

**Silas Creek Stream Restoration  
Final 2007 Monitoring Report  
Monitoring Year Four**

**Ecosystem Enhancement Program Project Number 00335**



Submitted to: NCDENR-Ecosystem Enhancement Program  
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Submitted: February 22, 2008



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- I. Stream Current Condition Plan View
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- VI. Cross Section Photos and Annual Overlays of Plots
- VII. Pebble Count Frequency Distribution Plots

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## 1.0 EXECUTIVE SUMMARY/PROJECT ABSTRACT

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URS Corporation (URS) was retained by the North Carolina Ecosystem Enhancement Program (EEP) to conduct stream monitoring at the Silas Creek stream restoration project, located in Winston-Salem, Forsyth County, North Carolina. The stream monitoring effort conducted by URS in August 2007 represents Monitoring Year 4 for this project. Prior to the monitoring effort, URS received a digital As-Built drawing for the project site from EEP. In addition, URS received a Mitigation Plan prepared by Buck Engineering (Buck 2004), a Year 1 Monitoring Report produced by Buck Engineering (Buck 2005), and a Year 2 Monitoring Report prepared by EcoLogic Associates, P.C. (EcoLogic 2006). URS produced the Year 3 Monitoring Report in January of 2007 (URS 2007).

The Silas Creek project is located within the city limits of Winston-Salem in a heavily developed, urban watershed. The project reach is situated within Shaffner Park, where Silas Creek crosses Silas Creek Parkway, near the intersection of Silas Creek Parkway and Yorkshire Road. The project reach crosses under two major roads and is confined by water, sewer and other underground utilities, overhead power lines, and a well used urban greenway.

In 2003, EEP restored 4,449 linear feet of stream along three reaches of Silas Creek (Reaches 1, 2, and 3) and one reach of Buena Vista Branch. According to the Mitigation Plan, prior to the restoration activities the project reach had low sinuosity with varying levels of incision due to historic channelization. The Priority 2 and 3 restoration converted the impaired channels into sinuous channels, where possible (mostly on the tributary). Rock and log crossvanes, single arm vanes, channel width restrictors, and rock toe protection root wads (tributary only) were incorporated for aquatic habitat enhancement and bed and bank stability. A riparian buffer was planted using native vegetation. The buffer ranged from 15 to 25 feet in width, dependent upon space and easement limitations.

No Vegetative Problem Areas were identified during 2005 monitoring (Year 2). During 2006 monitoring (Year 3), Mimosa (*Albizia julibrissin*), Japanese honeysuckle (*Lonicera japonica*), porcelain berry (*Ampelopsis brevipedunculata*), Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), bamboo (*Phyllostachys aurea*), tree of heaven (*Ailanthus altissima*), and kudzu (*Pueraria montana*) were present in varying densities throughout the site. During 2007 monitoring (Year 4), populations of the non-native, invasive floral species listed above remained, and, in some cases, the populations had grown in size. Several mimosa and privet saplings were observed along all reaches. In addition, mimosa was observed along Buena Vista Branch and Japanese knotweed (*Reynoutria japonica*) was observed along Reach 2. Taxonomy follows 'Flora of the Carolinas, Virginia, Georgia, and surrounding areas' (Weakley 2007).

Between the 2007 Initial Assessment and Project Status Report and 2007 monitoring, beavers have moved into Buena Vista Branch. Two large beaver dams were observed along the reach (one damaged, the other in-tact). Beaver activity is evident along the entirety of the upstream portions of Buena Vista Branch. The upstream 500 feet of the reach has been used for forage for the large beaver dam present at Station 15+00. Much of the streamside livestakes have been removed for use in their dam. Beaver 'slides' were also observed throughout the reach and are promoting bank erosion and instability. In addition to the detrimental effect they are having on streamside vegetation, the dam has backed water up within the majority of the project reach. Upstream of the dam, the channel has widened, deepened, and become almost stagnant. Beaver activity is also impacting water quality within Buena Vista Branch and, ultimately, Silas Creek. The water above and below the dam is extremely turbid. At the confluence of Buena Vista Branch and Silas Creek, the path of the turbid water entering Silas Creek from Buena Vista Branch can be seen from several feet away.

The Silas Creek restoration project is overall functioning fairly well, especially considering the highly urbanized watershed and flashy hydrology. However, beaver activity on Buena Vista Branch may begin

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to cause larger problems if not managed effectively. During 2007 monitoring a beaver was observed swimming in Reach 2 of Silas Creek, downstream of the confluence with Buena Vista Branch.

Reach 1 is exhibiting an inability to transport sediment in some areas. As a result, the reach shows signs of aggradation and bar formation. In addition, several cross vanes are not functioning correctly, possibly due to improper construction. Reach 2 has undergone downcutting in the lower part of the reach. Blockage at the downstream box culverts is causing some of the cross vanes in this section to be underwater during normal daily flows. Reach 3 is exhibiting bank erosion and scour in several areas along the reach.

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## **2.0 PROJECT BACKGROUND**

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### **2.1 PROJECT OBJECTIVES**

The restoration of Silas Creek was conducted as a Priority 3 Restoration by changing the channel dimension to allow for the construction of a bankfull bench and the addition of rock structures to stabilize the channel and increase the in-stream channel diversity of riffles and pools. The Buena Vista Branch restoration was a Priority 2 and 3 and included building a bankfull bench in the upper reach, changing the channel pattern and profile, and installing stone structures and root wads. Prior to restoration, Silas Creek had failing banks, unstable plan form and cross sectional geometry, little or no riparian buffer, and poor bed morphology, diversity, and aquatic habitat. The goals of the Silas Creek restoration project were listed in the 2004 Year 1 Monitoring Report as:

1. Restore 4,449 linear feet of channel dimension, pattern, and profile to the extent possible considering project constraints, watershed characteristics and data from reference reaches in similar watersheds.
2. Improve floodplain functionality by matching floodplain elevations with bankfull stage, therefore increasing watershed attenuation and reducing peak flows.
3. Stabilize native floodplain vegetation to allow treatment of diffuse storm flow and nutrient uptake while establishing part of a wildlife corridor in the watershed.
4. Improve the natural aesthetics of the stream corridor.
5. Improve the water quality of the Silas Creek watershed by reducing bank erosion, increasing nutrient storage and uptake, and increasing dissolved oxygen in the system.

### **2.2 PROJECT STRUCTURE, MITIGATION TYPE, AND APPROACH**

The Priority 2 and 3 restoration involved converting the impaired channels into sinuous channels, where possible (mostly on the tributary). Rock and log crossvanes, single arm vanes, channel width restrictors, and rock toe protection root wads (tributary only) were installed for aquatic habitat enhancement and bed and bank stability. A riparian buffer was planted using native vegetation.

Table I. Project Restoration Components Silas Creek EEP Project Number 00335						
Project Segment or Reach ID	Existing Feet	Mitigation Type	Approach	Linear Footage	Stationing	Comment
Silas Creek – Reach 1	999	EI	PIII	970	0+00 to 4+50	Cut new floodplain, restoration of incised channel
Silas Creek – Reach 2	897	EI	PIII	915	4+50 to 70+00	Cut new floodplain, restoration of incised channel
Silas Creek – Reach 3	1,771	EI	PIII	1,807	0+00 to 25+00	Cut new floodplain, restoration of incised channel
Buena Vista Branch	782	R	PII & III	799	0+00 to 15+00	Change dimension, pattern, and profile

Note: Existing feet, Mitigation Type, and Stationing were derived from the Monitoring Year 2 Report, Linear Footage was derived from the Year 3 longitudinal profiles.

R= Restoration  
EII= Enhancement II

P1= Priority I  
PIII= Priority III

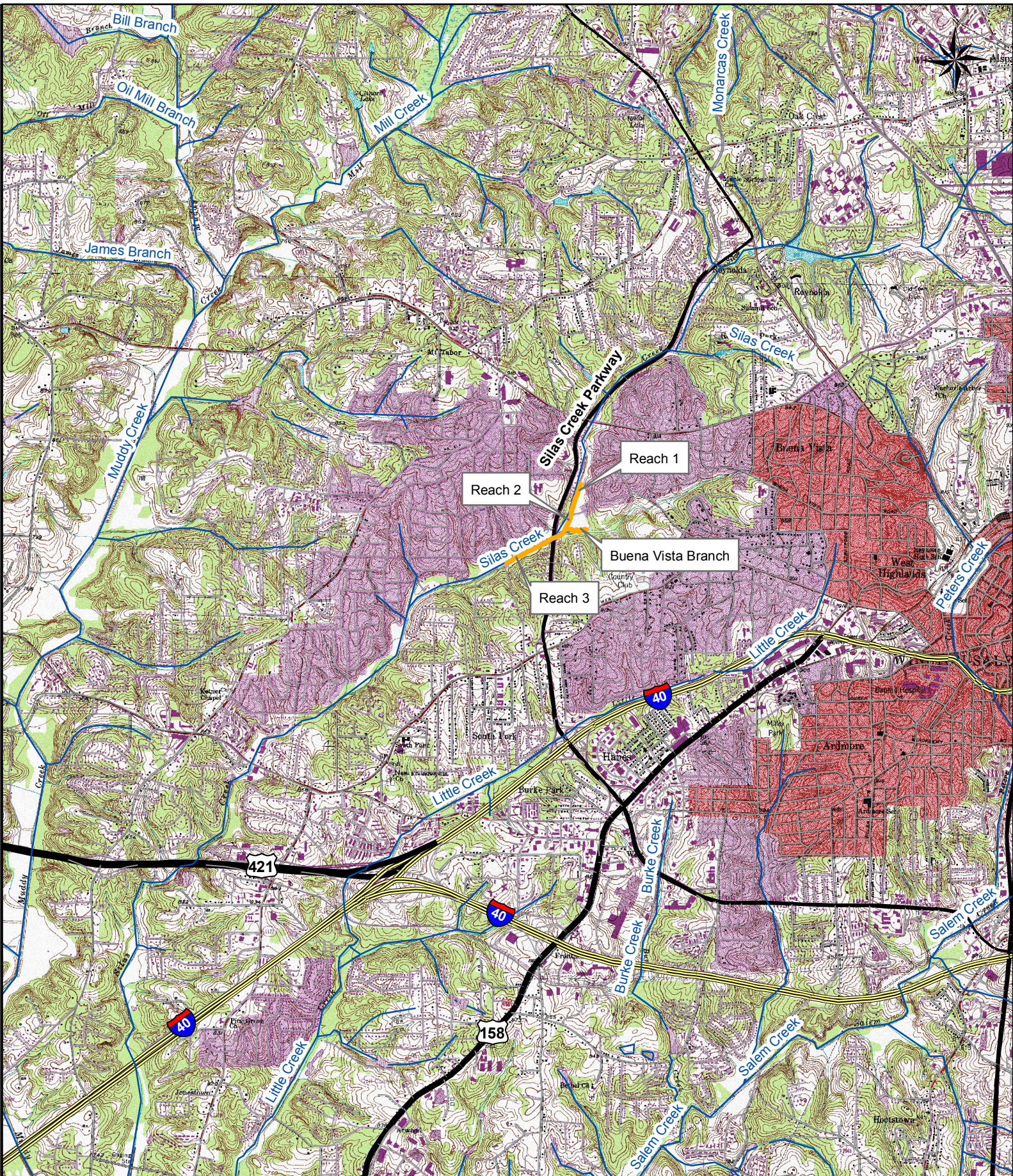
EI= Enhancement I  
S= Stabilization

PII= Priority II  
SS= Stream Bank Stabilization

### 2.3 LOCATION AND SETTING

The Silas Creek project is located within the city limits of Winston-Salem in a heavily developed urban watershed. The project reach is within Shaffner Park, located where Silas Creek crosses Silas Creek Parkway, near the intersection of Silas Creek Parkway and Yorkshire Road (Figure 1). The project crosses under two major roads and is confined by water, sewer and other underground utilities, overhead power lines, and a well used urban greenway. The project restored three reaches of Silas Creek and one reach of Buena Vista Branch. The reaches are divided as follows: Reach 1 of Silas Creek begins just upstream of the pedestrian bridge upstream/north of Yorkshire Road, and ends at the Yorkshire Road crossing. Reach 1 is 970 feet in length. Reach 2 of Silas Creek begins at Yorkshire Road and ends at the Silas Creek Parkway crossing. Reach 2 is 915 feet in length. Reach 3 of Silas Creek begins at Silas Creek Parkway and ends at a pedestrian bridge southwest of Silas Creek Parkway. Reach 3 is 1,807 feet in length. Buena Vista Branch is a tributary to Silas Creek. It is approximately 799 feet in length and joins Silas Creek between Yorkshire Road and Silas Creek Parkway (within Reach 2). Lengths are derived from the Year 3 longitudinal profiles.

To travel to the site from the Raleigh-area, take I-40 West towards Winston-Salem. Take Exit 188 onto I-40/US-421 South towards Winston-Salem. Take the Silas Creek Parkway/NC-67 West exit. The project reach is located in Shaffer Park, just north of Country Club Road. Reaches 1 and 2 and Buena Vista Branch are located east of Silas Creek Parkway. Reach 3 is west of Silas Creek Parkway.



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Prepared For:  
 NC Ecosystem  
 Enhancement Program

**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

**Project Number:**  
 00335

**Monitoring Year:**  
 4 (2007)

**Date:**  
 February 2008

**Legend**

— Project Reach

**Figure 1**  
 Project Vicinity

0 0.25 0.5 1  
 Miles



## 2.4 PROJECT HISTORY AND BACKGROUND

The Silas Creek restoration project was constructed during the spring and summer of 2003. The As-built survey was conducted in October of 2003.

The pre-restoration stream channels had low sinuosity and varying levels of incision due to historic channelization. The stream restoration design was based on natural channel design principals and considered differences in drainage area, adjacent land uses, upstream impoundments, and future development potential. The design addressed the channel dimension, pattern, and profile based on reference reach parameters and hydraulic geometry relationships. When considering design alternatives, every effort was made to create a stable meandering channel with bankfull stage located at the existing floodplain elevation. Where valley or development restrictions did not allow for channel pattern to be established, the existing incised channels were enhanced by excavating new floodplain benches and installing structures to improve bed features and control channel grade.

<b>Table II. Project Activity and Reporting History Silas Creek EEP Project Number 00335</b>			
<b>Activity or Report</b>	<b>Scheduled Completion</b>	<b>Data Collection Complete</b>	<b>Actual Completion or Delivery</b>
Restoration Plan	Unknown	Unknown	Unknown
Design 90%	Unknown	Unknown	Unknown
Construction	2003	Fall 2003	Fall 2003
Planting	2003	January 2004	January 2004
As-Built/Mitigation Report	2003	Fall 2003	Fall 2003
Year 1 Monitoring	2005	October 2004	February 2005
Year 2 Monitoring	2005	September 2005	April 2006
Year 3 Monitoring	2006	October 2006	December 2006
Year 4 Monitoring	2007	August 2007	September 2007
Year 5 Monitoring	2008	--	--
Year + Monitoring	Not scheduled	--	--

<b>Table III. Project Contacts Table Silas Creek EEP Project Number 00335</b>	
<b>Designer</b>	Buck Engineering 1152 Executive Circle, Suite 100 Cary, NC 27511 Will Harmon 919-463-5488
Primary project design POC	
<b>Construction Contractor</b>	North State Environmental 2889 Lowery Street Winston-Salem, NC 27101 Darryl Westmoreland 336-725-2010
Construction contractor POC	
<b>Planting Contractor</b>	North State Environmental 2889 Lowery Street Winston-Salem, NC 27101 Darryl Westmoreland 336-725-2010
Planting contractor POC	

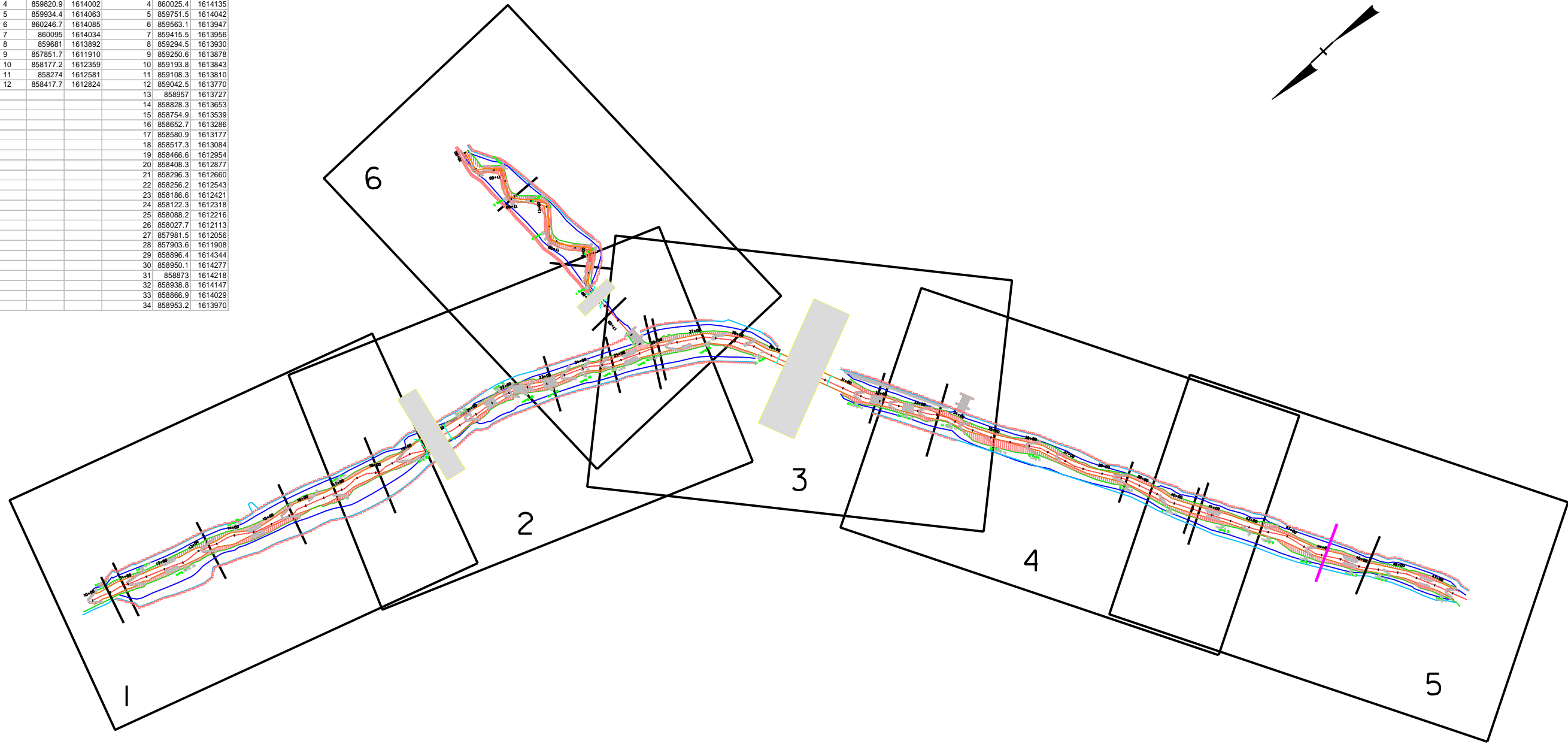
<b>Seeding Contractor</b> Seeding contractor POC	Unknown
<b>2004 Monitoring Performers</b>	Buck Engineering 1152 Executive Circle, Suite 100 Cary, NC 27511 Will Harmon 919-463-5488
<b>2005 Monitoring Performers</b>  Stream Monitoring POC Vegetation Monitoring POC	EcoLogic Associates, P.C. 4321-A S. Elm-Eugene St. Greensboro, NC 27406 Kyle Hoover 336-335-1108 Moni Bates 336-335-1108
<b>2006 Monitoring Performers</b>  Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 Kathleen McKeithan 919-461-1597
<b>2007 Monitoring Performers</b>  Monitoring POC	URS Corporation – North Carolina 1600 Perimeter Park Drive, Suite 400 Morrisville, NC 27560 Kathleen McKeithan 919-461-1597

<b>Table IV. Project Background Table</b>		
<b>Silas Creek</b>		
<b>EEP Project Number 00335</b>		
Project County		Forsyth County
Drainage Area	Silas Creek	7.2 square miles
	Buena Vista Branch	1.4 square miles
Drainage impervious cover estimate (%)		Estimated at >25%
Stream Order	Silas Creek	3 <sup>rd</sup>
	Buena Vista Branch	1 <sup>st</sup>
Physiographic Region		Piedmont/Foothills
Ecoregion		Northern Inner Piedmont (45b)
Rosgen Classification of As-Built	Silas Creek	B4c
	Buena Vista Branch	E4
Dominant soil types		Wehadkee, Chewacla, Urban land
Reference site ID		Unknown
USGS HUC for Project		03040103
NCDWQ Sub-basin for Project		03-07-06
NCDWQ classification for Project		C
Any portion of any project segment 303d listed?		No
Any portion of any project segment upstream of a 303d listed segment?		No
Reasons for 303d listing or stressor		NA
% of project easement fenced		0% - no cattle in reach

## 2.5 MONITORING PLAN VIEW

See following sheets for the Monitoring Plan View.

