Little Pine & Brush Creek

2003 Annual Monitoring Report

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Ecosystem Enhancement PROGRAM

NCDENR

NC STATE UNIVERSITY

2003 Little Pine & Brush Creek Monitoring Abstract

Brush Creek and one of its tributaries, Little Pine Creek were enhanced/restored through the North Carolina Ecosystem Enhancement Program (NCEEP). The objectives of the project are to:

1.) Establish an stable dimension, pattern and profile on 950 feet of Little Pine Creek
2.) Improve habitat within Little Pine Creek
3.) Establish an riparian buffer along Little Pine and Brush Creek
4.) Enhance channel stability along 2,300 linear feet of Brush Creek

This is the 3rd year of the 5-year monitoring plan for both Little Pine and Brush Creeks.

Table 1A. Background infor

Project Name	Little Pine and Brush Creek
Designer's Name	HDR Engineering, Inc. of the Carolinas 128 South Tryon St, Suite 1400 Charlotte, NC, 28202
Contractor's Name	A&D Environmental & Industrial Services
Directions to Project Site	From Interstate I-77 follow NC-21 north. Follow NC-21 turn right (north) on Shuffeltown Road (SR1464). Follow Shuffeltown road for 5 miles. Turn left on Glad Valley Road. Follow Glade Valley Road for 1 mile and turn right on Big Oak Road. The project is located downstream of the Big Oak Road Bridge.
Drainage Area	4.3 sq. mi. (Little Pine) 26.3 sq. mi. (Brush Creek)
USGS Hydro Unit	05050001
NCDWQ Subbasin	05-07-04
Project Length	950 linear feet (Little Pine) 2,640 Linear feet (Brush Creek)
Restoration Approach	950-feet of dimension, pattern, and profile on Little Pine Creek 340-feet of bank stabilization on Brush Creek 2,300-feet of bank and riparian enhancement on Brush Creek
Date of Completion	2001
Monitoring Dates	2001 (baseline); May, 2002; September, 2003

Results and Discussion

Overall, while the majorities of both streams are functioning well and are stable, each stream has areas of concern and areas of immediate need. Table 2 shows a summary of monitoring measurement results. Overall the project is performing well. Channel dimension, pattern, and profile are similar to as-built conditions with the exceptions of some limited areas of bank slumping. Vegetation is not succeeding to levels required for mitigation credit.

Table 2A. Summary of Channel Conditions

DIMENSION	Little Pine Cross-section #1 Riffle		Little Pine Cross-section #2 Riffle		Little Pine Cross-section #3 Pool		Brush Creek Cross-section #4 Riffle		Brush Creek Cross-section #5 Pool		Brush Creek Cross-section #6 Pool	
	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built*	2003	As-built*	2003
Bankfull Cross-sectional Area	86.7	101.7	88.7	87.8	86.6	100.4	266.9	305.7	387.1	384.6	285.3	297.6
Bankfull Width	31.5	31.5	33.7	32.6	35.4	40.4	55.3	53.2	106.0	105.4	67.0	68.0
Bankfull Mean Depth	2.8	3.2	2.6	2.7	2.4	2.5	4.8	5.7	3.7	3.6	4.3	4.4
Bankfull Max Depth	5.0	5.0	4.8	5.5	4.5	6.4	8.0	8.4	6.1	6.6	6.9	7.2

PATTERN	Little Pine As-built			Little Pine 2003			Brush Creek As-built			Brush Creek 2003		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Meander Wave Length	-	-	n/a	86	139	113	-	-	n/a	228	570	380
Radius of Curvature	-	-	50.5	18	65	42	-	-	n/a	25	192	72
Beltwidth	-	-	25	37	62	46	-	-	n/a	122	304	217

PROFILE	Little Pine As-built			Little Pine 2003			Brush Creek As-built			Brush Creek 2003		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Riffle Length	6.1	46.8	18.4	18	96	36.5	20	417	32.9	53	346	102.5
Riffle Slope	1.17%	2.79%	1.61%	0.64%	2.67%	1.75%	0.24%	1.65%	1.35%	0.13%	0.98%	0.53%
Pool Length	34.1	111.6	44.5	44	121	77.55	51	348	187	179	311	226
Pool to Pool Spacing	51	150.3	63.7	116	191.7	161.5	53	966	359	274	789	370

SUBSTRATE	Little Pine Cross-section #1 Riffle		Little Pine Cross-section #2 Riffle		Little Pine Cross-section #3 Pool		Brush Creek Cross-section #1 Riffle		Brush Creek Cross-section #2 Pool		Brush Creek Cross-section #3 Pool	
	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built	2003
D50	36.4	10.22	59.4	0.47	1.22	0.36	34.65	3.62	18.8	6.18	36.9	4.85
D85	116.1	50.9	119.7	15.5	7.78	6.35	71.75	29.54	68.2	44.9	263.5	36.9

VEGETATION	Trees Planted		Quad 1 - Little Pine Creek		Quad 2 - Little Pine Creek		Quad 3 - Brush Creek	
	Little Pine	Brush	% Cover	Density	% Cover	Density	% Cover	Density
	#/acre	#/acre		(trees/acre)		(trees/acre)		(trees/acre)
Tree Stratum			n/a	40	n/a	0	n/a	0
Shrub Stratum			0.05%	2509	0.0%	0	1.0%	809
Herb Stratum			145.5%	n/a	202.5%	n/a	24.5%	n/a

BEHI/NBS	Little Pine		Brush Creek	
Average conditions	BEHI	NBS	BEHI	NBS
	moderate	moderate	moderate	moderate

The following areas of concern should be monitored closely and considered for repair as suggested. A plan sheet follows which shows locations of areas of concern and plan view of existing conditions overlain as-built conditions.

Little Pine Creek

- Easement Limits
  - NCWRP should work with landowners to ensure easement limits are maintained.
  - Stations: Along left bank throughout.
- The lack of successful vegetation in the riparian buffer
  - Supplemental plantings are needed to meet minimum density.
  - Stations: Throughout.
  - Soil should be tested for fertility and amended as directed.
- Down-cutting near channel confluence
  - This area should be monitored to ensure the down-cutting does not continue up Little Pine Creek.
  - Stations: 8+50 to 9+50.
- Areas with bank slumping
  - These areas should be planted heavily with live stakes to help establish root mass along the channel bank.
  - Stations: 0+50, 1+00, 2+50, and 6+50.
  - These areas should be monitored closely during upcoming site visits to determine if the problem is localized to more regional in scale.
- Decrease in defined channel bedform
  - This should be closely monitored during upcoming site visits. If the bedform continues to decrease actions may become necessary.
  - Stations: Throughout.

Brush Creek

- The lack of successful vegetation in the riparian buffer
  - Supplemental plantings are needed to meet minimum density.
  - Stations: Throughout.
  - Soil should be tested for fertility and amended as directed.
- Areas with bank slumping
  - These areas should be planted heavily with live stakes to help establish root mass along the channel bank.
  - Stations: 1+50 and 2+00.
  - These areas should be monitored closely during upcoming site visits to determine if the problem is localized to more regional in scale.

Figure 1A. Plan view of 2003 Site Conditions

Photos
The following are photographs of typical sections and areas of concern throughout the project.

Little Pine Creek

Typical Photo 1.
Typical Riffle along Little Pine Creek.

Typical Photo 2.
Typical Pool along Little Pine Creek.

Issue Photo 1.
Little Pine near Station 1+00.
Bank slump on right bank

Issue Photo 2.
Little Pine near Station 2+50.
Bank slump on left bank.

Issue Photo 3. Little Pine near station 6+50.
Bank Scour on Right Bank

Brush Creek

Typical Photo 1.
Typical Riffle along Brush Creek.

Typical Photo 2.
Typical Pool along Brush Creek.

Issue Photo 1.
Brush Creek near Station1+50.
Left Bank slump and scour.

Issue Photo 2.
Brush Creek near Station 0+50.
Transverse bar at start of project.

Issue Photo 1.
Brush Creek near Station 2+00.
Right bank slump and scour.

Issue Photo 2.
Brush Creek near Station 5+00.
Large Woody Debris in channel.

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Tables and Figures

1.0 BACKGROUND INFORMATION

The background information for this report is referenced from previous monitoring reports conducted by HDR, Inc. The following was excerpted from 2003 HDR monitoring report section 2.1:

> The project site is located in Alleghany County, in the Blue Ridge Province of the Appalachian Mountains. At this site, Little Pine Creek, a third-order perennial stream draining a watershed of 4.3 square miles, enters Brush Creek, a fourth-order perennial stream draining a watershed area of 26.3 square miles (Figure 1). Brush Creek is a tributary to the Little River. These streams are part of the New River watershed, United States Geologic Survey (USGS) Hydrologic Unit 05050001, and North Carolina Division of Water Quality (NCDWQ) Subbasin 05-07-03. Streams have been assigned a best usage classification by NCDWQ that reflects water quality conditions and potential resource usage. The classification for Brush Creek is C TR. Waters classified as C TR are used for secondary recreation and protected for the intent of trout propagation and survival (NCDENR, 2000).
>
> In 1969, Little Pine Creek was channelized upstream of its confluence with Brush Creek. In the recent past, approximately 340 feet of Brush Creek stream bank, downstream of the Little Pine Creek confluence, experienced significant bank collapse. This collapse may be linked to a variety of factors, including the steep angle of the Little Pine Creek confluence, deflection of Brush Creek streamflow by point bar formation downstream of the confluence, the unconsolidated alluvial composition of the collapsing Brush Creek streambank, and limited riparian vegetation.
>
> In response to landowner desires to restore Little Pine Creek and Brush Creek to a condition of natural stability, restoration of these streams occurred from April to July 2001, ~~as shown in Figures 2 and 3~~. Riparian planting was completed in January 2002. Approximately 600 linear feet of altered Little Pine Creek channel were replaced with a new, 950-linear foot meandering channel reconnected to the flood plain and designed to maintain stable dimension, pattern, and profile while effectively transporting anticipated streamflow and sediment load. A vegetated riparian corridor was established along Little Pine Creek in order to improve water quality and increase aquatic and terrestrial habitat resources. In addition, 340 linear feet of Brush Creek were stabilized to eliminate existing severe bank collapse problems. Another 2,300 feet of degraded Brush Creek riparian corridor were enhanced in an effort to stabilize unstable banks, increase instream aquatic habitat, and improve the riparian buffer.
>
> The lower 700 feet of Brush Creek, which is included in the conservation easement, does not include cross-section or permanent photograph station establishment. No grading work or planting was performed in this stable reach. Two boulder clusters were placed in the stream in this section to augment existing riffle sections.

1.1 Goals and Objective

The goals and objectives of this project are as follows.

1.) Restore 950-linear feet of Little Pine Creek.
2.) Restore 340-linear feet of Brush Creek.
3.) Enhance 2,300 linear feet of Brush Creek through the use of bank stabilization and reforestation.
4.) Establish a riparian zone surrounding restored and enhanced sections of Little Pine and Brush Creeks.

