull event and Figure 1 illustrates the recorded rain gauge data that substantiates the date.

Table VIII b. Verification of Bankfull Events			
Date of Data Collection	**Date of Occurrence**	**Method**	**Photo # (if available)**
11/15/2007	October 26, 2007	Stream Gauge / Rain Gauge Haw River	None

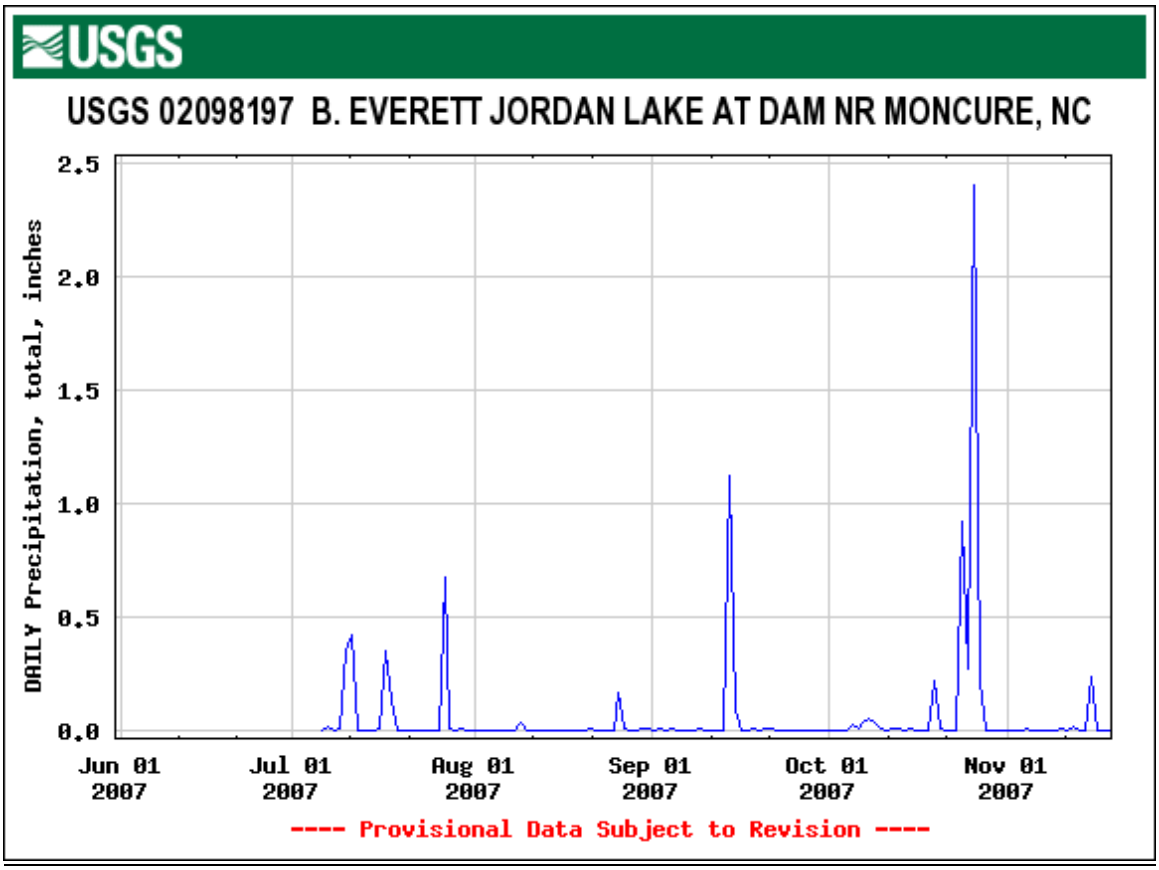

Figure 1. USGS rain gauge in Moncure, NC.

2. Current Conditions Plan View (Stream)

Reach 1: The overall stream conditions of the bank repairs and re-alignment are holding up very well. There are only a few areas along the stream that have minor toe erosion however the upper banks in these areas are well vegetated. At stream station 7+50 to 7+75 (photo 381) the bank is very vertical with large tree roots. This area was not part of the original repairs to the stream bank and the extensive tree roots in this area have stabilized the bank. All areas noted in Reach one have been identified as trouble areas that warrant future monitoring.

Reach 2: The overall channel pattern, profile and dimensions of Reach 2 have remained stable during this first year of monitoring. Most of the fabric placed on the channel broke down within the first 3 months of installation. However the vegetation has established well along the stream banks and floodplain. Because of the drought the stream was not subject to large storm events during the initial establishment of vegetation. The left stream bank from station 8+90 to 9+40 has no fabric or vegetation and the soils in this area are not conducive to vegetation establishment. Toe erosion has occurred at some constructed riffle locations due to vegetation establishment within the channel that has forced the water to the edge of the rocks.

Shortly after construction was completed the adjacent property owner to the west cleared his entire property. A tributary from this property enters Reach 2 at stream station 3+70. Two locations downstream have experienced channel incision as illustrated in photographs 447 and 449. The channel has become narrower and deeper. At the end of Reach 2 the land owner below the project constructed a road and installed an 18" pipe in the channel. This restriction has caused aggregation of the channel for a distance of approximately 23 feet. The rock cross vane structure is currently buried in sediment. Ms. Melonie Allen the EEP project manager is currently in the process of obtaining an easement from Mr. Pike to allow the replacement of the current 18" pipe with a 36"pipe. This 36-inch pipe will have sufficient capacity to pass the bankfull storm event. As a part of the pipe retrofit the channel incision at stations 1+60 – 1+80 and station 2+35 to 3+45 will also be addressed for repairs.

See Appendix B, Section 1, Figures 2 & 3: Current Conditions Plan View for Reach 1 and Reach 2.

3. Problem Areas Table

Table X a. Stream Problem Areas Reach 1 UT Rocky River Smith Tract / Number 046107			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Debris Forming Downstream of Culverts (watch)	1+20 1+28	Culverts Larger Velocity Causing Scour maybe a place to watch if enough debris builds up may go around either side	374
Left Bank	1+32 1+35	Left Bank erosion over roots - due to debris overflow upstream Still a lot of roots and rock	375
Bank toe erosion left	1+73 1+83	Channel shifting from center to left side	376
Bank undercut toe right	3+26 3+38	Channel has shifted to the right toe undercut ~ 1' good vegetation on top - maybe water line when water in channel	377
Steep Bank Vegetation has not established well	3+44 3+51	steep bank - still has vegetation and large tree roots to prevent mass failure - (picture 6) - overall upstream	378
Left Bank not much vegetation - however large tree roots	4+54 4+58	tree roots & steep bank left side hard for add vegetation to grow - bank is currently stable w/remaining fabric	379
Left Bank toe no vegetation - not undercut	5+74 6+00	no vegetation on bank, toe still holding slope maybe where pool is usually under water no flow currently in channel inside bend of pool	380
Left Bank Steep major roots not much other vegetation	7+54 7+77	Bank looks stable not repaired originally in project, large tree roots & trees on bank holding bank - no signs of erosion upstream	381

Table X b. Stream Problem Areas Reach 2 UT Rocky River Smith Tract / Number 046107			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Bed on Left Side Riffle Eroding - Bypass	10+70 10+76	Bypassing Rock - Vegetation very dominant on Right Hand Side, not as much vegetation on left side - move rip rap over	383
Bed on Left Ripple Erosion - Bypass	10+00 10+08	Riffle Downstream of tree - water bypassing on left side	384
Left Outer Bank No Vegetation	9+55 9+68	Stable bank - No vegetation some degradation - vane helping, sta. - 13.5'	432
Bank widening both sides of riffle	9+39 9+52	Riffle #5 - vegetation not established on bar - fabric gone 9'	433
Bank not protected	9+20 9+39	Loss of vegetation, fabric missing 19'	434
Riffle not stable no vegetation or rocks	9+15 9+23.5	8.5' - gravel starting to form, no vegetation - sediment causing shift in channel	435
Outside bank of pool & riffle no vegetation	8+85 9+15	No fabric - bad soils - 17'	436
Bank Erosion Sediment Loss	7+69 7+75	6' Water eroding left bank going around rip rap - lack of vegetation bank eroded	438
Bank bare	5+10 5+17	Loss of bank vegetation, some erosion	442
Fescue In Channel		Pool at Station 4+10, pool length has grass seed washing from upstream property this continues in channel downstream	444
Erosion at toe of riffle	3+76.5 3+90	Lack of vegetation on right bank toe, length = 13.5', ~ 6" deep at toe	445
Eroded toe left bank	3+05 3+13	too much vegetation growing on top of rip rap in channel forcing water to left toe L=8'	446
Riffle un-stable grade	2+54 2+60	caused by high velocities from upstream	450
Channel Incised bank erosion vertical	2+35 2+45	channel destabilized after adjacent field was cleared, LF 10'	447
Vertical bank erosion inside bend	1+60 1+70	Vertical erosion caused by rip rap forcing water to inside of bend, channel narrow at this location	448
down cut of channel	1+60 1+85	large rip rap & destabilizing from off side adjacent clearing	449
Sediment Filled Channel	0+00 0+23	Deposition from floodplain due to pipe restriction downstream, buried cross vane, silt check still in channel	452

4. Numbered Issue Photo Section

See Appendix B, Section 1, Figures 2 & 3: Current Conditions Plan View for Reach 1 and Reach 2. Also, See Appendix B, Section 2: Additional Stream Photos

5. Fixed station photos

See Appendix B, Section 4: Cross Section Plots and Raw Data Tables

6. Stability Assessment Table

Table XI a. Categorical Stream Feature Visual Stability Assessment based on Enhancement I length of 195 LF Station 9+00 to 10+95
UT Rocky River Smith Tract / Number 046107
Reach 1:1095 feet total length Enhancement I & III

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	80%				
B. Pools	100%	100%				
C. Thalweg	100%	100%				
D. Meanders	100%	100%				
E. Bed General	100%	100%				
F. Vanes/J Hooks etc.	100%	100%				
G. Wads and Boulders	100%	NA				

Table XI b. Categorical Stream Feature Visual Stability Assessment
UT Rocky River Smith Tract / Number 046107
Reach 2: 1108 feet

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	100%	92%				
B. Pools	100%	91%				
C. Thalweg	100%	95%				
D. Meanders	100%	96%				
E. Bed General	100%	99.98%				
F. Vanes/J Hooks etc.	100%	100%				
G. Wads and Boulders	100%	NA				

Table XII a. Baseline Morphology and Hydraulic Summary
UT Rocky River Smith Tract / Number 046107
Reach 1: 1095 feet total, Enhancement I length 208 feet Station 8+87 to 10+95

Parameter	USGS Gage Data			Regional Curve Data			Pre-Existing Condition (208')			Project Reference Stream			Design (208')			As-built (208')		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)		NA		8.1	28	14	17	22.3	19.9	12.7	13.9	13.3	-	-	24	-	-	23.9
Floodprone width (ft)		NA			NA		95	196	153	27	45	35.3	125	155	140	125	155	140
BF Cross Sectional Area (sq. ft)		NA		13	50	25	31.4	36	34	11.03	11.95	11.59	38	53	38.4	-	-	34.4
BF Mean depth (ft)		NA		1.03	2.6	1.6	1.5	2.08	1.74	0.85	0.91	0.88	-	-	1.6	-	-	1.44
BF Max Depth (ft)		NA			NA		2.45	3	2.62	1.26	1.44	1.34	2.3	2.6	2.45	2.3	2.6	2.8
Width/Depth Ratio		NA			NA		8.17	14.87	11.75	14.5	16.35	15.15	-	-	15	-	-	16.6
Entrenchment Ratio		NA			NA		4.8	7	6	2.13	3.24	2.65	5.2	6.45	5.8	5.23	6.48	5.85
Bank Height Ratio		NA			NA		1.0	1.3	1.2	0.84	1.8	1.19	1.0	1.2	1.1	1.0	1.2	1.15
Wetted Perimeter (ft)		NA			NA			-			-		-	-	24.93	-	-	26
Hydraulic Radius (ft)		NA			NA		1.5	1.74	1.5	0.79	0.81	0.8	-	-	1.54	-	-	1.32
Pattern																		
Channel Beltwidth (ft)		NA			NA		40	80	60	15	32	21.7	40	70	50	40	70	50
Radius of Curvature (ft)		NA			NA		15	70	40	11.7	35.9	21.5	55	70	60	55	70	62
Meander Wavelength (ft)		NA			NA		65	160	112	35	57.5	45.8	100	110	105	100	110	105
Meander Width Ratio		NA			NA		2.35	3.58	3.01	1.13	2.41	1.63	1.6	2.9	2.0	1.67	2.93	2.1
Profile																		
Riffle length (ft)		NA			NA		8	45	24.5	5	24	15.92	10	60	30	7	53	24
Riffle slope (ft/ft)		NA			NA		0.003	0.036	0.015	0.0156	0.149	0.0257	0.033	0.037	0.034	0.012	0.032	0.03
Pool length (ft)		NA			NA		7	46	23	5	19	9.99	19	55	40	19	50	36
Pool spacing (ft)		NA			NA		26	57.5	43.7	22.8	64	40.3	27	60	52.6	24	60	45.8
Substrate																		
d50 (mm)		NA			NA		-	-	37	-	-	3	-	-	36		10	
d84 (mm)		NA			NA		-	-	79	-	-	31	-	-	74		33	
Additional Reach Parameters																		
Valley Length (ft)		NA			NA		-	-	185	-	-	312	-	-	185	-	-	185
Channel Length (ft)		NA			NA		-	-	222	-	-	397	-	-	208	-	-	208
Sinuosity		NA			NA		-	-	1.2	-	-	1.27	-	-	1.12	-	-	1.12
Water Surface Slope (ft/ft)		NA			NA		-	-	0.0088	-	-	0.0078	-	-	0.0103	-	-	0.0093
BF slope (ft/ft)		NA			NA		-	-	0.0103	-	-	0.0079	-	-	0.0105	-	-	0.0105
Rosgen Classification		NA			NA		-	-	C4/E4	-	-	C4	-	-	C4	-	-	C4

*Data could not be collected for base line data directly after construction due to stream matting covering the substrate

Table XII b. Baseline Morphology and Hydraulic Summary
UT Rocky River Smith Tract / Number 046107
Reach 2: 1111 feet

