BRUSH CREEK – PROJECT NO. 54

MONITORING YEAR 7

2008

Submitted to:

NCDENR Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, NC 27699

January 2009

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I. Executive Summary

The North Carolina Ecosystem Enhancement Program (EEP) conducted an enhancement/ restoration on 1,000 feet of Little Pine Creek and 2,640 feet of Brush Creek for the purpose of obtaining mitigation credit (Brush Creek – Project # 54). The Brush Creek project is located in Alleghany County, North Carolina and is within the New River Basin. Little Pine Creek, a third-order perennial stream drains a watershed of 4.3 square miles and enters into Brush Creek, a fourth-order perennial stream that drains a watershed of 26.3 miles. Brush Creek and Little Pine Creek are located in the Upper New Watershed (USGS cataloging unit: 05050001) and North Carolina Division of Water Quality Subbasin NEW03 10-9-10.

Project planning was initiated for the Brush Creek and Little Pine Creek Stream Enhancement/Restoration in 2000. Implementation of the project was completed by September 2001. The original construction of Little Pine Creek took place in 2001. An as-built survey was conducted followed by four years of monitoring (2002 through 2005). Monitoring reports MY1, MY2, MY3, and the draft of MY4 reported significant morphological areas of concern for both Little Pine Creek and Brush Creek. These areas seemed to be getting worse over time and in addition, the vegetation success was not adequate for mitigation credit. No final report was completed for MY4. The decision was made to augment the project in 2006 with a new design and some re-construction. Re-construction of Little Pine Creek and portions of Brush Creek took place in 2006, therefore, no monitoring was conducted in 2006 (MY5). An as-built survey (denoted in this report as As-Built 2 or AB2) was conducted in November of 2006. New cross sections and vegetation plots were established during 2006 and one monitoring year (MY6) was performed. This report therefore reflects the second monitoring year (MY7) of data collected at four cross-sections and five vegetation plots, for Brush and Little Pine Creeks.

The objective of vegetation monitoring is to provide an accurate and rapid assessment of the survival and growth of woody plant restoration and regeneration as an integral component of the Brush Creek and Little Pine Creek restoration project. Survival of planted woody species in MY7 was 437 stems per acre, which meets the success criteria of a minimum of 320 stems acre. The number of planted stems decreased from MY6 (467 stems/acre), but the total number of stems per acre increased significantly from 542 stems/acre (MY6) to 1205 stems/acre.

Stream channel dimension and sinuosity remain similar to AB2 and MY6. The most significant change was a decrease in the size of channel material, which resulted in a change in the stream classification to a C5. The stream feature visual stability decreased; five pools have filled in or lack sufficient depth, some riffles have decreased in size, and nine engineered structures have failed or need to be watched. Small sections of bank scour and slumped banks were the most common problem areas.

A large storm event occurred in late August 2008 as a result of Hurricane Fay. All monitoring was conducted prior to the storm. A site visit was conducted in October 2008 to obtain fixed station photos. No obvious damage or changes were observed, with the exception of an increase in the amount bank scour on Brush Creek.

II. Project Background

A. Project Objectives

Brush Creek and its tributary, Little Pine Creek, were restored and/or enhanced in 2001 and 2006. The original goals and objectives stated in the Restoration Plan were as follows:

- To replace 600 feet of altered Little Pine Creek stream channel with a new, 950 foot meandering channel reconnected to the floodplain and designed to maintain stable dimension, pattern, and profile while effectively transporting anticipated streamflow and sediment load.
- To restore a vegetated riparian corridor 30 to 50 feet wide along the new, proposed reach of Little Pine Creek, in order to improve water quality and increase available aquatic and terrestrial habitat resources.
- To restore stable channel dimensions and stable streambank conditions to 340 feet of Brush Creek currently experiencing severe bank collapse, thereby improving downstream water quality through sedimentation reduction and enhancing aquatic habitat.
- To restore/enhance 2,300 feet of degraded Brush Creek riparian corridor, with bioengineering stabilization of unstable streambanks, instream aquatic habitat improvements, and increased riparian buffer vegetation.
- To improve overall terrestrial habitat connectivity through the restoration of riparian corridors along both streams, and improve overall aquatic habitat through the creation of increased habitat complexity.

B. Project Structure, Restoration Type, and Approach

A Priority 2 stream restoration design was implemented for 950-lf of Little Pine Creek and 340-lf of Brush Creek. An Enhancement 2 was implemented for 2,300-lf of Brush Creek and riparian buffer. The project involved channel dimension adjustments, pattern alterations, in-stream structures (rock vanes, root wads, and log vanes) to provide grade control and channel stability. The project involved riparian buffer restoration which included the replanting of woody vegetation, construction of floodplain wetland depressions, and fencing for exclusion of farm animals. Restoration details are provided in Table I below.

Table I. Project Restoration Components
Brush Creek - Project # 54

Project Segment or Reach ID	Type	Approach	Restored Length (lf)	Stationing	Comment
Brush Creek – Reach 1	R	P2	340		Channel relocation; rock sills; point bar construction; revegetated
Brush Creek – Reach 2	E	E2	2,300		repair and expand riparian buffer
Little Pine Creek	R	P2	950	0+00 – 10+00	relocation of channel; new pattern, profile, dimension, and structures

C. Location and Setting

The project consisted of 4.3 square mile portion of the Little Pine Creek and 26.3 square mile portion of the Brush Creek watershed (located within USGS Hydrologic Unit Code 05050001, NCDWQ Sub-basin NEW03 10-9-10 New River Basin). Both Brush Creek and Little Pine Creek are located on agricultural properties with cow and horse pasture.

The project area is located east of Sparta, North Carolina in Alleghany County (Figure 1). To access the site from I-77, travel north on North Carolina (NC) Highway 21. Follow NC-21 turn right (north) on Shawtown Road (SR 1464). Follow Shawtown Road for five miles. Turn left on Glade Valley Road (SR 1444). Follow Glade Valley Road for one mile and turn right on Big Oak Road (SR 1454). The project is located downstream of the Big Oak Road bridge, approximately one mile north of Glade Valley Road.

D. History and Background

Project planning was initiated for the Brush Creek and Little Pine Creek Stream Enhancement/Restoration in 2000 for the implementation of a stream restoration project in Alleghany County, North Carolina. Following coordination with local leaders, the Wetlands Restoration Program and citizen groups, the project was initiated and focused on the restoration of 950 linear feet of Little Pine Creek and 2,640 linear feet of Brush Creek. Detailed environmental assessments and engineering studies were conducted to help generate design plans and documents to facilitate stream and riparian buffer restoration.

Implementation of the project was completed by September 2001. The restoration of Brush Creek and Little Pine Creek was intended to correct system deficiencies including severe bank erosion, channel widening, stream channelization, the loss of riparian vegetation, and watershed development.

The original construction of Little Pine Creek took place in 2001. An as-built survey was conducted followed by four years of monitoring (2002 through 2005). Monitoring reports MY1, MY2, MY3, and the draft of MY4 reported significant morphological areas of concern for both Little Pine Creek and Brush Creek. These areas seemed to be getting worse overtime and in addition, the vegetation success was not adequate for mitigation credit. No final report was completed for MY4. The decision was made to augment the project in 2006 with a new design and some re-construction. Re-construction of Little Pine Creek and portions of Brush Creek took place in 2006, therefore, no monitoring was conducted in 2006 (MY5). An as-built survey (denoted in this report as As-Built 2 or AB2) was conducted in November of 2006. New cross sections and vegetation plots were established during 2006 and one monitoring year (MY6) was performed. This report therefore reflects the second monitoring year (MY7) of data collected at four cross-sections and five vegetation plots, for Brush and Little Pine Creeks.

In June of 2008, herbicide was applied to control Fescue along the entire restored reach of Little Pine Creek and portions of Brush Creek.

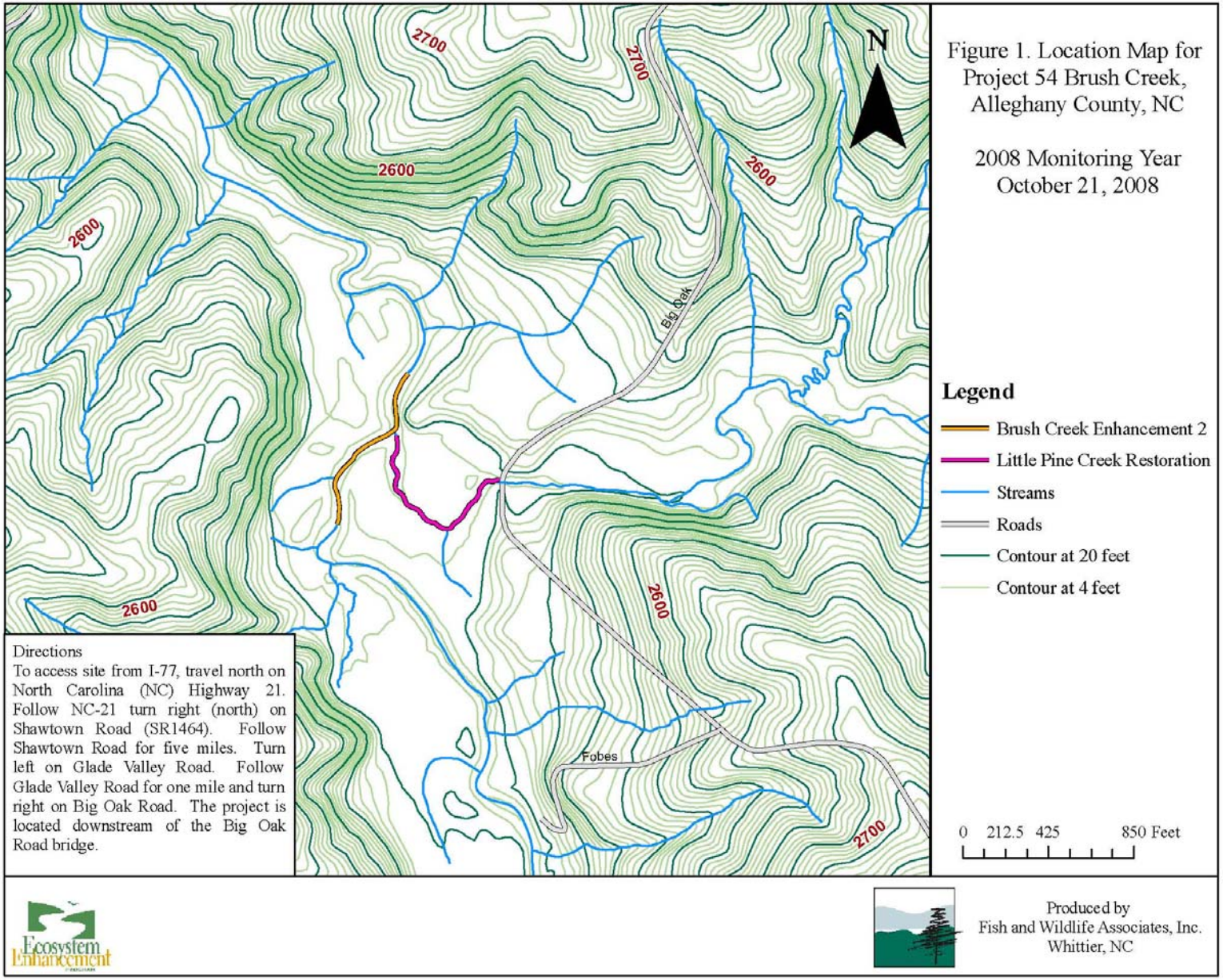


Figure 1. Location Map for Project 54 Brush Creek, Alleghany County, NC
2008 Monitoring Year
October 21, 2008
N
2700
2600
Big Oak
Fobes
Legend
Brush Creek Enhancement 2
Little Pine Creek Restoration
Streams
Roads
Contour at 20 feet
Contour at 4 feet
0 212.5 425 850 Feet
Directions
To access site from I-77, travel north on North Carolina (NC) Highway 21. Follow NC-21 turn right (north) on Shawtown Road (SR1464). Follow Shawtown Road for five miles. Turn left on Glade Valley Road. Follow Glade Valley Road for one mile and turn right on Big Oak Road. The project is located downstream of the Big Oak Road bridge.
Ecosystem Enhancement
Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

Table II. Project Activity and Reporting History Brush Creek – Project #54		
Activity or Report	**Calendar Year of Completion or Planned Completion**	**Actual Completion Date**
Restoration Plan	*	October 2000
Mitigation Plan	*	*
Temporary S & E mix applied to entire project area	*	*
As-Built Report	October 2001	October 2001
As-Built Report 2	January 2007	January 2007
Permanent seed mix applied to reach	*	*
Structural maintenance (bank repair and revegetation)	*	January 2007
Year 1 Monitoring	January 2002	June 2002
Year 2 Monitoring	November 2003	January 2004
Year 3 Monitoring	November 2004	December 2004
Year 4 Monitoring	November 2005	Not completed
Year 5 Monitoring	no monitoring was performed due to repair assessment and implementation	
As-Built 2	December 2006	January 2007
Year 6 Monitoring	November 2007	December 2007
Herbicide Application		June 2008
Year 7 Monitoring	November 2008	December 2008
Year 8 Monitoring	November 2009	

* Historical project documents reviewed did not provide these data

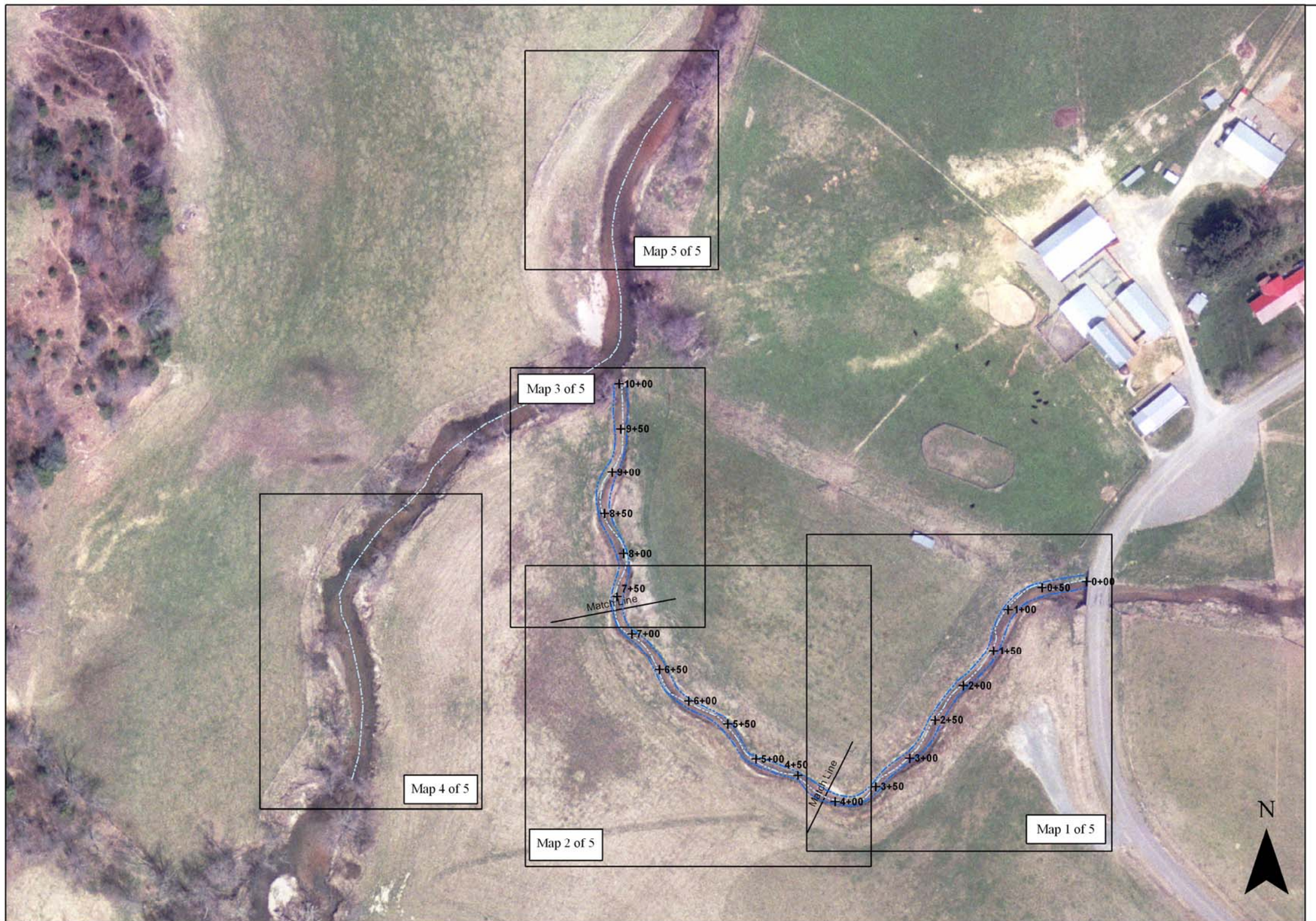
Table III. Project Contact Table Brush Creek - Project # 54	
Designer Primary project design POC	HDR Engineering, Inc. of the Carolinas. 128 South Tryon St, Suite 1400 Charlotte, North Carolina 28202 *
Construction Contractor Construction contractor POC	A&D Environmental & Industrial Services *
Planting Contractor Planting contractor POC	Shamrock Environmental Mr. Bill Wright (336) 375-1989
Seeding Contractor Planting contractor point of contact Seed Mix Sources Nursery Stock Suppliers	* * * *
Repair Designer Primary project design POC	HDR Engineering, Inc. of the Carolinas. 128 South Tryon St, Suite 1400 Charlotte, North Carolina 28202 *
Repair Construction Contractor Primary project design POC	North Carolina Wildlife Resources Commission Watershed Enhancement Group P.O. Box 387 Elkin, NC 28621 *
Monitoring Performers	
MY7 Stream Monitoring POC Vegetation Monitoring POC	Fish and Wildlife Associates, Inc. P.O. Box 241 Whittier, NC 28789 (828)497-6505 Barbara Wiggins Barbara Wiggins
MY6 Stream Monitoring POC Vegetation Monitoring POC	MACTEC Engineering and Consulting, Inc. 3301 Atlantic Avenue Raleigh, NC 27604 (919)876-0416 Robert Sain (828)252-8130 Admin Davis (919)876-0416
MY5	No annual monitoring conducted due to repair assessment and implementation