1.2 Project Location

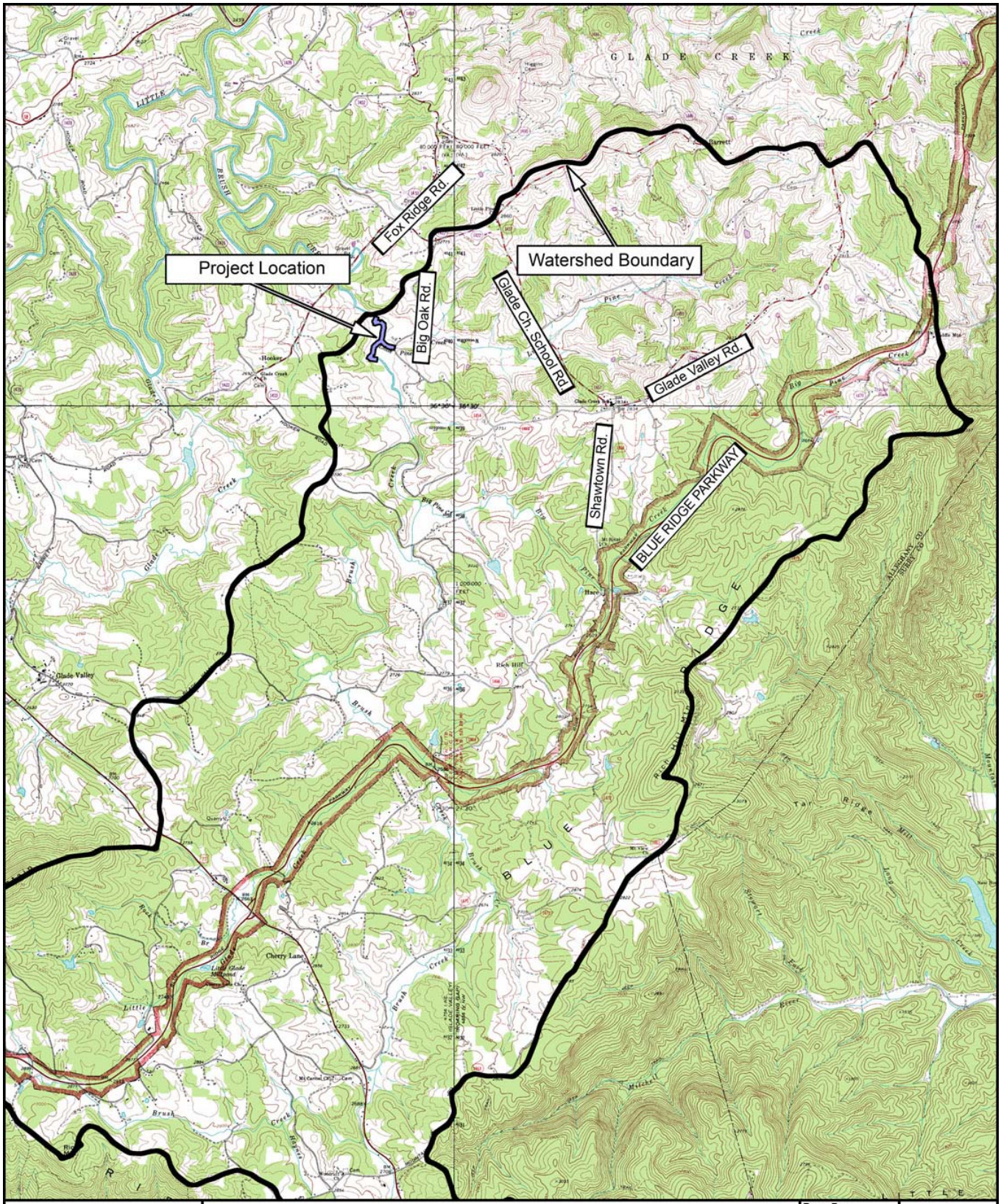
From Interstate I-77 follow NC-21 north. Follow NC-21 turn right (north) on Shuffeltown Road (SR1464). Follow Shuffeltown road for 5 miles. Turn left on Glad Valley Road. Follow Glade Valley Road for 1 mile and turn right on Big Oak Road. The project is located downstream of the Big Oak Road Bridge. See Figure 1 for map showing project location.

1.3 Project Description

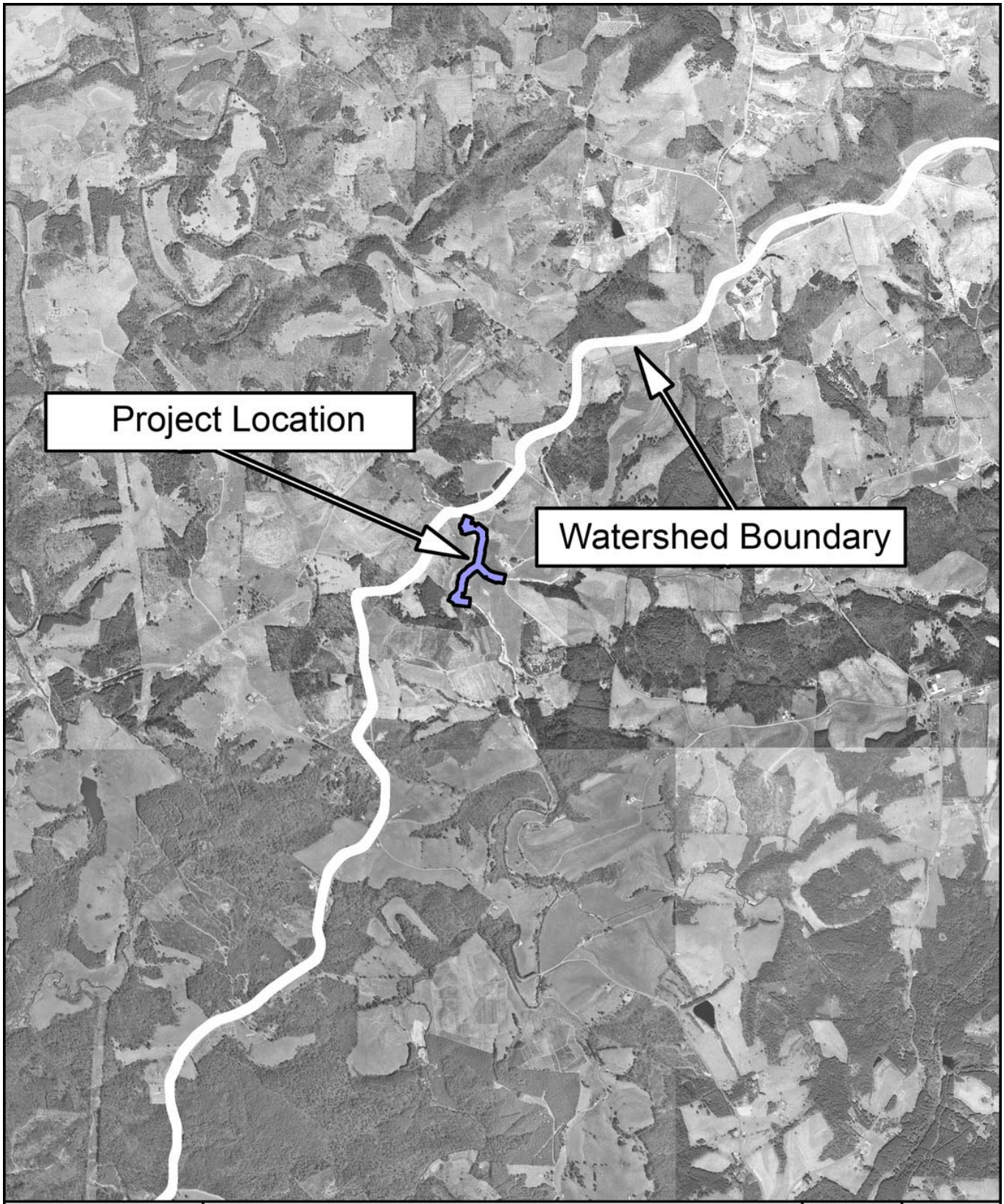
The restoration of 950 linear feet of Little Pine Creek consists of relocating the existing channel away from a previously straightened ditch. Riffle-pool bedform was constructed as well as a stable meander pattern developed from stable reference streams. Riffles were stabilized utilizing constructed riffles consisting of graded stone and biologs were used to stabilize outside meander bends. Vegetation was planted to establish a dense root mass along the stream banks and in the riparian zone.

The restoration of 340 linear feet of Brush Creek consisted of relocating a section of the channel that was rapidly eroding due to lack of vegetation and poor channel pattern. Rock sills were utilized to ensure the channel does not reopen previous channel. A low sloped point bar was graded into the area were the previous channel was located. This area was re-vegetated with native seedlings, shrubs, and herbs.

An additional 2,300 linear feet of Brush Creek was enhanced with vegetation and bank stabilization structures. Structures include single rock vanes, boulder bank toe, and log toe. The entire length of Brush Creek was also fenced to keep cattle out of the riparian area.



NC STATE UNIVERSITY Department of Biological & Agricultural Engineering Campus Box 7625 Raleigh, NC 27606	Project Location: Little Pine and Brush Creek Alleghany County, North Carolina EEP Monitoring Report SCALE 1:60,000	Dwn. By: MVH Ckd By: DAB Date: March 2004	FIGURE 1



NC STATE UNIVERSITY

Department of Biological & Agricultural Engineering

Campus Box 7625
Raleigh, NC 27606

Aerial Watershed Photo: Little Pine & Brush Creek
Alleghany County, North Carolina

EEP Monitoring Report

SCALE 1:30,000
0 1 MILE
0 1000 2000 3000 4000 5000 FEET

N

Dwn. By: MVH
Ckd By: DAB
Date: March 2004

FIGURE 2

Figure 3. Plan view of As-built conditions

(To be attached)
showing all structures with station numbers
showing vegetation permanent plots
showing permanent cross-sections and benchmarks
showing vegetation plots
showing monitoring gauges

Figure 4. Plan view of 2003 conditions
(To be attached)

2.0 YEAR 2003 RESULTS AND DISCUSSION

Year 2003 monitoring results are shown for Little Pine and Brush Creek Monitoring.

2.1 Vegetation

2.1.1 Results and Discussion

Using the Draft Vegetation Monitoring Plan for NCWRP Riparian Buffer and Wetland Restoration Projects, 2 vegetation-monitoring plots were randomly located within the riparian buffer of Little Pine Creek and 1 plot was placed within the buffer of Brush Creek. No reference area was studied; therefore no comparisons could be made to reference conditions.

Little Pine Creek

Vegetation within the riparian buffer of Little Pine Creek varied in degree of success. The planted native herbaceous vegetation was dense and appeared to be mostly outcompeting the fescue from the adjoining field. *Verbenia* spp., *Solidago* spp., and *Bidens* spp. are especially doing well throughout the area. Live stakes are marginally healthy in certain areas. Planted trees and shrubs are doing poorly throughout the entire buffer. In the first plot, only 1 tree stem was counted while 2 were found in the second plot. Although some stakes were found to be thriving, by and large, dead stakes were prevalent throughout. Further, of the shrub and tree stem found alive, most have been browsed.

There was some natural regeneration noted, however due to the season, much leaf drop had occurred and a complete picture of natural regeneration could not be formed. It was noted that a few large planted sycamores and walnuts were thriving and appeared not be have been browsed. Overall, the area appeared to be in an early successional state.

Buffer width is inconsistent along the creek and it appears that the adjoining pumpkin patch has encroached into the riparian buffer. Despite lack of woody vegetation, buffer was 100% covered with herbaceous vegetation.

Brush Creek

The Brush Creek vegetation quad contained no bare root trees, but had numerous live stake sprouts from *Cornus amomum.* Also, natural regeneration of *Alnus serrulata* was prevalent. Herbaceous vegetation was thick and lush throughout the plot and adjoining area. *Juncus* spp. and *Polygonum* spp. were dominant in the entire area. Next to the plot, several planted trees were doing well, although browse was noted. No major erosion problems were noted within the plot.

Vegetation overall within this project has mixed success. Herbaceous vegetation, both planted and naturally regenerating, are doing extremely well and contribute to the bank stability of the project. Live stakes are marginal in most areas. Planted trees are not successful.

2.2 Morphology

Restored channel dimension, pattern, profile and substrate were examined during the 2003 monitoring.

2.2.1 Results and Discussion

Little Pine Creek

Channel profile along Little Pine Creek has shown some down-cutting near the confluence with Brush Creek. The number of defined riffles in the bedform has decreased from 13 in 2001, to 10 in 2002, to 8 in 2003. This is also consistent with pebble count results which show a significant increase in fine particles since construction. With the exception of the area near the confluence with Brush Creek, Little Pine Creek has not shown any potential for significant down-cutting. Hardened riffle areas are maintaining elevation throughout the relocated reach. HDR results were recalculated using NCSU techniques for consistency purposes. Data was examined but field identified features were retained.

Cross-sections 1 and 2 were not field located; they have been re-established and will be monitored in the re-established locations during future monitoring periods. Channel cross-sections 1 and 3 along Little Pine Creek have increased in cross-sectional area. Cross-section 1, a riffle, enlarged in width due to bank slumping but the channel bed appears stable. Cross-section 3 has down-cut since construction. It is likely a result of adjustment to the near location to the confluence with Brush Creek. Cross-section 2 has not changed significantly since construction.

Channel substrate in the riffle sections continue to fine. The d50 decreased from 36.4mm to 10.2mm in riffle 1 and from 59.4mm to 0.47mm in riffle 2. There are areas of coarse sediments consisting of cobbles and the channel bed in the riffles are maintaining a mostly gravel substrate. The pool cross-section has decreased as well, from 1.2mm to 0.36mm, but not a significantly.

Post construction sedimentation, stream bank scouring and upstream sediment supply is the likely cause of the decrease in particle size. Another possible cause of decrease in particle size is measurement technique. It is not know if previous surveyors used similar sampling technique. Future monitoring should better evaluate channel substrate. It is common for substrate to decrease after construction for several years until fines can be flushed out.

Channel pattern appears to have been maintained since construction. A few of the outside meander bends are experiencing slight migration through bank slumping but no excessive migration is evident and no shoot cut-offs are apparent.

Channel banks throughout Little Pine Creek remain mostly stable with the exception of five spot areas of bank slumping. Slumping is likely the result of the lack of deep rooting vegetation, steep stream banks, and high stream velocities near the channel toe. The largest area of slumping is due to a beaver dam that was located near station 2+00. The Beaver Dam is no longer in the channel.

