SOUTH FORK HOPPERS CREEK STREAM AND WETLAND RESTORATION PROJECT

ANNUAL MONITORING REPORT FOR 2007 (YEAR 2)

Project Number: D04006-4

Submitted to:

NCDENR
Ecosystem Enhancement Program
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SUMMARY

This Annual Report details the monitoring activities during the 2007 growing season on the South Fork Hoppers Creek Wetland and Stream Restoration Site ("Site"). Construction of the Site, including planting of trees, was completed in April 2006. In order to document project success, ten vegetation monitoring plots, sixteen permanent cross-sections, 3,562 linear feet of longitudinal profiles, one rain gauge, one crest gauge and eight hydrologic monitoring gauges (five automated and three manual) were installed and assessed across the Site. The 2007 data represents results from the second year of vegetation and hydrologic monitoring for both wetlands and streams and from the first year of macroinvertebrate data for streams.

Prior to restoration, wetland, stream, and buffer functions on the Site were impaired as a result of agricultural conversion. Streams flowing through the Site had been channelized to reduce flooding and provide drainage for adjacent farm fields. After construction it was determined that 5.6 acres of riverine wetlands and 7,229 linear feet (LF) of stream were restored, and 1.4 acres of riverine wetlands were enhanced.

Weather station data from the Natural Resources Conservation Service (NRCS) National Climate and Water Center (Marion WETS Station in McDowell County – NC 5340) and the US Geological Survey (USGS) Water Data for North Carolina (USGS 03451500 French Broad River at Asheville, NC) were used in conjunction with a manual rain gauge located on the Site to document precipitation amounts. For the 2007 growing season, November 2006 through January 2007 rainfall was normal or above normal; however from February 2007 through October 2007 rainfall was recorded as below normal for greater than 55 percent of the time. The monitoring well data shows that six of the eight hydrologic monitoring gauges had met the 7 percent hydrologic success criteria based on field observations in 2007. The remaining two wells documented hydroperiods similar to those documented for the reference monitoring wells.

Ten monitoring plots that are 10 meters by 10 meters or 0.025 of an acre in size were used to assess survivability of the woody vegetation planted on site. They are randomly located to represent the different zones within the project. The vegetation monitoring documented a survivability range of 560 stems per acre to 720 stems per acre with an overall average of 644 stems per acre. Overall, the Site is on track for meeting the initial vegetation survival criteria of 320 stems per acre surviving after the third growing season.

In general, dimension, pattern, profile and in-stream structures remained stable during the second growing season. Minor scour erosion was noted along the upstream end of a few rootwads at stations 124+50, 126+75, and 133+50. The erosion appears to have taken place before vegetation was fully established. Minor stream dimension aggradation was documented at a few cross-sections and has occurred within the last year. On-site evaluation suggests that this is due to increased sediment supply upstream from the site and a beaver dam located just downstream of the site that is holding back flow and allowing sediment to settle out of the water column. Point bar formation along the inside of a meander bend indicates flow velocity vectors occurring as designed. All monitored cross-sections fell within the quantitative parameters defined for "C" type channels. Five bankfull events were observed and documented during the months of January, March, May, July, and September.

In summary, the Site is on track to achieve the hydraulic, vegetative, and stream success criteria specified in the Site's Restoration Plan.

1.0 PROJECT BACKGROUND

The South Fork Hoppers Creek Restoration Site is located in McDowell County, North Carolina (Figure 1). The Site lies in the Catawba River Basin within North Carolina Division of Water Quality (NCDWQ) sub-basin 03-08-30 and US Geologic Survey (USGS) hydrologic unit 03050101040020. The Site has a recent history of pasture and general agricultural usage. The streams of the Site were channelized and riparian vegetation was cleared in most locations. Stream and riparian functions on the Site had been severely impacted as a result of agricultural conversion.

The project involved the restoration of 5.6 acres of riverine wetlands, enhancement of 1.4 acres of riverine wetlands, and restoration of 7,229 linear feet (LF) of stream along South Fork Hoppers Creek (the mainstem) and one unnamed tributary (UT 1). A total of 33.8 acres of stream, wetland, and riparian buffer are protected through a permanent conservation easement.

1.1 Project Location

The Site is located approximately 30 miles northwest of the town of Shelby in McDowell County, North Carolina (Figure 1 & 2). From Shelby take NC Highway 226 north towards Dysartsville. Approximately 3 miles past the Rutherford/McDowell County line, turn left onto Walker Road. Take the next right onto Pierce Road. The Site is divided into two separate sections by Pierce Road. Access for the downstream section is northeast of the culvert crossing. The conservation easement gate for the upstream section is southwest of the culvert crossing.

1.2 Mitigation Goals and Objectives

The specific goals for the South Fork Hoppers Creek Restoration Project were as follows:

- Restoration of 7,229 LF of stream channel.
- Restoration of 5.6 acres of riverine wetlands.
- Enhancement of 1.4 acres of existing riverine wetlands.
- Removal of cattle access to the stream channel, wetland and riparian buffer areas.
- Improvement of floodplain functionality by matching floodplain elevations with the bankfull stage.
- Establishment of native wetland and floodplain vegetation within the conservation easement.
- Improvement of wildlife habitat functions of the Site.

1.3 Project Description and Restoration Approach

For assessment and analysis purposes, the on-site streams were divided into five reaches: four along the mainstem, and one on UT 1 that flows into the mainstem downstream of Pierce Road (Figure 3). The following paragraphs describe the Site's pre-construction conditions.

The mainstem entered the Site from the southwest and flowed east through a 48-inch corrugated metal pipe (CMP) culvert. Reach 1 continued east through a pasture for approximately 1,500 LF and then entered a second 48-inch CMP culvert. Reach 2 began 1,000 LF downstream of the second 48-inch culvert, at the confluence of a small tributary, and continued east and north for 578 LF to twin, 72-inch CMP culverts under Pierce Road. Reach 3 began downstream of the twin culverts and continued approximately 1,200 LF north through an abandoned pasture. Reach 4 extended the final 900 LF to the north project boundary and was characterized by a flatter slope, finer bed material, and a lower bank height ratio than the other 3 reaches.

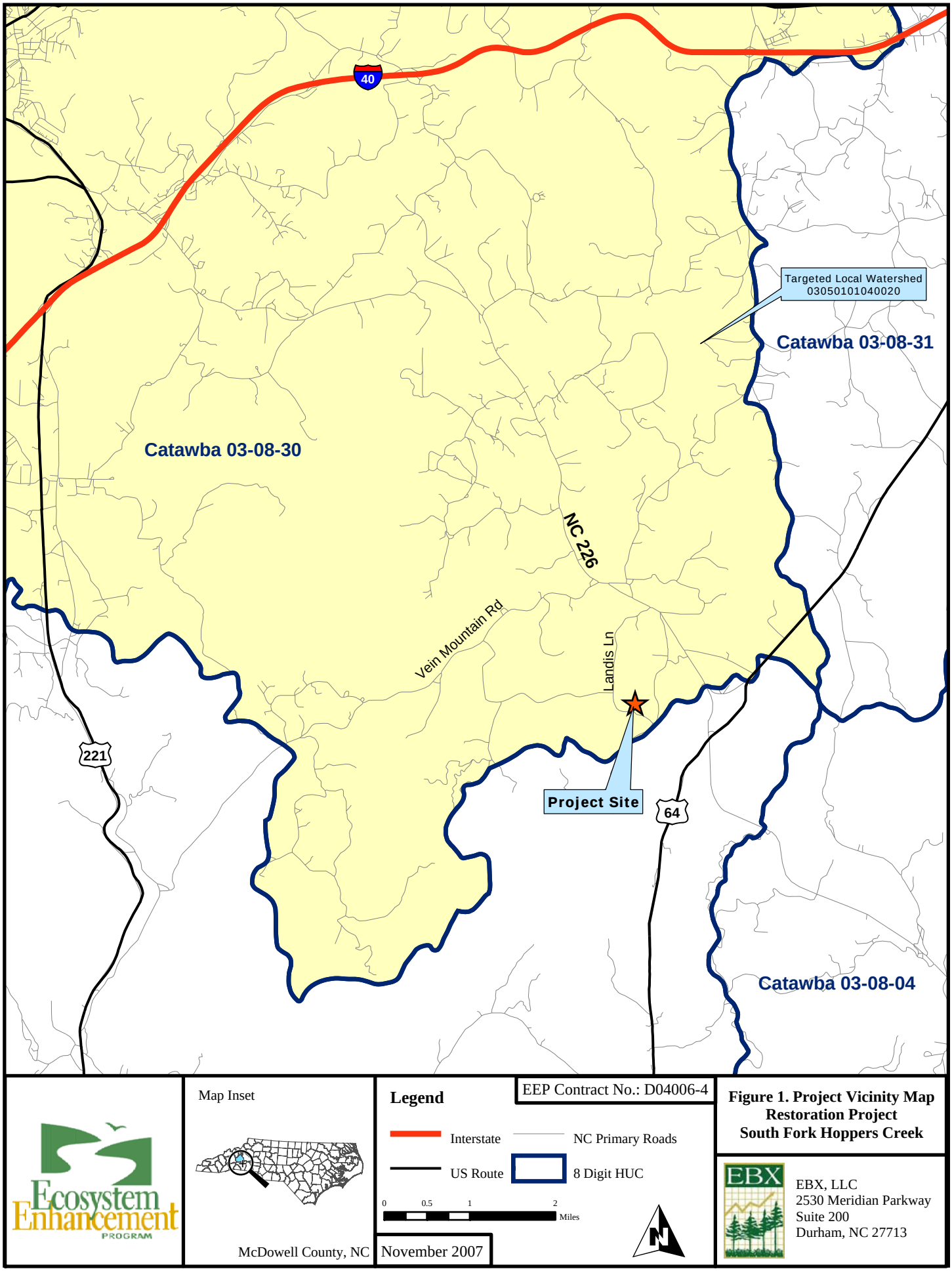
UT 1 entered the Site through a 36-inch culvert under Pierce Road, then flowed east to west, parallel to Pierce Road, and entered Reach 3 approximately 80 LF downstream of the twin, 72-inch culverts. UT 1 had a reach length of 306 LF on the project Site.

For design purposes, the mainstem was divided into two reaches. From the assessment, Reach 1 correlates to Design Reach 1, while Reaches 2, 3, and 4 were combined for Design Reach 2.

It is likely that much of the project area once existed as a wetland ecosystem, as evidenced by hydric soil areas across the bottomland fields of the Site, as well as landowner accounts of wet areas of the Site prior to drainage activities. Wetland areas that once existed on the Site were drained and manipulated to promote agricultural uses. The stream was channelized within the project site to improve surface and subsurface drainage and to decrease flooding. Subsurface drain tiles were also installed in floodplain areas of the project Site, particularly the field downstream of Pierce Road. As a result, wetland functions were impacted within the project area. The channelization of the stream impaired its ability to function naturally, resulting in areas of active bank erosion and an overall poor habitat condition.

Design for the restored stream involved the construction of a new channel meandering through the agricultural fields. The restored mainstem was a Rosgen "C" stream type channel with a low width/depth cross-sectional area approaching typical Rosgen "E" type dimensions. A Rosgen "B" stream type was used for the restored UT 1 channel. Each stream type's design dimensions are based on those of reference parameters. Wetland restoration of the agricultural fields on the Site involved raising the local water table to restore a natural flooding regime. The stream through the Site was restored to a stable dimension, pattern, and profile, such that riverine wetland functions were restored to the adjacent hydric soil areas. Drainage ditches within the restoration areas were filled to decrease surface and subsurface drainage and raise the local water table. Total stream length across the Site was increased from approximately 5,579 LF to 7,229 LF. Total wetland acreage was increased from 2.17 acres to 5.6 acres. Assessment of the restored site determined that 7,229 stream mitigation units (SMU) were provided for the stream restoration and a total of 6.3 wetlands mitigation units (WMU) were achieved for wetland restoration and enhancement.

The design allows stream flows larger than the bankfull to spread onto the floodplain, dissipating flow energies and reducing stress on stream banks. In-stream structures were used to control streambed grade, reduce stress on stream banks, and promote bedform sequences and habitat diversity. The in-stream structures consisted of root-wads, cover logs and log vanes, which promote a diversity of habitat features in the restored channel. Where grade control was a consideration, constructed riffles or rock cross vanes were installed to provide long-term stability. Stream banks were stabilized using a combination of erosion control matting, live stakes, bare-root planting, and transplants. Transplants provide living root mass to increase stream bank stability and create holding areas for fish and aquatic biota. Native vegetation was planted across the Site, and the entire restoration site is protected through a permanent conservation easement.



Ecosystem Enhancement Program

Map Inset

McDowell County, NC

Legend

Interstate
NC Primary Roads
US Route
8 Digit HUC

0 0.5 1 2 Miles

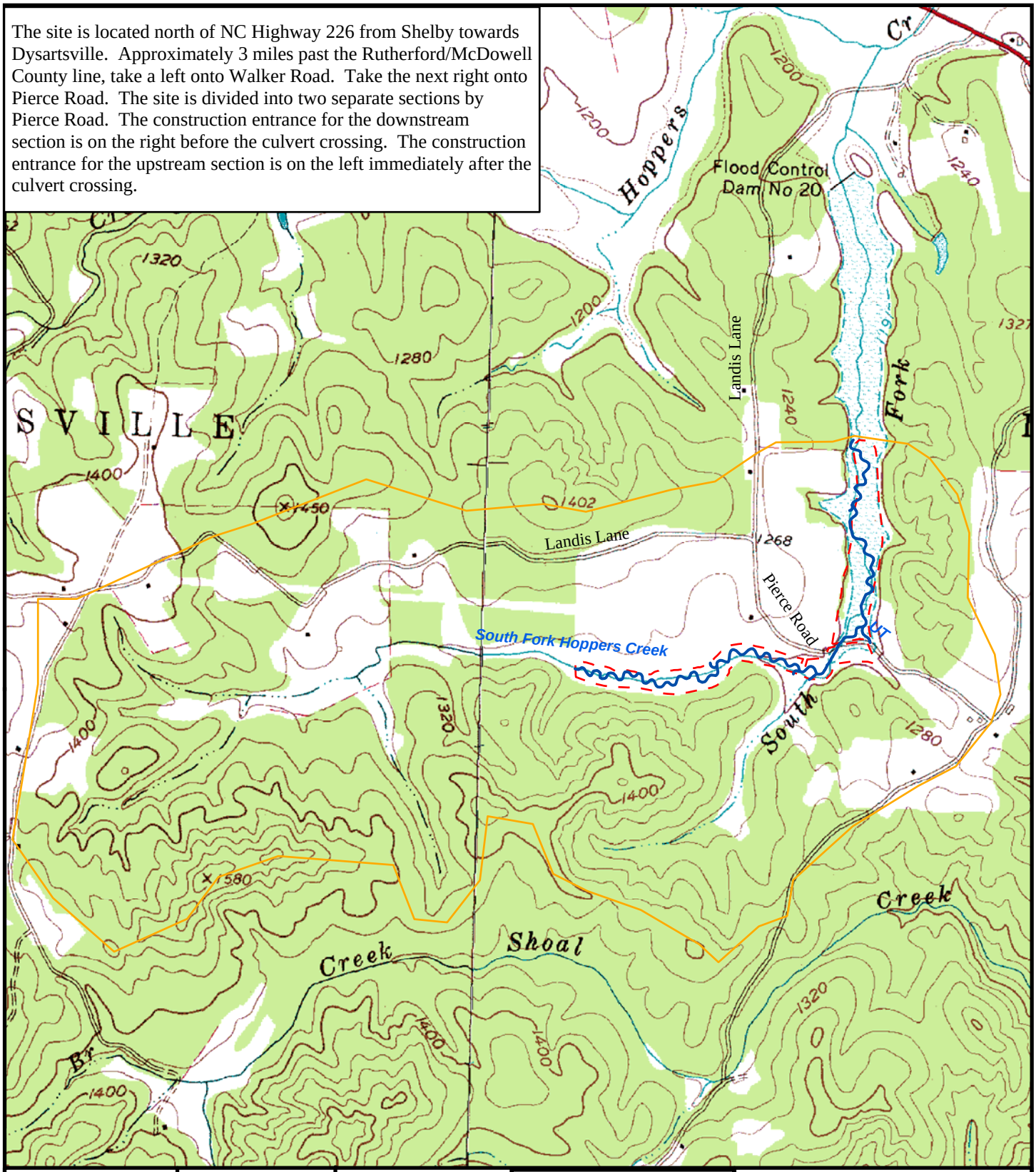
November 2007

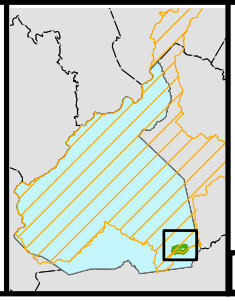
EEP Contract No.: D04006-4

Figure 1. Project Vicinity Map
Restoration Project
South Fork Hoppers Creek

EBX, LLC
2530 Meridian Parkway
Suite 200
Durham, NC 27713

The site is located north of NC Highway 226 from Shelby towards Dysartsville. Approximately 3 miles past the Rutherford/McDowell County line, take a left onto Walker Road. Take the next right onto Pierce Road. The site is divided into two separate sections by Pierce Road. The construction entrance for the downstream section is on the right before the culvert crossing. The construction entrance for the upstream section is on the left immediately after the culvert crossing.





Legend

- Watershed Boundary
- Project Boundary
- Project Reaches

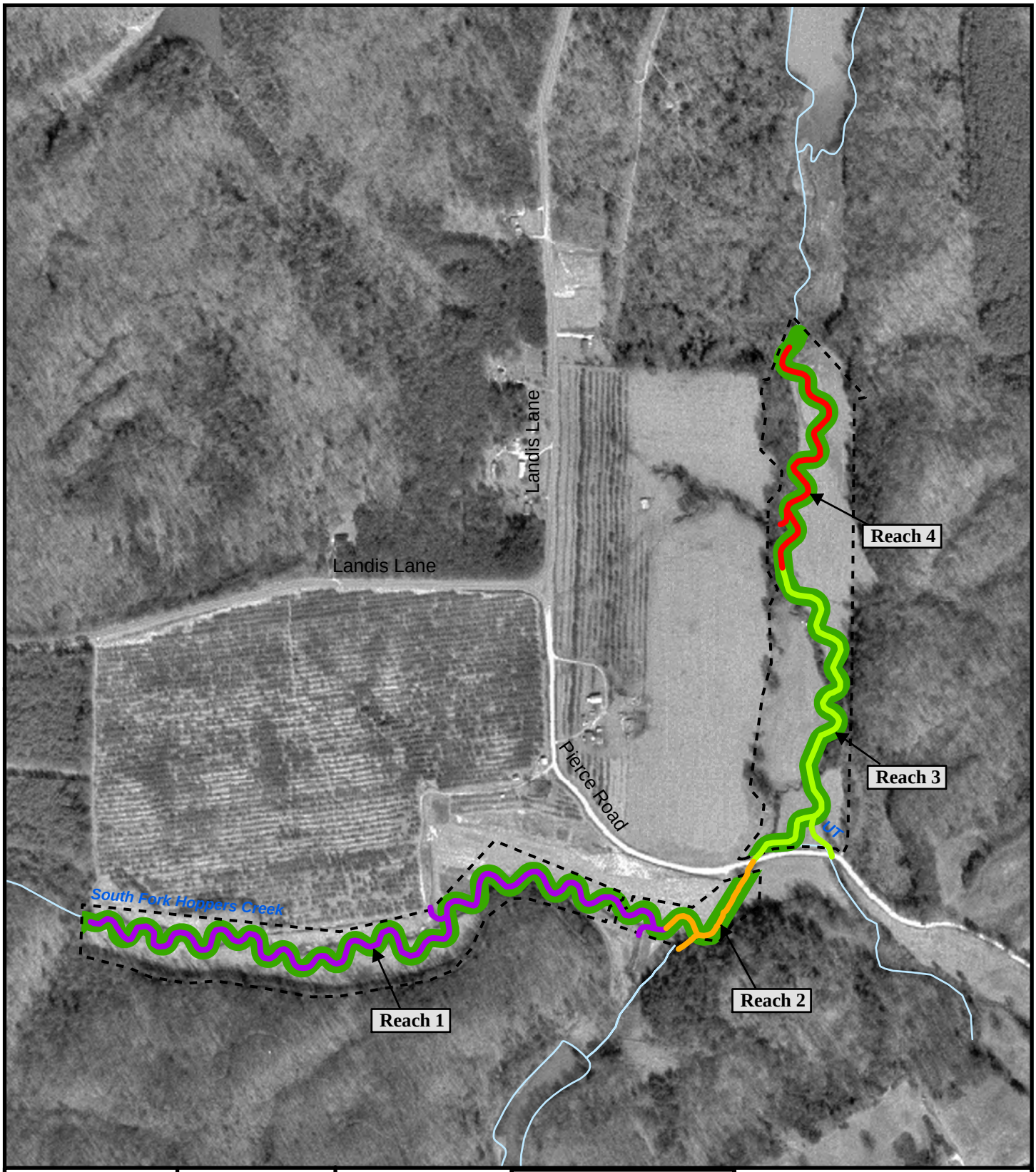
0 500 1,000 Feet

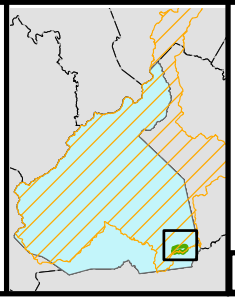
November 2007

EEP Contract No.: D04006-4

Figure 2. Site Topographic Map
Restoration Project
South Fork Hoppers Creek

EBX, LLC
2530 Meridian Parkway
Suite 200
Durham, NC 27713





Legend

Conservation Easement

30' Stream Buffer

Existing Streams

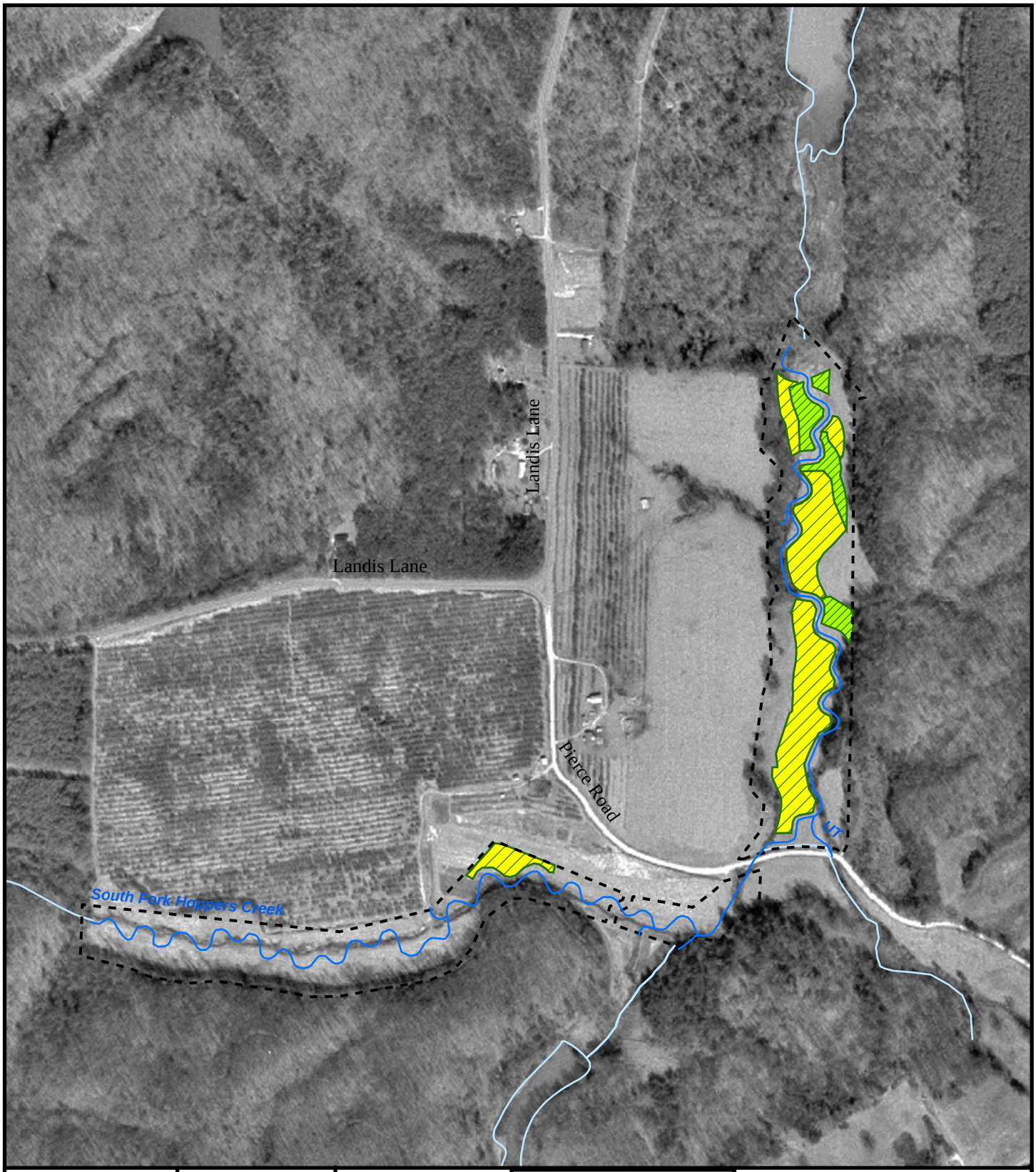
0 400 800 Feet

November 2007

EEP Contract No.: D04006-4

Figure 3. Restoration Summary Map
Restoration Project
South Fork Hoppers Creek

EBX, LLC
2530 Meridian Parkway
Suite 200
Durham, NC 27713



Ecosystem Enhancement Program

Legend

- Conservation Easement
- Existing Streams
- Project Reaches
- Enhancement
- Restoration

0 400 800 Feet

November 2007

EEP Contract No.: D04006-4

Figure 4. Wetland Summary Map
Restoration Project
South Fork Hoppers Creek

EBX, LLC
2530 Meridian Parkway
Suite 200
Durham, NC 27713

Table 1. Project Mitigation Approach

South Fork Hoppers Creek Restoration Site: Project No. D04006-4								
Existing Segment or Reach ID	**Existing Feet / Acreage**	**Mitigation Type ***	**Approach****	**Footage / Acreage**	**Mitigation Ratio**	**Mitigation Units**	**Stationing**	**Comment**
UT1	306 LF	R	P1	203 LF	1	203	200+00 - 202+03	Restoration of dimension, pattern, and profile to a "B" stream type.
South Fork Hoppers Reach 1	2,595 LF	R	P1 & P2	3,528 LF	1	3528	110+85 - 146+17	Restoration to a "C" approaching "E" stream type and P2 used to tie into the Pierce Road culvert.
South Fork Hoppers Reach 2	2,678 LF	R	P1 & P2	3,498 LF	1	3498	146+17 - 181+70	Restoration to a "C" approaching "E" stream type and P2 used to tie channel into the Pierce Road culvert.
Wetland Enhancement	2.53 Ac	E	---	1.4 Ac	0.5	0.7	164+50 - 166 + 90 (R) 171+05 - 176+79 (R) 175+91 - 179+52 (L) 178+31 - 179+52 (R)	Planting, and raising water table
Wetland Restoration		R	---	5.6 Ac	1	5.6	135+79 - 139+00 (L) 154+53 - 167+80 (L) 166+89 - 174+25 (R) 175+50 - 177+67 (R) 175+70 - 180+43 (L)	Grading, soil roughing, planting, and raising water table

Total linear feet of channel restored: 7,229 **Total Stream Mitigation Units:** 7,229

Total acres of wetlands restored: 5.6 **Total Wetland Mitigation Units:** 6.3

* R = Restoration
E = Enhancement
S = Stabilization

** P1 = Priority I
P2 = Priority II
P3 = Priority III
EI = Enhancement I
EII = Enhancement II

1.4 Project History and Background

The chronology of the South Fork Hoppers Creek Restoration Project is presented in Table 2. The contact information for all designers, contractors, and relevant suppliers is presented in Table 3. Relevant project background information is presented in Table 4.

Table 2. Project Activity and Reporting History

South Fork Hoppers Creek Restoration Site: Project No. D04006-4		
Activity or Report	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan Prepared	N/A	Mar-05
Restoration Plan Amended	N/A	Apr-05
Restoration Plan Approved	N/A	
Final Design – (at least 90% complete)	N/A	Aug-05
Construction Begins	N/A	Jun-05
Temporary S&E mix applied to entire project area	N/A	N/A
Permanent seed mix applied to entire project area	N/A	Apr-06
Planting of live stakes	N/A	Apr-06
Planting of bare root trees	N/A	Apr-06
End of Construction	N/A	May-06
Survey of As-built conditions (Year 0 Monitoring-baseline)	Jun-06	Jul-06
Repair work	Oct-06	Oct-06
	Unknown	Unknown
Year 1 Monitoring	Oct-06	Nov-06
Year 2 Monitoring	Oct-07	Nov-07
Year 3 Monitoring (Scheduled)	Oct-08	Nov-08
Year 4 Monitoring (Scheduled)	Oct-09	Nov-09
Year 5 Monitoring (Scheduled)	Oct-10	Nov-10

Table 3. Project Contact Table

South Fork Hoppers Creek Restoration Site : Project No.D04006-4	
Full Service Delivery Contractor	
EBX-Neuse I, LLC	2530 Meridian Parkway, Suite 200 Durham, NC 27713 Contact: Norton Webster, Tel. 919-806-4542
Designer	
Baker Engineering NY, Inc.	1447 S. Tryon Street, Suite 200 Charlotte, NC 28203 Contact: Eng. Chris Yow, Tel 704-334-4454
Construction Contractor	
Riverworks	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Planting Contractor	
Riverworks	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Seeding Contractor	
Riverworks	8000 Regency Parkway, Suite 200 Cary, NC 27518 Contact: Will Pedersen, Tel. 919-459-9001
Seed Mix Sources	Mellow Marsh Farm, 919-742-1200
Nursery Stock Suppliers	International Paper, 1-888-888-7159
Monitoring Performers	
Baker Engineering	1447 S. Tryon Street, Suite 200 Charlotte, NC 28203
Stream Monitoring Point of Contact:	Ian Eckardt, Tel.704-334-4454
Wetland Monitoring Point of Contact:	Ian Eckardt, Tel.704-334-4454
Vegetation Monitoring Point of Contact:	Chris Hysmen, Tel. 336-406-0906

Table 4. Project Background

South Fork Hoppers Creek Restoration Site: Project No. D04006-4	
Project County:	McDowell County, NC
Drainage Area:	
South Fork Hoppers Reach 1	0.93 mi^2
South Fork Hoppers Reach 2	1.38 mi^2
UT1	0.07 mi^2
Estimated Drainage % Impervious Cover:	
Reach: South Fork Hoppers Reach 1	< 5%
Reach: South Fork Hoppers Reach 2	< 5%
Reach: UT1	< 5%
Stream Order:	
South Fork Hoppers Reach 1	2
South Fork Hoppers Reach 2	2
UT1	1
Physiographic Region	Piedmont
Ecoregion	Northern Inner Piedmont
Rosgen Classification of As-built	
South Fork Hoppers Reach 1	C
South Fork Hoppers Reach 2	C
UT-1	B
Cowardin Classification	Riverine, Upper Perennial, Unconsolidated Bottom, Cobble-Gravel
Dominant Soil Types	
South Fork Hoppers Reach 1	IoA, EwE, HeD, HcC1
South Fork Hoppers Reach 2	IoA, EwE, HeD, HcC2
UT1	IoA
Reference Site ID	Spencer Creek, Craig Creek, Big Branch, Sals Branch
USGS HUC for Project and Reference Sites	03050101040020
NCDWQ Sub-basin for Project and Reference	03-08-30
NCDWQ classification for Project and Reference	C
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor?	N/A
Percent of project easement fenced	50%

1.5 Project Monitoring Plan

Plans depicting the as-built conditions of the major project elements, location of permanent monitoring cross-sections, locations of hydrologic monitoring stations, and locations of permanent vegetation monitoring plots are presented in Appendix C of this report.

2.0 VEGETATION MONITORING

2.1 Soil Data

The soil data for the Site is presented in Table 5.

Table 5. Soil Data for Project

South Fork Hoppers Creek Restoration Site: Project No. D04006-4					
Series	**Max Depth (in)**	**% Clay on Surface**	**K**	**T**	**OM %**
(IaA) - Iotla Sandy Loam, 0 to 3 percent slopes	60	12-18	0.2	5	2-5
(EwE) - Evard-Cowee Complex, 2 to 95 percent slopes	65	5-20	0.24	5	1-5
(HcC2) -Hayesville Clay Loam, 2 to 60 percent slopes	62	10-25	0.24	4	1-3
(HeD) -Hayesville-Evard Complex, 2 to 60 percent slopes	62	5-25	0.24	5	1-5

NRCS, USDA. Official Soil Series Descriptions (http://soils.usda.gov/soils/technical/classification/osd/index.html)

General taxonomy of Site soils:

Iotla:

The Iotla series (IaA) consists of very deep, somewhat poorly-drained soils with moderately rapid permeability on floodplains. They formed in loamy, recent alluvium. Slopes range from 0 to 3 percent.

Evard-Cowee:

The Evard-Cowee complex (EwE) is composed of very deep, well-drained, moderately permeable soils on ridges and side slopes. They formed in residuum affected by soil creep in the upper part and weathered from felsic to mafic, igneous and high-grade metamorphic rocks. Slopes range from 2 to 95 percent.

Hayesville:

The Hayesville Series (HcC2 and HeD) consists of very deep well-drained soils on gently sloping to very steep ridges. They most commonly formed in residuum weathered from igneous and high-grade metamorphic rocks such as granite, granodiorite, mica gneiss and schist; but in some places formed from thickly-bedded metagraywacke and metasandstone. On steeper slopes the upper part of some pedons may have some colluvial influence. Slopes range from 2 to 60 percent.

2.2 Description of Species and Monitoring Protocol

The Site was planted in bottomland hardwood forest species in March and April 2006. The following tree species were planted in the restoration area:

Table 6. Tree Species Planted

South Fork Hoppers Creek Restoration Site : Project No. D04006-4			
ID	**Scientific Name**	**Common Name**	**FAC Status**
1	*Betula nigra*	River Birch	FACW
2	*Fraxinus pennsylvanica*	Green Ash	FACW
3	*Platanus occidentalis*	Sycamore	FACW-
4	*Quercus phellos*	Coastal Willow Oak	FACW-
5	*Quercus rubra*	Northern Red Oak	FACU
6	*Quercus michauxii*	Swamp Chestnut Oak	FACW-
7	*Liriodendron tulipifera*	Yellow Poplar	FAC
8	*Celtis laevigata*	Sugar Berry	FACW
9	*Diospyrus virginiana*	Persimmon	FAC
10	*Nyssa sylvatica*	Blackgum	FAC

The following monitoring protocol was designed to predict vegetative survivability. Ten plots were established on the South Fork Hoppers Site, to monitor approximately 1.5 percent of the site. Six plots were established in areas that included both the wetlands and stream buffer. The remaining four plots were located adjacent to the newly constructed streambed to monitor the vegetation in the stream restoration buffer. The plots were randomly located within each zone and randomly oriented within the wetland restoration area.

Plot construction involved using metal fence posts at each of the four corners to clearly and permanently establish the area that was to be sampled. Then ropes were hung connecting all four corners to help in determining if trees close to the plot boundary were inside or outside of the plot. Trees right on the boundary and trees just outside of the boundary that appear to have greater than 50 percent of their canopy inside the boundary were counted inside the plot. A piece of white PVC pipe ten feet tall was placed over the metal post on one corner to facilitate visual location of plot throughout the five-year monitoring period.

