Year 3 Monitoring Report for South Muddy Creek Tributaries (Queen Properties)

South Muddy Creek Tributaries
McDowell County, NC
SCO # D04006-01

Prepared for:
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I. EXECUTIVE SUMMARY

The South Muddy Creek Tributaries restoration project is located near Dysartsville in McDowell County, North Carolina. The stream channels included in this project are designated as Tributaries A, A2, B and C. Prior to restoration, Tributaries A and A2 were drainage channels that had experienced modification in the form of ditching and vegetative management. Tributaries B and C were natural channels that were in a degraded condition attributed to head-cutting and streambank erosion exacerbated by cattle intrusion. The project consists of a combination of Priority 1 and Priority 2 Restoration and Enhancement Level 1. The project goal for the restoration plan, completed in 2005, was to re-establish geomorphologic features consistent with natural stream channel characteristics. Elements of the restoration design included grade control and bank stabilization using natural materials and native plantings, reconnection of the channels to functional floodplains, and the incorporation of instream habitat features including riffle/pool complexes to re-establish, sort and transport substrate materials. The following report documents the Year 3 Annual Monitoring for this project.

Vegetative monitoring was completed in September 2008 using the methodology of the Carolina Vegetation Survey. Stem counts completed in 30 vegetation plots showed an average density of 336 stems per acre for the site, which meets the success criteria of 320 stems/acre after three years of monitoring. Thirteen of the thirty vegetation plots fall below this threshold number; these plots are scattered throughout the project area. Despite this, stem counts for Year 3 represent a net gain of 10 stems over the previous year, due to remedial plantings conducted in the spring of 2008. Further plantings will only be conducted as necessary to continue to maintain the required stem counts.

It is likely that the spread of *Sericea lespedeza* throughout much of the project corridor has hindered the growth and survival of woody vegetation. This species is a common component of pasture mixes, and likely spread into the project area from the surrounding pasture lands. Management in 2008 included herbicide treatments, with spraying focused on targeted planted areas to minimize the impact of the invasive on woody survival. This species will be closely monitored, with further spraying conducted as deemed necessary to enhance survival of the planted species.

Monitoring of the stream identified some problem areas along the tributaries of South Muddy Creek, including areas of bank scour. Areas first noted as problems in a previous year of monitoring along Tributaries B and A have extensive vegetative development, which has increased streambank stability. Newly noted problem areas are expected to follow the same trend of vegetative development. Tributary C includes locations with steep stream banks that were not included in enhancement activities. Because these steep banks are remnants of an existing condition and do not appear to be progressing into further instability, they are not included in the monitored problem areas.

Bedform features continue to evolve along the restored reaches as shown on the long-term longitudinal profiles. Riffle lengths and slopes remain stable. Pool to pool spacings are representative of reference reach conditions, adjusted for drainage area and bankfull width. The pools have maintained their as-built depths and have developed excellent glide features, providing spawning habitat for native fishes together with riffle substrates conducive to benthic macro-invertebrate populations to re-emerge. Comparisons of As-Built, Year 1, Year 2 and Year 3 long-term stream monitoring show successive increases in channel-floodplain connectivity and

increasingly stable channel dimensions, interpreted from width/depth ratios, entrenchment ratios, bank height ratios, and channel geomorphologic parameters as shown on the long-term monitoring cross-sections. Median particle sizes of the stream channels ranged from fine to coarse gravel in the riffle/run areas to silt and fine to medium grained sand in the pool/glide areas. Remedial maintenance work on the restored reaches is not warranted at this time.

II. PROJECT BACKGROUND

A. Location and Setting

The project is located in McDowell County, North Carolina, approximately two miles south of Interstate 40, between Marion and Morganton near the community of Dysartsville. The tributaries lie east of Muddy Creek Road, north of Pinnacle Church Road and west of Dysartsville Road, as shown on Figure 1. The stream channels included in the project are designated as Tributaries A, A2, B and C. Tributaries A, B and C confluence directly with South Muddy Creek. Tributary A2 confluences with Tributary A.

Directions to the project site are as follow:

> From Marion, follow Interstate 40 east to Dysartsville Road (Exit 94). Turn right onto Dysartsville Road to travel south for approximately 2 miles to Pinnacle Church Road. Follow Pinnacle Church Road to Muddy Creek Road, and turn right. The project site is on the east side of the road. This is private property; access to the stream corridor is limited to the dedicated ingress/egress included as part of the recorded Conservation Easement. Coordination with the property owner is encouraged prior to accessing the property.

B. Project Structure, Mitigation Type, Approach and Objectives

Pre-restoration land use surrounding the project tributaries consisted of agricultural croplands along Tributaries A and A2 and cattle pastureland along Tributaries B and C. The upper reaches of Tributaries A2, B and C were characterized by a mix of pastureland and limited wooded corridor. Tributaries A and A2 were drainage channels that had experienced modification in the form of ditching and vegetative management prior to restoration. Tributaries B and C are natural channels that, prior to restoration, were in a degraded condition attributed to head-cutting and streambank failure and erosion exacerbated by cattle intrusion and associated hoof shear. All of the tributary channels, prior to restoration, had narrow or denuded riparian corridors.

Tributaries A, A2 and B were surrounded by either cropland or pasture with no significant buffer prior to restoration. Tributaries B and C lacked cattle intrusion fencing that adversely impacted streambank stability. Tributary C was less degraded, prior to restoration, in that it had a significant wooded riparian corridor on the south (left) bank with well sorted and well graded bed materials. However, Tributary C was impacted by a significantly degraded riparian corridor on the north (right) bank, with numerous locations of streambank erosion and failure associated with cattle intrusion.

Restoration of the project streams re-established geomorphologic features consistent with natural stream channel characteristics. Results achieved are listed below.

- Bankfull channels constructed with the appropriate geometries to convey bankfull flows and transport suspended and bedload materials available to the streams.
- Stable channel patterns consistent with natural streams in the region.
- Grade control and bank stabilization features that enhance environmental attributes of the stream channels though the use of natural materials and native plantings.

- In-stream habitat features, including riffle/pool complexes to re-establish, sort and transport substrate materials available to the streams.
- Reconnection of project stream channels to functional floodplains.
- Extensive indigenous instream and riparian revetment.

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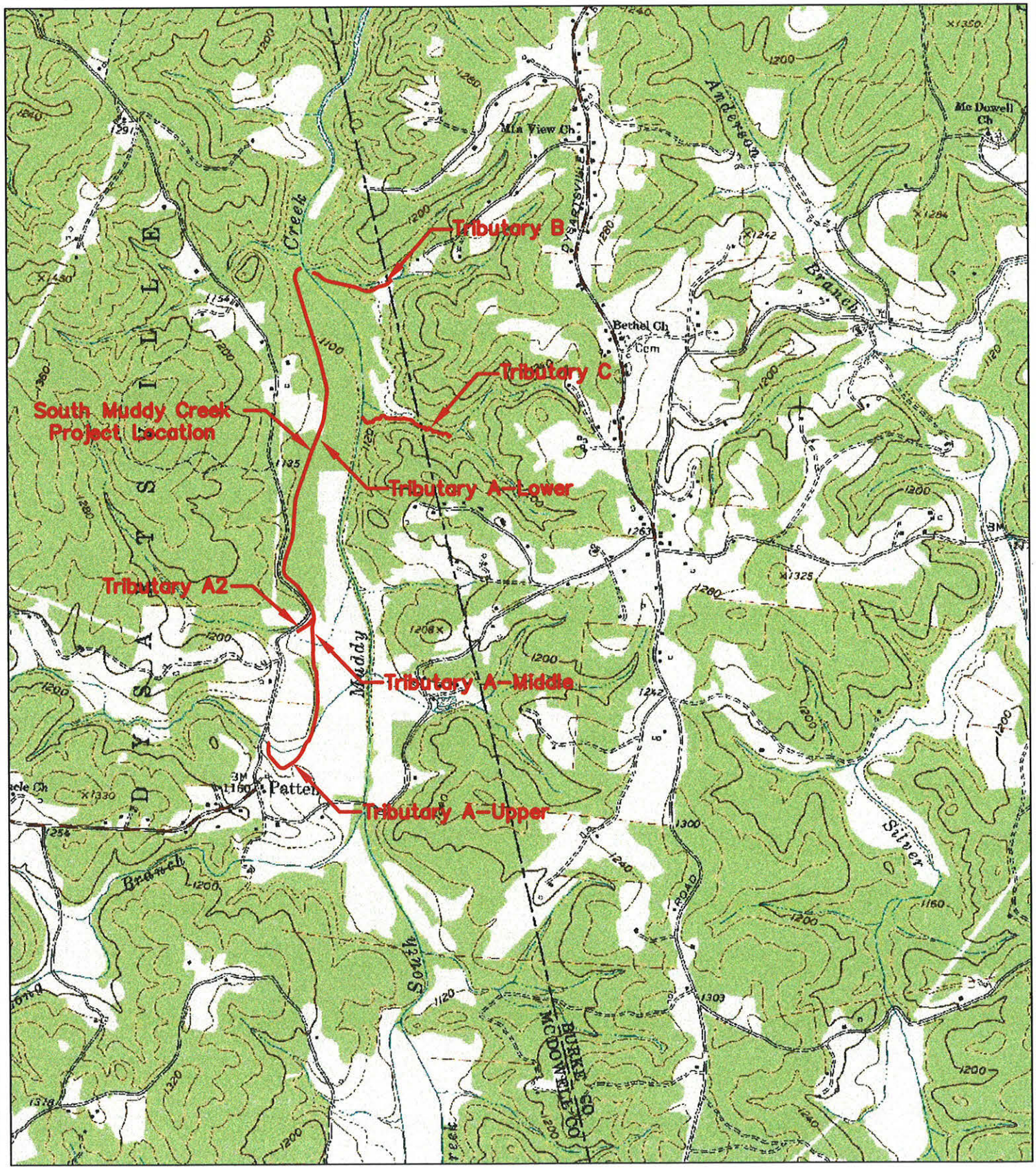
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 1

Date:	September, 2007	Job No.	2004-2359	Scale:	1" = 2000'



Restoration of Tributaries A, A2 and B was accomplished through the modification of the existing pattern, profile and dimension of the tributary channels to a stable condition. The restored channels are on an alignment that is offset from the pre-existing stream channels. Post-construction, the existing tributary channels were abandoned and filled. Restoration along these reaches was either Priority 2, where the elevation of the floodplain was lowered through excavation to re-connect it to the restored stream channel, or a combination of Priority 2 and Priority 1, where the floodplain was lowered and the stream thalweg was raised above the existing channel profile.

The lower reach of Tributary A has a low gradient, which flattens to 0.0012 ft/ft. Due to a relatively flat profile gradient, a series of successive pool and riffle complexes was not proposed. Instead, the restored stream channel has constructed point bars on the inside of meander bends at pool locations and is transporting its bedload through the run/pool complexes as the bed form of the channel naturally evolves. The steeper gradient associated with the restored stream channels along Tributaries A2 and B allowed the construction of a sinuous channel with constructed riffle/pool sequences.

Enhancement Level I was implemented along one of the reaches on Tributary A by modifying the profile and dimension of the channel. Along this segment, improvements were constructed along the alignment of the existing stream channel. Enhancement Level I on Tributary C provides bank stabilization, through cattle exclusion, with one hard-engineered, fenced and controlled cattle access point for watering, combined with continuous preservation of the riparian buffer zone via live stock exclusion fencing. Stabilization was accomplished by re-grading steep, undercut channel banks, and the use of jute matting and live plantings.

An important component of the restoration of Tributaries B and C is cattle exclusion. As mentioned previously, these channels are adjacent to pastureland, where cattle frequented the streams for shade and drinking water. Prior to restoration, the cattle accessed the streams at random locations and, in doing so, denuded and destabilized the pre-existing channel banks. The restoration of Tributary B includes fencing that permanently excludes cattle from the stream corridor. The fencing along Tributary C limits cattle access to a single point along the stream reinforced with stone underlain by non-woven geotextile to prevent degradation that would otherwise occur. All fencing has been placed at the outer edge of the perpetual conservation easement held by the State of North Carolina. Information regarding the project structure and objectives is included in Tables I and II that follows:

Table I. Project Structure Table
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Project Reach/Segment ID	Linear Footage
A (upper)	1,609 l.f.
A (middle)	1,094 l.f.
A	1,052 l.f.
A (lower)	7,349 l.f.
A2	480 l.f.
B	2,041 l.f.
C	1,601 l.f.
TOTAL	**15,226 l.f.**

Table II. Project Mitigation Objectives Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01				
Project Segment/ Reach ID	**Mitigation Type**	**Approach**	**Linear Footage or Acreage**	**Comment**
A (upper)	Restoration	Priority 1&2	1,609 l.f.	Restore dimension, pattern, and profile
A	Enhancement	Level 1	1,052 l.f.	Restore dimension and profile
A (middle)	Restoration	Priority 1&2	1,094 l.f.	Restore dimension, pattern, and profile
A (lower)	Restoration	Priority 2	7,349 l.f.	Restore dimension, pattern, and profile
A2	Restoration	Priority 2	480 l.f.	Restore dimension, pattern, and profile
B	Restoration	Priority 2	2,041 l.f.	Restore dimension, pattern, and profile
C	Enhancement	Level 1	1,601 l.f.	Restore dimension and pattern
TOTAL			**15,226 l.f.**	

C. Project History and Background

Project activity and reporting history are provided in Table III. The project contact information is provided in Table IV. The project background history is provided in Table V.

Table III. Project Activity and Reporting History South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration plan	Aug 2005	Fall 2004	Mar 2005
Final Design - 90%[1]	N/A	N/A	N/A
Construction	Feb 2006	N/A	Apr 2006
Temporary S&E applied to entire project area[2]	Jul 2005	N/A	Jul 2005
Permanent plantings	Apr 2006	N/A	Apr 2006
Mitigation plan/As-built	Jun 2006	Nov 2006	Jan 2007
Year 1 monitoring	2006	Sep 2006 (vegetation) Apr 2007 (geomorphology)	Jun 2007
Year 2 monitoring	2007	Sep 2007 (vegetation) Oct 2007 (geomorphology)	Jan 2008
Year 3 monitoring	2008	Sep 2008 (vegetation) Oct 2008 (geomorphology)	Dec 2008
Year 4 monitoring	2009		
Year 5 monitoring	2010		

[1]Full-delivery project; 90% submittal not provided.

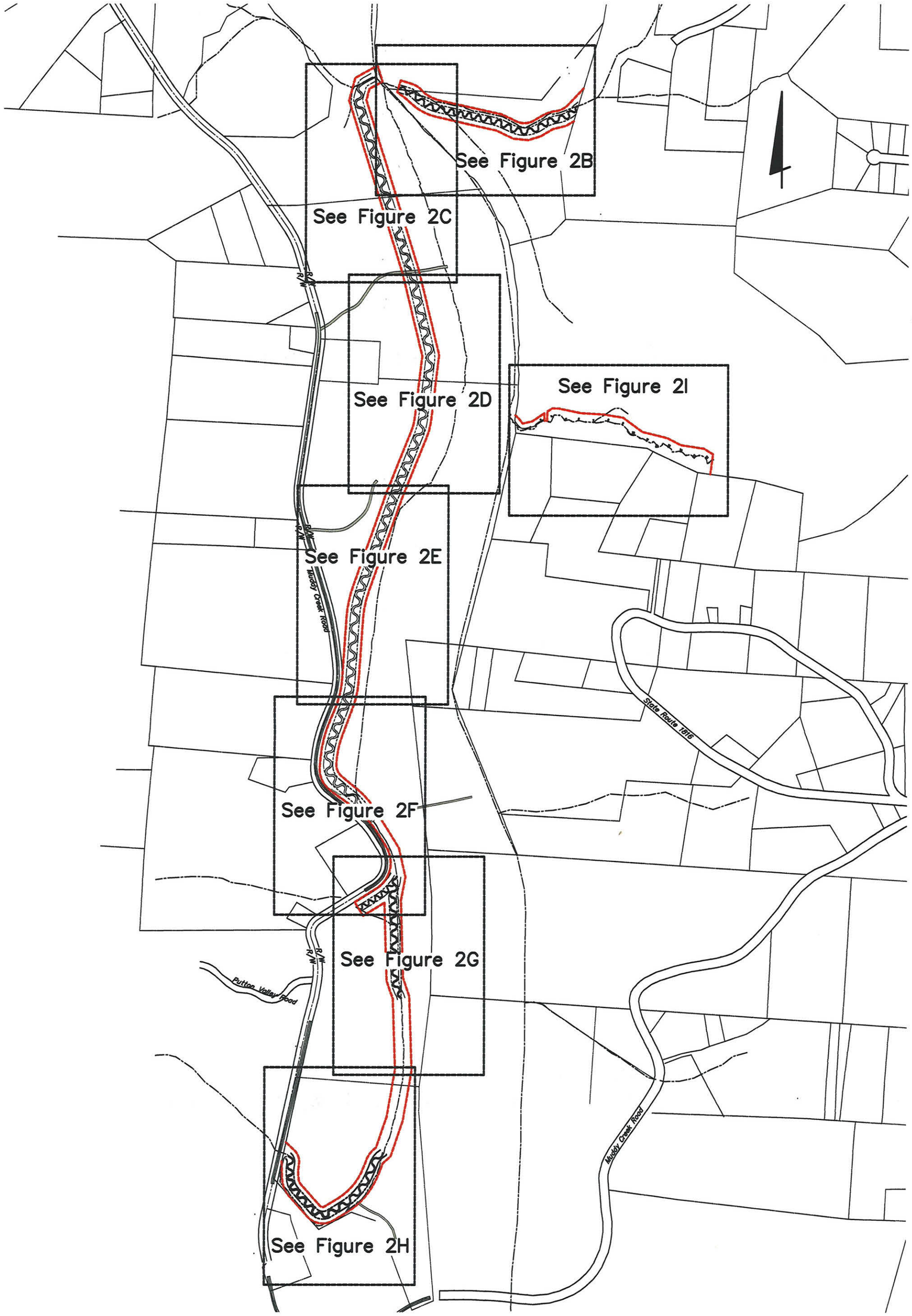
[2]Erosion and sediment control applied incrementally throughout the course of the project.
N/A: Data collection is not an applicable task to these project activities.

Table IV. Project Contact Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01	
Designer	Evans, Mechwart, Hambleton & Tilton, Inc. 5500 New Albany Road, Columbus, OH 43054
Construction Contractor	South Mountain Forestry 6624 Roper Hollow, Morganton, NC 28655
Monitoring Performers	Evans, Mechwart, Hambleton & Tilton, Inc. 5500 New Albany Road, Columbus, OH 43054
Stream Monitoring POC	Warren E. Knotts, P.G., EMH&T
Vegetation Monitoring POC	Holly Blunck, EMH&T

Table V. Project Background Table South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01	
Project County	McDowell
Drainage Area- A (upper & middle)	1.38 sq mi
Drainage Area-A (lower)	2.03 sq mi
Drainage Area-A2	0.27 sq mi
Drainage Area-B	0.44 sq mi
Drainage Area-C	0.37 sq mi
Drainage Impervious Cover Estimate	2%-6%
Stream Order	Tributary A, B, C -2nd Tributaries A2 – 1st
Physiographic Region	Blue Ridge Mountains
Ecoregion	Eastern Blue Ridge Foothills
Rosgen Classification of As-built	C4/C5
Dominant Soil Types	Iotla sandy loam, Dillard loam
Reference Site ID	South Muddy Birchfield, South Muddy "Tributary 4"
USGS HUC for Project and Reference	3050101
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
Reason for 303d listing or stressor	N/A
% of project easement fenced	24%

D. Monitoring Plan View

The monitoring plan view is included as Figure 2.



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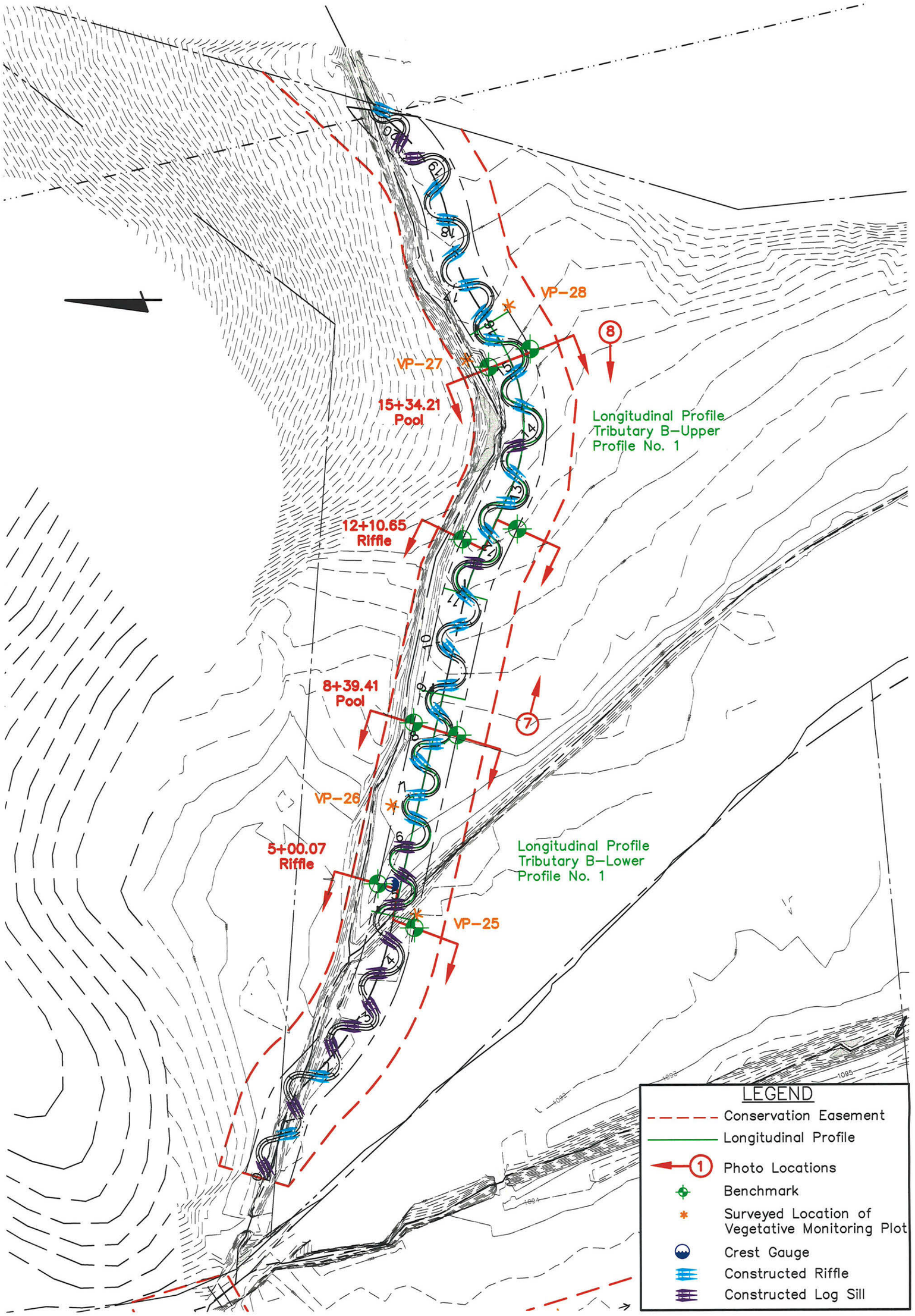
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2A

INDEX MAP

Date:	September, 2007
Scale:	1" = 600'
Job No:	2006-1627



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MONITORING

FIGURE 2B
TRIBUTARY B

Date: September, 2007

Scale: 1" = 600'

Job No: 2006-1627

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FIGURE 2C

TRIBUTARY A - LOWER

Date:	September, 2007
Scale:	1" = 100'
Job No:	2006-1627

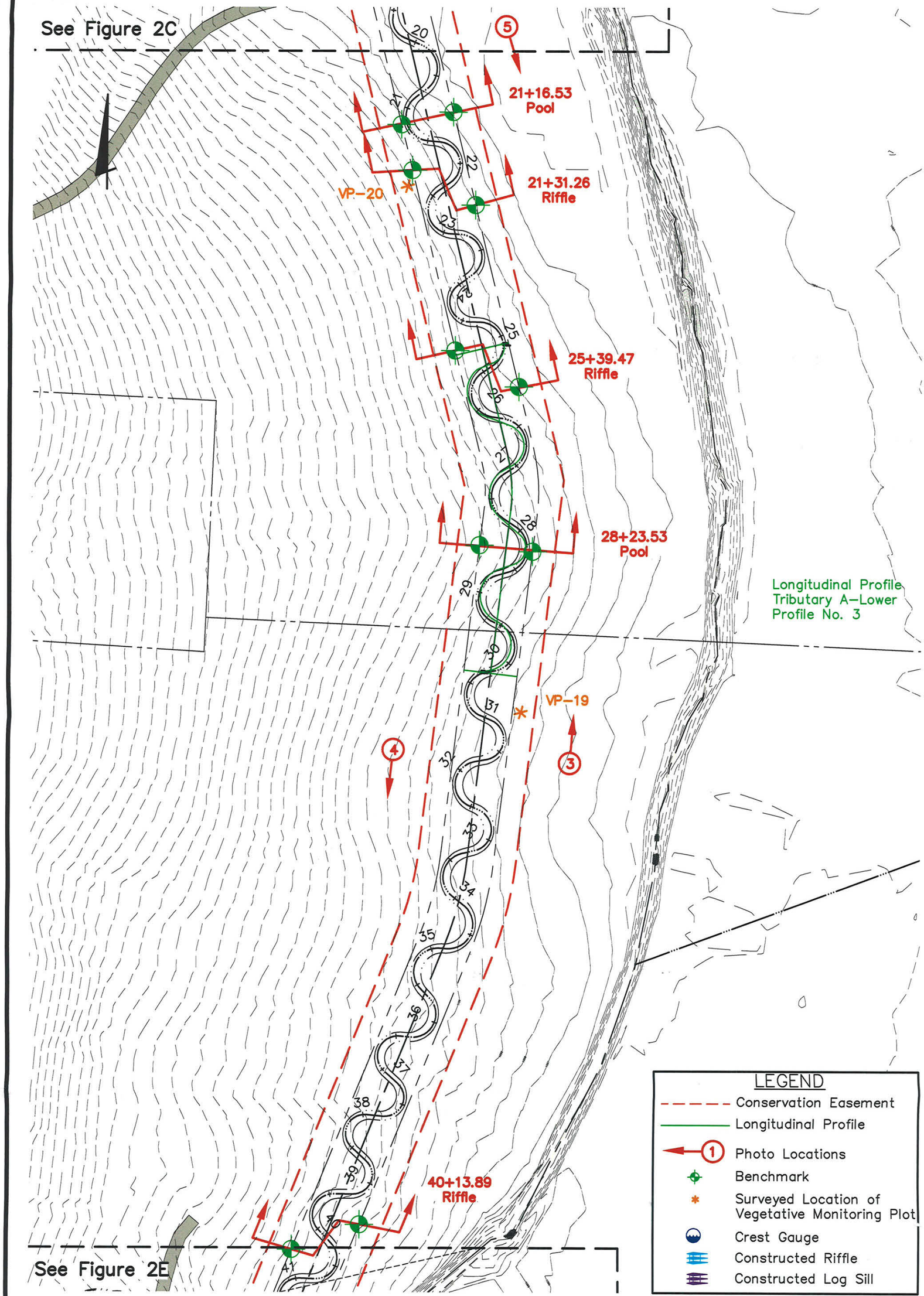

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FIGURE 2D

TRIBUTARY A - LOWER

Date: September, 2007

Scale: 1" = 100'

Job No: 2006-1627

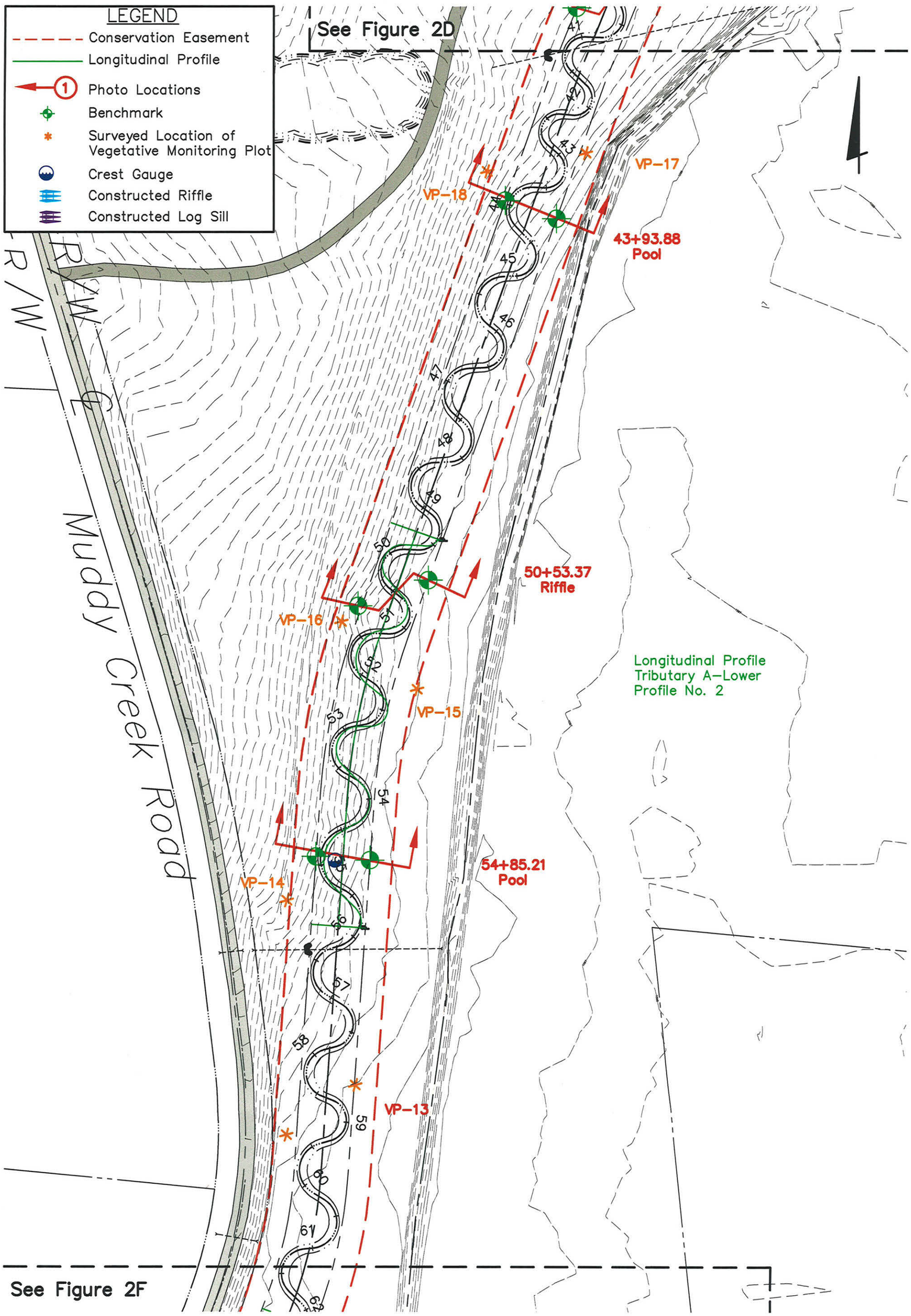

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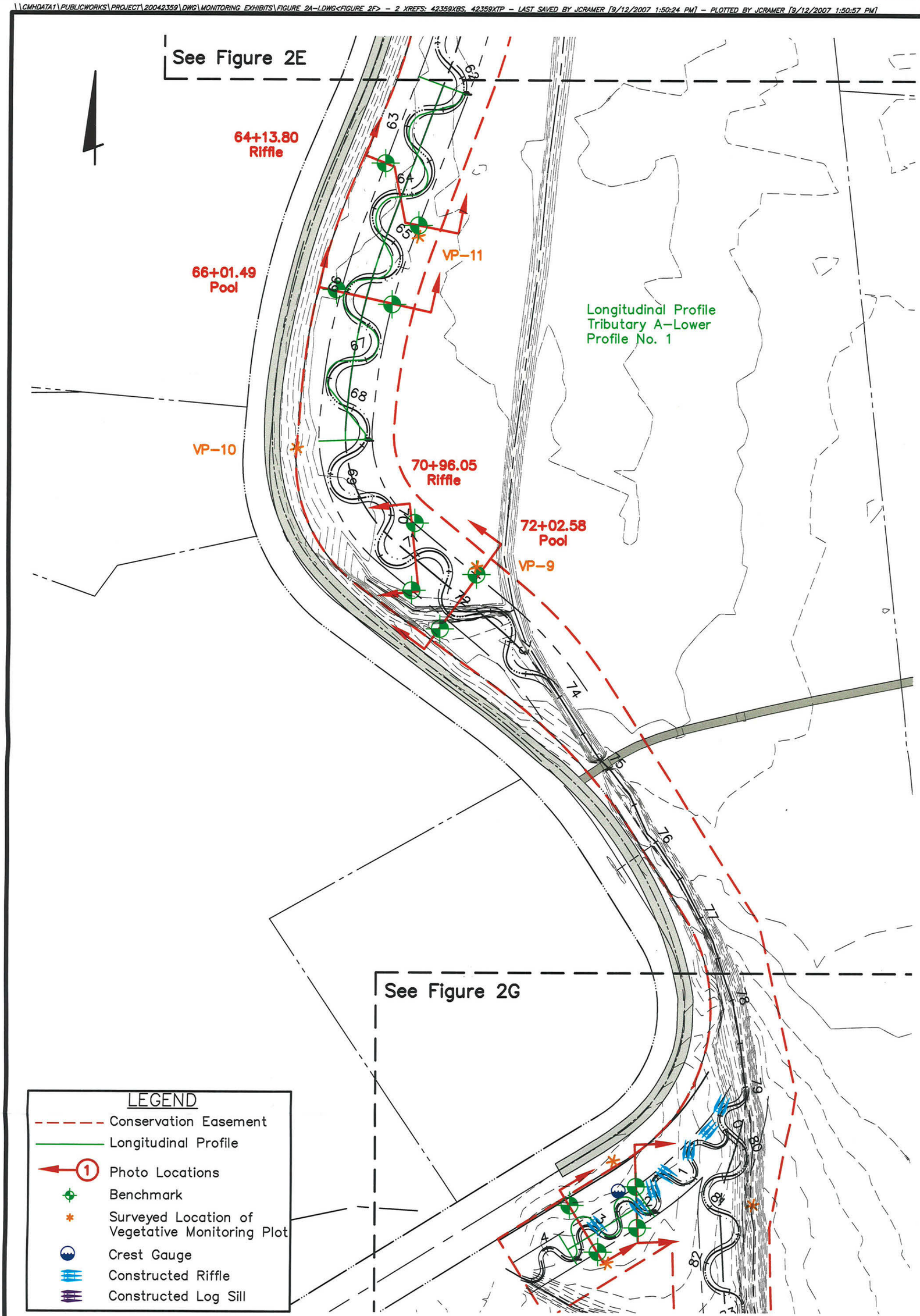
FIGURE 2E

