

# Lick Creek Stream Restoration Site MONITORING REPORT 2008 (Year 3)

Cataloging Unit: 0303004 EEP Contract #: D04013-1



**Submitted to:**



North Carolina Department of Environment and Natural Resources  
North Carolina Ecosystem Enhancement Program  
1652 Mail Service Center  
Raleigh, NC 27699-1652

**Submitted by:**



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**November 20, 2008**

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## **TABLE OF CONTENTS**

1.0 PROJECT BACKGROUND.....	1
1.1 LOCATION AND SETTING.....	1
1.2 PROJECT STRUCTURE AND OBJECTIVES .....	1
1.3 PROJECT BACKGROUND .....	2
2.0 PROJECT CONDITION AND MONITORING RESULTS .....	13
2.1 VEGETATION ASSESSMENT .....	13
2.1.1 Vegetative Problem.....	13
2.1.2 Stem Counts .....	14
2.1.3 Vegetation Plot Photos.....	15
2.2 STREAM ASSESSMENT .....	15
2.2.1 Hydrology .....	15
2.2.2 Geomorphology .....	16
2.2.3 Problem Areas.....	16
2.2.4 Photo Reference Stations .....	17
2.2.5 Stability Assessment Table.....	18
2.2.6 Quantitative Measure Summary Tables.....	19

## **LIST OF TABLES**

Table 1. Project Structure and Objectives.....	2
Table 2. Project Activity and Reporting History .....	2
Table 3. Project Contact Information.....	3
Table 4. Project Background Information .....	4
Table 5. Soil Data .....	N/A
Table 6. Vegetative Problem Areas .....	13
Table 7. Stem Counts .....	14
Table 8. Verification of Bankfull Events.....	16
Table 9. BEHI and Sediment Export Estimates (Not Required in Year 3).....	16
Table 10. Problem Areas.....	17

## **LIST OF FIGURES**

Figure 1. Vicinity Map

## **LIST OF APPENDICES**

### Appendix A: Vegetation Data

1. Monitoring Plot Photos

### Appendix B: Geomorphic Data

1. Problem Areas Plan View
2. Problem Area Photos
3. Stream Photo-station Photos
4. Table B.1. Qualitative Visual Stability Assessment
5. Cross Section Plots and Data Tables
6. Longitudinal Plots and Data Tables
7. Pebble Count Plots and Data Tables

## **EXECUTIVE SUMMARY**

The Lick Creek Stream Restoration Site located within the Cape Fear River Basin, consists of approximately 9,568 linear feet of Priority 1 stream restoration of portions of Lick Creek and Wallace Branch. These reaches consist of perennial, second and third order streams that have historically been impacted by riparian and bank vegetation removal, the introduction of agricultural ditch inputs, channel straightening, and unrestricted livestock access. The constructed stream channels have restored appropriate morphology including riffle-pool bed form and channel pattern. Cross-vanes, J-Hook vanes, and in-stream log structures have been integrated into the channel to provide grade control, maintain stable stream banks while the riparian vegetation reestablishes, and provide in-stream habitat.

### **Hydrology**

Following completion of construction in March of 2006, the site has been subjected to at least four greater than bankfull events and several near bankfull events. In June of 2006, Hurricane Alberto crossed central North Carolina resulting in five inches of rainfall on-site and water elevations three feet above bankfull. In November of 2006, heavy rainfall resulted in water elevations up to two feet above bankfull. In August and September of 2008, remnants of Tropical Storm Fay and Hurricane Hannah resulted in water elevations approximately one to two feet above bankfull. In October of 2007, the crest gages recorded a bankfull event on both Lick Creek and Wallace Branch. Five additional events including Hurricane Ernesto resulted in water elevations within one to two feet below bankfull. It should be noted that the summers of 2007 and 2008 have been some of the most severe droughts on record for the state of North Carolina.

### **Stream**

Most of the stream reaches have managed the extreme flow events of the first three years. However, bank failure was observed in some locations and some structures have subsided and lost functionality. Bed material is coarsening and additional bed load appears to be moving into the channel. However, areas of previous bed scour have not filled in with new bed material. There are a few areas where matting is no longer in place and bank vegetation has not become established.

### **Vegetation**

Native woody and herbaceous species were used to establish at minimum a fifty foot wide riparian buffer on each side of the restored reach. Planted herbaceous species have successfully established throughout the entire site along with volunteer species from upstream seed sources. While some of the live stakes used to stabilize the lower stream banks have survived, the ongoing drought has resulted in stunted growth and somewhat weak bank vegetation. The riparian buffer planting had an overall survival rate of 70% with additional volunteer species taking root. A number of Chinese privet (*Ligustrum sinense*) stems are emerging in areas where invasive species removal previously occurred.

**Planned Action**

- 1) Repair areas of bank failure with brush toe and brush mattress installation.
- 2) Continued visual monitoring of areas of concern.
- 3) Install supplemental live staking in select areas of weak or nonexistent bank vegetation.
- 4) Removal of emergent Chinese privet.

## **1.0 PROJECT BACKGROUND**

### **1.1 LOCATION AND SETTING**

The Lick Creek Stream Restoration Site is located approximately 2.6 miles northeast of the City of Sanford in rural Lee County, North Carolina. From Raleigh, NC take US-1 south, take Colon Rd exit, turn left onto Colon Road, turn left on Riddle Road, turn right on Lower Moncure Road and the site is approximately ¼ mile on the left and right side of the road. The project reach is located in the Lick Creek watershed of the Cape Fear River Basin (United States Geological Survey (USGS) 14-digit Hydrologic Unit 03030004010010) within North Carolina Division of Water Quality (NCDWQ) sub-basin 03-06-07. The 03-06-07 sub-basin contains all of the Lick Creek drainage area as well as all other drainages to the 25-river miles of the Cape Fear River extending from near the confluence at Lick Creek in Lee County to near Buies Creek in Harnett County. This sub-basin is primarily forested, although agriculture accounts for a significant portion of the sub-basin.

### **1.2 PROJECT STRUCTURE AND OBJECTIVES**

The pre-construction site consisted of approximately 51 acres of floodplain, 5,371 linear feet of stream designated as Lick Creek, and 3,512 linear feet of stream designated as Wallace Branch. These reaches consist of perennial, second and third order streams that have historically been impacted by riparian and bank vegetation removal, the introduction of agricultural ditch inputs, channel straightening, unrestricted livestock access, and the increasing development of the contributing drainage area. Prior land use within the site consists of forested areas and pasture.

The primary goals and objectives of the project were to improve local water quality, enhance flood attenuation and restore aquatic and riparian habitat. The overall mitigation strategy consisted of reconstruction of the stream channels to restore stable channel morphology, construction of in-stream habitat and grade/bank stabilization structures, exclusion of livestock, and reestablishment of native riparian buffers greater than 50 feet in width.

The project is divided into three distinct mitigation elements: Reach 1 consists of Wallace Branch from the upstream end of the site to its confluence with Lick Creek. Reach 2 consists of Lick Creek from the upstream end of the site to its confluence with Wallace Branch. Reach 3 consists of Lick Creek from the confluence with Wallace Branch to the downstream end of the site.

**Table 1. Project Structure and Objectives – Lick Creek Stream Restoration Site (D04013-1)**

<b>Reach ID</b>	<b>Mitigation Type</b>	<b>Priority Level</b>	<b>Linear Footage</b>	<b>Stationing</b>	<b>Description</b>
1	Restoration	P1	3,690 ft	10+00 – 46+90	3,690 ft of channel relocation of Wallace Branch
2	Restoration	P1	1,870 ft	10+00 – 28+70	1,870 ft of channel relocation of Upper Lick Creek
3	Restoration	P1	4,008 ft	28+70 – 65+20	3,650 ft of channel relocation of Lower Lick Creek and 358 ft of channel relocation of an Unnamed Tributary
Total			<b>9,568 ft</b>		

### 1.3 PROJECT BACKGROUND

**Table 2. Project Activity and Reporting History – Lick Creek Stream Restoration Site (D04013-1)**

<b>Activity or Report</b>	<b>Scheduled Completion</b>	<b>Data Collection Complete</b>	<b>Actual Completion or Delivery</b>
Restoration Plan	Oct-04	N/A	Apr-05
Final Design – (at least 90% complete)	Oct-04	N/A	Apr-05
Construction	Mar-05	N/A	Mar-06
Temporary S&E mix applied to entire project area	Mar-05	N/A	Apr-06
Permanent seed mix applied to entire project area	Mar-05	N/A	Apr-06
Live stakes planting	Mar-05	N/A	Apr-06
Bare root trees planting	Mar-05	N/A	Apr-06
Mitigation Plan / As-built (Year 0 Monitoring-baseline)	Mar-05	May-06	Jun-06
Maintenance following Hurricane Alberto (Log vanes added and bank repairs)	N/A	N/A	Nov-06
Year 1 Monitoring	Nov-06	Dec-06	Dec-06
Year 2 Monitoring	Nov-07	Nov-07	Dec-07
Year 3 Monitoring	Nov-08	Oct-08	Nov-08
Year 4 Monitoring	Nov-09		
Year 5 Monitoring	Nov-10		

**Table 3. Project Contact Information – Lick Creek Stream Restoration Site (D04013-1)**

<p><b>Designer</b> URS Corporation</p>	<p>1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560</p>
<p><b>Construction Contractor</b> North State Environmental, Inc.</p>	<p>2889 Lowery Street, Suite B Winston-Salem, NC 27101 <u>Contact:</u> Darrell Westmoreland, Tel. 336-725-2010</p>
<p><b>Planting Contractor</b> H &amp; J Forestry Services</p>	<p>910-264-1612</p>
<p><b>Seeding Contractor</b> North State Environmental, Inc.</p>	<p>2889 Lowery Street, Suite B Winston-Salem, NC 27101 <u>Contact:</u> Darrell Westmoreland, Tel. 336-725-2010</p>
<p>Nursery Stock Suppliers</p>	<p>S.C. Supertree Nursery, Tel 800-222-1290</p>
<p><b>Monitoring Performer</b> Wolf Creek Engineering</p>	<p>30 Ben Lippen School Rd. Asheville, NC 28806 <u>Contact:</u> Grant Ginn, Tel. 828-505-2186</p>

**Table 4. Project Background Information – Lick Creek Stream Restoration Site (D04013-1)**

Project County:	Lee County, NC
Drainage Area:	
Reach 1: Wallace Branch	4.94 mi <sup>2</sup>
Reach 2: Lick Creek	8.86 mi <sup>2</sup>
Reach 3: Lick Creek	13.9 mi <sup>2</sup>
Estimated Drainage % Impervious Cover:	
Reach 1: Wallace Branch	<5%
Reach 2: Lick Creek	5%
Reach 3: Lick Creek	5%
Stream Order:	
Reach 1: Wallace Branch	2
Reach 2: Lick Creek	2
Reach 3: Lick Creek	3
Physiographic Region	Piedmont
Ecoregion	Triassic Basin
Rosgen Classification of As-Built	E5
Cowardin Classification	Piedmont/Mountain Bottomland Forrest
Dominant Soil Types	
Reach 1: Wallace Branch	Congaree Silt Loam (Cp)
Reach 2: Lick Creek	Congaree Silt Loam (Cp)
Reach 3: Lick Creek	Congaree Silt Loam (Cp)
Reference site ID	UT to Reedy Creek
USGS HUC for Project and Reference sites	03030004
NCDWQ Sub-basin for Project and Reference	03-06-07
NCDWQ classification for Project and Reference	WS-IV
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%

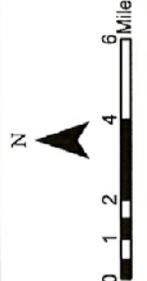


Restoration Systems, LLC  
Natural Resources  
Restoration & Conservation

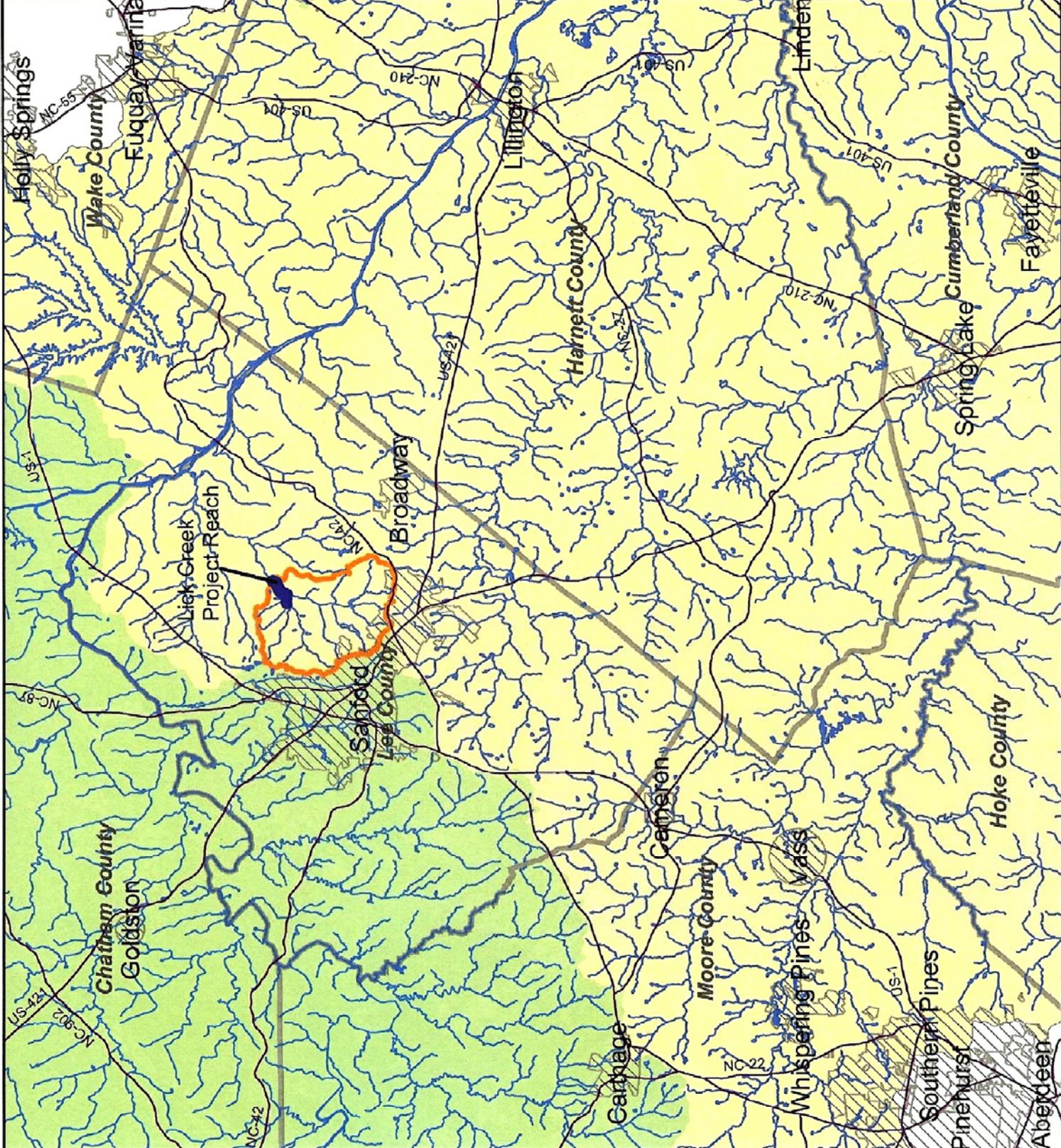
### Lick Creek Stream Restoration Full Delivery Project



- Legend**
- Cape Fear River Basin
  - HUC 03030004
  - Municipal Boundaries
  - NC Counties
  - Project Contributing Watershed
  - Hydrology
  - Lick Creek Project Reach
  - Primary Roads



**FIGURE 1**  
Vicinity Map

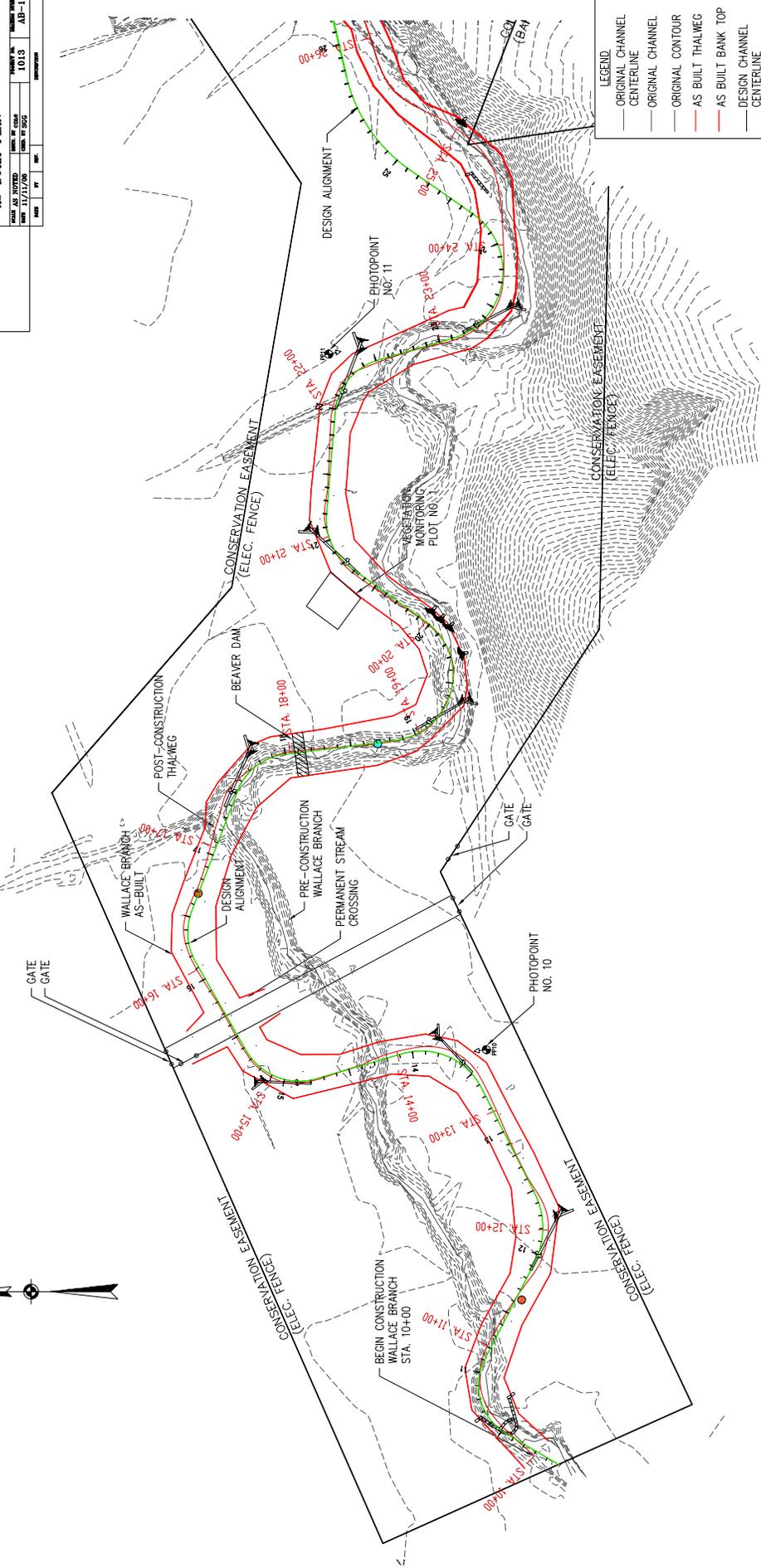


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PROJECT: WALLACE CREEK RESTORATION  
 CLIENT: NORTH CAROLINA DEP  
 DATE: 11/11/08

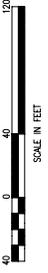
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 SHEET TOTAL: AB-1