All of the planted stems inside the plot were flagged with orange flagging and marked with a three-foot tall piece of half-inch PVC to identify them as the planted stems (vs. any colonizers) and to help in locating them in the future. Each stem was then tagged with a permanent, numbered aluminum tag.

2.3 Vegetation Success Criteria

The interim measure of vegetative success for the South Fork Hoppers Mitigation Plan will be the survival of at least 320, 3-year old planted trees per acre at the end of Year 3 of the monitoring period. The final vegetative success criteria will be the survival of 260, 5-year old planted trees per acre at the end of Year 5 of the monitoring period.

Up to 20 percent of the Site species composition may be comprised of invaders. Remedial action may be required should these (ie. Loblolly pine, red maple, sweet gum, etc.) volunteer species present a problem and exceed 20 percent composition.

2.4 Results of Vegetative Monitoring

The following tables present stem counts for each of the monitoring plots. Each planted tree species is identified down the left column, and each plot is identified across the top row. The numbers on the top row correlate to the ID column of the previous table. Trees are flagged in the field on an as-needed basis before the flags degrade. Flags are utilized, because they will not interfere with the growth of the tree. Volunteer species are also flagged during this process.

Table 7. Year 2 Stem Counts for Each Species Arranged by Plot

South Fork Hoppers Creek Restoration Site: Project No. D04006-4											Initial Totals	Year 1 Totals	Year 2 Totals	% Survival
	Year 2 Plot Counts													
Tree Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Betula nigra	2	0	0	0	0	0	0	0	0	0	2	2	2	100.0
Fraxinus pennsylvanica	9	1	4	3	0	2	0	0	0	4	24	25	23	95.8
Platanus occidentalis	2	0	8	4	5	10	0	0	3	0	30	31	32	106.7
Quercus phellos	4	0	4	8	4	1	0	0	7	4	25	32	32	128.0
Quercus rubra	0	0	0	0	0	0	0	0	2	0	2	3	2	100.0
Quercus michauxii	0	0	0	0	4	0	0	0	0	7	7	10	11	157.1
Liriodendron tulipiferra	0	7	0	0	0	2	6	5	4	0	0	27	24	0.0
Celtis laevigata	0	0	0	0	3	0	0	0	0	0	18	4	3	16.7
Diospyros virginiana	0	0	0	0	0	0	5	0	0	0	16	5	5	31.3
Nyssa sylvatica	0	6	0	0	0	0	5	10	0	0	10	22	21	210.0
Quercus spp.											19	0	0	0.0
Unknown											12	0	0	0.0
Stems/plot	17	14	16	15	16	15	16	15	16	15	165	161	155	93.9
Stems/acre	680	560	640	600	640	600	640	600	640	600	**620**	**average**		

Average Stems/Acre for Year 2: 620

Range of Stems/Acre for Year 2: 560-680

The data reflects that the overall site is on a trajectory to meet the minimum success interim criteria of 320 trees per acre by the end of year three and the final success criteria of 260 trees per acre by the end of year five.

Volunteer species will also be monitored throughout the five-year monitoring period. Table 8 depicts the most commonly found woody volunteer species.

Table 8. Volunteers within Wetland Restoration Area

South Fork Hoppers Creek Restoration Site: Project No. D04006-4			
ID	**Scientific Name**	**Common Name**	**FAC Status**
1	*Liquidambar styraciflua*	Sweetgum	FAC+
2	*Acer rubrum*	Red Maple	FAC

Few volunteer woody species were observed in any of the vegetation plots, and were deemed too small to tally. If these trees persist into the next growing season, they will be flagged and added to the overall stems per acre assessment of the site. Red Maple (*Acer rubrum*) was the most common volunteer, though Sweetgum (*Liquidambar styraciflua*) was also observed.

2.5 Vegetation Observations

After construction of the Site, a permanent ground cover seed mixture of Virginia wild rye (*Elymus virginicus*), switch grass (*Panicum virgatum*), and fox sedge (*Carex vulpinoidea*) was broadcast on the Site at a rate of 10 pounds per acre. These species were present on the Site. Hydrophytic herbaceous vegetation, including rush (*Juncus effusus*), spike-rush (*Eleocharis obtusa*), boxseed (*Ludwigia* sp.) and sedge (*Carex* sp.) were observed across the Site, particularly in areas of periodic inundation. The presence of these herbaceous wetland plants helps to confirm the presence of wetland hydrology on the Site.

Quite a few weedy species, including kudzu and lespedeza, were observed on the Site, though currently none seem to be posing any problems. Because both kudzu and lespedeza can very quickly affect the survivability of the planted stems, these weedy species should be treated aggressively to prevent any major mortality.

2.6 Vegetation Photos

Photos of the project showing the on-site vegetation are included in Appendix A of this report.

3.0 STREAM MONITORING

3.1 Description of Stream Monitoring

To document the stated success criteria, the following monitoring program was instituted following construction completion on the South Fork Hoppers Restoration Project:

Bankfull Events: The occurrence of bankfull events within the monitoring period was documented by the use of a crest gauge and photographs. One crest gauge was installed on the floodplain within 10 feet of the restored channel, near As-built Station 176+00. The crest gauge recorded the highest watermark between Site visits and was checked at each Site visit to determine if a bankfull event had occurred. Photographs were taken to document the occurrence of these bankfull events and are included in Appendix A.

Cross-sections: Two permanent cross-sections were installed per 1,000 LF of stream restoration work, with one located at a riffle cross-section and one located at a pool cross-section. Sixteen total cross sections were established. Each cross-section was marked on both banks with permanent pins to establish the exact transect used. A common benchmark was used for cross-sections and consistently referenced to facilitate comparison of year-to-year data. The annual cross-sectional survey included points measured at all breaks in slope, including top of bank, bankfull, inner berm, edge of water, and thalweg, if the features are present. Riffle cross-sections were classified using the Rosgen stream

classification system (Rosgen, 1994). Permanent cross-sections for 2007 (Year 2) were surveyed in October 2007 and are included in Appendix B.

Longitudinal Profiles: A partial longitudinal profile was surveyed for 2007 (Year 2). The profile was conducted for approximately 3,550 LF of South Fork Hoppers Creek, beginning upstream of the bridge at As-built Station 125+09 and continuing down to As-built Station 160+09 (natural migration of the thalweg accounts for the additional 50 feet surveyed within the As-built Stations). Measurements included thalweg, water surface, bankfull, and top of low bank. Each of these measurements was taken at the head of each feature (e.g., riffle, pool, glide). In addition, maximum pool depth was recorded. All survey was tied to a single permanent benchmark. This data is included in Appendix B of this report.

Bed Material Analysis: Pebble counts were conducted for the permanent cross sections (100 counts per cross section) on the Site. Pebble count data was plotted on a semi-log graph and are included in Appendix B.

Photo Reference Stations: Photographs were used to visually document restoration success. Seventy reference stations were established to document conditions at the constructed grade control structures across the Site. These photos are provided in Appendix A. Additional photo stations were established at each of the sixteen permanent cross-sections and hydrologic monitoring stations. Each streambank was photographed at each permanent cross-section photo station. For each streambank photo, the photo view line followed a survey tape placed across the channel, perpendicular to flow (representing the cross-section line). The photograph was framed so that the survey tape is centered in the photo (appears as a vertical line at the center of the photograph), keeping the channel water surface line horizontal and near the lower edge of the frame. These photos are presented along with the cross-section monitoring data in Appendix B.

The GPS coordinates of each photo station were noted as additional reference to ensure the same photo location was used throughout the monitoring period. These stations are included in the As-built Plan Sheets in Appendix C. Reference photos were taken once per year.

3.2 Stream Restoration Success Criteria

The approved Mitigation Plan requires the following criteria be met to achieve stream restoration success:

- *Bankfull Events*: Two bankfull flow events must be documented within the five-year monitoring period. The two bankfull events must occur in separate years.
- *Cross-sections:* There should be little change in as-built cross-sections. If changes to channel cross-section take place, they should be minor changes representing an increase in stability (e.g., settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio).
- *Longitudinal Profiles:* The longitudinal profiles should show that the bedform features are remaining stable (not aggrading or degrading). The pools should remain deep with flat water surface slopes and the riffles should remain steeper and shallower than the pools.
- *Bed Material Analysis:* Pebble counts should indicate maintenance of bed material.
- *Photo Reference Stations*: Photographs will be used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation and effectiveness of erosion control measures. Photos should indicate the absence of developing bars within the channel, no excessive bank erosion or increase in channel depth over time, and maturation of riparian vegetation. These stations are included in the As-built Plan Sheets in Appendix C.

3.3 Bankfull Discharge Monitoring Results

The on-site crest gauge documented the occurrence of five bankfull flow events during the second year (2007) of the post-construction monitoring period (Table 9). Inspection of site conditions following these events revealed visual evidence of out-of-bank flow, confirming the crest gauge reading. The largest stream flow documented by the crest gauge during Year 2 of monitoring was approximately 1.63 feet (19.56 inches) above the bankfull stage. Photos of these crest gauge readings are contained in Appendix A, except for September 17, 2007. There was a camera malfunction on this date and photos were not able to be saved.

Table 9. Verification of Bankfull Events

South Fork Hoppers Creek Restoration Site: Project No. D04006-4			
Date of Data Collection	**Date of Occurrence of Bankfull Event**	**Method of Data Collection**	**Gage Height (feet)**
1/16/2007	Unknown	Crest gauge	0.73
3/13/2007	Unknown	Crest gauge	1.13
5/22/2007	Unknown	Crest gauge	0.10
7/17/2007	Unknown	Crest gauge	0.08
9/17/2007	Unknown	Crest gauge	1.63

3.4 Stream Monitoring Data and Photos

A photo log of the project showing each of the 70 permanent photo locations is included in Appendix A of this report. Survey data and photos from each permanent cross-section are included in Appendix B of this report.

3.5 Stream Stability Assessment

Table 10 presents a summary of the results obtained from the visual inspection of in-stream structures performed during Year 2 of post-construction monitoring. The percentages noted are a general overall field evaluation of the how the features were performing at the time of the last photo point survey on November 5, 2007. These percentages are solely based on the field evaluator's visual assessment at the time of the site visit.

Visual observations of the various structures throughout the Year 2 growing season indicated that all structures were functioning as designed and holding their elevation grade. Cover logs placed in meander pool areas allowed scour to keep pools deep and provide cover for fish. Root wads placed on the outside of meander bends provided bank stability and in-stream cover for fish and other aquatic organisms. Isolated pockets of scour were observed along the upstream end of a few rootwads located at stations 124+50, 126+75, and 133+50. The scour appears to have taken place before vegetation had time to become established along the streambanks.

Table 10. Categorical Stream Feature Visual Stability Assessment

South Fork Hoppers Creek Restoration Site: Project No. D04006-4						
	Performance Percentage					
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
Riffles	100%	100%	100%			
Pools	100%	100%	100%			
Thalweg	100%	100%	100%			
Meanders	100%	100%	100%			
Bed General	100%	100%	100%			
Vanes / J Hooks etc.	100%	100%	100%			
Rootwads and Boulders	100%	100%	95%			

3.6 Cross-section, Longitudinal Profile, and Bed Material Analysis Monitoring Results

Cross Sections

Year 2 cross-section monitoring data for stream stability were collected during October and November 2007 and compared to as-built conditions and Year 1 data (collected October 2006).

The sixteen permanent cross-sections along the restored channels (eight located across riffles and eight located across pools) were re-surveyed to document stream dimension at the end of monitoring Year 2. Cross-sections are provided in Appendix B, and data from the cross-sections are summarized in Appendix E. The cross-sections show that there has been minor adjustment to stream dimension within the last year.

A few cross-sections have aggraded, including sections 2, 6, 11, and 16. Cross-section 2, located near the downstream end of the Site, is likely aggrading in response to a beaver impoundment approximately 120 feet downstream of the project limits. The impoundment is slowing stream flow, which has resulted in the accumulation of fine sediment within the project area immediately upstream. Cross-sections 6 and 11 are located across pools found at the apex of a meander bend. Survey data from these sections indicate the aggradation on point bar features on the inside bank of the meander bend. Flow through a meander bend possesses higher conveyance velocity along its boundary with the outer bank of the bend, and lower flow velocity along its boundary with the bend's inner bank. As flow velocity reduces, its sediment transport capacity also reduces, causing flow to drop some of its transported sediment as it slows down. Point bar formation along the inside of a meander bend indicates flow velocity vectors occurring as designed, and is therefore expected. Cross-section 16 is located at the most upstream extent of the Site and is receiving a large sediment supply from its contributing watershed. All monitored cross-sections fell within the quantitative parameters defined for "C" type channels.

Longitudinal Profiles

The Year 2 longitudinal profile was conducted during October and November 2007. A representative 3,550 LF section of the channel was surveyed, beginning at As-built Station 125+09 and ending at As-built Station 160+09. Placement of the rock cross vanes upstream of the bridge as well as natural

migration of the thalweg accounts for the 50 LF discrepancy between the surveyed length and the as-built conditions. The longitudinal profile is included in Appendix B. A summary of parameters measured are provided in Appendix E. Please note that this summary represents only the portion of the project that was surveyed.

The representative longitudinal profile along the restored channel was resurveyed to document stream profile at the end of monitoring Year 2. Riffle slopes, pool-to-pool spacing and sinuosity changed very little within Reach 1 of South Fork Hoppers Creek. The values for Reach 2 showed little change in pool-to-pool spacing and sinuosity, but a slight increase riffle slope. The change is a reflection of one riffle increasing in grade, thereby raising the mean riffle slope value. The majority of Reach 2 riffles were within the range of those documented in the As-Built survey.

Bed Material Analysis

Year 2 bed material samples were collected at each permanent cross-section during November 2007. Overall, bed material indicated coarser riffles and finer pools, however riffles showed a trend towards fining downstream of Pierce Road due to the backwater effects of the downstream beaver dam. Riffle cross-sections 1 and 3 had d50 of 0.15 mm and 0.7 mm, respectively, which corresponds to sand. The beaver dam causes the water to slow and fine particles to settle out of suspension, thus fining the riffle. Riffles begin to coarsen further upstream with a d50 of 7.5 mm at cross-section 5. Upstream of Pierce Road all riffle cross-sections have a d50 corresponding to very coarse gravel. Pools throughout the project site are dominated by sand. All pebble count data is provided in Appendix B.

4.0 HYDROLOGY MONITORING

Weather station data from the for NRCS National Climate and Water Center (Marion WETS Station in McDowell County – NC 5340) and the USGS Water Data for North Carolina (USGS 03451500 French Broad River at Asheville, NC) were used in conjunction with a manual rain gauge located on the Site to document precipitation amounts. For the 2007 growing season, November 2006 through January 2007 rainfall was normal or above normal; however from February 2007 through October 2007 rainfall was recorded as below normal for greater than 55 percent of the time.

The restoration plan for the Site specifies that eight monitoring gauges (five automated and three manual) would be established across the restored Site. These eight monitoring gauges were installed during early-March 2006 to document water table hydrology in all required monitoring locations. The wells were located across the site to document the variability in site hydrology, and the locations of monitoring gauges are shown on the as-built plan sheets. As stated in the Restoration Report, the well monitoring data should show that the site has been saturated within 12 inches of the soil surface for at least 7 percent of the growing season, and that the site has exhibited an increased frequency of flooding.

Hydrologic monitoring results are shown in Table 11, 12 and Figure 5.

Table 11. Comparison of Historic Rainfall to Observed Rainfall (Inches)

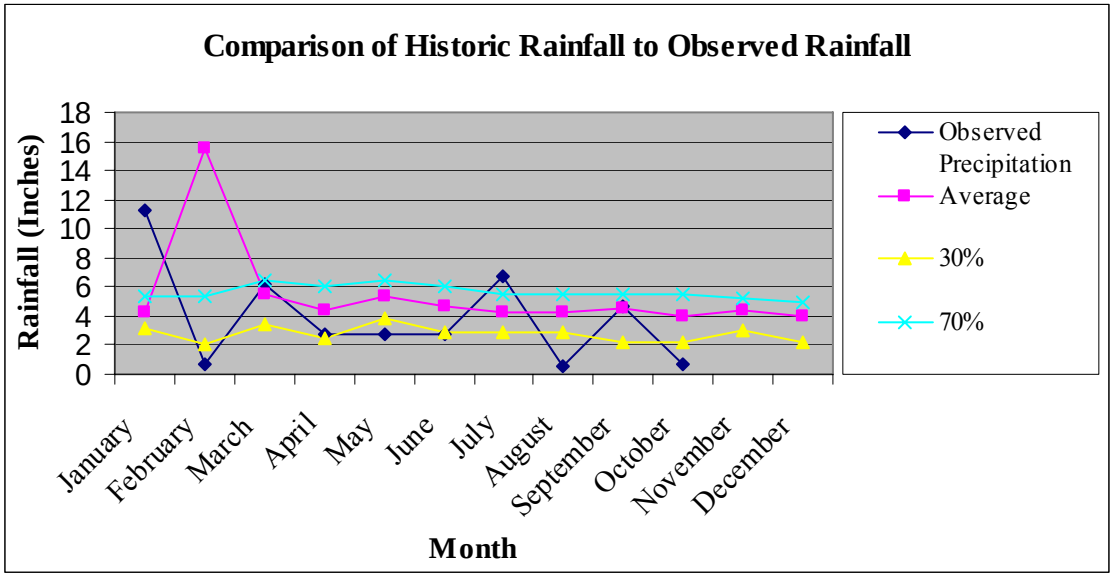
South Fork Hoppers Creek Restoration Site: EEP Contract No. D04006-4				
Month	**Average[A]**	**30%[A]**	**70%[A]**	**Observed 2007 Precipitation**
January	4.23	3.10	5.35	11.2
February	15.46	2.09	5.36	0.71[B]
March	5.43	3.45	6.52	6.15
April	4.41	2.54	6.00	2.79
May	5.40	3.88	6.41	2.70
June	4.70	2.91	5.98	2.75
July	4.28	2.87	5.53	6.79
August	4.24	2.88	5.44	0.53
September	4.48	2.22	5.45	4.68
October	3.95	2.17	5.43	0.70
November	4.43	2.96	5.29	-
December	3.96	2.20	5.00	-

(NRCS National Climate and Water Center, 2000 and USGS, 2007)

[A]Data in these columns presented exactly as reported by the NRCS National Climate and Water Center.

[B]Monthly on-site rainfall data unavailable, so total monthly rainfall data was calculated using the nearest USGS rain gauge data (USGS 03451500 FRENCH BROAD RIVER AT ASHEVILLE, NC) to the project site. (USGS, 2007)

Figure 5. Historic Average vs. Observed Rainfall



In 2007, six of the eight wells met the success criteria specified by the Restoration Plan. Automated wells (AW) 1, 2, and 5 met the soil saturation criteria throughout the entire growing season, as they did in 2006. Manual well 3 (MW3), also, met the criteria throughout most of the growing season. AW3 met the criteria more often and for longer consecutive periods than in 2006. AW4 met the criteria for a greater number of consecutive days than in 2006; however, the cumulative days were the same and the

instances that the criteria were met were more often than in 2006. MW1 and MW2 did not meet the criteria in 2007 or 2006, nor did the reference wells, except for cumulative days in Year 2 for REF1.

Table 12. **Comparison of Hydrologic Monitoring Results for Year 2 and Year 1**

South Fork Hoppers Creek Restoration Site: EEP Contract No. D04006-4						
Monitoring Station	Most Consecutive Days Meeting Criteria[1]		Cumulative Days Meeting Criteria[2]		Number of Instances Meeting Criteria[3]	
	Year 2 Monitoring	Year 1 Monitoring	Year 2 Monitoring	Year 1 Monitoring	Year 2 Monitoring	Year 1 Monitoring
AW1	222 (100%)	222 (100%)	222 (100%)	222 (100%)	1	1
AW2	222 (100%)	222 (100%)	222 (100%)	222 (100%)	1	1
AW3	133 (60%)	75 (34%)	218 (98%)	178 (77%)	2	6
AW4	33 (15%)	16 (7%)	58 (26%)	58 (26%)	13	12
AW5	222 (100%)	175 (79%)	222 (100%)	190 (86%)	1	2
MW1[4]	< 5%	< 5%	~ 5%	~ 10%	-	-
MW2[5]	< 5%	< 5%	~ 5%	~ 10%	-	-
MW3[4]	> 95%	> 75%	~ 100%	~ 90%	-	-
REF1[6]	5 (2%)	8 (4%)	26 (12%)	9 (4%)	8	1
REF2[6]	4 (2%)	3 (1%)	13 (6%)	4 (2%)	4	2

[1] Indicates the most consecutive number of days within the monitored growing season with a water table less than 12 inches form the soil surface.

[2] Indicates the cumulative number of days within the monitored growing season with a water table less than 12 inches from the soil surface.

[3] Indicates the number of instances within the monitored growing season when the water table rose to less than 12 inches from the soil surface.

[4] Groundwater gauges MW1 and MW3 are manual gauges. Hydrologic parameters are estimated based on observations and correlation with automated gauge AW1.

[5] Groundwater gauge MW2 is a manual gauge. Hydrologic parameters are estimated based on observations and correlation with automated gauge AW2.

[6] Reference ground water gauges are located on an Unnamed Tributary to Little Silver Creek in Morganton, NC

5.0 BENTHIC MACROINVERTEBRATE MONITORING

5.1 Description of Benthic Macroinvertebrate Monitoring

Benthic macroinvertebrate monitoring was conducted in conjunction with the South Fork Hoppers Creek Restoration Project. Because of seasonal fluctuations in populations, macroinvertebrate sampling must be consistently conducted in the same season. Benthic sampling for the Site is conducted during the month of January, therefore this report summarizes the benthic samples collected during the first year post-construction monitoring phase.

The sampling methodology followed the Qual 4 method listed in NCDWQ's Standard Operating Procedures for Benthic Macroinvertebrates (2006). Field sampling was conducted by Christine Miller and Anna Cathey of Baker. Laboratory identification of collected species was conducted by Chris Outlaw and Bobby Louque, biologists with the City of Durham.

Benthic macroinvertebrate samples were collected at two sites on the South Fork of Hoppers Creek site on January 16 and 17, 2007 and one reference site located upstream of the project on January 16, 2007. Site 1, the reference site, was located approximately 200 LF upstream of the conservation easement boundary on South Fork Hoppers Creek, Site 2 was located just upstream of Pierce Road, and Site 3 was located upstream of the downstream conservation easement boundary. Figure 1 illustrates the sampling site locations.

Benthic macroinvertebrates were collected to assess quantity and quality of life in the creek. In particular, specimens belonging to the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies) are useful as an index of water quality. These groups are generally the least tolerant to water pollution and therefore are very useful indicators of water quality. Sampling for these three orders is referred to as EPT sampling.

Habitat assessments using NCDWQ's protocols were also conducted at each site. Physical and chemical measurements including water temperature, percent dissolved oxygen, dissolved oxygen concentration, pH, and specific conductivity were recorded at each site. The habitat assessment field data sheets are presented in Appendix F. Photographs were taken at Sites 1 through 3 to document stream and bank conditions at the time of sampling. The Photograph Log is also presented in Appendix F.

5.2 Benthic Macroinvertebrate Sampling Results and Discussion

A comparison between the pre- and post-construction monitoring results is presented in Table 13 with complete results presented in Appendix F.

Table 13. Pre-restoration vs. Post-restoration Benthic Macroinvertebrate Sampling Data

South Fork Hoppers Creek Restoration Site: EEP Contract No. D04006-4						
Metric	**Site 1 Reference**		**Site 2 U/S Hoppers**		**Site 3 D/S Hoppers**	
	Pre 1/11/05	**Post 1/17/07**	**Pre 1/11/05**	**Post 1/16/07**	**Pre 1/12/05**	**Post 1/16/07**
Total Taxa Richness	36	50	31	43	27	40
EPT Taxa Richness	23	21	21	15	14	13
Total Biotic Index	3.15	3.47	3.03	5.58	3.03	5.53
EPT Biotic Index	2.62	3.17	2.56	4.50	2.33	3.93
Dominance in Common (%)	N/A	N/A	74	23	58	23
Baetidae/EPT Taxa (%)	0.0	0.0	0.0	13.3	0.0	7.7
Total Shredder/Scraper Index	5/9	8/7	5/8	7/7	6/5	2/5
EPT Shredder/Scraper Index	3/7	4/3	4/6	1/4	4/3	1/2
Habitat Assessment Rating	94	84	74	86	53	82
Water Temperature (˚C)	N/A	7.0	N/A	12.0	N/A	11.4
% Dissolved Oxygen (DO)	N/A	54.7	N/A	35.7	N/A	29.8
DO Concentration (mg/l)	N/A	6.61	N/A	3.87	N/A	3.25
pH	N/A	6.20	N/A	6.30	N/A	6.03
Conductivity (µmhos/cm)	N/A	40	N/A	40	N/A	50

At Site 1, the reference site, the post-construction community structure appears similar to that observed during the pre-construction monitoring period. Overall taxa richness increased in the post-construction sample and there was a marginal decrease in EPT taxa richness. Several of the EPT species that were common or abundant in the pre-construction sample, such as *Tallaperla* spp., *Stenonema pudicum, Diplectrona modesta*, and *Diploperla duplicata* (tolerance values of 1.2, 2.0, 2.2, and 2.7, respectively) were also common or abundant in the post-construction sample. *Dicranota* spp., which has a tolerance

value of 0.0, was not represented in the pre-construction sample but was common in the post-construction sample. These indicators show that the communities are stable and water quality is adequate to support intolerant species.

Site 2, which underwent complete restoration, exhibited increased total taxa richness but decreased EPT taxa richness. EPT abundance was 82 in the pre-construction sample and 84 in the post-construction sample, which indicates that EPT diversity has decreased. The increase in biotic indices from 2.56 to 4.50 indicates that the existing communities are comprised of more tolerant species. This is a typical response after a major disturbance to habitat such as the in-stream construction techniques implemented on Site 2. Thirteen percent of EPT taxa in the post-construction sample were Baetidae species, which are part of the scraper functional feeding group. The riparian buffer is non-existent along the newly constructed reach, allowing maximum light penetration for increased photosynthetic activity, thus producing an abundant food source (periphyton). Periphyton is an excellent food source for scrapers. No Baetidaes were present in the pre-construction sample, which was taken when the sampling site had an adequate forested buffer.

Currently Site 2 has 23 percent Dominance in Common (DIC) compared to the reference site, indicating that 23 percent of the dominant communities at the reference site are dominant at Site 2. In pre-construction conditions, Site 2 had a DIC of 74 percent. This indicates that post-construction recolonization from refugia upstream (represented at Site 1) has begun but that the communities in Site 1 and 2 are not as similar as they were during pre-construction conditions. It is anticipated that improvements in biotic indices and an increase in DIC will be seen in future monitoring reports as the project and buffer matures and as communities continue to recolonize.

Site 3 also underwent total restoration. The overall taxa richness increased in the post-construction sample but the EPT Taxa richness decreased slightly. The EPT biotic index increased from 2.33 to 3.93. This indicates that the EPT species in this sample were more tolerant than during the pre-construction conditions. *Neophylax mitchelli* (tolerance value of 0.1) was abundant in the post-construction sample, which indicates that water quality is adequate to support intolerant species. Post-construction shredder taxa were decreased from the pre-construction sample. These organisms feed on partially decomposed organic matter such as sticks and leaf packs, a rare habitat (see Habitat Assessment Results). The decrease in sensitive communities and lack of shredders are common responses after a major disturbance to habitat such as the in-stream construction techniques implemented at Site 3. It is anticipated that, as the project matures, shredder populations will increase as more habitat in the form of snags, logs, and leaf packs become available.

Currently Site 3 has 23 percent DIC with the reference site. In pre-construction conditions, Site 3 had a DIC of 58 percent. This indicates that recolonization post-construction from refugia upstream (represented at Site 1) has initialized but has not reached pre-construction conditions. It is anticipated that improvements in biotic indices and an increase in Dominance in Common will be seen in future monitoring reports as the project and buffer matures and as communities continue to recolonize.

5.3 Habitat Assessment Results and Discussion

Site 1, the reference site, received an 84 on the Habitat Assessment Field Data Sheet. The site exhibited excellent riffle substrate, habitat diversity and shading. Riffles were mostly gravel and cobbles, moderately embedded with sand and the pool bottoms were sandy. Site 1 had a mature hardwood buffer with minimal breaks. No snags or logs were present within this section of the channel.

Site 2 received an 86 on the Habitat Assessment Field Data Sheet. The site exhibited excellent riffle pool sequencing, pattern, stability, and habitat diversity. Riffles were mostly gravel and cobbles, and the pool bottoms were silty. The riparian buffer of Site 2 could be classified as fallow field, with immature hardwood seedlings scattered throughout. Despite the absence of woody vegetation directly adjacent to the channel, organic habitat such as sticks and leaf packs were common throughout Site 2. The stick and

leaf pack material must have originated upstream of the project area, within the reference reach. It is anticipated that as the project and buffer continues to mature, habitat will continue to improve and diversify.

Site 3 received an 82 on the Habitat Assessment Field Data Sheet. The site exhibited excellent riffle pool sequencing, pattern and stability. Riffles were mostly gravel and cobbles, moderately embedded with sand, and the pool bottoms were silty. Like Site 2, the riparian buffer of Site 3 could be classified as fallow field, with immature hardwood seedlings scattered throughout. The riparian vegetation was virtually non-existent and therefore there were few organic contributions to the stream. The lack of organic habitats is likely the cause for the decreased shredder communities from pre-construction monitoring to post-construction monitoring. It is anticipated that as the riparian buffer becomes established, the shredders from the upstream reference site (Site 1) will begin to colonize throughout the restoration reach.

The restoration of pattern and dimension as well as the addition of several root wads, vanes, and armored riffles has enhanced the overall in-stream habitat throughout the restoration sites. Newly planted riparian vegetation has had minimal effect on in-stream habitat at Sites 2 and 3, however future contributions from planted riparian vegetation will be evident as the woody plant species mature. Contributions will include in-stream structures such as sticks, leaf packs, and root mats.

The physical and chemical measurements of water temperature, percent dissolved oxygen, dissolved oxygen concentration, pH, and specific conductivity at all sites were within established norms for Piedmont streams.

5.4 Photograph Log

The photograph log is attached as Appendix F. Photos P-1 and P-2 show the stable, well defined riffle pool sequence at Site 1. The break in the riparian buffer is visible in P-1, and the embedded substrate can be seen in P-2. Undercut banks are visible in the background of P-2. Photos P-3 and P-4 show the well defined riffle pool sequence at Site 2. Due to recent project construction, Site 2 lacks a mature forested canopy; however, young woody vegetation is present along the banks. Site 3 is shown in P-5 and P-6. Both photos show the stability of the channel as well as the riffle pool sequence. Woody transplants are visible both upstream and downstream in P-5 and P-6, respectively.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Vegetation Monitoring: Vegetation monitoring has documented the average number of stems per acre on site to be 620, which is a survival rate of greater than 93 percent, based on the initial planting count of 664 stems per acre. A maintenance herbicide application should be scheduled for next year to prevent the invasive kudzu and lespedeza, which is observed on the Site perimeter and sparsely throughout the restoration area, from spreading throughout the Site. The Site is on track to meet the interim vegetative success criteria of 320 3-year old planted stems specified in the Restoration Plan.

Stream Monitoring: The total length of stream channel restored on the Site was 7,229 LF. This entire length was inspected during Year 2 of the monitoring period (2007) to assess stream performance. Based on the data collected, all riffles, pools, and other constructed features along the restored channel are stable and functioning as designed. Isolated scour was noted along the outer bank of a few pools upstream of Pierce Road. This erosion appears to be stabilized since vegetation has established along the streambanks. Although a beaver impoundment downstream of the restored area is slowing velocities through the lower half of the project and causing fine sediments to settle out of the water column, it has not been removed because it is not affecting the stability of the channel. The lack of major problem areas along the length of the restored channel after the occurrence of five stream flow events larger than bankfull discharge further supports functionality of the design. It is expected that stability and in-stream

habitat of the system will improve in the coming years as permanent vegetation becomes more established, and that the Site will achieve the stream stability success criteria specified in the Restoration Plan.

Hydrologic Monitoring: Data collected during the 2007 growing season by the eight monitoring gauges showed that hydrology varied across the Site. The hydrology of these areas is expected to be more variable throughout the growing season, with the wettest periods during the early spring and late fall. Groundwater levels met hydrologic success criteria for six of the eight gauges. MW1 and MW2 did not meet the hydrologic success criteria specified in the Restoration Plan but did achieve hydroperiods similar to those achieved by the reference monitoring wells. Overall, the Site appears to be on track to meet the hydrologic success criteria specified in the Restoration Plan.

7.0 WILDLIFE OBSERVATIONS

Observations of deer, including a deer carcass, and raccoon tracks are common on the Site. During certain times of the year, frogs, turtles and fish have also been observed.