Table III continued. Project Contact Table Brush Creek - Project # 54	
MY4	EcoLogic Associates 4321 A. South Elm-Eugene Street Greensboro, NC 27406
MY2/MY3	Biological and Agricultural Engineering Water Resources Research Institute North Carolina State University Campus Box 7625 Raleigh, NC 27695
MY1	HDR Engineering, Inc. of the Carolinas 128 South Tryon Street, Suite 1400 Charlotte, NC 28202

Table IV. Project Background Table Brush Creek/Little Pine Creek - Project #54	
Project County	Alleghany, North Carolina
Drainage Area	26.3 sq. mi. (Brush Creek) 4.3 sq.mi. (Little Pine Creek)
Drainage impervious cover estimate (%)	Estimated at <5%
Stream Order	4th order (Brush Creek)
	3rd order (Little Pine Creek)
Physiographic Region	Mountains
Ecoregion	Southern Crysalline Ridges and Mountains (66d)
Rosgen Classification of As-built	B3 (Brush Creek)
	E4 (Little Pine Creek)
Cowardin Classification	Not applicable
Dominant soil types	Cardorus complex, Tate loam, Chester loam, Alluvial
Reference site ID	Mill Creek, Surry County, NC
USGS HUC for Project and Reference	5050001
NCDWQ Sub-basin for Project and Reference	NEW03 10-9-10
NCDWQ classification for Project and Reference	C; Tr
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	N/A
% of project easement fenced	100% (Brush Creek) 100% (Little Pine Creek)

E. Monitoring Plan View

The Monitoring Plan View is provided below.



Monitoring
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-buit Data (AB2)

+ Station No
Thalweg*
Edge of Water

*Little Pine Creek Thalweg from Repair As-built Data (AB2). Brush Creek Thalweg from NC Onemap GIS Data.

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Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
054-01-LPV2 36.50580894 81.00908181
054-01-LPV3 36.50628667 81.00924745
054-01-LPV4 36.50554587 81.00827233

Cross Sections:
lp-xs-1-lb 36.50591981 81.00758077
lp-xs-1-bkf 36.50595858 81.00771178
lp-xs-1-rb 36.50602071 81.00791864
lp-xs-2-lb 36.50574429 81.00920903
lp-xs-2-bkf 36.50586082 81.00903444
lp-xs-2-rb 36.50596233 81.00887254
lp-xs-3-lb 36.50617149 81.00944020
lp-xs-3-bkf 36.50616173 81.00919816
lp-xs-3-rb 36.50615447 81.00901317

Longitudinal Profile (As-built data):
begin survey 36.50614744 81.00742900
end survey 36.50671371 81.00917776

Photo Stations:
PS-1 36.50623056 81.00733122
PS-2 36.50617709 81.00756979
PS-3 36.50595799 81.00770895
PS-4 36.50548606 81.00811273
PS-5 36.50554358 81.00858985
PS-6 36.50570996 81.00884450
PS-7 36.50586088 81.00903451
PS-8 36.50595143 81.00914380
PS-9 36.50616173 81.00919818
PS-10 36.50631667 81.00925134

Brush Creek

Veg Plots:
054-01-BCV1 36.50589788 81.00993449

Cross Sections:
bc-xs-4-lb 36.50578678 81.01028959
bc-xs-4-bkf 36.50580545 81.01000965
bc-xs-4-rb 36.50582344 81.00989429

Photo Stations:
PS-11 36.50560838 81.01004210
PS-12 36.50682348 81.00989432
PS-13 36.50596754 81.01008668
PS-14 36.50608395 81.01009412
PS-15 36.50716885 81.00925196

Monitoring
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-buit Data (AB2)

- Station No
- Photo Stations
- Thalweg
- Edge of Water
- Bankfull
- Top of Bank
- Existing Fence Line
- Rebar Pin Set
- Root Wad
- Rock Vane
- Rock Sill
- Log Vane
- Digger Log
- Augmented Riffle
- Cross Section
- Vegetation Plot

Ecosystem Enhancement Program

Map 1 of 5

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Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
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Monitoring
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-buit Data (AB2)

- Station No
- Photo Stations
- Thalweg
- Edge of Water
- Bankfull
- Top of Bank
- Existing Fence Line
- Rebar Pin Set
- Root Wad
- Rock Vane
- Rock Sill
- Log Vane
- Digger Log
- Augmented Riffle
- Cross Section
- Vegetation Plot

0 15 30 60 Feet

Map 2 of 5

Produced by
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Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
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Monitoring
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-buit Data (AB2)

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- Photo Stations
- Thalweg
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- Bankfull
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- Rebar Pin Set
- Root Wad
- Rock Vane
- Rock Sill
- Log Vane
- Digger Log
- Augmented Riffle
- Cross Section
- Vegetation Plot

Map 3 of 5

Produced by
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Monitoring Pin Coordinates:

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PS-15 36.50716885 81.00925196

Monitoring
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-Built Data (AB2)

- Photo Stations
- Cross Section
- Rock Vane
- Root Wad
- Vegetation Plot

NC Onemap GIS Data

- Thalweg

0 15 30 60 Feet

Map 4 of 5

Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

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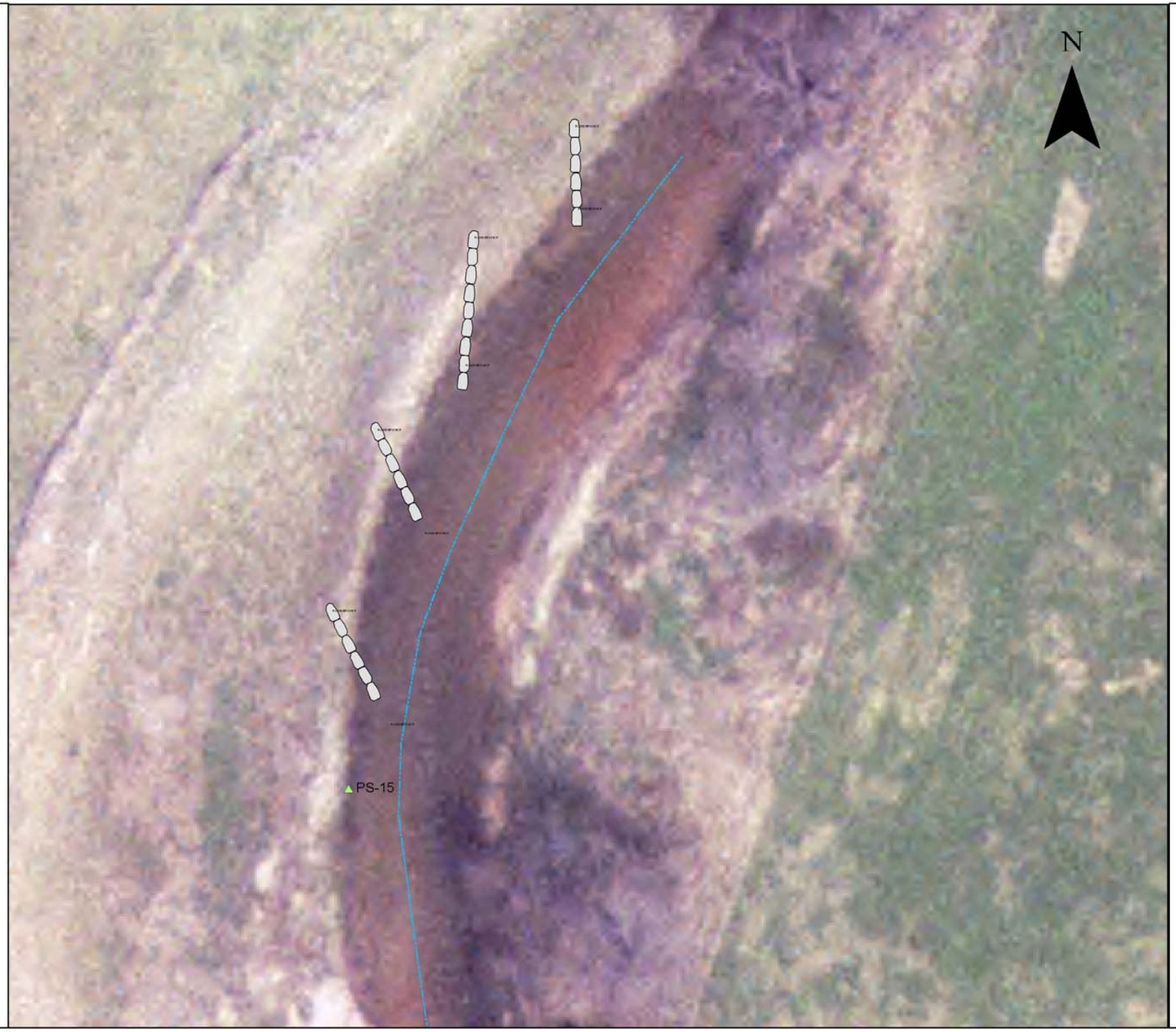
PS-13 36.50596754 81.01008668
PS-14 36.50608395 81.01009412
PS-15 36.50716885 81.00925196



Monitoring Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-Built Data (AB2)

- Photo Stations
- Rock Vane

NC Onemap GIS Data

- Thalweg

0 10 20 40 Feet

Map 5 of 5

Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

III. Project Condition and Monitoring Results

A. Vegetation Assessment

The initial assessment of Brush Creek and Little Pine Creek for MY7 was conducted in May 2008. During this time, the banks and flood plain area appeared to have an abundance of herbaceous vegetation with the exception of the vegetation plot on Brush Creek.

Five vegetation plots were monitored following the Level 2 *CVS-EEP Protocol for Recording Vegetation Version 4.0* (Lee et al. 2006) during August 2008. These plots were established in 2007 and resampled in the later part of 2007; therefore vegetation success is based on the initial plantings in 2007, October 2007 (MY6), and the August 2008 (MY7) sampling events. The taxonomic standard for vegetation followed Weakley (2006).

The total number of woody stems increased significantly from MY6 (542 stems/acre) to MY7 (1,205 stems/acre). The total number of planted stems decreased slightly from 467 stems/acre in MY6 to 437 stems/acre in MY7. The overall vegetation success has greatly improved as numerous natural stems have established. No damage was noted for a majority of the stems, although many appeared to be broken at the top. According to WRC staff, this may have been due to drift from the herbicide applications that took place in June 2008. In general, vegetation vigor was the same as MY6. Vegetation tables and vegetation plot photographs are provided in Appendix A.

Sambucus canadensis was the most successful naturally occurring woody species as 65 total stems were documented, while only seven were planted. As in MY6, *Hamamelis virginiana* (11 stems) and *Prunus serotina* (18 stems) continue to be abundant species, while the occurrence of *Asimina triloba* (6 stems) decreased.

1. Vegetation Problem Areas

Vegetation problems areas were categorized as bare bank, bare bench, bare flood plain, or invasive populations. Each category was classified as “failed” or “to be watched”. Few vegetation problem areas were encountered on Little Pine and Brush Creeks. Bare banks were often a result of bank slump, bank scour, or mammal holes. Bare banks that were actively eroding, scouring, or slumping were considered to be stream problem areas and are discussed in Section III.B. Bare banks, as the result of mammal holes, will not likely reestablish unless the burrow is abandoned. One bare bank location was the result of a washed out rock vane (Little Pine Creek, Station 01+85). Vegetation will likely reestablish in this area but should be watched for potential scouring.

Bare banks and benches were also observed due to recent aggradation. These were not considered problem areas as they appeared to be successful results from log vane and rock vane placement. (LP Stations 05+12, 06+61, 09+60, Brush Creek location along the downstream rock vanes). Vegetation was beginning to establish on newly deposited sediment; therefore these locations are not expected to be problem areas in the future.

Bare floodplain was observed along the right bank of Brush Creek in and near the vegetation plot. The number of woody stems in the vegetation plot did not differ significantly from the other plots, but the herbaceous cover was relatively sparse. The fiber matting was exposed and falling apart which resulted in soils with little erosion control.

Prior to FWA's initial assessment, invasive populations of *Festuca sp*. were documented along the top of bank and outer edge of the vegetation buffer. Herbicide was applied in June of 2008 and therefore these populations were not included in the vegetation problem areas. If *Festuca sp*. populations reestablish, it will be noted in MY8.

2. Vegetation Current Condition Plan View

The vegetation problem area table and representative photographs are provided in Appendix A. The Vegetation Current Condition Plan View is provided in the Project Problem Areas Plan View in Appendix C.

B. Stream Assessment

1. Procedural Items

Three cross-sectional dimensions were sampled on Little Pine Creek and one cross-sectional dimension was taken on Brush Creek in August 2008. These four cross-sections were established during the 2006 As-builts (AB2) and differ from the original cross-sections established in 2002. A longitudinal profile was taken only on Little Pine Creek as restoration on Brush Creek consisted mostly of enhancement activities. This report only compares morphological data between MY7, MY6, and AB2. Cross-sectional dimensions and longitudinal profiles were recorded using only XY data.

a. Morphological Criteria

Channel dimensions in Little Pine Creek remained similar to AB2 and MY6. The most significant change was in channel material. In cross sections 1 and 2, the channel material changed from course gravel in AB2 and MY6 to fine sand in MY7. The difference in channel material shifted the stream classification from C4 to C5. A similar change in channel material was also observed in Brush Creek.

Previous cross section data (MY6) depicted the flood prone width as the distance between the two cross section pins, which is not representative of the true flood prone area. In MY7, a more accurate flood prone width was determined and as a result entrenchment ratios increased for all cross sections applicable.

b. Hydrologic Criteria

No crest gauges were installed at the site to document bankfull events. No USGS stream gauge data is available on any streams in Alleghany County. A large storm event occurred throughout western North Carolina in late August 2008 as a result of Hurricane Fay. Bobby Irwin, the

property manager, visually documented an over bank event during this period. In addition, local weather data recorded 3.46 inches of rain in Ennice, NC from August 25-27, 2008. In October 2008, FWA personnel visited the site to acquire the fixed station photos. During this time, sediment deposits and wrack lines were observed; photographs were taken to document the evidence of bankfull (see Fixed Station Photos, Appendix B).

Data collection for MY7 was conducted prior to the storm event in late August; therefore any changes due to the storm event were not documented in cross-sectional or longitudinal samples. No obvious changes or damage to engineered structures or the stream channel were observed in October 2008, with the exception of one area of bank scour along Brush Creek (discussed below in Section III.B.2.).

