Big Warrior Creek Stream Restoration
2008 Final Monitoring Report
Monitoring Year Four

Ecosystem Enhancement Program Project Number 000412

Submitted to:

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

Project Designed by:

CDM
5400 Glenwood Ave, Suite 300
Raleigh, NC 27612

Submitted: February 17, 2009

Ecosystem Enhancement PROGRAM

Big Warrior Creek Stream Restoration
2008 Final Monitoring Report
Monitoring Year Four

Ecosystem Enhancement Program Project Number 000412

Prepared by:

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Project Manager:

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February 17, 2009

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1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

The Big Warrior Creek Stream Restoration Site is located in Wilkes County, North Carolina, approximately 10 miles southwest of Wilkesboro. Big Warrior Creek drains a watershed area of approximately 7.4 square miles, beginning on the Wilkes and Alexander County line. Two major tributaries (Mountain Creek and Unnamed Tributary) flow into the main channel of Big Warrior Creek within the project reach. Sections of these two tributaries were also restored. The project restoration segments that are on the downstream property are completely fenced to exclude cattle from the creek and riparian areas.

Per the 2005 Mitigation Plan and As-Built report (CDM 2005), the objectives of the Big Warrior Creek Stream Restoration Project include the following: reduce bank erosion, exclude cattle from the stream and riparian zone, improve water quality, establish a floodplain at a lower elevation, enhance in-stream habitat, improve functional and aesthetic value of the riparian corridor, and preserve existing beneficial channel, floodplain features, and riparian vegetation. Big Warrior Creek originally had failing banks, unstable plan form and cross sectional geometry, little or no riparian buffer, cattle access to the creek, and several unstable creek crossings (CDM 2002).

The Priority II restoration involved converting the impaired channels into stable channels that meander for a total of 11,035 linear feet. Rock cross-vanes, single arm vanes, staked log toe protection, and root wads were incorporated for aquatic habitat enhancement and bed and bank stability. A riparian buffer on either side of the stream was planted using native vegetation. The cattle were fenced from the riparian area along the Unnamed Tributary, Mountain Creek, and most of Big Warrior Creek. The upstream-most portion of Big Warrior Creek is not fenced, but cattle are not present on the surrounding property. In addition, two stabilized creek crossings and two culverts were installed to allow vehicular access to different parts of the farm while limiting impacts.

The 2008 Monitoring Year (MY) 4 monitoring indicated that the Big Warrior Creek restoration is functioning well and has continued to improve and evolve since 2007 (MY3) monitoring. The majority of the bed features appear stable with well-developed pools in the meander bends and long riffles in the straight reaches. Some of the rock structures have shifted; however, no problem areas were ranked as high concern. Several rootwads and log bank protectors have some scour behind the device. Several log bank protectors dislodged from the bank prior to 2007 (MY3) monitoring and have been carried downstream. Some bank erosion continues to be present along Big Warrior Creek. Beaver dams and signs of beaver activity were observed on Big Warrior Creek during 2007 (MY3) monitoring between stations 20+00 and 25+00 and 40+00 and 50+00. While these dams are still present, neither of them appear to be actively maintained. Vegetation is growing in from the sides of the channel in many areas, indicating that the system may eventually transition from a C channel to a narrower E. Mountain Creek is showing stabilization trends as the cross sections re-classified in 2007 (MY3) to an E type channel. Mountain Creek remains an E type channel in 2008 (MY4).

The planted woody vegetation is doing fair along all three reaches, but may not be meeting mitigation success criteria. Only one-third of the vegetation plots met the success criteria in 2008 (MY4). The streamside and floodplain zones are generally in better health than upland areas. Streamside survival appears to be the most successful. The banks of the Unnamed Tributary are covered with a dense mat of American hogpeanut (*Amphicarpaeae bracteata*) and arrowleaf tear thumb (*Polygonum sagittata*). This may become a problem in that the herbaceous species seem to be choking much of the planted vegetation along the streambanks. Tear thumb and hogpeanut are also evident along the mainstem and Mountain Creek; however, the presence of kudzu (*Pueraria montana* var. *lobata*) and Chinese privet (*Ligustrum sinense*) pose a more serious problem to the survival of vegetation along those reaches. Taxonomy

follows 'Flora of the Carolinas, Virginia, Georgia, and surrounding areas' (Weakley 2007). Kudzu continues to be a serious problem along the upstream reach of Big Warrior Creek, and has progressed further downstream since the 2007 (MY3) monitoring event. Maintenance to control the presence and spread of kudzu is recommended. There are also several large areas of bare ground where the soil appears compacted and not conducive to natural colonization. Soil amendments and reseeding are recommended in these areas. Fish, snails, and several aquatic insects were observed in all three reaches, and evidence of wildlife use was observed again in 2008 (MY4). All of the fencing and gates along the reaches are intact and functioning properly. However, the gates at the cattle crossings are not closed, allowing cattle to cross and/or congregate in the channel at their free will. It is recommended that these gates remain closed except when cattle are being herded. The unfenced, upstream edge of the project reach (Big Warrior Creek) has a very minimal buffer on the left floodplain. The landowner along the left bank has continued to mow the adjacent field to within five feet of the edge of the water.

2.0 PROJECT BACKGROUND

2.1 PROJECT OBJECTIVES

According to the 2005 Mitigation Plan prepared by CDM and Biohabitats, the overarching goal of the project was to establish a stable planform, cross-section, and profile pattern to Big Warrior Creek and it's tributaries, with the premise that geomorphic and habitat function will follow appropriate channel form. Specific project objectives included the following:

1. Reduce bank erosion.
2. Exclude cattle from the stream and riparian zone.
3. Improve water quality.
4. Establish a floodplain at a lower elevation.
5. Enhance in-stream habitat.
6. Improve functional and aesthetic value of the riparian corridor.
7. Preserve existing beneficial channel, floodplain features, and riparian vegetation.

2.2 PROJECT STRUCTURE, MITIGATION TYPE, AND APPROACH

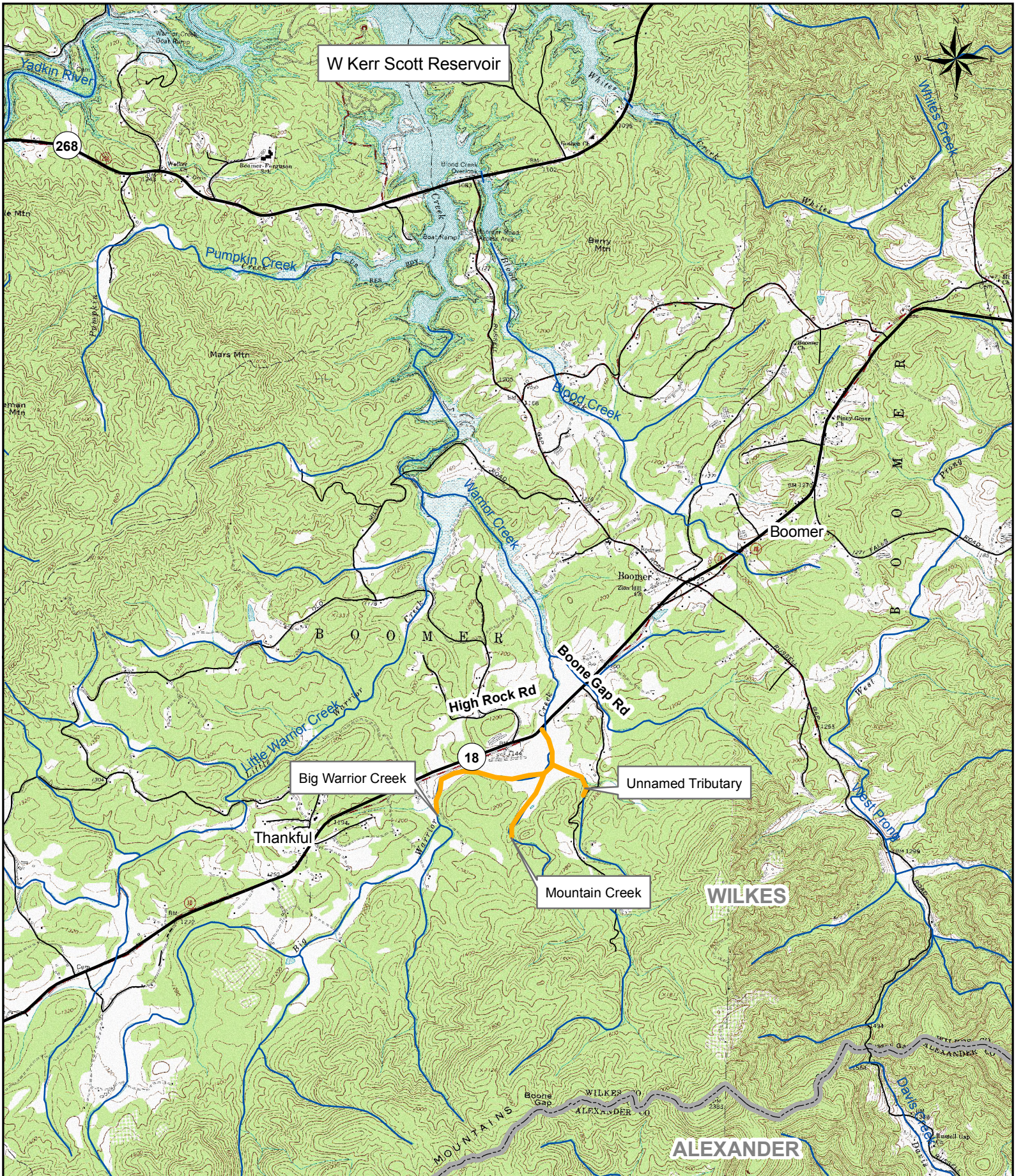
Big Warrior Creek originally had failing banks, unstable plan form and cross sectional geometry, little or no riparian buffer, cattle access to the creek, and several unstable creek crossings (CDM 2002).

The Priority II restoration involved converting the impaired channels into stable channels that meander for a restored total of 11,035 feet as measured along the thalweg. Rock cross-vanes, single arm vanes, staked log toe protection, and root wads were incorporated for aquatic habitat enhancement and bed and bank stability. A riparian buffer was planted using native vegetation. Cattle were fenced from the riparian area. In addition, two stabilized creek crossings and two culverts were installed to allow vehicular access to different parts of the farm while limiting impacts.

2.3 LOCATION AND SETTING

The Big Warrior Creek Stream Restoration Site is located in Wilkes County, North Carolina, approximately 10 miles southwest of Wilkesboro (Figure 1). The project site is on the south side of North Carolina Highway 18, across from the intersection of the northern end of the High Rock Road loop, which is about 4.5 miles east of the Caldwell County line. Big Warrior Creek drains a watershed area of approximately 7.4 square miles, beginning at the Wilkes and Alexander County line. Big Warrior Creek and its tributaries originate in the Brushy Mountains near the boundary between Wilkes County and Alexander County. Downstream of the project area, Big Warrior Creek ultimately flows into the W. Kerr Scott Reservoir, an impoundment of the Yadkin River. Two major tributaries (Mountain Creek and Unnamed Tributary) flow into the main channel of Big Warrior Creek within the project area. Sections of these two tributaries were also restored. The project restoration segments that are on the downstream property are completely fenced to exclude cattle from the creek and riparian areas.

To travel to the site from the Raleigh area, take I-40 West to US-421 North towards Wilkesboro. Take NC-16 South/NC-18 towards Wilkesboro/Lenoir/Taylorsville. Follow NC-18 to the site. It is approximately halfway between the towns of Boomer and Thankful.



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URS

Prepared For:
NC Ecosystem Enhancement Program

Ecosystem Enhancement PROGRAM

Project:
Big Warrior Creek
Stream Restoration
Wilkes County, NC

Project Number:
00412

Monitoring Year:
4 (2008)

Date:
February 2009

Legend
Project Reach

Figure 1
Project Vicinity

0 0.5 1 Miles

2.4 PROJECT HISTORY AND BACKGROUND

The Big Warrior Stream Restoration project was designed by CDM and construction was completed in November 2004. The Mitigation and As-built Plan were completed in March 2005. The estimated restoration length was 11,035 linear feet. This length includes 7,185 feet of Big Warrior Creek, 2,415 feet of Mountain Creek, and 1,435 feet of an Unnamed Tributary.

EcoLogic conducted monitoring in 2005 (MY1). At that time, EcoLogic was provided with an As-built site map. Other documentation such as project history, contacts, goals, and the As-built report were not provided. The measured restoration amount is 10,698 linear feet, as measured by EcoLogic (7,013 on Big Warrior, 2,373 on Mountain Creek, and 1,312 on Unnamed Tributary). Since EcoLogic did not have complete project data at the time of the Year 1 monitoring, much of their quantitative data differs from that presented in the As-built Plan (EcoLogic 2006).

At the time URS was given the contract, URS had only EcoLogic's Year One Monitoring Report. Therefore, 2006 (MY2), 2007 (MY3), and 2008 (MY4) surveys, cross-sections, photo stations, and vegetation plots follow those of Ecologic.

Table I: Project Mitigation Structure and Objectives Table

Big Warrior Creek EEP Project Number 00412						
Project Segment or Reach	**Existing Feet**	**Mitigation Type**	**Approach**	**Linear Footage**	**Stationing***	**Comment**
Big Warrior Creek	450	EII	PIII	450	0+00 to 4+50	Linear footage from Ecologic's 2006 survey.
Big Warrior Creek	6,735	R	PII	6,563	4+50 to 70+00	Linear footage from Ecologic's 2006 survey.
Mountain Creek	2,415	R	PII	2,373	0+00 to 25+00	Linear footage from Ecologic's 2006 survey.
Unnamed Tributary	1,435	R	PII	1,312	0+00 to 15+00	Linear footage from Ecologic's 2006 survey.

* Stationing from 2005 As-Built Plan.

R = Restoration
EI = Enhancement
EII = Enhancement II
S = Stabilization
PI = Priority I
PII = Priority II
PIII = Priority III
SS = Stream Bank Stabilization

Table II: Project Activity and Reporting History

Big Warrior Creek EEP Project Number 00412			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan	Unknown	Unknown	September 2002
Final Design – 90%	Unknown	Unknown	Unknown
Construction	Unknown	NA	November 2004
Permanent seed mix applied	Unknown	Unknown	Unknown
Live stakes and woody plants	Unknown	Unknown	Unknown
Final Walk Through	Unknown	Unknown	Unknown
Mitigation Plan/As-Built Report	Unknown	Unknown	March 2005
Year 1 Monitoring	October 2005	Unknown	April 2006
Year 2 Monitoring	Fall 2006	September 2006	December 2006
Year 3 Monitoring	Fall 2007	September 2007	November 2007
Year 4 Monitoring	Fall 2008	October 2008	December 2008
Year 5 Monitoring	Fall 2009	--	--

Table III: Project Contact Table

Big Warrior Creek EEP Project Number 00412	
Activity or Report	**Actual Completion or Delivery**
Designer Primary project design POC	Camp Dresser & McKee (CDM) 5400 Glenwood Ave, Suite 300 Raleigh, NC 27612 Kelly Boone 919-787-5620
Designer – Subcontractor Subcontractor POC	Biohabitats 15 W. Aylesbury Road Timonium, MD 21093 Ellen McClure 410-337-3659
Construction Contractor Construction contractor POC	Shamrock Environmental PO Box 14987 Greensboro, NC 27415 Mike Granson 336-375-1989
Planting Contractor Planting contractor POC	Seal Brothers Contracting 131 W Cleve Street Mt. Airy, NC 27030 Brian Seal 336-710-3560
Seeding Contractor Seeding contractor POC	Seal Brothers Contracting 131 W Cleve Street Mt. Airy, NC 27030 Brian Seal 336-710-3560

Seed Mix Sources	Unavailable
Nursery Stock Suppliers	Unavailable
2004 Monitoring Performers	Biohabitats 15 W. Aylesbury Road Timonium, MD 21093 Ellen McClure 410-337-3659
2005 Monitoring Performers	EcoLogic Associates, P.C. 4321-A South Elm-Eugene St. Greensboro, NC 27406 336-355-1108
2006 Monitoring Performers Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1100 Kathleen McKeithan 919-461-1597
2007 Monitoring Performers Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1100 Kathleen McKeithan 919-461-1597
2008 Monitoring Performers Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 919-461-1100 Kathleen McKeithan 919-461-1597

Table IV: Project Background Table

Big Warrior Creek EEP Project Number 00412	
Project County	Wilkes County
Drainage Area Big Warrior Creek Mountain Creek Unnamed Tributary	7.4 square miles 1.77 square miles 0.5 square miles
Drainage impervious cover estimate (%)	Estimated at <5%
Stream Order	3rd for Big Warrior Creek
	2nd for Mountain Creek and Unnamed Tributary
Physiographic Region	Piedmont/Foothills
Ecoregion	Northern Inner Piedmont (45e)
Rosgen Classification of As-Built	C

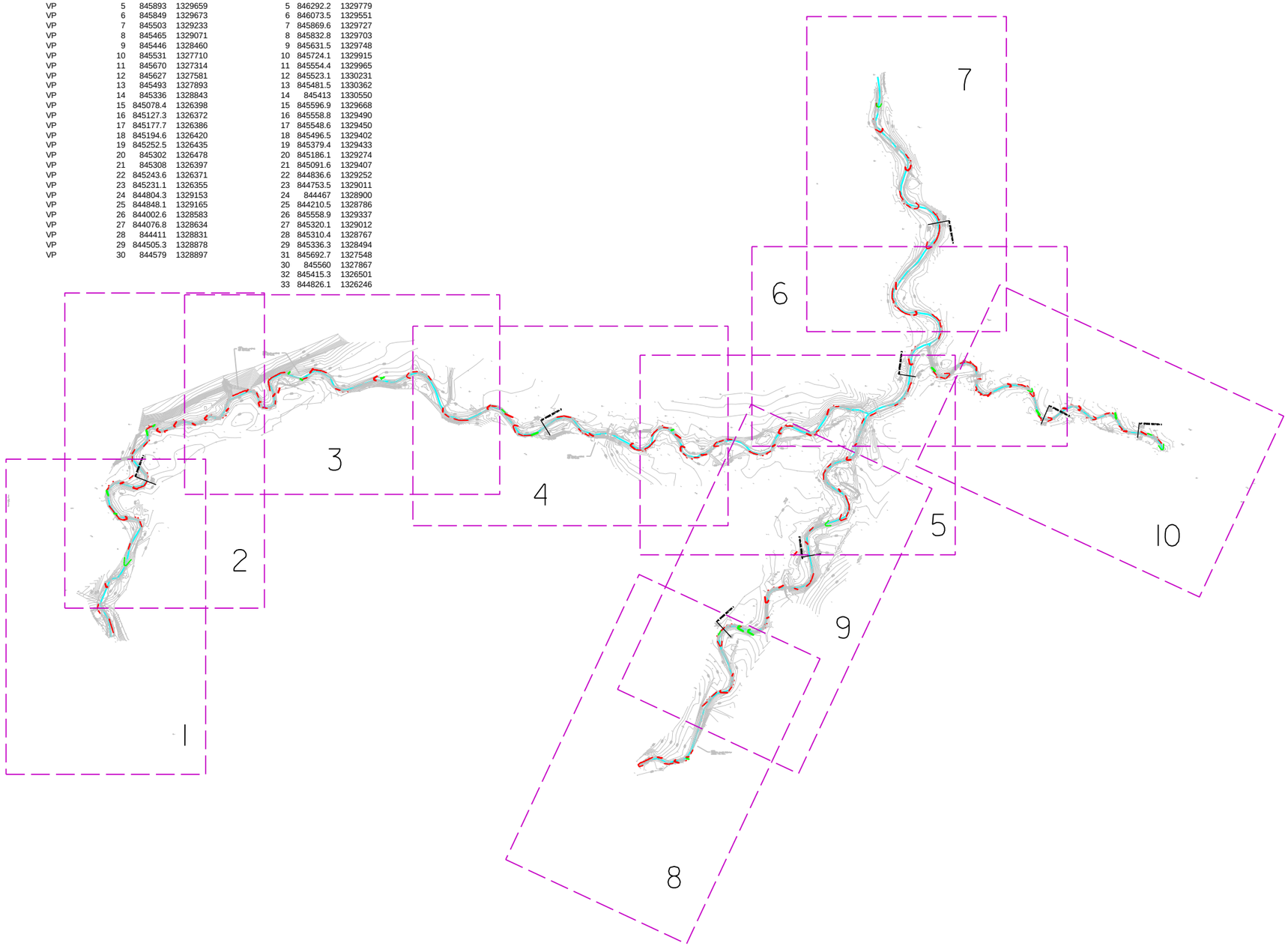
Dominant soil types	Toccoa sandy loam, Douge fine sandy loam
Reference site ID	Unknown. 4 sites evaluated: Mountain Tributary, Basin Creek, Joe's Creek, and Richland Creek
USGS HUC for Project	03040101
NCDWQ Sub-basin for Project	YAD01
NCDWQ classification for Project	Class C, Index no. 12-29-2-(1)
Any 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	NA
% of project easement fenced	75% - no cattle in upper reach

2.5 MONITORING PLAN VIEW

See Figure 2 for Monitoring Plan View.