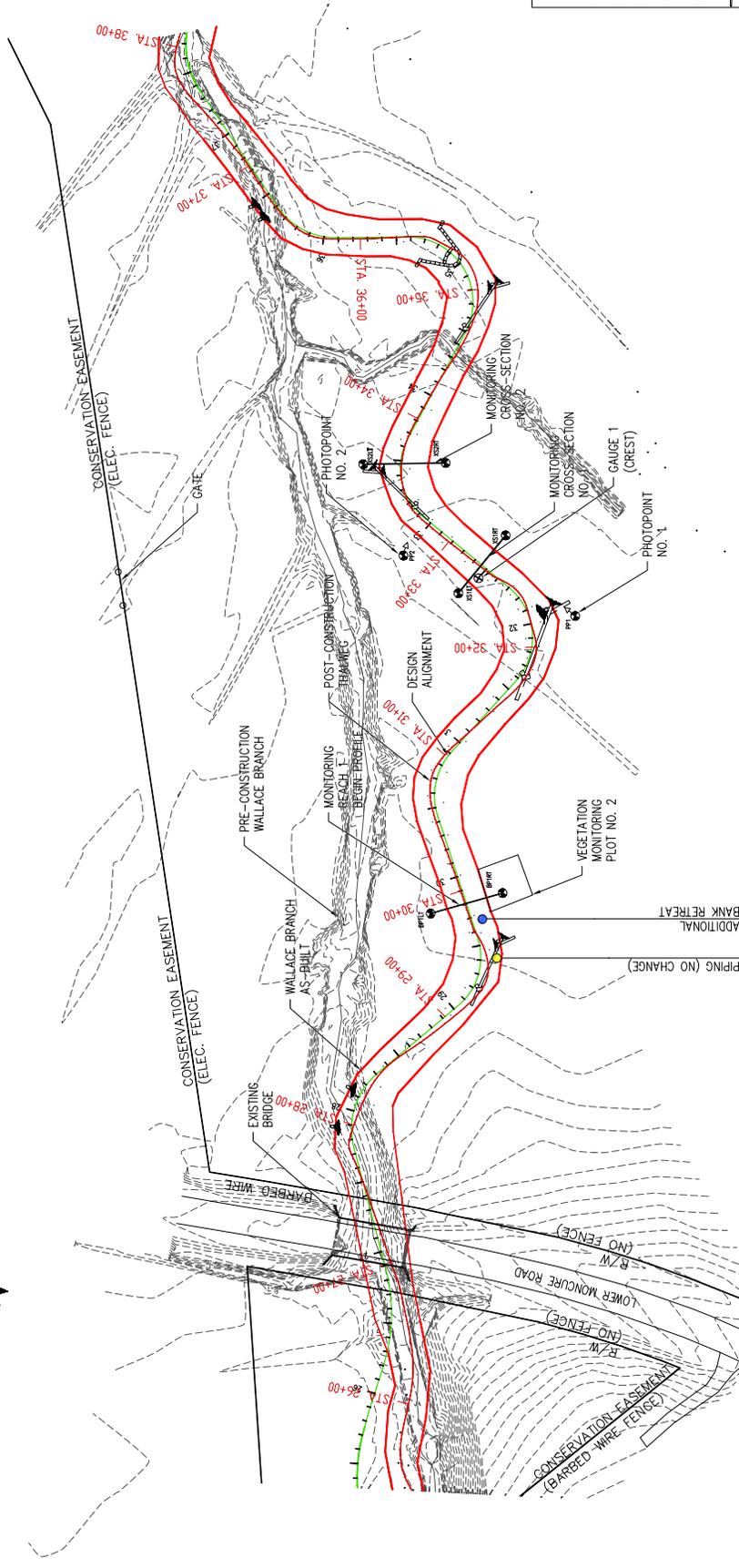


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- CENTERLINE
- ORIGINAL CHANNEL
- ORIGINAL CONTOUR
- AS BUILT THALWEG
- AS BUILT BANK TOP
- DESIGN CHANNEL CENTERLINE
- LOG VANE
- ROOTWAD
- CROSS VANE
- ROCK VANE
- ROCK VANE ADDED NOVEMBER 2006
- LOG VANE ADDED NOVEMBER 2006
- BANK EROSION
- TOE SCOUR
- BED SCOUR
- STRUCTURE ISSUE
- VEG. IN RIFFLE
- IRON ROD
- GALVANIZED

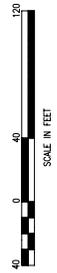


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PP10	641991.11	1962981.27	216.08
PP11	64210.51	1963508.24	214.29



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—	CENTERLINE
—	ORIGINAL CHANNEL
—	ORIGINAL CONTOUR
—	AS BUILT BANK TOP
—	DESIGN CHANNEL
—	CENTERLINE
—	LOG VANE
—	ROOTWAD
—	CROSS VANE
—	ROCK VANE
—	ROCK VANE ADDED NOVEMBER 2006
—	LOG VANE ADDED NOVEMBER 2006
●	BANK EROSION
●	TOE SCOUR
●	BED SCOUR
●	STRUCTURE ISSUE
●	VEG. IN RIFLE
—	IRON ROD
—	GAUGE



POINT DESCRIPTION	NORTHING	EASTING	ELEVATION
BP1L	642234.97	1964018.74	213.76
BP1R	642199.00	1964085.84	213.95
PP1	642251.23	1964276.46	213.69
XS1L	642328.91	1964249.75	213.24
XS1R	642320.55	1964300.86	213.46
PP2	642374.80	1964263.35	213.03
XS2L	642430.25	1964293.98	215.08
XS2R	642351.47	1964323.23	213.05

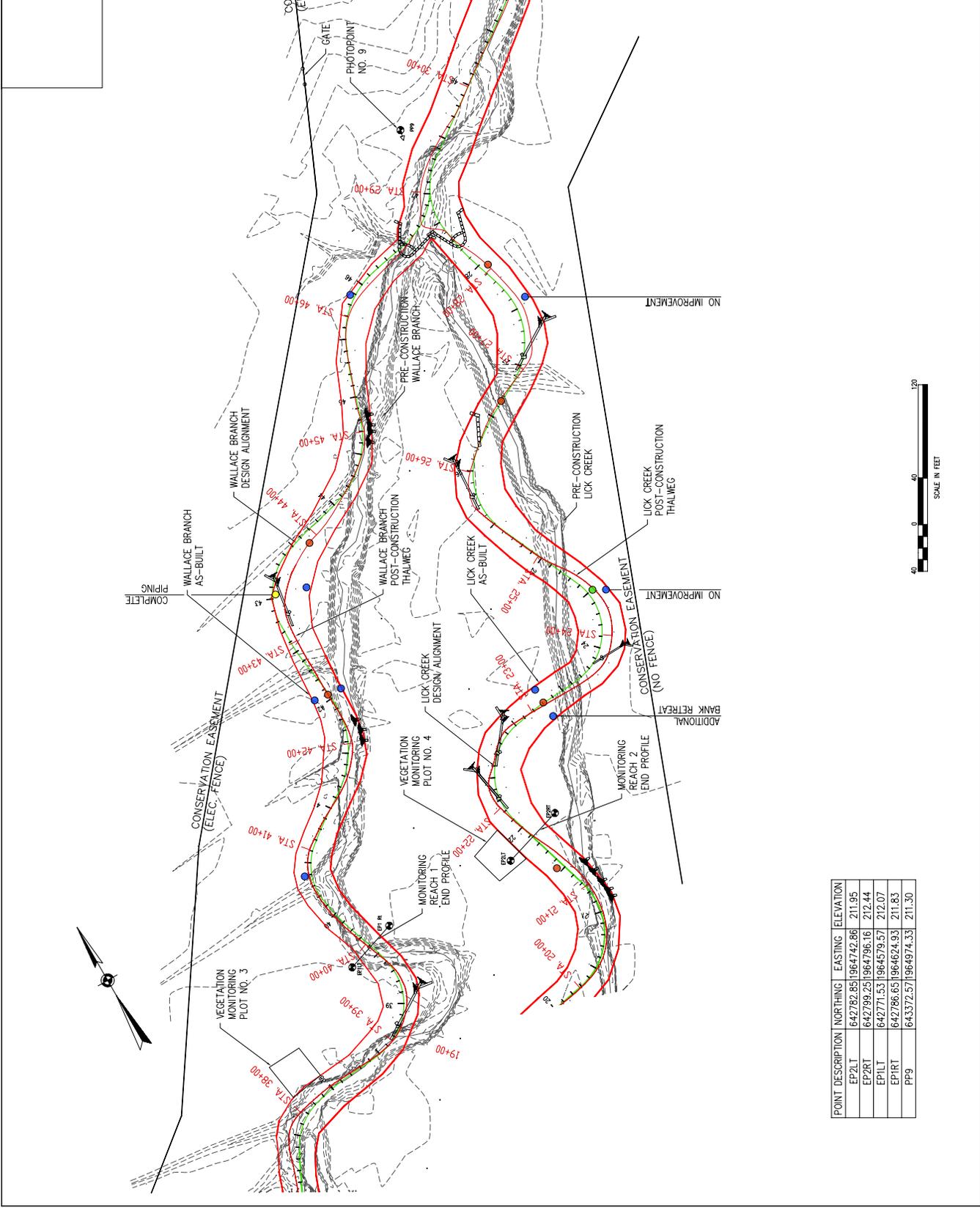


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**WOLF CREEK RESTORATION**  
 AS-BUILT PLAN

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BY: [Signature]	DATE: 11/11/06	PROJECT NO: 1015	DATE: 11/11/06
BY: [Signature]	DATE: 11/11/06	PROJECT NO: 1015	DATE: 11/11/06



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—	ORIGINAL CHANNEL
—	ORIGINAL CONTOUR
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—	AS BUILT BANK TOP
—	DESIGN CHANNEL CENTERLINE
—	LOG VANE
—	ROOTWAD
—	CROSS VANE
—	ROCK VANE
—	ROCK VANE ADDED NOVEMBER 2006
—	LOG VANE ADDED NOVEMBER 2006
—	BANK EROSION
—	TOE SCOUR
—	BED SCOUR
—	STRUCTURE ISSUE
—	VEG. IN RIFFLE
—	IRON ROD
—	GAUGE

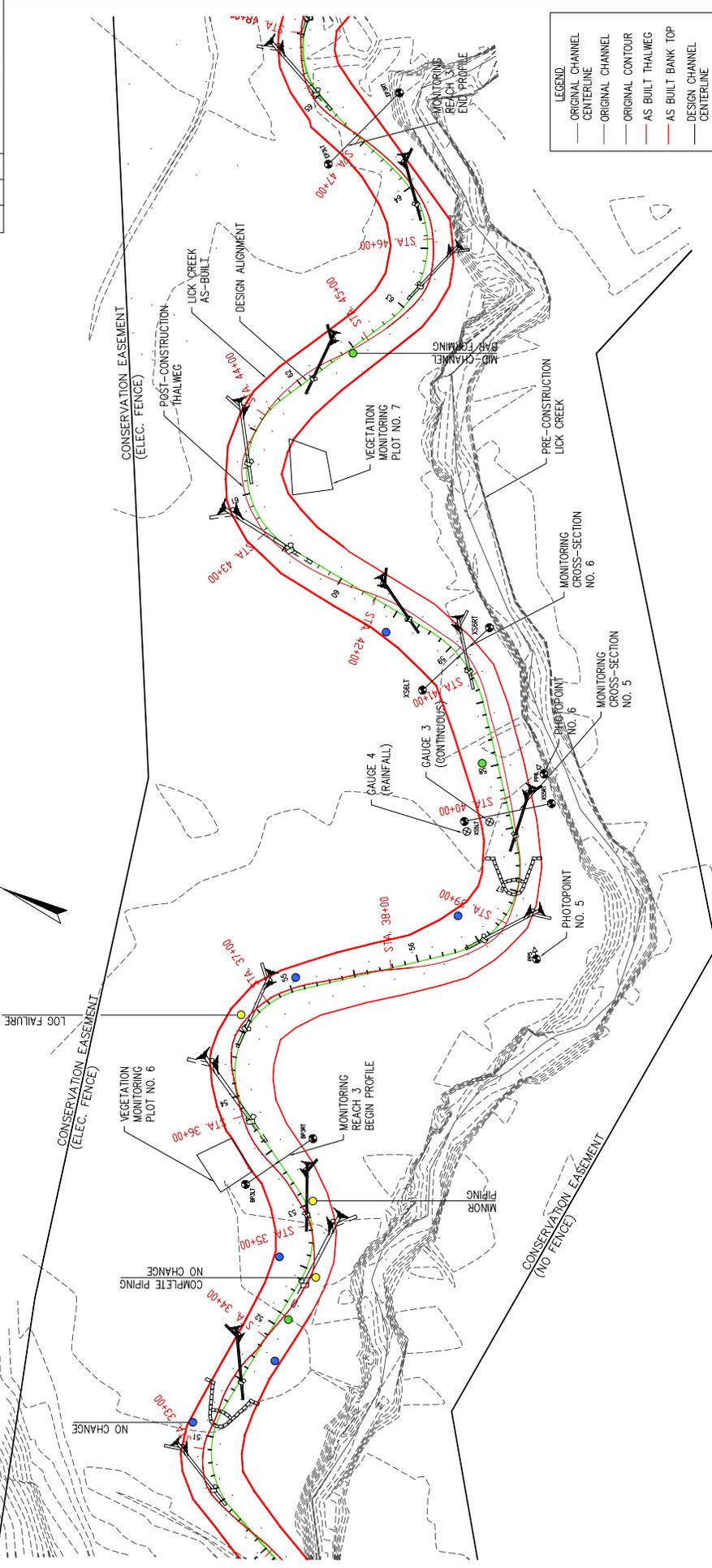


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EP2LT	642782.65	1964742.86	211.95
EP2RT	642799.25	1964796.16	212.44
EP1LT	642771.53	1964579.57	212.07
EP1RT	642786.65	1964624.93	211.83
PP9	643372.57	1964974.33	211.30

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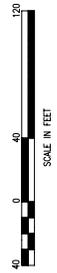
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 SHEET NO. 1015  
 TOTAL SHEETS 1015-5



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- ORIGINAL CHANNEL CENTERLINE
- ORIGINAL CONTOUR
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- DESIGN CHANNEL CENTERLINE
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- BANK EROSION
- TOE SCOUR
- BED SCOUR
- STRUCTURE ISSUE
- VEG. IN RIFLE
- IRON ROD
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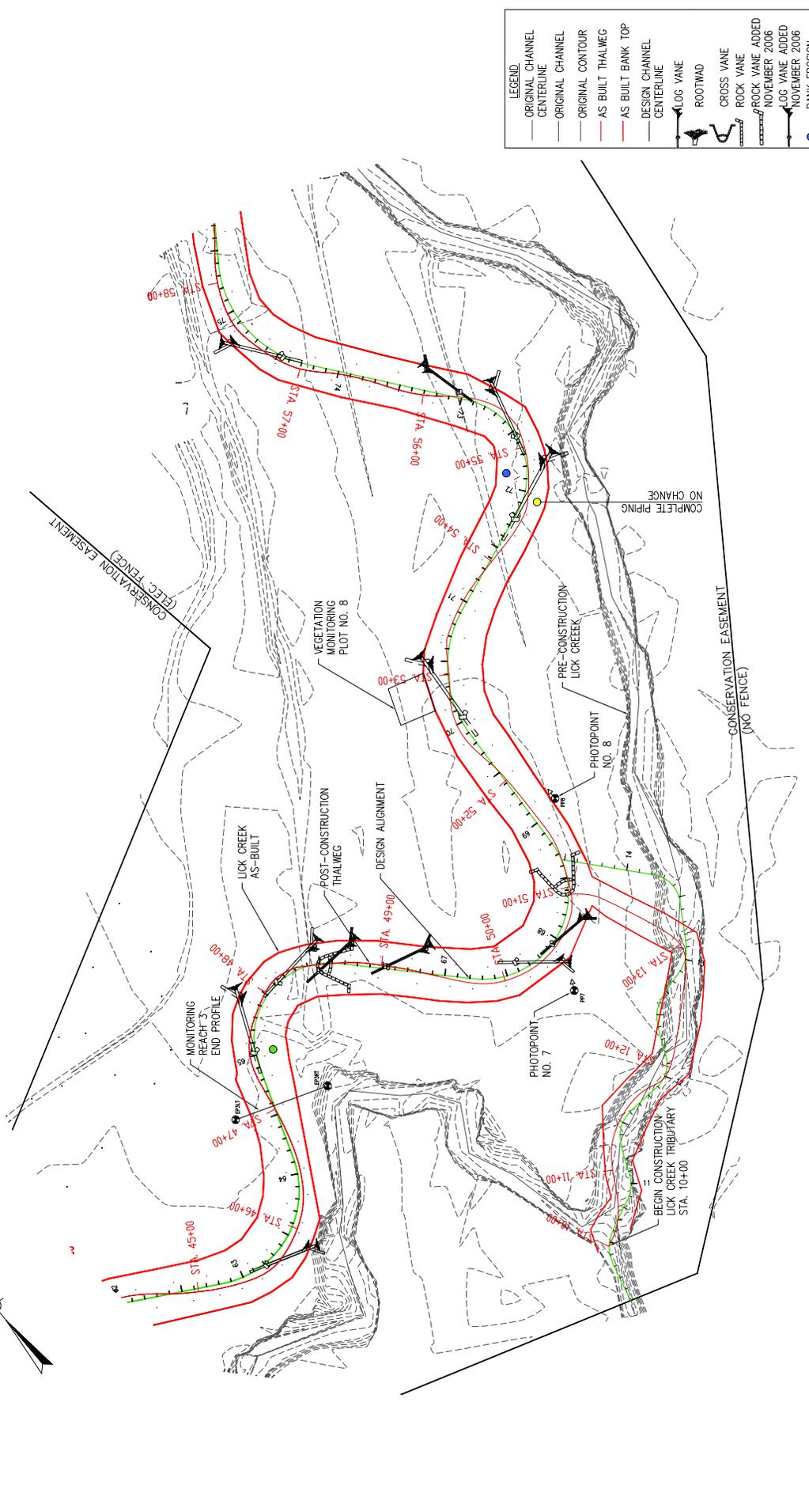
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BP-3LT	643656.13	1965422.68	210.51
BP-3RT	643623.83	1965476.86	210.50
PPS	643525.93	1965675.95	210.34
PP6	643561.04	1965608.22	210.05
XSSLT	643621.47	1965749.03	209.56
XSSRT	643666.26	1965790.05	210.22
XSSLT	643693.80	1965807.37	209.31
XSSRT	643667.29	1965893.12	210.12
EP-3LT	643931.89	1966165.79	208.45
EP-3RT	643905.52	1966239.12	208.06

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PROJECT: LICK CREEK RESTORATION  
 CLIENT: NORTH CAROLINA DEP  
 DRAWING: AS-BUILT PLAN

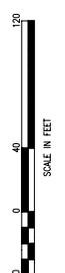
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11/11/06			10/15		
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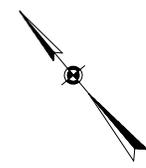


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- AS BUILT BANK TOP CENTERLINE
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- ROOTWAD
- CROSS VANE
- ROCK VANE
- NOVEMBER 2006 LOG VANE ADDED
- NOVEMBER 2006 BANK EROSION
- TOE SCOUR
- STRUCTURE ISSUE
- VEG. IN RIFFLE
- IRON ROD
- GAUGE



POINT DESCRIPTION	NORTHING	EASTING	ELEVATION
EP3LT	643931.89	1966165.79	208.45
EP3RT	643905.52	1966239.12	208.06
PP8	643964.34	1966524.28	207.04