Veg Plots			Photo Points		
ID	Northing	Easting	ID	Northing	Easting
VP 1	858899.7	1613989	1	860369.8	1614261
VP 2	858894.3	1614253	2	860268.4	1614219
VP 3	859086.7	1613723	3	860185.1	1614151
VP 4	859820.9	1614002	4	860025.4	1614135
VP 5	859934.4	1614063	5	859751.5	1614042
VP 6	860246.7	1614085	6	859563.1	1613947
VP 7	860095	1614034	7	859415.5	1613956
VP 8	859681	1613892	8	859294.5	1613930
VP 9	857851.7	1611910	9	859250.6	1613878
VP 10	858177.2	1612359	10	859193.8	1613843
VP 11	858274	1612581	11	859108.3	1613810
VP 12	858417.7	1612824	12	859042.5	1613770
			13	858957	1613727
			14	858828.3	1613653
			15	858754.9	1613539
			16	858652.7	1613286
			17	858580.9	1613177
			18	858517.3	1613084
			19	858466.6	1612954
			20	858408.3	1612877
			21	858296.3	1612660
			22	858256.2	1612543
			23	858186.6	1612421
			24	858122.3	1612318
			25	858088.2	1612216
			26	858027.7	1612113
			27	857981.5	1612056
			28	857903.6	1611908
			29	858896.4	1614344
			30	858950.1	1614277
			31	858873	1614218
			32	858938.8	1614147
			33	858866.9	1614029
			34	858953.2	1613970



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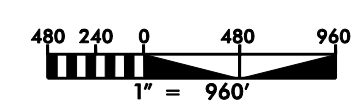
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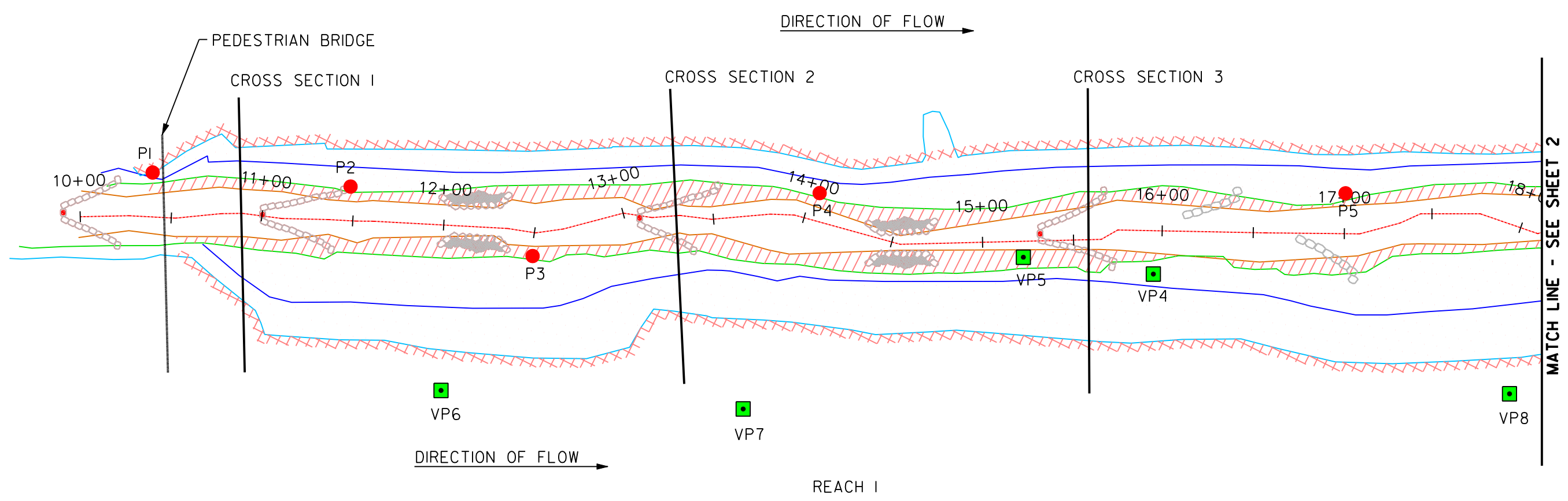
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 STREAM RESTORATION  
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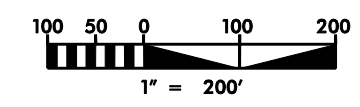
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**LEGEND**

- CHANNEL (10/03)
- TOP OF TERRACE (10/03)
- TOE OF TERRACE (10/03)
- THALWEG (10/03)
- BANKFULL (10/03)
- PHOTO POINT
- VEGETATION PLOT
- CROSS VANE
- JHOOK
- VANE
- STEP POOL
- MODIFIED CROSS VANE
- CONSTRUCTED RIFFLE
- DOUBLE WING DEFLECTOR
- ROOTWAD



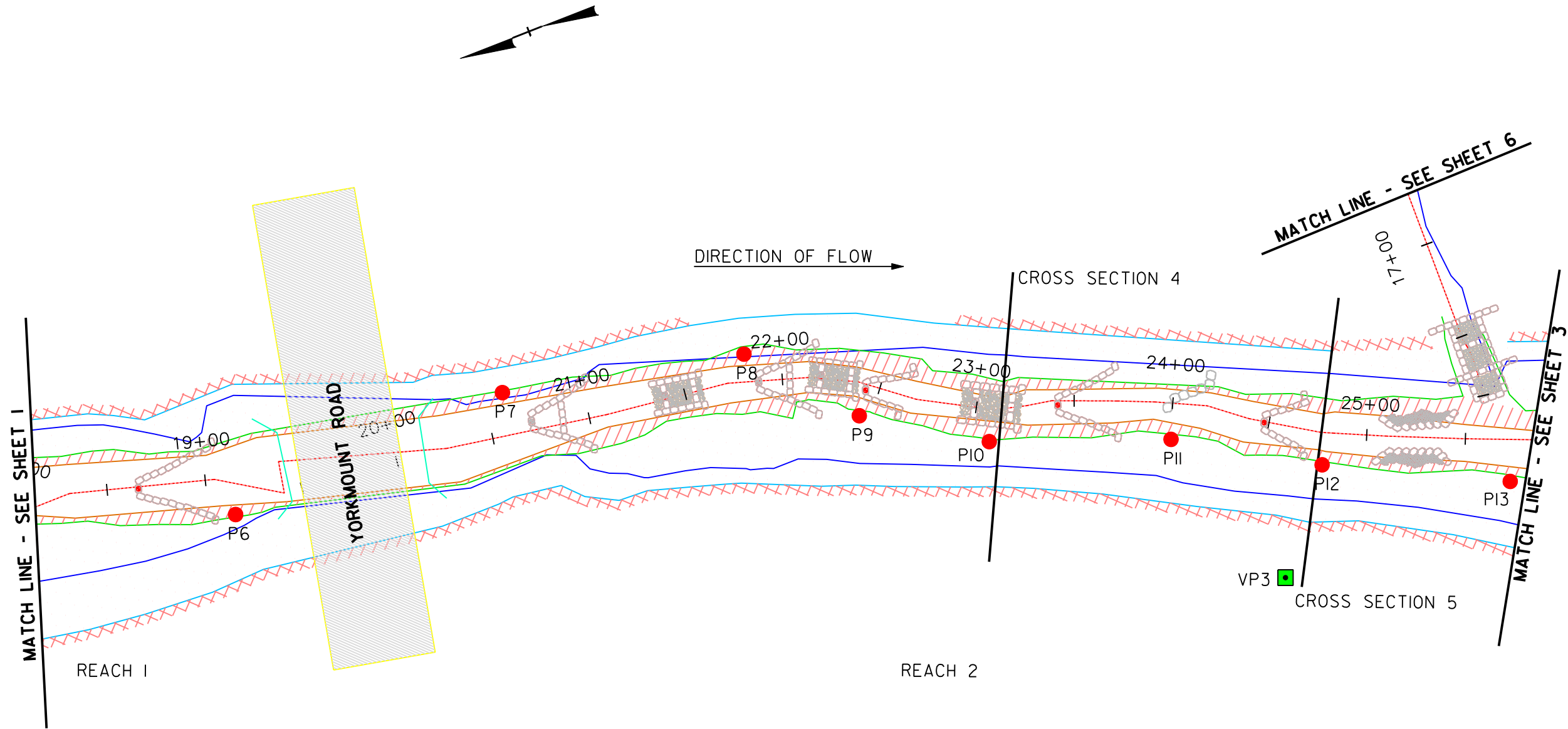
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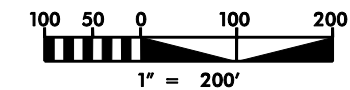
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**LEGEND**

- CHANNEL (10/03)
- TOP OF TERRACE (10/03)
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- THALWEG (10/03)
- BANKFULL (10/03)
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FIGURE 2  
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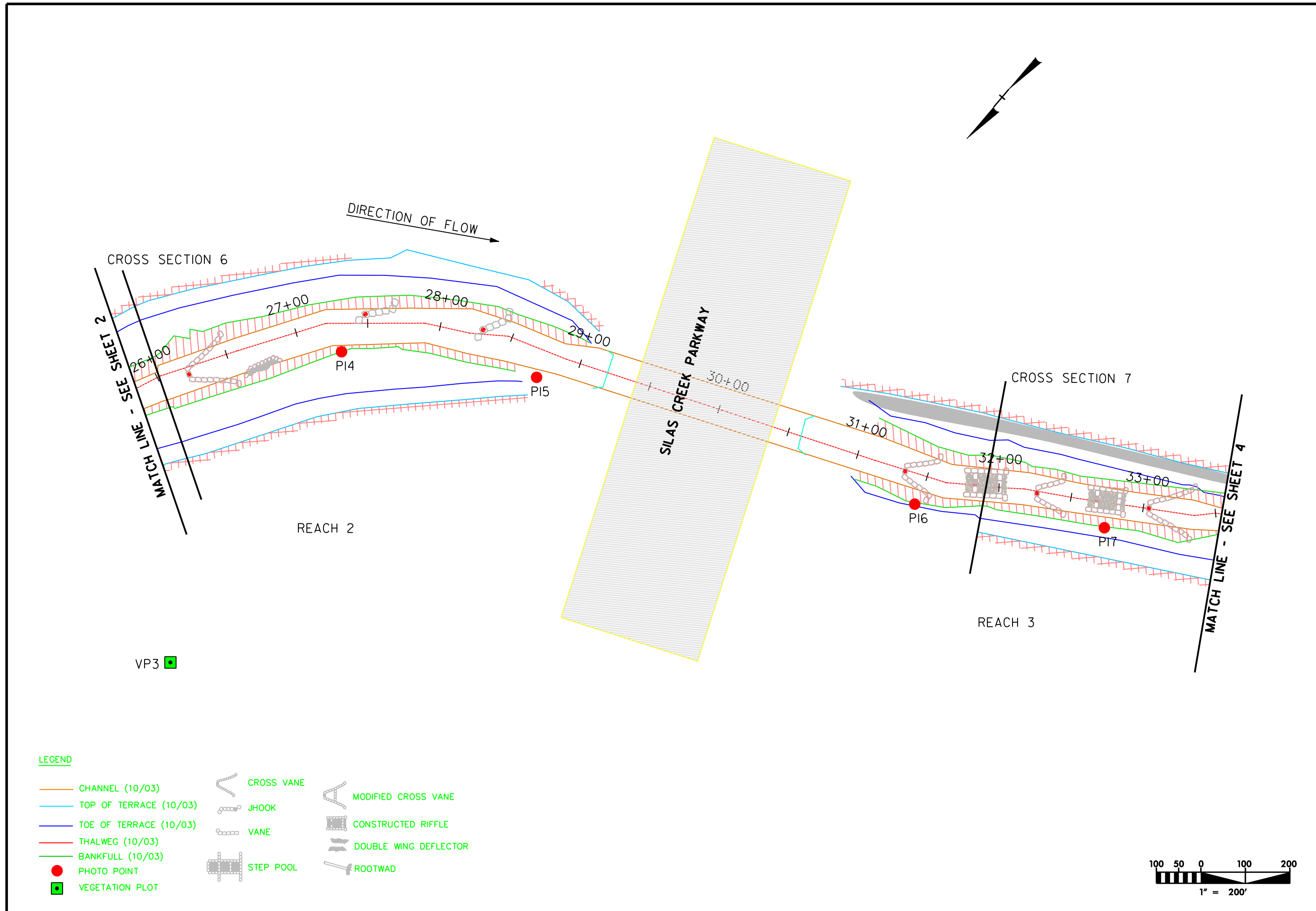
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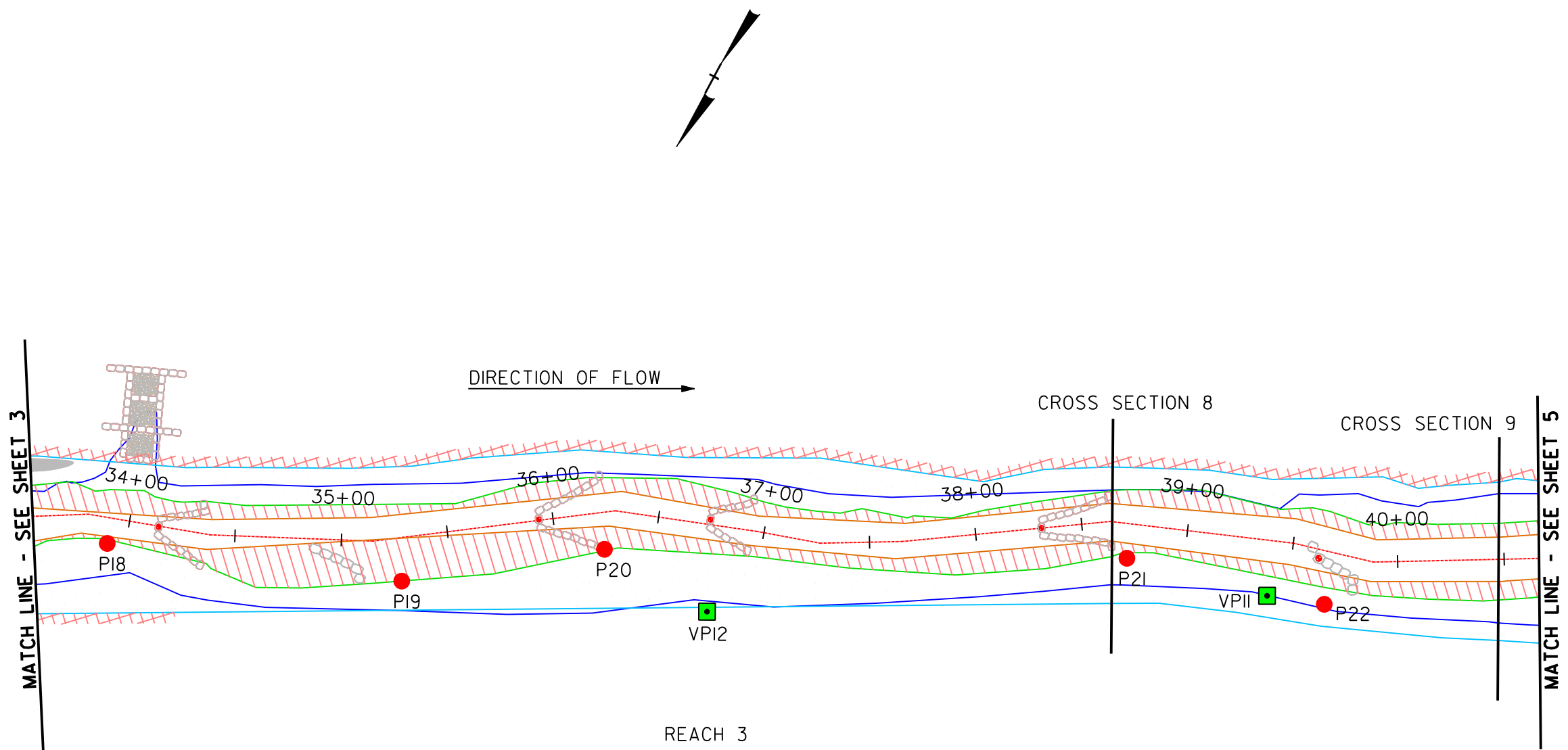
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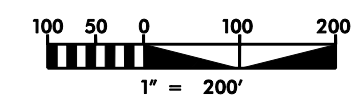

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 YEAR 4  
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 3



- LEGEND**
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 STREAM RESTORATION  
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**FIGURE 2**

DATE: FEB 2008

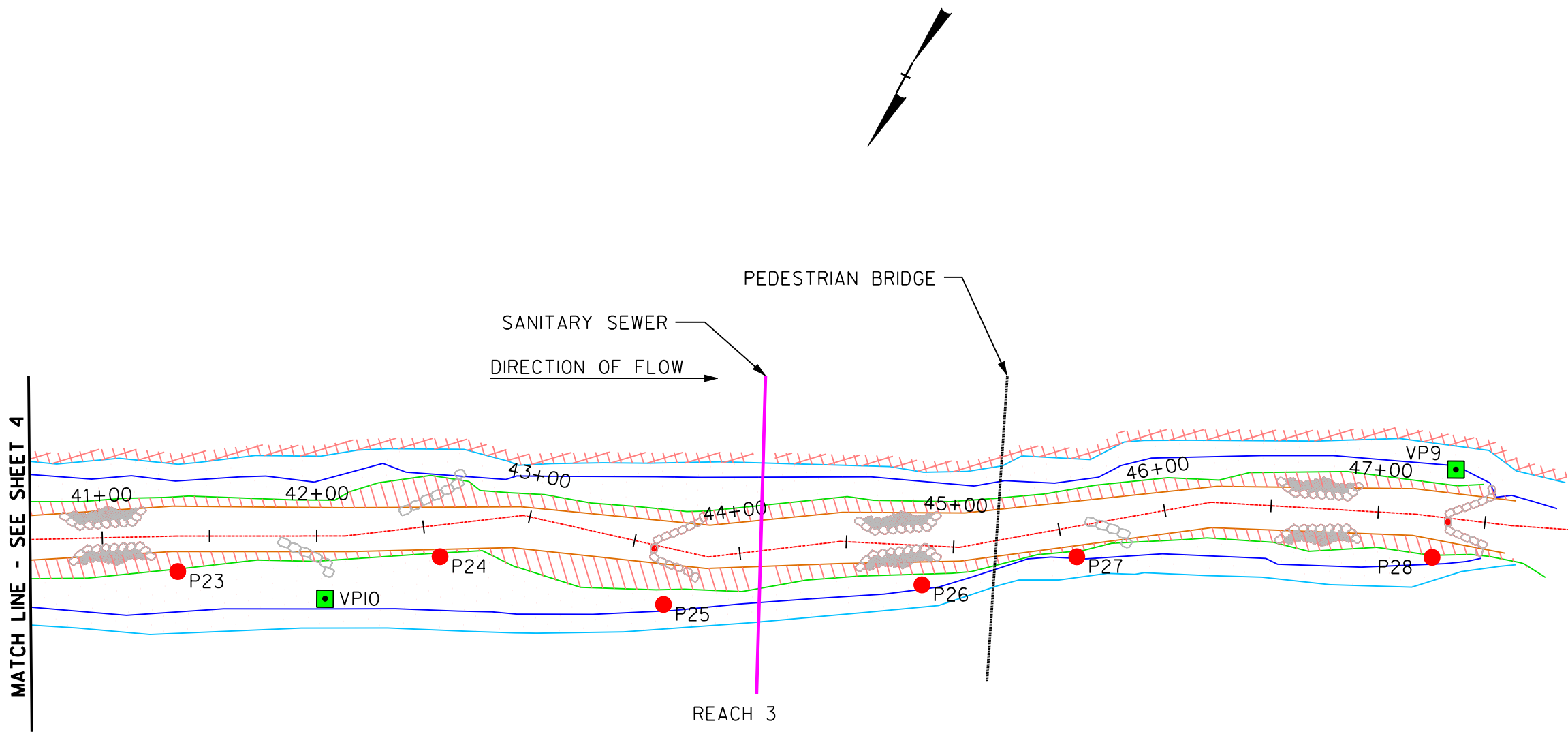
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CHECKED BY: KM

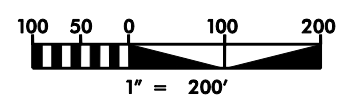
MONITORING  
 YEAR 4

EEP PROJECT NO.  
 00335

SHEET NO.  
 4



- LEGEND**
- CHANNEL (10/03)
  - TOP OF TERRACE (10/03)
  - TOE OF TERRACE (10/03)
  - THALWEG (10/03)
  - BANKFULL (10/03)
  - PHOTO POINT
  - VEGETATION PLOT
  - CROSS VANE
  - JHOOK
  - VANE
  - STEP POOL
  - MODIFIED CROSS VANE
  - CONSTRUCTED RIFFLE
  - DOUBLE WING DEFLECTOR
  - ROOTWAD



**REVISIONS**

NO.	DATE

Prepared by  
**URS**  
 URS Corporation - North Carolina  
 1600 Perimeter Park Drive  
 Morrisville, North Carolina 27560  
 TEL: 919.481.1100 FAX: 919.481.1415

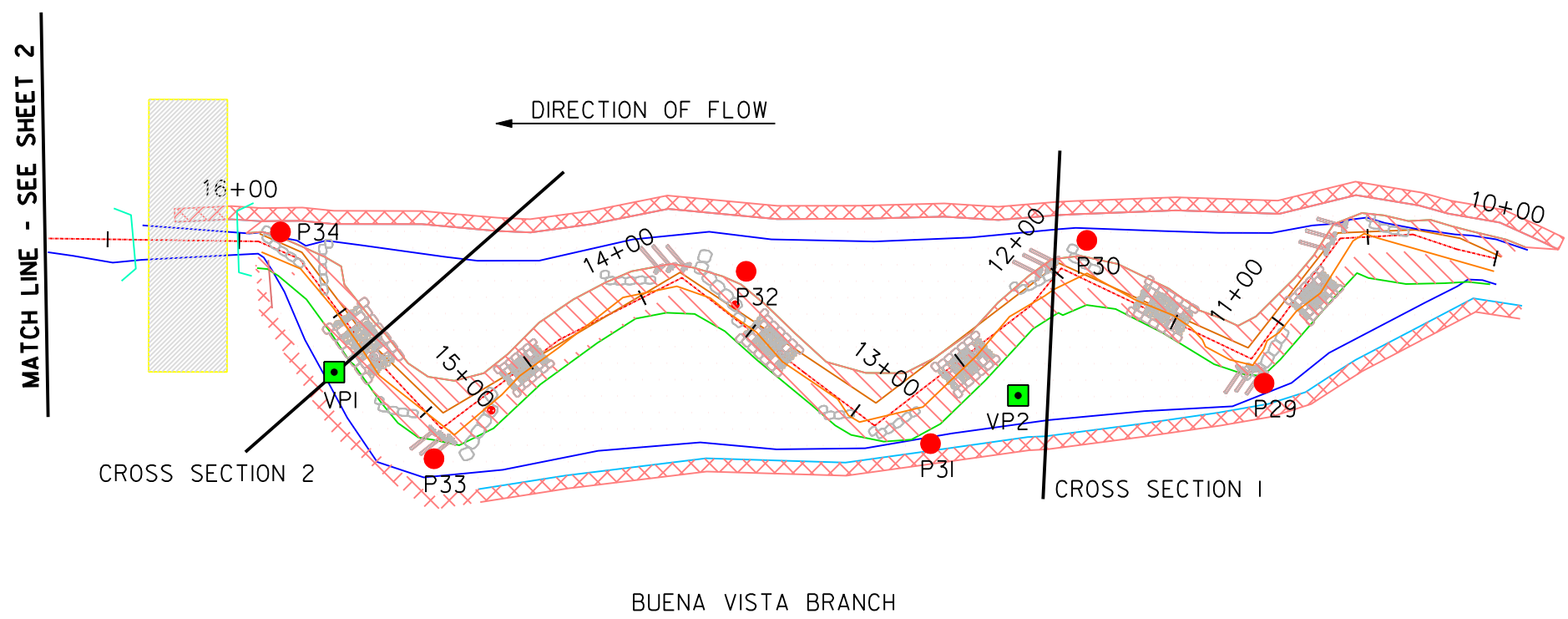
PROJECT: SILAS CREEK  
 STREAM RESTORATION  
 2007 MONITORING REPORT  
 TITLE: MONITORING PLAN VIEW

CLIENT: NORTH CAROLINA DEPARTMENT  
 OF ENVIRONMENT AND  
 NATURAL RESOURCES

**FIGURE 2**

DATE: FEB 2008  
 TECHNICIAN: ENJ  
 CHECKED BY: KM  
 MONITORING YEAR 4  
 EEP PROJECT NO. 00335  
 SHEET NO. 5

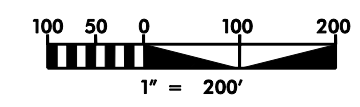




BUENA VISTA BRANCH

LEGEND

- CHANNEL (10/03)
- TOP OF TERRACE (10/03)
- TOE OF TERRACE (10/03)
- THALWEG (10/03)
- BANKFULL (10/03)
- PHOTO POINT
- VEGETATION PLOT
- CROSS VANE
- JHOOK
- VANE
- STEP POOL
- MODIFIED CROSS VANE
- CONSTRUCTED RIFFLE
- DOUBLE WING DEFLECTOR
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FIGURE 2  
 DATE: FEB 2008  
 TECHNICIAN: ENJ  
 CHECKED BY: KM  
 MONITORING  
 YEAR 4  
 EEP PROJECT NO.  
 00335  
 SHEET NO.  
 6

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### **3.0 PROJECT CONDITION AND MONITORING RESULTS**

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#### **3.1 VEGETATION ASSESSMENT**

##### **3.1.1 Vegetative Problem Areas**

No Vegetative Problem Areas were identified during 2005 monitoring (Year 2). During 2006 monitoring (Year 3), mimosa, Japanese honeysuckle, porcelain berry, Chinese privet, multiflora rose, bamboo, tree of heaven, and kudzu were present in varying densities throughout the site. During 2007 monitoring (Year 4), populations of the non-native, invasive floral species listed above remained, and, in some cases, the populations had grown in size. Several mimosa and privet saplings were observed along all reaches. In addition, mimosa was observed along Buena Vista Branch and Japanese knotweed was observed along Reach 2.