Veg	Plots ID	Northing	Easting
VP	1	846695	1329477
VP	2	846596	1329584
VP	3	846351	1329638
VP	4	846273	1329696
VP	5	845893	1329659
VP	6	845849	1329673
VP	7	845503	1329233
VP	8	845465	1329071
VP	9	845446	1328460
VP	10	845531	1327710
VP	11	845670	1327314
VP	12	845627	1327581
VP	13	845493	1327893
VP	14	845336	1328843
VP	15	845078.4	1326398
VP	16	845127.3	1326372
VP	17	845177.7	1326386
VP	18	845194.6	1326420
VP	19	845252.5	1326435
VP	20	845302	1326478
VP	21	845308	1326397
VP	22	845243.6	1326371
VP	23	845231.1	1326355
VP	24	844804.3	1329153
VP	25	844848.1	1329165
VP	26	844002.6	1328583
VP	27	844076.8	1328634
VP	28	844411	1328831
VP	29	844505.3	1328878
VP	30	844579	1328897

Photo ID	Points Northing	Easting
1	846912.8	1329523
2	846712.5	1329464
3	846569.1	1329649
4	846372	1329627
5	846292.2	1329779
6	846073.5	1329551
7	845869.6	1329727
8	845832.8	1329703
9	845631.5	1329748
10	845724.1	1329915
11	845554.4	1329965
12	845523.1	1330231
13	845481.5	1330362
14	845413	1330550
15	845596.9	1329668
16	845558.8	1329490
17	845548.6	1329450
18	845496.5	1329402
19	845379.4	1329433
20	845186.1	1329274
21	845091.6	1329407
22	844836.6	1329252
23	844753.5	1329011
24	844467	1328900
25	844210.5	1328786
26	845558.9	1329337
27	845320.1	1329012
28	845310.4	1328767
29	845336.3	1328494
31	845692.7	1327548
30	845560	1327867
32	845415.3	1326501
33	844826.1	1326246



240 120 0 240 480

1" = 480'

REVISIONS

NO.	DATE

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PROJECT: BIG WARRIOR CREEK STREAM RESTORATION 2008 MONITORING REPORT

TITLE: KEY MAP

CLIENT: NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

Ecosystem Enhancement Program

FIGURE 2

DATE: OCT 2008

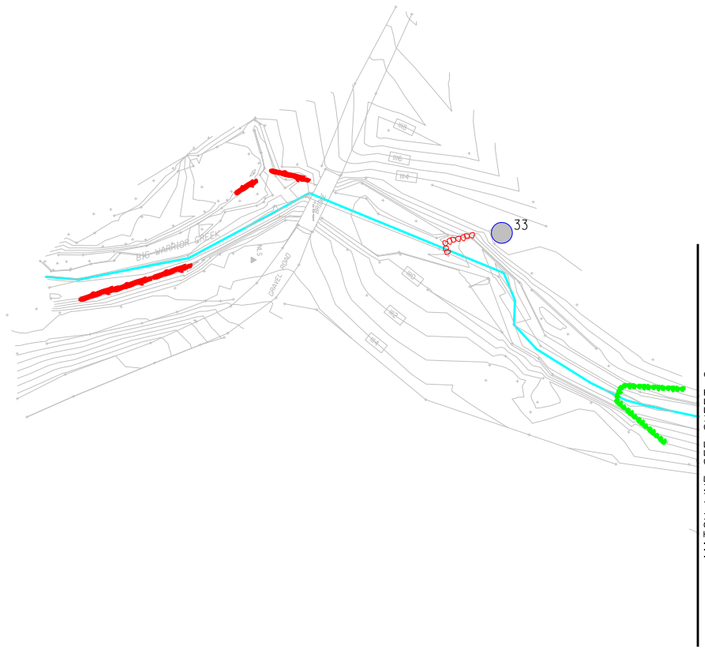
TECHNICIAN: EHJ

CHECKED BY: KM

MONITORING YEAR 4

EEP PROJECT NO. 00412

SHEET NO. 0



COLOR LEGEND FOR STRUCTURES:

SYMBOLS RED IN COLOR REPRESENT STRUCTURES AS BUILT AND SURVEYED

SYMBOLS GREEN IN COLOR REPRESENT STRUCTURES BUILT, BUT NOT SURVEY LOCATED

LEGEND FOR DRAWING

- ROCK CROSS VANE
- ROCK J-VANE
- LOG J-VANE
- ROCK VANE
- ROCK TOE PROTECTION
- ROOTWAD REVETMENT
- LOG TOE PROTECTION
- LOG VANE
- BRUSH PILE
- STANDING SNAG
- DOWNED LOG
- TS — TREE SAVE
- EXISTING SNAG TO REMAIN
- LIVE BRANCH LAYERING
- 32 — PHOTO PLOT
- VP 15 — VEG PLOT

40 30 0 40 80

1" = 80'

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TITLE: MONITORING PLAN VIEW

CLIENT: NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

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FIGURE 2

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MONITORING YEAR 4

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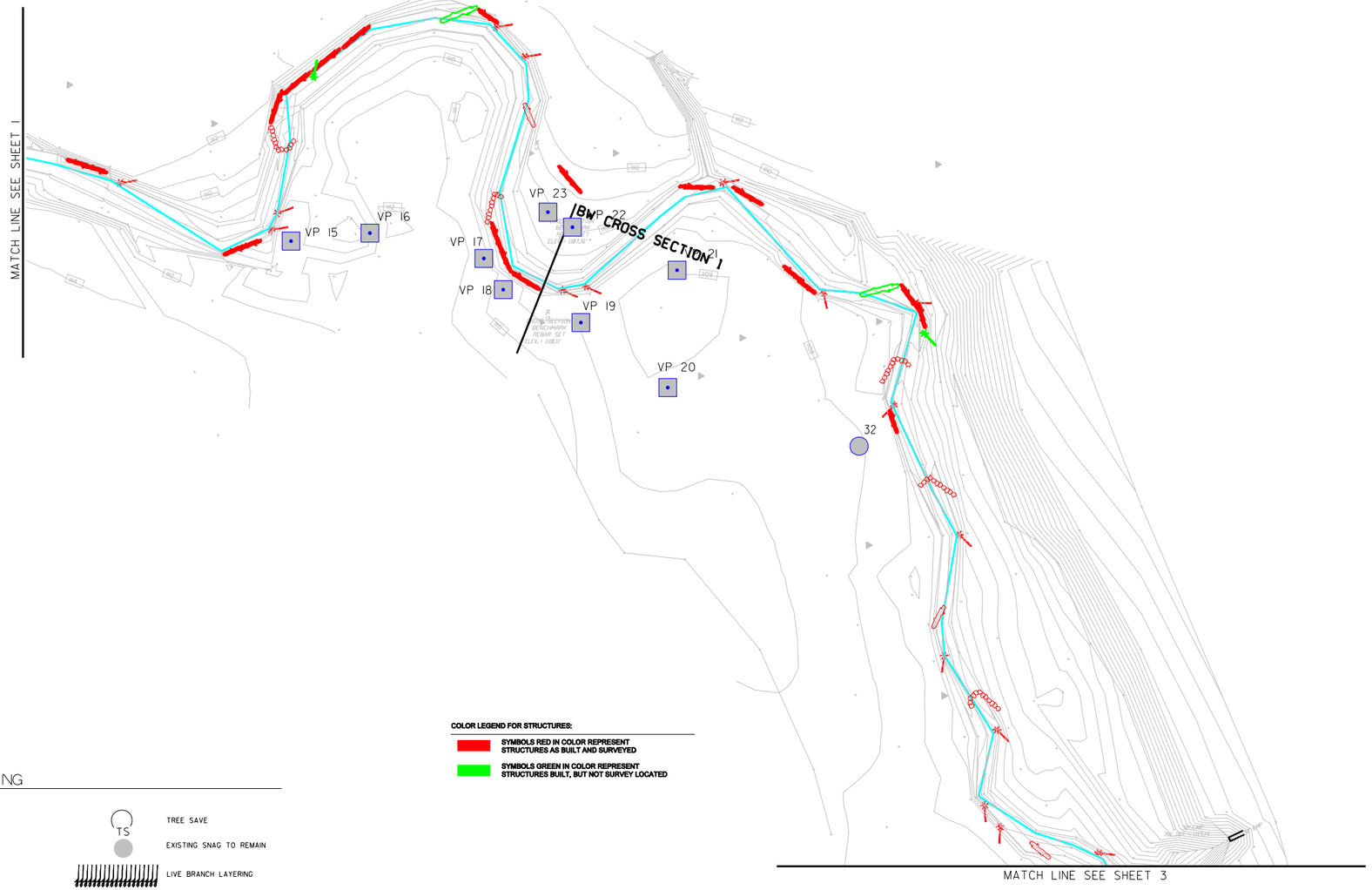
SHEET NO. 1



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SHEET NO. 2

NOTE:
LIVE BRANCH LAYERING
NOT INSTALLED.

NOTE:
LIVE BRANCH LAYERING
NOT INSTALLED.

MATCH LINE SEE SHEET 2

MATCH LINE SEE SHEET 4

VP 11

VP 12

VP 10

31

BIG WARRIOR CREEK

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FIGURE 2

DATE: OCT 2008

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MONITORING YEAR 4

EEP PROJECT NO. 00412

SHEET NO. 3

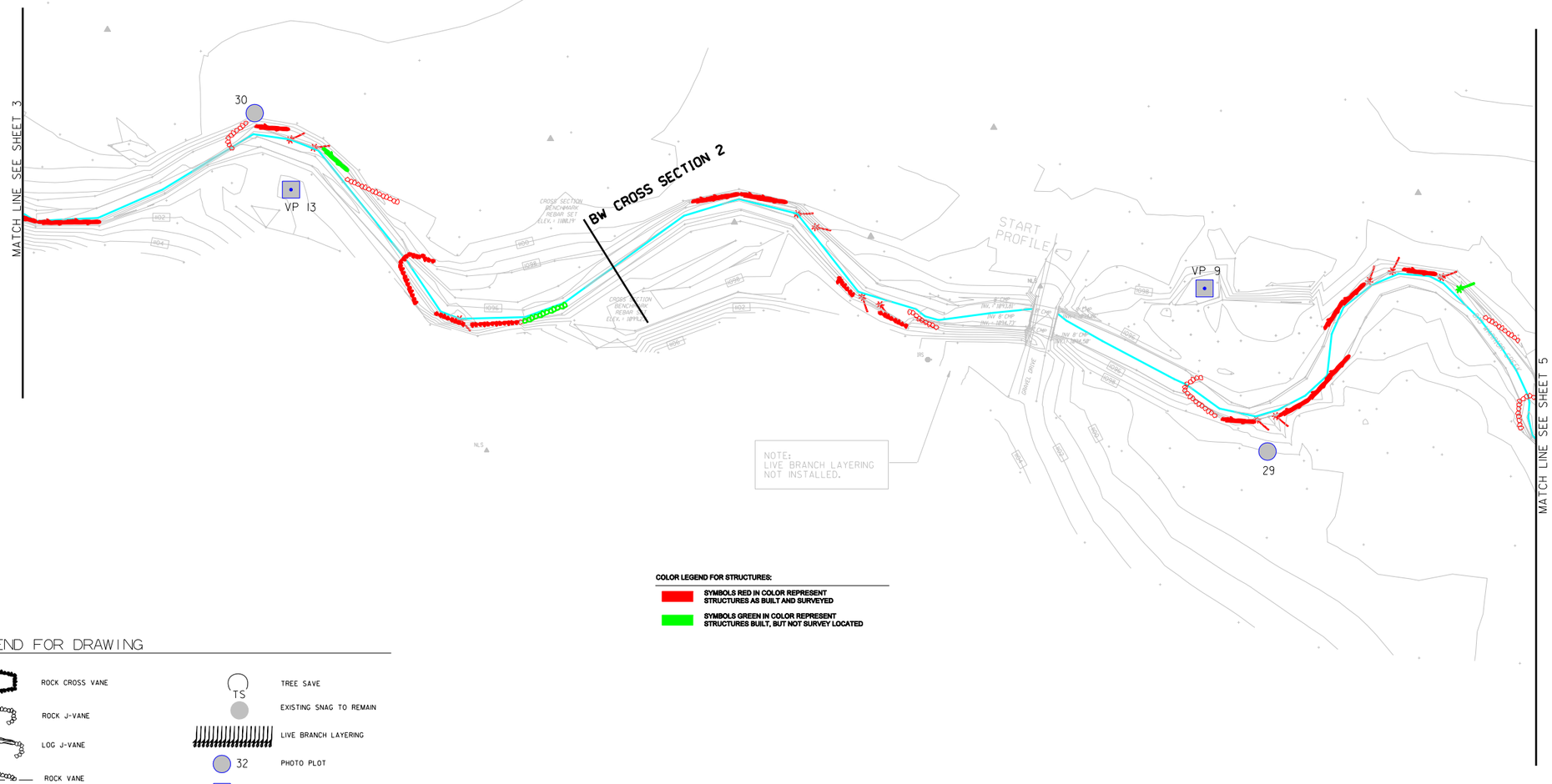

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FIGURE 2

DATE: OCT 2008

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MONITORING YEAR 4

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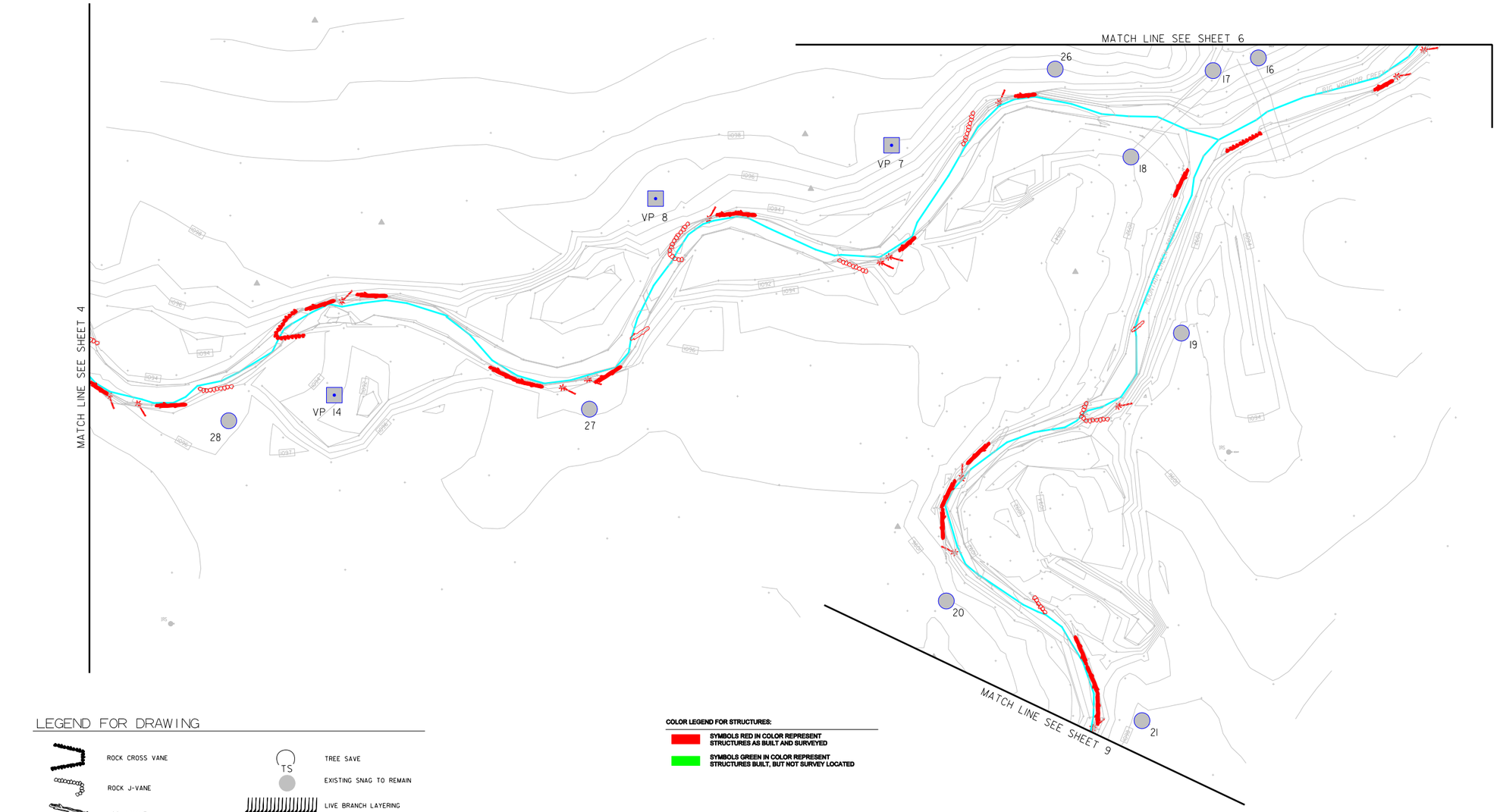

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FIGURE 2

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MONITORING YEAR 4

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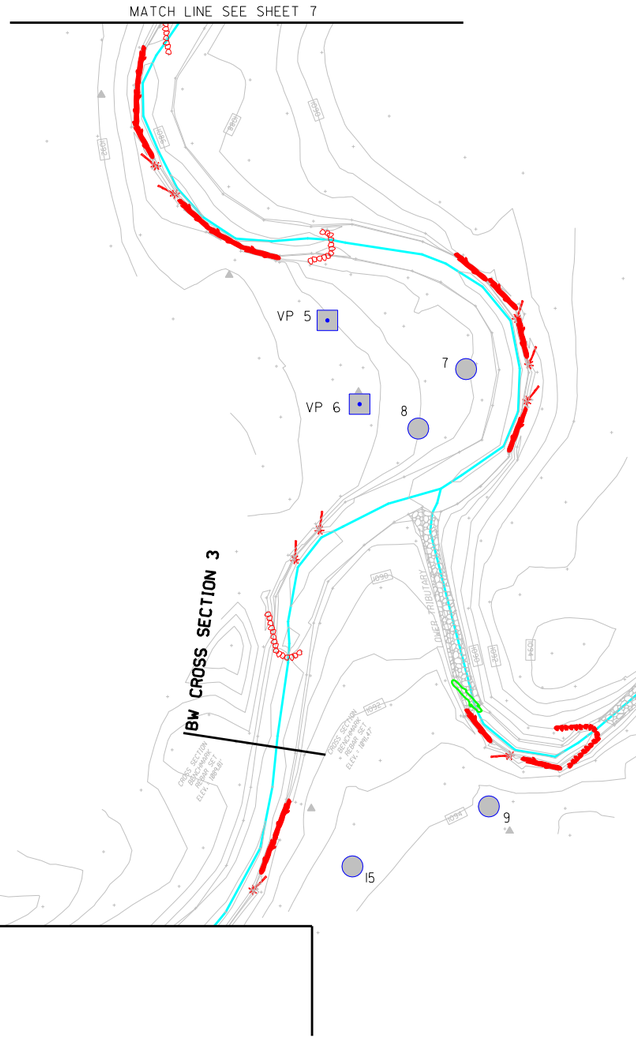

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- **SYMBOLS GREEN IN COLOR REPRESENT STRUCTURES BUILT, BUT NOT SURVEY LOCATED**

40 30 0 40 80

1" = 80'

REVISIONS

NO.	DATE

Prepared by
URS
URS Corporation – North Carolina
1600 Perimeter Park Drive
Morrisville, North Carolina 27560
TELEPHONE (919) 461-1100 FAX (919) 461-1415