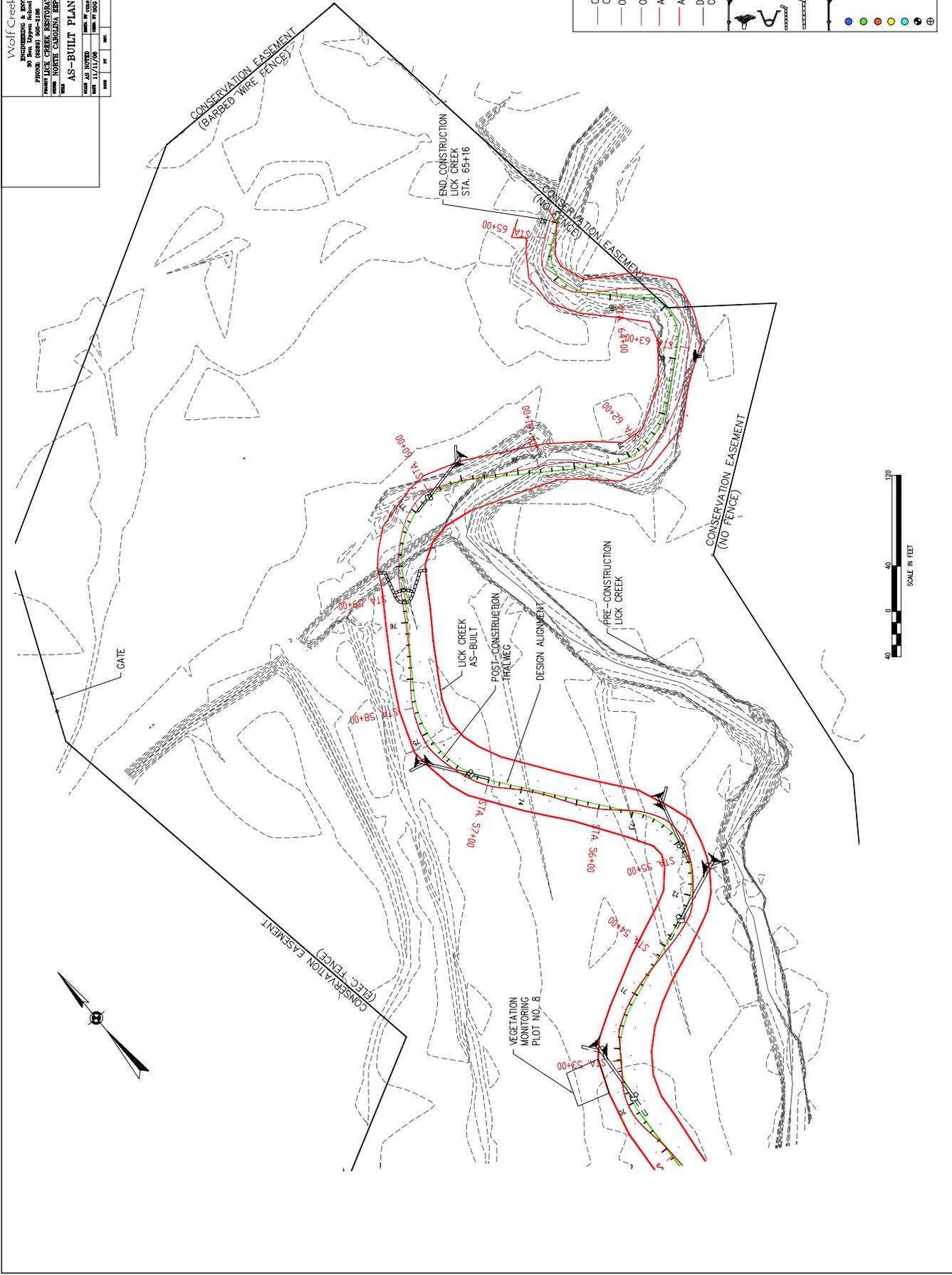


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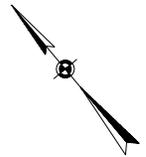
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**CLIENT: NORTH CAROLINA DEP**  
**AS-BUILT PLAN**

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BY: [Signature]	BY: [Signature]	BY: [Signature]	BY: [Signature]
1015	1015	1015	1015
AB-7	AB-7	AB-7	AB-7



**LEGEND**

—	ORIGINAL CHANNEL CENTERLINE
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—	IRON ROD
—	GAUGE



## 2.0 PROJECT CONDITION AND MONITORING RESULTS

### 2.1 VEGETATION ASSESSMENT

The survivability of the riparian buffer plantings is evaluated using eight (8) randomly placed 10 meter by 10 meter vegetative sampling plots providing combined sample coverage of two percent of the replanted area. The corners of each monitoring plot have been marked in the field and their position documented by GPS survey. The monitoring consists of a physical inventory within each plot in order to determine the composition and number of surviving species and the total number of stems per acre. To the extent possible, differentiation between planted and volunteer stems was accomplished. The presence of non-native, exotic, and undesirable species was noted. Additionally, sequential photographs are taken from the upstream corner located closest to the stream of each monitoring plot.

Planted herbaceous species have successfully established throughout the entire site along with volunteer species from upstream seed sources. Due to a prolonged and severe regional drought, the willow and dogwood live stakes used for bank stabilization exhibit significantly stunted growth. This has not had a noticeable impact on the stability of the stream banks. The riparian buffer planting had an overall survival rate of 70% with additional volunteer species taking root.

#### 2.1.1 Vegetative Problem

No significant vegetation problem areas were recorded within the site. An increasing number of non-native Chinese privet (*Ligustrum sinense*) stems were recorded emerging in areas where invasive species removal previously occurred. A relatively high occurrence of privet was observed within the conservation easement along the upstream reach of Lick Creek, adjacent to a densely populated off-site stand of privet. Measures will be implemented this winter to control the new growth of privet.

There are a number of localized areas where the combination of shear stress, loss of matting, and drought conditions have resulted in bare banks and toes. Supplemental live staking will be installed in these areas this winter.

**Table 6. Vegetative Problem Areas – Lick Creek Stream Restoration Site (D04013-1)**

Feature / Issue	Station # / Range	Problem Cause
Invasive / Exotic Populations	Various	Several Chinese privet re-sprouting in areas where it was removed
Bare Bank or Toe	Wallace Branch 29+50, 40+80, 42+50  Lick Creek 14+00, 14+50, 15+50, 17+20, 23+00, 24+50, 27+50, 34+00, 34+70, 37+00, 39+00	Local erosion or loss of matting

### 2.1.2 Stem Counts

Table 7 presents stem counts of surviving individuals found at each of the monitoring plot at the end of Year 3 of the post-construction monitoring period. Trees within each monitoring plot are flagged regularly to prevent the occurrence of unmarked trees due to flag degradation. Volunteer individuals found within the plots are also flagged during this process. The average bare root species survival rate was 70%.

All herbaceous species seeded throughout the site after construction were found onsite at the end of Year 3. In addition, native species such as Switch grass (*Panicum virgatum*), soft rush (*Juncus effuses*), fennel (*Eupatorium* sp.), goldenrod (*Solidago* spp.), sedge (*Carex* spp.), buttercup (*Ranunculus* spp.), plantain (*Plantago* spp.), fescue (*Festuca* spp.), crabgrass (*Digitaria* spp.), smartweed (*Polygonum* spp.), nightshade (*Solanum* spp.), poison ivy (*Toxicodendron radicans*), *Rumex* spp., and species of Aster (*Aster* spp.), were found to have colonized throughout the project's riparian area.

**Table 7. Stem Counts – Lick Creek Stream Restoration Site (D04013-1)**

Species	Plots - Year 3								Initial Totals	Year 3 Totals
	1	2	3	4	5	6	7	8		
<b>Trees</b>										
<i>Asimina triloba</i>			1	1	1			1	27	4
<i>Betula nigra</i>	1	2	5±	1		4	4	1	10	18
<i>Callicarpa americana</i>	1	2	2		1				11	6
<i>Cephalanthus occidentalis</i>	3	2		7	2	5		1	19	20
<i>Corylus americana</i>			1		2	2	2	3	17	10
<i>Diospyros virginiana</i>									6	0
<i>Fraxinus pennsylvanica</i>	1	1		2			1		6	5
<i>Liriodendron tulipifera</i>		2	1		1	1			6	5
<i>Myrica cerifera</i>	1	3	2	3	1	1	2	1	10	14
<i>Nyssa sylvatica</i>									2	0
<i>Platanus occidentalis</i>	1		1	2		2		1	7	7
<i>Quercus michauxii</i>	2		1	1	1	1		1	10	7
<i>Quercus nigra</i>									5	0
<i>Quercus phellos</i>		2	2		1	1	2		13	8
<i>Ulmus Americana</i>	3	2					3		14	8
<b>Initial Totals:</b>	<b>18</b>	<b>22</b>	<b>17</b>	<b>23</b>	<b>26</b>	<b>22</b>	<b>20</b>	<b>15</b>	<b>Average Stem Survival %</b>	
<b>Year 3 Totals:</b>	<b>13</b>	<b>16</b>	<b>16</b>	<b>17</b>	<b>10</b>	<b>17</b>	<b>14</b>	<b>9</b>		
<b>Stem Survival %</b>	<b>72.2</b>	<b>72.7</b>	<b>94.1</b>	<b>73.9</b>	<b>38.5</b>	<b>77.3</b>	<b>70</b>	<b>60</b>		
<b>Density (trees/acre)</b>	<b>526</b>	<b>647</b>	<b>647</b>	<b>688</b>	<b>405</b>	<b>688</b>	<b>567</b>	<b>364</b>	<b>567</b>	

### **2.1.3 Vegetation Plot Photos**

A photo point was established in each vegetation plot. Photo points are positioned at the upstream plot corner located closest to the stream bank and oriented in order to capture the entire vegetation plot. The photographs were captured on the same day as the vegetation plot surveys (Appendix A).

## **2.2 STREAM ASSESSMENT**

Monitoring protocol follows that outlined within the EEP Site Specific Mitigation Plan and detailed in the U.S. Army Corps of Engineers (USACE) Stream Mitigation Guidelines for Monitoring Level I. Specifically, stream monitoring included measurements of stream dimension, profile, pattern, bed materials, photo documentation, and stream bankfull return interval.

Most of the stream reaches have managed the extreme flow events of the first three years, however bank failure was noted in some reaches, and several structures have subsided and lost functionality. The bed profile appears to be stabilizing while bed material continues to coarsen. Bed material is beginning to refill scoured portions of the bed.

### **2.2.1 Hydrology**

Since completion of construction in March of 2006, the site has been subjected to at least four greater than bankfull events and several near bankfull events. In June of 2006, Hurricane Alberto crossed central North Carolina resulting in five inches of rainfall on-site and water elevations three feet above bankfull on Reaches 1 and 2 and almost two feet above bankfull on Reach 3. Additionally, Lower Moncure Road was overtopped by Wallace Branch. It is estimated that this storm was approximately a fifty-year event. In November of 2006, heavy rainfall resulted in water elevations up to two feet above bankfull. The severity of this storm resulted in a malfunction of the rain gauge so that the quantity of rainfall was not recorded. Heavy rainfall associated with remnants of Tropical Storm Fay and Hurricane Hannah produced two more events in August and September of 2008 which resulted in water elevations one to three feet above bankfull. Five additional events including Hurricane Ernesto resulted in water elevations within one to two feet below bankfull. Peak rainfall and flow events are documented in Appendix B.

**Table 8. Verification of Bankfull Events – Lick Creek Stream Restoration Site (D04013-1)**

<b>Date of Data Collection</b>	<b>Date of Occurrence of Bankfull Event</b>	<b>Method of Data Collection</b>
7/24/06	6/14/06	Crest Gauge and Pressure Transducer
12/1/06	11/22/06	Crest Gauge and Pressure Transducer
11/27/07	10/27/07	Crest Gauge
10/24/08	Summer '08	Crest Gauge

### **2.2.2 Geomorphology**

Following the procedures established in the USDA Forest Service Manual (Harrelson et al 1994) and the methodologies utilized in the Rosgen stream assessment and classification system (Rosgen 1994, 1996), data collected consisted of detailed dimension and pattern measurements, longitudinal profiles, and bed materials sampling.

Re-survey of the permanent cross sections and profile reaches have shown some alterations in local bed elevations with the bed form and the channel pattern remaining consistent with the Year 2 condition. Two of the riffle cross sections show nearly the same maximum depth as Year 2. The riffle in monitoring Reach 3 has cut down approximately one foot from the Year 2 bed elevation. The pools were generally found to be slightly, to significantly shallower than the Year 2 condition with their location relative to the pattern consistent with the Year 2 survey.

Pebble counts were conducted at each cross-section, as well as across the overall study reach. Pebble count data was plotted by size distribution in order to assess the D<sub>50</sub> and D<sub>84</sub> size class. In Reach 1, the material size increased from the second year survey with the D<sub>84</sub> increasing from 10 mm to 11 mm and the percent of gravel increased from 41% to 46%. In Reach 2, the D<sub>84</sub> increased in size from 7 mm to 18 mm and the percent of gravel increased from 24% to 69%. In Reach 3 the D<sub>84</sub> increased from 8 mm to 12 mm and percent of gravel increased from 25% to 59%.

**Table 9. BEHI and Sediment Export Estimates – (Not Required in Year 3)**

### **2.2.3 Problem Areas**

The Year 2 monitoring report identified several problem areas as part of the stream assessment. Of these areas, five (5) no longer appear to be areas of concern as they have healed through natural channel process, vegetation growth, or constructed repairs. However, the prolonged drought and localized shear stress have developed the following new areas of concern:

- 1.) A beaver dam has been constructed on the riffle at Sta. 18+00 on Wallace Branch. Currently the dam is impounding water on approximately 500' of the site.
- 2.) There were two (2) additional areas of toe scour identified.
- 3.) There were two (2) new locations of piping identified at log vanes.

4.) There were five (5) additional areas of bank scour identified.

Plan drawings of the Lick Creek Stream Restoration Site detailing stream problem areas requiring additional observation and/or remediation can be seen in Figures AB-1 through AB-7. Representative photos of these areas can be found in Appendix B.

Restoration Systems will monitor these areas over the next several months and will install live stakes and/or Brush Mattresses where necessary.

#### **2.2.4 Photo Reference Stations**

Photograph reference Stations (PRSs) have been established to assist in characterizing the site and to allow qualitative evaluation of the site conditions. The location of each photo station has been permanently marked in the field and the bearing/orientation of the photograph is indicated on the As-built plans to allow for consistent repetition. A total of eleven (11) PRSs have been established along the restored stream (Appendix B). Six of these PRSs have been located upstream of the permanent monitoring cross sections. These photographs are taken facing downstream looking at the section, and show as much of the banks and channel as possible.

### 2.2.5 Stability Assessment Table

Feature	Performance Percentage Reach 1: Wallace Branch (3,690 ft)					
	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	100%	100%	100%		
Pools	100%	100%	100%	100%		
Thalweg	100%	100%	100%	100%		
Meanders	100%	99%	99%	95%		
Bed General	100%	98%	98%	99%		
Vanes / J Hooks etc.	100%	94%	94%	96%		
Wads and Boulders	100%	100%	100%	100%		

Feature	Performance Percentage Reach 2: Lick Creek (1,870 ft)					
	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	89%	95%	82%		
Pools	100%	82%	91%	91%		
Thalweg	100%	100%	100%	100%		
Meanders	100%	100%	98%	82%		
Bed General	100%	97%	98%	98%		
Vanes / J Hooks etc.	100%	96%	96%	90%		
Wads and Boulders	100%	100%	100%	100%		

Feature	Performance Percentage Reach 3: Lick Creek (4,008 ft)					
	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
Riffles	100%	98%	98%	96%		
Pools	100%	100%	100%	100%		
Thalweg	100%	100%	100%	100%		
Meanders	100%	100%	100%	96%		
Bed General	100%	100%	100%	99%		
Vanes / J Hooks etc.	100%	95%	97%	96%		
Wads and Boulders	100%	97%	99%	100%		

## 2.2.6 Quantitative Measure Summary Tables







## **APPENDIX A**

### 1. Vegetation Monitoring Plot Photos

Vegetation Plot No. 1



Year 2

Photo No. 1



Year 3

Photo No. 2

Vegetation Plot No. 2



Year 2

Photo No. 3



Year 3

Photo No. 4

Vegetation Plot No. 3



Year 2

Photo No. 5



Year 3

Photo No. 6

Vegetation Plot No. 4



Year 2

Photo No. 7

**No photo available for Vegetation Plot 4 – Year 3 due to technical malfunction**

Year 3

Photo No. 8

Vegetation Plot No. 5



Year 2

Photo No. 9



Year 3

Photo No. 10

Vegetation Plot No. 6



Year 2

Photo No. 11



Year 3

Photo No. 12

Vegetation Plot No. 7



Year 2

Photo No. 13



Year 3

Photo No. 14

Vegetation Plot No. 8



Year 2

Photo No. 15



Year 3

Photo No. 16

## **APPENDIX B**

### **Stream Raw Data**

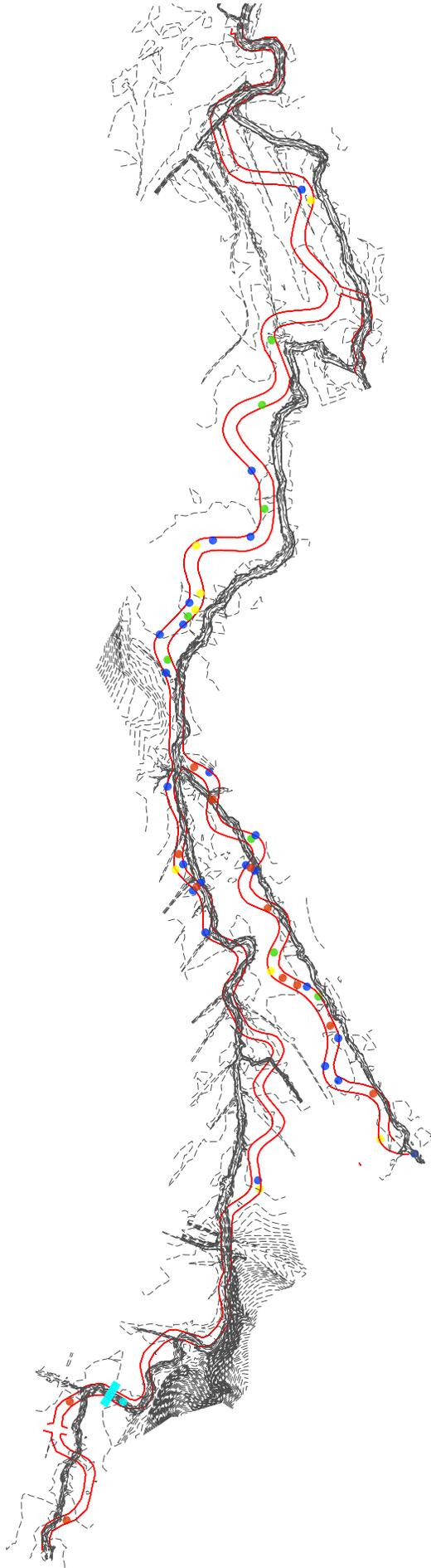
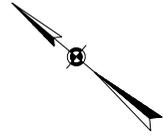
1. Exhibit Problem Areas Plan View (Stream)
2. Representative Stream Problem Area Photos
3. Stream Photo-points
4. Exhibit Table B.1. Qualitative Visual Stability Assessment
5. Cross section Plots and Raw Data Tables
6. Longitudinal Plots and Raw Data Tables
7. Pebble Count Plots and Raw Data Tables

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WATERWAYS & RESTORATION CONSULTANTS  
 JACK CREEK MONITORING  
 RESTORATION SYSTEMS