TRIBUTARY A - LOWER

Date:	September, 2007
Scale:	1" = 100'
Job No:	2006-1627



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MONITORING

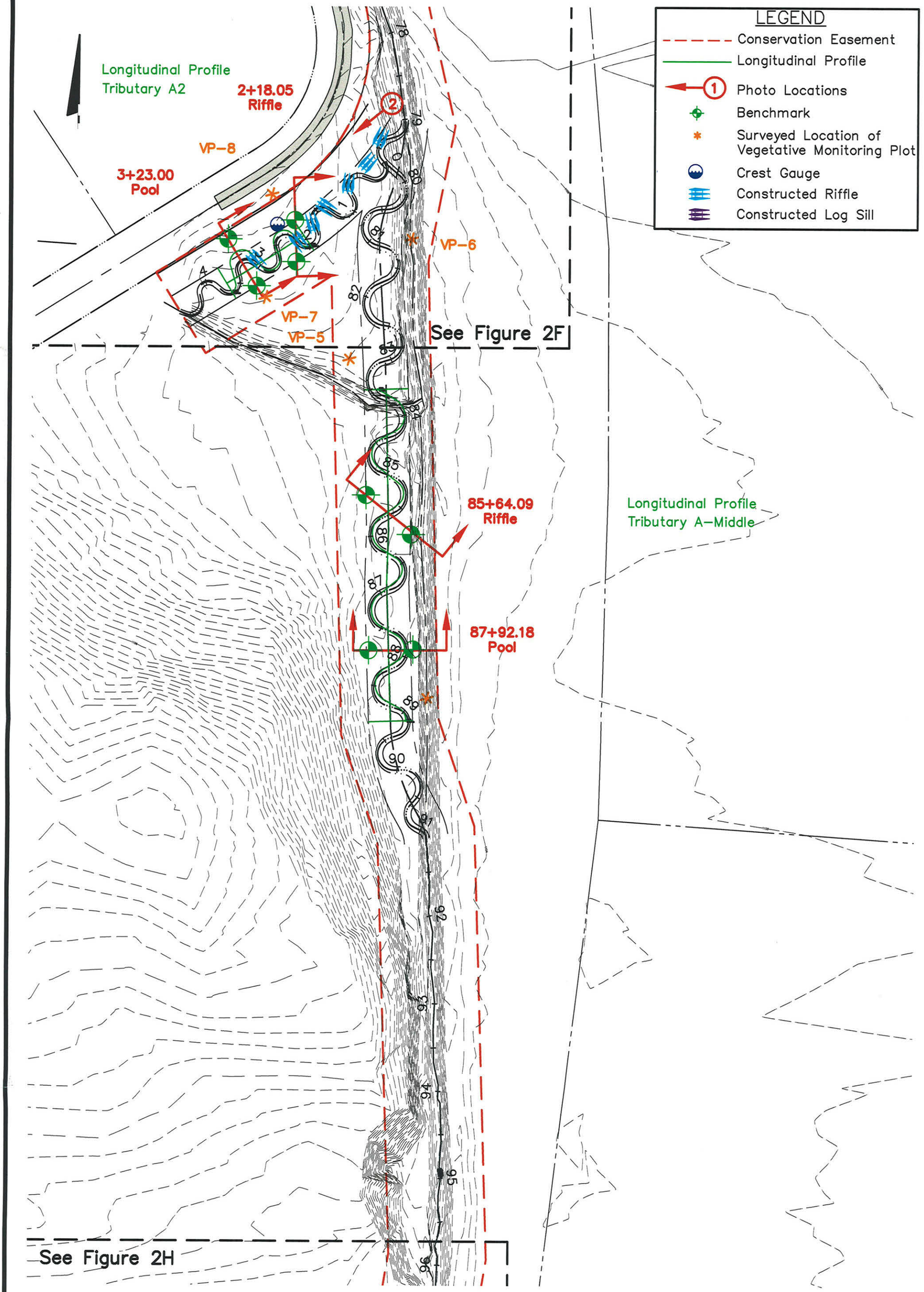
FIGURE 2F

TRIBUTARY A - LOWER

Date: September, 2007

Scale: 1" = 100'

Job No: 2006-1627



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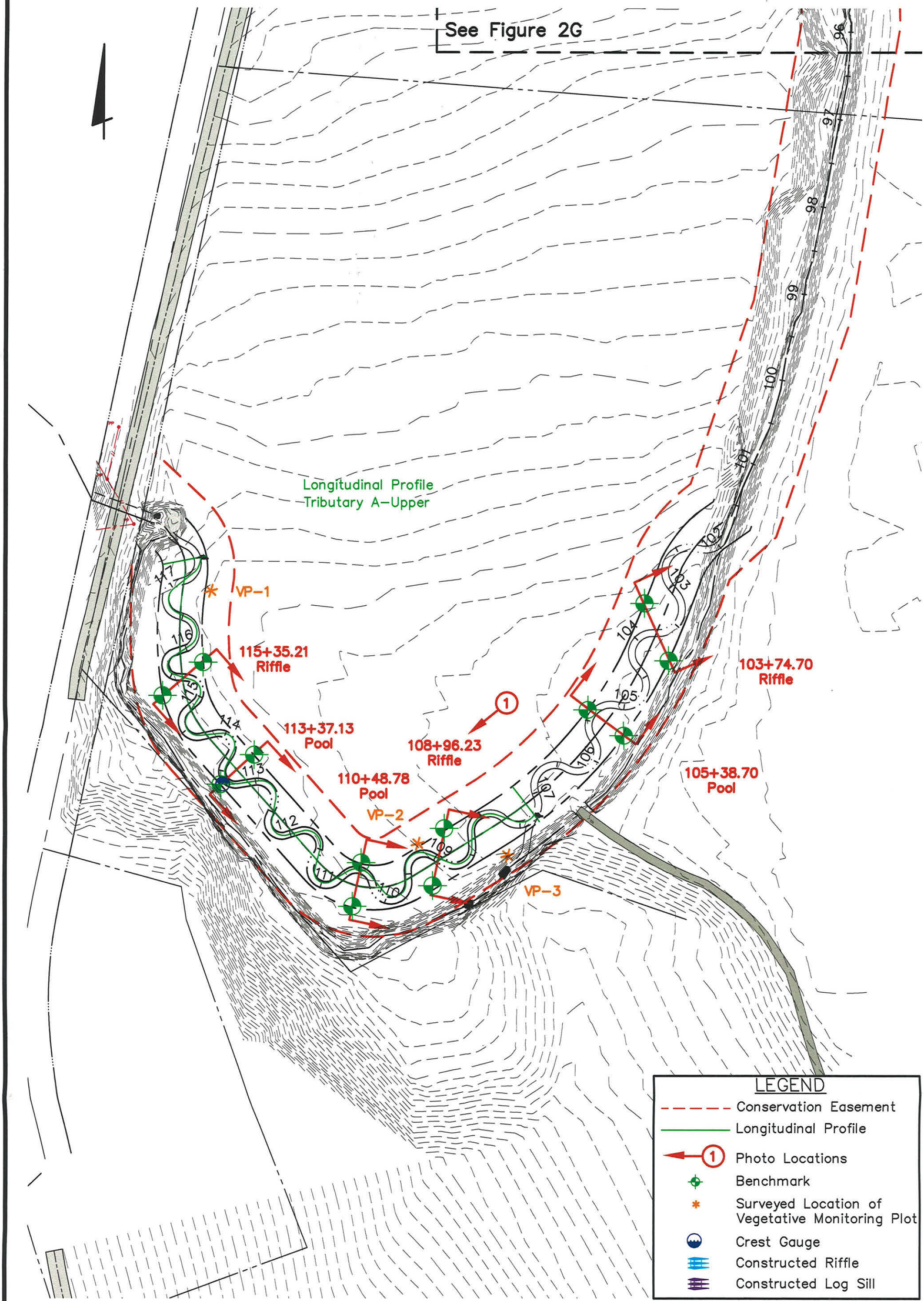
MONITORING

FIGURE 2G

TRIBUTARY A2 AND TRIBUTARY A - MIDDLE

Date:	September, 2007
Scale:	1" = 100'
Job No:	2006-1627



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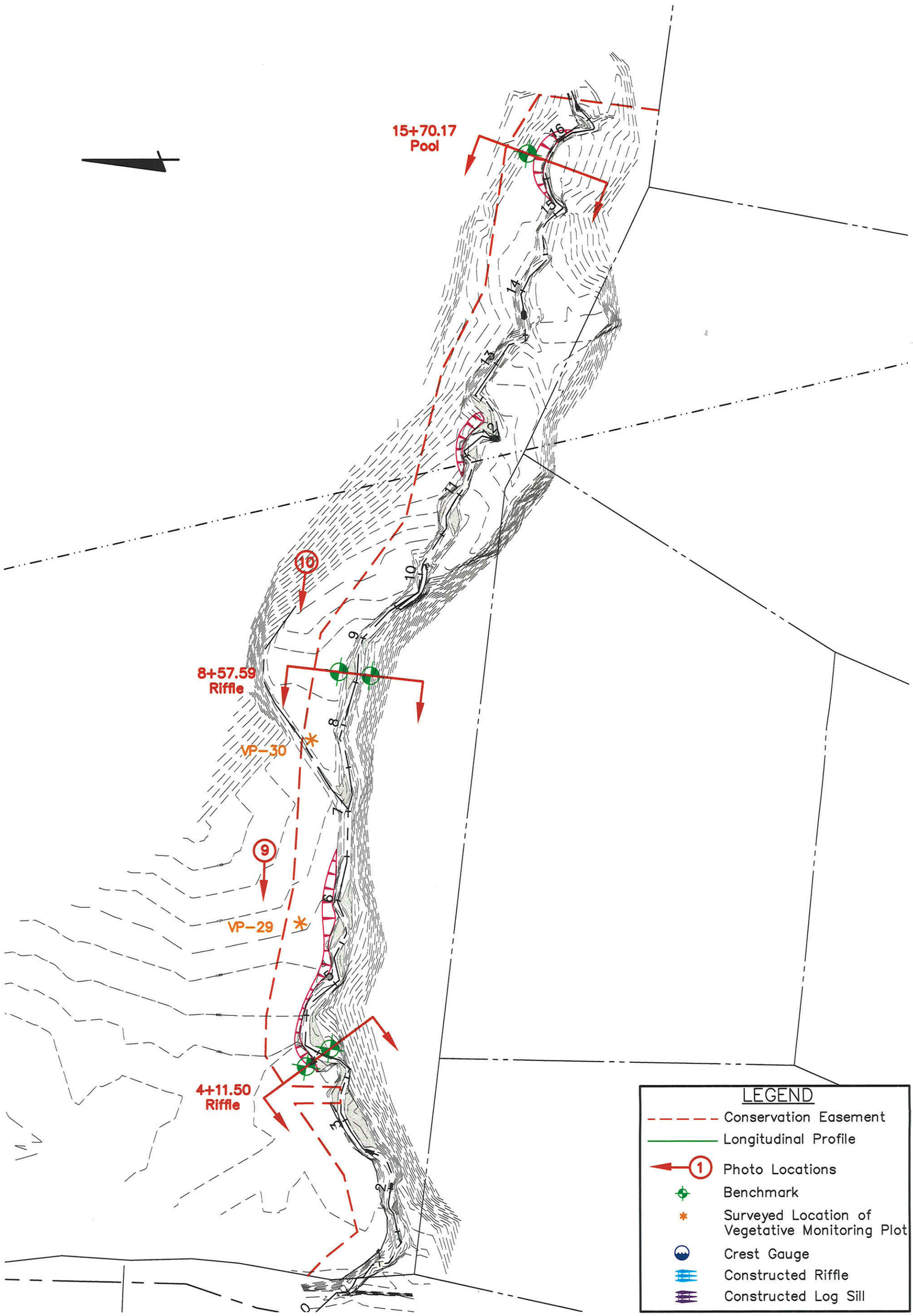
MONITORING

FIGURE 2H

TRIBUTARY A - UPPER

Date:	September, 2007
Scale:	1" = 100'
Job No:	2006-1627



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SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

FIGURE 2I

TRIBUTARY C

Date:	September, 2007
Scale:	1" = 100'
Job No:	2006-1627

III. PROJECT CONDITION AND MONITORING RESULTS

A. Vegetation Assessment

1. Soil Data

The project area is contained within the Iotla-Braddock-Rosman-Potomac soil association. This soil association typically consists of nearly level to very steep, somewhat poorly drained soils, which have a predominantly loamy, clayey or sandy subsoil formed in alluvium on floodplains and stream terraces (USDA, NRCS 1995).

The majority of Tributary A is mapped within Iotla sandy loam with 0-2% slopes, occasionally flooded. The upstream portion of the tributary flows through additional soil units including Elsinboro loam with 1-4% slopes, rarely flooded, Braddock clay loam with 6-15% slopes, eroded and Hayesville-Evard complex with 15-35% slopes. Tributary A2 is mapped in Iotla sandy loam. The portion of tributary B that is included in the restoration is mapped within Dillard loam, 1-4% slopes, rarely flooded. The portion of Tributary C that is included in the restoration is mapped within the Iotla sandy loam unit.

Data on the soils series found within and near the project site is summarized in Table VI.

Table VI. Preliminary Soil Data
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Series	Max. Depth (in.)	% Clay on Surface	K[1]	T[2]	% Organic Matter
Braddock clay loam (BrC2)	80+	27-40	0.32	5	0-2
Dillard loam (DdB)	80+	10-15	0.32	5	4-8
Elsinboro loam (EsB)	60+	8-18	0.28	5	1-3
Hayesville-Evard complex (HeD)	60+	7-25	0.24-0.28	5	1-5
Iotla sandy loam (IoA)	60+	12-18	0.2	5	4-8

[1]Erosion Factor K indicates the susceptibility of a soil to sheet and rill erosion, ranging from 0.05 to 0.69.
[2]Erosion Factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity, measured in tons per acre per year.

2. Vegetative Problem Areas

Vegetative Problem Areas are defined as areas either lacking vegetation or containing populations of exotic vegetation. All problem areas identified during each year of monitoring are summarized in Table VII. Photographs of the vegetative problem areas are shown in Appendix A. There are also a few locations where the density of planted woody stems is not high enough to meet the required stem counts. Densities of planted woody species are discussed in the Stem Counts section of this report.

Table VII. Vegetative Problem Areas

South Muddy Creek Stream Restoration / EEP Project No. D04006-01			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
Invasive Population	Throughout: See VPA Plan View	*Sericea lespedeza*: encroachment from pasture	VPA 1, VPA 2

The only type of vegetative problem is the spread of an invasive species, *Sericea lespedeza.* This species is a common component of pasture mixes, and as this project is adjacent to pasture lands, it likely spread into the project area from the surrounding landscape. The spread of the species is extensive throughout the project corridor, and has increased slightly over the past year. Management in 2008 included herbicide treatments, with spraying focused on the areas most densely planted with trees in an attempt to minimize the impact of the invasive on woody survival. This spraying had minimal negative effect on the spread of this species. Further spraying will be conducted throughout the monitoring period as deemed necessary to enhance survival of the planted species. Management of the woody vegetation is discussed in the Stem Counts section of this report.

3. Vegetation Problem Area Plan View

The location of each vegetation problem area is shown on the vegetative problem area plan view included in Appendix A. Each problem area is color coded with yellow for areas of low concern (areas to be watched) or red for high concern (areas where maintenance is warranted).

4. Stem Counts

A summary of the stem count data for each species arranged by plot is shown in Table VIII. This data was compiled from the information collected on each plot using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0*.

The average stem density for the entire site just meets the minimum criteria of 320 stems per acre after three years. However, thirteen of the thirty vegetation plots fall below this threshold number. The largest deficit in woody stems is found along Tributary C (Plots 29 and 30), the reach with thick naturally forested cover. Tributary B also exhibits a deficiency in woody stems throughout the entire length of stream; this is the reach most impacted by *Sericea lespedeza.* The remainder of the plots with an insufficient number of stems are scattered along Tributary A, particularly the lower segment.

Throughout the three years of monitoring, it has been clear that the survival of seedlings is being affected on this site, as many of the original and remedial plantings are not surviving through the growing season. It is likely that the stem densities were reduced in these plots largely due to an infestation of invasive *Sericea lespedeza*. Where present, this species is dominant, providing a thick coverage of growth approximately three feet high through which any species must break in order to receive sunlight or rainfall. Herbicide application was conducted within the South Muddy project area just prior to the 2008 vegetation monitoring in an attempt to eradicate the *Sericea lespedeza*. Some yellowing of the plant was observed in response to the herbicide during monitoring; however, sufficient time had not elapsed to realize total die-off. Management of this invasive population will continue through selective herbicide treatments, the results of which will be documented in subsequent monitoring reports.

Remedial plantings were conducted in late April, 2007 to supplement the number of trees along the streams. Approximately 2000 trees were planted at this time, including 500 trees along Tributary C, and 1500 trees along the other reaches. These additional trees brought the average live stem density to 323 stems per acre in Year 2, an increase over the average live stem density of 284 stems per acre in Year 1. An additional round of remedial tree plantings were conducted in 2008, which were intended to bring deficient areas of the site back into compliance with the 320 stems per acre minimum. Due to continued mortality of planted stems which is speculated to be due to the coverage of *Sericea lespedeza*, these plantings did not bring all areas of the site back to the minimum stem count. The remedial plantings did, however, result in a net gain of woody stems for the entire site.

To address the issue of the remaining low plant stem counts, specific areas will be targeted for replanting within the South Muddy Tributary riparian corridors, which will include the deficient sample plots and surrounding areas within the buffer. All deficient portions of the riparian corridors will be supplemented with additional native tree and shrub plantings. These supplemental plantings will follow the specifications of the project proposed in the project Restoration Plan and Mitigation Plan documents. Consideration will be given to using larger woody stock, such as three-gallon potted material versus bare root specimen in performing the remedial plantings. These larger saplings should have a more developed root system and thus be better able to compete with the existing vegetation. Supplemental replanting will occur during spring 2009. The subsequent Year 4 (2009) monitoring report will contain specific documentation of this remedial planting effort including the specific locations of replanting, and the quantity and species of tree and shrub material installed.

5. Vegetation Plot Photos

Vegetation plot photos are provided in Appendix A.

Table VIII. Stem counts for each species arranged by plot.
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Species	Plots																													Year 1 Totals
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
Shrubs																															
Alnus serrulata																									5	8	3	7			
Cephalanthus occidentalis																															
Cornus amomum	5	5	6		3	5	2	3	4	3	5	2		1	1	1		3	1	2	3	2	6	1							64
Sambucus canadensis										4		1																			5
Trees																															0
Fraxinus pennsylvanica	3	2	2			2		1	2			3		2	1	1	3	3					1	2						1	29
Platanus occidentalis	1		3	2	6			2	1				1		2			1	1	1	1	1		1							24
Quercus alba	1		2	5	1		1	1	3		1		1	2	4	2	1		2		6		1	3							37
Quercus phellos		1										1	5							2	1										10
Quercus pagoda																									3	3	3	4			13
Salix nigra							5																								
Year 1 Totals	10	8	13	7	10	7	8	7	10	7	6	7	7	5	8	4	4	7	4	5	11	3	8	7	8	11	6	11	0	1	210
Live Stem Density	405	324	527	284	405	284	324	284	405	284	243	284	284	203	324	162	162	284	162	203	446	122	324	284	324	446	243	446	0	41	
Average Live Stem Density	284																														

B. Stream Assessment

1. Hydrologic Criteria

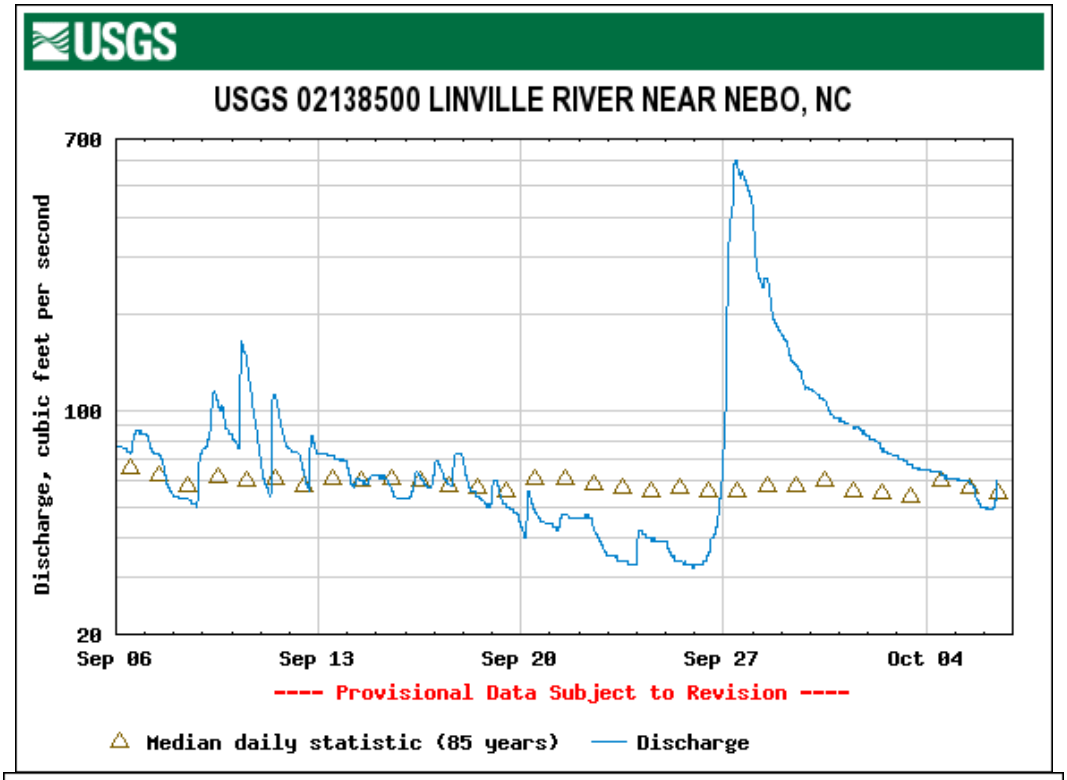
A network of six crest-stage stream gages was installed on each of the project reaches. The locations of the crest-stage stream gages are shown on the monitoring plan view (Figure 2). No bankfull events were documented for this site during the first year of monitoring. Bankfull events were recorded during Year 2, as documented in Table IX. Photographic documentation of the bankfull events is provided in Appendix B.

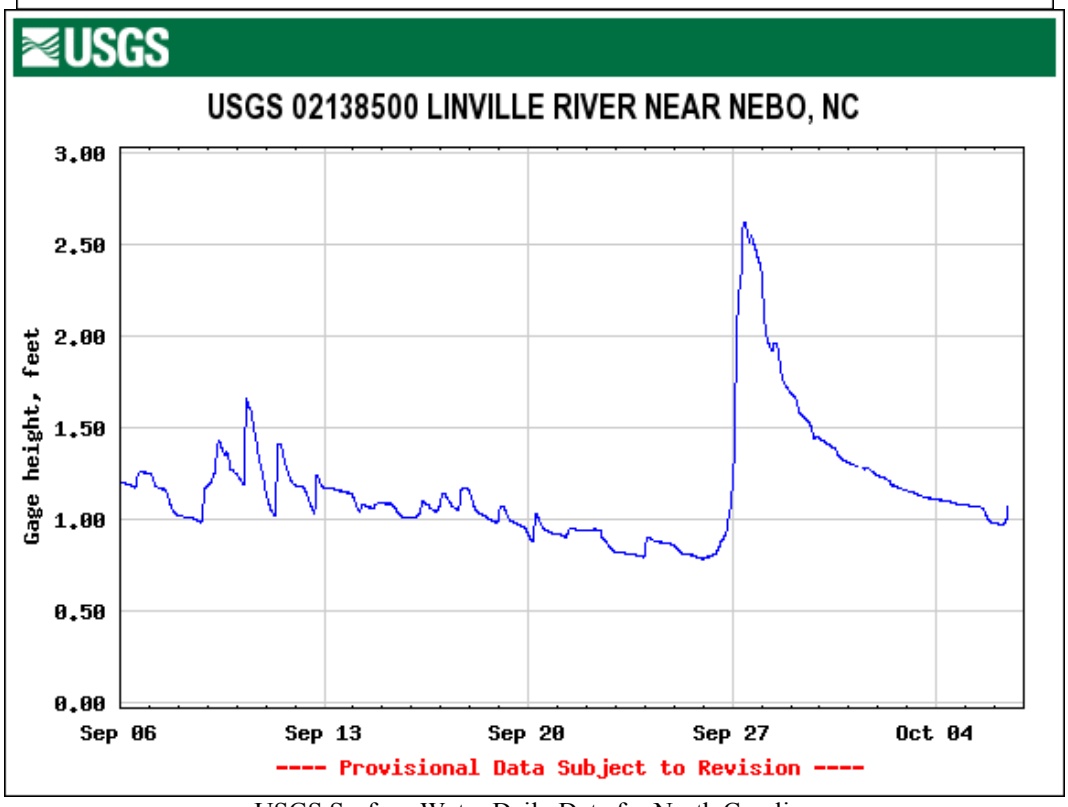
Table IX. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo #
7/18/07	Unknown	Crest gage at Station 5+00 on Tributary B	BF 1
7/18/07	Unknown (3 events)	Crest gage at Station 54+85 on Tributary A (Lower)	BF 2
10/19/07	9/14/07-9/15/07*	Crest gage at Station 113+37 on Tributary A (Upper)	BF 3
9/11/08	9/11/08	Photographed on-site	BF 4, BF 5, BF 6, BF 7

*Date is approximate; based on a review of recorded rainfall data

One bankfull event was photographed and observed during the Year 3 monitoring site visit. This corresponds to a high discharge event on September 11, 2008 as recorded at USGS Gage 02138500 at Nebo, North Carolina, located approximately 15 miles west of Morganton and 5 miles east of Marion, NC. The discharge and gage height recorded at the Nebo station are shown on the hydrographs below.





USGS Surface-Water Daily Data for North Carolina
http://waterdata.usgs.gov/nc/nwis/dv?

The photographic documentation from Year 3 and onsite crest gage network recorded the second monitoring year with a bankfull discharge event. The crest gages show evidence of this bankfull event during the annual data collection, including the larger bankfull event occurring on September 28, 2008. No additional bankfull events were documented by the onsite crest gage network during Monitoring Year 3.

2. Stream Problem Areas

A summary of the areas of concern identified during the visual assessment of the stream for each year of monitoring is included in Tables Xa through Xc.

Table Xa. Stream Problem Areas – Year 1
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Aggradation	4+50 (A2)	Large bar, 25 feet aggraded	SPA 1 (Year 1 Report)
	3+00 (A2)	Overwidened channel, 40 feet aggraded	
Bank failure	79+50 (A Middle)	Mat failed; scour hole, 5'	SPA 2, SPA 3 (Year 1 Report)
	12+10 (B)	Complete loss of riffle, bank failure.	
Bank scour	103+00 (A Upper)	Large hole, scour (15 feet)	SPA 4, SPA 5, SPA 6 (Year 1 Report)
	83+30 (A Middle)	Sloughing, coir log undercut and fallen into pool (15 feet)	
	82+70 (A Middle)	Sloughing, coir log undercut and fallen into pool (15 feet)	
	3+00 (A Lower)	Sloughing	
	19+70 (B)	Bank scour around log sill	
	18+50 (B)	Scour at outside meander bend; significant aggradation	
	16+00 (B)	Scour, matting loose and failing, bank slough	
	15+70 (C)	Bank scour/ sloughing	
	4+50 (C)	Bank scour/ sloughing	

Table Xb. Stream Problem Areas – Year 2
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01

Feature Issue	Station Numbers	Suspected Cause	Photo Number
Bank failure	12+10 (B)	Complete loss of riffle, bank recovering as a result of thick vegetation.	SPA 1
Bank scour	85+64 (A Middle)	Minor bank erosion	SPA 2
	15+70 (C)	Bank scour/ sloughing	
	4+50 (C)	Bank scour/ sloughing; heavily vegetated and stable	

Table Xb. Stream Problem Areas – Year 3 South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01			
Feature Issue	**Station Numbers**	**Suspected Cause**	**Photo Number**
Bank failure	12+10 (B)	Complete loss of riffle; banks are heavily vegetated and stable	SPA 1,2
Bank scour	84+75 (A Middle)	Bank scour/sloughing approximately 20 feet from stream at top of slope	SPA 3,4
	85+64 (A Middle)	Minor bank erosion; heavily vegetated and stable	
	16+50 (B)	Bank scour/sloughing on left bank	
	15+25 to15+70 (C)	Bank scour/ sloughing	
	4+11 to 4+50 (C)	Bank scour/ sloughing	

Some unstable areas were found along South Muddy Tributaries in Year 3, including areas of bank scour as noted in Table Xc. Tributaries B and C and the Middle section of Tributary A each had some areas of bank scour and/or bank erosion. Those areas first noted in a previous year, including the bank failure at station 12+10 along Tributary B and station 85+64 on Tributary A Middle, have become heavily vegetated in Year 3, providing streambank stability. The new areas of bank scour noted on Tributaries B and A Middle are expected to follow this same trend in future years of monitoring.

A few areas of bank scour have been noted on Tributary C in previous years of monitoring; these areas remain in Year 3. In addition, there are locations along this tributary with steep stream banks in danger of instability. These locations were not identified as areas for enhancement in the Restoration Plan, and as such, no restoration activities have occurred along these banks. Because these steep banks are remnants of an existing condition and do not appear to be progressing into further instability, they are not included in the monitored problem areas, but will be examined during future monitoring activities to ensure management activities along these stream banks does not become necessary to ensure the stability of restored areas.

3. Stream Problem Areas Plan View

The locations of problem areas are shown on the stream problem area plan view included in Appendix B. Each problem area is color coded with yellow for areas of low concern (areas to be watched) or red for high concern (areas where maintenance is warranted).

4. Stream Problem Areas Photos

Photographs of the stream problem areas are included in Appendix B.

5. Fixed Station Photos

Photographs were taken at each established photograph station on September 10 and September 11, 2008. These photographs are provided in Appendix B.

6. Stability Assessment Table

The visual stream assessment was performed to determine the percentage of stream features that remain in a stable state after the first year of monitoring. A summary of the assessment for each reach is included in Table XIa through Table XIf. This summary was compiled from the more comprehensive Table B1, included in Appendix B. Only those structures included in the as-built survey were assessed during monitoring and reported in the tables.

Table XIa. Categorical Stream Feature Visual Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (Upper)

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles[1]	100%	100%	100%	100%		
B. Pools[1]	100%	100%	100%	100%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	99%*	99%	100%		
E. Bed General	100%	100%	100%	100%		
F. Vanes / J Hooks etc. [2]	N/A	N/A	N/A	N/A		
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A		

Table XIb. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: A (Middle)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	100%	100%		
B. Pools[1]	100%	100%	100%	100%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	96%*	99%	99%		
E. Bed General	100%	100%	100%	100%		
F. Vanes / J Hooks etc. [2]	N/A	N/A	N/A	N/A		
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A		

Table XIc. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: A (Lower)						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	100%	100%	100%		
B. Pools[1]	100%	100%	100%	100%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	99%*	99%	100%		
E. Bed General	100%	100%	100%	100%		
F. Vanes / J Hooks etc. [2]	N/A	N/A	N/A	N/A		
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A		

Table XId. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: Tributary A2						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	97%*	100%	100%		
B. Pools[1]	100%	100%	100%	91%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	100%	100%	100%		
E. Bed General	100%	93%*	100%	100%		
F. Vanes / J Hooks etc. [2]	N/A	N/A	N/A	N/A		
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A		

Table XIe. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: B						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[1]	100%	99%*	99%	99%		
B. Pools[1]	100%	100%	100%	100%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	97%*	98%	100%		
E. Bed General	100%	100%	100%	100%		
F. Vanes / J Hooks etc. [2]	N/A	N/A	N/A	N/A		
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A		
H. Log Sills	100%	97%*	100%	100%		

Table XIf. Categorical Stream Feature Visual Stability Assessment South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01 Segment/Reach: C						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles[4]	100%	100%	100%	100%		
B. Pools[1]	100%	100%	100%	100%		
C. Thalweg	100%	100%	100%	100%		
D. Meanders	100%	99%*	98%	98%		
E. Bed General	100%	100%	100%	100%		
F. Vanes / J Hooks etc. [2]	N/A	N/A	N/A	N/A		
G. Wads and Boulders[2]	N/A	N/A	N/A	N/A		

* The percentages for Year 1 were updated, using the percentages derived from Table B1 in Appendix B, using the Feature Performance Mean percentages located in the last column of Table B1. The Feature Performance Mean percentages were used for Year 2; therefore, the percentages are now comparable across the years.

[1]The tables were completed to include a percentage of stability for pool and riffle features using the definitions provided below for the stream reaches along Tributary A.

Riffle: A portion of the linear stream segment located between two consecutive meander bends.

Pool: A portion of the curvilinear stream segment located in each meander bend.

[2]Those features not included in the stream restoration were labeled N/A. This includes features such as vanes, J-hooks, rootwads and boulders.

The only category that included unstable features for Tributaries Upper A, Middle A, Lower A and C were meanders, where minor erosion occurred along the outer bends. However, the meanders that had been in a state of degradation have improved through Years 2 and 3 due to the increased vegetative cover and associated root mass along the stream corridors. As the vegetation matures, the root mass is expanding in size, depth and density, enhancing streambank stability. As a result, the areas of instability along Tributaries Middle A and C have remained unchanged, with no further degradation, while the areas of instability on Tributaries Upper A and Lower A are stable after three years of monitoring.

The areas along Tributary A2 with unstable features in Year 1 were areas of aggradation and bar formation in the riffles. These areas are no longer considered problem areas in Year 3, as the vegetation cover increased along this reach and areas of aggradation noted during Year 1 are no longer evident. In Year 3, the "flushing" associated with two documented bankfull flows together with continued vegetation development has resulted in pools re-establishing their as-built depths. Based on three years of observations, including the severe draught during 2006 through 2008, are channel instability in future years is not anticipated.

The unstable features on Tributary B were erosion along meander bends and bank scouring around riffles. The overall percentage of stability improved from Year 1 to Year 3, indicating a trend in increased channel stability over time. As discussed for the other reaches, Tributary B is now heavily vegetated, increasing bank and streambed stability. Because of this vegetation development, the riffles have remained in a static state since the previous year, with no further erosion, and meanders have been deemed stable due to the stabilizing quality of the heavy vegetative cover. Log sills are functioning, maintaining grade control, providing aeration and enhancing aquatic habitat features.

7. Quantitative Measures

Graphic interpretations of cross-sections, profiles and pebble counts are provided in Appendix B. A summary of the baseline morphology for the site is included in Table XII for comparison with the monitoring data shown in the tables in the appendix.

The data provided in Table XII for Year 1 reflects data from only the long-term monitoring reaches assessed along the Year 1 longitudinal profiles. The As-Built data documents the entire stream restoration project. The stream pattern data provided for Year 1, Year 2 and Year 3 is the same as the data provided from the As-Built survey, as pattern has not changed based on post-construction stream surveys and comprehensive visual field assessments along each of the project reaches.