PROJECT: BIG WARRIOR CREEK STREAM RESTORATION 2008 MONITORING REPORT

TITLE: MONITORING PLAN VIEW

CLIENT: NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

Ecosystem Enhancement Program

FIGURE 2

DATE: OCT 2008

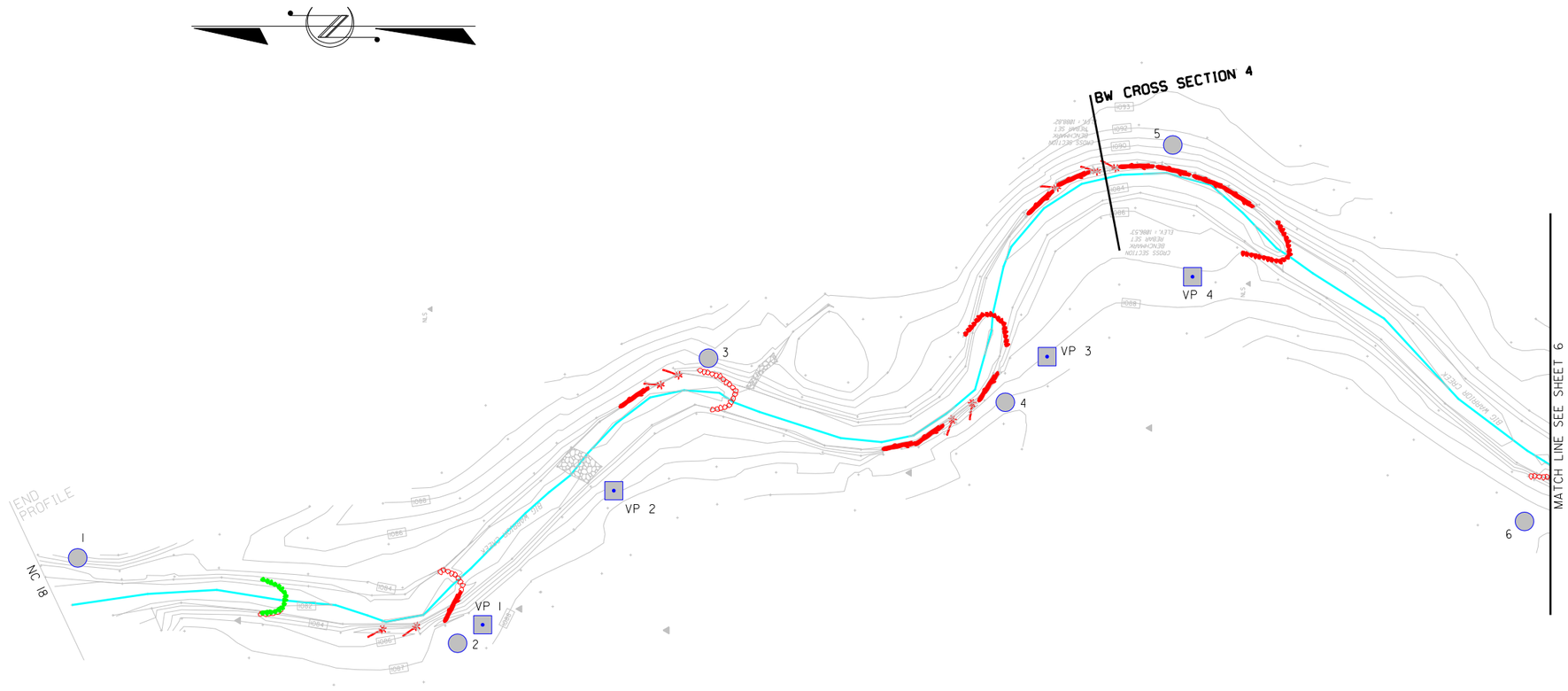
TECHNICIAN: EHJ

CHECKED BY: KM

MONITORING YEAR 4

EEP PROJECT NO. 00412

SHEET NO. 6



LEGEND FOR DRAWING

- ROCK CROSS VANE
- ROCK J-VANE
- LOG J-VANE
- ROCK VANE
- ROCK TOE PROTECTION
- ROOTWAD REVETMENT
- LOG TOE PROTECTION
- LOG VANE
- BRUSH PILE
- STANDING SNAG
- DOWNED LOG
- TS — TREE SAVE
- EXISTING SNAG TO REMAIN
- LIVE BRANCH LAYERING
- 32 — PHOTO PLOT
- VP 15 — VEG PLOT

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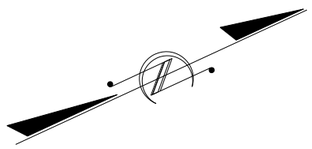

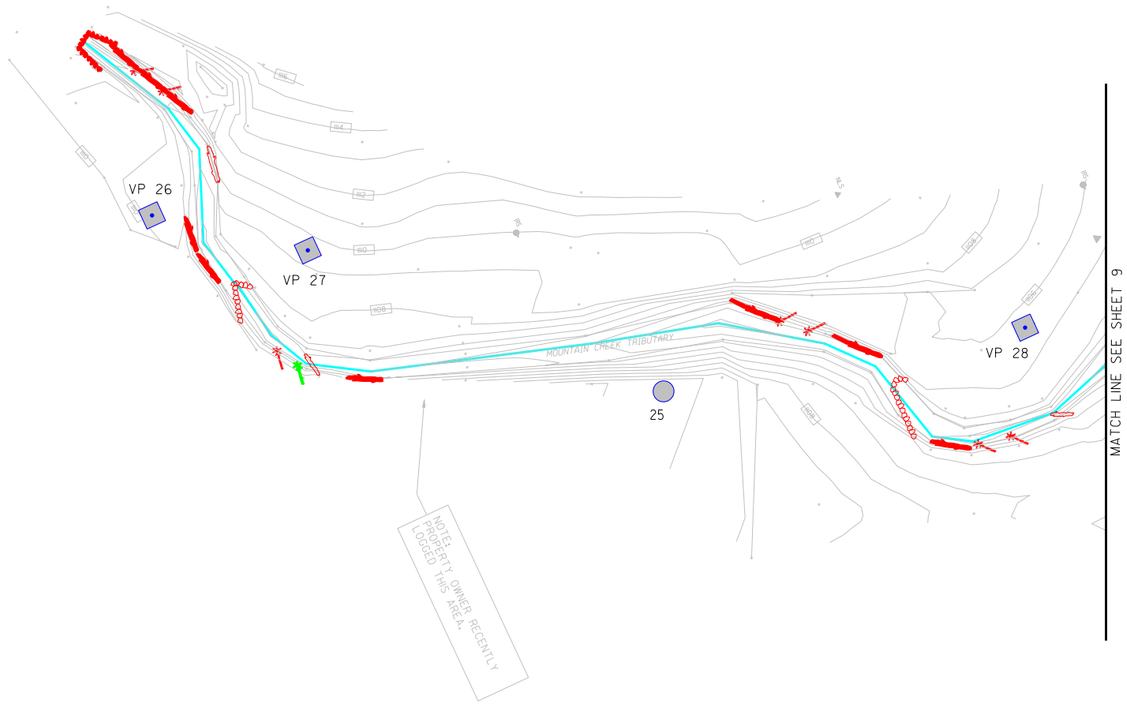

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MONITORING YEAR 4

EEP PROJECT NO. 00412

SHEET NO. 8

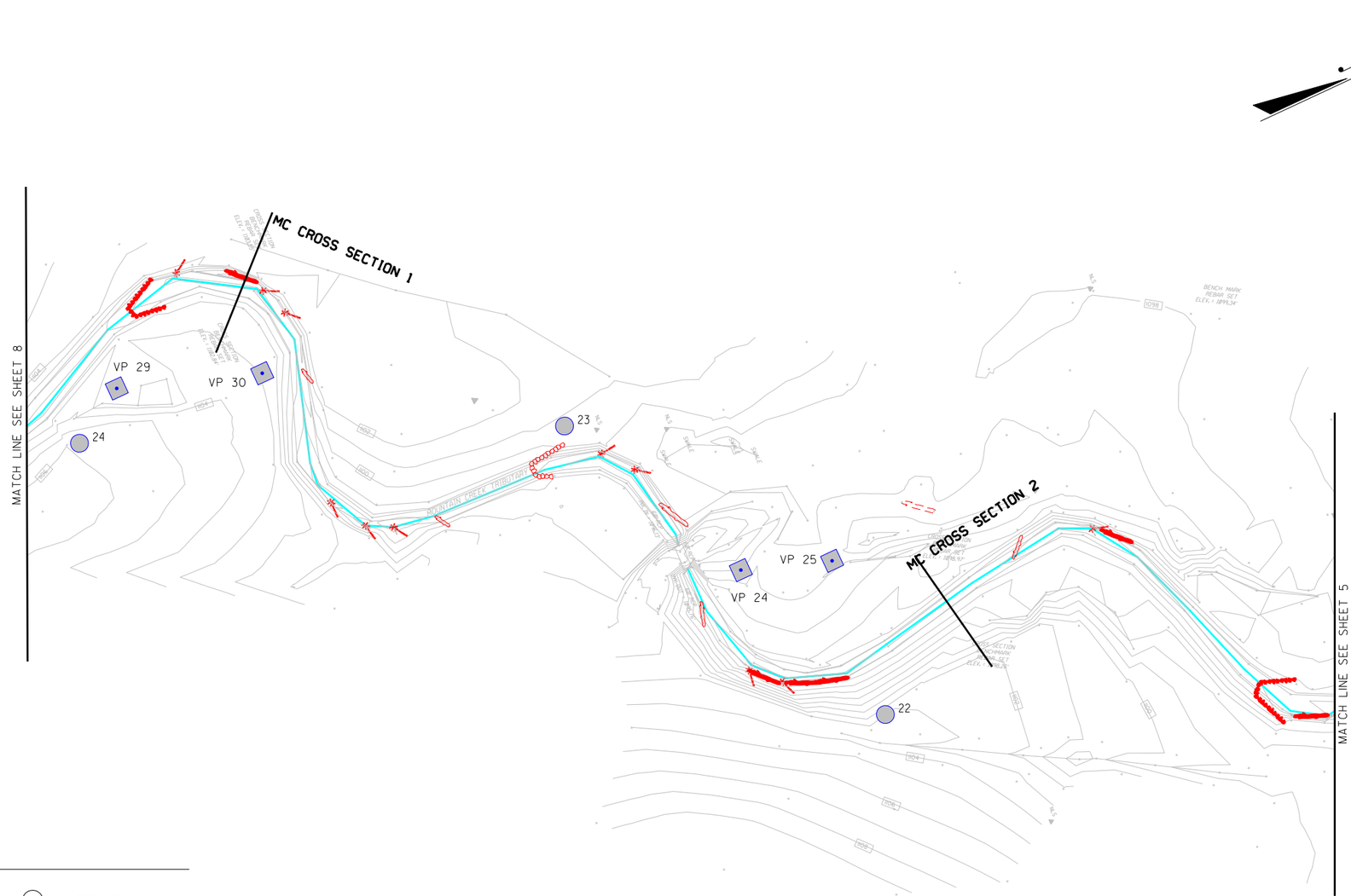

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FIGURE 2

DATE: OCT 2008

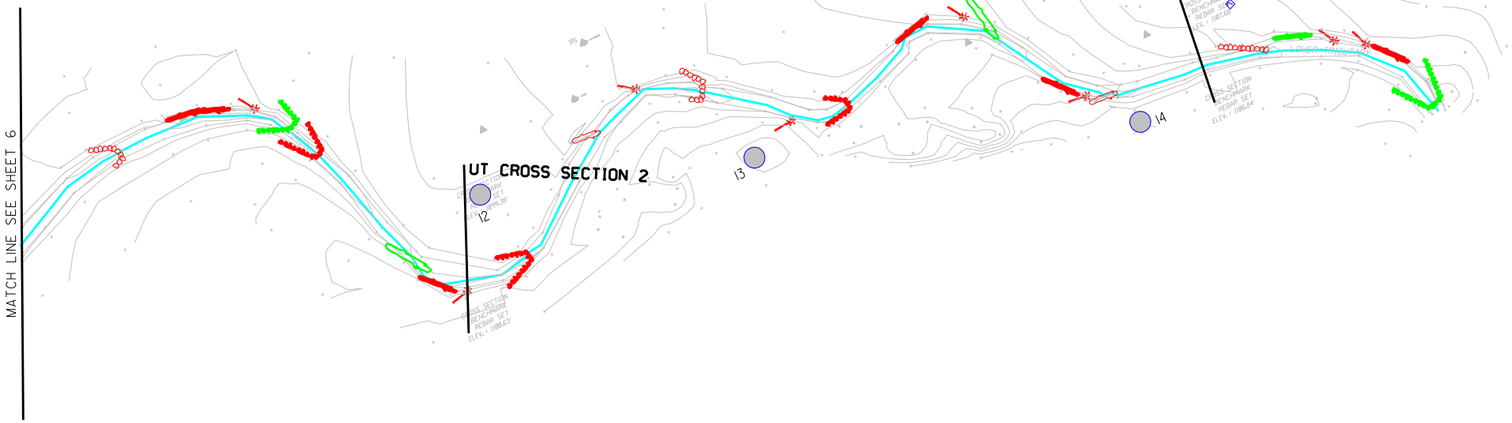
TECHNICIAN: EHJ

CHECKED BY: KM

MONITORING YEAR 4

EEP PROJECT NO. 00412

SHEET NO. 9



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MONITORING YEAR 4

EEP PROJECT NO. 00412

SHEET NO. 10

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 VEGETATION ASSESSMENT

Vegetation monitoring plot stem counts and photos are located in Appendices A-I and A-IV.

3.1.1 VEGETATION PROBLEM AREAS

The number of vegetative problem areas has decreased between 2007 (MY3) and 2008 (MY4), from 15 to 11, respectively. None of the 11 problem areas observed in 2008 are areas of high concern. However, URS recommends that areas dominated by kudzu receive treatment. Vegetative problem areas are listed in Tables A6a and A6b in Appendix A-I.

The presence and abundance of kudzu along Big Warrior Creek appears to have increased dramatically since 2006 (MY2) monitoring. Five notable areas are shown as problem areas. However, small patches of kudzu were observed along the majority of Big Warrior Creek. Because of the highly aggressive growth habit of kudzu, it is expected to continue expanding across the site and endangering the planted vegetation if it is not treated. American hogpeanut is also growing very aggressively along the Unnamed Tributary and portions of the other reaches. While this vine is a native species, it is a vigorous climber and may threaten the survivability of planted stems. Small Chinese privet were observed along the mainstem of Big Warrior Creek during the 2006 (MY2), 2007 (MY3), and 2008 (MY4) monitoring periods. While these individuals do not pose an immediate threat, their presence should be noted and monitored.

Other problem areas include bare banks and floodplains along the mainstem and Mountain Creek. These problems are likely resulting from poor site soils or soils that were compacted during construction. URS recommends soil amendments and reseeding in these areas. No problem areas were documented along the Unnamed Tributary.

Vegetative Problem Area Photos are located in Appendix A-II.

3.1.2 VEGETATION CURRENT CONDITION PLAN VIEW

The Vegetation Current Condition Plan View is located in Appendix A-III.

3.2 STREAM ASSESSMENT

3.2.1 PROCEDURAL ITEMS

3.2.1.1 Morphometric Criteria

Dimension and profile were sampled per the 2003 Stream Mitigation Guidelines (USACE 2003) as follows:

Dimension: Eight permanent cross sections were surveyed. Two are located on Mountain Creek (one riffle and one pool), two on the Unnamed Tributary (one riffle and one pool), and four on Big Warrior Creek (two riffles and two pools). The survey includes points measured at all breaks in slope, including top of bank, bankfull, and thalweg.

Profile: A total of 7,545 linear feet of longitudinal profile was surveyed, broken into three segments as follows: 2,574 linear feet on Mountain Creek, 1,503 linear feet on the Unnamed Tributary, and 3,468

linear feet on Big Warrior Creek. Survey points include the top of bank, the beginning of each stream feature such as riffle or pool and the maximum pool depth.

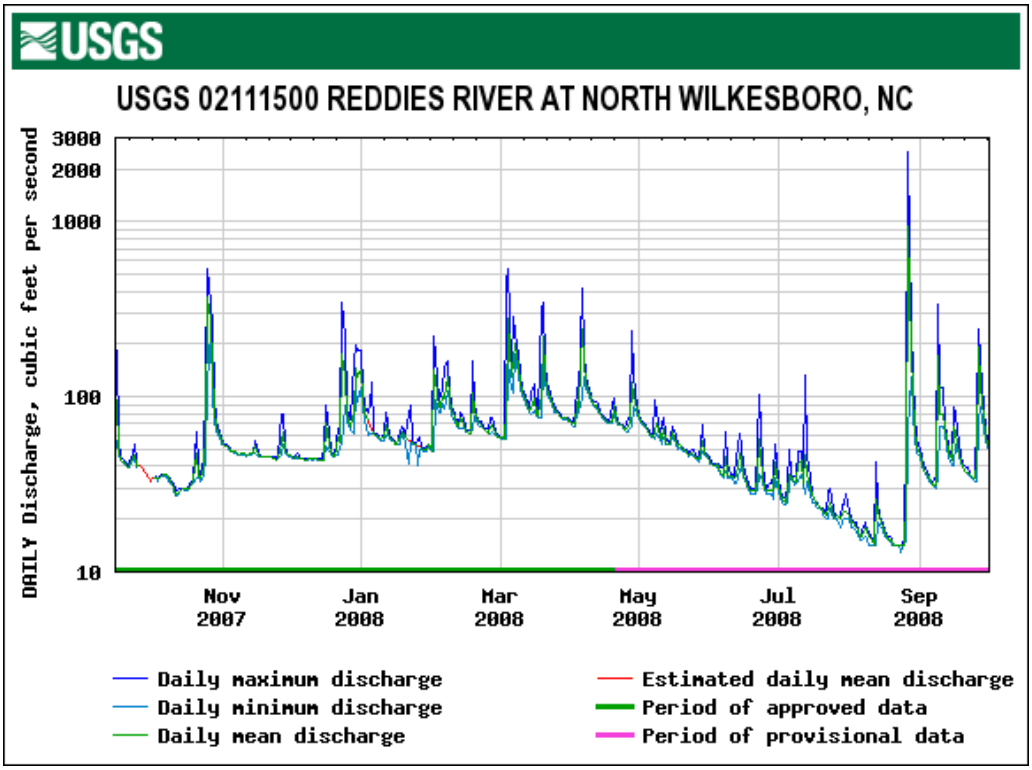
3.2.1.2 Hydrologic Criteria

No crest gages are installed at this site to document bankfull events. Therefore, potential occurrence was extrapolated based on USGS stream gage discharge data for the Reddies River at North Wilkesboro, NC (USGS 2008). The USGS gage plot is shown below. The gage is located about 10 miles from the project site in the same watershed and has a drainage area of 89 square miles. An estimate of the number of bankfull events in 2008 was made by comparing the stream discharges from the USGS data in cubic feet per second (cfs) against the bankfull discharge estimated from the drainage area on the Rural Piedmont Regional Curve. According to the regional curve, a bankfull event occurs on a stream with an 89-square mile drainage area when the discharge is about 2,250 cfs. Past bankfull events (2006 and 2007) are also shown in the table. This discharge was exceeded in August 2008, indicating that the Reddies River has had one bankfull event between September 15, 2007 and October 1, 2008. Big Warrior Creek is in close proximity to the Reddies River, and it is likely that the project site also experienced a bankfull event in August 2008.

Table V: Verification of Bankfull Events

Big Warrior Creek EEP Project Number 00412		
Date of Data Collection	Date of Occurrence	Method
10/19/2006	Late June 2006	Proximal USGS Gage Resource
9/13/2007	January 1, 2007	Proximal USGS Gage Resource
10/27/08	Late August 2008	Proximal USGS Gage Resource

Figure 3: USGS Stream Gage Discharge Data



3.2.2 STREAM PROBLEM AREAS

There were a total of 37 stream problem areas identified for the project in 2007 (MY3). Eighteen were removed during the 2008 Initial Assessment, leaving 19 problem areas in 2008 (MY4). Nine are present on Big Warrior Creek, and 10 on Mountain Creek. No problem areas were identified on the Unnamed Tributary.

The stream problem areas consisted primarily of bank erosion, structure failure, and bed aggradation. The structure at the beginning of Mountain Creek, MCPA1 continues to be a problem area. Water is piping behind and around the structure, and it is constructed at a large elevation drop. If this structure fails, it is likely to induce a headcut that will work up the unrestored section of Mountain Creek. However, there have been no significant changes between 2007 (MY3) and 2008 (MY4) at this structure.

A single beaver dam was observed on Big Warrior Creek during 2008 (MY4) monitoring at station 67+60. The dam does not appear to be actively maintained. Three additional beaver dams were observed during 2007 (MY3) monitoring at station 22+40 and between stations 20+00 and 25+00 and 40+00 and 50+00. These three beaver dams are no longer present.

The Stream Current Condition Plan View is located in Appendix B-I, Problem Area data tables are located in Appendix B-II, and Problem Area Photos are located in Appendix B-III.

3.2.3 FIXED PHOTO STATION PHOTOS

Stream Photo Station Photos are located in Appendix B-IV.