Table V. Verification of Bankfull Events
Brush Creek - Project 54

Date of Data Collection	Date of Occurrence	Method	Photograph Number (if available)
8/26/08 10/16/08	8/25/08-8/27/08	Visual documentation of over bank event, Land Manager, Bobby Irwin; Rain gauge for Ennice, NC equaled 3.46 inches of rain; Visual documentation of sediment deposits, debris deposits, and wrack lines	see Fixed Station Photos in Appendix B
11/1/2007	10/23/2007	On-site observation and high water indicators observed.	Not available
12/8/2006	12/8/2006	On-site observation and high water indicators observed.	Not Available

2. Stream Current Condition Plan View

Stream problems areas were noted for both Brush Creek and Little Pine Creek. The left descending bank of Little Pine Creek (Station 09+67 – 09+86) just above the confluence with Brush Creek had a significant undercut bank and lacked vegetation. The right descending bank of Brush Creek, near Photo Station 14, also had significant bank scour. Upon the October 2008 visit, it was noted that the amount of bank scour at this location had increased after the August storm event. Both locations should be watched and potentially repaired to prevent further erosion and scour. Representative photographs of stream problem areas are included in Appendix B.

Most of the engineered structures were intact and working properly. Of the engineered structures, the following were missing or no longer intact: three rock sills, two rock vanes, and one root wad. In addition to missing structures the following were shifted or need to be watched: two root wads and one digger log. Rock vanes that failed were likely due to the small size of the

rocks used. The most common failed structure was rock sills. The Stream Current Condition Plan View is provided in the Project Problem Areas Plan View in Appendix C.

During the October site visit, evidence of cattle trespass was observed along the top of the banks of Little Pine Creek and Brush Creek. Evidence was minimal and no damage to the banks was noted.

3. Problem Areas Table

The Stream Problem Areas Table (Table B.1) is provided in Appendix B.

4. Numbered issue photos section

Numbered issue photos (or representative photographs) of problem areas referenced in Table B.1 are provided following Table B.1 in Appendix B.

5. Fixed Station Photos

Fifteen fixed photo stations have been established along Brush Creek and Little Pine Creek. Fixed station photos were taken in mid-October 2008 and are provided in Appendix B.

6. Stability Assessment

Stream feature visual stability has generally decreased since MY6, with the exception of riffles. Pools in Little Pine Creek appeared to be the least stable in MY7. Three pools on AB2 were not documented in MY7 and therefore considered to be filled in. Two additional pools lacked sufficient depth. The instability of pools appears to be related to the channel material, which has increased in fine particles.

The stability of structures has also decreased as some were no longer present. Two additional root wads have been noted in the problem areas as "to be watched". These structures are being threatened by undercutting; therefore the percentage of stable structures may decrease in the future.

Table VI. Categorical Stream Feature Visual Stability Assessment Brush Creek - Project 54 Segment/Reach: Little Pine (1000feet)				
Features	**As Built2**	**MY6**	**MY7**	**MY8**
A. Riffles	100%	95%	104%*	
B. Pools	100%	100%	72%	
C. Thalweg	100%	100%	96%	
D. Meanders	100%	93%	93%	
E. Bed General	100%	95%	99%	
F. Bank Condition	100%	80%	85%	
G. Vanes / J Hooks etc.	100%	92%	88%	
H. Wads and Boulders	100%	100%	88%	

* As riffles have shifted since AB2, the number of riffles increased from 11 in AB2 to 12 in MY7.

7. Quantitative Measures Summary Tables

The quantitative measures summary tables are providing on the following pages.

Table VII. Baseline Morphology and Hydraulic Summary
Brush Creek - Project 54
Segment/Reach Little Pine Creek (1000 ft)

Parameter	Regional Curve Interval			Pre-Existing Condition			Project Reference Reach			Design			As-built 2002			As-built 2006		
Dimension	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
BF Width (ft)						19			18			20	31.5	33.7	32.6	24.7	24.91	24.8
Floodprone Width (ft)						22.7			334			82	>100	>100	>100	105.1	126.1	115.6
BF Cross-Sectional Area (ft^2)			56.27			27.7			34.6			41.1	86.7	88.7	87.7	45.07	45.29	45.2
BF Mean Depth (ft)						1.2			2.5			2.3	2.6	2.8	2.7	1.49	1.82	1.7
BF Max Depth (ft)						2			4.1			4	4.8	5	4.9	2.69	2.76	2.7
Width/Depth Ratio						16.34			7.17			8.81	11.3	13	12.15	13.69	20.72	17.2
Entrenchment Ratio						1.2			18.6			4.1	3.2	3.0	3.1	2.66	4.22	3.4
Bank Height Ratio													*	*	*	1.32	2.12	1.7
Wetted Perimeter (ft)													*	*	*	26.18	31.24	28.7
Hydraulic Radius (ft)													*	*	*	1.44	1.73	1.6
Pattern																		
Channel Beltwidth (ft)						41.7			39			50	24	50	33	24.9	45.3	35.38
Radius of Curvature (ft)									23			25	39	62	50.5	40.3	60.5	47.66
Meander Wavelength (ft)						125			1.105			110	90	125	110	89.2	124	108.4
Meander Width Ratio						6.6			5.6			5.5	0.76	1.48	1.01	0.9	1.64	1.28
Profile																		
Riffle Length (ft)													6	47	18	10.36	46.34	20.53
Riffle Slope (ft/ft)													0.003	0.0634	0.0309	0.0029	0.0188	0.0122
Pool Length (ft)													34	112	45	10.25	89.95	31.95
Pool Spacing (ft)						150.5			66.8			62.5	51	150	73	60.32	176.81	112.97
Substrate																		
D_{50} (mm)						11			40			50.00	*	*	*	27.30	39.10	33.20
D_{84} (mm)						60			110			100	*	*	*	40	66.7	53.35
Additional Reach Parameters																		
Valley Length (ft)																		571
Channel Length (ft)															950			1013
Sinuosity						1			1.7			1.6			1.7			1.77
Water Surface Slope (ft/ft)															0.0057			0.0067
BF Slope (ft/ft)						0.007			0.009			0.006			0.0058			0.0057
Rosgen Classification						F4			E4			E4			C4			C4

Table VIII. Morphology and Hydraulic Monitoring Summary Brush Creek - Project 54																
Parameter	Little Pine Creek Cross-section # 1 - Riffle				Little Pine Creek Cross-section # 2 - Pool				Little Pine Creek Cross-section # 3 - Riffle				Brush Creek Cross-section # 1 - Run			
Dimension	AB2	MY6	MY7	MY8	AB2	MY6	MY7	MY8	AB2	MY6	MY7	MY8	AB2	MY6	MY7	MY8
BF Width (ft)	24.9	25.4	25.4		24.7	26.4	20.6		30.3	34	30.3		63.5	65.0	56.6	
Floodprone Width (ft)	105.1	>100	171		126.1	>100	n/a		110	>100	73.9		181.8	>100	225	
BF Cross-sectional Area (ft^2)	45.3	44.39	47.9		54.4	51.85	40.2		45.1	45.97	48.3		177.5	146.0	128.8	
BF Mean Depth (ft)	1.8	1.7	1.9		2.2	2	1.9		1.8	1.4	1.6		2.8	2.2	2.3	
BF Max Depth (ft)	2.8	2.8	3		3.9	3.8	3.7		2.8	2.8	3		5.5	3.3	4.8	
Width/Depth Ratio	13.7	14.5	13.5		11.2	13.4	n/a		20.3	25.1	19.1		22.8	28.9	24.9	
Entrenchment Ratio	4.2	3.9	6.7		5.1	5.1	n/a		2.7	2.7	2.4		2.9	2.9	4	
Bank Height Ratio	1.3	1.3	1.9		1.7	1.1	2.1		2.1	2.1	2.1		1.6	1.4	2.1	
Wetted Perimeter (ft)	26.2	26.0	26.9		28.0	28.0	24.5		31.2	31.2	32.6		66.1	66.1	59.1	
Hydraulic Radius (ft)	1.7	1.7	1.8		1.9	1.9	1.6		1.4	1.5	1.5		2.7	2.2	2.2	
Substrate																
D_{50} (mm)	39.1	30.3	0.2		0.2	1.4	0.1		27.3	15.8	0.1		55.4	22.7	0.2	
D_{84} (mm)	82.3	64.4	53.0		40.0	54.3	0.3		66.7	50.0	27.3		95.8	75.0	46.5	

Table VIII continued. Morphology and Hydraulic Monitoring Summary Brush Creek - Project 54 Segment/Reach Little Pine Creek (1000 ft)												
Parameter	AB1 2002			AB2 2006			MY6 2007			MY7 2008		
Pattern	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Channel Beltwidth (ft)	24.0	50.0	33.0	33.0	45.3	35.4	33.0	45.3	35.4	--	--	--
Radius of Curvature (ft)	39.0	62.0	50.5	40.3	60.5	47.7	40.3	60.5	47.7	--	--	--
Meander Wavelength (ft)	90.0	125.0	110.0	89.2	111.4	108.4	89.2	111.4	108.4	--	--	--
Meander Width Ratio	0.8	1.5	1.0	1.3	1.7	1.3	1.3	1.7	1.3	--	--	--
Profile												
Riffle Length (ft)	6.0	47.0	18.0	10.4	46.3	20.5	10.8	88.3	23.1	7.0	30.0	20.6
Riffle Slope (ft/ft)	0.0030	0.0634	0.0309	0.0029	0.0188	0.0122	0.0035	0.0201	0.0111	0.0008	0.0420	0.0205
Pool Length (ft)	34.0	112.0	45.0	10.3	90.0	32.0	15.0	110.0	40.0	16.0	37.0	24.1
Pool Spacing (ft)	51.0	150.0	73.0	60.3	176.8	113.0	55.0	250.0	126.0	40.4	253.6	110.9
Additional Reach Parameters												
Valley Length (ft)						571.0			600.0			571.0
Channel Length (ft)			950			1013.0			1013.0			994.0
Sinuosity			1.7			1.77			1.7			1.7
Water Surface Slope (ft/ft)			0.0125			0.0057			0.0048			0.0054
BF Slope (ft/ft)						0.0058			0.0057			0.0051
Rosgen Classification			E4			C4			C4			C5
Habitat Index												--
Macrobenthos												--

-- Not sampled during MY7

IV. Methods

Methods used follow the US Army Corp of Engineers *Stream Mitigation Guidelines* and the Carolina Vegetation Survey, Ecosystem Enhancement Program's Level 2 *CVS-EEP Protocol for Recording Vegetation Version 4.0* (Lee et al. 2006, http://cvs.bio.unc.edu/methods.htm). Cross-sectional dimensions and longitudinal profiles were recorded using only XY data.

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APPENDIX A

VEGETATION RAW DATA

1. Vegetation Data Tables
2. Vegetation Problem Area Photos
3. Vegetation Monitoring Photos

Table 1. Vegetation Metadata Brush Creek - Project # 54	
Report Prepared By	Leslie Bilbrey
Date Prepared	9/8/2008 15:06
database name	54-brushcreeklittlecreek-2008-vmd-entrytool-v2.2.5.mdb
database location	\\Fran\F\Projects\EEP Consulting Services RFP\2008-2009 Monitoring Contract\Brush Creek\FWA Deliverables and monitoring data\Vegetation Monitoring
computer name	LESLIE-PC
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
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	A matrix of the 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	54
project Name	Brush Creek
Description	Stream repair on Brush and Little Pine Creeks in Alleghany County NC.
River Basin	New River
length(ft)	1000
stream-to-edge width (ft)	50
area (sq m)	9289.36
Required Plots (calculated)	4
Sampled Plots	5

Table 2. Planted Stems Per Acre Brush Creek - Project # 54			
Project Code	**Project Name**	**River Basin**	**Year 2**
54	Brush Creek	New River	437.06

Living planted stems, excluding live stakes, per acre: Negative (red) numbers Indicate the project failed to reach requirements in a particular year.

Table 3. Total Stems Per Acre Brush Creek - Project # 54			
Project Code	**Project Name**	**River Basin**	**Year 2**
54	Brush Creek	New River	1205.963216

Total stems, including planted stems of all kinds (including live stakes) and natural/volunteer stems.

Table 4. Plots Brush Creek - Project # 54									
Plot	**Plot Level**	**Year**	**Latitude/ Northing**	**Longitude/ Easting**	**Datum**	**Date Sampled**	**Planted Living Stems**	**Planted Living Stems EXCLUDING Live Stakes**	**Dead/ Missing Stems**
054-01-BCV1-year:2	2	2	36.50589788	-81.00993449	NAD83/WSG84	8/18/2008	13	5	18
054-01-LPV1-year:2	2	2	36.5059102	-81.00769455	NAD83/WSG84	8/18/2008	14	14	6
054-01-LPV2-year:2	2	2	36.50580894	-81.00908181	NAD83/WSG84	8/18/2008	11	11	2
054-01-LPV3-year:2	2	2	36.50628667	-81.00924745	NAD83/WSG84	8/18/2008	12	11	10
054-01-LPV4-year:2	2	2	36.50554587	-81.00827233	NAD83/WSG84	8/18/2008	13	13	7

Table 4 continued. Plots Brush Creek - Project # 54									
Plot	**Natural (Volunteer) Stems**	**Total Living Stems**	**Total Living Stems EXCLUDING Live Stakes**	**Planted Living Stems per ACRE**	**Planted Living Stems EXCLUDING Live Stakes PER ACRE**	**Natural (Volunteer) Stems PER ACRE**	**Total Living Stems PER ACRE**	**Total Living Stems EXCLUDING Live Stakes PER ACRE**	**# species**
054-01-BCV1-year:2	4	17	9	526.0913359	202.3428215	161.8742572	687.965593	364.2170787	7
054-01-LPV1-year:2	3	17	17	566.5599002	566.5599002	121.4056929	687.965593	687.9655931	8
054-01-LPV2-year:2	2	13	13	445.1542073	445.1542073	80.9371286	526.091336	526.0913359	6
054-01-LPV3-year:2	26	38	37	485.6227716	445.1542073	1052.182672	1537.80544	1497.336879	6
054-01-LPV4-year:2	51	64	64	526.0913359	526.0913359	2063.896779	2589.98812	2589.988115	6

Table 5. Vigor		
Brush Creek - Project # 54		
Vigor	**Count**	**Percent**
0	4	3.8
1	3	2.8
2	14	13.2
3	40	37.7
4	6	5.7
Missing	39	36.8

Table 6. Vegetation Vigor by Species Brush Creek - Project #54								
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**	**Unknown**
	Alnus serrulata			1				
	Asimina triloba		4		2		6	
	Betula nigra		2			3	2	
	Cornus amomum		1					
	Diospyros virginiana						2	
	Fraxinus americana		1					
	Fraxinus pennsylvanica	1	3				1	
	Juglans nigra	2						
	Pinus strobus	1	1					
	Quercus alba	1	1	1				
	Rhododendron calendulaceum		1				1	
	Rhododendron viscosum						1	
	Salix nigra		5				3	
	Sambucus canadensis		3	4			6	
	Tsuga canadensis						1	
	Carpinus caroliniana		2	1			3	
	Hamamelis virginiana		6	2	1		1	
	Liriodendron tulipifera		1					
	Physocarpus opulifolius	1	3				4	
	Prunus serotina		6	3			1	
	Acer rubrum			2				
	Unknown					1	7	
TOT:	**22**	**6**	**40**	**14**	**3**	**4**	**39**	

Table 7. Damage		
Brush Creek - Project # 54		
Damage	**Count**	**Percent Of Stems**
(no damage)	68	64.2
Insects	15	14.2
Unknown	11	10.4
Other/Unknown Animal	9	8.5
(other damage)	3	2.8

Table 8. Vegetation Damage by Species							
Brush Creek - Project # 54							
	Species	**All Damage Categories**	**(no damage)**	**Insects**	**Other/Unknown Animal**	**Unknown**	**(other damage)**
	Acer rubrum	2	1			1	
	Alnus serrulata	1				1	
	Asimina triloba	12	7	3		2	
	Betula nigra	7	5	1		1	
	Carpinus caroliniana	6	4		2		
	Cornus amomum	1	1				
	Diospyros virginiana	2	2				
	Fraxinus americana	1	1				
	Fraxinus pennsylvanica	5	3		1	1	
	Hamamelis virginiana	10	3	4		3	
	Juglans nigra	2	1	1			
	Liriodendron tulipifera	1		1			
	Physocarpus opulifolius	8	6	1	1		
	Pinus strobus	2	2				
	Prunus serotina	10	5	1	2	1	1
	Quercus alba	3	1	2			
	Rhododendron calendulaceum	2	2				
	Rhododendron viscosum	1	1				
	Salix nigra	8	8				
	Sambucus canadensis	13	6	1	3	1	2
	Tsuga canadensis	1	1				
	Unknown	8	8				
TOT:	**22**	**106**	**68**	**15**	**9**	**11**	**3**