Parameter	USGS Gage Data			Regional Curve Data			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)		NA		3.7	14	7.6	7.7	8.7	8.13	12.7	13.9	13.3	-	-	11	9.89	14.57	11.15
Floodprone width (ft)		NA			NA		11	12	11.33	27	45	35.3	100	200	144	104	200	141.2
BF Cross Sectional Area (sq. ft)		NA		3.4	15	7.5	6.03	7.04	6.7	11.03	11.95	11.59	8.2	9.2	8.2	8.04	14.87	9.86
BF Mean depth (ft)		NA		0.59	1.55	1.02	0.75	0.91	0.82	0.85	0.91	0.88	0.74	0.84	0.74	0.77	1.02	0.87
BF Max Depth (ft)		NA			NA		1.2	1.37	1.26	1.26	1.44	1.34	1.05	1.33	1.16	1.34	1.64	1.51
Width/Depth Ratio		NA			NA		8.42	10.94	10	14.5	16.35	15.15	13	16.35	15	11.16	14.28	12.75
Entrenchment Ratio		NA			NA		1.26	1.56	1.4	2.13	3.24	2.65	9.9	18	13	7.9	21.85	13.56
Bank Height Ratio		NA			NA		1.46	1.83	1.66	0.84	1.18	1.02	0.84	1.15	1.0	1.0	1.12	1.04
Wetted Perimeter (ft)		NA			NA			-			-			-		10.40	15.11	11.78
Hydraulic Radius (ft)		NA			NA		0.75	0.91	0.82	0.79	0.81	0.8		-		0.73	0.98	0.83
Pattern																		
Channel Beltwidth (ft)		NA			NA		13	35	20	15	32	21.7	12.5	26.5	18	14.3	35	21
Radius of Curvature (ft)		NA			NA		7.6	21.2	12.3	11.7	35.9	21.5	10	20	13.5	10	20	13.8
Meander Wavelength (ft)		NA			NA		35	85	57	35	57.5	45.8	24	65	38	24	65	37.1
Meander Width Ratio		NA			NA		1.6	4.3	2.46	1.13	2.41	1.63	1.13	2.41	1.63	1.3	2.7	1.98
Profile																		
Riffle length (ft)		NA			NA		4	117.5	22.78	5	24	15.92	4	26	9.5	3	26.3	9.48
Riffle slope (ft/ft)		NA			NA		0.005	0.0722	0.0305	0.0156	0.149	0.0257	0.02	0.083	0.035	0.012	0.064	0.033
Pool length (ft)		NA			NA		6	13	9.75	5	19	9.99	13	27	16.4	7.88	29.5	15.84
Pool spacing (ft)		NA			NA		14	139	40	22.8	64	40.3	17	51	27.5	12.3	63	28
Substrate																		
d50 (mm)		NA			NA		-	-	29	-	-	3	-	-	29		*	
d84 (mm)		NA			NA		-	-	110	-	-	31	-	-	110		*	
Additional Reach Parameters																		
Valley Length (ft)		NA			NA		-	-	950	-	-	312	-	-	950	-	-	950
Channel Length (ft)		NA			NA		-	-	1011	-	-	397	-	-	1165	-	-	1111
Sinuosity		NA			NA		-	-	1.06	-	-	1.27	-	-	1.23	-	-	1.2
Water Surface Slope (ft/ft)		NA			NA		-	-	0.0154	-	-	0.0078	0.0087	0.016	0.0126	-	-	-
BF slope (ft/ft)		NA			NA		-	-	0.0137	-	-	0.0079	0.0087	0.016	0.0126	-	-	0.009/0.014**
Rosgen Classification		NA			NA		-	-	G4	-	-	C4	-	-	C4	-	-	C4

*Data could not be collected for base line data directly after construction due to stream matting covering the substrate

**Upper portion of reach2/Lower portion of reach 2

Table XIII a. Morphology and Hydraulic Monitoring Summary
UT Rocky River Smith Tract / Number 046107
Reach 1: 1095 feet

Parameter	Cross Section 1 Riffle																	
Dimension	MY1	MY2	MY3	MY4	MY5	MY+												
BF Width (ft)	18.18																	
Floodprone Width (ft)	157.65																	
BF Cross Sectional Area (sq.ft)	27.81																	
BF Mean Depth (ft)	1.53																	
BF Max Depth (ft)	2.48																	
Width/Depth Ratio	11.89																	
Entrenchment Ratio	8.44																	
Bank Height Ratio	1.25																	
Wetted Perimeter (ft)	19.1																	
Hydraulic Radius (ft)	1.46																	
Substrate																		
d50 (mm)	10																	
d84 (mm)	33																	

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY-06 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	27	58	39															
Radius of Curvature (ft)	21	65	39															
Meander Wavelength (ft)	63	104	83.8															
Meander Width Ratio	1.23	2.04	1.63															
Profile																		
Riffle length (ft)	4	18	7.2															
Riffle slope (ft/ft)	0.02	0.04	0.03															
Pool length (ft)	13	18	14.2															
Pool spacing (ft)	17	36	21.7															
Additional Reach parameters																		
Valley Length (ft)	1060																	
Channel Length (ft)	1139																	
Sinuosity	1.07																	
Water Surface Slope (ft/ft)	*																	
BF Slope (ft/ft)	0.0093																	
Rosgen Classification	C4																	

* No Data - Stream was dry at time of survey

Table XIII b. Morphology and Hydraulic Monitoring Summary
Smith Tract / Number 046107
Reach 2: 1111 feet

Parameter	Cross Section 1 Riffle						Cross Section 2 Pool						Cross Section 3 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	13.17						9.94						9.15					
Floodprone Width (ft)	104.0						112.0						200.0					
BF Cross Sectional Area (sq.ft)	12.56						8.62						7.15					
BF Mean Depth (ft)	0.95						0.87						0.78					
BF Max Depth (ft)	1.59						1.35						1.30					
Width/Depth Ratio	13.81						11.45						11.72					
Entrenchment Ratio	7.90						11.27						21.85					
Bank Height Ratio	2.13						1.26						1.15					
Wetted Perimeter (ft)	13.68						10.46						9.72					
Hydraulic Radius (ft)	0.92						0.82						0.74					
Substrate																		
d50 (mm)	22.00						0.18						0.25					
d84 (mm)	110.00						11.00						11.00					

Parameter	MY-01 (2007)			MY-02 (2008)			MY-03 (2009)			MY-04 (2010)			MY-05 (2011)			MY-06 (2012)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	12.5	26.5	18															
Radius of Curvature (ft)	10	30	18															
Meander Wavelength (ft)	29	48	38															
Meander Width Ratio	1.13	2.41	1.63															
Profile																		
Riffle length (ft)	2.66	26.3	9.6															
Riffle slope (ft/ft)	-0.02	0.06	0.03															
Pool length (ft)	7.38	29	14.3															
Pool spacing (ft)	12.3	46.9	25.6															
Additional Reach parameters																		
Valley Length (ft)	950																	
Channel Length (ft)	1200																	
Sinuosity	1.26																	
Water Surface Slope (ft/ft)	*																	
BF Slope (ft/ft)	0.009 / 0.014**																	
Rosgen Classification	C4																	

* No Data - Stream was dry at time of survey

**Upper portion of reach2/Lower portion of reach 2

Table XIII b. Morphology and Hydraulic Monitoring Summary (cont.) Smith Tract / Number 046107 Reach 2: 1111 feet												
Parameter	Cross Section 4 Pool						Cross Section 5 Riffle					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	11						10.64					
Floodprone Width (ft)	160.0						130.0					
BF Cross Sectional Area (sq.ft)	11.05						10.33					
BF Mean Depth (ft)	1.00						0.97					
BF Max Depth (ft)	1.77						1.83					
Width/Depth Ratio	11.95						10.96					
Entrenchment Ratio	14.55						12.22					
Bank Height Ratio	1.46						0.61					
Wetted Perimeter (ft)	11.83						11.63					
Hydraulic Radius (ft)	0.93						0.89					
Substrate												
d50 (mm)	0.20						0.23					
d84 (mm)	16.00						90.00					

7. Quantitative Measures Summary Tables (Tables XII and XIII)

See Tables XII and XIII on the previous five pages for morphological data comparisons of pre existing conditions, reference stream, stream design, as-built and year one monitoring cross sections. (Tables XIIa and XIIIa are for Reach 1, and Tables XIIb and XIIIb are for Reach 2) The morphological data for the two reaches indicate that the stream has changed in only a few places during the last year. A pool has begun to form in the restoration portion of Reach 1 just downstream of the cattle crossing, but the rest of the restoration is performing as expected. The profile of Reach 2 has shifted in a few locations mainly due to the deepening of some pools. One particular pool on Reach 2 at station 2+40 has shifted approximately twelve feet downstream and the riffle at the top of it has been elongated, most likely due to the clearing of land above the tributary that enters the stream at station 3+60. Another reason that the profile may have shifted some could be due to the method of data collection. The stream was surveyed after construction using a tape and level and the year was survey was completed using a total station device. The total station data would remain fixed while the tape data could vary in places due to the tape layout or sliding when it was in the field.

The comparisons between the as-build and year one cross sections can be seen in Appendix B, Section 4. The overlays of the cross sections show that there has been very little erosion, aggradation or degradation in the permanent channel cross sections that represent each reach.

VI. Methodology Section

The data was collected for the year one monitoring report with a Nikon TDM 332 Total Station. The cross sections were surveyed between the permanent markers and compared on the cross sections to the base data collected for the Mitigation plan. The longitudinal profile was collected at every head of riffle, end of riffle and center of pool location. The thalweg elevation and top of bank (bankfull) were collected. No water was in the channel due to the drought therefore water surface elevations were unable to be obtained for the year one data. The total station data also allowed for the stream alignment to be established in plan view for the comparison of pattern data. The bank repair conditions for Reach 1 were located by station as marked by a tape measure located within the center of the channel.

Each of the vegetation plots were located by four preset metal conduits in the ground set according to the CVS protocol. Vegetation plots were monitored following the NCEEP/CVS protocols (Lee, M.T. et. al. 2007). This methodology provides a standardized method for gathering vegetation data. All data were subsequently entered into the NCEEP/CVS database and submitted electronically to NCEEP/CVS. All GPS data were collected using a Trimble GeoXT with sub-meter accuracy.

References:

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APPENDIX A

Vegetation Raw Data

1. **Vegetation Survey Data Tables**
    - **a.** Table 1. Vegetation Metadata
    - **b.** Table 2. Vegetation Vigor by Species
    - **c.** Table 3. Vegetation Damage by Species
    - **d.** Table 4. Vegetation Damage by Plot
    - **e.** Table 5. Planted Stem Count by Plot and Species
    - **f.** Table 6: All Stems (planted and natural) by Plot and Species

2. **Vegetation Problem Area Photos**
3. **Vegetation Monitoring Plot Photos**

1. Vegetation Survey Data Tables

Table 1. (Appendix A) Vegetation Metadata

Report Prepared By	Kate Montieth
Date Prepared	11/2/2007 10:50
database name	TheCatenaGroup-2006-A.mdb
database location	\\Gateway\catena\Mitigation Monitoring\cvs-eep-entrytool-v2.2.0
computer name	KATE

DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------

Metadata	This worksheet, which is a summary of the project and the project data.
Proj, planted	Each project is listed with its PLANTED stems, for each year. This excludes live stakes and lists stems per acre.
Proj, total stems	Each project is listed with its TOTAL stems, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems. Listed in stems per acre.
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.
ALL Stems by Plot and spp	Count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

PROJECT SUMMARY----------

Project Code	402
project Name	UT Rocky River Smith Tract
Description	1. Reconnect Reach 2 to its floodplain through the restoration of 1,011 linear feet of stream. 2. Relocate 150 feet and stabilize 955 feet of stream bank in Reach 1. 3. Provide a stable stream channel that neither degrades nor aggrades while maintaining
River Basin	
length(ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	0

Table 2. (Appendix A) Vegetation Vigor by Species

	Species	4	3	2	1	0	Missing
	Alnus serrulata	4	3			3	
	Betula nigra	5	6				1
	Carya cordiformis	6	12	5		4	
	Celtis laevigata		8	1			
	Fraxinus pennsylvanica	8	9				
	Ilex verticillata		4	1			1
	Nyssa sylvatica	1	4	1			
	Quercus alba	3	3	1			
	Quercus pagoda	4	3	1			
	Quercus phellos	2	6		1	1	
	Sambucus canadensis	4	1			2	1
	Viburnum nudum	1	1				
	Carpinus caroliniana					1	
	Quercus rubra	3	1				
	Lindera benzoin	2	1	2	1		2
	Liriodendron tulipifera	3	5			5	3
	Platanus occidentalis	4	1	1			
	Ulmus americana	2	3	1			1
TOT:	**18**	**52**	**71**	**14**	**2**	**16**	**9**

Table 3. (Appendix A) Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Flood	Human Trampled	Insects	Other/ Unknown Animal	Unknown	Vine Strangulation
	Alnus serrulata	10	5	3			1	1	
	Betula nigra	12	3	5			3	1	
	Carpinus caroliniana	1						1	
	Carya cordiformis	27	10	7			5	5	
	Celtis laevigata	9	5	2		1		1	
	Fraxinus pennsylvanica	17	13	4					
	Ilex verticillata	6	4				2		
	Lindera benzoin	8	5	2				1	
	Liriodendron tulipifera	16	9	2	1			4	
	Nyssa sylvatica	6	3		1		1		1
	Platanus occidentalis	6	6						
	Quercus alba	7	3		1	1	2		
	Quercus pagoda	8	5			1		2	
	Quercus phellos	10	7	1			2		
	Quercus rubra	4	3		1				
	Sambucus canadensis	8	5	1				2	
	Ulmus americana	7	2	4			1		
	Viburnum nudum	2	1			1			
TOT:	**18**	**164**	**89**	**31**	**4**	**4**	**17**	**18**	**1**

Table 4. (Appendix A) Vegetation Damage by Plot

	plot	All Damage Categories	(no damage)	Flood	Human Trampled	Insects	Other/ Unknown Animal	Unknown	Vine Strangulation
	402-01-0001-year:1	22	12				1	9	
	402-01-0002-year:1	21	17			1	2	1	
	402-01-0003-year:1	23	12		3	1	4	2	1
	402-01-0004-year:1	38	22	12	1	1		2	
	402-01-0005-year:1	26	9	11			6		
	402-01-0006-year:1	34	17	8		1	4	4	
TOT:	**6**	**164**	**89**	**31**	**4**	**4**	**17**	**18**	**1**

Table 5. (Appendix A) Planted Stem Count by Plot and Species

	Species	Total Planted Stems	# plots	avg# stems	plot 402-01-0001-year:1	plot 402-01-0002-year:1	plot 402-01-0003-year:1	plot 402-01-0004-year:1	plot 402-01-0005-year:1	plot 402-01-0006-year:1
	Alnus serrulata	7	4	1.75	1	2		1		3
	Betula nigra	11	4	2.75		1		4	5	1
	Carya cordiformis	23	6	3.83	7	3	2	4	1	6
	Celtis laevigata	9	3	3	1	3		5		
	Fraxinus pennsylvanica	17	5	3.4	2	4		5	5	1
	Ilex verticillata	5	2	2.5				1		4
	Lindera benzoin	6	3	2	1			1		4
	Liriodendron tulipifera	8	5	1.6	1	2	3	1	1	
	Nyssa sylvatica	6	1	6			6			
	Platanus occidentalis	6	3	2	3				2	1
	Quercus alba	7	1	7			7			
	Quercus pagoda	8	4	2	2	2		2	2	
	Quercus phellos	9	3	3		3			5	1
	Quercus rubra	4	1	4			4			
	Sambucus canadensis	5	2	2.5				1		4
	Ulmus americana	6	3	2				4	1	1
	Viburnum nudum	2	1	2						2
TOT:	**17**	**139**	**17**		**18**	**20**	**22**	**29**	**22**	**28**

Table 6: (Appendix A) All Stems (planted and natural) by Plot and Species

	Species	Total Stems	# plots	avg# stems	402-01-0001-year:1	402-01-0002-year:1	402-01-0003-year:1	402-01-0004-year:1	402-01-0005-year:1	402-01-0006-year:1
	Albizia julibrissin	2	1	2	2					
	Alnus serrulata	10	4	2.5	1	2		2		5
	Betula nigra	110	6	18.33	32	7	58	4	7	2
	Carya alba	2	1	2			2			
	Carya cordiformis	28	6	4.67	8	3	2	5	4	6
	Celtis laevigata	10	3	3.33	2	3		5		
	Fraxinus pennsylvanica	18	5	3.6	2	4		5	5	2
	Ilex verticillata	5	2	2.5				1		4
	Juglans nigra	4	1	4		4				
	Ligustrum sinense	8	2	4			4			4
	Liquidambar styraciflua	58	4	14.5			3	18	18	19
	Nyssa sylvatica	6	1	6			6			
	Pinus taeda	13	3	4.33			3	8	2	
	Quercus alba	7	1	7			7			
	Quercus pagoda	8	4	2	2	2		2	2	
	Quercus phellos	10	4	2.5		3		1	5	1
	Sambucus canadensis	7	2	3.5				1		6
	Viburnum nudum	2	1	2						2
	Ilex opaca	2	1	2			2			
	Carpinus caroliniana	1	1	1	1					
	Cercis canadensis	8	2	4		7				1
	Quercus rubra	5	1	5			5			
	Carya glabra	4	3	1.33			2		1	1
	Lindera benzoin	6	3	2	1			1		4
	Liriodendron tulipifera	35	6	5.83	3	2	9	12	4	5
	Morus	2	1	2			2			
	Platanus occidentalis	6	3	2	3				2	1
	Acer rubrum	74	5	14.8		2	14	35	18	5
	Ulmus americana	44	3	14.67				26	17	1
TOT:	**29**	**495**	**29**		**57**	**39**	**119**	**126**	**85**	**69**

2. Vegetation Problem Area Photos

Reach 1:

Photo 1

Photo 2

Photos 1 and 2: Site 1 - Small population of privet in floodplain, bank, and bench (about 20 stems). All appear to be less than 2 years old.