3.2.4 STABILITY ASSESSMENT

Table VI: Categorical Stream Feature Visual Stability Assessment (% Functioning)

Big Warrior Creek EEP Project Number 00412						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffle	100	N/A	100	100	100	
B. Pool	100	N/A	100	100	100	
C. Thalweg	100	N/A	96	96	96	
D. Meanders	100	N/A	98	98	98	
E. Bed General	100	N/A	93	93	99	
F. Bank Condition	100	N/A	96	98	97	
G. Vanes / J Hooks	100	N/A	72	75	93	
H. Wads and Boulders	100	N/A	70	73	85	
Mountain Creek EEP Project Number 00412						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffle	100	N/A	100	100	100	
B. Pool	100	N/A	100	100	100	
C. Thalweg	100	N/A	100	100	100	
D. Meanders	100	N/A	99	99	99	
E. Bed General	100	N/A	99	99	99	
F. Bank Condition	100	N/A	80	85	88	

G. Vanes / J Hooks	100	N/A	98	98	98	
H. Wads and Boulders	100	N/A	95	95	95	
Unnamed Tributary EEP Project Number 00412						
Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffle	100	N/A	100	100	100	
B. Pool	100	N/A	100	100	100	
C. Thalweg	100	N/A	100	100	100	
D. Meanders	100	N/A	100	100	100	
E. Bed General	100	N/A	100	100	100	
F. Bank Condition	100	N/A	100	100	100	
G. Vanes / J Hooks	100	N/A	100	100	100	
H. Wads and Boulders	100	N/A	100	100	100	

3.2.5 QUANTITATIVE MEASURES TABLES (MORPHOLOGY AND HYDROLOGY)

As-Built data were not provided for this project. Pre-Existing Condition, Project Reference Stream, and Design data were derived from the 2002 Restoration Plan (CDM 2002). A total of four reference sites were used in the design of the Big Warrior Creek Stream Restoration Project. An upstream portion of Mountain Creek was used as the reference for Mountain Creek and the Unnamed Tributary. Basin Creek, Joe's Creek, and Richland Creek were all used for the mainstem. However, Basin Creek was the most influential in the design. Data for Basin Creek and Mountain Creek are used for reference stream data in Table VII.

Table VII: Baseline Morphology and Hydraulic Summary

Big Warrior Creek Big Warrior Creek EEP Project Number 00412																		
Parameter	**USGS Gage Data***			**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream**			**Design**			**As-Built**		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	--	--	--	17	52	30	22.2	39.3	29.5	29.5	36.9	33.2	23	31	--	--	--	--
Floodprone Width (ft)	--	--	--	--	--	--	14.6	>80	50	--	--	--	>51	>68	--	--	--	--
BF Cross Sectional Area (ft^2)	--	--	--	45	170	80	45.0	76.2	56	64.9	71.9	68.4	29.2	53.6	--	--	--	--
BF Mean Depth (ft)	--	--	--	--	--	--	1.7	2.0	1.9	1.9	2.2	2.1	1.3	1.7	--	--	--	--
BF Max Depth (ft)	--	--	--	1.9	4.0	3.0	2.3	3.7	3.2	3.0	3.2	3.1	1.7	2.3	--	--	--	--
Width/Depth Ratio	--	--	--	--	--	--	10.5	32.8	15.3	13.4	19.4	16.4	--	--	18	--	--	--
Entrenchment Ratio	--	--	--	--	--	--	1.5	2.0	>1.8	--	--	8.9	--	--	>2.2	--	--	--
Bank Height Ratio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pattern																		
Channel Beltwidth (ft)	--	--	--	--	--	--	70	200	--	59	75	64.7	50	180	--	--	--	--
Radius of Curvature (ft)	--	--	--	--	--	--	17.8	71.1	--	40.1	69.3	51.2	60	110	--	--	--	--
Meander Wavelength (ft)	--	--	--	--	--	--	150	450	--	--	--	350	230	430	--	--	--	--
Meander Width Ratio	--	--	--	--	--	--	4.4	18.1	--	--	--	10.5	8.1	19.6	--	--	--	--
Profile																		
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Spacing (ft)	--	--	--	--	--	--	60	182.3	101.7	271	334	305	130	250	--	--	--	--
Substrate																		
D50 (mm)	--	--	--	--	--	--	10	18	--	--	--	--	--	--	--	--	--	--
D84 (mm)	--	--	--	--	--	--	40	60	--	--	--	--	--	--	--	--	--	--
Additional Reach Parameters																		
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Channel Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sinuosity	--	--	--	--	--	--	--	--	1.3	--	--	--	--	--	1.2	--	--	--
Water Surface Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0	--	--	0.0019	--	--	0.0	--	--	--
BF Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0	--	--	0.014	--	--	0.0053	--	--	--
Rosgen Classification	--	--	--	--	--	--	--	--	Bc4, F4, C4	--	--	C4	--	--	C4	--	--	--

* USGS Gage Data are unavailable for this project.

Table VII: Baseline Morphology and Hydraulic Summary (cont.)

Big Warrior Creek Mountain Creek EEP Project Number 00412																		
Parameter	**USGS Gage Data***			**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream**			**Design**			**As-Built**		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	--	--	--	17	60	30	16.8	22.0	19.4	22.0	25.0	23.9	--	--	21	--	--	--
Floodprone Width (ft)	--	--	--	--	--	--	--	--	>50	--	--	>50	--	--	>46	--	--	--
BF Cross Sectional Area (ft^2)	--	--	--	9	30	18	26.7	27.2	27	28.6	30.1	29.4	--	--	26.2	--	--	--
BF Mean Depth (ft)	--	--	--	1.1	3.0	1.9	1.2	1.6	1.4	1.2	1.3	1.2	--	--	1.3	--	--	--
BF Max Depth (ft)	--	--	--	--	--	--	2.1	2.3	2.2	1.5	2.6	1.9	--	--	1.7	--	--	--
Width/Depth Ratio	--	--	--	--	--	--	10.5	18.3	13.9	16.9	20.8	19.9	--	--	17	--	--	--
Entrenchment Ratio	--	--	--	--	--	--	--	--	>2.3	--	--	>1.1	--	--	>2.2	--	--	--
Bank Height Ratio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pattern																		
Channel Beltwidth (ft)	--	--	--	--	--	--	50	100	--	--	--	49	70	220	--	--	--	--
Radius of Curvature (ft)	--	--	--	--	--	--	15	20	--	16.9	18.0	17.5	40	60	--	--	--	--
Meander Wavelength (ft)	--	--	--	--	--	--	70	180	--	--	--	140	250	350	--	--	--	--
Meander Width Ratio	--	--	--	--	--	--	3.6	9.3	--	--	--	5.9	11.9	16.7	--	--	--	--
Profile																		
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Spacing (ft)	--	--	--	--	--	--	21.5	91.0	48.1	51.2	75.8	63.5	80	220	--	--	--	--
Substrate																		
D50 (mm)	--	--	--	--	--	--	--	--	18	--	--	--	--	--	--	--	--	--
D84 (mm)	--	--	--	--	--	--	--	--	50	--	--	--	--	--	--	--	--	--
Additional Reach Parameters																		
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Channel Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sinuosity	--	--	--	--	--	--	--	--	1.3	--	--	1.4	--	--	1.3	--	--	--
Water Surface Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0	--	--	0.0	--	--	0.0	--	--	--
BF Slope (ft/ft)	--	--	--	--	--	--	--	--	0.011	--	--	0.01	--	--	0.019	--	--	--
Rosgen Classification	--	--	--	--	--	--	--	--	C4, F4	--	--	C4	--	--	C4	--	--	--

* USGS Gage Data are unavailable for this project.

Table VII: Baseline Morphology and Hydraulic Summary (cont.)

Big Warrior Creek Unnamed Tributary EEP Project Number 00412																		
Parameter	**USGS Gage Data***			**Regional Curve Interval**			**Pre-Existing Condition**			**Project Reference Stream**			**Design**			**As-Built**		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	--	--	--	6	28	14	7.1	12.0	9.6	22.0	25.0	23.9	--	--	15	--	--	--
Floodprone Width (ft)	--	--	--	--	--	--	12	14.6	--	--	--	>50	--	--	>33	--	--	--
BF Cross Sectional Area (ft^2)	--	--	--	5.5	20	11	9.6	10.0	9.8	28.6	30.1	29.4	--	--	12.9	--	--	--
BF Mean Depth (ft)	--	--	--	0.8	2.0	1.5	0.8	1.4	1.1	1.2	1.3	1.2	--	--	0.9	--	--	--
BF Max Depth (ft)	--	--	--	--	--	--	1.4	1.9	1.7	1.5	2.6	1.9	--	--	1.2	--	--	--
Width/Depth Ratio	--	--	--	--	--	--	5.1	15.8	8.7	16.9	20.8	19.9	--	--	17	--	--	--
Entrenchment Ratio	--	--	--	--	--	--	1.2	1.7	1.5	--	--	>1.1	--	--	>2.2	--	--	--
Bank Height Ratio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic Radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pattern																		
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	50	--	--	49	60	100	--	--	--	--
Radius of Curvature (ft)	--	--	--	--	--	--	11.1	40	--	16.9	18.0	17.5	30	50	--	--	--	--
Meander Wavelength (ft)	--	--	--	--	--	--	60	80	70	--	--	140	150	215	--	--	--	--
Meander Width Ratio	--	--	--	--	--	--	5.0	11.3	7.3	--	--	5.9	10.0	14.3	--	--	--	--
Profile																		
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Spacing (ft)	--	--	--	--	--	--	18	61	28.0	51.2	75.8	63.5	70	160	--	--	--	--
Substrate																		
D50 (mm)	--	--	--	--	--	--	--	--	2.0	--	--	--	--	--	--	--	--	--
D84 (mm)	--	--	--	--	--	--	--	--	60	--	--	--	--	--	--	--	--	--
Additional Reach Parameters																		
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Channel Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sinuosity	--	--	--	--	--	--	--	--	1.2	--	--	1.4	--	--	1.4	--	--	--
Water Surface Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0	--	--	0.0	--	--	0.0	--	--	--
BF Slope (ft/ft)	--	--	--	--	--	--	--	--	0.019	--	--	0.01	--	--	0.011	--	--	--
Rosgen Classification	--	--	--	--	--	--	--	--	Bc4, F4	--	--	C4	--	--	C4	--	--	--

* USGS Gage Data are unavailable for this project.

Table VIII: Morphology and Hydraulic Monitoring Summary

Big Warrior Creek Big Warrior Creek EEP Project Number 00412																				
Parameter	Cross Section 1 Pool					Cross Section 2 Riffle					Cross Section 3 Riffle					Cross Section 4 Pool				
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	35.3	13.9	14.5	13.3		23	23.8	26.7	23.9		24.2	27.5	22.6	26.0		22.6	25.9	19.1	20.2	
Floodprone Width (ft)	99	>65	>65	>65		41.4	>55	>55	>55		31.6	>60	>60	>60		40.5	>60	>60	>60	
BF Cross Sectional Area (ft^2)	48.3	12.4	15.2	15.3		33.3	34.4	47	31.8		30	39.3	31.8	35.8		36.2	36.8	36.4	39.3	
BF Mean Depth	1.4	0.9	1.0	1.2		1.5	1.4	1.8	1.3		1.2	1.4	1.4	1.4		1.6	1.4	1.9	1.9	
BF Max Depth	3.2	1.6	2.1	2.1		2.5	2.5	2.8	2.1		1.8	2.1	1.8	2.1		3.1	3.1	2.9	3.2	
Width/Depth Ratio	25.8	15.5	13.9	11.5		15.9	16.5	15.2	17.9		19.6	19.2	16.1	18.8		14.1	18.2	10.1	10.4	
Entrenchment Ratio	2.8	>4.7	>4.5	>4.9		1.8	>2.3	>2.1	>2.3		1.3	>2.2	>2.7	>2.3		1.8	>2.3	>3.1	>3.0	
Bank Height Ratio	N/A	1.0	1.0	1.0		N/A	1.0	1.0	1.0		N/A	1.0	1.0	1.0		N/A	1.0	1.0	1.0	
Wetted Perimeter (ft)	36.5	15.2	15.8	14.9		24.7	26.0	28.2	25.1		24.8	28.6	23.6	26.6		23.9	27.3	20.4	21.8	
Hydraulic radius (ft)	1.3	0.8	1.0	1.0		1.4	1.3	1.7	1.3		1.2	1.4	1.4	1.3		1.5	1.3	1.8	1.8	
Substrate*																				
d50 (mm)	0.45	2.8	0.9	0.8		11.8	26	6	19		0.83	36	1.2	8		0.84	0.93	0.46	0.53	
d84 (mm)	1.5	25	16	8		39.4	82	36	64		1.91	110	10	18		8.83	12	1.5	4.2	

* The d50 and d84 for MY2 are not comparable to the MY1, MY3, and MY4 data because different methods were used for the pebble count.

Table VIII: Morphology and Hydraulic Monitoring Summary (cont.)

Big Warrior Creek Big Warrior Creek EEP Project Number 00412															
Parameter	MY1			MY2			MY3			MY4			MY5		
Pattern	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Channel Beltwidth (ft)	--	--	--	--	--	--	40	120	80	60	250	123			
Radius of Curvature (ft)	--	--	--	28	76	52	40	160	80	45	120	67			
Meander Wavelength (ft)	--	--	--	--	--	--	140	320	240	120	500	321			
Meander Width Ratio	--	--	--	--	--	--	1.5	4.5	3.0	2.4	10.0	4.9			
Profile															
Riffle Length (ft)	34	166	54	11	185	49	12	187	43.5	18	101.2	56.3			
Riffle Slope (ft/ft)	0.004	0.017	0.008	0.005	0. 026	0.010	0.004	0.072	0.019	0.001	0.022	0.012			
Pool Length (ft)	13	200	70.5	12	259	77	6	152.4	44.5	5	273.7	90.5			
Pool Spacing (ft)	37.9	397	119	16	453	132	24	350.4	94.2	40.8	405.5	166.5			
Additional Reach Parameters															
Valley Length (ft)	--	--	--	--	5200	--	--	5200	--	--	5200	--			
Channel Length (ft)*	--	7021	--	--	7185	--	--	7185	--	--	7185	--			
Sinuosity	--	--	--	--	1.38	--	--	1.38	--	--	1.38	--			
Water Surface Slope (ft/ft)	--	0.0041	--	--	0.0032	--	--	0.0038	--	--	0.0038	--			
BF Slope (ft/ft)	--	0.0041	--	--	0.0034	--	--	0.0041	--	--	0.0041	--			
Rosgen Classification	--	C/B/F	--	--	C4	--	--	C4	--	--	C4	--			

*Channel length derived from Ecologic's 2006 survey.

Table VIII: Morphology and Hydraulic Monitoring Summary (cont.)

Big Warrior Creek Mountain Creek EEP Project Number 00412										
Parameter	Cross Section 1 Pool					Cross Section 2 Riffle				
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	26.7	18.8	18.2	19.7		13.1	15.8	15.4	16.0	
Floodprone Width (ft)	56	>45	>45	>45		45.8	>45	>45	>45	
BF Cross Sectional Area (ft^2)	45.2	28.9	28.1	30.2		17.6	24.2	24.1	23.8	
BF Mean Depth	1.7	1.5	1.5	1.5		1.3	1.5	1.6	1.5	
BF Max Depth	3.4	2.8	2.5	2.8		1.9	2.3	2.5	2.5	
Width/Depth Ratio	15.9	12.2	11.8	12.9		9.76	10.3	9.9	10.8	
Entrenchment Ratio	2.1	>2.4	>2.5	>2.3		3.5	>2.8	>2.9	>2.8	
Bank Height Ratio	N/A	1.0	1.0	1.1		N/A	1.0	1.0	1.0	
Wetted Perimeter (ft)	28.4	20.0	19.5	21.3		14.1	17.0	16.5	17.2	
Hydraulic radius (ft)	1.6	1.4	1.4	1.4		1.3	1.4	1.5	1.4	
Substrate*										
d50 (mm)	2.36	0.41	2	22		6.85	23	1.8	2	
d84 (mm)	10.5	17	20	47		16.4	69	28	57	

* The d50 and d84 for MY2 are not comparable to the MY1, MY3, and MY4 data because different methods were used for the pebble count.

Table VIII: Morphology and Hydraulic Monitoring Summary (cont.)

Big Warrior Creek Mountain Creek EEP Project Number 00412															
Parameter	MY1			MY2			MY3			MY4			MY5		
Pattern	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Channel Beltwidth (ft)	84	180	147.5	--	--	--	50	160	80	80	140	112			
Radius of Curvature (ft)	40	70	50	--	--	--	70	140	100	32	65	54			
Meander Wavelength (ft)	140	300	200	--	--	--	240	360	280	260	400	266			
Meander Width Ratio	5.2	11.2	7.5	--	--	--	3.2	10.4	5.2	5.0	8.8	7.0			
Profile															
Riffle Length (ft)	9.3	16.7	47	6	167	37	6.5	228	41.9	3.3	217.6	50.8			
Riffle Slope (ft/ft)	0.009	0.055	0.027	0.0034	0.063	0.023	0	0.052	0.020	0.002	0.033	0.014			
Pool Length (ft)	12	85	38	8	136	38	4	66.4	31.9	14.6	59	31.3			
Pool Spacing (ft)	22	208	75	16	187	84	15.4	351.5	87.5	25.4	300.1	102.8			
Additional Reach Parameters															
Valley Length (ft)	--	1820	--	--	--	1820	--	--	1820	--	--	1820			
Channel Length (ft)	--	2373	--	--	--	2352	--	--	2361	--	--	2574			
Sinuosity	--	1.3	--	--	--	1.3	--	--	1.3	--	--	1.4			
Water Surface Slope (ft/ft)	--	0.009	--	--	--	0.008	--	--	0.009	--	--	0.008			
BF Slope (ft/ft)	--	0.009	--	--	--	0.008	--	--	0.009	--	--	0.008			
Rosgen Classification	--	B	--	--	--	C4	--	--	E4	--	--	E4			

Table VIII: Morphology and Hydraulic Monitoring Summary (cont.)

Big Warrior Creek Unnamed Tributary EEP Project Number 00412										
Parameter	Cross Section 1 Riffle					Cross Section 2 Pool				
Dimension	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
BF Width (ft)	10.6	10.9	10.9	8.4		8.12	17.8	13.1	7.4	
Floodprone Width (ft)	15.5	>25	>25	>25		26.7	>40	>40	>40	
BF Cross Sectional Area (ft^2)	6.1	7.9	7.6	5.1		3.9	8.7	4.8	4.4	
BF Mean Depth	0.6	0.7	0.7	0.6		0.5	0.5	0.4	0.6	
BF Max Depth	1	1.2	1.3	1.3		1	1.1	1.0	1.3	
Width/Depth Ratio	18.3	14.9	15.5	13.8		16.8	36.1	36.1	12.6	
Entrenchment Ratio	1.5	>2.3	>2.3	>30		3.3	>2.3	>3.1	>5.4	
Bank Height Ratio	N/A	1.0	1.0	0.8		N/A	1.0	1.0	1.0	
Wetted Perimeter (ft)	10.8	11.2	11.4	9.5		8.6	18.0	13.6	8.2	
Hydraulic radius (ft)	0.56	0.7	0.7	0.5		0.5	0.5	0.3	0.5	
Substrate*										
d50 (mm)	1.56	4	0.76	1.1		0.46	0.13	0.42	0.48	
d84 (mm)	13.6	48	15	66		0.83	0.42	15	0.85	

* The d50 and d84 for MY2 are not comparable to the MY1, MY3, and MY4 data because different methods were used for the pebble counts.

Table VIII: Morphology and Hydraulic Monitoring Summary (cont.)

Big Warrior Creek Unnamed Tributary EEP Project Number 00412															
Parameter	MY1			MY2			MY3			MY4			MY5		
Pattern	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean
Channel Beltwidth (ft)	100	200	165	--	--	--	50	120	80	40	100	67			
Radius of Curvature (ft)	50	115	60	--	--	--	50	120	80	40	65	49			
Meander Wavelength (ft)	250	345	285	--	--	--	160	260	220	140	280	205			
Meander Width Ratio	23.6	32.5	26.8	--	--	--	4.6	11.0	7.3	4.8	33.3	24.4			
Profile															
Riffle Length (ft)	9.6	60.2	32.5	5	54	31	6	99.1	35.4	16.6	98.6	44.1			
Riffle Slope (ft/ft)	0.002	0.065	0.035	0.006	0.043	0.024	0.001	0.054	0.029	0.018	0.035	0.025			
Pool Length (ft)	13.2	60.2	34	8	78	37	2	31.5	15	5.9	20.5	12.3			
Pool Spacing (ft)	15.7	200	64.4	20	137	61	7	146	59	18	119.1	59.7			
Additional Reach Parameters															
Valley Length (ft)	--	1000	--	--	--	1000	--	--	1000	--	--	1000			
Channel Length (ft)	--	1309	--	--	--	1409	--	--	1423	--	--	1503			
Sinuosity	--	--	--	--	--	1.4	--	--	1.4	--	--	1.5			
Water Surface Slope (ft/ft)	--	0.01	--	--	--	0.014	--	--	0.013	--	--	0.013			
BF Slope (ft/ft)	--	0.01	--	--	--	0.0135	--	--	0.014	--	--	0.013			
Rosgen Classification	--	B	--	--	--	C4	--	--	C4	--	--	C4			

4.0 METHODOLOGY SECTION

All monitoring methodologies follow the most current templates and guidelines provided by EEP (EEP 2006). Photographs were taken at high resolution using a Sealife EcoShot 6.0 megapixel digital camera. GPS location information was collected using a Trimble Geo XT handheld mapping grade GPS unit. GPS locations were collected in 2006 (MY2) on both banks of each cross section and on all four corners of each vegetation plot. Stream and vegetation problem areas were noted in the field on As-Built Plan Sheets. Permanent photo station photographs were taken from locations marked in the Year One Monitoring Report, prepared by EcoLogic Associates.