Planted vegetation along Buena Vista Branch has been impacted by the presence of beavers. Two large beaver dams were observed along the reach (one damaged, the other in-tact). Beaver activity is evident along the entirety of the upstream portions of Buena Vista Branch. Beaver are taking both planted and non-planted stems for use in dams.

Populations of non-native, invasive floral species should be monitored due to their propensity to outcompete and overwhelm the more desirable native vegetation planted during restoration. However, survival and proliferation of planted stems along all reaches appears to be successful. Due to the urban nature of this project, it would be extremely difficult to prevent the growth of common invasive species. The large population of kudzu at the upstream portion of Reach 3 appears to be growing. Management of this population may prevent the spread of the plant throughout Reach 3.

Areas with beaver damage and/or high densities of one or more invasive species were identified as Vegetative Problem Areas and are described in Tables A6a to A6c in Appendix A-I. Seventeen Vegetative Problem Areas were identified along Silas Creek. Two Vegetative Problem Areas were observed on Buena Vista Branch. Vegetative Problem Area Photographs are located in Appendix A-II.

##### **3.1.2 Vegetative Problem Areas Plan View**

See Figure 3 in Appendix A-III for the Vegetative Problem Areas Plan View.

---

## 3.2 STREAM ASSESSMENT

### 3.2.1 Procedural Items

#### 3.2.1.1 Morphometric Criteria

Dimension and profile were sampled at a rate as per the March 2004 Mitigation Plan completed by Buck Engineering.

**Dimension:** Nine permanent cross sections are located on Silas Creek for a total of five riffles and four pools. Two permanent cross sections, a riffle and a pool, are located on Buena Vista Branch.

**Profile:** Per the March 2004 Mitigation Plan completed by Buck Engineering, a longitudinal profile survey is not required for Monitoring Year 4 for this project.

#### 3.2.1.2 Hydrologic Criteria

No crest gages are installed at this site to document bankfull events. There are no USGS stream gage stations located in the vicinity of the site.

#### 3.2.1.3 Bank Stability Assessments

A detailed BEHI and NBS assessment was not required for the Silas Creek Restoration site during this monitoring year. According to the 2006 Monitoring Guidelines (EEP 2006), an assessment is required during year 5, post construction only.

### 3.2.2 Stream Current Condition Plan view

The Stream Current Condition Plan View, data tables, and photos are located in Appendices B-I, B-II, and B-III, respectively.

### 3.2.3 Fixed Photo Station Photos

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

### 3.2.4 Stability Assessment

**Table Va. Categorical Stream Feature Visual Stability Assessment (% Functioning)  
Reaches 1, 2, and 3 - Silas Creek  
EEP Project Number 00335**

Feature	Initial*	MY-01**	MY-02**	MY-03	MY-04	MY-05
A. Riffle	100	N/A	N/A	70	70	
B. Pool	100	N/A	N/A	95	100	
C. Thalweg	100	N/A	N/A	100	90	
D. Meanders	100	N/A	N/A	100	100	
E. Bed General	100	N/A	N/A	95	95	
F. Bank Condition	100	N/A	N/A	98	90	
G. Vanes / J Hooks	100	N/A	N/A	61	61	
H. Wads and Boulders	100	N/A	N/A	100	100	

\* It is assumed that all were 100 percent functional upon completion of construction

\*\* No stability data are presented in previous reports

<b>Table Vb. Categorical Stream Feature Visual Stability Assessment (% Functioning)</b>						
<b>Buena Vista Branch - Silas Creek</b>						
<b>EEP Project Number 00335</b>						
<b>Feature</b>	<b>Initial*</b>	<b>MY-01**</b>	<b>MY-02**</b>	<b>MY-03</b>	<b>MY-04</b>	<b>MY-05</b>
A. Riffle	100	N/A	N/A	78	27	
B. Pool	100	N/A	N/A	90	29	
C. Thalweg	100	N/A	N/A	86	29	
D. Meanders	100	N/A	N/A	100	100	
E. Bed General	100	N/A	N/A	93	93	
F. Bank Condition	100	N/A	N/A	99	99	
G. Vanes / J Hooks	100	N/A	N/A	67	42	
H. Wads and Boulders	100	N/A	N/A	100	100	

\* It is assumed that all were 100 percent functional upon completion of construction

\*\* No stability data are presented in previous reports

### **3.2.5 Quantitative Measures Tables (Morphology and Hydrology)**

**Table VIa. Baseline Morphology and Hydraulic Summary – Silas Creek  
Silas Creek  
EEP Project Number 00335**

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	--	--	--	18	50	30	--	--	40	--	--	--	--	--	40	33	39	36
Floodprone Width (ft)	--	--	--	--	--	--	68	272	--	--	--	--	120	272	--	66	95	79.8
BF Cross Sectional Area (ft <sup>2</sup> )	--	--	--	42	150	80	--	--	138	--	--	--	--	--	138	83	120	102
BF Mean Depth (ft)	--	--	--	1.7	4.0	3.0	--	--	3.5	--	--	--	--	--	3.5	2.43	3.42	2.83
BF Max Depth (ft)	--	--	--	--	--	--	--	--	4.5	--	--	--	--	--	4.5	3.27	4.82	4.13
Width/Depth Ratio	--	--	--	--	--	--	--	--	11.7	--	--	--	--	--	11.7	10.3	14.7	12.9
Entrenchment Ratio	--	--	--	--	--	--	1.7	6.8	--	--	--	--	3.0	6.8	--	2	2.7	2.2
Bank Height Ratio	--	--	--	--	--	--	--	--	1.6	--	--	--	--	--	1.0	--	--	--
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<b>Pattern</b>																		
Channel Beltwidth (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Radius of Curvature (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Meander Wavelength (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Meander Width Ratio	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<b>Profile</b>																		
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0028	--	--	--	--	--	0.0028	--	--	--
Pool Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Pool Spacing (ft)	--	--	--	--	--	--	82	189	--	--	--	--	72	144	--	54	457	210
<b>Substrate</b>																		
d50 (mm)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.74	8	0.94
d84 (mm)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	21.34	128	23.4

**Table VIa. Baseline Morphology and Hydraulic Summary – Silas Creek  
Silas Creek  
EEP Project Number 00335**

Additional Reach Parameters	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	3461
Channel Length (ft)	--	--	--	--	--	--	--	--	3667	--	--	--	--	--	3667	--	--	3808
Sinuosity	--	--	--	--	--	--	--	--	1.03	--	--	--	--	--	1.03	--	--	1.1
Water Surface Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0025	--	--	--	--	--	0.0025	--	--	0.003
BF Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.002
Rosgen Classification	--	--	--	--	--	--	--	--	B4c	--	--	--	--	--	B4c	--	--	B4c

**Table VIb. Baseline Morphology and Hydraulic Summary – Buena Vista Branch  
Silas Creek  
EEP Project Number 00335**

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
BF Width (ft)	--	--	--	8.0	30.0	18	--	--	14.5	--	--	--	--	--	17.6	16.64	62.72	--
Floodprone Width (ft)	--	--	--	--	--	--	20	119	--	--	--	--	60	160	--	--	--	--
BF Cross Sectional Area (ft <sup>2</sup> )	--	--	--	15	52	30	--	--	30.6	--	--	--	--	--	32.2	24.9	85.2	--
BF Mean Depth (ft)	--	--	--	1.1	2.9	1.8	--	--	2.11	--	--	--	--	--	1.8	1.36	1.5	--
BF Max Depth (ft)	--	--	--	--	--	--	--	--	3.21	--	--	--	--	--	2.6	2.29	3.58	--
Width/Depth Ratio	--	--	--	--	--	--	--	--	6.86	--	--	--	--	--	10	--	--	--
Entrenchment Ratio	--	--	--	--	--	--	1.4	8.2	--	--	--	--	3.4	9.1	--	--	--	--
Bank Height Ratio	--	--	--	--	--	--	--	--	1.8	--	--	--	--	--	1.0	--	--	1.7
Wetted Perimeter (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hydraulic radius (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
<b>Pattern</b>																		
Channel Beltwidth (ft)	--	--	--	--	--	--	15.4	23.8	--	--	--	--	53	88	--	54.5	66.9	60.4
Radius of Curvature (ft)	--	--	--	--	--	--	25	100	--	--	--	--	32	53	--	18.8	35.6	29.4
Meander Wavelength (ft)	--	--	--	--	--	--	72	105	--	--	--	--	120	200	--	117.3	164.9	144.6
Meander Width Ratio	--	--	--	--	--	--	1.1	1.6	--	--	--	--	3	5	--	--	--	--
<b>Profile</b>																		
Riffle Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	17.3	27.7	24
Riffle Slope (ft/ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.04%	2.46%	1.21%
Pool Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	43.1	84.7	62.2
Pool Spacing (ft)	--	--	--	--	--	--	45	160	--	--	--	--	60	100	--	65.1	103.0	87.0
<b>Substrate</b>																		
d50 (mm)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.31	18.44	10.48
d84 (mm)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	30.12	84.97	61.55

**Table VIIb. Baseline Morphology and Hydraulic Summary – Buena Vista Branch  
 Silas Creek  
 EEP Project Number 00335**

Additional Reach Parameters	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design			As-built		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Valley Length (ft)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Channel Length (ft)	--	--	--	--	--	--	--	--	668	--	--	--	--	--	782	--	--	782
Sinuosity	--	--	--	--	--	--	--	--	1.09	--	--	--	--	--	1.22	--	--	1.23
Water Surface Slope (ft/ft)	--	--	--	--	--	--	--	--	0.0107	--	--	--	--	--	0.009	--	--	--
BF Slope (ft/ft)	--	--	--	--	--	--	--	--		--	--	--	--	--		--	--	--
Rosgen Classification	--	--	--	--	--	--	--	--	E4	--	--	--	--	--	E4	--	--	E4



**Exhibit Table VIIa-1. Morphology and Hydraulic Monitoring Summary – Silas Creek**  
**Silas Creek**  
**EEP Project Number 00335**

Parameter	Reach 1 Cross Section 1 Rifle					Reach 1 Cross Section 2 Pool					Reach 1 Cross Section 3 Pool					Reach 2 Cross Section 4 Rifle				
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5
<b>Dimension</b>																				
BF Width (ft)	35.09	41.11	37.8	48.0		33.77	67.32	32.6	33.0		33.08	43.07	34.7	53.3		35.79	38.7	40.2	40.3	
Floodprone Width (ft)	65.96	93.56	>91.5	91.5		67.5	122.2	81.7	88.2		74.79	79.14	>83.0	93.3		95.05	81.39	>79.3	79.3	
BF Cross Sectional Area (ft <sup>2</sup> )	120	104.9	113.0	121.3		135.4	241.8	102.2	120.1		82.8	84.99	184.9	173.9		86.92	104.2	105.9	112.5	
BF Mean Depth	3.42	2.55	3.0	2.5		4.01	3.59	3.1	3.6		2.5	1.97	5.3	3.3		2.43	2.69	2.6	2.8	
BF Max Depth	4.5	4.21	4.8	5.6		7.1	5.47	6.5	7.5		4.34	3.2	8.4	7.1		3.27	4.96	5.4	5.3	
Width/Depth Ratio	10.27	16.11	12.6	19.0		8.42	18.87	10.4	9.1		13.22	21.82	6.5	16.3		14.73	14.39	15.3	14.4	
Entrenchment Ratio	2.1	2.28	>2.4	1.9		2	1.81	2.5	2.7		2	1.84	>2.4	1.8		2.7	2.1	>2.0	2.0	
Bank Height Ratio	2.2	--	1.0	1.0		1.72	--	1.0	1.0		2.06	--	1.0	0.9		2.72	--	1.0	0.4	
Wetted Perimeter (ft)	--	42.6	40.0	50.6		--	69.73	36.3	37.4		--	44.19	42.3	58.1		--	40.81	42.8	42.5	
Hydraulic radius (ft)	--	2.46	2.8	2.4		--	3.47	2.8	3.2		--	1.92	4.4	3.0		--	2.55	2.5	2.6	
<b>Substrate</b>																				
d50 (mm)	--	4.46	6	16		--	11.97	0.23	0.63		--	3	0.23	0.63		--	17.65	40	12	
d84 (mm)	--	15.85	14	44		--	28.87	0.88	8.8		--	12.15	0.88	8.8		--	77.87	240	70	

**Exhibit Table VIIa-2. Morphology and Hydraulic Monitoring Summary – Silas Creek**  
**Silas Creek**  
**EEP Project Number 00335**

Parameter	Reach 2 Cross Section 5 Pool					Reach 2 Cross Section 6 Run*					Reach 3 Cross Section 7 Pool					Reach 3 Cross Section 8 Pool									
	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5	MY1	MY2	MY3	MY4	MY5					
<b>Dimension</b>																									
BF Width (ft)	35.27	32.97	29.6	30.3		37.47	41.89	32.1	43.0		44.74	37.49	35.4	37.6		37.31	35.97	27.1	31.9						
Floodprone Width (ft)	89.88	92.63	83.0	78.1		80.14	102.4	92.2	111.5		100.2	52.96	70	67.7		82.4	56.92	73.8	80.0						
BF Cross Sectional Area (ft <sup>2</sup> )	119.8	141.7	143.5	140.3		115.7	100.3	91.8	129.1		135.5	102	92.6	107.3		98.87	146.1	111.5	121.8						
BF Mean Depth	3.4	4.3	4.9	4.6		2.93	2.39	2.9	3.0		3.03	2.72	2.6	2.9		2.65	4.06	4.1	3.8						
BF Max Depth	5.36	7.67	6.4	6.2		4.82	3.74	3.7	4.6		5.87	4.69	4.4	4.7		4.84	7.68	7.7	7.9						
Width/Depth Ratio	10.39	7.67	6.1	6.5		13.46	17.5	11.2	14.3		14.77	13.78	13.6	13.2		14.08	8.86	6.6	8.3						
Entrenchment Ratio	2.55	2.81	2.8	2.6		2.03	2.44	2.9	2.6		2.24	1.41	2.0	1.8		2.21	1.58	2.7	2.5						
Bank Height Ratio	1.81	--	1.0	0.8		1.82	--	1.0	0.6		1.72	--	1.0	1.0		2.08	--	1.0	1.0						
Wetted Perimeter (ft)	--	37.39	34.9	34.7		--	43.57	35.6	45.5		--	39.77	38.7	39.8		--	40.41	33.3	38.5						
Hydraulic radius (ft)	--	3.79	4.1	4.0		--	2.3	2.6	2.8		--	2.56	2.4	2.7		--	3.61	3.4	3.2						
<b>Substrate</b>																									
d50 (mm)	--	10.83	0.25	1.9		--	26.36	40	12		--	15.06	0.64	1.2		--	10.81	0.64	1.2						
d84 (mm)	--	92.53	16	15		--	96.33	240	70		--	53.14	13	11		--	30.29	13	11						

<b>Exhibit Table VIIa-3. Morphology and Hydraulic Monitoring Summary – Silas Creek Silas Creek EEP Project Number 00335</b>						
<b>Parameter</b>	<b>Reach 3 Cross Section 9 Pool</b>					
	<b>MY1</b>	<b>MY2</b>	<b>MY3</b>	<b>MY4</b>	<b>MY5</b>	<b>MY+</b>
<b>Dimension</b>						
BF Width (ft)	37.17	35.66	25.6	32.8		
Floodprone Width (ft)	81	79.03	58.3	100.0		
BF Cross Sectional Area (ft <sup>2</sup> )	106.3	132.4	95.4	97.4		
BF Mean Depth	2.86	3.71	3.7	3.0		
BF Max Depth	3.7	5.26	5.1	5.0		
Width/Depth Ratio	12.99	9.61	6.9	11.1		
Entrenchment Ratio	2.2	2.22	2.3	3.0		
Bank Height Ratio	2.28	--	1.0	1.0		
Wetted Perimeter (ft)	NA	39.5	31.4	37.4		
Hydraulic radius (ft)	NA	3.35	3.0	2.6		
<b>Substrate</b>						
d50 (mm)	NA	8.99	0.64	1.2		
d84 (mm)	NA	21.72	13	11		

<b>Exhibit Table VIIIb. Morphology and Hydraulic Monitoring Summary – Buena Vista Branch Silas Creek EEP Project Number 00335</b>										
<b>Parameter</b>	<b>Cross Section 1 Riffle</b>					<b>Cross Section 2 Pool</b>				
	<b>MY1</b>	<b>MY2</b>	<b>MY3</b>	<b>MY4</b>	<b>MY5</b>	<b>MY1</b>	<b>MY2</b>	<b>MY3</b>	<b>MY4</b>	<b>MY5</b>
<b>Dimension</b>										
BF Width (ft)	16.6	10.04	13.6	15.4		62.72	14.4	9.8	11.5	
Floodprone Width (ft)	85	106	>73.0	76.0		88	136	113.6	124.0	
BF Cross Sectional Area (ft <sup>2</sup> )	24.9	16.2	19.7	22.5		85.2	19.6	12.9	19.0	
BF Mean Depth	1.5	1.6	1.5	1.5		1.36	1.36	1.3	1.7	
BF Max Depth	2.29	2.4	2.6	2.6		3.58	2.29	1.8	2.5	
Width/Depth Ratio	11.09	6.2	9.3	10.5		46.17	10.64	7.4	6.9	
Entrenchment Ratio	5.3	10.6	>5.4	4.9		1.4	9.45	11.7	10.8	
Bank Height Ratio	1.74	--	1.0	1.1		1.33	--	1.0	1.0	
Wetted Perimeter (ft)	--	12	15.5	17.4		--	15.33	11.0	13.6	
Hydraulic radius (ft)	--	1.4	1.3	1.3		--	1.28	1.2	1.4	
<b>Substrate</b>										
d50 (mm)	--	12.35	8.6	15		--	10.35	0.68	0.5	
d84 (mm)	--	18.6	15	29		--	20.2	6.9	18	

**Exhibit Table VIIc. Morphology and Hydraulic Monitoring Summary – Silas Creek  
Silas Creek  
EEP Project Number 00335**

Parameter	MY1 (2004)			MY2 (2005)			MY3 (2006)			MY4 (2007)*			MY5 (2008)			MY+		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
<b>Pattern</b>																		
Channel Beltwidth (ft)	--	--	--	35	45	40	--	--	--	--	--	--						
Radius of Curvature (ft)	--	--	--	200	200	200	--	--	--	--	--	--						
Meander Wavelength (ft)	--	--	--	85	85	85	--	--	--	--	--	--						
Meander Width Ratio	--	--	--	2.3	2.3	2.3	--	--	--	--	--	--						
<b>Profile</b>																		
Riffle Length (ft)	--	--	--	34	166	54	8	53	23	--	--	--						
Riffle Slope (ft/ft)	--	--	--	0.004	0.017	0.008	0.001	0.04	0.01	--	--	--						
Pool Length (ft)	--	--	--	13	200	70.5	12	287	57	--	--	--						
Pool Spacing (ft)	30	388	143	37.9	397	119	12	268	85	--	--	--						
<b>Additional Reach Parameters</b>																		
Valley Length (ft)	--	--	--	--	--	3495	--	--	3495	--	--	--						
Channel Length (ft)	--	--	--	--	--	3949	--	--	3692	--	--	--						
Sinuosity	--	--	--	--	--	1.13	--	--	1.06	--	--	--						
Water Surface Slope (ft/ft)	--	--	--	--	--	0.004	--	--	0.003	--	--	--						
BF Slope (ft/ft)	--	--	--	--	--	0.004	--	--	0.003	--	--	--						
Rosgen Classification	--	--	--	--	--	C/B/F	E5, B5c, C5, B4c			--	--	B5						

\* Per the 2004 Mitigation Plan produced by Buck Engineering, longitudinal profile data collection is not required during MY4.