Photo 3

Photo 4

Photos 3 and 4: Site 2 - Bare floodplain, 30-80% soil exposure in 3 x 10 meter area

Photo 5

Photo 6

Photo 7

Photo 5-7: Site 3 - Microstegium invasion (50-90% coverage) in floodplain depression along side slope and in adjacent floodplain

Photo 8

Photo 8: Site 4 - Bare bank and outbreak of *Rosa multiflora* on bank.

Photo 9

Photo 10

Photo 11

Photo 9-11: Site 5 - Privet outbreak on top of bank (about 15 stems). All appear to be 2 to 3 years old. Microstegium sp. (70-100% coverage) on entire left descending floodplain. Bare bench on left descending side.

Photo 12

Photo 12: Site 6 - Small outbreak of privet (5-10 stems) and a few blackberry stems on banks and top of banks

Photo 13

Photo 13: Site 7 - Privet outbreak (about 30stems) on banks and large bench. All appear to be between one and two years old.

Photo 14

Photo 14: Site 8 – Privet outbreak (around 20 stems) on bench and banks. All appear to be between one and two years old.

Reach 2:

Photo 15

Photo 16

Photo 17

Photos 15-17: Site 9 – Significant outbreak of blackberry (about 15 stems) and privet (about 20 stems) in floodplain. All appear to be less than one year old. Japanese honeysuckle is the dominant herbaceous plant. Microstegium is dominant as well. One Japanese lantern as well.

Photo 18

Photo 19

Photo 20

Photos 18-20: Sites 10a-f – Bare bank and bench at several sites along reach.

Photo 21

Photo 21: Site 11 – Bare floodplain (about 25 m^2) with between 20-100% soil exposure.

Photo 22

Photo 23

Photos 22-23: Site 12 – Floodplain area (3 meter by 15 metr) that was not planted but has dense Microstegium cover (approx. 80%). Also, Blackberry and privet are present (about 30 stems). Additionally, there are three stems of autumn olive (1-3 years old) present.

3. Vegetation Monitoring Plot Photos

Photo 1: Plot 402-01-0001-year: 1 from origin (29 October 2007)

Photo 2: Plot 402-01-0001-year: 1 from (20,5) (29 October 2007)

Photo 3: 402-01-0002-year: 1 from origin (29 October 2007)

Photo 4: 402-01-0002-year: 1 from (20,5) (29 October 2007)

Photo 5: Plot 402-01-0003-year: 1 from origin (16 November 2007)

Photo 6: Plot 402-01-0003-year: 1 from (20,5) (16 November 2007)

Photo 7: Plot 402-01-0004-year: 1 from origin (29 October 2007)

Photo 8: Plot 402-01-0004-year: 1 from origin(29 October 2007)

Photo 9: Plot 402-01-0005-year: 1 from origin(30 October 2007)

Photo 10: Plot 402-01-0005-year: 1 from (20,5) (30 October 2007)

Photo 11: Plot 402-01-0006-year: 1 from origin (30 October 2007)

Photo 12: Plot 402-01-0006-year: 1 from (20,5) (30 October 2007)

APPENDIX B

1. Current Conditions Plan View (Stream) with Stream Problem Area Photos
   - Figure 2: Reach 1
   - Figure 3: Reach 2

2. Additional Stream Photos

3. Table B.1. a: Reach 1 Qualitative Visual Stability Assessment
   Table B.1. b: Reach 2 Qualitative Visual Stability Assessment

4. Cross section Plots and Raw Data Tables
   - Figure 4: Reach 1 Cross Section 1
   - Figures 5-9: Reach 2 Cross Sections 1-5

5. Longitudinal Plots and Raw Data Tables

6. Pebble Count Plots and Raw Data Tables

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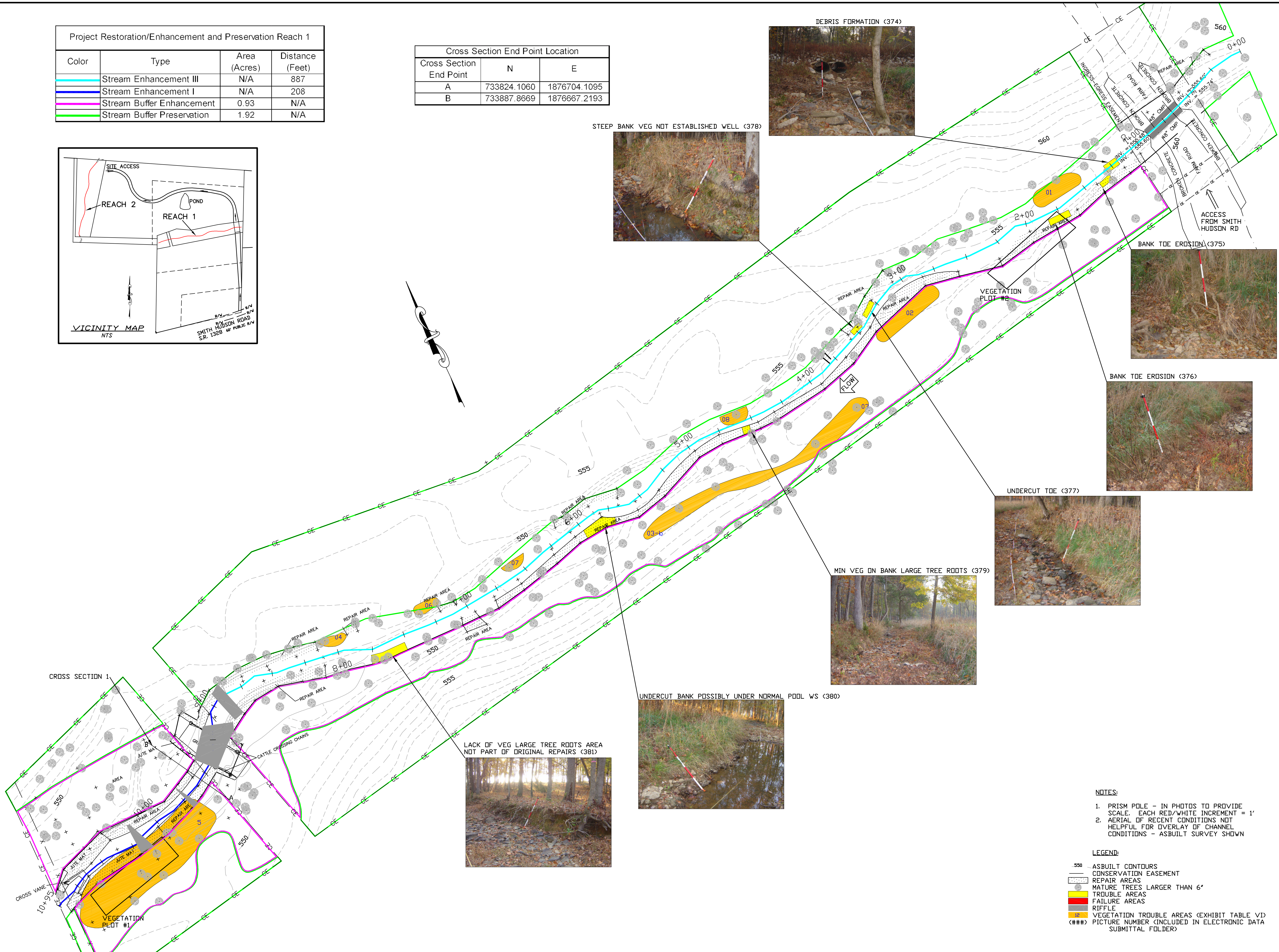
Project Restoration/Enhancement and Preservation Reach 1			
Color	Type	Area (Acres)	Distance (Feet)
(light blue line)	Stream Enhancement III	N/A	887
(blue line)	Stream Enhancement I	N/A	208
(magenta line)	Stream Buffer Enhancement	0.93	N/A
(green line)	Stream Buffer Preservation	1.92	N/A

Cross Section End Point Location		
Cross Section End Point	N	E
A	733824.1060	1876704.1095
B	733887.8669	1876667.2193



NOTES:

1. PRISM POLE - IN PHOTOS TO PROVIDE SCALE. EACH RED/WHITE INCREMENT = 1'
2. AERIAL OF RECENT CONDITIONS NOT HELPFUL FOR OVERLAY OF CHANNEL CONDITIONS - ASBUILT SURVEY SHOWN

LEGEND:

- 550 ASBUILT CONTOURS
- CONSERVATION EASEMENT
- REPAIR AREAS
- MATURE TREES LARGER THAN 6"
- TROUBLE AREAS
- FAILURE AREAS
- RIFFLE
- 12 VEGETATION TROUBLE AREAS (EXHIBIT TABLE VI)
- (###) PICTURE NUMBER (INCLUDED IN ELECTRONIC DATA SUBMITTAL FOLDER)

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North Carolina - Ecosystem Enhancement Program
UT Rocky River Smith Tract Stream Restoration/Enhancement & Buffer Enhancement & Preservation
Chatham County, North Carolina

Ecosystem Enhancement PROGRAM

SEAL:

NORTH CAROLINA PROFESSIONAL SEAL 1344 ENGINEER BECKY LYNNE WARD

SMITH TRACT REACH 1 CURRENT CONDITIONS PLAN VIEW YEAR 1 MONITORING

CHATHAM COUNTY, NORTH CAROLINA

DATE: 30 NOV 2007

REVISIONS:

PROJECT NAME: Smith Tract\Year 1

DWG NAME: Current Conditions

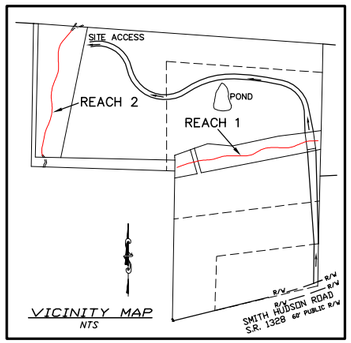
SCALE: 1" = 30'

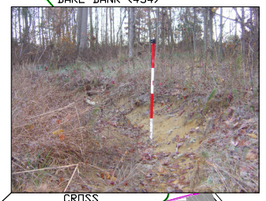
FIGURE NO. FIGURE 2

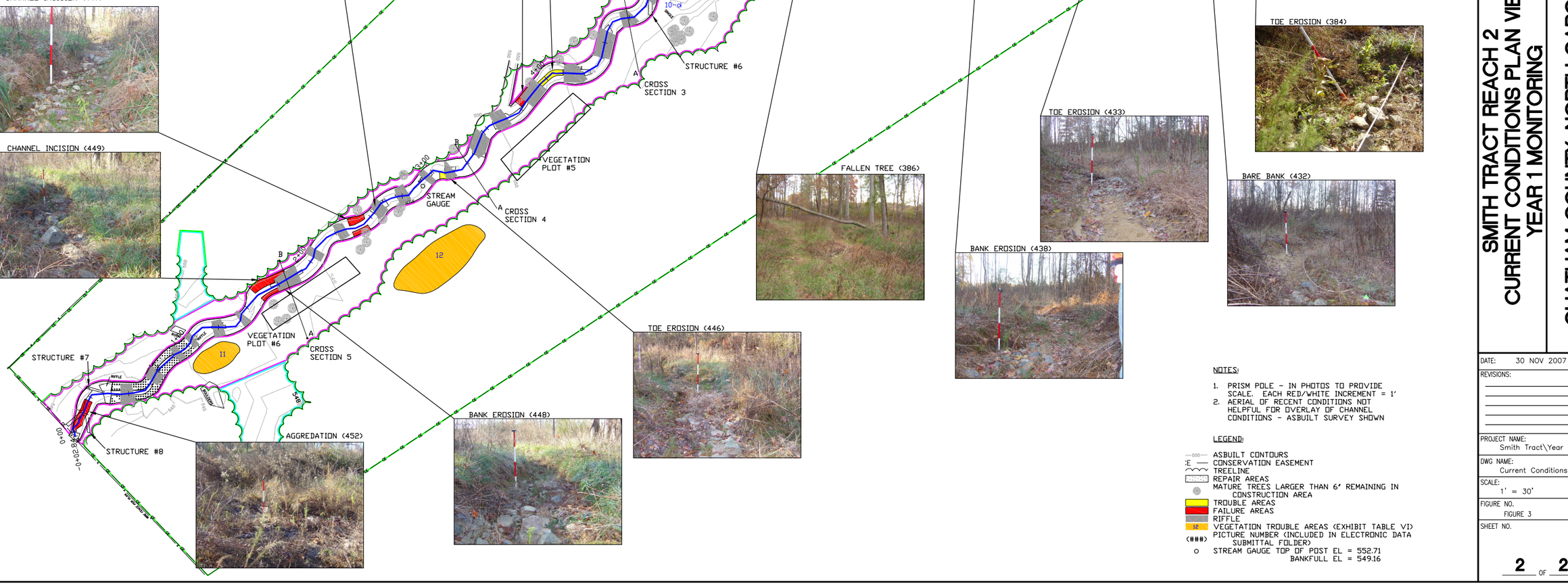
SHEET NO. 1 OF 2

Cross Section End Point Location		
Cross Section End Point	N	E
1A	734770.6815	1875860.2341
1B	734765.6764	1875825.7475
2A	734621.3458	1875826.4058
2B	734610.9128	1875782.0127
3A	734295.4879	1875723.9208
3B	734325.6398	1875679.0059
4A	734172.2999	1875721.5460
4B	734182.0824	1875674.4448
5A	734030.8050	1875695.0275
5B	734052.8321	1875648.3779

Project Restoration/Enhancement and Preservation Reach 2			
Color	Type	Area (Acres)	Distance (Feet)
	Stream Restoration	N/A	1111
	Stream Buffer Enhancement	0.76	N/A
	Stream Buffer Preservation	4.48	N/A
	Stream Buffer Restoration	0.15	N/A







NOTES:

1. PRISM POLE - IN PHOTOS TO PROVIDE SCALE. EACH RED/WHITE INCREMENT = 1'
2. AERIAL OF RECENT CONDITIONS NOT HELPFUL FOR OVERLAY OF CHANNEL CONDITIONS - ASBUILT SURVEY SHOWN

LEGEND:

- ASBUILT CONTOURS
- CONSERVATION EASEMENT
- TREELINE
- REPAIR AREAS
- MATURE TREES LARGER THAN 6' REMAINING IN CONSTRUCTION AREA
- TROUBLE AREAS
- FAILURE AREAS
- RIFFLE
- VEGETATION TROUBLE AREAS (EXHIBIT TABLE VI)
- (###) PICTURE NUMBER (INCLUDED IN ELECTRONIC DATA SUBMITTAL FOLDER)
- STREAM GAUGE TOP OF POST EL = 552.71, BANKFULL EL = 549.16