4.1 STREAM METHODOLOGY

The methods used to generate the data in this report are standard fluvial geomorphology techniques as described in *Applied River Morphology* (Rosgen 1996) and related publications from US Forest Service and the interagency Stream Mitigation Guidelines (USACE 2003). URS' field morphology survey was conducted using a Nikon Total Station and the data were analyzed and displayed using the Reference Reach Spreadsheet, Version 4.1T (Mecklenburg 2006). Modified Wolman pebble counts were conducted within the feature of each cross section. Photographs were taken from both banks at each cross section. A photo was taken from the left bank towards the right bank and from the right bank towards the left bank.

4.2 VEGETATION METHODOLOGY

Seven vegetation plots were established by CDM in 2004. These seven plots were evaluated for the As-built survey. These plots consisted of 1/10-acre circular plots with the center points marked with rebar. In 2005 (MY1), EcoLogic did not have As-built project data. EcoLogic established 30 10-meter by 10-meter vegetation plots, per EEP's current protocol at that time.

According to the 2006, Version 4.0 CVS-EEP Protocol for Recording Vegetation (Lee *et al* 2006), the Big Warrior Creek Stream Restoration Project requires the monitoring of 16 vegetation plots. The new CVS-EEP Protocol for Recording Vegetation was used to inventory 16 (1, 2, 4, 6, 7, 8, 9, 11, 13, 15, 19, 25, 26, 28, 29, and 30) of the 30 vegetation plots established by EcoLogic.

Vegetation monitoring methods followed the 2006, Version 4.0 CVS-EEP Protocol for Recording Vegetation (http://cvs.bio.unc.edu/methods.htm). Vegetation plot photographs were collected at the southwest corner of each vegetation plot. Vegetation monitoring plots were re-marked in the field by replacing all old flagging with new flagging. Each vegetation plot was marked by EcoLogic in 2005 with a four-foot PVC pipe at the upstream, outside corner. The remaining three corners were marked with steel conduit. URS placed orange flagging at the southwest corner of each vegetation plot and blue flagging at the remaining corners. The orientation of the plot was marked on the CVS-EEP data sheet if the PVC was not in the southwest corner (the origin of the plot). Planted stems were flagged in white. Volunteer/natural regeneration stems were inventoried, but not flagged. Monitoring taxonomy follows 'Flora of the Carolinas, Virginia, Georgia, and Surrounding Areas' (Weakley 2007). Stem height was measured with a folding one-meter rule. Diameter at breast height and decimeter height were measured with calipers. The X,Y coordinates relative to the southwest corner (origin) of each stem in the plot were recorded, as was the bearing of the x axis from the southwest corner. The results of the stem counts are located in Appendix A-I. Photographs of the monitoring plots are located in Appendix A-IV.

5.0 REFERENCES

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Appendices

Appendix A: Vegetation Raw Data

Appendix A-I: Vegetation Survey Data Tables

Table A1: Vegetation Metadata

Report Prepared By	Susan Shelingoski
Date Prepared	12/2/2008 14:03

database name	BigWarrior_Beaver_Silas_Snow Database.mdb
database location	P:\Jobs3\31825348_Monitoring\Veg\2008 DATABASES
computer name	RDUXPL160
file size	57237504

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

Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
ALL Stems by Plot and spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.

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

Project Code	412
project Name	Big Warrior Creek
Description	Stream Restoration
River Basin	Yadkin River
length(ft)	10,698
stream-to-edge width (ft)	10
area (sq m)	14.7 acres
Required Plots (calculated)	16
Sampled Plots	16

Table A2: Vegetation Vigor by Species

	Species	4	3	2	1	0	Missing	Unknown
	Alnus serrulata	1	8				1	
	Betula nigra	2	3	2				
	Cephalanthus occidentalis						1	
	Cornus amomum	1	12			1	3	
	Fraxinus pennsylvanica					3	1	
	Juglans nigra	1	5				13	
	Nyssa sylvatica		1					
	Salix nigra	2	2			1	2	
	Cercis canadensis		1				2	
	Lindera benzoin						1	
	Liriodendron tulipifera	9	7			1	3	
	Platanus occidentalis	9	9		1		1	
	Physocarpus opulifolius		4	4	1		5	
TOT:	**13**	**25**	**52**	**6**	**2**	**6**	**33**	

Table A3: Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Beaver	Insects	Site Too Dry	Unknown	Vine Strangulation
	Alnus serrulata	11	11					
	Betula nigra	7	5			2		
	Cephalanthus occidentalis	1	1					
	Cercis canadensis	3	3					
	Cornus amomum	17	16					1
	Fraxinus pennsylvanica	4	3			1		
	Juglans nigra	19	19					
	Lindera benzoin	1	1					
	Liriodendron tulipifera	20	20					
	Nyssa sylvatica	1	1					
	Physocarpus opulifolius	14	12				1	1
	Platanus occidentalis	20	19		1			
	Salix nigra	7	6	1				
TOT:	**13**	**125**	**117**	**1**	**1**	**3**	**1**	**2**

Table A4: Vegetation Damage by Plot

	Plot	All Damage Categories	(no damage)	Beaver	Insects	Site Too Dry	Unknown	Vine Strangulation
	412-01-0001-year:4	16	16					
	412-01-0002-year:4	10	10					
	412-01-0004-year:4	4	4					
	412-01-0006-year:4	6	6					
	412-01-0007-year:4	15	14					1
	412-01-0008-year:4	1	1					
	412-01-0009-year:4	9	9					
	412-01-0011-year:4	15	15					
	412-01-0013-year:4	9	8	1				
	412-01-0015-year:4	4	4					
	412-01-0019-year:4	5	5					
	412-01-0025-year:4	8	8					
	412-01-0026-year:4	9	9					
	412-01-0028-year:4	6	2			2	1	1
	412-01-0029-year:4	2	1		1			
	412-01-0030-year:4	6	5			1		
TOT:	**16**	**125**	**117**	**1**	**1**	**3**	**1**	**2**

Table A5: Stem Count by Plot and Species

	Species	Total Planted Stems	# plots	avg# stems	plot 412-01-0001-year:4	plot 412-01-0002-year:4	plot 412-01-0006-year:4	plot 412-01-0007-year:4	plot 412-01-0008-year:4	plot 412-01-0009-year:4	plot 412-01-0011-year:4	plot 412-01-0013-year:4	plot 412-01-0015-year:4	plot 412-01-0019-year:4	plot 412-01-0025-year:4	plot 412-01-0026-year:4	plot 412-01-0028-year:4	plot 412-01-0029-year:4	plot 412-01-0030-year:4
	Alnus serrulata	9	6	1.5		1				1	1	1	1	4					
	Betula nigra	7	4	1.75								1			3		2		1
	Cercis canadensis	1	1	1			1												
	Cornus amomum	13	5	2.6	2			7		1	2				1				
	Juglans nigra	6	4	1.5	3					1			1		1				
	Liriodendron tulipifera	16	4	4	5	5					4								2
	Nyssa sylvatica	1	1	1							1								
	Physocarpus opulifolius	9	4	2.25	2							3	2				2		
	Platanus occidentalis	19	7	2.71		2	1		1		6				2	6		1	
	Salix nigra	4	3	1.33											1	2		1	
TOT:	**10**	**85**	**10**		**12**	**8**	**2**	**7**	**1**	**3**	**14**	**5**	**4**	**4**	**8**	**8**	**4**	**2**	**3**

Table A6: Vegetation Problem Areas

Table A6a: Big Warrior Creek EEP Project Number 00412				
Feature #	**Feature/Issue**	**Station #/Range**	**Probable Cause**	**Photo #**
BWVPA2	Invasive/exotic plant	12+00 to 20+10	Kudzu	BWVPA2
BWVPA4	Invasive/exotic plant	33+00 to 37+00	Kudzu	BWVPA4
BWVPA6	Invasive/exotic plant	44+15	Kudzu	BWVPA6
BWVPA8	Invasive/exotic plant	63+50	Kudzu	BWVPA8
BWVPA9	Invasive/exotic plant	5+00	Kudzu	BWVPA9
BWVPA10	Bare bank	28+00 to 30+00	Bank erosion	BWVPA10

Table A6b: Mountain Creek EEP Project Number 00412				
Feature #	**Feature/Issue**	**Station #/Range**	**Probable Cause**	**Photo #**
MCVPA2	Bare bank	5+90 to 6+10	Bank erosion	MCVPA2
MCVPA3	Bare bank	13+10 to 13+40	Bank erosion	MCVPA3
MCVPA4	Bare bank	14+90 to 15+05	Bank erosion	MCVPA4
MCVPA6	Bare bank	17+00	Bank erosion	MCVPA6
MCVPA8	Bare bank	19+00 to 19+30	Bank erosion	MCVPA8

Appendix A-II: Vegetation Problem Area Photos

BIG WARRIOR CREEK


BWVPA2 facing left bank


BWVPA4 facing left bank


BWVPA6 facing right bank


BWVPA8 facing upstream


BWVPA9 facing left bank


BWVPA10 facing upstream

MOUNTAIN CREEK


MCVPA2 facing upstream


MCVPA3 facing right bank

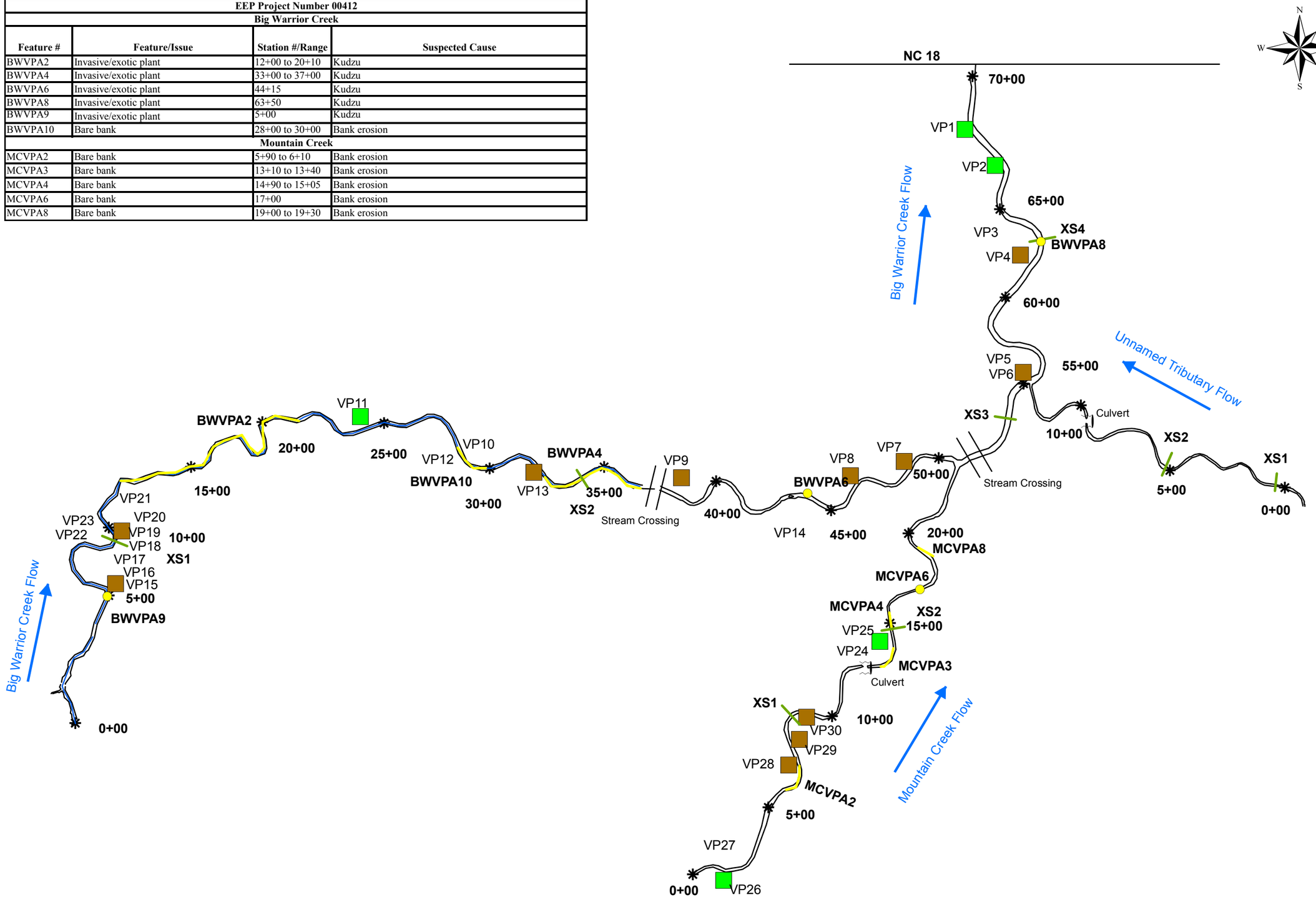

MCVPA4 facing left bank


MCVPA6 facing right bank


MCVPA8 facing right bank

Appendix A-III: Vegetation Current Condition Plan View

Big Warrior Creek Vegetative Problem Areas			
EEP Project Number 00412			
Big Warrior Creek			
Feature #	**Feature/Issue**	**Station #/Range**	**Suspected Cause**
BWVPA2	Invasive/exotic plant	12+00 to 20+10	Kudzu
BWVPA4	Invasive/exotic plant	33+00 to 37+00	Kudzu
BWVPA6	Invasive/exotic plant	44+15	Kudzu
BWVPA8	Invasive/exotic plant	63+50	Kudzu
BWVPA9	Invasive/exotic plant	5+00	Kudzu
BWVPA10	Bare bank	28+00 to 30+00	Bank erosion
Mountain Creek			
MCVPA2	Bare bank	5+90 to 6+10	Bank erosion
MCVPA3	Bare bank	13+10 to 13+40	Bank erosion
MCVPA4	Bare bank	14+90 to 15+05	Bank erosion
MCVPA6	Bare bank	17+00	Bank erosion
MCVPA8	Bare bank	19+00 to 19+30	Bank erosion



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Enhancement Program

Project:
Big Warrior Creek
Stream Restoration
Wilkes County, NC

Monitoring Year:
4 (2008)

Project Number:
00412

Date:
February 2009

Legend
- Problem Area Concern
- Problem Area Concern
- Stations
- Cross Section
- As-Built Centerline
- As-Built Streambank
- Vegetation Plot Meeting Success Criteria
- Vegetation Plot Not Meeting Success Criteria

Vegetation
Current Condition
Plan View

Appendix A-IV: Vegetation Monitoring Plot Photos


VP1


VP2


VP4


VP6


VP7


VP8


VP9


VP11


VP13


VP15


VP19


VP25


VP26


VP28

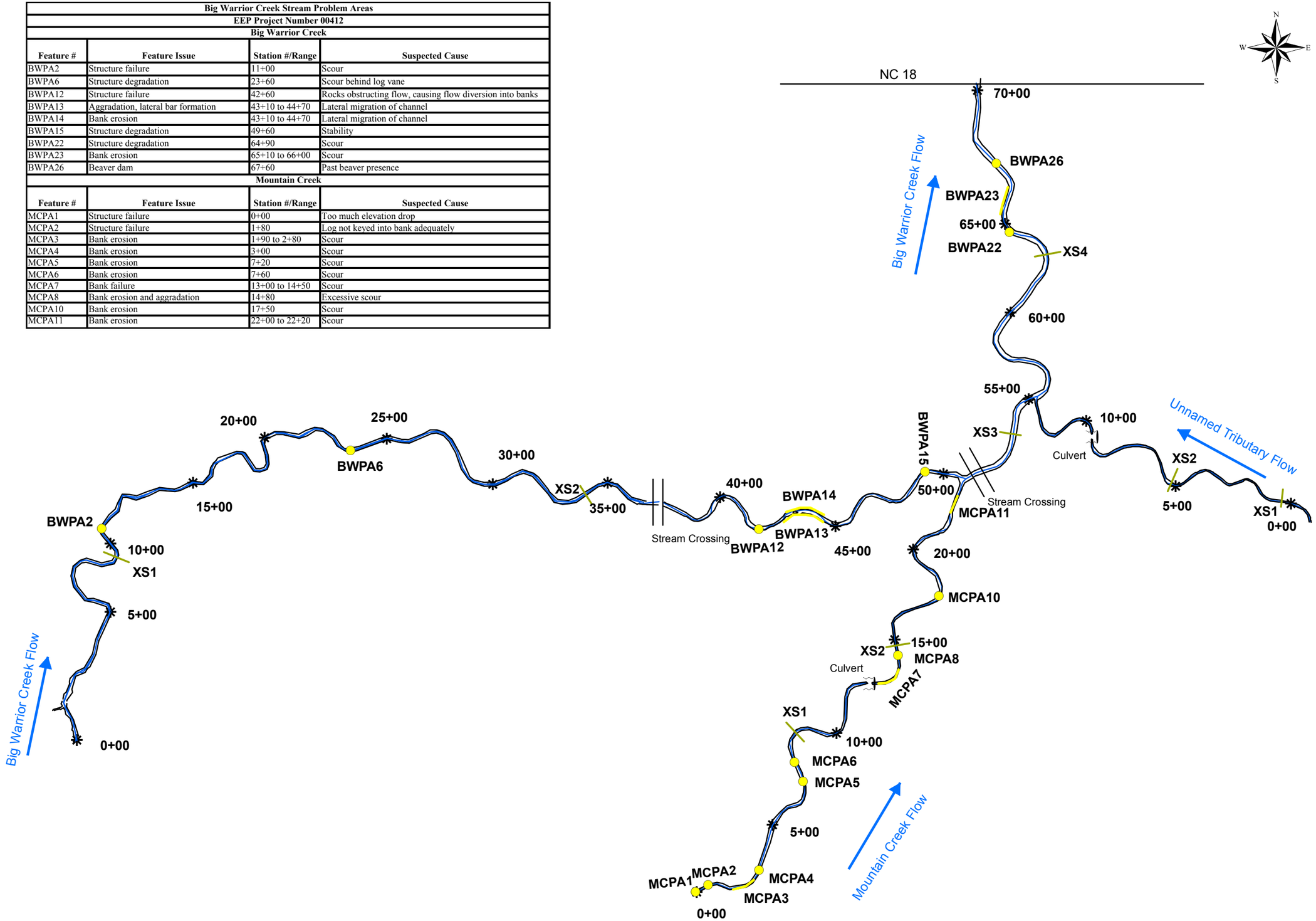

VP29


VP30

Appendix B: Geomorphic Raw Data

Appendix B-I: Stream Current Condition Plan View

Big Warrior Creek Stream Problem Areas			
EEP Project Number 00412			
Big Warrior Creek			
Feature #	**Feature Issue**	**Station #/Range**	**Suspected Cause**
BWPA2	Structure failure	11+00	Scour
BWPA6	Structure degradation	23+60	Scour behind log vane
BWPA12	Structure failure	42+60	Rocks obstructing flow, causing flow diversion into banks
BWPA13	Aggradation, lateral bar formation	43+10 to 44+70	Lateral migration of channel
BWPA14	Bank erosion	43+10 to 44+70	Lateral migration of channel
BWPA15	Structure degradation	49+60	Stability
BWPA22	Structure degradation	64+90	Scour
BWPA23	Bank erosion	65+10 to 66+00	Scour
BWPA26	Beaver dam	67+60	Past beaver presence
Mountain Creek			
Feature #	**Feature Issue**	**Station #/Range**	**Suspected Cause**
MCPA1	Structure failure	0+00	Too much elevation drop
MCPA2	Structure failure	1+80	Log not keyed into bank adequately
MCPA3	Bank erosion	1+90 to 2+80	Scour
MCPA4	Bank erosion	3+00	Scour
MCPA5	Bank erosion	7+20	Scour
MCPA6	Bank erosion	7+60	Scour
MCPA7	Bank failure	13+00 to 14+50	Scour
MCPA8	Bank erosion and aggradation	14+80	Excessive scour
MCPA10	Bank erosion	17+50	Scour
MCPA11	Bank erosion	22+00 to 22+20	Scour



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Enhancement Program

Project:
Big Warrior Creek
Stream Restoration
Wilkes County, NC

Monitoring Year:
4 (2008)

Project Number:
00412

Date:
February 2009

Legend
- Problem Area Concern
- Problem Area Concern
- Stations
- Cross Section
- As-Built Centerline
- As-Built Streambank