8.0 REFERENCES

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APPENDIX A

PHOTO LOG

PROJECT ID PHOTOS

S. Fork Hoppers – PID 1

S. Fork Hoppers – PID 2

S. Fork Hoppers – PID 3

S. Fork Hoppers – PID 4

S. Fork Hoppers – PID 5

S. Fork Hoppers – PID 6

S. Fork Hoppers – PID 7

S. Fork Hoppers – PID 8

S. Fork Hoppers – PID 9

S. Fork Hoppers – PID 10

S. Fork Hoppers – PID 11

S. Fork Hoppers – PID 12

S. Fork Hoppers – PID 13

S. Fork Hoppers – PID 14

S. Fork Hoppers – PID 15

S. Fork Hoppers – PID 16

S. Fork Hoppers – PID 17

S. Fork Hoppers – PID 18

S. Fork Hoppers – PID 19

S. Fork Hoppers – PID 20

S. Fork Hoppers – PID 21

S. Fork Hoppers – PID 22

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S. Fork Hoppers – PID 63

S. Fork Hoppers – PID 64

S. Fork Hoppers – PID 65

S. Fork Hoppers – PID 66

S. Fork Hoppers – PID 67

S. Fork Hoppers – PID 68

S. Fork Hoppers – PID 69

S. Fork Hoppers – PID 70

VEG PLOT PHOTOS

Veg Plot #1

Veg Plot #2

Veg Plot #3

Veg Plot #4

Veg Plot #5

Veg Plot #6

Veg Plot #7

Veg Plot #8

Veg Plot #9

Veg Plot #10

Crest Gauge Photos

CREST GAUGE PHOTOS OF BANKFULL

Crest Gauge – 1/16/07

Crest Gauge – 3/13/07

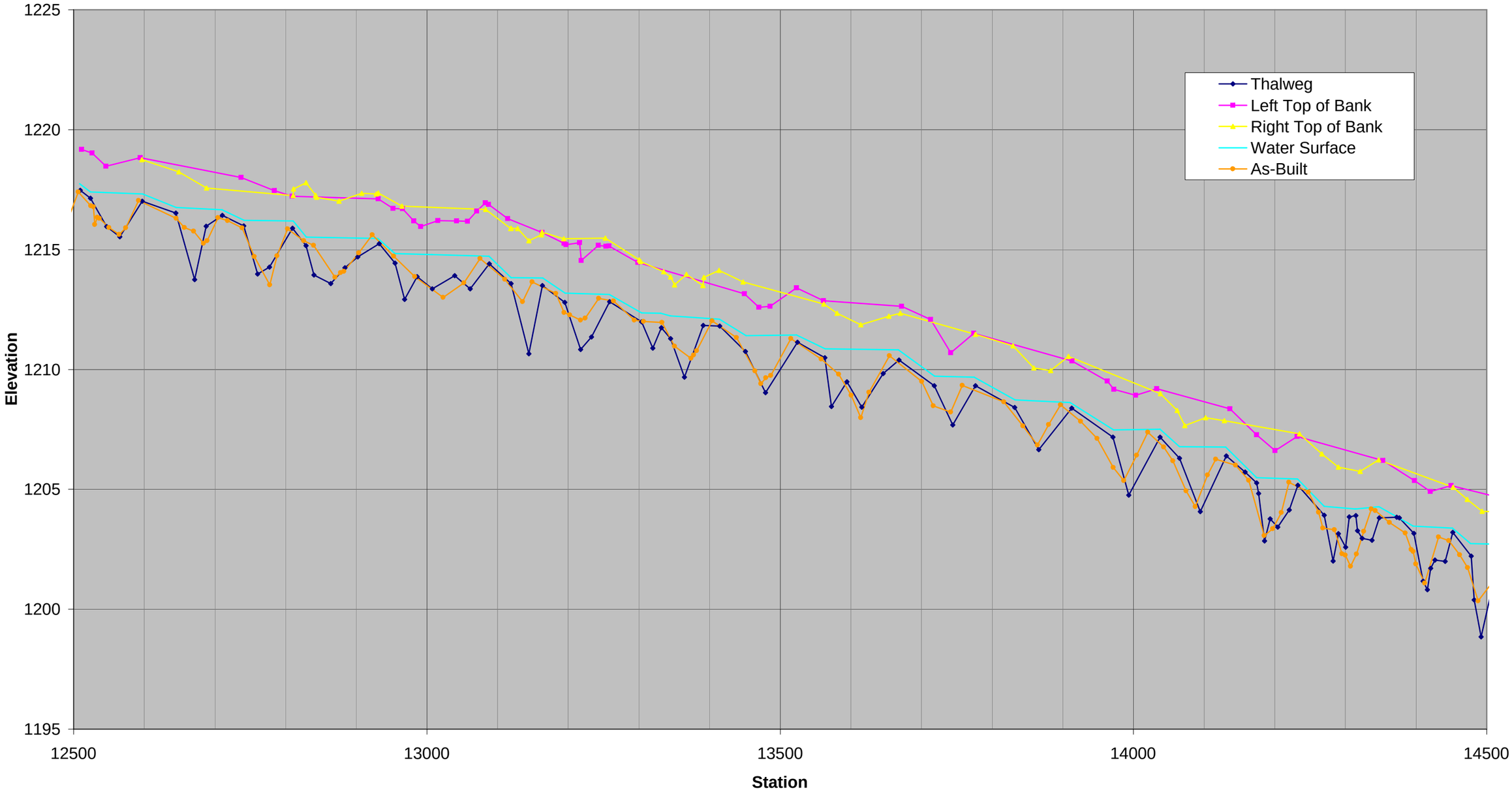
Crest Gauge – 5/22/07

Crest Gauge – 7/17/07

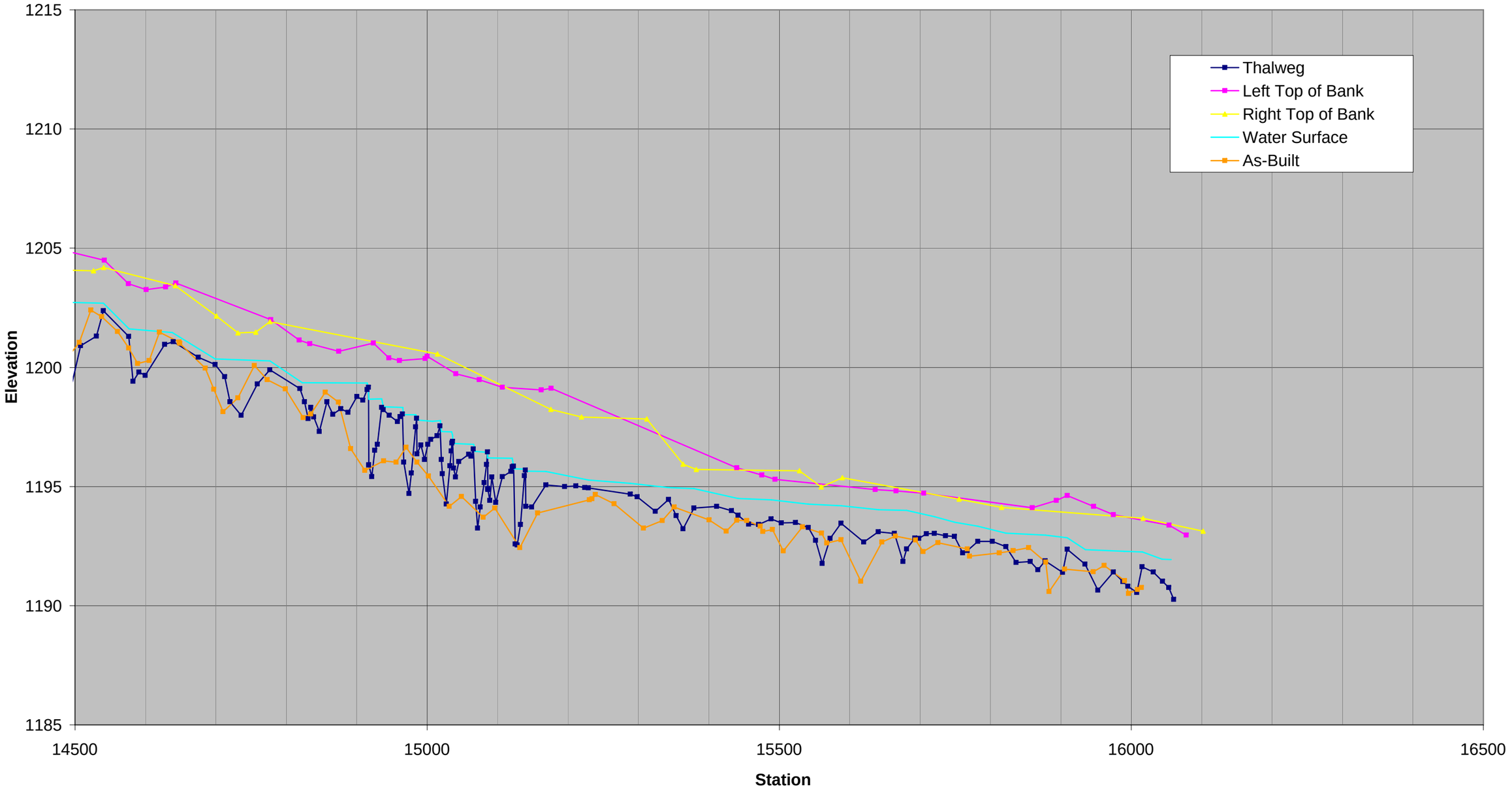
APPENDIX B

STREAM MONITORING DATA

South Fork Hoppers Creek - Year 2 (2007) Monitoring Profile



South Fork Hoppers Creek - Year 2 (2007) Monitoring Profile



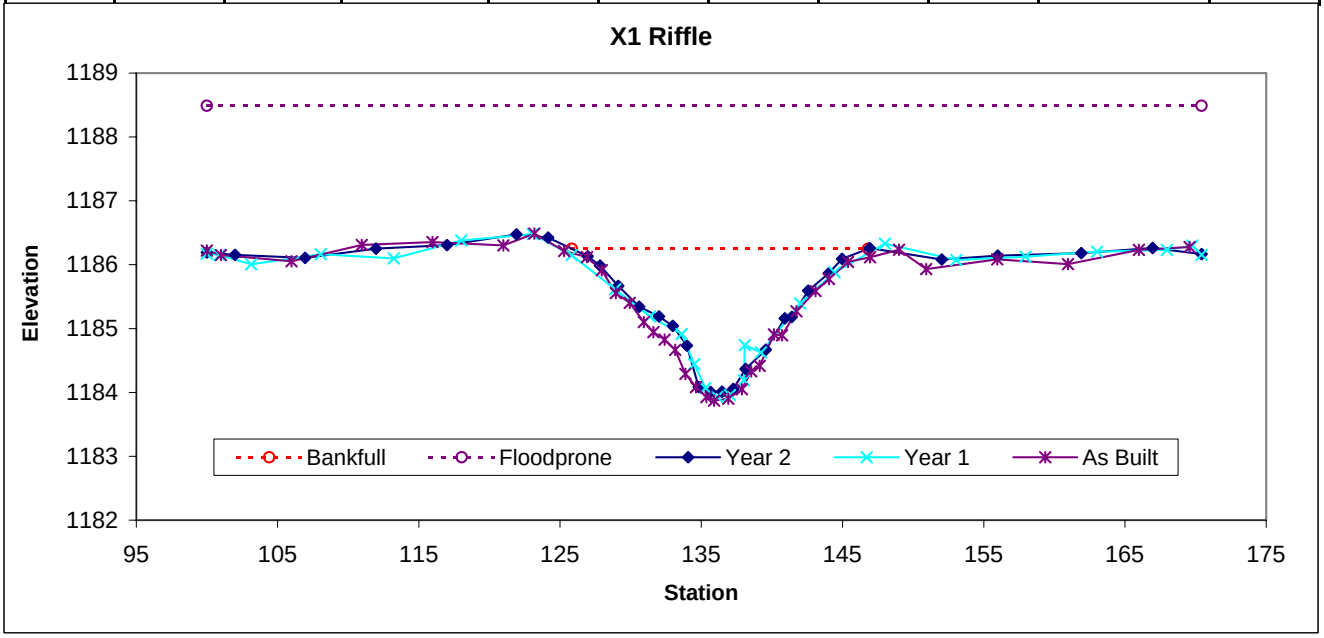
Permanent Cross Section X1

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	21.5	21	1.02	2.24	20.55	1	3.4	1186.25	1186.26



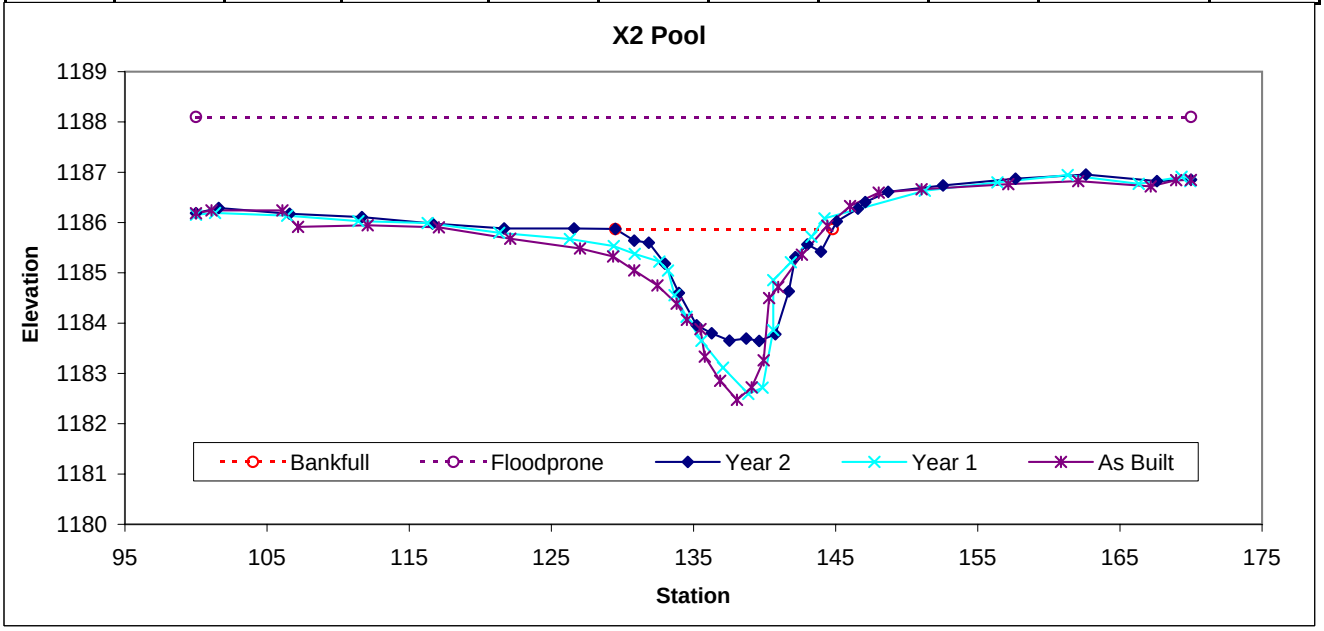
Permanent Cross Section X2

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		18.7	15.3	1.22	2.23	12.52	1	4.6	1185.87	1185.87



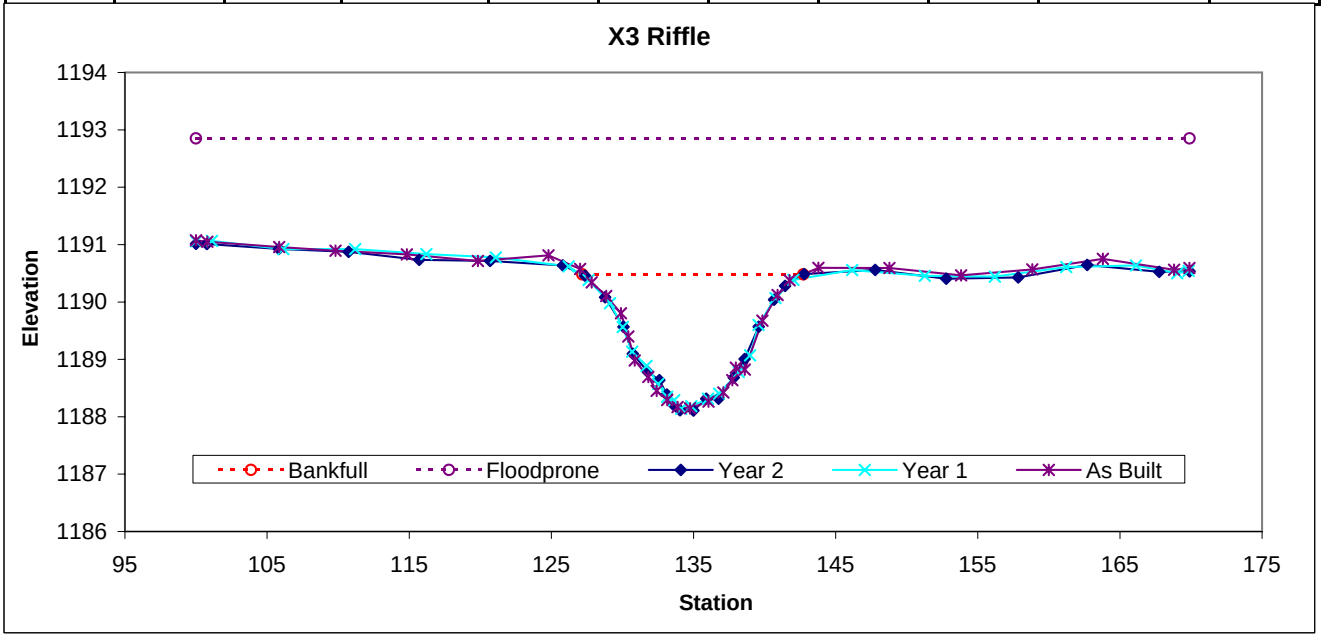
Permanent Cross Section X3

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	19.9	15.56	1.28	2.37	12.16	1	4.5	1190.48	1190.49



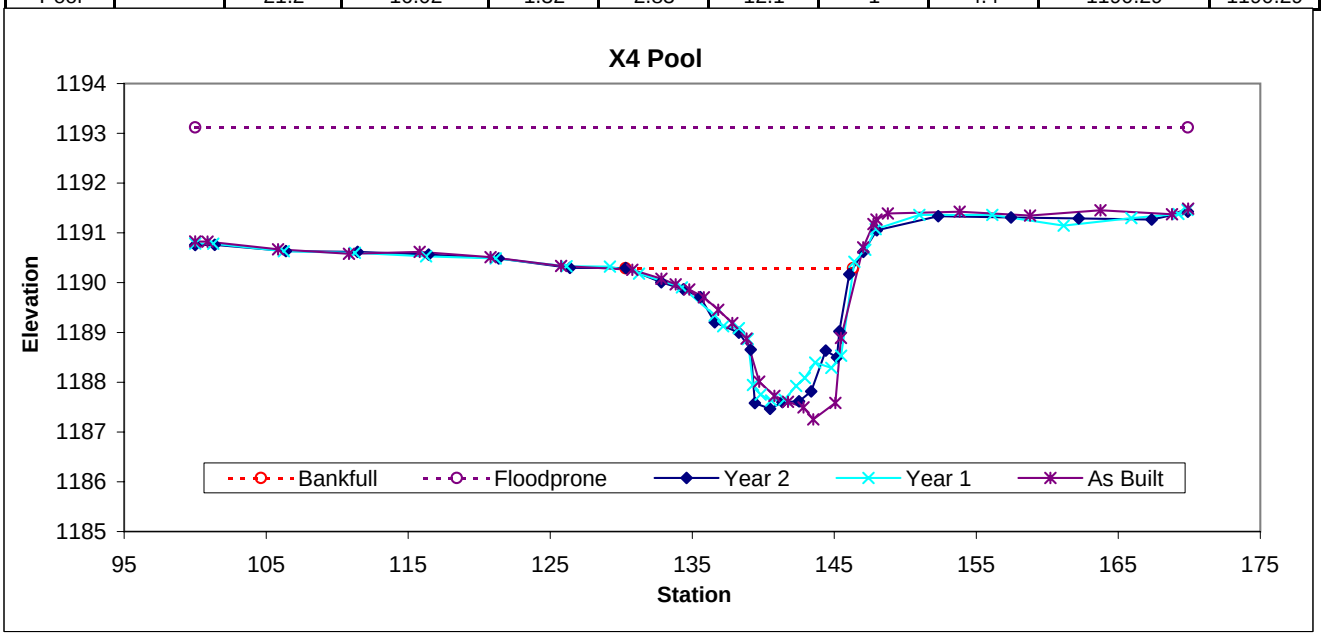
Permanent Cross Section X4

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

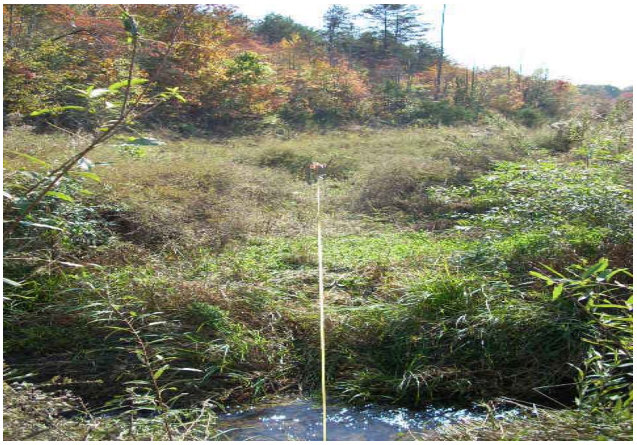
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		21.2	16.02	1.32	2.83	12.1	1	4.4	1190.29	1190.29



Permanent Cross Section X5

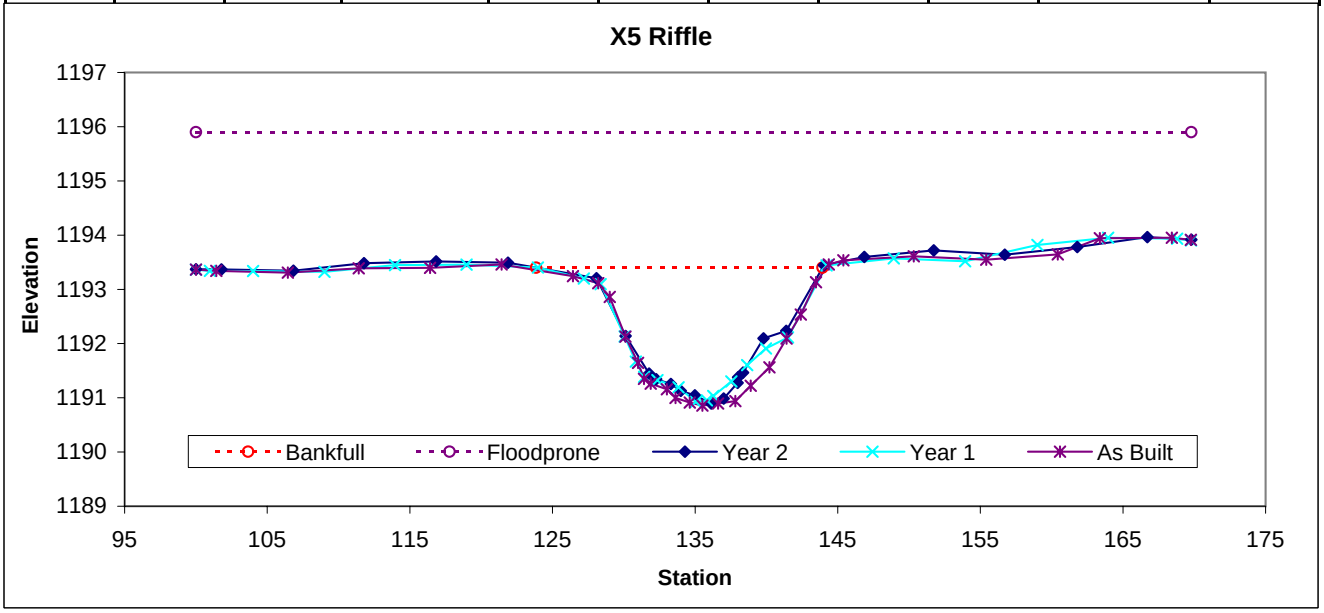
(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	25.2	20.09	1.25	2.5	16.01	1	3.5	1193.4	1193.44



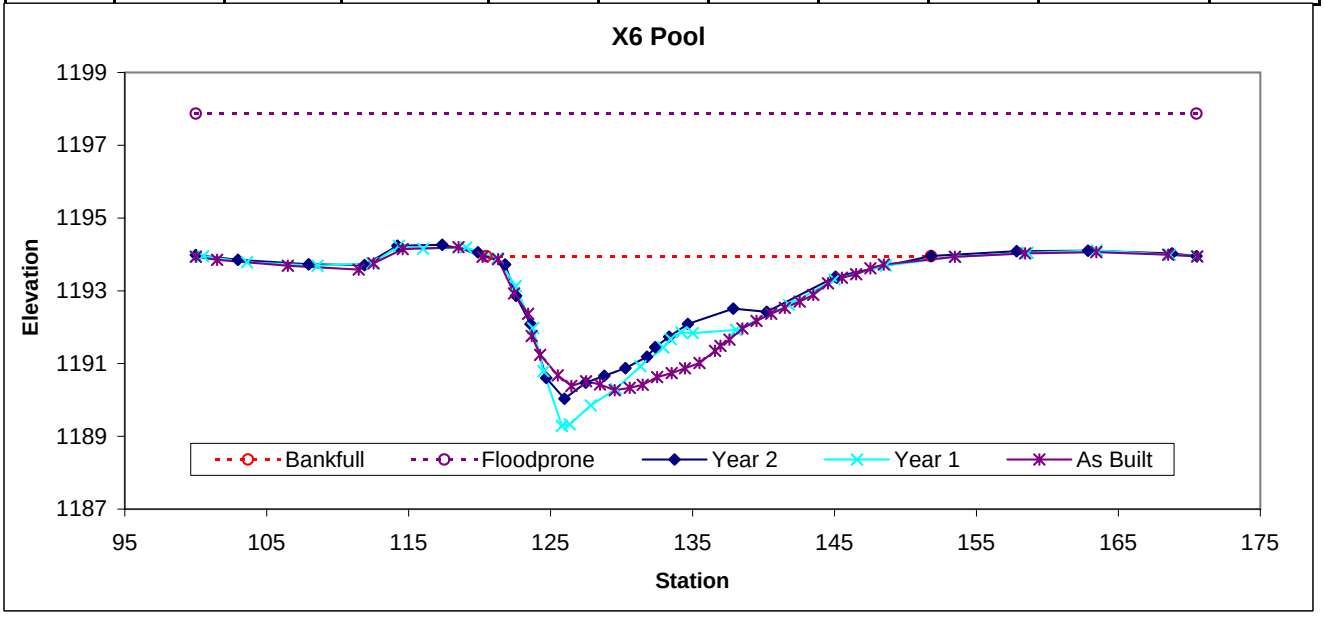
Permanent Cross Section X6

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

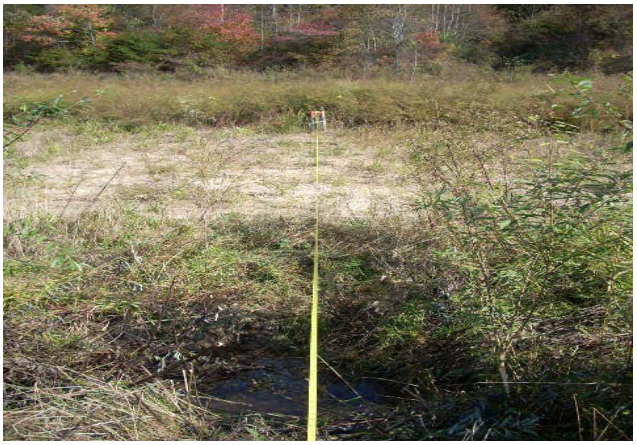
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		51.2	31.33	1.63	3.92	19.16	1	2.3	1193.95	1193.96



Permanent Cross Section X7

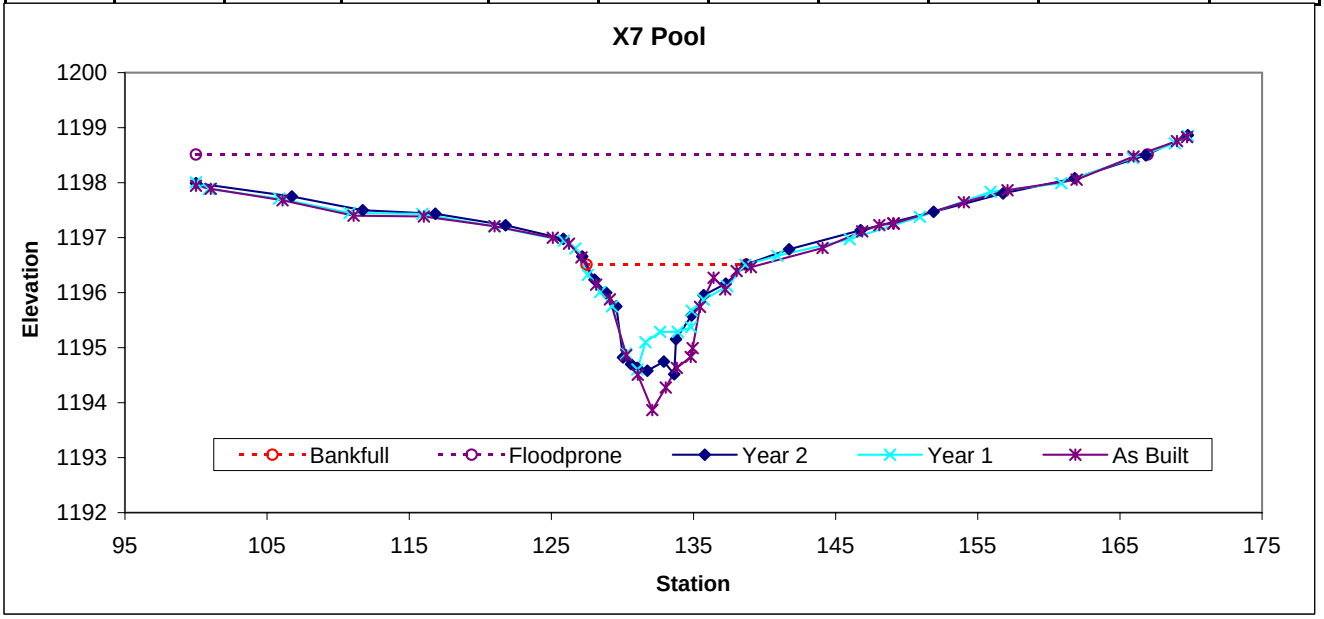
(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		11.2	11.26	0.99	2	11.34	1	5.9	1196.51	1196.51



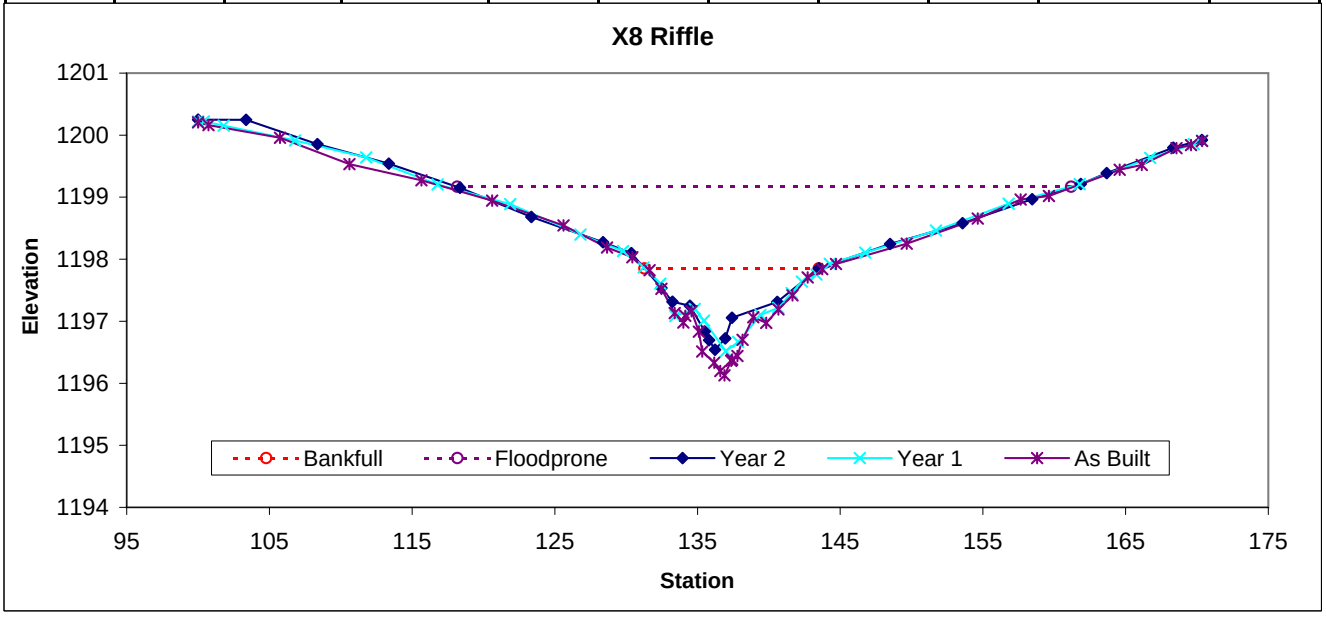
Permanent Cross Section X8

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	7.1	12.22	0.58	1.31	20.91	1	3.5	1197.85	1197.85



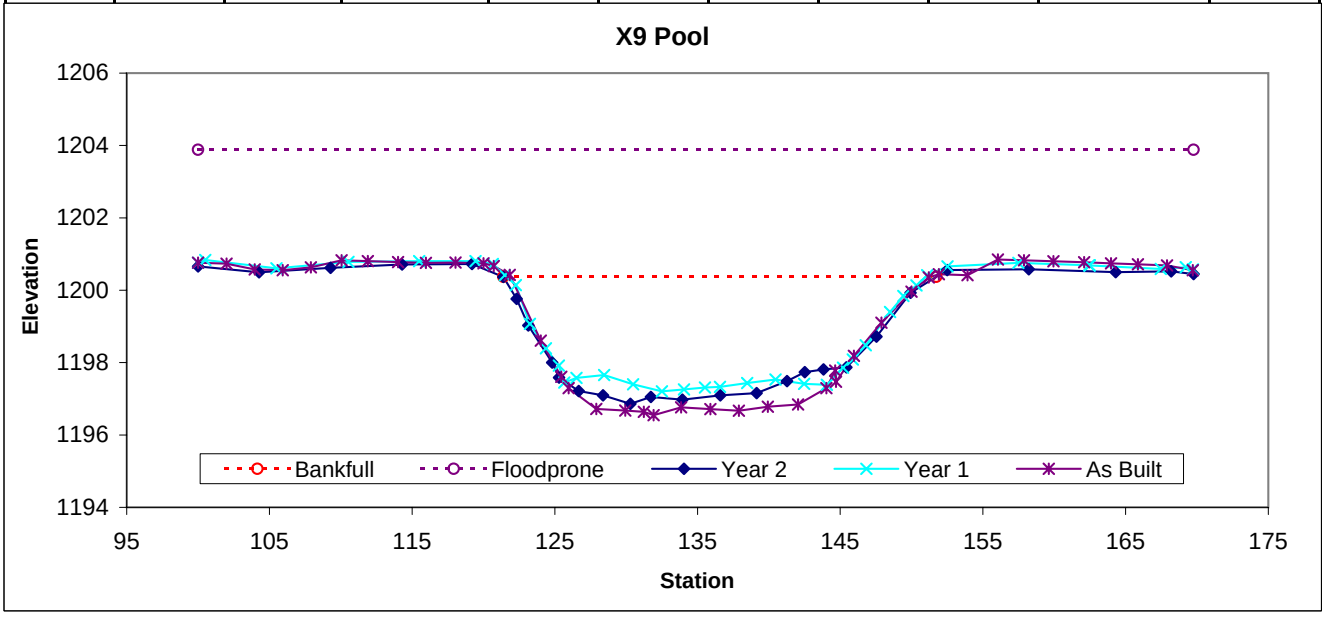
Permanent Cross Section X9

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

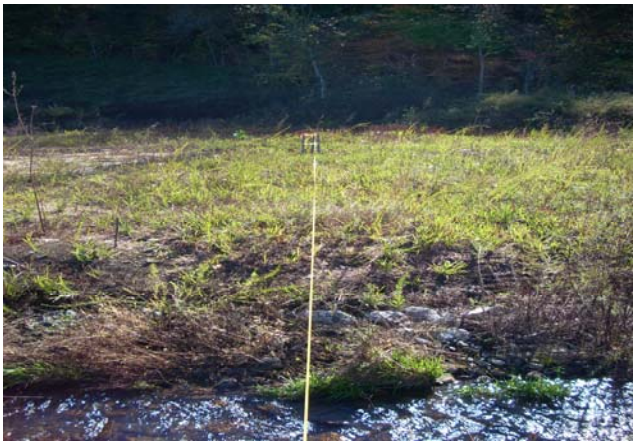
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		75.6	30.33	2.49	3.51	12.18	1	2.3	1200.37	1200.37