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North Carolina – Ecosystem Enhancement Program

UT Rocky River Smith Tract Stream Restoration/ Enhancement & Buffer Enhancement & Preservation
Chatham County, North Carolina

SEAL:

SMITH TRACT REACH 2
CURRENT CONDITIONS PLAN VIEW
YEAR 1 MONITORING

CHATHAM COUNTY, NORTH CAROLINA

DATE: 30 NOV 2007

REVISIONS:

PROJECT NAME: Smith Tract\Year 1

DWG NAME: Current Conditions

SCALE: 1' = 30'

FIGURE NO. FIGURE 3

SHEET NO. 2 OF 2

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Appendix B, Section 2: Additional Stream Photos

Reach 1:

Photo 382 - looking upstream at cross vane Reach 1

Reach 2:

Photo 459 – Structure #1

Photo 437 – Structure #2

Photo 439 – Structure #3

Photo 440 – Structure #4

Photo 441 – Structure #5

Photo 443 – Structure #6

Photo 451 – Structure #7

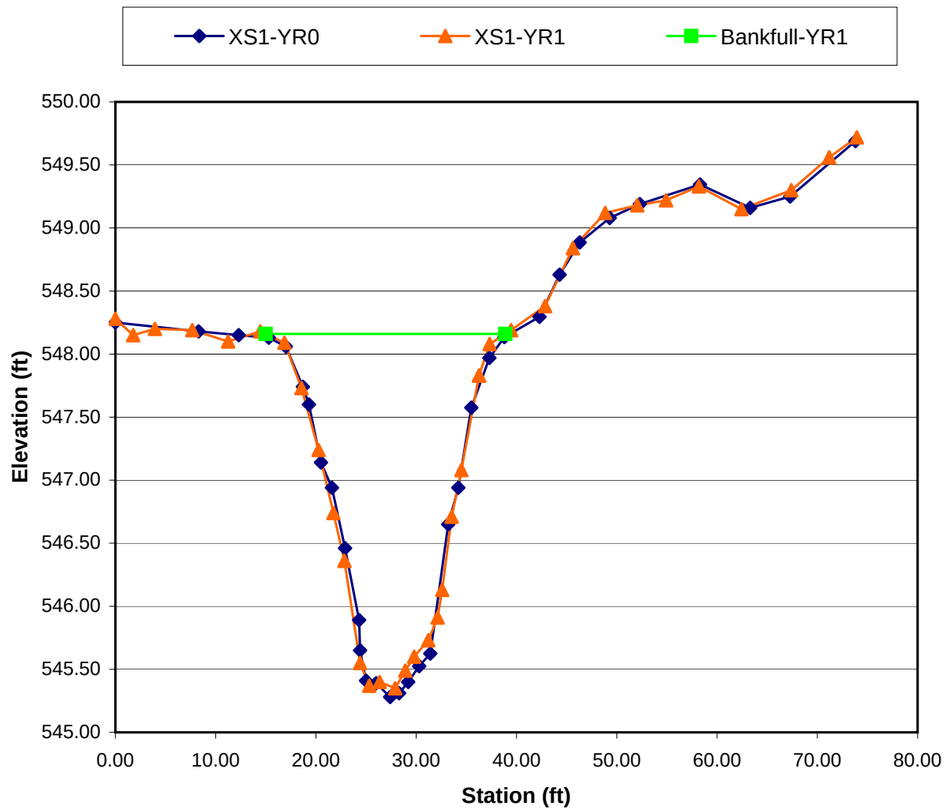
Table B.1. a. Visual Morphological Stability Assessment
Smith Tract / Number 046107
Reach 1: 1095 feet (reconstructed channel: sta. 8+87 to 10+95)

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 [1]	% Perform in Stable Condition [2]	Feature perform Mean or Total [3]
A. Riffles	1. Present? [4]	4	4	NA	100	
	2. Armor stable (e.g.no displacement?)	3	4	NA	75	
	3. Facet grade appears stable?	3	4	NA	75	
	4. Minimal evidence of embedding/fining?	4	4	NA	100	
	5. Length appropriate?	2	4	NA	50	**80%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. Or migrat.?) [4]	3	3	NA	100	
	2. Sufficiently deep (Max. Pool D:Mean Bkf>1.6?)	3	3	NA	100	
	3. Length appropriate?	3	3	NA	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering? [5]	3	3	NA	100	
	2. Downstream of meander (glide/inflection) centering? [5]	3	3	NA	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	3	3	NA	100	
	2. Of those eroding, # w/concomitant point bar formation?	3	3	NA	100	
	3. apparent Rc within spec?	3	3	NA	100	
	4. Sufficient floodplain access and relief? [6]	3	3	NA	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	NA	NA	
	2. Channel bed degradation-areas of increasing downcutting of head cutting?	NA	NA	NA	NA	**100%**
F. Vanes	1. Free of back or arm scour?	1	1	NA	100	
	2. Height appropriate?	1	1	NA	100	
	3. Angle and geometry appear appropriate?	1	1	NA	100	
	4. Free of piping or other structural failures?	1	1	NA	100	**100%**
G. Wads/ Boulders	1. Free of scour?	NA	NA	NA	NA	
	2. Footing stable?	NA	NA	NA	NA	NA

Table B.1. b. Visual Morphological Stability Assessment
Smith Tract / Number 046107
Reach 2: 1111 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 [1]	% Perform in Stable Condition [2]	Feature perform Mean or Total [3]
A. Riffles	1. Present? [4]	40	41	NA	98	
	2. Armor stable (e.g.no displacement?)	37	41	NA	90	
	3. Facet grade appears stable?	38	41	NA	93	
	4. Minimal evidence of embedding/fining?	39	41	NA	95	
	5. Length appropriate?	35	41	NA	85	**92%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. Or migrat.?) [4]	41	42	NA	98	
	2. Sufficiently deep (Max. Pool D:Mean Bkf>1.6?)	36	42	NA	86	
	3. Length appropriate?	38	42	NA	90	**91%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering? [5]	38	41	NA	93	
	2. Downstream of meander (glide/inflection) centering? [5]	40	41	NA	98	**95%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	39	42	NA	93	
	2. Of those eroding, # w/concomitant point bar formation?	3	3	NA	100	
	3. apparent Rc within spec?	41	42	NA	98	
	4. Sufficient floodplain access and relief? [6]	39	42	NA	93	**96%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	1/23	0.021	
	2. Channel bed degradation-areas of increasing downcutting of head cutting?	NA	NA	1/32	0.029	**99.98%**
F. Vanes	1. Free of back or arm scour?	8	8	NA	100	
	2. Height appropriate?	8	8	NA	100	
	3. Angle and geometry appear appropriate?	8	8	NA	100	
	4. Free of piping or other structural failures?	8	8	NA	100	**100%**
G. Wads/ Boulders	1. Free of scour?	NA	NA	NA	NA	
	2. Footing stable?	NA	NA	NA	NA	NA

Survey Data			Cross Section #1 (Reach 1)	
Station	**Elevation**	**Feature**	**Cross Section Plot - Looking Downstream**	**Cross Section Photo - Looking Upstream**
0.00	548.28	PVC		
1.77	548.15			
3.94	548.20			
7.67	548.19			
11.24	548.10			
14.45	548.18			
16.86	548.09	TOBL		
18.56	547.73			
20.26	547.24			
21.75	546.74			
22.84	546.36			
24.41	545.55	TOE L		
25.31	545.37			
26.36	545.40			
27.91	545.35	TW		
28.91	545.49			
29.79	545.60			
31.20	545.73			
32.14	545.91	TOE R		
32.59	546.13			
33.53	546.71			
34.50	547.08			
36.27	547.83	TOBR		
36.27	547.83	BANKFULL R		
37.33	548.08			
39.47	548.19			
42.85	548.38			
45.62	548.84			
48.84	549.12			
52.05	549.18			
54.92	549.22			
58.19	549.33			
62.43	549.15			
67.41	549.30			
71.19	549.56			
73.94	549.72	PVC		



Summary Data	
Bankfull Cross Sectional Area	34.65
Bankfull Width	23.90
Bankfull Mean Depth	1.45
Bankfull Max Depth	2.81
Width/Depth Ratio	16.49
Entrenchment Ratio	8.44
Classification	C4

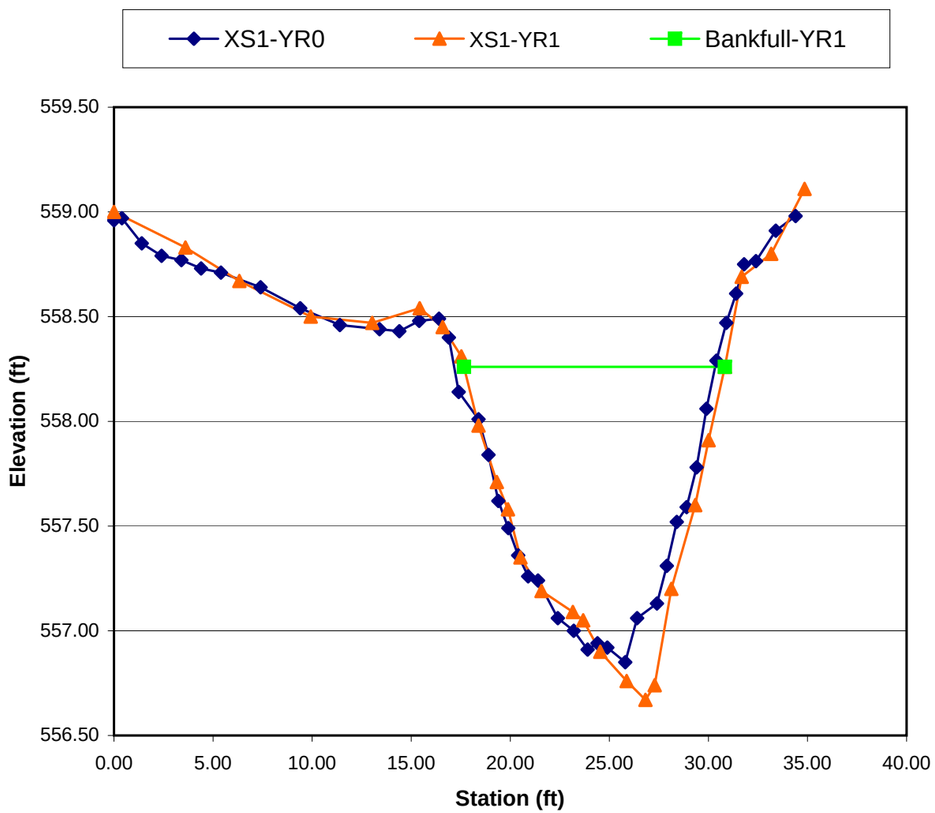
Title	Cross Section 1, Reach 1, Smith Tract			
Prepared For: Ecosystem Enhancement Program	**Project**	Smith Tract Restoration Project, Chatham County, North Carolina	**Project #**	046107
			Figure	4
	Survey Date	**Field Team**	**Location**	
	November 14, 2007	Becky Ward, Zach Pitts	Reach 1	

Survey Data		
Station	Elevation	Feature
0.00	559.00	PVC
3.61	558.83	
6.33	558.67	
9.93	558.50	
13.03	558.47	
15.43	558.54	
16.59	558.45	TOBL
17.53	558.31	
18.40	557.98	
19.32	557.71	
19.88	557.58	
20.51	557.35	
21.58	557.19	
23.16	557.09	
23.68	557.05	
24.54	556.90	
25.87	556.76	TW
26.82	556.67	
27.29	556.74	TOE R
28.13	557.20	
29.33	557.60	
30.01	557.91	
30.83	558.26	BANKFULL R
31.68	558.69	TOBR
33.17	558.80	
34.85	559.11	PVC

Summary Data	
Bankfull Cross Sectional Area	12.56
Bankfull Width	13.17
Bankfull Mean Depth	0.95
Bankfull Max Depth	1.59
Width/Depth Ratio	13.81
Entrenchment Ratio	4.78
Classification	C4

Cross Section #1 (Reach 2)

Cross Section Plot - Looking Downstream



Cross Section Photo - Looking Upstream

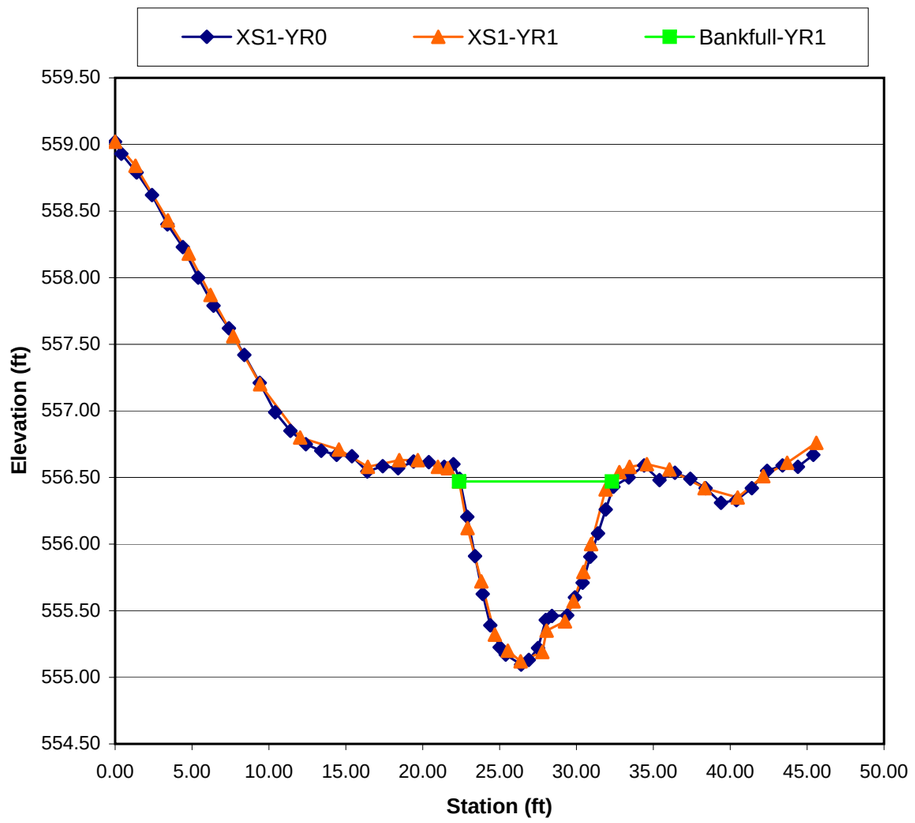
Title	Cross Section 1, Reach 2, Smith Tract		
Prepared For: Ecosystem Enhancement Program	Project	Smith Tract Restoration Project, Chatham County, North Carolina	Project # 046107
			Figure 5
	Survey Date	Field Team	Location
	November 14, 2007	Becky Ward, Zach Pitts	Reach 2

Survey Data		
Station	**Elevation**	**Feature**
0.00	559.02	PVC
1.32	558.84	
3.43	558.43	
4.79	558.18	
6.20	557.87	
7.68	557.56	
9.43	557.20	
12.03	556.80	
14.55	556.71	
16.43	556.58	
18.48	556.63	
19.68	556.63	
20.99	556.58	
21.64	556.57	
22.37	556.47	Bankfull L, TOBL
22.92	556.12	
23.81	555.72	
24.69	555.32	TOE L
25.54	555.20	
26.37	555.12	TW
27.78	555.19	TOE R
28.06	555.35	
29.25	555.42	
29.81	555.57	
30.45	555.79	
30.95	556.00	
31.89	556.41	
32.79	556.54	
33.45	556.58	TOBR
34.58	556.60	
36.05	556.56	
38.33	556.42	
40.48	556.35	
42.15	556.51	
43.70	556.61	
45.60	556.76	PVC