Stream
Current Condition
Plan View

Appendix B-II: Stream Problem Areas Data Table

Table B1: Stream Problem Areas

B1a: Big Warrior Creek EEP Project Number 00412				
Feature #	**Feature/Issue**	**Station # / Range**	**Probable Cause**	**Photo #**
BWPA2	Structure failure	11+00	Scour	BWPA2
BWPA6	Structure degradation	23+60	Scour behind log vane	BWPA6
BWPA12	Structure failure	42+60	Rocks obstructing flow, causing flow diversion into banks	BWPA12
BWPA13	Aggradation, lateral bar formation	43+10 to 44+70	Lateral migration of channel	BWPA13
BWPA14	Bank erosion	43+10 to 44+70	Lateral migration of channel	BWPA14
BWPA15	Structure degradation	49+60	Stability	BWPA15
BWPA22	Structure degradation	64+90	Scour	BWPA22
BWPA23	Bank erosion	65+10 to 66+00	Scour	BWPA23
BWPA26	Beaver dam	67+60	Past beaver presence	BWPA26

B1b: Mountain Creek EEP Project Number 00412				
Feature #	**Feature/Issue**	**Station # / Range**	**Probable Cause**	**Photo #**
MCPA1	Structure failure	0+00	Too much elevation drop	MCPA1
MCPA2	Structure failure	1+80	Log not keyed into bank adequately	MCPA2
MCPA3	Bank erosion	1+90 to 2+80	Scour	MCPA3
MCPA4	Bank erosion	3+00	Scour	MCPA4
MCPA5	Bank erosion	7+20	Scour	MCPA5
MCPA6	Bank erosion	7+60	Scour	MCPA6
MCPA7	Bank failure	13+00 to 14+50	Scour	MCPA7
MCPA8	Bank erosion and aggradation	14+80	Excessive scour	MCPA8
MCPA10	Bank erosion	17+50	Scour	MCPA10
MCPA11	Bank erosion	22+00 to 22+20	Scour	MCPA11

Appendix B-III: Representative Stream Problem Area Photos

BIG WARRIOR


BWPA2 facing right bank


BWPA6 facing downstream


BWPA12 facing downstream


BWPA13/14 facing downstream


BWPA13/14 facing downstream


BWPA15 facing left bank


BWPA22 facing right bank


BWPA23 facing upstream


BW26 facing upstream (10/23/08)

MOUNTAIN CREEK


MCPA1 facing right bank


MCPA2 facing right bank


MCPA3 facing downstream


MCPA4 facing downstream


MCPA5 facing downstream (9/12/07)


MCPA6 facing downstream (9/12/07)


MCPA7 facing right bank (9/12/07)


MCPA8 facing downstream (9/12/07)

MCPA10 facing right bank

MCPA11 facing right bank

Appendix B-IV: Stream Photo Station Photos


PS1 facing upstream


PS2 facing upstream


PS3 facing upstream


PS4 facing upstream


PS5 facing downstream


PS6 facing downstream


PS7 facing upstream


PS8 facing downstream


PS9 facing upstream


PS10 facing downstream


PS11 facing upstream


PS12 facing downstream


PS13 facing upstream


PS14 facing downstream


PS15 facing downstream


PS16 facing right bank


PS17 facing left bank


PS18 facing left bank


PS19 facing upstream


PS20 facing upstream


PS21 facing upstream


PS22 facing upstream


PS23 facing upstream


PS24 facing downstream


PS25 facing upstream


PS26 facing upstream


PS27 facing downstream


PS28 facing upstream


PS29 facing upstream


PS30 facing upstream


PS31 facing upstream


PS32 facing upstream


PS33 facing upstream

Appendix B-V: Visual Morphological Stability Assessment Table

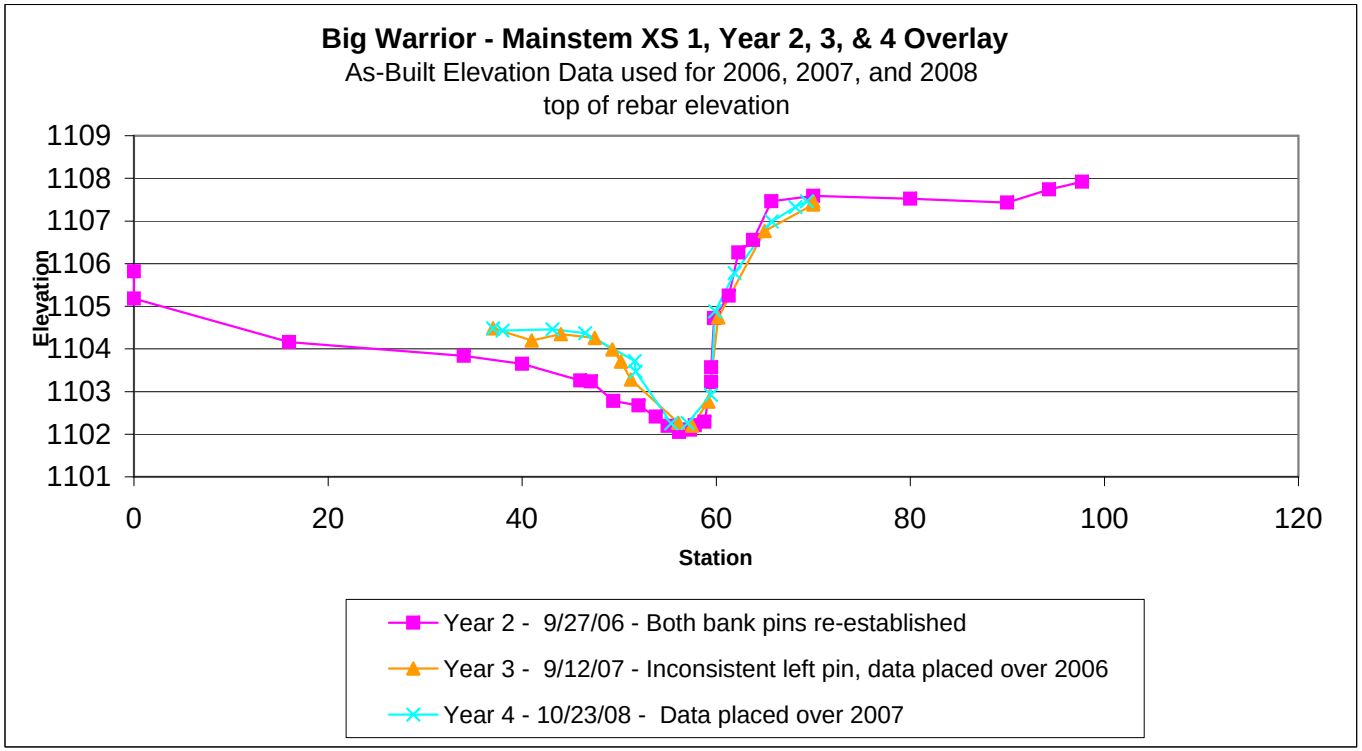
Table B2: Visual Morphological Stability Assessment

Big Warrior Creek EEP Project Number 00412						
Feature Category	**Metric (per As-built and reference baselines)**	**(# stable) Number performing as Intended**	**Total Number per As-Built**	**Total number/feet in unstable state**	**% perform in stable condition**	**Feature perform. Mean or total**
A. Riffles	Present?	41	41	N/A	100	
	Armor stable (no displacement)?	41	41	N/A	100	
	Facet grade appears stable?	41	41	N/A	100	
	Minimal evidence of embedding/fining?	41	41	N/A	100	
	Length appropriate?	41	41	N/A	100	
						100
B. Pools	Present (not subject to severe aggrad. or migration)?	56	56	N/A	100	
	Sufficiently deep (max pool D:mean Bkf >1.6)	56	56	N/A	100	
	Length appropriate?	56	56	N/A	100	
						100
C. Thalweg	Upstream of meander bend (run/inflection) centering?	54	56	N/A	96	
	Downstream of meander (glide/inflection) centering?	54	56	N/A	96	
						96
D. Meanders	Outer bend in state of limited/controlled erosion?	53	56	N/A	95	
	Of those eroding, # w/concomitant point bar formation?	0	N/A	N/A	N/A	
	Apparent Rc within spec?	56	56	N/A	100	
	Sufficient floodplain access and relief?	56	56	N/A	100	
						98
E. Bed General	General channel bed aggradation areas (bar formation)	7,135	7,185	1/50	99	
	Channel bed degradation–areas of increasing downcutting/headcutting?	N/A	N/A	N/A	N/A	
						99
F. Bank	Actively eroding, wasting, or slumping bank	6,985	7,185	10/200	97	
						97
G. Vanes	Free of back or arm scour?	83	89	N/A	93	
	Height appropriate?	83	89	N/A	93	
	Angle and geometry appear appropriate?	83	89	N/A	93	
	Free of piping or other structural failures?	83	89	N/A	93	
						93
H. Wads/ Boulders	Free of scour?	60	71	N/A	85	
	Footing stable?	60	71	N/A	85	
						85

Mountain Creek EEP Project Number 00412						
Feature Category	**Metric (per As-built and reference baselines)**	**(# stable) Number performing as Intended**	**Total Number per As-Built**	**Total number/feet in unstable state**	**% perform in stable condition**	**Feature perform. Mean or total**
A. Riffles	Present?	25	25	N/A	100	
	Armor stable (no displacement)?	25	25	N/A	100	
	Facet grade appears stable?	25	25	N/A	100	
	Minimal evidence of embedding/fining?	25	25	N/A	100	
	Length appropriate?	25	25	N/A	100	
						100
B. Pools	Present (not subject to severe aggrad. or migration)?	31	31	N/A	100	
	Sufficiently deep (max pool D:mean Bkf >1.6)	31	31	N/A	100	
	Length appropriate?	31	31	N/A	100	
						100
C. Thalweg	Upstream of meander bend (run/inflection) centering?	31	31	N/A	100	
	Downstream of meander (glide/inflection) centering?	31	31	N/A	100	
						100
D. Meanders	Outer bend in state of limited/controlled erosion?	30	31	N/A	97	
	Of those eroding, # w/concomitant point bar formation?	0	N/A	N/A	N/A	
	Apparent Rc within spec?	31	31	N/A	100	
	Sufficient floodplain access and relief?	31	31	N/A	100	
						99
E. Bed General	General channel bed aggradation areas (bar formation)	2,395	2,415	2,415	99	
	Channel bed degradation–areas of increasing downcutting/headcutting?	N/A	N/A	N/A	N/A	
						99
F. Bank	Actively eroding, wasting, or slumping bank	2,115	2,415	7/300	88	
						88
G. Vanes	Free of back or arm scour?	15	15	N/A	100	
	Height appropriate?	14	15	N/A	93	
	Angle and geometry appear appropriate?	15	15	N/A	100	
	Free of piping or other structural failures?	15	15	N/A	100	
						98
H. Wads/ Boulders	Free of scour?	20	21	N/A	95	
	Footing stable?	20	21	N/A	95	
						95

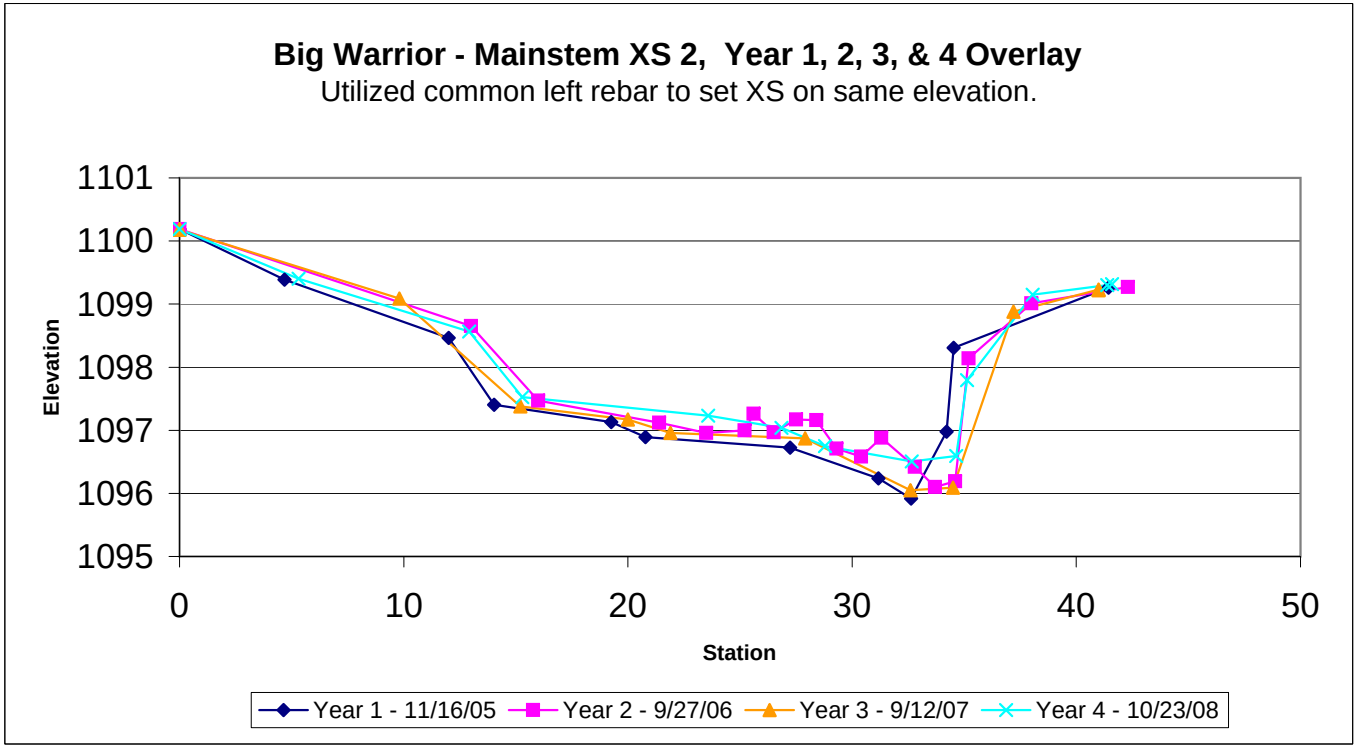
Unnamed Tributary EEP Project Number 00412						
Feature Category	**Metric (per As-built and reference baselines)**	**(# stable) Number performing as Intended**	**Total Number per As-Built**	**Total number/feet in unstable state**	**% perform in stable condition**	**Feature perform. Mean or total**
A. Riffles	Present?	15	15	N/A	100	
	Armor stable (no displacement)?	15	15	N/A	100	
	Facet grade appears stable?	15	15	N/A	100	
	Minimal evidence of embedding/fining?	15	15	N/A	100	
	Length appropriate?	15	15	N/A	100	
						100
B. Pools	Present (not subject to severe aggrad. or migration)?	15	15	N/A	100	
	Sufficiently deep (max pool D:mean Bkf >1.6)	15	15	N/A	100	
	Length appropriate?	15	15	N/A	100	
						100
C. Thalweg	Upstream of meander bend (run/inflection) centering?	15	15	N/A	100	
	Downstream of meander (glide/inflection) centering?	15	15	N/A	100	
						100
D. Meanders	Outer bend in state of limited/controlled erosion?	15	15	N/A	100	
	Of those eroding, # w/concomitant point bar formation?	15	N/A	N/A	N/A	
	Apparent Rc within spec?	15	15	N/A	100	
	Sufficient floodplain access and relief?	15	15	N/A	100	
						100
E. Bed General	General channel bed aggradation areas (bar formation)	1,435	1,435	0	100	
	Channel bed degradation–areas of increasing downcutting/headcutting?	N/A	N/A	N/A	N/A	
						100
F. Bank	Actively eroding, wasting, or slumping bank	1,435	1,435	0	100	
						100
G. Vanes	Free of back or arm scour?	9	9	N/A	100	
	Height appropriate?	9	9	N/A	100	
	Angle and geometry appear appropriate?	9	9	N/A	100	
	Free of piping or other structural failures?	9	9	N/A	100	
						100
H. Wads/ Boulders	Free of scour?	11	11	N/A	100	
	Footing stable?	11	11	N/A	100	
						100