Brush Creek

Channel profile along the relocated section of Brush Creek decreased after year one but has maintained the adjusted elevation over the past year suggesting an equilibrium has been reached. Future monitoring should confirm this. Most other areas have maintained grade throughout the project. Pools throughout the project have deepened over the three years of monitoring. The number and location of defined riffles has remained relatively constant. Brush Creek has not shown any potential for down-cutting over the past year. Hardened riffle areas are maintaining elevation throughout the relocated reach. HDR results were recalculated using NCSU techniques for consistency purposes. Data was examined but field identified features were retained.

Channel cross-section 4 along Brush Creek has maintained similar dimension as 2002 monitoring period. The enlargement exhibited between 2001 and 2002 has stopped and the banks have stabilized and re-established vegetation along them. Cross-sections 5 and 6 are very similar to previous measurements.

Channel substrate in all sections continue to fine. The d50 decreased from 34.6mm to 3.6mm in riffle 4 and from 18.8mm to 6.2mm in riffle 5. There are areas of course sediments consisting of cobbles and the channel bed in the riffles are maintaining a mostly gravel substrate. The pool cross-section has decreases as well, from 37.0mm to 36.9mm, but not a significantly.

Post construction sedimentation, stream bank scouring and upstream sediment supply is the likely cause of the decrease in particle size. Another possible cause of decrease in particle size is measurement technique. It is not know if previous surveyors used similar sampling technique. Future monitoring should better evaluate channel substrate. It is common for substrate to decrease after construction for several years until fines can be flushed out.

Channel pattern appears to have been maintained since construction and no excessive migration is evident and no shoot cut-offs are apparent.

Channel banks throughout Brush Creek remain mostly stable with the exception of spot areas upstream of the confluence with Little Pine Creek. These should be able to be re-stabilized with the re-establishment of vegetation.

Table 1. Summary of Channel Conditions

DIMENSION	Little Pine Cross-section #1 Riffle		Little Pine Cross-section #2 Riffle		Little Pine Cross-section #3 Pool		Brush Creek Cross-section #4 Riffle		Brush Creek Cross-section #5 Pool		Brush Creek Cross-section #6 Pool	
	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built	2003
Bankfull Cross-sectional Area	86.7	101.7	88.7	87.8	86.6	100.4	266.9	305.7	392.0	384.6	305.0	297.6
Bankfull Width	31.5	31.5	33.7	32.6	35.4	40.4	55.3	53.2	104.3	105.4	67.3	68.0
Bankfull Mean Depth	2.8	3.2	2.6	2.7	2.4	2.5	4.8	5.7	3.8	3.6	4.5	4.4
Bankfull Max Depth	5.0	5.0	4.8	5.5	4.5	6.4	8.0	8.4	6.1	6.6	6.9	7.2

PATTERN	Little Pine As-built			Little Pine 2003			Brush Creek As-built			Brush Creek 2003		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Meander Wave Length	-	-	n/a	86	139	113	-	-	n/a	228	570	380
Radius of Curvature	-	-	50.5	18	65	42	-	-	n/a	25	192	72
Beltwidth	-	-	25	37	62	46	-	-	n/a	122	304	217

PROFILE	Little Pine As-built			Little Pine 2003			Brush Creek As-built			Brush Creek 2003		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Riffle Length	6.1	46.8	18.4	18	96	36.5	20	417	32.9	53	346	102.5
Riffle Slope	1.17%	2.79%	1.61%	0.64%	2.67%	1.75%	0.24%	1.65%	1.35%	0.13%	0.98%	0.53%
Pool Length	34.1	111.6	44.5	44	121	77.55	51	348	187	179	311	226
Pool to Pool Spacing	51	150.3	63.7	116	191.7	161.5	53	966	359	274	789	370

SUBSTRATE	Little Pine Cross-section #1 Riffle		Little Pine Cross-section #2 Riffle		Little Pine Cross-section #3 Pool		Brush Creek Cross-section #1 Riffle		Brush Creek Cross-section #2 Pool		Brush Creek Cross-section #3 Pool	
	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built	2003	As-built	2003
D50	36.4	10.22	59.4	0.47	1.22	0.36	34.65	3.62	18.8	6.18	36.9	4.85
D85	116.1	50.9	119.7	15.5	7.78	6.35	71.75	29.54	68.2	44.9	263.5	36.9

VEGETATION	Trees Planted		Quad 1 - Little Pine Creek		Quad 2 - Little Pine Creek		Quad 3 - Brush Creek	
	Little Pine	Brush	% Cover	Density	% Cover	Density	% Cover	Density
	#/acre	#/acre		(trees/acre)		(trees/acre)		(trees/acre)
Tree Stratum			n/a	40	n/a	0	n/a	0
Shrub Stratum			0.05%	2509	0.0%	0	1.0%	809
Herb Stratum			145.5%	n/a	202.5%	n/a	24.5%	n/a

BEHI/NBS	Little Pine		Brush Creek	
Average conditions	BEHI	NBS	BEHI	NBS
	moderate	moderate	moderate	moderate

Figure 5 . Little Pine Profile

Little Pine Creek
Longitudinal Profile
2003 Monitoring
N.C. State University

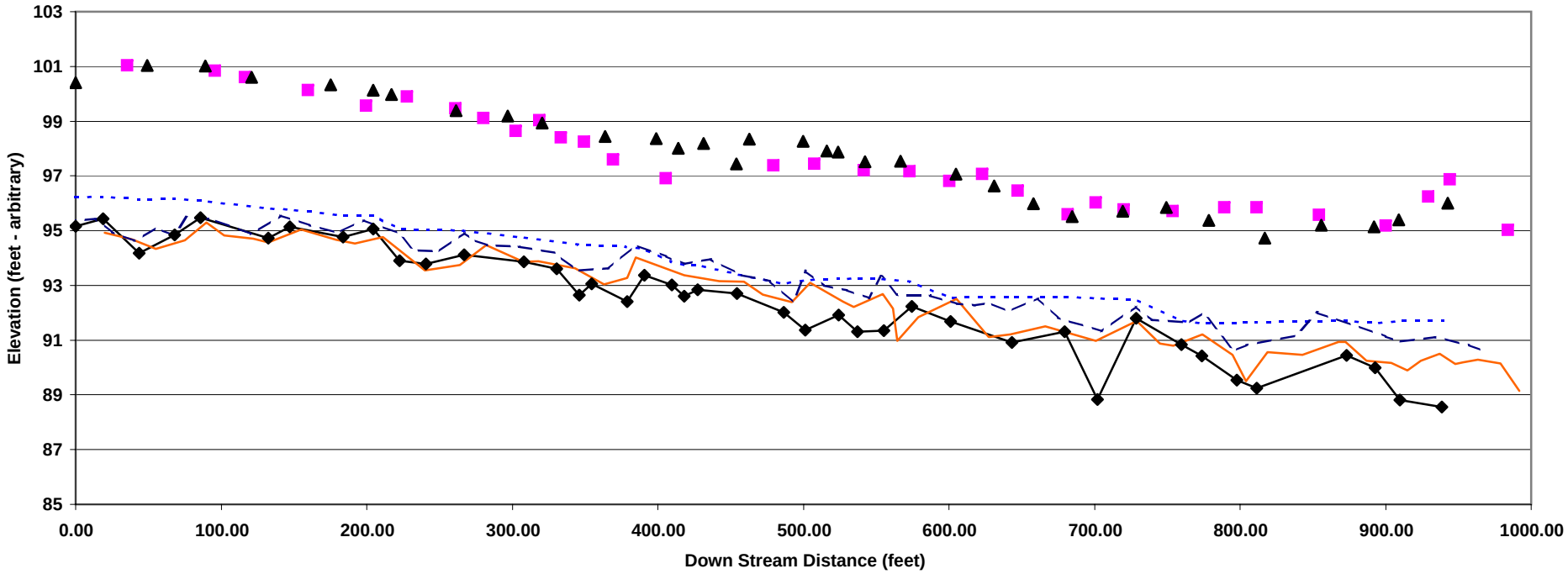
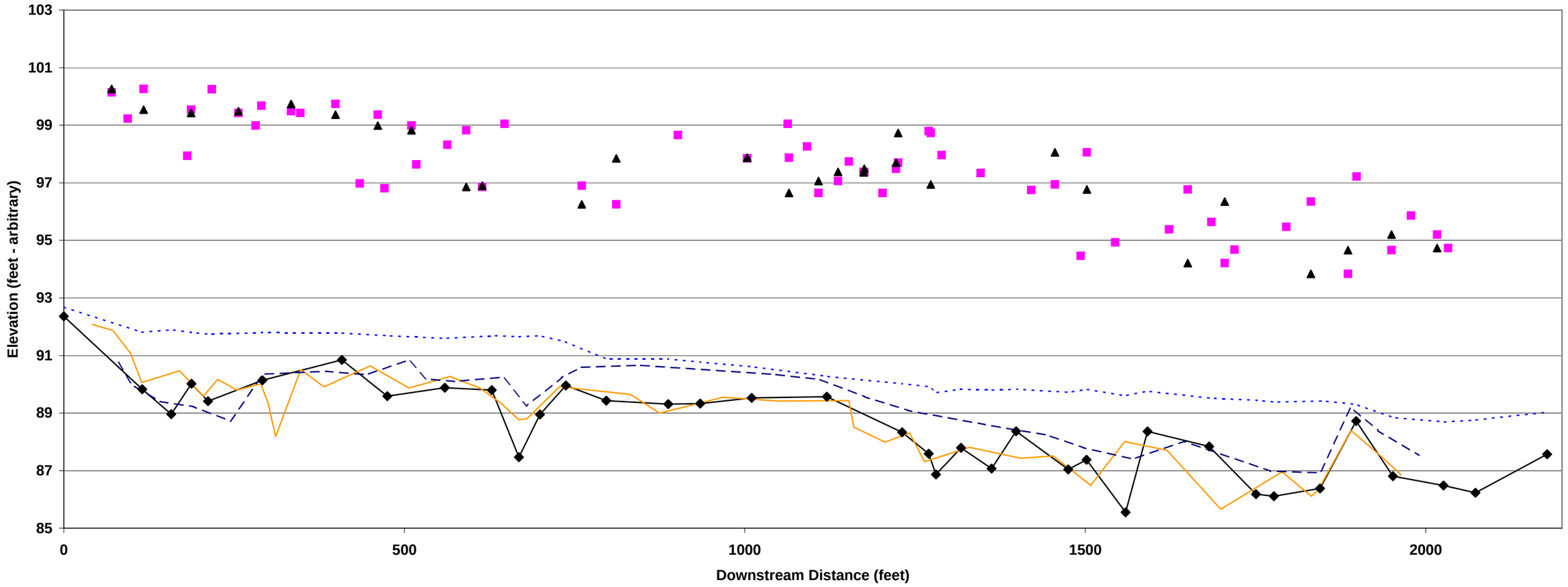


Figure 6. Brush Creek Profile

Brush Creek Longitudinal Profile 2003 Monitoring N.C. State University



2.3 Areas of Concern

The following areas of concern should be monitored closely and considered for repair as suggested:

Little Pine Creek

- Easement Limits
    - NCWRP should work with landowners to ensure easement limits are maintained.
- The lack of successful vegetation in the riparian buffer
    - Supplemental plantings are needed to meet minimum density.
    - Soil should be tested for fertility and amended as directed.
- Down-cutting near channel confluence
    - This area should be monitored to ensure the down-cutting does not continue up Little Pine Creek.
- Areas with bank slumping
    - These areas should be planted heavily with live stakes to help establish root mass along the channel bank.
    - These areas should be monitored closely during upcoming site visits to determine if the problem is localized to more regional in scale.
- Decrease in defined channel bedform
    - This should be closely monitored during upcoming site visits. If the bedform continues to decrease actions may become necessary.

Brush Creek

- Bank Scour upstream of the confluence with Little Pine Creek
    - These areas should be planted heavily with live stakes to help establish root mass along the channel bank.
    - These areas should be monitored closely during upcoming site visits to determine if the problem is localized to more regional in scale.
- The lack of successful vegetation in the riparian buffer
    - Supplemental plantings are needed to meet minimum density.
    - Soil should be tested for fertility and amended as directed.

Vegetation Overall

- Replanting trees to obtain mitigation requirements
- Stake only in areas where erosion is problematic
- Monitor invasive vegetation
    - The fescue in the adjacent field should be monitored.
- The pumpkin patch should be pushed back and the riparian buffer should be extended to its rightful width in that area.
- Deer are an issue on this site. Measures should be taken to prevent deer browse of planted vegetation.