Table 9. Vegetation Damage by Plot Brush Creek - Project # 54							
	Plot	**All Damage Categories**	**(no damage)**	**Insects**	**Other/Unknown Animal**	**Unknown**	**(other damage)**
	054-01-BCV1-year:2	31	28	1	1	1	
	054-01-LPV1-year:2	20	8	7		5	
	054-01-LPV2-year:2	13	8	1	2	1	1
	054-01-LPV3-year:2	22	13	2	5	1	1
	054-01-LPV4-year:2	20	11	4	1	3	1
TOT:	**5**	**106**	**68**	**15**	**9**	**11**	**3**

Table 10. Planted Stems by Plot and Species Brush Creek - Project # 54									
	Species	**Total Planted Stems**	**# plots**	**avg# stems**	**plot 054-01-BCV1-year:2**	**plot 054-01-LPV1-year:2**	**plot 054-01-LPV2-year:2**	**plot 054-01-LPV3-year:2**	**plot 054-01-LPV4-year:2**
	Acer rubrum	2	2	1		1	1		
	Alnus serrulata	1	1	1				1	
	Asimina triloba	6	3	2		3	1		2
	Betula nigra	2	1	2		2			
	Carpinus caroliniana	3	2	1.5	1			2	
	Cornus amomum	1	1	1					1
	Fraxinus americana	1	1	1	1				
	Fraxinus pennsylvanica	4	2	2	1		3		
	Hamamelis virginiana	9	3	3		4	1		4
	Juglans nigra	2	1	2				2	
	Liriodendron tulipifera	1	1	1		1			
	Physocarpus opulifolius	4	2	2	3			1	
	Pinus strobus	2	1	2					2
	Prunus serotina	9	5	1.8	1	1	3	3	1
	Quercus alba	3	2	1.5		1	2		
	Rhododendron calendulaceum	1	1	1		1			
	Salix nigra	5	1	5	5				
	Sambucus canadensis	7	3	2.33	1			3	3
TOT:	**18**	**63**	**18**		**13**	**14**	**11**	**12**	**13**

Table 11. All Stems by Plot and Species Brush Creek - Project # 54									
	Species	**Total Stems**	**# plots**	**avg# stems**	**054-01-BCV1-year:2**	**054-01-LPV1-year:2**	**054-01-LPV2-year:2**	**054-01-LPV3-year:2**	**054-01-LPV4-year:2**
	Alnus serrulata	1	1	1				1	
	Asimina triloba	6	3	2		3	1		2
	Betula nigra	6	3	2		2	1		3
	Cornus amomum	9	1	9					9
	Fraxinus americana	1	1	1	1				
	Fraxinus pennsylvanica	4	2	2	1		3		
	Juglans nigra	5	2	2.5				4	1
	Pinus strobus	2	1	2					2
	Quercus alba	3	2	1.5		1	2		
	Rhododendron calendulaceum	1	1	1		1			
	Salix nigra	7	2	3.5	5				2
	Sambucus canadensis	65	3	21.67	1			23	41
	Carpinus caroliniana	5	2	2.5	1			4	
	Hamamelis virginiana	11	4	2.75	2	4	1		4
	Liriodendron tulipifera	1	1	1		1			
	Physocarpus opulifolius	4	2	2	3			1	
	Prunus serotina	18	5	3.6	3	3	4	5	3
	Acer rubrum	2	2	1		1	1		
	Unknown	2	2	1	1	1			
TOT:	**19**	**153**	**19**		**18**	**17**	**13**	**38**	**67**

Table 12. Vegetation Problem Areas Table			
Brush Creek - Project # 54			
Feature/Issue	**Station Number/Range***	**Probable Cause**	**Representative Photo #**
Bare Bank	00+65	mammal hole	19
	01+78 - 01+92	missing rock vane	11
	02+80	mammal hole	19
Bare Bench	Not observed		n/a
Bare Flood Plain	BC-see CCPV	planting unsuccessful/unknown	66
Invasive/Exotic	Not observed		n/a

* Station numbers refer to Little Pine Creek; see CCPV for location of problem areas along Brush Creek.

North Carolina Ecosystem Enhancement Program (NC EEP)
Vegetation Problem Areas Representative Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Little Pine Creek Station 01+78-01+92
Date: May 2008
Photo No: 11
Photographed by: L. Bilbrey
Description: Bare bank observed along the left descending bank on Little Pine Creek. A rock vane was washed out from this location, exposing the bank. Vegetation is likely to reestablish.

Alleghany County, NC
Site: Little Pine Creek, Station 02+80
Date: May 2008
Photo No: 19
Photographed by: L. Bilbrey
Description: Representative photograph of bare bank as a result of mammal burrows.

North Carolina Ecosystem Enhancement Program (NC EEP)
Vegetation Problem Areas Representative Photo Log
Brush Creek– Project # 54

Alleghany County, NC
Site: Brush Creek
Date: May 2008
Photo No: 66
Photographed by: L. Bilbrey
Description: Bare flood plain near BCVP 1, facing upstream.

North Carolina Ecosystem Enhancement Program (NC EEP)
Vegetation Monitoring Plot Photos
Brush Creek– Project # 54

Alleghany County, NC
Site: Little Pine Creek Plot ID: 054-01-LPV1
Date: August 18, 2008
Photo No: 70
Photographed by: L. Bilbrey
Description: Taken from plot origin toward diagonally opposite corner.

Alleghany County, NC
Site: Little Pine Creek Plot ID: 054-01-LPV2
Date: August 18, 2008
Photo No: 71
Photographed by: L. Bilbrey
Description: Taken from plot origin toward diagonally opposite corner.

North Carolina Ecosystem Enhancement Program (NC EEP)
Vegetation Monitoring Plot Photos
Brush Creek– Project # 54

Alleghany County, NC
Site: Little Pine Creek Plot ID: 054-01-LPV3
Date: August 18, 2008
Photo No: 72
Photographed by: L. Bilbrey
Description: Taken from plot origin toward diagonally opposite corner.

Alleghany County, NC
Site: Little Pine Creek Plot ID: 054-01-LPV4
Date: August 18, 2008
Photo No: 73
Photographed by: L. Bilbrey
Description: Taken from plot origin toward diagonally opposite corner.

North Carolina Ecosystem Enhancement Program (NC EEP)
Vegetation Monitoring Plot Photos
Brush Creek– Project # 54

Alleghany County, NC
Site: Little Pine Creek Plot ID: 054-01BCV1
Date: August 18, 2008
Photo No: 75
Photographed by: L. Bilbrey
Description: Taken from plot origin toward diagonally opposite corner.

APPENDIX B

GEOMORPHOLOGIC RAW DATA

1. Stream Problem Areas Table
2. Representative Stream Problem Area Photos
3. Stream Fixed Station Photos
4. Qualitative Visual Stability Assessment
5. Annual Overlays of Cross Section Plots
6. Annual Overlays of Longitudinal Plots
7. Annual Overlays of Pebble Count Frequency Distribution Plots

Table B.1 Stream Problem Areas			
Brush Creek - Project # 54			
Feature/Issue	**Station Number/Range***	**Suspected Cause**	**Representative Photo #**
Aggradation/Bar Formation	00+10 - 00+22	wide channel under bridge and upstream bank disturbance	1
	02+33	bank slump, forming midbar	16
Bank Scour	02+61	high water event	18
	06+18	unknown	18
	07+62	high water event	18
	09+67 - 09+86	high water event at confluence	57
	BC-see CCPV-near photo station 14	eroding under matting/may be result of some debris damage	18
	BC-see CCPV	high flow event	18
Engineered Structures			
Missing rock vane	01+85	high water event	12
Rock sill failure	04+87	high water event	28
Rock sill failure	06+00	high water event	28
Root wads	06+29 - 06+31	water flowing under root wads, causing scour	39
Missing root wad	07+60	high water event	47
Shifted digger log	07+60	high water event	50
Rock sill failure	07+74	high water event	28
Root wads	08+63 - 08+68	water flowing under root wads, causing scour	39
Missing rock vane	09+60	high water event	12
Mammal holes	07+09 - 07+25	muskrat holes	55
	08+73	muskrat holes	55
	09+31	muskrat holes	55
Slumped bank	02+33 - 02+41	unknown	16
	06+00	unknown	16
	06+59	unknown	16

* Station numbers refer to Little Pine Creek; see CCPV for location of problem areas along Brush Creek.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Problem Areas Numbered Issues Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Little Pine Creek Station 00+10-00+22
Date: May 2008
Photo No: 1
Photographed by: L. Bilbrey
Description: Representative photograph of mid-bar formation observed along Little Pine Creek, facing upstream.

Alleghany County, NC
Site: Little Pine Creek Station 01+85
Date: May 2008
Photo No: 12
Photographed by: L. Bilbrey
Description: Photograph of missing rock vane, likely the result of a high water event. Facing downstream at left descending bank.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Problem Areas Numbered Issues Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Little Pine Creek Station 02+45-02+50
Date: May 2008
Photo No: 16
Photographed by: L. Bilbrey
Description: Representative photograph of bank slump observed along Little Pine Creek.

Alleghany County, NC
Site: Little Pine Creek Station 02+61
Date: May 2008
Photo No: 18
Photographed by: L. Bilbrey
Description: Representative photograph of bank scour observed along Little Pine Creek.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Problem Areas Numbered Issues Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Little Pine Creek Station 04+87
Date: May 2008
Photo No: 28
Photographed by: L. Bilbrey
Description: Representative photograph of failed rock sills in some riffles (04+87, 06+00, 07+74) in Little Pine Creek, facing upstream.

Alleghany County, NC
Site: Little Pine Creek Station 06+29-06+31
Date: May 2008
Photo No: 39
Photographed by: L. Bilbrey
Description: Flow directed at bank, causing undercut banks under root wads. These structures should be watched (06-29-06+61, 08+63-08+68).

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Problem Areas Numbered Issues Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Little Pine Creek Station 07+52
Date: May 2008
Photo No: 47
Photographed by: L. Bilbrey
Description: Missing root wad, facing upstream at left bank.

Alleghany County, NC
Site: Little Pine Creek Station 07+50
Date: May 2008
Photo No: 50
Photographed by: L. Bilbrey
Description: Digger log shifted and turned downstream, likely due to a high water event.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Problem Areas Numbered Issues Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Little Pine Creek Station 08+73
Date: May 2008
Photo No: 55
Photographed by: L. Bilbrey
Description: Representative photograph of muskrat burrows observed along the downstream portion of Little Pine Creek.

Alleghany County, NC
Site: Little Pine Creek Station 09+67-09+86
Date: May 2008
Photo No: 57
Photographed by: L. Bilbrey
Description: Major bank scour and undercut bank just at the confluence of Little Pine Creek and Brush Creek, facing downstream at left bank.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Problem Areas Numbered Issues Photo Log
Brush Creek – Project # 54

Alleghany County, NC
Site: Brush Creek
Date: May 2008
Photo No: 62
Photographed by: L. Bilbrey
Description: Bank Scour, near Photo Station 14 along the right descending bank.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Fixed Station Photos
Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 1
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 100 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 1
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 225 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 2
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 70 degrees from north, facing upstream. Midbar forming under bridge (station 00+10-00+22).

Site: Little Pine Creek
Project No: 54
Photo Station: 2
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 200 degrees from north. Facing downstream towards riffle cross section 1.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Fixed Station Photos
Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 3
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 25 degrees from north, showing sediment deposits.

Site: Little Pine Creek
Project No: 54
Photo Station: 3
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 228 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 4
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 45 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 4
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 270 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Fixed Station Photos
Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 5
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 90 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 5
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 300 degrees from north, facing downstream towards shifted riffle and breached rock sill.

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 6
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 115 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 6
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 332 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Fixed Station Photos
Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 7
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 115 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 7
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 352 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Fixed Station Photos
Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 8
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 100 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 8
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 350 degrees from north, muskrat holes along the left descending bank.

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 9
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 20 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 9
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 170 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 10
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 20 degrees from north, water flowing under root wads along left descending bank.

Site: Little Pine Creek
Project No: 54
Photo Station: 10
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 160 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 11
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 226 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 11
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 350 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 12
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 224 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 12
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 270 degrees from north, showing a portion of the Brush Creek Vegetation Plot.

North Carolina Ecosystem Enhancement Program (NC EEP)
Stream Fixed Station Photos
Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 13
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 195 degrees from north

Site: Little Pine Creek
Project No: 54
Photo Station: 13
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 345 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 14
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 190 degrees from north, facing upstream, bank scour is visible along the right descending bank.

Site: Little Pine Creek
Project No: 54
Photo Station: 14
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 330 degrees from north

North Carolina Ecosystem Enhancement Program (NC EEP)

Stream Fixed Station Photos

Brush Creek – Project # 54

Site: Little Pine Creek
Project No: 54
Photo Station: 15
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 35 degrees from north

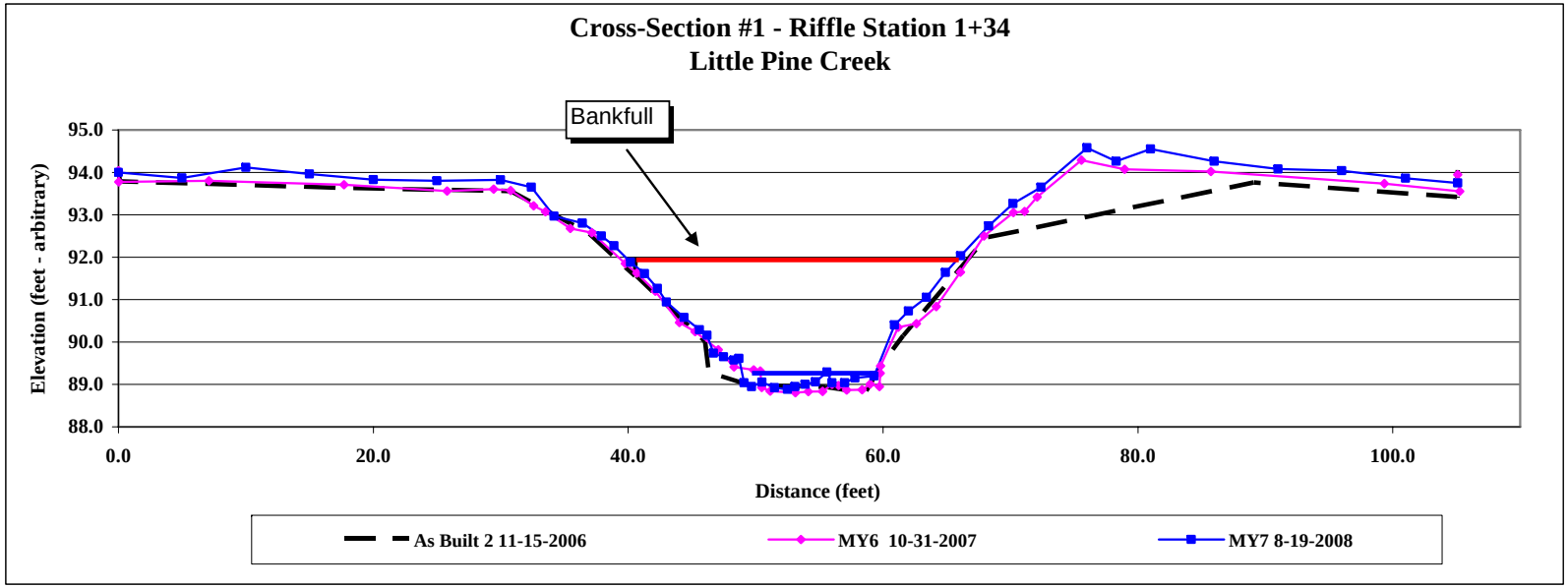
Site: Little Pine Creek
Project No: 54
Photo Station: 15
Date: October 16, 2008
Photographed by: L. Bilbrey
Description: Taken 160 degrees from north

Table B.2 Visual Morphological Stability Assessment Brush Creek - Project # 54 Segment/Reach: Little Pine Creek (1000 ft)						
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?	12	11	NA	109	
	2. Armor stable (e.g. no displacement)?	11	11	NA	100	
	3. Facet grade appears stable?	11	11	NA	100	
	4. Minimal evidence of embedding/ fining?	12	11	NA	109	
	5. Length Appropriate?	11	11	NA	100	**104**
B. Pools	1. Present? (e.g not subject to severe aggradation or migration?)	10	13	NA	77	
	2. Sufficiently deep (Max Pool D:Mean Bkf >1.6?)	8	13	NA	62	
	3. Length Appropriate?	10	13	NA	77	**72**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	12	13	NA	92	
	2. Downstream of meander (glide/inflection) centering?	13	13	NA	100	**96**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	14	15	NA	93	
	2. Of those eroding, # w/concomitant point bar formation?	0	NA	NA	NA	
	3. Apparent Rc within spec?	14	15	NA	93	
	4. Sufficient floodplain access and relief?	14	15	NA	93	**93**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	3/19	98	
	2. Channel bed degradation – areas of increasing down-cutting or head cutting?	NA	NA	NA	100	**99**
F. Banks	1. Actively eroding, wasting, or slumping bank	NA	NA	15/148	85	**85**
G. Vanes	1. Free of back or arm scour?	14	16	NA	88	
	2. Height appropriate?	14	16	NA	88	
	3. Angle and geometry appear appropriate?	14	16	NA	88	
	4. Free of piping or other structural failures?	14	16	NA	88	**88**
H. Wads/ Boulders	1. Free of scour?	4	4	NA	100	
	2. Footing stable?	3	4	3/3	75	**88**

Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 1 of 3
Feature	Riffle
Date Surveyed	8/19/2008
Crew	Bilbrey, L., Lawson, C.