Appendix B-VI: Cross Section Photos and Plots



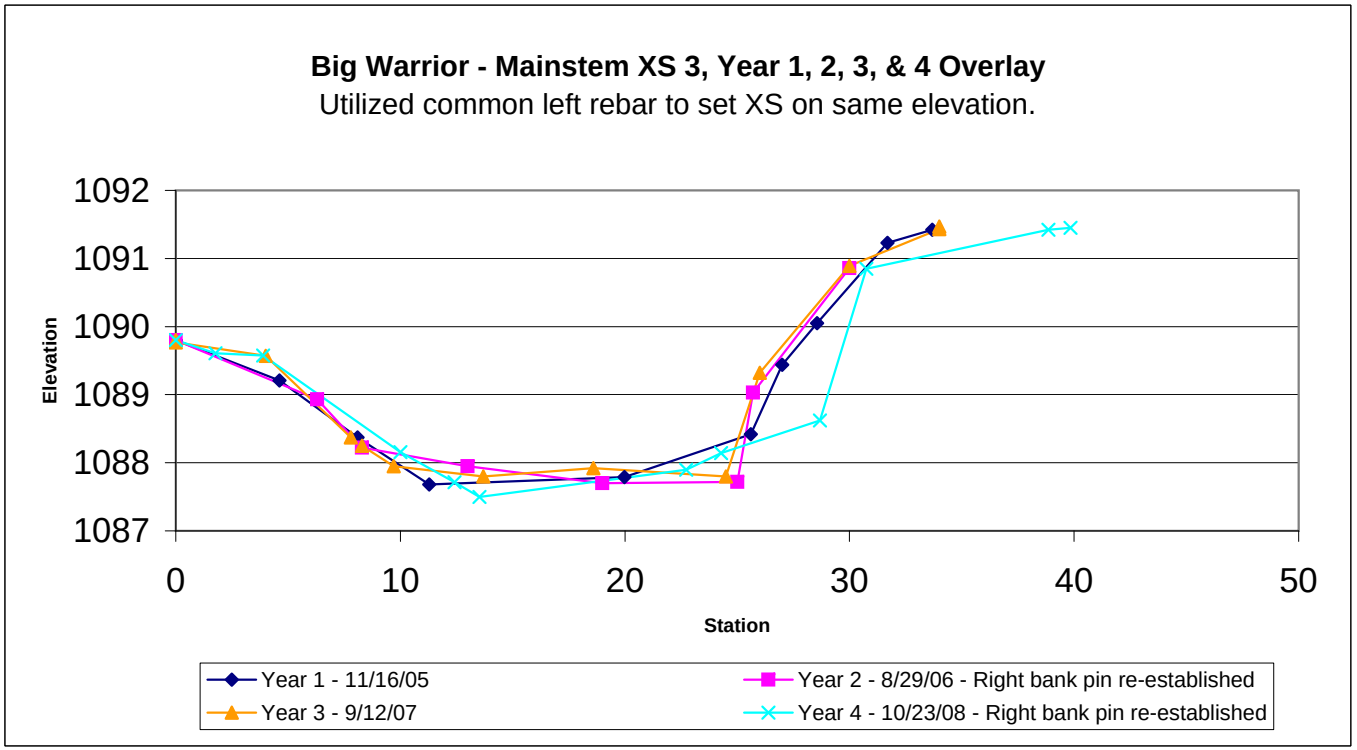
Facing Left Bank

Facing Right Bank



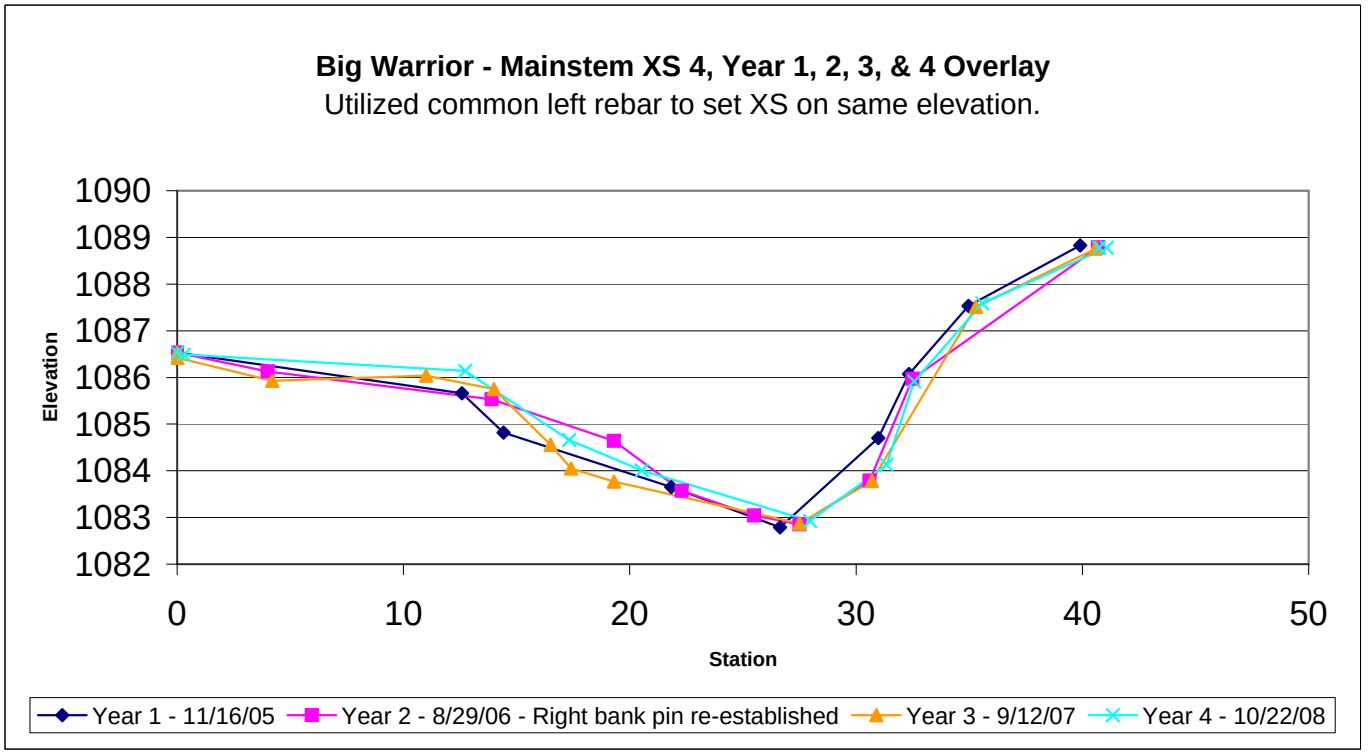
Facing Left Bank

Facing Right Bank



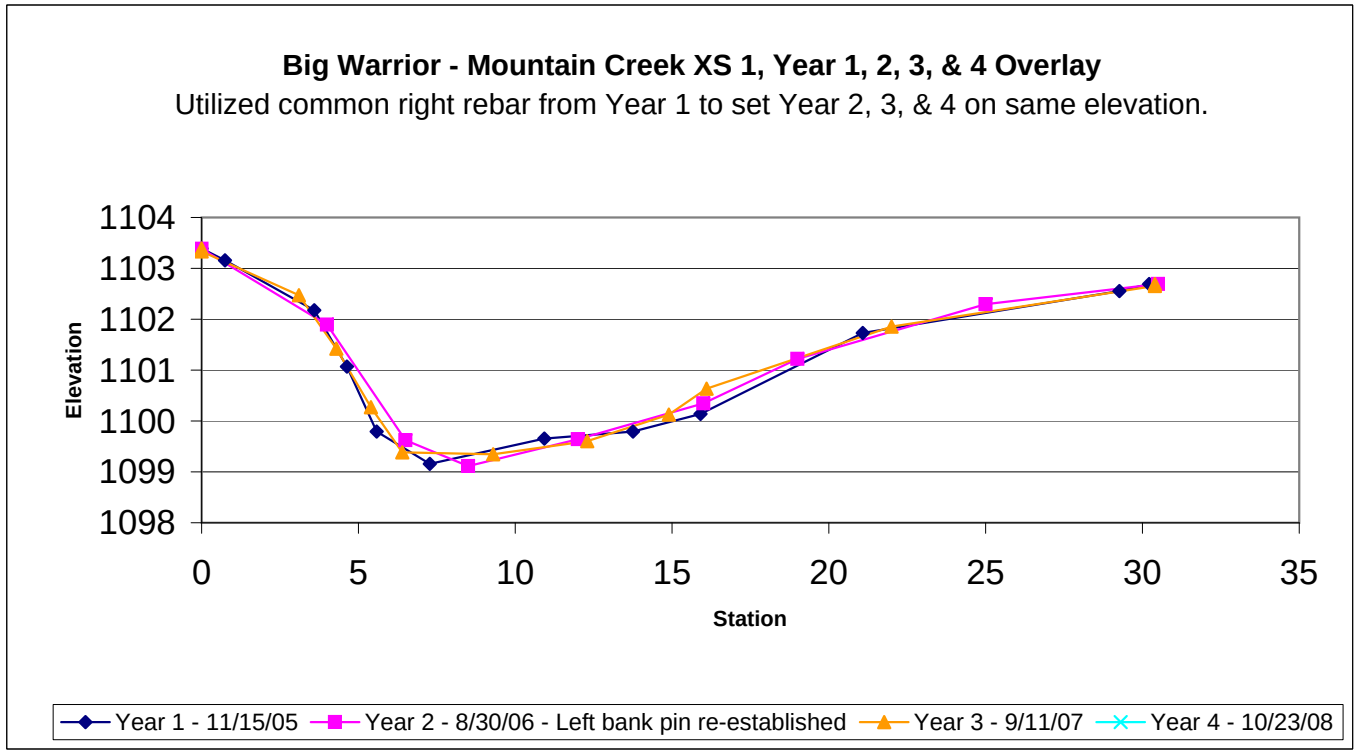
Facing Left Bank

Facing Right Bank



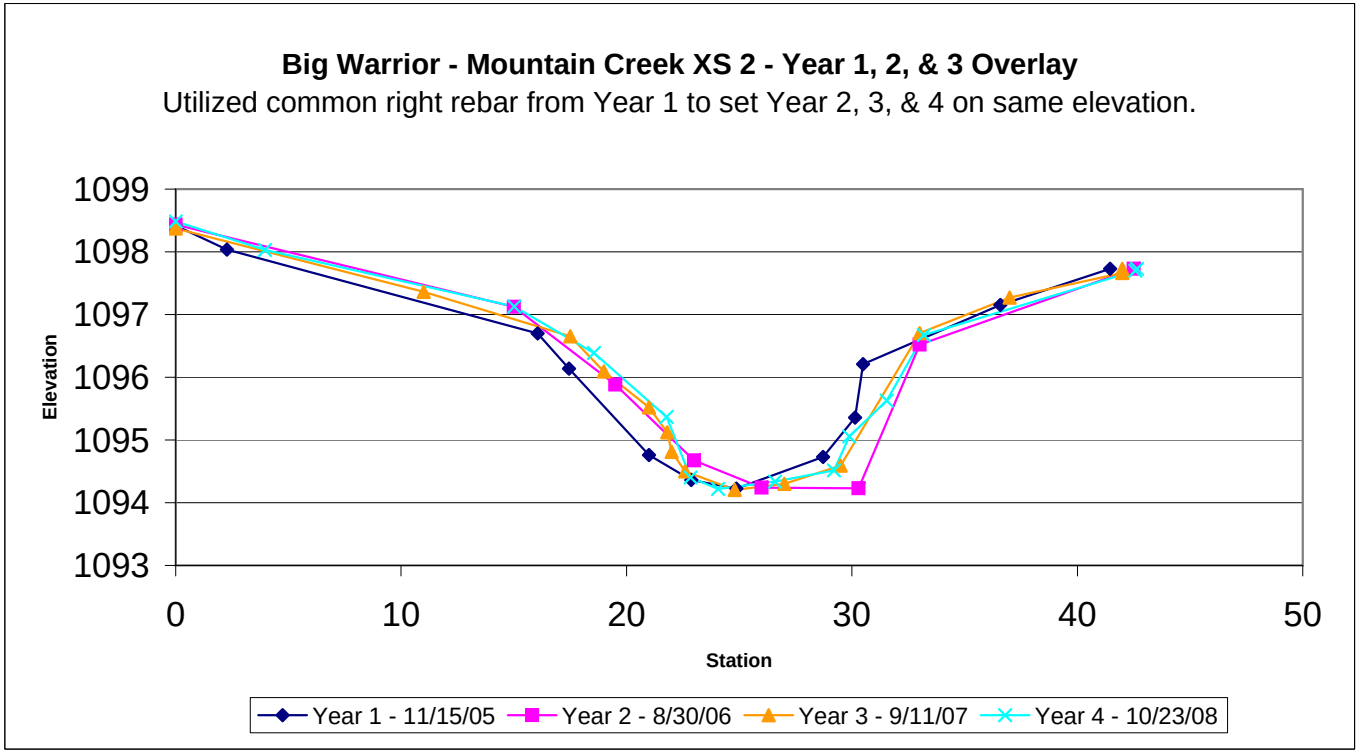
Facing Left Bank

Facing Right Bank



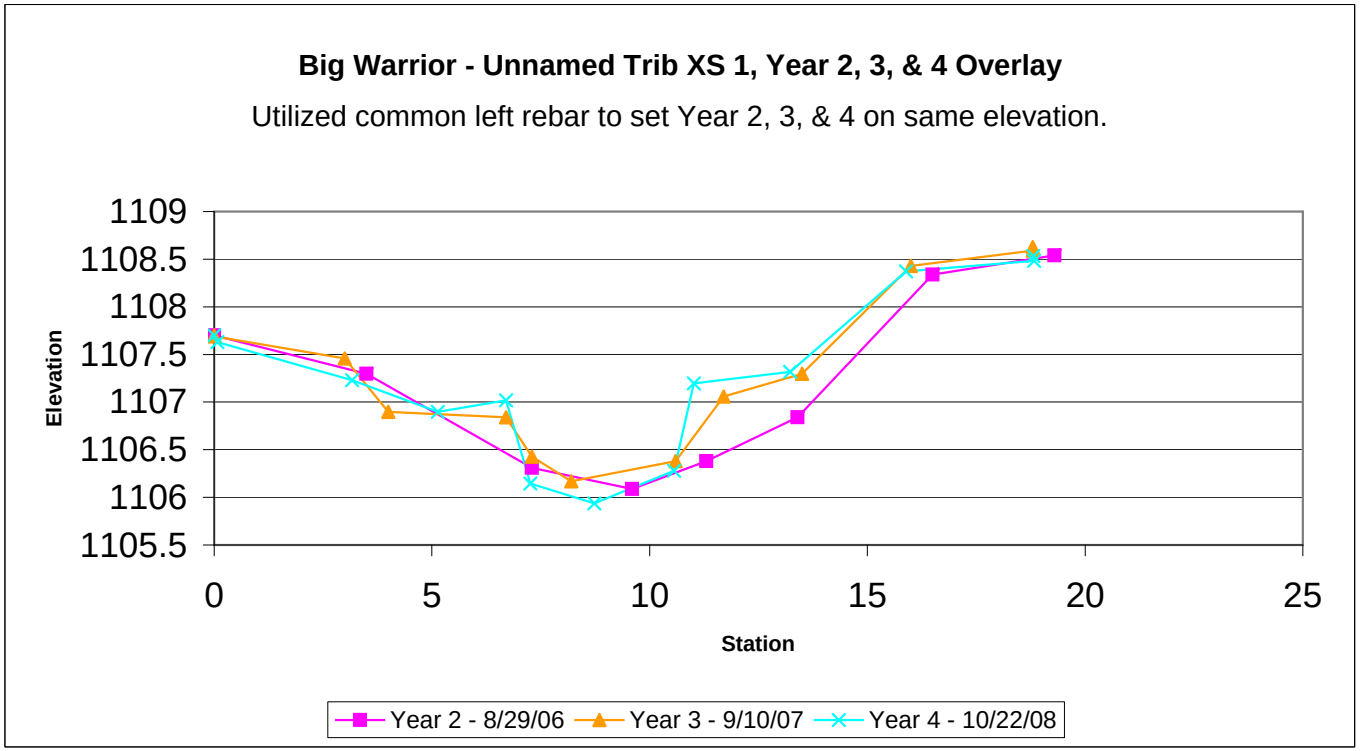
Facing Left Bank

Facing Right Bank



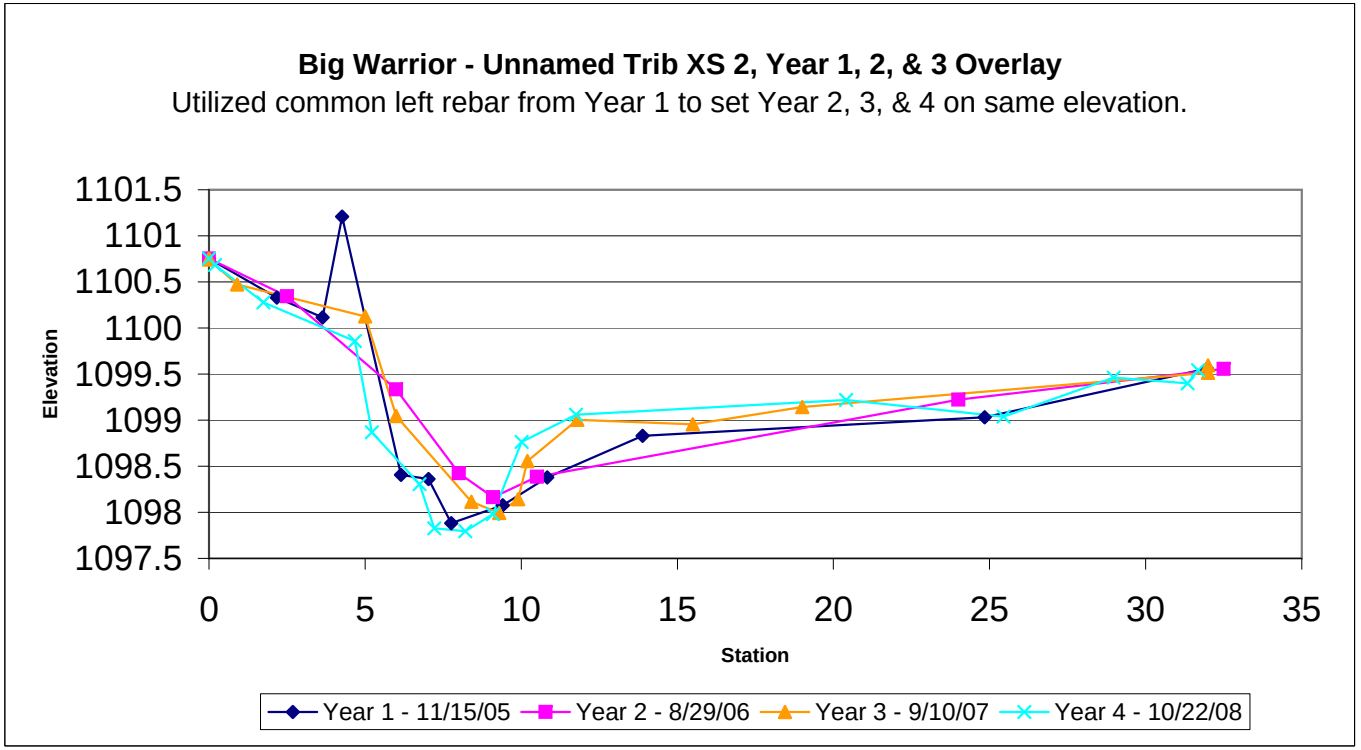
Facing Left Bank

Facing Right Bank



Facing Left Bank

Facing Right Bank



Facing Left Bank

Facing Right Bank

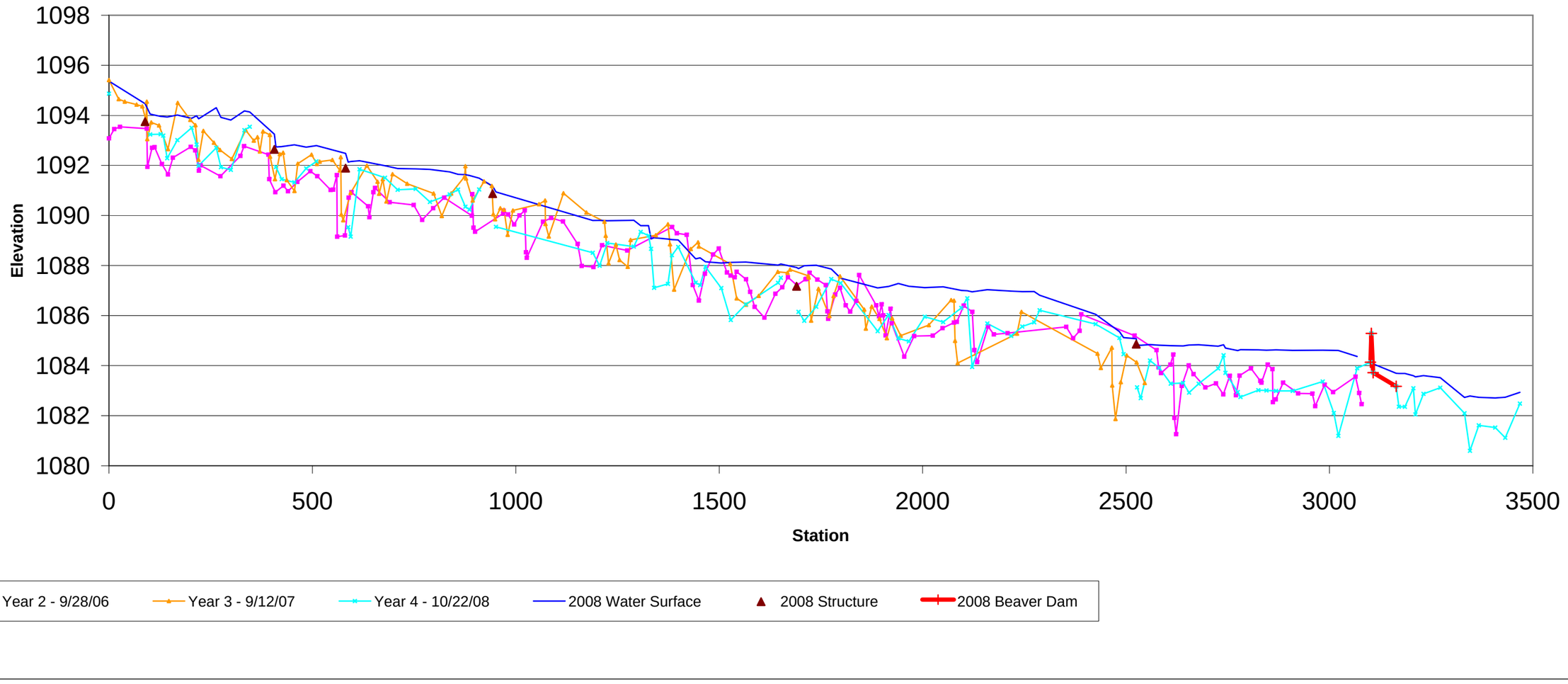
Appendix B-VII: Longitudinal Plot

Big Warrior - Mainstem, Year 2, 3, & 4 Overlay

Surveyed 3000 ft per EEP protocol

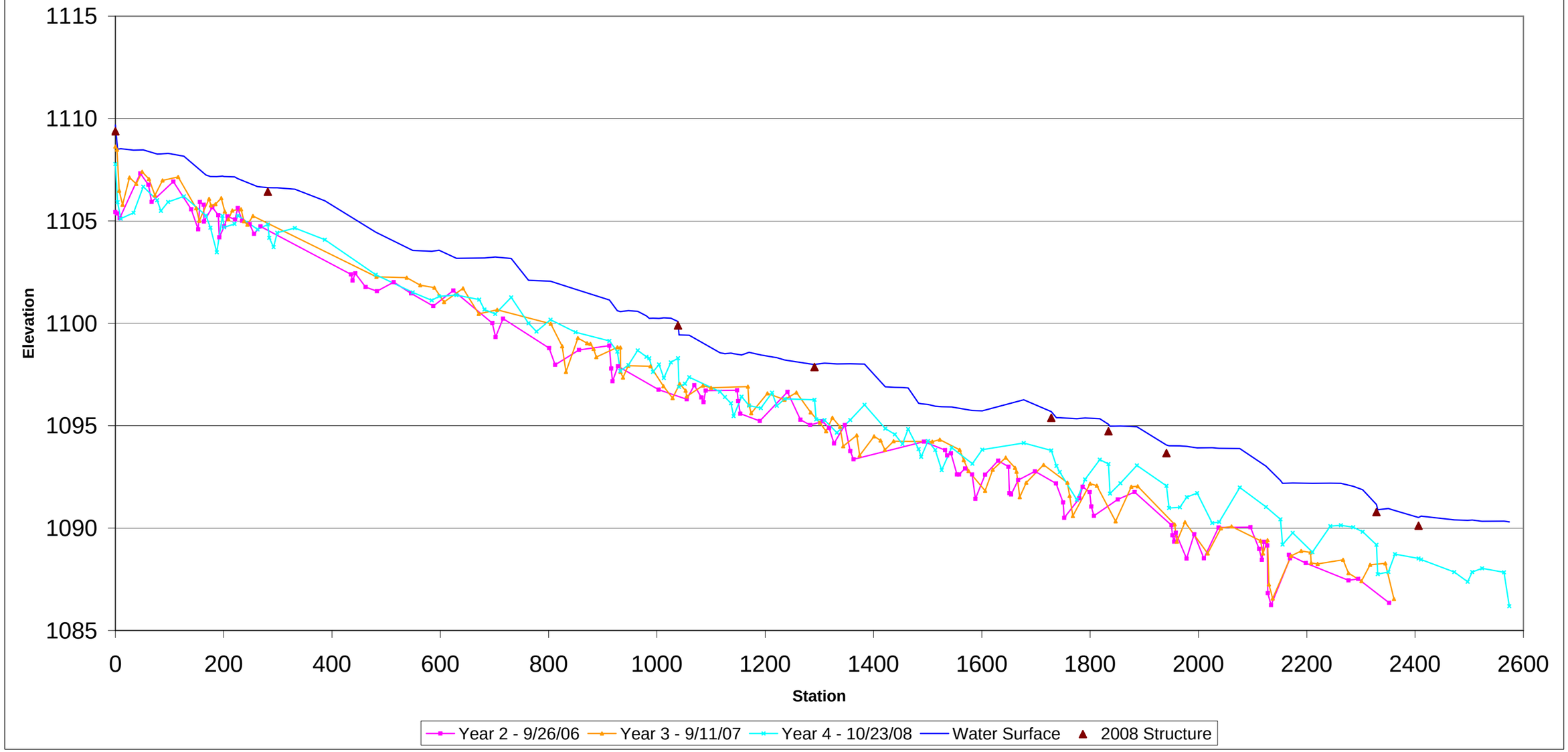
Set downstream-most point of 2005 survey to the 2008 downstream-most culvert reading.