MONITORING PLAN

DATE	BY	SCALE	PROJECT NO.	PROJECT NAME
11/17/09	SM	1" = 400'	1013	JACK CREEK MONITORING



**LEGEND**

- AS BUILT BANK TOP
- BANK EROSION
- TOE SCOUR
- BED SCOUR
- VEG. IN RIFFLE
- STRUCTURE ISSUE
- BEAVER DAM



Toe Scour on Lick Creek, STA 23+00 11/27/07  
Photo No. 17



Toe Scour on Lick Creek, STA 23+00 10/24/08  
Photo No. 18



Bank Erosion at Wallace Branch, STA 10+00 12/03/06  
Photo No. 19



Bank Erosion at Wallace Branch, STA 10+00 11/27/07  
Photo No. 20



Bank Erosion at Wallace Branch, STA 10+00 10/24/08  
Photo No. 21



Piping at Log Vane on Wallace Branch, STA 29+50 10/24/08  
Photo No. 22



Piping at Log Vane on Lick Creek, STA 34+40 10/24/08  
Photo No. 23



Piping at Log Vane on Lick Creek, STA 18+50 10/24/08  
Photo No. 24



Bank Failure, Wallace Branch STA 40+50 11/27/07  
Photo No. 25



Bank Failure, Wallace Branch STA 40+80, 10/24/08  
Photo No. 26

Photo Station 1



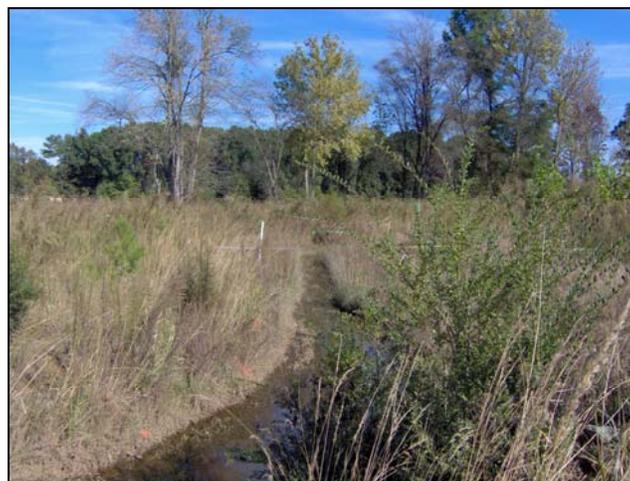
Year 1

Photo No. 27



Year 2 - 10' offset from PP1

Photo No. 28



Year 3 - 25' offset from PP1

Photo No. 29

Photo Station 2



Year 1

Photo No. 30



Year 2 - 10' offset from PP2

Photo No. 31



Year 3 - 10' offset from PP2

Photo No. 32

Photo Station 3



Year 1 Photo No. 33



Year 3 - 10' offset from PP3 Photo No. 34



Year 3 - 10' offset from PP3 Photo No. 35

Photo Station 4



Year 1

Photo No. 36



Year 2 - 10' offset from PP4

Photo No. 37



Year 3 - 10' offset from PP4

Photo No. 38

Photo Station 5



Year 1

Photo No. 39



Year 2 - 10' offset from PP5

Photo No. 40



Year 3 - 10' offset from PP5

Photo No. 41

Photo Station 6



Year 1

Photo No. 42



Year 2 - 10' offset from PP6

Photo No. 43



Year 3 - 10' offset from PP6

Photo No. 44

Photo Station 7



Year 1

Photo No. 45



Year 2

Photo No. 46



Year 3

Photo No. 47

Photo Station 8



Year 1

Photo No. 48



Year 2

Photo No. 49



Year 3 - 10' offset from PP8

Photo No. 50

Photo Station 9



Year 1

Photo No. 51



Year 2 - 10' offset from PP9

Photo No. 52



Year 3 - 10' offset from PP9

Photo No. 53

Photo Station 10



Year 1

Photo No. 54



Year 2

Photo No. 55



Year 3

Photo No. 56

Photo Station 11



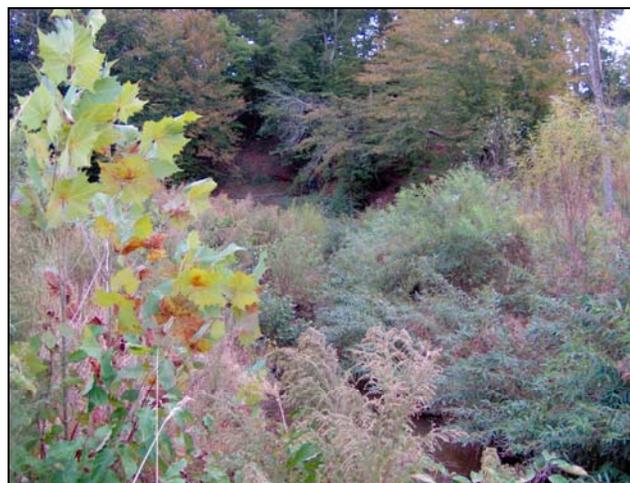
Year 1

Photo No. 57



Year 2 - 10' offset from PP11

Photo No. 58



Year 3 - 10' offset from PP11

Photo No. 59

<b>Table B1. Visual Morphological Stability Assessment</b>						
<b>Lick Creek Stream Restoration Site (D04013-1)</b>						
<b>Wallace Branch: Reach 1                      3,690 ft</b>						
Feature Category	Metric	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Performing Mean or Total
A. Riffles	1. Present	25	25	N/A	100%	
	2. Armor stable	1	1	N/A	100%	
	3. Facet grade appears stable	25	25	N/A	100%	
	4. Minimal evidence of embedding/fining	25	25	N/A	100%	
	5. Length appropriate	25	25	N/A	100%	<b>100%</b>
B. Pools	1. Present	26	26	N/A	100%	
	2. Sufficiently deep	26	26	N/A	100%	
	3. Length appropriate	26	26	N/A	100%	<b>100%</b>
C. Thalweg	1. Upstream of meander bend centered	13	13	N/A	100%	
	2. Downstream of meander bend centered	13	13	N/A	100%	<b>100%</b>
D. Meanders	1. Outer bend in state of limited erosion	23	26	N/A	88%	
	2. Of those eroding, # w/ concomitant point bar formation	0	N/A	N/A	88%	
	3. Apparent Rc within specification	26	26	N/A	100%	
	4. Sufficient floodplain access and relief	25	26	N/A	96%	<b>95%</b>
E. Bed General	1. General channel bed aggradation areas	N/A	N/A	1/50	99%	
	2. Channel bed degradation - areas of increasing down-cutting or head-cutting	N/A	N/A	1/100	98%	<b>99%</b>
F. Vanes	1. Free of back or arm scour	16	17	N/A	94%	
	2. Height appropriate	17	17	N/A	100%	
	3. Angle and geometry appear appropriate	17	17	N/A	100%	
	4. Free of piping or other structural failures	15	17	N/A	88%	<b>96%</b>
G. Wads/Boulders	1. Free of scour	33	33	N/A	100%	
	2. Footing stable	33	33	N/A	100%	<b>100%</b>

<b>Table B1. Visual Morphological Stability Assessment</b>						
<b>Lick Creek Stream Restoration Site (D04013-1)</b>						
<b>Lick Creek: Reach 2                      1,870 ft</b>						
Feature Category	Metric	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Performing Mean or Total
A. Riffles	1. Present	9	11	N/A	82%	
	2. Armor stable	2	2	N/A	100%	
	3. Facet grade appears stable	5	11	N/A	45%	
	4. Minimal evidence of embedding/fining	11	11	N/A	100%	
	5. Length appropriate	9	11	N/A	82%	<b>82%</b>
B. Pools	1. Present	10	11	N/A	91%	
	2. Sufficiently deep	10	11	N/A	91%	
	3. Length appropriate	10	11	N/A	91%	<b>91%</b>
C. Thalweg	1. Upstream of meander bend centered	5	5	N/A	100%	
	2. Downstream of meander bend centered	6	6	N/A	100%	<b>100%</b>
D. Meanders	1. Outer bend in state of limited erosion	6	11	N/A	55%	
	2. Of those eroding, # w/ concomitant point bar formation	3	N/A	N/A	73%	
	3. Apparent Rc within specification	11	11	N/A	100%	
	4. Sufficient floodplain access and relief	11	11	N/A	100%	<b>82%</b>
E. Bed General	1. General channel bed aggradation areas	N/A	N/A	2/40	98%	
	2. Channel bed degradation - areas of increasing down-cutting or head-cutting	N/A	N/A	3/60	97%	<b>98%</b>
F. Vanes	1. Free of back or arm scour	10	13	N/A	77%	
	2. Height appropriate	13	13	N/A	100%	
	3. Angle and geometry appear appropriate	13	13	N/A	100%	
	4. Free of piping or other structural failures	11	13	N/A	85%	<b>90%</b>
G. Wads/Boulders	1. Free of scour	22	22	N/A	100%	
	2. Footing stable	22	22	N/A	100%	<b>100%</b>

**Table B1. Visual Morphological Stability Assessment**

Lick Creek Stream Restoration Site (D04013-1)

Lick Creek: Reach 3 4,008 ft

Feature Category	Metric	(# Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Performing Mean or Total
A. Riffles	1. Present	16	17	N/A	94%	
	2. Armor stable	1	1	N/A	100%	
	3. Facet grade appears stable	15	17	N/A	88%	
	4. Minimal evidence of embedding/fining	17	17	N/A	100%	
	5. Length appropriate	17	17	N/A	100%	<b>96%</b>
B. Pools	1. Present	18	18	N/A	100%	
	2. Sufficiently deep	18	18	N/A	100%	
	3. Length appropriate	18	18	N/A	100%	<b>100%</b>
C. Thalweg	1. Upstream of meander bend centered	9	9	N/A	100%	
	2. Downstream of meander bend centered	9	9	N/A	100%	<b>100%</b>
D. Meanders	1. Outer bend in state of limited erosion	17	18	N/A	94%	
	2. Of those eroding, # w/ concomitant point bar formation	0	N/A	N/A	94%	
	3. Apparent Rc within specification	18	18	N/A	100%	
	4. Sufficient floodplain access and relief	18	18	N/A	100%	<b>98%</b>
E. Bed General	1. General channel bed aggradation areas	N/A	N/A	1/50	99%	
	2. Channel bed degradation - areas of increasing down-cutting or head-cutting	N/A	N/A	1/5	99%	<b>99%</b>
F. Vanes	1. Free of back or arm scour	29	30	N/A	97%	
	2. Height appropriate	30	30	N/A	100%	
	3. Angle and geometry appear appropriate	30	30	N/A	100%	
	4. Free of piping or other structural failures	26	30	N/A	87%	<b>96%</b>
G. Wads/Boulders	1. Free of scour	35	35	N/A	100%	
	2. Footing stable	36	36	N/A	100%	<b>100%</b>

**Lick Creek Stream Restoration Site**

Lee County, NC  
Cross Section No. 1

Reach 1 - Wallace Branch - Sta 12+83

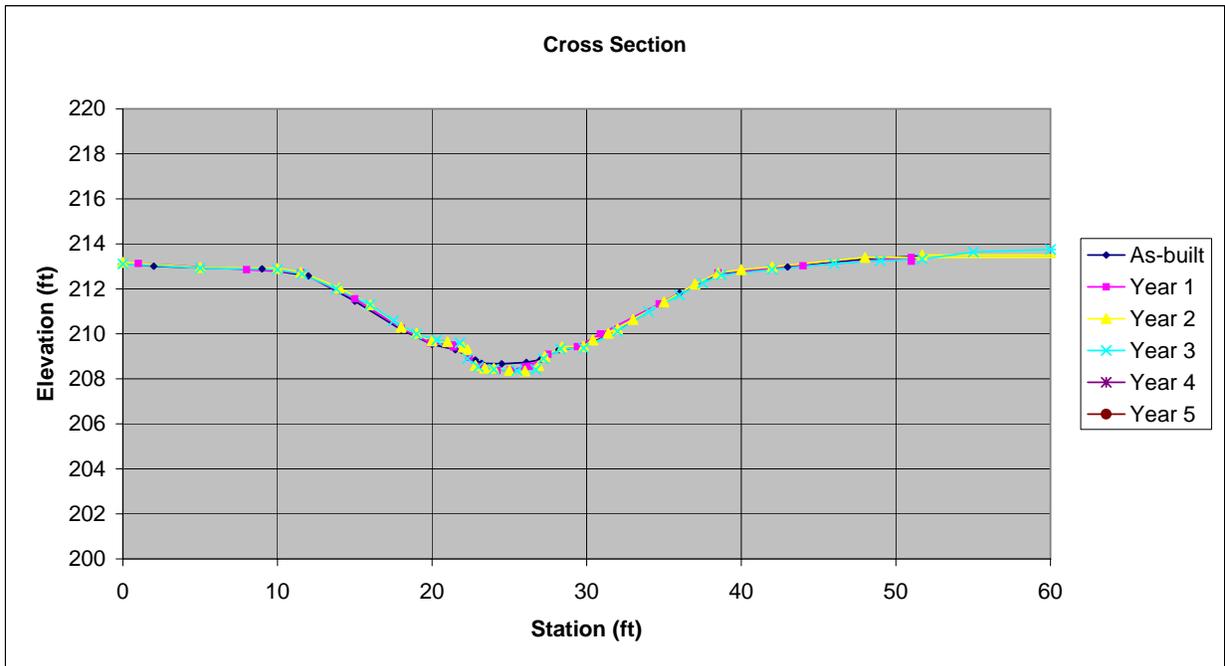


Year 2



Year 3

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	5/4/06	Date	11/17/06	Date	11/26/07	Date	10/23/08	Date	0/0/0	Date	0/0/0
Area	60.5	Area	63.8	Area	62.7	Area	64.2	Area	0.0	Area	0.0
Bkf W	26.5	Bkf W	27	Bkf W	27	Bkf W	27.3	Bkf W	10	Bkf W	10
Dmean	2.3	Dmean	2.4	Dmean	2.3	Dmean	2.3	Dmean	0.0	Dmean	0.0
Dmax	3.9	Dmax	4.3	Dmax	4.4	Dmax	4.3	Dmax	0.0	Dmax	0.0
W/d	11.6	W/d	11.4	W/d	11.6	W/d	11.6	W/d	0.0	W/d	0.0

**Lick Creek Stream Restoration Site**

Lee County, NC  
Cross Section No. 1

Reach 1 - Wallace Branch - Sta 12+83

As-Built				Year 1				Year 2			
Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.
BM	4.65	213.24	IR Lt	BM	5.54	213.24	IR Lt	BM	5.01	213.24	IR Lt
HI		217.89		HI		218.78		HI		218.25	
0	4.75	213.14	GRND	1	5.65	213.13		0	5.07	213.18	
2	4.88	213.01		8	5.93	212.85	ToB	5	5.30	212.95	
5	4.96	212.93		11.5	6.06	212.72	BKF	10	5.34	212.91	
9	5.00	212.89		15	7.22	211.56		11.5	5.51	212.74	
12	5.31	212.58	TOB	18	8.53	210.25		14	6.20	212.05	
15	6.44	211.45		19.9	9.19	209.59		16	6.96	211.29	
18	7.70	210.19		21.3	9.28	209.50	LEW	18	7.95	210.30	
20	8.36	209.53		21.4	9.36	209.42		19	8.22	210.03	
21.5	8.59	209.30		22.4	9.82	208.96	TOE	20	8.56	209.69	
22.8	9.05	208.84	EOW	23.1	10.24	208.54		21	8.60	209.65	
23.2	9.20	208.69		24.2	10.40	208.38		22	8.84	209.41	
24.5	9.22	208.67		25.1	10.39	208.39		22.3	8.95	209.30	
26.1	9.16	208.73		26	10.25	208.53	TOE	22.8	9.65	208.60	EOW
27	9.04	208.85	EOW	26.3	10.22	208.56		23.4	9.77	208.48	
28.2	8.59	209.30		27.5	9.69	209.09	REW	24	9.78	208.47	
29.5	8.48	209.41		29.4	9.35	209.43		25	9.87	208.38	
32	7.71	210.18		30.9	8.78	210.00	BKF	26	9.90	208.35	
36	6.07	211.82	HW	34.7	7.45	211.33	ToB	26.9	9.66	208.59	EOW
38.5	5.22	212.67	TOB	38.5	6.07	212.71		27.3	9.25	209.00	
43	4.92	212.97		44	5.76	213.02		28.4	8.83	209.42	
48	4.56	213.33		51	5.39	213.39	IR Rt	29.8	8.80	209.45	
51.7	4.43	213.46	IP	51	5.55	213.23		30.4	8.52	209.73	
								31.4	8.22	210.03	
								32	8.03	210.22	
								33	7.61	210.64	
								35	6.83	211.42	
								37	6.04	212.21	
								38.5	5.54	212.71	
								40	5.40	212.85	
								42	5.27	212.98	
								48	4.85	213.40	
								5136	4.80	213.45	
								51.7	4.75	213.50	IR Rt

Year 3			
Station	FS/BS	Elev.	Desc.
BM	5.02	213.71	IR Lt
HI		218.73	
-20	6.05	212.68	
-10	5.94	212.79	
0	5.62	213.11	GRND
5	5.81	212.92	
10	5.87	212.86	TOB
11.6	6.07	212.66	
13.8	6.73	212.00	
16	7.43	211.30	
17.5	8.15	210.58	
19	8.74	209.99	
20.3	9	209.73	
21.8	9.12	209.61	
22.3	9.83	208.90	EOW
23	10.2	208.53	
24	10.3	208.43	
25.5	10.37	208.36	
26.7	10.32	208.41	
27.2	9.83	208.90	EOW
28.3	9.4	209.33	
29.8	9.36	209.37	
32	8.62	210.11	
34	7.74	210.99	
36	7.01	211.72	
37.5	6.48	212.25	
38.7	6.12	212.61	
42	5.88	212.85	TOB
46	5.61	213.12	
49	5.48	213.25	
51.7	5.41	213.32	GRND
55	5.09	213.64	
60	4.98	213.75	
70	5.16	213.57	

Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

**Lick Creek Stream Restoration Site**

Lee County, NC

Cross Section No. 2 - Pool

Reach 1 - Wallace Branch - Sta 13+78

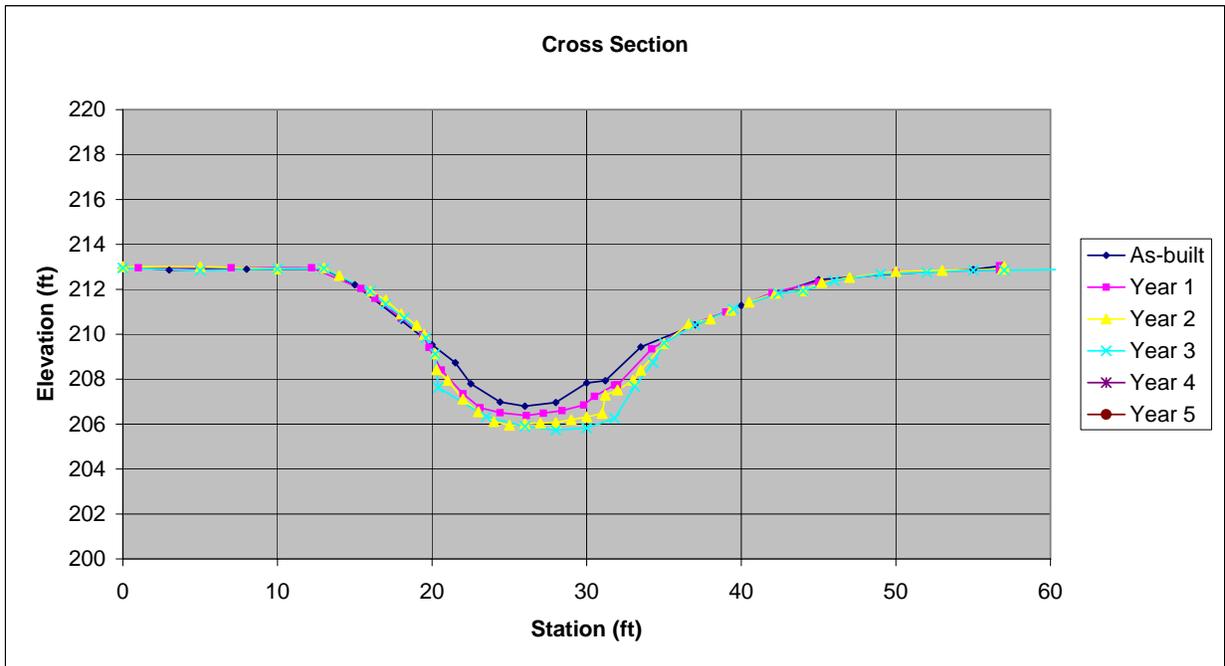


Year 2



Year 3

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	5/4/06	Date	11/17/06	Date	11/26/07	Date	10/23/08	Date	0/0/0	Date	0/0/0
Area	69.2	Area	72.3	Area	83.5	Area	88.1	Area	0.0	Area	0.0
Bkf W	27.3	Bkf W	25.7	Bkf W	26.2	Bkf W	26.2	Bkf W	10	Bkf W	10
Dmean	2.5	Dmean	2.8	Dmean	3.2	Dmean	3.4	Dmean	0.0	Dmean	0.0
Dmax	5.0	Dmax	5.2	Dmax	5.9	Dmax	6.1	Dmax	0.0	Dmax	0.0
W/d	10.8	W/d	9.1	W/d	8.2	W/d	7.8	W/d	0.0	W/d	0.0