Bankfull Area			
	AB2	MY6	MY7
Area	45.3	44.4	47.9
Width	24.9	25.4	25.4
Mean Depth	1.8	1.7	1.9
Max Depth	2.8	2.8	3.0
w/d ratio	13.7	14.5	13.5
FPW	105.1	>100	171.0
ER	4.2	3.9	6.7

Facing downstream x-section #1



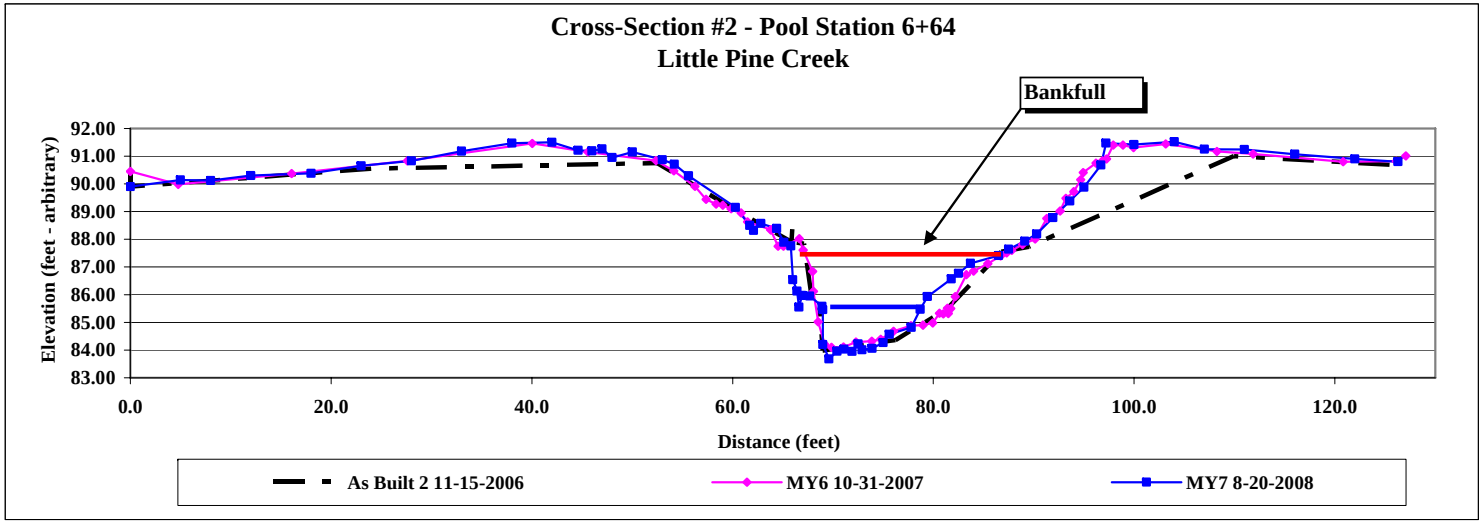
Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 1 of 3
Feature	Riffle
Date Surveyed	8/19/2008
Crew	Bilbrey, L., Lawson, C.

11/15/2006 As-Built #2 Survey			10/31/2007 MY6 Survey			10/31/2007 MY6 Survey (cont.)			8/20/2008 MY7 Survey			8/20/2008 MY7 Survey (cont.)		
Station	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**
0.0	94.1	IPS	0.0	94.0	tolp	61.2	90.3		0	94	L pin	57	89.04	
0.1	93.8	GS	0.0	93.8		62.6	90.4		5	93.87		57.8	89.15	
18.0	93.6		7.1	93.8		64.2	90.8		10	94.12		59.3	89.2	we
30.8	93.6	LB	17.7	93.7		66.1	91.6		15	93.96		60.9	90.4	
36.9	92.6		25.8	93.6		67.9	92.5		20	93.83		62	90.73	
40.5	91.6	BKF	29.4	93.6		70.2	93.1		25	93.8		63.4	91.05	rbkfl
40.6	92.1	IPSBKF	30.8	93.6		71.1	93.1		30	93.82		64.9	91.64	
40.6	91.6		32.6	93.2		72.1	93.4		32.4	93.65		66.1	92.03	
46.1	90.0	TS	33.5	93.1		75.6	94.3		34.2	92.97		68.3	92.74	
46.3	89.3	LEW	35.5	92.7		79.0	94.1		36.4	92.8		70.2	93.26	
49.5	89.0		37.2	92.6		85.7	94.0		37.9	92.5		72.4	93.65	
55.5	88.9		39.8	91.8		99.3	93.7		38.9	92.27		76	94.58	
58.6	88.8		40.7	91.6		105.2	93.6		40.2	91.88	bkf pin	78.3	94.26	
59.8	89.4	REW	42.1	91.2	bkf	105.1	93.9	torp	41.3	91.61		81	94.55	
61.6	90.2	TS	44.0	90.5					42.3	91.26		86	94.26	
68.1	92.5		45.2	90.2					43	90.94		91	94.08	
89.1	93.8		47.1	89.8					44.4	90.58		96	94.04	
105.0	93.4	GS	48.3	89.4					45.6	90.29		101	93.86	
105.1	94.1	IPS	49.8	89.3					46.2	90.16		105.1	93.75	
			50.4	89.3	ws				46.7	89.74				
			50.5	88.9	lew				47.5	89.65				
			51.1	88.8					48.3	89.57				
			53.1	88.8					48.7	89.61				
			54.1	88.8					49.1	89.04	we			
			55.3	88.8					49.7	88.95				
			56.0	89.0					50.5	89.05				
			56.5	89.0					51.5	88.92				
			57.1	88.9					52.5	88.88				
			58.4	88.9					53.1	88.95				
			59.0	89.0					53.9	89				
			59.7	88.9	rew				54.7	89.06				
			59.8	89.3	ws				55.6	89.29				
			59.8	89.4					56	89.04				

Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 2 of 3
Feature	Pool
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

Bankfull Area			
	AB2	MY6	MY7
Area	54.35	51.85	40.21
Width	24.7	26.4	20.6
Mean Depth	2.2	2.0	1.9
Max Depth	3.9	3.8	3.7
w/d ratio	11.2	13.4	n/a
FPW	126.1	>100	n/a
ER	5.1	3.8	n/a

Facing down stream x-section #2



Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 2 of 3
Feature	Pool
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

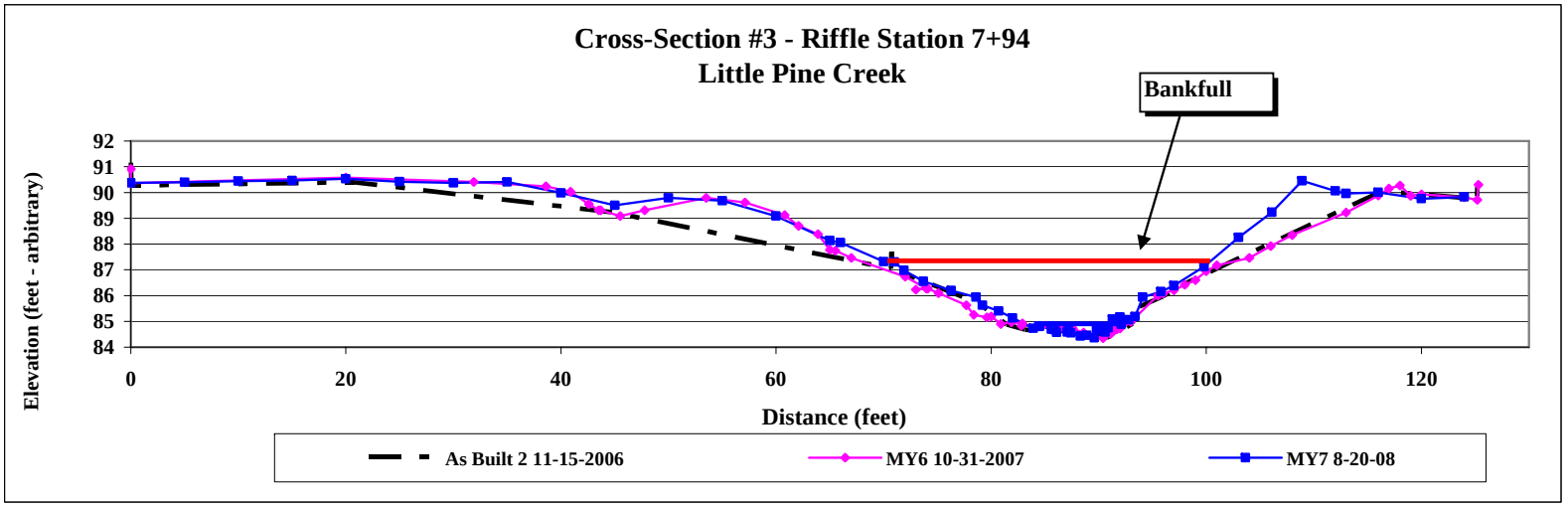
11/15/2006 As-Built #2 Survey			10/31/2007 MY6 Survey			10/31/2007 MY6 Survey (cont.)			8/20/2008 MY7 Survey			8/20/2008 MY7 Survey (cont.)		
Station	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**
0.0	90.50	IPS	0.0	90.45	xs 2 tlp	79.9	84.98		0.0	89.9	lpin	69.6	83.68	twg
0.0	89.90	GS	4.8	89.98		80.6	85.33		5.0	90.14		70.4	83.96	
24.0	90.55		16.1	90.37		81.0	85.31		8.0	90.12		71.1	84.03	
52.5	90.75	LB	27.6	90.83		81.5	85.32	rew	12.0	90.3		71.9	83.95	
59.1	89.32		40.0	91.46		81.4	85.51	ws	18.0	90.38		72.5	84.22	
65.9	87.91	BKF	45.6	91.15		81.7	85.50		23.0	90.65		72.9	84.01	
65.9	88.38	IPS BKF	52.4	90.84		82.2	85.93		28.0	90.83		73.9	84.06	
66.0	87.91		54.1	90.47		83.3	86.72		33.0	91.18		75.0	84.27	
67.1	87.84		56.2	89.91		84.0	86.85		38.0	91.47		75.6	84.57	
67.9	85.92		57.3	89.44		85.4	87.12		42.0	91.5	tob	77.8	84.82	
68.6	85.74	LEW	58.3	89.27		86.7	87.40		44.6	91.21		78.7	85.47	we
69.0	83.98		59.0	89.23		87.3	87.51		46.0	91.19		79.4	85.93	
76.2	84.36		59.8	89.10		87.8	87.60	bkf	47.0	91.26		81.8	86.57	
81.4	85.49	REW	60.8	88.95		88.9	87.81		48.0	90.95		82.5	86.77	
86.8	87.55		61.5	88.63		90.1	88.01		50.0	91.15		83.7	87.13	
89.5	87.73		63.8	88.34		91.3	88.75		53.0	90.87		86.5	87.41	
109.9	91.00		63.8	88.34		92.6	89.02		54.2	90.71		87.5	87.64	rbkf
126.1	90.68	GS	64.5	87.75	bkf	93.2	89.48		55.6	90.29		89.1	87.93	
126.0	91.07	IPS	65.1	87.75		94.0	89.72		60.3	89.15		90.3	88.19	
			66.6	88.02		94.7	90.15		61.7	88.5		91.9	88.78	
			67.0	87.61		94.9	90.41		62.1	88.32		93.6	89.38	
			68.0	86.84		96.2	90.75		62.8	88.57		95.0	89.88	
			68.1	86.12		96.8	90.83		64.4	88.39		96.7	90.68	
			68.5	85.02	llew	97.2	90.90		65.1	87.89		97.2	91.47	
			69.1	84.21		97.9	91.40		65.8	87.76	lbkf pin	100.0	91.42	tob
			69.9	84.10		98.9	91.40		66.0	86.54		104.0	91.52	
			71.0	84.11		99.9	91.31		66.4	86.13		107.0	91.25	
			72.3	84.29		103.2	91.44		66.6	85.55		111.0	91.24	
			73.9	84.32		108.2	91.17		66.9	85.97		116.0	91.07	
			74.8	84.39		111.9	91.08		67.7	85.95		122.0	90.90	
			76.0	84.68	rew	120.8	90.80		68.9	85.58		126.3	90.80	rpin
			77.8	84.88	ws	126.1	90.82		69.0	85.46	we			
			79.0	84.90		127.1	91.01	top rpin	69.0	84.2				

* bankfull pin missing .

Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 3 of 3
Feature	Riffle
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

Bankfull Area			
	AB2	MY6	MY7
Area	45.3	45.97	48.3
Width	24.9	34.0	30.3
Mean Depth	1.8	1.4	1.6
Max Depth	2.8	2.8	3.0
w/d ratio	13.7	25.1	19.1
FPW	105.1	>100	73.9
ER	4.2	2.9	2.4

Facing down stream x-section #3



Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 3 of 3
Feature	Riffle
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

11/15/2006 As-Built #2 Survey			10/31/2007 MY6 Survey			10/31/2007 MY6 Survey (cont)			10/31/2007 MY6 Survey (cont)		
Station	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**
0	91.16	IPS	0.0	90.9	xs3 tlp	82.8	84.8	xs3 ws	118.0	90.3	
0.05	90.27		0.0	90.4		84.8	84.8		119.0	89.9	
20.83	90.4		20.0	90.6		85.7	84.8		120.0	89.9	
44.79	89.23		31.9	90.4		86.7	84.8		124.0	89.8	
70.69	87.05	BKF	38.6	90.2		87.6	84.7		125.2	89.7	
70.7	87.69	IPS BKF	40.9	90.0		88.6	84.6		125.3	90.3	xs3 top rp
70.72	87.05		42.6	89.6		89.5	84.4				
78.88	85.69		43.5	89.3		90.4	84.3				
81.43	84.87	LEW	43.7	89.3		90.5	84.5				
83.12	84.67		45.5	89.1		90.7	84.5				
86.21	84.64		47.8	89.3		90.9	84.6				
90.73	84.36		53.5	89.8		91.1	84.5				
93.15	84.91	REW	57.1	89.6		91.3	84.6				
93.24	85.47		60.8	89.1		91.5	84.7				
95.72	85.92		62.1	88.7		91.7	84.7				
98.34	86.53		63.9	88.4		92.0	84.7	xs3 rew			
116.32	90.05		65.0	87.8		92.1	84.9	xs3 ws			
125.16	89.76		65.5	87.7		92.5	85.0				
125.23	90.34	IPS	67.0	87.5	xs3-bkf	93.0	85.0				
			72.0	86.7		95.5	86.0				
			74.0	86.3		96.0	86.1				
			73.0	86.2		97.0	86.2				
			74.0	86.3		98.0	86.4				
			74.1	86.3		99.0	86.6				
			75.1	86.1		100.0	86.9				
			77.7	85.6		101.0	87.2	bkf			
			78.4	85.3		104.0	87.5				
			79.6	85.2		106.0	87.9				
			80.0	85.2		108.0	88.4				
			80.9	84.9		113.0	89.2				
			81.9	85.0		116.0	89.9				
			82.9	84.9		117.0	90.1				

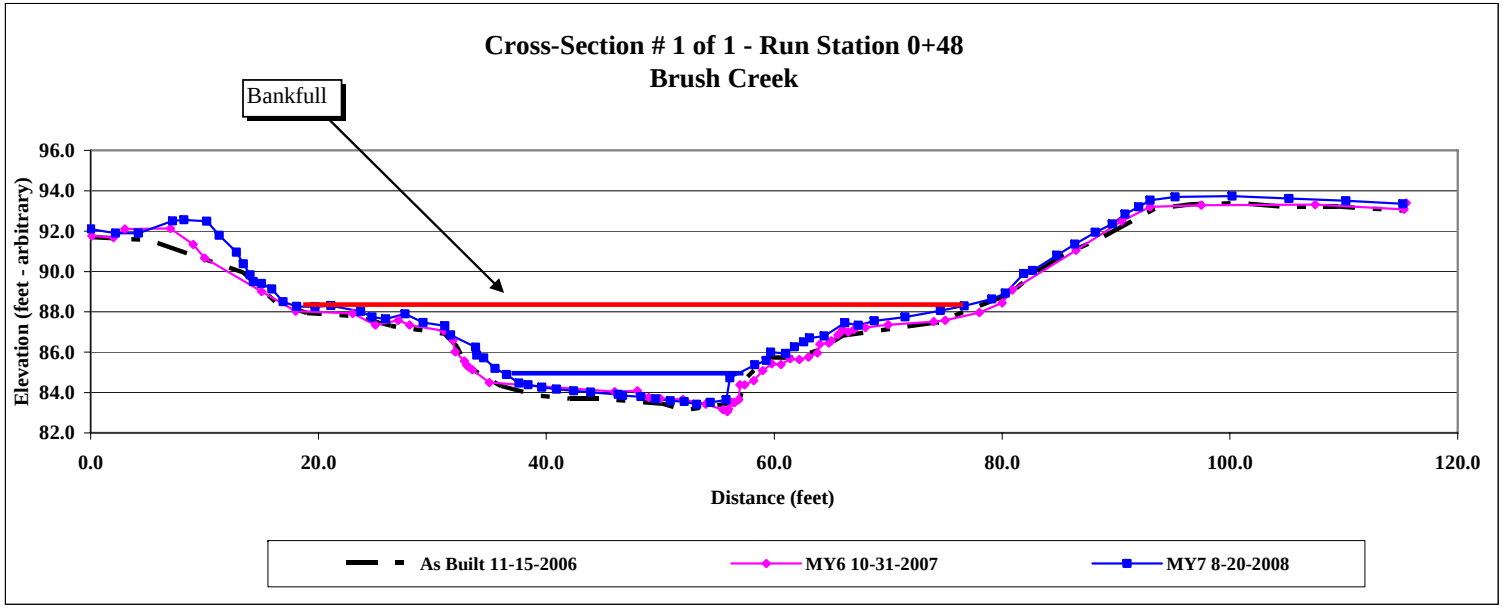
Project Name	Brush Creek Project 54
Cross Section	Little Pine Creek 3 of 3
Feature	Riffle
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

8/20/2008 MY7 Survey			**8/20/2008 MY7 Survey (cont)**		
Station	**Elev**	**Notes**	**Station**	**Elev**	**Notes**
0.0	90.4	L Pin	87.4	84.6	
5.0	90.4		88.3	84.4	twg
10.0	90.4		88.9	84.5	
15.0	90.5		89.6	84.4	
20.0	90.5	tob	89.8	84.7	rock
25.0	90.4		90.1	84.65	rock
30.0	90.4		90.4	84.67	rock
35.0	90.4		90.6	84.58	rock
40.0	90.0		90.9	84.75	we
45.0	89.5		91.3	85.09	
50.0	89.8		92.0	85.17	
55.0	89.7		92.1	84.88	
60.0	89.1		92.8	85.06	
65.0	88.1		93.4	85.19	
66.0	88.1		94.1	85.94	
70.0	87.3	lbkf	95.8	86.15	
71.0	87.3	bkf pin	97.0	86.39	
71.9	87.0		99.8	87.13	
73.7	86.6		103.0	88.26	
76.3	86.2		106.1	89.23	
78.6	85.9		108.9	90.45	
79.2	85.6		112.0	90.06	
80.7	85.4		113.0	89.96	
82.0	85.1		116.0	90.01	
83.9	84.7	we	120.0	89.76	
84.5	84.8		124.0	89.83	
85.9	84.7		125.7	89.78	r pin
85.6	84.7				
85.8	84.8				
86.1	84.6				
87.1	84.6				
87.2	84.7				

Project Name	Brush Creek Project 54
Cross Section	Brush Creek 1 of 1
Feature	Run
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

Bankfull Area			
	AB2	MY6	MY7
Area	177.5	45.97	128.8
Width	63.5	34.0	56.6
Mean Depth	2.8	1.4	2.3
Max Depth	5.5	2.8	4.8
w/d ratio	22.8	25.1	24.9
FPW	181.8	>100	225.0
ER	2.9	2.9	4.0

Facing down stream x-section #1

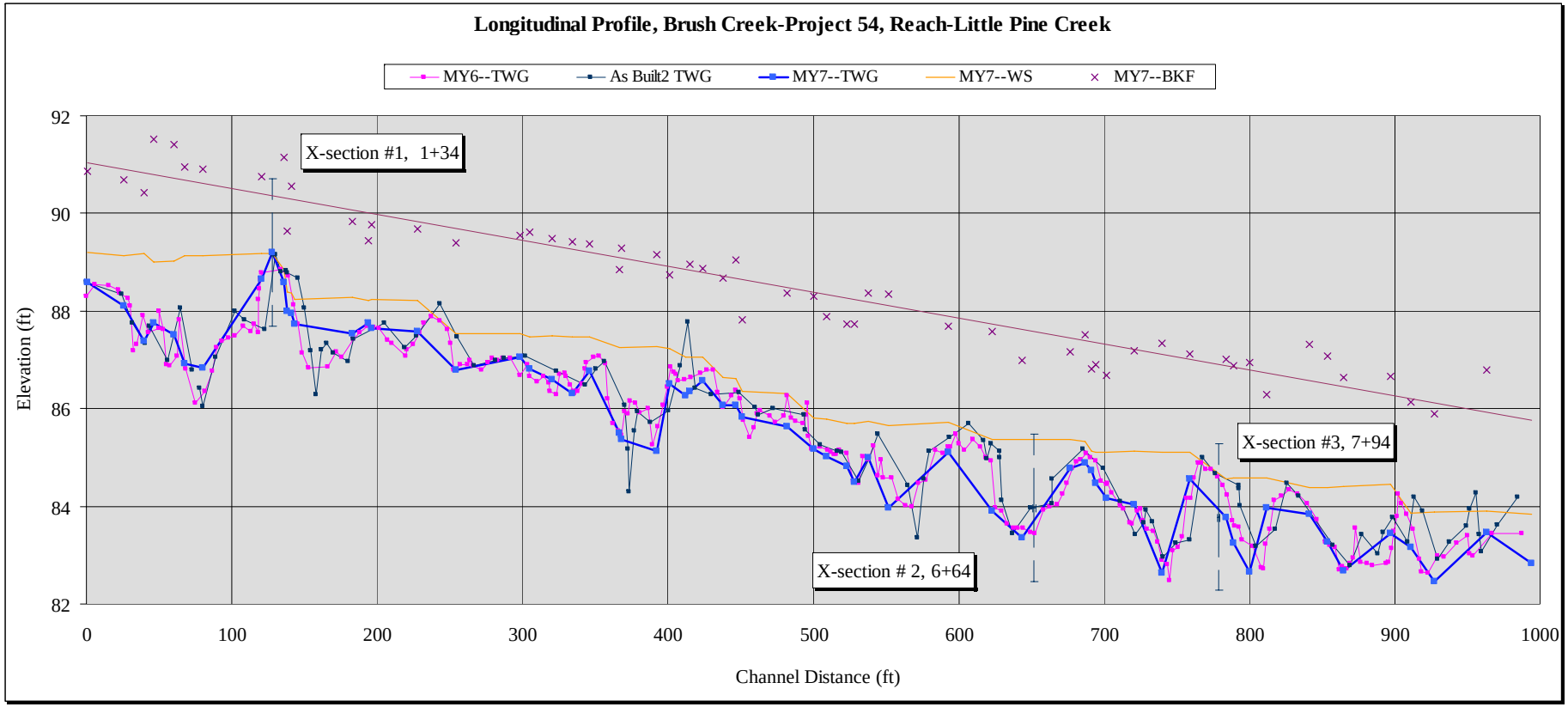


Project Name	Brush Creek Project 54
Cross Section	Brush Creek 1 of 1
Feature	Run
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

11/15/2006 As-Built #2 Survey			11/15/2006 As-Built #2 Survey cont.			10/31/2007 MY6 Survey			10/31/2007 MY6 Survey (cont.)		
Station	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**
0.0	92.2	IPS	93.4	93.1	RB	0.0	92.1	top	58.2	84.6	
0.1	91.7		96.5	93.3		0.1	91.8		59.0	85.1	rew-ws
5.1	91.6		100.5	93.4		2.0	91.7		59.8	85.4	bcxs 1
13.4	89.9		104.4	93.2		3.0	92.1		60.6	85.4	
16.4	88.4	BKF	109.5	93.2		7.0	92.1		61.4	85.7	
19.0	87.9		115.2	93.0		9.0	91.3		62.2	85.6	
23.0	87.8		115.3	93.4	IPS	10.0	90.7		63.0	85.8	
26.4	87.3		115.3	93.02		15.0	89.0		63.8	86.0	
31.0	86.9					18.0	88.0	bkf	64.0	86.4	
32.2	86.3					23.0	87.9		64.8	86.5	
33.0	85.3	LEW				25.0	87.4		65.0	86.6	
36.1	84.3					27.0	87.6		65.6	86.9	
39.0	83.9					28.0	87.3		66.0	87.1	
42.1	83.7					31.0	87.1		66.5	87.0	
44.6	83.7					31.8	86.6		67.0	87.1	
47.7	83.6					32.0	86.0		68.0	87.2	
50.1	83.5					32.8	85.6		70.0	87.4	
52.0	83.1	TW				33.0	85.4		74.0	87.5	
54.7	83.4					33.2	85.3		75.0	87.6	
56.9	83.5					33.5	85.1	ws-lew	78.0	88.0	
57.5	84.7					35.0	84.5		80.0	88.4	bkf
58.4	85.2					46.0	84.0		80.9	89.1	
59.4	85.2	REW				48.0	84.1		86.5	91.0	
59.5	85.8					49.0	83.8		90.5	92.5	
61.9	85.7					50.0	83.7		93.0	93.2	
64.2	86.2					52.0	83.7		97.5	93.3	
66.1	86.8					54.0	83.4		107.5	93.3	
74.4	87.5					55.5	83.2		115.3	93.1	
80.4	88.8	BKF				55.9	83.1		115.5	93.4	torp
80.5	89.0	IPSBKF				56.0	83.2				
80.5	88.8					56.3	83.5				
82.6	89.8					56.5	83.5				
85.2	90.8					56.9	83.7				
88.4	91.6					57.0	84.4				
						57.4	84.4				

Project Name	Brush Creek Project 54
Cross Section	Brush Creek 1 of 1
Feature	Run
Date Surveyed	8/20/2008
Crew	Bilbrey, L., Lawson, C.

8/20/2008 MY7 Survey			8/20/2008 MY7 Survey (cont.)			8/20/2008 MY7 Survey (cont.)		
Station	**Elev**	**Notes**	**Station**	**Elev**	**Notes**	**Station**	**Elev**	**Notes**
0.0	92.1	L pin	43.9	84.0		92.0	93.2	
2.2	91.9		46.3	83.9		93.0	93.5	
4.2	91.9		46.7	83.9		95.2	93.7	tob
7.2	92.5		48.3	83.8		100.2	93.7	
8.2	92.6		49.6	83.7		105.2	93.6	
10.2	92.5		50.9	83.6		110.2	93.5	
11.3	91.8		52.1	83.6		115.2	93.4	r pin
12.8	91.0		53.2	83.4	twg			
13.4	90.4		54.4	83.5				
14.0	89.8		55.8	83.7				
14.3	89.5		56.1	84.7				
15.0	89.4		58.3	85.4				
15.9	89.1		59.3	85.6				
16.9	88.5		59.7	86.0				
18.1	88.3	l bkf	61.0	85.9				
19.7	88.3		61.8	86.3				
21.1	88.3		62.6	86.5				
23.7	88.0		63.1	86.7				
24.7	87.7		64.4	86.8				
25.9	87.7		66.2	87.5				
27.6	87.9		67.4	87.3				
29.2	87.5		68.8	87.6				
31.1	87.3		71.5	87.7				
31.6	86.9		74.6	88.1				
33.8	86.3		76.7	88.3				
33.9	85.9		79.1	88.6				
34.5	85.7		80.3	88.9	bkfl			
35.5	85.2		81.9	89.9				
36.5	84.9	we	82.7	90.1				
37.6	84.5		84.8	90.8				
38.4	84.4		86.4	91.4				
39.6	84.3		88.2	91.9				
40.9	84.2		89.7	92.4				
42.4	84.1		90.8	92.8				

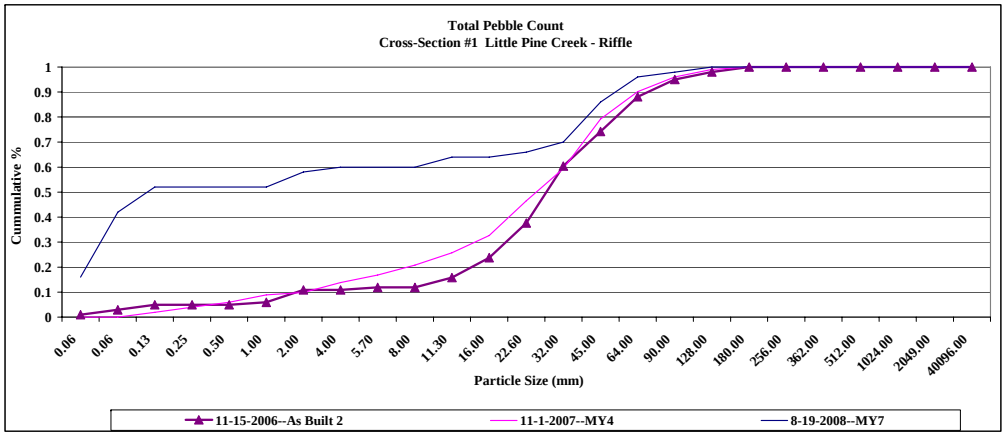

Longitudinal Profile, Brush Creek-Project 54, Reach-Little Pine Creek
MY6--TWG
As Built2 TWG
MY7--TWG
MY7--WS
MY7--BKF
X-section #1, 1+34
X-section #3, 7+94
X-section # 2, 6+64
Elevation (ft)
92
90
88
86
84
82
0
100
200
300
400
500
600
700
800
900
1000
Channel Distance (ft)

Project Name	Brush Creek Project 54
Cross Section	Little Pine CS # 1
Feature	Riffle
Date	8/19/08
Crew	Bilbrey, L., Lawson, C.
Notes	Pebble count data