Permanent Cross Section X10

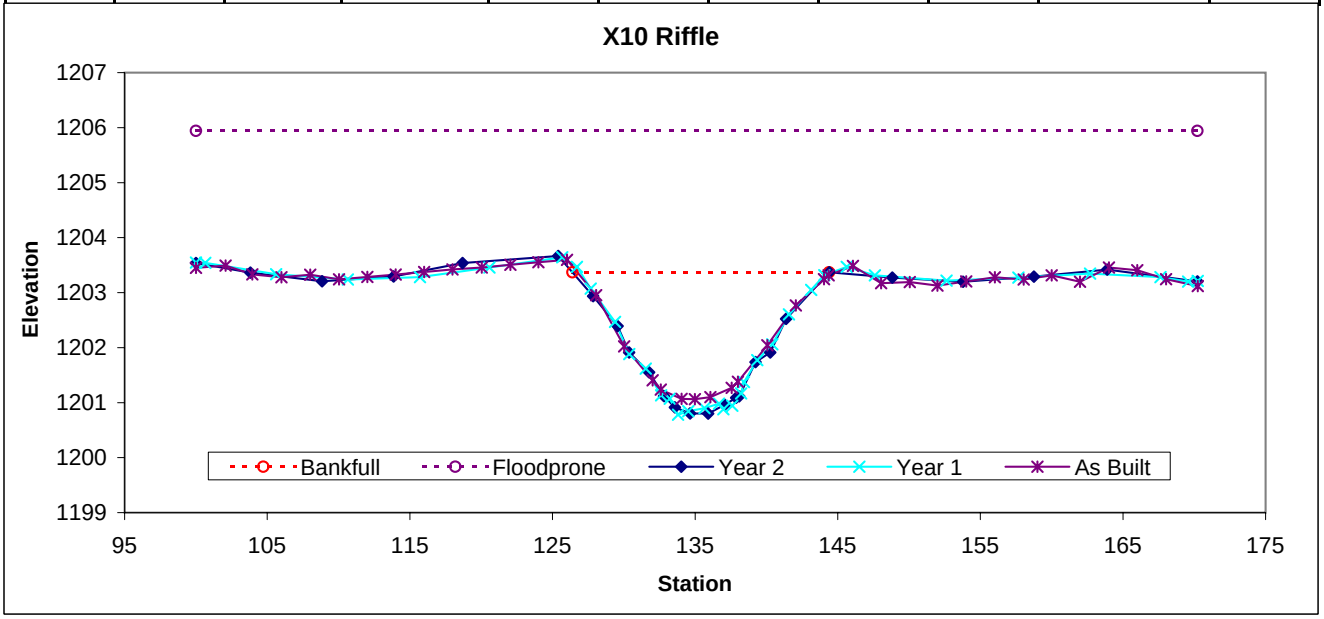
(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank



Looking at the Right Bank

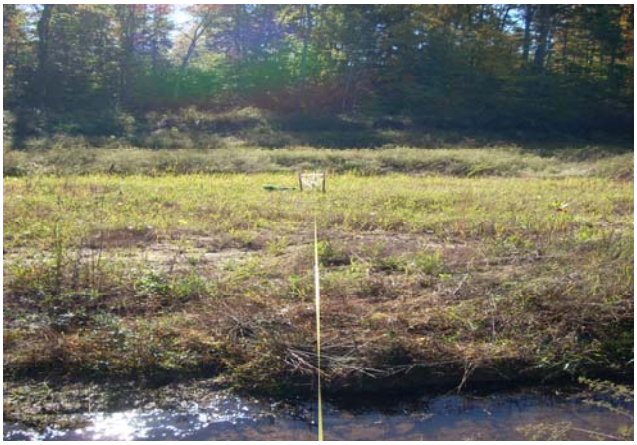
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	26.3	18.01	1.46	2.57	12.34	1	3.9	1203.37	1203.37



Permanent Cross Section X11

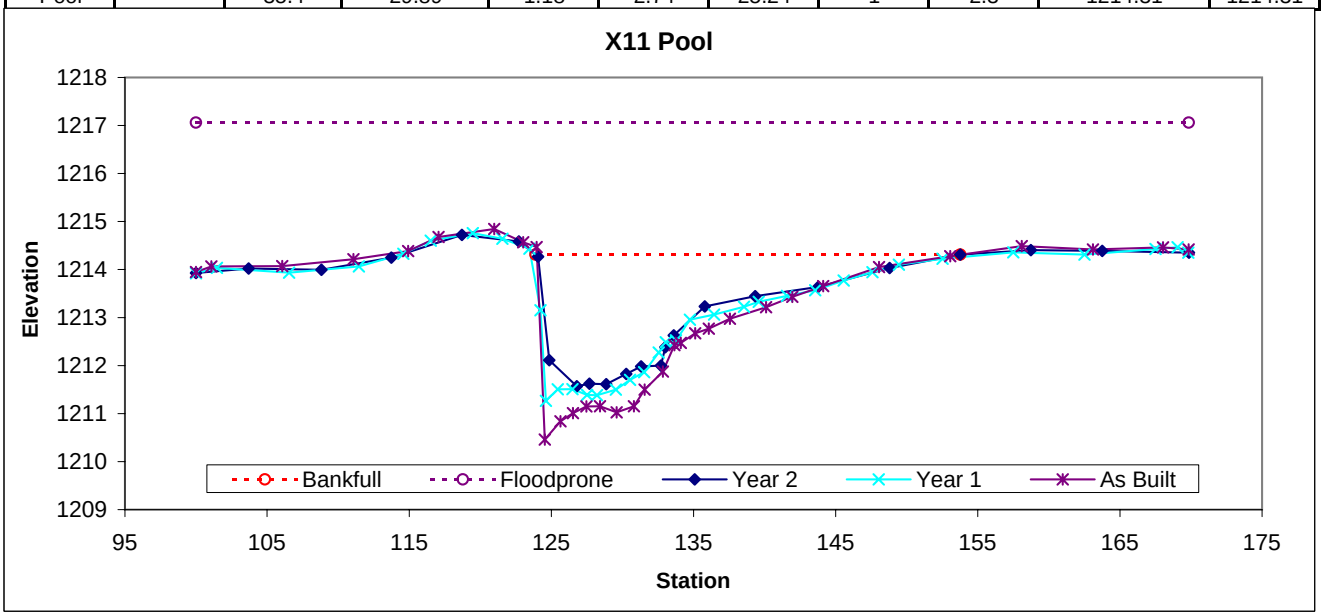
(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank



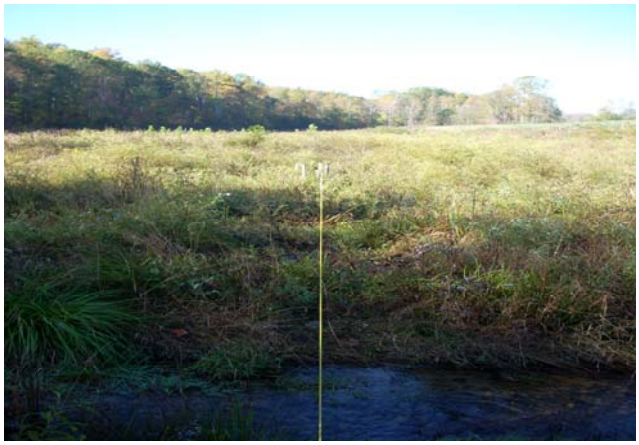
Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		35.4	29.89	1.18	2.74	25.24	1	2.3	1214.31	1214.31



Permanent Cross Section X12

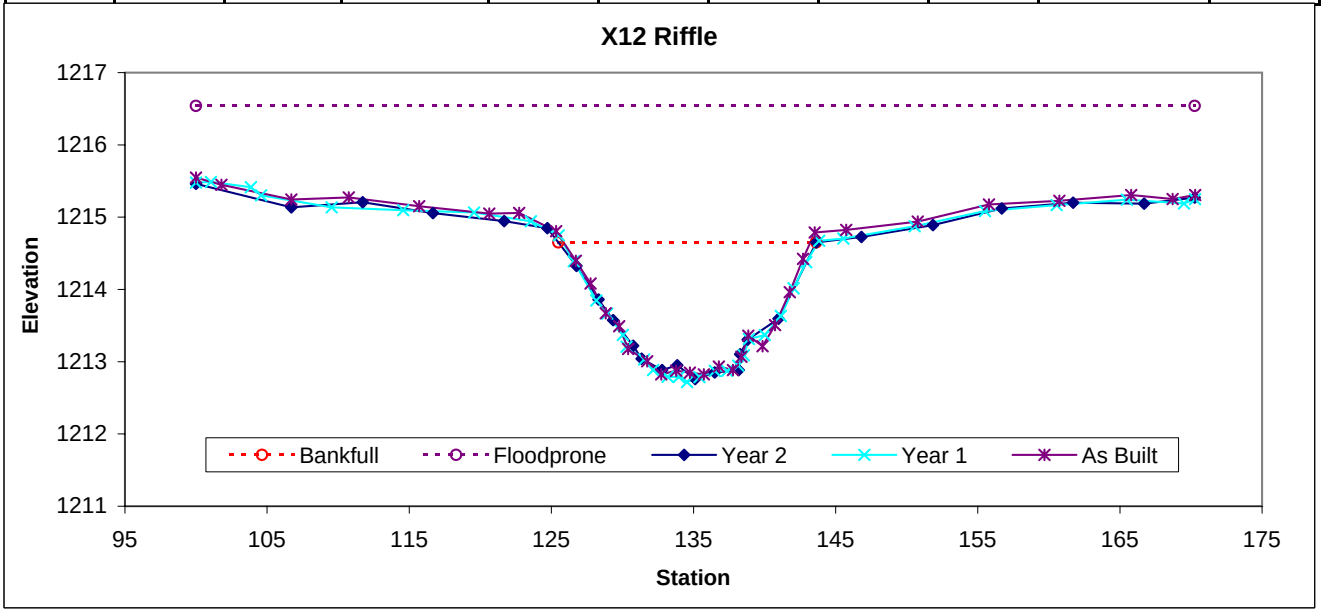
(Year 2 Monitoring Data - collected October 2007)



Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	21.7	18.15	1.2	1.89	15.14	1	3.9	1214.65	1214.65



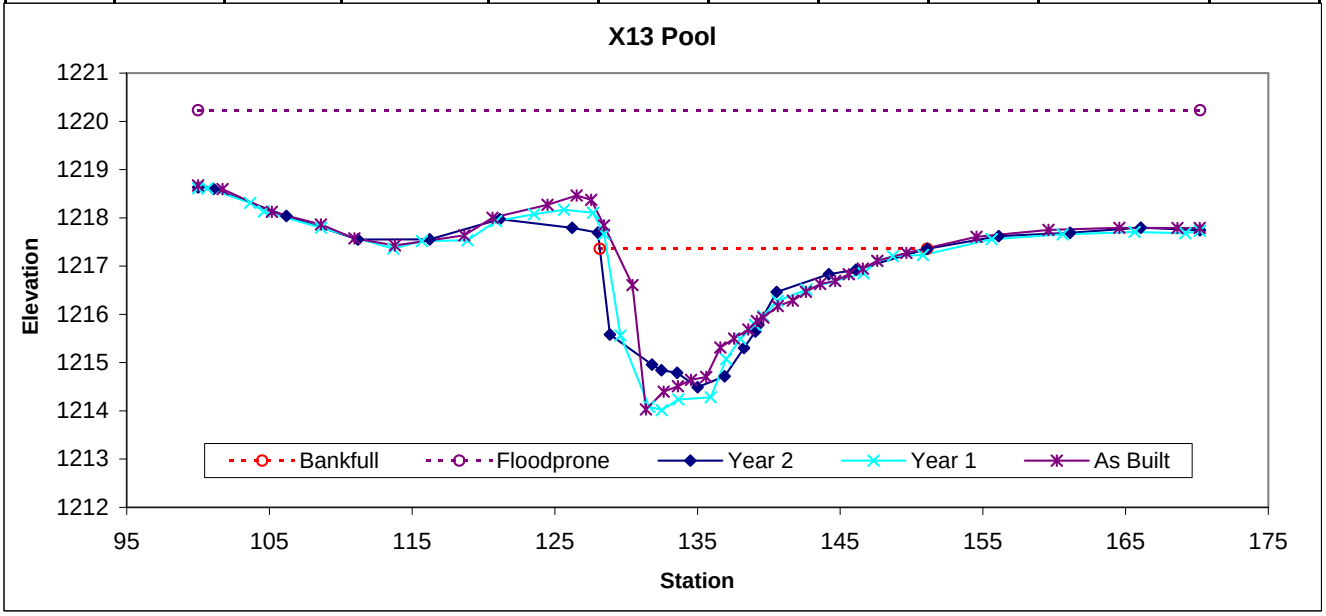
Permanent Cross Section X13

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		31.6	22.93	1.38	2.87	16.67	1	3.1	1217.36	1217.36



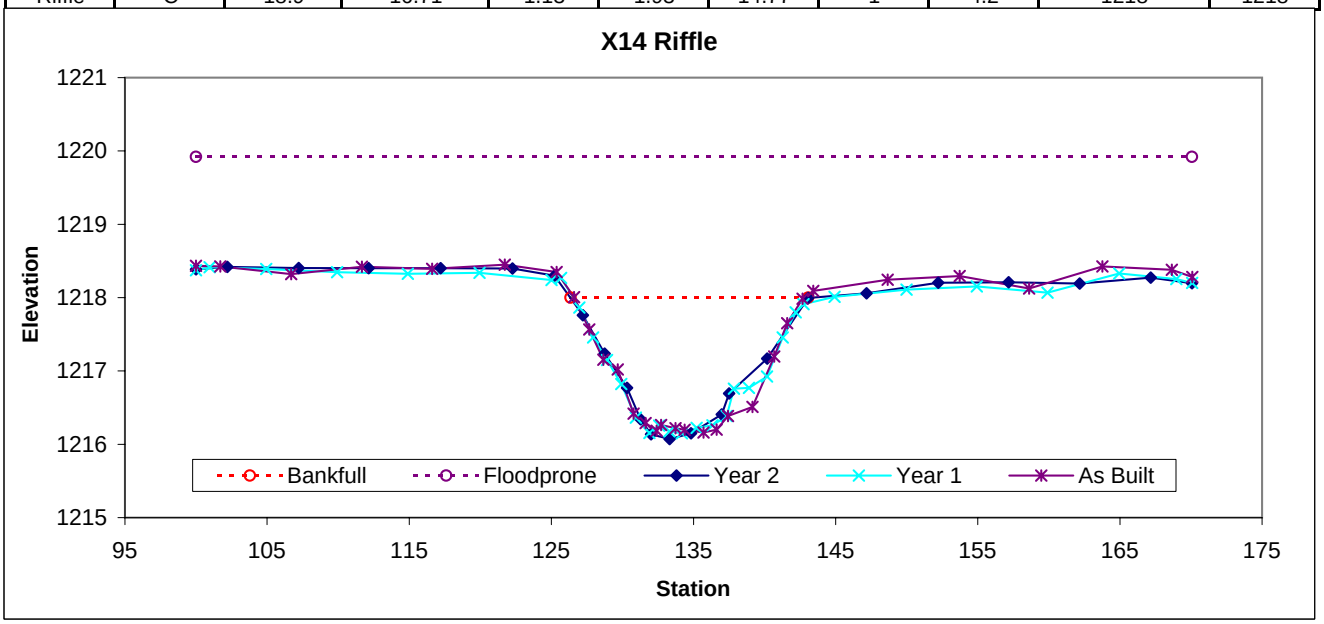
Permanent Cross Section X14

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

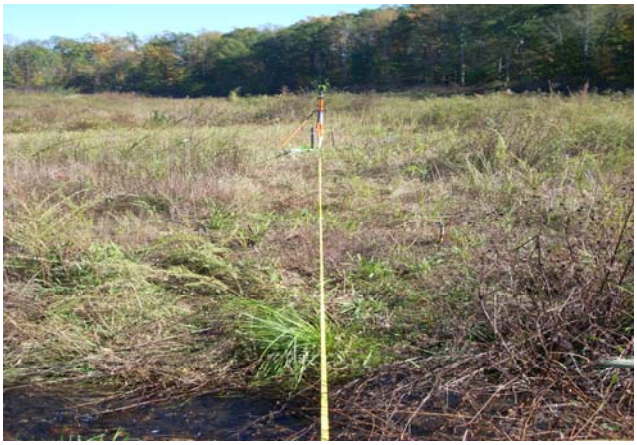
Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	18.9	16.71	1.13	1.93	14.77	1	4.2	1218	1218



Permanent Cross Section X15

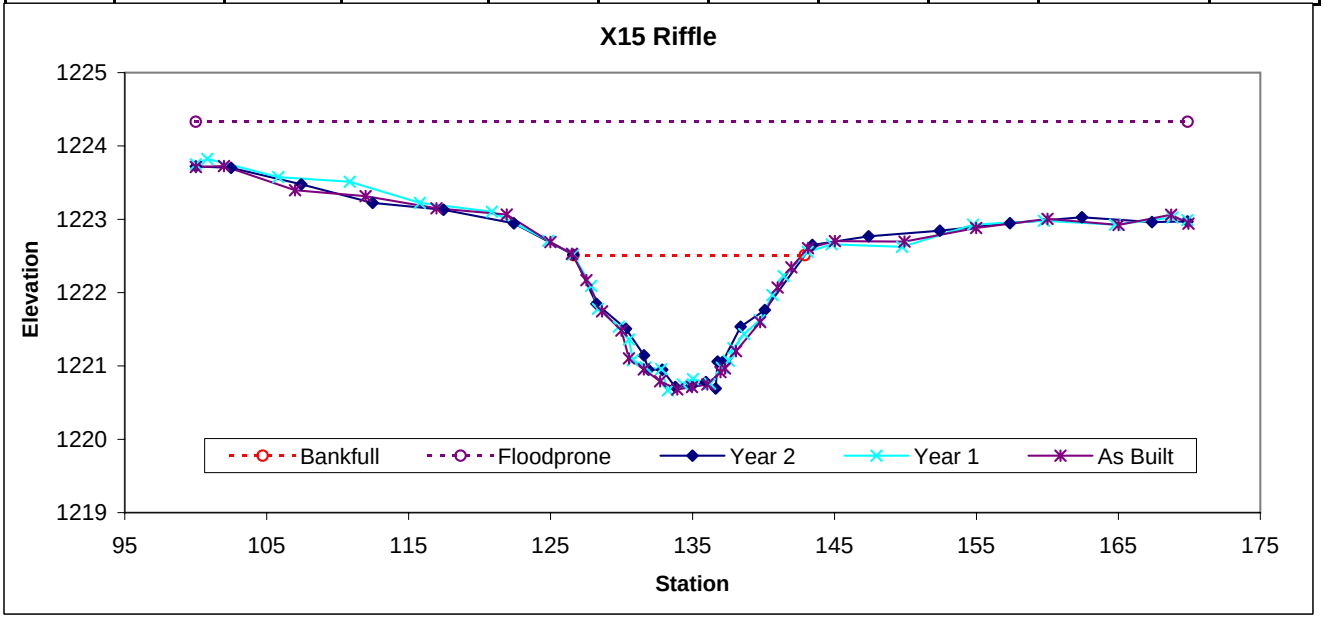
(Year 2 Monitroing Data - collected October 2007)

Looking at the Left Bank



Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Riffle	C	17.1	16.29	1.05	1.82	15.49	1	4.3	1222.51	1222.52



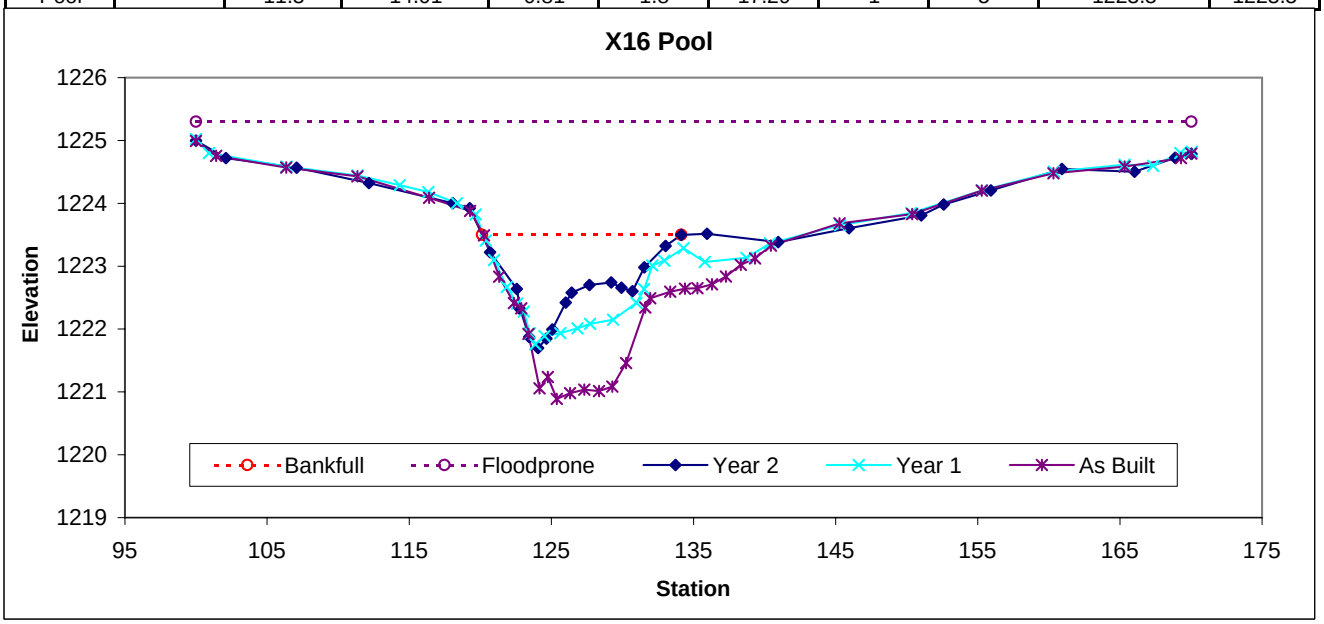
Permanent Cross Section X16

(Year 2 Monitoring Data - collected October 2007)

Looking at the Left Bank

Looking at the Right Bank

Feature	Stream Type	BKF Area	BKF Width	BKF Depth	Max BKF Depth	W/D	BH Ratio	ER	BKF Elev	TOB Elev
Pool		11.3	14.01	0.81	1.8	17.29	1	5	1223.5	1223.5



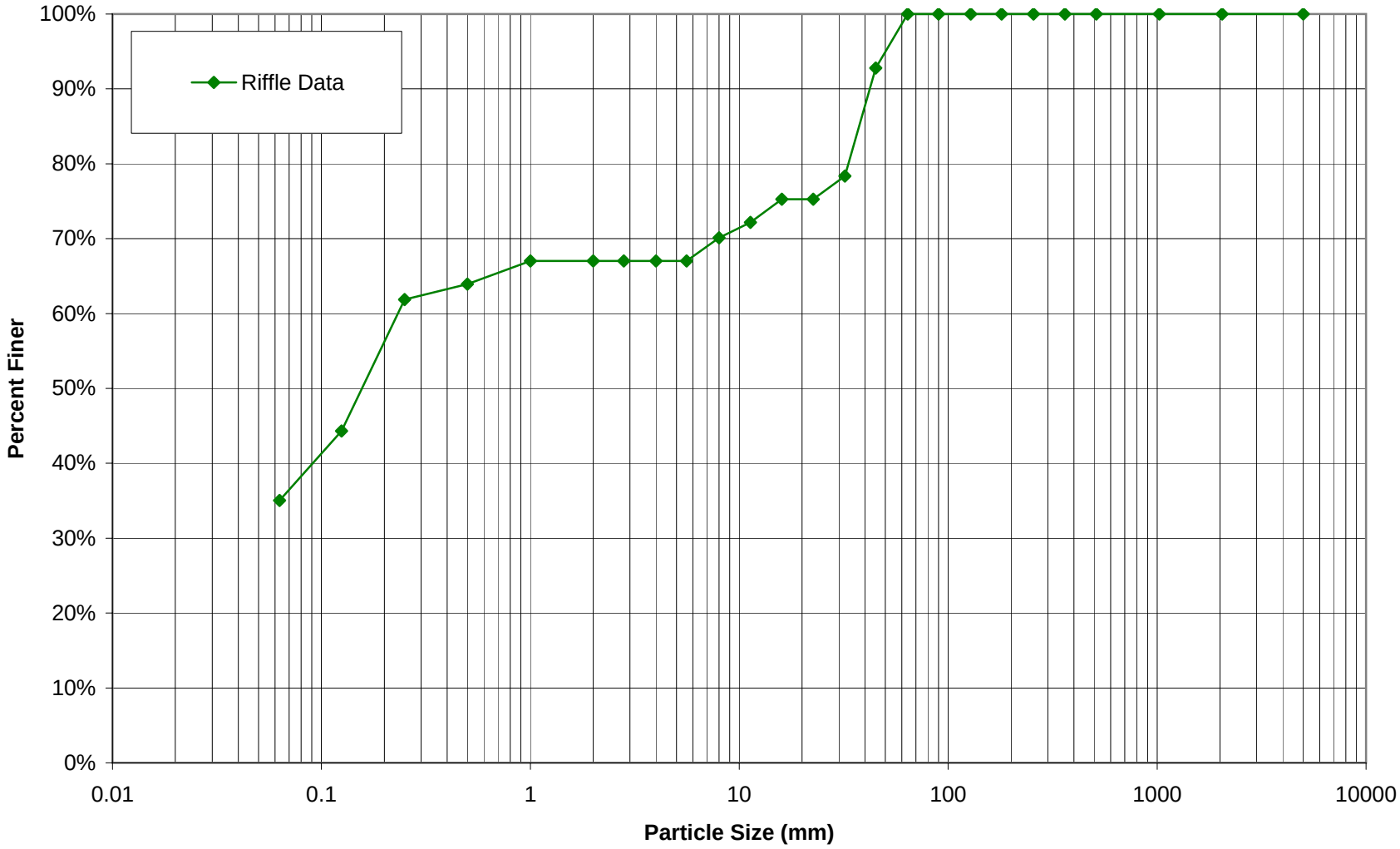
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X1-Riffle
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Riffle	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	34	35%	35%	0.063
SAND	Very Fine	.063 - .125	9	9%	44%	0.125
	Fine	.125 - .25	17	18%	62%	0.25
	Medium	.25 - .50	2	2%	64%	0.50
	Coarse	.50 - 1.0	3	3%	67%	1.0
	Very Coarse	1.0 - 2.0			67%	2.0
GRAVEL	Very Fine	2.0 - 2.8			67%	2.8
	Very Fine	2.8 - 4.0			67%	4.0
	Fine	4.0 - 5.6			67%	5.6
	Fine	5.6 - 8.0	3	3%	70%	8.0
	Medium	8.0 - 11.0	2	2%	72%	11.3
	Medium	11.0 - 16.0	3	3%	75%	16.0
	Coarse	16.0 - 22.6			75%	22.6
	Coarse	22.6 - 32	3	3%	78%	32
	Very Coarse	32 - 45	14	14%	93%	45
	Very Coarse	45 - 64	7	7%	100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**97**	**100%**		

Largest particles: _____ **(riffle)**

South Fork Hoppers Creek
X1-Riffle
Pebble Count Particle Size Distribution



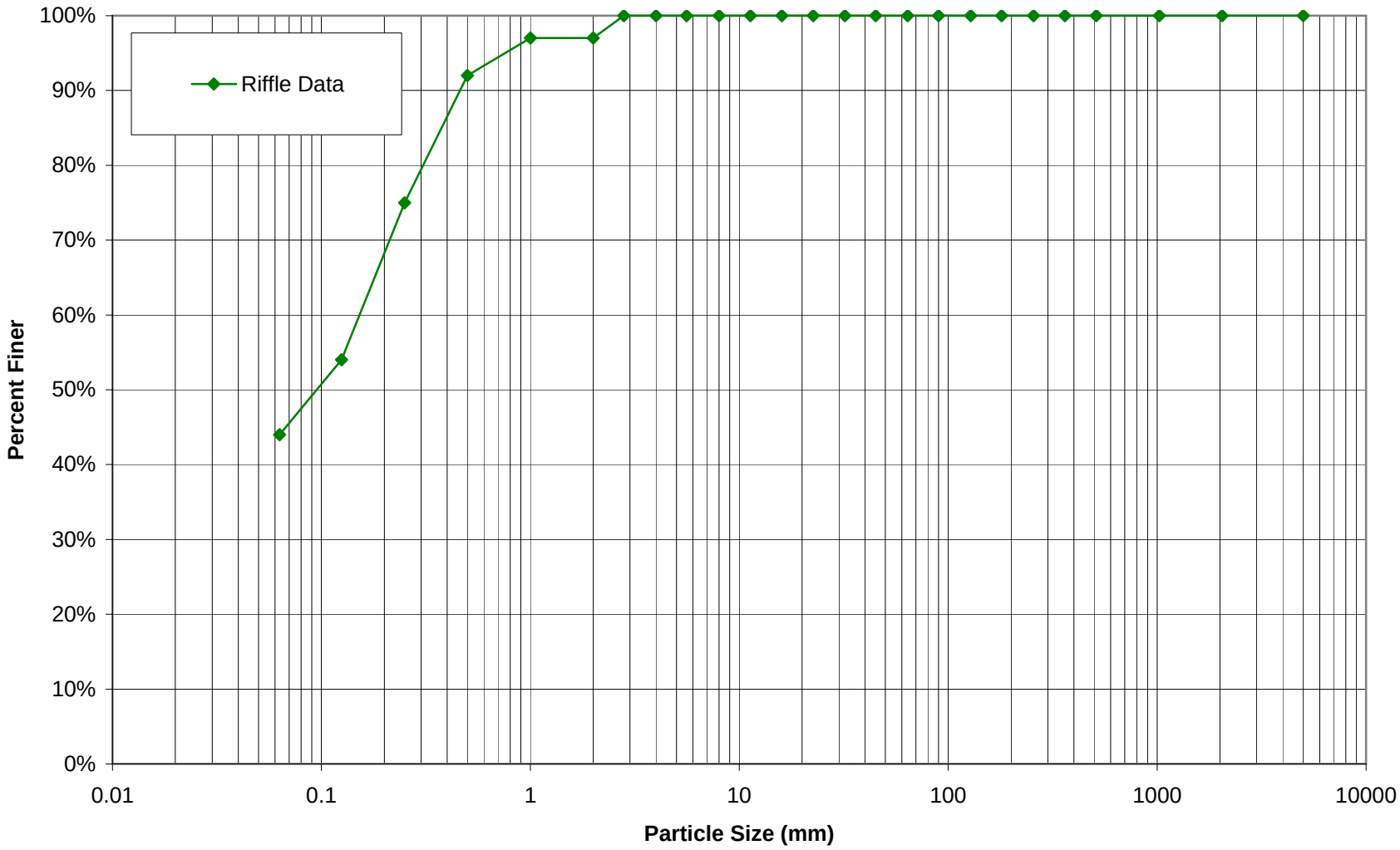
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X2-Pool
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Pool	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	44	44%	44%	0.063
SAND	Very Fine	.063 - .125	10	10%	54%	0.125
	Fine	.125 - .25	21	21%	75%	0.25
	Medium	.25 - .50	17	17%	92%	0.50
	Coarse	.50 - 1.0	5	5%	97%	1.0
	Very Coarse	1.0 - 2.0			97%	2.0
GRAVEL	Very Fine	2.0 - 2.8	3	3%	100%	2.8
	Very Fine	2.8 - 4.0			100%	4.0
	Fine	4.0 - 5.6			100%	5.6
	Fine	5.6 - 8.0			100%	8.0
	Medium	8.0 - 11.0			100%	11.3
	Medium	11.0 - 16.0			100%	16.0
	Coarse	16.0 - 22.6			100%	22.6
	Coarse	22.6 - 32			100%	32
	Very Coarse	32 - 45			100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**100**	**100%**		

Largest particles: _____
(pool)

South Fork Hoppers Creek
X2-Pool
Pebble Count Particle Size Distribution



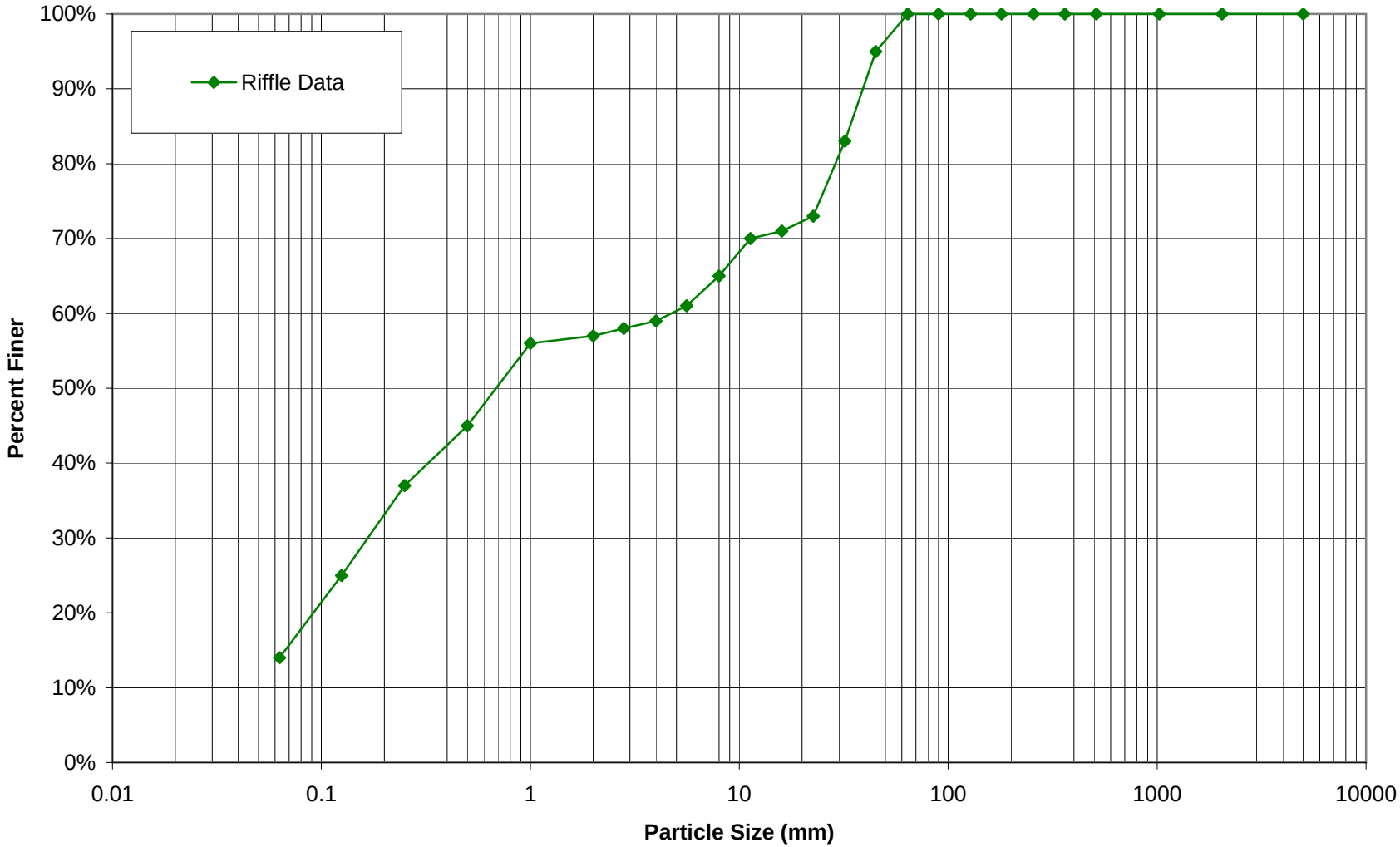
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X3-Riffle
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Riffle	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	14	14%	14%	0.063
SAND	Very Fine	.063 - .125	11	11%	25%	0.125
	Fine	.125 - .25	12	12%	37%	0.25
	Medium	.25 - .50	8	8%	45%	0.50
	Coarse	.50 - 1.0	11	11%	56%	1.0
	Very Coarse	1.0 - 2.0	1	1%	57%	2.0
GRAVEL	Very Fine	2.0 - 2.8	1	1%	58%	2.8
	Very Fine	2.8 - 4.0	1	1%	59%	4.0
	Fine	4.0 - 5.6	2	2%	61%	5.6
	Fine	5.6 - 8.0	4	4%	65%	8.0
	Medium	8.0 - 11.0	5	5%	70%	11.3
	Medium	11.0 - 16.0	1	1%	71%	16.0
	Coarse	16.0 - 22.6	2	2%	73%	22.6
	Coarse	22.6 - 32	10	10%	83%	32
	Very Coarse	32 - 45	12	12%	95%	45
	Very Coarse	45 - 64	5	5%	100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**100**	**100%**		