Bedform features continue to evolve along the restored reaches as shown on the long-term longitudinal profiles. Riffle lengths and slopes remain stable. Pool to pool spacings are representative of reference reach conditions, adjusted for drainage area and bankfull width. The pools have maintained their as-built depths and have developed excellent glide features, providing spawning habitat for native fishes together with riffle substrates conducive to benthic macro-invertebrate populations to re-emerge. Comparisons of As-Built, Year 1, Year 2 and Year 3 long-term stream monitoring show successive increases in channel-floodplain connectivity and increasingly stable channel dimensions, interpreted from width/depth ratios, entrenchment ratios, bank height ratios, and channel geomorphologic parameters as shown on the long-term monitoring cross-sections. Median particle sizes of the stream channels ranged from fine to coarse gravel in the riffle/run areas to silt and fine to medium grained sand in the pool/glide areas. Remedial maintenance work on the restored reaches is not warranted at this time.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Upper Tributary A {Long-Term Monitoring Profile Station 0+00 to 9+26.47 (926.47 feet)}

Parameter	Reference Reach Data [1]						XS 114+61.61, -35.13									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			1.38			1.38			1.38			1.38
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.55			7.60	11.00	14.00	12.50	11.00	14.00	
Flood Prone Width (Wfpa) - ft.			100			43			9.12			50.00			50			50
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			5.91			10.44	8.86	12.24	10.55	8.86	12.24	
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.90			1.80	0.63	1.11	0.87	0.63	1.11	
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.78				1.28	1.66	1.47	1.28	1.66	
Width/Depth Ratio			5.6			6.1			7.28			4.22	9.91	22.22	16.07	9.91	22.22	
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.39			6.58	3.57	4.55	4.06	3.57	4.55	
Bank Height Ratio			1.0			1.8			3.59			1.00			1.11			1.11
Wetted Perimeter - ft.			14.6			9.95			8.35			9.09	12.00	14.38	13.19	12.00	14.38	
Hydraulic radius - ft.			1.42			0.91			0.71			1.15	0.62	1.02	0.82	0.62	1.02	
Pattern																		
Belt Width (Wblt) - ft.						50				46.38	64.9				50			50
Radius of Curvature (Rc) - ft.						10						19.00	10.67	24.71	16.26	10.67	24.71	16.26
Meander Length (Lm) - ft.						50				76	106.4		60	107	78.5	60	107	78.5
Meander Width Ratio (Wblt/Wbkf)						6.8						6.58			4.00			4.00
Profile																		
Min Run Length (Lrif) - ft.			16			10							23.8	130.3	53.3	23.8	130.3	53.3
Min Run Slope (Srif) - ft./ft.			0.026			0.032							0.0026	0.0069	0.0048	0.0026	0.0069	0.0048
Pool Length (Lpool) - ft.			9			24							26.8	96.8	46.8	26.8	96.8	46.8
Pool-Pool Spacing (p-p) - ft.			40			27							85.3	159.9	128.7	85.3	159.9	128.7
Substrate																		
d_{50} (mm)			20			26						20			3.4			3.4
d_{84} (mm)			38			76						38			12.5			12.5
Additional Reach Parameters																		
Valley Length (ft)						295			2520			1049			1097			660.04
Channel Length (ft)			236			479			2644			1539			1609			926.47
Sinuosity						1.6			1.05			1.47			1.47			1.40
Water Surface Slope (Save)			0.006			0.022			0.0035			0.0030			0.0023			0.0023
Bankfull Slope (Sval)			NA			0.025						0.0044			0.0033			0.0033
Rosgen Classification			E4			E4			F/G			E4			C5			C5
Bankfull mean velocity (Vbkf)			4.7			6.9			2.77			1.98			1.98			1.98
Bankfull Discharge (Qbkf)			98			60			26.00			20.7			20.7			20.7

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.

Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Middle Tributary A {Long-Term Monitoring Profile Station 0+00 to 5+17.09 (517.09 feet)}

Parameter	Reference Reach Data [1]						XS 114+61.61, -35.13									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			1.38			1.38			1.38			1.38
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.55			8.00			15.00			15.00
Flood Prone Width (Wfpa) - ft.			100			43			9.12			50.00			60.00			60.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			5.91			12.00			12.61			12.61
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.90			2.00			0.84			0.84
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.78						1.50			1.50
Width/Depth Ratio			5.6			6.1			7.28			4.00			17.86			17.86
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.39			6.25			4.00			4.00
Bank Height Ratio			1.0			1.8			3.59			1.00			1.11			1.11
Wetted Perimeter - ft.			14.6			9.95			8.35			9.66			15.49			15.49
Hydraulic radius - ft.			1.42			0.91			0.71			1.24			0.81			0.81
Pattern																		
Belt Width (Wblt) - ft.						50				48.80	68.32				50.00			50.00
Radius of Curvature (Rc) - ft.						10						20.00	15.04	41.80	20.62	15.04	41.80	20.62
Meander Length (Lm) - ft.						50				80.00	112.00		75.00	91.00	85.00	75.00	91.00	85.00
Meander Width Ratio (Wblt/Wbkf)						6.8						6.25			3.33			3.33
Profile																		
Min Run Length (Lrif) - ft.			16			10							36.5	72.5	52.3	36.5	72.5	52.3
Min Run Slope (Srif) - ft./ft.			0.026			0.032							0.0012	0.0032	0.0026	0.0012	0.0032	0.0026
Pool Length (Lpool) - ft.			9			24							18.4	42.5	34.1	18.4	42.5	34.1
Pool-Pool Spacing (p-p) - ft.			40			27							49.8	83.6	66.5	49.8	83.6	66.5
Substrate																		
d_{50} (mm)			20			26						20			0.23			0.23
d_{84} (mm)			38			76						38			0.41			0.41
Additional Reach Parameters																		
Valley Length (ft)						295			816			816			816			375.94
Channel Length (ft)			236			479			824			1203			1094			517.09
Sinuosity						1.6			1.01			1.47			1.34			1.38
Water Surface Slope (Save)			0.006			0.022			0.0035			0.002			0.0017			0.0017
Bankfull Slope (Sval)			NA			0.025						0.003			0.0020			0.0020
Rosgen Classification			E4			E4			F/G			E			C5			C5
Bankfull mean velocity (Vbkf)			4.7			6.9			2.77			1.71			1.98			1.98
Bankfull Discharge (Qbkf)			98			60			26.00			20.5			20.7			20.7

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.
Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Tributary A2 {Long-Term Monitoring Profile Station 0+00 to 1+96.06 (196.06 feet)}

Parameter	Reference Reach Data [1]						XS 3+61.77, -216.17									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			0.27			0.27			0.27			0.27
Bankfull Width (Wbkf) - ft.			10.8			7.35			7.09			5.00			11.65			11.65
Flood Prone Width (Wfpa) - ft.			100			43			11.19			30.00			30			30
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.29			2.40			7.63			7.63
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.60			2.80			0.66			0.66
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.12						1.41			1.41
Width/Depth Ratio			5.6			6.1			11.82			3.85			17.65			17.65
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00			9.44			9.44
Bank Height Ratio			1.0			1.8			5.85			1.00			1.26			1.26
Wetted Perimeter - ft.			14.6			9.95			7.52			6.08			12.04			12.04
Hydraulic radius - ft.			1.42			0.91			0.57			0.79			0.63			0.63
Pattern																		
Belt Width (Wblt) - ft.						50				30.5	42.7				40.00			40.00
Radius of Curvature (Rc) - ft.						10						12.5	8.19	14.26	12.00	8.19	14.26	12.00
Meander Length (Lm) - ft.						50				50	70		47.00	57.00	51.00	47.00	57.00	51.00
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00			3.43			3.43
Profile																		
Min Riffle Length (Lrif) - ft.			16			10							8.30	11.20	9.80	8.30	11.20	9.80
Min Riffle Slope (Srif) - ft./ft.			0.026			0.032							0.0534	0.0718	0.0626	0.0534	0.0718	0.0626
Pool Length (Lpool) - ft.			9			24							31.90	47.10	39.50	31.90	47.10	39.50
Pool-Pool Spacing (p-p) - ft.			40			27							55.50	79.40	67.60	55.50	79.40	67.60
Substrate																		
d_{50} (mm)			20			26						26						
d_{84} (mm)			38			76						76						
Additional Reach Parameters																		
Valley Length (ft)						295			310			334			334			102.45
Channel Length (ft)			236			479			325			462			480			196.06
Sinuosity						1.6			1.05			1.38			1.44			1.91
Water Surface Slope (Save)			0.006			0.022			0.0156			0.0206			0.01025			0.0017
Bankfull Slope (Sval)			NA			0.025						0.0284			0.01035			0.0020
Rosgen Classification			E4			E4			F/G			E4			C4			C4
Bankfull mean velocity (Vbkf)			4.7			6.9			4.46			3.87			3.87			3.87
Bankfull Discharge (Qbkf)			98			60			18.4			18.4			18.4			18.4

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.
Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 1 Station 0+00 to 5+88.16 (588.16 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	23.00	16.00			13.00
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00			60.00			60.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.89			20.16	7.10	19.87	13.29			7.10
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			0.55
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.09	1.62			1.00
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	31.08	19.28			23.64
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.61	7.98	16.76			4.62
Bank Height Ratio			1.0			1.8			5.85			1.00			1.28			1.28
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			13.28
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.53
Pattern																		
Belt Width (Wblt) - ft.						50				61.00	85.40				60.00			60.00
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	16.70	26.55	21.70
Meander Length (Lm) - ft.						50				100.00	140.00		90.00	145.00	107.00	90.00	145.00	107.00
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	3.75			4.62
Profile																		
Min Run Length (Lrif) - ft.			16			10										124.10	138.10	131.10
Min Run Slope (Srif) - ft./ft.			0.026			0.032										0.00281	0.00283	0.00282
Pool Length (Lpool) - ft.			9			24										3.78	101.40	58.60
Pool-Pool Spacing (p-p) - ft.			40			27										72.70	118.70	99.70
Substrate																		
d_{50} (mm)			20			26									0.13			0.13
d_{84} (mm)			38			76									0.29			0.29
Additional Reach Parameters																		
Valley Length (ft)						295			5710			5164			5178			419.5
Channel Length (ft)			236			479			5948			7391			7349			588.16
Sinuosity						1.6			1.04			1.43			1.42			1.4
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0012
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.00099	0.00084			0.0009
Rosgen Classification			E4			E4			F/G			E			C5			C5
Bankfull mean velocity (Vbkf)			4.7			6.9			2.47			1.65			1.65			1.65
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.7

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.
Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 2 Station 0+00 to 6+23.77 (623.77 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	23.00	16.00			23.00
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00			60			60.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.89			20.16	7.10	19.87	13.29			16.69
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			0.74
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.09	1.62			1.42
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	31.08	19.28			31.80
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.61	7.98	16.76			2.61
Bank Height Ratio			1.0			1.8			5.85			1.00			1.28			1.28
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			23.59
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.72
Pattern																		
Belt Width (Wblt) - ft.						50				61.00	85.40				60			60
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	15.22	39.94	23.19
Meander Length (Lm) - ft.						50				100.00	140.00		90	145	107	90	145	107
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	3.75			2.61
Profile [3]																		
Min Run Length (Lrif) - ft.			16			10										65.60	78.70	70.00
Min Run Slope (Srif) - ft./ft.			0.026			0.032										0.00228	0.00344	0.00229
Pool Length (Lpool) - ft.			9			24										41.90	56.40	47.10
Pool-Pool Spacing (p-p) - ft.			40			27										66.20	124.30	87.80
Substrate [3]																		
d_{50} (mm)			20			26									0.13			0.13
d_{84} (mm)			38			76									0.29			0.29
Additional Reach Parameters [3]																		
Valley Length (ft)						295			5710			5164			5178			449.17
Channel Length (ft)			236			479			5948			7391			7349			623.77
Sinuosity						1.6			1.04			1.43			1.42			1.39
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0012
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.00099	0.00084			0.0007
Rosgen Classification			E4			E4			F/G			E			C5			C5
Bankfull mean velocity (Vbkf)			4.7			6.9			2.47			1.65			1.65			1.65
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.70

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.

Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 3 Station 0+00 to 5+18.94 (518.94 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built [3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	23.00	16.00			18.00
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00			60.00			60.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.89			20.16	7.10	19.87	13.29			14.39
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			0.80
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.09	1.62			1.62
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	31.08	19.28			22.50
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.61	7.98	16.76			3.33
Bank Height Ratio			1.0			1.8			5.85			1.00			1.28			1.28
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			18.70
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.77
Pattern																		
Belt Width (Wblt) - ft.						50				61.00	85.40				60			60.00
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	19.56	32.82	29.53
Meander Length (Lm) - ft.						50				100.00	140.00		90	145	107	90	145	107
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	3.75			3.33
Profile [3]																		
Min Run Length (Lrif) - ft.			16			10										77.50	132.00	104.70
Min Run Slope (Srif) - ft./ft.			0.026			0.032										0.00195	0.00289	0.00242
Pool Length (Lpool) - ft.			9			24										37.90	63.70	53.40
Pool-Pool Spacing (p-p) - ft.			40			27										101.80	106.70	104.30
Substrate [3]																		
d_{50} (mm)			20			26									0.13			0.13
d_{84} (mm)			38			76									0.29			0.29
Additional Reach Parameters [3]																		
Valley Length (ft)						295			5710			5164			5178			369.80
Channel Length (ft)			236			479			5948			7391			7349			518.94
Sinuosity						1.6			1.04			1.43			1.42			1.40
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0012
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.00099	0.00084			0.00099
Rosgen Classification			E4			E4			F/G			E			C5			C5
Bankfull mean velocity (Vbkf)			4.7			6.9			2.47			1.65			1.65			1.65
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.70

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.

[4] Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.

Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Lower Tributary A {Long-Term Monitoring Profile No. 4 Station 0+00 to 3+46.16 (346.16 feet)}

Parameter	Reference Reach Data [1]						XS 1+66.16, -4.60									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			2.03			2.03			2.03			2.03
Bankfull Width (Wbkf) - ft.			10.8			7.35			6.59			10.00	13.00	23.00	16.00			16.00
Flood Prone Width (Wfpa) - ft.			100			43			10.41			60.00			60.00			60.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.89			20.16	7.10	19.87	13.29			13.29
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.74			2.80	0.55	1.16	0.83			0.83
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.39				1.00	2.09	1.62			1.80
Width/Depth Ratio			5.6			6.1			8.91			4.00	14.79	31.08	19.28			19.28
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.58			6.00	2.61	7.98	16.76			3.75
Bank Height Ratio			1.0			1.8			5.85			1.00			1.28			1.28
Wetted Perimeter - ft.			14.6			9.95			7.34			12.32	13.28	23.59	16.76			16.76
Hydraulic radius - ft.			1.42			0.91			0.67			1.64	0.53	1.12	0.81			0.79
Pattern																		
Belt Width (Wblt) - ft.						50				61.00	85.40				60			60
Radius of Curvature (Rc) - ft.						10						25.00	15.22	39.94	24.86	24.54	33.26	30.15
Meander Length (Lm) - ft.						50				100.00	140.00		90	145	107	90	145	107
Meander Width Ratio (Wblt/Wbkf)						6.8						6.00	2.37	4.62	3.75			3.75
Profile																		
Min Run Length (Lrif) - ft.			16			10										80.40	89.30	84.80
Min Run Slope (Srif) - ft./ft.			0.026			0.032										0.00224	0.00310	0.00267
Pool Length (Lpool) - ft.			9			24												214.10
Pool-Pool Spacing (p-p) - ft.			40			27										28.60	34.40	
Substrate																		
d_{50} (mm)			20			26									0.04			0.04
d_{84} (mm)			38			76									0.07			0.07
Additional Reach Parameters																		
Valley Length (ft)						295			5710			5164			5178			259.00
Channel Length (ft)			236			479			5948			7391			7349			346.16
Sinuosity						1.6			1.04			1.43			1.42			1.34
Water Surface Slope (Save)			0.006			0.022			0.0019			0.0014	0.0012	0.0012	0.0012			0.0012
Bankfull Slope (Sval)			NA			0.025						0.0020	0.0007	0.00099	0.00084			0.00078
Rosgen Classification			E4			E4			F/G			E			C5			C5
Bankfull mean velocity (Vbkf)			4.7			6.9			2.47			1.65			1.65			1.65
Bankfull Discharge (Qbkf)			98			60			40.7			20.70			20.70			20.70

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.
Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Tributary B {Upper Tributary B Long-Term Monitoring Profile Station 0+00 to 4+75.72 (475.72 feet)}

Parameter	Reference Reach Data [1]						XS 12+28.00, -35.88									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			0.44			0.44			0.44			0.44
Bankfull Width (Wbkf) - ft.			10.8			7.35			7.83			6.20	5.11	10.98				5.11
Flood Prone Width (Wfpa) - ft.			100			43			11.86			45.38			50.00			50.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.86			7.36	6.06	7.56				2.99
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.62			1.60	0.58	0.69				0.58
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.22				1.17	1.84				1.17
Width/Depth Ratio			5.6			6.1			12.63			3.88	8.81	15.91				8.81
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.51			7.32	10.02	21.51				21.51
Bank Height Ratio			1.0			1.8			4.40			1.00	1.00	1.18				1.00
Wetted Perimeter - ft.			14.6			9.95			8.22			7.53	5.68	11.84				5.68
Hydraulic radius - ft.			1.42			0.91			0.59			0.98	0.53	0.64				0.53
Pattern																		
Belt Width (Wblt) - ft.						50				45.38	52.95				50.00			50.00
Radius of Curvature (Rc) - ft.						10						15.50	10.20	19.38	14.05	12.95	19.38	16.79
Meander Length (Lm) - ft.						50				62.00	86.80		60.00	80.00	70.00	60.00	80.00	70.00
Meander Width Ratio (Wblt/Wbkf)						6.8						7.32						9.78
Profile																		
Min Riffle Length (Lrif) - ft.			16			10										11.50	15.70	14.50
Min Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.016	0.060	0.040
Pool Length (Lpool) - ft.			9			24										18.10	23.50	20.10
Pool-Pool Spacing (p-p) - ft.			40			27										51.90	66.10	59.80
Substrate																		
d_{50} (mm)			20			26									55.06			55.1
d_{84} (mm)			38			76									83.88			83.9
Additional Reach Parameters																		
Valley Length (ft)						295			1360			1302			1312			320.61
Channel Length (ft)			236			479			1455			2052			2041			475.72
Sinuosity						1.6			1.07			1.58			1.56			1.48
Water Surface Slope (Save)			0.006			0.022			0.0124			0.0123	0.0091	0.0099				0.0099
Bankfull Slope (Sval)			NA			0.025						0.0078	0.0089	0.0097				0.0097
Rosgen Classification			E4			E4			B			E	E4	C4				E4
Bankfull mean velocity (Vbkf)			4.7			6.9			4.18			2.83			2.83			2.83
Bankfull Discharge (Qbkf)			98			60			20.4			20.4			20.4			20.4

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.
Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

Exhibit Table XI. Baseline Morphology and Hydraulic Summary
South Muddy Creek Tributaries Stream Restoration / EEP Project No. D04006-01
Station/Reach: Tributary B {Lower Tributary B Long-Term Monitoring Profile Station 0+00 to 4+ 4.08 (404.08 feet)}

Parameter	Reference Reach Data [1]						XS 12+28.00, -35.88									Monitoring		
	S. Muddy Birchfield [2]			S. Muddy Trib 4 [2]			Pre-Existing			Design			As-Built[3]			Year 1 [4]		
Dimension	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Drainage Area - mi.^{2}			1.3			0.14			0.44			0.44			0.44			0.44
Bankfull Width (Wbkf) - ft.			10.8			7.35			7.83			6.20	5.11	10.98				10.98
Flood Prone Width (Wfpa) - ft.			100			43			11.86			45.38			50.00			50.00
Bankfull Cross-Section Area (Abkf) - ft.^{2}			20.7			9.1			4.86			7.36	6.06	7.56				7.56
Bankfull Mean Depth (Dbkf) - ft.			1.9			1.3			0.62			1.60	0.58	0.69				0.69
Bankfull Max Depth (Dmax) - ft.			2.5			1.8			1.22				1.17	1.84				1.84
Width/Depth Ratio			5.6			6.1			12.63			3.88	8.81	15.91				15.91
Entrenchment Ratio (Wfpa/Wbkf)			9.3			3			1.51			7.32	10.02	21.51				10.02
Bank Height Ratio			1.0			1.8			4.40			1.00	1	1.18				1.18
Wetted Perimeter - ft.			14.6			9.95			8.22			7.53	5.68	11.84				11.84
Hydraulic radius - ft.			1.42			0.91			0.59			0.98	0.53	0.64				0.64
Pattern																		
Belt Width (Wblt) - ft.						50				45.38	52.95				50.00			50.00
Radius of Curvature (Rc) - ft.						10						15.5	10.20	19.38	14.05	10.20	15.54	13.34
Meander Length (Lm) - ft.						50				62	86.8		60.00	80.00	70.00	60.00	80.00	70.00
Meander Width Ratio (Wblt/Wbkf)						6.8						7.32						4.55
Profile																		
Min Riffle Length (Lrif) - ft.			16			10										12.00	25.00	18.60
Min Riffle Slope (Srif) - ft./ft.			0.026			0.032										0.02	0.04	0.03
Pool Length (Lpool) - ft.			9			24										13.30	21.40	17.10
Pool-Pool Spacing (p-p) - ft.			40			27										84.10	113.70	97.50
Substrate																		
d_{50} (mm)			20			26									55.06			55.06
d_{84} (mm)			38			76									83.88			83.88
Additional Reach Parameters																		
Valley Length (ft)						295			1360			1302			1312			404.08
Channel Length (ft)			236			479			1455			2052			2041			251.58
Sinuosity						1.6			1.07			1.58			1.56			1.61
Water Surface Slope (Save)			0.006			0.022			0.0124			0.0123	0.0091	0.0099				0.0091
Bankfull Slope (Sval)			NA			0.025						0.0078	0.0089	0.0097				0.0089
Rosgen Classification			E4			E4			B			E	E4	C4				C4
Bankfull mean velocity (Vbkf)			4.7			6.9			4.18			2.83			2.83			2.83
Bankfull Discharge (Qbkf)			98			60			20.4			20.4			20.4			20.4

[1] Data provided by Natural Systems Engineering (NSE) and used in the Restoration Plan for S. Muddy Tributaries

[2] S Muddy Birchfield Ref for Trib A; S. Muddy Trib 4 Ref for Tribs B & C

[3] As-Built dimension data includes all run and/or riffle cross-sections in a described reach.
Monitoring Year 1 thru 5 data is derived by EMH&T from the long-term profile reach only

Note: Where only two measurements were taken, they are listed as 'Min' and 'Max' values with no 'Med' value; where only one measurement was taken, that is listed as a 'Med' value.
Blank fields indicate either no measurement was taken or data were not available at the time of this report.

IV. METHODOLOGY

Year 1 vegetation monitoring was conducted in September 2006 using the *CVS-EEP Protocol for Recording Vegetation, Version 4.0* (Lee, M.T., Peet, RK., Roberts, S.R., Wentworth, T.R. 2006). Year 3 vegetation monitoring was conducted in September 2008 using the same protocol as used in Years 1 and 2. Year 1 stream monitoring was conducted in April 2007 to provide adequate time between the as-built survey (accepted in January 2007) and the Year 1 monitoring survey. Stream monitoring for Year 2 occurred in October 2007, to provide six months between the Year 1 and Year 2 surveys. Year 3 monitoring occurred in the fall of 2008 to provide a full year between surveys. Subsequent stream monitoring will occur in the fall of Years 4 and 5 to continue providing adequate time for vegetation to mature between surveys. Vegetation monitoring will continue to be conducted in the fall of each subsequent year of monitoring, providing a full year between vegetative surveys.

APPENDIX A
Vegetation Raw Data

1. Vegetation Problem Area Photos
2. Vegetation Problem Area Plan View
3. Vegetation Monitoring Plot Photos
4. Vegetation Data Tables

VPA 1
View of *Sericea lespedeza* growing along bank of Tributary A (lower), across the stream valley atstation 64+13.
(EMH&T, Inc. 9/11/08)

VPA 2
View of *Sericea lespedeza* growing along bank of Tributary A (lower), looking upstream from station 28+23.
(EMH&T, Inc. 9/11/08)

VPA 3
View of *Sericea lespedeza* growing in Vegetation Plot 2 along Tributary A (upper).
(EMH&T, Inc. 9/10/08)

VPA 4
View of *Sericea lespedeza* growing in Vegetation Plot 5 along Tributary A (middle).
(EMH&T, Inc. 9/10/08)

EMH&T
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Phone: 614.775.4500 Fax: 614.775.4800
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McDOWELL COUNTY, NORTH CAROLINA

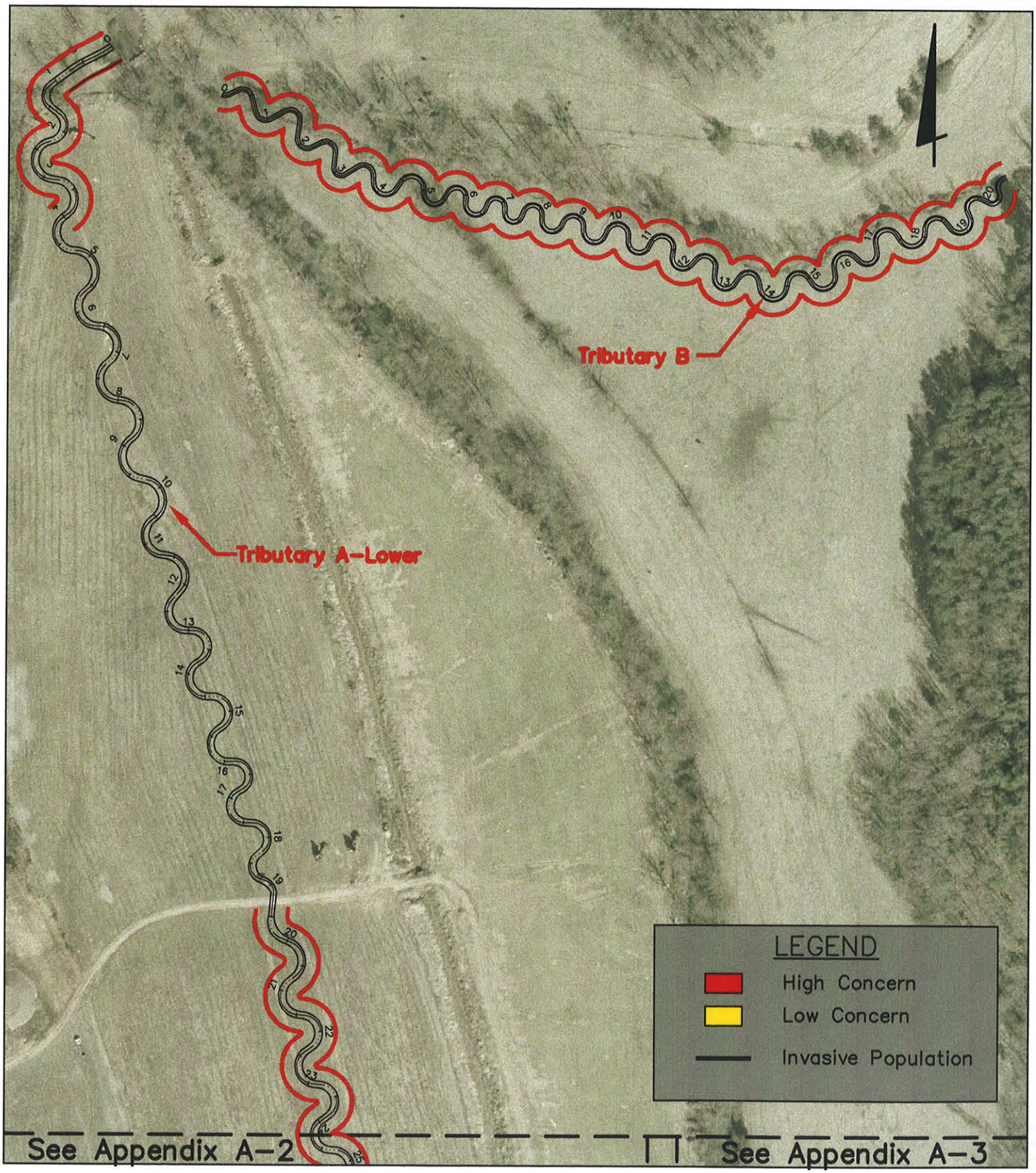
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING YEAR 2

APPENDIX A-1

TRIBUTARY A - LOWER AND TRIBUTARY B

Date:	November, 2008	Job No.	2006-1627	Scale:	1" = 500'



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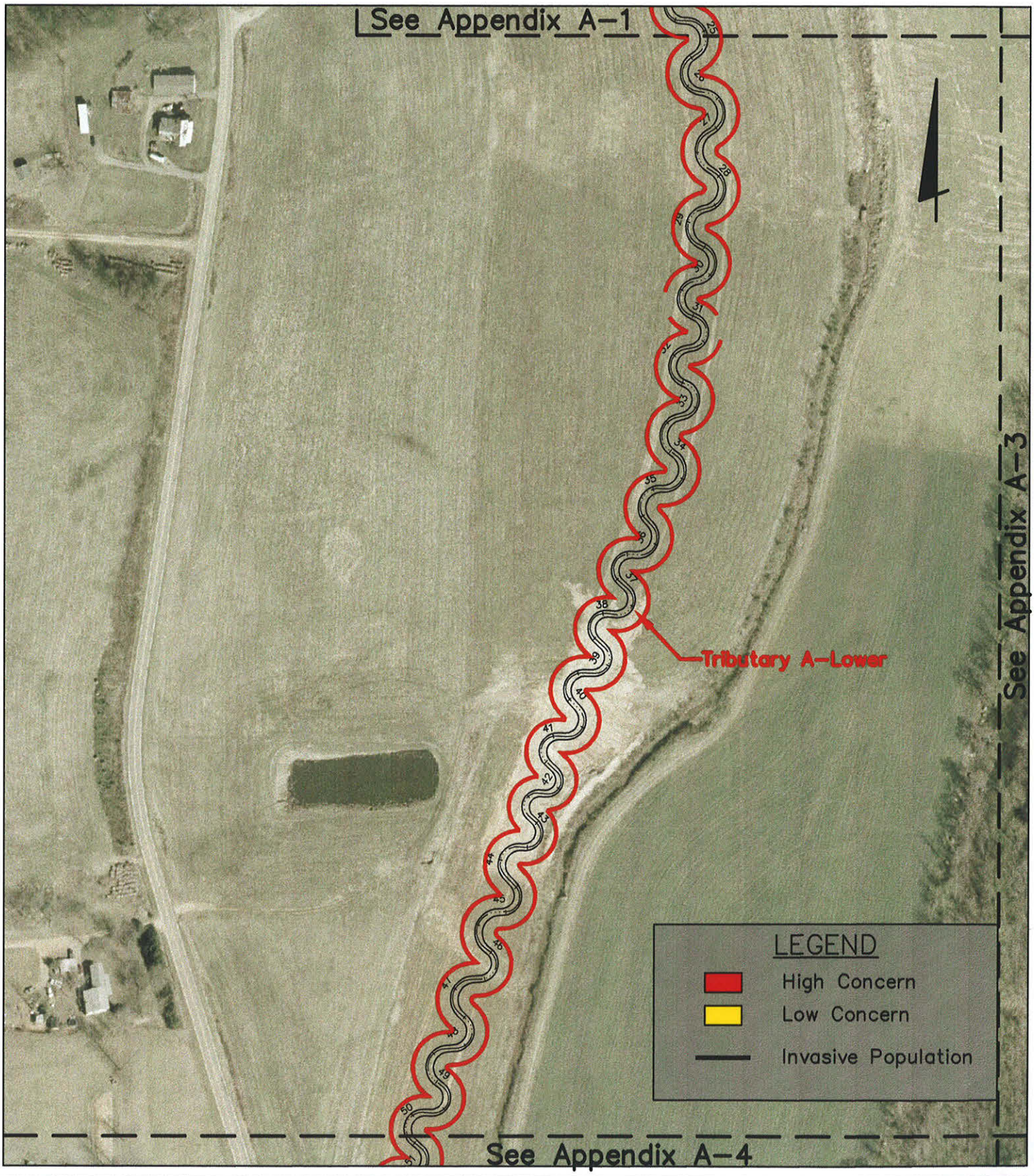
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX A-2

TRIBUTARY A-LOWER

Date:	November, 2008	Job No.	2006-1627	Scale:	1" = 500'



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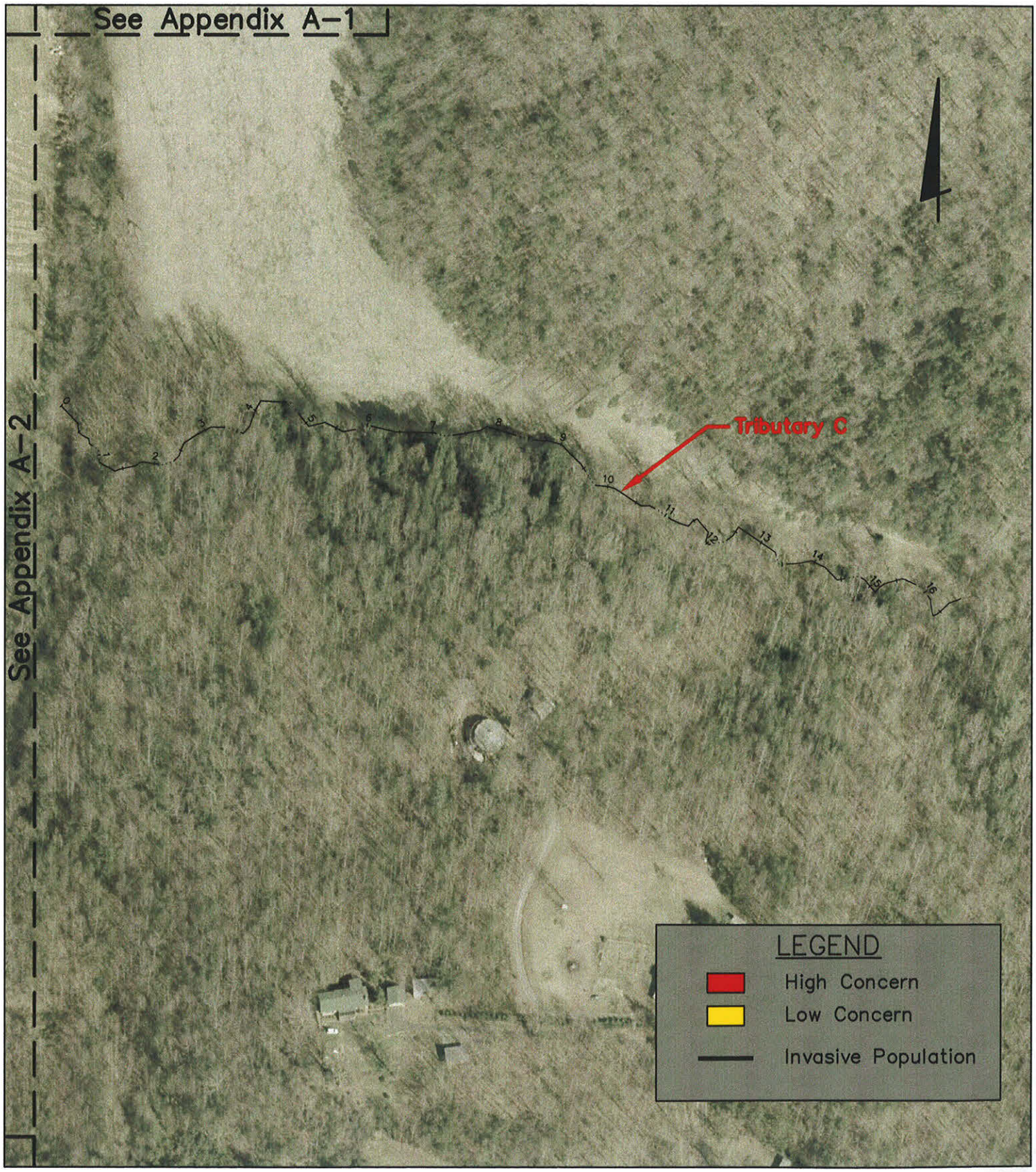
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX A-3