2.4 Photo Log

Little Pine and Brush Creek Photo Log

Appendices

A. Methods
    1. Vegetation
    2. Morphology
B. Vegetation data
    1. Listed by plot
    2. Species, number and age
    3. Analysis of planted vs. natural recruitment
C. Morphology Data
    1. Cross-section data and plotted (DONE)
    2. Longitudinal data and plotted (DONE)
    3. Pebble count data and plotted (DONE)
    4. Pattern (DONE)

2.4 Photo Log

Little Pine Creek Photo Log

2002 **2003**

Little Pine Creek Photograph Station 1
260º from North

Little Pine Creek Photograph Station 2
North

Little Pine Creek Photograph Station 2
320º from North


Little Pine Creek Photograph Station 2
320º from North


Little Pine Creek Photograph Station 2
280º from North


Little Pine Creek Photograph Station 3
100º from North


Little Pine Creek Photograph Station 3
60º from North


Little Pine Creek Photograph Station 3
60º from North


Little Pine Creek Photograph Station 3
20º from North


Little Pine Creek Photograph Station 4
120º from North


Little Pine Creek Photograph Station 4
80º from North


Little Pine Creek Photograph Station 4
80º from North


Little Pine Creek Photograph Station 4
40º from North


Little Pine Creek Photograph Station 5
180º from North


Little Pine Creek Photograph Station 5
105º from North

Little Pine Vegetation Plot Quad 1 on Little Pine Creek - 2003.

Little Pine Vegetation Plot Quad 2 on Little Pine Creek - 2003.

Little Pine Creek Photo Log

2002 **2003**

Brush Creek Photograph Station 1
235º from North

Brush Creek Photograph Station 1
275º from North


Brush Creek Photograph Station 2
310º from North


Brush Creek Photograph Station 2
330º from North


Brush Creek Photograph Station 2
330º from North


Brush Creek Photograph Station 2
10º from North


Brush Creek Photograph Station 3
160º from North


Brush Creek Photograph Station 3
120º from North


Brush Creek Photograph Station 3
80º from North


Brush Creek Photograph Station 3
North


Brush Creek Photograph Station 4
145º from North


Brush Creek Photograph Station 4
95º from North


Brush Creek Photograph Station 4
55º from North


Brush Creek Photograph Station 5
40º from North


Brush Creek Photograph Station 6
150º from North


Brush Creek Photograph Station 6
115º from North


Brush Creek Photograph Station 6
55º from North


Brush Creek Photograph Station 6
5º from North


Brush Creek Photograph Station 7
90º from North


Brush Creek Photograph Station 7
335º from North


Brush Creek Photograph Station 8
140º from North21


Brush Creek Photograph Station 8
180º from North22


Brush Creek Photograph Station 8
220º from North23


Brush Creek Photograph Station 9
130º from North24


Brush Creek Photograph Station 9
170º from North25


Brush Creek Photograph Station 9
230º from North26


Brush Creek Photograph Station 9
270º from North27


Brush Creek Photograph Station 9
310º from North28


Brush Creek Photograph Station 9
340º from North29


Brush Creek Photograph Station 10
120º from North30


Brush Creek Photograph Station 10
85º from North31


Brush Creek Photograph Station 10
50º from North32

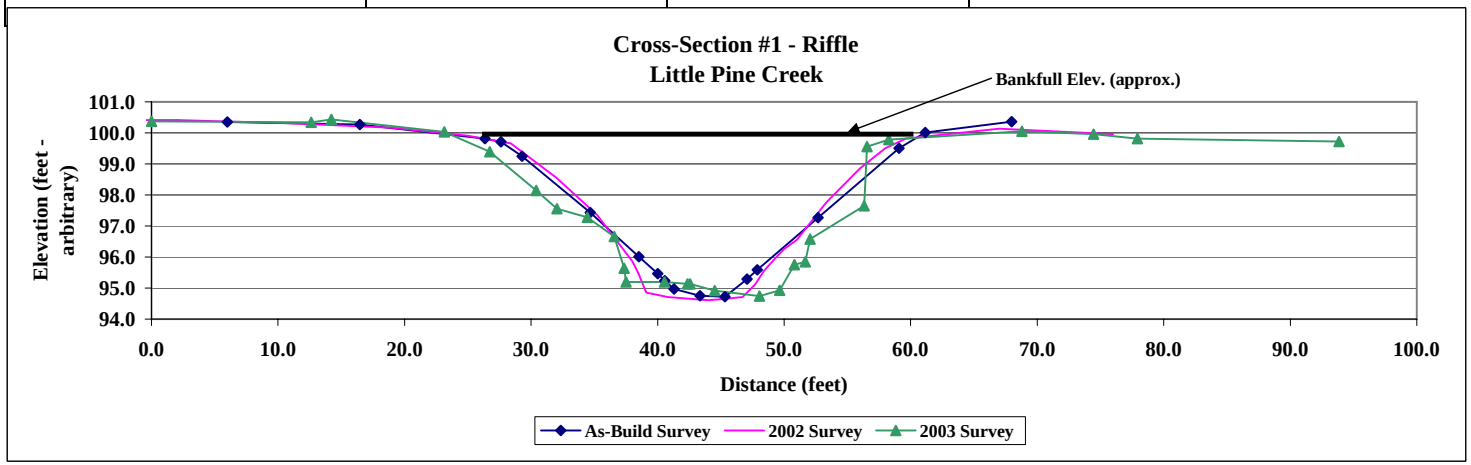
Brush Creek Photograph Station 10
30º from North33

Project Name	Little Pine Creek
Cross Section	#1
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
6.0	100.4		-6.4	100.41		0	100.37	
16.5	100.3		2	100.41		12.62	100.34	
26.4	99.8		11	100.31		14.22	100.43	Left Pin
27.6	99.7	BKF	19	100.16		23.15	100.03	BKF
29.3	99.3		25	99.91	BKF	26.74	99.39	
34.7	97.4		28.4	99.66		30.41	98.14	
38.5	96.0		32	98.56		32.04	97.56	
40.0	95.5		35.2	97.36		34.44	97.28	
40.6	95.2		38	95.86		36.56	96.66	
41.3	95.0		38.5	95.46		37.35	95.64	
43.3	94.8		39.1	94.86		37.5	95.2	
45.3	94.7		40.8	94.71		40.54	95.2	
47.1	95.3		44	94.61		42.36	95.13	
47.9	95.6		45.5	94.66		42.56	95.13	
52.7	97.3		46.7	94.71		44.52	94.92	
59.1	99.5		47.7	95.11		48.04	94.74	
61.2	100.0	BKF	48.4	95.56		49.65	94.93	
68.0	100.4		49.3	95.96		50.81	95.75	
			50	96.26		51.67	95.85	
			51	96.56		52.04	96.58	
			53.34	97.76		56.33	97.65	
			56	98.86		56.55	99.56	
			58	99.51		58.26	99.78	BKF
			59.6	99.81	BKF	68.78	100.05	
			67	100.13		74.46	99.96	Right Pin
			76	99.96		77.93	99.81	
			89	99.81		93.86	99.72	
			95.5	99.76				

Photo of Cross-Section #1 - Looking Downstream

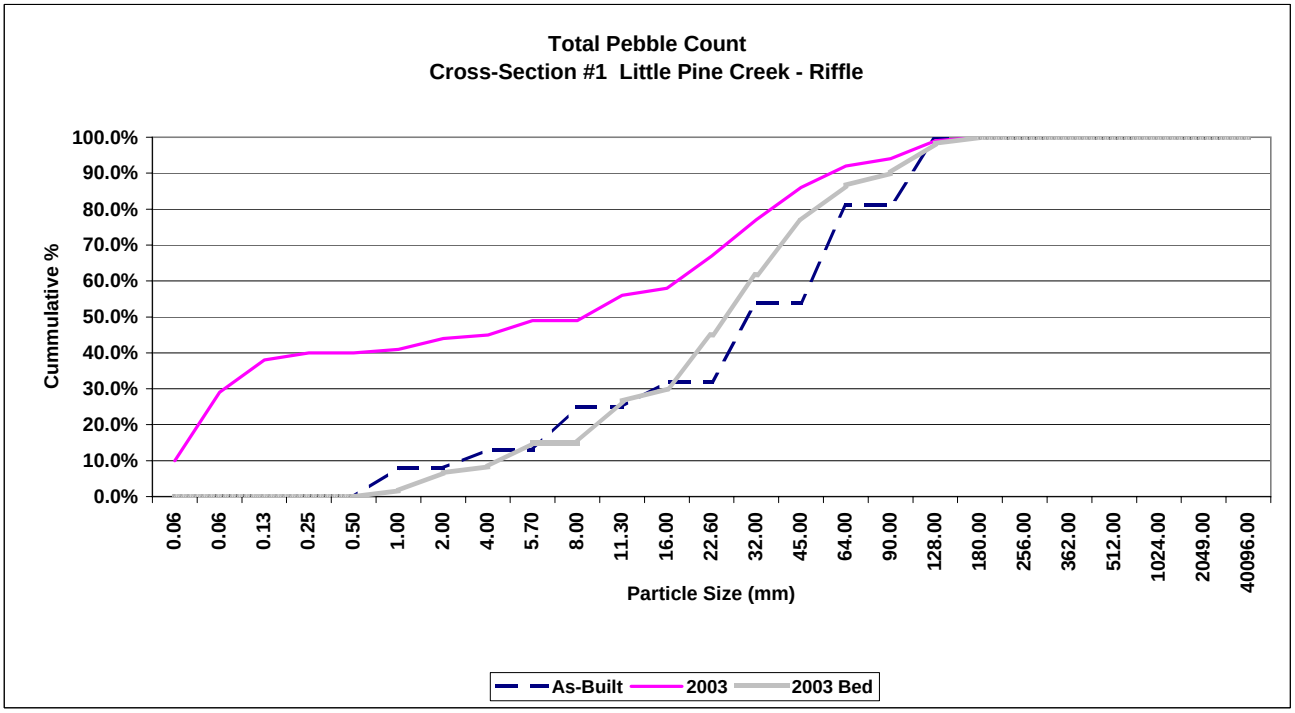
	As-Built	2002	2003
Area	86.7	90.55	101.74
Width	31.5	31.2	31.5
Mean Dept	2.8	2.9	3.2
Max Depth	5.0	5.2	5.0



Project Name	Little Pine Creek
Cross Section	#1
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

			As-Built			2003			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	10	10.0%	10.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	19	19.0%	29.0%
	fine sand	0.125	0	0.0%	0.0%	0	9	9.0%	38.0%
	medium sand	0.25	0	0.0%	0.0%	0	2	2.0%	40.0%
	course sand	0.50	0	0.0%	0.0%	0	0	0.0%	40.0%
	very course sand	1.0	8	8.0%	8.0%	1	0	1.0%	41.0%
G r a v e l	very fine gravel	2.0	0	0.0%	8.0%	3	0	3.0%	44.0%
	fine gravel	4.0	5	5.0%	13.0%	1	0	1.0%	45.0%
	fine gravel	5.7	0	0.0%	13.0%	4	0	4.0%	49.0%
	medium gravel	8.0	12	12.0%	25.0%	0	0	0.0%	49.0%
	medium gravel	11.3	0	0.0%	25.0%	7	0	7.0%	56.0%
	course gravel	16.0	7	7.0%	32.0%	2	0	2.0%	58.0%
	course gravel	22.6	0	0.0%	32.0%	9	0	9.0%	67.0%
	very course gravel	32	22	22.0%	54.0%	10	0	10.0%	77.0%
	very course gravel	45	0	0.0%	54.0%	9	0	9.0%	86.0%
Cobble	small cobble	64	27	27.0%	81.0%	6	0	6.0%	92.0%
	medium cobble	90	0	0.0%	81.0%	2	0	2.0%	94.0%
	large cobble	128	19	19.0%	100.0%	5	0	5.0%	99.0%
	very large cobble	180	0	0.0%	100.0%	1	0	1.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		60	40	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
As-Built	7.55	28.83	36.46	116.11	142.16
2003	0.07	0.16	10.22	50.94	118.00