Summary Data	
Bankfull Cross Sectional Area	8.62
Bankfull Width	9.94
Bankfull Mean Depth	0.87
Bankfull Max Depth	1.35
Width/Depth Ratio	11.45
Entrenchment Ratio	11.27
Classification	C4

Cross Section #2 (Reach 2)

Cross Section Plot - Looking Downstream

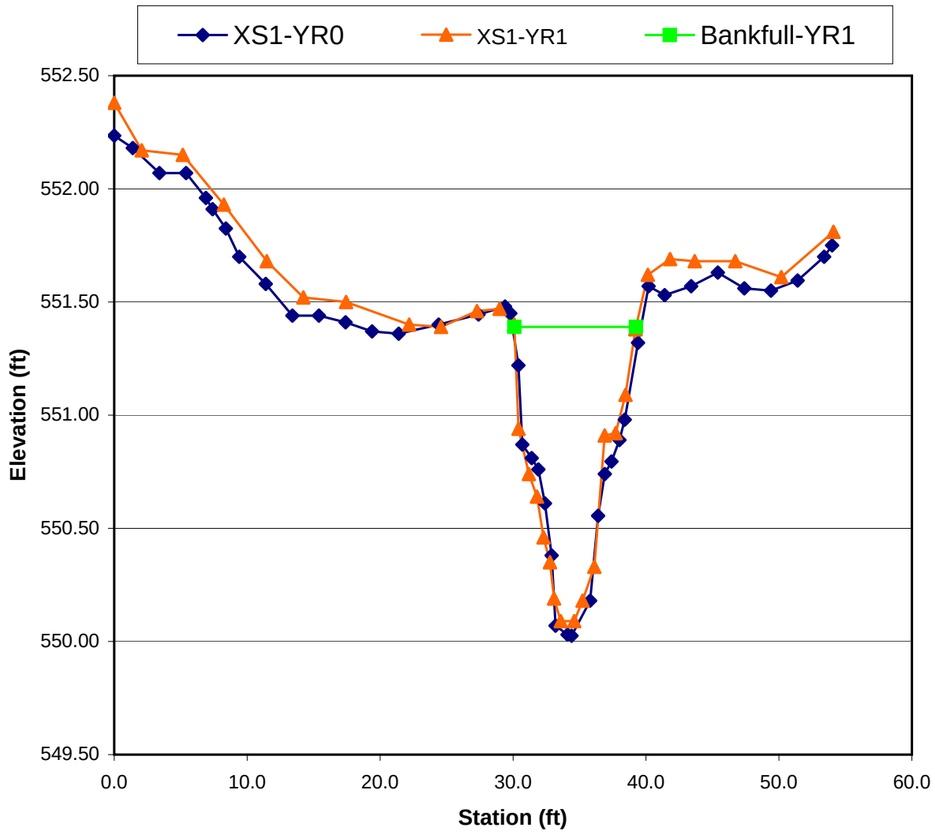


Cross Section Photo - Looking Upstream

Title	Cross Section 2, Reach 2, Smith Tract		
Prepared For: Ecosystem Enhancement Program	**Project**	Smith Tract Restoration Project, Chatham County, North Carolina	**Project #** 046107
			Figure 6

Survey Date	Field Team	Location
November 14, 2007	Becky Ward, Zach Pitts	Reach 2

Survey Data			Cross Section #3 (Reach 2)	
Station	Elevation	Feature	Cross Section Plot - Looking Downstream	Cross Section Photo - Looking Upstream
0.00	552.38	PVC		
2.07	552.17			
5.16	552.15			
8.24	551.93			
11.47	551.68			
14.23	551.52			
17.44	551.50			
22.19	551.40			
24.58	551.39			
27.29	551.46			
28.99	551.47			
30.09	551.40	TOBL		
30.09	551.40	BANKFULL L		
30.41	550.94			
31.19	550.74			
31.80	550.64			
32.29	550.46			
32.78	550.35			
33.08	550.19	TOE L		
33.59	550.09			
34.60	550.09	TW		
35.23	550.18			
36.11	550.33	TOE R		
36.89	550.91			
37.72	550.92			
38.46	551.09			
39.21	551.38	TOBR		
39.21	551.38	BANKFULL R		
40.14	551.62			
41.81	551.69			
43.66	551.68			
46.71	551.68			
50.18	551.61			
54.10	551.81	PVC		



Summary Data	
Bankfull Cross Sectional Area	7.15
Bankfull Width	9.15
Bankfull Mean Depth	0.78
Bankfull Max Depth	1.30
Width/Depth Ratio	11.72
Entrenchment Ratio	21.85
Classification	C4

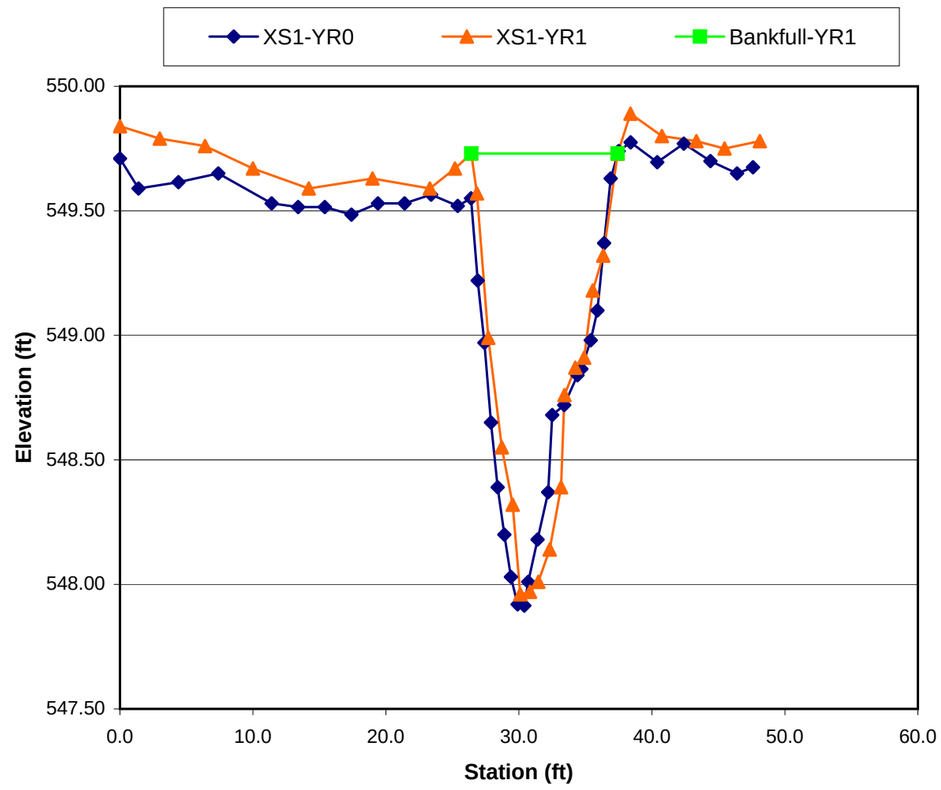
Title	Cross Section 3, Reach 2, Smith Tract		
Prepared For: Ecosystem Enhancement Program	**Project**	Smith Tract Restoration Project, Chatham County, North Carolina	**Project #** 046107
			Figure 7
	Survey Date	**Field Team**	**Location**
	November 14, 2007	Becky Ward, Zach Pitts	Reach 2

Survey Data		
Station	Elevation	Feature
0.00	549.84	PVC
2.99	549.79	
6.40	549.76	
10.00	549.67	
14.20	549.59	
18.99	549.63	
23.30	549.59	
25.19	549.67	
26.42	549.73	TOBL
26.84	549.57	
27.70	548.99	
28.71	548.55	
29.53	548.32	
30.10	547.96	TW TOE L
30.83	547.97	
31.46	548.01	
32.31	548.14	
33.17	548.39	TOE R
33.42	548.76	
34.24	548.87	
34.90	548.91	
35.55	549.18	
36.34	549.32	
37.42	549.73	BANKFULL R
37.42	549.73	TOBR
38.39	549.89	
40.75	549.80	
43.35	549.78	
45.46	549.75	
48.11	549.78	PVC

Summary Data	
Bankfull Cross Sectional Area	11.05
Bankfull Width	11.00
Bankfull Mean Depth	1.00
Bankfull Max Depth	1.77
Width/Depth Ratio	10.95
Entrenchment Ratio	14.55
Classification	C4

Cross Section #4 (Reach 2)

Cross Section Plot - Looking Downstream



Cross Section Photo - Looking Upstream

Title	Cross Section 4, Reach 2, Smith Tract		
Prepared For: Ecosystem Enhancement Program	**Project**	Smith Tract Restoration Project, Chatham County, North Carolina	**Project #** 046107
			Figure 8

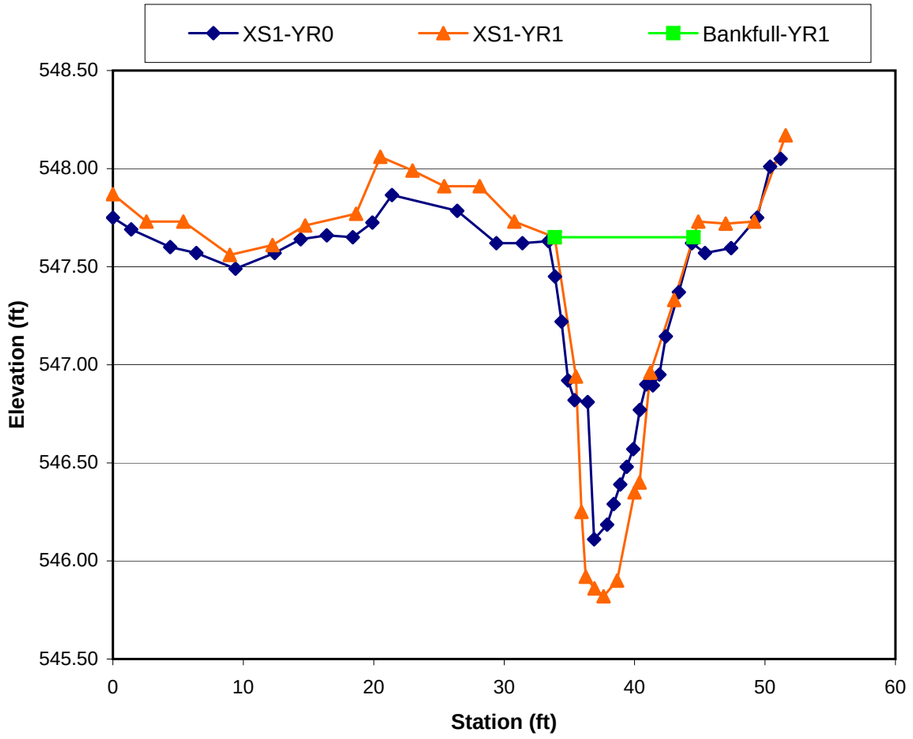
Survey Date	Field Team	Location
November 14, 2007	Becky Ward, Zach Pitts	Reach 2

Survey Data		
Station	Elevation	Feature
0.00	547.87	PVC
2.58	547.73	
5.40	547.73	
8.97	547.56	
12.24	547.61	
14.75	547.71	
18.65	547.77	
20.51	548.06	
22.98	547.99	
25.41	547.91	
28.13	547.91	
30.78	547.73	
33.88	547.65	Bankfull L, TOBL
35.50	546.94	
35.93	546.25	
36.26	545.92	TOE L
36.93	545.86	
37.62	545.82	TW
38.66	545.90	
40.00	546.35	
40.38	546.40	TOE R
41.21	546.96	TOBR
43.04	547.33	
44.89	547.73	
46.99	547.72	
49.18	547.73	
51.59	548.17	PVC

Summary Data	
Bankfull Cross Sectional Area	10.33
Bankfull Width	10.64
Bankfull Mean Depth	0.97
Bankfull Max Depth	1.83
Width/Depth Ratio	10.96
Entrenchment Ratio	12.22
Classification	C4

Cross Section #5 (Reach 2)

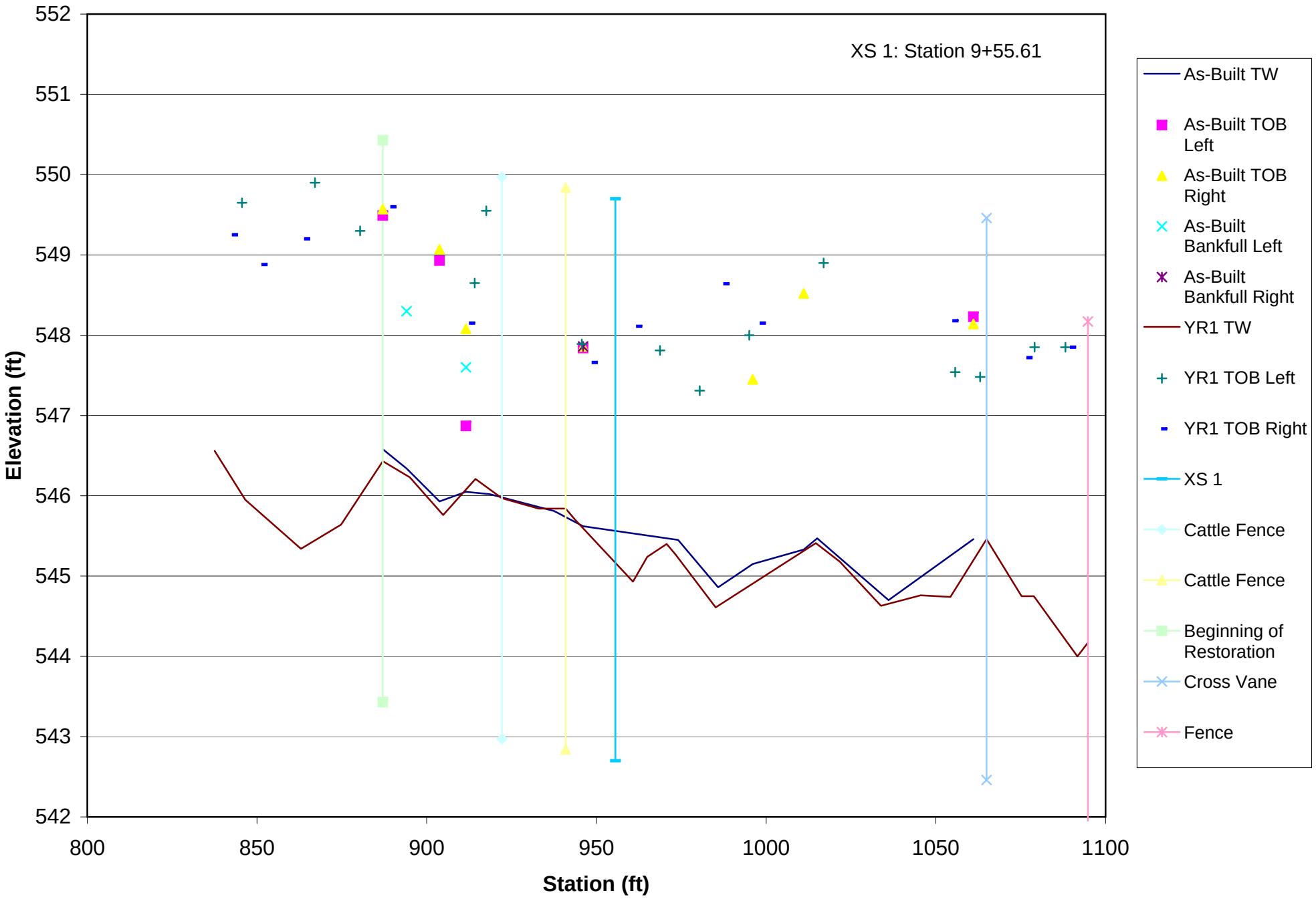
Cross Section Plot - Looking Downstream



Cross Section Photo - Looking Upstream

Title	Cross Section 5, Reach 2, Smith Tract			
Prepared For: Ecosystem Enhancement Program	**Project**	Smith Tract Restoration Project, Chatham County, North Carolina	**Project #**	046107
			Figure	9
	Survey Date	**Field Team**	**Location**	
	November 14, 2007	Becky Ward, Zach Pitts	Reach 2	