TRIBUTARY C

Date:	November, 2008	Job No.	2006-1627	Scale:	1" = 500'



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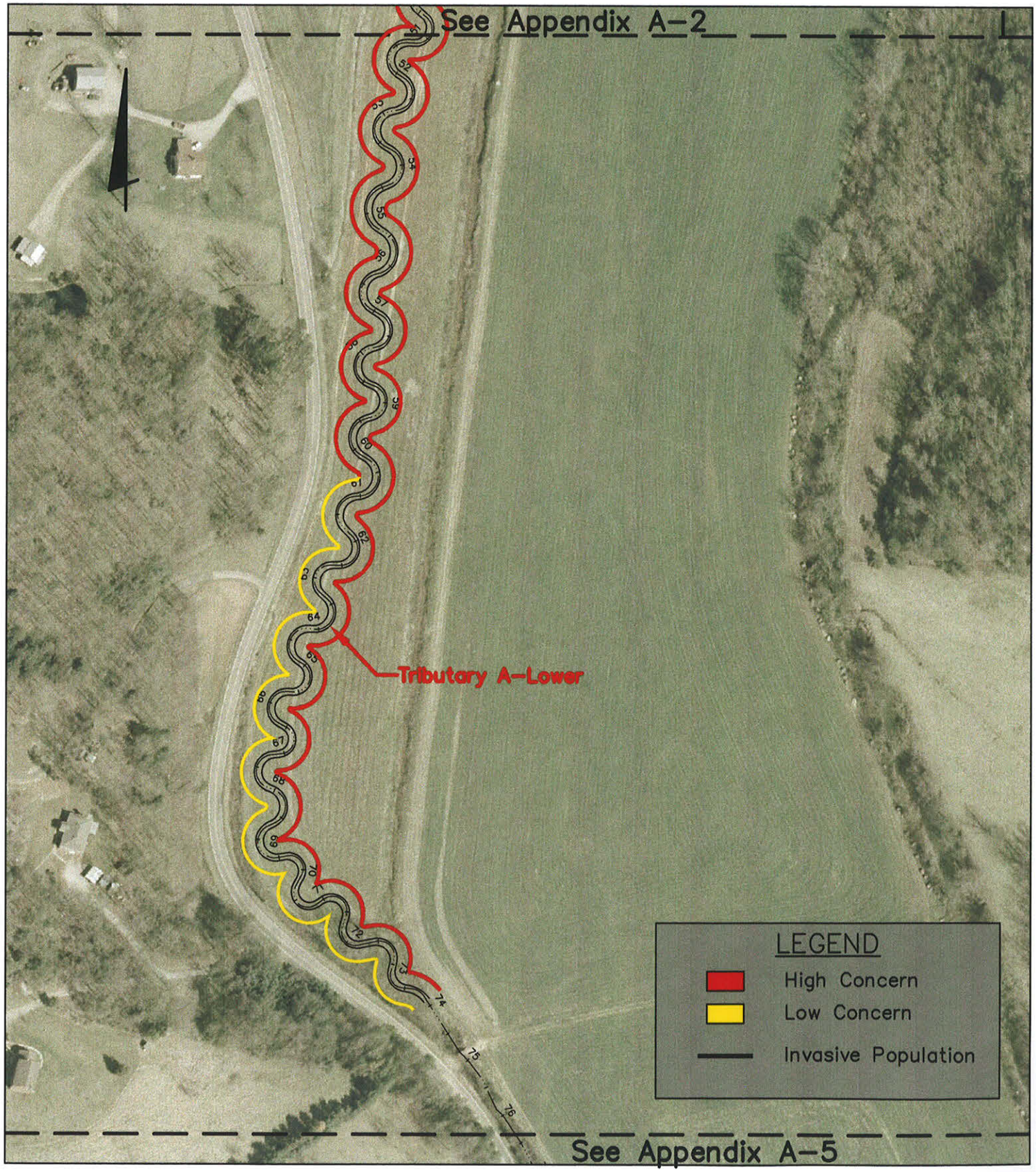
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX A-4

TRIBUTARY A-LOWER

Date:	November, 2008	Job No.	2006-1627	Scale:	1" = 500'



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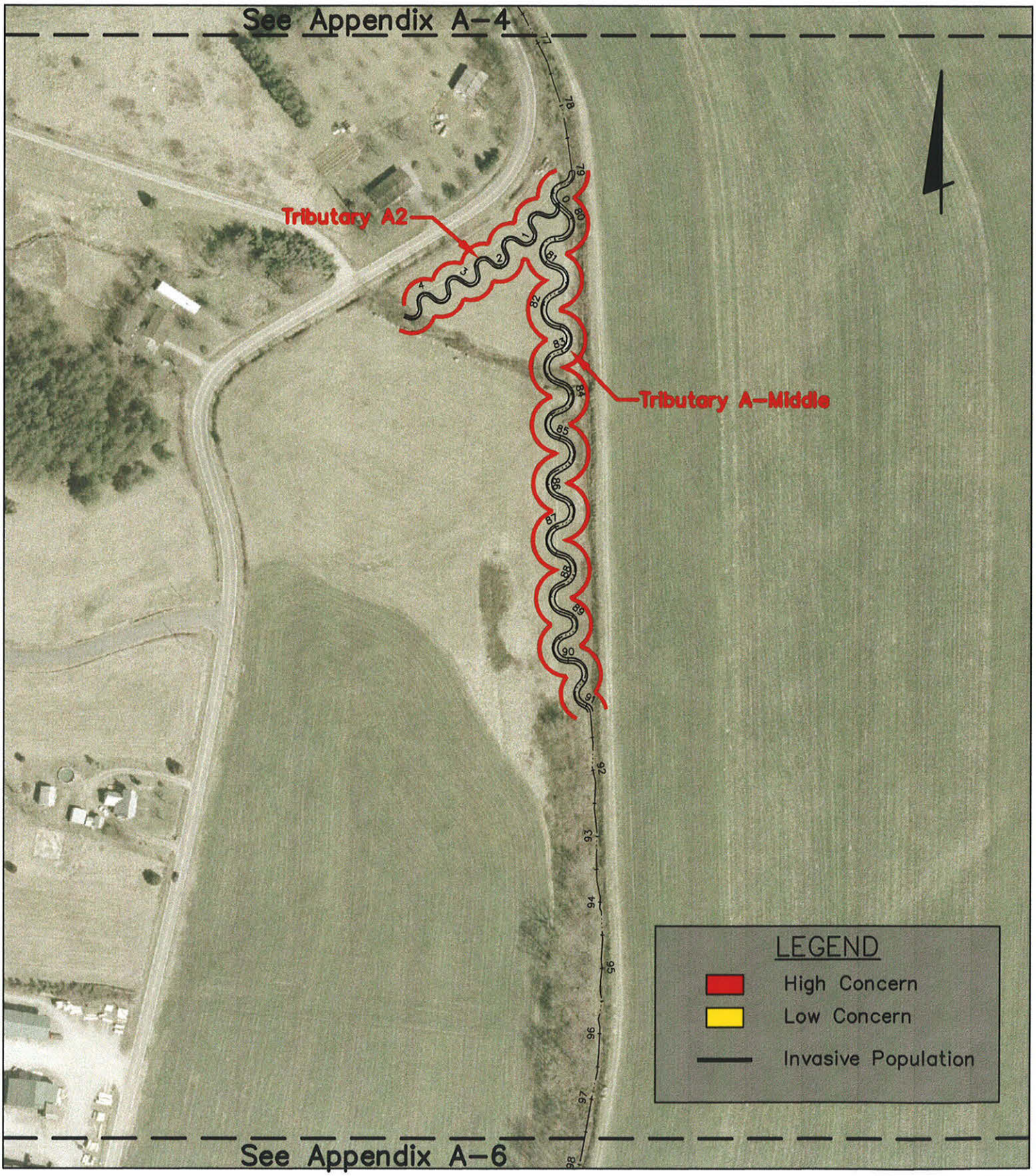
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX A-5

TRIBUTARY A-MIDDLE AND TRIBUTARY A2

Date:	November, 2008	Job No.	2006-1627	Scale:	1" = 500'



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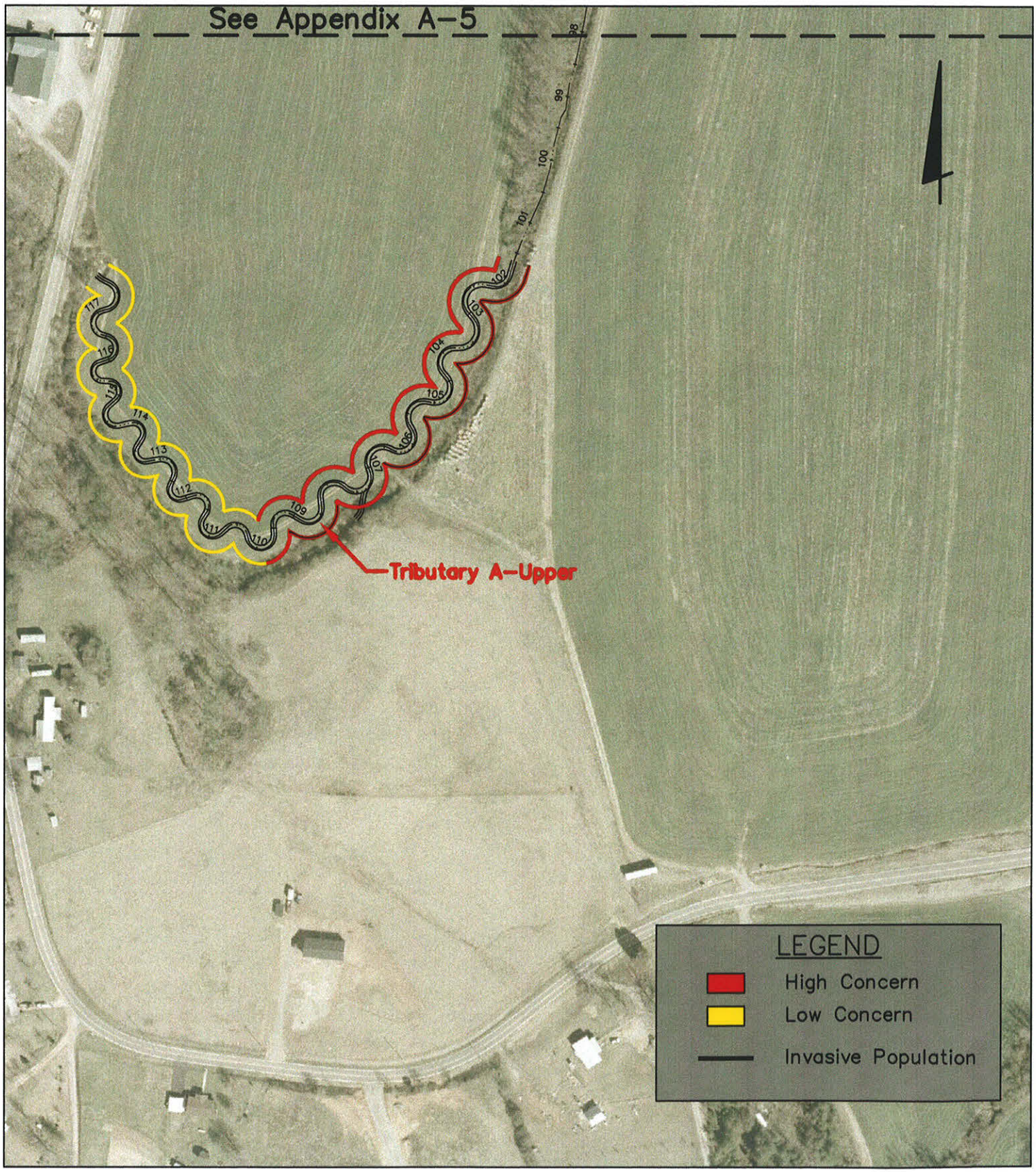
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX A-6

TRIBUTARY A-UPPER

Date:	November, 2008	Job No.	2006-1627	Scale:	1" = 500'



Vegetation Plot 1
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 2
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 3
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 4
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 5
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 6
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 7
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 8
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 9
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 10
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 11
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 12
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 13
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 14
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 15
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 16
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 17
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 18
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 19
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 20
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 21
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 22
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 23
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 24
Monitoring Year 3
(EMH&T, Inc. 9/10/08)

Vegetation Plot 25
Monitoring Year 3
(EMH&T, Inc. 9/11/08)

Vegetation Plot 26
Monitoring Year 3
(EMH&T, Inc. 9/11/08)

Vegetation Plot 27
Monitoring Year 3
(EMH&T, Inc. 9/11/08)

Vegetation Plot 28
Monitoring Year 3
(EMH&T, Inc. 9/11/08)

Vegetation Plot 29
Monitoring Year 3
(EMH&T, Inc. 9/11/08)

Vegetation Plot 30
Monitoring Year 3
(EMH&T, Inc. 9/11/08)

Table 1. Vegetation Metadata	
Report Prepared By	Holly Blunck
Date Prepared	9/30/2008 11:20
database name	CVS_EEP_DataEntry_v202.mdb
database location	Q:\ENVIRONMENTAL\Monitoring\EEP Vegetation Database
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	This worksheet, which is a summary of the project and the project data.
Plots	List of plots surveyed.
Vigor	Frequency distribution of vigor classes.
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.
Stem Count by Plot and Spp	Count of living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	D0400601
project Name	South Muddy Creek
Description	Restoration of tributaries A, A2, B and C of South Muddy Creek
length (ft)	
stream-to-edge width (ft)	
area (sq m)	
Required Plots (calculated)	
Sampled Plots	30

Table 2. Vegetation Vigor by Species							
	Species	**4**	**3**	**2**	**1**	**0**	**Missing**
	Alnus serrulata	11	10				19
	Betula nigra	1	6	1			
	Cephalanthus occidentalis	2	5				
	Cornus amomum	36	24	6		1	8
	Fraxinus pennsylvanica	18	28	13	4	2	9
	Platanus occidentalis	8	9	3		1	3
	Quercus alba	13	14	5			5
	Quercus pagoda	4	9				6
	Quercus phellos	2	7	2			4
	Salix nigra	7		1			
	Sambucus canadensis	2					
TOT:	**11**	**108**	**115**	**33**	**5**	**4**	**54**

Table 3. Vegetation Damage by Species												
	Species	All Damage Categories	(no damage)	Dry	Deer	Diseased	Flood	Insects	Other/Unknown Animal	Site Too Dry	Unknown	(other damage)
	Alnus serrulata	21	16			2		2			1	
	Betula nigra	8	7									1
	Cephalanthus occidentalis	7	6									1
	Cornus amomum	66	66									
	Fraxinus pennsylvanica	63	61								1	1
	Platanus occidentalis	20	20									
	Quercus alba	32	32									
	Quercus pagoda	13	12					1				
	Quercus phellos	11	11									
	Salix nigra	8	8									
	Sambucus canadensis	2	2									
TOT:	**11**	**251**	**241**	**0**	**0**	**2**	**0**	**3**	**0**	**0**	**2**	**3**

Table 4.Vegetation Damage by Plot													
	plot	All Damage Categories	(no damage)	_Enter other damage_	Deer	Diseased	Flood	Insects	Other/Unknown Animal	Site Too Dry	Unknown	(other damage)
	D0400601-01-0001 (year 3)	13	12								1	
	D0400601-01-0002 (year 3)	11	11									
	D0400601-01-0003 (year 3)	15	15									
	D0400601-01-0004 (year 3)	7	6					1				
	D0400601-01-0005 (year 3)	8	8									
	D0400601-01-0006 (year 3)	15	14					1				
	D0400601-01-0007 (year 3)	9	9									
	D0400601-01-0008 (year 3)	11	10								1	
	D0400601-01-0009 (year 3)	13	12			1						
	D0400601-01-0010 (year 3)	12	11	1								
	D0400601-01-0011 (year 3)	14	14									
	D0400601-01-0012 (year 3)	10	10									
	D0400601-01-0013 (year 3)	8	8									
	D0400601-01-0014 (year 3)	6	6									
	D0400601-01-0015 (year 3)	9	9									
	D0400601-01-0016 (year 3)	5	5									
	D0400601-01-0017 (year 3)	11	11									
	D0400601-01-0018 (year 3)	7	7									
	D0400601-01-0019 (year 3)	3	3									
	D0400601-01-0020 (year 3)	4	4									
	D0400601-01-0021 (year 3)	14	14									
	D0400601-01-0022 (year 3)	4	4									
	D0400601-01-0023 (year 3)	9	8			1						
	D0400601-01-0024 (year 3)	9	9									
	D0400601-01-0025 (year 3)	4	4									
	D0400601-01-0026 (year 3)	7	6					1				
	D0400601-01-0027 (year 3)	6	4									2
	D0400601-01-0028 (year 3)	5	5									
	D0400601-01-0029 (year 3)	0	0									
	D0400601-01-0030 (year 3)	2	2									
TOT:	**30**	**251**	**241**	**1**	**0**	**2**	**0**	**3**	**0**	**0**	**2**	**2**

Table 5. Stem Count by Plot and Species

	Species	Total Stems	# plots	avg# stems	plot D0400601-01-0001 (year 3)	plot D0400601-01-0002 (year 3)	plot D0400601-01-0003 (year 3)	plot D0400601-01-0004 (year 3)	plot D0400601-01-0005 (year 3)	plot D0400601-01-0006 (year 3)	plot D0400601-01-0007 (year 3)	plot D0400601-01-0008 (year 3)	plot D0400601-01-0009 (year 3)	plot D0400601-01-0010 (year 3)	plot D0400601-01-0011 (year 3)	plot D0400601-01-0012 (year 3)	plot D0400601-01-0013 (year 3)	plot D0400601-01-0014 (year 3)	plot D0400601-01-0015 (year 3)	plot D0400601-01-0016 (year 3)	plot D0400601-01-0017 (year 3)	plot D0400601-01-0018 (year 3)	plot D0400601-01-0019 (year 3)	plot D0400601-01-0020 (year 3)	plot D0400601-01-0021 (year 3)	plot D0400601-01-0022 (year 3)	plot D0400601-01-0023 (year 3)	plot D0400601-01-0024 (year 3)	plot D0400601-01-0025 (year 3)	plot D0400601-01-0026 (year 3)	plot D0400601-01-0027 (year 3)	plot D0400601-01-0028 (year 3)	plot D0400601-01-0029 (year 3)	plot D0400601-01-0030 (year 3)
	Alnus serrulata	21	13	1.62	2	2	1	1	3	4	1		1							2	1						1		1			1		
	Betula nigra	8	4	2																									1	2	3	2		
	Cephalanthus occidentalis	7	2	3.5										6					1															
	Cornus amomum	66	20	3.3	6	4	5			5	1	4	4	4	10	2		1		1	1	3	2	1	3	2	6	1						
	Fraxinus pennsylvanica	63	24	2.62	4	2	5	1		4	1	2	4		3	6	2	2	3	1	7	3		1	1	2	1	4		1	2			1
	Platanus occidentalis	20	14	1.43	1		3	1	4			2	1		1		1		1			1	1		1			1						1
	Quercus alba	32	14	2.29			1	4	1		1	1	3				1	2	4	1	1				8		1	3						
	Quercus pagoda	13	7	1.86										2			1	1											2	4	1	2		
	Quercus phellos	11	6	1.83		2						2				1	3							2	1									
	Salix nigra	8	3	2.67		1				2	5																							
	Sambucus canadensis	2	2	1												1					1													
TOT:	**11**	**251**	**11**		**13**	**11**	**15**	**7**	**8**	**15**	**9**	**11**	**13**	**12**	**14**	**10**	**8**	**6**	**9**	**5**	**11**	**7**	**3**	**4**	**14**	**4**	**9**	**9**	**4**	**7**	**6**	**5**	**0**	**2**

APPENDIX B

Geomorphologic Raw Data

1. Stream Problem Areas Plan View
2. Stream Problem Area Photos
3. Fixed Station Photos
4. Table B1. Qualitative Visual Stability Assessment
5. Cross Section Plots
6. Longitudinal Plots
7. Pebble Count Plots
8. Bankfull Event Photos

EMH&T
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McDOWELL COUNTY, NORTH CAROLINA

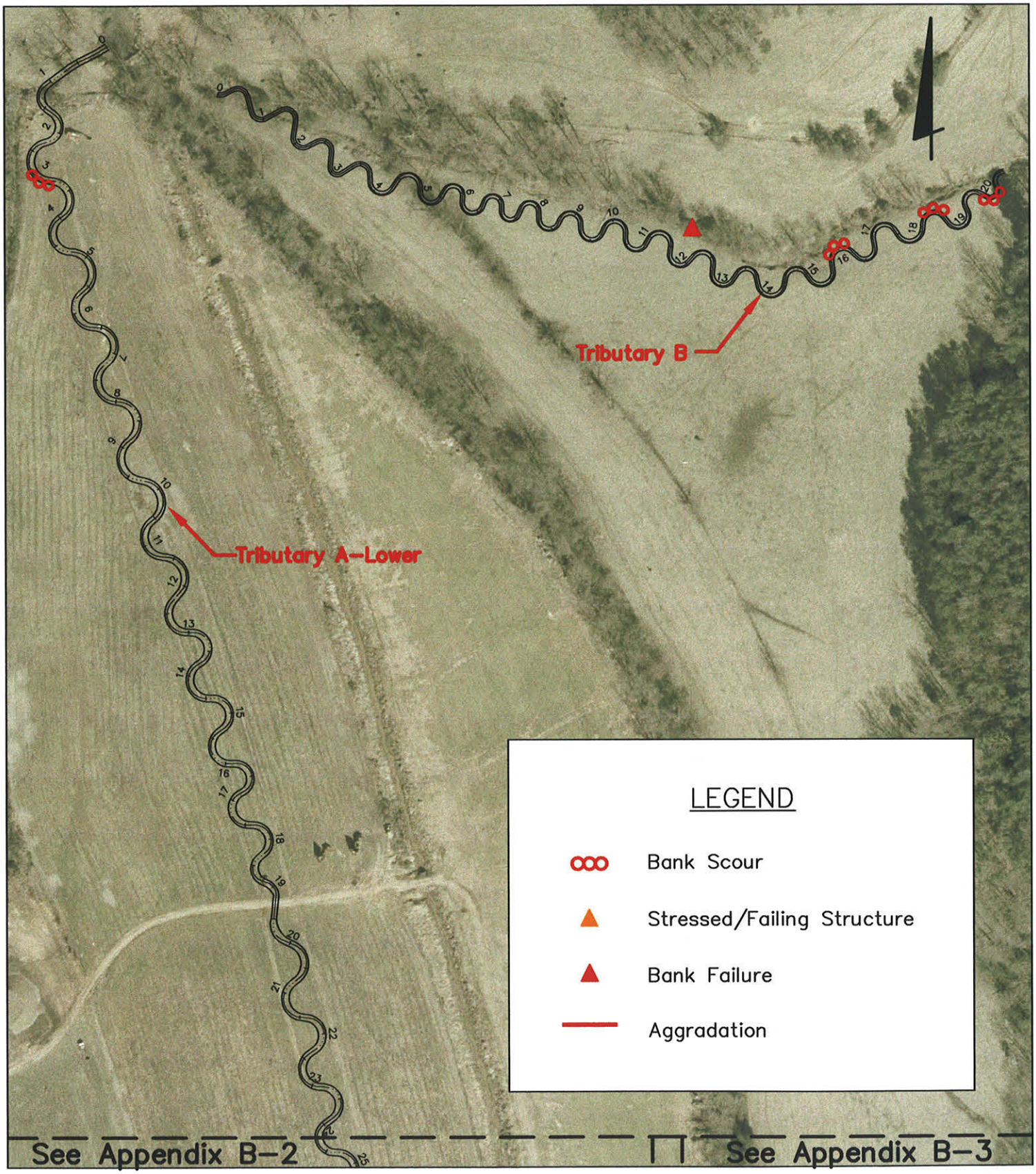
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX B-1

TRIBUTARY A - LOWER AND TRIBUTARY B

Date:	September, 2007	Job No.	2006-1627	Scale:	1" = 500'



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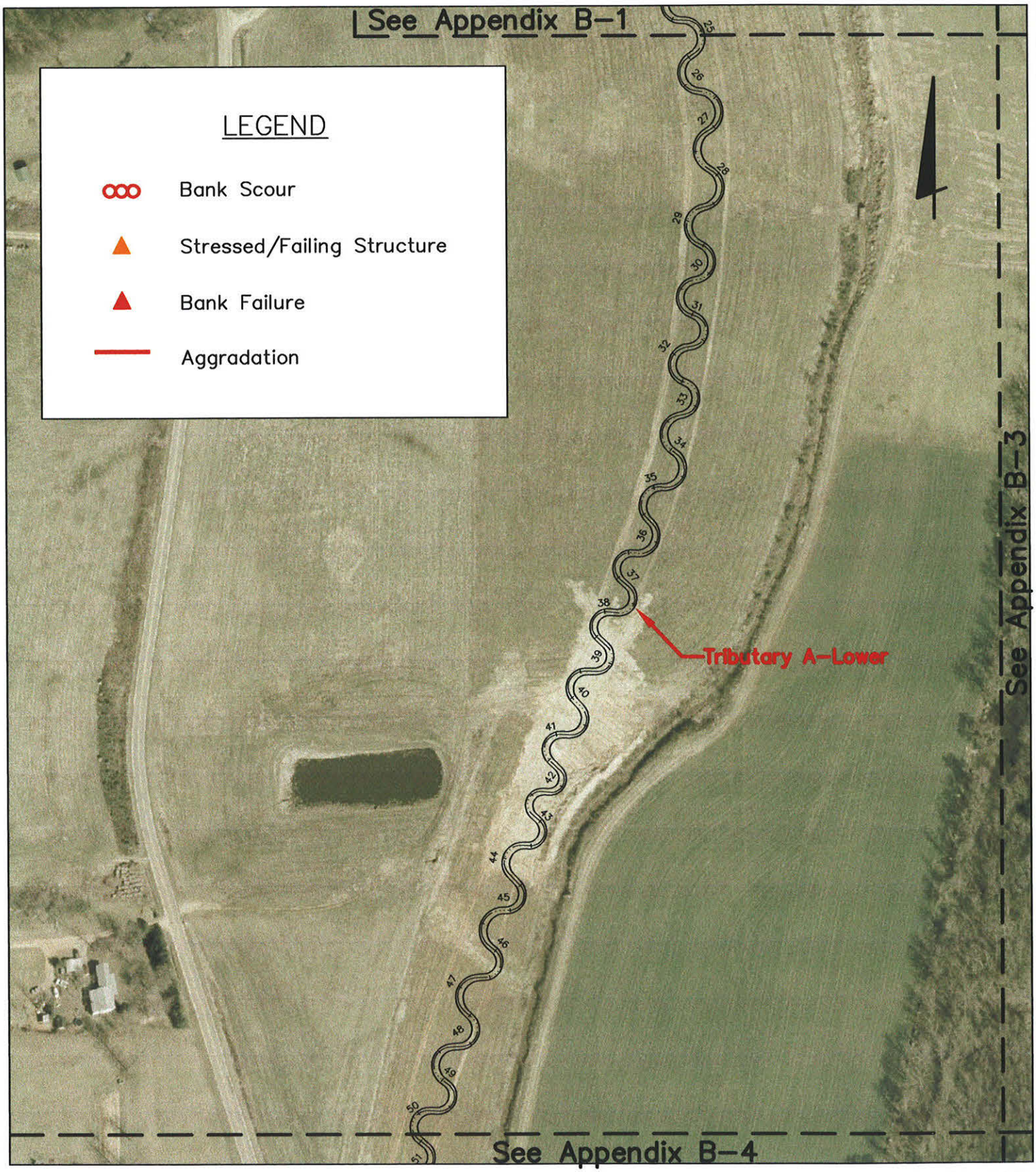
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX B-2

TRIBUTARY A-LOWER

Date:	September, 2007	Job No.	2006-1627	Scale:	1" = 500'



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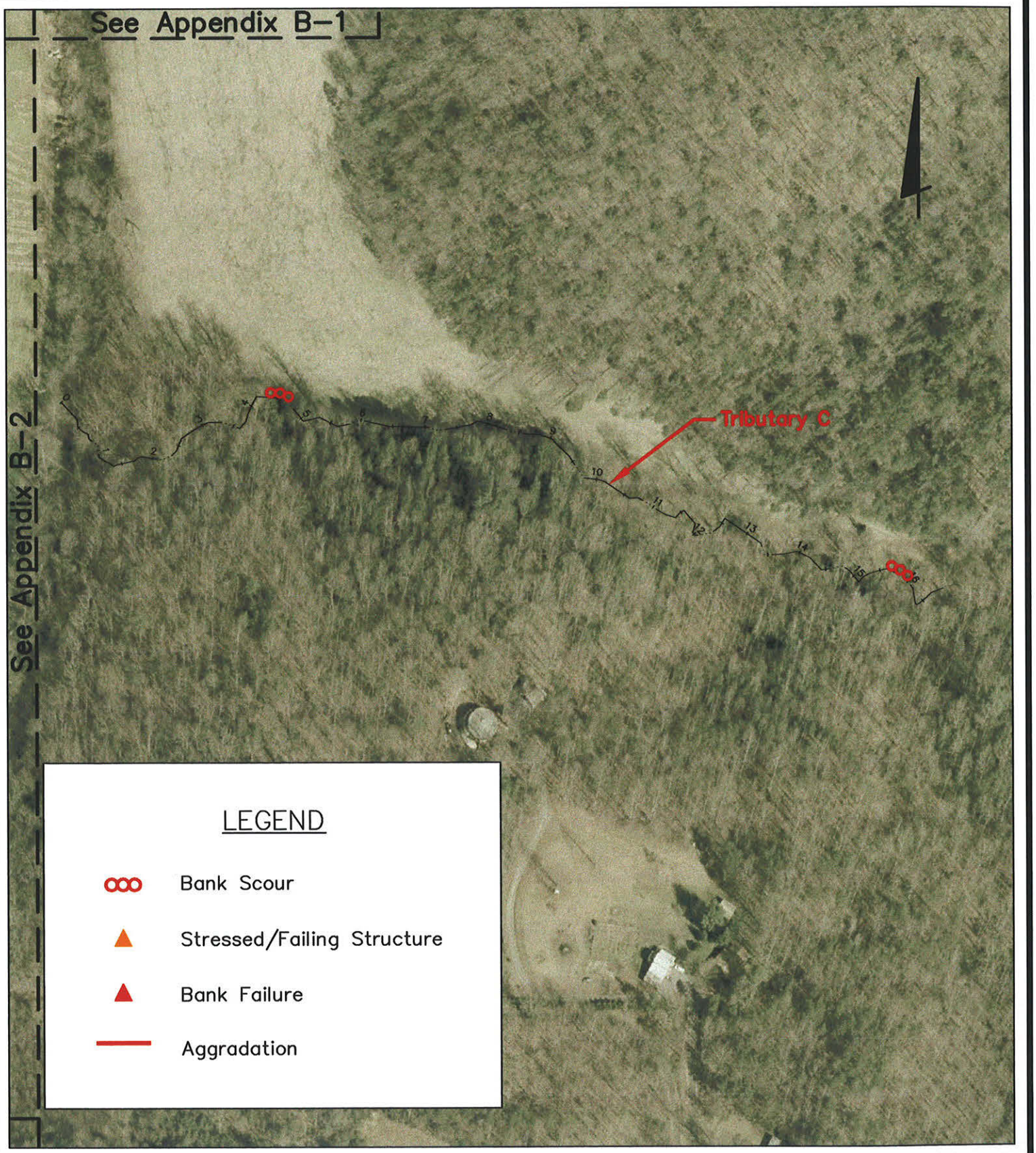
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX B-3

TRIBUTARY C

Date:	September, 2007	Job No.	2006-1627	Scale:	1" = 500'



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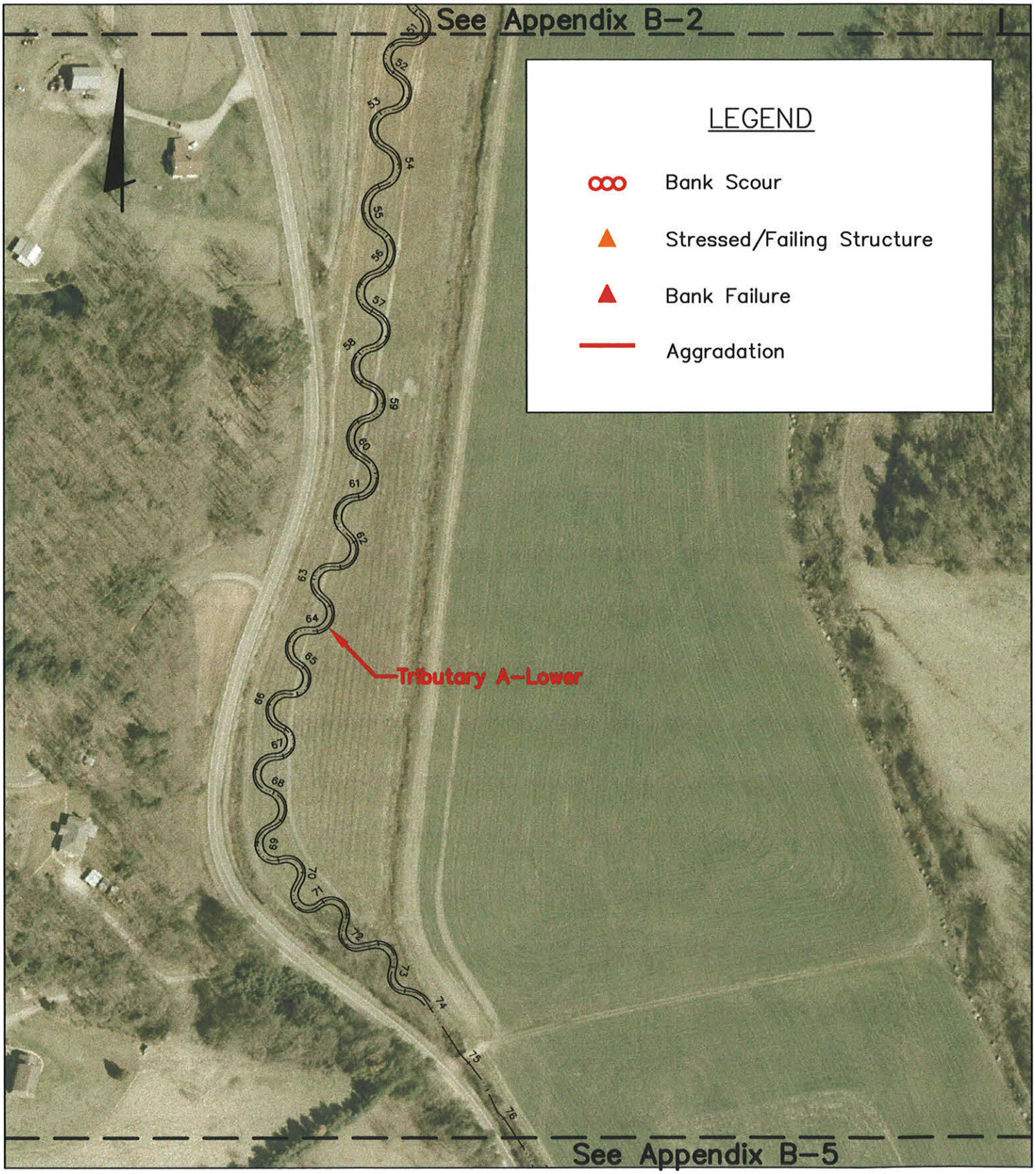
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX B-4