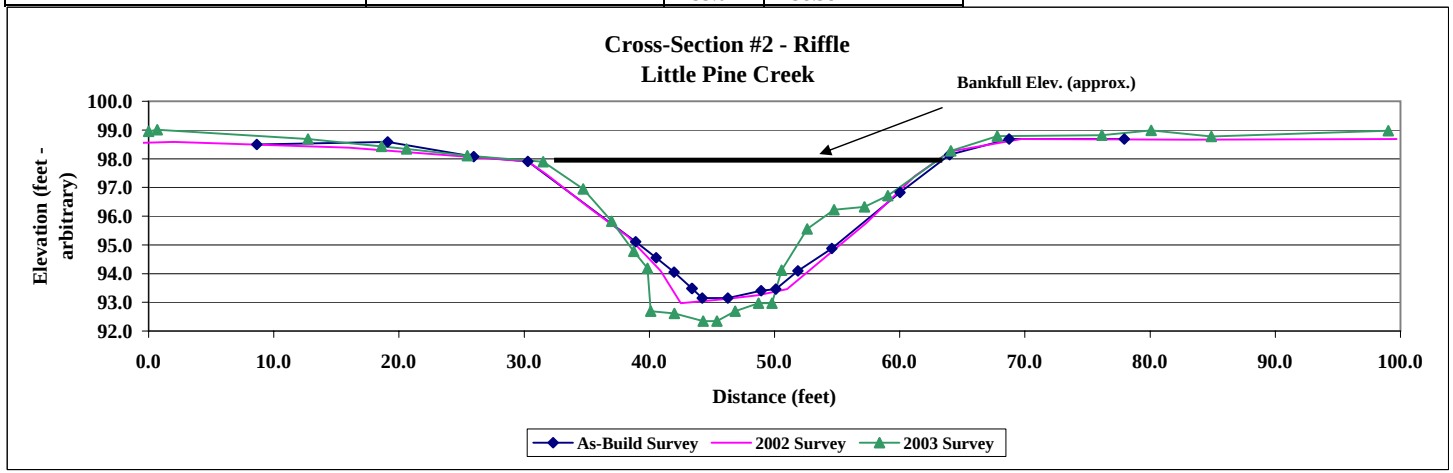


Project Name	Little Pine Creek
Cross Section	#2
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
8.7	98.5		-5	98.5		0.0	98.95	
19.1	98.6		2	98.58		0.7	99.01	
26.0	98.1		16	98.38		12.7	98.69	
30.3	97.9	BKF	30.3	97.91	BKF	18.6	98.43	
38.9	95.1		31.8	97.45		20.6	98.34	Left Pin
40.5	94.6		35.3	96.26		25.5	98.11	
42.0	94.1		38.3	95.29		31.5	97.89	BKF
43.4	93.5		40.9	94.09		34.7	96.95	
43.4	93.5		42.5	92.97		37.0	95.82	
44.2	93.2		46.1	93.11		38.7	94.77	
46.3	93.2		48.7	93.25		39.8	94.18	
48.9	93.4		51	93.46		40.1	92.69	
50.1	93.5		52.7	94.08		42.0	92.61	
51.9	94.1		57.3	95.75		44.3	92.35	
54.6	94.9		61.2	97.39		45.4	92.35	
60.0	96.8		64	98.25	BKF	46.9	92.69	
64.0	98.1	BKF	69.7	98.68		48.7	92.97	
68.7	98.7		83	98.66		49.8	92.97	
77.9	98.7		99.7	98.69		50.6	94.12	
						52.6	95.55	
						54.76	96.22	
						57.18	96.32	
						59.06	96.71	
						64.08	98.27	BKF
						67.79	98.79	
						76.14	98.82	
						80.09	98.99	Right Pin
						84.88	98.77	
						99.04	98.98	

Photo of Cross-Section #2 - Looking Downstream

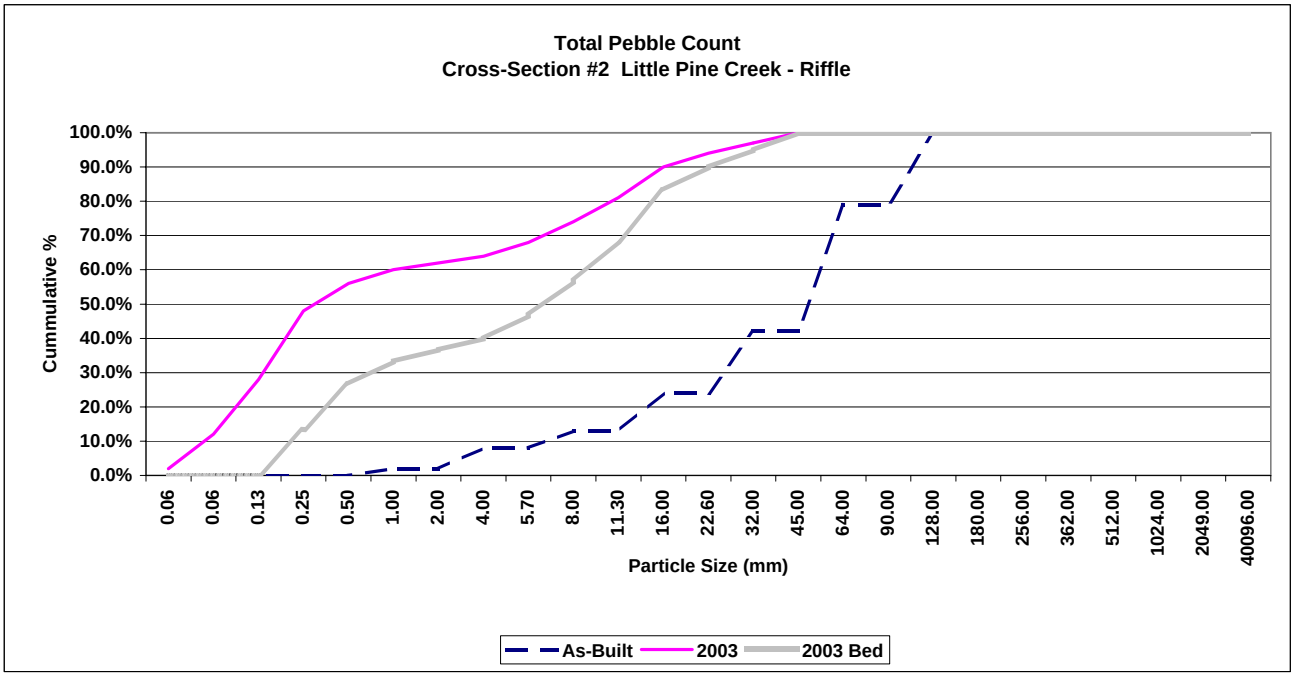
	As-Built	2002	2003
Area	88.7	92.42	87.80
Width	33.7	33.7	32.6
Mean Dept	2.6	2.7	2.7
Max Depth	4.8	4.9	5.5



Project Name	Little Pine Creek
Cross Section	#2
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

			As-Built			2003			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	2	2.0%	2.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	10	10.0%	12.0%
	fine sand	0.125	0	0.0%	0.0%	0	16	16.0%	28.0%
	medium sand	0.25	0	0.0%	0.0%	8	12	20.0%	48.0%
	course sand	0.50	0	0.0%	0.0%	8	0	8.0%	56.0%
	very course sand	1.0	2	2.0%	2.0%	4	0	4.0%	60.0%
G r a v e l	very fine gravel	2.0	0	0.0%	2.0%	2	0	2.0%	62.0%
	fine gravel	4.0	6	6.0%	8.0%	2	0	2.0%	64.0%
	fine gravel	5.7	0	0.0%	8.0%	4	0	4.0%	68.0%
	medium gravel	8.0	5	5.0%	13.0%	6	0	6.0%	74.0%
	medium gravel	11.3	0	0.0%	13.0%	7	0	7.0%	81.0%
	course gravel	16.0	11	11.0%	24.0%	9	0	9.0%	90.0%
	course gravel	22.6	0	0.0%	24.0%	4	0	4.0%	94.0%
	very course gravel	32	18	18.0%	42.0%	3	0	3.0%	97.0%
	very course gravel	45	0	0.0%	42.0%	3	0	3.0%	100.0%
Cobble	small cobble	64	37	37.0%	79.0%	0	0	0.0%	100.0%
	medium cobble	90	0	0.0%	79.0%	0	0	0.0%	100.0%
	large cobble	128	21	21.0%	100.0%	0	0	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		60	40	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
As-Built	15.19	34.14	59.36	119.71	143.29
2003	0.12	0.25	0.47	15.53	31.03

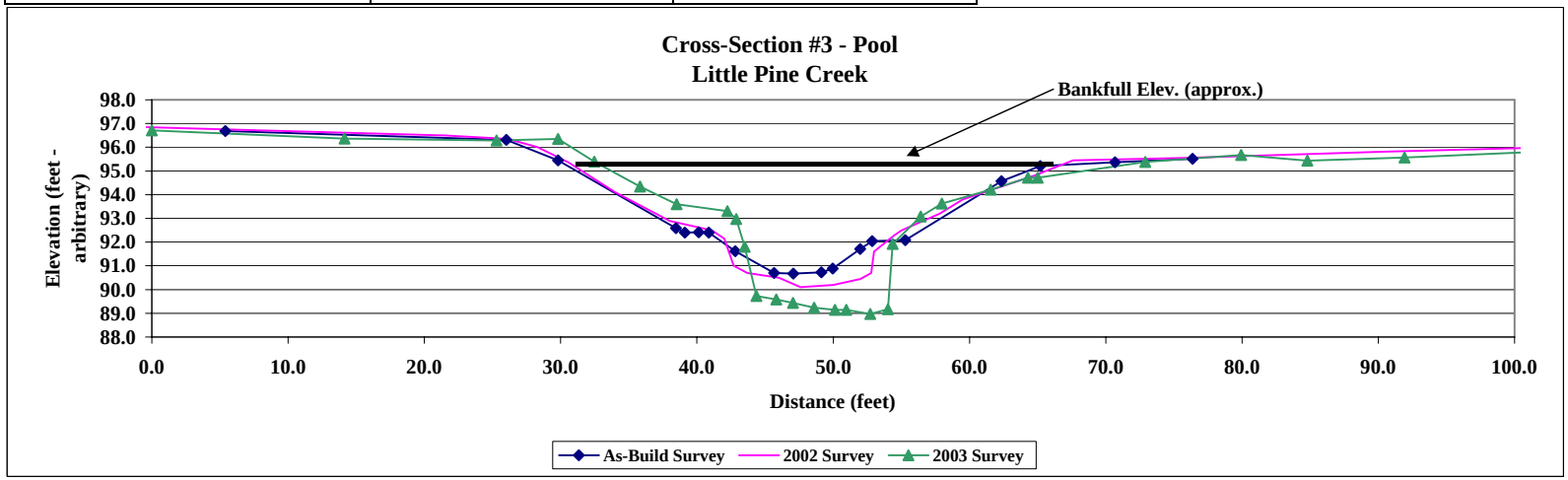


Project Name	Little Pine Creek
Cross Section	#3
Feature	Pool
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
5.4	96.7		-1	96.86		0	96.71	
26.0	96.3		9.7	96.68		14.14	96.36	
29.8	95.4	BKF	21.5	96.5		25.29	96.29	
38.5	92.6		26.1	96.35		29.8	96.35	Left Pin
39.1	92.4		28.3	96		32.46	95.39	BKF
40.1	92.4		30.6	95.35	BKF	35.82	94.34	
40.9	92.4		34	94.1		38.5	93.6	
42.8	91.6		38	92.9		42.24	93.3	
45.7	90.7		41.1	92.5		42.88	92.98	
47.1	90.7		42	92.15		43.51	91.8	
49.1	90.7		42.7	91		44.37	89.73	
50.0	90.9		43.7	90.7		45.83	89.58	
52.0	91.7		46	90.5		47.04	89.43	
52.9	92.0		47.6	90.1		48.61	89.24	
55.3	92.1		50	90.2		50.12	89.14	
62.3	94.6		52	90.45		50.95	89.15	
65.2	95.2	BKF	52.8	90.7		52.73	88.97	
70.7	95.4		53	91.6		54.01	89.17	
76.4	95.5		54.5	92.3		54.36	91.92	
			55	92.5		56.43	93.08	
			57.8	93.2		57.98	93.63	
			59.5	93.8		61.55	94.21	
			64.7	94.8		64.3	94.72	BKF Field
			67.6	95.45	BKF	65	94.72	
			76	95.55		72.89	95.38	BKF
			90	95.8		79.93	95.67	Right Pin
			103.2	96		84.79	95.43	
						91.92	95.56	
						100.54	95.78	