**Lick Creek Stream Restoration Site**

Lee County, NC

Cross Section No. 2 - Pool

Reach 1 - Wallace Branch - Sta 13+78

As-Built				Year 1				Year 2			
Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.
BM	4.81	213.08	IR Lt	BM	4.87	213.08	IR Lt	BM	5.07	213.08	IR Lt
HI		217.89		HI		217.95		HI		218.15	
0	4.87	213.02	GRND	1	4.99	212.96		0	5.14	213.01	
3	5.03	212.86		7	4.99	212.96		5	5.14	213.01	
8	4.99	212.90		12.2	4.99	212.96	ToB	10	5.24	212.91	
13	4.98	212.91	TOB	15.4	5.91	212.04		13	5.19	212.96	
15	5.69	212.20		16.3	6.35	211.60	BKF	14	5.54	212.61	
18	7.27	210.62		18	7.21	210.74		16	6.23	211.92	
20	8.36	209.53		19.4	7.95	210.00		17	6.63	211.52	
21.5	9.16	208.73	EOW	19.8	8.54	209.41	LEW	18	7.24	210.91	
22.5	10.09	207.80		20.6	9.54	208.41		19	7.75	210.40	
24.4	10.91	206.98		22	10.60	207.35		19.5	8.16	209.99	
26	11.09	206.80		23.1	11.22	206.73		20.2	9.02	209.13	
28	10.93	206.96		24.4	11.44	206.51		20.3	9.73	208.42	EOW
30	10.06	207.83		26.1	11.57	206.38		21	10.20	207.95	
31.2	9.96	207.93		27.2	11.46	206.49		22	11.04	207.11	
33.5	8.46	209.43		28.4	11.35	206.60		23	11.60	206.55	
37	7.47	210.42		29.8	11.10	206.85		24	12.04	206.11	
40	6.61	211.28		30.5	10.71	207.24		25	12.20	205.95	
42.3	6.08	211.81	TOB	31.8	10.21	207.74		26	12.14	206.01	
45	5.46	212.43		32	10.20	207.75	TOE	27	12.10	206.05	
50	5.20	212.69		34.2	8.60	209.35	REW	28	12.08	206.07	
55	5.01	212.88		36.7	7.53	210.42		29	11.95	206.20	
56.9	4.84	213.05		39	6.96	210.99	BKF	30	11.83	206.32	
				42	6.10	211.85		31	11.68	206.47	
				45	5.62	212.33	ToB	31.2	10.86	207.29	
				50	5.21	212.74		32	10.63	207.52	
				56.7	5.08	212.87		33	10.20	207.95	
				56.7	4.90	213.05	IR Rt	33.5	9.75	208.40	EOW
								35	8.56	209.59	
								36.6	7.69	210.46	
								38	7.47	210.68	
								39.3	7.08	211.07	
								40.5	6.72	211.43	
								42.2	6.32	211.83	
								44	6.22	211.93	
								45.2	5.85	212.30	
								47	5.62	212.53	
								50	5.36	212.79	
								53	5.31	212.84	
								56.9	5.25	212.90	
								57	5.13	213.02	IR Rt

Year 3			
Station	FS/BS	Elev.	Desc.
BM	5.02	213.71	IR Lt
HI		218.73	
-20	5.77	212.96	
-10	6.03	212.70	
0	5.78	212.95	GRND
5	5.89	212.84	
10	5.82	212.91	
13	5.8	212.93	
16	6.81	211.92	TOB
17	7.39	211.34	
18.2	8.01	210.72	
19.6	8.89	209.84	
20.2	9.6	209.13	
20.4	11.1	207.63	
23.5	12.4	206.33	
26	12.84	205.89	
28	13	205.73	
30	12.9	205.83	
31.8	12.48	206.25	
33.1	11.05	207.68	
34.3	9.99	208.74	EOW
35	9.12	209.61	
37	8.32	210.41	
39.5	7.6	211.13	
42.4	6.9	211.83	TOB
44	6.8	211.93	
46	6.35	212.38	
49	6.05	212.68	
52	5.98	212.75	
55	5.88	212.85	
57	5.88	212.85	GRND
61	5.85	212.88	
70	5.85	212.88	

Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

**Lick Creek Stream Restoration Site**

Lee County, NC  
 Cross Section No. 3 - Riffle  
 Reach 2 - Lick Creek - Sta 13+37

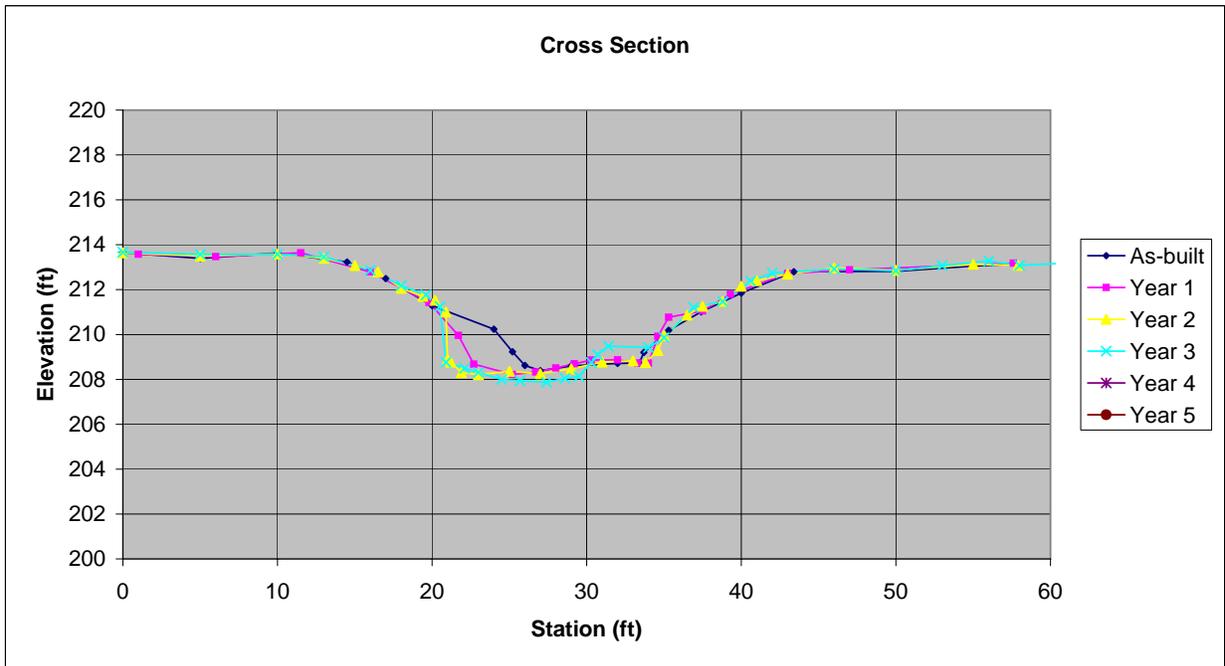


Year 2



Year 3

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	5/5/06	Date	11/17/06	Date	11/26/07	Date	10/23/08	Date	0/0/0	Date	0/0/0
Area	64.5	Area	68.0	Area	69.8	Area	69.4	Area	0.0	Area	0.0
Bkf W	28.9	Bkf W	27	Bkf W	26.4	Bkf W	26.4	Bkf W	10	Bkf W	10
Dmean	2.2	Dmean	2.5	Dmean	2.6	Dmean	2.6	Dmean	0.0	Dmean	0.0
Dmax	4.4	Dmax	4.5	Dmax	4.5	Dmax	4.8	Dmax	0.0	Dmax	0.0
W/d	13.0	W/d	10.7	W/d	10.0	W/d	10.0	W/d	0.0	W/d	0.0



### Lick Creek Stream Restoration Site

Lee County, NC  
 Cross Section No. 4 - Pool  
 Reach 2 - Lick Creek - Sta 15+91

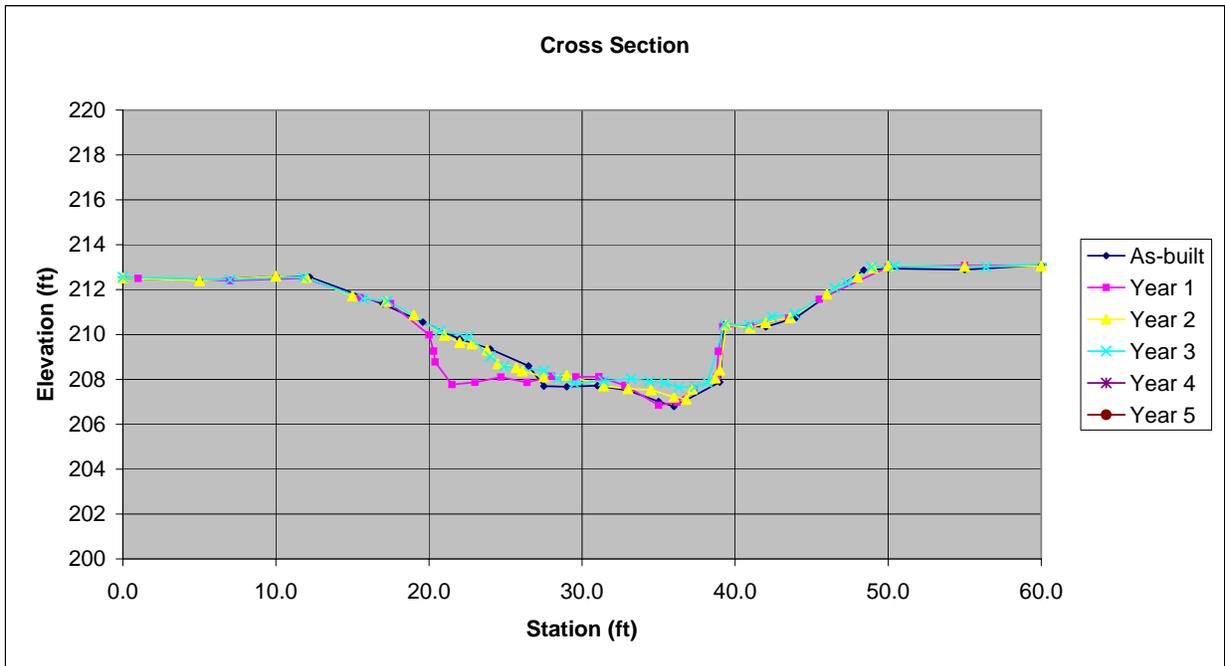


Year 2



Year 3

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	5/5/06	Date	11/17/06	Date	11/26/07	Date	10/23/08	Date	0/0/0	Date	0/0/0
Area	105.2	Area	109.7	Area	102.9	Area	96.2	Area	0.0	Area	0.0
Bkf W	36.2	Bkf W	38.1	Bkf W	36	Bkf W	36	Bkf W	10	Bkf W	10
Dmean	2.9	Dmean	2.9	Dmean	2.9	Dmean	2.7	Dmean	0.0	Dmean	0.0
Dmax	5.8	Dmax	5.7	Dmax	5.4	Dmax	4.9	Dmax	0.0	Dmax	0.0
W/d	12.5	W/d	13.2	W/d	12.6	W/d	13.5	W/d	0.0	W/d	0.0

**Lick Creek Stream Restoration Site**

Lee County, NC  
Cross Section No. 4 - Pool  
Reach 2 - Lick Creek - Sta 15+91

As-Built				Year 1				Year 2			
Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.
BM	5.27	212.56	IR Lt	BM	5.80	212.56	IR Lt	BM	6.00	212.56	IR Lt
HI		217.83		HI		218.36		HI		218.56	
0.0	5.31	212.52		1.0	5.86	212.50		0	6.04	212.52	
5.0	5.42	212.41		7.0	5.96	212.40		5	6.17	212.39	
10.0	5.23	212.60		11.9	5.85	212.51	ToB	10	5.96	212.60	
12.2	5.27	212.56	TOB	15.5	6.72	211.64	BKF	12	6.02	212.54	
17.0	6.47	211.36		17.5	6.98	211.38		15	6.84	211.72	
19.6	7.28	210.55	HW	20.0	8.38	209.98		17.2	7.09	211.47	
22.0	8.03	209.80		20.3	9.10	209.26	LEW	19	7.69	210.87	
24.0	8.48	209.35		20.4	9.58	208.78	TOE	21	8.60	209.96	
26.5	9.23	208.60	EW	21.5	10.59	207.77		22	8.92	209.64	
27.5	10.13	207.70		23.0	10.49	207.87		22.8	8.98	209.58	
29.0	10.16	207.67		24.7	10.26	208.10		23.8	9.26	209.30	
31.0	10.11	207.72		26.4	10.50	207.86		24.5	9.87	208.69	
33.0	10.32	207.51		28.0	10.22	208.14		25.7	10.04	208.52	
35.0	10.82	207.01		29.6	10.25	208.11		26.1	10.19	208.37	EOW
36.0	11.04	206.79		31.1	10.24	208.12		27.5	10.44	208.12	
39.0	9.95	207.88		32.8	10.63	207.73		29	10.38	208.18	
39.3	7.39	210.44		35.0	11.51	206.85		31.4	10.85	207.71	
42.0	7.49	210.34		36.2	11.38	206.98		33	10.98	207.58	
44.0	7.07	210.76		37.3	10.77	207.59		34.5	11.03	207.53	
46.0	6.11	211.72		38.8	10.26	208.10	TOE	36	11.35	207.21	
48.4	4.96	212.87	TOB	38.9	9.11	209.25	REW	36.8	11.45	207.11	
50.0	4.89	212.94		39.2	8.01	210.35		37.2	10.99	207.57	
55.0	4.94	212.89		41.0	7.99	210.37		38.7	10.50	208.06	
60.0	4.74	213.09		43.5	7.63	210.73		39	10.15	208.41	EOW
63.2	4.61	213.22	IP RT	45.5	6.79	211.57	BKF	39.4	8.13	210.43	
				50.0	5.35	213.01	ToB	41	8.25	210.31	
				55.0	5.28	213.08		42	8.03	210.53	
				61.0	5.28	213.08		43.6	7.81	210.75	
				63.0	5.25	213.11		46	6.76	211.80	
				63.0	5.16	213.20	IR Rt	48	6.00	212.56	
								49	5.60	212.96	
								50	5.50	213.06	
								55	5.52	213.04	
								60	5.51	213.05	
								63.3	5.49	213.07	GROUND

Year 3			
Station	FS/BS	Elev.	Desc.
BM	8.72	209.63	IR Lt
HI		218.35	
-20	5.43	212.92	
-10	5.73	212.62	
0	5.79	212.56	GRND
7	5.91	212.44	
11.8	5.79	212.56	TOB
15.7	6.75	211.60	
17.3	6.84	211.51	
20.7	8.19	210.16	
22.6	8.45	209.90	
24	9.34	209.01	
24.9	9.77	208.58	
27.5	9.96	208.39	
28.4	10.29	208.06	EOW
29.5	10.53	207.82	
31.4	10.42	207.93	
33.2	10.32	208.03	
34.4	10.43	207.92	
35.4	10.50	207.85	
36.3	10.71	207.64	
37.4	10.68	207.67	
38.2	10.49	207.86	
39.3	7.91	210.44	
40.9	7.92	210.43	
42.4	7.55	210.80	
43.9	7.44	210.91	
46.5	6.28	212.07	
47.3	6.05	212.30	
48.9	5.35	213	TOB
50.4	5.3	213.05	
56.4	5.34	213.01	
62	5.12	213.23	
63.3	5.25	213.1	GRND
68	5.26	213.09	
71	5.16	213.19	

Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

### Lick Creek Stream Restoration Site

Lee County, NC  
 Cross Section No. 5 - Riffle  
 Reach 3 - Lick Creek - Sta 14+41.5

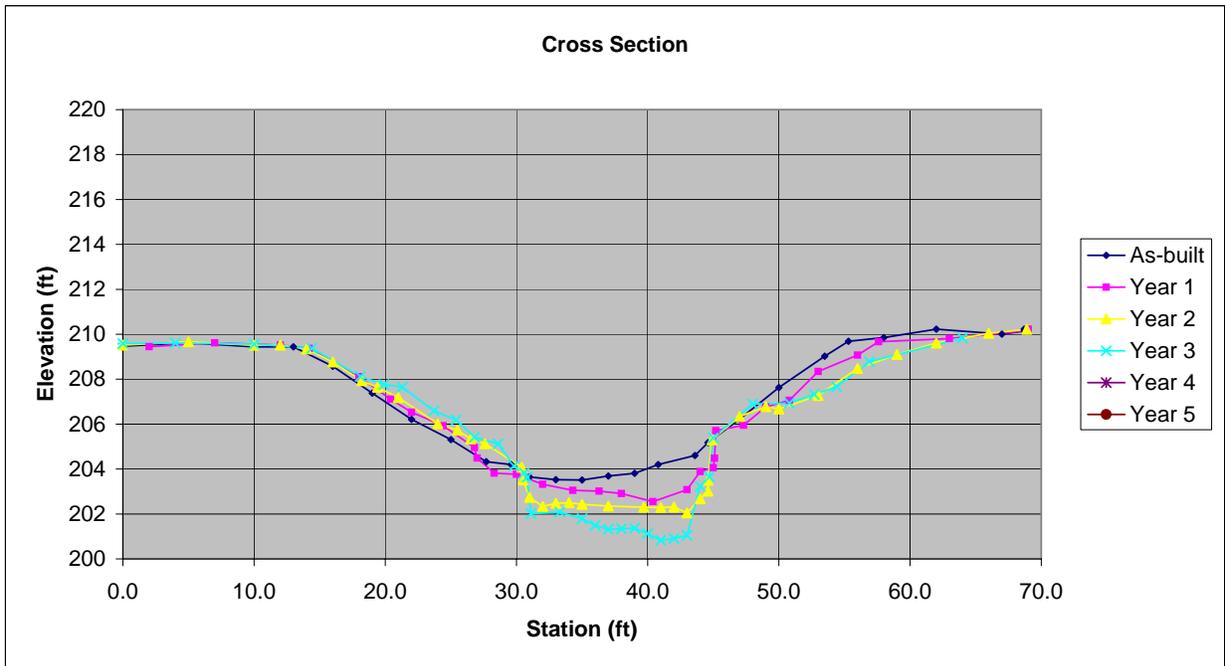


Year 2



Year 3

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	5/5/06	Date	11/17/06	Date	11/26/07	Date	10/24/08	Date	0/0/0	Date	0/0/0
Area	150.3	Area	162.1	Area	160.2	Area	164.0	Area	0.0	Area	0.0
Bkf W	42.3	Bkf W	43.4	Bkf W	44.5	Bkf W	44.5	Bkf W	10	Bkf W	10
Dmean	3.6	Dmean	3.7	Dmean	3.6	Dmean	3.7	Dmean	0.0	Dmean	0.0
Dmax	5.9	Dmax	6.8	Dmax	7.0	Dmax	8.3	Dmax	0.0	Dmax	0.0
W/d	11.9	W/d	11.6	W/d	12.4	W/d	12.1	W/d	0.0	W/d	0.0