Utilized common rebar from XS4 to set Year 2, 3, & 4 on same elevation.



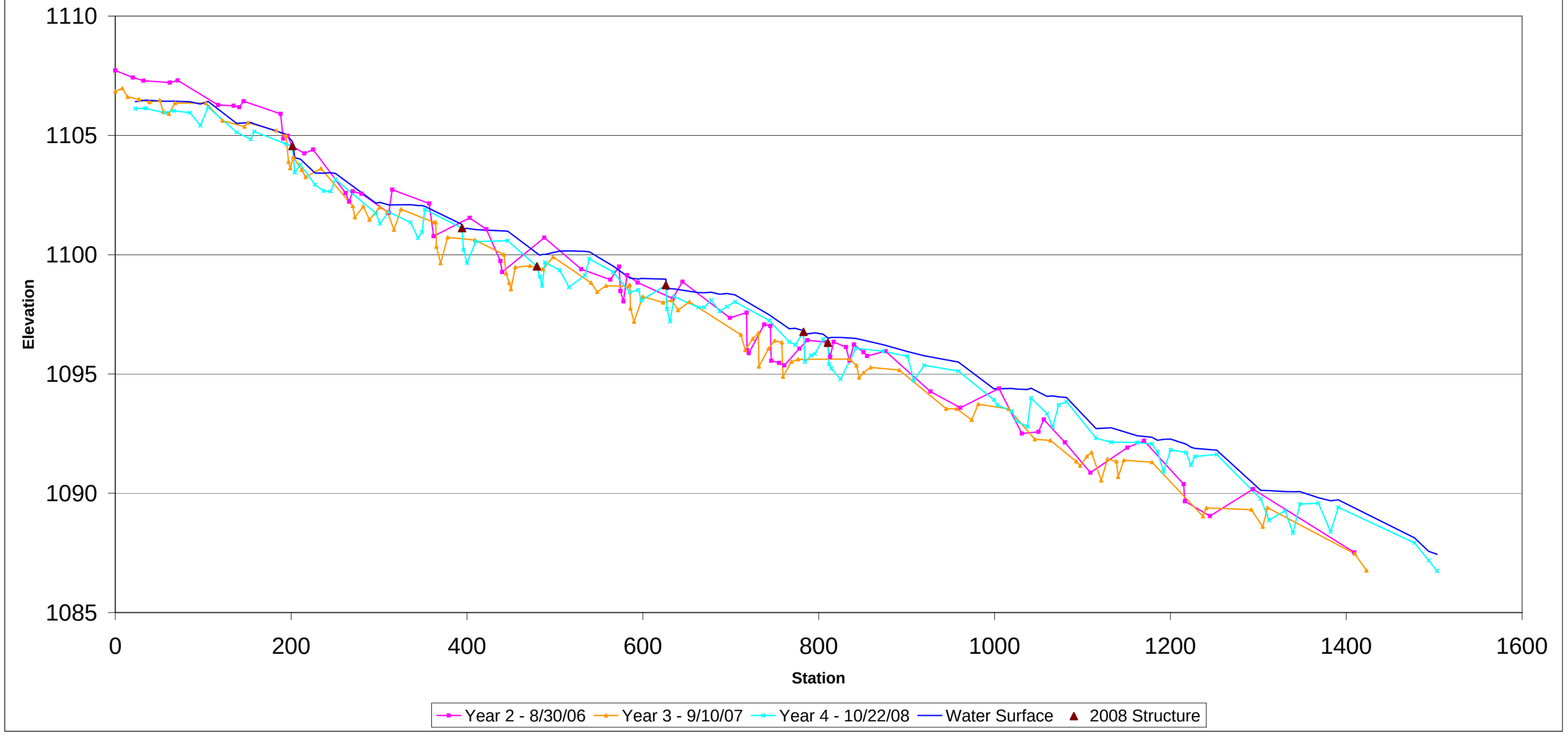
Big Warrior - Mountain Creek, Year 2, 3, & 4 Overlay

Utilized common rebar from XS2 to set Year 2, 3, & 4 on same elevation.



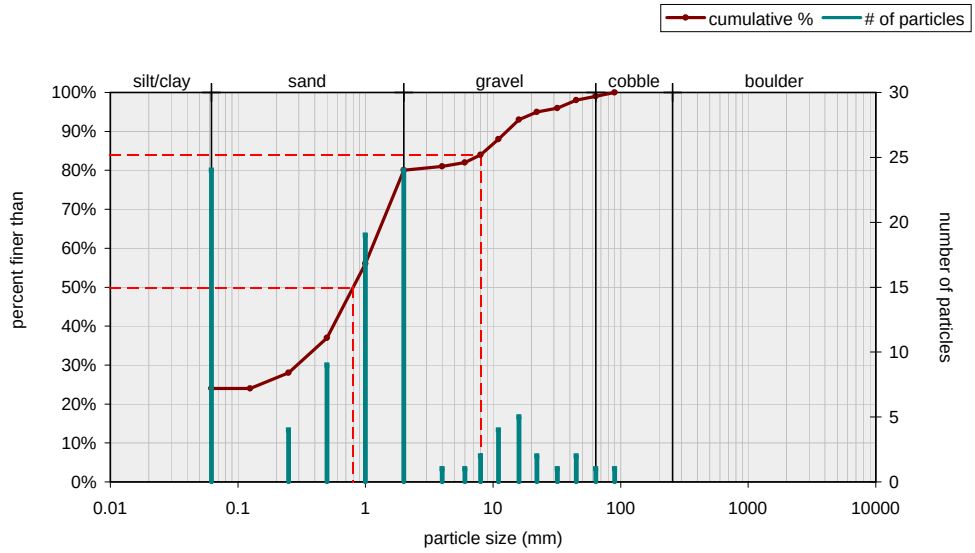
Big Warrior - Unnamed Trib, Year 2, 3, & 4 Overlay

Utilized common rebar from XS2 to set Year 2, 3, & 4 on same elevation.



Appendix B-VIII: Pebble Count Frequency Distribution Plots

Bed Surface Pebble Count, Big Warrior Creek - Mainstem

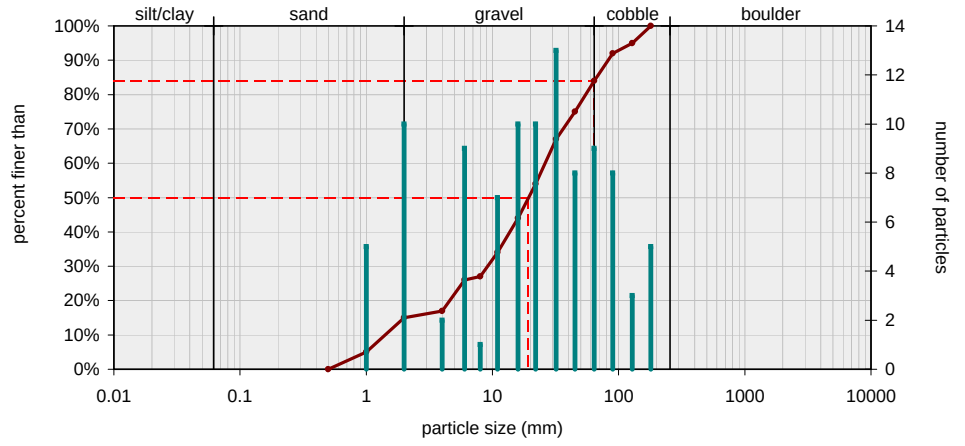


Size (mm)	
D16	0.062
D35	0.43
D50	0.8
D65	1.3
D84	8
D95	22

Size Distribution	
mean	0.7
dispersion	11.5
skewness	-0.04

Type	
silt/clay	24%
sand	56%
gravel	19%
cobble	1%
boulder	0%

Riffle Surface Pebble Count, Big Warrior Creek - Mainstem

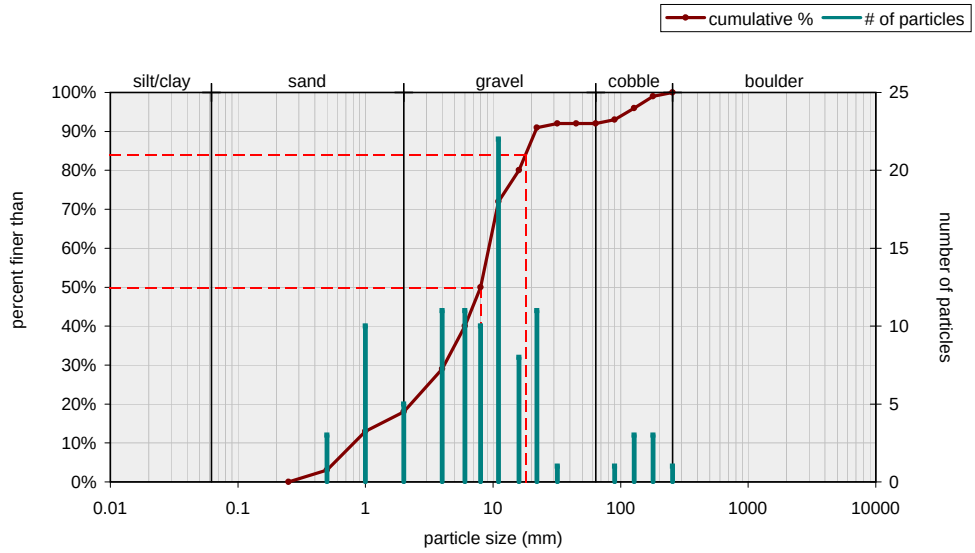


Size (mm)		
D16	2.8	3.4
D35	11	12
D50	19	17
D65	30	20
D84	64	29
D95	130	39

Size Distribution	
mean	13.4
dispersion	5.1
skewness	-0.13

Type	
silt/clay	0%
sand	15%
gravel	69%
cobble	16%
boulder	0%

Riffle Surface Pebble Count, Big Warrior Creek - Mainstem

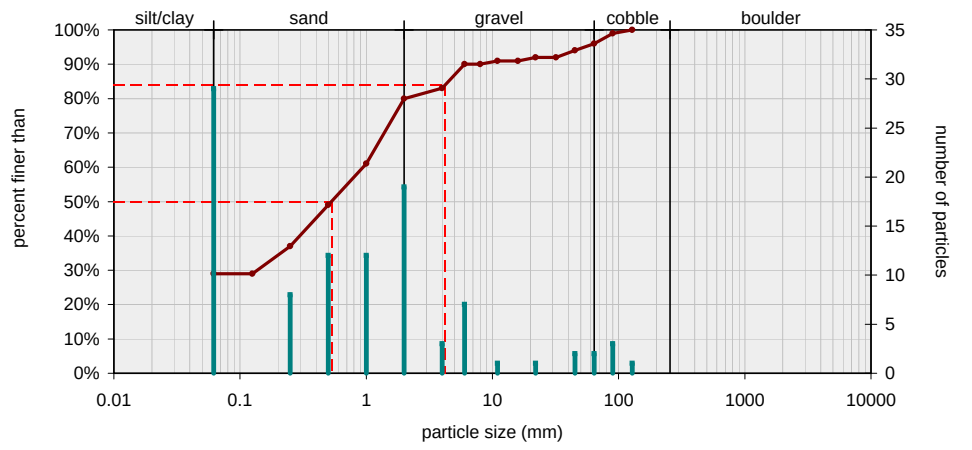


Size (mm)	
D16	1.5
D35	5
D50	8
D65	9.9
D84	18
D95	110

Size Distribution	
mean	5.2
dispersion	3.8
skewness	-0.18

Type	
silt/clay	0%
sand	18%
gravel	74%
cobble	8%
boulder	0%

Bed Surface Pebble Count, Big Warrior Creek - Mainstem

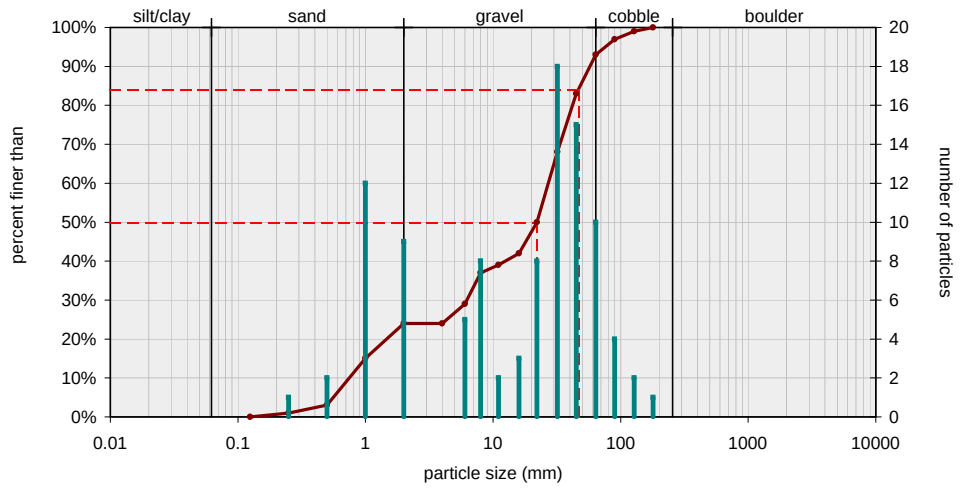


Size (mm)		
D16	0.062	3.4
D35	0.21	12
D50	0.53	17
D65	1.2	20
D84	4.2	29
D95	54	39

Size Distribution	
mean	0.5
dispersion	8.2
skewness	-0.01

Type	
silt/clay	29%
sand	51%
gravel	16%
cobble	4%
boulder	0%

Bed Surface Pebble Count, Big Warrior Creek - Mountain Creek

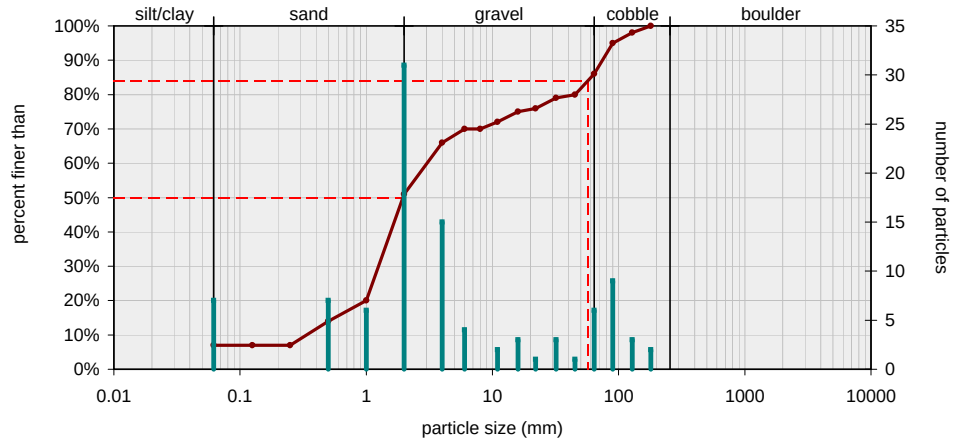


Size (mm)	
D16	1.1
D35	7.4
D50	22
D65	30
D84	47
D95	76

Size Distribution	
mean	7.2
dispersion	11.1
skewness	-0.38

Type	
silt/clay	0%
sand	24%
gravel	69%
cobble	7%
boulder	0%

Riffle Surface Pebble Count, Big Warrior Creek - Mountain Creek

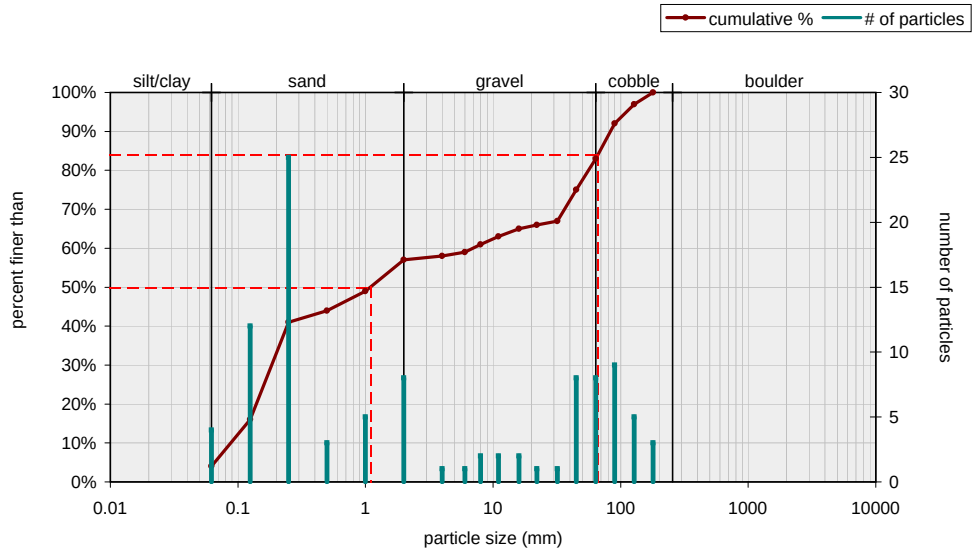


Size (mm)		
D16	0.63	3.4
D35	1.4	12
D50	2	17
D65	3.8	20
D84	57	29
D95	90	39

Size Distribution	
mean	6.0
dispersion	15.8
skewness	0.34

Type	
silt/clay	7%
sand	44%
gravel	35%
cobble	14%
boulder	0%

Riffle Surface Pebble Count, Big Warrior Creek - Unnamed Tributary

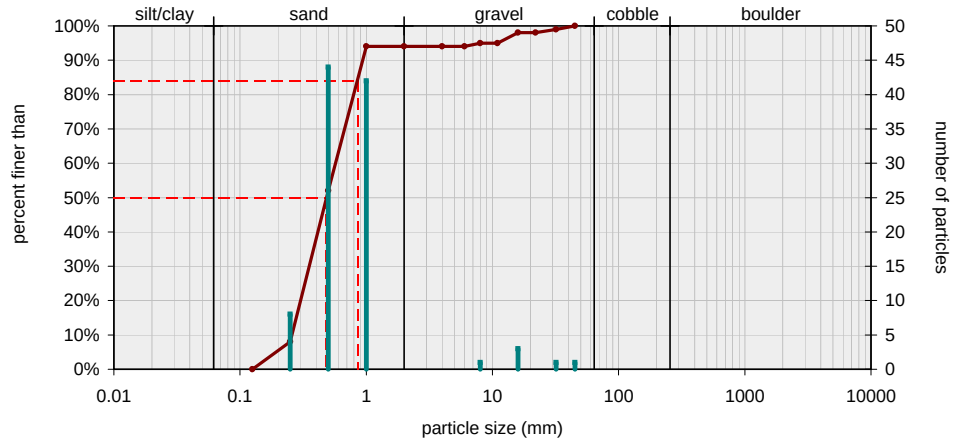


Size (mm)	
D16	0.13
D35	0.21
D50	1.1
D65	16
D84	66
D95	110

Size Distribution	
mean	2.9
dispersion	34.2
skewness	0.26

Type	
silt/clay	4%
sand	53%
gravel	26%
cobble	17%
boulder	0%

Bed Surface Pebble Count, Big Warrior Creek - Unnamed Tributary



Size (mm)		
D16	0.28	3.4
D35	0.38	12
D50	0.48	17
D65	0.62	20
D84	0.85	29
D95	8	39

Size Distribution	
mean	0.5
dispersion	1.7
skewness	0.01

Type	
silt/clay	0%
sand	94%
gravel	6%
cobble	0%
boulder	0%