Photo of Cross-Section #3 - Looking Downstream

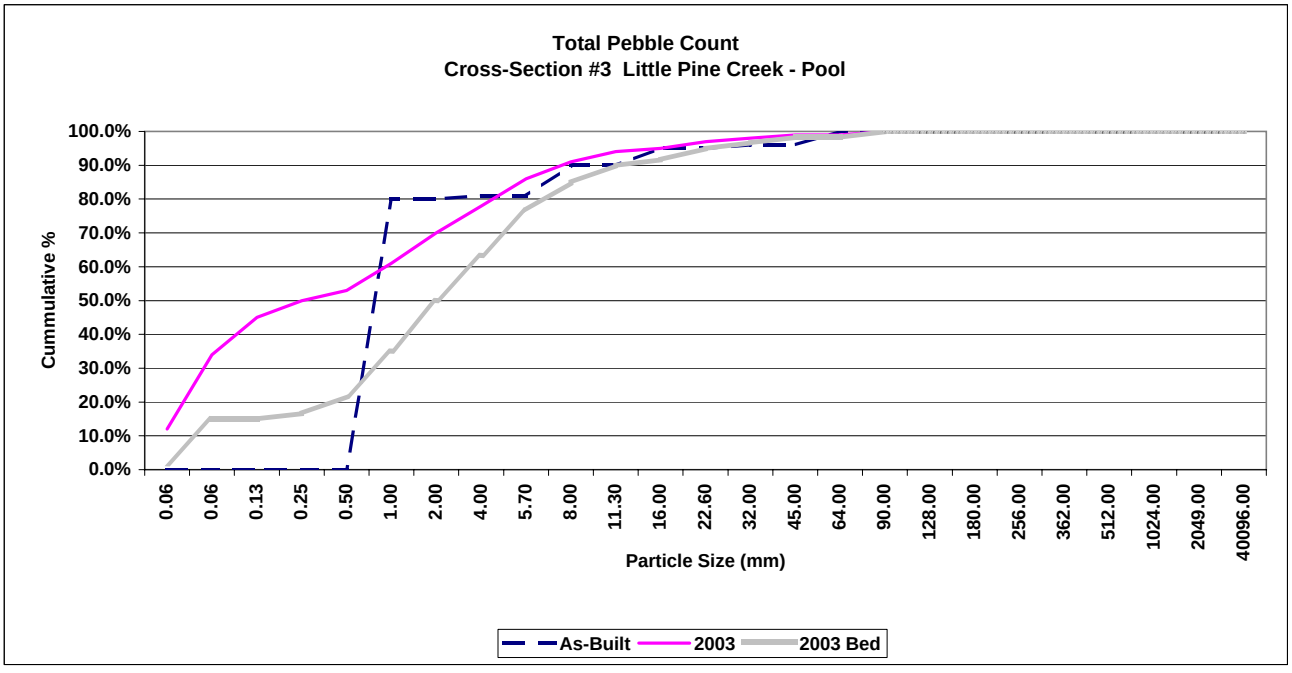
	As-Built	2002	2003
Area	86.6	96.63	100.41
Width	35.4	37.0	40.4
Mean Dept	2.4	2.6	2.5
Max Depth	4.5	5.3	6.4



Project Name	Little Pine Creek
Cross Section	#3
Feature	Pool
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

			As-Built			2003			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	1	11	12.0%	12.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	8	14	22.0%	34.0%
	fine sand	0.125	0	0.0%	0.0%	0	11	11.0%	45.0%
	medium sand	0.25	0	0.0%	0.0%	1	4	5.0%	50.0%
	course sand	0.50	0	0.0%	0.0%	3	0	3.0%	53.0%
	very course sand	1.0	80	80.0%	80.0%	8	0	8.0%	61.0%
Gravel	very fine gravel	2.0	0	0.0%	80.0%	9	0	9.0%	70.0%
	fine gravel	4.0	1	1.0%	81.0%	8	0	8.0%	78.0%
	fine gravel	5.7	0	0.0%	81.0%	8	0	8.0%	86.0%
	medium gravel	8.0	9	9.0%	90.0%	5	0	5.0%	91.0%
	medium gravel	11.3	0	0.0%	90.0%	3	0	3.0%	94.0%
	course gravel	16.0	5	5.0%	95.0%	1	0	1.0%	95.0%
	course gravel	22.6	0	0.0%	95.0%	2	0	2.0%	97.0%
	very course gravel	32	1	1.0%	96.0%	1	0	1.0%	98.0%
	very course gravel	45	0	0.0%	96.0%	1	0	1.0%	99.0%
Cobble	small cobble	64	4	4.0%	100.0%	0	0	0.0%	99.0%
	medium cobble	90	0	0.0%	100.0%	1	0	1.0%	100.0%
	large cobble	128	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		60	40	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
As-Built	0.90	1.08	1.22	7.78	46.60
2003	0.07	0.10	0.38	6.35	19.30



Project Name	Brush Creek
Cross Section	#4
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2001
As-Build Survey

Station	Elevation	Notes
8.4	97.8	
12.5	98.1	BKF
12.7	97.9	
18.8	95.7	
22.6	94.2	
25.7	93.2	
30.9	91.1	
32.3	90.7	
35.1	90.4	
38.8	90.1	
40.4	89.9	
44.3	90.4	
48.2	90.3	
50.2	91.1	
51.3	91.6	
62.4	95.9	
68.0	97.9	BKF
72.7	99.1	
74.8	99.3	
76.5	99.0	
92.4	98.5	

2002
2002 Survey

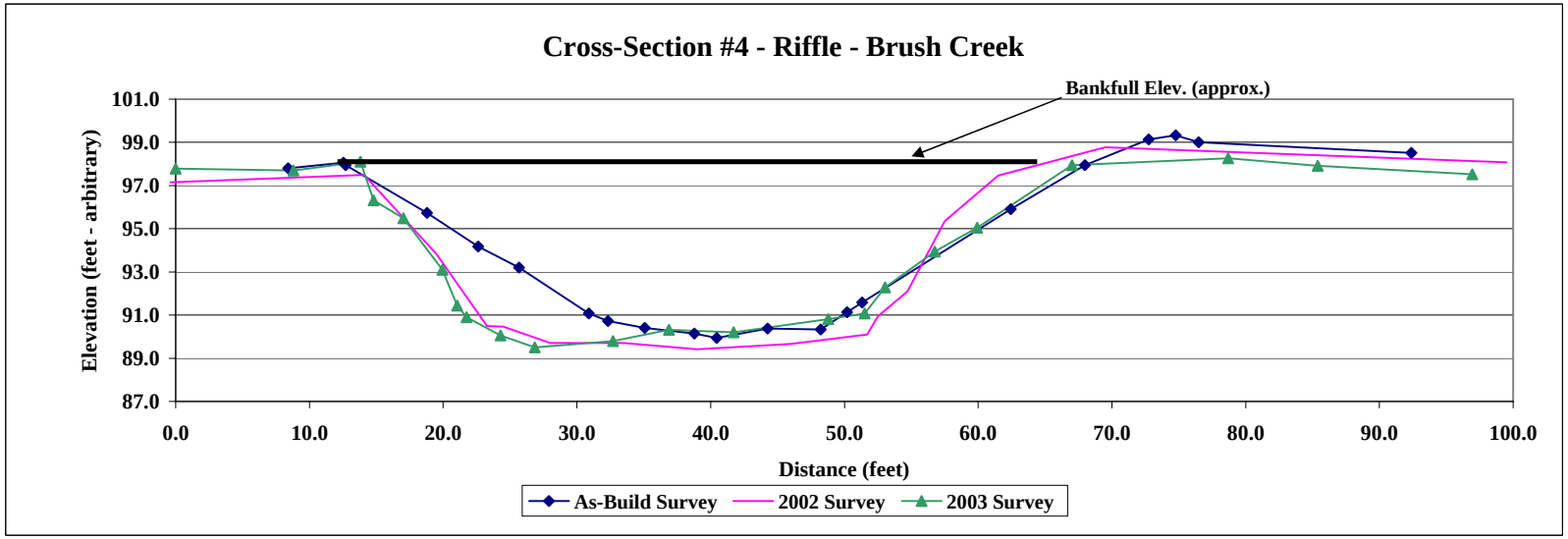
Station	Elevation	Notes
-2.5	97.1	
14.1	97.49	BKF
19.5	93.82	
23.27	90.5	
24.5	90.46	
28	89.7	
33.5	89.71	
39	89.42	
46	89.66	
51.7	90.1	
52.5	90.95	
54.7	92.09	
57.5	95.35	
61.5	97.46	BKF
69.5	98.77	
99.5	98.08	

2003
2003 Survey

Station	Elevation	Notes
0	97.78	
8.82	97.69	Left Pin
13.82	98.1	BKF
14.8	96.31	
17.02	95.48	
19.95	93.1	
21.04	91.44	
21.76	90.9	
24.3	90.06	
26.86	89.5	
32.69	89.79	
36.89	90.32	
41.72	90.2	
48.79	90.81	
51.52	91.08	
53.05	92.29	
56.76	93.94	
59.92	95.05	
67.03	97.94	BKF
78.7	98.27	Right Pin
85.38	97.91	
96.95	97.52	

Photo of Cross-Section #4 - Looking Downstream

	As-Built	2002	2003
Area	266.9	283.59	305.71
Width	55.3	47.4	53.2
Mean Dept	4.8	6.0	5.7
Max Depth	8.0	8.1	8.4

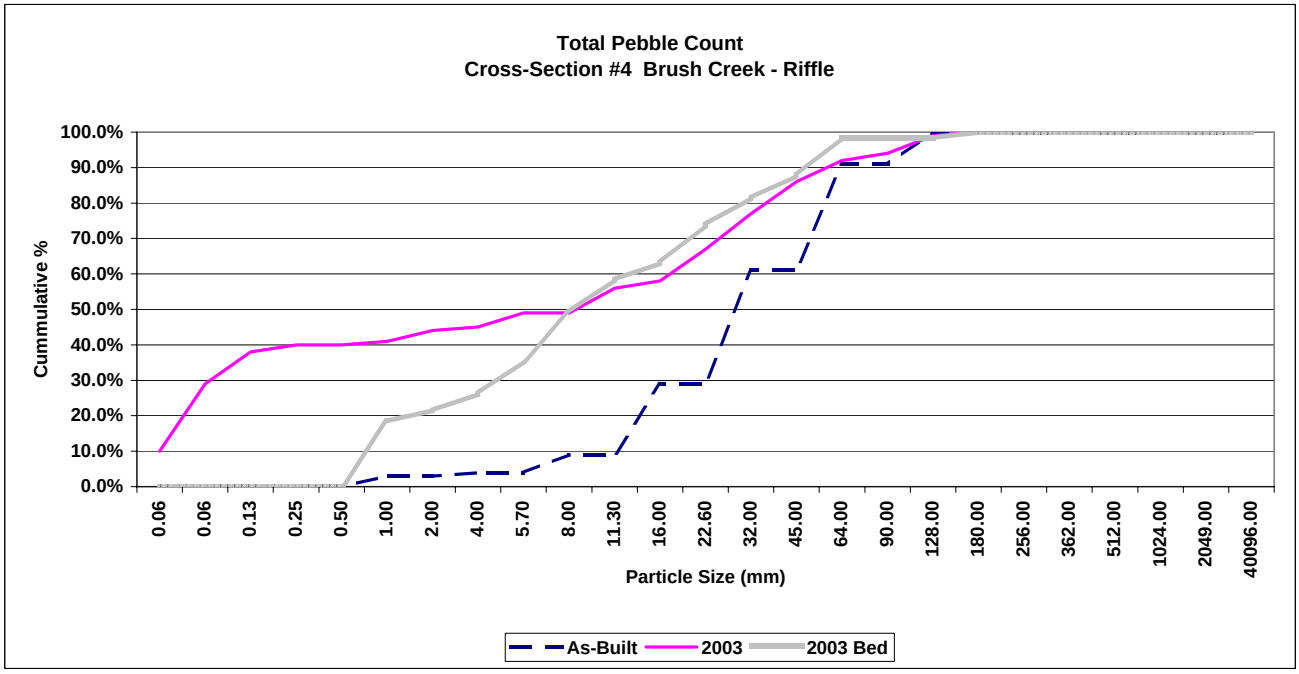


Project Name	Brush
Cross Section	#4
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

Cross Section #1
Brush Creek

			As-Built			2003			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	0	0.0%	0.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	17	17.0%	17.0%
	fine sand	0.125	0	0.0%	0.0%	0	15	15.0%	32.0%
	medium sand	0.25	0	0.0%	0.0%	0	3	3.0%	35.0%
	course sand	0.50	0	0.0%	0.0%	0	0	0.0%	35.0%
	very course sand	1.0	3	3.0%	3.0%	12	0	12.0%	47.0%
G r a v e l	very fine gravel	2.0	0	0.0%	3.0%	2	0	2.0%	49.0%
	fine gravel	4.0	1	1.0%	4.0%	3	0	3.0%	52.0%
	fine gravel	5.7	0	0.0%	4.0%	6	0	6.0%	58.0%
	medium gravel	8.0	5	5.0%	9.0%	9	0	9.0%	67.0%
	medium gravel	11.3	0	0.0%	9.0%	6	0	6.0%	73.0%
	course gravel	16.0	20	20.0%	29.0%	3	0	3.0%	76.0%
	course gravel	22.6	0	0.0%	29.0%	7	0	7.0%	83.0%
	very course gravel	32	32	32.0%	61.0%	5	0	5.0%	88.0%
	very course gravel	45	0	0.0%	61.0%	4	0	4.0%	92.0%
Cobble	small cobble	64	30	30.0%	91.0%	7	0	7.0%	99.0%
	medium cobble	90	0	0.0%	91.0%	0	0	0.0%	99.0%
	large cobble	128	9	9.0%	100.0%	0	0	0.0%	99.0%
	very large cobble	180	0	0.0%	100.0%	1	0	1.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		65	35	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
As-Built	15.63	29.40	34.65	71.75	129.00
2003	0.09	1.13	3.62	29.54	64.14