### Lick Creek Stream Restoration Site

Lee County, NC

Cross Section No. 6 - Pool

Reach 3 - Lick Creek - Sta 15+73.5

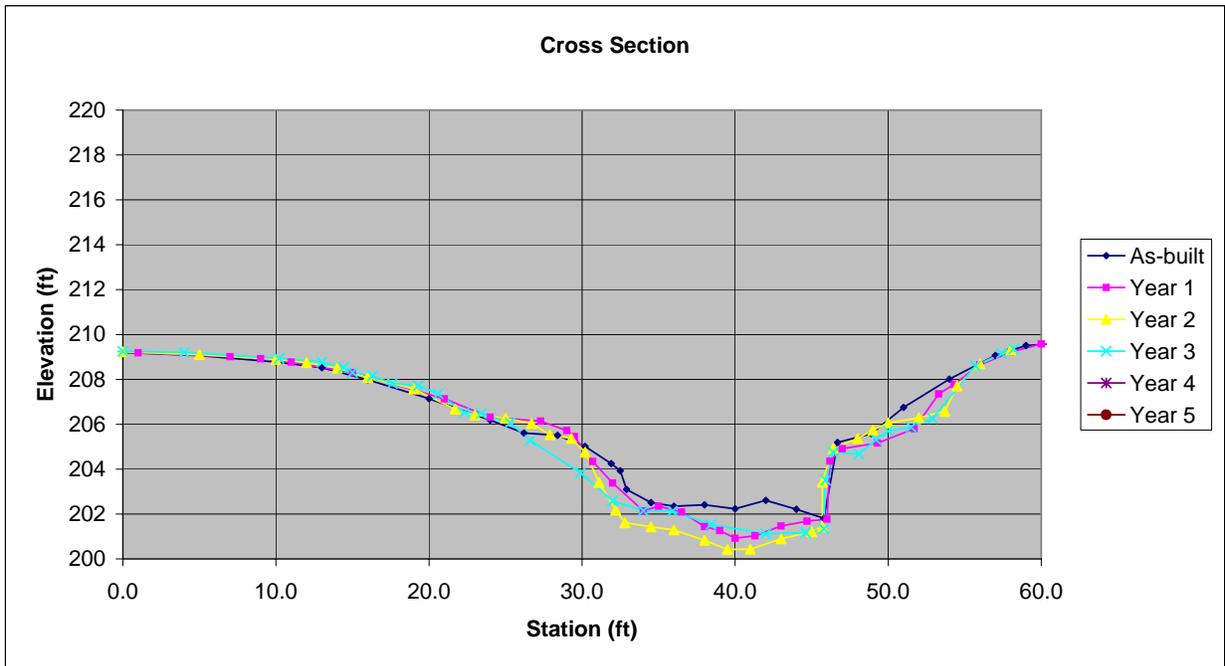


Year 2



Year 3

Facing Downstream



As-Built		Year 1		Year 2		Year 3		Year 4		Year 5	
Date	5/5/06	Date	11/17/06	Date	11/26/07	Date	10/24/08	Date	0/0/0	Date	0/0/0
Area	140.7	Area	164.1	Area	170.9	Area	169.4	Area	0.0	Area	0.0
Bkf W	43	Bkf W	45	Bkf W	43	Bkf W	43	Bkf W	10	Bkf W	10
Dmean	3.3	Dmean	3.6	Dmean	4.0	Dmean	3.9	Dmean	0.0	Dmean	0.0
Dmax	6.7	Dmax	7.8	Dmax	8.3	Dmax	7.6	Dmax	0.0	Dmax	0.0
W/d	13.1	W/d	12.3	W/d	10.8	W/d	10.9	W/d	0.0	W/d	0.0

Lick Creek Stream Restoration Site												
Lee County, NC												
Cross Section No. 6 - Pool												
Reach 3 - Lick Creek - Sta 15+73.5												
As-Built				Year 1				Year 2				
Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.	Station	FS/BS	Elev.	Desc.	
BM		209.31	IR Lt	BM	4.77	209.31	IR Lt	BM	5.87	209.31	IR Lt	
HI	5.40	214.71		HI		214.08		HI		215.18		
0.0	5.51	209.20	GRND	1.0	4.90	209.18		0	5.95	209.23		
5.0	5.65	209.06		7.0	5.07	209.01		5	6.08	209.10		
10.0	5.93	208.78		9.0	5.16	208.92	ToB	10	6.29	208.89		
13.0	6.19	208.52	TOB	11.0	5.31	208.77		12	6.43	208.75		
16.0	6.73	207.98		15.0	5.78	208.30		14	6.68	208.50		
20.0	7.57	207.14		21.0	6.95	207.13	BKF	16	7.10	208.08		
24.0	8.53	206.18		24.0	7.76	206.32		19	7.61	207.57		
26.2	9.10	205.61		27.3	7.94	206.14		21.7	8.51	206.67		
28.4	9.20	205.51		29.0	8.36	205.72		23	8.77	206.41		
30.2	9.70	205.01		29.5	8.63	205.45		25	8.91	206.27		
31.9	10.46	204.25		30.7	9.74	204.34	LEW	26.7	9.15	206.03		
32.5	10.78	203.93	EOW	32.0	10.70	203.38		27.9	9.65	205.53		
32.9	11.61	203.10		34.0	11.94	202.14	TOE	29.3	9.81	205.37		
34.5	12.20	202.51		35.0	11.73	202.35		30.2	10.42	204.76		
36.0	12.36	202.35		36.5	11.99	202.09		31.1	11.78	203.40	EOW	
38.0	12.30	202.41		38.0	12.64	201.44		32.2	13.00	202.18		
40.0	12.48	202.23		39.0	12.82	201.26		32.8	13.57	201.61		
42.0	12.10	202.61		40.0	13.16	200.92		34.5	13.75	201.43		
44.0	12.50	202.21		41.3	13.05	201.03		36	13.89	201.29		
45.8	12.90	201.81		43.0	12.61	201.47		38	14.35	200.83		
46.7	9.52	205.19		44.7	12.40	201.68		39.5	14.76	200.42		
48.9	9.13	205.58		46.0	12.31	201.77	REW	41	14.75	200.43		
51.0	7.96	206.75		46.2	9.73	204.35		43	14.29	200.89		
54.0	6.70	208.01		47.0	9.17	204.91		45	13.97	201.21		
56.0	6.00	208.71		49.3	8.92	205.16		45.7	13.75	201.43		
57.0	5.64	209.07	TOB	51.7	8.28	205.80		45.7	11.76	203.42	EOW LOG	
59.0	5.20	209.51		53.3	6.73	207.35		46.4	10.27	204.91		
62.0	5.06	209.65		54.3	6.30	207.78	BKF	48	9.82	205.36		
66.0	4.72	209.99		56.0	5.43	208.65		49	9.44	205.74		
70.9	4.68	210.03		58.0	4.86	209.22	ToB	50	9.12	206.06		
70.9	4.56	210.15	IR RT	60.0	4.50	209.58		52	8.89	206.29		
				64.0	4.43	209.65		53.7	8.61	206.57		
				68.0	3.96	210.12	IR Rt	54.5	7.47	207.71		
				71.0	4.12	209.96		56	6.48	208.70		
								58	5.87	209.31		
								60	5.59	209.59		
								61.3	5.59	209.59		
								62	5.94	209.24		
								65	5.96	209.22		
								67	5.38	209.80		
								70.9	5.23	209.95	GROUND	

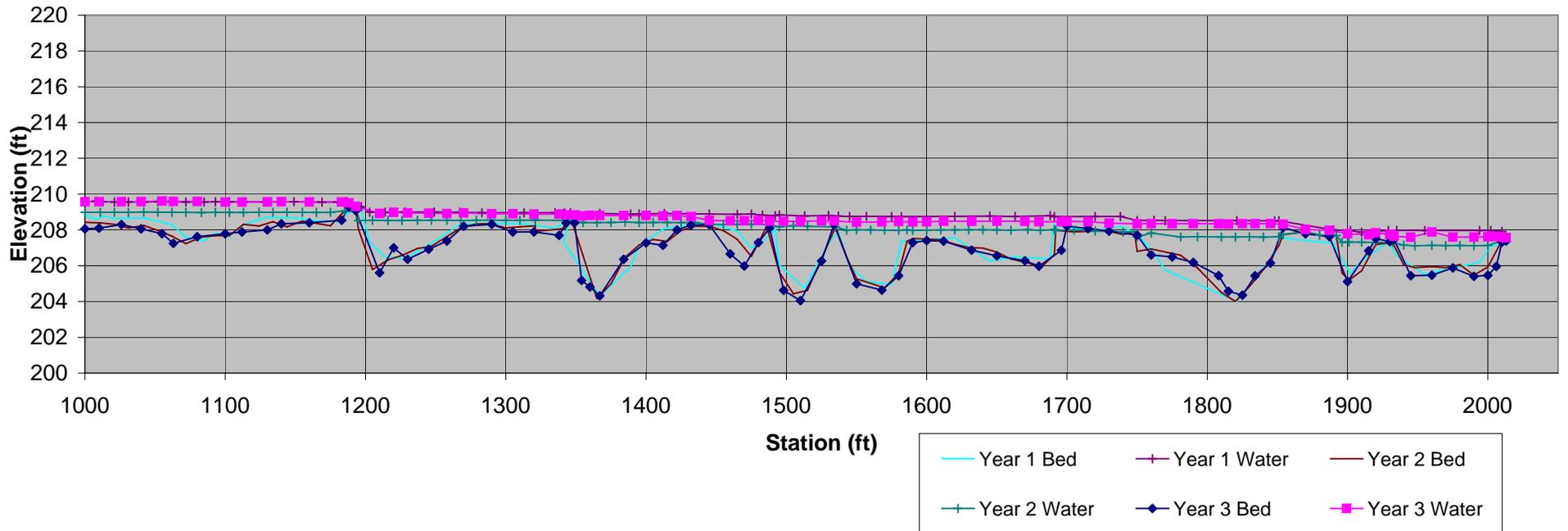
Year 3			
Station	FS/BS	Elev.	Desc.
BM	10.57	204.58	IR Lt
HI		215.15	
-18	6.33	208.82	
-15	5.99	209.16	
-5	6.02	209.13	
0	5.90	209.25	GRND
4	5.95	209.20	
10.2	6.22	208.93	
13	6.38	208.77	TOB
14.4	6.63	208.52	
15	6.84	208.31	
16.3	6.99	208.16	
17.6	7.33	207.82	
19.3	7.43	207.72	
20.6	7.79	207.36	
22.3	8.62	206.53	
23.4	8.68	206.47	
25.3	9.08	206.07	
26.6	9.87	205.28	
29.9	11.31	203.84	EOW
32	12.57	202.58	
34	13.00	202.15	
35.9	13.02	202.13	
38.4	13.62	201.53	
42	14.03	201.12	
44.6	13.98	201.17	
45.8	13.81	201.34	
45.9	11.64	203.51	EOW LOG
46.4	10.40	204.75	
48.1	10.47	204.68	
49.2	9.84	205.31	
50	9.46	205.69	
51.5	9.28	205.87	
52.9	8.9	206.25	
55.7	6.56	208.59	TOB
57.4	5.99	209.16	
58.2	5.79	209.36	
60.5	5.49	209.66	
62	5.92	209.23	
65	5.92	209.23	
68.9	5.39	209.76	
70.9	5.21	209.94	GRND
72	5.15	210	
76	6.03	209.12	
79	6.22	208.93	

Year 4			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Year 5			
Station	FS/BS	Elev.	Desc.
BM	0.00	100.00	IR Lt
HI		100.00	

Lick Creek Stream Restoration Site  
Lee County, NC  
Profile Reach 1 - Wallace Branch

Profile



**Lick Creek Stream Restoration Site**

Lee County, NC

Profile Reach 1 - Wallace Branch

**Year 3**

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
218.73	1000	10.67	208.06		209.57			Begin Profile
218.73	1010	10.63	208.10		209.57			
218.73	1026	10.43	208.30	1.27	209.57			
218.73	1040	10.67	208.06	1.52	209.58			
218.73	1055	10.94	207.79	1.82	209.61			
218.73	1063	11.48	207.25	2.34	209.59			Pool
218.73	1080	11.11	207.62	1.97	209.59			
218.73	1100	10.94	207.79	1.76	209.55			
218.73	1112	10.85	207.88	1.67	209.55			
218.73	1130	10.73	208.00	1.56	209.56			HoR
218.73	1140	10.39	208.34	1.23	209.57			
218.73	1160	10.33	208.40	1.16	209.56			
218.73	1183	10.19	208.54	1.02	209.56			
218.73	1188	9.44	209.29	0.22	209.51			
218.73	1193	9.65	209.08	0.23	209.31			Log Vane INV
218.73	1210	13.13	205.60	3.32	208.92			Pool
218.73	1220	11.73	207.00	1.98	208.98			
218.73	1230	12.37	206.36	2.59	208.95			
218.73	1245	11.81	206.92	2.01	208.93			
218.73	1258	11.35	207.38	1.53	208.91			
218.73	1270	10.53	208.20	0.75	208.95			
218.73	1290	10.42	208.31	0.59	208.90			
218.73	1305	10.85	207.88	1.02	208.90			
218.73	1320	10.84	207.89	0.99	208.88			
218.73	1338	11.04	207.69	1.19	208.88			
218.73	1343	10.34	208.39	0.45	208.84			
218.73	1349	10.33	208.40	0.43	208.83			Log Vane INV
218.73	1354	13.55	205.18	3.60	208.78			
218.73	1360	13.92	204.81	4.00	208.81			
218.73	1367	14.41	204.32	4.49	208.81			
218.73	1384	12.37	206.36	2.44	208.80			
218.73	1400	11.45	207.28	1.53	208.81			
218.73	1412	11.59	207.14	1.64	208.78			
218.73	1422	10.73	208.00	0.80	208.80			
218.73	1432	10.46	208.27	0.47	208.74			
218.55	1445	10.26	208.29	0.24	208.53			
218.55	1460	11.89	206.66	1.85	208.51			
218.55	1470	12.57	205.98	2.53	208.51			Confluence with trib
218.55	1480	11.26	207.29	1.23	208.52			
218.55	1488	10.44	208.11	0.38	208.49			Log Vane INV
218.55	1498	13.93	204.62	3.85	208.47			
218.55	1510	14.50	204.05	4.44	208.49			
218.55	1525	12.29	206.26	2.24	208.50			
218.55	1534	10.23	208.32	0.18	208.50			RCV INV
218.55	1550	13.56	204.99	3.43	208.42			
218.55	1568	13.91	204.64	3.81	208.45			
218.55	1580	13.11	205.44	3.03	208.47			
218.55	1590	11.26	207.29	1.15	208.44			
218.55	1600	11.15	207.40	1.05	208.45			
218.55	1612	11.18	207.37	1.12	208.49			
218.55	1632	11.68	206.87	1.61	208.48			
218.55	1650	12.00	206.55	1.94	208.49			
218.55	1670	12.27	206.28	2.20	208.48			
218.55	1680	12.58	205.97	2.49	208.46			
218.55	1696	11.69	206.86	1.60	208.46			
218.55	1700	10.34	208.21	0.27	208.48			
218.55	1715	10.48	208.07	0.39	208.46			
215.22	1730	7.29	207.93	0.45	208.38			
215.22	1750	7.51	207.71	0.63	208.34			
215.22	1760	8.62	206.60	1.75	208.35			
215.22	1775	8.73	206.49	1.85	208.34			
215.22	1790	9.04	206.18	2.17	208.35			
215.22	1808	9.77	205.45	2.89	208.34			
215.22	1815	10.65	204.57	3.76	208.33			
215.22	1825	10.87	204.35	4.00	208.35			
215.22	1834	9.79	205.43	2.92	208.35			
215.22	1845	9.07	206.15	2.20	208.35			

**Lick Creek Stream Restoration Site**

Lee County, NC

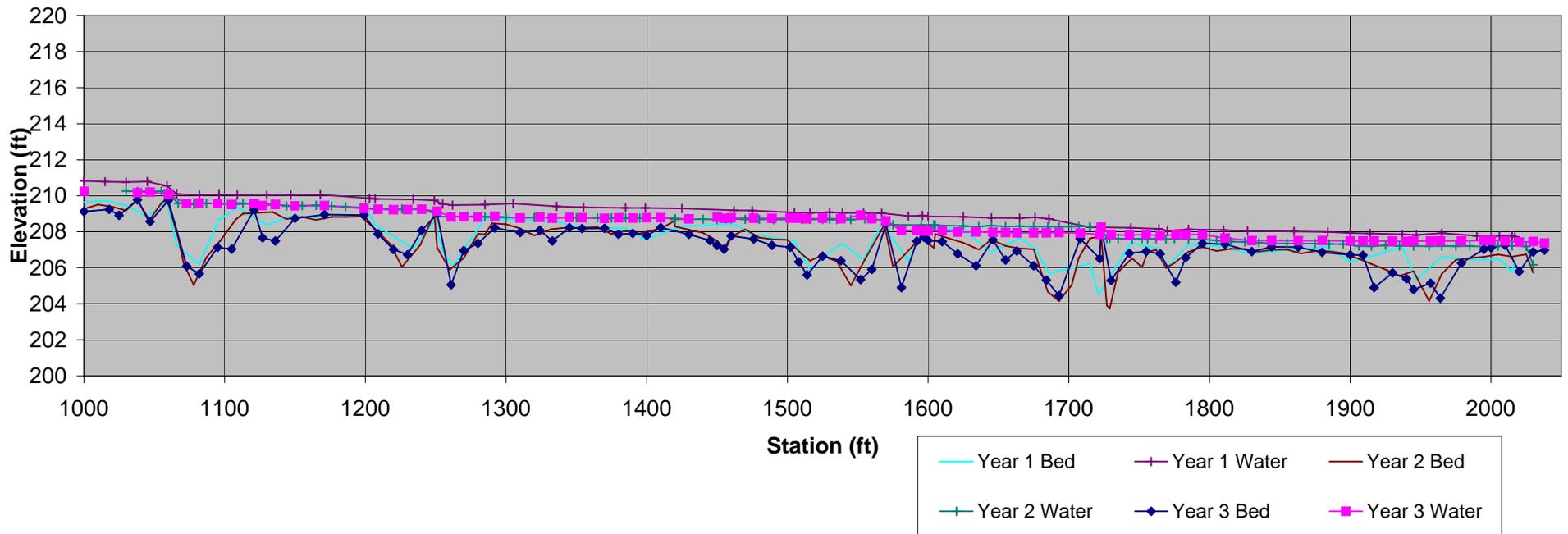
Profile Reach 1 - Wallace Branch

**Year 3**

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
215.22	1854	7.09	208.13	0.19	208.32			
215.22	1870	7.44	207.78	0.25	208.03			
215.22	1887	7.59	207.63	0.35	207.98			
215.22	1900	10.11	205.11	2.68	207.79			
215.22	1915	8.39	206.83	0.90	207.73			
215.22	1920	7.71	207.51	0.33	207.84			
215.22	1930	7.87	207.35	0.40	207.75			
215.22	1933	7.75	207.47	0.18	207.65			Log Vane INV
216.85	1945	11.41	205.44	2.15	207.59			
216.85	1960	11.38	205.47	2.41	207.88			
216.85	1975	10.97	205.88	1.72	207.60			
216.85	1990	11.45	205.40	2.20	207.60			
216.85	2000	11.39	205.46	2.15	207.61			
216.85	2006	10.89	205.96	1.66	207.62			
216.85	2010	9.54	207.31	0.29	207.60			
216.85	2013	9.47	207.38	0.19	207.57			End Profile

Lick Creek Stream Restoration Site  
Lee County, NC  
Profile Reach 2 - Lick Creek