			2006--As Built 2											2008--MY7										
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	1		1.0%	1.0%						1.0%	1.0%	8		16.0%	16.0%	0.062					16.0%	16.0%
	very fine sand	0.062	2		2.0%	3.0%						2.0%	3.0%	13		26.0%	42.0%		0.085				26.0%	42.0%
	fine sand	0.125	2		2.0%	5.0%						2.0%	5.0%	5		10.0%	52.0%			0.169			10.0%	52.0%
Sand	medium sand	0.25			0.0%	5.0%						0.0%	5.0%			0.0%	52.0%						0.0%	52.0%
	course sand	0.50			0.0%	5.0%						0.0%	5.0%			0.0%	52.0%						0.0%	52.0%
	very course sand	1.0	1		1.0%	5.9%						1.0%	5.9%			0.0%	52.0%						0.0%	52.0%
	very fine gravel	2.0	5		5.0%	10.9%						5.0%	10.9%	3		6.0%	58.0%						6.0%	58.0%
	fine gravel	4.0			0.0%	10.9%						0.0%	10.9%	1		2.0%	60.0%						2.0%	60.0%
G	fine gravel	5.7	1		1.0%	11.9%						1.0%	11.9%			0.0%	60.0%						0.0%	60.0%
r	medium gravel	8.0			0.0%	11.9%						0.0%	11.9%			0.0%	60.0%						0.0%	60.0%
a	medium gravel	11.3	4		4.0%	15.8%						4.0%	15.8%	2		4.0%	64.0%						4.0%	64.0%
v	course gravel	16.0	8		7.9%	23.8%	13.76					7.9%	23.8%			0.0%	64.0%						0.0%	64.0%
e	course gravel	22.6	14		13.9%	37.6%		25.79				13.9%	37.6%	1		2.0%	66.0%						2.0%	66.0%
l	very course gravel	32	23		22.8%	60.4%			33.39			22.8%	60.4%	2		4.0%	70.0%						4.0%	70.0%
	very course gravel	45	14		13.9%	74.3%						13.9%	74.3%	8		16.0%	86.0%				52.50		16.0%	86.0%
	small cobble	64	14		13.9%	88.1%				70.31		13.9%	88.1%	5		10.0%	96.0%					74.75	10.0%	96.0%
Cobble	medium cobble	90	7		6.9%	95.0%					108.77	6.9%	95.0%	1		2.0%	98.0%						2.0%	98.0%
	large cobble	128	3		3.0%	98.0%						3.0%	98.0%	1		2.0%	100.0%						2.0%	100.0%
	very large cobble	180	2		2.0%	100.0%						2.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	small boulder	256			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	small boulder	362			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
Boulder	medium boulder	512			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	large boulder	1024			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	very large boulder	2049			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
Bedrock	bedrock	40096			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
TOTAL / %of whole count			101	0	100.0%		13.76	25.79	33.39	70.31	108.77	100.0%		50	0	100.0%		0.06	0.08	0.17	52.50	74.75	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As Built	*	*	*	*	*
MY1	*	*	*	*	*
MY2	*	*	*	*	*
MY3	*	*	*	*	*
As Built 2	13.76	25.79	33.39	70.31	108.77
MY4	6.29	20.64	30.32	64.40	103.40
MY7	0.06	0.08	0.17	52.50	74.75

* Data collected prior to As-Built 2, not applicable, location has changed

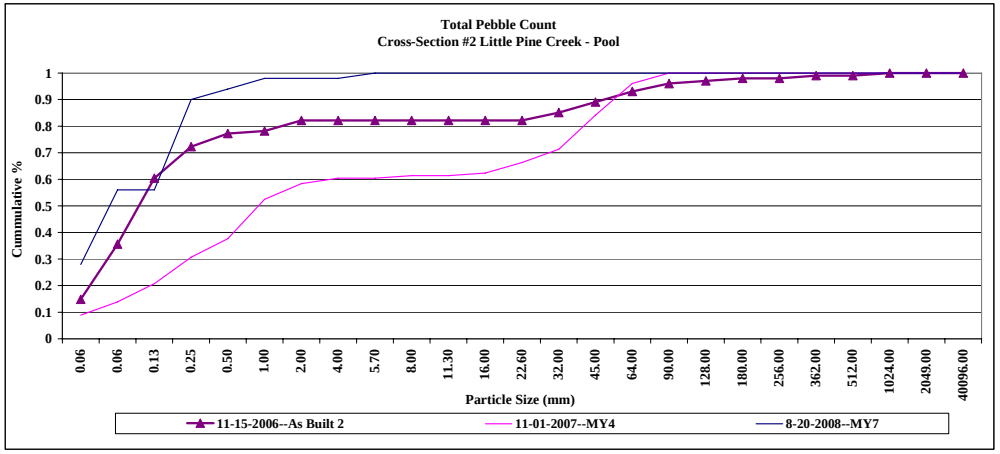


Project Name	Brush Creek Project 54
Cross Section	Little Pine CS #2
Feature	Pool
Date	8/20/08
Crew	Bilbrey, L., Lawson, C.
Notes	Pebble count data

		2006--As Built 2														2008--MY7									
Description	**Material**	**Size (mm)**	**Pool - Bed**	**Pool - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**	**Pool - Bed**	**Pool - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	15		14.9%	14.9%						14.9%	14.9%	14		28.0%	28.0%						28.0%	28.0%
Sand	very fine sand	0.062	21		20.8%	35.6%	0.06	0.09				20.8%	35.6%	14		28.0%	56.0%		0.07	0.09			28.0%	56.0%
	fine sand	0.125	25		24.8%	60.4%			0.15			24.8%	60.4%			0.0%	56.0%						0.0%	56.0%
	medium sand	0.25	12		11.9%	72.3%						11.9%	72.3%	17		34.0%	90.0%				0.34		34.0%	90.0%
	course sand	0.50	5		5.0%	77.2%						5.0%	77.2%	2		4.0%	94.0%						4.0%	94.0%
	very course sand	1.0	1		1.0%	78.2%						1.0%	78.2%	2		4.0%	98.0%					0.94	4.0%	98.0%
G r a v e l	very fine gravel	2.0	4		4.0%	82.2%						4.0%	82.2%			0.0%	98.0%						0.0%	98.0%
	fine gravel	4.0			0.0%	82.2%						0.0%	82.2%			0.0%	98.0%						0.0%	98.0%
	fine gravel	5.7			0.0%	82.2%						0.0%	82.2%	1		2.0%	100.0%						2.0%	100.0%
	medium gravel	8.0			0.0%	82.2%						0.0%	82.2%			0.0%	100.0%						0.0%	100.0%
	medium gravel	11.3			0.0%	82.2%						0.0%	82.2%			0.0%	100.0%						0.0%	100.0%
	course gravel	16.0			0.0%	82.2%						0.0%	82.2%			0.0%	100.0%						0.0%	100.0%
	course gravel	22.6			0.0%	82.2%						0.0%	82.2%			0.0%	100.0%						0.0%	100.0%
	very course gravel	32	3		3.0%	85.1%				34.17		3.0%	85.1%			0.0%	100.0%						0.0%	100.0%
	very course gravel	45	4		4.0%	89.1%						4.0%	89.1%			0.0%	100.0%						0.0%	100.0%
Cobble	small cobble	64	4		4.0%	93.1%						4.0%	93.1%			0.0%	100.0%						0.0%	100.0%
	medium cobble	90	3		3.0%	96.0%					97.80	3.0%	96.0%			0.0%	100.0%						0.0%	100.0%
	large cobble	128	1		1.0%	97.0%						1.0%	97.0%			0.0%	100.0%						0.0%	100.0%
	very large cobble	180	1		1.0%	98.0%						1.0%	98.0%			0.0%	100.0%						0.0%	100.0%
Boulder	small boulder	256			0.0%	98.0%						0.0%	98.0%			0.0%	100.0%						0.0%	100.0%
	small boulder	362	1		1.0%	99.0%						1.0%	99.0%			0.0%	100.0%						0.0%	100.0%
	medium boulder	512			0.0%	99.0%						0.0%	99.0%			0.0%	100.0%						0.0%	100.0%
	large boulder	1024	1		1.0%	100.0%						1.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	very large boulder	2049			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
Bedrock	bedrock	40096			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
TOTAL / %of whole count			101	0	100.0%		0.06	0.09	0.15	34.17	97.80	100.0%		50	0	100.0%		0.00	0.07	0.09	0.34	0.94	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As Built	*	*	*	*	*
MY1	*	*	*	*	*
MY2	*	*	*	*	*
MY3	*	*	*	*	*
As Built 2	0.06	0.09	0.15	34.17	97.80
MY4	0.12	0.61	1.38	54.30	75.03
MY7	0.00	0.07	0.09	0.34	0.94

* Data collected prior to As-Built 2, not applicable, location has changed

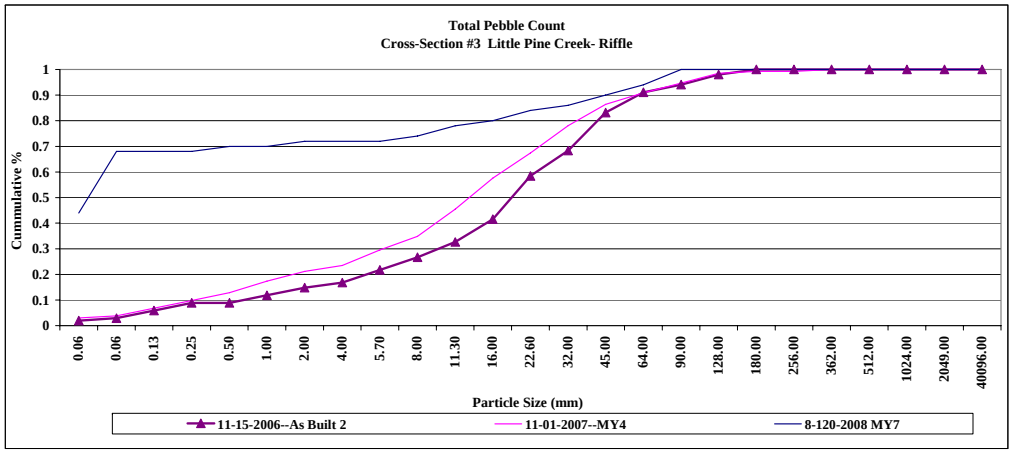


Project Name	Brush Creek Project 54
Cross Section	Little Pine CS #3
Feature	Riffle
Date	8/20/08
Crew	Bilbrey, L., Lawson, C.
Notes	Pebble count data

					2006--As Built 2										2008--MY7								
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	2		2.0%	2.0%						2.0%	2.0%	22		44.0%	44.0%						44.0%	44.0%
Sand	very fine sand	0.062	1		1.0%	3.0%						1.0%	3.0%	12		24.0%	68.0%			0.070			24.0%	68.0%
	fine sand	0.125	3		3.0%	5.9%						3.0%	5.9%			0.0%	68.0%						0.0%	68.0%
	medium sand	0.25	3		3.0%	8.9%						3.0%	8.9%			0.0%	68.0%						0.0%	68.0%
	course sand	0.50			0.0%	8.9%						0.0%	8.9%	1		2.0%	70.0%						2.0%	70.0%
	very course sand	1.0	3		3.0%	11.9%						3.0%	11.9%			0.0%	70.0%						0.0%	70.0%
G r a v e l	very fine gravel	2.0	3		3.0%	14.9%						3.0%	14.9%	1		2.0%	72.0%						2.0%	72.0%
	fine gravel	4.0	2		2.0%	16.8%	4.07					2.0%	16.8%			0.0%	72.0%						0.0%	72.0%
	fine gravel	5.7	5		5.0%	21.8%						5.0%	21.8%			0.0%	72.0%						0.0%	72.0%
	medium gravel	8.0	5		5.0%	26.7%						5.0%	26.7%	1		2.0%	74.0%						2.0%	74.0%
	medium gravel	11.3	6		5.9%	32.7%						5.9%	32.7%	2		4.0%	78.0%						4.0%	78.0%
	course gravel	16.0	9		8.9%	41.6%		15.13				8.9%	41.6%	1		2.0%	80.0%						2.0%	80.0%
	course gravel	22.6	17		16.8%	58.4%			23.30			16.8%	58.4%	2		4.0%	84.0%				27.30		4.0%	84.0%
	very course gravel	32	10		9.9%	68.3%						9.9%	68.3%	1		2.0%	86.0%						2.0%	86.0%
	very course gravel	45	15		14.9%	83.2%						14.9%	83.2%	2		4.0%	90.0%						4.0%	90.0%
Cobble	small cobble	64	8		7.9%	91.1%				56.86		7.9%	91.1%	2		4.0%	94.0%						4.0%	94.0%
	medium cobble	90	3		3.0%	94.1%						3.0%	94.1%	3		6.0%	100.0%					82.33	6.0%	100.0%
	large cobble	128	4		4.0%	98.0%					119.69	4.0%	98.0%			0.0%	100.0%						0.0%	100.0%
	very large cobble	180	2		2.0%	100.0%						2.0%	100.0%			0.0%	100.0%						0.0%	100.0%
Boulder	small boulder	256			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	small boulder	362			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	medium boulder	512			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	large boulder	1024			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
	very large boulder	2049			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
Bedrock	bedrock	40096			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
TOTAL / %of whole count			101	0	100.0%		4.1	15.1	23.3	56.9	119.7	100.0%		50.0	0.0	100.0%		0.0	0.0	0.1	27.3	82.3	100.0%	

	d16	**d35**	**d50**	**d84**	**d95**
As Built	*	*	*	*	*
MY1	*	*	*	*	*
MY2	*	*	*	*	*
MY3	*	*	*	*	*
As Built 2	4.07	15.13	23.30	56.86	119.69
MY4	1.27	9.71	15.77	49.96	112.60
MY7	0.00	0.00	0.07	27.30	82.33

* Data collected prior to As-Built 2, not applicable, location has changed

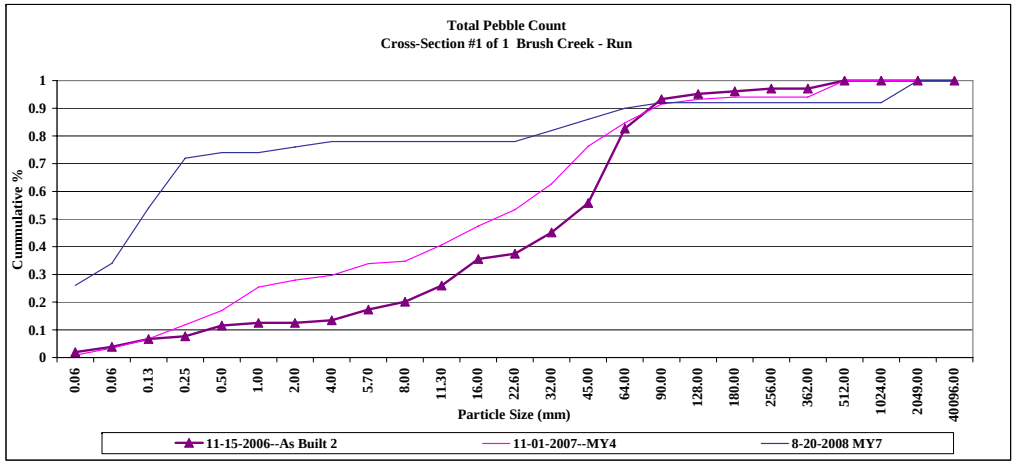


Project Name	Brush Creek Project 54
Cross Section	Brush Creek CS #1
Feature	Run
Date	8/20/08
Crew	Bilbrey, L., Lawson, C.
Notes	Pebble count data