**Exhibit Table VIIId. Morphology and Hydraulic Monitoring Summary – Buena Vista Branch  
Silas Creek  
EEP Project Number 00335**

Parameter	MY1 (2004)			MY2 (2005)			MY3 (2006)			MY4 (2007)*			MY5 (2008)			MY+		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
<b>Pattern</b>																		
Channel Beltwidth (ft)	54.5	66.9	60.4	47	73	70	--	--	--	--	--	--						
Radius of Curvature (ft)	19.0	41.0	31.5	15	35	25	--	--	--	--	--	--						
Meander Wavelength (ft)	139.4	167.2	146.1	108	165	155	--	--	--	--	--	--						
Meander Width Ratio	--	--	--	7.5	11.4	10.7	--	--	--	--	--	--						
<b>Profile</b>																		
Riffle Length (ft)	11.4	28.8	21.8	4.8	12.2	8.9	4	96	22	--	--	--						
Riffle Slope (ft/ft)	0.002	0.012	0.007	0.010	0.029	0.020	0.002	3.1	1.2	--	--	--						
Pool Length (ft)	43	84.7	62.2	8	71	21	5	27	13	--	--	--						
Pool Spacing (ft)	65	103	87	9.81	98	52.7	9	189	49	--	--	--						
<b>Additional Reach Parameters</b>																		
Valley Length (ft)	--	--	--	--	--	682	--	--	682	--	--	--						
Channel Length (ft)	--	--	--	--	--	814	--	--	799	--	--	--						
Sinuosity	--	--	--	--	--	1.19	--	--	1.17	--	--	--						
Water Surface Slope (ft/ft)	--	--	0.004	--	--	0.004	--	--	0.003	--	--	--						
BF Slope (ft/ft)	--	--	0.005	--	--	0.004	--	--	0.01	--	--	--						
Rosgen Classification	--	--	E	--	--	E	--	--	E4	--	--	E4						

\* Per the 2004 Mitigation Plan produced by Buck Engineering, longitudinal profile data collection is not required during MY4.

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## 4.0 METHODOLOGY SECTION

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All monitoring methodologies follow the most current templates and guidelines provided by EEP. Photographs were taken at high resolution using an Olympus Stylus 4.0 megapixel digital camera. GPS location information was collected using a Trimble Geo XT handheld mapping grade GPS unit. GPS locations were collected on both banks of each cross section and on all four corners of each vegetation plot during Year 3 monitoring. Stream and vegetation problem areas were noted in the field on As-Built Plan Sheets. Permanent photo station photographs were taken from locations marked in the Monitoring Year 2 Report, prepared by EcoLogic Associates.

### 4.1 STREAM METHODOLOGY

The methods used to generate the data in this report are standard fluvial geomorphology techniques as described in *Applied River Morphology* (Rosgen 1996) and related publications from US Forest Service and the interagency Stream Mitigation Guidelines (USACE 2003). URS' field morphological survey was conducted using a Topcon PL-H3C Rotating Laser and the data were analyzed and displayed using the Reference Reach Spreadsheet, Version 4.2L (Mecklenburg 2006). Modified Wolman weighted pebble counts were conducted for each reach. Photographs were taken at each cross section. A photo was taken from the left bank towards the right bank, and from the right bank towards the left bank.

### 4.2 VEGETATION METHODOLOGY

Two vegetation plots were established by Buck Engineering in 2003. These two plots were also evaluated for Monitoring Year 1 in 2004. In 2005, EcoLogic established 14 10-meter by 10-meter vegetation plots. Per EEP's 2006 guidance, 7 of the 14 monitoring plots established by EcoLogic were inventoried during 2006 and 2007 (MY3 and MY4).

Vegetation monitoring methods followed the 2006, Version 4.0 CVS-EEP Protocol for Recording Vegetation (Lee *et al* 2006) for the Year 3 and 4 stem counts. According to the protocol, the Silas Creek Stream Restoration Project requires the monitoring of 7 vegetation plots. The protocol was used to inventory 7 (2, 3, 6, 8, 10, 13, and 14) of the 14 vegetation plots established by EcoLogic.

EcoLogic used rebar to mark all four corners of the vegetation plots and the southwest corner was marked with a 4-foot PVC pipe flagged with orange. The remaining three corners were marked with blue flagging. Planted stems were also marked with blue flagging. GPS coordinates were taken for the southwest corner of each plot during Monitoring Year 3. A reference photograph was taken from the southwest corner towards the northeast corner for each plot during each monitoring year. Plot photographs are located in Appendix A-IV.

During Year 3 (2006) monitoring, all planted stems were marked with white flagging. Stems found with blue flagging from the previous year were re-flagged with white. Blue flagging was removed. Natural regeneration stems were marked with red flagging and recorded. Monitoring taxonomy follows 'Manual of the Vascular Flora of the Carolinas' (Radford *et. al* 1968). Year 4 (2007) monitoring was conducted in the same manner and Year 3. The results of the stem counts are summarized in Tables A1 to A5 in Appendix A-I.

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## 5.0 REFERENCES

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- Zimmerman, James L. 1976. Soil Survey of Forsyth County, North Carolina. US Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS).



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## **APPENDIX A**

# **VEGETATION RAW DATA**

Table A1. Vegetation Metadata

<b>Report Prepared By</b>	Susan Shelingoski	
<b>Date Prepared</b>		8/21/2007 14:59
<b>database name</b>	URS-2007-A-VMD-v210.mdb	
<b>database location</b>	P:\Jobs3\31825348_Monitoring\Veg	

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

<b>Metadata</b>	This worksheet, which is a summary of the project and the project data.
<b>Plots</b>	List of plots surveyed.
<b>Vigor</b>	Frequency distribution of vigor classes.
<b>Vigor by Spp</b>	Frequency distribution of vigor classes listed by species.
<b>Damage</b>	List of most frequent damage classes with number of occurrences and percent of total stems impacted by each.
<b>Damage by Spp</b>	Damage values tallied by type for each species.
<b>Damage by Plot</b>	Damage values tallied by type for each plot.
<b>Stem Count by Plot and Spp</b>	Count of living stems of each species for each plot; dead and missing stems are excluded.

**PROJECT SUMMARY-----**

<b>Project Code</b>		335
<b>project Name</b>	Silas Creek	
<b>Description</b>	Stream Restoration	
<b>length(ft)</b>		
<b>stream-to-edge width (ft)</b>		
<b>area (sq m)</b>		
<b>Required Plots (calculated)</b>		7
<b>Sampled Plots</b>		7

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A2. Vegetation Vigor by Species

	<b>Species</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>Missing</b>
	Acer floridanum	6	6		1		1
	Ailanthus altissima						
	Albizia julibrissin						
	Alnus serrulata	2	4				
	Aronia arbutifolia		1				1
	Betula nigra	23	30	3			
	Carya cordiformis						
	Carya ovata	2	2				
	Cornus amomum	14	12	4			
	Fraxinus pennsylvanica	1	1				
	Liquidambar styraciflua						
	Morus alba						
	Pinus serotina						
	Pinus virginiana						
	Quercus phellos	8	14				2
	Rhus typhina						
	Robinia pseudoacacia						
	Salix nigra						
	Sambucus canadensis						
	Morus rubra						
	Rhus copallinum						
	Carpinus caroliniana						
	Mimosa						
	Lindera benzoin	1			1		
	Liriodendron tulipifera						
	Myrica		4				
	Platanus occidentalis	16	29				4
	Acer negundo						
<b>TOT:</b>	<b>28</b>	<b>73</b>	<b>103</b>	<b>7</b>	<b>2</b>		<b>8</b>

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A3. Vegetation Damage by Species

	Species	All Damage Categories	(no damage)	Drought	Insects	Unknown	Vine Strangulation
	Acer floridanum	14	13		1		
	Acer negundo	5	5				
	Ailanthus altissima	2	2				
	Albizia julibrissin	7	7				
	Alnus serrulata	6	6				
	Aronia arbutifolia	2	2				
	Betula nigra	67	64	2			1
	Carpinus caroliniana	1	1				
	Carya cordiformis	1	1				
	Carya ovata	4	4				
	Cornus amomum	32	27		1		4
	Fraxinus pennsylvanica	11	11				
	Lindera benzoin	2	1			1	
	Liquidambar styraciflua	10	10				
	Liriodendron tulipifera	9	9				
	Mimosa	4	4				
	Morus alba	1	1				
	Morus rubra	1	1				
	Myrica	6	6				
	Pinus serotina	1	1				
	Pinus virginiana	3	3				
	Platanus occidentalis	56	52		4		
	Quercus phellos	28	28				
	Rhus copallinum	1	1				
	Rhus typhina	1	1				
	Robinia pseudoacacia	3	3				
	Salix nigra	1	1				
	Sambucus canadensis	1	1				
<b>TOT:</b>	<b>28</b>	<b>280</b>	<b>266</b>	<b>2</b>	<b>6</b>	<b>1</b>	<b>5</b>

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A4. Vegetation Damage by Plot

	Plot	All Damage Categories	(no damage)	Drought	Insects	Unknown	Vine Strangulation
	335-01-0002-year:3	7	7				
	335-01-0002-year:4	9	7		1	1	
	335-01-0003-year:3	22	21				1
	335-01-0003-year:4	25	21				4
	335-01-0006-year:3	16	16				
	335-01-0006-year:4	15	14		1		
	335-01-0008-year:3	16	14		2		
	335-01-0008-year:4	20	19		1		
	335-01-0010-year:3	38	38				
	335-01-0010-year:4	36	35		1		
	335-01-0013-year:3	13	13				
	335-01-0013-year:4	7	5	2			
	335-01-0014-year:3	29	29				
	335-01-0014-year:4	27	27				
<b>TOT:</b>	<b>14</b>	<b>280</b>	<b>266</b>	<b>2</b>	<b>6</b>	<b>1</b>	<b>5</b>

APPENDIX A-I. VEGETATION SURVEY DATA TABLES

Table A5. Stem Count by Plot and Species

		Total Stems	# Plots	avg# stems	plot 335-01-0002-year:3	plot 335-01-0002-year:4	plot 335-01-0003-year:3	plot 335-01-0003-year:4	plot 335-01-0006-year:3	plot 335-01-0006-year:4	plot 335-01-0008-year:3	plot 335-01-0008-year:4	plot 335-01-0010-year:3	plot 335-01-0010-year:4	plot 335-01-0013-year:3	plot 335-01-0013-year:4	plot 335-01-0014-year:3	plot 335-01-0014-year:4
	Species																	
	Acer floridanum	13	7	1.86			2	2	1				1	1			3	3
	Alnus serrulata	6	4	1.5			2	2			1	1						
	Aronia arbutifolia	1	1	1					1									
	Betula nigra	56	10	5.6			1	1			1	1	21	21	2	2	3	3
	Carya ovata	4	4	1			1	1									1	1
	Cornus amomum	30	6	5			5	5			1	1					9	9
	Fraxinus pennsylvanica	2	2	1							1	1						
	Lindera benzoin	2	2	1	1	1												
	Myrica	4	2	2							2	2						
	Platanus occidentalis	45	14	3.21	1	1	6	3	5	5	5	5	2	2	2	2	3	3
	Quercus phellos	22	11	2	1	1			1	1	1	1	6	5	1		2	2
<b>TOT:</b>	<b>11</b>	<b>185</b>	<b>11</b>		<b>3</b>	<b>3</b>	<b>17</b>	<b>14</b>	<b>8</b>	<b>6</b>	<b>12</b>	<b>12</b>	<b>30</b>	<b>29</b>	<b>5</b>	<b>4</b>	<b>21</b>	<b>21</b>

<b>Table A6a. Vegetative Problem Areas – Reach 1</b>			
<b>Silas Creek</b>			
<b>EEP Project Number 00335</b>			
<b>Feature/Issue</b>	<b>Station #/Range</b>	<b>Probable Cause</b>	<b>Photo #</b>
Invasive population	11+10	Privet, honeysuckle, rose	R1VPA1, R1VPA2
Invasive population	11+50	Privet, honeysuckle, rose	R1VPA1, R1VPA2
Invasive population	13+00	Bamboo	R1VPA3
Invasive population	13+00	Mimosa	R1VPA4
Bare Slope	13+80	Herbaceous veg. not established	R1VPA5, R1VPA6, R1VPA7
Bare Slope	13+90	Herbaceous veg. not established	R1VPA5, R1VPA6, R1VPA7
Bare Slope	17+10	Herbaceous veg. not established	R1VPA5, R1VPA6, R1VPA7
Invasive population	19+50	Japanese knotweed, honeysuckle	R1VPA8

<b>Table A6b. Vegetative Problem Areas – Reach 2</b>			
<b>Silas Creek</b>			
<b>EEP Project Number 00335</b>			
<b>Feature/Issue</b>	<b>Station #/Range</b>	<b>Probable Cause</b>	<b>Photo #</b>
Invasive population	21+90	Mimosa	R2VPA1, R2VPA2, R2VPA3
Invasive population	22+00	Mimosa, Japanese knotweed	R2VPA1, R2VPA2, R2VPA3
Invasive population	26+50	Mimosa	R2VPA1, R2VPA2, R2VPA3

<b>Table A6c. Vegetative Problem Areas – Reach 3</b>			
<b>Silas Creek</b>			
<b>EEP Project Number 00335</b>			
<b>Feature/Issue</b>	<b>Station #/Range</b>	<b>Probable Cause</b>	<b>Photo #</b>
Invasive population	33+80 to 34+80	Kudzu	R3VPA1
Invasive population	39+00	Mimosa	R3VPA2, R2VPA3, R2VPA4
Invasive population	39+00	Rose	R3VPA2, R2VPA3, R2VPA4
Invasive population	33+90 to 34+80	Mimosa	R3VPA2, R2VPA3, R2VPA4
Bare bank	42+50	No woody vegetation	R3VPA5
Bare bank	44+00	No woody vegetation	R3VPA6

<b>Table A6d. Vegetative Problem Areas – Buena Vista Branch Silas Creek EEP Project Number 00335</b>			
<b>Feature/Issue</b>	<b>Station #/Range</b>	<b>Probable Cause</b>	<b>Photo #</b>
Vegetation mortality	10+00 to 15+00	Beaver	BVNVPA1
Invasive population	10+00 to 18+00	Mimosa	BVNVPA2



APPENDIX A-II. VEGETATION PROBLEM AREA PHOTOS

Photos taken 8/7/07 to 8/8/07

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REACH 1



R1VPA1, R1VPA2



R1VPA3



R1VPA4



R1VPA5, R1VPA6, R1VPA7



R1VPA8

APPENDIX A-II. VEGETATION PROBLEM AREA PHOTOS

Photos taken 8/7/07 to 8/8/07

---

REACH 2



R2VPA1, R2VPA2, R2VPA3

REACH 3



R3VPA1



R3VPA2, R3VPA3, R2VPA4



R3VPA5



R3VPA6

APPENDIX A-II. VEGETATION PROBLEM AREA PHOTOS

Photos taken 8/7/07 to 8/8/07

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BUENA VISTA BRANCH



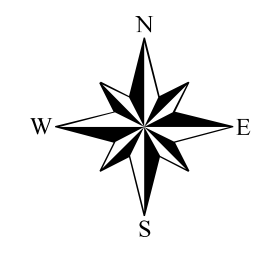
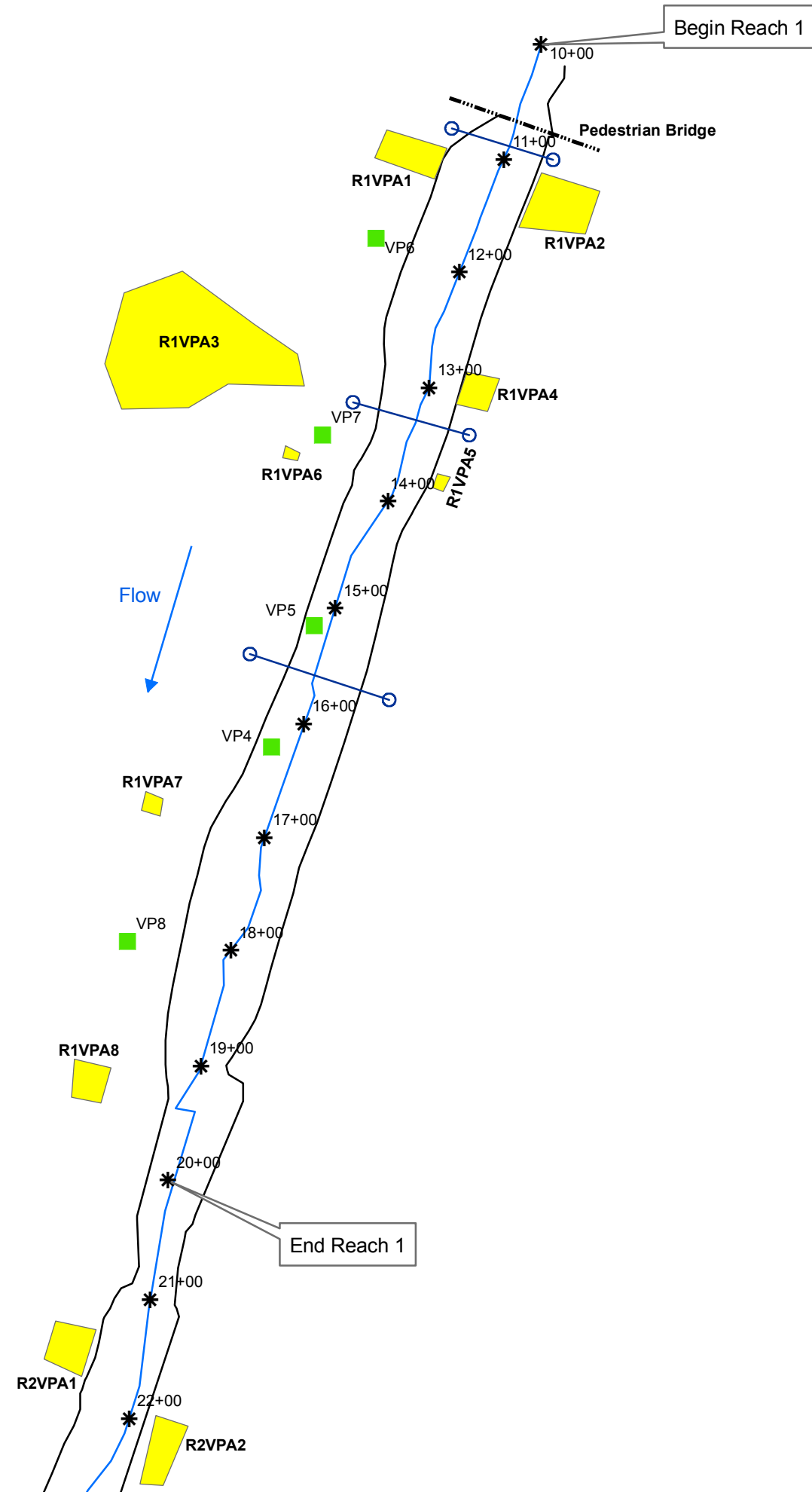
BVNVPA1



BVNVPA2



Vegetative Problem Areas – Reach 1			
Silas Creek 00335			
2006 Problem #	Feature/Issue	Station #/Range	Probable Cause
R1VPA1	Invasive population	11+10	Privet, honeysuckle, rose
R1VPA2	Invasive population	11+50	Privet, honeysuckle, rose
R1VPA3	Invasive population	13+00	Bamboo
R1VPA4	Invasive population	13+00	Mimosa
R1VPA5	Bare Slope	13+80	Herbaceous veg. not established
R1VPA6	Bare Slope	13+90	Herbaceous veg. not established
R1VPA7	Bare Slope	17+10	Herbaceous veg. not established
R1VPA8	Invasive population	19+50	Japanese knotweed, honeysuckle



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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program



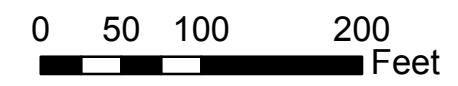
**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

**Monitoring Year:**  
 4 (2007)

**Project Number:**  
 00335

**Date:**  
 September 2007

- Legend**
- Problem Area Concern
  - Vegetation Plot
  - \* Stations
  - Cross Section
  - As-Built Streambank
  - As-Built Thalweg



Reach 1  
 Vegetative  
 Problem Areas  
 Plan View

Vegetative Problem Areas – Reach 2			
Silas Creek 00335			
2006 Problem #	Feature/Issue	Station #/Range	Probable Cause
R2VPA1	Invasive population	21+90	Mimosa
R2VPA2	Invasive population	22+00	Mimosa, Japanese knotweed
R2VPA3	Invasive population	26+50	Mimosa

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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program