Reach 1 Longitudinal Profile - As-Built & Monitoring Year 1



Project Name	Smith Tract (UT to Rocky River)
Task	Longitudinal Profile
Reach	Reach 1
Date	11/14/2007
Crew	Becky Ward, Zach Pitts

Year 1 (2007) Survey

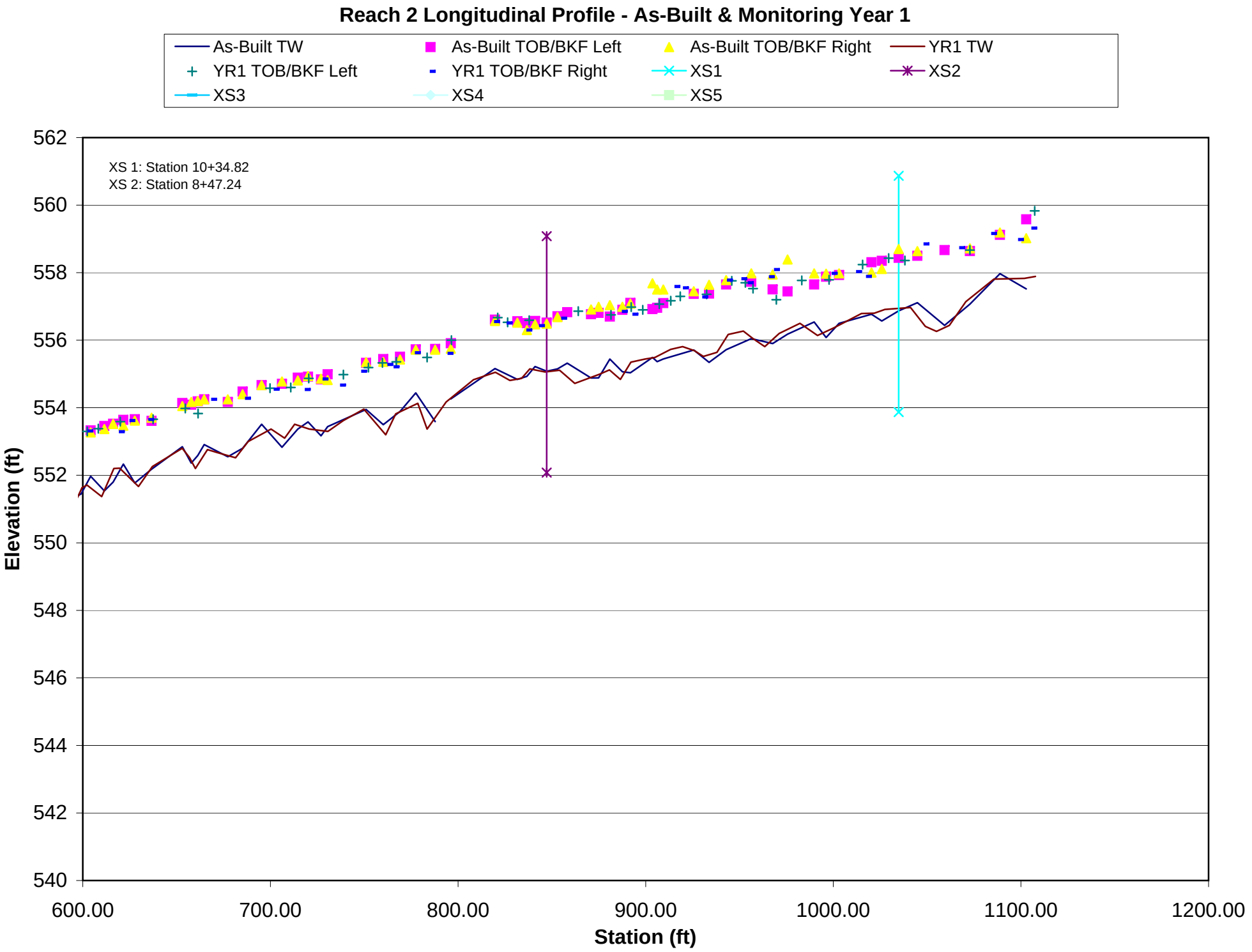
TW Station	TW Elevation	Feature	TOB Left Station	TOB Left Elevation	TOB Right Station	TOB Right Elevation
837.52	546.56	ER 837	845.58	549.65	842.85	549.25
846.57	545.95	ERUN 846	867.09	549.9	851.55	548.88
862.96	545.34	CP 863	880.38	549.3	864.12	549.2
874.76	545.64	HG 874	914.15	548.65	889.52	549.6
887.06	546.43	HR 886	917.56	549.55	912.68	548.15
895.05	546.23	ER 893	945.71	547.89	948.84	547.66
904.84	545.76	CP 903	968.73	547.81	961.93	548.11
914.37	546.21	HR 910	980.44	547.31	987.61	548.64
922.14	545.97	CATTLE XING	995.04	548	998.34	548.15
932.96	545.84	CATTLE XING	1016.93	548.9	1055.11	548.18
940.94	545.84	CATTLE XING	1055.71	547.54	1076.92	547.72
943.75	545.7	ER 939	1063.06	547.48	1089.76	547.85
960.75	544.93	CP 956	1079.1	547.85		
964.98	545.24	EP 961	1088.17	547.85		
970.69	545.4	HR 966				
973.27	545.27	ER 969				
985.13	544.61	CP 981				
998.45	544.97	HG 994				
1014.64	545.41	HR 1010				
1021.69	545.18	ER 1018				
1033.83	544.63	CP 1029				
1045.54	544.76					
1054.28	544.74					
1064.95	545.46	ROCKVANE 1061				
1075.25	544.75					
1078.89	544.75					
1091.71	544	CP 1088				
1094.81	544.17	FENCE				

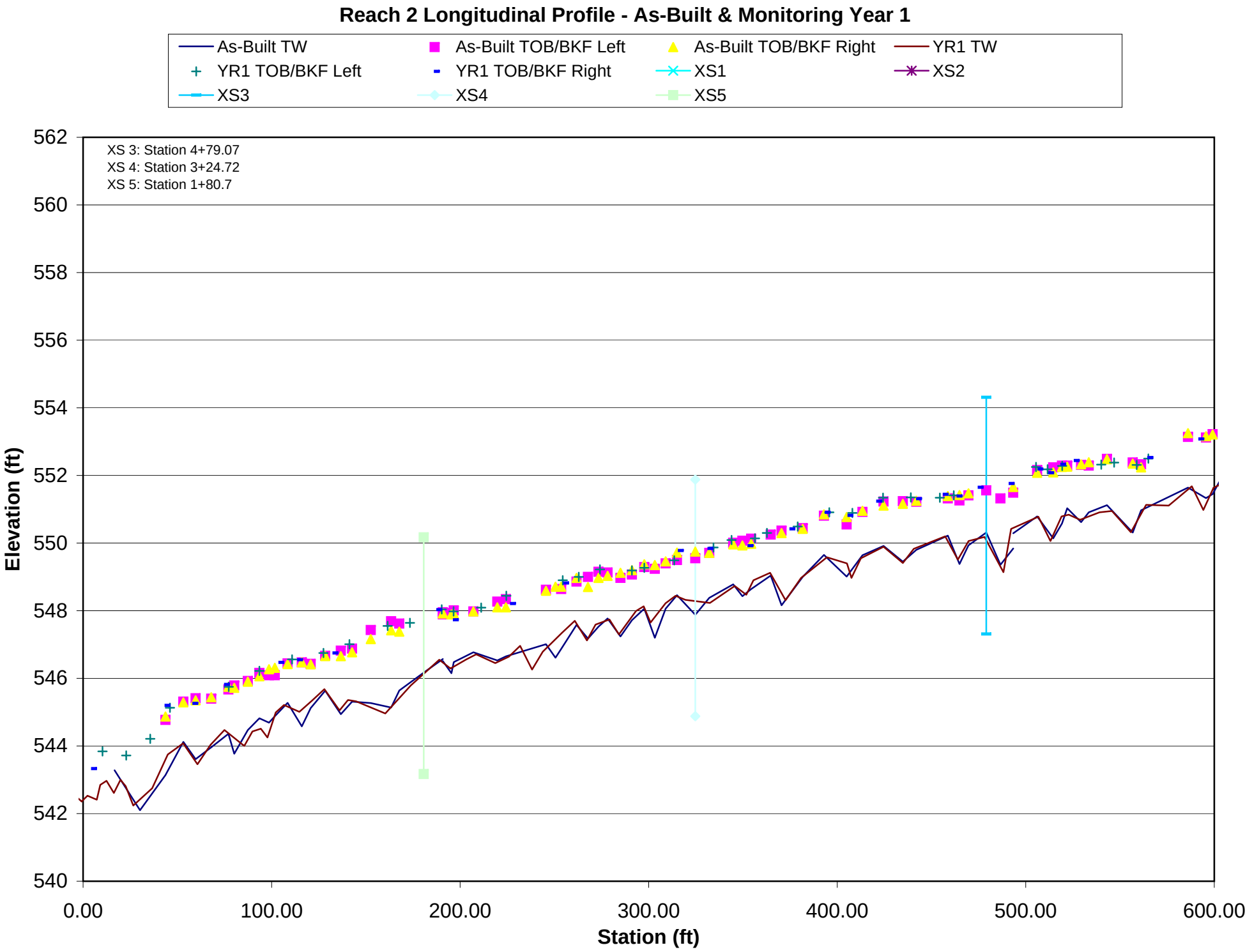
Project	Smith Tract
Name	UT Rocky River
Task	Pattern Measurements
Reach	1
Date	11/14/2007
Crew	Becky Ward, Zach Pitts

	Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**
	180	198	40
	86	163	48
	46	172	53
Min	**46**	**163**	**40**
Max	**180**	**198**	**53**
Med	**104**	**177.7**	**47**

Reach 1

Pool	length	p-p spacing
895.05		
914.37	19.32	
943.75		
964.98	21.23	49.655
973.27		
998.45	25.18	31.495
1021.69		
1045.54	23.85	47.755


Reach 2 Longitudinal Profile - As-Built & Monitoring Year 1
As-Built TW
As-Built TOB/BKF Left
As-Built TOB/BKF Right
YR1 TW
YR1 TOB/BKF Left
YR1 TOB/BKF Right
XS1
XS2
XS3
XS4
XS5
XS 1: Station 10+34.82
XS 2: Station 8+47.24
Elevation (ft)
562
560
558
556
554
552
550
548
546
544
542
540
600.00
700.00
800.00
900.00
1000.00
1100.00
1200.00
Station (ft)


Reach 2 Longitudinal Profile - As-Built & Monitoring Year 1
As-Built TW
As-Built TOB/BKF Left
As-Built TOB/BKF Right
YR1 TW
YR1 TOB/BKF Left
YR1 TOB/BKF Right
XS1
XS2
XS3
XS4
XS5
XS 3: Station 4+79.07
XS 4: Station 3+24.72
XS 5: Station 1+80.7
Elevation (ft)
562
560
558
556
554
552
550
548
546
544
542
540
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Station (ft)

Project Name	Smith Tract (UT to Rocky River)
Task	Longitudinal Profile
Reach	Reach 2
Date	11/14/2007
Crew	Becky Ward, Zach Pitts

Year 1 (2007) Survey

TW Station	TW Elevation	Feature	TOB Left Station	TOB Left Elevation	TOB Right Station	TOB Right Elevation
-2.84	542.46		10.32	543.84	4.65	543.33
-0.74	542.36		22.88	543.72	43.63	545.2
2.34	542.53		35.63	544.21	58.39	545.26
7.27	542.41		46.06	545.13	75.19	545.82
9.13	542.85		77.24	545.75	104.01	546.47
12.39	542.97		93.49	546.22	113.95	546.55
16.33	542.61		110.86	546.56	132.71	546.75
19.82	543		127.48	546.75	172.93	
22.6	542.81		141.25	547.01	187.78	548.03
26.62	542.24	CP	161.56	547.55	196.54	547.73
36.62	542.75	CP	173.37	547.64	226.89	548.21
44.95	543.75	ER	190.25	548.04	237.46	
53.09	544.08	HR	196.52	547.98	255.07	548.82
60.64	543.46	CP	211.13	548.09	315.89	549.78
67.55	544.03	ER	224.49	548.44	331.63	549.84
74.96	544.47	HR	254.4	548.9	352.85	549.92
85.5	544	CP	262.9	549	375.07	550.42
89.8	544.43	ER	274.14	549.22	393.8	550.91
94.29	544.51	HR	291.12	549.19	405.87	550.82
97.79	544.25	CP	297.68	549.27	421.13	551.24
102.17	544.99	ER	313.54	549.49	442.26	551.31
106.59	545.21	HR	334.37	549.87	456.4	551.44
114.72	545.01	CP	343.99	550.09	463.7	551.39
121.41	545.34	ER	356.4	550.14	474.93	551.65
128.01	545.68	HR	362.7	550.3	491.37	551.76
135.99	545.05	CP	379.06	550.49	506.61	552.19
140.54	545.36	ER	395.78	550.91	512.36	552.08
144.81	545.32	HR	408.04	550.89	518.72	552.33
160.32	544.96	CP	424.33	551.34	525.87	552.44
173.81	545.79	ER	439.05	551.35	564.95	552.53
188.94	546.55	HR	454.47	551.34	591.95	553.08
194.89	546.29	CP	461.8	551.41	602.82	553.31
203.21	546.56	ER	505.44	552.25	619.69	553.29
208.5	546.71	HR	511.57	552.18	625.28	553.62
218.61	546.45	CP	519.33	552.28	635.35	553.65
225.83	546.64	ER	540.04	552.32	668.85	554.25
231.83	546.96	HR	546.87	552.38	686.89	554.28
238.17	546.26	CP	556.4		702.18	554.55
243.83	546.79	ERUN	558.83	552.31	718.73	554.54
254.11	547.35	ER	559.69		728.22	554.85
260.79	547.7	HR	565.05	552.5	737.53	554.67
267.25	547.12	CP	602.38	553.3	748.82	555.08
271.81	547.59	ER	608.27	553.38	762.77	555.28
279.19	547.74	HR	620.01	553.59	766.08	555.21
284.21	547.3	CP	637.46	553.66	777.39	555.63

Year 1 (2007) Survey (cont.)