TRIBUTARY A-LOWER

Date:	September, 2007	Job No.	2006-1627	Scale:	1" = 500'



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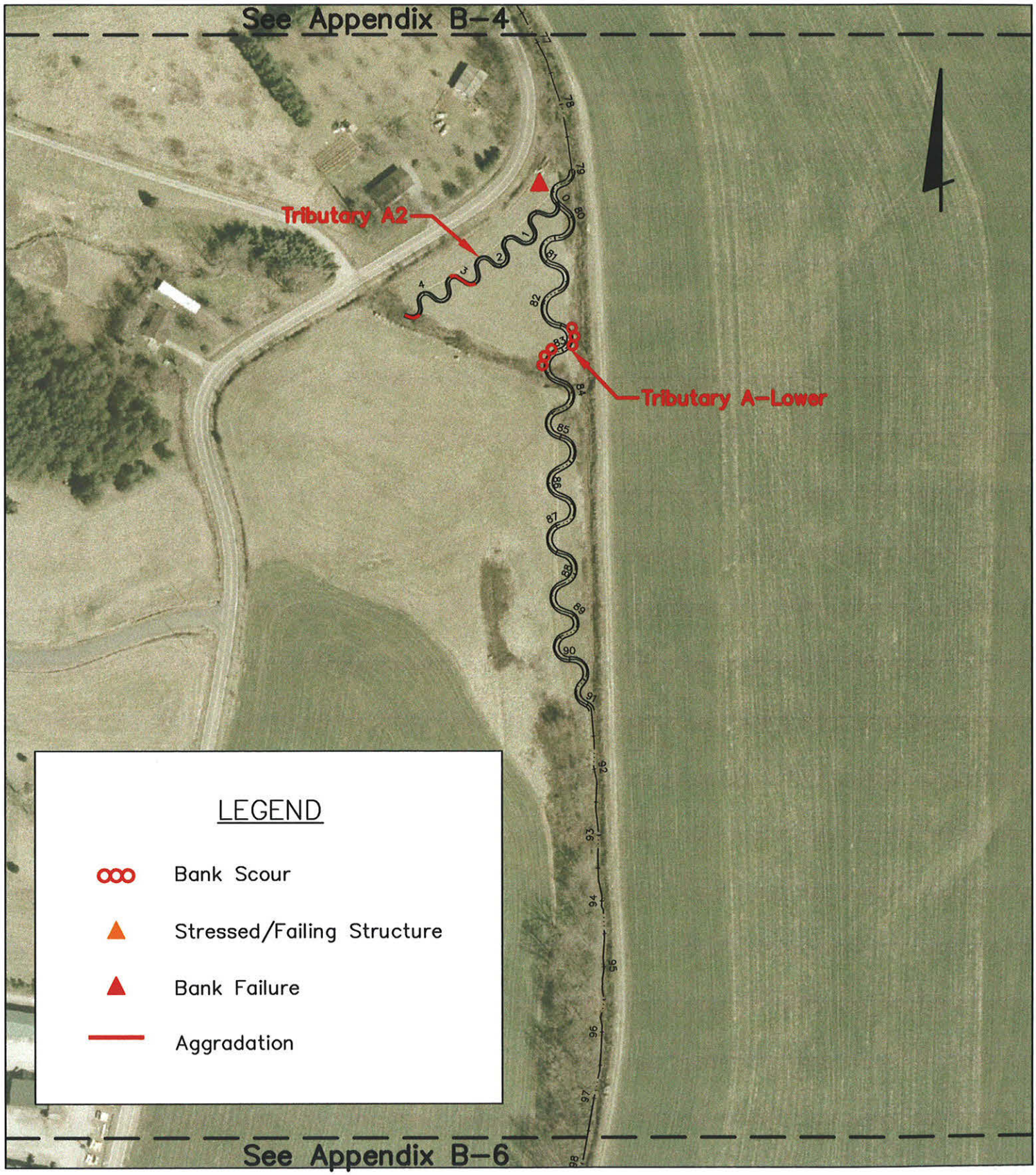
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX B-5

TRIBUTARY A-MIDDLE AND TRIBUTARY A2

Date:	September, 2007	Job No.	2006-1627	Scale:	1" = 500'



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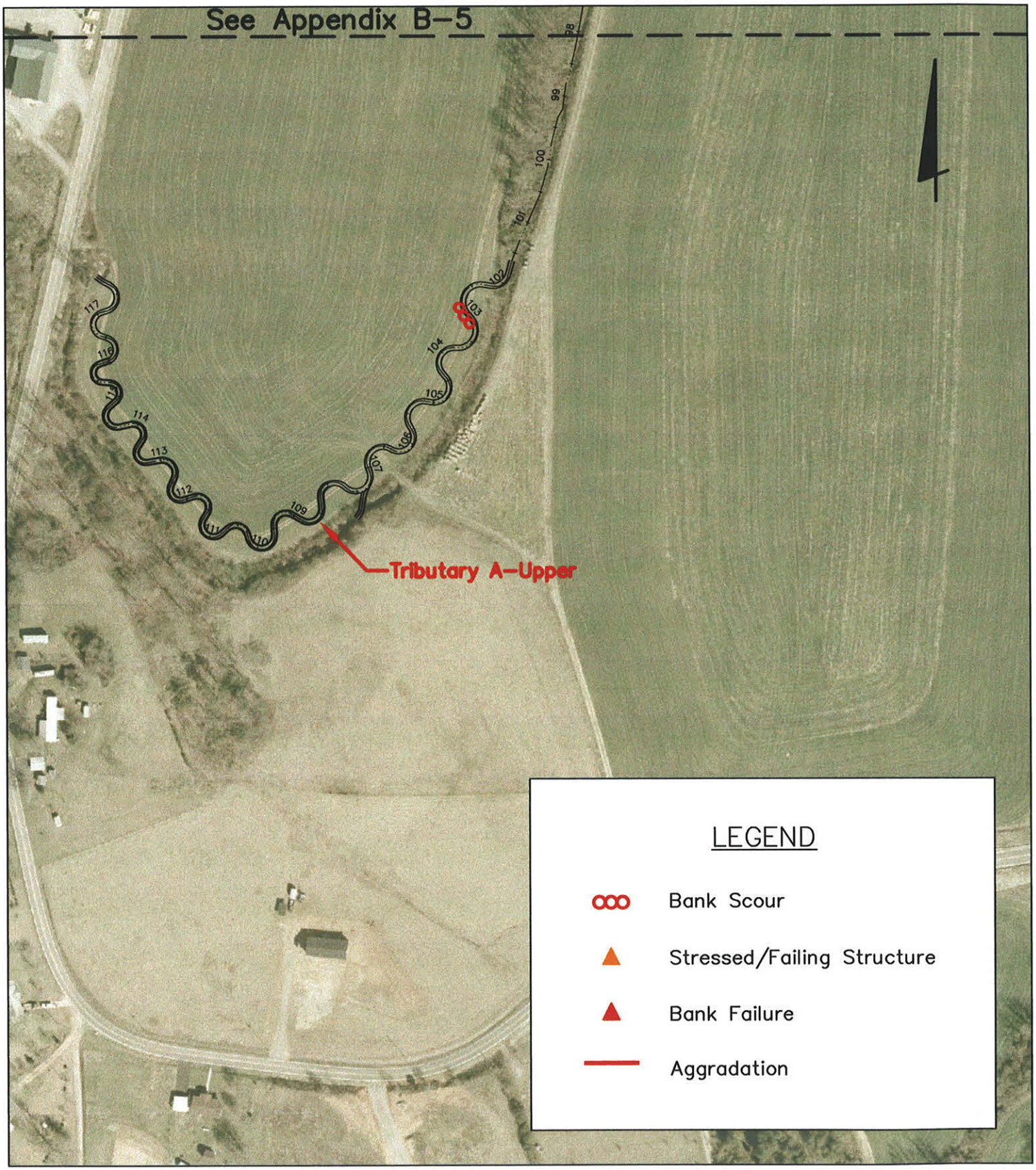
SOUTH MUDDY CREEK TRIBUTARIES

MONITORING

APPENDIX B-6

TRIBUTARY A-UPPER

Date:	September, 2007	Job No.	2006-1627	Scale:	1" = 500'



SPA 1
Aggradation in Tributary A2 at station 3+00.
(EMH&T, Inc. 9/19/06)

SPA 2
Bank failure along Tributary B at station 12+10.
(EMH&T, Inc. 4/14/07)

SPA 3
Bank failure along Tributary B at station 12+10.
(EMH&T, Inc. 4/14/07)

SPA 4
Bank scour along Tributary B at station 19+70.
(EMH&T, Inc. 4/14/07)

SPA 5
Bank scour along Tributary A (middle) at station 83+30.
(EMH&T, Inc. 4/14/07)

SPA 6
Bank scour along Tributary C at station 15+70.
(EMH&T, Inc. 4/14/07)

Fixed Station 1
Overview of Tributary A (upper), facing upstream.
(EMH&T, Inc. 9/20/06)

Fixed Station 2
Overview of valley along Tributary A2 at confluence with Tributary A, facing upstream.
(EMH&T, Inc. 97/11/06)

Fixed Station 3
Overview of valley along Tributary A (lower) near station 31+50, facing downstream.
(EMH&T, Inc. 9/19/06)

Fixed Station 4
Overview of valley along Tributary A (lower) near station 31+50, facing upstream.
(EMH&T, Inc. 9/20/06)

Fixed Station 5
Overview of valley on Tributary A (lower) at large culvert, facing upstream.
(EMH&T, Inc. 9/19/06)

Fixed Station 6
Overview of valley on Tributary A (lower) at large culvert, facing downstream.
(EMH&T, Inc. 9/19/06)

Fixed Station 7
Overview of valley along Tributary B, facing upstream.
(EMH&T, Inc. 9/19/06)

Fixed Station 8
Overview of valley along Tributary B, facing downstream.
(EMH&T, Inc. 9/19/06)

Fixed Station 9
Overview of Tributary C near station 6+50, facing downstream.
(EMH&T, Inc. 9/19/06)

Fixed Station 10
Overview of Tributary C near station 8+60, facing downstream.
(EMH&T, Inc. 9/19/06)

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (upper)

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	24	24	N/A	100	
	2. Armor stable (e.g. no displacement)?	24	24	N/A	100	
	3. Facet grade appears stable?	24	24	N/A	100	
	4. Minimal evidence of embedding/fining?	24	24	N/A	100	
	5. Length appropriate?	24	24	N/A	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	25	25	N/A	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	25	25	N/A	100	
	3. Length appropriate?	25	25	N/A	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	25	25	0	100	
	2. Downstream of meander (glide/inflection) centering?	25	25	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	24	25	1	96	
	2. Of those eroding, # w/concomitant point bar formation?	25	25	0	100	
	3. Apparent Rc within spec?	25	25	0	100	
	4. Sufficient floodplain access and relief?	25	25	0	100	**99%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (middle)

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	18	18	N/A	100	
	2. Armor stable (e.g. no displacement)?	18	18	N/A	100	
	3. Facet grade appears stable?	18	18	N/A	100	
	4. Minimal evidence of embedding/fining?	18	18	N/A	100	
	5. Length appropriate?	18	18	N/A	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	19	19	N/A	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	19	19	N/A	100	
	3. Length appropriate?	19	19	N/A	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	19	19	0	100	
	2. Downstream of meander (glide/inflection) centering?	19	19	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	16	19	3	84	
	2. Of those eroding, # w/concomitant point bar formation?	19	19	0	100	
	3. Apparent Rc within spec?	19	19	0	100	
	4. Sufficient floodplain access and relief?	19	19	0	100	**96%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A (lower)

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	93	93	N/A	100	
	2. Armor stable (e.g. no displacement)?	93	93	N/A	100	
	3. Facet grade appears stable?	93	93	N/A	100	
	4. Minimal evidence of embedding/fining?	93	93	N/A	100	
	5. Length appropriate?	93	93	N/A	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	95	95	N/A	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	95	95	N/A	100	
	3. Length appropriate?	95	95	N/A	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	95	95	0	100	
	2. Downstream of meander (glide/inflection) centering?	95	95	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	94	95	1	98	
	2. Of those eroding, # w/concomitant point bar formation?	95	95	0	100	
	3. Apparent Rc within spec?	95	95	0	100	
	4. Sufficient floodplain access and relief?	95	95	0	100	**99%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: C

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	33	33	N/A	100	
	2. Armor stable (e.g. no displacement)?	33	33	N/A	100	
	3. Facet grade appears stable?	33	33	N/A	100	
	4. Minimal evidence of embedding/fining?	33	33	N/A	100	
	5. Length appropriate?	33	33	N/A	100	**100%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	34	34	N/A	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	34	34	N/A	100	
	3. Length appropriate?	34	34	N/A	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	19	19	0	100	
	2. Downstream of meander (glide/inflection) centering?	19	19	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	32	34	2	94	
	2. Of those eroding, # w/concomitant point bar formation?	34	34	0	100	
	3. Apparent Rc within spec?	34	34	0	100	
	4. Sufficient floodplain access and relief?	34	34	0	100	**99%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: B

Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	22	23	1	96	
	2. Armor stable (e.g. no displacement)?	23	23	0	100	
	3. Facet grade appears stable?	23	23	0	100	
	4. Minimal evidence of embedding/fining?	23	23	0	100	
	5. Length appropriate?	23	23	0	100	**99%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	23	23	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	23	23	0	100	
	3. Length appropriate?	23	23	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	36	36	0	100	
	2. Downstream of meander (glide/inflection) centering?	36	36	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	32	36	4	89	
	2. Of those eroding, # w/concomitant point bar formation?	35	36	1	97	
	3. Apparent Rc within spec?	36	36	0	100	
	4. Sufficient floodplain access and relief?	36	36	0	100	**97%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	0/ 0 feet	100	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100	**100%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A
H. Log Sills	1. Maintaining grade control?	13	14	1	93	
	2. Minimal evidence of sedimentation in adjacent pool?	14	14	0	100	**97%**

Table B1. Visual Morphological Stability Assessment
South Muddy Creek Tributaries Restoration / EEP Project No. D04006-01
Segment/Reach: A2

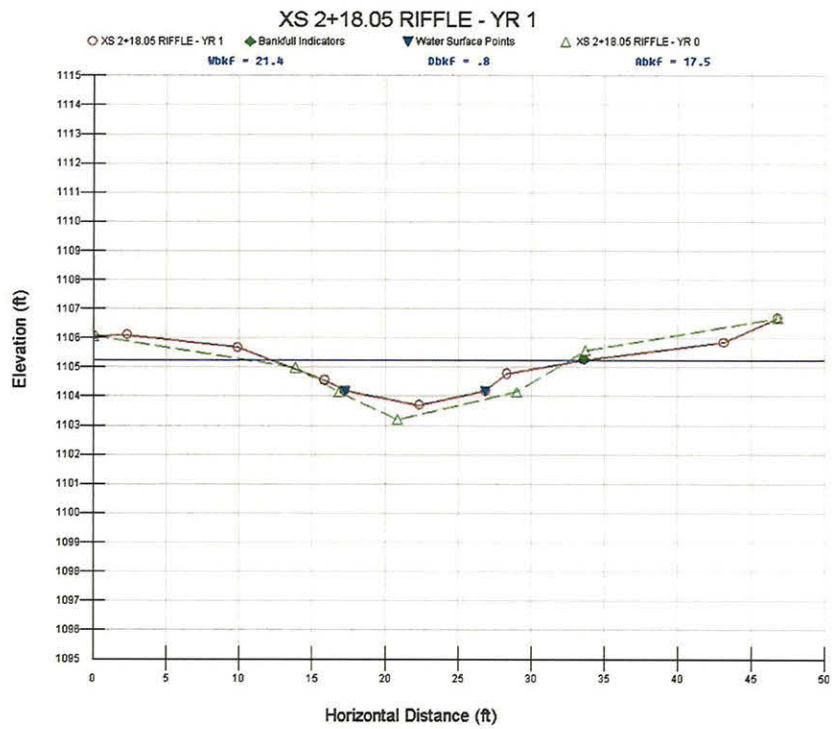
Feature Category	Metric (per As-built and reference baselines	(# Stable) Number Performing as Intended	Total number per As-built	Total Number / feet in unstable state	% Perform in Stable Condition	Feature Perform. Mean or Total
A. Riffles	1. Present?	7	7	0	100	
	2. Armor stable (e.g. no displacement)?	7	7	0	100	
	3. Facet grade appears stable?	7	7	0	100	
	4. Minimal evidence of embedding/fining?	6	7	1	100	
	5. Length appropriate?	7	7	0	86	**97%**
B. Pools	1. Present? (e.g. not subject to severe aggrad. or migrat.?)	7	7	0	100	
	2. Sufficiently deep (Max Pool D:Mean Bkf>1.6?)	7	7	0	100	
	3. Length appropriate?	7	7	0	100	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering?	11	11	0	100	
	2. Downstream of meander (glide/inflection) centering?	11	11	0	100	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion?	11	11	0	100	
	2. Of those eroding, # w/concomitant point bar formation?	11	11	0	100	
	3. Apparent Rc within spec?	11	11	0	100	
	4. Sufficient floodplain access and relief?	11	11	0	100	**100%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	N/A	N/A	2/ 65 feet	86%	
	2. Channel bed degradation - areas of increasing downcutting or headcutting?	N/A	N/A	0/ 0 feet	100%	**93%**
F. Vanes	1. Free of back or arm scour?	N/A	0	N/A	N/A	
	2. Height appropriate?	N/A	0	N/A	N/A	
	3. Angle and geometry appear appropriate?	N/A	0	N/A	N/A	
	4. Free of piping or other structural failures?	N/A	0	N/A	N/A	N/A
G. Wads/ Boulders	1. Free of scour?	N/A	0	N/A	N/A	
	2. Footing stable?	N/A	0	N/A	N/A	N/A

Summary Data
All dimensions in feet.

Bankfull Area	17.52
Bankfull Width	21.43
Mean Depth	0.82
Maximum Depth	1.55
Width/Depth Ratio	26.13
Entrenchment Ratio	2.18
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A2
DATE	4/27/07
CROSS SECTION:	2+18
FEATURE:	Riffle

Cross-section photo – looking downstream

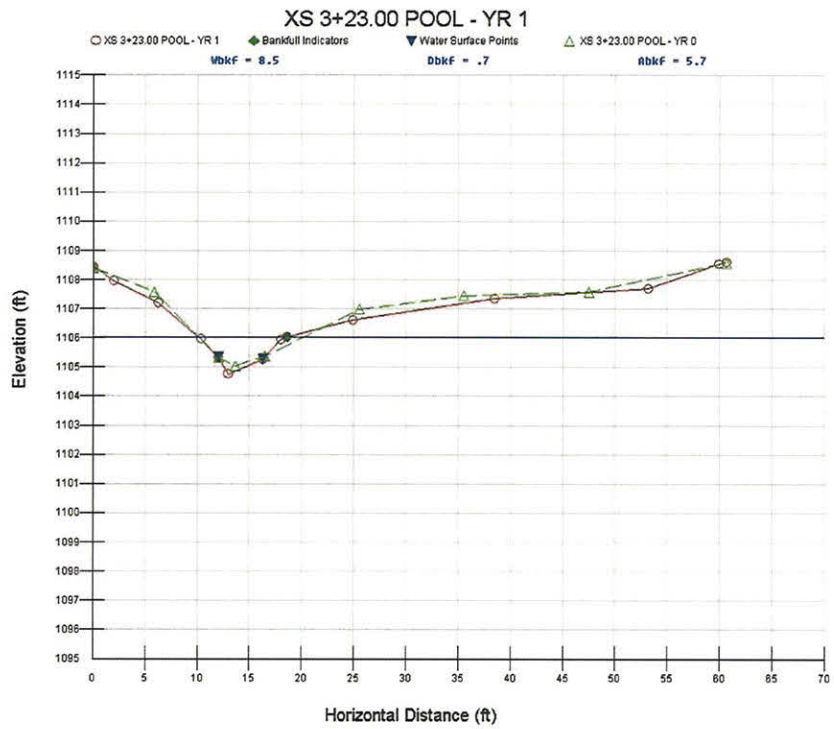


Summary Data
All dimensions in feet.

Bankfull Area	5.7
Bankfull Width	8.47
Mean Depth	0.67
Maximum Depth	1.27
Width/Depth Ratio	12.64
Entrenchment Ratio	3.78
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A2
DATE	4/27/07
CROSS SECTION:	3+23
FEATURE:	Pool

Cross-section photo – looking upstream

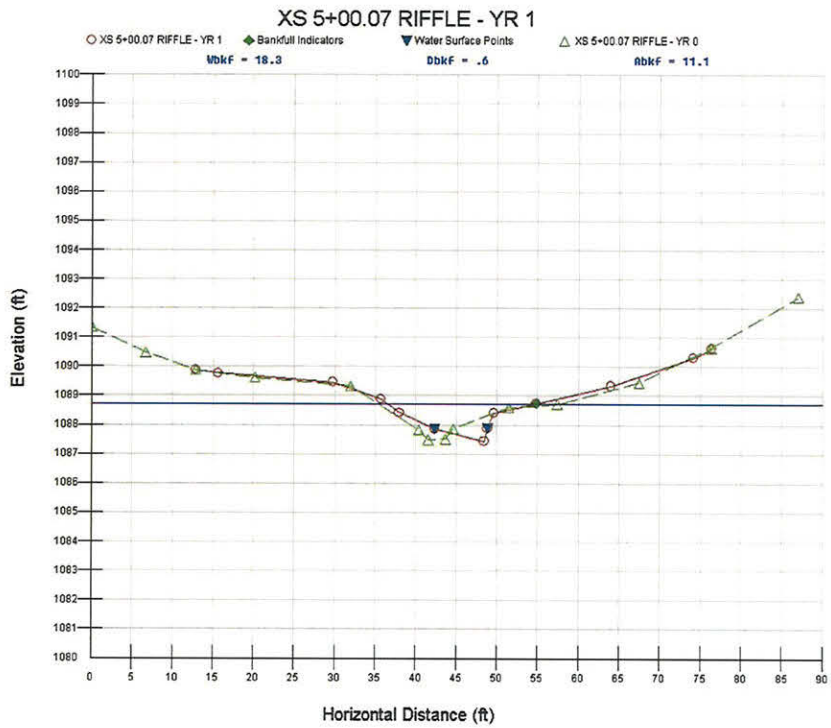


Summary Data
All dimensions in feet.

Bankfull Area	11.12
Bankfull Width	18.34
Mean Depth	0.61
Maximum Depth	1.3
Width/Depth Ratio	30.07
Entrenchment Ratio	3.18
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	B
DATE	4/27/07
CROSS SECTION:	5+00
FEATURE:	Riffle

Cross-section photo – looking downstream



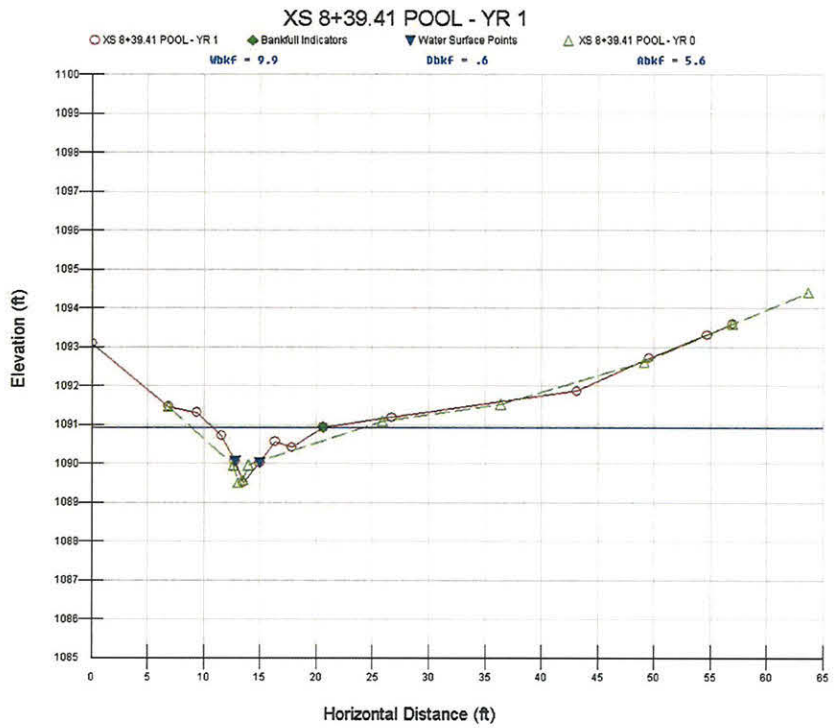
Summary Data
All dimensions in feet.

Bankfull Area	5.57
Bankfull Width	9.93
Mean Depth	0.56
Maximum Depth	1.42
Width/Depth Ratio	17.73
Entrenchment Ratio	4.41
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	B
DATE	4/27/07
CROSS SECTION:	8+39
FEATURE:	Pool

Ecosystem Enhancement

Cross-section photo – looking upstream



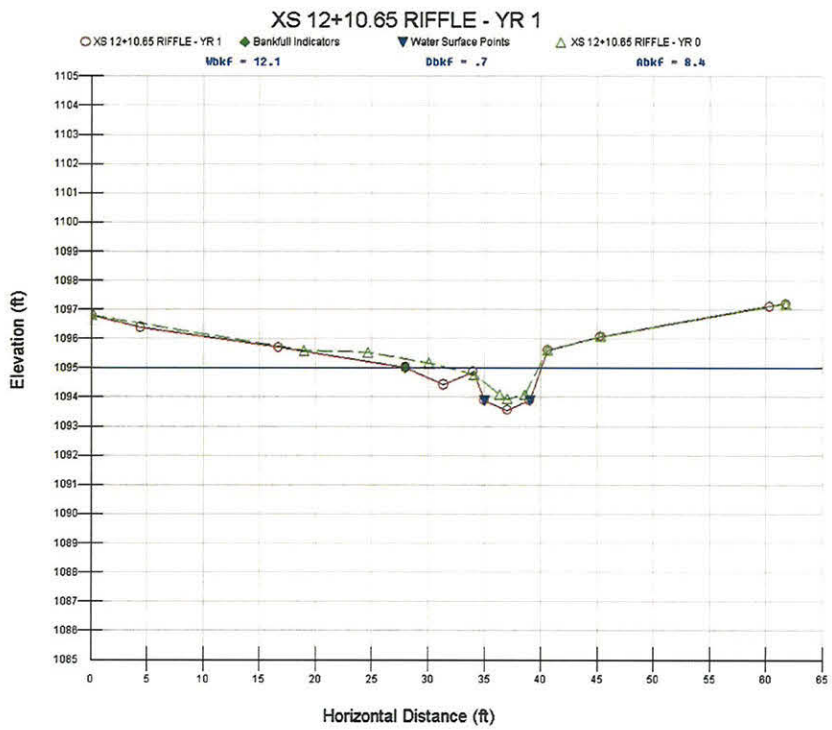
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	8.37
Bankfull Width	12.11
Mean Depth	0.69
Maximum Depth	1.46
Width/Depth Ratio	17.55
Entrenchment Ratio	3.92
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	B
DATE	4/27/07
CROSS SECTION:	12+10
FEATURE:	Riffle

Cross-section photo – looking upstream

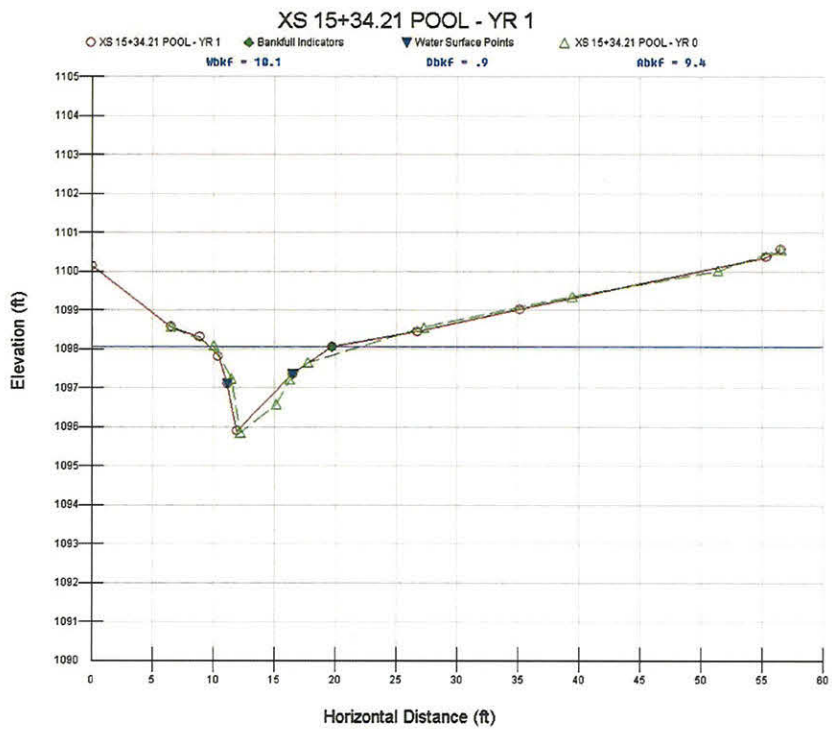


Summary Data
All dimensions in feet.

Bankfull Area	9.41
Bankfull Width	10.08
Mean Depth	0.93
Maximum Depth	2.16
Width/Depth Ratio	10.84
Entrenchment Ratio	5.25
Classification	E

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	B
DATE	4/27/07
CROSS SECTION:	15+34
FEATURE:	Pool

Cross-section photo – looking upstream



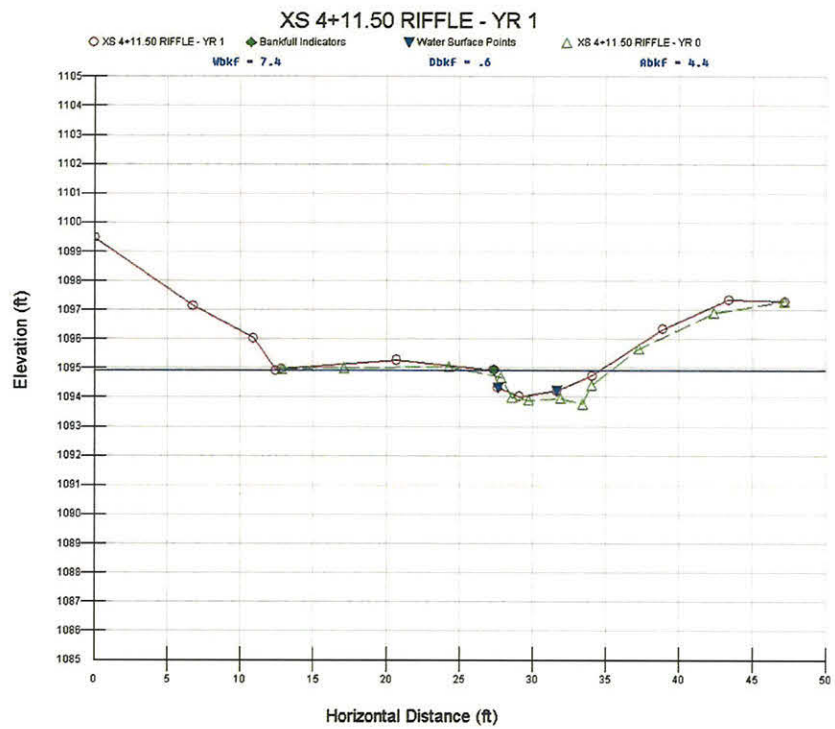
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	4.41
Bankfull Width	7.45
Mean Depth	0.59
Maximum Depth	0.91
Width/Depth Ratio	12.63
Entrenchment Ratio	3.52
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	C
DATE	4/27/07
CROSS SECTION:	4+11
FEATURE:	Riffle

Cross-section photo – looking downstream

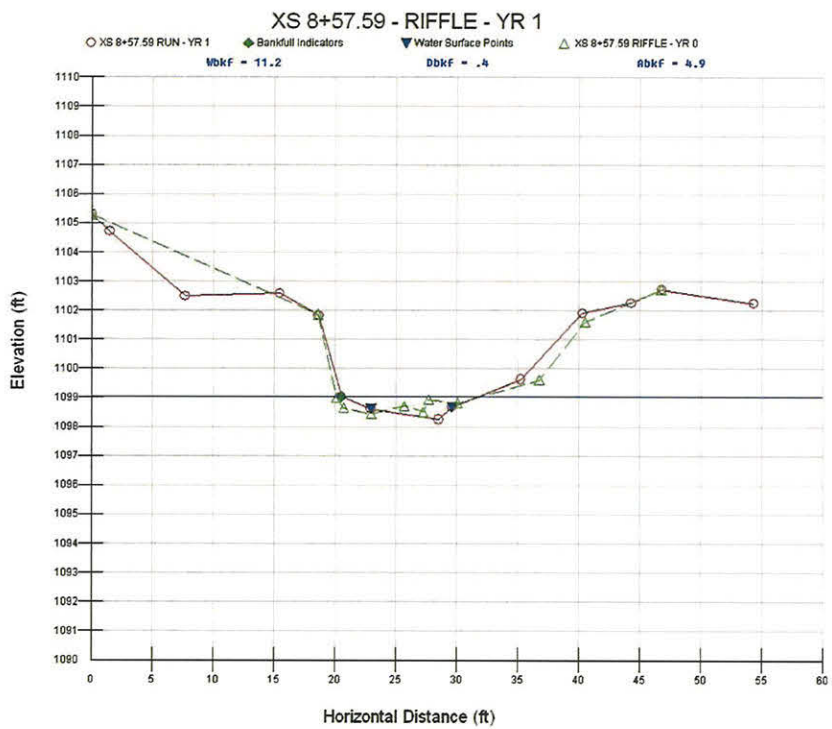


Summary Data
All dimensions in feet.

Bankfull Area	4.91
Bankfull Width	11.25
Mean Depth	0.44
Maximum Depth	0.79
Width/Depth Ratio	25.57
Entrenchment Ratio	1.4
Classification	B

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	C
DATE	4/27/07
CROSS SECTION:	8+57
FEATURE:	Riffle

Cross-section photo – looking downstream

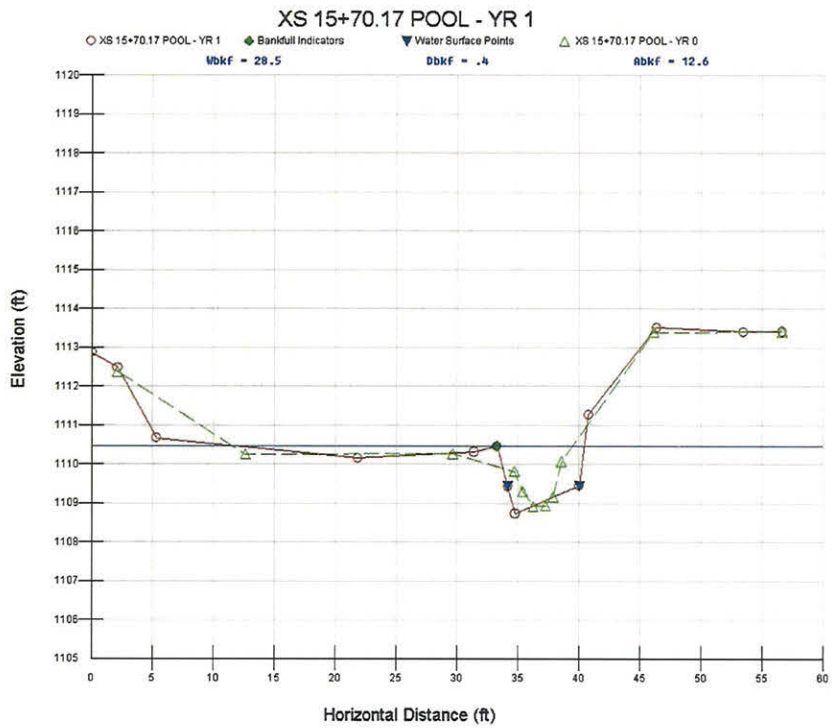


Summary Data
All dimensions in feet.