Profile



**Lick Creek Stream Restoration Site**

Lee County, NC

Profile Reach 2 - Lick Creek

**Year 2**

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
220.01	1000	10.89	209.12	1.12	210.24			Begin Profile
220.01	1018	10.77	209.24	0.97				
220.01	1025	11.1	208.91	1.29				
220.01	1038	10.24	209.77	0.40	210.17			
220.01	1047	11.45	208.56	1.64	210.20			
220.01	1060	10.27	209.74	0.33	210.07			RCV INV
220.01	1073	13.92	206.09	3.48	209.57			Pool
220.01	1082	14.34	205.67	3.92	209.59			
220.01	1095	12.88	207.13	2.43	209.56			
220.01	1105	12.97	207.04	2.47	209.51			
220.01	1121	10.8	209.21	0.35	209.56			
220.01	1127	12.35	207.66	1.79	209.45			
220.01	1136	12.52	207.49	2.02	209.51			
220.01	1150	11.27	208.74	0.70	209.44			
220.01	1171	11.06	208.95	0.50	209.45			
220.01	1199	11.09	208.92	0.37	209.29			
220.01	1209	12.13	207.88	1.36	209.24			
220.01	1220	12.99	207.02	2.20	209.22			
220.01	1230	13.28	206.73	2.50	209.23			
220.01	1240	11.94	208.07	1.18	209.25			
218.86	1251	9.87	208.99	0.15	209.14			Log Vane INV
218.86	1261	13.8	205.06	3.76	208.82			Pool
218.86	1270	11.9	206.96	1.88	208.84			
218.86	1280	11.5	207.36	1.45	208.81			
218.86	1292	10.65	208.21	0.65	208.86			
218.86	1310	10.9	207.96	0.80	208.76			
218.86	1324	10.78	208.08	0.72	208.80			
218.86	1333	11.37	207.49	1.26	208.75			
218.86	1345	10.63	208.23	0.56	208.79			
218.86	1354	10.68	208.18	0.60	208.78			
218.86	1370	10.67	208.19	0.55	208.74			
218.86	1380	11	207.86	0.91	208.77			
218.86	1390	10.95	207.91	0.85	208.76			
218.86	1400	11.07	207.79	0.99	208.78			
218.86	1410	10.63	208.23	0.55	208.78			
218.86	1430	11	207.86	0.85	208.71			
218.86	1445	11.35	207.51	1.25				
218.35	1450	11.11	207.24	1.57	208.81			
218.35	1455	11.32	207.03	1.71	208.74			
218.35	1460	10.58	207.77	1.00	208.77			
218.35	1476	10.75	207.60	1.15	208.75			
218.35	1489	11.1	207.25	1.49	208.74			
218.35	1502	11.21	207.14	1.62	208.76			
218.35	1508	12.02	206.33	2.42	208.75			
218.35	1514	12.75	205.60	3.11	208.71			
218.35	1525	11.7	206.65	2.10	208.75			
218.35	1538	11.96	206.39	2.33	208.72			
218.35	1552	13.01	205.34	3.58	208.92			
218.35	1560	12.44	205.91	2.81	208.72			
218.35	1570	9.92	208.43	0.17	208.60			RCV INV
218.35	1581	13.45	204.90	3.17	208.07			
218.35	1592	10.87	207.48	0.61	208.09			
218.35	1597	10.65	207.70	0.35	208.05			
218.35	1600	10.83	207.52	0.52	208.04			
218.35	1610	10.9	207.45	0.62	208.07			
218.35	1621	11.57	206.78	1.20	207.98			
218.35	1634	12.24	206.11	1.88	207.99			
218.35	1646	10.8	207.55	0.42	207.97			
218.35	1655	11.92	206.43	1.52	207.95			
218.35	1663	11.42	206.93	1.01	207.94			
218.35	1675	12.24	206.11	1.83	207.94			
218.35	1684	13.04	205.31	2.63	207.94			
218.35	1693	13.89	204.46	3.49	207.95			
218.35	1708	10.73	207.62	0.30	207.92			
218.35	1722	11.84	206.51	1.35	207.86			Log Vane INV
218.35	1723	10.1	208.25	0.00	208.25			
218.35	1730	13.05	205.30	2.54	207.84			

**Lick Creek Stream Restoration Site**

Lee County, NC

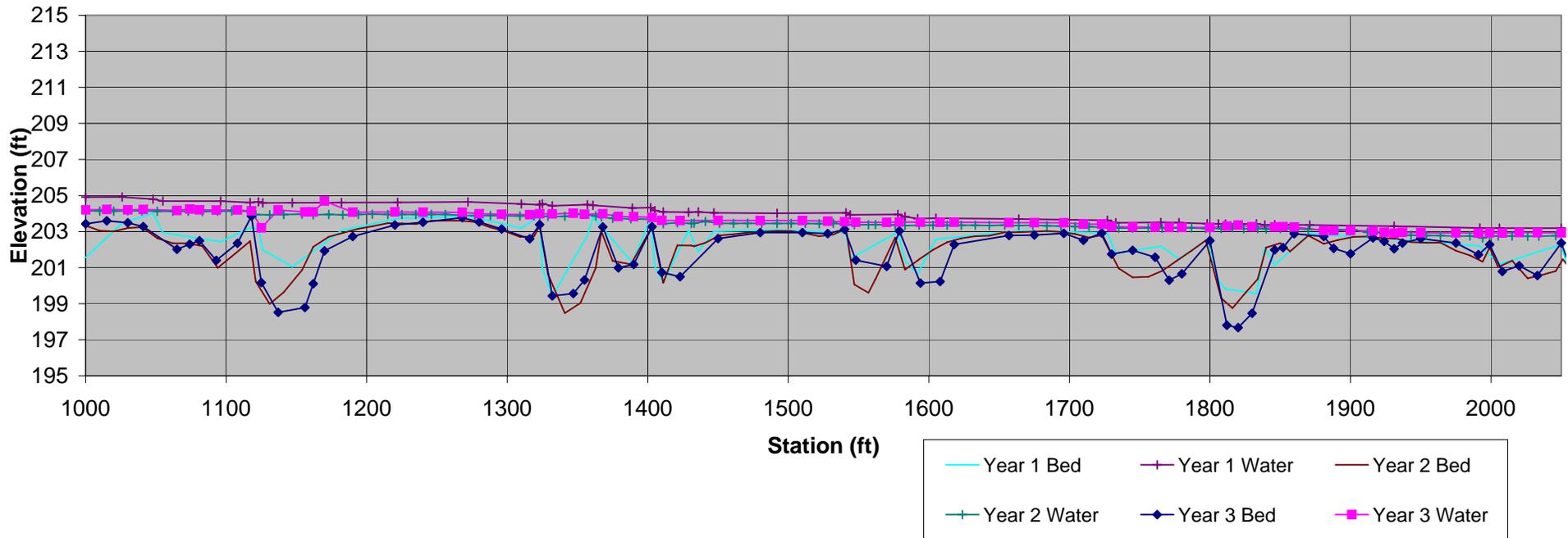
Profile Reach 2 - Lick Creek

Year 2

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
218.35	1743	11.54	206.81	1.00	207.81			
218.35	1755	11.44	206.91	0.95	207.86			
218.91	1765	12.14	206.77	1.00	207.77			Log Vane INV
218.91	1776	13.71	205.20	2.65	207.85			
218.91	1783	12.35	206.56	1.29	207.85			
218.91	1795	11.55	207.36	0.49	207.85			
218.91	1811	11.6	207.31	0.34	207.65			
218.91	1830	12.01	206.90	0.61	207.51			
218.91	1844	11.75	207.16	0.35	207.51			
218.91	1863	11.76	207.15	0.35	207.50			
218.91	1880	12.05	206.86	0.65	207.51			
218.91	1900	12.19	206.72	0.76	207.48			
218.91	1909	12.21	206.70	0.79	207.49			
218.91	1917	14.01	204.90	2.59	207.49			
218.91	1930	13.19	205.72	1.76	207.48			
218.91	1940	13.52	205.39	2.07	207.46			
218.91	1945	14.12	204.79	2.69	207.48			
218.91	1957	13.76	205.15	2.33	207.48			
218.91	1964	14.6	204.31	3.18	207.49			
218.91	1979	12.65	206.26	1.23	207.49			
218.91	1995	11.88	207.03	0.49	207.52			
218.91	2000	11.8	207.11	0.41	207.52			
218.91	2010	11.65	207.26	0.23	207.49			
218.91	2020	13.12	205.79	1.63	207.42			
218.91	2030	12.03	206.88	0.58	207.46			
218.91	2038	11.93	206.98	0.39	207.37			End Profile

Lick Creek Stream Restoration Site  
Lee County, NC  
Profile Reach 3 - Lick Creek

Profile



**Lick Creek Stream Restoration Site**

Lee County, NC

Profile Reach 3 - Lick Creek

**Year 2**

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
215.67	1000	12.24	203.43	0.78	204.21			Begin Profile
215.67	1015	12.07	203.60	0.63	204.23			
215.67	1030	12.18	203.49	0.72	204.21			
215.67	1041	12.39	203.28	0.95	204.23			Log Vane INV
215.67	1065	13.65	202.02	2.15	204.17			Pool
215.67	1074	13.37	202.30	1.95	204.25			Pool
215.67	1081	13.18	202.49	1.72	204.21			Pool
215.67	1093	14.27	201.40	2.79	204.19			
215.67	1108	13.32	202.35	1.85	204.20			
215.67	1118	11.81	203.86	0.29	204.15			Log Vane INV
215.67	1125	15.50	200.17	3.04	203.21			Pool
215.67	1137	17.15	198.52	5.68	204.20			
215.67	1156	16.88	198.79	5.30	204.09			
215.67	1162	15.56	200.11	3.98	204.09			
215.67	1170	13.74	201.93	2.76	204.69			Glide
215.67	1190	12.94	202.73	1.35	204.08			
215.67	1220	12.30	203.37	0.72	204.09			
215.67	1240	12.15	203.52	0.56	204.08			
215.67	1268	11.90	203.77	0.30	204.07			
215.67	1280	12.14	203.53	0.46	203.99			
215.67	1296	12.53	203.14	0.82	203.96			
215.67	1316	13.07	202.60	1.34	203.94			
215.67	1323	12.28	203.39	0.60	203.99			Log Vane INV
215.67	1332	16.24	199.43	4.55	203.98			Pool
215.67	1347	16.11	199.56	4.46	204.02			
215.67	1355	15.35	200.32	3.64	203.96			
215.67	1368	12.41	203.26	0.73	203.99			Rock Vane INV
215.15	1379	14.16	200.99	2.85	203.84			
215.15	1390	13.97	201.18	2.65	203.83			
215.15	1403	11.88	203.27	0.52	203.79			Log Vane INV
215.15	1410	14.41	200.74	2.88	203.62			Pool
215.15	1423	14.65	200.50	3.11	203.61			
215.15	1450	12.54	202.61	1.01	203.62			
215.15	1480	12.2	202.95	0.66	203.61			
215.15	1510	12.2	202.95	0.66	203.61			
215.15	1528	12.26	202.89	0.69	203.58			
215.15	1540	12.03	203.12	0.43	203.55			
215.15	1548	13.73	201.42	2.10	203.52			
215.15	1570	14.08	201.07	2.44	203.51			
215.15	1579	12.11	203.04	0.49	203.53			
215.15	1594	15.01	200.14	3.38	203.52			
215.15	1608	14.92	200.23	3.28	203.51			
215.15	1618	12.86	202.29	1.23	203.52			
215.15	1657	12.36	202.79	0.71	203.50			
215.15	1675	12.34	202.81	0.69	203.50			
215.15	1696	12.25	202.90	0.59	203.49			
215.15	1710	12.63	202.52	0.90	203.42			
215.15	1723	12.23	202.92	0.49	203.41			Log Vane INV
215.15	1730	13.4	201.75	1.52	203.27			Pool
215.15	1745	13.19	201.96	1.30	203.26			
215.15	1761	13.57	201.58	1.66	203.24			
215.15	1771	14.85	200.30	2.93	203.23			
215.15	1780	14.49	200.66	2.57	203.23			
215.15	1800	12.65	202.50	0.73	203.23			
213.87	1812	16.07	197.80	5.51	203.31			
213.87	1820	16.2	197.67	5.69	203.36			
213.87	1830	15.4	198.47	4.80	203.27			
213.87	1846	11.88	201.99	1.27	203.26			Log Vane INV
213.87	1852	11.76	202.11	1.16	203.27			
213.87	1860	10.99	202.88	0.38	203.26			HoR
213.87	1881	11.14	202.73	0.33	203.06			
213.87	1888	11.8	202.07	0.99	203.06			
213.87	1900	12.1	201.77	1.29	203.06			
213.87	1916	11.22	202.65	0.39	203.04			
213.87	1924	11.41	202.46	0.50	202.96			
213.87	1931	11.82	202.05	0.86	202.91			
213.87	1937	11.5	202.37	0.59	202.96			

**Lick Creek Stream Restoration Site**

Lee County, NC

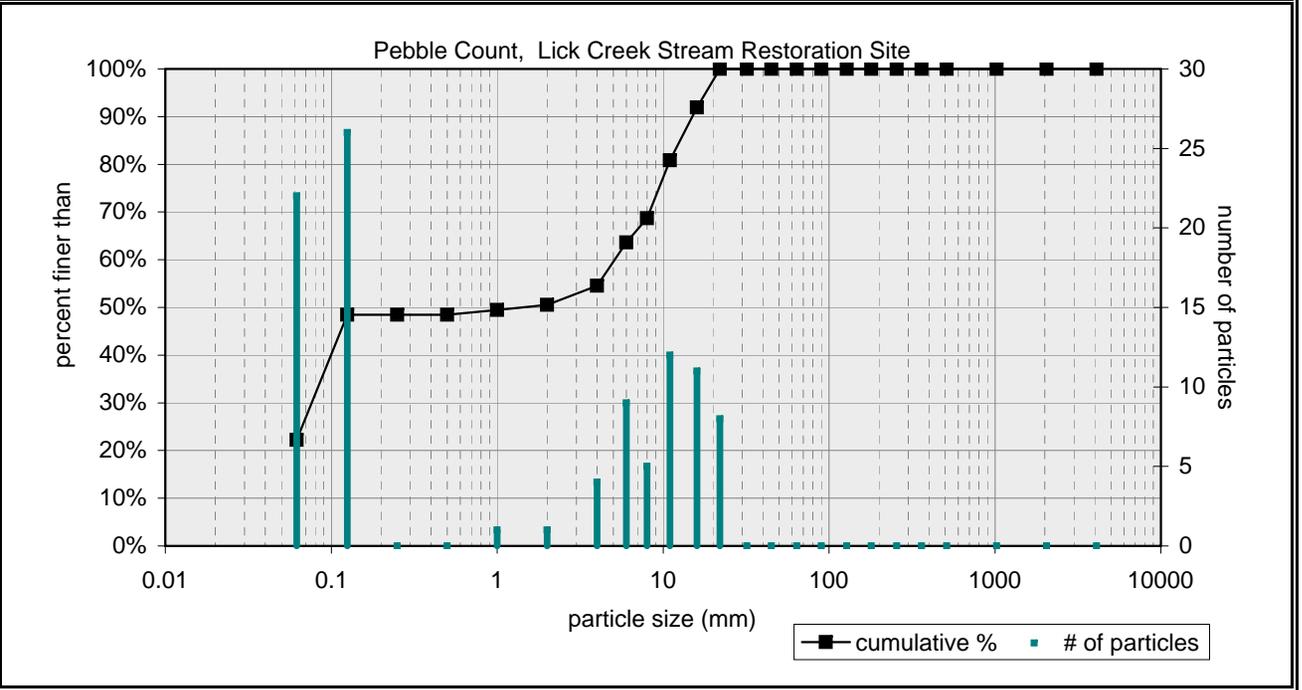
Profile Reach 3 - Lick Creek

**Year 2**

HI	Station	Bed FS	Bed Elev.	Water Depth	Water Elev.	Bankfull FS	Bankfull Elev.	Description
213.87	1950	11.26	202.61	0.32	202.93			
213.87	1975	11.5	202.37	0.56	202.93			
213.87	1991	12.15	201.72	1.20	202.92			
213.87	1999	11.59	202.28	0.65	202.93			Log Vane INV
213.87	2008	13.08	200.79	2.13	202.92			Pool
213.87	2020	12.76	201.11	1.84	202.95			
213.87	2033	13.31	200.56	2.38	202.94			
213.87	2050	11.5	202.37	0.56	202.93			Log Vane INV
213.87	2065	14.75	199.12	3.80	202.92			Pool
213.87	2086	13.06	200.81	2.13	202.94			
213.87	2100	13.3	200.57	2.42	202.99			
213.87	2117	11.56	202.31	0.66	202.97			Glide
213.87	2127	11.26	202.61	0.31	202.92			HoR
213.87	2146	11.6	202.27	0.46	202.73			End Profile

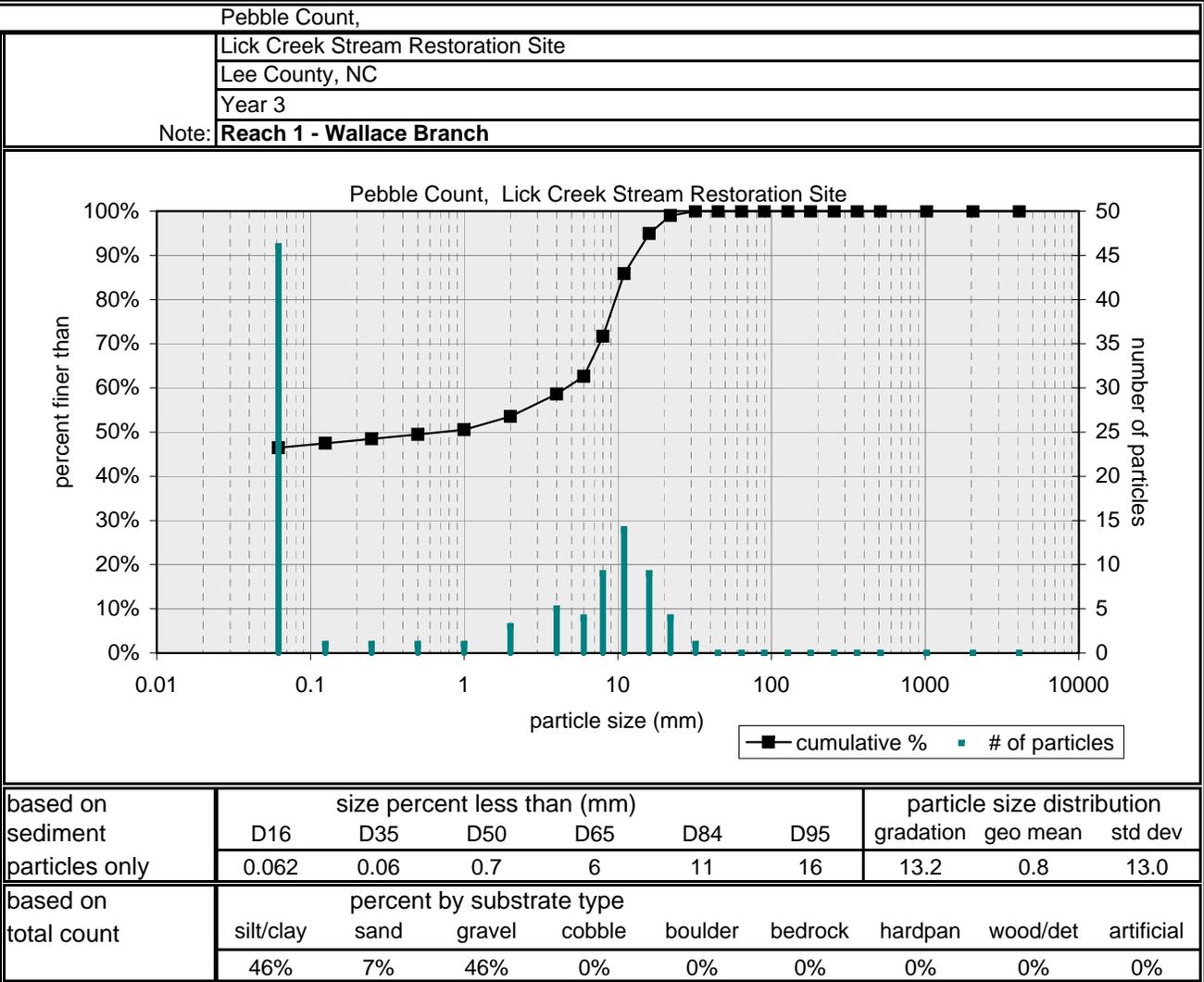
Pebble Count of Channel Reach			
Material	Size Range (mm)		Count
silt/clay	0	0.062	22
very fine sand	0.062	0.13	26
fine sand	0.13	0.25	0
medium sand	0.25	0.5	0
coarse sand	0.5	1	1
very coarse sand	1	2	1
very fine gravel	2	4	4
fine gravel	4	6	9
fine gravel	6	8	5
medium gravel	8	11	12
medium gravel	11	16	11
coarse gravel	16	22	8
coarse gravel	22	32	0
very coarse gravel	32	45	0
very coarse gravel	45	64	0
small cobble	64	90	0
medium cobble	90	128	0
large cobble	128	180	0
very large cobble	180	256	0
small boulder	256	362	0
small boulder	362	512	0
medium boulder	512	1024	0
large boulder	1024	2048	0
very large boulder	2048	4096	0
total particle count:			99
bedrock			
clay hardpan			
detritus/wood			
artificial			
total count:			99