Largest particles: _____ **(riffle)**

South Fork Hoppers Creek
X3-Riffle
Pebble Count Particle Size Distribution



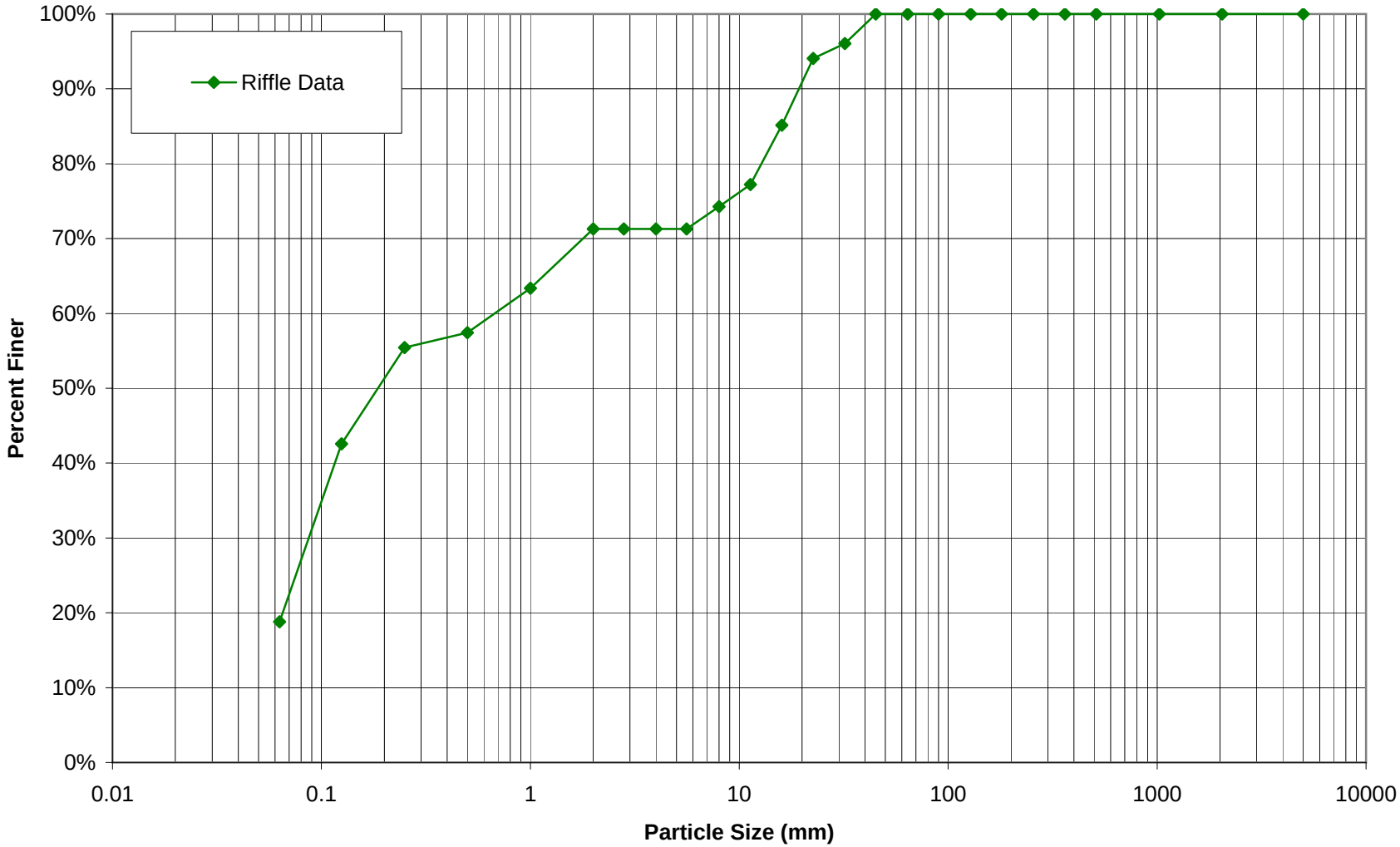
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X4-Pool
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Pool	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	19	19%	19%	0.063
SAND	Very Fine	.063 - .125	24	24%	43%	0.125
	Fine	.125 - .25	13	13%	55%	0.25
	Medium	.25 - .50	2	2%	57%	0.50
	Coarse	.50 - 1.0	6	6%	63%	1.0
	Very Coarse	1.0 - 2.0	8	8%	71%	2.0
GRAVEL	Very Fine	2.0 - 2.8			71%	2.8
	Very Fine	2.8 - 4.0			71%	4.0
	Fine	4.0 - 5.6			71%	5.6
	Fine	5.6 - 8.0	3	3%	74%	8.0
	Medium	8.0 - 11.0	3	3%	77%	11.3
	Medium	11.0 - 16.0	8	8%	85%	16.0
	Coarse	16.0 - 22.6	9	9%	94%	22.6
	Coarse	22.6 - 32	2	2%	96%	32
	Very Coarse	32 - 45	4	4%	100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**101**	**100%**		

Largest particles: _____ **(pool)**

South Fork Hoppers Creek
X4-Pool
Pebble Count Particle Size Distribution



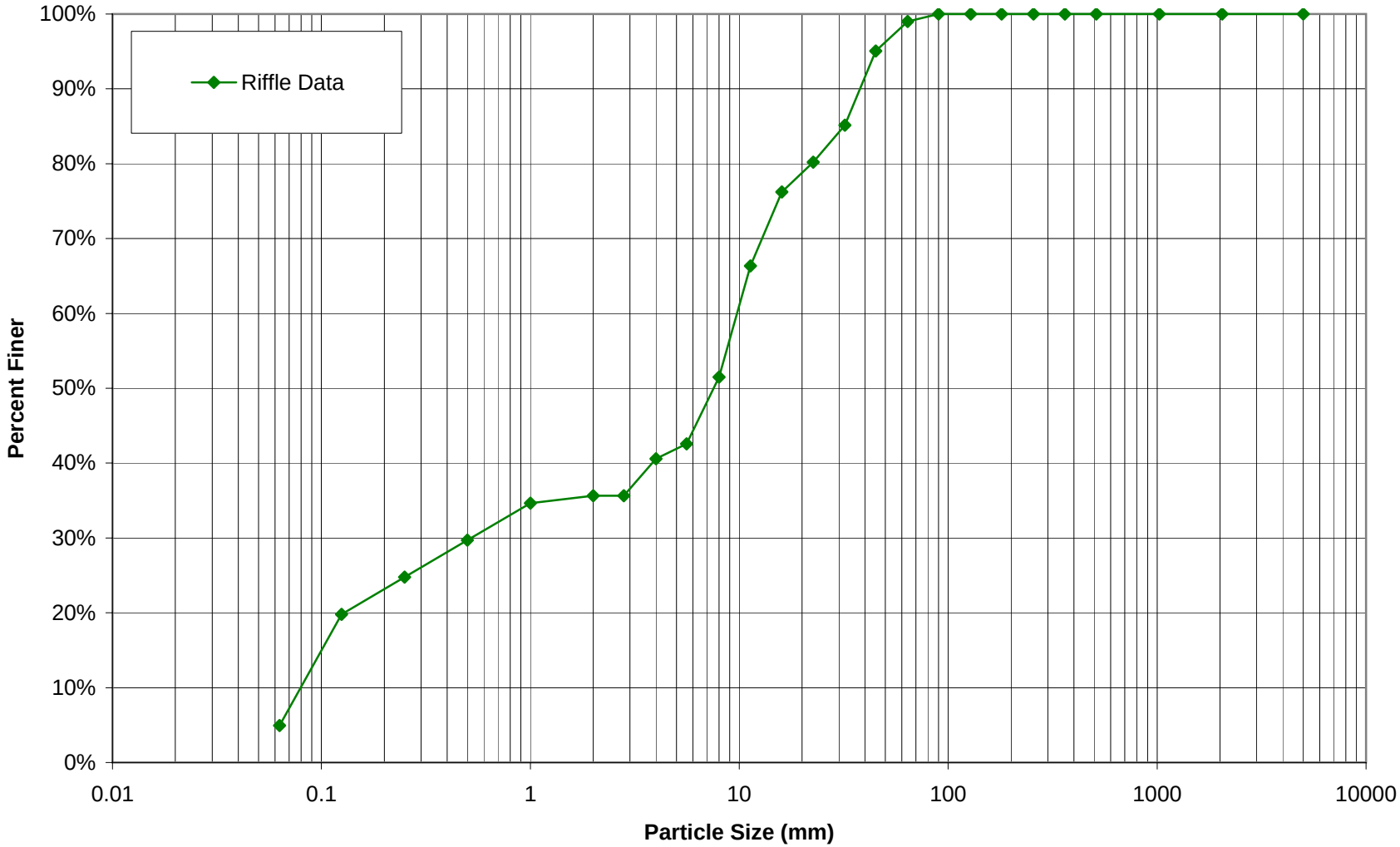
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X5-Riffle
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Riffle	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	5	5%	5%	0.063
SAND	Very Fine	.063 - .125	15	15%	20%	0.125
	Fine	.125 - .25	5	5%	25%	0.25
	Medium	.25 - .50	5	5%	30%	0.50
	Coarse	.50 - 1.0	5	5%	35%	1.0
	Very Coarse	1.0 - 2.0	1	1%	36%	2.0
GRAVEL	Very Fine	2.0 - 2.8			36%	2.8
	Very Fine	2.8 - 4.0	5	5%	41%	4.0
	Fine	4.0 - 5.6	2	2%	43%	5.6
	Fine	5.6 - 8.0	9	9%	51%	8.0
	Medium	8.0 - 11.0	15	15%	66%	11.3
	Medium	11.0 - 16.0	10	10%	76%	16.0
	Coarse	16.0 - 22.6	4	4%	80%	22.6
	Coarse	22.6 - 32	5	5%	85%	32
	Very Coarse	32 - 45	10	10%	95%	45
	Very Coarse	45 - 64	4	4%	99%	64
COBBLE	Small	64 - 90	1	1%	100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**101**	**100%**		

Largest particles: _____ **(riffle)**

South Fork Hoppers Creek
X5-Riffle
Pebble Count Particle Size Distribution



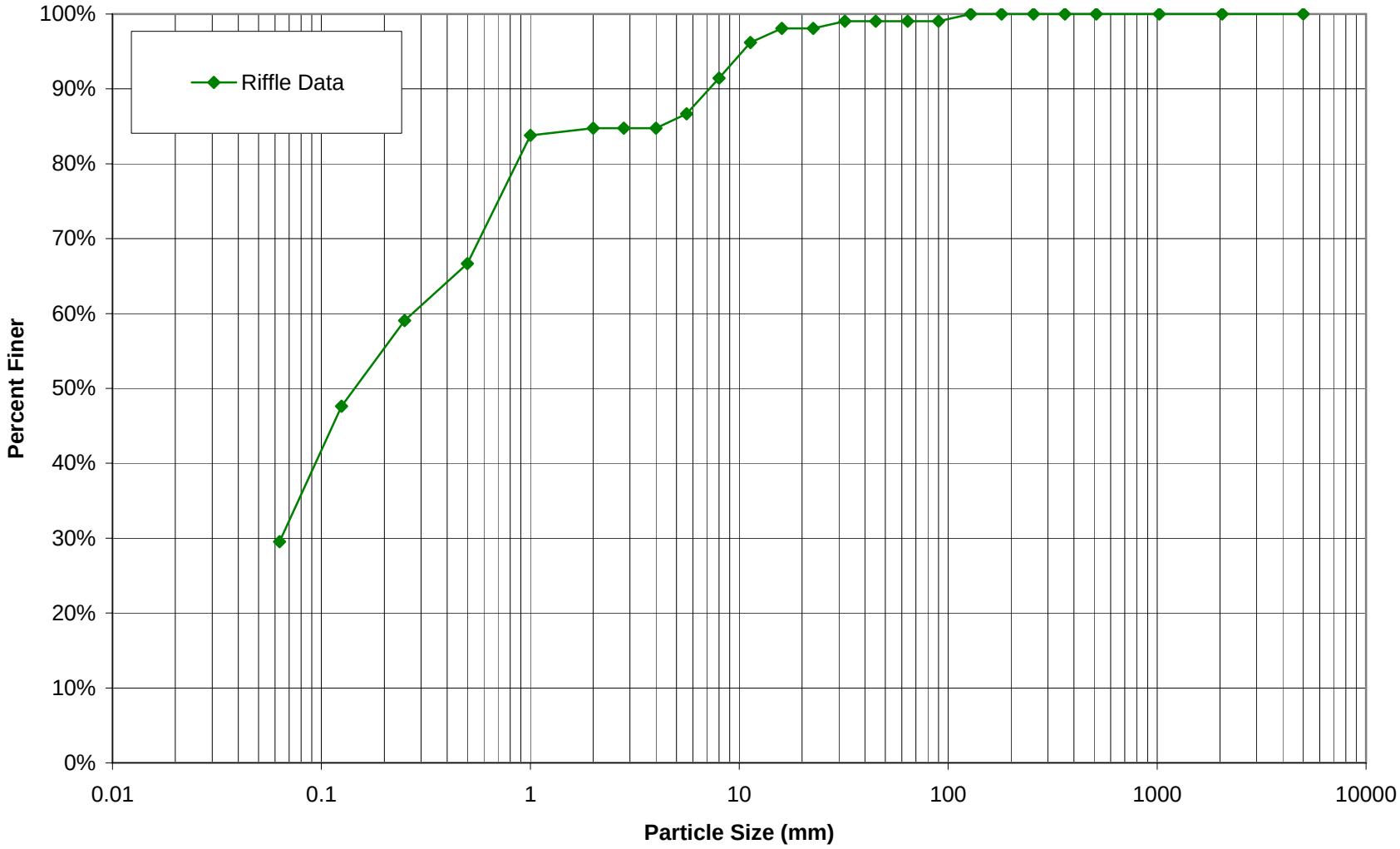
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X6-Pool
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Pool	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	31	30%	30%	0.063
SAND	Very Fine	.063 - .125	19	18%	48%	0.125
	Fine	.125 - .25	12	11%	59%	0.25
	Medium	.25 - .50	8	8%	67%	0.50
	Coarse	.50 - 1.0	18	17%	84%	1.0
	Very Coarse	1.0 - 2.0	1	1%	85%	2.0
GRAVEL	Very Fine	2.0 - 2.8			85%	2.8
	Very Fine	2.8 - 4.0			85%	4.0
	Fine	4.0 - 5.6	2	2%	87%	5.6
	Fine	5.6 - 8.0	5	5%	91%	8.0
	Medium	8.0 - 11.0	5	5%	96%	11.3
	Medium	11.0 - 16.0	2	2%	98%	16.0
	Coarse	16.0 - 22.6			98%	22.6
	Coarse	22.6 - 32	1	1%	99%	32
	Very Coarse	32 - 45			99%	45
	Very Coarse	45 - 64			99%	64
COBBLE	Small	64 - 90			99%	90
	Small	90 - 128	1	1%	100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**105**	**100%**		

Largest particles: _____
(pool)

South Fork Hoppers Creek
X6-Pool
Pebble Count Particle Size Distribution



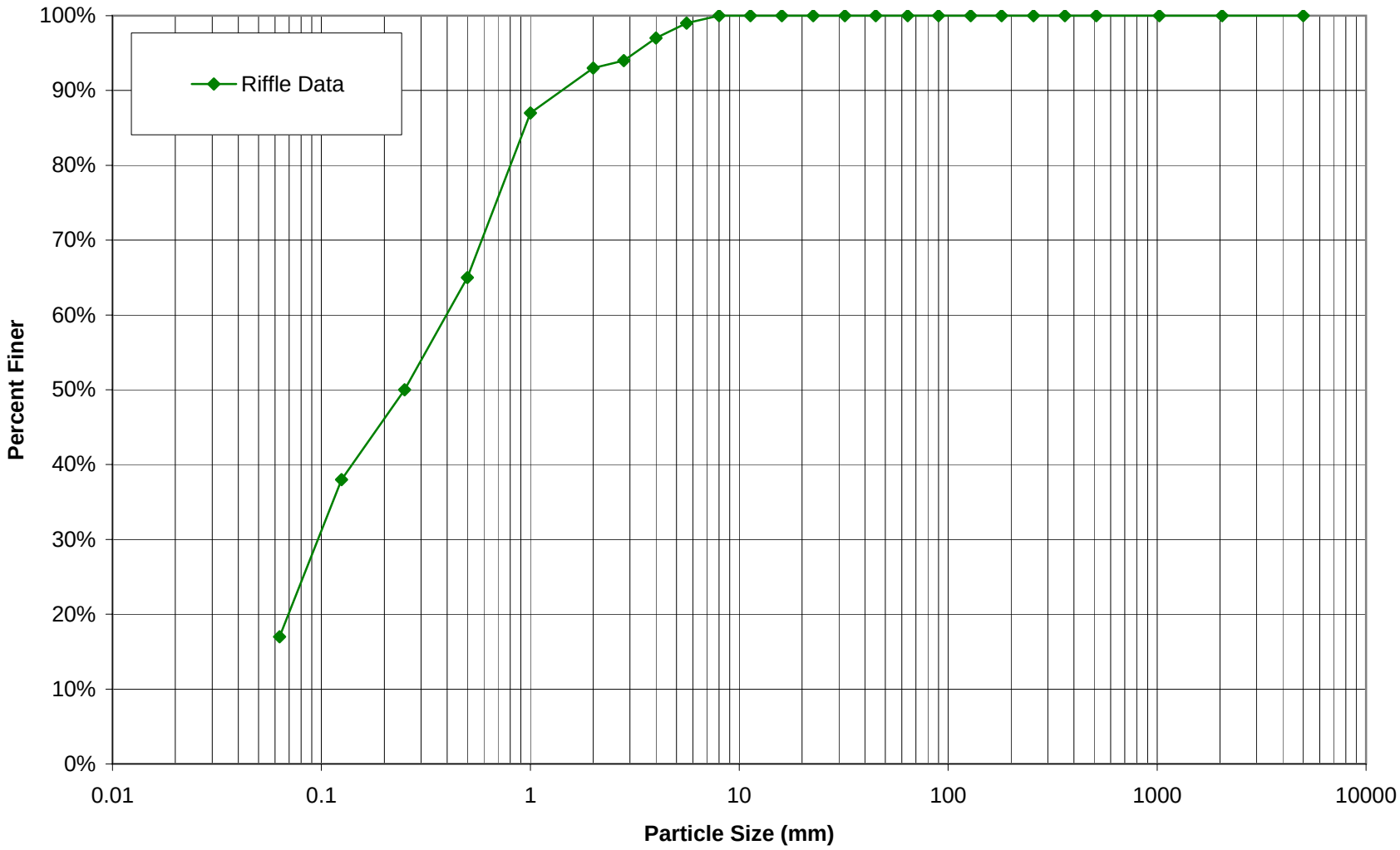
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X7-Pool
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Pool	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	17	17%	17%	0.063
SAND	Very Fine	.063 - .125	21	21%	38%	0.125
	Fine	.125 - .25	12	12%	50%	0.25
	Medium	.25 - .50	15	15%	65%	0.50
	Coarse	.50 - 1.0	22	22%	87%	1.0
	Very Coarse	1.0 - 2.0	6	6%	93%	2.0
GRAVEL	Very Fine	2.0 - 2.8	1	1%	94%	2.8
	Very Fine	2.8 - 4.0	3	3%	97%	4.0
	Fine	4.0 - 5.6	2	2%	99%	5.6
	Fine	5.6 - 8.0	1	1%	100%	8.0
	Medium	8.0 - 11.0			100%	11.3
	Medium	11.0 - 16.0			100%	16.0
	Coarse	16.0 - 22.6			100%	22.6
	Coarse	22.6 - 32			100%	32
	Very Coarse	32 - 45			100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	100	100%		

Largest particles: _____ **(pool)**

South Fork Hoppers Creek
X7-Pool
Pebble Count Particle Size Distribution



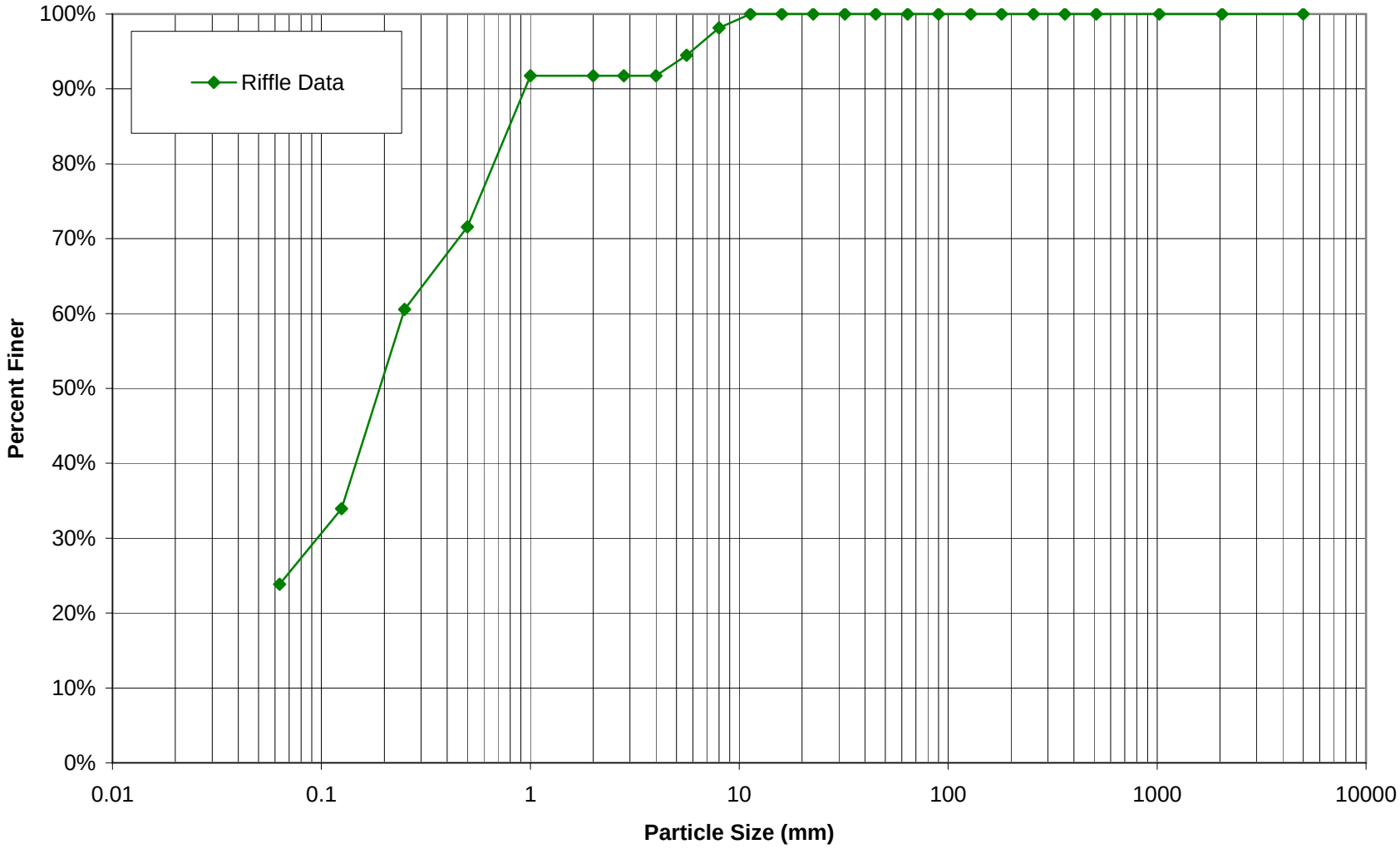
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X8-Riffle
DATE COLLECTED:	11/6/2007
FIELD COLLECTION BY:	RR/SU
DATA ENTRY BY:	KS

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	26	24%	24%	0.063
SAND	Very Fine	.063 - .125	11	10%	34%	0.125
	Fine	.125 - .25	29	27%	61%	0.25
	Medium	.25 - .50	12	11%	72%	0.50
	Coarse	.50 - 1.0	22	20%	92%	1.0
	Very Coarse	1.0 - 2.0			92%	2.0
GRAVEL	Very Fine	2.0 - 2.8			92%	2.8
	Very Fine	2.8 - 4.0			92%	4.0
	Fine	4.0 - 5.6	3	3%	94%	5.6
	Fine	5.6 - 8.0	4	4%	98%	8.0
	Medium	8.0 - 11.0	2	2%	100%	11.3
	Medium	11.0 - 16.0			100%	16.0
	Coarse	16.0 - 22.6			100%	22.6
	Coarse	22.6 - 32			100%	32
	Very Coarse	32 - 45			100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	109	100%		

Largest particles: _____ **(riffle)**

South Fork Hoppers Creek
X8-Riffle
Pebble Count Particle Size Distribution



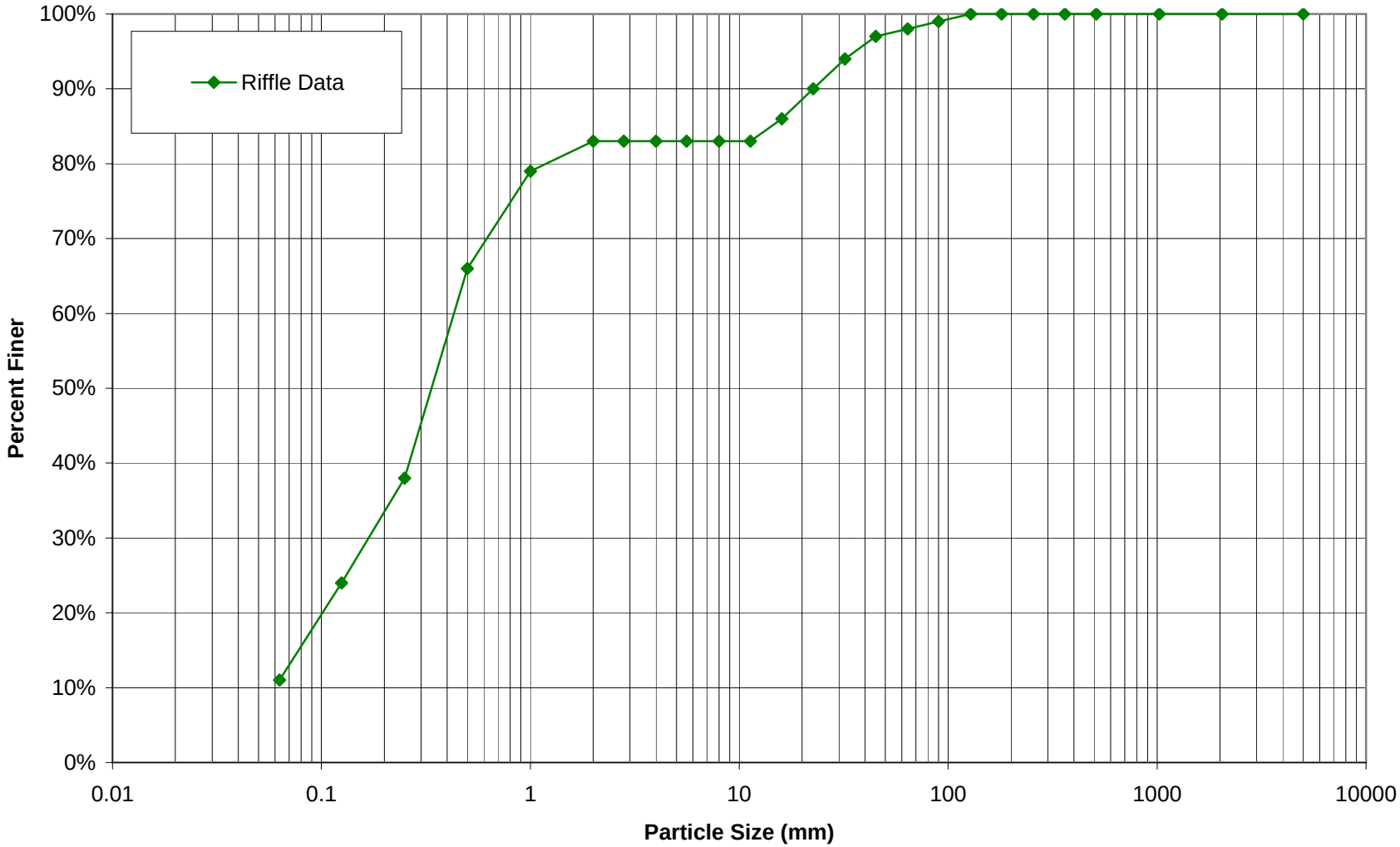
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X9-Pool
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Pool	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	11	11%	11%	0.063
SAND	Very Fine	.063 - .125	13	13%	24%	0.125
	Fine	.125 - .25	14	14%	38%	0.25
	Medium	.25 - .50	28	28%	66%	0.50
	Coarse	.50 - 1.0	13	13%	79%	1.0
	Very Coarse	1.0 - 2.0	4	4%	83%	2.0
GRAVEL	Very Fine	2.0 - 2.8			83%	2.8
	Very Fine	2.8 - 4.0			83%	4.0
	Fine	4.0 - 5.6			83%	5.6
	Fine	5.6 - 8.0			83%	8.0
	Medium	8.0 - 11.0			83%	11.3
	Medium	11.0 - 16.0	3	3%	86%	16.0
	Coarse	16.0 - 22.6	4	4%	90%	22.6
	Coarse	22.6 - 32	4	4%	94%	32
	Very Coarse	32 - 45	3	3%	97%	45
	Very Coarse	45 - 64	1	1%	98%	64
COBBLE	Small	64 - 90	1	1%	99%	90
	Small	90 - 128	1	1%	100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**100**	**100%**		

Largest particles: _____ **(pool)**

South Fork Hoppers Creek
X9-Pool
Pebble Count Particle Size Distribution



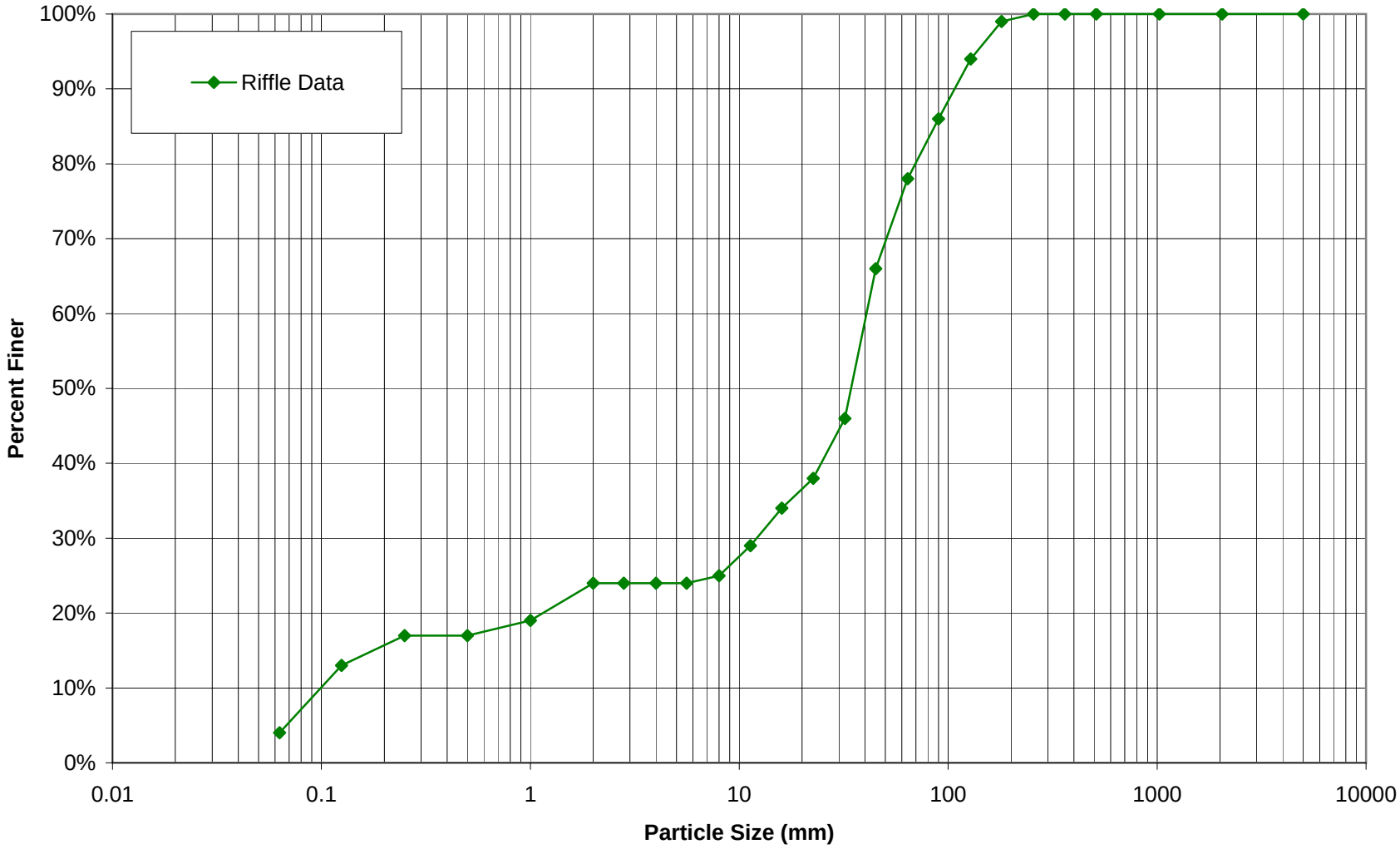
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X10-Riffle
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	4	4%	4%	0.063
SAND	Very Fine	.063 - .125	9	9%	13%	0.125
	Fine	.125 - .25	4	4%	17%	0.25
	Medium	.25 - .50			17%	0.50
	Coarse	.50 - 1.0	2	2%	19%	1.0
	Very Coarse	1.0 - 2.0	5	5%	24%	2.0
GRAVEL	Very Fine	2.0 - 2.8			24%	2.8
	Very Fine	2.8 - 4.0			24%	4.0
	Fine	4.0 - 5.6			24%	5.6
	Fine	5.6 - 8.0	1	1%	25%	8.0
	Medium	8.0 - 11.0	4	4%	29%	11.3
	Medium	11.0 - 16.0	5	5%	34%	16.0
	Coarse	16.0 - 22.6	4	4%	38%	22.6
	Coarse	22.6 - 32	8	8%	46%	32
	Very Coarse	32 - 45	20	20%	66%	45
	Very Coarse	45 - 64	12	12%	78%	64
COBBLE	Small	64 - 90	8	8%	86%	90
	Small	90 - 128	8	8%	94%	128
	Large	128 - 180	5	5%	99%	180
	Large	180 - 256	1	1%	100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	100	100%		

Largest particles: 250.00
(riffle)