Bankfull Area	12.58
Bankfull Width	28.47
Mean Depth	0.44
Maximum Depth	1.73
Width/Depth Ratio	64.7
Entrenchment Ratio	1.42
Classification	B

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	C
DATE	4/27/07
CROSS SECTION:	15+70
FEATURE:	Pool

Cross-section photo – looking downstream

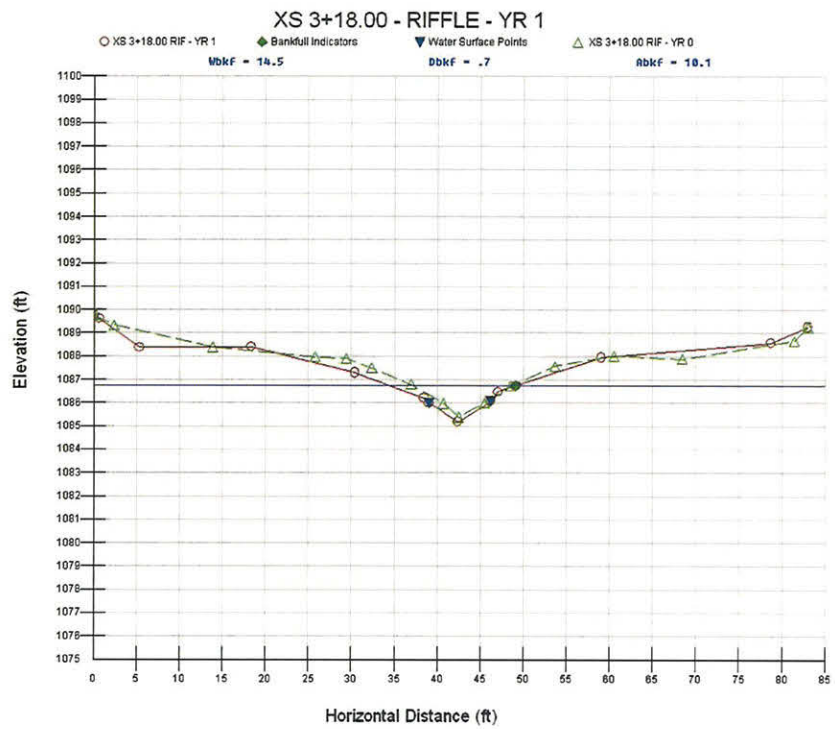


Summary Data
All dimensions in feet.

Bankfull Area	10.09
Bankfull Width	14.52
Mean Depth	0.70
Maximum Depth	1.55
Width/Depth Ratio	20.74
Entrenchment Ratio	3.40
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	3+18
FEATURE:	Riffle

Cross section photo – looking downstream



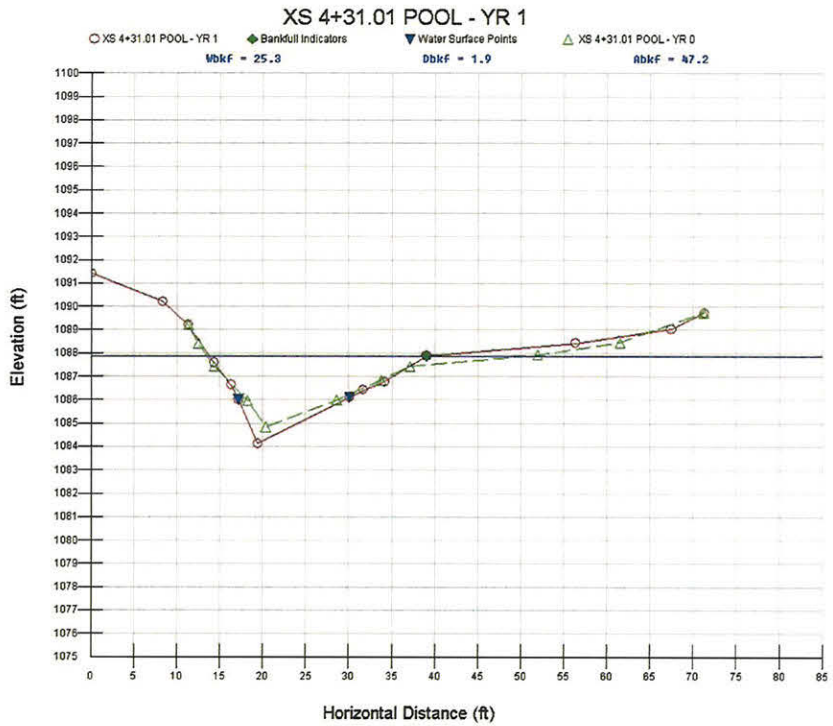
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	47.21
Bankfull Width	25.28
Mean Depth	1.87
Maximum Depth	3.75
Width/Depth Ratio	13.52
Entrenchment Ratio	2.82
Classification	E

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	4+31
FEATURE:	Pool

Cross section photo – looking upstream

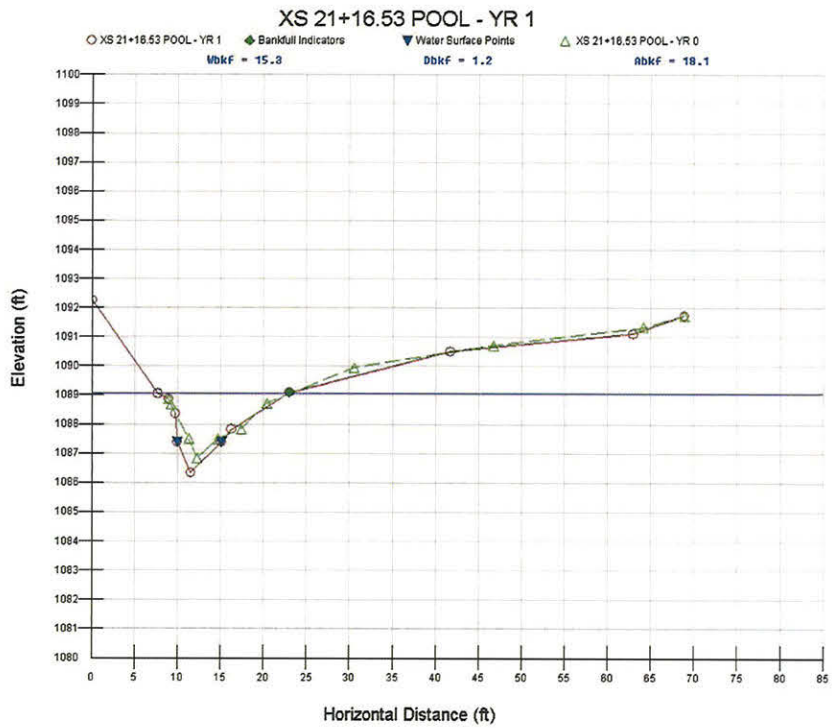


Summary Data
All dimensions in feet.

Bankfull Area	18.13
Bankfull Width	15.34
Mean Depth	1.18
Maximum Depth	2.74
Width/Depth Ratio	13
Entrenchment Ratio	4.42
Classification	E

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	21+16
FEATURE:	Pool

Cross section photo – looking downstream

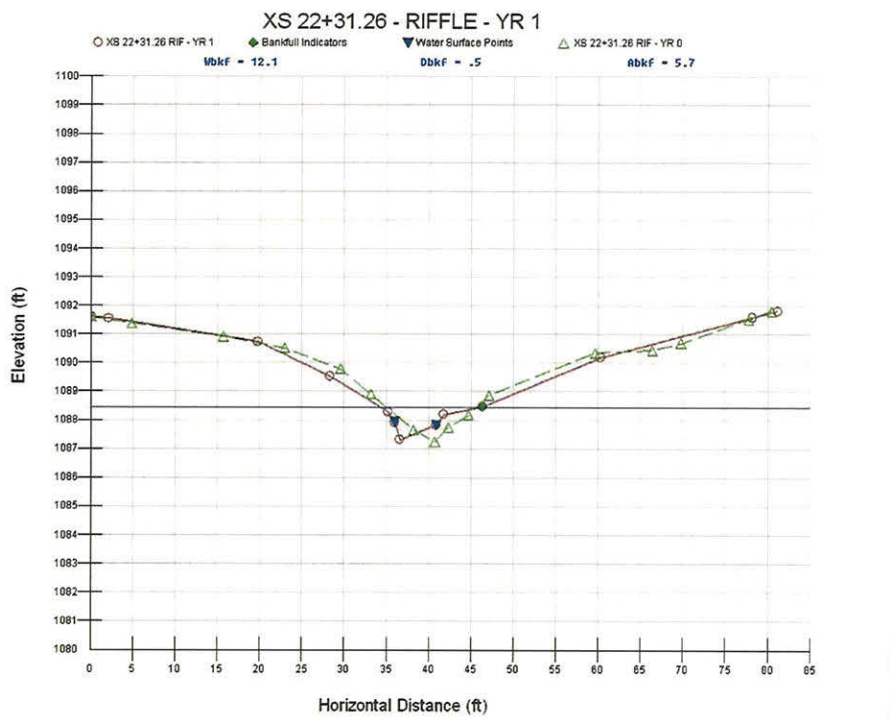


Summary Data
All dimensions in feet.

Bankfull Area	5.67
Bankfull Width	27.84
Mean Depth	0.47
Maximum Depth	1.14
Width/Depth Ratio	25.72
Entrenchment Ratio	2.30
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	22+31
FEATURE:	Riffle

Cross section photo – looking downstream

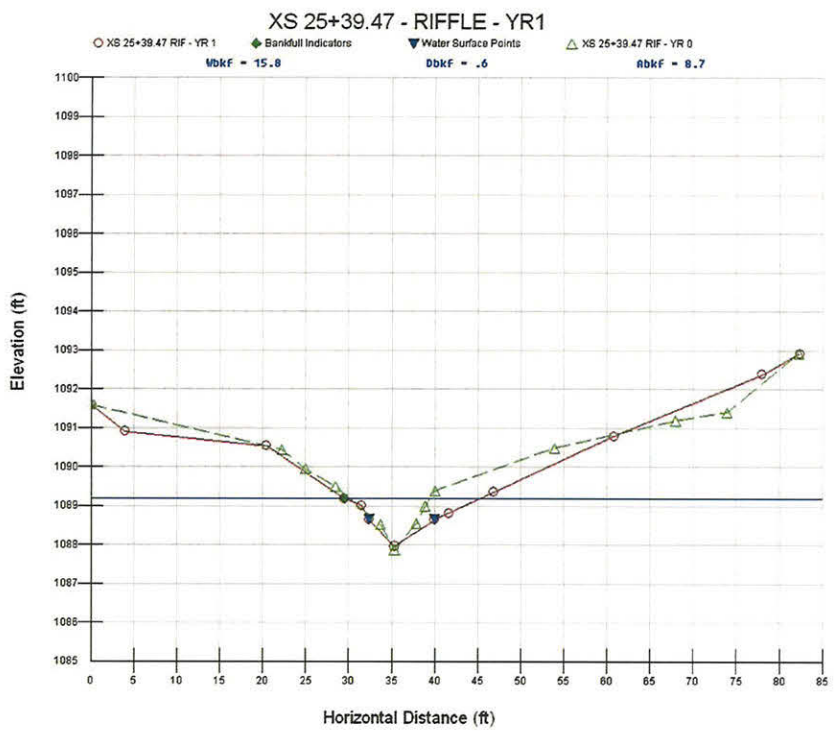


Summary Data
All dimensions in feet.

Bankfull Area	8.72
Bankfull Width	36.07
Mean Depth	0.55
Maximum Depth	1.23
Width/Depth Ratio	28.78
Entrenchment Ratio	2.28
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	25+39
FEATURE:	Riffle

Cross section photo – looking downstream

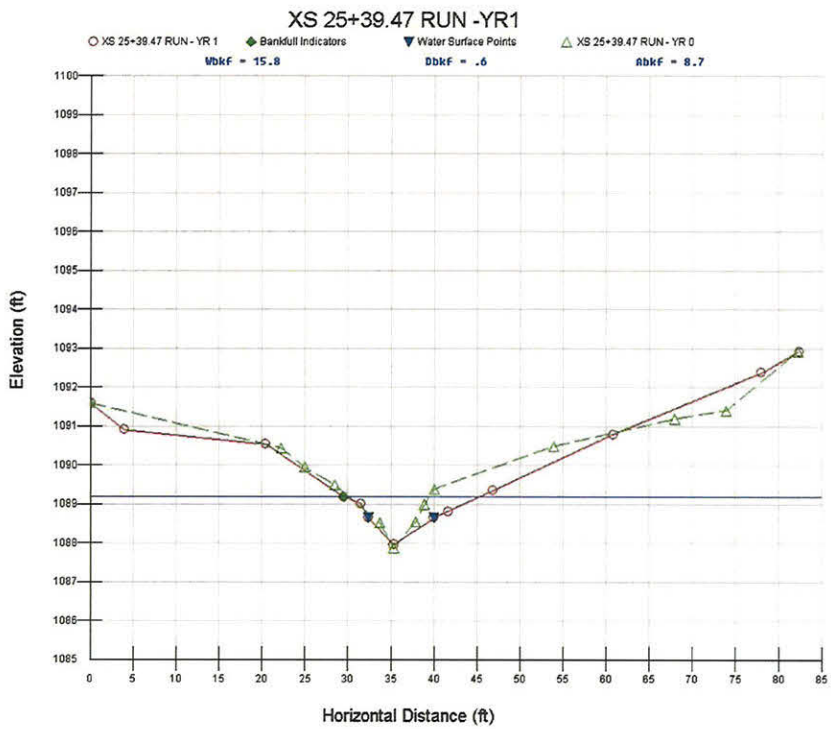


Summary Data
All dimensions in feet.

Bankfull Area	14.12
Bankfull Width	16.60
Mean Depth	0.85
Maximum Depth	2.13
Width/Depth Ratio	19.53
Entrenchment Ratio	3.48
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	28+23
FEATURE:	Pool

Cross section photo – looking upstream

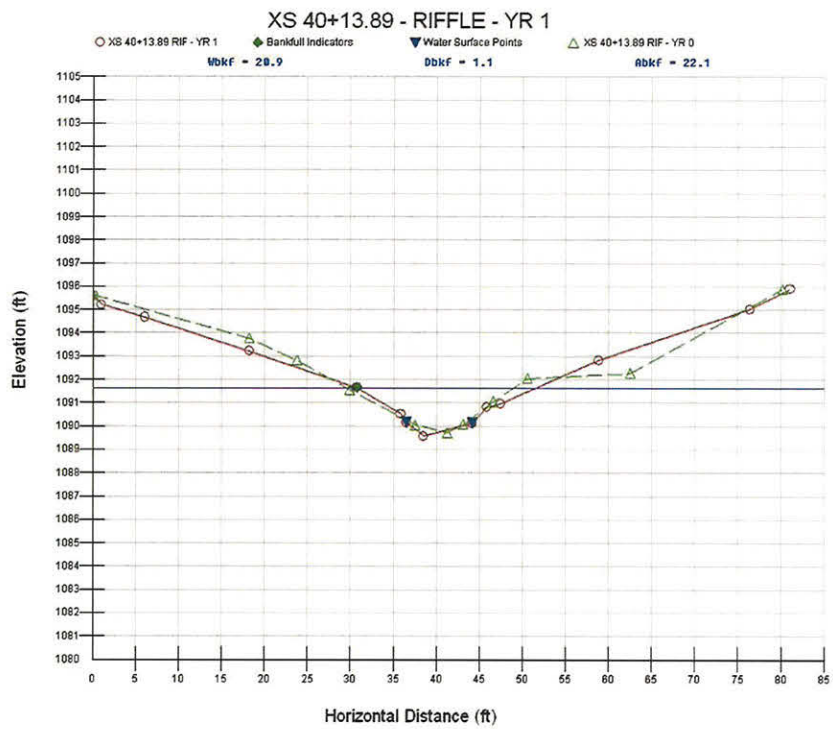


Summary Data
All dimensions in feet.

Bankfull Area	22.09
Bankfull Width	20.91
Mean Depth	1.06
Maximum Depth	2.07
Width/Depth Ratio	19.73
Entrenchment Ratio	2.48
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	40+13
FEATURE:	Riffle

Cross section photo – looking downstream

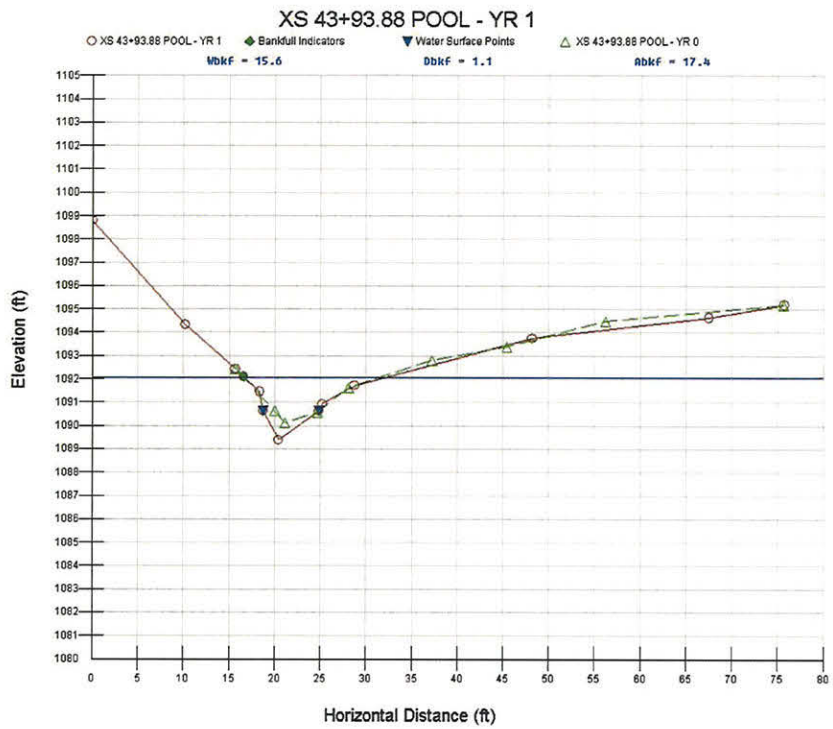


Summary Data
All dimensions in feet.

Bankfull Area	17.40
Bankfull Width	15.62
Mean Depth	1.11
Maximum Depth	2.68
Width/Depth Ratio	14.07
Entrenchment Ratio	3.85
Classification	E

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	43+93
FEATURE:	Pool

Cross section photo – looking downstream

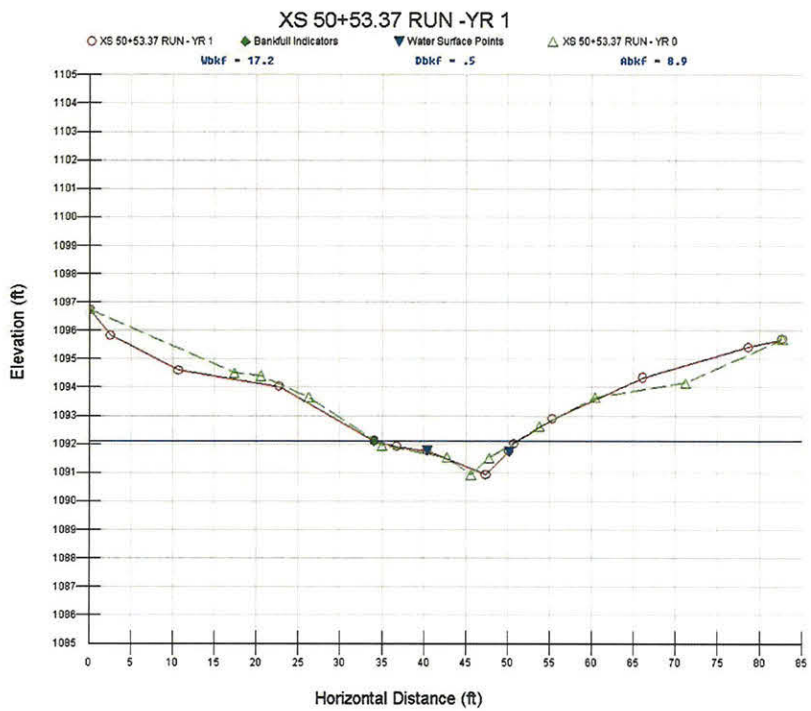


Summary Data
All dimensions in feet.

Bankfull Area	8.87
Bankfull Width	17.21
Mean Depth	0.52
Maximum Depth	1.17
Width/Depth Ratio	33.10
Entrenchment Ratio	1.82
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	50+53
FEATURE:	Riffle

Cross section photo – looking upstream



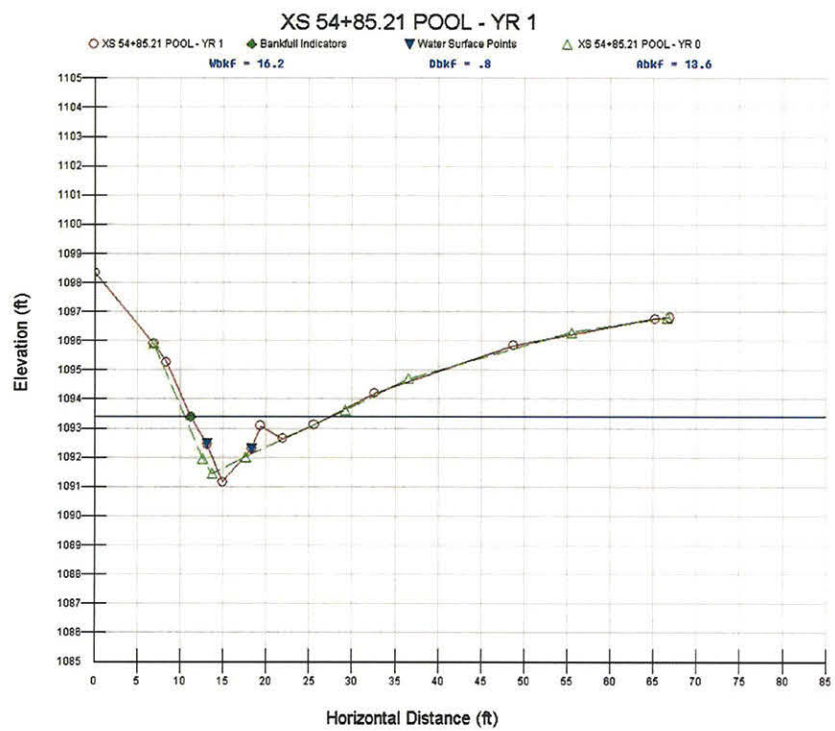
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	13.56
Bankfull Width	16.15
Mean Depth	0.84
Maximum Depth	2.23
Width/Depth Ratio	19.23
Entrenchment Ratio	2.42
Classification	B

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	54+85
FEATURE:	Pool

Cross section photo – looking downstream

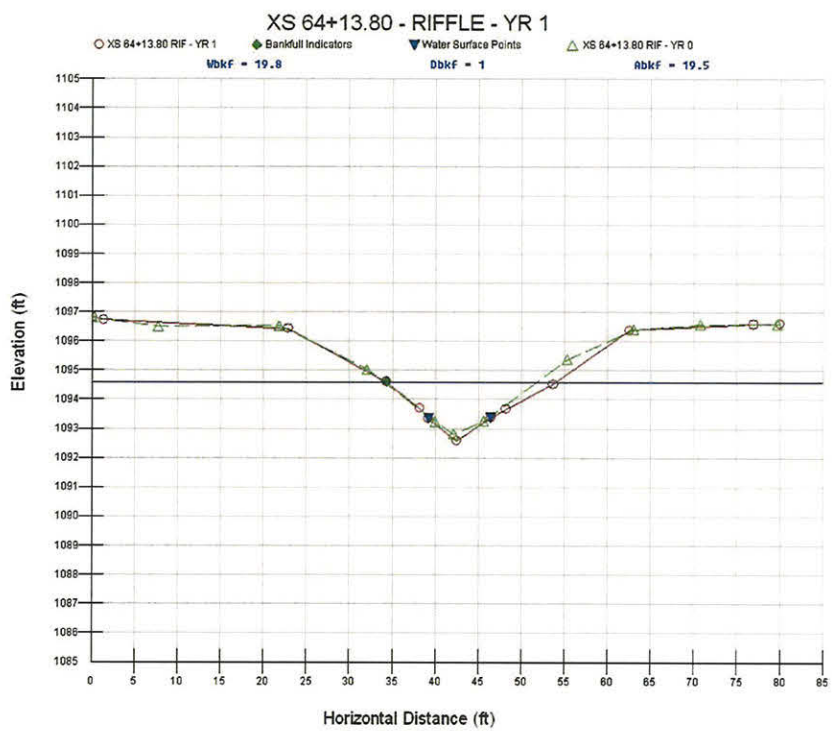


Summary Data
All dimensions in feet.

Bankfull Area	19.46
Bankfull Width	19.78
Mean Depth	3.60
Maximum Depth	2.02
Width/Depth Ratio	20.18
Entrenchment Ratio	3.60
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	64+13
FEATURE:	Riffle

Cross section photo – looking upstream

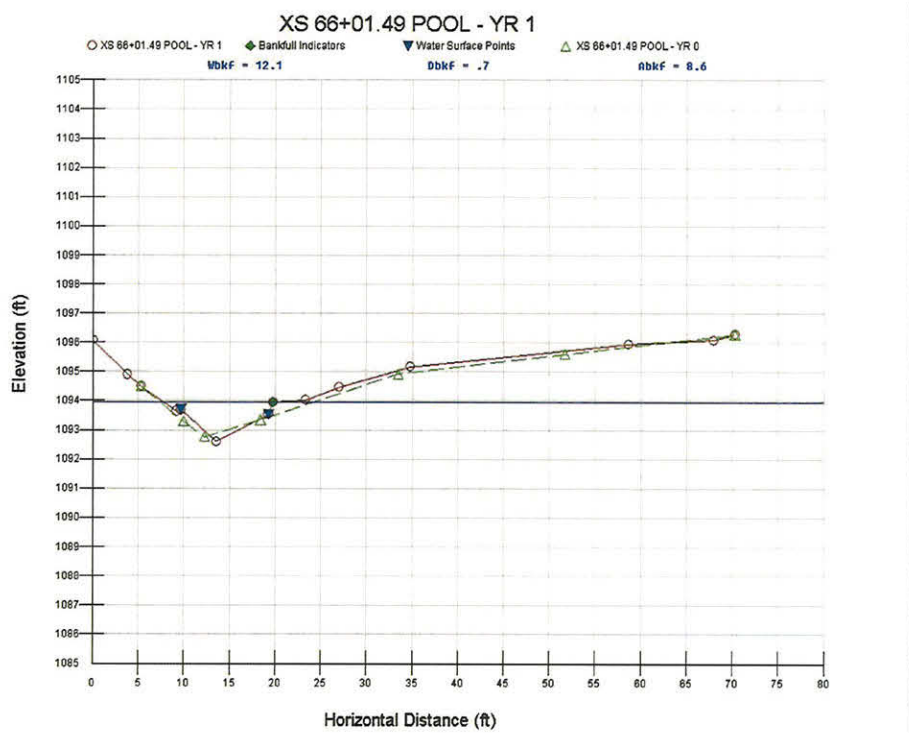


Summary Data
All dimensions in feet.

Bankfull Area	8.61
Bankfull Width	12.09
Mean Depth	0.71
Maximum Depth	1.34
Width/Depth Ratio	17.03
Entrenchment Ratio	2.99
Classification	E

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	4/27/07
CROSS SECTION:	66+01
FEATURE:	Pool

Cross section photo – looking downstream

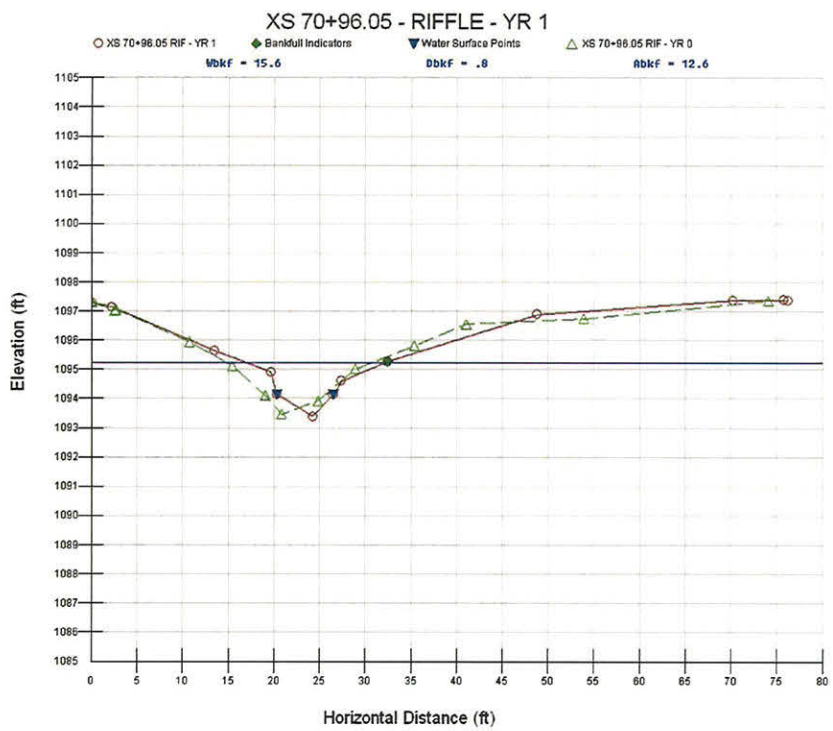


Summary Data
All dimensions in feet.

Bankfull Area	12.06
Bankfull Width	13.79
Mean Depth	0.87
Maximum Depth	1.6
Width/Depth Ratio	15.85
Entrenchment Ratio	7.98
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	11/13/06
CROSS SECTION:	70+96
FEATURE:	Riffle

Cross section photo – looking downstream

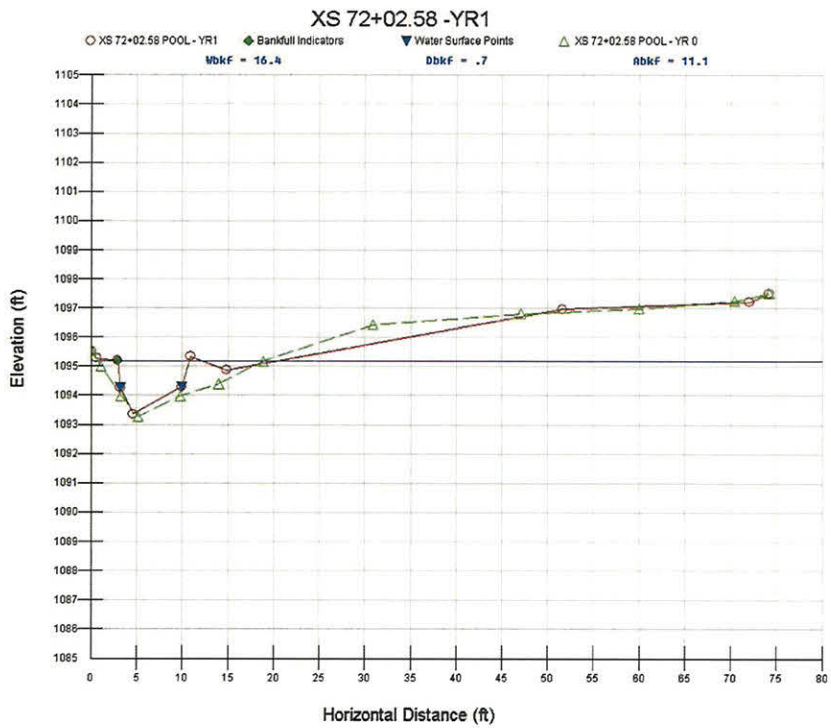


Summary Data
All dimensions in feet.

Bankfull Area	27.81
Bankfull Width	22.4
Mean Depth	1.24
Maximum Depth	2.54
Width/Depth Ratio	18.06
Entrenchment Ratio	4.91
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Lower
DATE	11/13/06
CROSS SECTION:	72+02
FEATURE:	Pool

Cross section photo – looking upstream



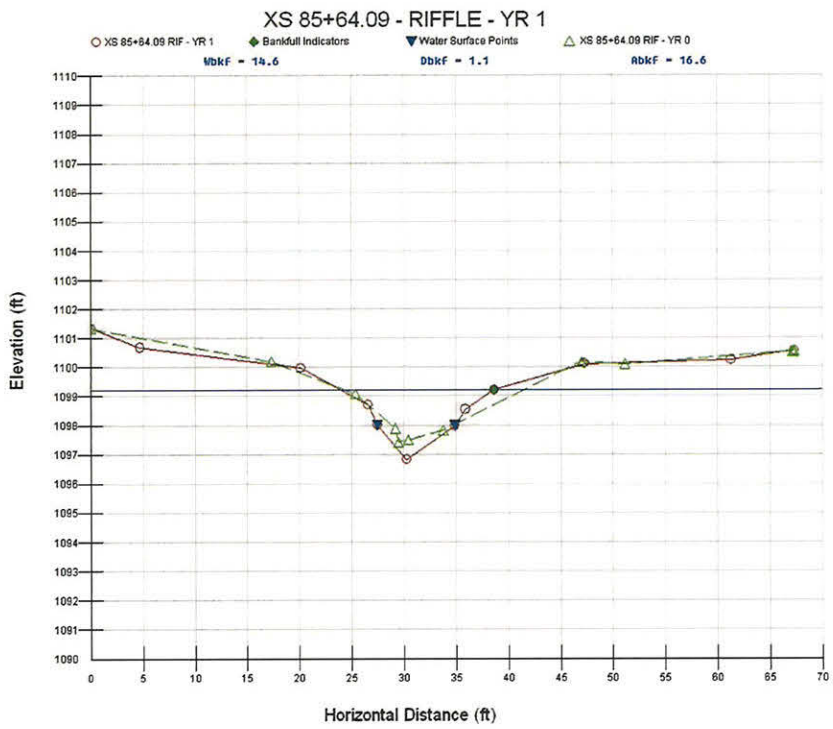
Summary Data
All dimensions in feet.