**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

**Monitoring Year:**  
 4 (2007)

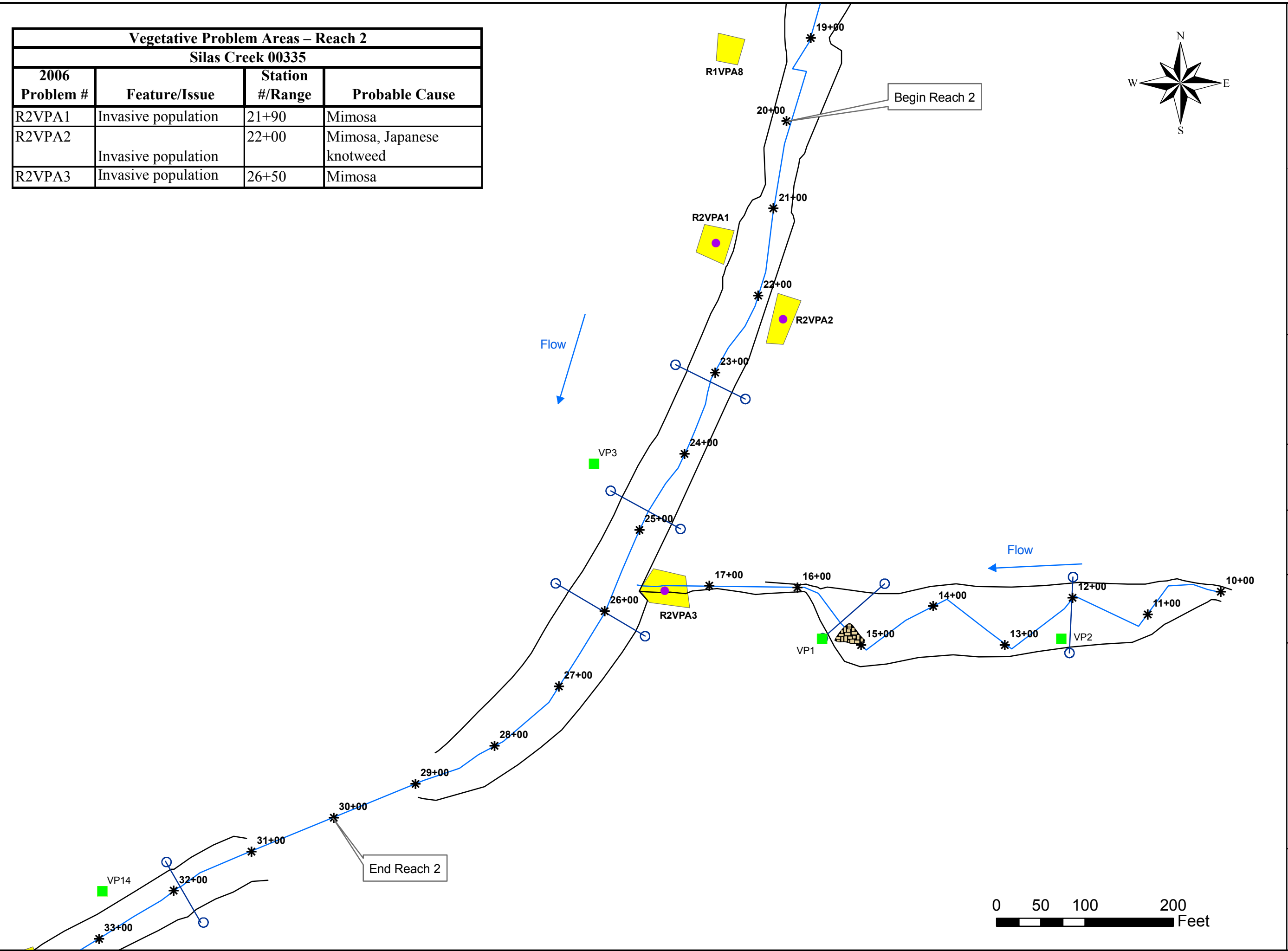
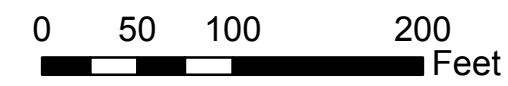
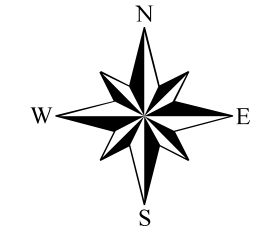
**Project Number:**  
 00335

**Date:**  
 September 2007

**Legend**

- Worsening Problem Area
- Problem Area Concern
- Beaver Dam
- \* Stations
- Cross Section
- As-Built Streambank
- As-Built Thalweg
- Vegetation Plot

**Reach 2  
 Vegetative  
 Problem Areas  
 Plan View**



Vegetative Problem Areas – Reach 3 Silas Creek 00335			
2006 Problem #	Feature/Issue	Station #/Range	Probable Cause
R3VPA1	Invasive population	33+80 to 34+80	Kudzu
R3VPA2	Invasive population	39+00	Mimosa
R3VPA3	Invasive population	39+00	Rose
R3VPA4	Invasive population	33+90 to 34+80	Mimosa
R3VPA5	Bare bank	42+50	No woody vegetation
R3VPA6	Bare bank	44+00	No woody vegetation

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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program



**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

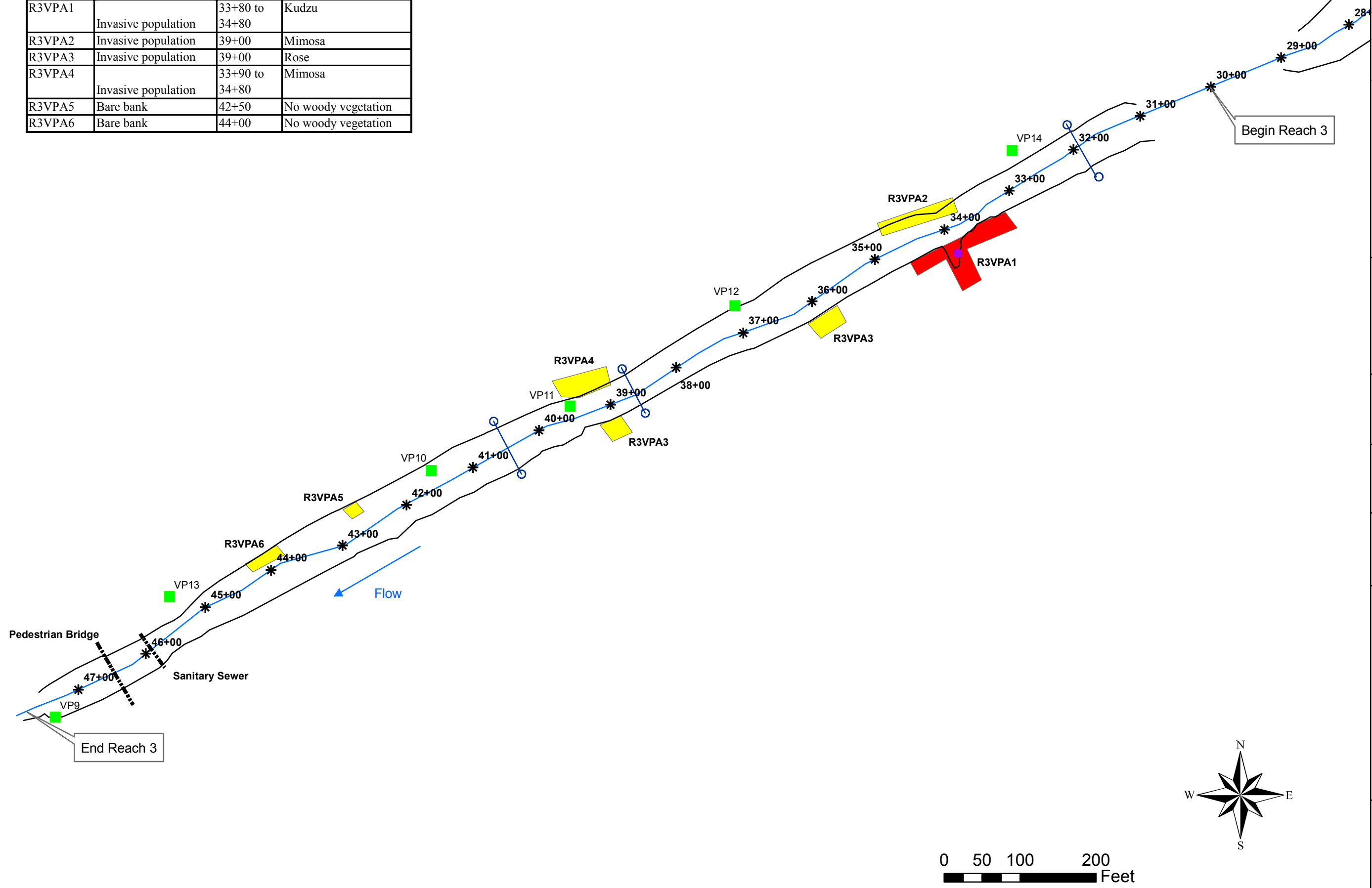
**Monitoring Year:**  
 4 (2007)

**Project Number:**  
 00335

**Date:**  
 September 2007

- Legend**
- Worsening Problem Area
  - Problem Area Concern
  - Problem Area High Concern
  - \* Stations
  - Cross Section
  - As-Built Streambank
  - As-Built Thalweg
  - Vegetation Plot

**Reach 3  
 Vegetative  
 Problem Areas  
 Plan View**



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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program



**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

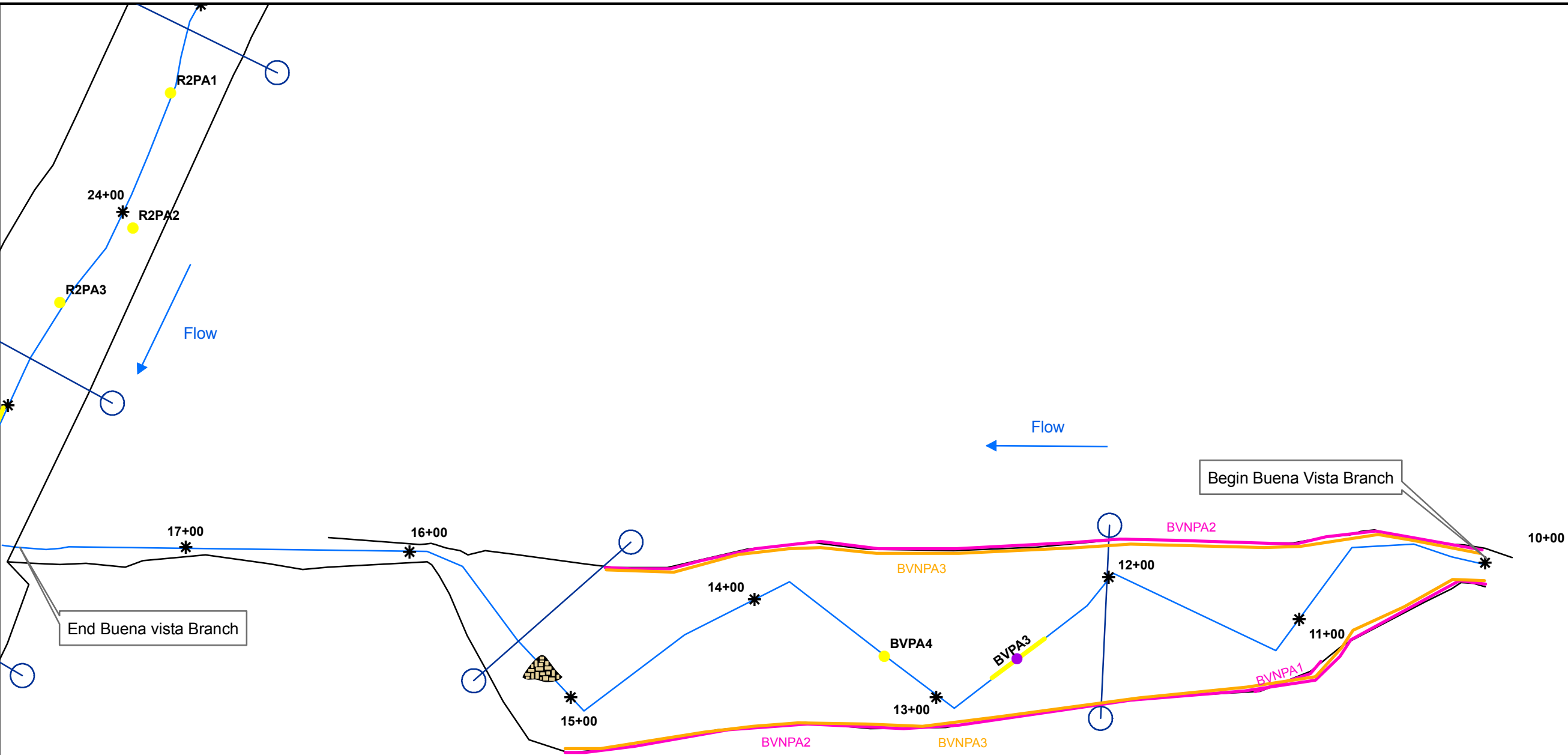
**Monitoring Year:**  
 4 (2007)

**Project Number:**  
 00335

**Date:**  
 September 2007

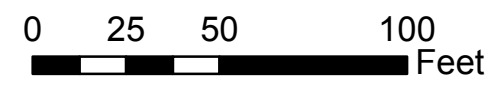
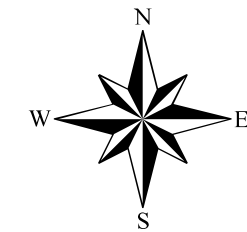
**Legend**

- Beaver Dam
- 2006 Problem Area Concern
- 2006 Problem Area Concern
- 2006 Problem Area High Concern
- 2007 Problem Area High Concern
- 2007 Problem Area Concern
- Worsening Problem Area
- Cross Section
- As-Built Streambank
- Stations
- As-Built Thalweg



Stream Problem Areas – Buena Vista Branch			
Silas Creek 00335			
Problem #	Feature Issue	Station	Suspected Cause
BVPA1*	Bar formation/Aggradation	10+50	Inability to transport sediment
BVPA2*	Bar formation/Aggradation	10+90	Inability to transport sediment
BVPA3	Bank erosion	12+50	Bank angle too steep
BVPA4	Bar formation/Aggradation	13+30	Inability to transport sediment
BVPA5	Bar formation/Aggradation	16+00	Inability to transport sediment
BVNPA1	Bank erosion	11+10	Improper design and/or construction
BVNPA2	Channel widening, deepening, beaver slides	10+00 to 15+00	Beaver presence
BVNPA3	Sedimentation on banks	10+00 to 15+00	Beaver dam downstream

\* Problem areas have been removed. Beaver presence has widened and deepened the channel. No bars are apparent.



**Buena Vista Branch  
 Stream Problem Areas  
 Plan View**



APPENDIX A-IV. VEGETATION MONITORING PLOT PHOTOS

---



VP2 (8/7/07)



VP3 (8/8/07)



VP6 (8/7/07)



VP8 (8/7/07)



VP10 (8/8/07)



VP13 (8/8/07)



VP14 (8/8/07)

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## **APPENDIX B**

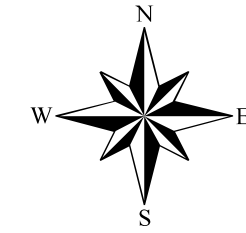
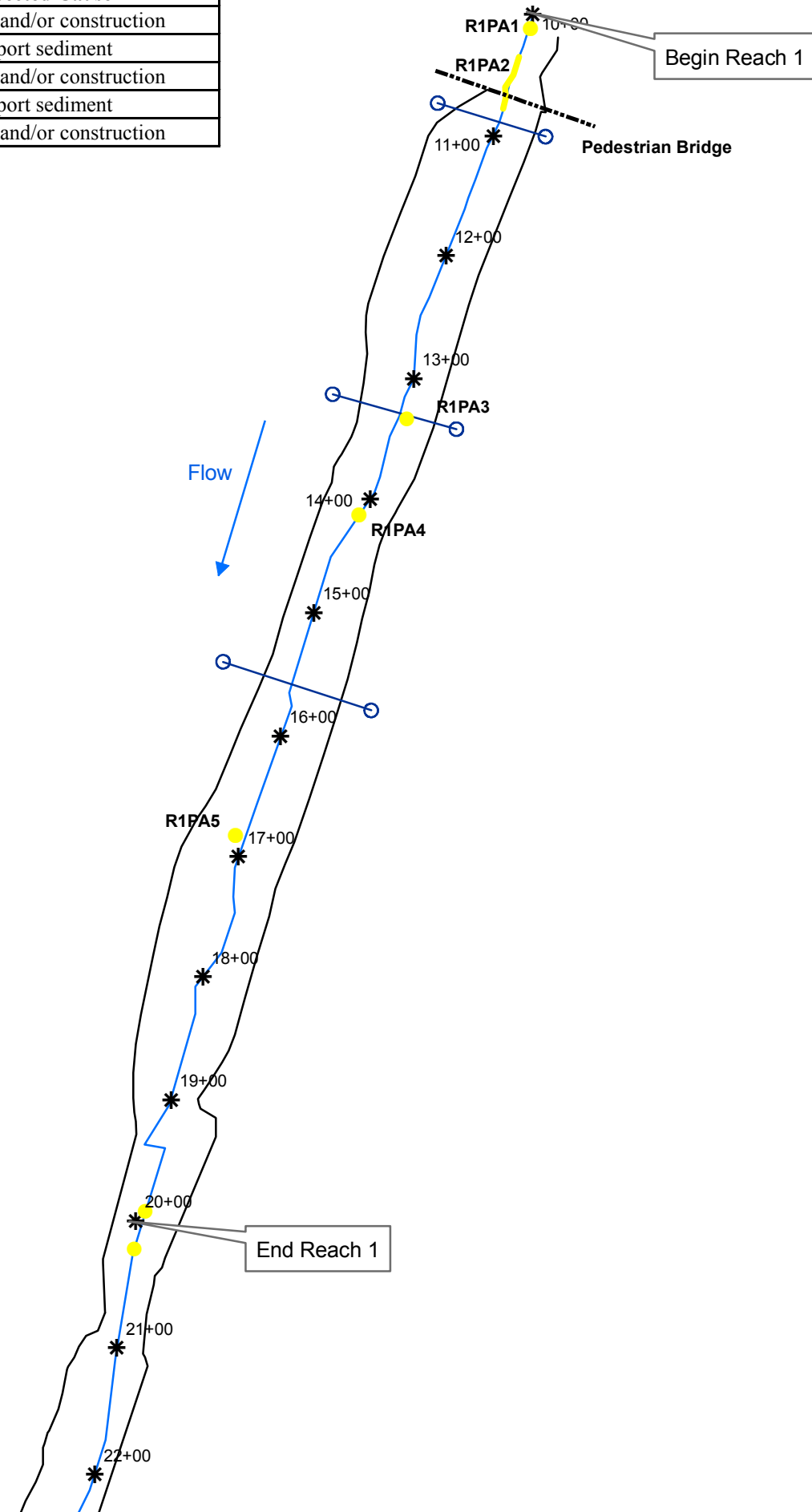
# **GEOMORPHIC RAW DATA**



**Stream Problem Areas – Reach 1**

**Silas Creek 00335**

Problem #	Feature Issue	Station	Suspected Cause
R1PA1	Vane failure	10+00	Improper design and/or construction
R1PA2	Bar formation/Aggradation	10+70	Inability to transport sediment
R1PA3	Vane erosion/failure	14+10	Improper design and/or construction
R1PA4	Bar formation/Aggradation	14+10	Inability to transport sediment
R1PA5	Vane failure	16+80	Improper design and/or construction



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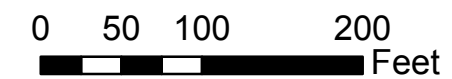
**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

**Monitoring Year:**  
 4 (2007)

**Project Number:**  
 00335

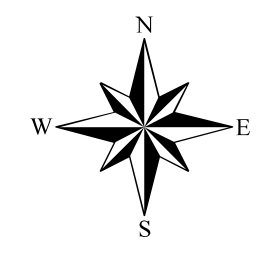
**Date:**  
 February 2008

- Legend**
- Problem Area Concern
  - Problem Area Concern
  - \* Stations
  - Cross Section
  - As-Built Streambank
  - As-Built Thalweg




**Reach 1 Stream  
 Current Condition  
 Plan View**

Stream Problem Areas – Reach 2			
Silas Creek 00335			
Problem #	Feature Issue	Station	Suspected Cause
R2PA1	Bank erosion/Scour	20+00	Bank angle too steep
R2PA2	Vane failure	20+10	Channel downcutting
R2PA3	Debris Collection	20+00	Box bridge blocking debris movement
R2PA4	Vane failure	23+50	Channel downcutting
R2PA5	Vane failure	24+00	Channel downcutting
R2PA6	Vane failure	24+40	Channel downcutting
R2PA7	Structure failure	25+00 to 25+50	Channel downcutting
R2PA8	Bank erosion/Scour	25+10	Bank angle too steep
R2PA9	Bank erosion/Scour and	25+80	Confluence with Buena Vista Branch
R2PA10	Vane failure	26+30	Channel downcutting
R2PA11	Vane failure	27+50	Channel downcutting



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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program












**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

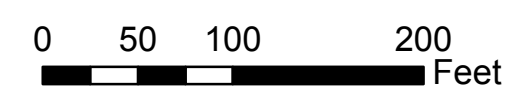
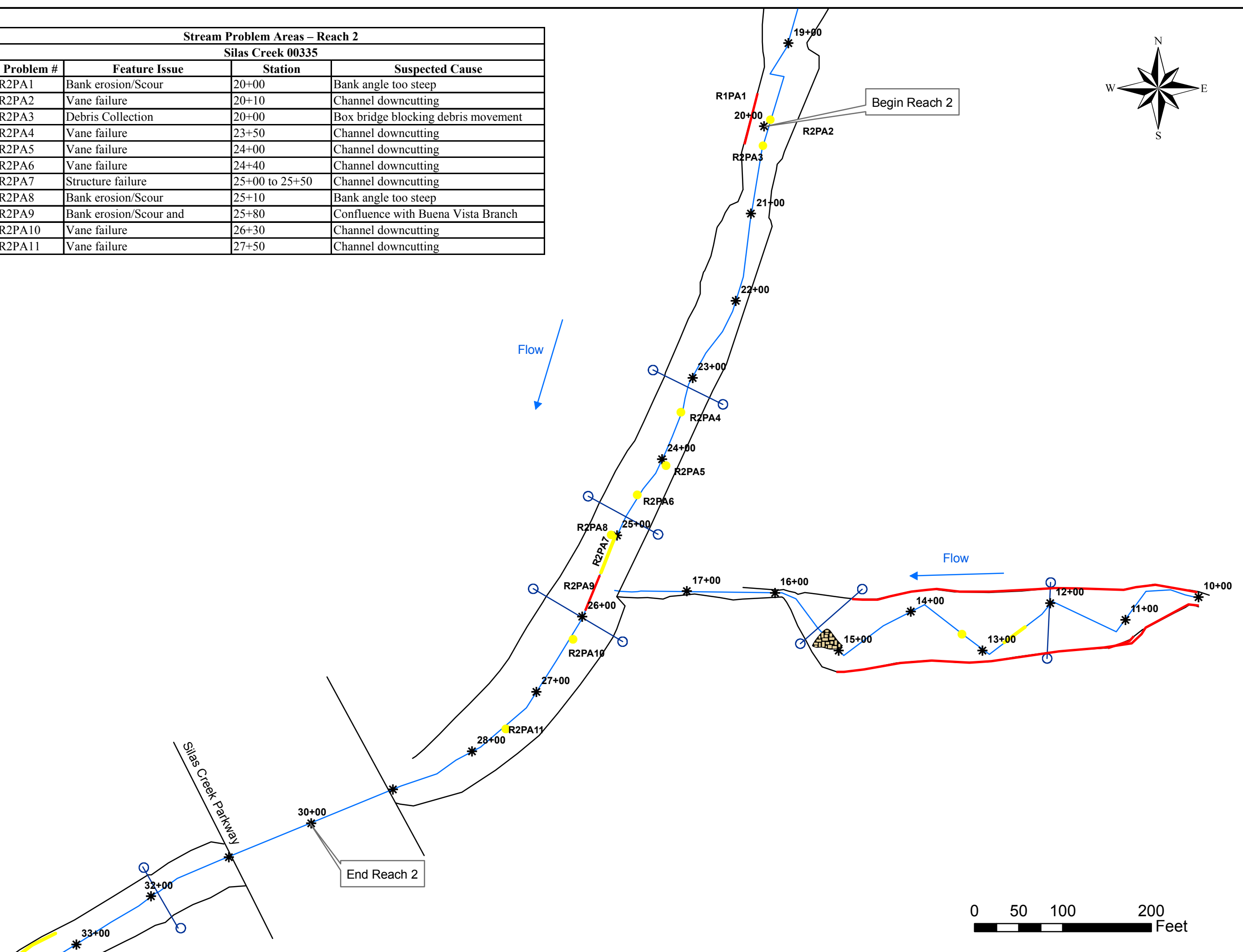
**Monitoring Year:**  
 4 (2007)