TW Station	TW Elevation	Feature	TOB Left Station	TOB Left Elevation	TOB Right Station	TOB Right Elevation
293.3	547.99	ER	654.66	553.98	782.42	
297.34	548.13	HR	661.42	553.83	794.82	555.61
300.97	547.65	CP	699.78	554.58	819.62	556.55
308.92	548.22	ER	710.83	554.6	826.31	556.51
314.27	548.44	HR	720.46	554.87	836.84	556.3
319.53	548.32	HG	738.89	554.98	843.58	556.43
332.48	548.23	ER	752.23	555.19	855.4	556.65
345.66	548.73	HR	759.73	555.33	875.72	
351.77	548.47	CP	767.13	555.36	887.71	556.85
355.59	548.9	ER	783.51	555.49	893.4	556.77
364.39	549.12	HR	796.49	556	915.79	557.59
372.61	548.31	CP	821.14	556.67	920.27	557.55
380.85	548.97	ER	826.45	556.53	930.56	557.28
394.56	549.58	HR	837.95	556.59	943.79	557.78
405.17	549.4	HG	864.09	556.86	951.43	557.82
407.57	548.97	CP	875.3		954.87	557.7
412.55	549.55	ER	881.49	556.75	966.09	557.88
424.58	549.89	HR	892.29	556.98	968.82	558.09
434.8	549.41	CP	898.46	556.9	999.62	557.98
440.63	549.83	ER	907.25	557.07	1012.55	558.03
457.26	550.2	HR	913.39	557.17	1017.85	557.89
463.97	549.51	CP	918.46	557.3	1048.49	558.85
469.68	550.06	ER	932.47	557.36	1067.5	558.74
478.11	550.18	HR	945.87	557.76	1084.59	559.16
488.14	549.14	CP	953.13	557.7	1098.92	558.98
492.24	550.42	ER	957.23	557.53	1105.98	559.32
506.72	550.78	HR	969.66	557.2		
513.12	550.06	CP	983.23	557.77		
519	550.79	ER	997.74	557.79		
522.81	550.84	HR	1015.64	558.24		
528.82	550.69	CP	1029.52	558.43		
539.11	550.91	ER	1038.14	558.36		
545.71	550.95	HR	1049.01			
555.79	550.32	CP	1056.88			
563.84	551.13	ER	1072.83	558.67		
575.83	551.11		1107.32	559.83		
588.05	551.68	HR				
594.18	550.98	CP				
599.55	551.63	ER				
602.21	551.71	HR				
610.05	551.37	CP				
616.56	552.2	ER				
619.69	552.21	HR				
629.7	551.67	CP				
637.09	552.26	ER				
652.99	552.8	HR				
656.8	552.53	HG				
660.05	552.2	CP				
666.45	552.76	HP				
671.28	552.68	HR				
681.45	552.52	CP				
688.11	553	ER				

Year 1 (2007) Survey (cont.)

TW Station	TW Elevation	Feature	TOB Left Station	TOB Left Elevation	TOB Right Station	TOB Right Elevation
700.31	553.37	HR				
707.6	553.1	CP				
712.93	553.51	ER				
720.69	553.37	HR				
730.61	553.3	CP				
738.84	553.62	ER				
749.81	553.96	HR				
761.47	553.2	CP				
766.77	553.82	ER				
778.55	554.13	HR				
783.51	553.37	CP				
793.63	554.17	ER				
808.24	554.83					
819.92	555.05	HR				
827.61	554.81	CP				
833.85	554.87	ER				
838.25	555.15	HR				
846.39	555.06	CP				
854.1	555.11	HR				
862.25	554.72	CP				
875.32	554.99	ER				
880.71	555.12	HR				
886.52	554.84	CP				
892.11	555.35	ER				
899.59	555.44	HR				
904.95	555.49	CP				
913.31	555.73	ER				
919.7	555.81	HR				
925.99	555.69	HG				
930.75	555.52	CP				
937.99	555.64	HP				
943.99	556.17	ER				
952.06	556.27	HR				
957.16	556.05	HG				
963.51	555.81	CP				
971.14	556.2	ER				
982.24	556.5	HR				
991.59	556.14	CP				
1000.1	556.36	ER				
1014.99	556.79	HR				
1021.84	556.8	CP				
1027.47	556.91	ER				
1041.16	556.97	HR				
1049.04	556.41	HG				
1054.99	556.26	CP				
1061.87	556.44	HP				
1070.65	557.14	ER				
1085.59	557.81	HR				
1101.84	557.83	CP				
1107.72	557.89	FENCE				

Project	Smith Tract
Name	UT Rocky River
Task	Pattern Measurements
Reach	2
Date	11/14/2007
Crew	Becky Ward, Zach Pitts

	Radius of Curvature	Meander Wavelength	Channel Beltwidth
	17.6	63.8	30.8
	14.3	55	26.4
	24.2	39.6	16.5
	22	30.8	14.3
	15.4	41.8	17.6
	24.2	50.6	22
	27.5	57.2	19.8
	35.2	61.6	19.8
	27.5	55	19.8
	33	46.2	17.6
	19.8	39.6	17.6
	14.3	37.4	16.5
	24.2	44	18.7
	11	52.8	25.3
	23.1	48.4	22
	52.8	55	19.8
	15.4	59.4	24.2
	17.6	57.2	28.6
	15.4	52.8	22
	19.8	50.6	22
	17.6	44	17.6
	26.4	35.2	16.5
	13.2	48.4	35.2
	19.8	70.4	28.6
	17.6	61.6	26.4
	11	46.2	26.4
	15.4	50.6	19.8
	24.2	55	22
	23.1	48.4	19.8
	24.2	57.2	24.2
	22	70.4	28.6
	61.6	57.2	15.4
	15.4	39.6	22
	11	41.8	17.6
	24.2	37.4	16.5
	13.2	41.8	22
	18.7	55	24.2
	14.3	55	26.4
	81.4	50.6	15.4
	44	55	20.9
	19.8	50.6	24.2
Min	**11**	**30.8**	**14.3**
Max	**81.4**	**70.4**	**35.2**
Med	**23.7**	**50.5**	**21.7**

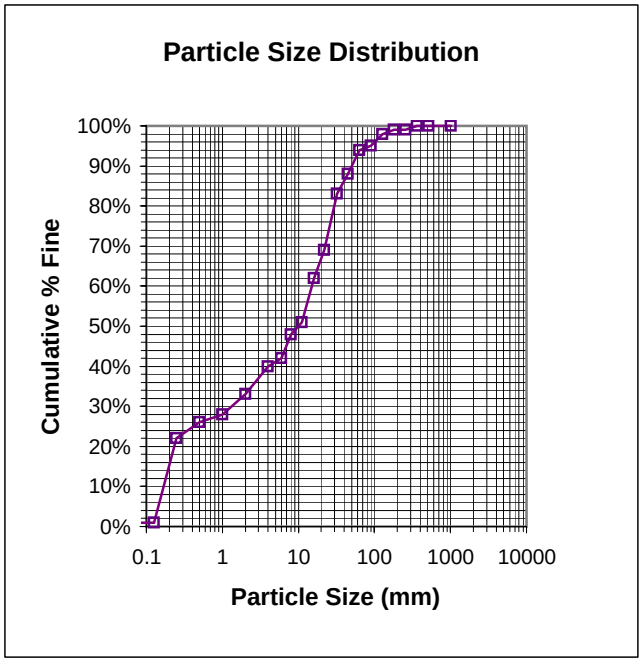
Reach 2

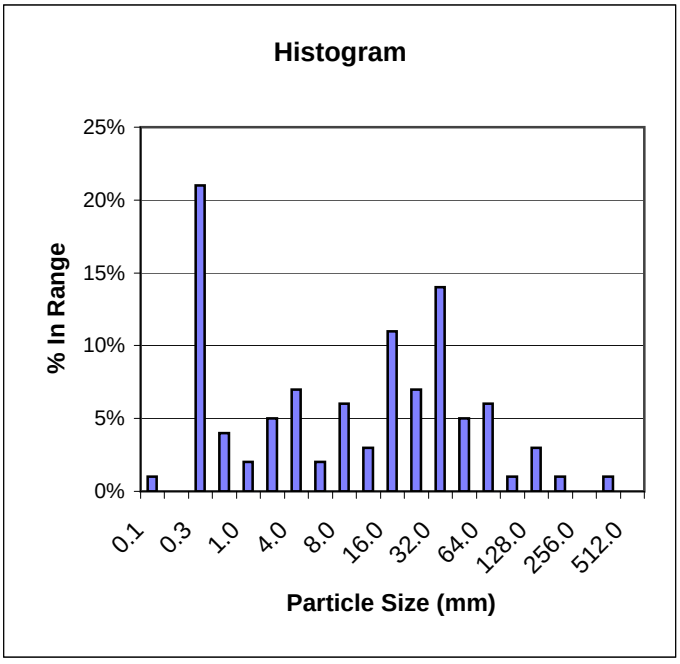
Pool	length	p-p spacing
22.6		
44.95	22.35	
53.09		
67.55	14.46	26.545
74.96		
89.8	14.84	22.06
94.29		
102.17	7.88	15.85
106.59		
121.41	14.82	15.77
128.01		
140.54	12.53	20.275
144.81		
173.81	29	25.035
188.94		
203.21	14.27	36.765
208.5		
225.83	17.33	21.09
231.83		
243.83	12	20.665
260.79		
271.81	11.02	28.47
279.19		
293.3	14.11	19.945
297.34		
308.92	11.58	16.885
319.53		
332.48	12.95	22.875
345.66		
355.59	9.93	24.62
364.39		
380.85	16.46	21.995
405.17		
412.55	7.38	36.24
424.58		
440.63	16.05	23.745
457.26		
469.68	12.42	30.865
478.11		
492.24	14.13	21.705
506.72		
519	12.28	27.685
522.81		
539.11	16.3	18.1
545.71		
563.84	18.13	23.815
588.05		
599.55	11.5	39.025
602.21		

Reach 2 (cont.)

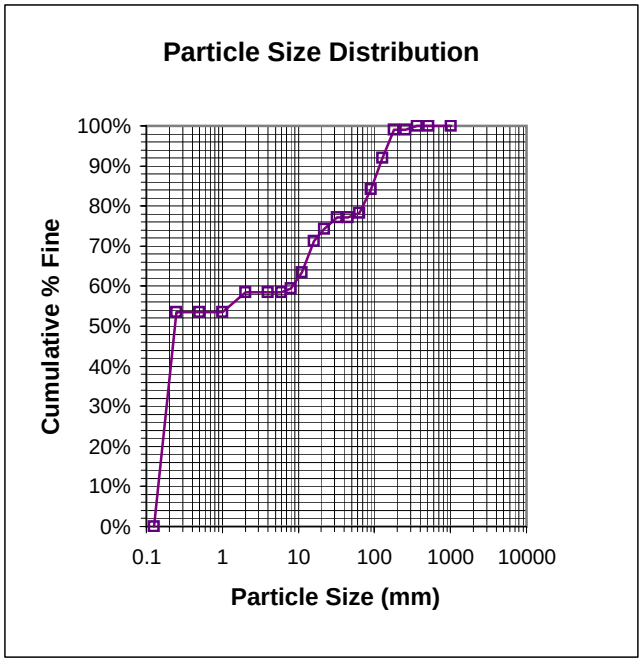
Pool	length	p-p spacing
616.56	14.35	15.585
619.69		
637.09	17.4	19.005
656.8		
666.45	9.65	33.235
671.28		
688.11	16.83	18.07
700.31		
712.93	12.62	26.925
720.69		
738.84	18.15	23.145
749.81		
766.77	16.96	28.525
778.55		
793.63	15.08	27.8
819.92		
833.85	13.93	40.795
838.25		
854.1	15.85	19.29
854.2		
875.32	21.12	18.585
880.71		
892.11	11.4	21.65
899.59		
913.31	13.72	20.04
925.99		
937.99	12	25.54
957.16		
971.14	13.98	32.16
982.24		
1000.1	17.86	27.02
1014.99		
1027.47	12.48	30.06
1049.04		
1061.87	12.83	34.225
1085.59		
1107.72	22.13	41.2

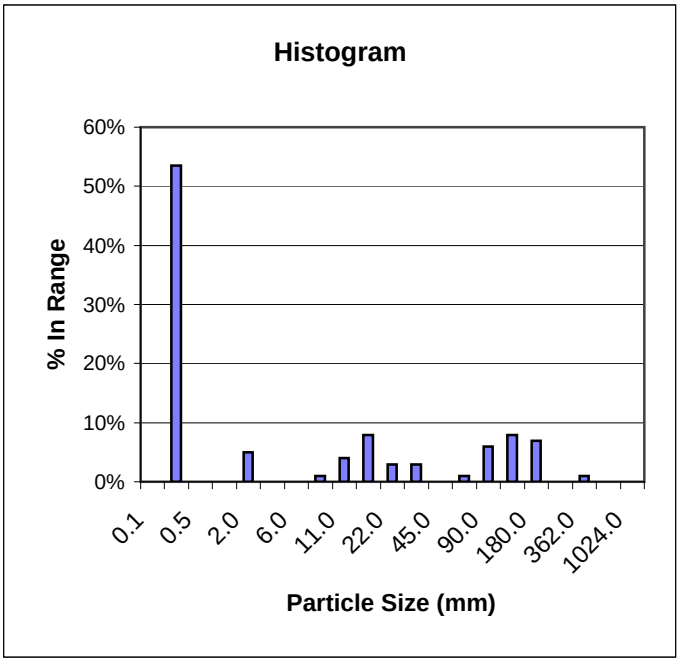
YEAR 1 MONITORING, PEBBLE COUNT				
Site Name:	Smith Tract		Pebble Count Data Sheet	
Project No:	046107		Reach 1, Cross Section 1	
Date:	11/24/2007		Station Number 9+55.61	
	Particle Size (mm)	Total #	% In Range	% Cumulative
Silt/Clay	< 0.062	1	1%	1%
Very Fine	.062 - .125	0	0%	1%
Fine	.125 - .25	21	21%	22%
Medium	.25 - .50	4	4%	26%
Coarse	.50 - 1.0	2	2%	28%
Very Coarse	1.0 - 2.0	5	5%	33%
Very Fine	2.0 - 4.0	7	7%	40%
Fine	4.0 - 5.7	2	2%	42%
Fine	5.7 - 8.0	6	6%	48%
Medium	8.0 - 11.3	3	3%	51%
Medium	11.3 - 16.0	11	11%	62%
Coarse	16.0 - 22.6	7	7%	69%
Coarse	22.6 - 32.0	14	14%	83%
Very Coarse	32.0 - 45.0	5	5%	88%
Very Coarse	45.0 - 64.0	6	6%	94%
Small	64 - 90	1	1%	95%
Small	90 - 128	3	3%	98%
Large	128 - 180	1	1%	99%
Large	180 - 256	0	0%	99%
Small	256 - 362	1	1%	100%
Small	362 - 512	0	0%	100%
Medium	512 - 1024	0	0%	100%
Lrg- Very Lrg	1024 - 2048	0	0%	100%
Bedrock		0	0%	100%
	Totals	**100**	**100%**	**100%**
D_{50} = 10 mm, D_{75} = 24 mm, D_{84} = 33 mm, D_{90} = 50 mm				