Bankfull Area	16.62
Bankfull Width	14.63
Mean Depth	1.14
Maximum Depth	2.38
Width/Depth Ratio	12.83
Entrenchment Ratio	4.60
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Middle
DATE	4/27/07
CROSS SECTION:	85+64
FEATURE:	Riffle

Ecosystem Enhancement

Cross section photo – looking upstream



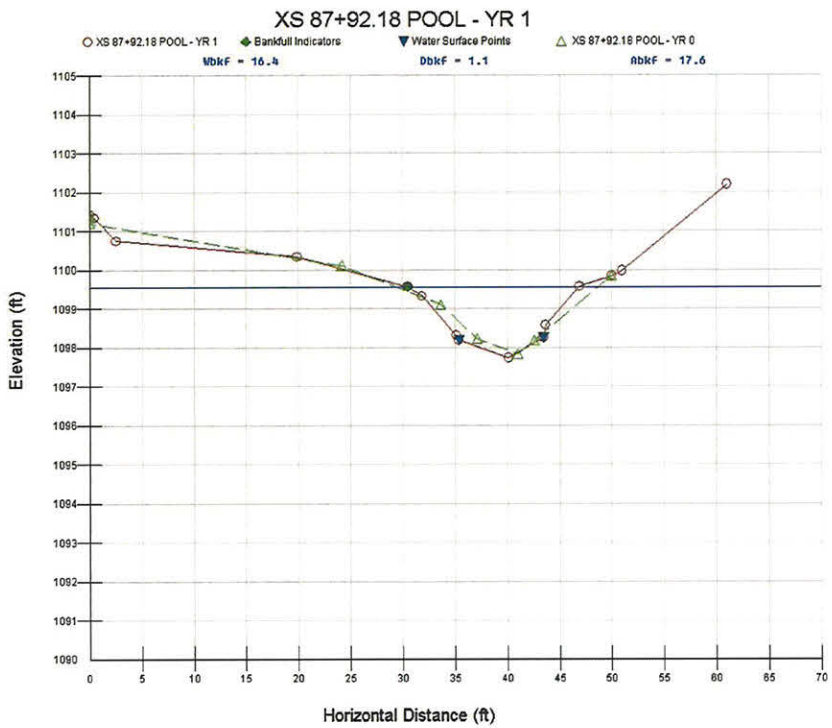
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	17.60
Bankfull Width	16.43
Mean Depth	1.07
Maximum Depth	1.83
Width/Depth Ratio	15.36
Entrenchment Ratio	3.48
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Middle
DATE	4/27/07
CROSS SECTION:	87+92
FEATURE:	Pool

Cross section photo – looking downstream

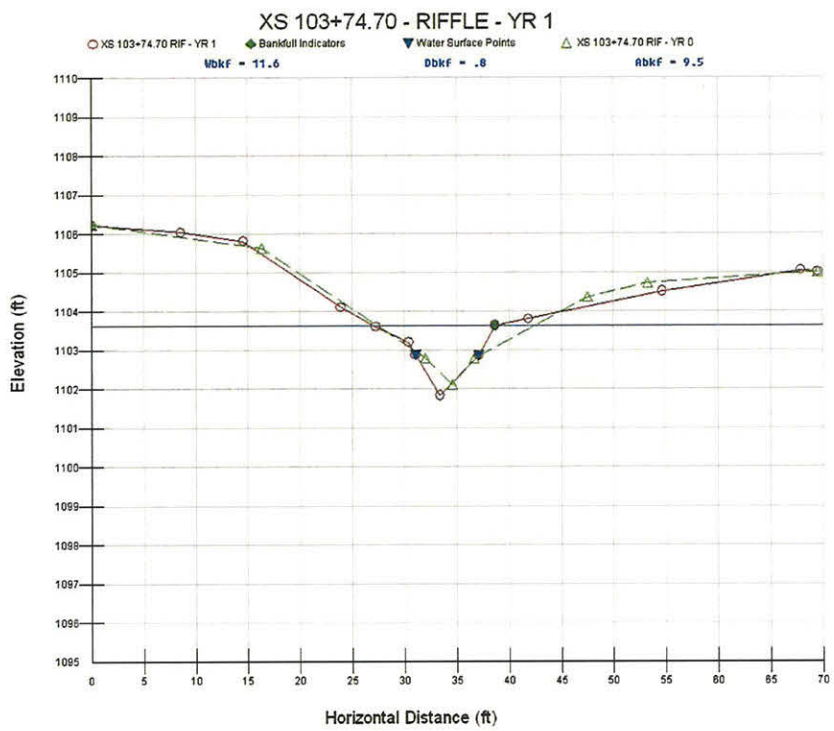


Summary Data
All dimensions in feet.

Bankfull Area	9.49
Bankfull Width	11.64
Mean Depth	0.82
Maximum Depth	1.80
Width/Depth Ratio	14.20
Entrenchment Ratio	4.54
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	4/27/07
CROSS SECTION:	103+74
FEATURE:	Riffle

Cross-section photo – looking across the stream



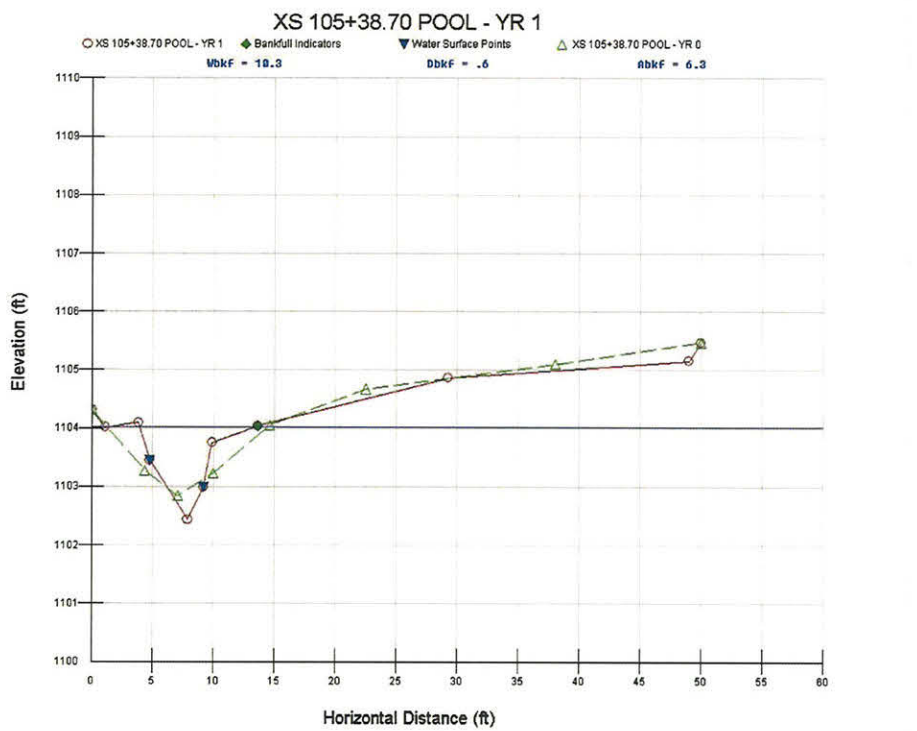
EMH&T

Summary Data
All dimensions in feet.

Bankfull Area	6.32
Bankfull Width	10.35
Mean Depth	0.61
Maximum Depth	1.59
Width/Depth Ratio	16.97
Entrenchment Ratio	4.83
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	4/27/07
CROSS SECTION:	105+38
FEATURE:	Pool

Cross-section photo – looking downstream

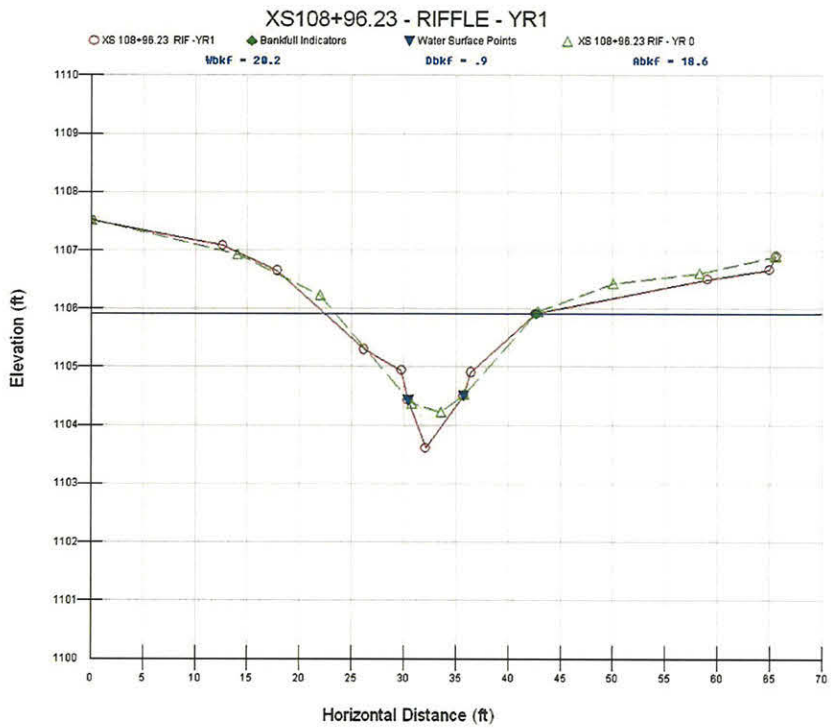


Summary Data
All dimensions in feet.

Bankfull Area	18.64
Bankfull Width	20.22
Mean Depth	0.92
Maximum Depth	2.30
Width/Depth Ratio	21.98
Entrenchment Ratio	3.25
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	4/27/07
CROSS SECTION:	108+96
FEATURE:	Riffle

Cross-section photo – looking upstream

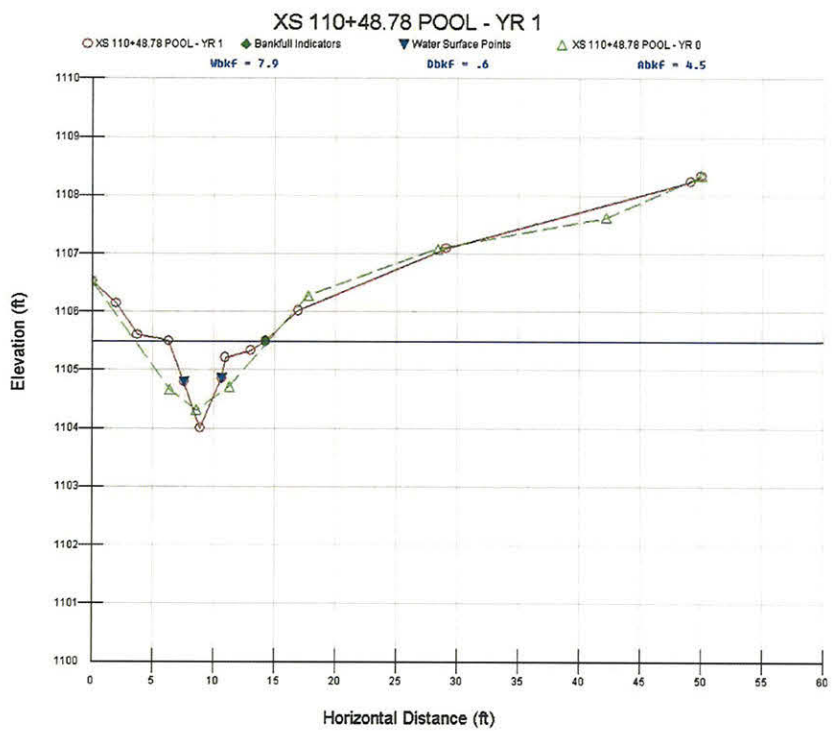


Summary Data
All dimensions in feet.

Bankfull Area	4.46
Bankfull Width	7.94
Mean Depth	0.56
Maximum Depth	1.49
Width/Depth Ratio	14.18
Entrenchment Ratio	3.50
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	4/27/07
CROSS SECTION:	110+48
FEATURE:	Pool

Cross-section photo – looking downstream

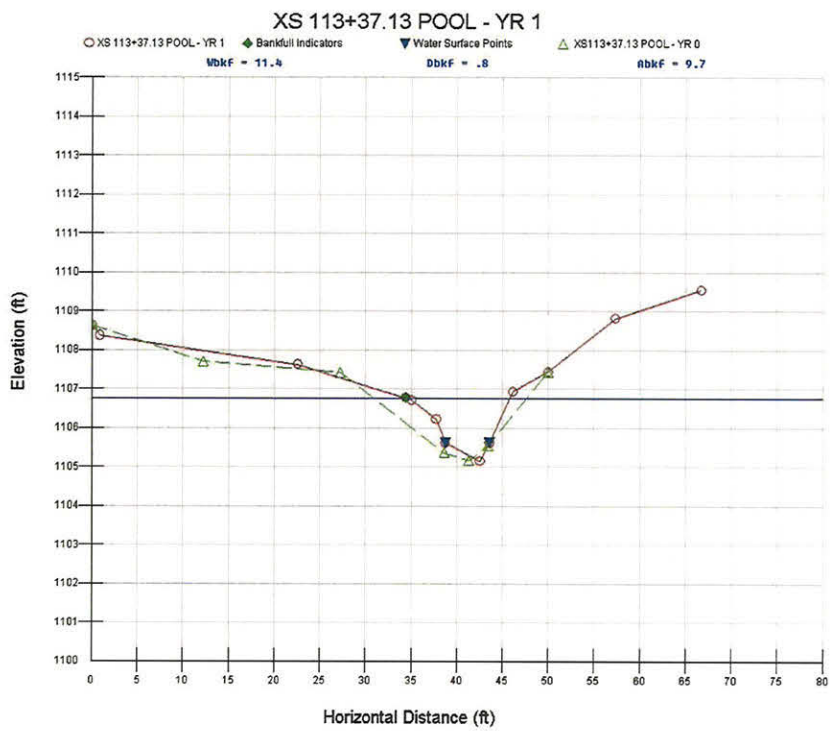


Summary Data
All dimensions in feet.

Bankfull Area	9.69
Bankfull Width	11.41
Mean Depth	0.85
Maximum Depth	1.63
Width/Depth Ratio	13.42
Entrenchment Ratio	4.76
Classification	C

PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	4/27/07
CROSS SECTION:	113+37
FEATURE:	Pool

Cross-section photo – looking upstream

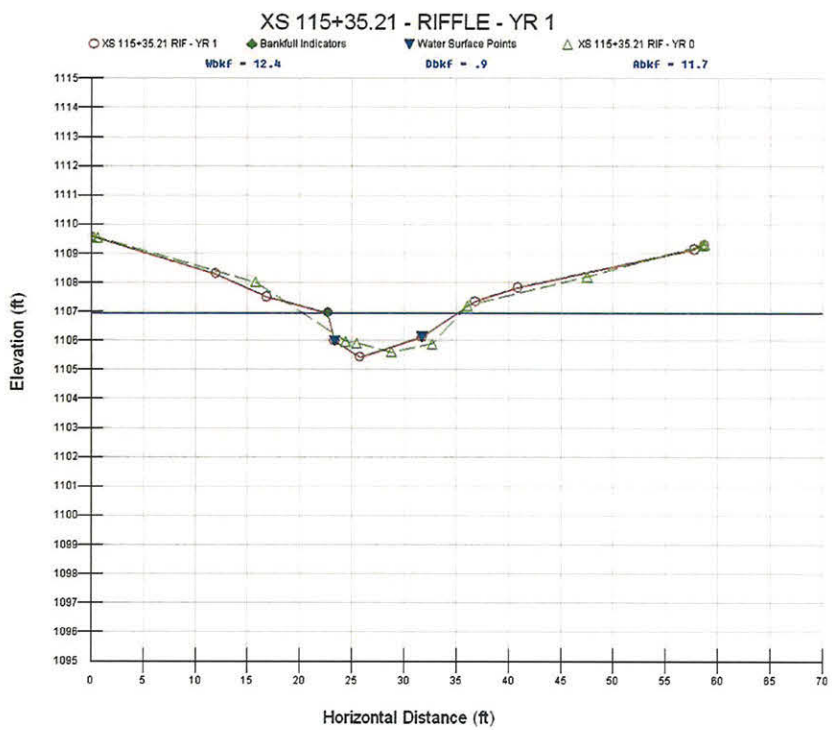


Summary Data
All dimensions in feet.

Bankfull Area	11.69
Bankfull Width	12.42
Mean Depth	0.94
Maximum Depth	1.52
Width/Depth Ratio	13.21
Entrenchment Ratio	3.13
Classification	E

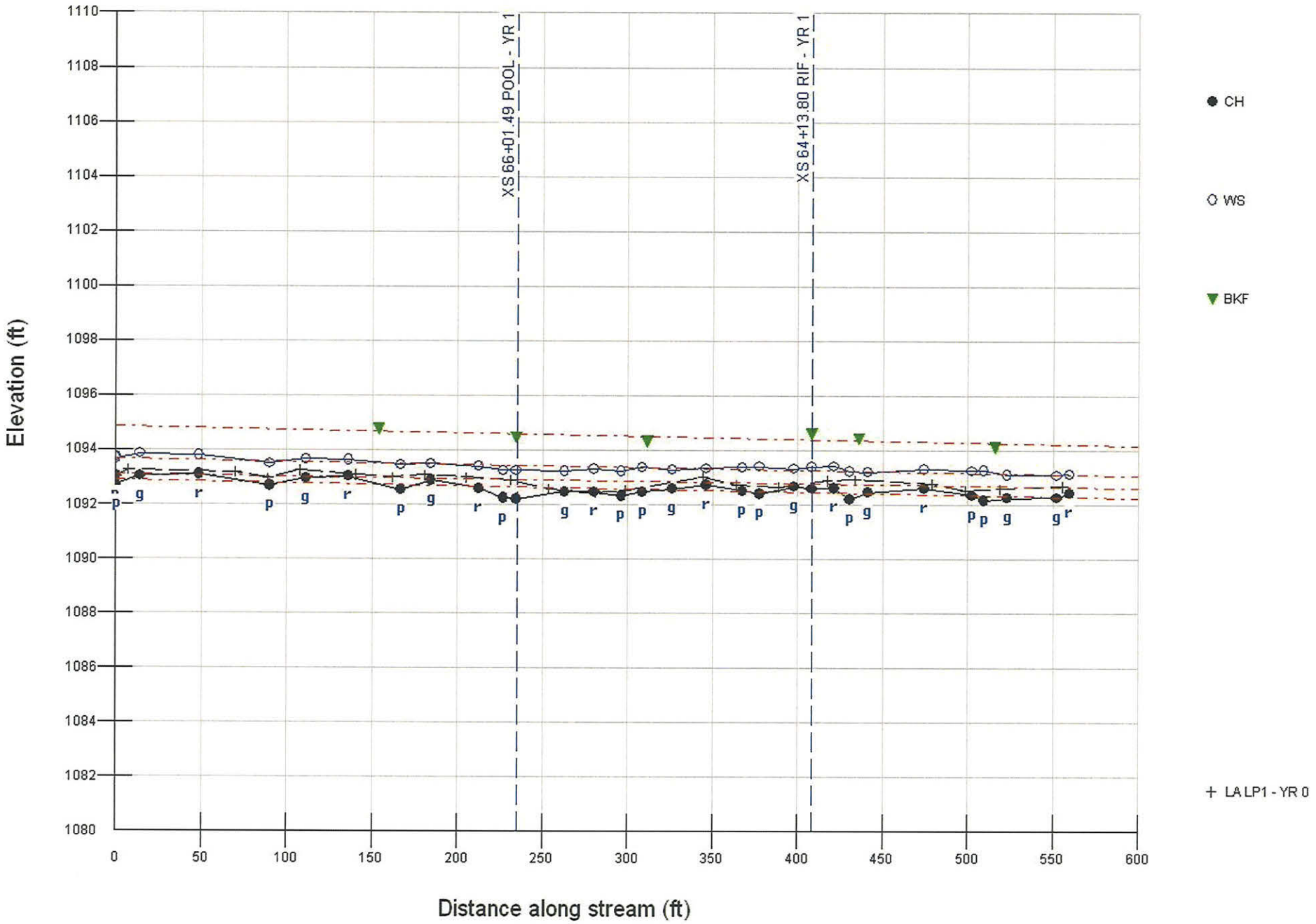
PROJECT	South Muddy
	D04006-1
	1-YEAR
TASK	Cross-Section
REACH	A Upper
DATE	4/27/07
CROSS SECTION:	115+35
FEATURE:	Riffle

Cross-section photo – looking downstream

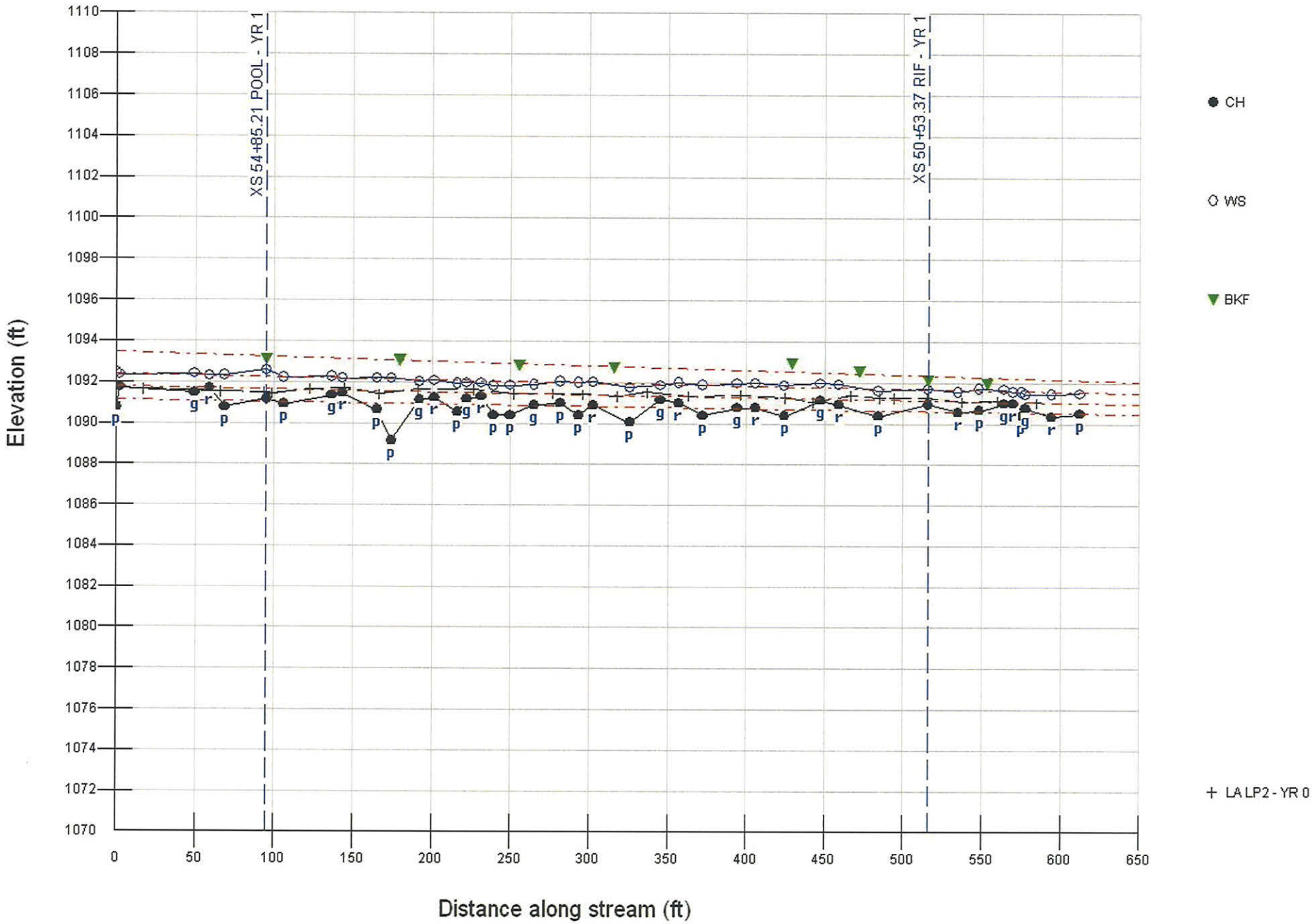


EMH&T

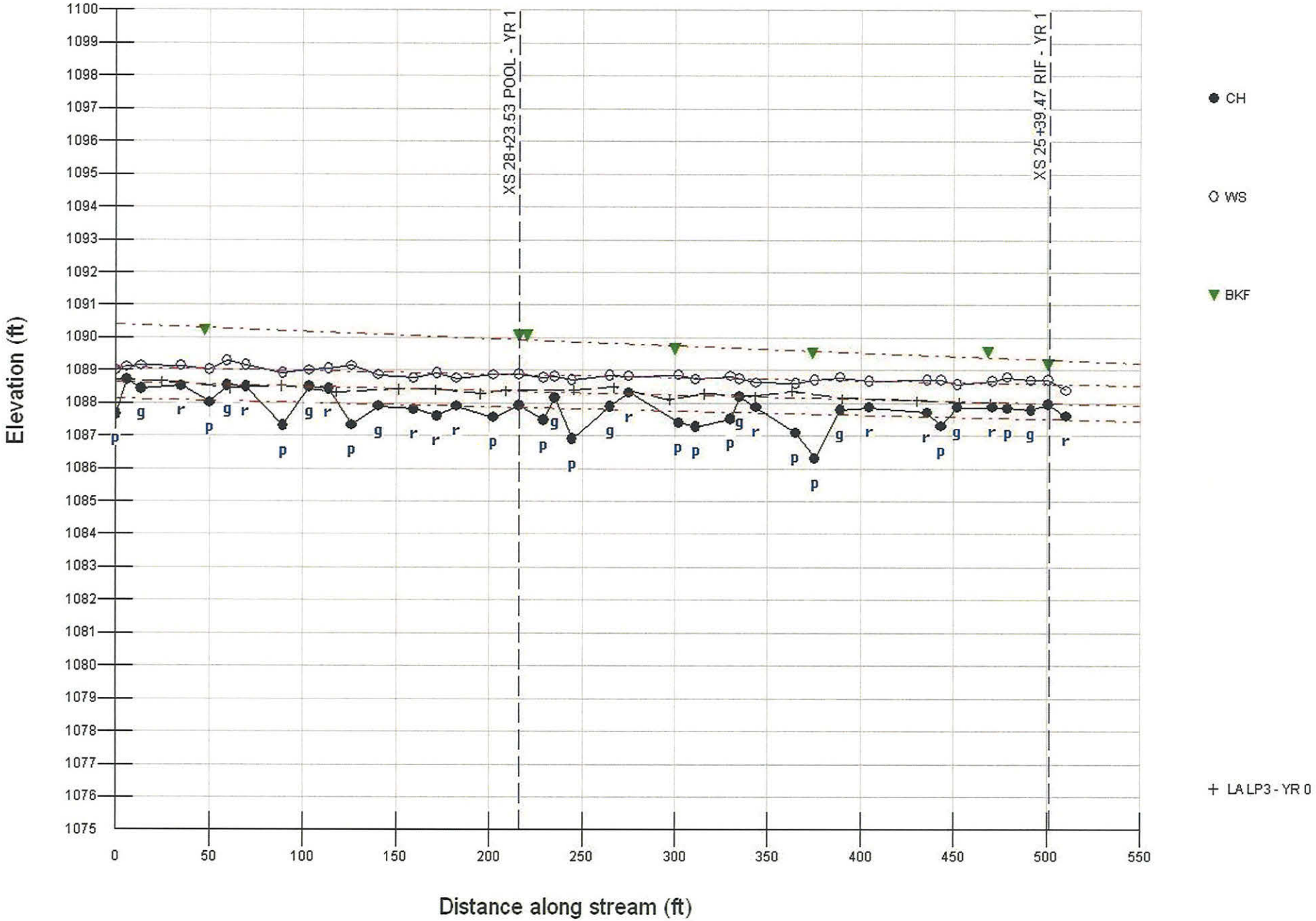
LOWER TRIB A - LONGITUDINAL PROFILE No. 1 - YR 1



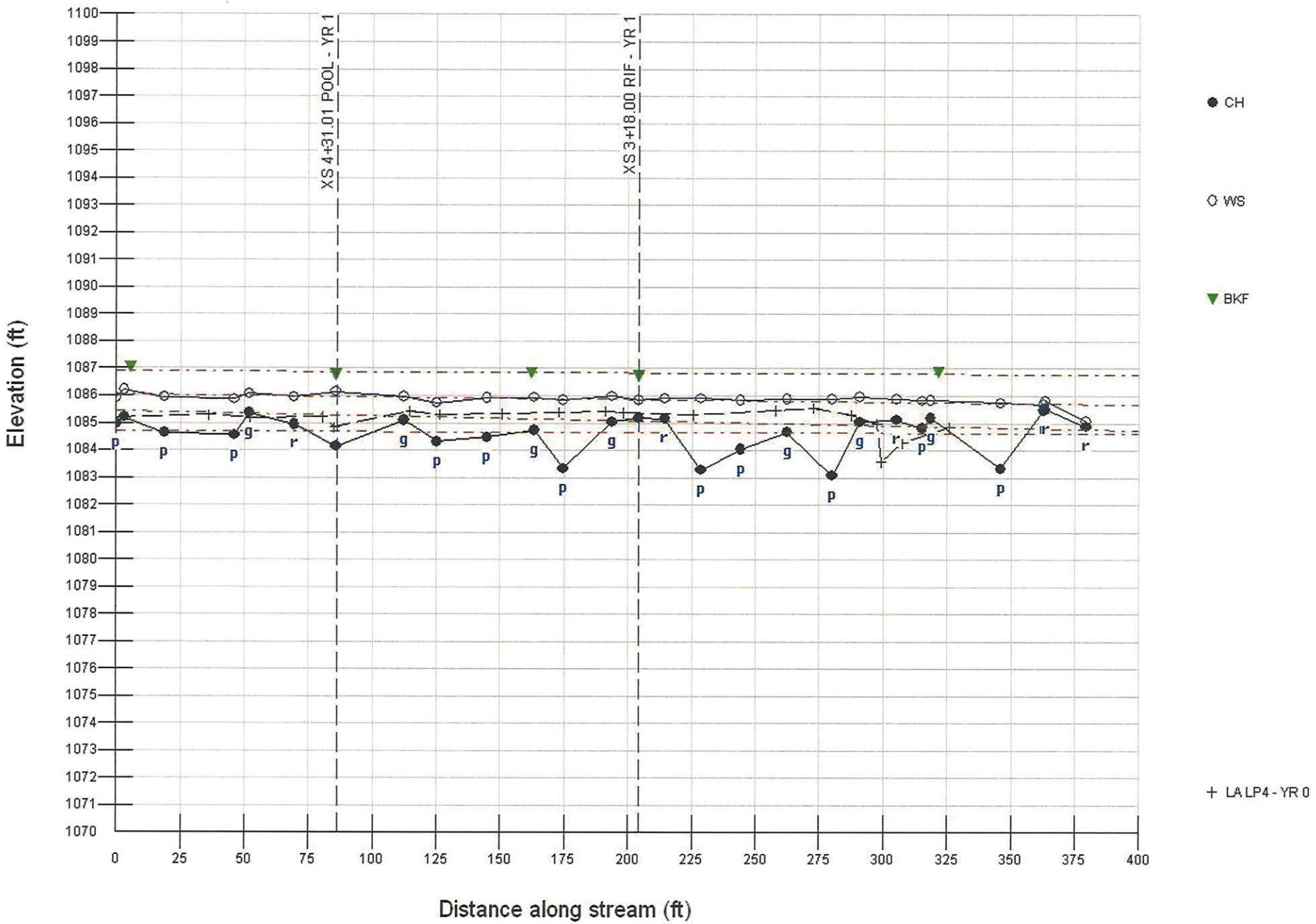
LOWER TRIB A - LONGITUDINAL PROFILE No. 2 - YEAR 1



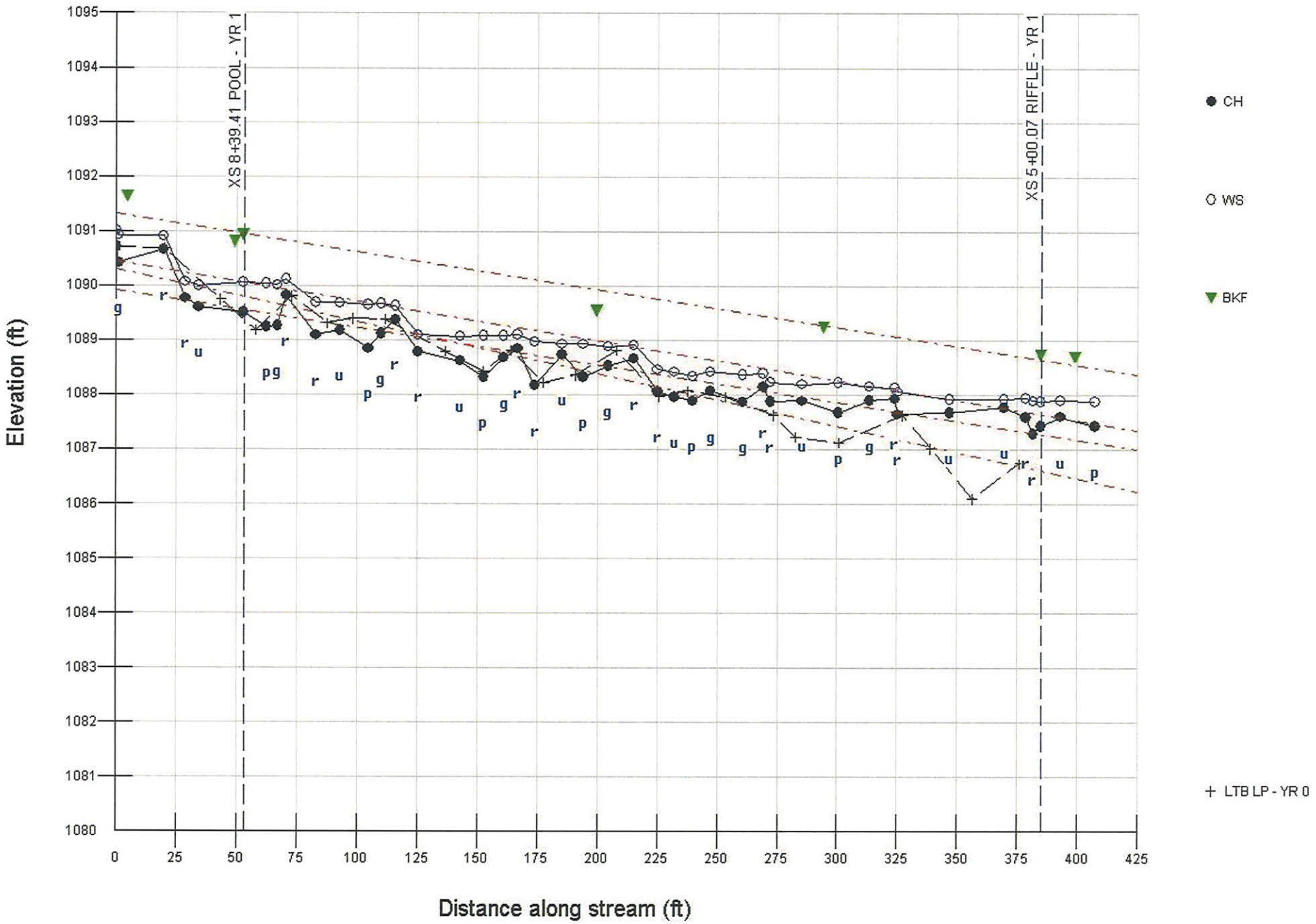
LOWER TRIB A - LONGITUDINAL PROFILE No. 3 - YEAR 1