**Project Number:**  
 00335

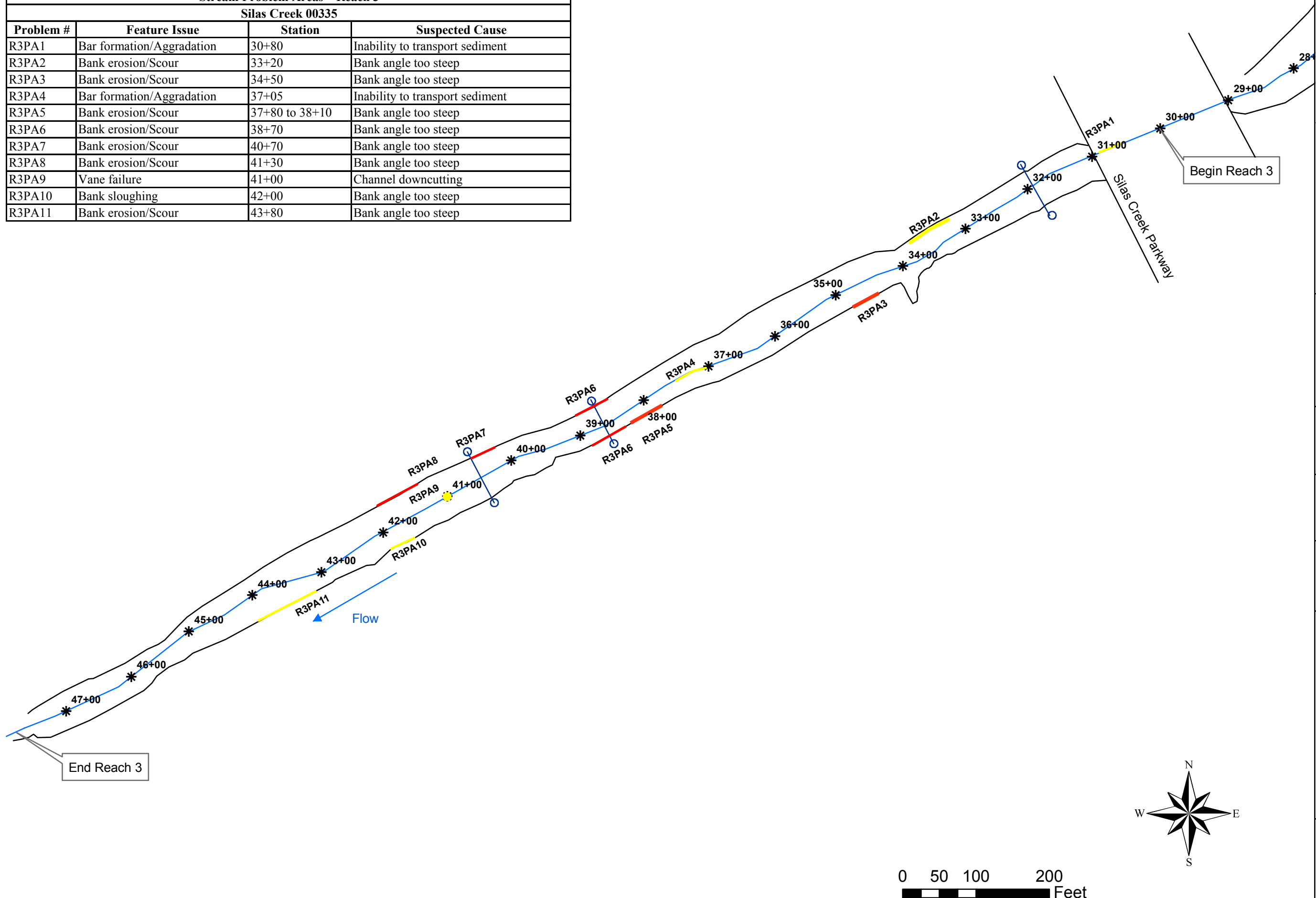
**Date:**  
 February 2008

- Legend**
-  Beaver Dam
  -  Problem Area Concern
  -  Problem Area Concern
  -  2007 Problem Area Concern
  -  Problem Area High Concern
  -  Cross Section
  -  As-Built Streambank
  -  Stations
  -  As-Built Thalweg

**Reach 2 Stream  
 Current Condition  
 Plan View**



Stream Problem Areas – Reach 3			
Silas Creek 00335			
Problem #	Feature Issue	Station	Suspected Cause
R3PA1	Bar formation/Aggradation	30+80	Inability to transport sediment
R3PA2	Bank erosion/Scour	33+20	Bank angle too steep
R3PA3	Bank erosion/Scour	34+50	Bank angle too steep
R3PA4	Bar formation/Aggradation	37+05	Inability to transport sediment
R3PA5	Bank erosion/Scour	37+80 to 38+10	Bank angle too steep
R3PA6	Bank erosion/Scour	38+70	Bank angle too steep
R3PA7	Bank erosion/Scour	40+70	Bank angle too steep
R3PA8	Bank erosion/Scour	41+30	Bank angle too steep
R3PA9	Vane failure	41+00	Channel downcutting
R3PA10	Bank sloughing	42+00	Bank angle too steep
R3PA11	Bank erosion/Scour	43+80	Bank angle too steep



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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program



**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

**Monitoring Year:**  
 4 (2007)

**Project Number:**  
 00335

**Date:**  
 February 2008

- Legend**
- Problem Area Concern
  - ▬ 2006 Problem Area Concern
  - ▬ Problem Area High Concern
  - 2007 Problem Area Concern
  - ▬ 2007 Problem Area High Concern
  - ▬ Problem Area Concern
  - ▬ Cross Section
  - ▬ As-Built Streambank
  - \* Stations
  - ▬ As-Built Thalweg

**Reach 3 Stream  
 Current Condition  
 Plan View**

**Prepared By:**  
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**Prepared For:**  
 NC Ecosystem  
 Enhancement Program











**Project:**  
 Silas Creek  
 Stream Restoration  
 Forsyth County, NC

**Monitoring Year:**  
 4 (2007)

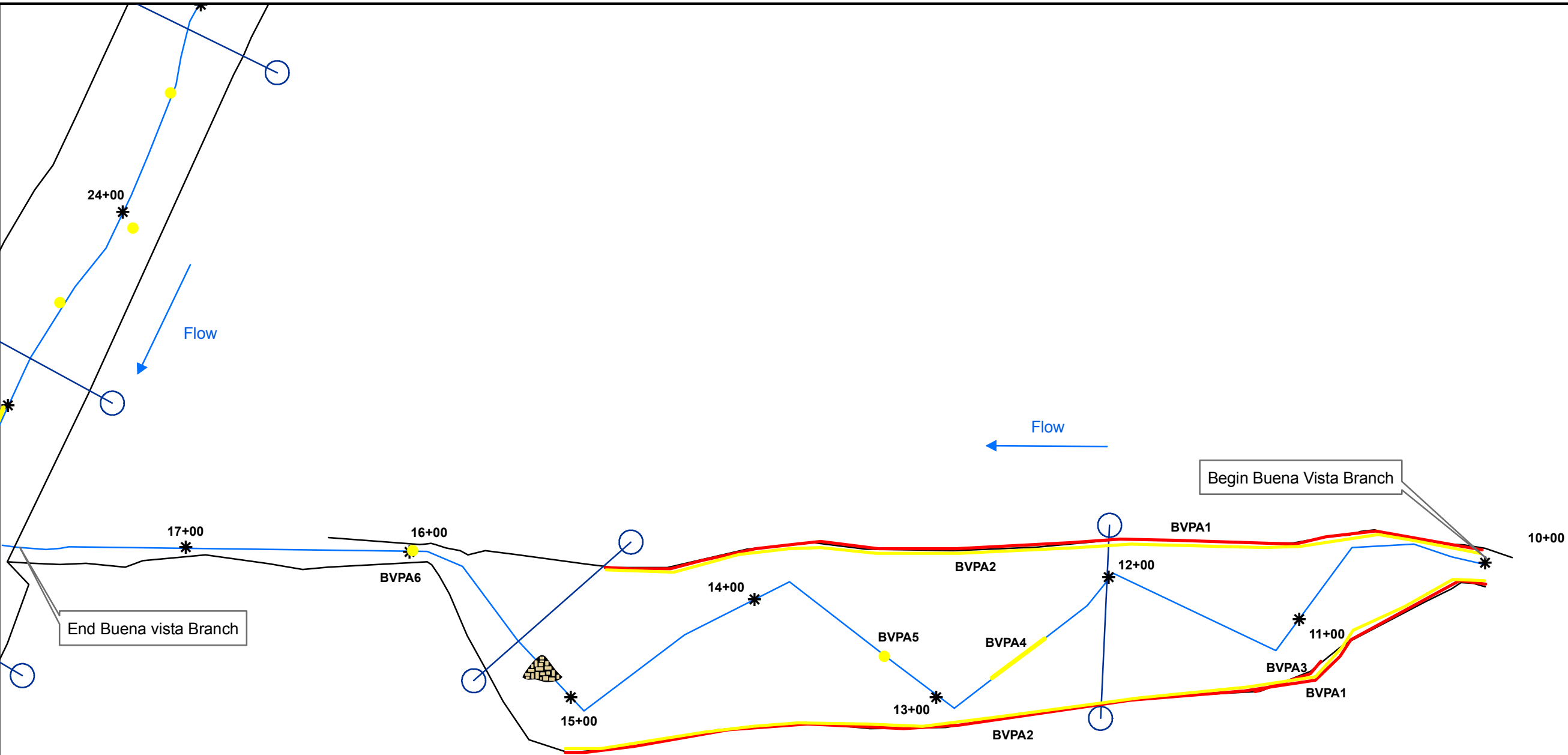
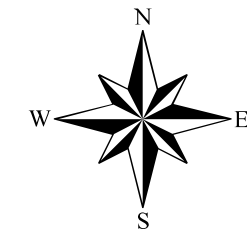
**Project Number:**  
 00335

**Date:**  
 February 2008

**Legend**

-  Beaver Dam
-  Problem Area Concern
-  Problem Area Concern
-  Problem Area High Concern
-  Cross Section
-  As-Built Streambank
-  Stations
-  As-Built Thalweg

Stream Problem Areas – Buena Vista Branch			
Silas Creek 00335			
Problem #	Feature Issue	Station	Suspected Cause
BVPA1	Channel widening, deepening,	10+00 to 15+00	Beaver presence
BVPA2	Sedimentation on banks	10+00 to 15+00	Beaver dam downstream
BVPA3	Bank erosion	11+10	Improper design and/or construction
BVPA4	Bank erosion	12+50	Bank angle too steep
BVPA5	Bar formation/Aggradation	13+30	Inability to transport sediment
BVPA6	Bar formation/Aggradation	16+00	Inability to transport sediment



**Buena Vista  
 Branch Stream  
 Current Condition  
 Plan View**



APPENDIX B-II. STREAM PROBLEM AREAS DATA TABLES

<b>Table B1a. Stream Problem Areas – Reach 1</b>			
<b>Silas Creek</b>			
<b>EEP Project Number 00335</b>			
<b>Feature Issue</b>	<b>Station</b>	<b>Suspected Cause</b>	<b>Photo #</b>
Vane failure	10+00	Improper design and/or construction	R1PA1
Bar formation/Aggradation	10+70	Inability to transport sediment	R1PA2
Vane failure/erosion	14+10	Improper design and/or construction	R1PA3
Bar formation/Aggradation	14+10	Inability to transport sediment	R1PA4
Vane failure	16+80	Improper design and/or construction	R1PA5

<b>Table B1b. Stream Problem Areas – Reach 2</b>			
<b>Silas Creek</b>			
<b>EEP Project Number 00335</b>			
<b>Feature Issue</b>	<b>Station</b>	<b>Suspected Cause</b>	<b>Photo #</b>
Bank erosion/scour	20+00	Bank angle too steep	R2PA1
Vane failure	20+10	Channel downcutting	R2PA2
Debris collection	20+00	Box bridge blocking debris movement	R2PA3
Vane failure	23+50	Channel downcutting	R2PA4
Vane failure	24+00	Channel downcutting	R2PA5
Vane failure	24+40	Channel downcutting	R2PA6
Structure failure	25+00 to 25+50	Channel downcutting	R2PA7
Bank erosion/scour	25+10	Bank angle too steep	R2PA8
Bank erosion/scour, turbidity	25+80	Confluence with Buena Vista Branch	R2PA9
Vane failure	26+30	Channel downcutting	R2PA10
Vane failure	27+50	Channel downcutting	R2PA11

<b>Table B1c. Stream Problem Areas – Reach 3</b>			
<b>Silas Creek</b>			
<b>EEP Project Number 00335</b>			
<b>Feature Issue</b>	<b>Station</b>	<b>Suspected Cause</b>	<b>Photo #</b>
Bar formation/Aggradation	30+80	Inability to transport sediment	R3PA1
Bank erosion/Scour	33+20	Bank angle too steep	R3PA2
Bank erosion/Scour	34+50	Bank angle too steep	R3PA3
Bar formation/Aggradation	37+05	Inability to transport sediment	R3PA4
Bank erosion/Scour	37+80 to 38+10	Bank angle too steep	R3PA5
Bank erosion/scour	38+70	Bank angle too steep	R3PA6
Bank erosion/scour	40+70	Bank angle too steep	R3PA7
Bank erosion/scour	41+30	Bank angle too steep	R3PA8
Vane failure	41+00	Channel downcutting	R3PA9
Bank sloughing	42+00	Bank angle too steep	R3PA10
Bank erosion/scour	43+80	Bank angle too steep	R3PA11

<b>Table B1d. Stream Problem Areas – Buena Vista Branch Silas Creek EEP Project Number 00335</b>			
<b>Feature Issue</b>	<b>Station</b>	<b>Suspected Cause</b>	<b>Photo #</b>
Channel widening, deepening, beaver slides	10+00 to 15+00	Beaver presence (dam presence)	BVPA1
Sedimentation on banks	10+00 to 15+00	Beaver dam downstream	BVPA2
Bank erosion	11+10	Improper design and/or construction	BVPA3
Bank erosion	12+50	Bank angle too steep	BVPA4
Bar formation/Aggradation	13+30	Inability to transport sediment	BVPA5
Bar formation/Aggradation	16+00	Inability to transport sediment	BVPA6

APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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REACH 1



R1PA1



R2PA2



R1PA3



R1PA4



R1PA5

APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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REACH 2



R2PA1



R2PA2



R2PA3



R2PA4



R2PA5



R2PA6

APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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R2PA7



R2PA8



R2PA9



R2PA9



R2PA10



R2PA11

APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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REACH 3



R3PA1



R3PA2



R3PA3



R3PA4



R3PA5



R3PA6

APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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R3PA7



R3PA8



R3PA9



R3PA10



R3PA11

APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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BUENA VISTA BRANCH



BVPA1



BVPA1



BVPA1



BVPA1



BVPA2



BVPA3



APPENDIX B-III. REPRESENTATIVE STREAM CURRENT CONDITION PHOTOS

Photos taken 8/7/07 and 8/8/07

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BVPA4



BVPA5



BVPA6

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos taken 8/7/07 and 8/8/07

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REACH 1



PS1



PS2



PS3



PS4



PS5



PS6

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos taken 8/7/07 and 8/8/07

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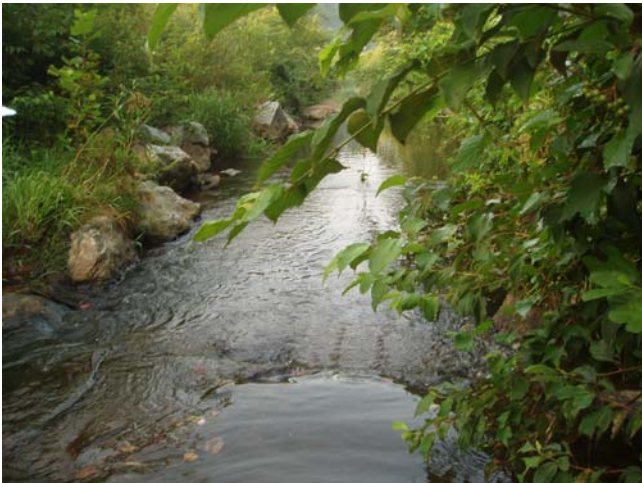
REACH 2



PS7



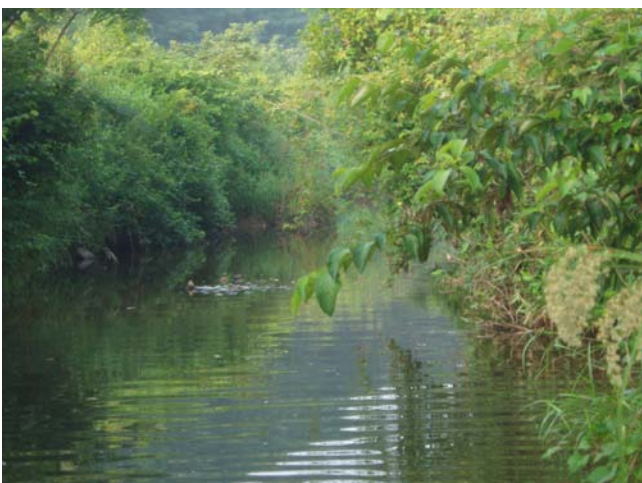
PS8



PS9



PS10



PS11



PS12

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos taken 8/7/07 and 8/8/07

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PS13



PS14



PS15

REACH 3



PS16



PS17

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos taken 8/7/07 and 8/8/07

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PS18



PS19



PS20



PS21



PS22



PS23

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos taken 8/7/07 and 8/8/07

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PS24



PS25



PS26



PS27



PS28

APPENDIX B-IV. STREAM PHOTO STATION PHOTOS

Photos taken 8/7/07 and 8/8/07

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BUENA VISTA BRANCH



PS29



PS30



PS31



PS32



PS33



PS34

APPENDIX B-V. VISUAL MORPHOLOGICAL STABILITY ASSESSMENT

**Table B2a. Visual Morphological Stability Assessment – Silas Creek Reaches 1, 2, and 3**  
**Silas Creek**  
**EEP Project Number 00335**

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
<b>A. Riffles</b>	Present?	13	14	1	93	
	Armor stable (no displacement)?	9	14	5	64	
	Facet grade appears stable?	9	14	5	64	
	Minimal evidence of embedding/fining?	10	14	4	71	
	Length appropriate?	8	14	6	57	
						<b>70</b>
<b>B. Pools*</b>	Present (not subject to severe aggrad. or migration)?	37	31	0	100	
	Sufficiently deep (max pool D:mean Bkf >1.6)	35	31	0	100	
	Length appropriate?	33	31	0	100	
						<b>100</b>
<b>C. Thalweg</b>	Upstream of meander bend (run/inflection) centering?	28	31	3	90	
	Downstream of meander (glide/inflection) centering?	28	31	3	90	
						<b>90</b>
<b>D. Meanders</b>	Outer bend in state of limited/controlled erosion?	31	31	0	100	
	Of those eroding, # w/concomitant point bar formation?	31	31	0	100	
	Apparent Rc within spec?	31	31	0	100	
	Sufficient floodplain access and relief?	31	31	0	100	
						<b>100</b>
<b>E. Bed General</b>	General channel bed aggradation areas (bar formation)	3678	3808	2/130 feet	97	
	Channel bed degradation—areas of increasing downcutting/headcutting?	3508	3808	300 feet	92	
						<b>95</b>
<b>F. Bank</b>	Actively eroding, wasting, or slumping bank	NA	3427	381/3808 feet	90	
						<b>90</b>
<b>G. Vanes</b>	Free of back or arm scour?	21	42	21	50	
	Height appropriate?	27	42	15	64	
	Angle and geometry appear appropriate?	29	42	13	69	
	Free of piping or other structural failures?	26	42	16	62	
						<b>61</b>
<b>H. Wads/ Boulders</b>	Free of scour?	All	Unknown	0	100	
	Footing stable?	All	Unknown	0	100	
						<b>100</b>

\* 31 pools were reported in the As-built report. Thirty-seven were observed during 2006 monitoring