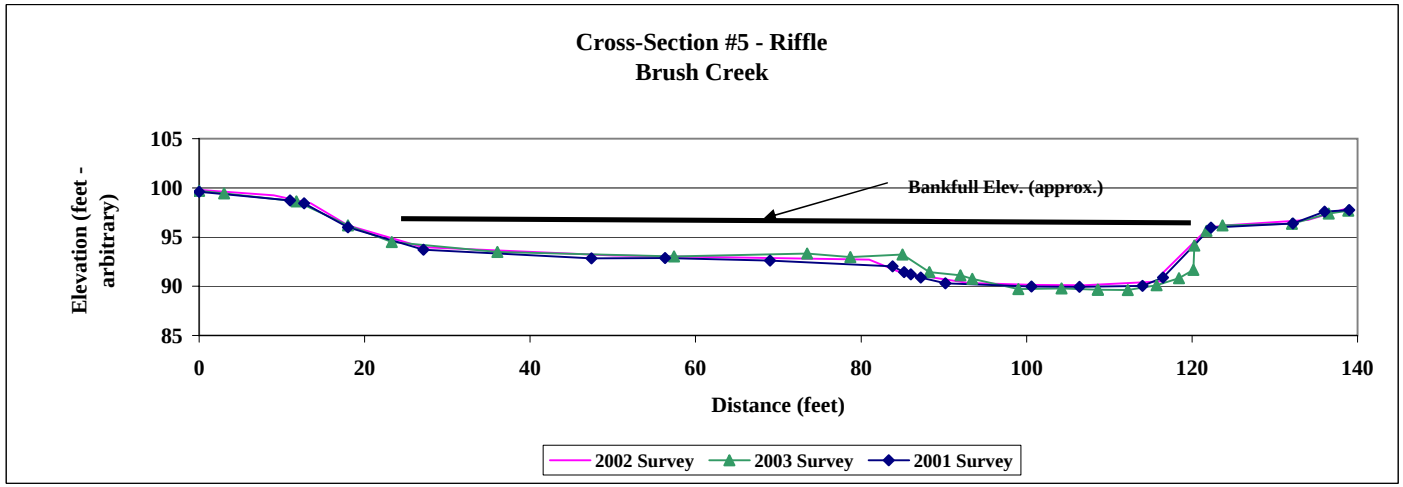


Project Name	Brush Creek
Cross Section	#5
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0.0	99.6		0	99.81		0	99.69	Left Pin
11.0	98.7		9	99.25		3	99.43	
12.7	98.4		13.5	98.42		11.75	98.62	
18.0	96.0	BKF	18	96.2		18	96.2	
27.1	93.7		27	93.96		23.27	94.51	
47.4	92.9		50	93.12		36.06	93.5	
56.3	92.9		81	92.71		57.41	93.02	
69.0	92.6		86	90.99		73.48	93.34	
83.8	92.0		86.9	91.11		78.72	92.97	
85.2	91.4		93	90.34		84.99	93.24	
86.0	91.2		101	90.13		88.24	91.44	
87.2	90.9		107	90.1		92.02	91.12	
90.2	90.3		116.3	90.51		93.45	90.75	
100.6	90.0		116.6	91.48		98.99	89.72	
106.4	89.9		122	95.96	BKF	104.22	89.77	
114.0	90.0		124	96.2		108.6	89.66	
116.5	90.9		134	96.75		108.65	89.66	
122.3	96.0	BKF	139	97.97		112.24	89.63	
132.2	96.4					115.73	90.1	
136.0	97.6					118.42	90.83	
139	97.75					120.16	91.66	
						120.26	94.14	
						121.75	95.65	
						123.67	96.19	BKF
						132.08	96.35	
						136.53	97.38	
						138.87	97.69	Right Pin

Photo of Cross-Section #5 - Looking Downstream

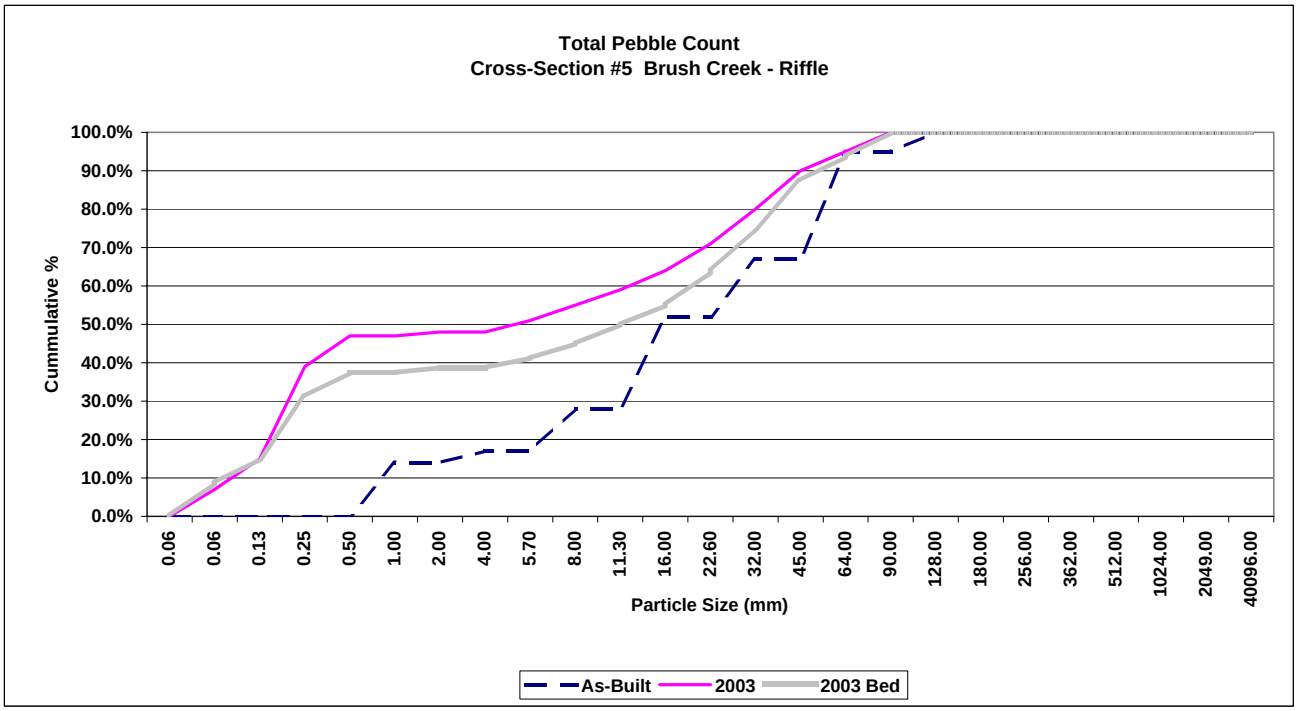
	As-Built	2002	2003
Area	392.0	387.12	384.62
Width	104.3	106.0	105.4
Mean Dept	3.8	3.7	3.6
Max Depth	6.1	6.1	6.6



Project Name	Brush Creek
Cross Section	#5
Feature	Riffle
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

Brush Creek			As-Built			2003			
Description	**Material**	**Size (mm)**	**Riffle - Bed**	**%**	**Cum %**	**Riffle - Bed**	**Riffle - Bank**	**%**	**Cum %**
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	0	0.0%	0.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	7	0	7.0%	7.0%
	fine sand	0.125	0	0.0%	0.0%	5	3	8.0%	15.0%
	medium sand	0.25	0	0.0%	0.0%	13	11	24.0%	39.0%
	course sand	0.50	0	0.0%	0.0%	5	3	8.0%	47.0%
	very course sand	1.0	14	14.0%	14.0%	0	0	0.0%	47.0%
G r a v e l	very fine gravel	2.0	0	0.0%	14.0%	1	0	1.0%	48.0%
	fine gravel	4.0	3	3.0%	17.0%	0	0	0.0%	48.0%
	fine gravel	5.7	0	0.0%	17.0%	2	1	3.0%	51.0%
	medium gravel	8.0	11	11.0%	28.0%	3	1	4.0%	55.0%
	medium gravel	11.3	0	0.0%	28.0%	4	0	4.0%	59.0%
	course gravel	16.0	24	24.0%	52.0%	4	1	5.0%	64.0%
	course gravel	22.6	0	0.0%	52.0%	7	0	7.0%	71.0%
	very course gravel	32	15	15.0%	67.0%	9	0	9.0%	80.0%
	very course gravel	45	0	0.0%	67.0%	10	0	10.0%	90.0%
Cobble	small cobble	64	28	28.0%	95.0%	5	0	5.0%	95.0%
	medium cobble	90	0	0.0%	95.0%	5	0	5.0%	100.0%
	large cobble	128	5	5.0%	100.0%	0	0	0.0%	100.0%
	very large cobble	180	0	0.0%	100.0%	0	0	0.0%	100.0%
Boulder	small boulder	256	0	0.0%	100.0%	0	0	0.0%	100.0%
	small boulder	362	0	0.0%	100.0%	0	0	0.0%	100.0%
	medium boulder	512	0	0.0%	100.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	100.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	100.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	0	0.0%	100.0%	0	0	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		80	20	100.0%	

	d16	**d35**	**d50**	**d85**	**d95**
As-Built	4.23	15.30	18.83	68.16	186.00
2003	0.20	0.34	6.18	44.90	77.00

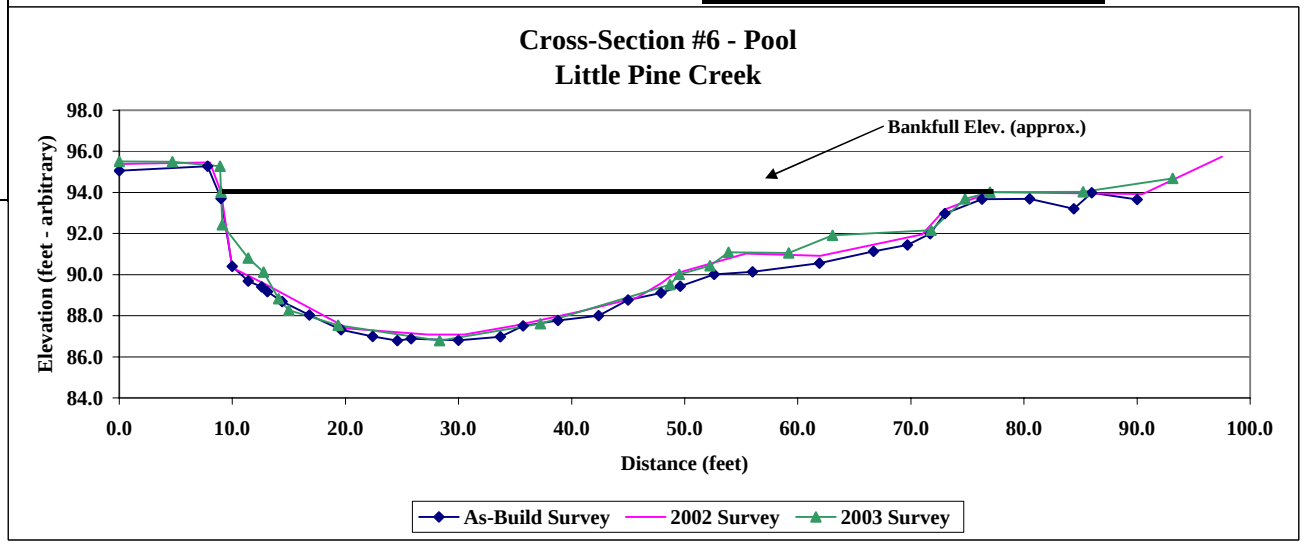


Project Name	Brush Creek
Cross Section	#6
Feature	Pool
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2001 As-Build Survey			2002 2002 Survey			2003 2003 Survey		
Station	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**	**Station**	**Elevation**	**Notes**
0.0	95.1		0	95.38		0	95.51	Left Pin
7.8	95.3		8	95.46		4.69	95.49	
9.0	93.7	BKF	9	94.01		8.92	95.27	
10.0	90.4		10	90.34		9	94.01	
11.4	89.7		13	89.52		9.12	92.42	
12.6	89.4		20.2	87.38		11.41	90.8	
13.1	89.2		27.3	87.09		12.75	90.12	
14.4	88.7		30.5	87.08		14.08	88.82	
16.8	88.0		35	87.52		14.99	88.27	
19.6	87.3		40.6	88.19		19.35	87.54	
22.4	87.0		45.8	88.89		28.33	86.79	
24.6	86.8		48	89.6		37.25	87.61	
25.8	86.9		49	90.02		48.7	89.52	
30.0	86.8		55.4	91.03		49.53	90.01	
33.7	87.0		62	90.91		52.23	90.43	
35.7	87.5		71	91.95		53.88	91.09	
38.8	87.8		73	93.18		59.19	91.05	
42.4	88.0		77	94.01	BKF	63.08	91.91	
45.0	88.8		90.5	93.92		71.79	92.16	
47.9	89.1		97.5	95.74		74.79	93.68	BKF
49.6	89.4					77	94.01	
52.6	90.0					85.24	94.03	
56.0	90.1					93.15	94.68	
61.9	90.6							
66.7	91.1							
69.7	91.4							
71.7	92.0							
73.0	93.0							
76.3	93.7	BKF						
80.5	93.7							
84.4	93.2							
86.0	94.0							
90.0	93.7							