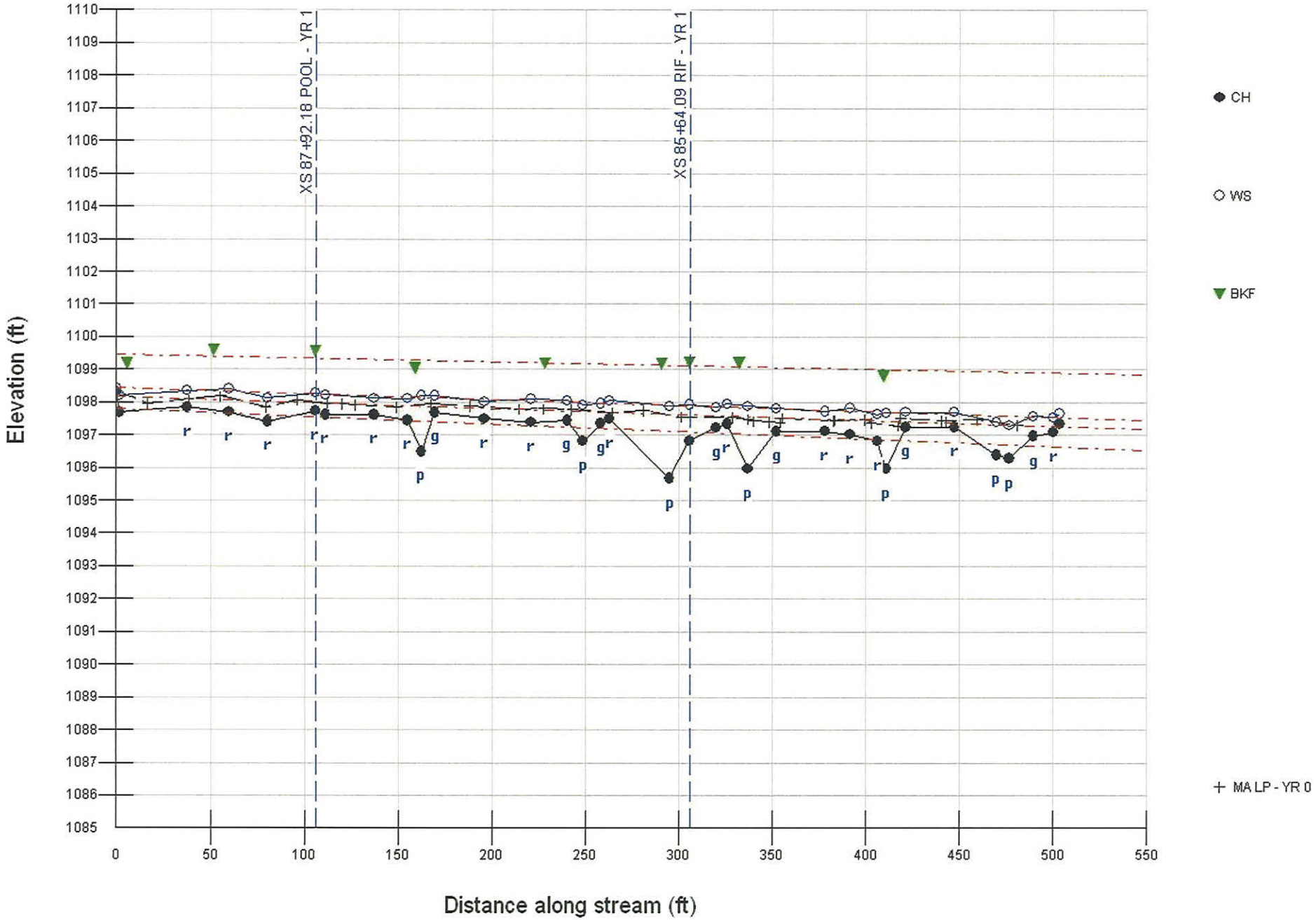
LOWER TRIB A - LONGITUDINAL PROFILE No. 4 - YEAR 1



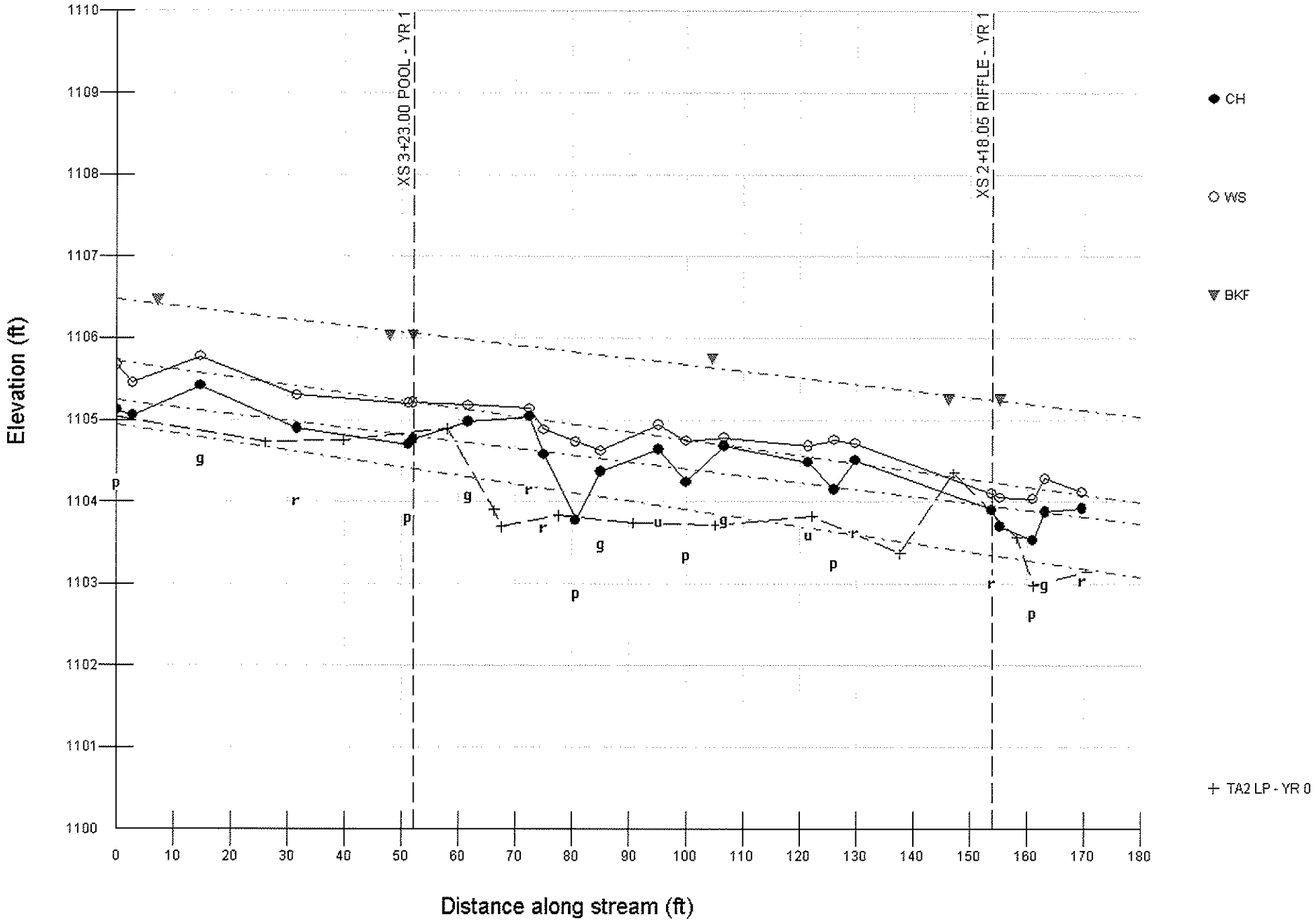
LOWER TRIB B - LONGITUDINAL PROFILE - YEAR 1



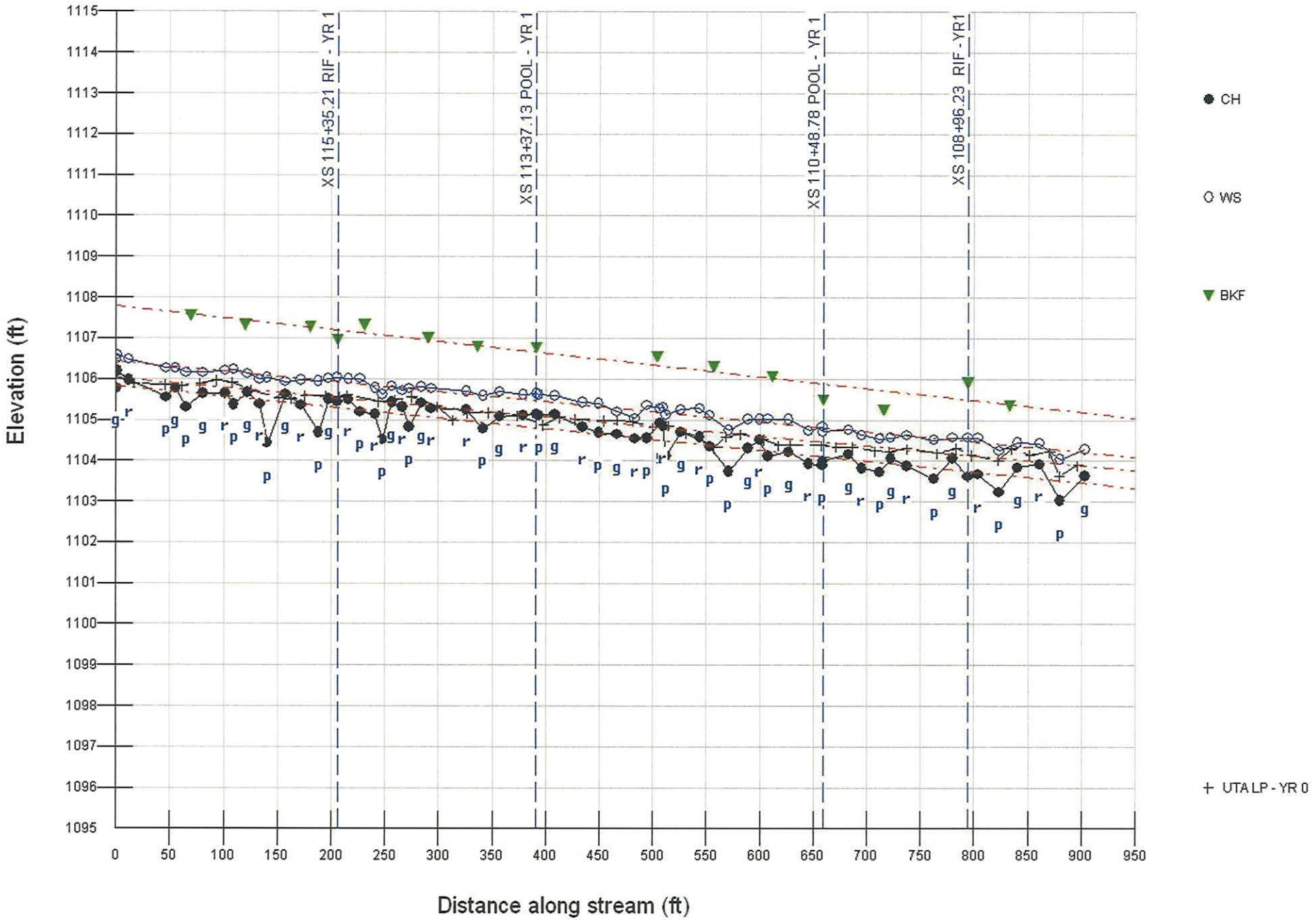
MIDDLE TRIB A - LONGITUDINAL PROFILE - YR 1



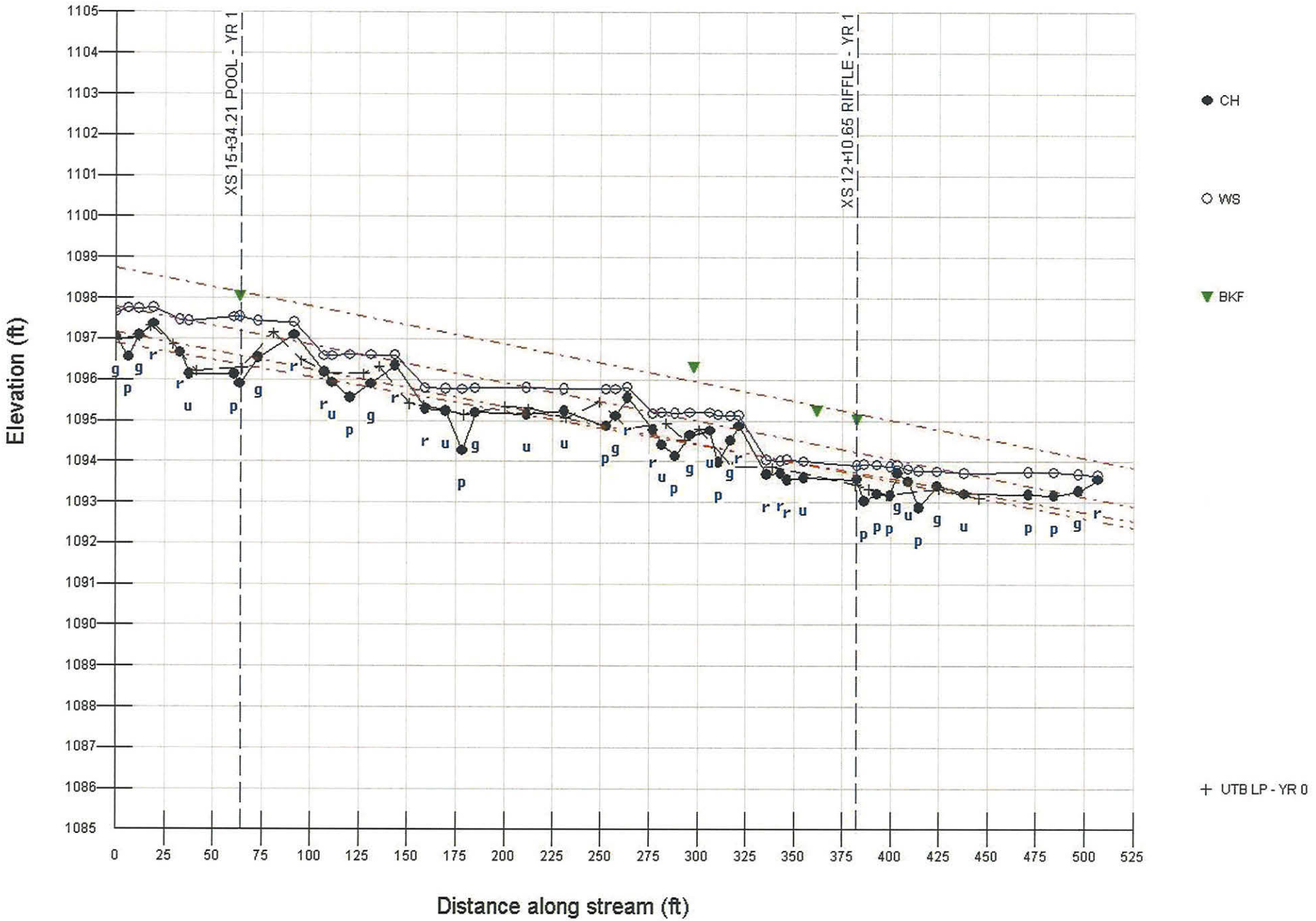
TRIB A2 LONGITUDINAL PROFILE - YEAR 1



UPPER TRIB A - LONGITUDINAL PROFILE - YEAR 1

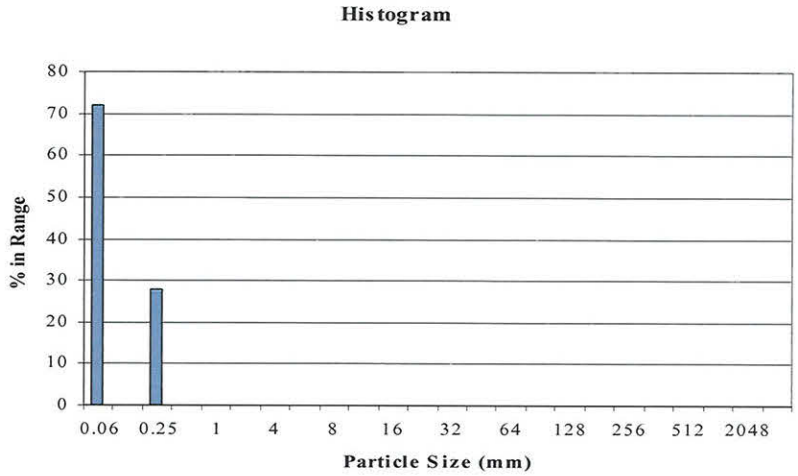


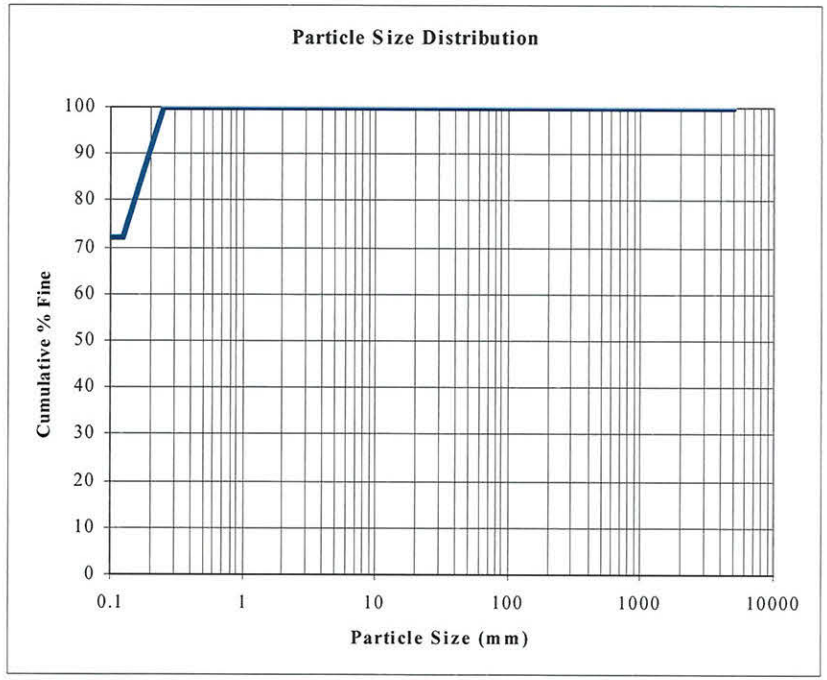
UPPER TRIB B - LONGITUDINAL PROFILE - YEAR 1



Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	72	72	72
Very Fine Sand	0.062-0.125	0	0	72
Fine Sand	0.125-0.25	28	28	100
Medium Sand	0.25-0.5	0	0	100
Coarse Sand	0.5-1.0	0	0	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0	0	0	100
Fine Gravel	4.0-5.7	0	0	100
Fine Gravel	5.7-8.0	0	0	100
Medium Gravel	8.0-11.3	0	0	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

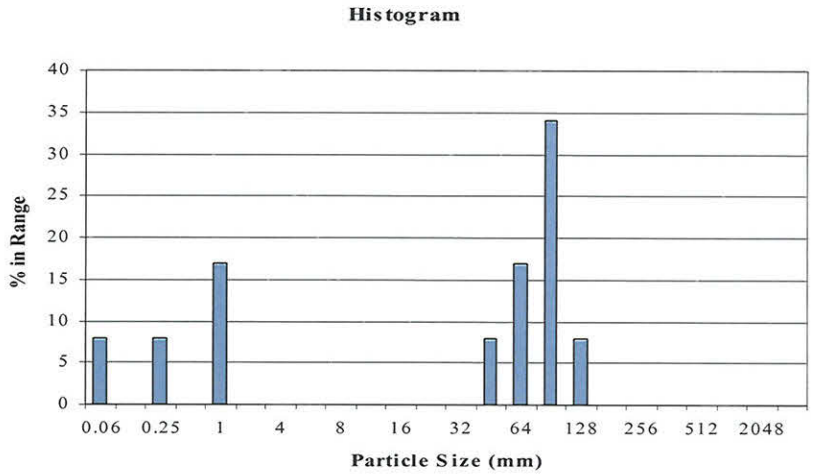
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	B	**X Sec**	N/A
Date	9/19/2006	**Sta No.**	15+34

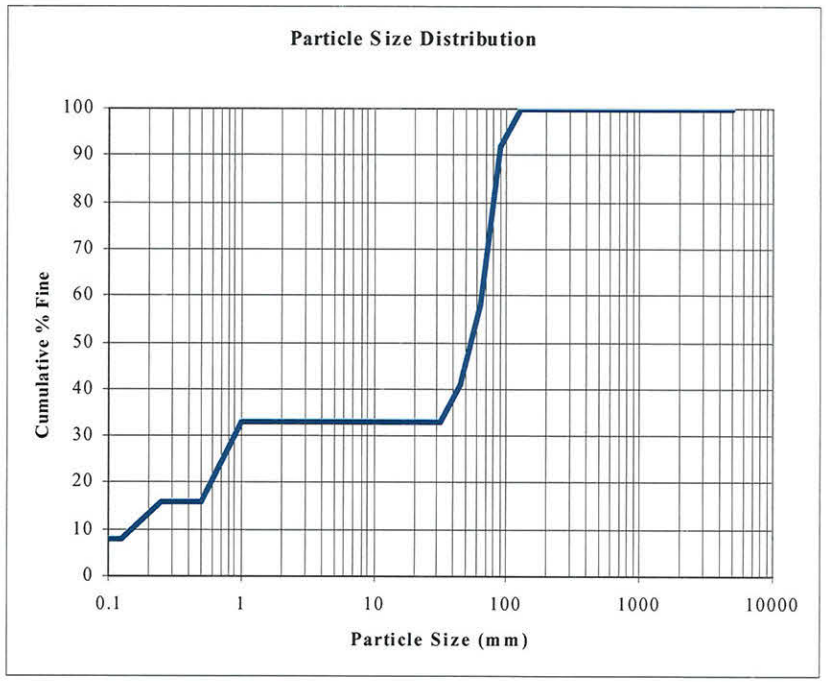




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	8	8	8
Very Fine Sand	0.062-0.125	0	0	8
Fine Sand	0.125-0.25	8	8	16
Medium Sand	0.25-0.5	0	0	16
Coarse Sand	0.5-1.0	17	17	33
Very Coarse Sand	1.0-2.0	0	0	33
Very Fine Gravel	2.0-4.0	0	0	33
Fine Gravel	4.0-5.7	0	0	33
Fine Gravel	5.7-8.0	0	0	33
Medium Gravel	8.0-11.3	0	0	33
Medium Gravel	11.3-16.0	0	0	33
Coarse Gravel	16.0-22.6	0	0	33
Coarse Gravel	22.6-32	0	0	33
Very Coarse Gravel	32-45	8	8	41
Very Coarse Gravel	45-64	17	17	58
Small Cobble	64-90	34	34	92
Small Cobble	90-128	8	8	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

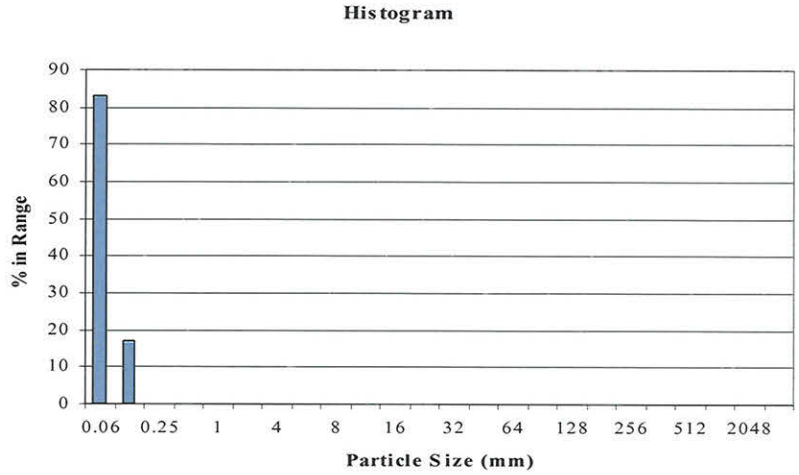
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	B	**X Sec**	N/A
Date	9/19/2006	**Sta No.**	2+25

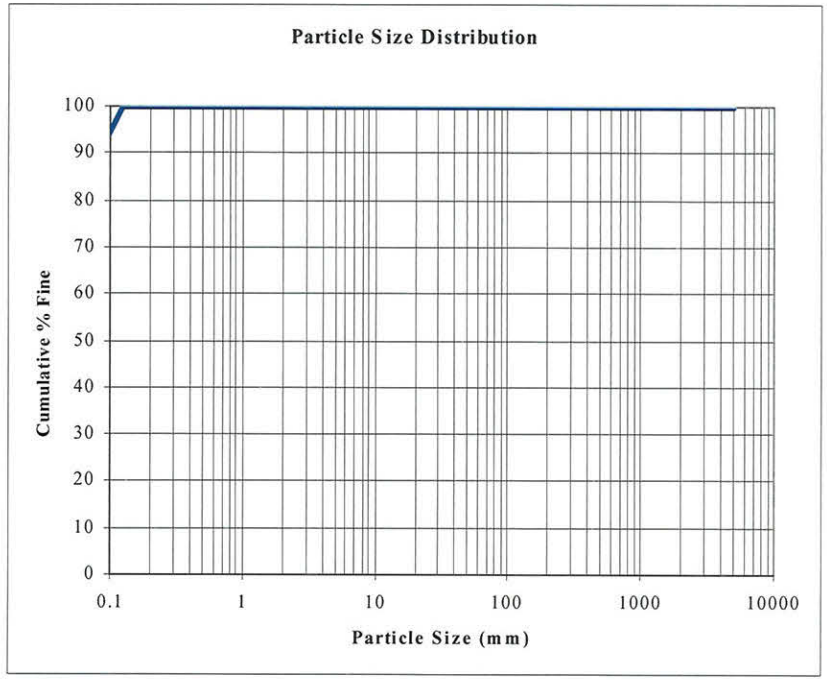




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	83	83	83
Very Fine Sand	0.062-0.125	17	17	100
Fine Sand	0.125-0.25	0	0	100
Medium Sand	0.25-0.5	0	0	100
Coarse Sand	0.5-1.0	0	0	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0	0	0	100
Fine Gravel	4.0-5.7	0	0	100
Fine Gravel	5.7-8.0	0	0	100
Medium Gravel	8.0-11.3	0	0	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

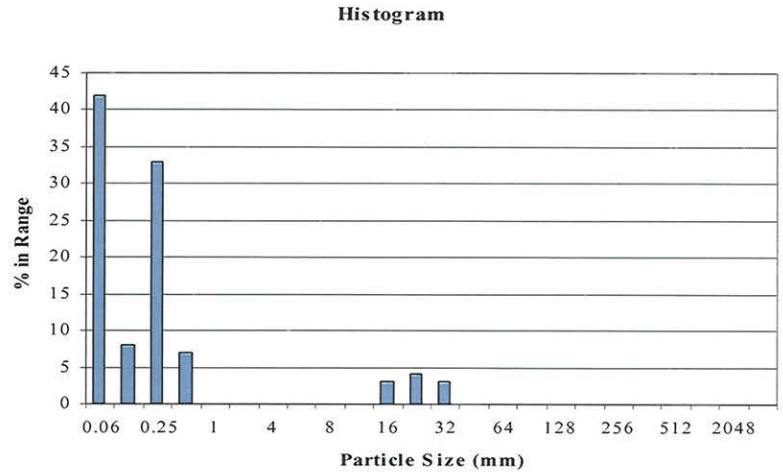
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (lower)	**X Sec**	N/A
Date	9/19/2006	**Sta No.**	4+31

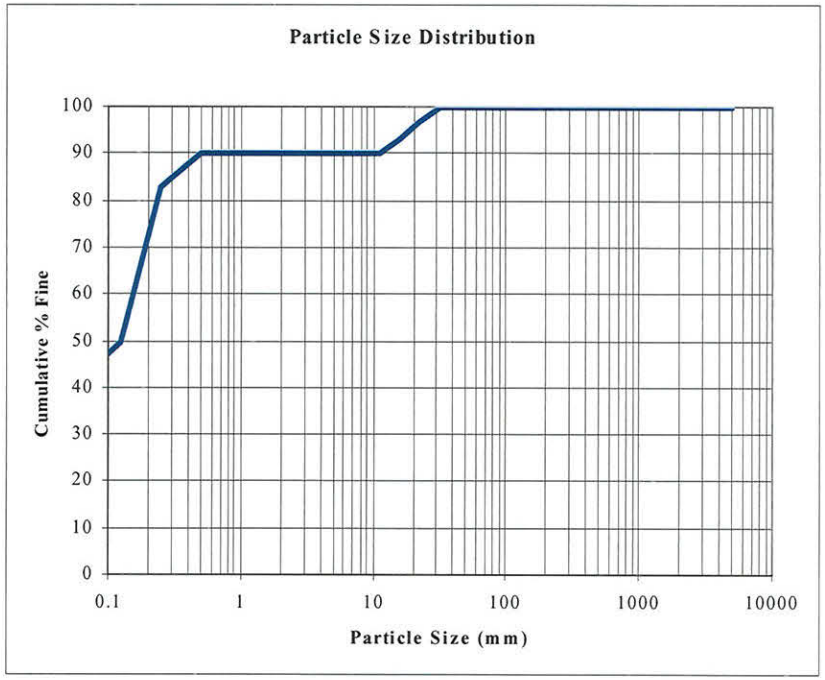




Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	42	42	42
Very Fine Sand	0.062-0.125	8	8	50
Fine Sand	0.125-0.25	33	33	83
Medium Sand	0.25-0.5	7	7	90
Coarse Sand	0.5-1.0	0	0	90
Very Coarse Sand	1.0-2.0	0	0	90
Very Fine Gravel	2.0-4.0	0	0	90
Fine Gravel	4.0-5.7	0	0	90
Fine Gravel	5.7-8.0	0	0	90
Medium Gravel	8.0-11.3	0	0	90
Medium Gravel	11.3-16.0	3	3	93
Coarse Gravel	16.0-22.6	4	4	97
Coarse Gravel	22.6-32	3	3	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

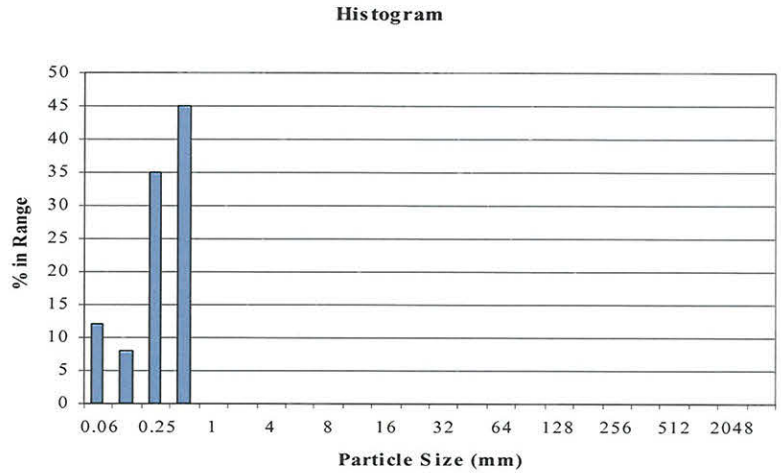
South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (lower)	**X Sec**	N/A
Date	9/19/2006	**Sta No.**	40+13

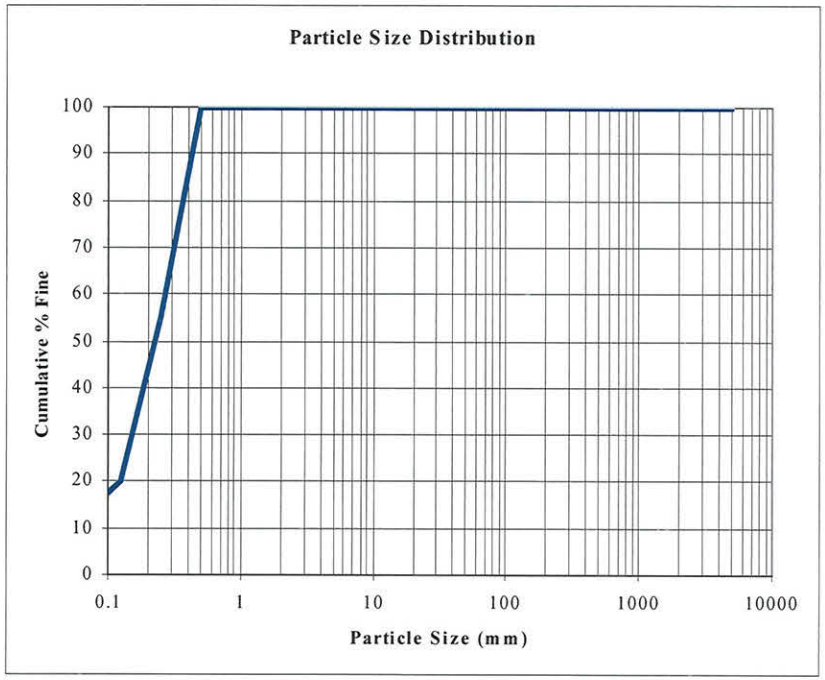




Pebble Count - Pool				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	12	12	12
Very Fine Sand	0.062-0.125	8	8	20
Fine Sand	0.125-0.25	35	35	55
Medium Sand	0.25-0.5	45	45	100
Coarse Sand	0.5-1.0	0	0	100
Very Coarse Sand	1.0-2.0	0	0	100
Very Fine Gravel	2.0-4.0	0	0	100
Fine Gravel	4.0-5.7	0	0	100
Fine Gravel	5.7-8.0	0	0	100
Medium Gravel	8.0-11.3	0	0	100
Medium Gravel	11.3-16.0	0	0	100
Coarse Gravel	16.0-22.6	0	0	100
Coarse Gravel	22.6-32	0	0	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (middle)	**X Sec**	N/A
Date	9/19/2006	**Sta No.**	87+92





Pebble Count - Riffle				
Material	**Particle Size (mm)**	**Count**	**% in Range**	**% Cumulative**
Silt/Clay	<0.062	20	20	20
Very Fine Sand	0.062-0.125	0	0	20
Fine Sand	0.125-0.25	0	0	20
Medium Sand	0.25-0.5	0	0	20
Coarse Sand	0.5-1.0	2	2	22
Very Coarse Sand	1.0-2.0	8	8	30
Very Fine Gravel	2.0-4.0	28	28	58
Fine Gravel	4.0-5.7	11	11	69
Fine Gravel	5.7-8.0	9	9	78
Medium Gravel	8.0-11.3	2	2	80
Medium Gravel	11.3-16.0	16	16	96
Coarse Gravel	16.0-22.6	3	3	99
Coarse Gravel	22.6-32	1	1	100
Very Coarse Gravel	32-45	0	0	100
Very Coarse Gravel	45-64	0	0	100
Small Cobble	64-90	0	0	100
Small Cobble	90-128	0	0	100
Large Cobble	128-180	0	0	100
Large Cobble	180-256	0	0	100
Small Boulder	256-362	0	0	100
Small Boulder	362-512	0	0	100
Medium Boulder	512-1024	0	0	100
Large Boulder	1024-2048	0	0	100
Bedrock	<2048	0	0	100
Totals		100	100	

South Muddy Creek Tributaries Restoration EEP Project No. D04006-01			
Reach	A (upper)	**X Sec**	N/A
Date	9/19/2006	**Sta No.**	108+96