Pebble Count,  
 Lick Creek Stream Restoration Site  
 Lee County, NC  
 Year 3  
 Note: **Reach 1 - Wallace Branch Riffle**



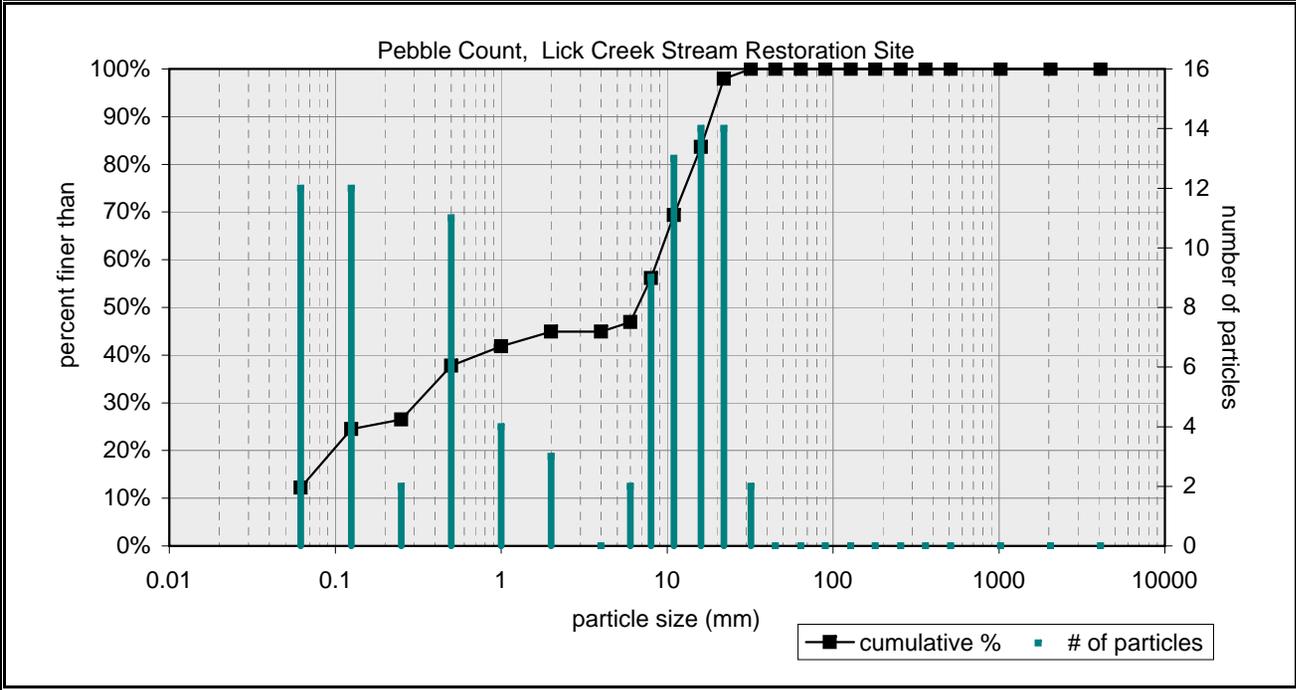
based on sediment particles only	size percent less than (mm)						particle size distribution gradation			
	D16	D35	D50	D65	D84	D95	geo mean	std dev		
	0.062	0.09	1.4	6	12	18	15.7	0.9	14.1	
based on total count	percent by substrate type									
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial	
	22%	28%	49%	0%	0%	0%	0%	0%	0%	0%

Pebble Count of Channel Reach			
Material	Size Range (mm)		Count
silt/clay	0	0.062	46
very fine sand	0.062	0.13	1
fine sand	0.13	0.25	1
medium sand	0.25	0.5	1
coarse sand	0.5	1	1
very coarse sand	1	2	3
very fine gravel	2	4	5
fine gravel	4	6	4
fine gravel	6	8	9
medium gravel	8	11	14
medium gravel	11	16	9
coarse gravel	16	22	4
coarse gravel	22	32	1
very coarse gravel	32	45	0
very coarse gravel	45	64	0
small cobble	64	90	0
medium cobble	90	128	0
large cobble	128	180	0
very large cobble	180	256	0
small boulder	256	362	0
small boulder	362	512	0
medium boulder	512	1024	0
large boulder	1024	2048	0
very large boulder	2048	4096	0
total particle count:			99
bedrock			
clay hardpan			
detritus/wood			
artificial			
total count:			99



Pebble Count of Channel Reach			
Material	Size Range (mm)		Count
silt/clay	0	0.062	12
very fine sand	0.062	0.13	12
fine sand	0.13	0.25	2
medium sand	0.25	0.5	11
coarse sand	0.5	1	4
very coarse sand	1	2	3
very fine gravel	2	4	0
fine gravel	4	6	2
fine gravel	6	8	9
medium gravel	8	11	13
medium gravel	11	16	14
coarse gravel	16	22	14
coarse gravel	22	32	2
very coarse gravel	32	45	0
very coarse gravel	45	64	0
small cobble	64	90	0
medium cobble	90	128	0
large cobble	128	180	0
very large cobble	180	256	0
small boulder	256	362	0
small boulder	362	512	0
medium boulder	512	1024	0
large boulder	1024	2048	0
very large boulder	2048	4096	0
total particle count:			98
bedrock			
clay hardpan			
detritus/wood			
artificial			
total count:			98

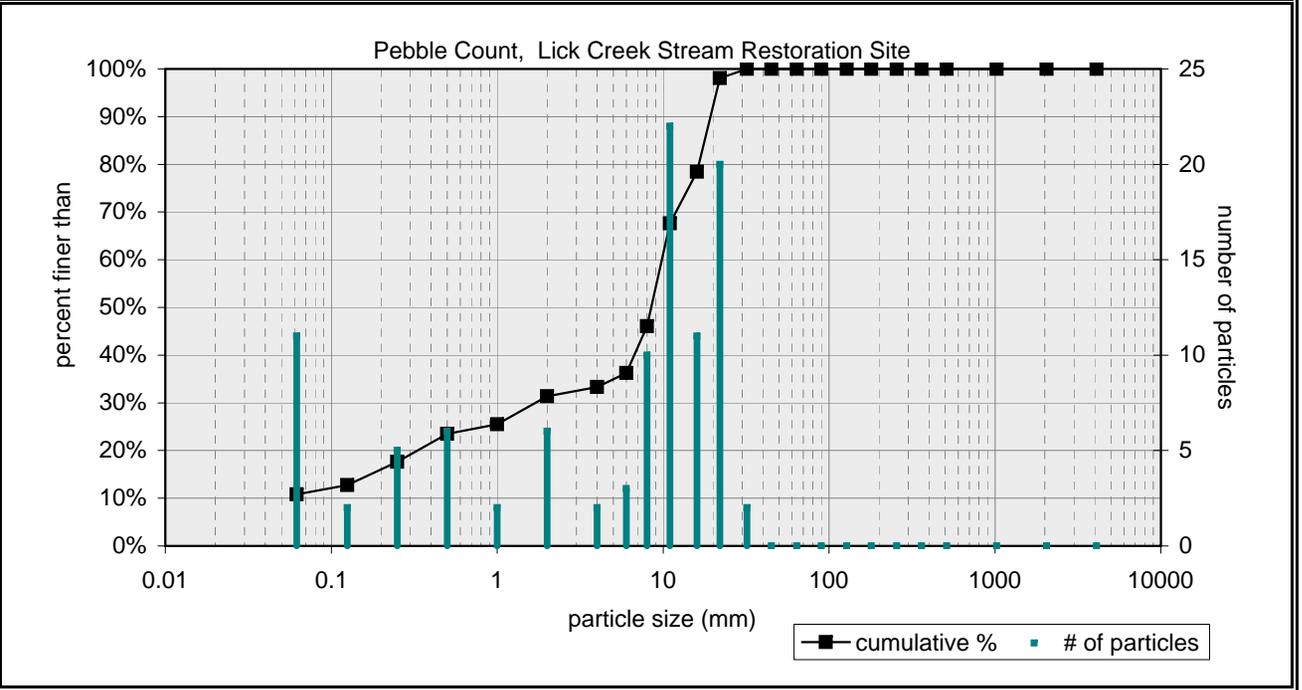
Pebble Count,	
Lick Creek Stream Restoration Site	
Lee County, NC	
Year 3	
Note:	<b>Reach 2 - Lick Creek Riffle</b>



based on sediment particles only	size percent less than (mm)						particle size distribution			
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev	
	0.077	0.42	6.6	10	16	21	44.2	1.1	14.5	
based on total count	percent by substrate type									
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial	
	12%	33%	55%	0%	0%	0%	0%	0%	0%	

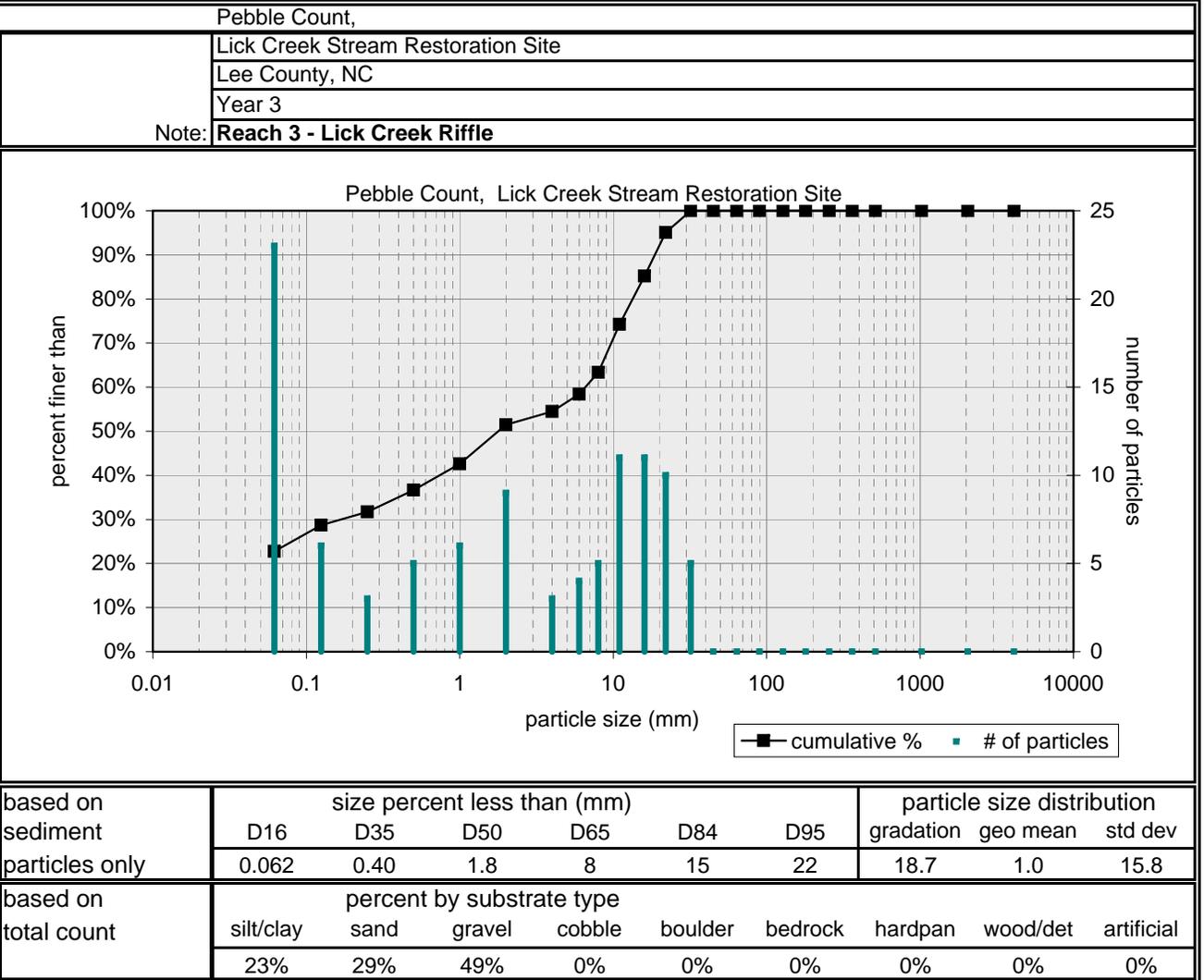
Pebble Count of Channel Reach			
Material	Size Range (mm)		Count
silt/clay	0	0.062	11
very fine sand	0.062	0.13	2
fine sand	0.13	0.25	5
medium sand	0.25	0.5	6
coarse sand	0.5	1	2
very coarse sand	1	2	6
very fine gravel	2	4	2
fine gravel	4	6	3
fine gravel	6	8	10
medium gravel	8	11	22
medium gravel	11	16	11
coarse gravel	16	22	20
coarse gravel	22	32	2
very coarse gravel	32	45	0
very coarse gravel	45	64	0
small cobble	64	90	0
medium cobble	90	128	0
large cobble	128	180	0
very large cobble	180	256	0
small boulder	256	362	0
small boulder	362	512	0
medium boulder	512	1024	0
large boulder	1024	2048	0
very large boulder	2048	4096	0
total particle count:			102
bedrock			
clay hardpan			
detritus/wood			
artificial			
total count:			102

Pebble Count,  
 Lick Creek Stream Restoration Site  
 Lee County, NC  
 Year 3  
 Note: **Reach 2 - Lick Creek**



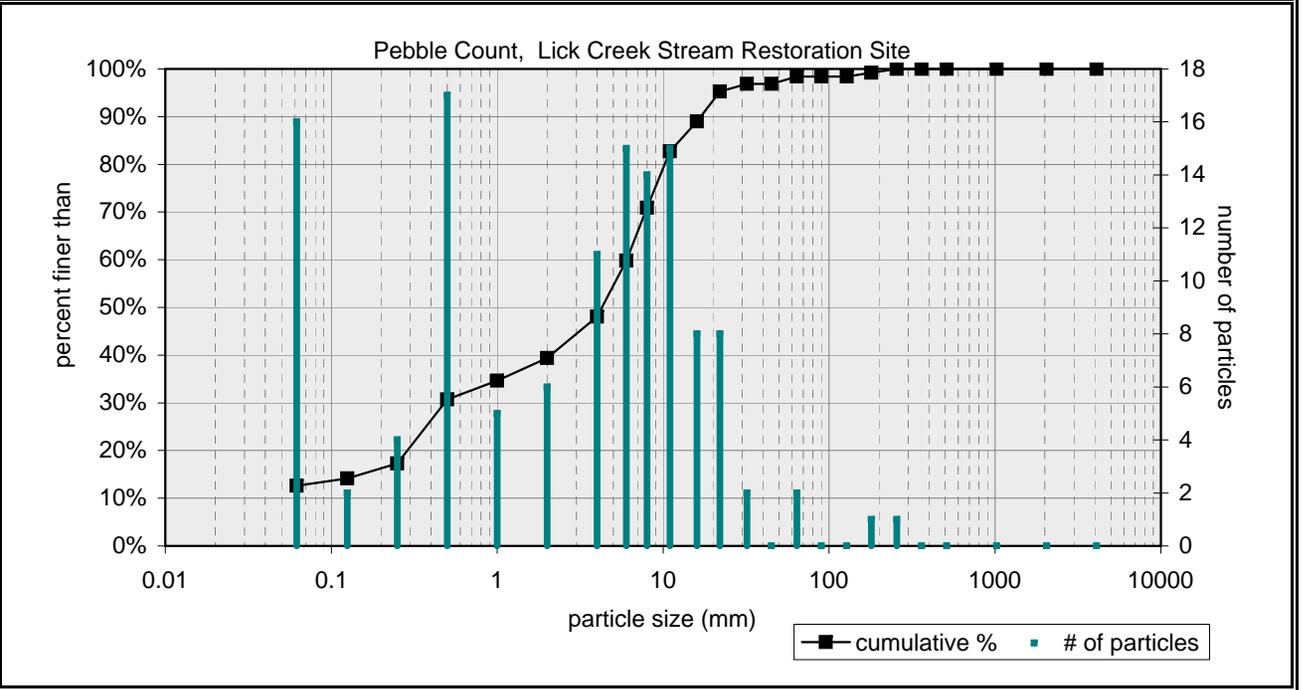
based on sediment particles only	size percent less than (mm)						particle size distribution			
	D16	D35	D50	D65	D84	D95	gradation	geo mean	std dev	
	0.198	5.03	8.5	11	18	21	22.4	1.9	9.4	
based on total count	percent by substrate type									
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial	
	11%	21%	69%	0%	0%	0%	0%	0%	0%	

Pebble Count of Channel Reach			
Material	Size Range (mm)		Count
silt/clay	0	0.062	23
very fine sand	0.062	0.13	6
fine sand	0.13	0.25	3
medium sand	0.25	0.5	5
coarse sand	0.5	1	6
very coarse sand	1	2	9
very fine gravel	2	4	3
fine gravel	4	6	4
fine gravel	6	8	5
medium gravel	8	11	11
medium gravel	11	16	11
coarse gravel	16	22	10
coarse gravel	22	32	5
very coarse gravel	32	45	0
very coarse gravel	45	64	0
small cobble	64	90	0
medium cobble	90	128	0
large cobble	128	180	0
very large cobble	180	256	0
small boulder	256	362	0
small boulder	362	512	0
medium boulder	512	1024	0
large boulder	1024	2048	0
very large boulder	2048	4096	0
total particle count:			101
bedrock			
clay hardpan			
detritus/wood			
artificial			
total count:			101



Pebble Count of Channel Reach			
Material	Size Range (mm)		Count
silt/clay	0	0.062	16
very fine sand	0.062	0.13	2
fine sand	0.13	0.25	4
medium sand	0.25	0.5	17
coarse sand	0.5	1	5
very coarse sand	1	2	6
very fine gravel	2	4	11
fine gravel	4	6	15
fine gravel	6	8	14
medium gravel	8	11	15
medium gravel	11	16	8
coarse gravel	16	22	8
coarse gravel	22	32	2
very coarse gravel	32	45	0
very coarse gravel	45	64	2
small cobble	64	90	0
medium cobble	90	128	0
large cobble	128	180	1
very large cobble	180	256	1
small boulder	256	362	0
small boulder	362	512	0
medium boulder	512	1024	0
large boulder	1024	2048	0
very large boulder	2048	4096	0
total particle count:			127
bedrock			
clay hardpan			
detritus/wood			
artificial			
total count:			127

Pebble Count,  
 Lick Creek Stream Restoration Site  
 Lee County, NC  
 Year 3  
 Note: **Reach 3 - Lick Creek**



based on sediment particles only	size percent less than (mm)						particle size distribution gradation			
	D16	D35	D50	D65	D84	D95	geo mean	std dev		
	0.187	1.05	4.3	7	12	22	12.8	1.5	8.0	
based on total count	percent by substrate type									
	silt/clay	sand	gravel	cobble	boulder	bedrock	hardpan	wood/det	artificial	
	13%	27%	59%	2%	0%	0%	0%	0%	0%	0%