South Fork Hoppers Creek
X10-Riffle
Pebble Count Particle Size Distribution



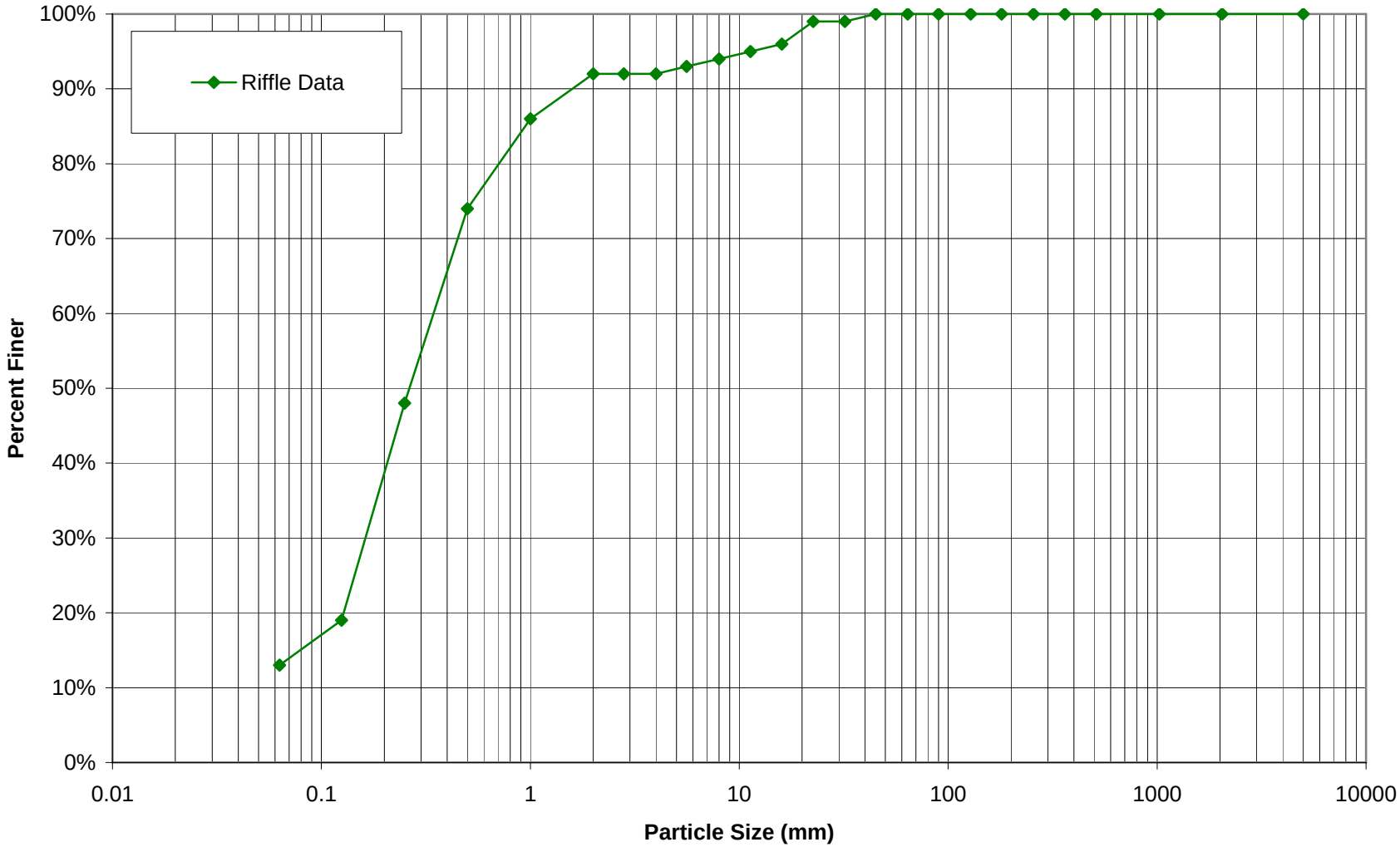
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X11-Pool
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Pool	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	13	13%	13%	0.063
SAND	Very Fine	.063 - .125	6	6%	19%	0.125
	Fine	.125 - .25	29	29%	48%	0.25
	Medium	.25 - .50	26	26%	74%	0.50
	Coarse	.50 - 1.0	12	12%	86%	1.0
	Very Coarse	1.0 - 2.0	6	6%	92%	2.0
GRAVEL	Very Fine	2.0 - 2.8			92%	2.8
	Very Fine	2.8 - 4.0			92%	4.0
	Fine	4.0 - 5.6	1	1%	93%	5.6
	Fine	5.6 - 8.0	1	1%	94%	8.0
	Medium	8.0 - 11.0	1	1%	95%	11.3
	Medium	11.0 - 16.0	1	1%	96%	16.0
	Coarse	16.0 - 22.6	3	3%	99%	22.6
	Coarse	22.6 - 32			99%	32
	Very Coarse	32 - 45	1	1%	100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**100**	**100%**		

Largest particles: _____
(pool)

South Fork Hoppers Creek
X11-Pool
Pebble Count Particle Size Distribution



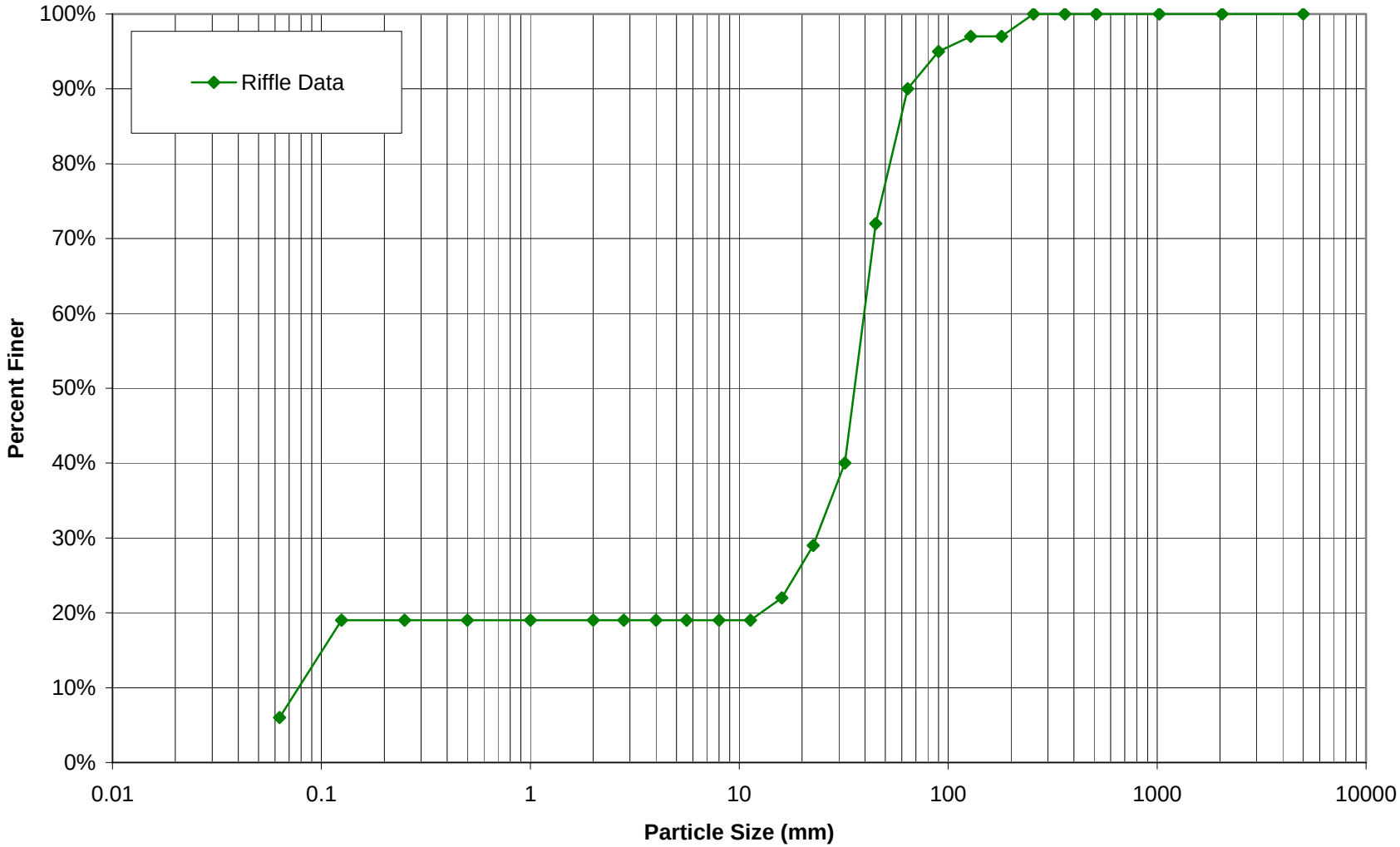
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X12-Riffle
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	6	6%	6%	0.063
SAND	Very Fine	.063 - .125	13	13%	19%	0.125
	Fine	.125 - .25			19%	0.25
	Medium	.25 - .50			19%	0.50
	Coarse	.50 - 1.0			19%	1.0
	Very Coarse	1.0 - 2.0			19%	2.0
GRAVEL	Very Fine	2.0 - 2.8			19%	2.8
	Very Fine	2.8 - 4.0			19%	4.0
	Fine	4.0 - 5.6			19%	5.6
	Fine	5.6 - 8.0			19%	8.0
	Medium	8.0 - 11.0			19%	11.3
	Medium	11.0 - 16.0	3	3%	22%	16.0
	Coarse	16.0 - 22.6	7	7%	29%	22.6
	Coarse	22.6 - 32	11	11%	40%	32
	Very Coarse	32 - 45	32	32%	72%	45
	Very Coarse	45 - 64	18	18%	90%	64
COBBLE	Small	64 - 90	5	5%	95%	90
	Small	90 - 128	2	2%	97%	128
	Large	128 - 180			97%	180
	Large	180 - 256	3	3%	100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**100**	**100%**		

Largest particles: 240.00
(riffle)

South Fork Hoppers Creek
X12-Riffle
Pebble Count Particle Size Distribution



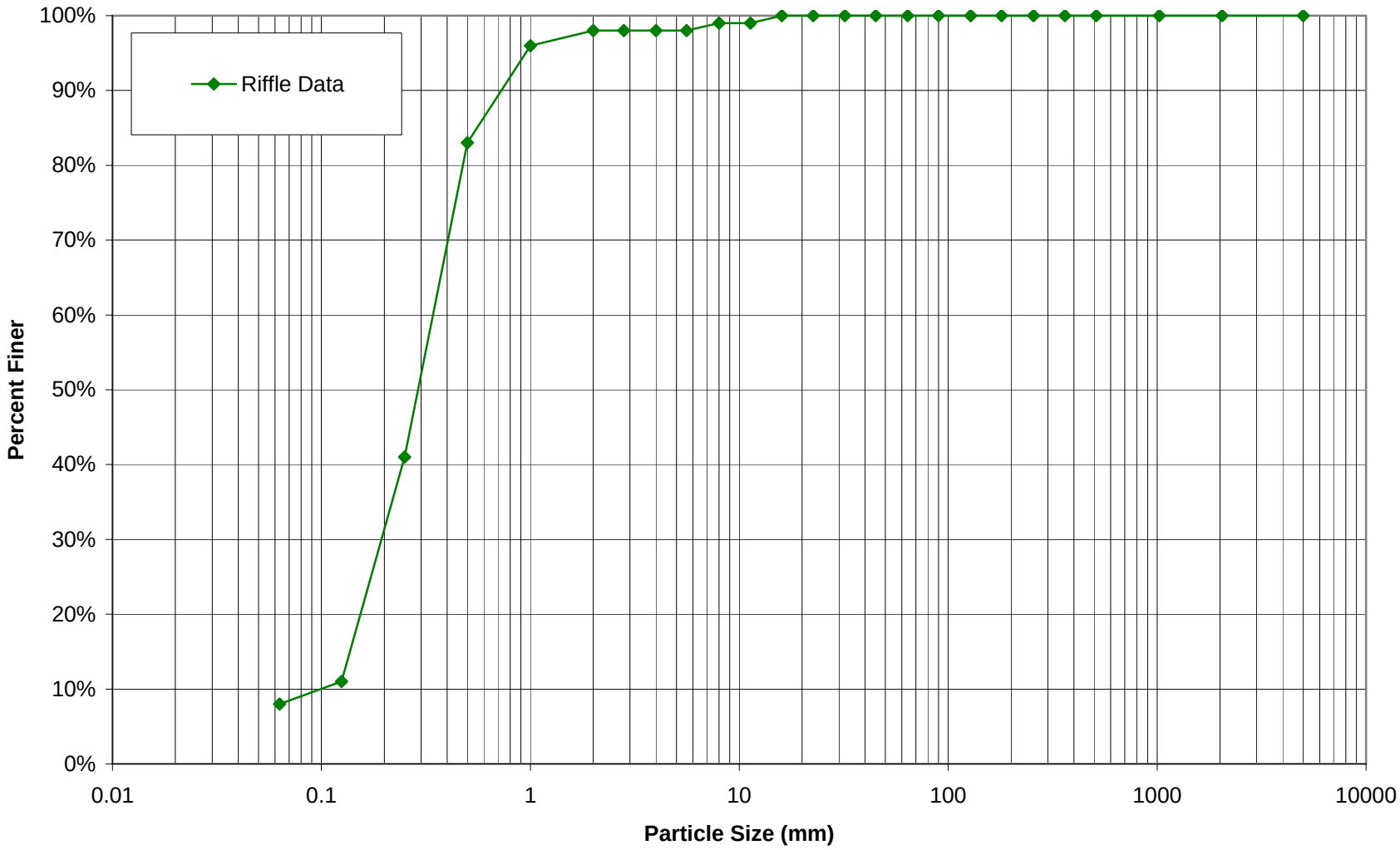
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X13-Pool
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Pool	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	8	8%	8%	0.063
SAND	Very Fine	.063 - .125	3	3%	11%	0.125
	Fine	.125 - .25	30	30%	41%	0.25
	Medium	.25 - .50	42	42%	83%	0.50
	Coarse	.50 - 1.0	13	13%	96%	1.0
	Very Coarse	1.0 - 2.0	2	2%	98%	2.0
GRAVEL	Very Fine	2.0 - 2.8			98%	2.8
	Very Fine	2.8 - 4.0			98%	4.0
	Fine	4.0 - 5.6			98%	5.6
	Fine	5.6 - 8.0	1	1%	99%	8.0
	Medium	8.0 - 11.0			99%	11.3
	Medium	11.0 - 16.0	1	1%	100%	16.0
	Coarse	16.0 - 22.6			100%	22.6
	Coarse	22.6 - 32			100%	32
	Very Coarse	32 - 45			100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	100	100%		

Largest particles: _____
(pool)

South Fork Hoppers Creek
X13-Pool
Pebble Count Particle Size Distribution



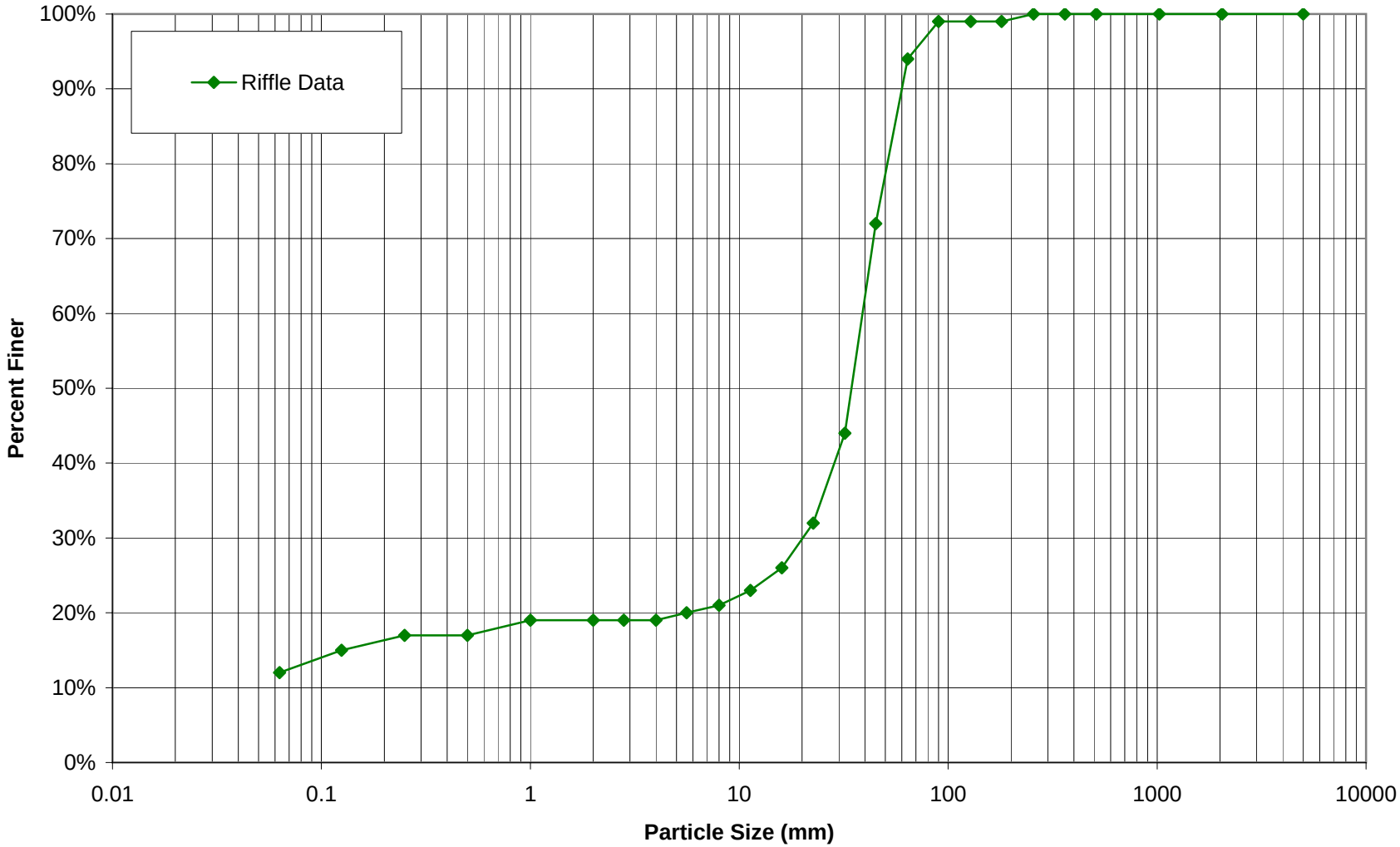
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X14-Riffle
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	12	12%	12%	0.063
SAND	Very Fine	.063 - .125	3	3%	15%	0.125
	Fine	.125 - .25	2	2%	17%	0.25
	Medium	.25 - .50			17%	0.50
	Coarse	.50 - 1.0	2	2%	19%	1.0
	Very Coarse	1.0 - 2.0			19%	2.0
GRAVEL	Very Fine	2.0 - 2.8			19%	2.8
	Very Fine	2.8 - 4.0			19%	4.0
	Fine	4.0 - 5.6	1	1%	20%	5.6
	Fine	5.6 - 8.0	1	1%	21%	8.0
	Medium	8.0 - 11.0	2	2%	23%	11.3
	Medium	11.0 - 16.0	3	3%	26%	16.0
	Coarse	16.0 - 22.6	6	6%	32%	22.6
	Coarse	22.6 - 32	12	12%	44%	32
	Very Coarse	32 - 45	28	28%	72%	45
	Very Coarse	45 - 64	22	22%	94%	64
COBBLE	Small	64 - 90	5	5%	99%	90
	Small	90 - 128			99%	128
	Large	128 - 180			99%	180
	Large	180 - 256	1	1%	100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	100	100%		

Largest particles: 200.00
(riffle)

South Fork Hoppers Creek
X14-Riffle
Pebble Count Particle Size Distribution



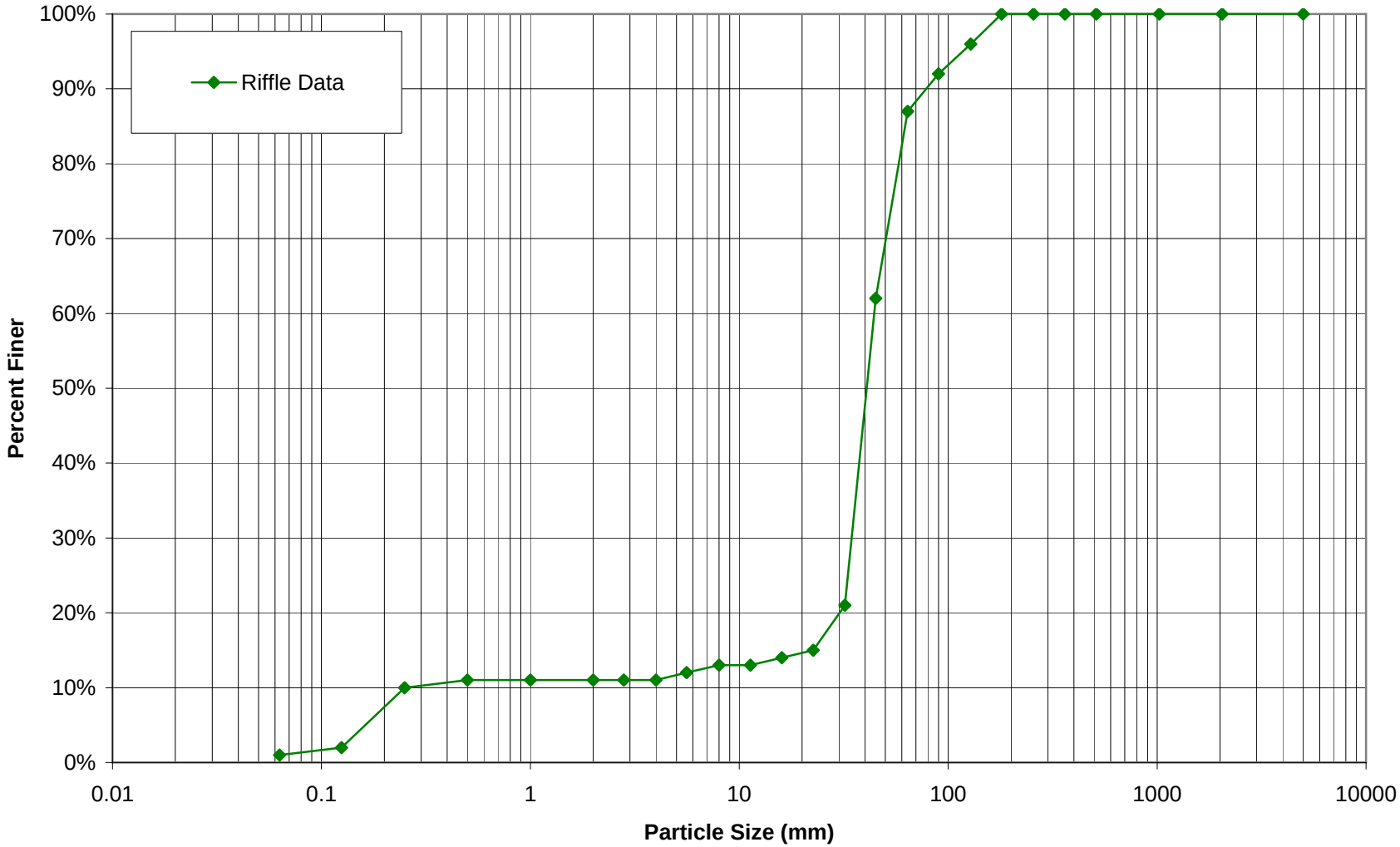
PEBBLE COUNT DATA SHEET: RIFFLE 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X15-Riffle
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

			PARTICLE CLASS COUNT	Summary		Distribution
MATERIAL	PARTICLE	SIZE (mm)	Riffle	Class %	% Cum	Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	1	1%	1%	0.063
SAND	Very Fine	.063 - .125	1	1%	2%	0.125
	Fine	.125 - .25	8	8%	10%	0.25
	Medium	.25 - .50	1	1%	11%	0.50
	Coarse	.50 - 1.0			11%	1.0
	Very Coarse	1.0 - 2.0			11%	2.0
GRAVEL	Very Fine	2.0 - 2.8			11%	2.8
	Very Fine	2.8 - 4.0			11%	4.0
	Fine	4.0 - 5.6	1	1%	12%	5.6
	Fine	5.6 - 8.0	1	1%	13%	8.0
	Medium	8.0 - 11.0			13%	11.3
	Medium	11.0 - 16.0	1	1%	14%	16.0
	Coarse	16.0 - 22.6	1	1%	15%	22.6
	Coarse	22.6 - 32	6	6%	21%	32
	Very Coarse	32 - 45	41	41%	62%	45
	Very Coarse	45 - 64	25	25%	87%	64
COBBLE	Small	64 - 90	5	5%	92%	90
	Small	90 - 128	4	4%	96%	128
	Large	128 - 180	4	4%	100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	100	100%		

Largest particles: _____ **(riffle)**

South Fork Hoppers Creek
X15-Riffle
Pebble Count Particle Size Distribution



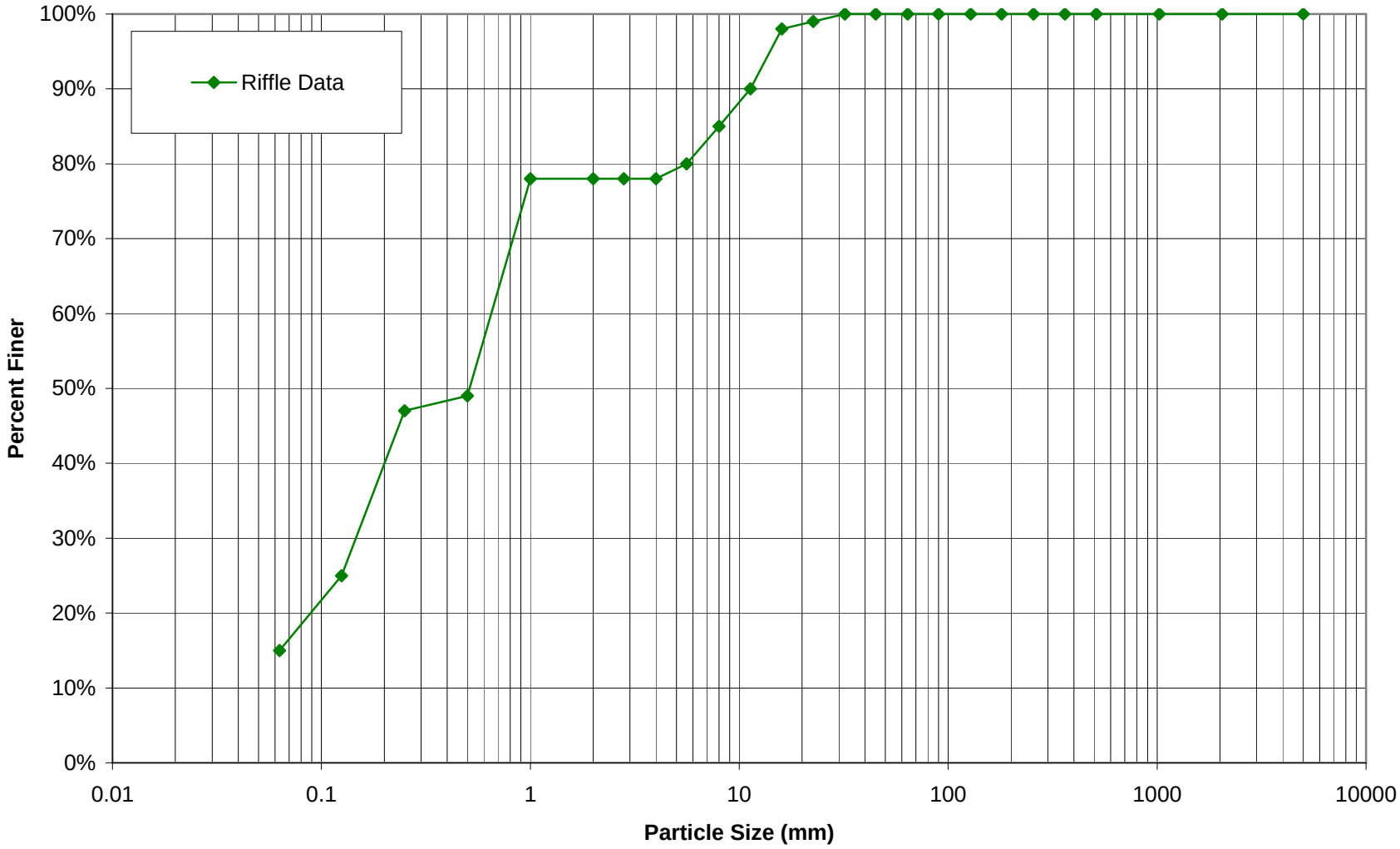
PEBBLE COUNT DATA SHEET: POOL 100-COUNT

	BUCK PROJECT NO. 108410
SITE OR PROJECT:	South Fork Hoppers Creek, Year 2 Monitoring
REACH/LOCATION:	X16-Pool
DATE COLLECTED:	11/5/2007
FIELD COLLECTION BY:	RR/IE
DATA ENTRY BY:	IE

MATERIAL	PARTICLE	SIZE (mm)	PARTICLE CLASS COUNT Pool	Summary Class %	Summary % Cum	Distribution Plot Size (mm)
SILT/CLAY	Silt / Clay	< .063	15	15%	15%	0.063
SAND	Very Fine	.063 - .125	10	10%	25%	0.125
	Fine	.125 - .25	22	22%	47%	0.25
	Medium	.25 - .50	2	2%	49%	0.50
	Coarse	.50 - 1.0	29	29%	78%	1.0
	Very Coarse	1.0 - 2.0			78%	2.0
GRAVEL	Very Fine	2.0 - 2.8			78%	2.8
	Very Fine	2.8 - 4.0			78%	4.0
	Fine	4.0 - 5.6	2	2%	80%	5.6
	Fine	5.6 - 8.0	5	5%	85%	8.0
	Medium	8.0 - 11.0	5	5%	90%	11.3
	Medium	11.0 - 16.0	8	8%	98%	16.0
	Coarse	16.0 - 22.6	1	1%	99%	22.6
	Coarse	22.6 - 32	1	1%	100%	32
	Very Coarse	32 - 45			100%	45
	Very Coarse	45 - 64			100%	64
COBBLE	Small	64 - 90			100%	90
	Small	90 - 128			100%	128
	Large	128 - 180			100%	180
	Large	180 - 256			100%	256
BOULDER	Small	256 - 362			100%	362
	Small	362 - 512			100%	512
	Medium	512 - 1024			100%	1024
	Large-Very Large	1024 - 2048			100%	2048
BEDROCK	Bedrock	> 2048			100%	5000
		Total	**100**	**100%**		

Largest particles: _____ **(pool)**

South Fork Hoppers Creek
X16-Pool
Pebble Count Particle Size Distribution



APPENDIX C

AS-BUILT PLAN SHEETS

PROJECT REFERENCE NO.	SHEET NO.
0224C	T1

PROJECT ENGINEER
CLY

APPROVED BY
EGR

DATE
06/30/2006

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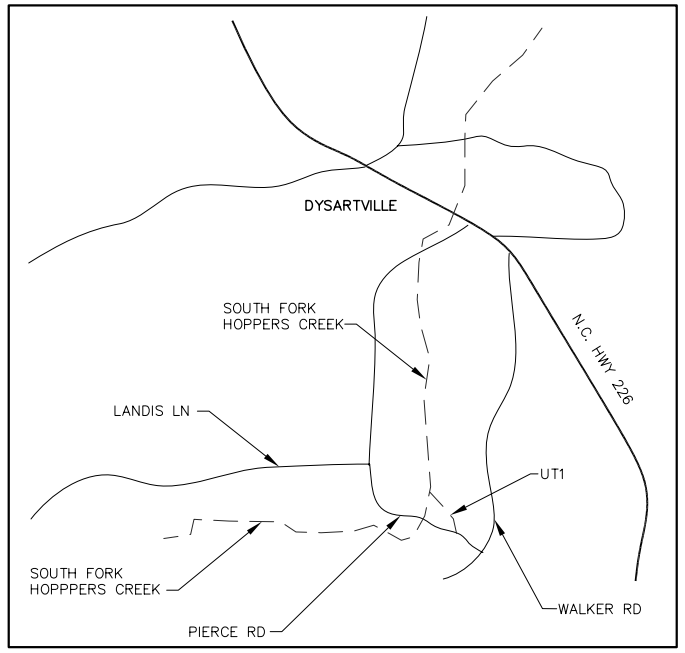


VICINITY MAP – NTS

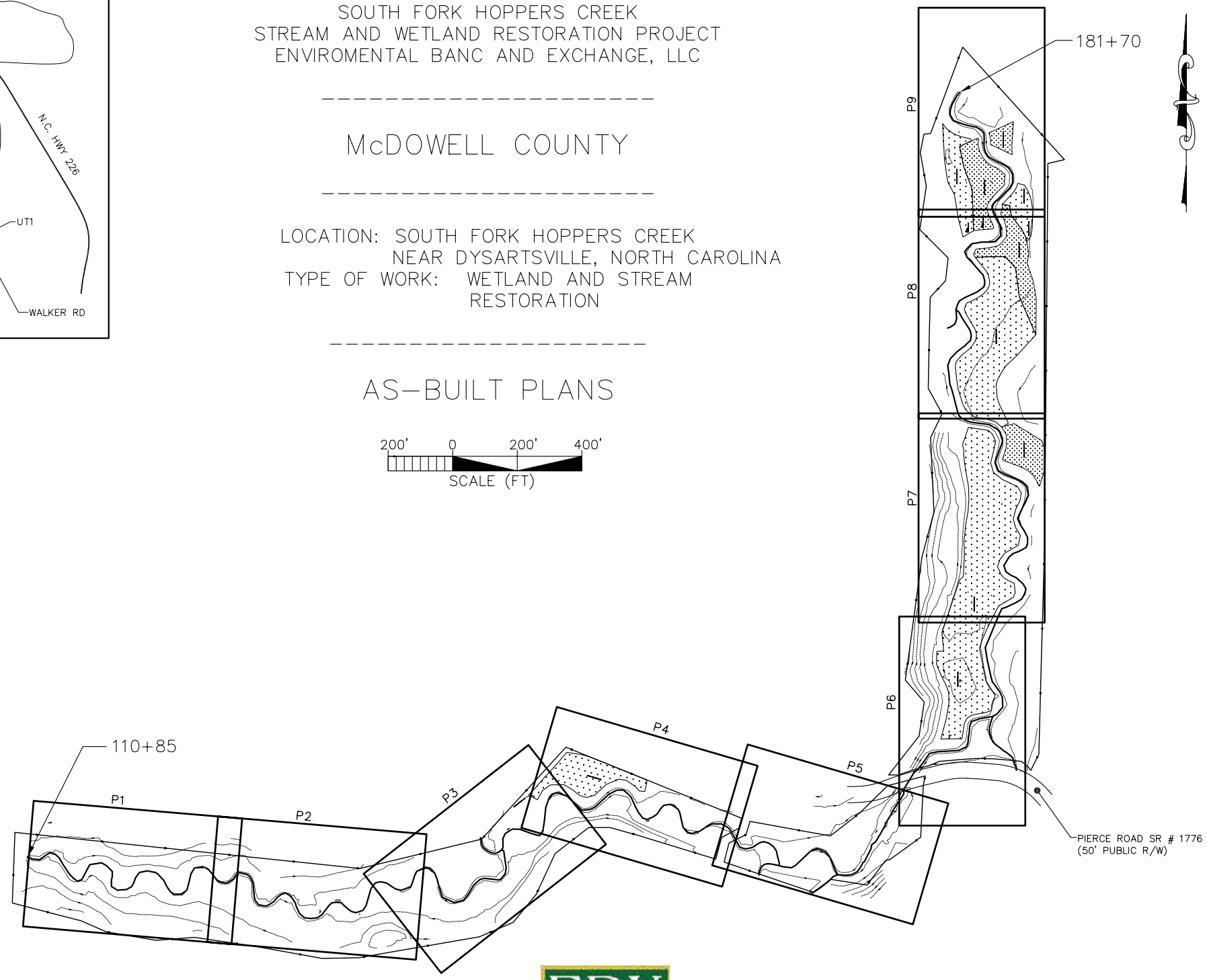
SOUTH FORK HOPPERS CREEK
STREAM AND WETLAND RESTORATION PROJECT
ENVIROMENTAL BANC AND EXCHANGE, LLC

McDOWELL COUNTY

LOCATION: SOUTH FORK HOPPERS CREEK
NEAR DYSARTSVILLE, NORTH CAROLINA
TYPE OF WORK: WETLAND AND STREAM
RESTORATION

AS–BUILT PLANS

200' 0 200' 400'
SCALE (FT)



INDEX OF SHEETS

T1	–	TITLE SHEET
S1	–	SYMBOL SHEET
P1–P9	–	PLAN SHEETS

NOTE:

1. PHOTO ID POINTS AND VEGETATION PLOTS LOCATED USING GPS
2. THESE PLANS WERE ORGINIIALLY SEALED ON 06/30/06 AND ARE PROVIDED WITH THIS MONITORING REPORT FOR REFERENCE ONLY.