		2006--As Built 2												2008--MY7										
Description	**Material**	**Size (mm)**	**Run - Bed**	**Run - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**	**Run - Bed**	**Run - Bank**	**%**	**Cum %**	**d16**	**d35**	**d50**	**d84**	**d95**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	2		1.9%	1.9%						1.9%	1.9%	13		26.0%	26.0%						26.0%	26.0%
Sand	very fine sand	0.062	2		1.9%	3.8%						1.9%	3.8%	4		8.0%	34.0%						8.0%	34.0%
	fine sand	0.125	3		2.9%	6.7%						2.9%	6.7%	10		20.0%	54.0%		0.10	0.17			20.0%	54.0%
	medium sand	0.25	1		1.0%	7.7%						1.0%	7.7%	9		18.0%	72.0%						18.0%	72.0%
	course sand	0.50	4		3.8%	11.5%						3.8%	11.5%	1		2.0%	74.0%						2.0%	74.0%
	very course sand	1.0	1		1.0%	12.5%						1.0%	12.5%			0.0%	74.0%						0.0%	74.0%
G r a v e l	very fine gravel	2.0			0.0%	12.5%						0.0%	12.5%	1		2.0%	76.0%						2.0%	76.0%
	fine gravel	4.0	1		1.0%	13.5%						1.0%	13.5%	1		2.0%	78.0%						2.0%	78.0%
	fine gravel	5.7	4		3.8%	17.3%	6.17					3.8%	17.3%			0.0%	78.0%						0.0%	78.0%
	medium gravel	8.0	3		2.9%	20.2%						2.9%	20.2%			0.0%	78.0%						0.0%	78.0%
	medium gravel	11.3	6		5.8%	26.0%						5.8%	26.0%			0.0%	78.0%						0.0%	78.0%
	course gravel	16.0	10		9.6%	35.6%		18.96				9.6%	35.6%			0.0%	78.0%						0.0%	78.0%
	course gravel	22.6	2		1.9%	37.5%						1.9%	37.5%			0.0%	78.0%						0.0%	78.0%
	very course gravel	32	8		7.7%	45.2%						7.7%	45.2%	2		4.0%	82.0%						4.0%	82.0%
	very course gravel	45	11		10.6%	55.8%			45.77			10.6%	55.8%	2		4.0%	86.0%				46.50		4.0%	86.0%
Cobble	small cobble	64	28		26.9%	82.7%						26.9%	82.7%	2		4.0%	90.0%						4.0%	90.0%
	medium cobble	90	11		10.6%	93.3%				80.96		10.6%	93.3%	1		2.0%	92.0%						2.0%	92.0%
	large cobble	128	2		1.9%	95.2%					149.50	1.9%	95.2%			0.0%	92.0%						0.0%	92.0%
	very large cobble	180	1		1.0%	96.2%						1.0%	96.2%			0.0%	92.0%						0.0%	92.0%
Boulder	small boulder	256	1		1.0%	97.1%						1.0%	97.1%			0.0%	92.0%						0.0%	92.0%
	small boulder	362			0.0%	97.1%						0.0%	97.1%			0.0%	92.0%						0.0%	92.0%
	medium boulder	512	3		2.9%	100.0%						2.9%	100.0%			0.0%	92.0%						0.0%	92.0%
	large boulder	1024			0.0%	100.0%						0.0%	100.0%			0.0%	92.0%						0.0%	92.0%
	very large boulder	2049			0.0%	100.0%						0.0%	100.0%	4		8.0%	100.0%					8862.50	8.0%	100.0%
Bedrock	bedrock	40096			0.0%	100.0%						0.0%	100.0%			0.0%	100.0%						0.0%	100.0%
TOTAL / %of whole count			104	0	100.0%		6.17	18.96	45.77	80.96	149.50	100.0%		50	0	100.0%		0.00	0.10	0.17	46.50	8862.50	100.0%	

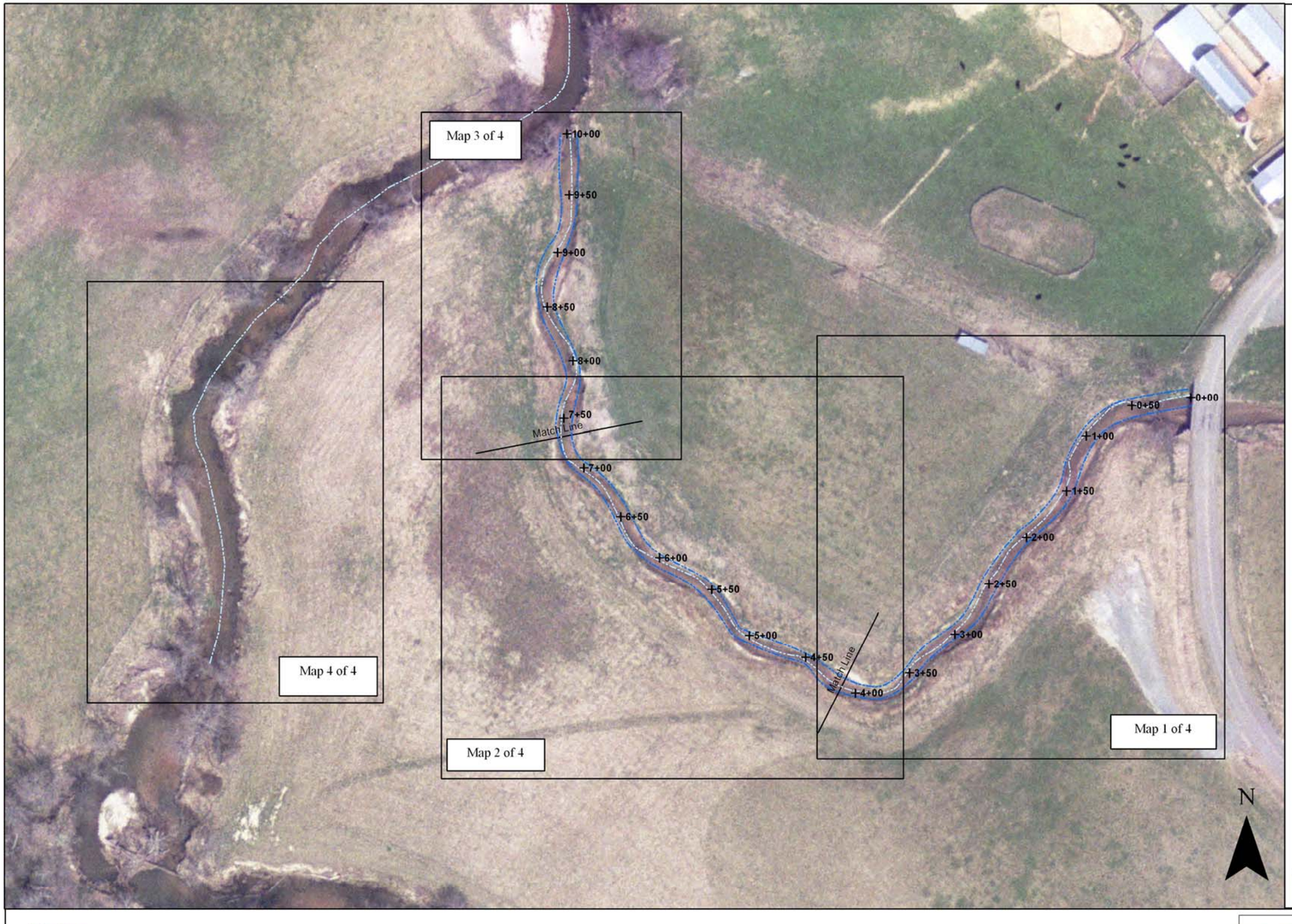
	d16	**d35**	**d50**	**d84**	**d95**
As Built	*	*	*	*	*
MY1	*	*	*	*	*
MY2	*	*	*	*	*
MY3	*	*	*	*	*
As Built 2	6.17	18.96	45.77	80.96	149.50
MY4	0.68	9.82	22.73	75.02	489.01
MY7	0.00	0.10	0.17	46.50	8862.50

* Data collected prior to As-Built 2, not available. New cross section



APPENDIX C

PROJECT PROBLEM AREAS PLAN VIEW



Current Condition
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Repair As-buit Data (AB2)

+ Station No
Thalweg*
Edge of Water

*Little Pine Creek Thalweg from Repair As-built Data (AB2). Brush Creek Thalweg from NC Onemap GIS Data.

Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
054-01-LPV2 36.50580894 81.00908181
054-01-LPV3 36.50628667 81.00924745
054-01-LPV4 36.50554587 81.00827233

Cross Sections:
lp-xs-1-lb 36.50591981 81.00758077
lp-xs-1-bkf 36.50595858 81.00771178
lp-xs-1-rb 36.50602071 81.00791864
lp-xs-2-lb 36.50574429 81.00920903
lp-xs-2-bkf 36.50586082 81.00903444
lp-xs-2-rb 36.50596233 81.00887254
lp-xs-3-lb 36.50617149 81.00944020
lp-xs-3-bkf 36.50616173 81.00919816
lp-xs-3-rb 36.50615447 81.00901317

Longitudinal Profile (As-built data):
begin survey 36.50614744 81.00742900
end survey 36.50671371 81.00917776

Photo Stations:
PS-1 36.50623056 81.00733122
PS-2 36.50617709 81.00756979
PS-3 36.50595799 81.00770895
PS-4 36.50548606 81.00811273
PS-5 36.50554358 81.00858985
PS-6 36.50570996 81.00884450
PS-7 36.50586088 81.00903451
PS-8 36.50595143 81.00914380
PS-9 36.50616173 81.00919818
PS-10 36.50631667 81.00925134

Brush Creek

Veg Plots:
054-01-BCV1 36.50589788 81.00993449

Cross Sections:
bc-xs-4-lb 36.50578678 81.01028959
bc-xs-4-bkf 36.50580545 81.01000965
bc-xs-4-rb 36.50582344 81.00989429

Photo Stations:
PS-11 36.50560838 81.01004210
PS-12 36.50682348 81.00989432
PS-13 36.50596754 81.01008668
PS-14 36.50608395 81.01009412
PS-15 36.50716885 81.00925196

Current Condition
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Vegetation Problem Areas

Bare Bank
- To Be Watched
- Failed

Stream Problem Areas

Engineered Structures Other
- To be watched
- Failed

Engineered Structures Grade
- Failed

Mammal Holes
- To Be Watched
- Failed

Slumped Bank
- To Be Watched
- Failed

Bank Scour
- To Be Watched
- Failed

Aggradation/Bar Formation
- To Be Watched
- Failed

Repair As-buit Data (AB2)
- Station No
- Photo Stations
- Thalweg
- Edge of Water
- Bankfull
- Top of Bank
- Existing Fence Line
- Rebar Pin Set
- Root Wad
- Rock Vane
- Rock Sill
- Log Vane
- Digger Log
- Augmented Riffle
- Cross Section
- Vegetation Plot

0 15 30 60 Feet

Map 1 of 4

Leveling was used to obtain
2008 stream data instead of XYZ data

Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
054-01-LPV2 36.50580894 81.00908181
054-01-LPV3 36.50628667 81.00924745
054-01-LPV4 36.50554587 81.00827233

Cross Sections:
lp-xs-1-lb 36.50591981 81.00758077
lp-xs-1-bkf 36.50595858 81.00771178
lp-xs-1-rb 36.50602071 81.00791864
lp-xs-2-lb 36.50574429 81.00920903
lp-xs-2-bkf 36.50586082 81.00903444
lp-xs-2-rb 36.50596233 81.00887254
lp-xs-3-lb 36.50617149 81.00944020
lp-xs-3-bkf 36.50616173 81.00919816
lp-xs-3-rb 36.50615447 81.00901317

Longitudinal Profile (As-built data):
begin survey 36.50614744 81.00742900
end survey 36.50671371 81.00917776

Photo Stations:
PS-1 36.50623056 81.00733122
PS-2 36.50617709 81.00756979
PS-3 36.50595799 81.00770895
PS-4 36.50548606 81.00811273
PS-5 36.50554358 81.00858985
PS-6 36.50570996 81.00884450
PS-7 36.50586088 81.00903451
PS-8 36.50595143 81.00914380
PS-9 36.50616173 81.00919818
PS-10 36.50631667 81.00925134

Brush Creek

Veg Plots:
054-01-BCV1 36.50589788 81.00993449

Cross Sections:
bc-xs-4-lb 36.50578678 81.01028959
bc-xs-4-bkf 36.50580545 81.01000965
bc-xs-4-rb 36.50582344 81.00989429

Photo Stations:
PS-11 36.50560838 81.01004210
PS-12 36.50682348 81.00989432
PS-13 36.50596754 81.01008668
PS-14 36.50608395 81.01009412
PS-15 36.50716885 81.00925196

Current Condition
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Vegetation Problem Areas

Bare Bank
- To Be Watched
- Failed

Stream Problem Areas

Engineered Structures Other
- To be watched
- Failed

Engineered Structures Grade
- Failed

Mammal Holes
- To Be Watched
- Failed

Slumped Bank
- To Be Watched
- Failed

Bank Scour
- To Be Watched
- Failed

Aggradation/Bar Formation
- To Be Watched
- Failed

Repair As-buit Data (AB2)
- Station No
- Photo Stations
- Thalweg
- Edge of Water
- Bankfull
- Top of Bank
- Existing Fence Line
- Rebar Pin Set
- Root Wad
- Rock Vane
- Rock Sill
- Log Vane
- Digger Log
- Augmented Riffle
- Cross Section
- Vegetation Plot

0 15 30 60 Feet

Ecosystem Enhancement Program

Map 2 of 4

Leveling was used to obtain
2008 stream data instead of XYZ data

Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
054-01-LPV2 36.50580894 81.00908181
054-01-LPV3 36.50628667 81.00924745
054-01-LPV4 36.50554587 81.00827233

Cross Sections:
lp-xs-1-lb 36.50591981 81.00758077
lp-xs-1-bkf 36.50595858 81.00771178
lp-xs-1-rb 36.50602071 81.00791864
lp-xs-2-lb 36.50574429 81.00920903
lp-xs-2-bkf 36.50586082 81.00903444
lp-xs-2-rb 36.50596233 81.00887254
lp-xs-3-lb 36.50617149 81.00944020
lp-xs-3-bkf 36.50616173 81.00919816
lp-xs-3-rb 36.50615447 81.00901317

Longitudinal Profile (As-built data):
begin survey 36.50614744 81.00742900
end survey 36.50671371 81.00917776

Photo Stations:
PS-1 36.50623056 81.00733122
PS-2 36.50617709 81.00756979
PS-3 36.50595799 81.00770895
PS-4 36.50548606 81.00811273
PS-5 36.50554358 81.00858985
PS-6 36.50570996 81.00884450
PS-7 36.50586088 81.00903451
PS-8 36.50595143 81.00914380
PS-9 36.50616173 81.00919818
PS-10 36.50631667 81.00925134

Brush Creek

Veg Plots:
054-01-BCV1 36.50589788 81.00993449

Cross Sections:
bc-xs-4-lb 36.50578678 81.01028959
bc-xs-4-bkf 36.50580545 81.01000965
bc-xs-4-rb 36.50582344 81.00989429

Photo Stations:
PS-11 36.50560838 81.01004210
PS-12 36.50682348 81.00989432
PS-13 36.50596754 81.01008668
PS-14 36.50608395 81.01009412
PS-15 36.50716885 81.00925196

Current Condition
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Vegetation Problem Areas

Bare Bank
- To Be Watched
- Failed

Stream Problem Areas

Engineered Structures Other
- To be watched
- Failed

Engineered Structures Grade
- Failed

Mammal Holes
- To Be Watched
- Failed

Slumped Bank
- To Be Watched
- Failed

Bank Scour
- To Be Watched
- Failed

Aggradation/Bar Formation
- To Be Watched
- Failed

Repair As-buit Data (AB2)
- Station No
- Photo Stations
- Thalweg
- Edge of Water
- Bankfull
- Top of Bank
- Existing Fence Line
- Rebar Pin Set
- Root Wad
- Rock Vane
- Rock Sill
- Log Vane
- Digger Log
- Augmented Riffle
- Cross Section
- Vegetation Plot

0 15 30 60 Feet

Map 3 of 4

Leveling was used to obtain
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Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC

Monitoring Pin Coordinates:

Location Latitude (N) Longitude (W)

Little Pine Creek

Veg Plots:
054-01-LPV1 36.50591020 81.00769455
054-01-LPV2 36.50580894 81.00908181
054-01-LPV3 36.50628667 81.00924745
054-01-LPV4 36.50554587 81.00827233

Cross Sections:
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lp-xs-1-bkf 36.50595858 81.00771178
lp-xs-1-rb 36.50602071 81.00791864
lp-xs-2-lb 36.50574429 81.00920903
lp-xs-2-bkf 36.50586082 81.00903444
lp-xs-2-rb 36.50596233 81.00887254
lp-xs-3-lb 36.50617149 81.00944020
lp-xs-3-bkf 36.50616173 81.00919816
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PS-5 36.50554358 81.00858985
PS-6 36.50570996 81.00884450
PS-7 36.50586088 81.00903451
PS-8 36.50595143 81.00914380
PS-9 36.50616173 81.00919818
PS-10 36.50631667 81.00925134

Brush Creek

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054-01-BCV1 36.50589788 81.00993449

Cross Sections:
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Photo Stations:
PS-11 36.50560838 81.01004210
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PS-13 36.50596754 81.01008668
PS-14 36.50608395 81.01009412
PS-15 36.50716885 81.00925196

Current Condition
Plan View

Project 54 Brush Creek
2008 Monitoring Year
Alleghany County, NC
January 8, 2009

Vegetation Problem Areas

Bar Flood Plain

To Be Watched

Stream Problem Areas

Bank Scour

To Be Watched

Failed

Repair As-Built Data (AB2)

Photo Stations

Cross Section

Rock Vane

Root Wad

Vegetation Plot

NC Onemap GIS Data

Thalweg

0 15 30 60 Feet

Map 4 of 4

Leveling was used to obtain
2008 stream data instead of XYZ data

Produced by
Fish and Wildlife Associates, Inc.
Whittier, NC