Photo of Cross-Section #6 - Looking Downstream

	As-Built	2002	2003
Area	305.0	285.27	297.58
Width	67.3	67.0	68.0
Mean Dept	4.5	4.3	4.4
Max Depth	6.9	6.9	7.2

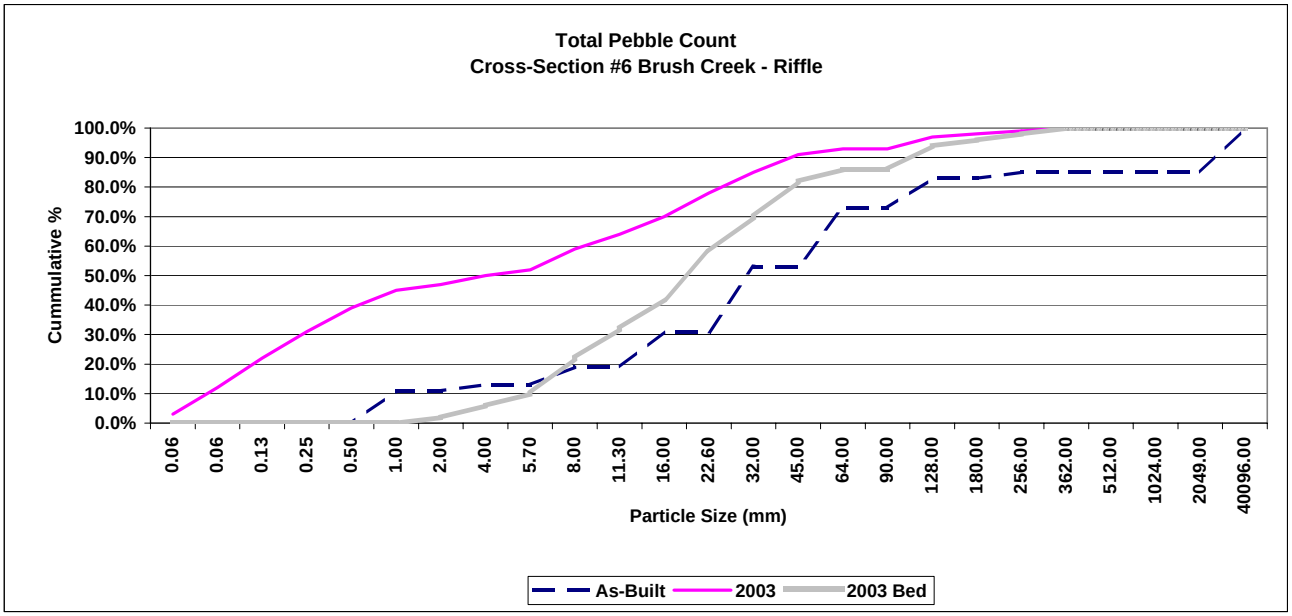


Project Name	Brush Creek
Cross Section	#6
Feature	Pool
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

Brush Creek — **As-Built** — **2003**

Description	Material	Size (mm)	Riffle - Bed	%	Cum %	Riffle - Bed	Riffle - Bank	%	Cum %
Silt/Clay	silt/clay	0.061	0	0.0%	0.0%	0	3	3.0%	3.0%
Sand	very fine sand	0.062	0	0.0%	0.0%	0	9	9.0%	12.0%
	fine sand	0.125	0	0.0%	0.0%	0	10	10.0%	22.0%
	medium sand	0.25	0	0.0%	0.0%	0	9	9.0%	31.0%
	course sand	0.50	0	0.0%	0.0%	0	8	8.0%	39.0%
	very course sand	1.0	11	11.0%	11.0%	0	6	6.0%	45.0%
Gravel	very fine gravel	2.0	0	0.0%	11.0%	1	1	2.0%	47.0%
	fine gravel	4.0	2	2.0%	13.0%	2	1	3.0%	50.0%
	fine gravel	5.7	0	0.0%	13.0%	2	0	2.0%	52.0%
	medium gravel	8.0	6	6.0%	19.0%	6	1	7.0%	59.0%
	medium gravel	11.3	0	0.0%	19.0%	5	0	5.0%	64.0%
	course gravel	16.0	12	12.0%	31.0%	5	1	6.0%	70.0%
	course gravel	22.6	0	0.0%	31.0%	8	0	8.0%	78.0%
	very course gravel	32	22	22.0%	53.0%	6	1	7.0%	85.0%
	very course gravel	45	0	0.0%	53.0%	6	0	6.0%	91.0%
Cobble	small cobble	64	20	20.0%	73.0%	2	0	2.0%	93.0%
	medium cobble	90	0	0.0%	73.0%	0	0	0.0%	93.0%
	large cobble	128	10	10.0%	83.0%	4	0	4.0%	97.0%
	very large cobble	180	0	0.0%	83.0%	1	0	1.0%	98.0%
Boulder	small boulder	256	2	2.0%	85.0%	1	0	1.0%	99.0%
	small boulder	362	0	0.0%	85.0%	1	0	1.0%	100.0%
	medium boulder	512	0	0.0%	85.0%	0	0	0.0%	100.0%
	large boulder	1024	0	0.0%	85.0%	0	0	0.0%	100.0%
	very large boulder	2049	0	0.0%	85.0%	0	0	0.0%	100.0%
Bedrock	bedrock	40096	15	15.0%	100.0%	0	0	0.0%	100.0%
TOTAL / %of whole count			100	100.0%		50	50	100.0%	

	d16	d35	d50	d85	d95
As-Built	8.25	29.34	36.97	263.50	33754.83
2003	0.13	0.56	4.85	36.90	131.50



Project Name	Little Pine and Brush Creeks
Task	Feature Slope and Length Calculations
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

2003 Data

Little Pine

Riffle Station	Change	Bed elevation	Water elevation	change	slope
85		95.48	96.1		
132	47	94.73	95.8	0.3	0.64%
204		95.07	95.55		
222	18	93.91	95.07	0.48	2.67%
266		94.12	95.01		
308	42	93.86	94.74	0.27	0.64%
390		93.37	94.33		
486	96	92.02	93.06	1.27	1.32%
574		92.23	93.14		
601	27	91.68	92.55	0.59	2.19%
728		91.8	92.48		
759	31	90.83	91.7	0.78	2.52%

Pool	length	p-p spacing
18.75		
85.85	67.1	
222		
266	44	191.7
330		
390	60	116
486		
574	88	170
601		
722	121	131.5
773		
873	100	161.5

	min	max	median
Length	18.0	96.0	36.5
Slope	0.64%	2.67%	1.75%
Length	44.0	121.0	77.6
Spacing	116	192	162

Brush Creek

Riffle Station	Change	Water elevation	change	slope
0		92.68		
114	114	91.81	0.87	0.76%
408		91.78		
559	151	91.59	0.19	0.13%
736		91.47		
796	60	90.88	0.59	0.98%
935		90.77		
1281	346	89.71	1.06	0.31%
1591		89.76		
1682	91	89.52	0.24	0.26%
1898		89.3		
1951	53	88.84	0.46	0.87%

Pool	length	p-p spacing
114		
408	294	
557		
736	179	385.5
1280		
1591	311	789
1682		
1898	216	354.5
1951		
2177	226	274

	min	max	median
Length	53.0	346.0	102.5
Slope	0.13%	0.98%	0.53%
Length	179.0	311.0	226.0
Spacing	274	789	370

PROFILE	Little Pine As-built - 2001			Brush Creek As-built - 2001			Little Pine 2003			Brush Creek 2003		
	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median	Minimum	Maximum	Median
Riffle Length	6.1	46.8	18.4	20	417	32.9	18	96	36.5	53	346	102.5
Riffle Slope	1.17%	2.79%	1.61%	0.24%	1.65%	1.35%	0.64%	2.67%	1.75%	0.13%	0.98%	0.53%
Pool Length	34.1	111.6	44.5	51	348	187	44	121	77.55	179	311	226
Pool to Pool Spacing	51	150.3	63.7	53	966	359	116	191.7	161.5	274	789	370

Project Nam	Little Pine and Brush Creeks
Task	Channel Pattern Measurements
Date	9/30/03
Crew	Shaffer, Bidelspach, Clinton

Little Pine Creek				Brush Creek		
Radius of Curvature	**Meander Wavelength**	**Channel Beltwidth**		**Radius of Curvature**	**Meander Wavelength**	**Channel Beltwidth**
43	139	39		75	248	122
62	113	37		25	512	167
39	116	43		52	570	304
65	117	62		72	228	267
35	86	50		90		
18	108	46		192		
38	94	50		119		
50	97	37		62		
52	116	54		60		
42		46				
33		50				
65						
33						
18	86	37	***min***	25	228	122
65	139	62	***max***	192	570	304
42	113	46	***median***	72	380	217

Project Name	Brush Creek
Quadrant Number	#1
Date	9/30/03
Crew	Hall, Clinton

Brush Creek Quad 1

Tree Stratum

Species	Height (cm)	Diameter (mm)	Σ X-sec. (cm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)

(none)

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Cornus amomum	0.5	50	9	45	2
Alnus serrulata	0.5	50	11	55	1
Total	**1**	**100**	**20**	**100**	

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Aster sp.	2	8.2	4
Panicum virgatum	2	8.2	4
Polygonum sagittatum	5	20.4	2
Eupatorium sp.	10	40.8	1
Helenium sp.	3	12.2	3
Polygonum sp.	0.5	2.0	5
Solidago sp.	2	8.2	4
Total	**24.5**	100.0	

Project Name	Little Pine Creek
Quadrant Number	#1
Date	9/30/03
Crew	Hall, Clinton

Little Pine Creek Quad 1

Tree Stratum

Species	Height (cm)	Diameter (mm)	Σ X-sec. (cm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
Betula nigra	40	5			1	100	1

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
Cornus amomum	0.5	100	62	100	1

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Aster sp.	0.5	0.3	6
Bidens sp.	2	1.4	5
Cassia sp.	2	1.4	5
Elymus virginicus	70	48.1	1
Festuca sp.	5	3.4	3
Helenium sp.	0.5	0.3	6
Impatiens capensis	0.5	0.3	6
Juncus sp.	3	2.1	4
Krigia sp.	0.5	0.3	6
Plantago sp.	0.5	0.3	6
Solidago sp.	0.5	0.3	6
Trifolium sp.	0.5	0.3	6
Unkwn grass	60	41.2	2
Total	**145.5**	**100.0**	

Project Name	Little Pine Creek
Quadrant Number	#2
Date	9/30/03
Crew	Hall, Clinton

Little Pine Creek Quad 2

Tree Stratum

Species	Height (cm)	Diameter (mm)	Σ X-sec. (cm²)	Rel. x-sec (%)	Density	Rel. Density (%)	Rank (Importance)
Unknown	25	10					
Unknown	25	10					

Shrub Stratum

Species	Cover (%)	Rel. cover (%)	Density	Rel. Density (%)	Rank (Importance)
(none)					

Herb Stratum

Species	Cover (%)	Rel. cover (%)	Rank (Importance)
Elymus virginicus	40	19.8	3
Impatiens capensis	50	24.7	2
Juncus sp.	10	4.9	4
Mikania scandens	0.5	0.2	7
Polygnum sagittatum	8	4.0	5
Polygonum sp.	2	1.0	6
Ranunculus sp.	2	1.0	6
Unkwn grass	90	44.4	1
Total	**202.5**	**100.0**	