EBX

PREPARED FOR THE OFFICE OF:
ENVIROMENTAL BANC AND EXCHANGE, LLC
2530 MERIDIAN PARKWAY, SUITE 200
DURHAM, NC 27713

EBX CONTACT:
THOMAS RINKER
PROJECT MANAGER

SOUTH FORK
HOPPERS AS–BUILT

TITLE SHEET

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PROJECT REFERENCE NO.	SHEET NO.
0224C	S1

PROJECT ENGINEER
CLY

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EGR

DATE
06/30/2006

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LEGEND

110+00 — AS-BUILT THALWEG (STA 100+85 TO 181+70)

10+00 — DESIGN THALWEG ALIGNMENT (STA 10+85 TO 82+00)

900 — MAJOR (INDEX) CONTOUR

MINOR CONTOUR

CE — CONSERVATION EASEMENT

CONSERVATION EASEMENT FENCE

BAMBOO BARRIER

X12 CROSS SECTION — CROSS SECTION

ROOTWAD

CONSTRUCTED RIFFLE

PHOTO ID POINT

SURVEY CONTROL POINT

CROSS VANE

LOG VANE

VEGETATION TRANSPLANT

COVER LOG

BAMBOO TREATMENT AREA

VEGETATION PLOT

FORD STREAM CROSSING

WETLAND RESTORATION

WETLAND ENHANCEMENT

SOUTH FORK
HOPPERS AS-BUILT

SYMBOL SHEET

PROJECT REFERENCE NO.	SHEET NO.
0224C	P1

PROJECT ENGINEER
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DATE
06/30/2006

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1235
1230
1225
1240
CE
30
PHOTO ID POINT #69
PHOTO ID POINT #67
PHOTO ID POINT #63
PHOTO ID POINT #70
PHOTO ID POINT #65
11+00
110+85
111+00
112+00
12+00
13+00
113+00
114+00
4+00
X16 CROSS SECTION
16+00
116+00
115+00
X15 CROSS SECTION
18+00
119+00
19+00
117+00
17+00
118+00
COVER LOG
COVER LOG
BEGIN CONSTRUCTION 110+85
LOG VANE
PHOTO ID POINT #68
PHOTO ID POINT #66
LOG VANE
PHOTO ID POINT #64
VEG PLOT #10
BCP #2201
REBAR/CAP
N 677316.00
E 1146813.90
ELEV.= 1230.97
MATCHLINE - P2 - 119+50

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

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PROJECT REFERENCE NO.	SHEET NO.
0224C	P2

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MATCHLINE – P1 – 119+50

MATCHLINE – P3 – 128+00

CONSERVATION EASEMENT FENCE

PHOTO ID POINT #61

PHOTO ID POINT #62

PHOTO ID POINT #59

PHOTO ID POINT #60

PHOTO ID POINT #57

PHOTO ID POINT #58

PHOTO ID POINT #55

PHOTO ID POINT #54

PHOTO ID POINT #56

COVER LOG

COVER LOG

COVER LOG

COVER LOG

X14 CROSS SECTION

VEG PLOT #9

BAMBOO TREATMENT AREA

BCP #2900
REBAR/CAP
N 677253.99
E 1147190.52
ELEV.= 1223.87

1225

1220

1225

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

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PROJECT REFERENCE NO.	SHEET NO.
0224C	P3

PROJECT ENGINEER
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Phone: 704.334.4454
Fax: 704.334.4492

MATCHLINE – P2 – 128+00

MATCHLINE – P4 – 135+75

PHOTO ID POINT #53

LOG VANE

COVER LOG

COVER LOG

X13 CROSS SECTION

128+00

129+00

BCP #2207
REBAR/CAP
N 677611.09
E 1147689.06
ELEV.= 1216.11

WETLAND RESTORATION AREA

PHOTO ID POINT #48

PHOTO ID POINT #46

133+00

134+00

135+00

X11 CROSS SECTION

PHOTO ID POINT #47

PHOTO ID POINT #52

130+00

PHOTO ID POINT #51

31+00

COVER LOG

131+00

X12 CROSS SECTION

COVER LOG

32+00

132+00

PHOTO ID POINT #49

BSP #2211
REBAR/CAP
N 677356.73
E 1147632.26
ELEV.= 1218.48

PHOTO ID POINT #50

1215

1220

1225

30

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

PROJECT REFERENCE NO.	SHEET NO.
0224C	P4

PROJECT ENGINEER
CLY

APPROVED BY
EGR

DATE
06/30/2006

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BCP #2209
REBAR/CAP
N 677822.79
E 1148096.72
ELEV.= 1213.05

CONSERVATION EASEMENT FENCE

AUTOMATIC WELL #5

VEG PLOT #8

WETLAND RESTORATION AREA

PHOTO ID POINT #44

PHOTO ID POINT #42

VEG PLOT #7

ARCHEOLOGICAL NON-DISTURBANCE AREA

PHOTO ID POINT #40

36+00

37+00

137+00

138+00

1210

1215

1220

38+00

139+00

40+00

140+00

141+00

414.00

143+00

LOG VANE

COVER LOG

42+00

142+00

FORD STREAM CROSSING

MATCHLINE - P3 - 135+75

COVER LOG

LOG VANE

PHOTO ID POINT #45

LOG VANE

PHOTO ID POINT #43

PHOTO ID POINT #41

BAMBOO BARRIER

MATCHLINE - P5 - 143+50

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

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PROJECT REFERENCE NO.	SHEET NO.
0224C	P5

PROJECT ENGINEER
CLY

APPROVED BY
EGR

DATE
06/30/2006

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MATCHLINE – P6 – 151+80

MATCHLINE – P4 – 143+50

PIERCE ROAD SR # 1776
(50' PUBLIC R/W)

ARCHAEOLOGICAL
NON-DISTURBANCE AREA

FORD STREAM CROSSING

X9 CROSS SECTION

X10 CROSS SECTION

VEG PLOT #6

BCP #5963
REBAR/CAP
N 677453.68
E 1148706.25
ELEV.= 1206.05

COVER LOG

COVER LOG

PHOTO ID
POINT #33

PHOTO ID
POINT #34

PHOTO ID
POINT #35

PHOTO ID
POINT #36

PHOTO ID
POINT #37

PHOTO ID
POINT #38

PHOTO ID
POINT #39

BAMBOO BARRIER

BAMBOO BARRIER

1215
1210
1205
1200
1195
1205
1200
1205
1210
1215
1220
1225

44+00
45+00
46+00
47+00
48+00
49+00
50+00
51+00
144+00
146+00
147+00
148+00
149+00
150+00
151+00

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

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SOUTH FORK
HOPPERS AS-BUILT

SCALE (FT)
20' 0 20' 40'

MATCHLINE – P7 – 159+20

MATCHLINE – P5 – 151+80

PIERCE ROAD SR # 1776
(50' PUBLIC R/W)

EXISTING 24" CMP

RAIN GAUGE

LOG VANE

BCP #210Q
REBAR/CAP
N 678177.31
E 1149316.15
ELEV.= 1199.02

MAIN TRIB: 54+92.30
END OF TRIB: 202+02.79

X1 CROSS SECTION

X2 CROSS SECTION

VEG PLOT #5

WETLAND RESTORATION AREA

PHOTO ID POINT #22
PHOTO ID POINT #23
PHOTO ID POINT #24
PHOTO ID POINT #25
PHOTO ID POINT #26
PHOTO ID POINT #27
PHOTO ID POINT #28
PHOTO ID POINT #29
PHOTO ID POINT #30
PHOTO ID POINT #31
PHOTO ID POINT #32

PROJECT REFERENCE NO.	SHEET NO.
0224C	P6

PROJECT ENGINEER
CLY
APPROVED BY
ECR
DATE
06/30/2006

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PROJECT REFERENCE NO.	SHEET NO.
0224C	P7

PROJECT ENGINEER
CLY

APPROVED BY
EGR

DATE
06/30/2006

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MATCHLINE – P6 – 159+20

MATCHLINE – P8 – 168+15

WETLAND RESTORATION AREA

WETLAND ENHANCEMENT AREA

AUTOMATIC WELL #4

VEG PLOT #4

BCP #33
REBAR/CAP
N 678848.23
E 1149181.83
ELEV.= 1190.89

1193.2
1194.5
1193.4
1192.8

1215
1210
1205
1200
1195

60+00
61+00
62+00
63+00
64+00
65+00
66+00
67+00
68+00

160+00
161+00
162+00
163+00
164+00
165+00
166+00
167+00
168+00

X3 CROSS SECTION
X4 CROSS SECTION
X5 CROSS SECTION
X6 CROSS SECTION

COVER LOG

LOG VANE

PHOTO ID POINT #14
PHOTO ID POINT #15
PHOTO ID POINT #16
PHOTO ID POINT #17
PHOTO ID POINT #18
PHOTO ID POINT #19
PHOTO ID POINT #20
PHOTO ID POINT #21

30

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

L:\Projects\0224C\Design\LD-0224-ASBUILT\dwg\PLANSHEETS.dwg Nov 12, 2007

PROJECT REFERENCE NO.	SHEET NO.
0224C	P8

PROJECT ENGINEER
CLY

APPROVED BY
EGR

DATE
06/30/2006

Baker
Buck Engineering
A Unit of Michael Baker
1447 South Tryon Street
Suite 200
Charlotte, NC 28203
Phone: 704.334.4454
Fax: 704.334.4492

MATCHLINE – P7 – 168+15

LOG VANE

PHOTO ID POINT #12

PHOTO ID POINT #13

PHOTO ID POINT #11

PHOTO ID POINT #10

PHOTO ID POINT #9

PHOTO ID POINT #8

PHOTO ID POINT #7

VEG PLOT #3

VEG PLOT #2

MONITORING WELL #2

AUTOMATIC WELL #2

MONITORING WELL #1

CREST GAUGE

WETLAND RESTORATION AREA

WETLAND ENHANCEMENT AREA

WETLAND RESTORATION AREA

WETLAND ENHANCEMENT AREA

WETLAND RESTORATION AREA

1187.15

MATCHLINE – P9 – 176+60

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

L:\Projects\0224C\Design\LD-0224-ASBUILT\dwg\PLANSHEETS.dwg Nov 12, 2007

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MATCHLINE - P8 - 176+60

WETLAND RESTORATION AREA

WETLAND ENHANCEMENT AREA

AUTOMATIC WELL #1

PHOTO ID POINT #6

PHOTO ID POINT #5

PHOTO ID POINT #4

PHOTO ID POINT #3

PHOTO ID POINT #2

PHOTO ID POINT #1

X1 CROSS SECTION

X2 CROSS SECTION

VEG PLOT #1

BCP #2100
REBAR/CAP
N 679762.49
E 1149281.08
ELEV.= 1185.65

MONITORING WELL #3

END CONSTRUCTION
181+70

1185

1185.4

1186.4

1184.8

1186.1

1186

176+00

177+00

178+00

179+00

180+00

181+00

181+70.04

80+00

81+00

82+00

SOUTH FORK
HOPPERS AS-BUILT

20' 0 20' 40'
SCALE (FT)

L:\Projects\0224C\Design\LD-0224-ASBUILT\dwg\PLANSHEETS.dwg Nov 12, 2007

APPENDIX D

BASELINE STREAM SUMMARY FOR RESTORATION REACHES

South Fork Hoppers Creek Restoration Site : Project No. D04006-4

South Fork Hoppers Creek Restoration Site - Mainstem Reach 1

Parameter	USGS Gauge		Regional Curve Interval			Pre-Construction Condition			Reference Reach(es) Data								
									Big Branch, NCDOT			Sals Branch, Clinton			Spencer Creek, Buck Eng.		
Dimension - Riffle	Jacob	Norwood	LL	UL	Eq.	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Bankfull Width (ft)	61.3	32.0	7.0	26.0	24.4	-----	11.3	-----	19.3	-----	21.5	-----	8.7	-----	10.7	-----	11.2
Floodprone Width (ft)	96.3	-----	-----	-----	-----	-----	119+	-----	-----	130	-----	-----	N/A	-----	60	-----	114+
Bankfull Mean Depth (ft)	4.7	3.1	0.9	2.3	1.5	-----	2.0	-----	1.8	----	2.1	-----	1.2	-----	1.6	-----	1.8
Bankfull Max Depth (ft)	5.8	-----	-----	-----	-----	-----	3.2	-----	2.5	----	2.7	-----	2.4	-----	2.1	-----	2.6
Bankfull Cross Sectional Area (ft2)	290.0	99.0	10.0	38.0	20.4	-----	22.2	-----	36.9	----	39.9	-----	10.4	-----	17.8	-----	19.7
Width/Depth Ratio	13.0	10.3	-----	-----	-----	-----	5.7	-----	----	10.6	----	-----	7.3	-----	5.8	-----	7.1
Entrenchment Ratio	1.6	-----	-----	-----	-----	-----	10.6	-----	----	6.4	----	-----	----	-----	5.5	-----	10.2
Bank Height Ratio	1.3	-----	-----	-----	-----	-----	1.4	-----	----	----	----	-----	----	-----	-----	1.0	-----
Bankfull Velocity (fps)	3.9	2.6	-----	-----	-----	-----	-----	-----	----	----	----	-----	5.2	-----	4.9	-----	5.9
Pattern																	
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	30.5	-----	44	10	-----	16	38.3	-----	40.8
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	42.3	-----	63.1	13.1	-----	29.6	10.9	-----	14.6
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	185	-----	260	-----	-----	-----	46	-----	48
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	----	1.83	----	-----	-----	-----	3.4	-----	3.6
Profile																	
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	0.015	-----	0.019	-----	0.0833	-----	-----	0.013	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	97.5	-----	179.8	35.5	-----	47	-----	77	-----
Substrate and Transport Parameters																	
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	<0.063 / 0.2 / 0.75 / 15 / 45			0.13 / 0.3 / 1.9 / 50 / 100			4.8 / N/A / 9.5 / 30 / N/A			<0.062 / 3 / 8.8 / 42 / 90		
Reach Shear Stress (competency) lb/f2	-----	-----	-----	-----	-----	-----	0.84	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																	
Channel length (ft)	850	-----	-----	-----	-----	-----	-----	2531	-----	-----	-----	-----	-----	-----	-----	-----	-----
Drainage Area (SM)	25.7	7.2	-----	-----	-----	0.74	-----	0.93	-----	-----	1.9	-----	-----	0.2	-----	-----	0.96
Rosgen Classification	C4	E	-----	-----	-----	-----	E4/5	-----	----	E4	----	-----	E4	----	-----	E4	-----
Bankfull Discharge (cfs)	1140	254	30	235	84	-----	102	-----	----	-----	----	-----	53.6	----	-----	97	-----
Sinuosity	1.06	-----	-----	-----	-----	-----	1.0	-----	----	1.1	----	----	1.1	----	-----	2.3	-----
BF slope (ft/ft)	0.0025	0.0008	-----	-----	-----	-----	0.009	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

South Fork Hoppers Creek Restoration Site : Project No. D04006-4

South Fork Hoppers Creek Restoration Site - Mainstem Reach 1

Parameter	Design			As-built			MY-1 (2006)			MY-2 (2007)		
Dimension - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Bankfull Width (ft)	-----	16.0	-----	16.3	18.0	19.7	15.92	17.32	18.93	16.29	17.2	18.15
Floodprone Width (ft)	-----	35.2+	-----	69.9	70.1	70.3	69.9	70.1	70.3	69.9	70.1	70.3
Bankfull Mean Depth (ft)	-----	1.4	-----	1.1	1.3	1.4	1.1	1.2	1.5	1.1	1.3	1.5
Bankfull Max Depth (ft)	-----	2.0	-----	1.9	2.1	2.4	1.8	2.1	2.7	1.8	2.2	2.6
Bankfull Cross Sectional Area (ft2)	-----	22.0	-----	18.6	22.7	26.8	17.7	21.6	27.7	17.1	21.7	26.3
Width/Depth Ratio	10.0	-----	12.0	13.6	14.0	14.5	12.9	14.1	15.0	12.3	13.9	15.5
Entrenchment Ratio	-----	>2.2	-----	3.6	3.9	4.3	3.7	4.1	4.4	3.9	4.1	4.3
Bank Height Ratio	-----	1.0	-----	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bankfull Velocity (fps)	-----	3.8	-----	-----	3.5	-----	-----	3.6	-----	-----	3.6	-----
Pattern												
Channel Beltwidth (ft)	56	-----	96	56	-----	96	56	-----	96	----	-----	-----
Radius of Curvature (ft)	32	-----	54.5	32	-----	55	32	-----	54.5	----	-----	-----
Meander Wavelength (ft)	112	-----	176	112	-----	176	112	-----	176	----	-----	-----
Meander Width Ratio	3.5	-----	6	3.5	-----	6.0	3.5	-----	6	----	-----	-----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	0.01	0.015	0.02	0.01	0.015	0.02	0.01	0.015	0.02	0.01	0.02	0.03
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	64	88	112	64	88	112	64	88	112	60	91	122
Substrate and Transport Parameters												
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.1-23 / 17-35 / 34-40 / 54-80 / 65-130		
Reach Shear Stress (competency) lb/f2	-----	0.52	-----	-----	0.52	-----	-----	0.52	-----	-----	-----	-----
Stream Power (transport capacity) W/m2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters												
Channel length (ft)	-----	3665	-----	-----	3725	-----	-----	3725	-----	-----	2130	-----
Drainage Area (SM)	0.74	-----	0.93	0.74	-----	0.93	0.74	-----	0.93	0.74	-----	0.93
Rosgen Classification	-----	C4	-----	-----	C	-----	-----	C	-----	-----	C	-----
Bankfull Discharge (cfs)	80	100	120	80	100	120	80	100	120	-----	-----	-----
Sinuosity	-----	>1.2	-----	-----	1.5	-----	-----	1.5	-----	-----	1.4	-----
BF slope (ft/ft)	-----	0.005	-----	-----	0.005	-----	-----	0.005	-----	-----	0.008	-----

South Fork Hoppers Creek Restoration Site : Project No. D04006-4

South Fork Hoppers Creek Restoration Site - Mainstem Reach 2, 3, & 4

Parameter	USGS Gauge		Regional Curve Interval			Pre-Construction Condition			Reference Reach(es) Data								
									Big Branch, NCDOT			Sals Branch, Clinton			Specner Creek, Buck Eng.		
Dimension - Riffle	Jacob	Norwood	LL	UL	Eq.	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Bankfull Width (ft)	61.3	32.0	8.0	29.0	13.7	12.5	16.9	21.2	19.3	-----	21.5	-----	8.7	-----	10.7	-----	11.2
Floodprone Width (ft)	96.3	-----	-----	-----	-----	18.0	-----	150+	-----	130	-----	-----	N/A	-----	60	-----	114+
Bankfull Mean Depth (ft)	4.7	3.1	1.1	2.7	1.7	1.1	1.5	1.8	1.8	----	2.1	-----	1.2	-----	1.6	-----	1.8
Bankfull Max Depth (ft)	5.8	-----	-----	-----	-----	2.3	2.4	2.4	2.5	----	2.7	-----	2.4	-----	2.1	-----	2.6
Bankfull Cross Sectional Area (ft2)	290.0	99.0	14.0	52.0	26.7	20.4	23.1	25.7	36.9	----	39.9	-----	10.4	-----	17.8	-----	19.7
Width/Depth Ratio	13.0	10.3	-----	-----	-----	7.5	13.9	20.3	----	10.6	----	-----	7.3	-----	5.8	-----	7.1
Entrenchment Ratio	1.6	-----	-----	-----	-----	1.2	-----	>2.2	----	6.4	----	-----	----	-----	5.5	-----	10.2
Bank Height Ratio	1.3	-----	-----	-----	-----	1.0	1.6	2.2	----	----	----	-----	----	-----	-----	1.0	-----
Bankfull Velocity (fps)	3.9	2.6	-----	-----	-----	-----	-----	-----	----	----	----	-----	5.2	-----	4.9	-----	5.9
Pattern																	
Channel Beltwidth (ft)	-----	-----	-----	-----	-----	-----	-----	-----	30.5	-----	44	10	-----	16	38.3	-----	40.8
Radius of Curvature (ft)	-----	-----	-----	-----	-----	-----	-----	-----	42.3	-----	63.1	13.1	-----	29.6	10.9	-----	14.6
Meander Wavelength (ft)	-----	-----	-----	-----	-----	-----	-----	-----	185	-----	260	-----	-----	-----	46	-----	48
Meander Width Ratio	-----	-----	-----	-----	-----	-----	-----	-----	----	1.83	----	-----	-----	-----	3.4	-----	3.6
Profile																	
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	-----	-----	-----	-----	-----	-----	-----	-----	0.015	-----	0.019	-----	0.0833	-----	-----	0.013	-----
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	-----	-----	-----	-----	-----	-----	-----	-----	97.5	-----	179.8	35.5	-----	47	-----	77	-----
Substrate and Transport Parameters																	
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	<0.063/0.17-3.5/0.36-5/10-40/17-128			0.13 / 0.3 / 1.9 / 50 / 100			4.8 / N/A / 9.5 / 30 / N/A			<0.062 / 3 / 8.8 / 42 / 90		
Reach Shear Stress (competency) lb/f2	-----	-----	-----	-----	-----	0.14	-----	0.94	-----	-----	-----	-----	-----	-----	-----	-----	-----
Stream Power (transport capacity) W/m2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters																	
Channel length (ft)	850	-----	-----	-----	-----	-----	-----	2742	-----	-----	-----	-----	-----	-----	-----	-----	-----
Drainage Area (SM)	25.7	7.2	-----	-----	-----	0.93	-----	1.38	-----	-----	1.9	-----	-----	0.2	-----	-----	0.96
Rosgen Classification	C4	E	-----	-----	-----	E4/5, G4/5c, C4			----	E4	----	-----	E4	----	-----	E4	-----
Bankfull Discharge (cfs)	1140	254	38	300	112.4	35	-----	118	----	-----	----	-----	53.6	----	-----	97	-----
Sinuosity	1.06	-----	-----	-----	-----	1.03	1.34	1.65	----	1.1	----	----	1.1	----	-----	2.3	-----
BF slope (ft/ft)	0.0025	0.0008	-----	-----	-----	0.0024	0.007	0.012	-----	-----	-----	-----	-----	-----	-----	-----	-----

South Fork Hoppers Creek Restoration Site : Project No. D04006-4

South Fork Hoppers Creek Restoration Site - Mainstem Reach 2, 3, & 4

Parameter	Design			As-built			MY-1 (2006)			MY-2 (2007)		
Dimension - Riffle	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Bankfull Width (ft)	-----	18.0	-----	16.6	17.3	18.1	14.43	19.42	23.67	15.56	18.3	21
Floodprone Width (ft)	----	39.6+	-----	69.6	69.7	69.9	69.8	70.0	70.4	69.8	70.1	70.4
Bankfull Mean Depth (ft)	-----	1.5	-----	1.1	1.2	1.3	1.0	1.2	1.3	1.0	1.2	1.3
Bankfull Max Depth (ft)	-----	2.3	-----	2.2	2.4	2.6	2.3	2.4	2.5	2.2	2.4	2.5
Bankfull Cross Sectional Area (ft2)	-----	27.0	-----	20.3	24.9	29.5	18.4	22.9	26.1	19.9	22.6	25.2
Width/Depth Ratio	-----	12.0	-----	12.7	15.2	17.7	11.3	16.7	23.1	12.2	16.4	20.6
Entrenchment Ratio	-----	>2.2	-----	3.1	3.6	4.2	3.0	3.8	4.8	3.4	3.9	4.5
Bank Height Ratio	-----	1.0	-----	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bankfull Velocity (fps)	-----	2.9	-----	-----	3.1	-----	-----	2.6	-----	-----	2.6	-----
Pattern												
Channel Beltwidth (ft)	63	-----	108	63	-----	108	63	-----	108	----	-----	----
Radius of Curvature (ft)	36	-----	61.2	36	-----	61	36	-----	61	----	-----	----
Meander Wavelength (ft)	126	-----	198	126	-----	198	126	-----	198	----	-----	----
Meander Width Ratio	3.5	-----	6	3.5	-----	6.0	3.5	-----	6.0	----	-----	----
Profile												
Riffle Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Riffle Slope (ft/ft)	0.0045	0.00675	0.009	0.0045	0.00675	0.009	0.0045	0.00675	0.009	0.003	0.020	0.011
Pool Length (ft)	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Pool Spacing (ft)	72	99	126	72	99	126	72	99	126	58	93	128
Substrate and Transport Parameters												
d16 / d35 / d50 / d84 / d95	-----	-----	-----	-----	-----	-----	-----	-----	-----	<0.063-0.12 / 0.063-1.5 / 0.16-7.5 / 30-35 / 45-50		
Reach Shear Stress (competency) lb/f2	0.25	-----	0.57	0.25	-----	0.57	0.25	-----	0.57	-----	-----	-----
Stream Power (transport capacity) W/m2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Additional Reach Parameters												
Channel length (ft)	-----	3,340	-----	-----	3,301	-----	-----	3,301	-----	-----	1,432	-----
Drainage Area (SM)	0.93	1.155	1.38	0.93	-----	1.38	0.93	-----	1.38	0.93	-----	1.38
Rosgen Classification	-----	C4	-----	-----	C	-----	-----	C	-----	-----	C	-----
Bankfull Discharge (cfs)	80	100	120	-----	-----	-----	-----	-----	-----	-----	-----	-----
Sinuosity	-----	1.4	-----	-----	1.4	-----	-----	1.4	-----	-----	1.3	-----
BF slope (ft/ft)	-----	0.004	-----	0.003	-----	0.004	0.003	-----	0.004	----	0.0073	----

APPENDIX E

MORPHOLOGY AND HYDRAULIC MONITORING SUMMARY – YEAR 2

South Fork Hoppers Creek Restoration Site : Project No. D04006-4

Reach: Unnamed Tributary 1 (UT1)

I. Cross-Section Parameters	Cross Section 7 Pool					Cross Section 8 Riffle				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension										
BF Width (ft)	11.4	11.3				13.4	12.2			
Floodprone Width (ft)	65.5	66.9				47.9	43.0			
BF Cross Sectional Area (ft2)	10.1	11.2				9.1	7.1			
BF Mean Depth (ft)	0.9	1.0				0.7	0.6			
BF Max Depth (ft)	1.9	2.0				1.4	1.3			
Width/Depth Ratio	13.0	11.3				19.6	20.9			
Entrenchment Ratio	5.7	6.0				3.6	3.5			
Wetted Perimeter (ft)	13.2	13.2				14.7	13.4			
Hydraulic Radius (ft)	0.8	0.8				0.6	0.5			
Substrate										
d50 (mm)	-	0.25				-	0.19			
d84 (mm)	-	0.9				-	0.8			

II. Reachwide Parameters	MY-1 (2006)			MY-2 (2007)			MY-3 (2008)			MY-4 (2009)			MY-5 (20010)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Pattern															
Channel Beltwidth (ft)	-	-	-	-	-	-									
Radius of Curvature (ft)	-	-	-	-	-	-									
Meander Wavelength (ft)	-	-	-	-	-	-									
Meander Width Ratio	-	-	-	-	-	-									
Profile															
Riffle length (ft)	-	-	-	-	-	-									
Riffle Slope (ft/ft)	-	-	-	-	-	-									
Pool Length (ft)	8	15	12	-	-	-									
Pool Spacing (ft)	10	20	15	-	-	-									
Additional Reach Parameters															
Valley Length (ft)	-	-	179.3	-	-	-									
Channel Length (ft)	-	-	203	-	-	-									
Sinuosity	-	-	1.13	-	-	-									
Water Surface Slope (ft/ft)	-	-	0.0314	-	-	-									
BF Slope (ft/ft)	-	-	0.03	-	-	-									
Rosgen Classification	-	-	B	-	-	-									

South Fork Hoppers Creek Restoration Site : Project No. D04006-4																					
Reach: South Fork Hoppers Reach 2																					
I. Cross-Section Parameters	Cross Section 1 Riffle					Cross Section 2 Pool					Cross Section 3 Riffle					Cross Section 4 Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension																					
BF Width (ft)	23.7	21				13.38	15.3				14.43	15.56				15.05	16.02			
Floodprone Width (ft)	70.42	70.42				69.95	70				69.83	69.9				69.88	69.9			
BF Cross Sectional Area (ft2)	24.2	21.46				17.17	18.68				18.41	19.9				19.07	21.2			
BF Mean Depth (ft)	1.0	1.02				1.28	1.22				1.28	1.28				1.27	1.32			
BF Max Depth (ft)	2.4	2.24				2.94	2.23				2.25	2.37				2.55	2.83			
Width/Depth Ratio	23.1	20.55				10.42	12.52				11.31	12.16				11.87	12.1			
Entrenchment Ratio	3.0	3.35				5.23	4.58				4.84	4.49				4.64	4.36			
Wetted Perimeter (ft)	25.71	23.04				15.94	17.74				16.99	18.12				17.59	18.66			
Hydraulic Radius (ft)	0.942	0.9314				1.077	1.053				1.084	1.098				1.084	1.136			
Substrate																					
d50 (mm)	-	0.16				-	0.095				-	0.7				-	0.19			
d84 (mm)	-	0.35				-	0.35				-	34				-	15			

II. Reachwide Parameters	MY-1 (2006)			MY-2 (2007)			MY-3 (2008)			MY-4 (2009)			MY-5 (2010)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Pattern															
Channel Beltwidth (ft)	63	108	-	-	-	-									
Radius of Curvature (ft)	36	61.2	-	-	-	-									
Meander Wavelength (ft)	126	198	-	-	-	-									
Meander Width Ratio	3.5	6	-	-	-	-									
Profile															
Riffle length (ft)	-	-	-	-	-	-									
Riffle Slope (ft/ft)	0.005	0.009	0.007	0.003	0.02	0.011									
Pool Length (ft)	-	-	-	-	-	-									
Pool Spacing (ft)	72	126	90	58	128	93									
Additional Reach Parameters															
Valley Length (ft)	-	-	2447	-	-	1150									
Channel Length (ft)	-	-	3301	-	-	1432									
Sinuosity	-	-	1.35	-	-	1.25									
Water Surface Slope (ft/ft)	-	-	0.0047	-	-	0.0067									
BF Slope (ft/ft)	-	-	0.0035	-	-	0.0073									
Rosgen Classification	-	-	C	-	-	C									

Reach: South Fork Hoppers Reach 2 (cont'd)																					
I. Cross-Section Parameters	Cross Section 5 Riffle					Cross Section 6 Pool					Cross Section 9 Pool										
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5						
Dimension																					
BF Width (ft)	15.14	20.09				22.76	31.33				29.6	30.33									
Floodprone Width (ft)	69.77	69.8				70.52	70.5				69.71	69.76									
BF Cross Sectional Area (ft2)	20.77	25.2				40.74	51.22				71.57	75.57									
BF Mean Depth (ft)	1.37	1.25				1.79	1.63				2.42	2.49									
BF Max Depth (ft)	2.17	2.5				4.02	3.92				3.21	3.51									
Width/Depth Ratio	11.03	16.01				12.72	19.16				12.25	12.18									
Entrenchment Ratio	4.61	3.48				3.1	2.25				2.35	2.3									
Wetted Perimeter (ft)	17.88	22.59				26.34	34.59				34.44	35.31									
Hydraulic Radius (ft)	1.162	1.1155				1.547	1.481				2.078	2.14									
Substrate																					
d50 (mm)	-	7.5				-	0.15				-	0.32									
d84 (mm)	-	30				-	2				-	12									

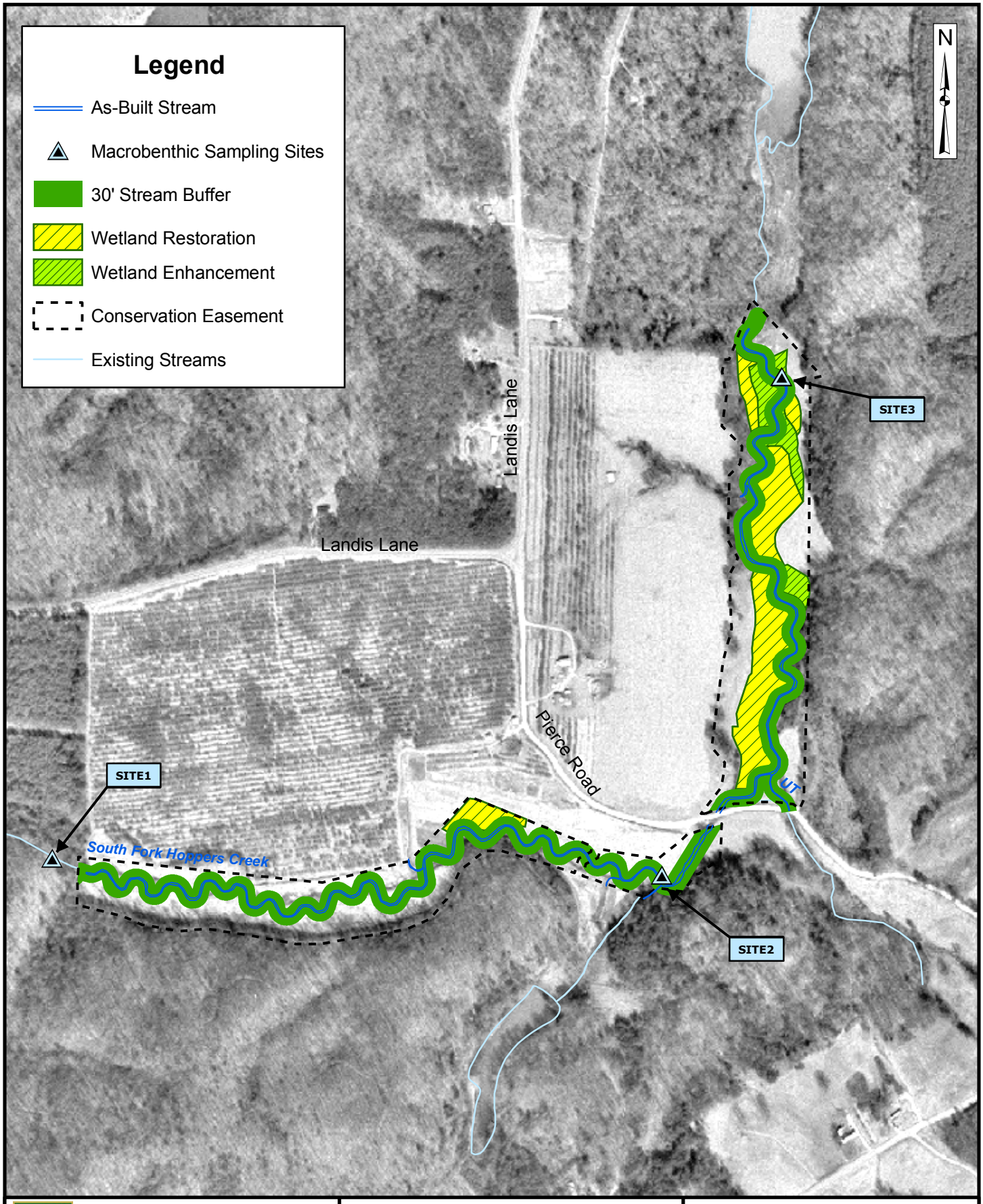
South Fork Hoppers Creek Restoration Site : Project No. D04006-4																					
Reach: South Fork Hoppers Reach 1																					
I. Cross-Section Parameters	Cross Section 10 Riffle					Cross Section 11 Pool					Cross Section 12 Riffle					Cross Section 13 Pool				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
Dimension																					
BF Width (ft)	18.93	18.01				25.8	29.89				18.1	18.15				19.98	22.93			
Floodprone Width (ft)	70.24	70.22				69.81	69.85				70.29	70.26				70.2	70.22			
BF Cross Sectional Area (ft2)	27.68	26.27				33.17	35.29				22.71	21.75				30.69	31.55			
BF Mean Depth (ft)	1.46	1.46				1.29	1.18				1.25	1.20				1.54	1.38			
BD Max Depth (ft)	2.69	2.57				2.84	2.74				1.95	1.89				3.19	2.87			
Width/Depth Ratio	12.94	12.34				20.06	25.24				14.43	15.14				13	16.67			
Entrenchment Ratio	3.71	3.9				2.71	2.34				3.88	3.87				3.51	3.06			
Wetted Perimeter (ft)	21.85	20.93				28.38	32.25				20.6	20.55				23.06	25.69			
Hydraulic Radius (ft)	1.267	1.2551				1.169	1.094				1.102	1.058				1.331	1.228			
Substrate																					
d50 (mm)	-	34				-	0.27				-	36				-	0.3			
d84 (mm)	-	80				-	0.9				-	55				-	0.52			