APPENDIX B-V. VISUAL MORPHOLOGICAL STABILITY ASSESSMENT

<b>Table B2b. Visual Morphological Stability Assessment – Buena Vista Branch</b> <b>Silas Creek</b> <b>EEP Project Number 00335</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
<b>A. Riffles</b>	Present?	4	14	10	29	
	Armor stable (no displacement)?	3	14	11	21	
	Facet grade appears stable?	4	14	10	29	
	Minimal evidence of embedding/fining?	4	14	10	29	
	Length appropriate?	4	14	10	29	
						<b>27</b>
<b>B. Pools</b>	Present (not subject to severe aggrad. or migration)?	4	14	10	29	
	Sufficiently deep (max pool D:mean Bkf >1.6)	4	14	10	29	
	Length appropriate?	4	14	10	29	
						<b>29</b>
<b>C. Thalweg</b>	Upstream of meander bend (run/inflection) centering?	4	14	10	29	
	Downstream of meander (glide/inflection) centering?	4	14	10	29	
						<b>29</b>
<b>D. Meanders</b>	Outer bend in state of limited/controlled erosion?	7	7	0	100	
	Of those eroding, # w/concomitant point bar formation?	7	7	0	100	
	Apparent Rc within spec?	7	7	0	100	
	Sufficient floodplain access and relief?	7	7	0	100	
						<b>100</b>
<b>E. Bed General</b>	General channel bed aggradation areas (bar formation)	662	782	4/120	85	
	Channel bed degradation—areas of increasing downcutting/headcutting?	782	782	0	100	
						<b>93</b>
<b>F. Bank</b>	Actively eroding, wasting, or slumping bank	NA	782	10/782 feet	99	
						<b>99</b>
<b>G. Vanes</b>	Free of back or arm scour?	3	12	9	25	
	Height appropriate?	7	12	5	58	
	Angle and geometry appear appropriate?	7	12	5	58	
	Free of piping or other structural failures?	3	12	9	25	
						<b>42</b>
<b>H. Wads/ Boulders</b>	Free of scour?	All	Unknown	0	100	
	Footing stable?	All	Unknown	0	100	
						<b>100</b>

**SILAS CREEK**

**REACH ONE**

Photos taken 8/7/07

APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS  
Photos taken 8/7/07

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XS1 facing right bank



XS1 facing left bank



XS2 facing right bank



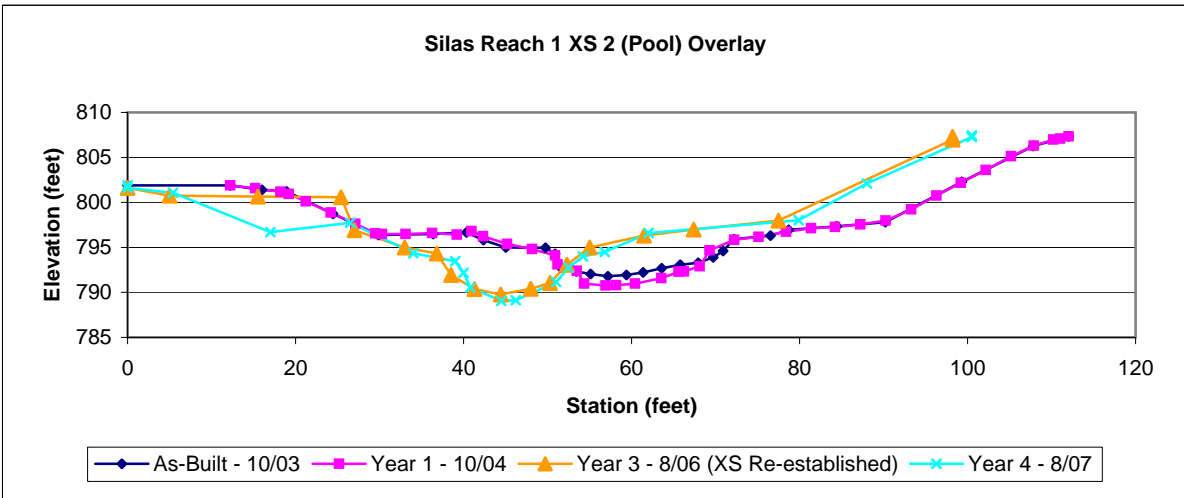
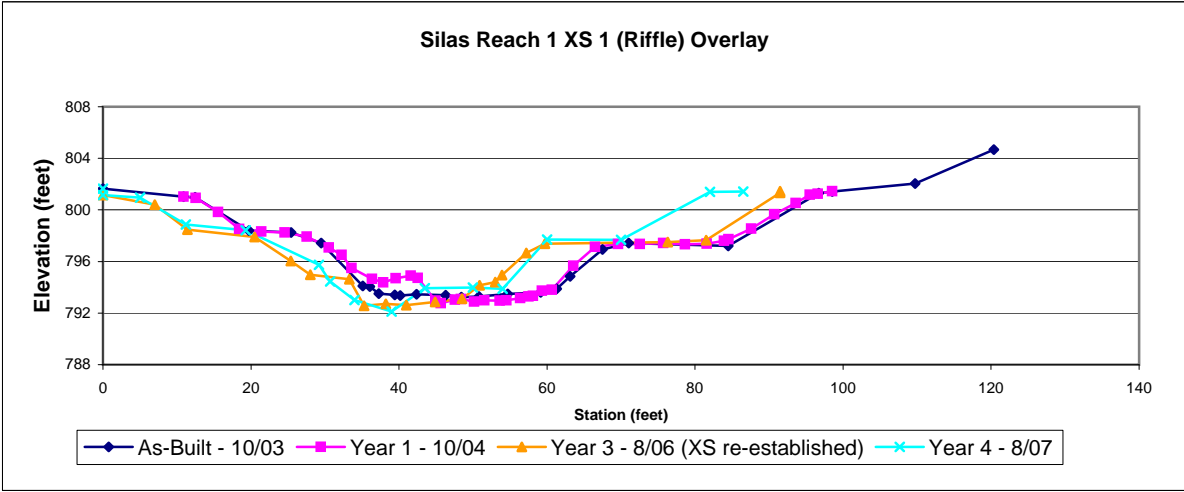
XS2 facing left bank



XS3 facing right bank



XS3 facing left bank



**SILAS CREEK**

**REACH TWO**

Photos taken 8/8/07

APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS  
Photos taken 8/8/07

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XS4 facing right bank



XS4 facing left bank



XS5 facing right bank



XS5 facing left bank

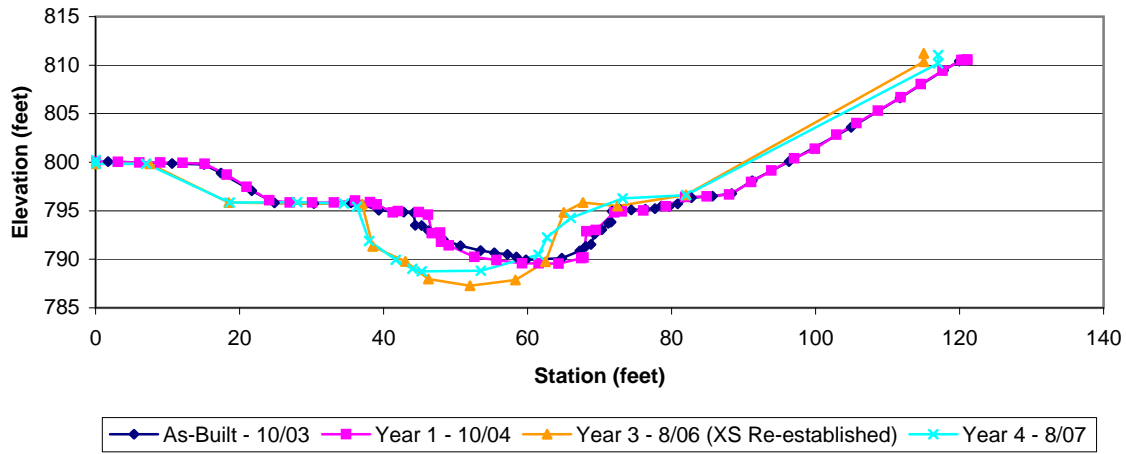


XS6 facing right bank

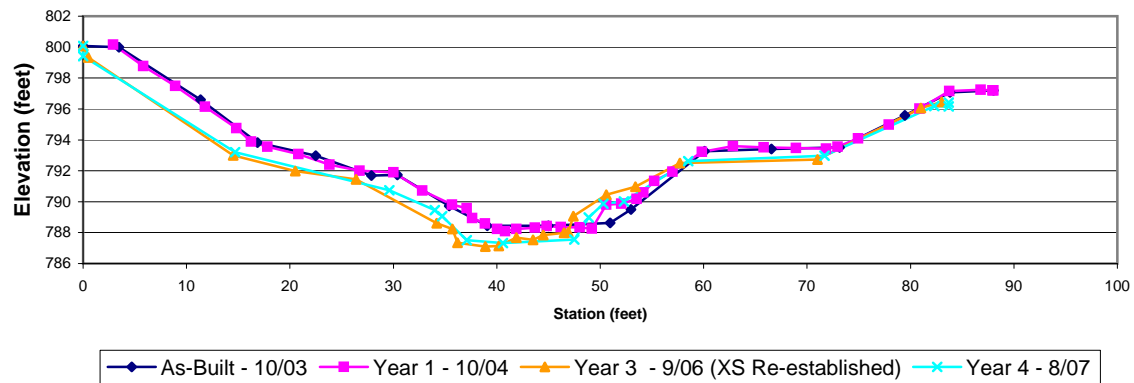


XS6 facing left bank

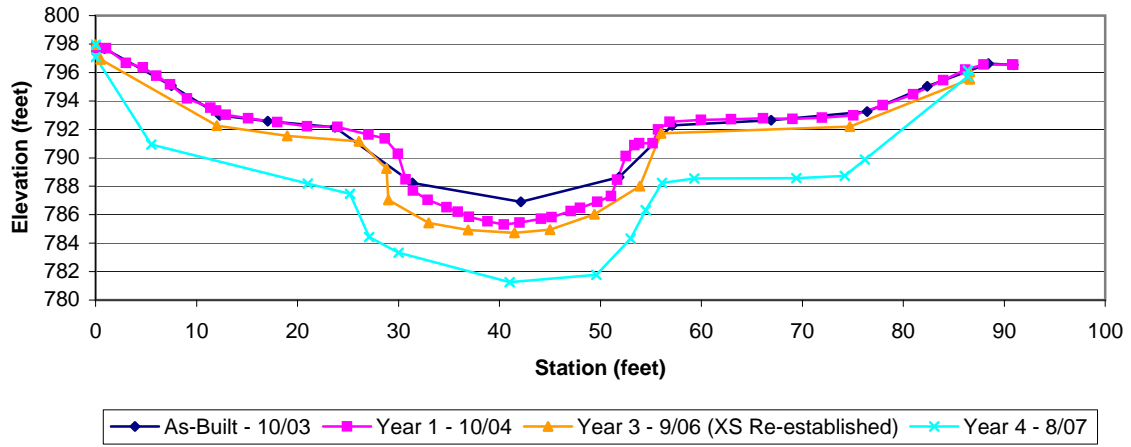
Silas Reach 2 XS 3 (Pool) Overlay



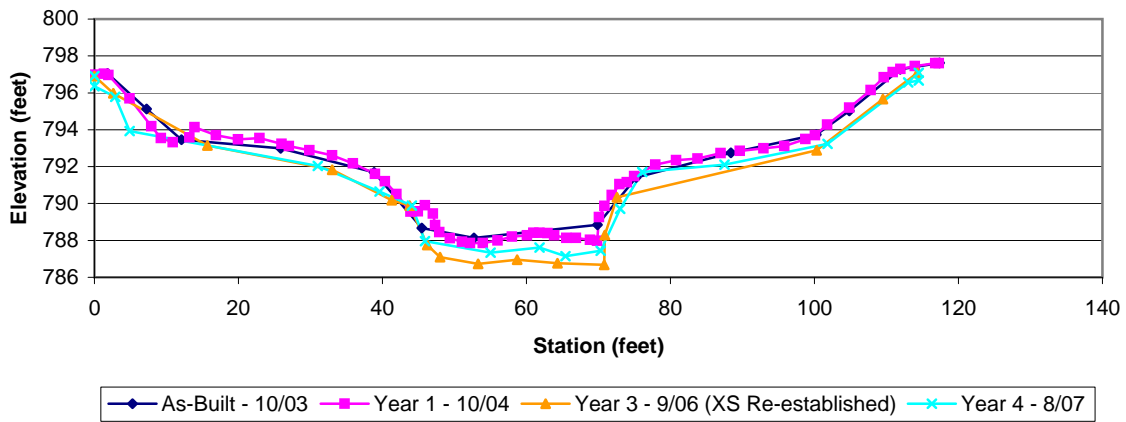
Silas Reach 2 XS 4 (Riffle) Overlay



Silas Reach 2 XS 5 (Pool) Overlay



Silas Reach 2 XS 6 [Run (formerly Pool)] Overlay





**SILAS CREEK**

**REACH THREE**

Photos taken 8/8/07

APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS  
Photos taken 8/8/07

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XS7 facing right bank



XS7 facing left bank



XS8 facing right bank



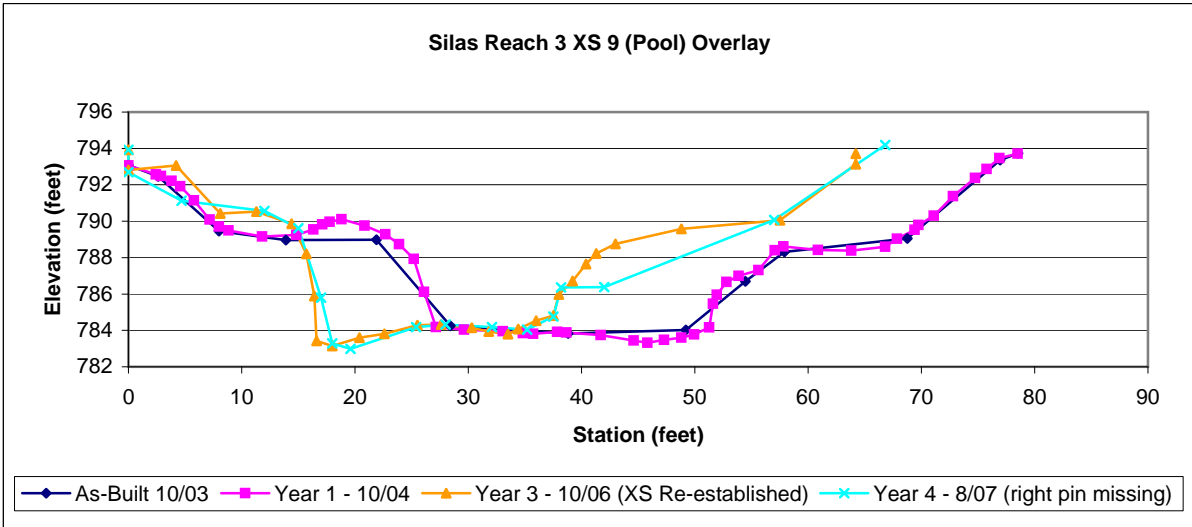
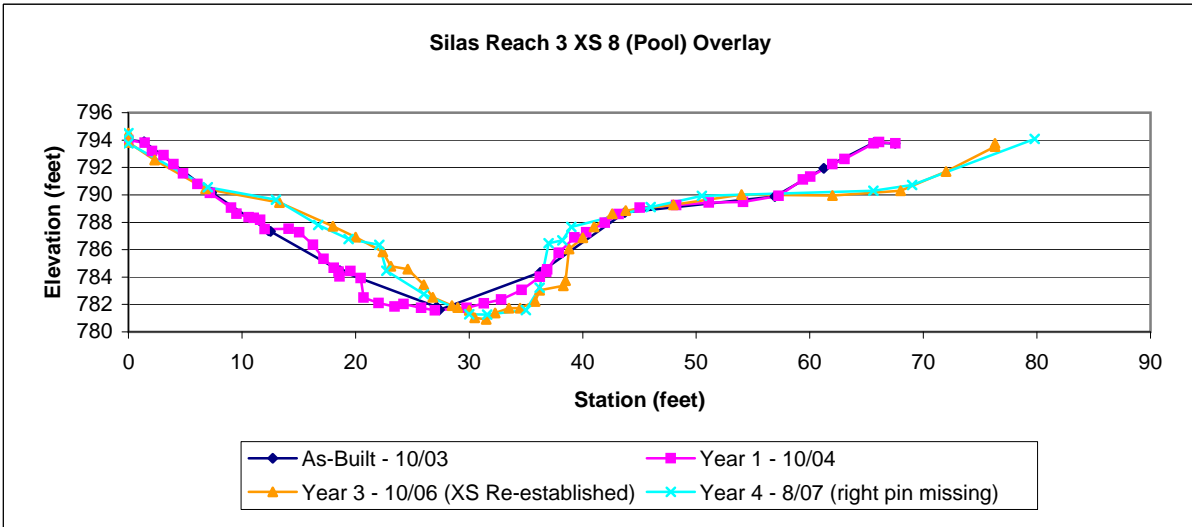
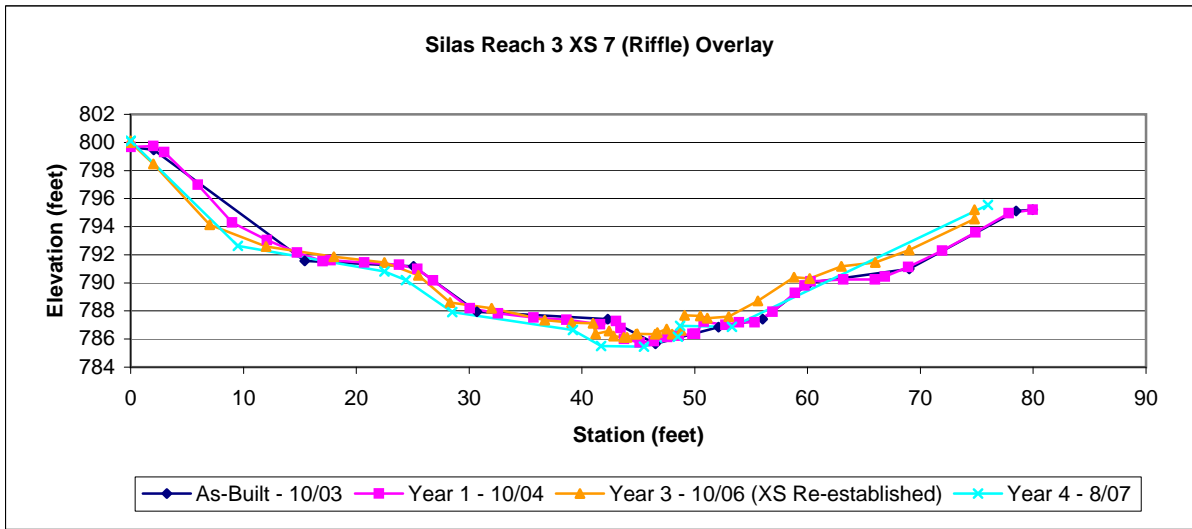
XS8 facing left bank



XS9 facing right bank



XS9 facing left bank



**BUENA VISTA BRANCH**

Photos taken 8/7/07

APPENDIX B-VI. CROSS SECTION PHOTOS AND ANNUAL OVERLAYS OF PLOTS

Photos taken 8/7/07

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XS1 facing right bank



XS1 facing left bank

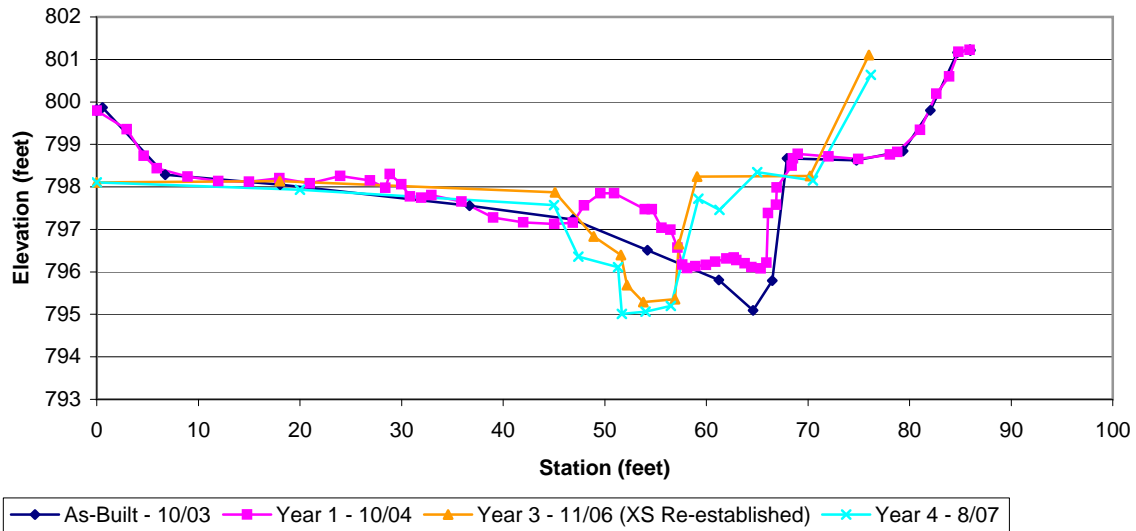


XS2 facing right bank

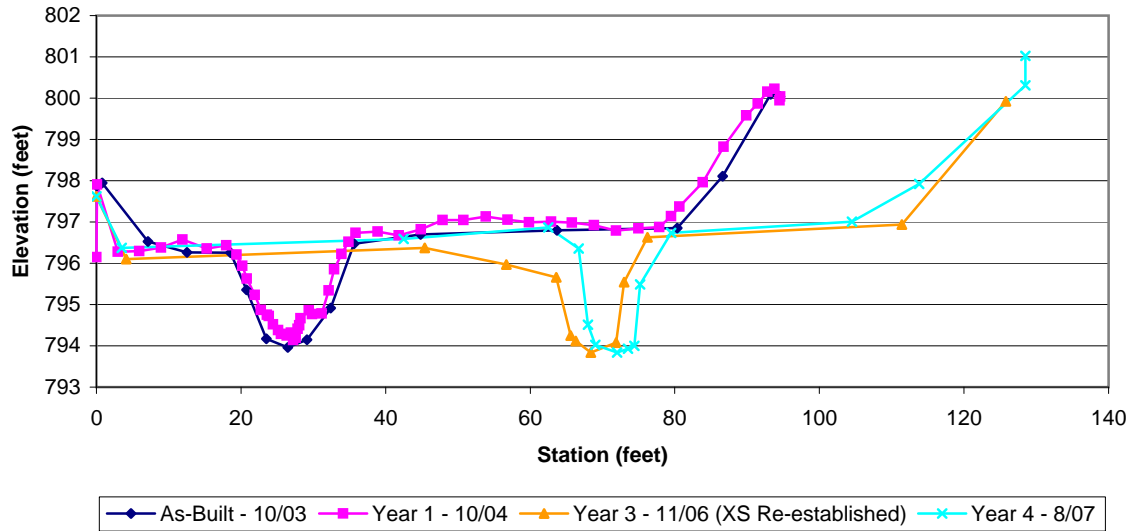


XS2 facing left bank

**Buena Vista XS 1 (Pool) Overlay**



**Buena Vista XS 2 (Riffle) Overlay**



**SILAS CREEK**  
**REACH ONE**

**2) Weighted Pebble Count**

**Feature Percent of Reach**

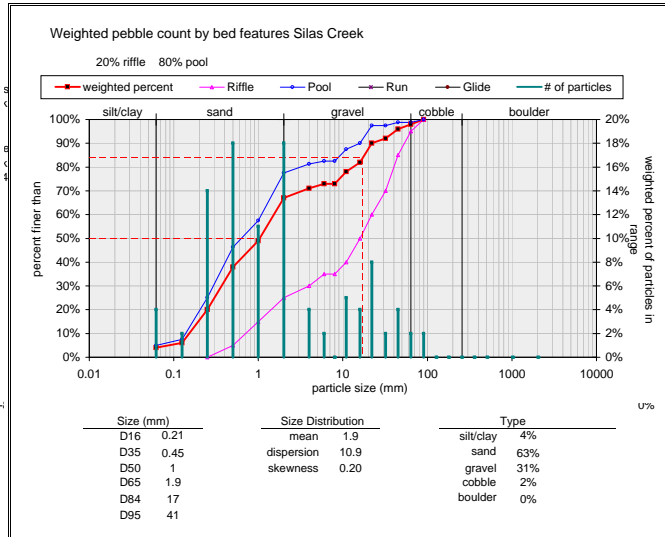
Riffle  % Run  %  
 Pool  % Glide  %

Riffle, Pool, Run, Glide

**Weighted pebble count by bed features**

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	4.0
very fine sand	0.062 - 0.125	2.0
fine sand	0.125 - 0.25	14.0
medium sand	0.25 - 0.5	18.0
coarse sand	0.5 - 1	11.0
very coarse sand	1 - 2	18.0
very fine gravel	2 - 4	4.0
fine gravel	4 - 6	2.0
medium gravel	6 - 11	5.0
coarse gravel	11 - 16	4.0
very coarse gravel	16 - 22	8.0
small cobble	22 - 32	2.0
medium cobble	32 - 45	4.0
large cobble	45 - 64	2.0
very large cobble	64 - 90	2.0
small boulder	90 - 128	0.0
medium boulder	128 - 180	0.0
large boulder	180 - 256	0.0
very large boulder	256 - 362	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		100.0