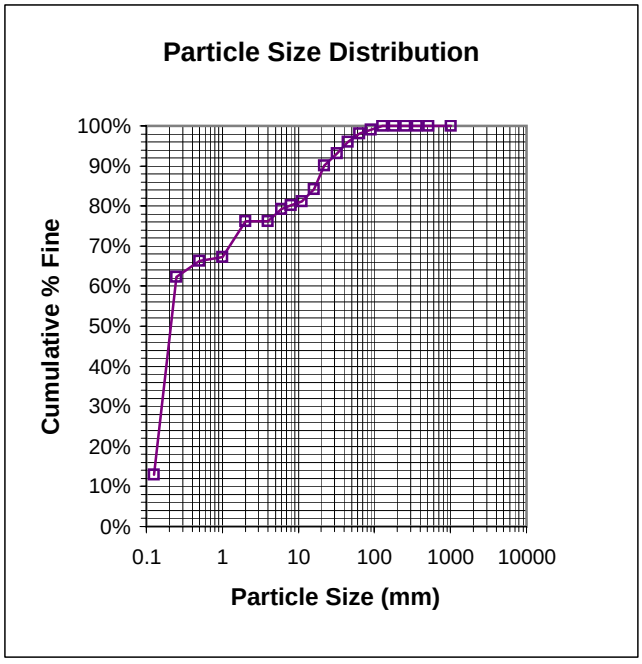


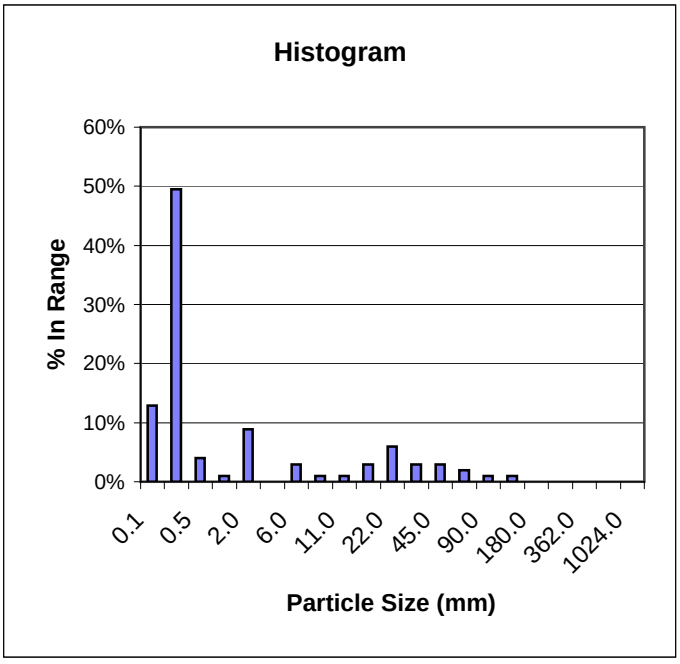
YEAR 1 MONITORING, PEBBLE COUNT				
Site Name:	Smith Tract		Pebble Count Data Sheet	
Project No:	046107		Reach 2, Cross Section 1	
Date:	11/24/2007		Station Number 10+34.82	
	Particle Size (mm)	Total #	% In Range	% Cumulative
Silt/Clay	< 0.062	0	0%	0%
Very Fine	.062 - .125	0	0%	0%
Fine	.125 - .25	54	53%	53%
Medium	.25 - .50	0	0%	53%
Coarse	.50 - 1.0	0	0%	53%
Very Coarse	1.0 - 2.0	5	5%	58%
Very Fine	2.0 - 4.0	0	0%	58%
Fine	4.0 - 5.7	0	0%	58%
Fine	5.7 - 8.0	1	1%	59%
Medium	8.0 - 11.3	4	4%	63%
Medium	11.3 - 16.0	8	8%	71%
Coarse	16.0 - 22.6	3	3%	74%
Coarse	22.6 - 32.0	3	3%	77%
Very Coarse	32.0 - 45.0	0	0%	77%
Very Coarse	45.0 - 64.0	1	1%	78%
Small	64 - 90	6	6%	84%
Small	90 - 128	8	8%	92%
Large	128 - 180	7	7%	99%
Large	180 - 256	0	0%	99%
Small	256 - 362	1	1%	100%
Small	362 - 512	0	0%	100%
Medium	512 - 1024	0	0%	100%
Lrg- Very Lrg	1024 - 2048	0	0%	100%
Bedrock		0	0%	100%
	Totals	**101**	**100%**	**100%**
D_{50} = 0.23 mm, D_{75} = 24 mm, D_{84} = 90 mm, D_{90} = 101 mm				



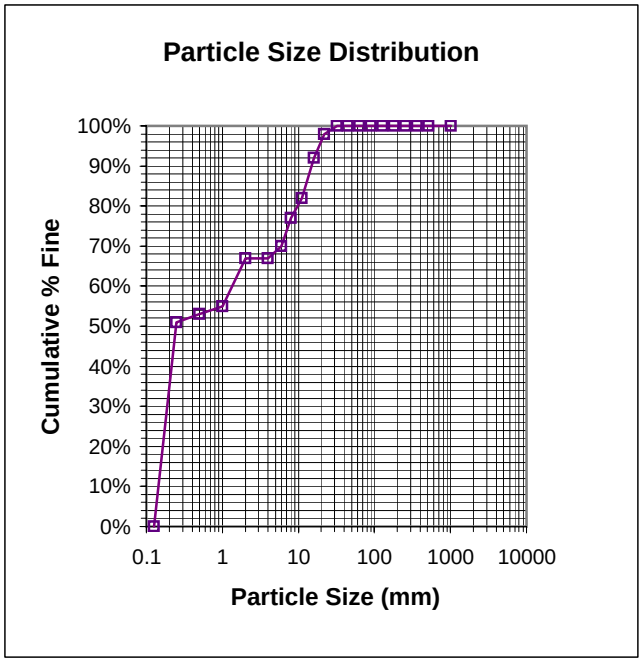


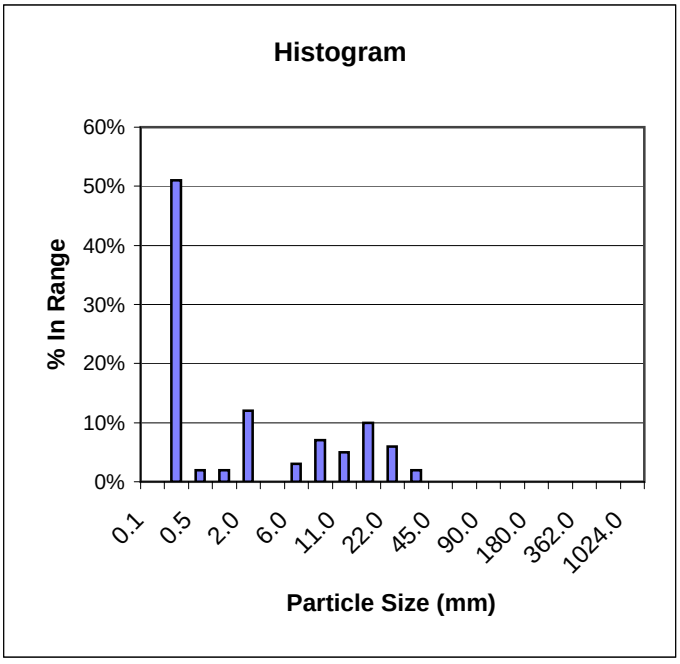
YEAR 1 MONITORING, PEBBLE COUNT				
Site Name:	Smith Tract		Pebble Count Data Sheet	
Project No:	046107		Reach 2, Cross Section 2	
Date:	11/24/2007		Station Number 8+47.24	
	Particle Size (mm)	Total #	% In Range	% Cumulative
Silt/Clay	< 0.062	0	0%	0%
Very Fine	.062 - .125	13	13%	13%
Fine	.125 - .25	50	50%	62%
Medium	.25 - .50	4	4%	66%
Coarse	.50 - 1.0	1	1%	67%
Very Coarse	1.0 - 2.0	9	9%	76%
Very Fine	2.0 - 4.0	0	0%	76%
Fine	4.0 - 5.7	3	3%	79%
Fine	5.7 - 8.0	1	1%	80%
Medium	8.0 - 11.3	1	1%	81%
Medium	11.3 - 16.0	3	3%	84%
Coarse	16.0 - 22.6	6	6%	90%
Coarse	22.6 - 32.0	3	3%	93%
Very Coarse	32.0 - 45.0	3	3%	96%
Very Coarse	45.0 - 64.0	2	2%	98%
Small	64 - 90	1	1%	99%
Small	90 - 128	1	1%	100%
Large	128 - 180	0	0%	100%
Large	180 - 256	0	0%	100%
Small	256 - 362	0	0%	100%
Small	362 - 512	0	0%	100%
Medium	512 - 1024	0	0%	100%
Lrg- Very Lrg	1024 - 2048	0	0%	100%
Bedrock		0	0%	100%
	Totals	**101**	**100%**	**100%**
D_{50} = 0.203 mm, D_{75} = 1.6 mm, D_{84} = 16 mm, D_{90} = 22 mm				



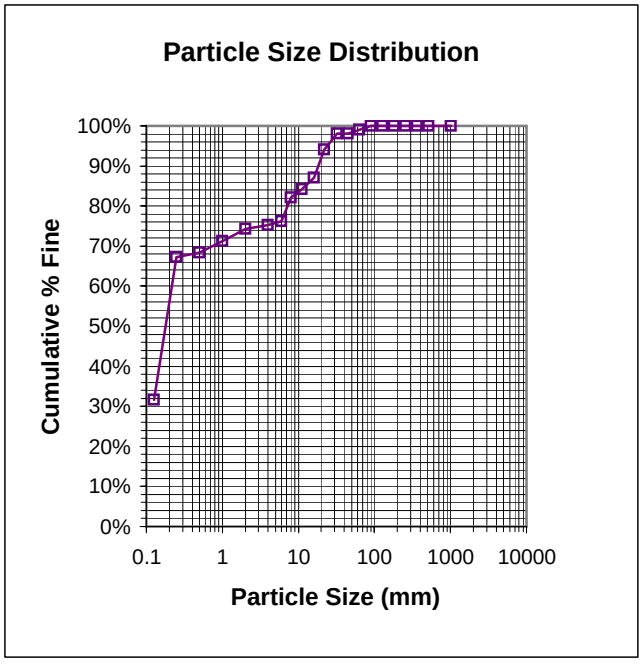


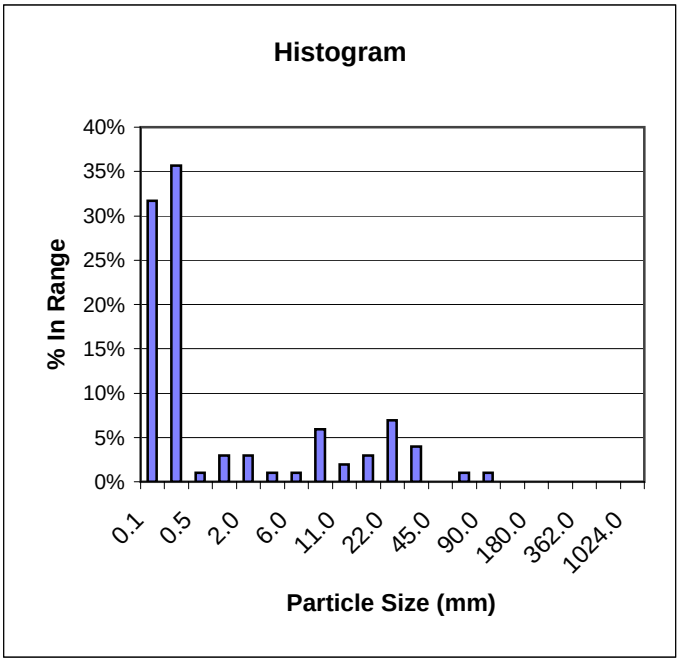
YEAR 1 MONITORING, PEBBLE COUNT				
Site Name:	Smith Tract		Pebble Count Data Sheet	
Project No:	046107		Reach 2, Cross Section 3	
Date:	11/24/2007		Station Number 4+79.07	
	Particle Size (mm)	Total #	% In Range	% Cumulative
Silt/Clay	< 0.062	0	0%	0%
Very Fine	.062 - .125	0	0%	0%
Fine	.125 - .25	51	51%	51%
Medium	.25 - .50	2	2%	53%
Coarse	.50 - 1.0	2	2%	55%
Very Coarse	1.0 - 2.0	12	12%	67%
Very Fine	2.0 - 4.0	0	0%	67%
Fine	4.0 - 5.7	3	3%	70%
Fine	5.7 - 8.0	7	7%	77%
Medium	8.0 - 11.3	5	5%	82%
Medium	11.3 - 16.0	10	10%	92%
Coarse	16.0 - 22.6	6	6%	98%
Coarse	22.6 - 32.0	2	2%	100%
Very Coarse	32.0 - 45.0	0	0%	100%
Very Coarse	45.0 - 64.0	0	0%	100%
Small	64 - 90	0	0%	100%
Small	90 - 128	0	0%	100%
Large	128 - 180	0	0%	100%
Large	180 - 256	0	0%	100%
Small	256 - 362	0	0%	100%
Small	362 - 512	0	0%	100%
Medium	512 - 1024	0	0%	100%
Lrg- Very Lrg	1024 - 2048	0	0%	100%
Bedrock		0	0%	100%
	Totals	**100**	**100%**	**100%**
D_{50} = 0.25 mm, D_{75} = 7.1 mm, D_{84} = 11 mm, D_{90} = 12.5 mm				





YEAR 1 MONITORING, PEBBLE COUNT				
Site Name:	Smith Tract		Pebble Count Data Sheet	
Project No:	046107		Reach 2, Cross Section 4	
Date:	11/24/2007		Station Number 3+24.72	
	Particle Size (mm)	Total #	% In Range	% Cumulative
Silt/Clay	< 0.062	0	0%	0%
Very Fine	.062 - .125	32	32%	32%
Fine	.125 - .25	36	36%	67%
Medium	.25 - .50	1	1%	68%
Coarse	.50 - 1.0	3	3%	71%
Very Coarse	1.0 - 2.0	3	3%	74%
Very Fine	2.0 - 4.0	1	1%	75%
Fine	4.0 - 5.7	1	1%	76%
Fine	5.7 - 8.0	6	6%	82%
Medium	8.0 - 11.3	2	2%	84%
Medium	11.3 - 16.0	3	3%	87%
Coarse	16.0 - 22.6	7	7%	94%
Coarse	22.6 - 32.0	4	4%	98%
Very Coarse	32.0 - 45.0	0	0%	98%
Very Coarse	45.0 - 64.0	1	1%	99%
Small	64 - 90	1	1%	100%
Small	90 - 128	0	0%	100%
Large	128 - 180	0	0%	100%
Large	180 - 256	0	0%	100%
Small	256 - 362	0	0%	100%
Small	362 - 512	0	0%	100%
Medium	512 - 1024	0	0%	100%
Lrg- Very Lrg	1024 - 2048	0	0%	100%
Bedrock		0	0%	100%
	Totals	**101**	**100%**	**100%**
D_{50} = 0.18 mm, D_{75} = 3 mm, D_{84} = 11 mm, D_{90} = 18 mm				





YEAR 1 MONITORING, PEBBLE COUNT				
Site Name:	Smith Tract		Pebble Count Data Sheet	
Project No:	046107		Reach 2, Cross Section 5	
Date:	11/24/2007		Station Number 1+80.7	
	Particle Size (mm)	Total #	% In Range	% Cumulative
Silt/Clay	< 0.062	0	0%	0%
Very Fine	.062 - .125	1	1%	1%
Fine	.125 - .25	23	23%	24%
Medium	.25 - .50	7	7%	31%
Coarse	.50 - 1.0	2	2%	33%
Very Coarse	1.0 - 2.0	2	2%	35%
Very Fine	2.0 - 4.0	0	0%	35%
Fine	4.0 - 5.7	1	1%	36%
Fine	5.7 - 8.0	4	4%	40%
Medium	8.0 - 11.3	0	0%	40%
Medium	11.3 - 16.0	6	6%	46%
Coarse	16.0 - 22.6	3	3%	49%
Coarse	22.6 - 32.0	10	10%	59%
Very Coarse	32.0 - 45.0	2	2%	61%
Very Coarse	45.0 - 64.0	7	7%	68%
Small	64 - 90	6	6%	74%
Small	90 - 128	14	14%	88%
Large	128 - 180	7	7%	95%
Large	180 - 256	2	2%	97%
Small	256 - 362	3	3%	100%
Small	362 - 512	0	0%	100%
Medium	512 - 1024	0	0%	100%
Lrg- Very Lrg	1024 - 2048	0	0%	100%
Bedrock		0	0%	100%
	Totals	**100**	**100%**	**100%**
D_{50} = 22 mm, D_{75} = 92 mm, D_{84} = 110 mm, D_{90} = 135 mm