II. Reachwide Parameters	MY-1 (2006)			MY-2 (2007)			MY-3 (2008)			MY-4 (2009)			MY-5 (2010)		
	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Pattern															
Channel Beltwidth (ft)	56	96	-	-	-	-									
Radius of Curvature (ft)	32	54.4	-	-	-	-									
Meander Wavelength (ft)	112	176	-	-	-	-									
Meander Width Ratio	3.5	6	-	-	-	-									
Profile															
Riffle length (ft)	-	-	-	-	-	-									
Riffle Slope (ft/ft)	0.01	0.02	0.015	0.01	0.03	0.02									
Pool Length (ft)	-	-	-	-	-	-									
Pool Spacing (ft)	64	112	88	60	122	91									
Additional Reach Parameters															
Valley Length (ft)	-	-	2527	-	-	1508									
Channel Length (ft)	-	-	3725	-	-	2130									
Sinuosity	-	-	1.47	-	-	1.4									
Water Surface Slope (ft/ft)	-	-	0.0068	-	-	0.0076									
BF Slope (ft/ft)	-	-	0.005	-	-	0.0078									
Rosgen Classification	-	-	C	-	-	C									

South Fork Hoppers Creek Restoration Site : Project No. D04006-4																
Reach: South Fork Hoppers Reach 1 (Cont'd)																
I. Cross-Section Parameters	Cross Section 14 Riffle					Cross Section 15 Riffle					Cross Section 16 Pool					
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	
Dimension																
BF Width (ft)	15.92	16.71				16.33	16.29				13.68	14.01				
Floodprone Width (ft)	70.08	70.07				69.86	69.88				69.01	70.03				
BF Cross Sectional Area (ft2)	18.18	18.91				17.74	17.13				12.16	11.35				
BF Mean Depth (ft)	1.14	1.13				1.09	1.05				0.89	0.81				
BD Max Depth (ft)	1.76	1.93				1.85	1.82				1.53	1.8				
Width/Depth Ratio	13.94	14.77				15.03	15.49				15.39	17.29				
Entrenchment Ratio	4.4	4.19				4.28	4.29				5.04	5				
Wetted Perimeter (ft)	18.2	18.97				18.51	18.39				15.46	15.63				
Hydraulic Radius (ft)	0.999	0.9968				0.958	0.931				0.787	0.726				
Substrate																
d50 (mm)	-	35				-	40				-	0.52				
d84 (mm)	-	54				-	60				-	7.5				

APPENDIX F

BENTHIC MACROINVERTEBRATE MONITORING DATA



Environmental Banc and Exchange, LLC
2530 Meridian Parkway, Suite 200
Durham, NC 27713

0 400 800 Feet

Figure 1. Benthic Macroinvertebrate Sampling Sites

South Fork Hoppers Creek

P-1

Site 1 – looking upstream

P-2

Site 1 – looking downstream

P-3

Site 2 – looking upstream

P-4

Site 2 – looking downstream

P-5

Site 3 – looking upstream

P-6

Site 3 – looking downstream

Benthos Data for South Fork Hoppers Creek Collected on January 16-17, 2007

SPECIES	Tolerance Values	Functional Feeding Group	Site 1 Reference 1/17/07	Site 2 U/S Hoppers 1/16/07	Site 3 D/S Hoppers 1/16/07
ANNELIDA					
Oligchaeta					
Naididae					
Nais spp.	**8.9**	**GC**			**R**
Tubificidae	**7.1**	**GC**		**C**	**C**
ARTHROPODA					
Crustacea					
Hydracarina	**5..5**				**R**
Isopoda					
Asellidae					
Caecidotea spp.	**9.1**	**CG**	**R**		
Insecta					
Coleoptera					
Dryopidae					
Helichus spp.	**4.6**	**SH**	**C**	**R**	
Dytiscidae					
Laccophilus spp.	**10**	**PR**		**C**	**R**
Elmidae					
Microcylloepus pusillus	**2.1**	**GC**	**C**		
Optioservus ovalis	**2.4**	**SC**	**A**		
Promoresia spp.	**2.4**	**SC**	**R**		
Eubriidae					
Ectopria nervosa	**4.2**	**SC**	**R**		
Haliplidae					
Haliplus spp.	**9.7**	**SH?**		**R**	
Hydrophilidae					
Enochrus spp.	**8.8**	**GC**		**R**	
Tropisternus spp.	**9.7**	**PR**		**R**	
Ptilodactylidae					
Anchytarsus bicolor	**3.6**	**SH**	**R**		
Staphylinidae	**n/a**	**PR**	**R**		
Diptera					
Ceratopogonidae					
Palpomyia complex	**6.9**	**PR**			**R**
Chironomidae					
BrillIa spp.	**5.2**	**SH**	**R**		
Conchapelopia grp	**8.4**	**PR**	**R**	**A**	**A**
Corynoneura spp.	**6.0**	**GC**		**R**	**R**
Cricotopus bicinctus	**8.5**	**SH**		**C**	
Demicryptochironomus spp.	**2.1**	**GC**	**R**		
Diamesa spp.	**8.1**	**GC**		**A**	**C**
Lopescladius spp.	**1.7**	**GC**		**R**	
Microtendipes spp.	**5.5**	**FC**		**C**	
Parametriocnemus lundbecki	**3.7**	**GC**		**C**	**R**

SPECIES	Tolerance Values	Functional Feeding Group	Site 1 Reference 1/17/07	Site 2 U/S Hoppers 1/16/07	Site 3 D/S Hoppers 1/16/07
Polypedilum flavum	**4.9**	**SH?**		**C**	
Polypedilum illinoense grp.	**9.0**	**SH?**		**C**	
Potthastia longimana	**6.5**	**GC**		**C**	
Rheotanytarsus spp.	**5.9**	**FC**	**C**	**R**	**C**
Thienemanniella spp.	**5.9**	**GC**		**R**	
Tvetenia bavarica	**3.7**	**GC**			**C**
Dixidae					
Dixa spp.	**2.6**	**GC**	**C**	**R**	**R**
Simulidae					
Prosimulium spp.	**6.0**	**FC**	**C**		
Simulium spp.	**6.0**	**FC**	**R**	**C**	**C**
Tipulidae					
Antocha spp.	**4.3**	**GC**		**C**	**A**
Dicranota spp.	**0.0**	**PR**	**C**		
Hexatoma spp.	**4.3**	**PR**			**R**
Limnophila spp.	**n/a**	**PR**	**R**		
Tipula spp.	**7.3**	**SH**	**C**	**R**	**A**
Ephemeroptera					
Baetidae					
Acentrella spp.	**4.0**	**GC**		**A**	**C**
Centroptilum spp.	**6.6**	**GC**		**A**	
Ephemerellidae					
Ephemerella spp.	**2**	**GC**	**R**	**A**	**A**
Eurylophella spp.	**4.3**	**SC**		**R**	**R**
Heptageniidae					
Stenonema modestum	**5.5**	**SC**	**A**	**A**	**A**
Stenonema pudicum	**2.0**	**SC?**	**C**	**C**	
Isonychiidae					
Isonychia spp.	**3.5**	**FC**	**R**		
Megaloptera					
Corydalidae					
Corydalus cornutus	**5.2**	**PR**		**R**	
Nigronia fasciatus	**5.6**	**PR**	**R**		**R**
Nigronia serricornis	**5.0**	**PR**	**C**		**R**
Odonata					
Aeshnidae					
Basiaeschna janata	**7.4**	**PR**			**R**
Boyeria vinosa	**5.9**	**PR**		**R**	**R**
Calopterygidae					
Calopteryx spp.	**7.8**	**PR**	**R**	**C**	**A**
Coenagrionidae					
Argia spp.	**8.2**	**PR**		**R**	
Cordulegastridae					
Cordulegaster spp.	**5.7**	**PR**	**R**		**R**
Gomphidae					
Lanthus spp.	**1.8**	**??**	**R**		
Ophiogomphus spp.	**5.5**	**PR**	**R**	**A**	**A**

SPECIES	Tolerance Values	Functional Feeding Group	Site 1 Reference 1/17/07	Site 2 U/S Hoppers 1/16/07	Site 3 D/S Hoppers 1/16/07
Plecoptera					
Capniidae					
Allocapnia spp.	**2.5**	**SH**	**C**		
Chloroperlidae					
Suwallia spp.	**1.5**	**PR**	**C**		
Peltoperlidae					
Tallaperla spp.	**1.2**	**??**	**C**	**R**	
Perlidae					
Acroneuria abnormis	**2.1**	**PR**	**R**		
Eccoptura xanthenes	**3.7**	**??**	**R**		**R**
Perlodidae					
Clioperla clio	**4.7**	**??**			**R**
Diploperla duplicata	**2.7**	**??**	**C**	**R**	
Isoperla bilineata	**5.4**	**??**	**A**	**R**	**R**
Malirekus hastatus	**1.2**	**??**	**C**		
Pteronarcyidae					
Pteronarcys spp.	**1.7**	**SH**	**R**		
Taeniopterygidae					
Strophopteryx spp.	**2.7**	**??**	**R**		**C**
Trichoptera					
Glossosomatidae					
Glossosoma spp.	**1.6**	**SC**	**R**	**R**	
Hydropsychidae					
Cheumatopsyche spp.	**6.2**	**FC**	**C**	**A**	**C**
Diplectrona modesta	**2.2**	**FC**	**C**		
Hydropsyche betteni	**7.8**	**FC**		**A**	**A**
Symphitopsyche sparna	**2.7**	**??**	**R**		
Lepidostomatidae					
Lepidostoma spp.	**0.9**	**SH**	**C**		
Limnephilidae					
Pycnopsyche spp.	**2.5**	**SH**	**C**	**C**	**R**
Philopotamidae					
Chimarra spp.	**2.8**	**FC**		**A**	**R**
Dolophilodes spp.	**0.8**	**GC**	**R**		
Rhyacophilidae					
Rhyacophila fuscula	**1.9**	**??**	**R**		
Rhyacophila nigrita	**0.0**	**??**	**R**		
Rhyacophila carolina	**0.0**	**??**	**R**		
Uenoidae					
Neophylax mitchelli	**0.1**	**??**	**R**	**C**	**A**
MOLLUSCA					
Gastropoda					
Lymnaeidae					
Pseudosuccinea columella	**7.7**	**SC**		**R**	**R**
Physidae					
Physella spp.	**8.8**	**SC**		**C**	**A**
Pleuroceridae					
Elimia spp.	**2.5**	**SC**	**A**	**C**	**A**

SPECIES	Tolerance Values	Functional Feeding Group	Site 1 Reference 1/17/07	Site 2 U/S Hoppers 1/16/07	Site 3 D/S Hoppers 1/16/07
Total Taxa Richness			**50**	**43**	**40**
EPT Taxa Richness			**21**	**15**	**13**
Total Biotic Index			**3.47**	**5.58**	**5.53**
EPT Biotic Index			**3.17**	**4.50**	**3.93**
Dominant in Common Taxa				**23%**	**23%**

Notes: Tolerance Values: ranges from 0 (least tolerant to pollution) to 10 (most tolerant to pollution).
Functional Feeding Group: CG = Collector-Gatherer, FC = Filterer-Collector, OM = Omnivore, PR = Predator, SC = Scraper, SH = Shredder.
Abundance: R = Rare (1-2 individuals); C = Common (3-9 individuals); A = Abundant (10 or more individuals).

3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

TOTAL SCORE 84

Biological Assessment Unit, DWQ

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an upstream direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream South Fork Hoppers **Location/road:** Site 1 **(Road Name** Landis Lane **)County** McDowell

Date 1/17/07 **CC#** _____ **Basin** Catawba **Subbasin** 11-32-2-9-1

Observer(s) AMC / CDM **Type of Study:** ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Northing **Latitude** 677520.9 Easting **Longitude** 1196210.7 **Ecoregion:** ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature 7.0 °C DO 6.61 mg/l 54.7% Conductivity (corr.) 40 µS/cm pH 6.20

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 50 %Forest 10 %Residential _____%Active Pasture _____% Active Crops
40 %Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe:_____

Watershed land use : ☐Forest ☐Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream 1.5 Channel (at top of bank) 4 **Stream Depth:** (m) Avg 0.15 Max 0.2
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) 1.5

Bank Angle: 60° ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☒Deeply incised-steep, straight banks ☐Both banks undercut at bend ☐Channel filled in with sediment
☐ Recent overbank deposits ☒Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☒N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☒Normal ☐Low
Turbidity: ☒Clear ☐ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☐ **YES** ☒ **NO Details**_____

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☐
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☒
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: 30° Sunny **Photos:** ☐N ☒Y ☒Digital ☐35mm

Remarks:_____

UTM NAD 83 from topo
17 421824E
3937445 N

I. Channel Modification

	Score
A. channel natural, frequent bends	5
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	(3)
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks_____ Subtotal 3

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

X(A) Rocks R Macrophytes X(A) Sticks and leafpacks R Snags and logs X(A) Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	(19)	~~15~~	11	7
2 types present	18	14	10	6
1 type present	17	13	9	5
No types present	0			

☐ No woody vegetation in riparian zone Remarks_____ Subtotal 19

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	(11)
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks_____ Subtotal 11

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	(4)
B. Pools absent	0

Subtotal 4

☐ Pool bottom boulder-cobble=hard ☐ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks_____ 38 Page Total 33

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	(16)	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☒Typical for area ☐Steep=fast flow ☐Low=like a coastal stream

Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	(6)	(6)
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 12

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	(10)
B. Stream with **full canopy** - breaks for light penetration absent.....	
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks _____ Subtotal 10

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☐ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	5	5
2. width 12-18 meters.....	(4)	(4)
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	(4)	(4)
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

Total 8

Remarks _____

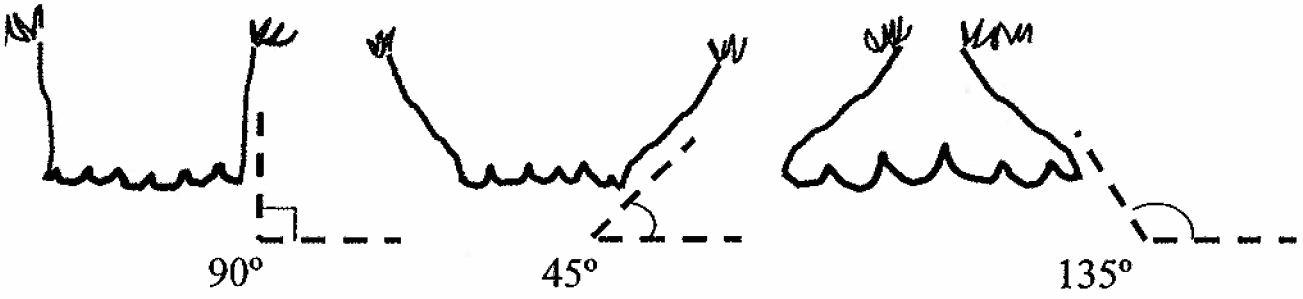
Page Total 46

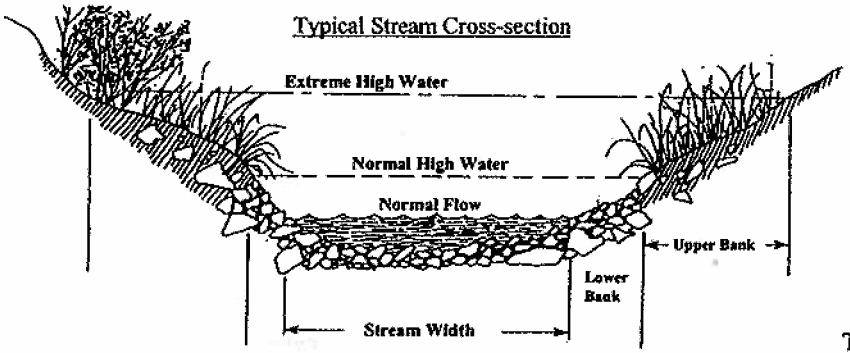
☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

TOTAL SCORE 84

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:_____

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3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

Biological Assessment Unit, DWQ **TOTAL SCORE** 70

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream Baileys Fork Location/road: Site 2 (Road Name Hopewell) County Burke

Date 1/17/07 **CC#** _____ Basin Catawba Subbasin 11-34-8-(3)

Observer(s) CDM AMC Type of Study: ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Northing ~~Latitude~~ 7752314 Easting ~~Longitude~~ 1192166 Ecoregion: ☐ MT ☐ P ☐ Slate Belt ☐ Triassic Basin

Water Quality: Temperature 8.4 °C DO 32.1% 3.76 mg/l Conductivity (corr.) 50 µS/cm pH 5.97

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 75 %Forest 25 %Residential _____%Active Pasture _____% Active Crops
_____%Fallow Fields _____% Commercial _____%Industrial _____%Other - Describe: _____

Watershed land use : ☒Forest ☒Agriculture ☐Urban ☐ Animal operations upstream

Width: (meters) Stream 2m Channel (at top of bank) 4.5 **Stream Depth:** (m) Avg 6 in Max 24
☐ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m)_____

Bank Angle: 60 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☒Deeply incised-steep, straight banks ☒Both banks undercut at bend ☒Channel filled in with sediment
☐ Recent overbank deposits ☐Bar development ☐Buried structures ☐Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐Green tinge ☐ Sewage smell
Manmade Stabilization: ☒N ☐Y: ☐Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐Berm/levee
Flow conditions : ☐High ☒Normal ☐Low
Turbidity: ☐Clear ☒ Slightly Turbid ☐Turbid ☐Tannic ☐Milky ☐Colored (from dyes)
Good potential for Wetlands Restoration Project?? ☐ **YES** ☐**NO Details** when walked in

Channel Flow Status

Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: SUNNY cold **Photos:** ☐N ☒Y ☒Digital ☐35mm

Remarks: _____

I. Channel Modification

	Score
A. channel natural, frequent bends	(5)
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks _____ Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

C X **Rocks** R **Macrophytes** C X **Sticks and leafpacks** C X **Snags and logs** A **Undercut banks or root mats**

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score		20-40% Score	<20% Score
4 or 5 types present	20	16	(14)	12	8
3 types present	19	15		11	7
2 types present	18	14		10	6
1 type present	17	13		9	5
No types present	0				

☐ No woody vegetation in riparian zone Remarks minimal large substrate riffles Subtotal 14

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	11
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	(4)
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks Many sand riffles Subtotal 4

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	10
b. pools about the same size (indicates pools filling in)	(8)
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal 8

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☐ Silt bottom ☐ Some pools over wader depth

Remarks lots of silt/sand in pools

Page Total 31

3/18/05

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles Frequent Score	Riffles Infrequent Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	16	12
B. riffle as wide as stream but riffle length is not 2X stream width	(14)	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☐Typical for area ☐Steep=fast flow ☐Low=like a coastal stream

Subtotal 14

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion..	7	7
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	(6)	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	(5)
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0

Total 11

Remarks _____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	(7)
D. Stream with **minimal** canopy - full sun in all but a few areas.....	2
E. **No canopy** and no shading.....	0

Remarks _____ Subtotal 7

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☒ Trees ☒ Shrubs ☒ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	(5)	5
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	(2)
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	0	0

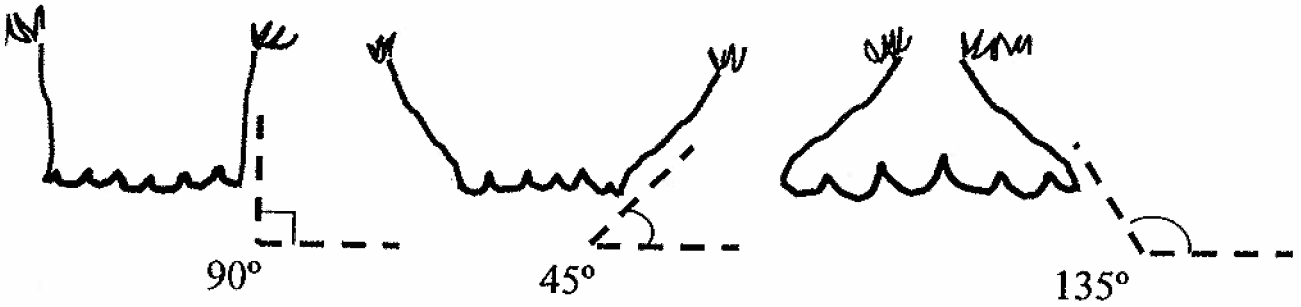
Remarks _____ Total 7

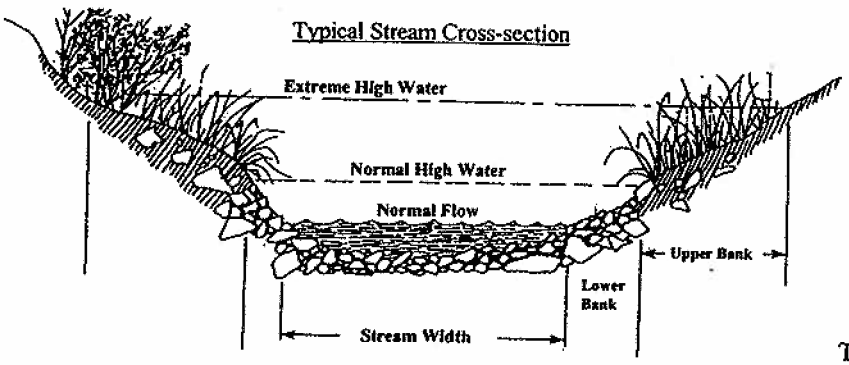
Page Total 39

☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream. **TOTAL SCORE** 70

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments:_____

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3/06 Revision 6

Habitat Assessment Field Data Sheet
Mountain/ Piedmont Streams

82

Biological Assessment Unit, DWQ **TOTAL SCORE** 82

Directions for use: The observer is to survey a **minimum of 100 meters with 200 meters preferred** of stream, preferably in an **upstream** direction starting above the bridge pool and the road right-of-way. The segment which is assessed should represent average stream conditions. To perform a proper habitat evaluation the observer needs to get into the stream. To complete the form, select the description which best fits the observed habitats and then circle the score. If the observed habitat falls in between two descriptions, select an intermediate score. A final habitat score is determined by adding the results from the different metrics.

Stream South Fork Hoppers **Location/road:** Site 3 **(Road Name** Pierce Rd **)County** McDowell

Date 1/16/07 **CC#** _____ **Basin** Catawba **Subbasin** 03-02-09-1

Observer(s) COM AMC **Type of Study:** ☐ Fish ☒ Benthos ☐ Basinwide ☐ Special Study (Describe) _____

Northing **Latitude** 6791922 **Easting Longitude** 1149293.6 **Ecoregion:** ☐ MT ☒ P ☐ Slate Belt ☐ Triassic Basin

29.8 %

Water Quality: Temperature 11.4 °C DO 3.25 mg/l Conductivity (corr.) 50 µS/cm pH 6.03

Physical Characterization: Visible land use refers to immediate area that you can see from sampling location - include what you estimate driving thru the watershed in watershed land use.

Visible Land Use: 50 %Forest _____ %Residential _____ %Active Pasture _____ % Active Crops
50 %Fallow Fields _____ % Commercial _____ %Industrial _____ %Other - Describe: _____

Watershed land use : ☒ Forest ☒ Agriculture ☐ Urban ☐ Animal operations upstream

Width: (meters) Stream 1.5m Channel (at top of bank) 15 ft **Stream Depth:** (m) Avg 1.5 ft Max 4 ft
☒ Width variable ☐ Large river >25m wide

Bank Height (from deepest part of riffle to top of bank-first flat surface you stand on): (m) _____

Bank Angle: 30 ° or ☐ NA (Vertical is 90°, horizontal is 0°. Angles > 90° indicate slope is towards mid-channel, < 90° indicate slope is away from channel. NA if bank is too low for bank angle to matter.)

☐ Channelized Ditch
☐ Deeply incised-steep, straight banks ☐ Both banks undercut at bend ☒ Channel filled in with sediment Narrowing
☐ Recent overbank deposits ☒ Bar development ☐ Buried structures ☐ Exposed bedrock
☐ Excessive periphyton growth ☐ Heavy filamentous algae growth ☐ Green tinge ☐ Sewage smell
Manmade Stabilization: ☐ N ☒ Y: ☐ Rip-rap, cement, gabions ☐ Sediment/grade-control structure ☐ Berm/levee Natural channel design
Flow conditions : ☐ High ☐ Normal ☐ Low
Turbidity: ☐ Clear ☒ Slightly Turbid ☐ Turbid ☐ Tannic ☐ Milky ☐ Colored (from dyes) when walking
Good potential for Wetlands Restoration Project?? ☒ **YES** ☐ **NO Details** wetlands created in floodplain

Channel Flow Status
Useful especially under abnormal or low flow conditions.

A. Water reaches base of both lower banks, minimal channel substrate exposed	☒
B. Water fills >75% of available channel, or <25% of channel substrate is exposed	☐
C. Water fills 25-75% of available channel, many logs/snags exposed	☐
D. Root mats out of water	☐
E. Very little water in channel, mostly present as standing pools	☐

Weather Conditions: SUNNY **Photos:** ☐ N ☒ Y ☒ Digital ☐ 35mm

Remarks: _____

I. Channel Modification

	Score
A. channel natural, frequent bends	(5)
B. channel natural, infrequent bends (channelization could be old)	4
C. some channelization present	3
D. more extensive channelization, >40% of stream disrupted	2
E. no bends, completely channelized or rip rapped or gabioned, etc	0

☐ Evidence of dredging ☐Evidence of desnagging=no large woody debris in stream ☐Banks of uniform shape/height

Remarks Natural channel design Subtotal 5

II. Instream Habitat: Consider the percentage of the reach that is favorable for benthos colonization or fish cover. If >70% of the reach is rocks, 1 type is present, circle the score of 17. Definition: leafpacks consist of older leaves that are packed together and have begun to decay (not piles of leaves in pool areas). Mark as Rare, Common, or Abundant.

A (C) X Rocks C X Macrophytes R Sticks and leafpacks R Snags and logs R Undercut banks or root mats

AMOUNT OF REACH FAVORABLE FOR COLONIZATION OR COVER

	>70% Score	40-70% Score	20-40% Score	<20% Score
4 or 5 types present	20	16	12	8
3 types present	19	15	11	7
2 types present	18	(14)	10	6
1 type present	17	13	9	5
No types present	0			

☒ No woody vegetation in riparian zone Remarks Minimal Subtotal 14

III. Bottom Substrate (silt, sand, detritus, gravel, cobble, boulder) Look at entire reach for substrate scoring, but only look at riffle for embeddedness, and use rocks from all parts of riffle-look for "mud line" or difficulty extracting rocks.

	Score
A. substrate with good mix of gravel, cobble and boulders	
1. embeddedness <20% (very little sand, usually only behind large boulders)	15
2. embeddedness 20-40%	12
3. embeddedness 40-80%	8
4. embeddedness >80%	3
B. substrate gravel and cobble	
1. embeddedness <20%	14
2. embeddedness 20-40%	(11)
3. embeddedness 40-80%	6
4. embeddedness >80%	2
C. substrate mostly gravel	
1. embeddedness <50%	8
2. embeddedness >50%	4
D. substrate homogeneous	
1. substrate nearly all bedrock	3
2. substrate nearly all sand	3
3. substrate nearly all detritus	2
4. substrate nearly all silt/ clay	1

Remarks Subtotal 11

IV. Pool Variety Pools are areas of deeper than average maximum depths with little or no surface turbulence. Water velocities associated with pools are always slow. Pools may take the form of "pocket water", small pools behind boulders or obstructions, in large high gradient streams, or side eddies.

	Score
A. Pools present	
1. Pools Frequent (>30% of 200m area surveyed)	
a. variety of pool sizes	(10)
b. pools about the same size (indicates pools filling in)	8
2. Pools Infrequent (<30% of the 200m area surveyed)	
a. variety of pool sizes	6
b. pools about the same size	4
B. Pools absent	0

Subtotal 10

☐ Pool bottom boulder-cobble=hard ☒ Bottom sandy-sink as you walk ☒ Silt bottom ☐ Some pools over wader depth

Remarks Page Total 40

V. Riffle Habitats

Definition: Riffle is area of reaeration-can be debris dam, or narrow channel area.

	Riffles **Frequent** Score	Riffles **Infrequent** Score
A. well defined riffle and run, riffle as wide as stream and extends 2X width of stream....	(16)	12
B. riffle as wide as stream but riffle length is not 2X stream width	14	7
C. riffle not as wide as stream and riffle length is not 2X stream width	10	3
D. riffles absent.....	0	

Channel Slope: ☒Typical for area ☐Steep=fast flow ☐Low=like a coastal stream

Subtotal 16

VI. Bank Stability and Vegetation

FACE UPSTREAM

	Left Bank Score	Rt. Bank Score
A. Banks stable		
1. little evidence of erosion or bank failure(except outside of bends), little potential for erosion.	(7)	(7)
B. Erosion areas present		
1. diverse **trees**, shrubs, grass; plants healthy with good root systems.....	6	6
2. few trees or small trees and **shrubs**; vegetation appears generally healthy.....	5	5
3. sparse **mixed** vegetation; plant types and conditions suggest poorer soil binding.....	3	3
4. mostly **grasses**, few if any trees and shrubs, high erosion and failure potential at high flow..	2	2
5. little or no bank vegetation, mass erosion and bank failure evident.....	0	0
		Total 14

Remarks_____

VII. Light Penetration Canopy is defined as tree or vegetative cover directly above the stream's surface. Canopy would block out sunlight when the sun is directly overhead. Note shading from mountains, but not use to score this metric.

	Score
A. Stream with **good** canopy with some breaks for light penetration	10
B. Stream with **full canopy** - breaks for light penetration absent.....	8
C. Stream with **partial** canopy - sunlight and shading are essentially equal.....	7
D. Stream with **minimal** canopy - full sun in all but a few areas.....	(2)
E. **No canopy** and no shading.....	0

Remarks Alder transplants on a few meander bends, but otherwise full sun Subtotal 2

VIII. Riparian Vegetative Zone Width

Definition: Riparian zone for this form is area of natural vegetation adjacent to stream (can go beyond floodplain). Definition: A break in the riparian zone is any place on the stream banks which allows sediment or pollutants to directly enter the stream, such as paths down to stream, storm drains, uprooted trees, otter slides, etc.

FACE UPSTREAM

Dominant vegetation: ☐ Trees ☒ Shrubs ☐ Grasses ☐ Weeds/old field ☐Exotics (kudzu, etc)

	Lft. Bank Score	Rt. Bank Score
A. Riparian zone **intact** (no breaks)		
1. width > 18 meters.....	(5)	(5)
2. width 12-18 meters.....	4	4
3. width 6-12 meters.....	3	3
4. width < 6 meters.....	2	2
B. Riparian zone **not intact** (breaks)		
1. breaks rare		
a. width > 18 meters.....	4	4
b. width 12-18 meters.....	3	3
c. width 6-12 meters.....	2	2
d. width < 6 meters.....	1	1
2. breaks common		
a. width > 18 meters.....	3	3
b. width 12-18 meters.....	2	2
c. width 6-12 meters.....	1	1
d. width < 6 meters.....	(0)	(0)
		Total 10

Remarks planted but still young veg

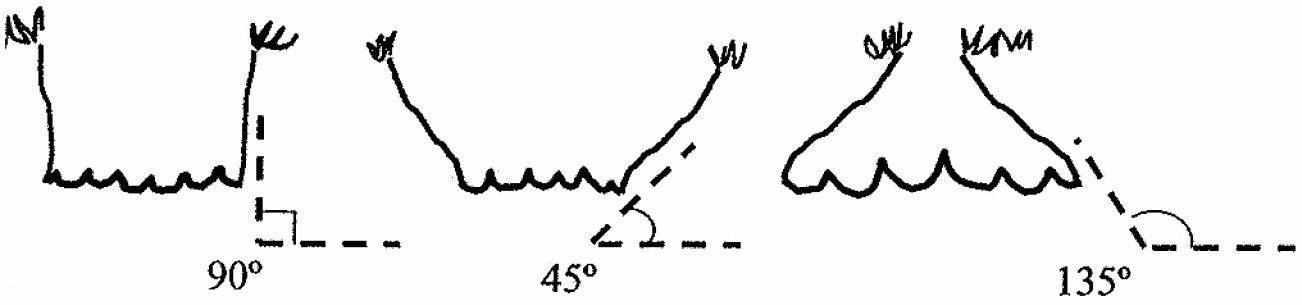
Page Total 32

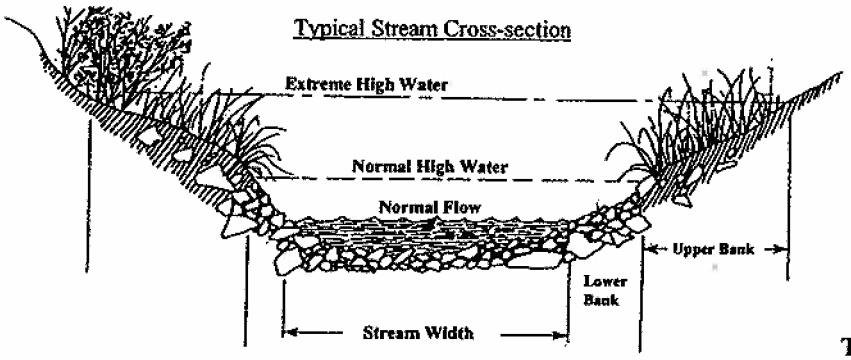
☐ Disclaimer-form filled out, but score doesn't match subjective opinion-atypical stream.

TOTAL SCORE_____

Supplement for Habitat Assessment Field Data Sheet

Diagram to determine bank angle:





This side is 45° bank angle.

Site Sketch:

Other comments: _____

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