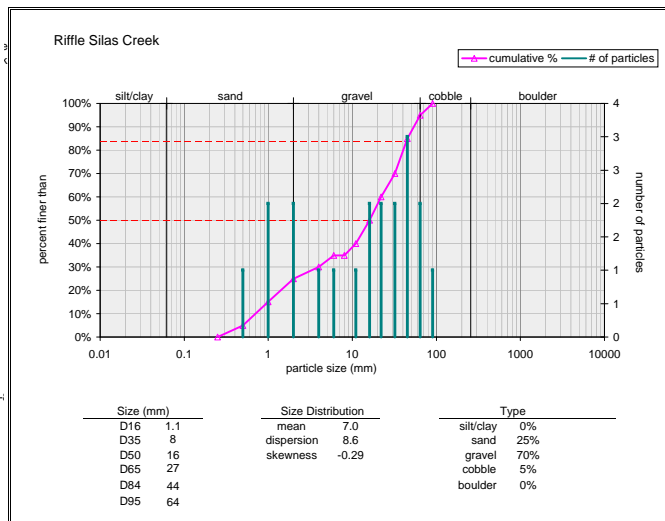
Note: \_\_\_\_\_



**Riffle**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	1
coarse sand	0.5 - 1	2
very coarse sand	1 - 2	2
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
medium gravel	6 - 11	1
coarse gravel	11 - 16	2
very coarse gravel	16 - 22	2
small cobble	22 - 32	2
medium cobble	32 - 45	3
large cobble	45 - 64	2
very large cobble	64 - 90	1
small boulder	90 - 128	
medium boulder	128 - 180	
large boulder	180 - 256	
very large boulder	256 - 362	
total particle count:		20
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		20

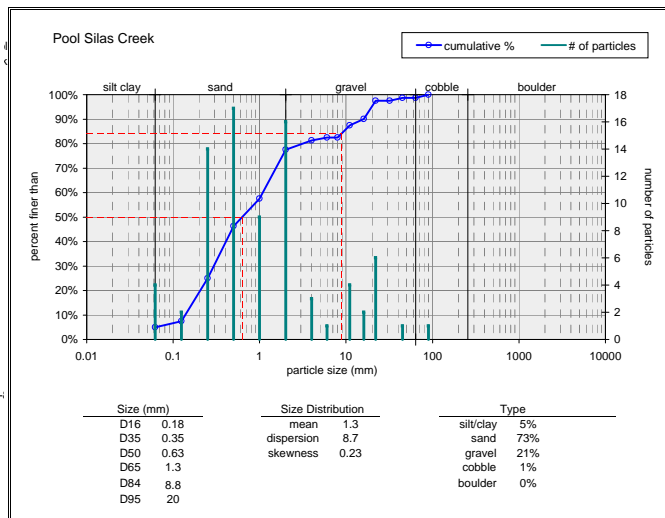
Note: \_\_\_\_\_



**Pool**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	4
very fine sand	0.062 - 0.125	2
fine sand	0.125 - 0.25	14
medium sand	0.25 - 0.5	17
coarse sand	0.5 - 1	9
very coarse sand	1 - 2	16
very fine gravel	2 - 4	3
fine gravel	4 - 6	1
medium gravel	6 - 11	4
coarse gravel	11 - 16	2
very coarse gravel	16 - 22	6
small cobble	22 - 32	1
medium cobble	32 - 45	1
large cobble	45 - 64	1
very large cobble	64 - 90	1
small boulder	90 - 128	
medium boulder	128 - 180	
large boulder	180 - 256	
very large boulder	256 - 362	
total particle count:		80
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		80

Note: \_\_\_\_\_





**SILAS CREEK**  
**REACH TWO**

**2) Weighted Pebble Count**

**Feature Percent of Reach**

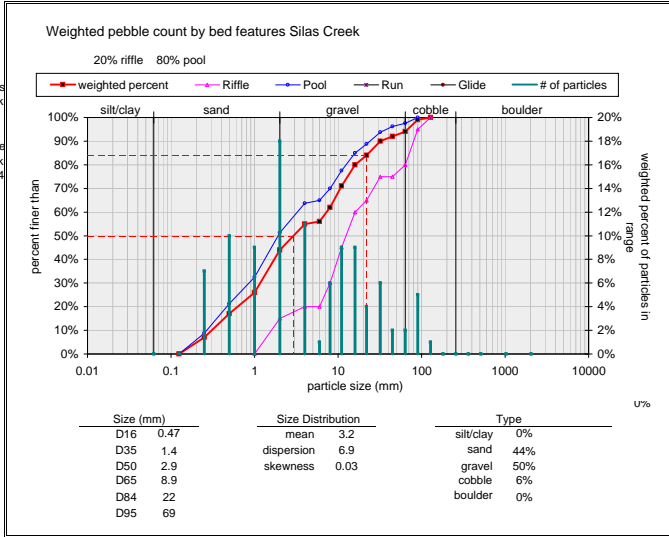
Riffle  % Run  %  
 Pool  % Glide  %

Riffle, Pool, Run, Glide

**Weighted pebble count by bed features**

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	0.0
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	7.0
medium sand	0.25 - 0.5	10.0
coarse sand	0.5 - 1	9.0
very coarse sand	1 - 2	18.0
very fine gravel	2 - 4	11.0
fine gravel	4 - 6	1.0
fine gravel	6 - 8	6.0
medium gravel	8 - 11	9.0
medium gravel	11 - 16	9.0
coarse gravel	16 - 22	4.0
coarse gravel	22 - 32	6.0
very coarse gravel	32 - 45	2.0
very coarse gravel	45 - 64	2.0
small cobble	64 - 90	5.0
medium cobble	90 - 128	1.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
<b>total particle weighted count:</b>		<b>100</b>
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
<b>total weighted count:</b>		<b>100.0</b>

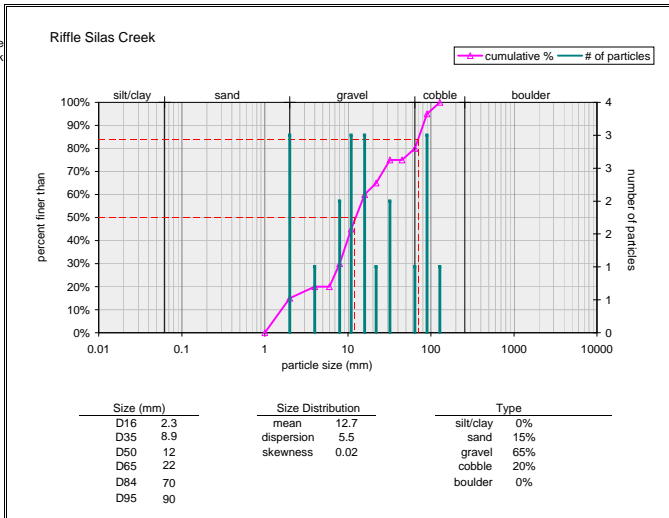
Note:



**Riffle**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	
very coarse sand	1 - 2	3
very fine gravel	2 - 4	1
fine gravel	4 - 6	
fine gravel	6 - 8	2
medium gravel	8 - 11	3
medium gravel	11 - 16	3
coarse gravel	16 - 22	1
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	
very coarse gravel	45 - 64	1
small cobble	64 - 90	3
medium cobble	90 - 128	1
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
<b>total particle count:</b>		<b>20</b>
bedrock		
clay hardpan		
detritus/wood		
artificial		
<b>total count:</b>		<b>20</b>

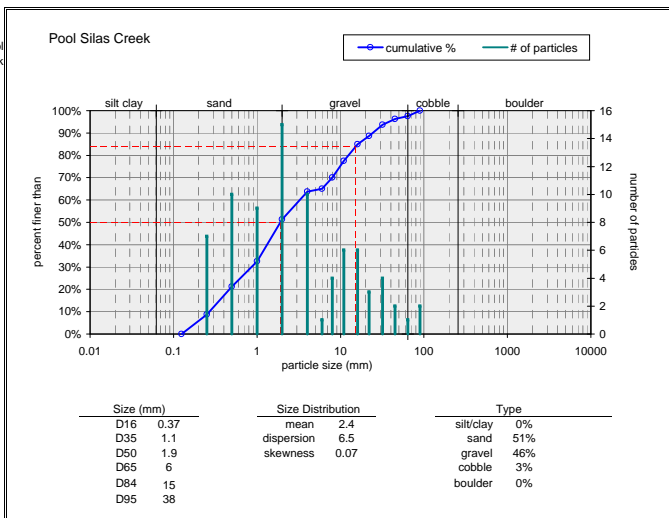
Note:



**Pool**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	7
medium sand	0.25 - 0.5	10
coarse sand	0.5 - 1	9
very coarse sand	1 - 2	15
very fine gravel	2 - 4	10
fine gravel	4 - 6	1
fine gravel	6 - 8	4
medium gravel	8 - 11	6
medium gravel	11 - 16	6
coarse gravel	16 - 22	3
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	1
small cobble	64 - 90	2
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
<b>total particle count:</b>		<b>80</b>
bedrock		
clay hardpan		
detritus/wood		
artificial		
<b>total count:</b>		<b>80</b>

Note:



**SILAS CREEK**  
**REACH THREE**

**2) Weighted Pebble Count**

**Feature Percent of Reach**

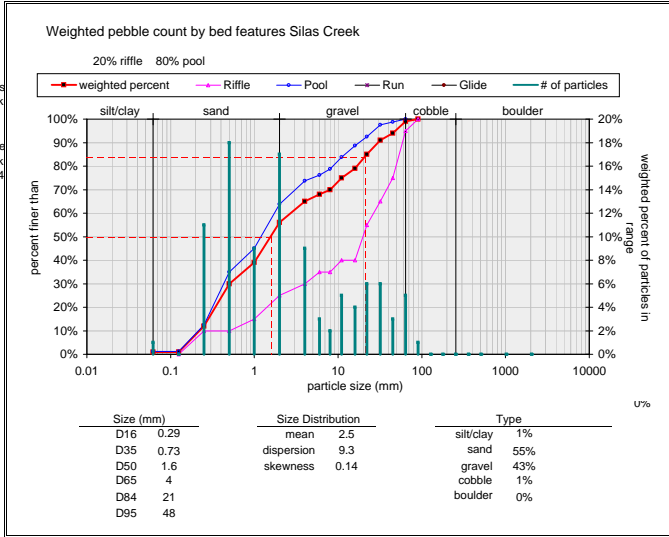
Riffle  % Run  %  
 Pool  % Glide  %

Riffle, Pool, Run, Glide

**Weighted pebble count by bed features**

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	1.0
very fine sand	0.062 - 0.125	0.0
fine sand	0.125 - 0.25	11.0
medium sand	0.25 - 0.5	18.0
coarse sand	0.5 - 1	9.0
very coarse sand	1 - 2	17.0
very fine gravel	2 - 4	9.0
fine gravel	4 - 6	3.0
fine gravel	6 - 8	2.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	4.0
coarse gravel	16 - 22	6.0
coarse gravel	22 - 32	6.0
very coarse gravel	32 - 45	3.0
very coarse gravel	45 - 64	5.0
small cobble	64 - 90	1.0
medium cobble	90 - 128	0.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
total particle weighted count:		100
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
total weighted count:		100.0

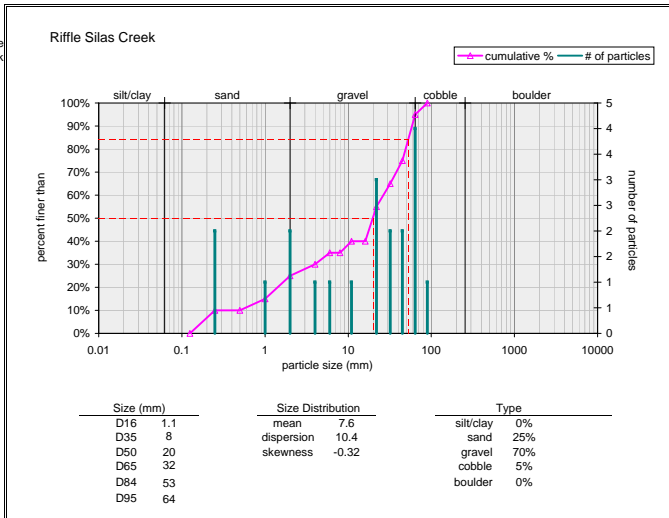
Note: \_\_\_\_\_



**Riffle**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	2
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	2
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
fine gravel	6 - 8	
medium gravel	8 - 11	1
medium gravel	11 - 16	
coarse gravel	16 - 22	3
coarse gravel	22 - 32	2
very coarse gravel	32 - 45	2
very coarse gravel	45 - 64	4
small cobble	64 - 90	1
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		20
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		20

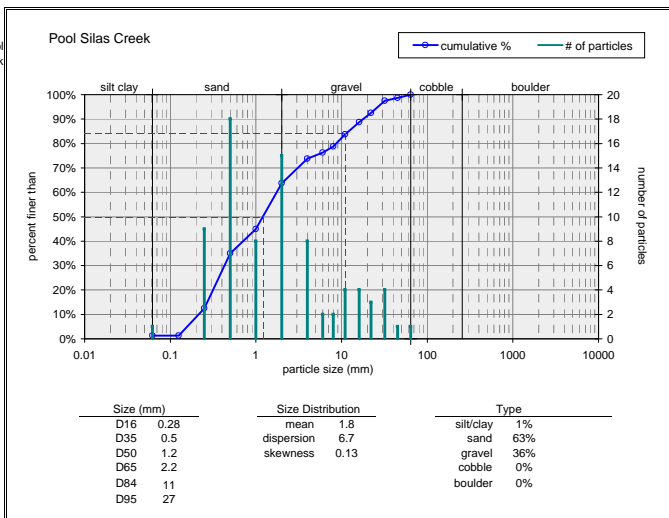
Note: \_\_\_\_\_



**Pool**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	1
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	9
medium sand	0.25 - 0.5	18
coarse sand	0.5 - 1	8
very coarse sand	1 - 2	15
very fine gravel	2 - 4	8
fine gravel	4 - 6	2
fine gravel	6 - 8	2
medium gravel	8 - 11	4
medium gravel	11 - 16	4
coarse gravel	16 - 22	3
coarse gravel	22 - 32	4
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	1
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		80
bedrock		
clay hardpan		
detritus/wood		
artificial		
total count:		80

Note: \_\_\_\_\_



**BUENA VISTA BRANCH**

**2) Weighted Pebble Count**

**Feature Percent of Reach**

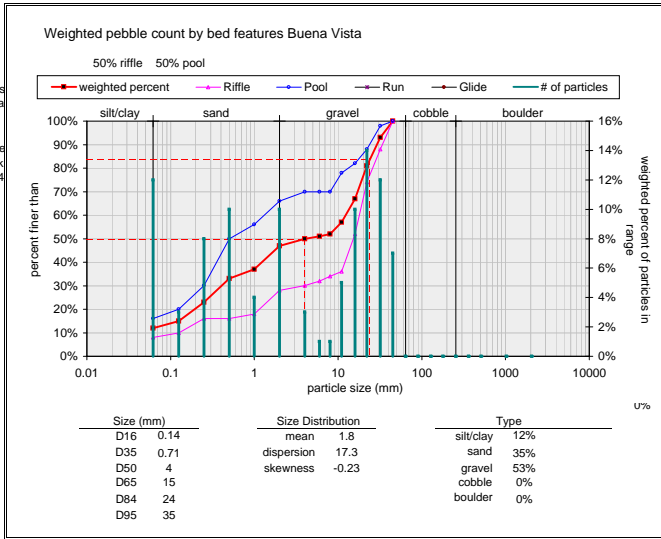
Riffle  % Run  %  
 Pool  % Glide  %

Riffle, Pool, Run, Glide

**Weighted pebble count by bed features**

Material	Size Range (mm)	weighted
silt/clay	0 - 0.062	12.0
very fine sand	0.062 - 0.125	3.0
fine sand	0.125 - 0.25	8.0
medium sand	0.25 - 0.5	10.0
coarse sand	0.5 - 1	4.0
very coarse sand	1 - 2	10.0
very fine gravel	2 - 4	3.0
fine gravel	4 - 6	1.0
fine gravel	6 - 8	1.0
medium gravel	8 - 11	5.0
medium gravel	11 - 16	10.0
coarse gravel	16 - 22	14.0
coarse gravel	22 - 32	12.0
very coarse gravel	32 - 45	7.0
very coarse gravel	45 - 64	0.0
small cobble	64 - 90	0.0
medium cobble	90 - 128	0.0
large cobble	128 - 180	0.0
very large cobble	180 - 256	0.0
small boulder	256 - 362	0.0
small boulder	362 - 512	0.0
medium boulder	512 - 1024	0.0
large boulder	1024 - 2048	0.0
very large boulder	2048 - 4096	0.0
<b>total particle weighted count:</b>		<b>100</b>
bedrock		0.0
clay hardpan		0.0
detritus/wood		0.0
artificial		0.0
<b>total weighted count:</b>		<b>100.0</b>

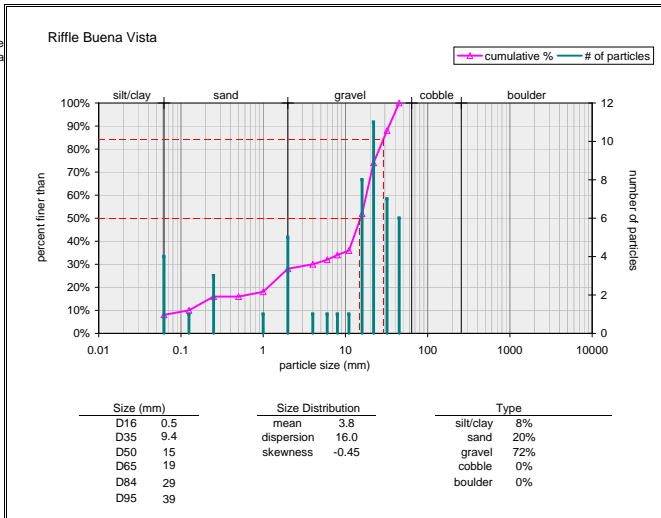
Note:



**Riffle**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	4
very fine sand	0.062 - 0.125	1
fine sand	0.125 - 0.25	3
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	1
very coarse sand	1 - 2	5
very fine gravel	2 - 4	1
fine gravel	4 - 6	1
fine gravel	6 - 8	1
medium gravel	8 - 11	1
medium gravel	11 - 16	8
coarse gravel	16 - 22	11
coarse gravel	22 - 32	7
very coarse gravel	32 - 45	6
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
<b>total particle count:</b>		<b>50</b>
bedrock		
clay hardpan		
detritus/wood		
artificial		
<b>total count:</b>		<b>50</b>

Note:



**Pool**

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	8
very fine sand	0.062 - 0.125	2
fine sand	0.125 - 0.25	5
medium sand	0.25 - 0.5	10
coarse sand	0.5 - 1	3
very coarse sand	1 - 2	5
very fine gravel	2 - 4	2
fine gravel	4 - 6	
fine gravel	6 - 8	
medium gravel	8 - 11	4
medium gravel	11 - 16	2
coarse gravel	16 - 22	3
coarse gravel	22 - 32	5
very coarse gravel	32 - 45	1
very coarse gravel	45 - 64	
small cobble	64 - 90	
medium cobble	90 - 128	
large cobble	128 - 180	
very large cobble	180 - 256	
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
<b>total particle count:</b>		<b>50</b>
bedrock		
clay hardpan		
detritus/wood		
artificial		
<b>total count:</b>		<b>50</b>

Note:

