WELLS CREEK
FINAL MONITORING REPORT
YEAR 4
2008

EEP Project # 414
Alamance County, North Carolina

Submitted to:

NCDENR-EEP
1652 Mail Service Center
Raleigh, NC 27699

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Original Design Firm:

ARCADIS G&M of North Carolina, Inc.
801 Corporate Center Drive, Suite 300
Raleigh, NC 27607

Submitted to:

NCDENR-EEP
1652 Mail Service Center
Raleigh, NC 27699

Monitoring Firm:

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Raleigh, NC 27605
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Project Manager:
Phillip Todd
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Executive Summary

The North Carolina Ecosystem Enhancement Program (EEP) restored two reaches along Wells Creek and an unnamed tributary in 2004. This project is located in Alamance County, NC. The three different reaches flow through pasture areas and wooded sections. Prior to restoration, cattle and horses had unlimited access to the stream channels which created areas of severe bank erosion and loss of vegetation. Since the restoration has been complete, the livestock have been fenced out of the stream with the exception of a few crossings that are used throughout the year to move the cattle from one field to another.

Goals of the Wells Creek stream project included: reducing the bank erosion; reducing nutrient runoff on the site; stabilizing stream channel banks by planting vegetation; and helping the stream reach its equilibrium through the proper design ratios for dimension, pattern, and profile.

This report documents the data collected for Monitoring Year 4. Current monitoring for the site consists of evaluating both stream morphology and riparian vegetation.

All reaches are considered to have remained stable between Monitoring Years 3 and 4. There were some aggradation areas occurring in riffle sections in Reaches 1 and UT. However, it should be clarified that these aggradation areas are not necessarily areas where an actual rise in thalweg elevation was measured, but rather areas where sediment deposition along the sides of the riffles (and in a few cases mid-channel) was observed. In most cases this deposition on the channel margins has formed inner-berm features as the stream is actually heading toward a narrower dimension at these locations. This trend may be correlated with the fact that all riffle pebble counts for both reaches show consistency with Monitoring Year 3 or even a coarsening of the sediment. The stream may be more efficiently transporting fine sediments out of the riffles as the riffles attain a more stable dimension with a narrower low-flow channel as the inner-berm forms. These areas will be observed closely in Monitoring Year 5 and if it appears that no additional deposition has occurred at the thalweg at that time, then they will not be reported as problems. There were three severe cases of bank erosion on Reach 2. One of these areas (Station 15+36 along the right bank) may warrant repair assessment first. The length of this bank erosion section is 60 feet. The majority of the problems found with in-stream structures were based on placement angle and/or position. These areas were listed only if it was found that the angle or placement location of the particular structure was a possible cause for an adjacent problem such as bank erosion (i.e. structure was placed so that it was not adequately protecting bank) or if the structure was forming a feature in the wrong place (e.g., if a structure was forming a pool along a straight riffle section). However, there was a crossvane located at Station 12+75 on Reach 1 that had water piping around the right arm. A j-hook located at Station 14+08 on Reach 2 had significant piping around the right side and minor piping around the left side. In addition, there was a rootwad at Station 18+16 on Reach UT that had some bank failure/undermining around the structure, and two others (Station 19+35 and Station 19+43) where similar bank failure/undermining has started.

The stem densities on Reaches 2 and the UT are well above the Monitoring Year 5 stem density goal (260 stems per acre), except for Vegetation Plot (VP) #4 on Reach UT that had a stem density of 91 stems per acre. Stem densities on Reach 1 were below the Monitoring Year 5 goal (260 stems/acre). Japanese stilt grass was documented in VP #3 and #4, which may have limited seedling survival in those plots. Otherwise, it is unknown why densities are so low in VP #1 through #4. The overall survival rate among all vegetation plots was just over 55% between Monitoring Years 1 and 4 and 76% between Monitoring Years 3 and 4.

The only vegetation-specific problem areas documented in Monitoring Year 4 were associated with invasive species. Invasive species documented at one ore more of the reaches include: *Rosa multiflora, Ligustrum sinense, Ailanthus altissima,* and *Microstegium virmineum* (see Plan Views in Appendix C).

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1.0 PROJECT BACKGROUND

1.1 Project Objectives

The goal of this stream restoration project is to improve the water quality in the Cape Fear River Basin. Wells Creek and its unnamed tributary (UT) at this project site are typical of streams within this and surrounding watersheds. Prior to restoration, the channels exhibited instability and degradation in response to the current and historical land use practices. Nutrient input should decrease with the establishment of a riparian buffer and fencing the cattle out of the streams. In time, the buffer will provide wildlife cover and shade to the stream which will encourage wildlife diversity, both aquatic and terrestrial.

1.2 Project Structure, Restoration Type, and Approach

Reach 1 (the northern-most section) is the longest section of Wells Creek covering approximately 1,246 linear feet. Reach 2 includes 1,140 linear feet and is located south of Reach 1. The Unnamed Tributary (UT) reach is approximately 1,014 linear feet and lies west of Reach 2. Figure 2 shows the relative location of the three reaches.

Priority Level I, II and III restoration were implemented to restore the streams to a more stable condition. Boulder structures were constructed and installed at strategic locations to provide stream bed and bank stability. Root wads were installed to provide bank protection and increase habitat diversity. Table I details the specific restoration components employed on each reach.

Table I. Project Restoration Components
Wells Creek/EEP Project Number 414

Project Segment or Reach ID	Pre-Existing Footage	Type	Approach	As-Built Footage	As-Built Stationing	Monitoring Year 4 Stationing	Comments
Reach 1	*	R & E (I)**	PI, PII, and PIII**	1,193	10+00 – 21+93	10+00 - 20+68	Mix of approaches used according to Initial Monitoring Report
Reach 2	*	R & E (I)**	PI, PII, and PIII**	1,127	10+00 – 21+27	10+00 - 20+40	Mix of approaches used according to Initial Monitoring Report
Unnamed Tributary	*	R & E (I)**	PI, PII, and PIII**	1,083	10+00 - 20+83	10+00 - 20+21	Mix of approaches used according to Initial Monitoring Report

*Restoration plan information unavailable to SEPI.
**Information found in Year 1 monitoring report (ARCADIS) and may be erroneous; SEPI does not have the original Restoration Plan.
P in the Approach column refers to Priority Level.
R refers to 'Restoration'.
E (I) refers to Enhancement Level I.

1.3 Project Location and Setting

This project is near Snow Camp, North Carolina in south-central Alamance County. To reach the site from Raleigh, go west on US 64 to Siler City. From Siler City, go north on Martin Luther King Boulevard. The North Carolina Atlas and Gazetteer (DeLorme 1997) labels Martin Luther King

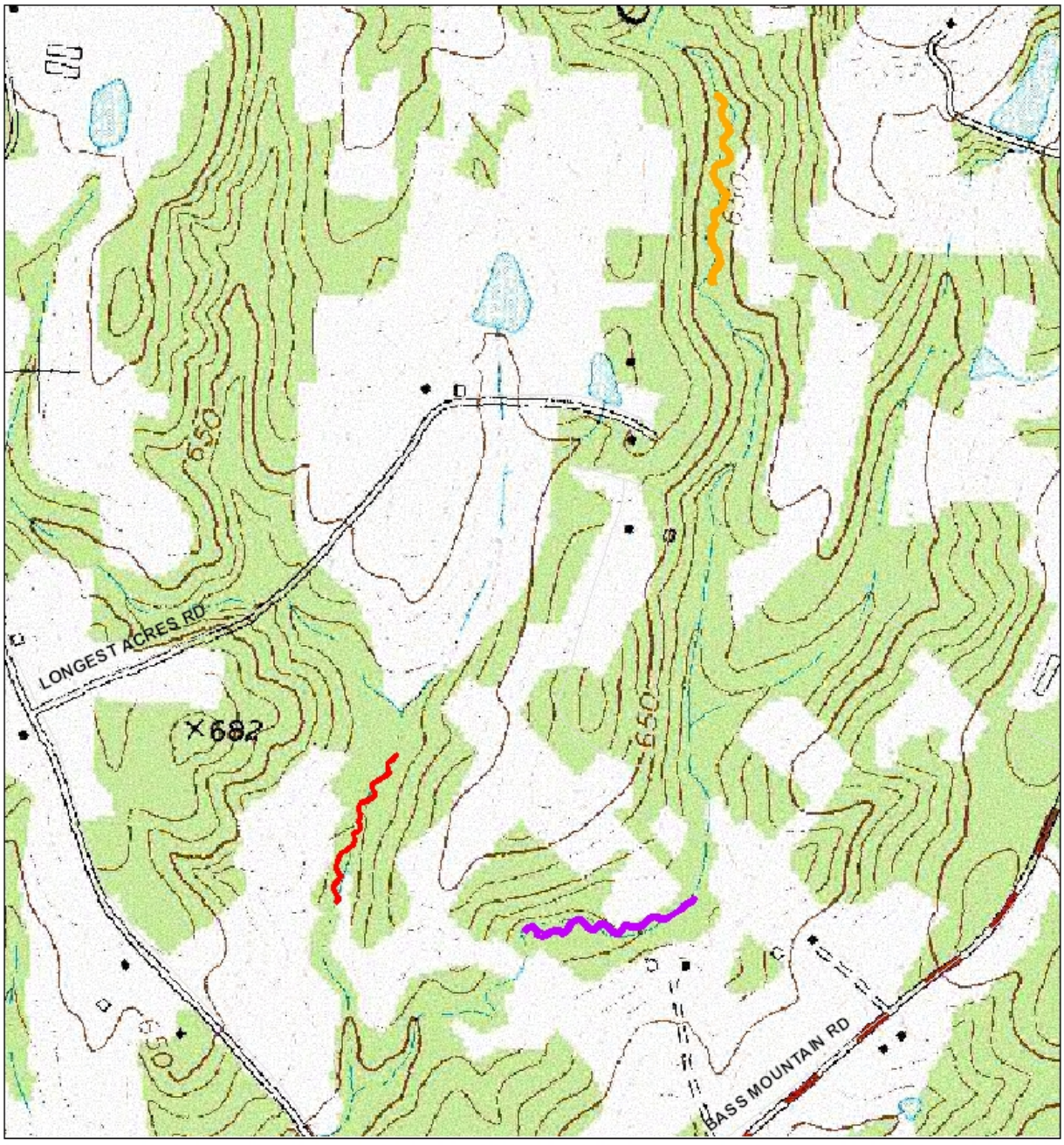
Boulevard as Snow Camp Road. Continue north toward the community of Snow Camp (approximately 12 miles). Just before Snow Camp, take a left on SR 2360 (Sylvan School Road). Continue on Sylvan School Road for approximately 2 miles then take a right on Bass Mountain Road. Continue on Bass Mountain Road for approximately ½ mile and take a left on Beale Road. Continue on Beale Road for approximately 1 mile, then turn right on Longest Acre Road (Wright Road in the NC Gazetteer). Reach 1 is at the end of Longest Acre Road. All three reaches are located in the triangle created by Bass Mountain Road, Beale Road, and Thompson Road. Figure 1 shows the location of the three reaches. The site is located in a rural portion of Alamance County on a working livestock farm. The stream reaches flow through pasture and wooded areas. Prior to restoration, livestock had unlimited access to several portions of the channel. Since the completion of restoration, the stream has been fenced off from the livestock. The surrounding topography has gently sloping hills.

1.4 History and Background

Wells Creek and its tributary were in an active cattle pasture prior to restoration. The current land owner cleared the land for pasture in the 1970's. Prior to the 1970's the land was forested. According to the owner, there was a mill on site. An old rock dam is located upstream of Reach 2, and an old breached rock dam is at the downstream end of Reach 1. Prior to restoration the streams lacked sinuosity and they were likely altered for agriculture. Tables II-IV provide background information for the project.

Table II. Project Activity and Reporting History

Wells Creek/EEP Project Number 414			
Activity or Report	**Scheduled Completion**	**Data Collection Complete**	**Actual Completion or Delivery**
Restoration Plan			August 1, 2002
Final Design - 90%			unknown
Construction			August 2003-April 2004
Temporary S&E mix applies to entire project area			August 2003-April 2004
Permanent seed mix applies to reach/segments 1&2			August 2003-April 2005
Containerized and B&B plantings for reach/segments 1&2			August 2003-April 2006
Mitigation Plan/ As-built (Year 0 Monitoring - baseline)		Dec-04	December 2004/July 2004
Year 1 monitoring			Sep-05
Year 2 monitoring		Apr-06	Nov-06
Year 3 monitoring		Oct-07	Dec-07
Year 4 monitoring	Apr-08	Nov-08	December 15, 2008
Year 5 monitoring	Apr-09		
Year 5+ monitoring			

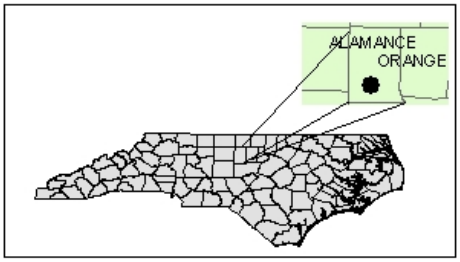


WELLS CREEK
SITE VICINITY MAP

Ecosystem Enhancement Program

FIGURE 1
ALAMANCE COUNTY NC

Reach
- Monitoring Reach 1
- Monitoring Reach 2
- Monitoring Reach UT



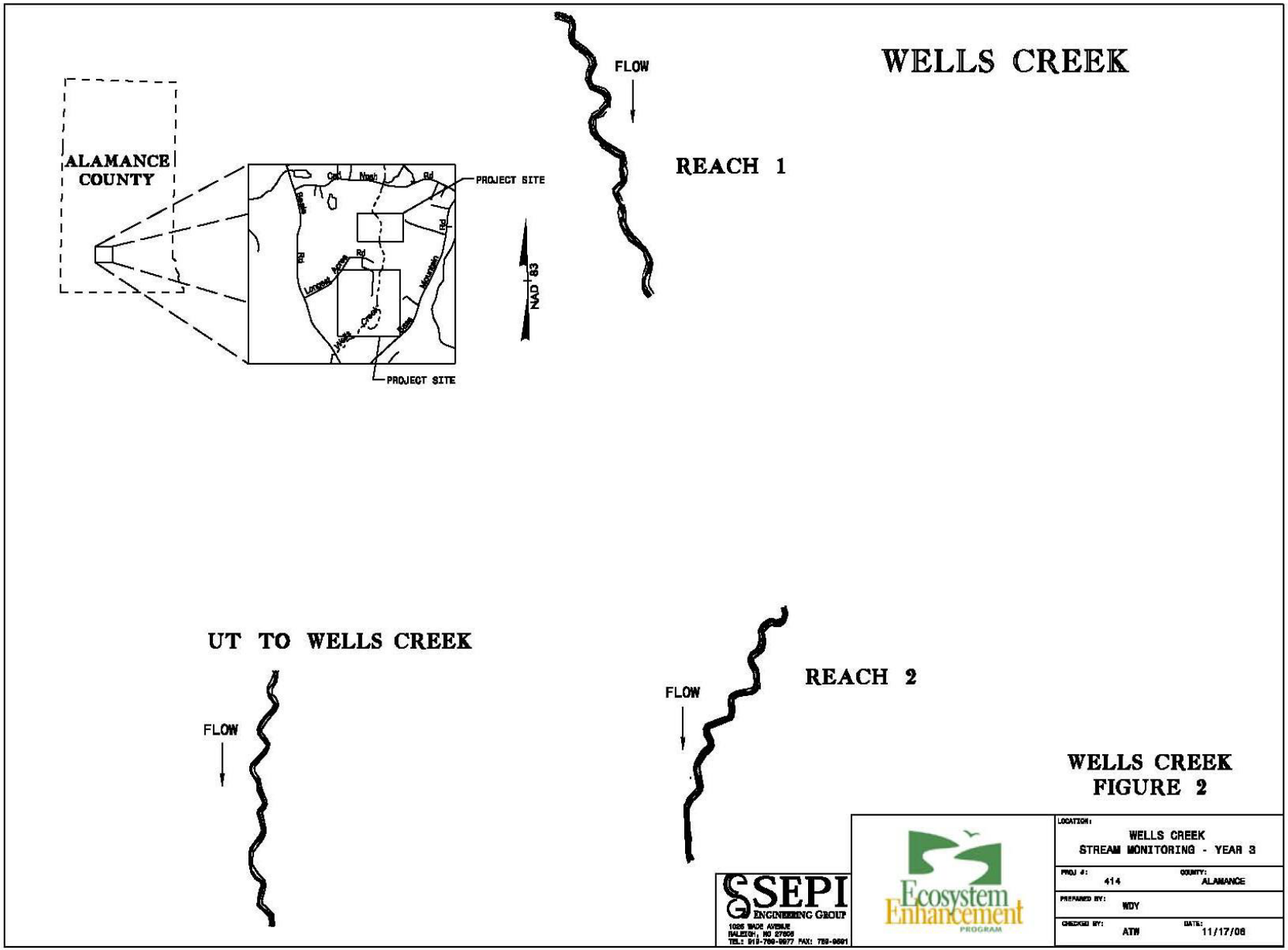

WELLS CREEK
FLOW
REACH 1
ALAMANCE COUNTY
PROJECT SITE
PROJECT SITE
NAD 83
UT TO WELLS CREEK
FLOW
FLOW
REACH 2
WELLS CREEK
FIGURE 2
SEPI ENGINEERING GROUP
1025 TAOS AVENUE
RALEIGH, NC 27606
TEL: 919-799-0977 FAX: 799-0991
Ecosystem Enhancement PROGRAM
LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 3
PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: WDY
CHECKED BY: ATW
DATE: 11/17/08

Table III. Project Contact Table	
Wells Creek/EEP Project Number 414	
Designer	ARCADIS G&M of North Carolina 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607
Construction Contractor	A&D Environmental and Industrial Services, Inc. Gerald Walker 2718 Uwharrie Road Archdale, NC 27263 336-434-7750
Planting Contractor	Seal Brothers Contracting Eddie Tobler PO BOX 86 Dobson, NC 27017 336-786-8863
Seeding Contractor	A&D Environmental and Industrial Services, Inc. Gerald Walker 2718 Uwharrie Road Archdale, NC 27263 336-434-7750
2005 Monitoring Performers	ARCADIS G&M of North Carolina 801 Corporate Center Drive, Suite 300 Raleigh, NC 27607
2006 - 2008 Monitoring Performers	SEPI Engineering Group 1025 Wade Avenue Raleigh, NC 27605 Phillip Todd (919) 789-9977
Stream Monitoring POC	Ira Poplar-Jeffers (919) 573-9914
Vegetation Monitoring POC	Phil Beach (919) 573-9936
Wetland Monitoring POC	N/A

Table IV. Project Background Table	
Wells Creek/EEP Project Number 414	
Project County	Alamance
Drainage Area	Reach 1: 1.63 sq mi Reach 2: 2.23 sq mi and UT: 0.71 sq. mi
Drainage impervious cover estimate (%) For example	Wells Creek Reach 1 & 2 ~3%; Unnamed Tributary <1%
Stream Order	Wells Creek Reach 1: 2nd Order
	Wells Creek Reach 2: 3rd Order
	Unnamed Tributary: 1st Order
Physiographic Region	Piedmont
Ecoregion	Southern Outer Piedmont Carolina Slate Belt
Rosgen Classification of As-built	C 4/1
Cowardin Classification	Disturbed Cattle Pasture
Dominant soil types	Colfax, Lignum, Georgeville, Tarrus, Herndon, Local Alluvial Land, and Vance
Reference site ID	UT to Wells Creek, Cane Creek Mountains, Alamance County and UT to Varnals Creek
USGS HUC for Project and Reference	03030002 Haw River
NCDWQ Sub-basin for Project and Reference	03-06-04
NCDWQ classification for Project and Reference	Project and reference are Class C, NSW
Any portion of any project segment 303d listed?	No
Any portion of any project segment upstream of a 303d listed segment?	No
Reasons for 303d listing or stressor	N/A
% of project easement fenced	100%
% of project easement demarcated with bollards (if fencing absent)	NA

2.0 PROJECT MONITORING METHODOLOGY

2.1 Vegetation Methodology

For this monitoring project, a total of nine (9) plots were studied. Plot sizes measure 10 meters by 10 meters (or equivalent to 100 square meters) depending on buffer width. The vegetation monitoring was not the Carolina Vegetation Survey (CVS) protocol, but was based on the number of stems for the targeted species that were planted for the stream restoration project. The planted material in the plot (previously marked with flagging) was identified by species and a tally of each species was kept and recorded in a field book. Any stems for a given species in a given plot that were not flagged and were counted over and above the baseline total were considered volunteers.

2.2 Stream Methodology

The project monitoring for the stream channel included a longitudinal survey, cross-sectional surveys, pebble counts and photo documentation. These measurements were taken at each reach. The stationing was based on thalweg. The methodology for each portion of the stream monitoring is described in detail below.

2.2.1 Longitudinal Profile and Plan View

A longitudinal profile was surveyed for each reach with a Nikon DTM-520 Total Station, prism, and a TDS Recon Pocket PC. The heads of features (i.e. riffles, runs, pools, and glides) were surveyed, as well as the point of maximum depth of each pool, boundaries of problem areas, and any other significant slope-breaks or points of interest. At the head of each feature and at the maximum pool depth, thalweg, water surface, edge of water, left and right bankfull, and left and right top of bank were surveyed. All profile measurements were extracted from this survey, including channel and valley length and length of each feature, water surface slope for each reach and feature, bankfull slope for the reach, and pool-to-pool spacing. This survey also was used to draw plan view figures with Microstation v8 (Bentley Systems, Inc., Exton, PA) for each reach, and all pattern measurements (i.e. meander length, radius of curvature, belt width, meander width ratio, and sinuosity) were extracted from the plan view. Stationing was calculated along the thalweg.

2.2.2 Permanent Cross Sections

Four permanent cross sections (two riffles and two pools) were surveyed at each reach. The beginning and end of each permanent cross section were originally marked with a wooden stake. Cross sections were established perpendicular to the stream flow with station 0+00 feet located on the left bank. The survey noted all changes in slopes, tops of both banks, left and right bankfull, edges of water, thalweg and water surface. Before each cross section was surveyed, bankfull level was identified, and a quick bankfull area was calculated by measuring a bankfull depth at 1-foot intervals between bankfulls and adding the area of each block across the channel. This rough area was then compared to the North Carolina Rural Piedmont Regional Curve-calculated bankfull area to ensure that bankfull was accurately located prior to the survey. The cross sections were plotted, and Monitoring Year data was overlain on all previous monitoring years for comparison. All dimension measurements (i.e., bankfull width, floodprone width, bankfull mean depth, cross sectional area, width-to-depth ratio, entrenchment ratio, bank height ratio, wetted perimeter, and hydraulic radius) were extracted from these plots and compared to Monitoring Year 1 and Monitoring Year 2 data.

2.2.3 Pebble Counts

A modified Wolman pebble count (Rosgen 1994), consisting of 50 samples, was taken at each permanent cross section. The cumulative percentages were plotted, and the D50 and D84 particle sizes were calculated and compared to Monitoring Year 1 (where available) and 2 data.

2.3 Photo Documentation

Permanent photo points were established during Year 1 monitoring. A set of three photographs (facing upstream, facing downstream, and facing the channel) were taken at each photo point with a digital camera. Two photographs were taken at each cross-section (facing upstream and downstream). A representative photograph of each vegetation plot was taken at the designated corner of the vegetation plot and in the same direction as the Year 2 photograph. An arrow was placed on the designated corner of each vegetation plot on the plan view sheets to document the corner and direction of each photograph. Photos were also taken of all significant stream and vegetation problem areas.

3.0 PROJECT CONDITION AND MONITORING RESULTS

3.1 Vegetation Assessment

3.1.1 Soils Data

Preliminary Soil Data					
Series	**Max Depth (in.)**	**% Clay on Surface**	**K**	**T**	**OM %**
Colfax (Ce)	67	5.0 - 20.0	0.45	*	1.0 - 3.0
Colfax (Cf)	67	7.0 - 25.0	0.36	*	1.0 - 3.0
Efland (EaC)	86	<<<<<<< Information unavailable >>>>>>>			
Efland (EaC2)	86	<<<<<<< Information unavailable >>>>>>>			
Efland (EbC3)	86	<<<<<<< Information unavailable >>>>>>>			
Georgeville (GaC2)	63	5.0 - 20.0	0.48	*	0.5 - 2.0
Georgeville (GaD2)	63	5.0 - 20.0	0.48	*	0.5 - 2.0
Local alluvial (Ld)		<<<<<<< High variability of data >>>>>>>			
Starr (Sb)	70	10.0 - 25.0	0.34	*	0.5 - 2.0
Vance (VcC2)	72	8.0 - 20.0	0.55	*	0.5 - 2.0

* The soils information was not available from the Natural Resources Conservation Service (NRCS)

3.1.2 Vegetative Problem Area Plan View

Overall, there is strong vegetation along the stream channel. All three monitoring reaches have thick herbaceous vegetative cover. The only problems associated with vegetation were with invasive species. Multiflora rose (*Rosa multiflora*) was documented at several locations along Reaches 1 and 2. Although not considered to be a problem, it should be noted that cattail, sometimes considered invasive, were documented at one location on Reach 1 (Station 18+93 – 18+69). Japanese stilt grass (*Microstegium virmineum*) was found at all three reaches. Reach 1 has only one documented area of Japanese stilt grass, located at Station 20+22 on the left bank, and Reaches 2 and UT have multiple locations (see Table VI in Appendix A3). Reach 2 had two large areas of Chinese privet (*Ligustrum sinense*). The first area of privet is located on the left side of the project (facing downstream) from Station 15+76 to 16+65 and the

second is located along the right side of the project (facing downstream) from Station 17+68 to 18+78. Tree of heaven (*Ailanthus altissima*) also was documented at two locations on Reach 2. The first location of tree of heaven is along the left side of the project (facing downstream) from Station to 17+75 to 18+03 and the second is along the right side (facing downstream) from 17+83 to 18+47 (see Plan Views in Appendix C).

3.1.3 Stem Counts

The stem densities on Reaches 2 and the UT are well above the Monitoring Year 5 stem density goal (260 stems per acre), except for Vegetation Plot (VP) #4 on Reach UT that had a stem density of 91 stems per acre. Stem densities on Reach 1 were below the Monitoring Year 5 goal (260 stems/acre). Japanese stilt grass was documented in VP #3 and #4, which may have limited seedling survival in those plots. Otherwise, it is unknown why densities are so low in VP #1 through #4.

The overall survival rate among all vegetation plots (VP) was just over 55% between Monitoring Years 1 and 4 and 76% between Monitoring Years 3 and 4. Vegetation plot photos are located in Appendix A2, and vegetation data tables are located in Appendix A3.

It should be noted that there were several species for which one-to-many additional stems were counted in a given plot relative to the Monitoring Year 3 stem count. These additional stems were assumed to be volunteers and were not included in the survival calculations. Volunteer species documented in Monitoring Year 4 included: *Alnus serrulata, Acer rubrum, Cercis canadensis, Fraxinus americana, Liriodendron tulipifera, Baccharis halimifolia, Prunus serotina, Diospyros virginiana, Liquidambar styraciflua, Ailanthus altissima,* and *Ligustrum sinense*. Vegetation plots #1 through #4 would probably be above the Monitoring Year 5 stem density goal if these volunteers were included in the stem count.

3.2 Stream Assessment

Considering the 5 year timeframe of standard mitigation monitoring, restored streams should demonstrate morphologic stability in order to be considered successful. Stability does not equate to an absence of change, but rather to sustainable rates of change or stable patterns of variation. Restored streams often demonstrate some level of initial adjustment in the several months that follow construction and some change/variation subsequent to that is to also be expected. However, the observed change should not indicate a high rate or be unidirectional over time such that a robust trend is evident. If some trend is evident, it should be very modest or indicate migration to another stable form. Examples of the latter include depositional processes resulting in the development of constructive features on the banks and floodplain, such as an inner berm, slight channel narrowing, modest natural levees, and general floodplain deposition. Annual variation is to be expected, but over time this should demonstrate maintenance around some acceptable central tendency while also demonstrating consistency or a reduction in the amplitude of variation. Lastly, all of this must be evaluated in the context of hydrologic events to which the system is exposed over the monitoring period.

For channel dimension, cross-sectional overlays and key parameters such as cross-sectional area and the channel's width to depth ratio should demonstrate modest overall change and patterns of variation that are in keeping with above. For the channels' profile, the reach under assessment should not demonstrate any consistent trends in thalweg aggradation or degradation over any significant continuous portion of its length. Over the monitoring period, the profile should also demonstrate the maintenance or development of bedform (facets) more in keeping with reference level diversity and distributions for the stream type in question. It should also provide a meaningful contrast in terms of bedform diversity against the pre-existing condition. Bedform distributions, riffle/pool lengths and slopes will vary, but should do so with

maintenance around design/As-built distributions. This requires that the majority of pools are maintained at greater depths with lower water surface slopes and riffles are shallow with greater water surface slopes. Substrate measurements should indicate the progression towards, or the maintenance of, the known distributions from the design phase.

In addition to these geomorphic criteria, a minimum of two bankfull events must be documented during separate monitoring years within the five year monitoring period for the monitoring to be considered complete. Table VIII documents all bankfull events recorded since the start of Monitoring Year 1.

Table V. Verification of Bankfull Events

Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
7/19/2006	Unknown	Bankfull event recorded: evident by crest stage gauge (0.6" wet on the measuring stick).	no photo
1/19/2007	Unknown	Bankfull event recorded: evident by crest stage gauge (7.0" wet on the measuring stick).	no photo
4/5/2007	Unknown	Crest gauge reading of 4.75 inches over bankfull (located at 0.00 inches on gauge).	no photo
6/4/2007	6/3/2007	Bankfull event observed as a result of ~1.5 inch rainfall event. Noted wrack lines.	no photo
2/1/2008	Unknown	Crest gauge reading of 5.0 inches over bankfull (located at 0.00 inches on gauge). Noted wrack lines.	no photo
9/1/2008	8/27/2008 - 8/28/2008	According to NCDC Station Coop ID 313555 - Graham ENE, NC , 6.58 inches of precipitation fell on this day. It was assumed, but not verified, that this rainfall produced a bankfull event.	no photo
9/8/2008	Unknown	Several bankfull events resulting from 9/1/2008 storm event. Note wrack lines located above the top of bank elevation in photo.	Photo 6 in SR-1 SPA Photolog

3.2.1 Longitudinal Profile and Plan View

All other profile parameters remained consistent through Monitoring Year 4, with the exception of an apparent increase in median meander wavelength of Reach 1. This observation is best explained by the fact that fewer meanders were included in this years' survey (i.e., survey stopped at cross section #4 this year per EEP request to stop the survey as close to 1,000 feet as possible). This left a fairly long meander out of the meander wavelength calculation. In addition, the plan view overlay was very tight between monitoring years, so it is clear that this does not represent actual change in the stream pattern.

The overall water surface slopes of the three reaches appear stable between Monitoring Years 1 through 4, and all other profile parameters appear consistent with previous monitoring years, with two exceptions. Median riffle slope seems to have decreased to some degree on Reach 1 and increased on Reach UT (see Table XIII in Appendix B3). However, based on the consistency of the profile overlays, it is most likely that human error in survey and/or erroneous water surface elevations account for the observed differences in riffle slope. Aggradation in the riffles may play a small part in these changes since it is a documented problem on these two reaches, however this is unlikely b/c the documented aggradation areas were not areas where there was a measurable change in thalweg elevations between monitoring years, but rather areas where sediment deposition along the sides of the riffles (and in a few cases mid-channel) was observed, where it appeared that the stream was heading toward a narrower dimension.

3.2.2 Permanent Cross Sections

All cross sections appear to have remained stable through Monitoring Year 4. There is some apparent deposition on the right side of cross section #9 on Reach 2. The deposition is located on the inside of the meander and represents normal point bar development. There was some downcutting in the channel along the right side (inside of the meander bend) of cross section 12 on Reach 2 which should be watched next year. However, considering this is a pool cross section and the pool does not appear to be overly deep, this is not a major concern at this time.

There were issues of monument loss in Monitoring Years 2 and 3 at cross sections 1 and 4 (monuments on right side of cross sections) of Reach UT, as can be observed on the cross section overlay figures (Appendix B4). It should be noted that these monuments were relocated during Monitoring Year 4, and the cross section surveys now match the Monitoring Year 1 survey much more closely in Monitoring Year 4.

3.2.3 Pebble Counts

Based on the pebble data overlays, it appears that the upper end of Reach 1 has experienced a coarsening of the streambed substrate. The pebble distribution plots for cross sections #1 and #2 show a decrease between Monitoring Years 3 and 4 in the percentages of silt and pebble distributions have remained consistent on cross sections #3 and #4 (Appendix B6). This result may be correlated with the increase in storm flow frequency in Monitoring Year 4. Silt that was deposited at these cross sections in Monitoring Year 3 was probably flushed downstream during high flow events. In addition, as the riffles get closer to their stable dimension, they are probably becoming more efficient at transporting sediments. This could be correlated to the substrate coarsening trend observed.

Reach UT pebble count overlays show that the substrate make-up in reach UT remained consistent with Monitoring Year 3. Cross section #8 (pool) did show an increase in silt percentages, however this is not abnormal for a pool.

Reach 2 pebble counts show consistency with Monitoring Year 3, or even a substrate coarsening trend in cross sections #10, #11, and #12. This result may be correlated with the result that no aggradation areas (i.e. riffle deposition/narrowing areas) recorded in Monitoring Year 3 were documented in Monitoring Year 4 on Reach 2. The reach is probably reaching a stable equilibrium with regards to sediment transport as the riffles narrow to a stable dimension. The coarsening trend observed on cross sections #10, #11, and #12 may also with the increase in storm flow frequency in Monitoring Year 4.

3.2.4 Stream Problem Areas

Aggradation in riffle sections remains prominent in Reaches 1 and UT. However, it should be clarified that these aggradation areas are not necessarily areas where an actual rise in thalweg elevation was measured, but rather areas where sediment deposition along the channel margins of the riffles (and in a few cases mid-channel) was observed. In most cases this deposition on the channel margins has formed inner-berm features as the stream is actually heading toward a narrower dimension at these locations. This trend may be correlated with the fact that all riffle pebble counts for both reaches show consistency with Monitoring Year 3 or even a coarsening of the sediment. The stream may be more efficiently transporting fine sediments out of the riffles as the riffles attain a more stable dimension with a narrower low-flow channel as the inner-berm forms. These areas will be observed closely in Monitoring Year 5 and if it appears that no additional deposition has occurred at the thalweg at that time, then they will not be reported as problems. Reach 2 had no aggradation areas documented in Monitoring Year 4 since all areas previously documented were observed to be at stable dimension (i.e. side deposition has stabilized

with grass and other rooted vegetation taking hold) and appear to be efficiently transporting fine sediment through the riffle.

Although there were two areas of bank erosion on Reach 1 and two cases on Reach 2, none were rated severe. There were three severe cases of bank erosion on Reach 2. One of these areas (Station 15+36 along the right bank) may warrant repair assessment; the length of this section is 60 feet (See Table X in Appendix B3).

The majority of the problems found with in-stream structures were based on placement angle and/or position. These areas were listed only if it was found that the angle or placement location of the particular structure was a possible cause for an adjacent problem such as bank erosion (i.e. structure was placed so that it was not adequately protecting bank) or if the structure was forming a feature in the wrong place (e.g., if a structure was forming a pool along a straight riffle section). However, there was a crossvane located at Station 12+75 on Reach 1 that had water piping around the right arm. There was a j-hook located at Station 14+08 on Reach 2 that had significant piping around the right side and minor piping around the left side. In addition, there was a rootwad at Station 18+16 on Reach UT that had some bank failure/undermining around the structure, and two others (Station 19+35 and Station 19+43) where similar bank failure/undermining has started.

Table VII a. Categorical Stream Feature Visual Stability Assessment

Wells Creek

Segment/Reach: 1

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	Unknown	Unknown	95%	79%	72%	
B. Pools			95%	92%	93%	
C. Thalweg			92%	93%	92%	
D. Meanders			74%	76%	93%	
E. Bed General			96%	92%	92%	
F. Bank Condition			95%	98%	98%	
G. Vanes / J Hooks etc.			94%	99%	98%	
H. Wads and Boulders			88%	97%	97%	

Table VII b. Categorical Stream Feature Visual Stability Assessment

Wells Creek

Segment/Reach: 2

Feature	Initial	MY-01	MY-02	MY-03	MY-04	MY-05
A. Riffles	Unknown	Unknown	80%	84%	88%	
B. Pools			85%	95%	100%	
C. Thalweg			83%	93%	100%	
D. Meanders			53%	77%	72%	
E. Bed General			90%	92%	99%	
F. Bank Condition			70%	79%	87%	
G. Vanes / J Hooks etc.			86%	89%	85%	
H. Wads and Boulders			71%	86%	83%	

Table VII c. Categorical Stream Feature Visual Stability Assessment						
Wells Creek						
Segment/Reach: UT						
Feature	**Initial**	**MY-01**	**MY-02**	**MY-03**	**MY-04**	**MY-05**
A. Riffles	Unknown	Unknown	83%	96%	80%	
B. Pools			88%	96%	100%	
C. Thalweg			87%	93%	100%	
D. Meanders			81%	76%	81%	
E. Bed General			84%	85%	92%	
F. Bank Condition			83%	94%	99%	
G. Vanes / J Hooks etc.			85%	94%	96%	
H. Wads and Boulders			69%	88%	81%	

3.3 Photo Documentation

Photos taken of the vegetation problem areas and photos of the vegetation plots are in Appendix A. Stream problem area photographs are provided in Appendix B1. The photographs taken at the marked photo point locations and at the cross-sections are provided in Appendix B2.

4.0 RECOMMENDATIONS AND CONCLUSIONS

All reaches are considered to have remained geomorphically stable between Monitoring Years 3 and 4, with the exception of some areas of aggradation occurring in riffle sections in Reaches 1 and UT. However, it should be clarified that these aggradation areas are not necessarily areas where an actual rise in thalweg elevation was measured, but rather areas where sediment deposition along the channel margins of the riffles (and in a few cases mid-channel) was observed. In most cases this deposition on the channel margins has formed inner-berm features as the stream is actually heading toward a narrower dimension at these locations. This trend may be correlated with the fact that all riffle pebble counts for both reaches show consistency with Monitoring Year 3 or even a coarsening of the sediment. The stream may be more efficiently transporting fine sediments out of the riffles as the riffles attain a more stable dimension with a narrower low-flow channel as the inner-berm forms. These areas will be observed closely in Monitoring Year 5 and if it appears that no additional deposition has occurred at the thalweg at that time, then they will not be reported as problems. Reach 2 had no aggradation areas documented in Monitoring Year 4 since all areas previously documented were observed to be at stable dimension (i.e. side deposition has stabilized with grass and other rooted vegetation taking hold) and appear to be efficiently transporting fine sediment at the new riffle dimension. Although there were two areas of bank erosion on Reach 1 and two cases on Reach 2, none were rated severe. There were three severe cases of bank erosion on Reach 2. One of these areas (Station 15+36 along the right bank) may warrant repair assessment; the length of this section is 60 feet (See Table X in Appendix B3). The majority of the problems found with in-stream structures were based on placement angle and/or position. However, there was a crossvane located at Station 12+75 on Reach 1 that had water piping around the right arm. A j-hook located at Station 14+08 on Reach 2 had significant piping around the right side and minor piping around the left side. In addition, there was a rootwad at Station 18+16 on Reach UT that had some bank failure/undermining around the structure, and two others (Station 19+35 and Station 19+43) where similar bank failure/undermining has started.

The stem densities on Reaches 2 and the UT are well above the Monitoring Year 5 stem density goal (260 stems per acre), except for Vegetation Plot (VP) #4 on Reach UT that had a stem density of 91 stems per acre. Stem densities on Reach 1 were below the Monitoring Year 5 goal (260 stems/acre). Japanese stilt

grass was documented in VP #3 and #4, which may have limited seedling survival in those plots. Otherwise, it is unknown why densities are so low in VP #1 through #4. The overall survival rate among all vegetation plots (VP) was just over 55% between Monitoring Years 1 and 4 and 76% between Monitoring Years 3 and 4.

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APPENDIX A1

VEGETATION DATA TABLES

Table VII. Stem counts for each species arranged by plot (Wells Creek)															
Species	**Plots**									**Year 1 Totals**	**Year 2 Totals**	**Year 3 Totals**	**Year 4 Totals**	**Survival %**	**Additional volunteers noted in plots**
	1	2	3	4	5	6	7	8	9						
Shrubs															
Cornus ammomum			2	1	(7 LS)				(1 LS)	11 (12 LS)	4 (13 LS)	3 (11 LS)	3 (8 LS)	47.8%	X
Trees															
Betula nigra					2			2	1	10	9	9	5	50.0%	X
Carpinus caroliniana					3	3		2		11	10	8	8	72.7%	X
Diospyros virginiana										0	2	0	0	0.0%	X
Fraxinus pennsylvanica							2		3	2	6	3	5	83.3%	
Juglans nigra			1		1	2				12	13	10	4	33.3%	X
Nyssa sylvatica										1	0	0	0	0.0%	X
Platanus occidentalis	1	1		1		3	1	3		22	16	16	10	45.5%	X
Salix nigra							16			13	17	17	16	94.1%	
Sambucus canandensis										1	0	0	0	0.0%	
Quercus michauxii						1	3		1	16	9	6	5	31.3%	X
Quercus rubra										2	2	0	0	0.0%	
Quercus alba		1			1					5	4	4	2	40.0%	X
Quercus marilandica										1	1	0	0	0.0%	
Total including live stake	1	2	3	2	14	9	22	7	6	119	102	87	66	55.5%	
Stems per acre	48	95	143	91	700	410	1047	350	286						
Total exluding live stake	1	2	3	2	7	9	22	7	5	107	89	76	58	54.2%	
Stems per acre	48	95	143	91	350	410	1047	350	238						

Note: Survival was calculated between Monitoring Year 1 and Monitoring Year 4 totals.

**Volunteers of the following species, not initially recorded as planted, were counted: Alnus serrulata, Acer rubrum, Cercis canadensis, Fraxinus americana, Liriodendron tulipifera, Baccharis halimifolia, Prunus serotina, Diospyros virginiana, Liquidambar styraciflua, Ailanthus altissima, and Ligustrum sinense.*

**Liquidambar styraciflua were too numerous to count where new volunteers were noted.*

Table VI. Vegetative Problem Areas			
Feature/Issue	**Station # / Range**	**Probable Cause**	**Photo #**
Stream Reach 1			
Rosa multiflora (Left Bank)	12+34	Invasive vegetative opportunism	
Rosa multiflora (Left Bank)	12+72 to 12+99	Invasive vegetative opportunism	
Rosa multiflora (Right Bank)	13+65	Invasive vegetative opportunism	
Rosa multiflora (Right Bank)	17+42	Invasive vegetative opportunism	1
Rosa multiflora (Right Bank)	18+38 to 18+79	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	20+22 to 20+67	Invasive vegetative opportunism	2
Stream Reach 2			
Rosa multiflora (Left Bank)	10+87 to 11+21	Invasive vegetative opportunism	
Rosa multiflora and Microstegium virmineum (Left Bank)	11+78 to 12+18	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	11+78 to 12+27	Invasive vegetative opportunism	
Rosa multiflora (Left Bank)	13+99 to 14+98	Invasive vegetative opportunism	1
Microstegium virmineum (Right Bank)	14+72 to 16+05	Invasive vegetative opportunism	2
Microstegium virmineum (Left Bank)	15+07 to 16+80	Invasive vegetative opportunism	
Ligustrum sinense (Left Bank)	15+76 to 16+65	Invasive vegetative opportunism	3
Microstegium virmineum (Right Bank)	16+38 to 16+97	Invasive vegetative opportunism	
Microstegium virmineum (Right Bank)	17+18 to 17+61	Invasive vegetative opportunism	
Rosa multiflora (Left Bank)	17+20 to 17+99	Invasive vegetative opportunism	
Ailanthus altissima (Left Bank)	17+75 to 18+03	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	17+49 to 18+97	Invasive vegetative opportunism	
Rosa multiflora (Right Bank)	17+68 to 19+69	Invasive vegetative opportunism	
Ligustrum sinense (Right Bank)	17+68 to 18+78	Invasive vegetative opportunism	
Ailanthus altissima (Right Bank)	17+83 to 18+47	Invasive vegetative opportunism	4
Microstegium virmineum (Right Bank)	18+69 to 19+49	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	19+29 to 20+39	Invasive vegetative opportunism	
Microstegium virmineum (Right Bank)	19+95 to 20+39	Invasive vegetative opportunism	
Stream Reach UT			
Microstegium virmineum (Right Bank)	12+16 to 12+42	Invasive vegetative opportunism	2
Microstegium virmineum (Left Bank)	12+80	Invasive vegetative opportunism	
Microstegium virmineum (Right Bank)	12+63 to 14+17	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	13+42 to 14+86	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	14+75	Invasive vegetative opportunism	
Microstegium virmineum (Right Bank)	14+75 to 15+09	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	15+30 to 15+39	Invasive vegetative opportunism	
Microstegium virmineum (Left Bank)	15+67	Invasive vegetative opportunism	
Microstegium virmineum (Right Bank)	15+20 to 16+88	Invasive vegetative opportunism	1
Microstegium virmineum (Right Bank)	19+58 to 19+77	Invasive vegetative opportunism	

APPENDIX A2

PHOTOLOG VEGETATION PROBLEM AREAS

APPENDIX A2
PHOTOLOG – WELLS CREEK (REACH 1)

PROBLEM AREAS (Vegetation)

Photo 1: Multiflora rose (*Rosa multiflora)* growth (Station No. 17+42; view upstream on right bank; 11-6-2008).

Photo 2: Japanese grass (*Microstegium virmineum)* growth (Station No. 20+; view upstream on right bank; 11-6-2008).

APPENDIX A2
PHOTOLOG – WELLS CREEK (REACH 2)

PROBLEM AREAS (Vegetation)

Photo 1: Multiflora rose (*Rosa multiflora)* growth (Station No. 13+99; view downstream on right bank; 11-6-2008).

Photo 2: Japanese grass (*Microstegium virmineum)* growth (Station No. 14+78; view downstream on right bank; 11-6-2008).

Photo 3: Chinese privet (*Ligustrum sinense)* growth (Station No. 15+76; view is within Vegetation Plot 8; 11-6-2008).

Photo 4: Tree of Heaven (*Ailanthus altissima)* growth (Station No. 17+83; view is within Vegetation Plot 9, *Ailanthus* trees appear leafless in photo; 11-6-2008).

APPENDIX A2
PHOTOLOG – WELLS CREEK (UT)

PROBLEM AREAS (Vegetation)

Photo 1: Japanese grass (*Microstegium virmineum*) growth (Station No. 15+20; view of right bank; 11-6-2008).

Photo 2: Japanese grass (*Microstegium virmineum*) growth along sidebar (Station No. 15+20; view dowsntream; 12-16-2008).

APPENDIX A3

PHOTOLOG VEGETATION PLOTS

APPENDIX A3
PHOTOLOG - WELLS CREEK

VEGETATION PLOTS


Photo 1: Vegetation Plot 1 (9-08-2008).


Photo 2: Vegetation Plot 2 (11-6-2008).


Photo 3: Vegetation Plot 3 (9-08-2008).


Photo 4: Vegetation Plot 4 (9-08-2008).


Photo 5: Vegetation Plot 5 (9-08-2008).

Photo 6: Vegetation Plot 6 (9-08-2008).

Photo 7: Vegetation Plot 7 (9-08-2008).

Photo 8: Vegetation Plot 8 (9-08-2008).

Photo 9: Vegetation Plot 9 (9-08-2008).

APPENDIX B1

PHOTOLOG STREAM PROBLEM AREAS

APPENDIX B1
PHOTOLOG – WELLS CREEK (REACH 1)

PROBLEM AREAS (Stream)

Photo 1: Representative aggradation/midbar problem area (Station No. 18+04; view upstream; 11-6-2008).

Photo 2: Representative aggradation problem area (Station No. 15+74; view downstream; 11-6-2008).

Photo 3: Representative midbar problem area (Station No. 18+02; view downstream; 11-6-2008).

Photo 4: Representative crossvane problem area (Station No. 12+75; view upstream; 11-6-2008).

Photo 5: Representative bank erosion problem area (Station No. 10+83; view across stream toward left bank on 3-20-2008).

Photo 6: Evidence of bankfull event (Station No. 12+75; view of right bank, note vegetation impact on bank; 9-8-2008).

APPENDIX B1
PHOTOLOG – WELLS CREEK (REACH 2)

PROBLEM AREAS (Stream)

Photo 1: Representative bank erosion problem area (Station No. 17+11; view upstream; 6-17-2008).

Photo 2: Representative problem j-hook and bank erosion (Station No. 17+74; view downstream; 6-17-2008).

Photo 3: Representative side bar problem area (Station No. 14+08; view downstream; 11-6-2008).

Photo 4: Representative beaver dam problem area (Station No. 12+59; view downstream; 2-25-2008).

APPENDIX B1
PHOTOLOG REACH 1 – WELLS CREEK (UT)

PROBLEM AREAS (Stream)

Photo 1: Representative jhook and bank erosion problem area (Station No. 16+42; bank erosion is in the right corner of picture; view downstream; 11-6-2008).

Photo 3: Representative sidebar problem area (Station No. 10+96; view downstream; 11-6-2008).

Photo 2: Representative bank erosion problem area (Station No. 10+11; view downstream of left bank; 6-10-2008).

Photo 4: Representative aggradation problem area (Station No. 11+99; view downstream; 6-9-2008).

APPENDIX B2

PHOTOLOG OF CROSS-SECTIONS AND PHOTO POINTS

APPENDIX B2
PHOTOLOG – WELLS CREEK (REACH 1)

CROSS-SECTIONS & PHOTOPOINTS

Cross-Section 1: View Downstream (3-20-2008).

Cross-Section 1: View Upstream (3-20-2008).

Cross-Section 2: View Downstream (3-20-2008).

Cross-Section 2: View Upstream (3-20-2008).

Cross-Section 3: View Downstream (11-6-2008).

Cross-Section 3: View Upstream (11-6-2008).

Cross-Section 4: View Downstream (11-6-2008).

Cross-Section 4: View Upstream (11-6-2008).

Photo point 1: View Upstream (3-20-2008).

Photo point 2: View Upstream (3-20-2008).

Photo point 1: View Downstream (3-20-2008).

Photo point 2: View Downstream (3-20-2008).

Photo point 1: Facing Channel (3-20-2008).

Photo point 2: Facing Channel (3-20-2008).


Photo point 3: View Upstream (3-20-2008).


Photo point 4: View Upstream (3-20-2008).


Photo point 3: View Downstream (3-20-2008).


Photo point 4: View Downstream (3-20-2008).


Photo point 3: Facing Channel (3-20-2008).


Photo point 4: Facing Channel (3-20-2008).

APPENDIX B2
PHOTOLOG WELLS CREEK (REACH 2)

CROSS-SECTIONS & PHOTOPOINTS


Cross-Section 9: View Downstream (6-12-2008).


Cross-Section 9: View Upstream (6-12-2008).


Cross-Section 10: View Downstream (6-12-2008).


Cross-Section 10: View Upstream (6-12-2008).


Cross-Section 11: View Downstream (6-17-2008).


Cross-Section 11: View Upstream (6-17-2008).

Cross-Section 12: View Downstream (6-19-2008).

Photo point 5: View Downstream (11-6-2008).

Cross-Section 12: View Upstream (6-19-2008).

Photo point 5: View Upstream (11-6-2008).

Photo point 5: Facing Channel (11-6-2008).

Photo point 6: View Downstream (6-12-2008).

Photo point 7: View Downstream (6-12-2008).

Photo point 6: View Upstream (6-12-2008).

Photo point 7: View Upstream (6-12-2008).

Photo point 6: Facing Channel (6-12-2008).

Photo point 7: Facing Channel (6-12-2008).

Photo point 8: View Downstream (6-17-2008).

Photo point 9: View Downstream (6-19-2008).

Photo point 8: View Upstream (6-17-2008).

Photo point 9: View Upstream (6-19-2008).

Photo point 8: Facing Channel (6-17-2008).

Photo point 9: Facing Channel (6-19-2008).

APPENDIX B2
PHOTOLOG WELLS CREEK (UT)


Cross-Section 5: View Downstream (6-09-2008).


Cross-Section 5: View Upstream (6-09-2008).


Cross-Section 6: View Downstream (6-10-2008).


Cross-Section 6: View Upstream (6-10-2008).


Cross-Section 7: View Downstream (6-10-2008).


Cross-Section 7: View Upstream (6-10-2008).

Cross-Section 8: View Downstream (6-10-2008).

Cross-Section 8: View Upstream (6-10-2008).

Photo point 10: View Downstream (6-09-2008).

Photo point 11: View Downstream (6-10-2008).

Photo point 10: View Upstream (6-09-2008).

Photo point 11: View Upstream (6-10-2008).

Photo point 10: Facing Channel (6-09-2008).

Photo point 11: Facing Channel (6-10-2008).

Photo point 12: View Downstream (6-10-2008).

Photo point 12: View Upstream (6-10-2008).

Photo point 12: Facing Channel (6-10-2008).

APPENDIX B3

STREAM DATA TABLES

Table VIII Baseline Morphologyand Hydraulic Summary
Wells Creek/EEP Number 414

Parameter	USGS Gage Data			Regional Curve Interval			Pre-Existing Condition			Project Reference Stream			Design (SR#1)			As-built (SR#1)			Design (SR#2)			As-built (SR#2)			Design (UT)			As-built (UT)		
	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Dimension																														
BF Width (ft)	28	30	29			14.77	15.4	28.9	22.75	6.5	10	8			25	20.1	27.4	23.7			20	19.3	31.6	25.4			15	13.5	16	14.9
Floodporne Width (ft)	40	100	70				24.5	50	40.7	16	22	18.8			>55	48	66	57			>50			100			>33	50	77	63.5
BFCross Sectional Area (ft)	58.6	58.9	58			29.9	22.2	34.8	31	3.9	6.3	5.3			33	25.2	42.8	34	32.2	36	34.1	44.2	47.1	45.6			17	13.5	16	14.7
BF Mean Depth (ft)	2	2.1	2			1.75	0.8	1.9	1.4	0.4	1	0.7			1.3	1.3	1.6	1.4			1.8	1.5	2.3	1.9			1.1			1
Max Depth (ft)	2.7	3	2.9				1.3	3.1	2.1	0.9	1.4	1.1	1.7	2.6	2.1	1.6	3.1	2.3	2.3	3.6	2.9	2.5	3.5	3	1.4	2.2	1.8	1.4	2.1	1.6
Width/Depth Ratio	13	15	14				8	38	18.3	7	26	13.5			19	16.1	17.6	16.8			11	8.4	21.2	14.8			12.5	14.8	15.3	15
Entrenchment Ratio	1.3	3.6	2.4				1	3.2	1.9	2	3.4	2.4			>2.2			2.4			>2.2	3.2	5.2	4.2			>2.2	3.5	4.9	4.2
Wetted Perimeter (ft)	33.6	33.7	33.65				16.8	29.2	24.1	7.2	11.7	9			27.6	21.5	28.2	24.9			23.6	21	33.1	27			17.2	14.7	16.2	15.5
Hydraulic radious (ft)	1.7	1.7	1.7				1	1.8	1.4	0.3	0.9	0.7			1.2	1.2	1.5	1.35			1.4	1.4	2.1	1.8			1	0.9	1	0.95
Pattern																														
Channel Beltwidth (ft)							6	271	69.4	10	35	20.9	33	110	65	29.5	105.6	55.9	26	88	52	32.5	81.8	57.2	19.5	66	39	17.8	71.7	45.4
Radius of Curvature (ft)							2.5	641	81.9	2.3	31.8	13.5	8	100	40	10	80	44.6	6	80	32	40	130	69.2	4.5	60	24	20	150	70.7
Meander Wavelenght (ft)							56	360	182.2	35	70	50	110	220	157	49.3	232.4	137.5	88	176	126	113.1	151.3	129.5	66	132	94.5	55	184.3	116.5
Meander Width Ratio							3.2	9.1	5.3	1.3	4.4	2.6	1.3	4.4	2.6	1.2	4.4	2.3	1.3	4.4	2.6	1.3	3.2	2.2	1.3	4.4	2.6	1.2	4.8	3
Profile																														
Riffle length (ft)							3.4	108.5	40.2	2	25	13.9	6.3	77.5	42.5	20.1	110.8	41.1	5	62	34	14.3	128.3	38.2	3.8	46.5	25.5	5.6	89.5	26.7
Riffle slope (ft/ft)							0.0006	0.041	0.0208	0.0173	0.078	0.039	0.0042	0.019	0.011	0.002	0.019	0.007	0.006	0.0276	0.017	0.002	0.0228	0.0107	0.0058	0.0256	0.0154	0.0027	0.0483	0.02
Pool length (ft)							3.5	218.6	43.8	7	27	14.5	22.5	85	45	7.4	93.9	27.2	18	68	36	4.6	84.8	43.6	13.5	51	27	8	61.1	36.8
Pool spacing (ft)							10.2	258.1	90.4	17	63	36.5	30	197.5	115	31	176.5	66.2	42	158	92	22.4	170.6	79.9	31.5	118.5	69	29.8	139.6	59.9
Substrate																														
d50 (mm)									0.9			4.5						0.1						0.5						0.6
d84 (mm)									68			53						9						17						13
Additional Reach Parameters																														
Valley Length (ft)							2850			337			945			960			1010			1010			1415			859		
Channel Length (ft)							3714			447			1127			1193			1244			1127			1696			1083		
Sinuosity							1.3			1.3			1.2			1.2			1.3			1.1			1.2			1.3		
Water Surface Slope (ft/ft)	0.0016						0.0084			0.0197			0.0047			0.0049			0.0069			0.0062			0.0064			0.0053		
BF slope (ft/ft)							0.79			0.0199			0.0047			0.0049			0.0069			0.0062			0.0064			0.0053		
Rosgen Classification	B/C						E5, B5, F5, and G5			C4/1			C4/1			C5/1			C4/1			C/E4/1			C4/1			C5/1		
*Habitat Index							N/A																							
*Macrobenthos							N/A																							

Table IX a. Morphology and Hydraulic Monitoring Summary
Wells Creek
Segment/Reach: 1

Parameter	Cross Section 1 Pool						Cross Section 2 Riffle						Cross Section 3 Riffle						Cross Section 4 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	36.9	26.4	26.4	25.76			19.6	20.4	20.1	16.6			33	28.8	27.6	28.3			30.4	26.1	24.6	24.0		
Floodprone Width (ft)	100+	NA	NA	NA			100+	85+	84+	83+			70+	43	49.5	71+			100+	NA	NA	NA		
BFCross Sectional Area (ft)	66.9	46.9	42.0	43.71			32.9	38.7	38.3	33.63			41.7	40.7	33.7	37.42			36.3	40.3	38.7	38.4		
BF Mean Depth (ft)	1.8	1.8	1.6	1.7			1.7	1.9	1.9	2.0			1.3	1.4	1.2	1.3			1.2	1.5	1.6	1.6		
Width/Depth Ratio	20.5	NA	NA	NA			11.5	10.7	10.6	8.2			25.4	20.5	22.6	21.4			25.3	NA	NA	NA		
Entrenchment Ratio	2.7	NA	NA	NA			5.1+	3.3+	4.2+	5.0+			>2.1	1.5	1.8	2.5+			3.3	NA	NA	NA		
Bank Height Ratio	NA	NA	NA	NA			1	1	1	1.03			1	1	1	1.01			NA	NA	NA	NA		
Wetted Perimeter (ft)	39.2	44.7	29.0	30.06			21.7	23.4	22.9	19.87			33.5	49.7	28.3	29.4			31.6	30.9	27.3	26.1		
Hydraulic radius (ft)	1.7	1.6	1.4	1.5			1.5	1.7	1.7	0.8			1.2	2	1.2	1.3			1.1	1.3	1.4	1.5		
Substrate																								
d50 (mm)	NA	0.25	<0.062	0.19			8.3	0.25	<0.062	18			8	0.125	4.9	0.17			NA	0.25	1.1	9		
d84 (mm)	NA	11.3	<0.062	16			41	18	0.1	50			19	11.3	15.5	8.8			NA	11.3	70	64		

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)			MY+ (2010)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	29	101.7	63.4	37.45	107.3	67.26	37.81	106.4	64.7	35.2	98.4	60.4						
Radius of Curvature (ft)	20	100	52.7	15	120	40	15	120	46.63	13.8	113.5	45.2						
Meander Wavelenght (ft)	123	465.1	246	136.45	324.8	198.45	119.0	357.2	195.1	116.6	238.2	152.9						
Meander Width Ratio	0.8	2.8	1.7	1.30	3.72	2.34	1.59	4.46	2.71	1.5661	4.38	2.69						
Profile																		
Riffle length (ft)	6.8	46.7	24.6	1.5	38.8	8.1	8.2	37.4	18.1	7.94	91.2	30.885						
Riffle slope (ft/ft)	0.000	0.032	0.012	0.000	0.473	0.015	0.000	0.038	0.010	0.001	0.027	0.004						
Pool length (ft)	5.9	128.9	36.5	6.2	108.0	23.5	12.2	134.0	33.9	13.73	125.27	34.15						
Pool spacing (ft)	20.5	169.5	66.2	25.1	239.4	46.5	22.6	220.2	49.5	30.56	246.44	56.25						
Additional Reach Parameters																		
Valley Length (ft)	952			995			995			847								
Channel Length (ft)	1213			1244			1241			1068								
Sinuosity	1.3			1.2			1.2			1.3								
Water Surface Slope (ft/ft)	0.005			0.0052			0.0051			0.0050								
BF slope (ft/ft)	0.0055			0.0042			0.0045			0.0048								
Rosgen Classification	C4/1			C4			C4			C4/5								
*Habitat Index	NA			NA			NA			NA								
*Macrobenthos	NA			NA			NA			NA								

Table IX b. Morphology and Hydraulic Monitoring Summary
Wells Creek
Segment/Reach: 2

Parameter	Cross Section 9 Riffle						Cross Section 10 Pool						Cross Section 11 Riffle						Cross Section 12 Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	23.1	19.5	20.6	21.1			27	20.8	20.8	21.4			20.9	18.8	19.6	22.9			22.1	22.1	21.4	25.1		
Floodprone Width (ft)	100+	45+	42+	42+			100+	NA	NA	NA			100+	38	45+	45+			100+	NA	NA	NA		
BFCross Sectional Area (ft)	44	41.6	42.6	41.8			54.8	51.4	48.4	47.9			40.9	47	44.0	42.9			35.5	52	46	53		
BF Mean Depth (ft)	1.9	2.1	2.1	2.0			2	2.4	2.3	2.2			2	2.5	2.2	1.9			1.6	2.3	2.2	2.1		
Width/Depth Ratio	12.1	10.8	10.0	10.6			13.5	NA	NA	NA			10.5	7.5	8.7	12.2			13.8	NA	NA	NA		
Entrenchment Ratio	4.3	2.3+	2.0+	2.0+			3.7+	NA	NA	NA			4.8+	2.0	2.3+	2.0+			4.5+	NA	NA	NA		
Bank Height Ratio	1	1	1	1.01			NA	NA	NA	NA			1	1	1	1.04			NA	NA	NA	NA		
Wetted Perimeter (ft)	24.9	22.4	22.4	23.2			28.6	23.7	23.2	23.9			22.5	22.9	22.6	25.9			23.4	31.9	26.3	29.7		
Hydraulic radius (ft)	1.8	1.9	1.9	1.8			1.9	2.2	2.1	2.0			1.8	2.1	1.9	1.7			1.5	1.7	1.7	1.8		
Substrate																								
d50 (mm)	12.5	8	39	17			NA	0.45	0.63	7			13.5	0.45	8.5	19.5			NA	0.25	0.59	4.9		
d84 (mm)	43	44	81	44			NA	32	1.7	15			23	32	58	32			NA	1	0.9	29		

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)			MY+ (2010)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	13.1	85.4	55	38.52	85.07	54.16	35.72	89.2	52.59	40.99	80.45	53.03						
Radius of Curvature (ft)	15	120	39.4	22	70	31.5	22	61	32.6	21.66	76	39.66						
Meander Wavelenght (ft)	105	180	134.8	115.79	149.77	127	94.3	156.5	126.0	108.01	157.39	137.54						
Meander Width Ratio	0.6	3.9	2.5	2.02	4.45	2.84	1.65	4.13	2.43	1.864	3.66	2.41						
Profile																		
Riffle length (ft)	3.8	53.9	26	13.0	53.0	26	12.0	42.8	22	15.29	46.3	26.6						
Riffle slope (ft/ft)	0.0018	0.039	0.014	0.000	0.041	0.011	0.002	0.051	0.018	0.004	0.030	0.023						
Pool length (ft)	17	128.4	42.9	5.8	208.8	39.7	7.2	78.4	34.0	21.75	93.5	46.7						
Pool spacing (ft)	46.4	184.3	87	23.6	117.8	76.8	22.2	102.2	69.0	21.87	123.9	73.7						
Additional Reach Parameters																		
Valley Length (ft)	906			903			908			829								
Channel Length (ft)	1127			1140			1153			1040								
Sinuosity	1.24			1.26			1.27			1.25								
Water Surface Slope (ft/ft)	0.0053			0.0050			0.0055			0.0060								
BF slope (ft/ft)	0.0058			0.0050			0.0058			0.0060								
Rosgen Classification	C4/1			E4			C4			C4								
*Habitat Index	NA			NA			NA			NA								
*Macrobenthos	NA			NA			NA			NA								

Table IX c. Morphology and Hydraulic Monitoring Summary
Wells Creek
Segment/Reach: UT

Parameter	Cross Section 5- Pool						Cross Section 6 -Riffle						Cross Section 7 - Riffle						Cross Section 8 - Pool					
Dimension	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+	MY1	MY2	MY3	MY4	MY5	MY+
BF Width (ft)	17	14.4	14.7	16.8			18.2	20.4	14.7	18.0			17.8	9.2	14.6	14.2			15.8	18.9	17.4	19.4		
Floodprone Width (ft)	67	NA	NA	NA			72	67	73	75			50	67	59	59			50	NA	NA	NA		
BFCross Sectional Area (ft)	18.3	21.9	22.8	21.3			12.8	14.4	15.8	14.6			13.1	13.6	16.8	15.6			22.3	23	26.2	26.9		
BF Mean Depth (ft)	1.1	1.5	1.6	1.3			0.7	0.7	0.9	0.8			0.7	1.5	1.2	1.1			1.4	1.2	1.5	1.4		
Width/Depth Ratio	15.5	NA	NA	NA			26	26.9	17.1	22.0			25.4	6.2	12.7	12.9			11.3	NA	NA	NA		
Entrenchment Ratio	3.9	NA	NA	NA			4	3.4	4.6	4.2			2.8	7.2	4.0	4.2			3.2	NA	NA	NA		
Bank Height Ratio	NA	NA	NA	NA			1	1	1	1.04			1	1	1	1.13			NA	NA	NA	NA		
Wetted Perimeter (ft)	18.1	19.9	17.4	19.66			18.5	21.6	16.6	18.63			18.2	39.6	15.4	14.88			17.2	26.2	20.0	21.29		
Hydraulic radius (ft)	1	1.1	1.3	1.1			1	0.7	0.9	0.8			0.7	0.8	1.1	1.1			1.3	1.1	1.3	1.3		
Substrate																								
d50 (mm)	NA	0.5	7.2	10.9			0.2	1	10	17			0.1	0.5	2	1.8			NA	0.5	1.7	<0.062		
d84 (mm)	NA	23	42	31			22	32	25	44			35	18	30	50			NA	18	18	13		

Parameter	MY-01 (2005)			MY-02 (2006)			MY-03 (2007)			MY-04 (2008)			MY-05 (2009)			MY+ (2010)		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	9.4	67.7	42.4	27.33	72.73	56.87	30.93	72.93	58.77	32.63	63.7	48.0						
Radius of Curvature (ft)	8	110	40.1	18.63	79.72	28.26	18.11	87.52	26.88	17.73	80.9	27.9						
Meander Wavelenght (ft)	71	176	116.7	91.3	191.72	136.74	88.71	189.8	144	85.44	191.0	134.5						
Meander Width Ratio	0.5	3.8	2.4	1.39	3.71	2.90	1.82	4.29	3.46	2.0267	3.959	2.9789						
Profile																		
Riffle length (ft)	8.2	49.8	21.8	3.3	69.3	19.1	6.2	42.7	15.2	5.87	55.64	16.5						
Riffle slope (ft/ft)	0.000	0.045	0.016	0.000	0.038	0.012	0.000	0.050	0.013	0.004	0.052	0.022						
Pool length (ft)	7.6	57.2	27	4.8	39.2	25.2	7.7	54.7	31.2	15.53	78.64	44.6						
Pool spacing (ft)	22	125.4	64	35.3	100.6	60.7	16.8	89.3	52.3	22.16	102.7	65.2						
Additional Reach Parameters																		
Valley Length (ft)	841			853			852			846								
Channel Length (ft)	1014			1012			1014			1021								
Sinuosity	1.2			1.2			1.2			1.2								
Water Surface Slope (ft/ft)	0.0057			0.0060			0.0060			0.0058								
BF slope (ft/ft)	0.0060			0.0060			0.0060			0.0052								
Rosgen Classification	C4/1			C4			C4/5			C4/5								
*Habitat Index	NA			NA			NA			NA								
*Macrobenthos	NA			NA			NA			NA								

Table B1 a. Stream Problem Areas

Wells Creek Reach 1

Feature Issue	Station numbers	Suspected Cause	Photo number
Aggradation	10+17.59	Channel built too wide for riffle; narrowing to a stable dimension	
	10+49.44		
Rootwad	10+85.92	Location of rootwads upstream creating backeddys around downstream rootwads and contributing to bank erosion problem directly downstream	5
Rootwad	10+92.05		
Rootwad	10+97.30		
Bank Erosion (Left)	10+97.30	Upstream rootwads should have been placed further downstream to prevent erosion.	
	11+18.09		
Cross-Vane	12+75	Piping around right side of structure.	4
Bank Erosion (Left)	12+96	Lack of vegetation; Also flow direction coming from upstream crossvane and backwater affect of downstream j-hook.	
	13+13		
Aggradation	15+74.5	Channel built too wide; narrowing to a stable dimension	2
	16+18.15		
Central Bar Formation	17+33.30	Sediment aggradation forming bar in middle of pool.	
	17+40.57		
Aggradation	17+59.5	Channel built too wide; narrowing to a stable dimension	
	17+73		
Aggradation	17+98.63	Channel built too wide; narrowing to a stable dimension	3
	18+03.73		
Central Bar Formation	18+04.44	Downstream rootwads and cross-vane causing deposition upstream and creation of a central bar with grasses.	1
	18+28.29		
Aggradation	19+12.66	Channel built too wide; narrowing to a stable dimension	
	19+32.94		
Aggradation	19+73.20	Channel built too wide; narrowing to a stable dimension	
	19+83.80		
Aggradation	19+97.66	Channel built too wide; narrowing to a stable dimension	
	20+09.84		

Table B1 b. Stream Problem Areas

Wells Creek Reach 2

Feature Issue	Station numbers	Suspected Cause	Photo number
Bank Erosion (Left)	10+31.77 10+35.79	Possibly due to rootwad/j-hook placement upstream, soil stability, lack of vegetation, and/or radius of curvature	
Bank Erosion (Left)	10+83.00 11+44.30	Soil instability and/or lack of protective vegetation.	
Bank Erosion (Right)	10+82.63 11+14.39	Soil instability and/or lack of protective vegetation.	
Rootwad	11+97.63	Angle/placement possibly cause of bank erosion directly downstream.	
Bank Erosion (Left)	12+01.85 12+16.23	Angle/placement of rootwad directly upstream. Also soil instability and/or lack of protective vegetation.	
Rootwad	12+83.37	Placement angle/size is major cause of severe erosion directly downstream.	
Bank Erosion (Right)	12+86.43 12+96.19	Placement angle & size of rootwad directly upstream.	
Side Bar Formation (right)	13+18.83 13+49.97	Sediment bar forming along a riffle section.	
Severe Bank Erosion (Left)	13+41.33 13+44.37	Soil instability and/or lack of protective vegetation. Adjacent j-hook possibly placed too far downstream and/or angle is directing flow into bank.	
J-hook	13+41.27	See above comment.	
Bank Erosion (Left)	13+70.88 13+78.80	Soil instability and/or lack of protective vegetation on outside of meander.	
J-hook	14+08.23	Significant piping around right side of structure, minor piping around left side.	3
Bank Erosion (Right)	14+51.23 14+56.43	Soil instability and/or lack of protective vegetation on outside of meander.	
Severe Bank Erosion (Right)	14+72.51 14+96.31	Soil instability and/or lack of protective vegetation.	
J-hook	15+11.87	Placement/angle possible cause of downstream adjacent erosion.	
Severe Bank Erosion (Right)	15+36.40 15+97.12	Placement/angle of j-hook directly upstream. Also soil instability and/or lack of protective vegetation.	
J-hook (severe)	16+15.52	Placement/angle probable cause of downstream adjacent erosion. Flow being directed into bank.	
Bank Erosion (Left)	17+11.16 17+48.71	Soil instability and/or lack of protective vegetation. Crossvane directly upstream not adequtely dissipating flow energy during high flow events.	1
J-hook	17+74.81	Placement/angle possible cause of downstream erosion.	2
Bank Erosion (Right)	19+50.56 19+63.57	Soil instability and/or lack of protective vegetation. Adjacent j-hook possibly placed too far downstream and/or angle is directing flow into bank.	
J-hook	19+61.24	See above comment.	
Beaver Dam	end	Beaver dam has been built just upstream of the culvert at the end of the restoration reach.	4

Table B1 c. Stream Problem Areas

Wells Creek Reach UT

Feature Issue	Station numbers	Suspected Cause	Photo number
J-hook	10+00.00	Improper angle and placement of J-hook may be cause of adjacent bank erosion	
Bank Erosion (Left)	10+11.19 10+26.86	Possibly caused by improper placement of J-hook directly upstream	2
Side Bar Formation (Both Banks)	10+96.5 11+13	Former aggradation and resultant downcutting has the stream to narrow and form side bars along this riffle.	3
Side Bar Formation (Right)	11+79.04 11+88.02	Excess sediment deposition has formed a side bar along this riffle.	
Aggradation	11+99.69 12+15.41	Channel narrowing to stable state	4
Aggradation	12+63.86 12+82.80	Channel narrowing to stable state	
Aggradation	13+39.02 13+46.90	Channel narrowing to stable state as evidenced by lateral bar formation.	
Aggradation	14+29.59 14+50.45	Channel narrowing to stable state	
Aggradation	14+94.38 15+02.93	Channel narrowing to stable state	
J-hook	16+42.88	Angle and/or placement of J-hook causing bank erosion downstream	1
Bank Erosion (Left)	16+57.82 16+60.64	Possibly due to midirected flow (into outside bank of meander) from J-hook directly upstream	
Rootwad (severe)	18+15.83	Bank failure/undermining around structure and placement too high	
Rootwad	18+21.85	Placed too high.	
Rootwad	18+28.19	Placed too high.	
Aggradation	18+94.16 19+13.69	Channel narrowing to stable state	
Rootwad	19+35.61	Some minimal bank failure/undermining around structure.	
Rootwad	19+42.96	Some minimal bank failure/undermining around structure.	
Side Bar Formation (Left)	19+37.35 19+70.02	Channel narrowing to stable state	

Table B2 a. Visual Morphological Stability Assessment

Wells Creek

Segment/Reach: 1 (1241 feet)

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	% Performing in Stable Condition	Feature Performance Mean or Total
A. Riffles	1. Present	12	15	NA	80%	
	2. Armor stable	12	15	NA	80%	
	3. Facet grade appears stable	12	15	NA	80%	
	4. Minimal evidence of embedding/fining	6	15	NA	40%	
	5. Length appropriate	12	15	NA	80%	**72%**
B. Pools	1. Present	17	18	NA	94%	
	2. Sufficiently deep	17	18	NA	94%	
	3. Length appropriate	16	18	NA	89%	**93%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	5	6	NA	83%	
	2. Downstream of meander (glide/inflection) centering	5	5	NA	100%	**92%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	9	10	NA	90%	
	2. Of those eroding, # w/concomitant point bar formation	1	1	NA	100%	
	3. Apparent Rc within specifications	8	10	NA	80%	
	4. Sufficient floodplain access and relief	10	10	NA	100%	**93%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	9/168.3	84%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	**92%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	2/37.8	98%	**98%**
G. Vanes / J Hooks etc.	1. Free of back or arm scour	14	14	NA	100%	
	2. Height appropriate	14	14	NA	100%	
	3. Angle and geometry appear appropriate	14	14	NA	100%	
	4. Free of piping or other structural failures	13	14	NA	93%	**98%**
H. Wads and Boulders	1. Free of scour	15	16	NA	94%	
	2. Footing stable	16	16	NA	100%	**97%**

Table B2 b. Visual Morphological Stability Assessment

Wells Creek

Segment/Reach: 2 (1153 feet)

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	% Performing in Stable Condition	Feature Performance Mean or Total
A. Riffles	1. Present	9	10	NA	90%	
	2. Armor stable	9	10	NA	90%	
	3. Facet grade appears stable	9	10	NA	90%	
	4. Minimal evidence of embedding/fining	9	10	NA	90%	
	5. Length appropriate	8	10	NA	80%	**88%**
B. Pools	1. Present	13	13	NA	100%	
	2. Sufficiently deep	13	13	NA	100%	
	3. Length appropriate	13	13	NA	100%	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	6	6	NA	100%	
	2. Downstream of meander (glide/inflection) centering	5	5	NA	100%	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	4	10	NA	40%	
	2. Of those eroding, # w/concomitant point bar formation	4	6	NA	67%	
	3. Apparent Rc within specifications	8	10	NA	80%	
	4. Sufficient floodplain access and relief	10	10	NA	100%	**72%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	1/31.1	97%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	0/0	100%	**99%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	12/272.5	87%	**87%**
G. Vanes / J Hooks etc.	1. Free of back or arm scour	11	13	NA	85%	
	2. Height appropriate	13	13	NA	100%	
	3. Angle and geometry appear appropriate	8	13	NA	62%	
	4. Free of piping or other structural failures	12	13	NA	92%	**85%**
H. Wads and Boulders	1. Free of scour	4	6	NA	67%	
	2. Footing stable	6	6	NA	100%	**83%**

Table B2 c. Visual Morphological Stability Assessment

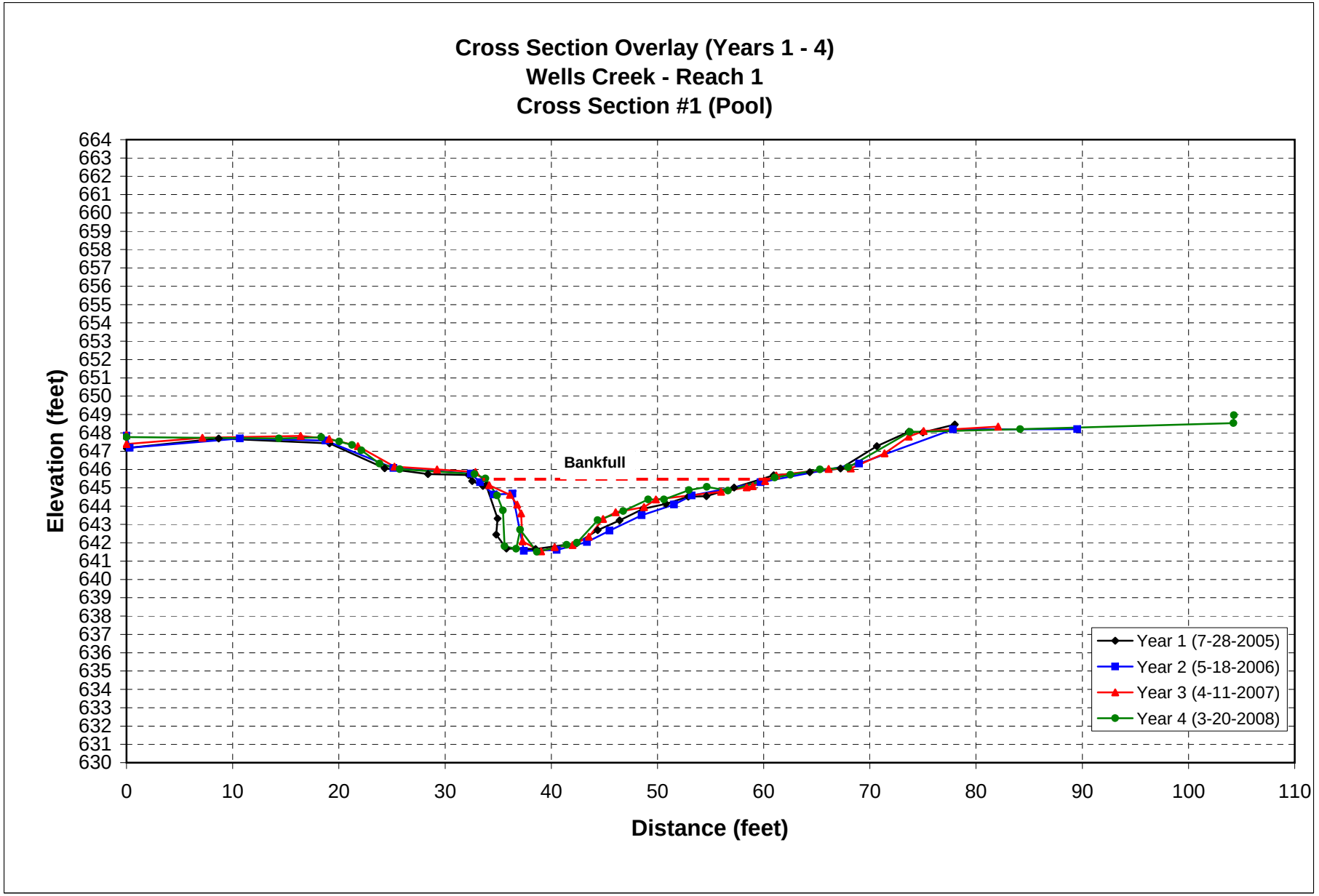
Wells Creek

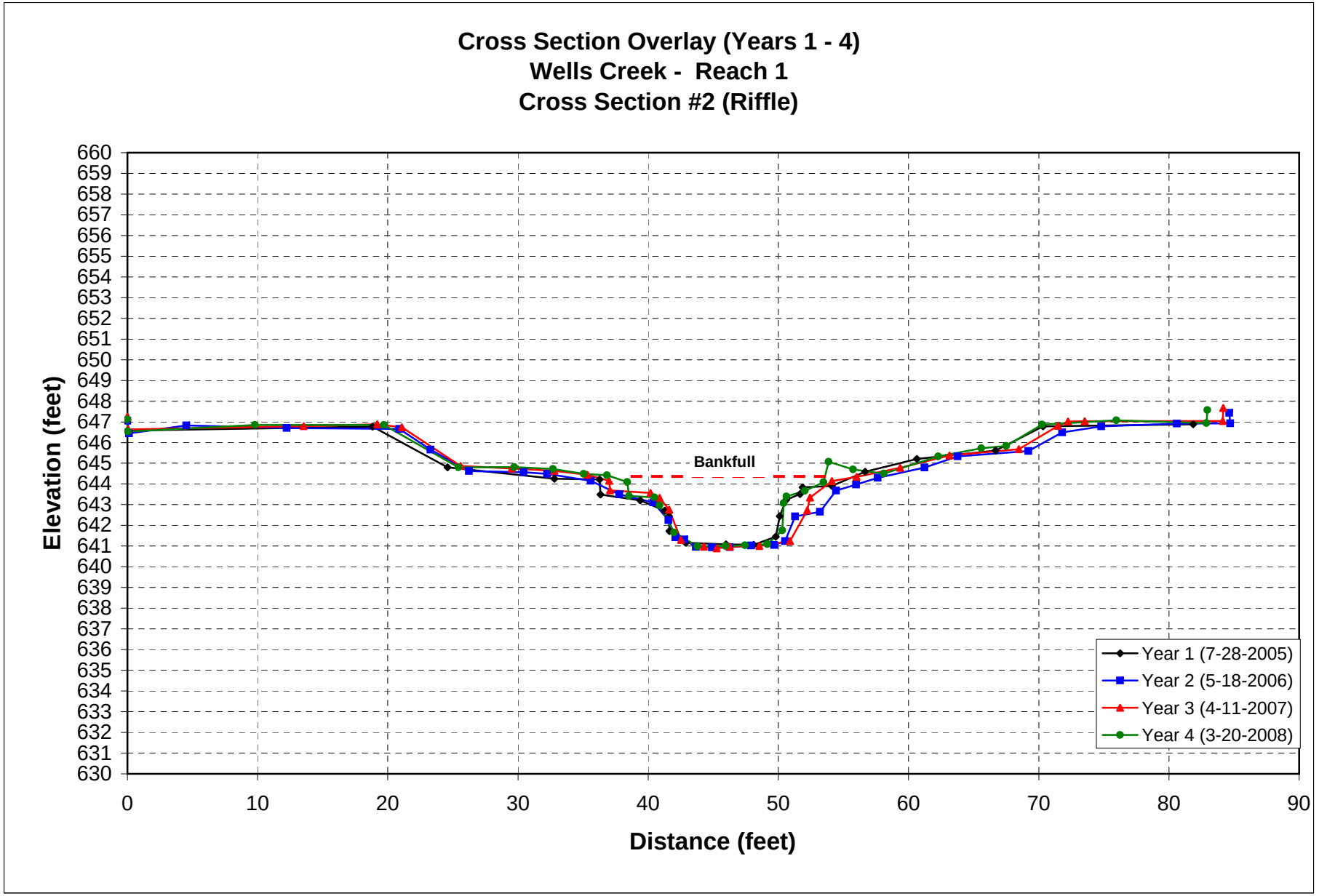
Segment/Reach: UT (1013 feet)

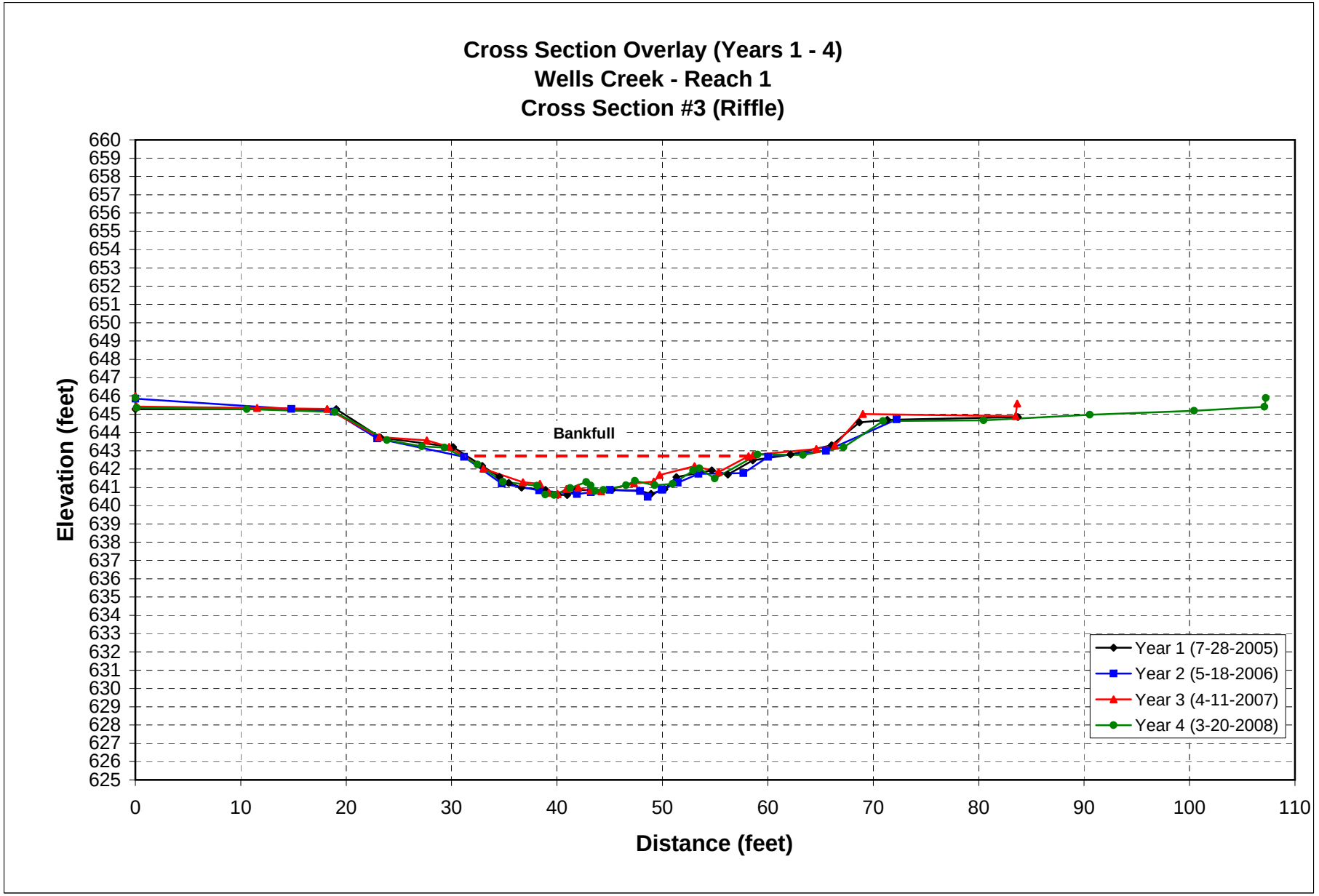
Feature Category	Metric (per As-built and reference baselines)	(#Stable) Number Performing as Intended	Total Number per As-built	Total Number / feet in unstable state	% Performing in Stable Condition	Feature Performance Mean or Total
A. Riffles	1. Present	14	15	NA	93%	
	2. Armor stable	13	15	NA	87%	
	3. Facet grade appears stable	13	15	NA	87%	
	4. Minimal evidence of embedding/fining	8	15	NA	53%	
	5. Length appropriate	12	15	NA	80%	**80%**
B. Pools	1. Present	17	17	NA	100%	
	2. Sufficiently deep	17	17	NA	100%	
	3. Length appropriate	17	17	NA	100%	**100%**
C. Thalweg	1. Upstream of meander bend (run/inflection) centering	6	6	NA	100%	
	2. Downstream of meander (glide/inflection) centering	6	6	NA	100%	**100%**
D. Meanders	1. Outer bend in state of limited/controlled erosion	11	13	NA	85%	
	2. Of those eroding, # w/concomitant point bar formation	1	2	NA	50%	
	3. Apparent Rc within specifications	10	11	NA	91%	
	4. Sufficient floodplain access and relief	13	13	NA	100%	**81%**
E. Bed General	1. General channel bed aggradation areas (bar formation)	NA	NA	9/149.6	85%	
	2. Channel bed degradation - areas of increasing down cutting or head cutting	NA	NA	1/16.5	98%	**92%**
F. Bank Condition	1. Actively eroding, wasting, or slumping bank	NA	NA	2/18.5	99%	**99%**
G. Vanes / J Hooks etc.	1. Free of back or arm scour	13	13	NA	100%	
	2. Height appropriate	13	13	NA	100%	
	3. Angle and geometry appear appropriate	11	13	NA	85%	
	4. Free of piping or other structural failures	13	13	NA	100%	**96%**
H. Wads and Boulders	1. Free of scour	13	16	NA	81%	
	2. Footing stable	13	16	NA	81%	**81%**

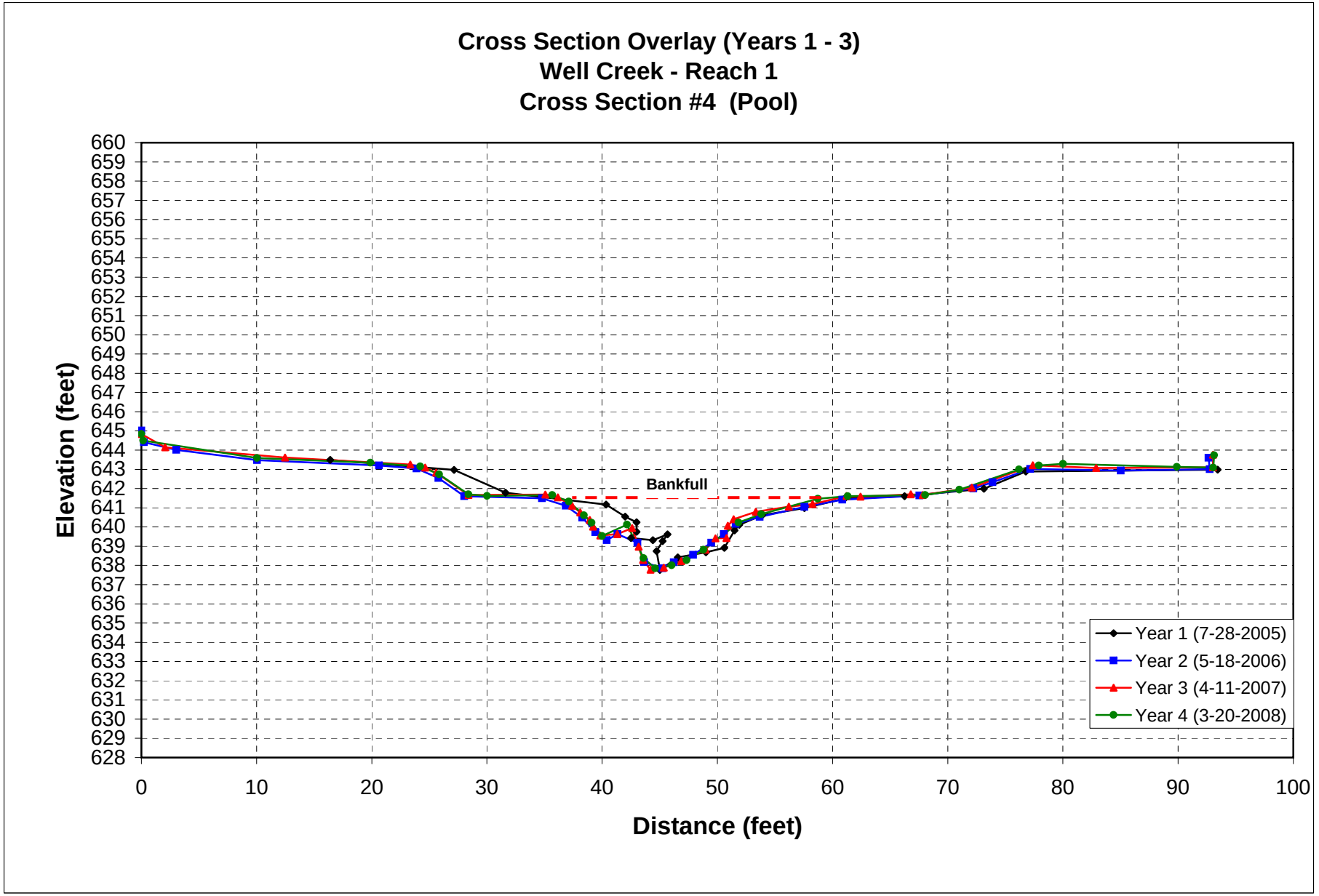
APPENDIX B4

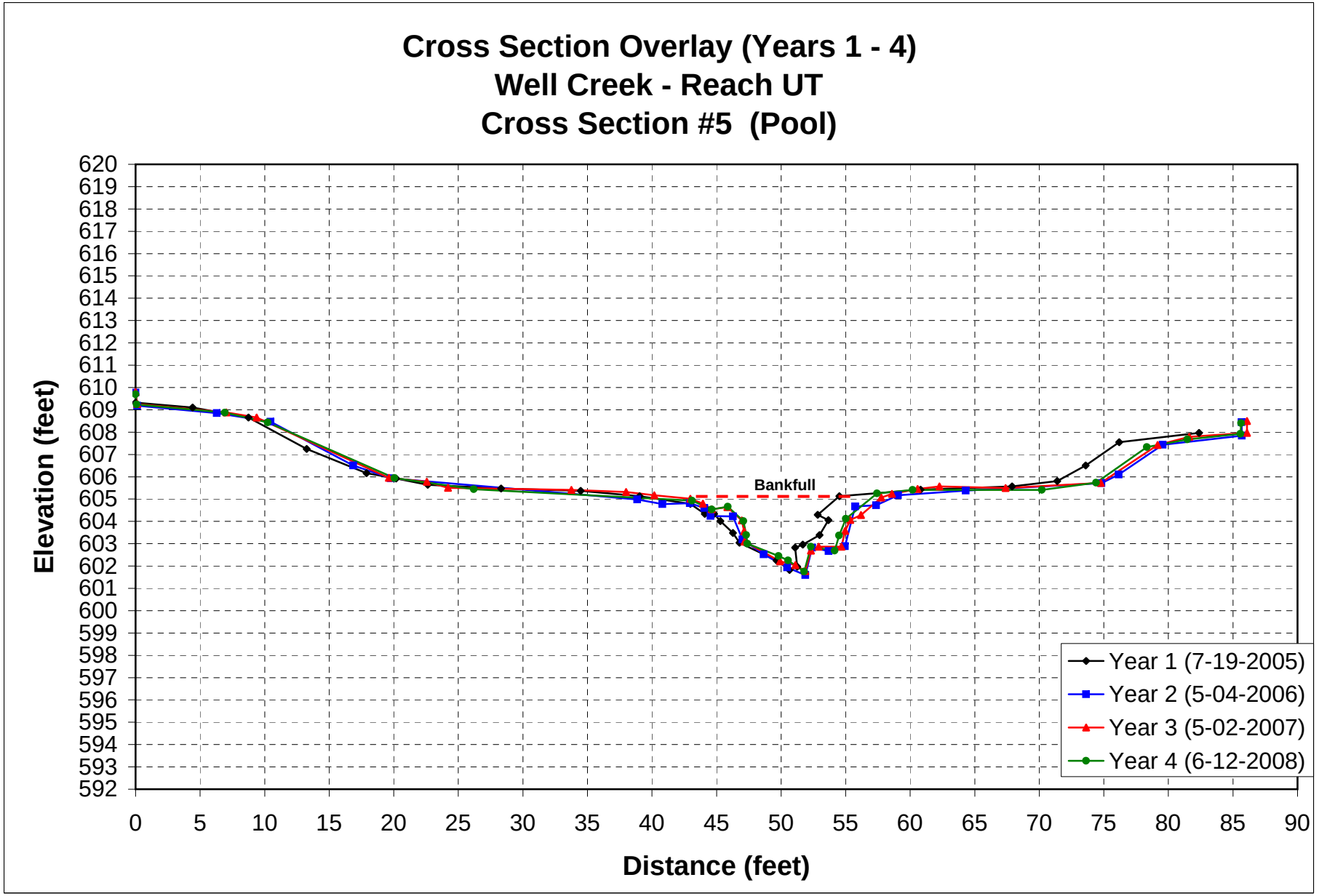
STREAM CROSS-SECTIONS

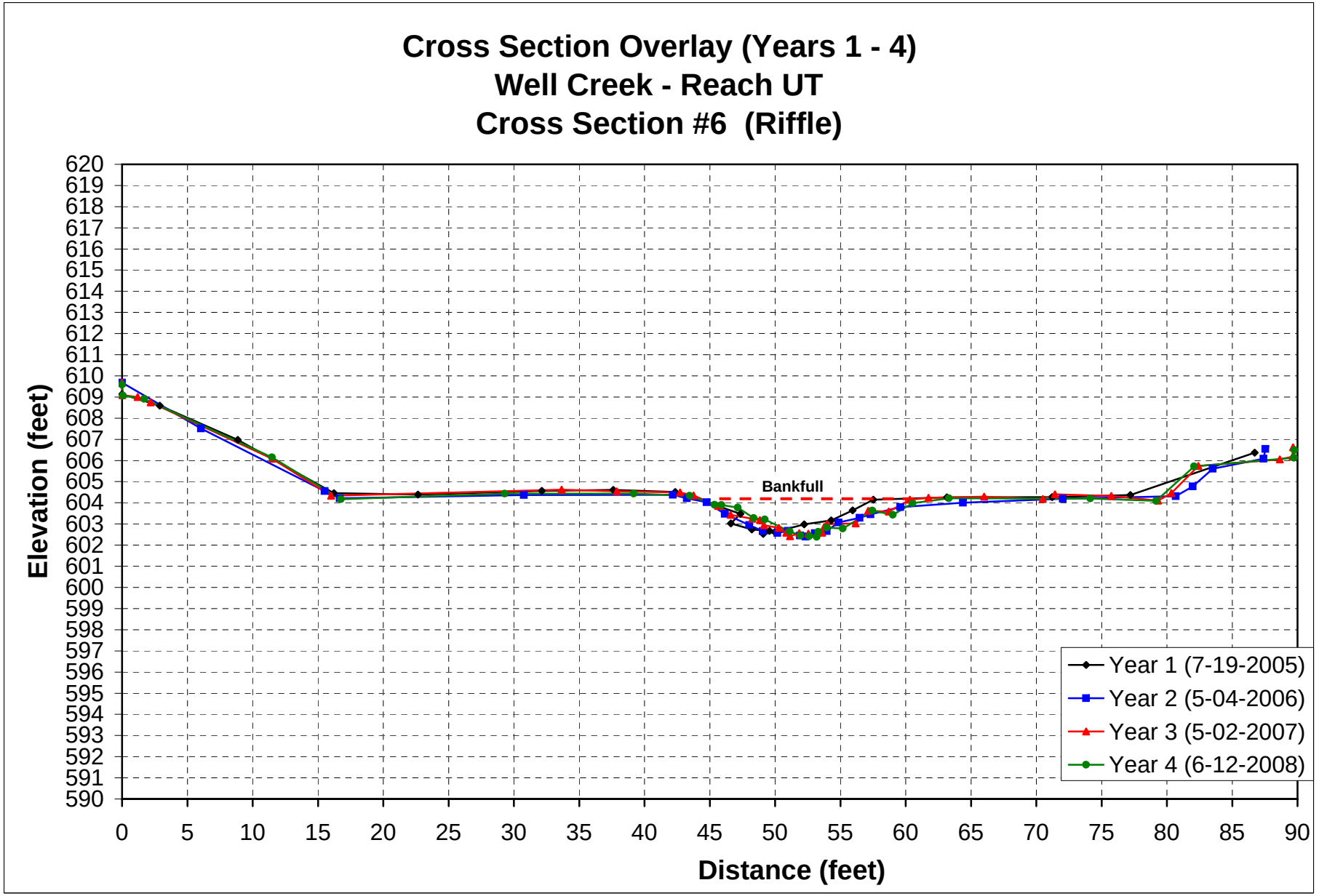

Cross Section Overlay (Years 1 - 4)
Wells Creek - Reach 1
Cross Section #1 (Pool)
Elevation (feet)
664
663
662
661
660
659
658
657
656
655
654
653
652
651
650
649
648
647
646
645
644
643
642
641
640
639
638
637
636
635
634
633
632
631
630
Bankfull
0
10
20
30
40
50
60
70
80
90
100
110
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-18-2006)
Year 3 (4-11-2007)
Year 4 (3-20-2008)

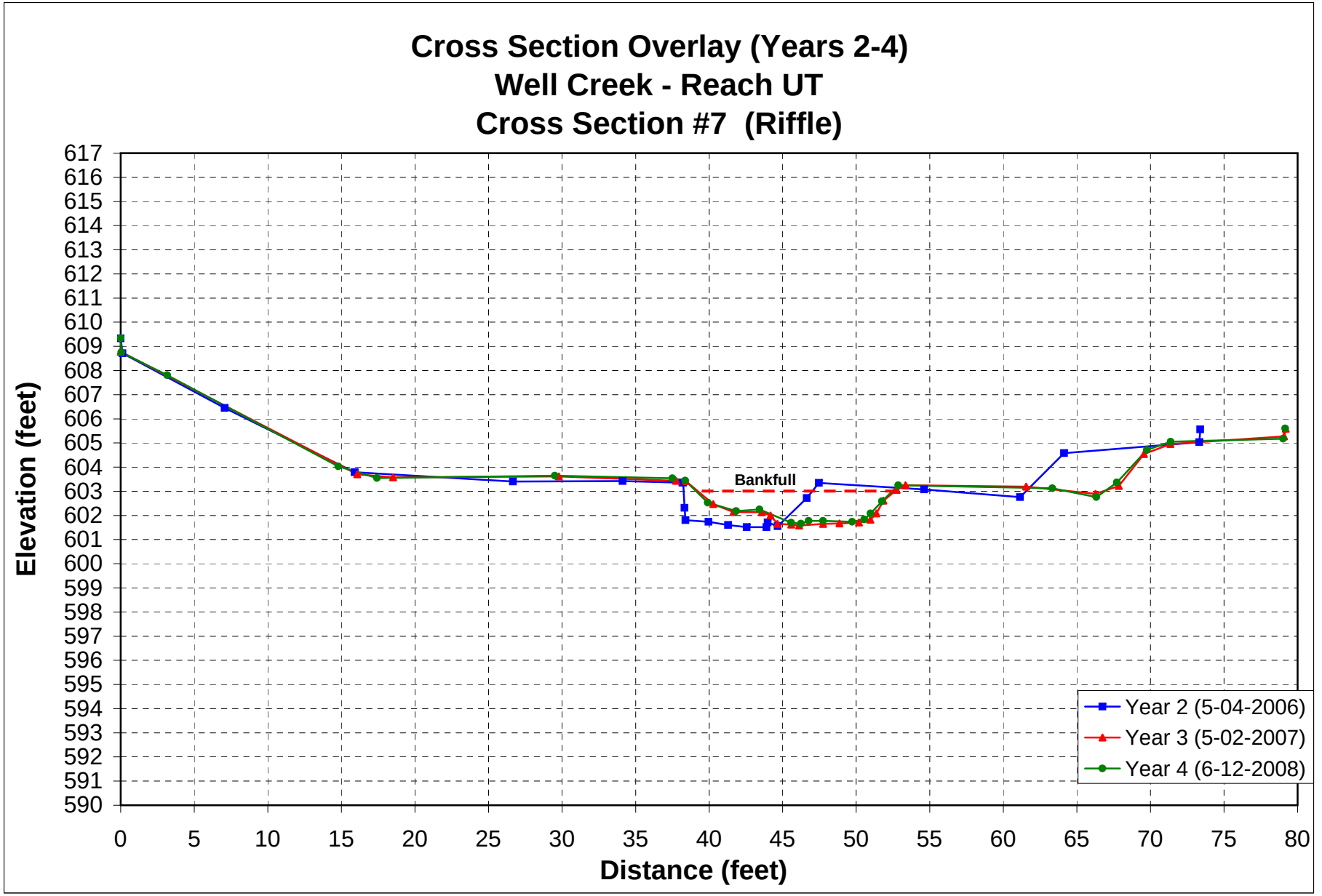

Cross Section Overlay (Years 1 - 4)
Wells Creek - Reach 1
Cross Section #2 (Riffle)
Elevation (feet)
660
659
658
657
656
655
654
653
652
651
650
649
648
647
646
645
644
643
642
641
640
639
638
637
636
635
634
633
632
631
630
Bankfull
0
10
20
30
40
50
60
70
80
90
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-18-2006)
Year 3 (4-11-2007)
Year 4 (3-20-2008)

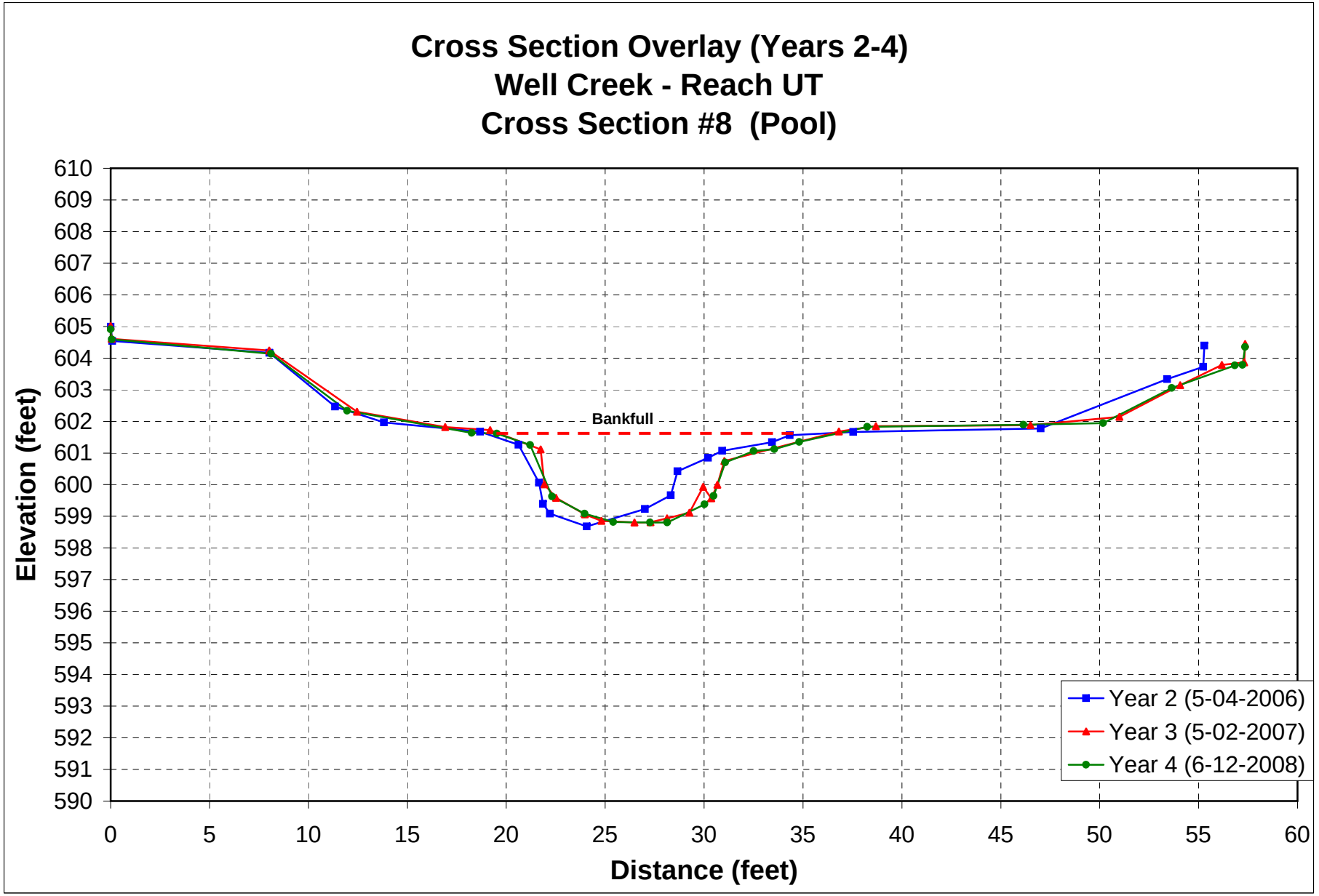

Cross Section Overlay (Years 1 - 4)
Wells Creek - Reach 1
Cross Section #3 (Riffle)
Elevation (feet)
660
659
658
657
656
655
654
653
652
651
650
649
648
647
646
645
644
643
642
641
640
639
638
637
636
635
634
633
632
631
630
629
628
627
626
625
Bankfull
0
10
20
30
40
50
60
70
80
90
100
110
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-18-2006)
Year 3 (4-11-2007)
Year 4 (3-20-2008)

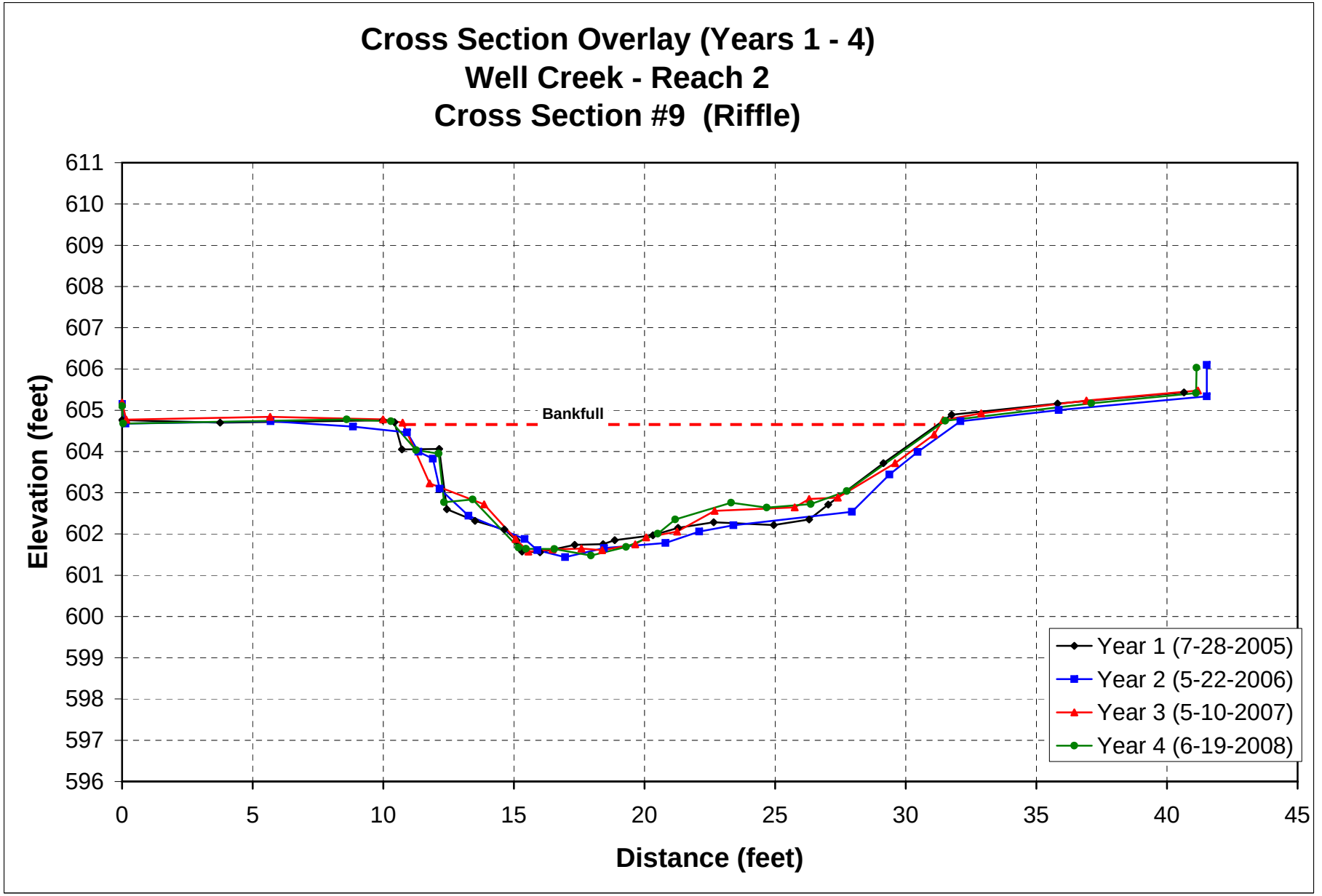

Cross Section Overlay (Years 1 - 3)
Well Creek - Reach 1
Cross Section #4 (Pool)
Elevation (feet)
660
659
658
657
656
655
654
653
652
651
650
649
648
647
646
645
644
643
642
641
640
639
638
637
636
635
634
633
632
631
630
629
628
Bankfull
0
10
20
30
40
50
60
70
80
90
100
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-18-2006)
Year 3 (4-11-2007)
Year 4 (3-20-2008)

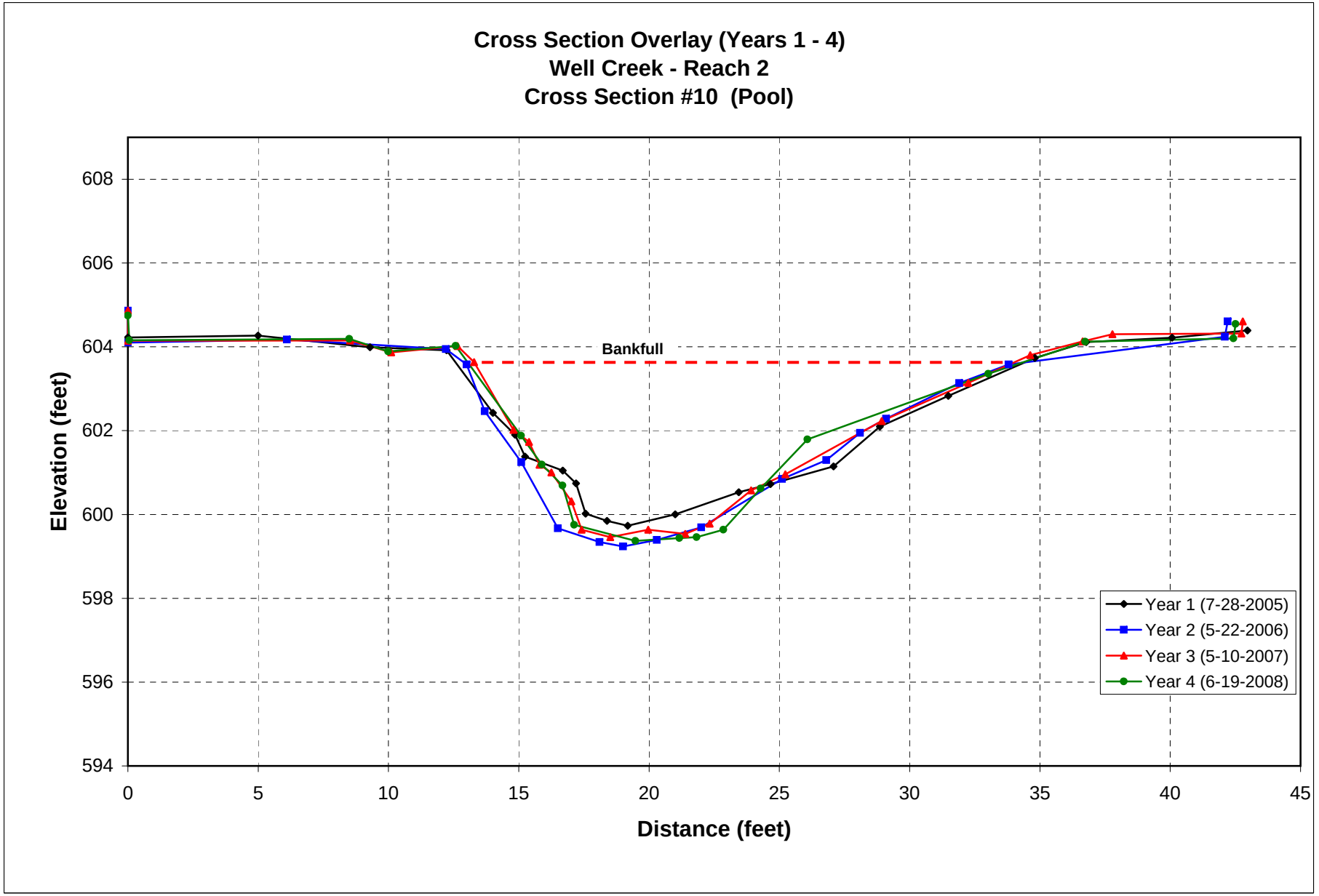

Cross Section Overlay (Years 1 - 4)
Well Creek - Reach UT
Cross Section #5 (Pool)
Elevation (feet)
620
619
618
617
616
615
614
613
612
611
610
609
608
607
606
605
604
603
602
601
600
599
598
597
596
595
594
593
592
Bankfull
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Distance (feet)
Year 1 (7-19-2005)
Year 2 (5-04-2006)
Year 3 (5-02-2007)
Year 4 (6-12-2008)

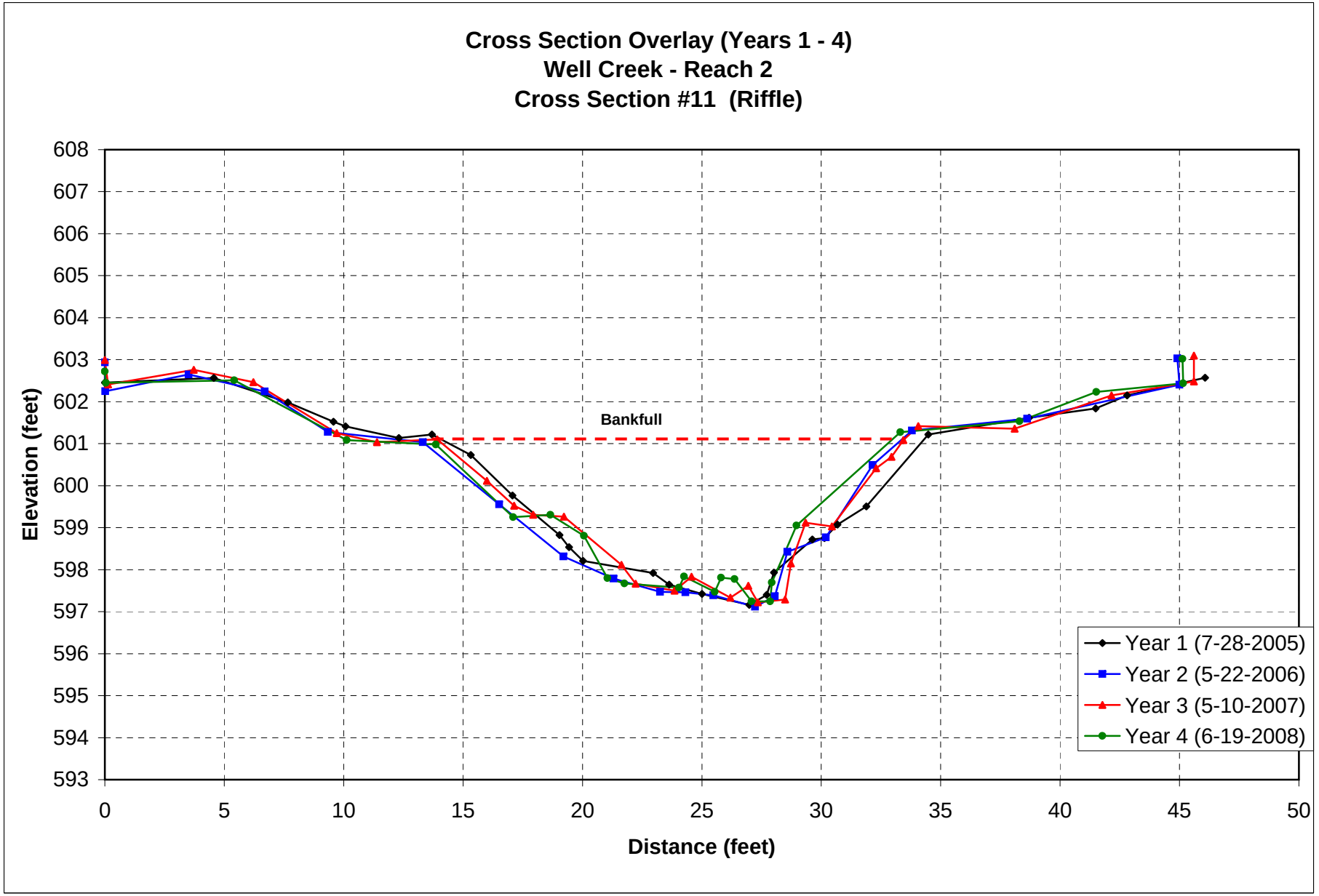

Cross Section Overlay (Years 1 - 4)
Well Creek - Reach UT
Cross Section #6 (Riffle)
Elevation (feet)
620
619
618
617
616
615
614
613
612
611
610
609
608
607
606
605
604
603
602
601
600
599
598
597
596
595
594
593
592
591
590
Bankfull
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Distance (feet)
Year 1 (7-19-2005)
Year 2 (5-04-2006)
Year 3 (5-02-2007)
Year 4 (6-12-2008)

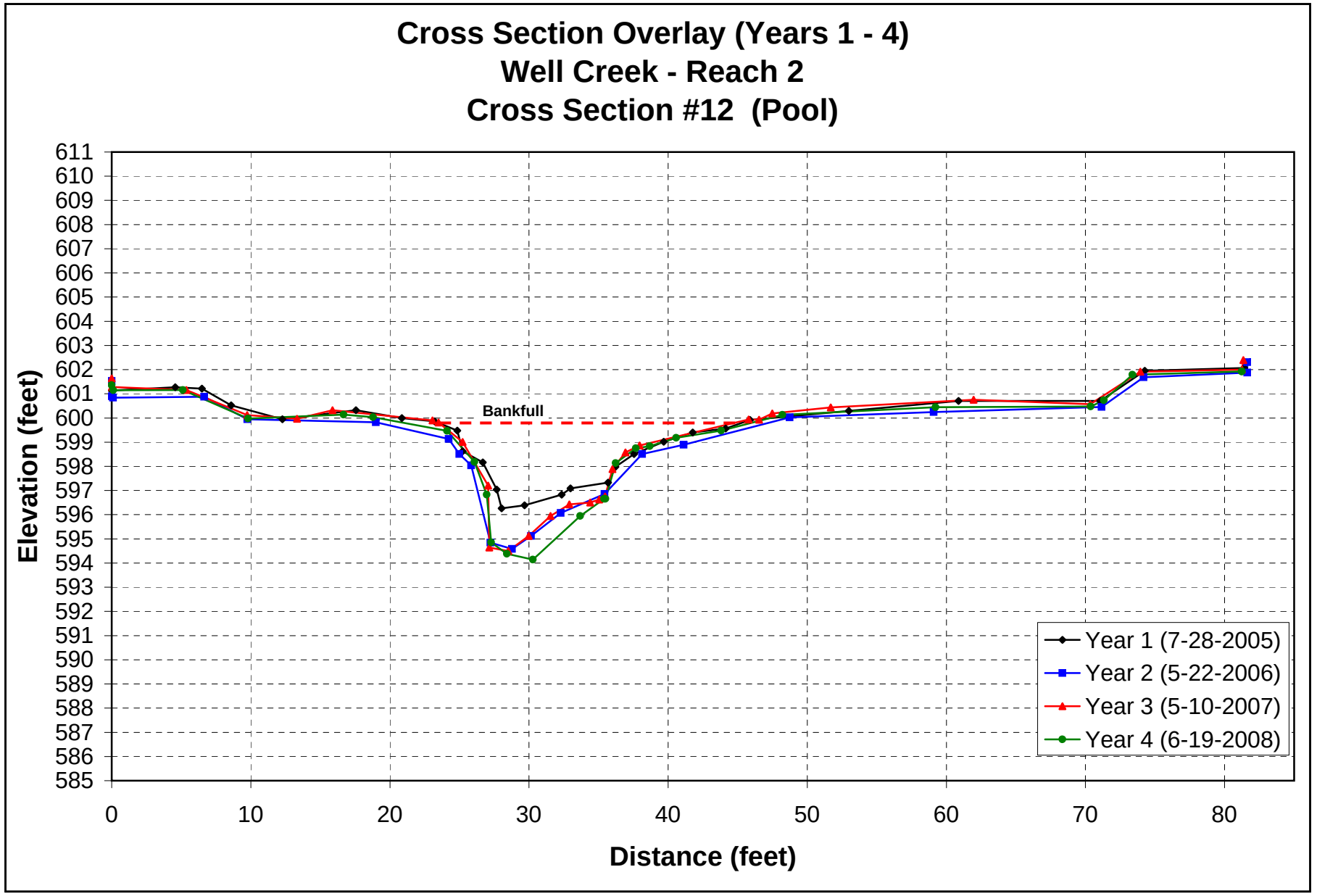

Cross Section Overlay (Years 2-4)
Well Creek - Reach UT
Cross Section #7 (Riffle)
Elevation (feet)
617
616
615
614
613
612
611
610
609
608
607
606
605
604
603
602
601
600
599
598
597
596
595
594
593
592
591
590
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
Distance (feet)
Bankfull
Year 2 (5-04-2006)
Year 3 (5-02-2007)
Year 4 (6-12-2008)


Cross Section Overlay (Years 2-4)
Well Creek - Reach UT
Cross Section #8 (Pool)
Elevation (feet)
610
609
608
607
606
605
604
603
602
601
600
599
598
597
596
595
594
593
592
591
590
Bankfull
0
5
10
15
20
25
30
35
40
45
50
55
60
Distance (feet)
Year 2 (5-04-2006)
Year 3 (5-02-2007)
Year 4 (6-12-2008)


Cross Section Overlay (Years 1 - 4)
Well Creek - Reach 2
Cross Section #9 (Riffle)
Elevation (feet)
611
610
609
608
607
606
605
604
603
602
601
600
599
598
597
596
Bankfull
0
5
10
15
20
25
30
35
40
45
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-22-2006)
Year 3 (5-10-2007)
Year 4 (6-19-2008)


Cross Section Overlay (Years 1 - 4)
Well Creek - Reach 2
Cross Section #10 (Pool)
Elevation (feet)
608
606
604
602
600
598
596
594
Bankfull
0
5
10
15
20
25
30
35
40
45
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-22-2006)
Year 3 (5-10-2007)
Year 4 (6-19-2008)


Cross Section Overlay (Years 1 - 4)
Well Creek - Reach 2
Cross Section #11 (Riffle)
Elevation (feet)
608
607
606
605
604
603
602
601
600
599
598
597
596
595
594
593
Bankfull
0
5
10
15
20
25
30
35
40
45
50
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-22-2006)
Year 3 (5-10-2007)
Year 4 (6-19-2008)


Cross Section Overlay (Years 1 - 4)
Well Creek - Reach 2
Cross Section #12 (Pool)
Elevation (feet)
611
610
609
608
607
606
605
604
603
602
601
600
599
598
597
596
595
594
593
592
591
590
589
588
587
586
585
Bankfull
0
10
20
30
40
50
60
70
80
Distance (feet)
Year 1 (7-28-2005)
Year 2 (5-22-2006)
Year 3 (5-10-2007)
Year 4 (6-19-2008)

Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-08
Monitoring Year	4

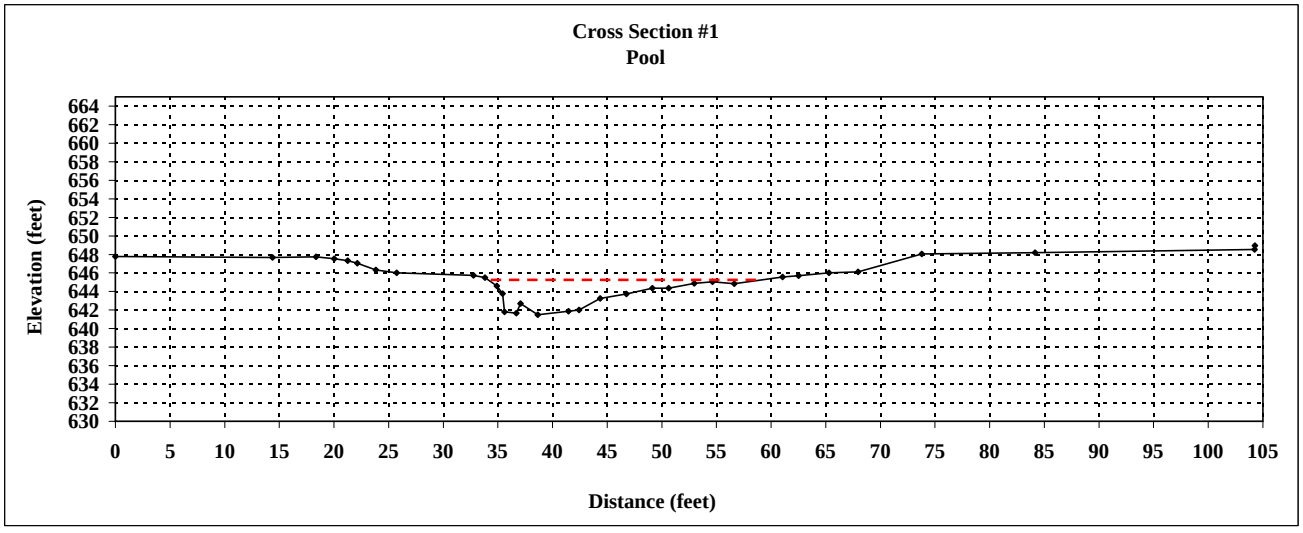
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	647.77	
14.36	647.69	
18.36	647.76	
20.04	647.52	
21.25	647.34	
22.13	647.05	
23.83	646.32	
25.73	646.01	
32.76	645.75	TOB
33.81	645.51	
34.89	644.58	
35.44	643.77	LEW
35.60	641.82	
36.69	641.67	
37.07	642.71	
38.65	641.50	Thalweg
41.46	641.88	
42.43	642.01	
44.36	643.24	
46.77	643.74	REW
49.12	644.36	
50.62	644.36	
52.97	644.87	
54.65	645.05	
56.64	644.85	
61.04	645.56	
62.51	645.71	
65.30	646.00	
67.95	646.12	
73.77	648.05	
84.16	648.21	
104.23	648.52	
104.27	648.96	

	Bankfull Hydraulic Geometry			
	Width (Feet)	**Depth (Feet)**	**Perimeter (Feet)**	**Area (Sq. Ft.)**
	0.00	0.00	0.00	0.00
	0.90	0.78	1.19	0.35
	0.55	1.59	0.98	0.65
	0.15	3.54	1.96	0.40
	1.09	3.69	1.10	3.94
	0.38	2.65	1.10	1.22
	1.58	3.86	1.99	5.14
	2.81	3.48	2.83	10.30
	0.97	3.35	0.98	3.30
	1.94	2.12	2.30	5.30
	2.41	1.62	2.46	4.51
	2.35	1.00	2.43	3.08
	1.50	1.00	1.50	1.50
	2.35	0.49	2.40	1.74
	1.68	0.31	1.69	0.67
	1.99	0.51	2.00	0.82
	3.11	0.00	3.16	0.79
TOTALS	25.76		30.06	43.71

SUMMARY DATA	
A(BKF)	43.71
W(BKF)	25.76
Max d	3.86
Mean d	1.70
Wet. P	30.06
Hyd. R	1.45

Bankfull datum* = 645.36

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-08
Monitoring Year	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	647.12	
0.04	646.53	
9.80	646.84	
19.70	646.85	
25.43	644.80	
29.72	644.81	
32.68	644.72	
35.05	644.48	
36.84	644.42	TOB
38.39	644.10	
38.54	643.42	
40.49	643.35	
40.89	642.97	
41.98	641.65	LEW
43.78	640.99	
45.95	641.01	
47.44	641.04	Thalweg
49.16	641.10	
50.30	641.76	
50.41	643.07	REW
50.62	643.40	
52.04	643.67	
53.46	644.09	
53.87	645.08	
55.74	644.71	
58.10	644.50	
62.29	645.34	
65.60	645.72	
67.51	645.84	
70.27	646.87	
75.97	647.08	
82.89	646.94	
82.96	647.57	

Bankfull Hydraulic Geometry

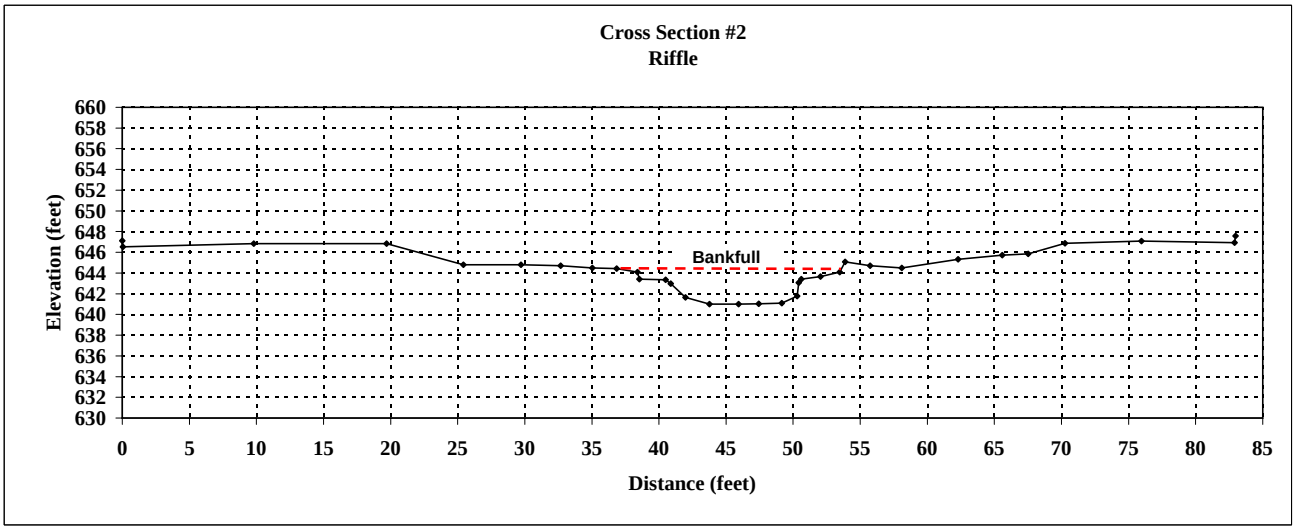
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.00	0.00	0.00	0.00
	1.39	0.24	1.42	0.17
	0.15	0.92	0.69	0.08
	1.95	0.99	1.95	1.86
	0.39	1.37	0.55	0.47
	1.10	2.69	1.72	2.23
	1.79	3.35	1.91	5.40
	2.17	3.33	2.17	7.25
	1.49	3.30	1.49	4.95
	1.73	3.24	1.73	5.65
	1.14	2.58	1.32	3.33
	0.10	1.27	1.31	0.20
	0.21	0.94	0.39	0.23
	1.43	0.67	1.45	1.15
	1.42	0.25	1.48	0.66
	0.14	0.00	0.29	0.02
TOTALS	16.60		19.87	33.63

SUMMARY DATA (BANKFULL)

A(BKF)	33.63	W(FPA)	83+
W(BKF)	16.60	WP	19.87
Max d	3.35	Hydraulic Radius	0.84
Mean d	2.03	Wetted Perimeter=	WP
W/D	8.19	Area=	A
Bank Height	3.43	Width=	W
Entrenchment	5.0+	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			30.5

Bankfull datum* = 644.34

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-08
Monitoring Year	4

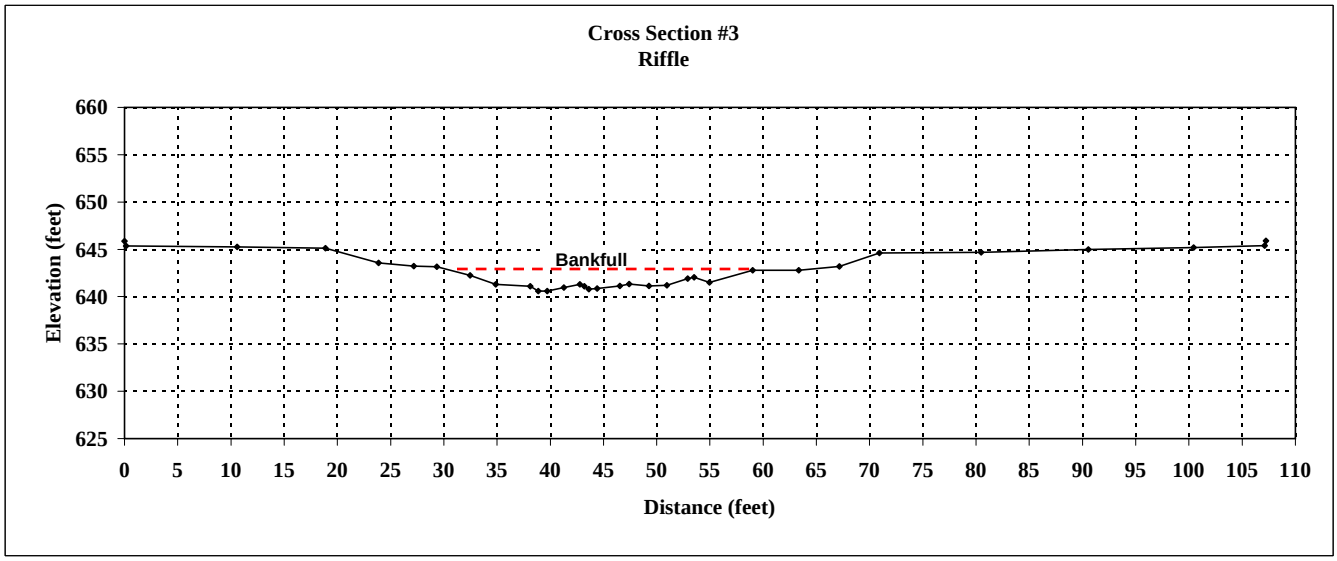
STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	645.88	
0.14	645.35	
10.57	645.27	
18.89	645.12	
23.87	643.58	
27.18	643.24	
29.33	643.17	
32.47	642.24	
34.86	641.30	
38.11	641.09	LEW
38.88	640.60	
39.72	640.57	Thalweg
41.26	640.97	Edge bar
42.77	641.30	
43.20	641.10	Edge bar
43.62	640.79	
44.40	640.86	
46.54	641.12	REW
47.40	641.35	
49.27	641.12	
50.97	641.19	
52.91	641.92	
53.51	642.04	
54.97	641.49	
59.02	642.80	TOB
63.34	642.77	
67.17	643.19	
70.93	644.63	
80.48	644.66	
90.55	644.97	
100.44	645.19	
107.11	645.40	
107.23	645.89	

Bankfull Hydraulic Geometry			
Width (Feet)	**Depth (Feet)**	**Perimeter (Feet)**	**Area (Sq. Ft.)**
0.00	0.00	0.00	0.00
1.77	0.53	1.84	0.46
2.40	1.47	2.57	2.39
3.24	1.68	3.25	5.10
0.77	2.17	0.92	1.49
0.84	2.20	0.84	1.83
1.54	1.80	1.59	3.08
1.51	1.47	1.54	2.47
0.43	1.67	0.47	0.68
0.42	1.98	0.52	0.76
0.78	1.91	0.78	1.52
2.14	1.65	2.16	3.81
0.86	1.42	0.89	1.32
1.86	1.65	1.88	2.86
1.70	1.58	1.70	2.75
1.94	0.85	2.07	2.35
0.61	0.73	0.62	0.48
1.46	1.28	1.56	1.47
4.03	0.00	4.23	2.58
TOTALS 28.30		29.44	37.42

SUMMARY DATA (BANKFULL)			
A(BKF)	37.42	W(FPA)	71+
W(BKF)	28.30	WP	29.44
Max d	2.20	Hydraulic Radius	1.27
Mean d	1.32	Wetted Perimeter=	WP
W/D	21.40	Area=	A
Bank Height	2.22	Width=	W
Entrenchment	2.5+	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			30.5

Bankfull datum* = 642.77

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and PDB
Stream Reach:	1
Project:	Wells Creek
Drainage Area:	1.63
Date:	Jan-08
Monitoring Year	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	644.83	
0.16	644.50	
10.04	643.59	
19.88	643.34	
24.21	643.15	
25.84	642.74	
28.40	641.70	
30.02	641.62	
35.68	641.66	
37.10	641.32	
38.41	640.61	
39.09	640.22	LEW
39.99	639.53	
42.17	640.13	
43.60	638.38	
44.60	637.85	Thalweg
46.03	638.00	
47.33	638.28	
48.81	638.82	
51.85	640.23	REW
53.81	640.67	
58.72	641.47	
61.31	641.60	TOB
68.04	641.67	
71.01	641.95	
76.20	643.00	
77.92	643.20	
80.01	643.28	
89.90	643.13	
93.06	643.09	
93.13	643.73	

Bankfull/Top of Bank Hydraulic Geometry

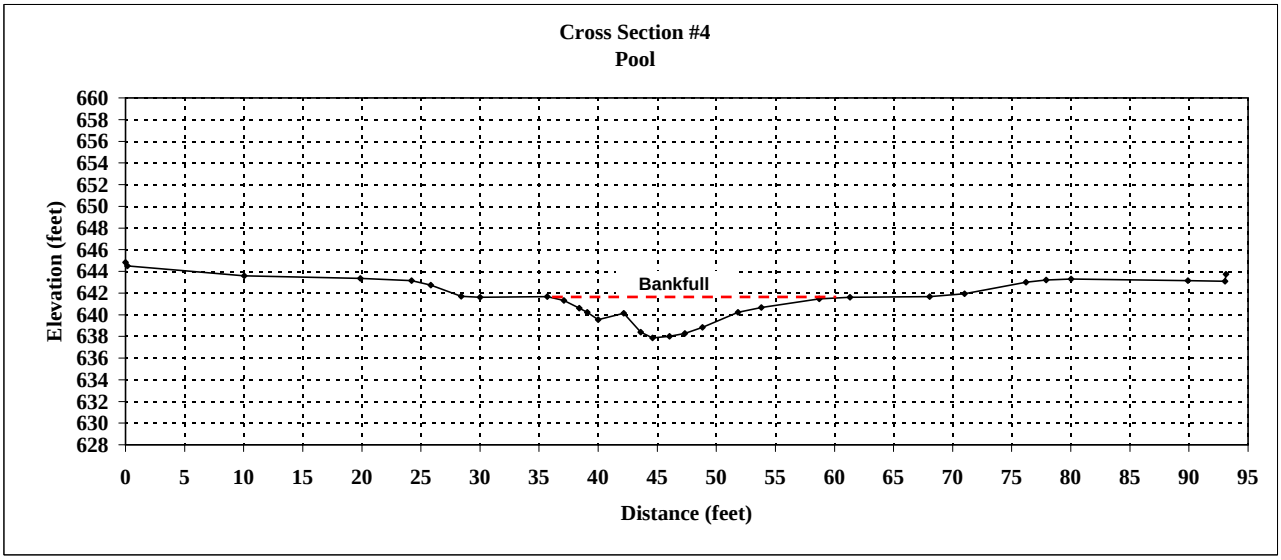
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.00	0.00	0.00	0.00
	0.95	0.23	0.97	0.11
	1.31	0.94	1.50	0.77
	0.68	1.33	0.78	0.77
	0.90	2.02	1.13	1.51
	2.18	1.42	2.26	3.75
	1.43	3.17	2.26	3.29
	1.00	3.70	1.13	3.42
	1.44	3.55	1.44	5.20
	1.30	3.27	1.33	4.43
	1.48	2.73	1.58	4.46
	3.03	1.32	3.34	6.14
	1.97	0.88	2.01	2.17
	4.91	0.08	4.98	2.37
	1.38	0.00	1.38	0.06
TOTALS	23.95		26.09	38.44

SUMMARY DATA

A(BKF)	38.44
W(BKF)	23.95
Max d	3.70
Mean d	1.60
Wet. P	26.09
Hyd. R	1.47

Bankfull datum* = 641.55

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Jun-07
Monitoring Year	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	609.70	
0.10	609.24	
6.92	608.88	
10.24	608.43	
20.06	605.94	
26.20	605.45	
43.11	604.93	
44.63	604.54	
45.88	604.66	
47.08	604.02	
47.29	603.39	LEW
47.40	603.00	
49.81	602.45	
50.55	602.25	
51.79	601.75	Thalweg
52.32	602.86	
54.14	602.69	
54.49	603.37	REW
55.01	604.12	
57.44	605.26	TOB
60.20	605.41	
70.20	605.41	
74.40	605.73	
78.33	607.33	
81.47	607.67	
85.58	607.92	
85.64	608.41	

Bankfull/Top of Bank Hydraulic Geometry

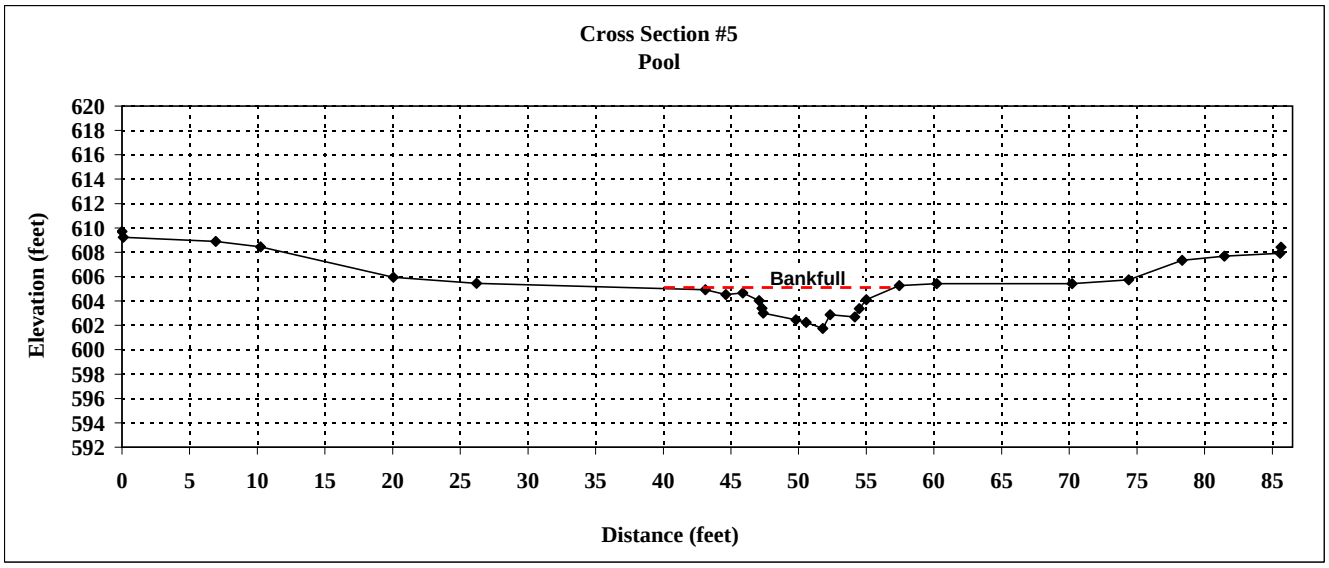
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	3.0	0.1	3.01	0.1
	1.5	0.5	1.58	0.4
	1.2	0.4	1.25	0.5
	1.2	1.0	1.36	0.8
	0.2	1.6	0.66	0.3
	0.1	2.0	0.40	0.2
	2.4	2.6	2.47	5.5
	0.7	2.8	0.77	2.0
	1.2	3.3	1.33	3.7
	0.5	2.2	1.23	1.4
	1.8	2.3	1.83	4.1
	0.3	1.7	0.76	0.7
	0.5	0.9	0.92	0.7
	1.9		2.09	0.8
TOTALS	16.8		19.66	21.3

SUMMARY DATA

A(BKF)	21.3
W(BKF)	16.8
Max d	3.3
Mean d	1.3
Wet. P	19.66
Hyd. R	1.09

Bankfull datum* = 605.02

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Jun-07
Monitoring Year	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	609.58	
0.06	609.07	
1.69	608.91	
11.49	606.14	
16.76	604.16	
29.31	604.43	
39.18	604.43	
43.46	604.33	TOB
45.36	603.91	
45.90	603.89	
47.16	603.78	
48.35	603.28	
49.21	603.21	
51.12	602.64	LEW
51.94	602.45	
52.61	602.42	Thalweg
53.19	602.39	
53.32	602.63	REW
53.96	602.82	
55.18	602.78	
57.46	603.63	
59.01	603.43	
60.53	603.98	
63.32	604.21	TOB
74.13	604.21	
79.19	604.10	
82.08	605.72	
89.73	606.13	
89.77	606.49	

Bankfull/Top of Bank Hydraulic Geometry

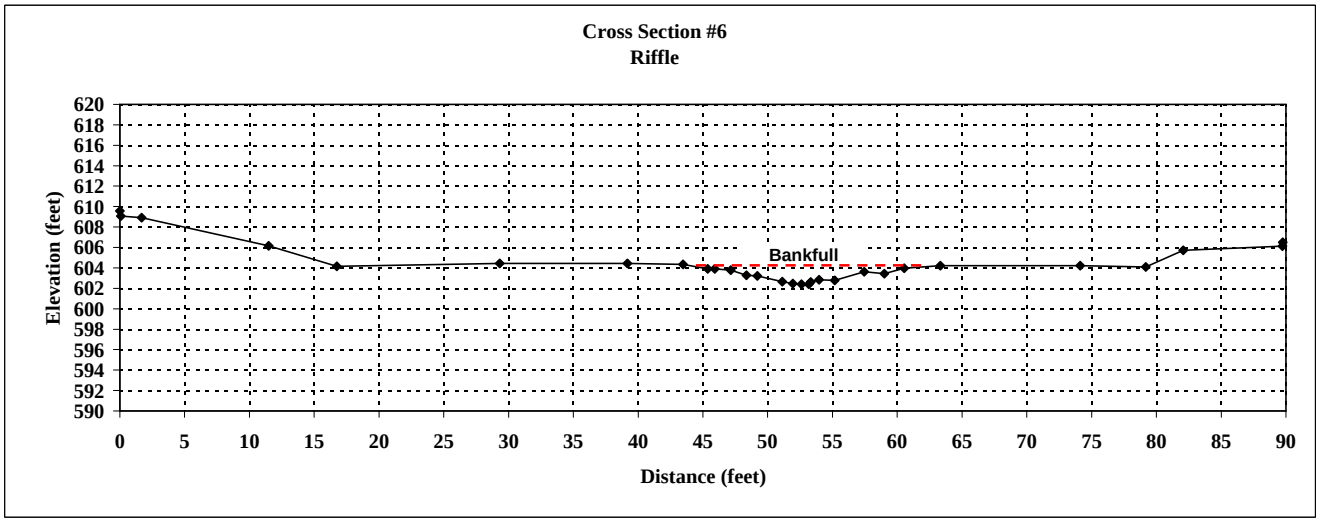
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	1.0	0.2	0.99	0.1
	0.5	0.3	0.54	0.1
	1.3	0.4	1.26	0.4
	1.2	0.9	1.30	0.7
	0.9	0.9	0.86	0.8
	1.9	1.5	2.00	2.3
	0.8	1.7	0.84	1.3
	0.7	1.7	0.68	1.2
	0.6	1.8	0.57	1.0
	0.1	1.5	0.28	0.2
	0.6	1.3	0.67	0.9
	1.2	1.4	1.22	1.6
	2.3	0.5	2.43	2.1
	1.6	0.7	1.57	1.0
	1.5	0.2	1.61	0.7
	1.8		1.83	0.2
TOTALS	18.0		18.63	14.6

SUMMARY DATA (BANKFULL)

A(BKF)	14.6	W(FPA)	75
W(BKF)	18.0	WP	18.63
Max d	1.8	Hydraulic Radius	0.79
Mean d	0.8	Wetted Perimeter=	WP
W/D	22.0	Area=	A
Bank Height	1.83	Width=	W
Entrenchment	4.2	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			17.5

Bankfull datum* = 604.15

*Datum reset during Monitoring Year 3.



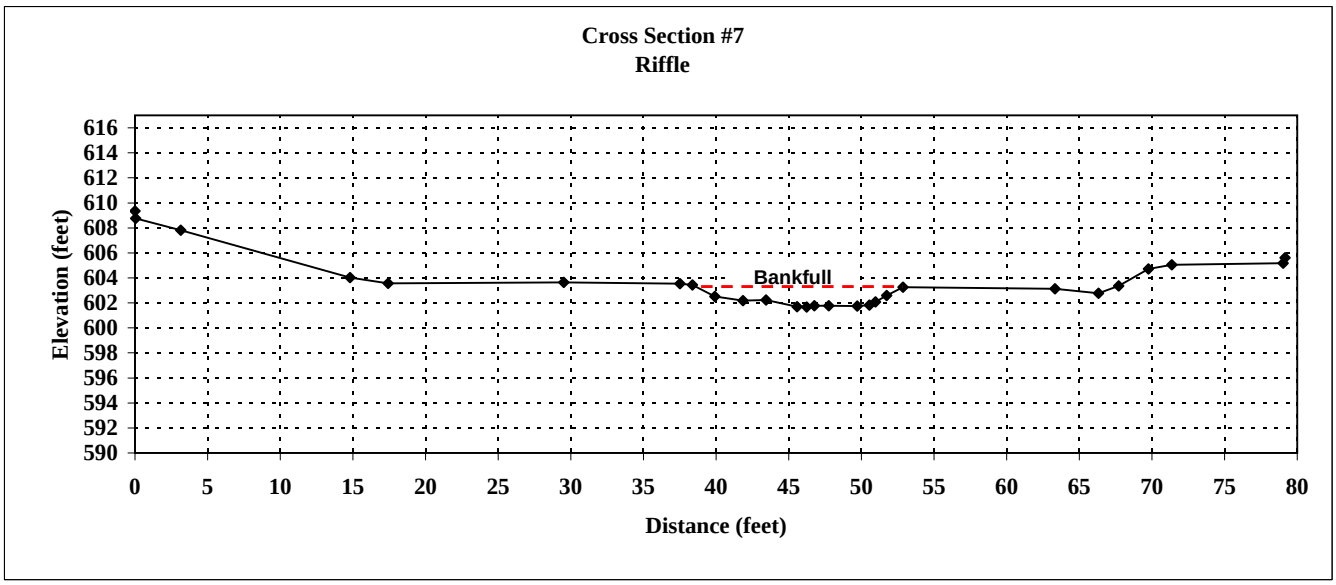
Field Crew:	IPJ and KC
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Jun-07
Monitoring Year	4

STATION (Feet)	HI (Feet)	NOTES
0.00	609.34	
0.05	608.75	
3.16	607.80	
14.80	604.03	
17.43	603.55	
29.51	603.65	
37.51	603.53	
38.38	603.45	TOB
39.91	602.52	
41.85	602.18	
43.43	602.25	
45.57	601.69	LEW
46.24	601.66	Thalweg
46.77	601.77	REW
47.75	601.77	
49.72	601.73	
50.55	601.84	
50.97	602.09	
51.75	602.58	
52.87	603.25	BKF
63.33	603.13	
66.33	602.76	
67.72	603.36	
69.77	604.71	
71.37	605.05	
79.02	605.18	
79.16	605.60	

Bankfull Hydraulic Geometry			
Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
0.0	0.0	0.00	0.0
1.2	0.7	1.41	0.4
1.9	1.1	1.97	1.7
1.6	1.0	1.59	1.6
2.1	1.6	2.21	2.7
0.7	1.6	0.67	1.1
0.5	1.5	0.53	0.8
1.0	1.5	0.99	1.5
2.0	1.5	1.97	2.9
0.8	1.4	0.84	1.2
0.4	1.2	0.49	0.5
0.8	0.7	0.92	0.7
1.1		1.30	0.4
TOTALS 14.2		14.88	15.6

SUMMARY DATA (BANKFULL)			
A(BKF)	15.6	W(FPA)	59.1
W(BKF)	14.2	WP	14.88
Max d	1.6	Hydraulic Radius	1.05
Mean d	1.1	Wetted Perimeter=	WP
W/D	12.9	Area=	A
Bank Height	1.78	Width=	W
Entrenchment	4.2	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			17.5

Bankfull datum* = 603.25
*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	UT
Project:	Wells Creek
Drainage Area:	0.71
Date:	Jun-07
Monitoring Year	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	604.91	
0.05	604.59	
8.10	604.14	
11.96	602.33	
18.25	601.64	
19.53	601.62	
21.21	601.25	
22.32	599.63	REW
23.97	599.09	
25.41	598.82	Thalweg
27.27	598.80	
28.14	598.80	
30.03	599.38	
30.49	599.64	REW
31.07	600.70	
32.51	601.06	
33.55	601.12	
34.82	601.35	
38.25	601.83	TOB
46.15	601.90	
50.18	601.95	
53.65	603.06	
56.84	603.77	
57.23	603.78	
57.35	604.35	

Bankfull/Top of Bank Hydraulic Geometry

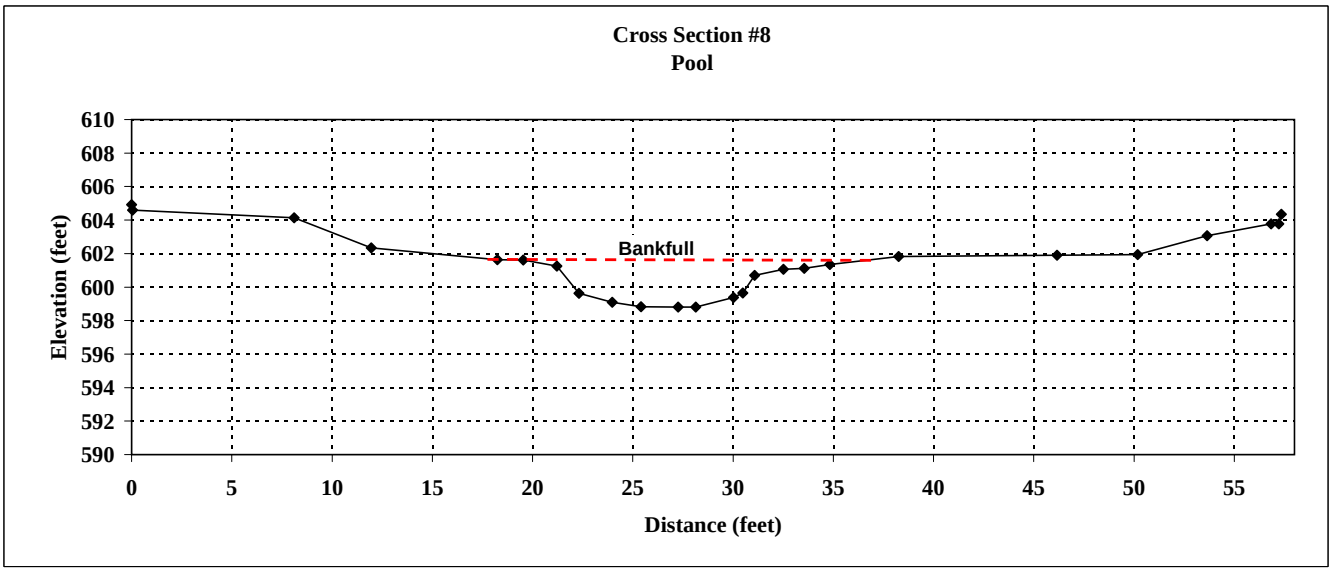
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	0.5	0.0	0.50	0.0
	1.3	0.1	1.28	0.1
	1.7	0.4	1.72	0.4
	1.1	2.1	1.96	1.4
	1.7	2.6	1.74	3.8
	1.4	2.9	1.47	3.9
	1.9	2.9	1.85	5.3
	0.9	2.9	0.87	2.5
	1.9	2.3	1.98	4.9
	0.5	2.0	0.53	1.0
	0.6	1.0	1.21	0.9
	1.4	0.6	1.48	1.1
	1.0	0.6	1.05	0.6
	1.3	0.3	1.29	0.6
	2.3		2.36	0.4
TOTALS	19.4		21.29	26.9

SUMMARY DATA

A(BKF)	26.9
W(BKF)	19.4
Max d	2.9
Mean d	1.4
Wet. P	21.29
Hyd. R	1.27

Bankfull datum* = 601.68

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	Jun-08
Monitoring Year:	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	605.10	
0.05	604.68	
8.60	604.78	
10.29	604.73	BKF
11.26	604.03	
12.12	603.95	
12.33	602.77	
13.42	602.84	
15.18	601.67	LEW
15.46	601.64	
16.55	601.63	
17.95	601.48	Thalweg
19.29	601.69	REW
20.51	602.01	
21.17	602.35	
23.32	602.76	
24.68	602.64	
26.37	602.73	
27.75	603.04	
31.52	604.75	TOB
37.10	605.16	
41.11	605.41	
41.13	606.03	

Bankfull/Top of Bank Hydraulic Geometry

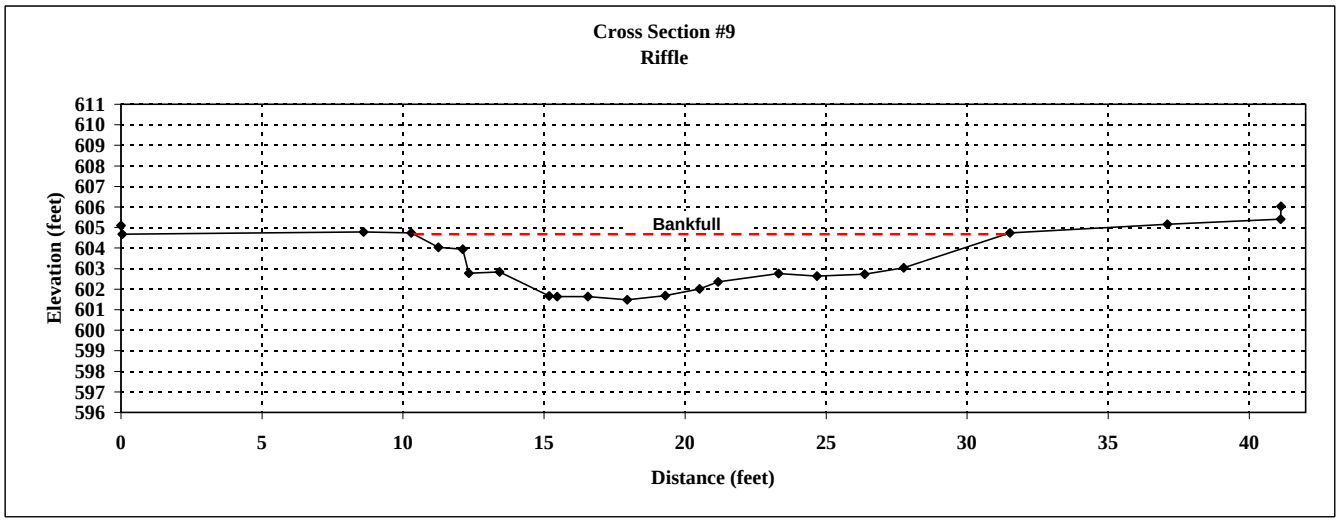
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	0.9	0.7	1.15	0.3
	0.9	0.8	0.87	0.6
	0.2	1.9	1.20	0.3
	1.1	1.9	1.09	2.1
	1.8	3.0	2.11	4.3
	0.3	3.1	0.29	0.9
	1.1	3.1	1.09	3.3
	1.4	3.2	1.40	4.4
	1.3	3.0	1.36	4.2
	1.2	2.7	1.26	3.5
	0.7	2.3	0.75	1.7
	2.1	1.9	2.18	4.6
	1.4	2.1	1.37	2.7
	1.7	2.0	1.69	3.4
	1.4	1.7	1.42	2.5
	3.7		4.01	3.0
TOTALS	21.1		23.23	41.8

SUMMARY DATA (BANKFULL)

A(BKF)	41.8	W(FPA)	42+
W(BKF)	21.08	WP	23.23
Max d	3.2	Hydraulic Radius	1.80
Mean d	2.0	Wetted Perimeter=	WP
W/D	10.6	Area=	A
Bank Height	3.27	Width=	W
Entrenchment	2.0+	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			37.6

Bankfull datum* = 604.70

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	Jun-08
Monitoring Year:	4

STATION (Feet)	ELEVATION (Feet)	NOTES	
0.00	604.75		
0.06	604.16		
8.50	604.19		
9.99	603.89		
12.58	604.03	TOB	
15.09	601.88		
15.88	601.19		13.02
16.68	600.69	LEW	34.40
17.13	599.75		
19.48	599.37	Thalweg	
21.17	599.43		
21.82	599.46		
22.85	599.64		
24.28	600.62	REW	
26.08	601.79		
33.02	603.36		
36.74	604.12	TOB	
42.43	604.20		
42.51	604.55		

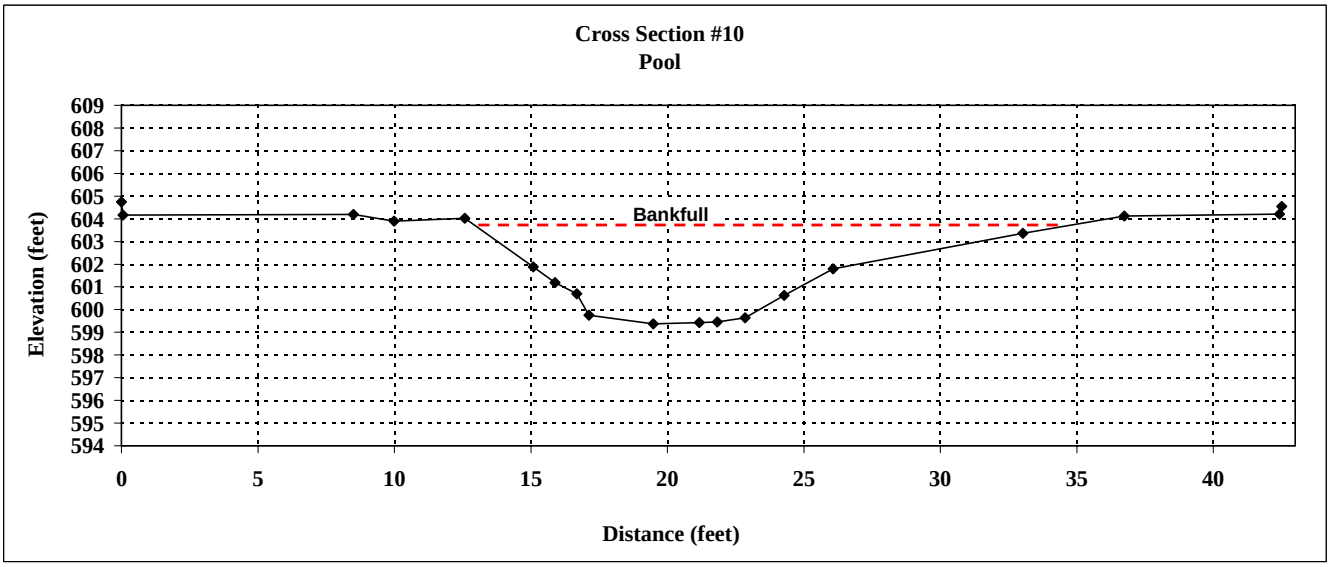
Bankfull/Top of Bank Hydraulic Geometry

	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	2.1	1.8	2.72	1.8
	0.8	2.4	1.05	1.7
	0.8	2.9	0.94	2.1
	0.4	3.9	1.04	1.5
	2.4	4.3	2.38	9.6
	1.7	4.2	1.69	7.2
	0.7	4.2	0.66	2.7
	1.0	4.0	1.04	4.2
	1.4	3.0	1.74	5.0
	1.8	1.8	2.14	4.4
	6.9	0.3	7.12	7.4
	1.4		1.41	0.2
TOTALS	21.4		23.93	47.9

SUMMARY DATA

A(BKF)	47.9
W(BKF)	21.4
Max d	4.3
Mean d	2.2
Wet. P	23.93
Hyd. R	2.00

Bankfull datum* = 603.64
*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	Jun-08
Monitoring Year:	4

STATION (Feet)	HI (Feet)	NOTES
0.00	602.72	
0.05	602.45	
5.42	602.51	
10.13	601.09	BKF
13.87	600.98	
17.10	599.25	
18.66	599.31	
20.07	598.81	
21.05	597.80	
21.76	597.67	LEW
24.04	597.57	
24.26	597.84	
25.54	597.47	
25.81	597.81	
26.37	597.78	
27.08	597.24	Thalweg
27.86	597.24	
27.93	597.69	REW
28.96	599.05	
33.31	601.27	TOB
38.30	601.53	
41.52	602.23	
45.16	602.43	
45.13	603.02	

Bankfull Hydraulic Geometry

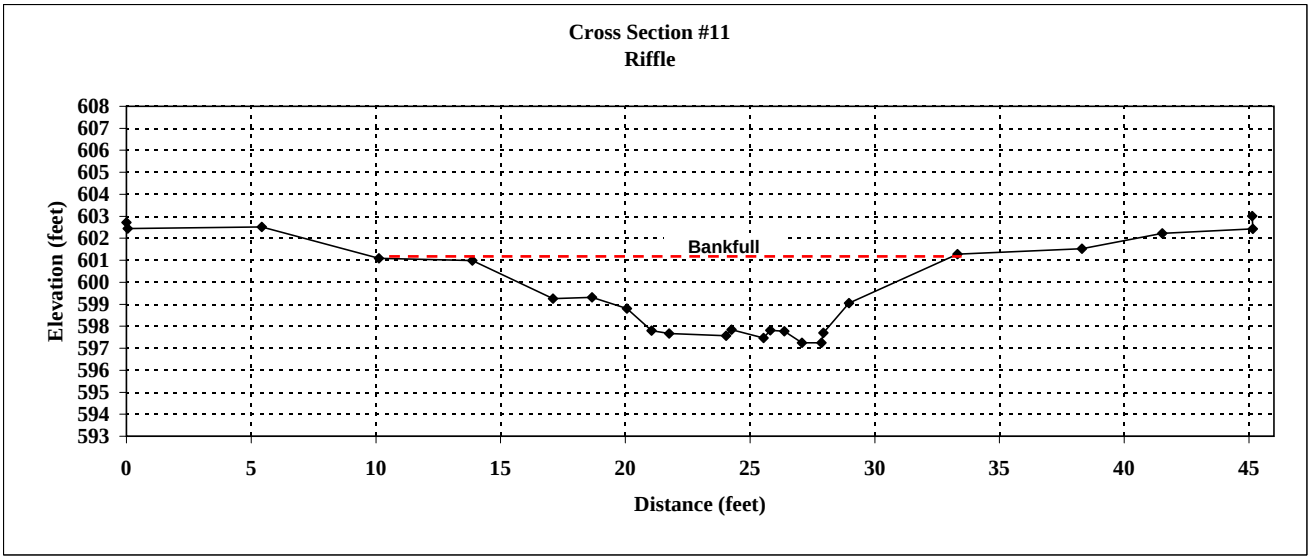
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	0.0	0.0	0.05	0.0
	3.7	0.1	3.74	0.2
	3.2	1.8	3.66	3.2
	1.6	1.8	1.57	2.8
	1.4	2.3	1.49	2.9
	1.0	3.3	1.41	2.8
	0.7	3.4	0.72	2.4
	2.3	3.5	2.28	7.9
	0.2	3.3	0.34	0.7
	1.3	3.6	1.33	4.4
	0.3	3.3	0.43	0.9
	0.6	3.3	0.56	1.9
	0.7	3.9	0.89	2.5
	0.8	3.9	0.78	3.0
	0.1	3.4	0.46	0.3
	1.0	2.0	1.70	2.8
	4.0		4.51	4.1
TOTALS	22.9		25.94	42.9

SUMMARY DATA (BANKFULL)

A(BKF)	42.9	W(FPA)	45+
W(BKF)	22.9	WP	25.94
Max d	3.9	Hydraulic Radius	1.65
Mean d	1.9	Wetted Perimeter=	WP
W/D	12.2	Area=	A
Bank Height	4.03	Width=	W
Entrenchment	2.0+	Depth=	D
Stream Type	C	Bankfull=	BKF
Area from Rural Regional Curve			37.6

Bankfull datum* = 601.10

*Datum reset during Monitoring Year 3.



Field Crew:	IPJ and KC
Stream Reach:	2
Project:	Wells Creek
Drainage Area:	2.23
Date:	Jun-08
Monitoring Year:	4

STATION (Feet)	ELEVATION (Feet)	NOTES
0.00	601.36	
0.11	601.14	
5.12	601.16	
9.81	599.98	
16.67	600.14	
18.78	600.03	
24.11	599.47	
26.07	598.19	
26.96	596.83	LEW
27.28	594.85	
28.41	594.38	Thalweg
30.28	594.14	
33.67	595.95	
35.40	596.65	
35.49	596.66	REW
36.23	598.13	
37.68	598.75	
38.68	598.84	
40.58	599.18	
43.82	599.47	
48.21	600.13	TOB
59.22	600.44	
70.38	600.47	
71.33	600.74	
73.38	601.79	
81.23	601.93	
81.25	601.92	

Bankfull/Top of Bank Hydraulic Geometry

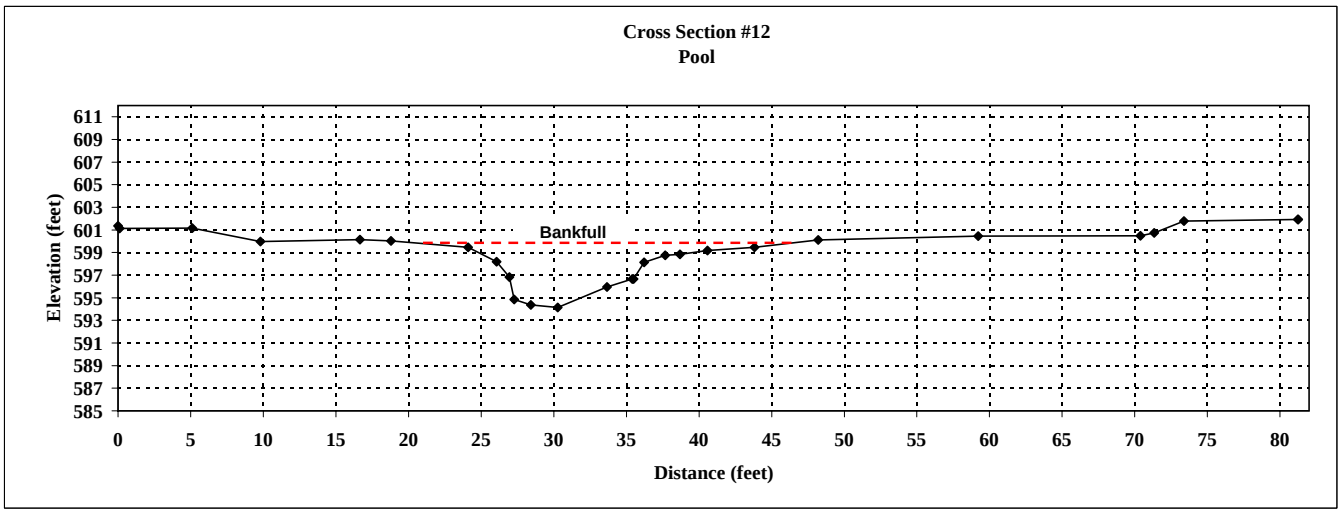
	Width (Feet)	Depth (Feet)	Perimeter (Feet)	Area (Sq. Ft.)
	0.0	0.0	0.00	0.0
	3.2	0.3	3.23	0.6
	2.0	1.6	2.35	1.9
	0.9	3.0	1.62	2.0
	0.3	5.0	2.01	1.3
	1.1	5.4	1.22	5.9
	1.9	5.7	1.88	10.4
	3.4	3.9	3.85	16.2
	1.7	3.2	1.87	6.1
	0.1	3.2	0.09	0.3
	0.7	1.7	1.65	1.8
	1.5	1.1	1.58	2.0
	1.0	1.0	1.00	1.0
	1.9	0.6	1.94	1.5
	3.2	0.3	3.25	1.6
	2.2		2.21	0.4
TOTALS	25.1		29.73	53.0

SUMMARY DATA

A(BKF)	53.0
W(BKF)	25.1
Max d	5.7
Mean d	2.1
Wet. P	29.73
Hyd. R	1.78

Bankfull datum* = 599.82

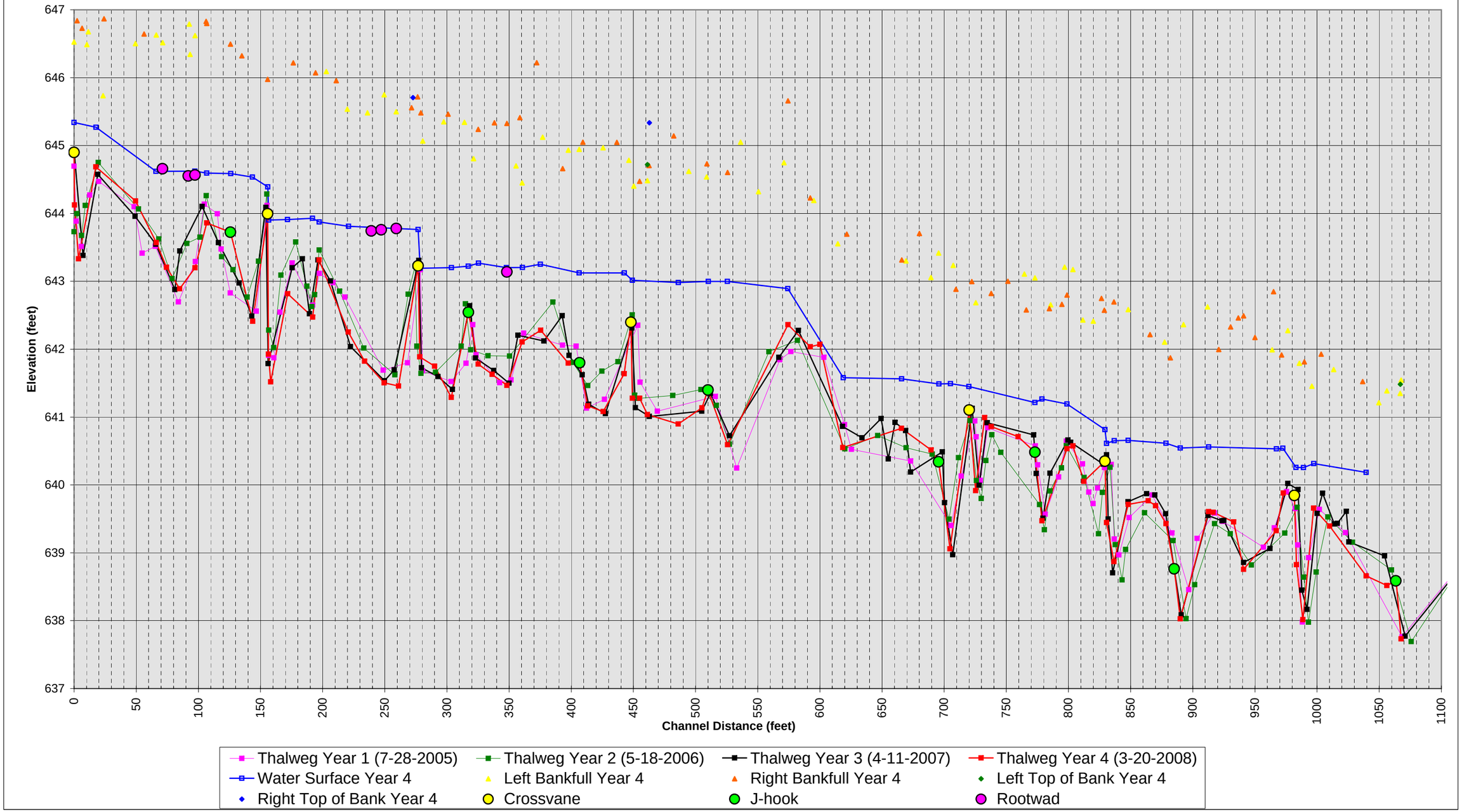
*Datum reset during Monitoring Year 3.



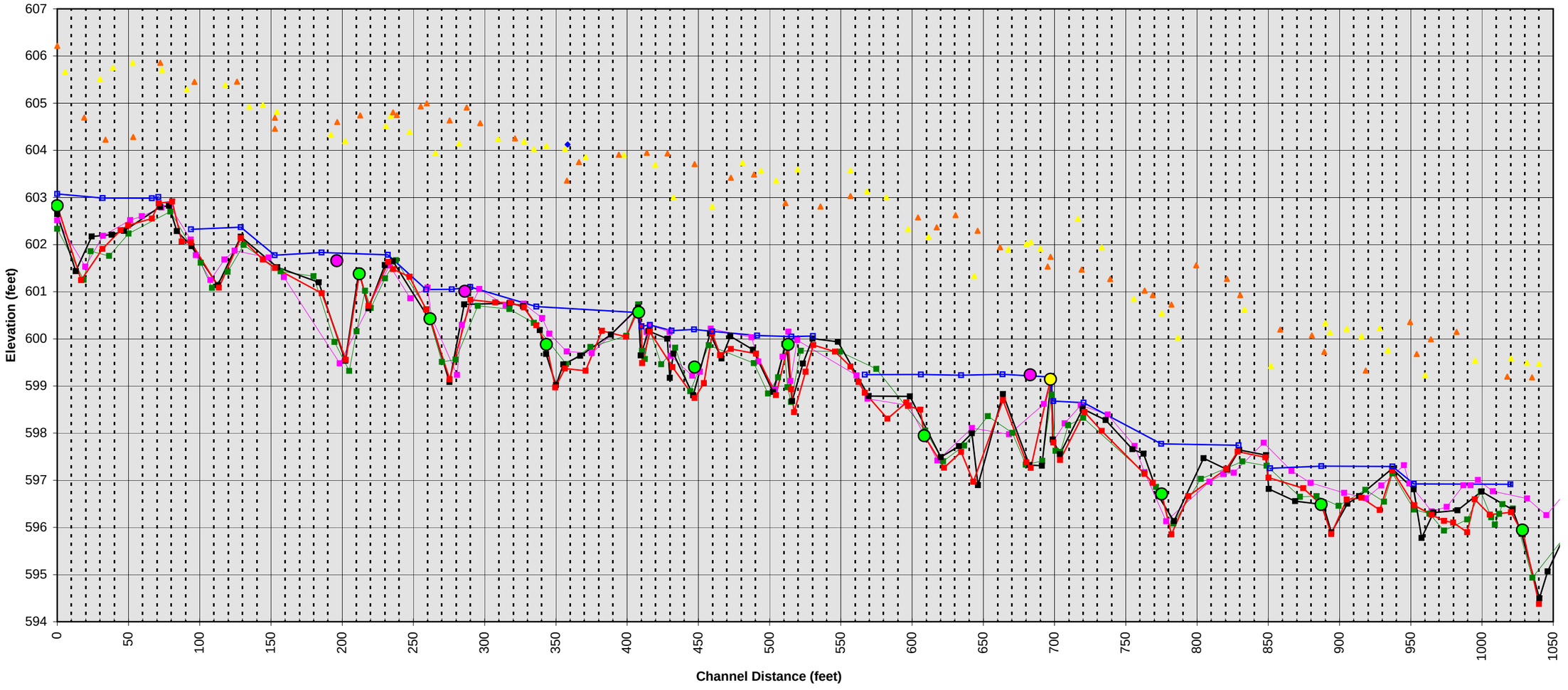
APPENDIX B5

STREAM LONGITUDINAL PROFILE

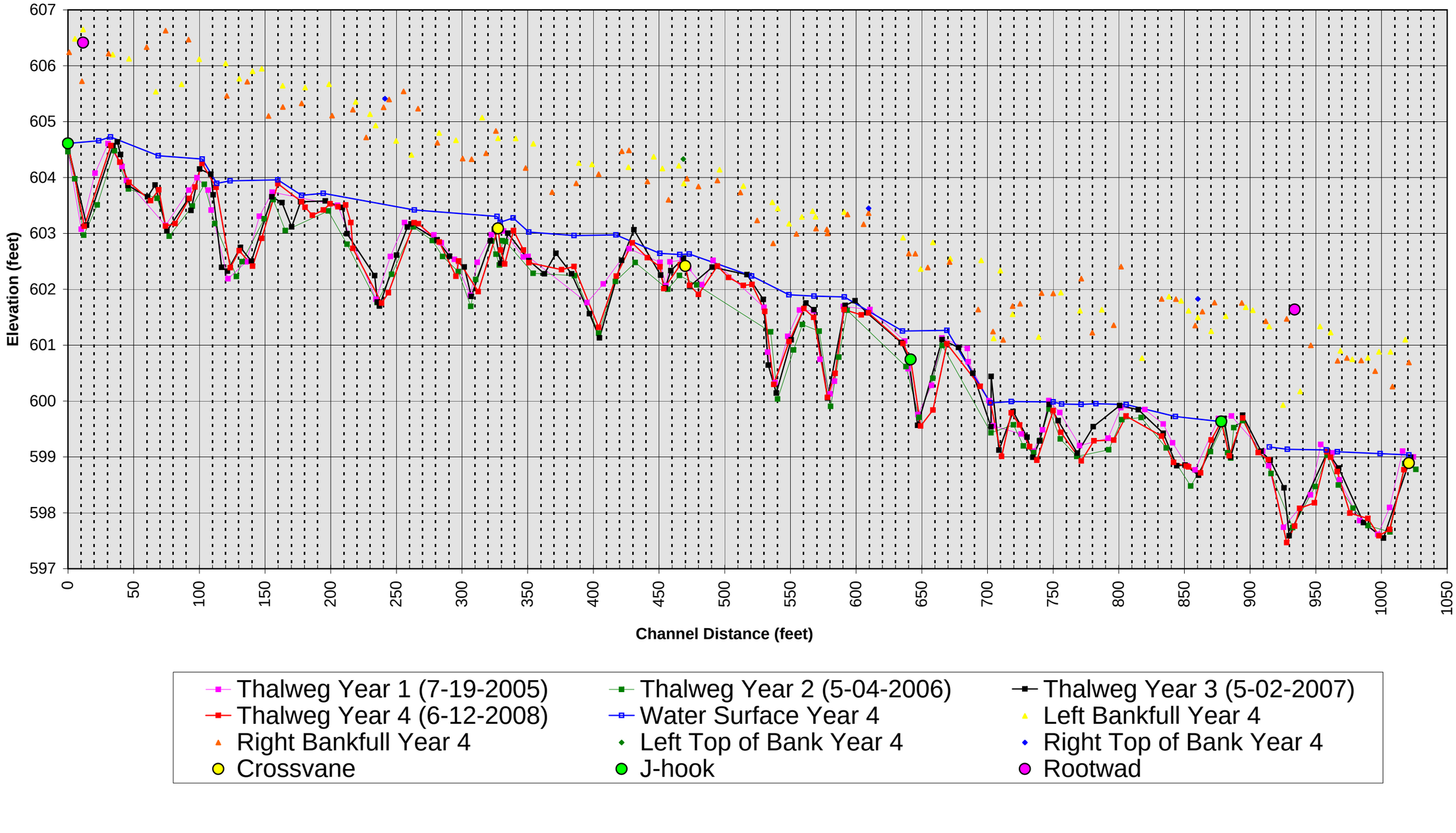
Longitudinal Profile Overlay (Years 3-4)
Wells Creek - Reach 1



Longitudinal Profile Overlay (Years 3-4)
Wells Creek - Reach 2



Longitudinal Profile Overlay (Years 3-4)
Wells Creek - Reach UT



APPENDIX B6

STREAM PEBBLE COUNTS

PEBBLE COUNT

Site: Wells Creek

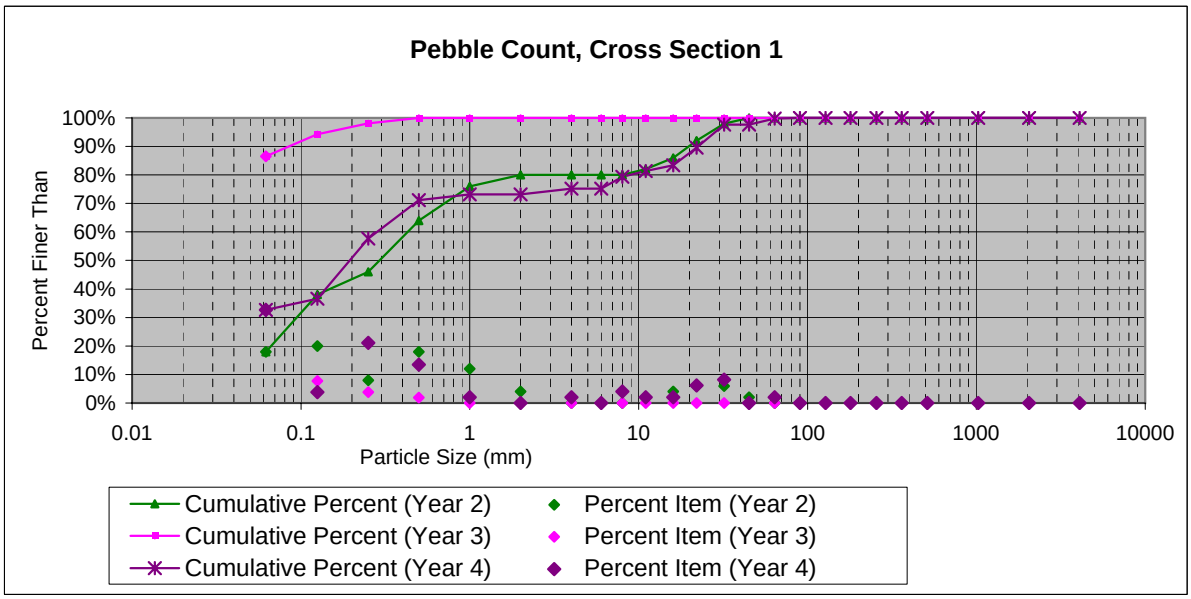
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 1	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	17	17	33%	33%
	Very Fine	.062-.125	SAND	2	2	4%	37%
	Fine	.125-.25		11	11	21%	58%
	Medium	.25-.50		7	7	13%	71%
	Coarse	.50-1.0		1	1	2%	73%
.04-.08	Very Coarse	1.0-2			0	0%	73%
.08-.16	Very Fine	2.0-4.0		1	1	2%	75%
.16-.22	Fine	4-5.7	GRAVEL		0	0%	75%
.22-.31	Fine	5.7-8		2	2	4%	79%
.31-.44	Medium	8-11.3		1	1	2%	81%
.44-.63	Medium	11.3-16		1	1	2%	83%
.63-.89	Coarse	16-22.6		3	3	6%	90%
.89-1.26	Coarse	22.6-32		4	4	8%	98%
1.26-1.77	Very Coarse	32-45			0	0%	98%
1.77-2.5	Very Coarse	45-64		1	1	2%	100%
2.5-3.5	Small	64-90	COBBLE		0	0%	100%
3.5-5.0	Small	90-128			0	0%	100%
5.0-7.1	Large	128-180			0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	51	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

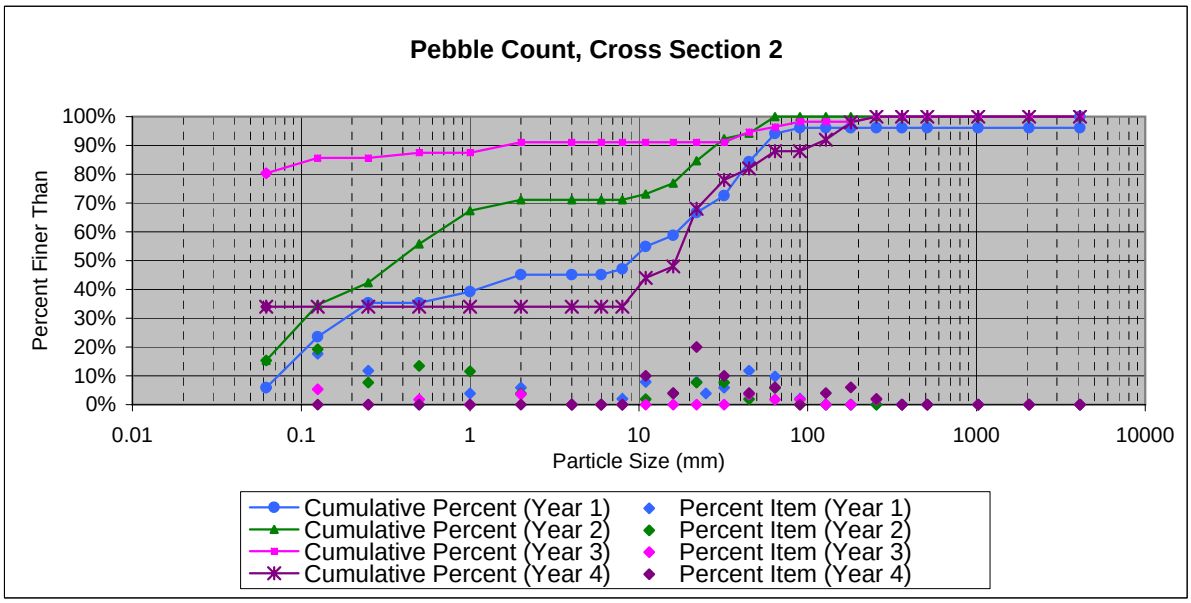
Party: PDB & KD

Date: 11/6/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 2	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	17	17	34%	34%
	Very Fine	.062-.125	SAND		0	0%	34%
	Fine	.125-.25	SAND		0	0%	34%
	Medium	.25-.50	SAND		0	0%	34%
	Coarse	.50-1.0	SAND		0	0%	34%
.04-.08	Very Coarse	1.0-2	SAND		0	0%	34%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	34%
.16-.22	Fine	4-5.7	GRAVEL		0	0%	34%
.22-.31	Fine	5.7-8	GRAVEL		0	0%	34%
.31-.44	Medium	8-11.3	GRAVEL	5	5	10%	44%
.44-.63	Medium	11.3-16	GRAVEL	2	2	4%	48%
.63-.89	Coarse	16-22.6	GRAVEL	10	10	20%	68%
.89-1.26	Coarse	22.6-32	GRAVEL	5	5	10%	78%
1.26-1.77	Very Coarse	32-45	GRAVEL	2	2	4%	82%
1.77-2.5	Very Coarse	45-64	GRAVEL	3	3	6%	88%
2.5-3.5	Small	64-90			0	0%	88%
3.5-5.0	Small	90-128	COBBLE	2	2	4%	92%
5.0-7.1	Large	128-180	COBBLE	3	3	6%	98%
7.1-10.1	Large	180-256	COBBLE	1	1	2%	100%
10.1-14.3	Small	256-362			0	0%	100%
14.3-20	Small	362-512	BOULDER		0	0%	100%
20-40	Medium	512-1024	BOULDER		0	0%	100%
40-80	Large	1024-2048	BOULDER		0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	50	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

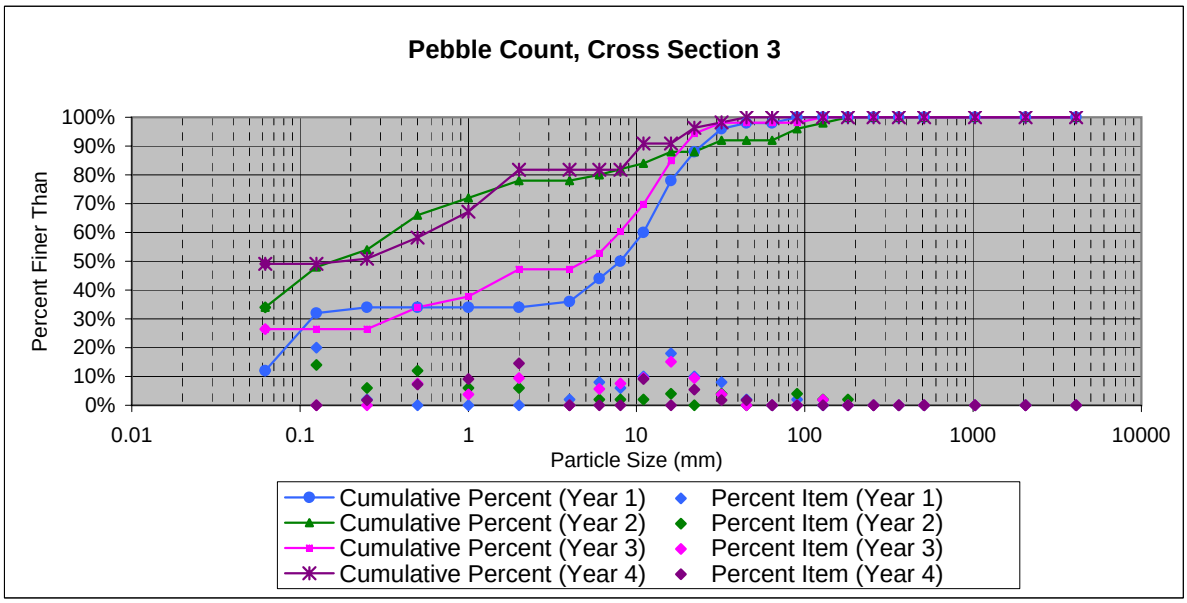
Party: PDB & KD

Date: 11/6/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 3	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	27	27	49%	49%
	Very Fine	.062-.125	SAND		0	0%	49%
	Fine	.125-.25	SAND	1	1	2%	51%
	Medium	.25-.50	SAND	4	4	7%	58%
	Coarse	.50-1.0	SAND	5	5	9%	67%
.04-.08	Very Coarse	1.0-2	SAND	8	8	15%	82%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	82%
.16-.22	Fine	4-5.7	GRAVEL		0	0%	82%
.22-.31	Fine	5.7-8	GRAVEL		0	0%	82%
.31-.44	Medium	8-11.3	GRAVEL	5	5	9%	91%
.44-.63	Medium	11.3-16	GRAVEL		0	0%	91%
.63-.89	Coarse	16-22.6	GRAVEL	3	3	5%	96%
.89-1.26	Coarse	22.6-32	GRAVEL	1	1	2%	98%
1.26-1.77	Very Coarse	32-45	GRAVEL	1	1	2%	100%
1.77-2.5	Very Coarse	45-64	GRAVEL		0	0%	100%
2.5-3.5	Small	64-90	COBBLE		0	0%	100%
3.5-5.0	Small	90-128	COBBLE		0	0%	100%
5.0-7.1	Large	128-180	COBBLE		0	0%	100%
7.1-10.1	Large	180-256	COBBLE		0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512	BOULDER		0	0%	100%
20-40	Medium	512-1024	BOULDER		0	0%	100%
40-80	Large	1024-2048	BOULDER		0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	55	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

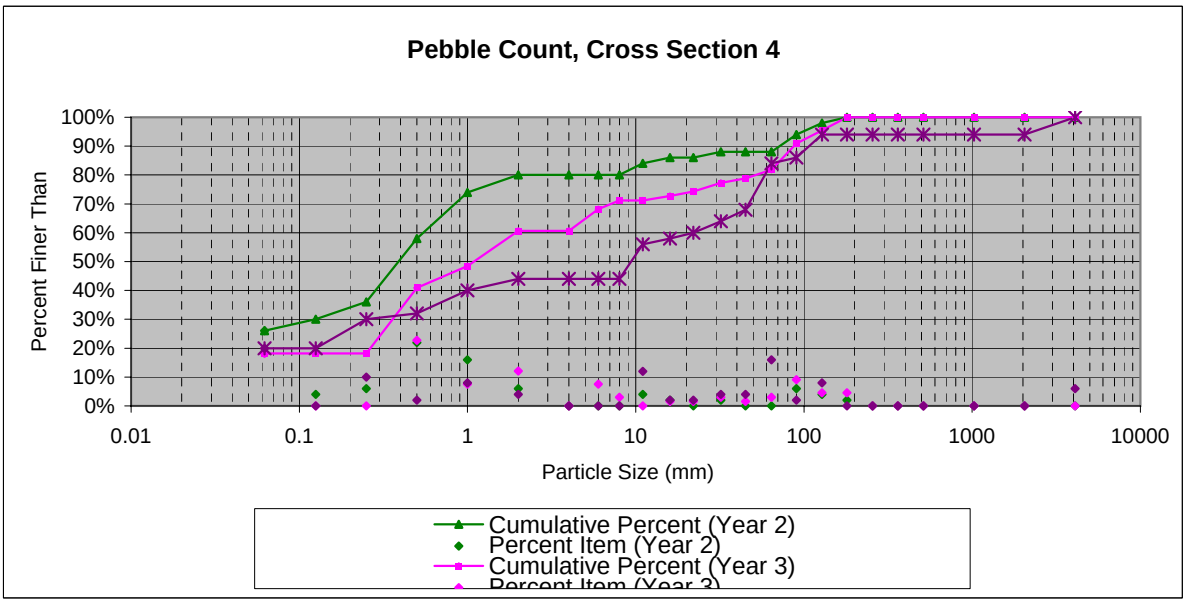
Party: PDB & KD

Date: 11/6/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 4	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	10	10	20%	20%
	Very Fine	.062-.125	SAND		0	0%	20%
	Fine	.125-.25	SAND	5	5	10%	30%
	Medium	.25-.50	SAND	1	1	2%	32%
	Coarse	.50-1.0	SAND	4	4	8%	40%
.04-.08	Very Coarse	1.0-2	SAND	2	2	4%	44%
.08-.16	Very Fine	2.0-4.0	GRAVEL		0	0%	44%
.16-.22	Fine	4-5.7	GRAVEL		0	0%	44%
.22-.31	Fine	5.7-8	GRAVEL		0	0%	44%
.31-.44	Medium	8-11.3	GRAVEL	6	6	12%	56%
.44-.63	Medium	11.3-16	GRAVEL	1	1	2%	58%
.63-.89	Coarse	16-22.6	GRAVEL	1	1	2%	60%
.89-1.26	Coarse	22.6-32	GRAVEL	2	2	4%	64%
1.26-1.77	Very Coarse	32-45	GRAVEL	2	2	4%	68%
1.77-2.5	Very Coarse	45-64	GRAVEL	8	8	16%	84%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	86%
3.5-5.0	Small	90-128	COBBLE	4	4	8%	94%
5.0-7.1	Large	128-180	COBBLE		0	0%	94%
7.1-10.1	Large	180-256	COBBLE		0	0%	94%
10.1-14.3	Small	256-362	BOULDER		0	0%	94%
14.3-20	Small	362-512	BOULDER		0	0%	94%
20-40	Medium	512-1024	BOULDER		0	0%	94%
40-80	Large	1024-2048	BOULDER		0	0%	94%
	Bedrock		**BDRK**	3	3	6%	100%
				TOTALS →	50	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

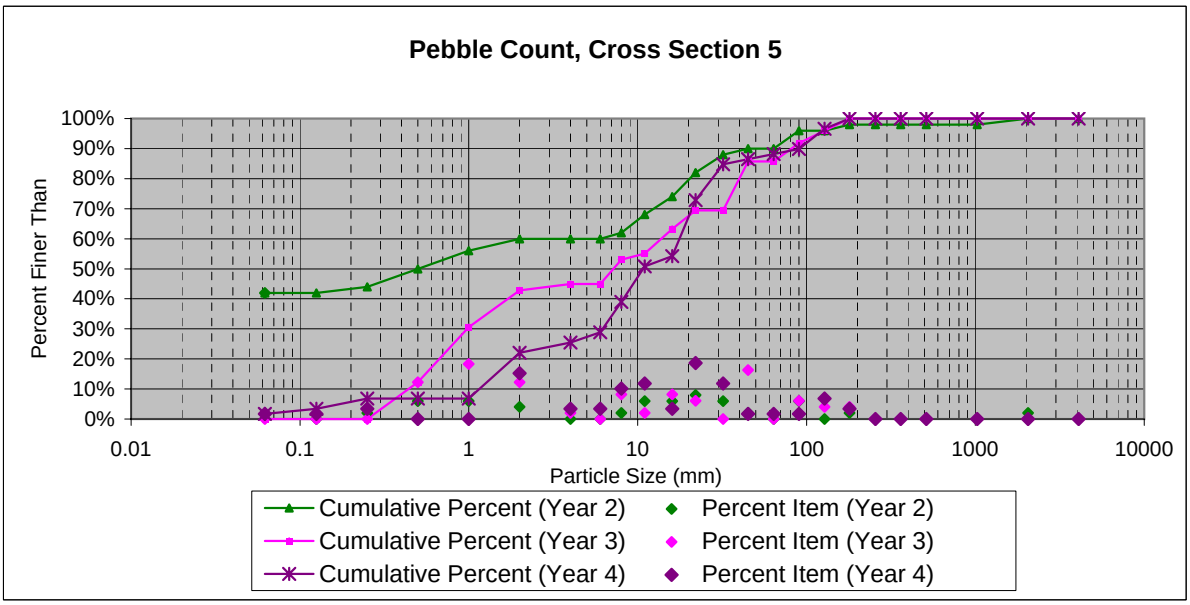
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 5	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	1	1	2%	2%
	Very Fine	.062-.125	SAND		1	2%	3%
	Fine	.125-.25	SAND	1	2	3%	7%
	Medium	.25-.50	SAND	0	0	0%	7%
	Coarse	.50-1.0	SAND	0	0	0%	7%
.04-.08	Very Coarse	1.0-2	SAND	9	9	15%	22%
.08-.16	Very Fine	2.0-4.0	GRAVEL	2	2	3%	25%
.16-.22	Fine	4-5.7	GRAVEL	2	2	3%	29%
.22-.31	Fine	5.7-8	GRAVEL	6	6	10%	39%
.31-.44	Medium	8-11.3	GRAVEL	7	7	12%	51%
.44-.63	Medium	11.3-16	GRAVEL	2	2	3%	54%
.63-.89	Coarse	16-22.6	GRAVEL	11	11	19%	73%
.89-1.26	Coarse	22.6-32	GRAVEL	7	7	12%	85%
1.26-1.77	Very Coarse	32-45	GRAVEL	1	1	2%	86%
1.77-2.5	Very Coarse	45-64	GRAVEL	1	1	2%	88%
2.5-3.5	Small	64-90	COBBLE	1	1	2%	90%
3.5-5.0	Small	90-128	COBBLE	4	4	7%	97%
5.0-7.1	Large	128-180	COBBLE	2	2	3%	100%
7.1-10.1	Large	180-256	COBBLE		0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512	BOULDER		0	0%	100%
20-40	Medium	512-1024	BOULDER		0	0%	100%
40-80	Large	1024-2048	BOULDER		0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	59	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

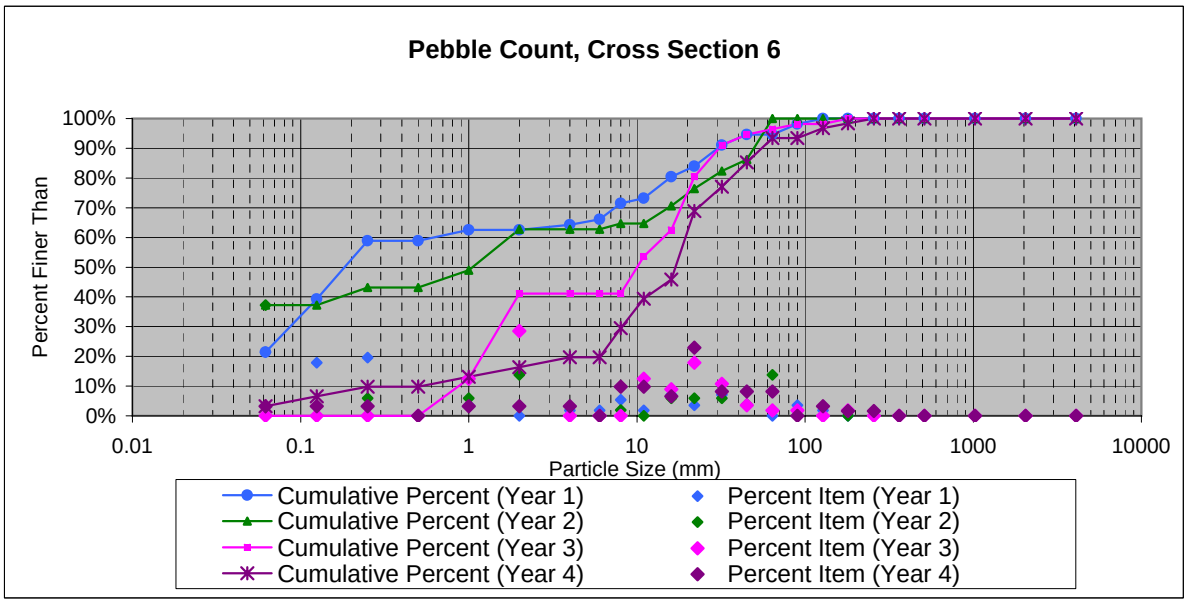
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 6	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	2	2	3%	3%
	Very Fine	.062-.125	SAND		2	3%	7%
	Fine	.125-.25			2	3%	10%
	Medium	.25-.50			0	0%	10%
	Coarse	.50-1.0		2	2	3%	13%
.04-.08	Very Coarse	1.0-2		2	2	3%	16%
.08-.16	Very Fine	2.0-4.0		2	2	3%	20%
.16-.22	Fine	4-5.7	GRAVEL		0	0%	20%
.22-.31	Fine	5.7-8		6	6	10%	30%
.31-.44	Medium	8-11.3		6	6	10%	39%
.44-.63	Medium	11.3-16		4	4	7%	46%
.63-.89	Coarse	16-22.6		14	14	23%	69%
.89-1.26	Coarse	22.6-32		5	5	8%	77%
1.26-1.77	Very Coarse	32-45		5	5	8%	85%
1.77-2.5	Very Coarse	45-64		5	5	8%	93%
2.5-3.5	Small	64-90	COBBLE	0	0	0%	93%
3.5-5.0	Small	90-128		2	2	3%	97%
5.0-7.1	Large	128-180		1	1	2%	98%
7.1-10.1	Large	180-256		1	1	2%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	61	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

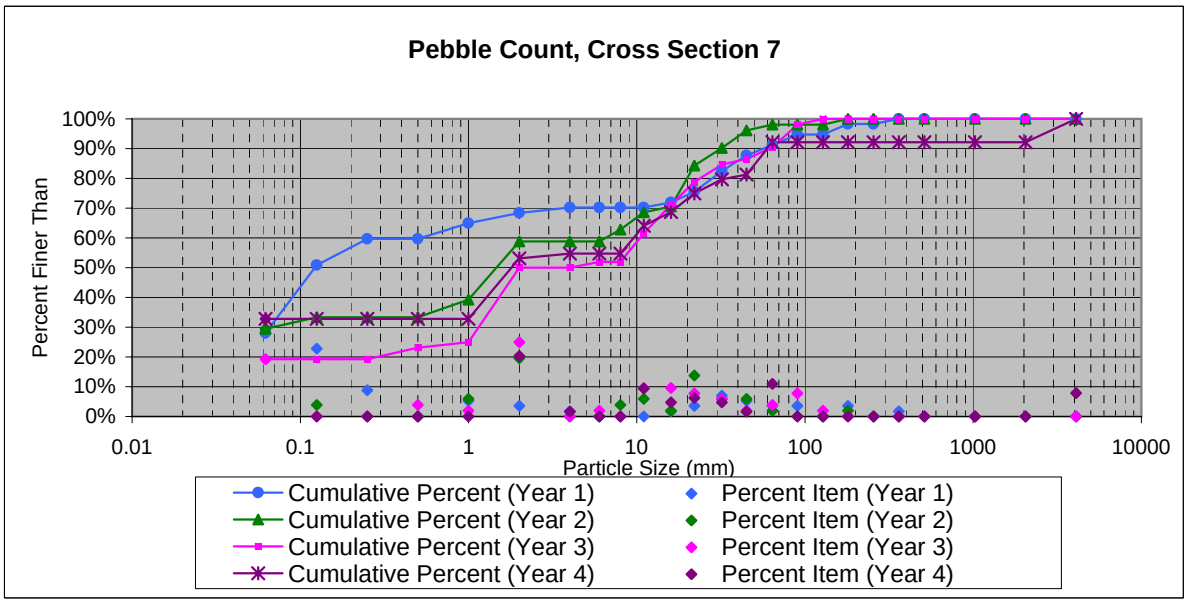
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 7	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	21	21	33%	33%
	Very Fine	.062-.125	SAND		0	0%	33%
	Fine	.125-.25			0	0%	33%
	Medium	.25-.50		0	0	0%	33%
	Coarse	.50-1.0		0	0	0%	33%
.04-.08	Very Coarse	1.0-2		13	13	20%	53%
.08-.16	Very Fine	2.0-4.0	GRAVEL	1	1	2%	55%
.16-.22	Fine	4-5.7		0	0	0%	55%
.22-.31	Fine	5.7-8			0	0%	55%
.31-.44	Medium	8-11.3		6	6	9%	64%
.44-.63	Medium	11.3-16		3	3	5%	69%
.63-.89	Coarse	16-22.6		4	4	6%	75%
.89-1.26	Coarse	22.6-32		3	3	5%	80%
1.26-1.77	Very Coarse	32-45		1	1	2%	81%
1.77-2.5	Very Coarse	45-64		7	7	11%	92%
2.5-3.5	Small	64-90	COBBLE	0	0	0%	92%
3.5-5.0	Small	90-128		0	0	0%	92%
5.0-7.1	Large	128-180			0	0%	92%
7.1-10.1	Large	180-256			0	0%	92%
10.1-14.3	Small	256-362	BOULDER		0	0%	92%
14.3-20	Small	362-512			0	0%	92%
20-40	Medium	512-1024			0	0%	92%
40-80	Large	1024-2048			0	0%	92%
	Bedrock		**BDRK**	5	5	8%	100%
				TOTALS →	64	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

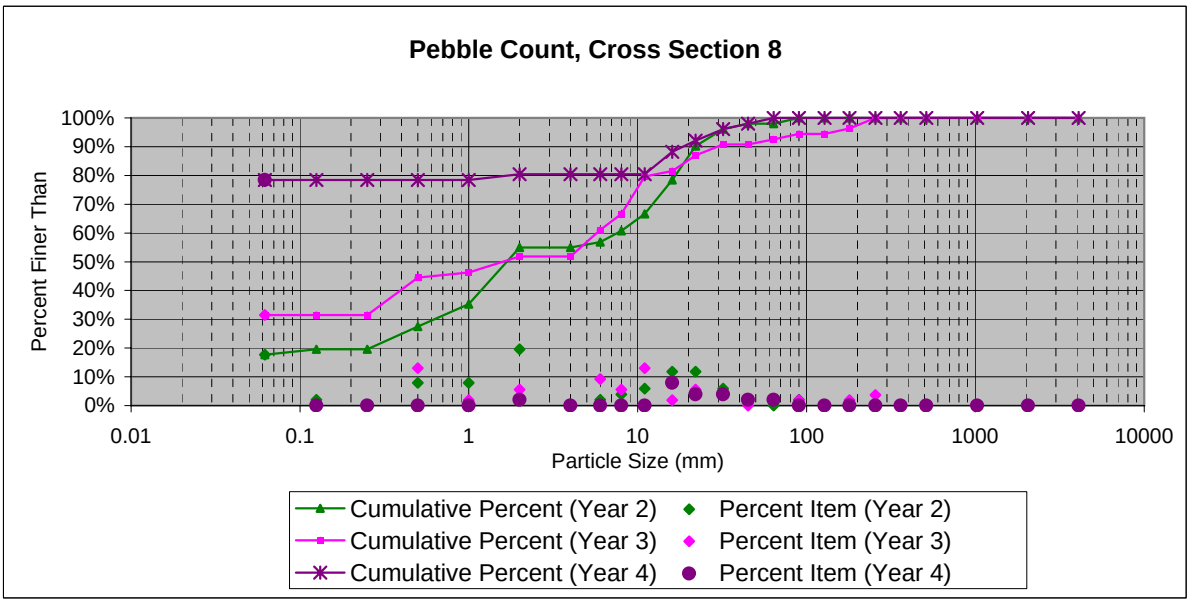
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 8	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	40	40	78%	78%
	Very Fine	.062-.125	SAND	0	0	0%	78%
	Fine	.125-.25		0	0	0%	78%
	Medium	.25-.50		0	0	0%	78%
	Coarse	.50-1.0		0	0	0%	78%
.04-.08	Very Coarse	1.0-2		1	1	2%	80%
.08-.16	Very Fine	2.0-4.0	GRAVEL	0	0	0%	80%
.16-.22	Fine	4-5.7		0	0	0%	80%
.22-.31	Fine	5.7-8		0	0	0%	80%
.31-.44	Medium	8-11.3		0	0	0%	80%
.44-.63	Medium	11.3-16		4	4	8%	88%
.63-.89	Coarse	16-22.6		2	2	4%	92%
.89-1.26	Coarse	22.6-32		2	2	4%	96%
1.26-1.77	Very Coarse	32-45		1	1	2%	98%
1.77-2.5	Very Coarse	45-64		1	1	2%	100%
2.5-3.5	Small	64-90	COBBLE	0	0	0%	100%
3.5-5.0	Small	90-128		0	0	0%	100%
5.0-7.1	Large	128-180		0	0	0%	100%
7.1-10.1	Large	180-256		0	0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	51	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

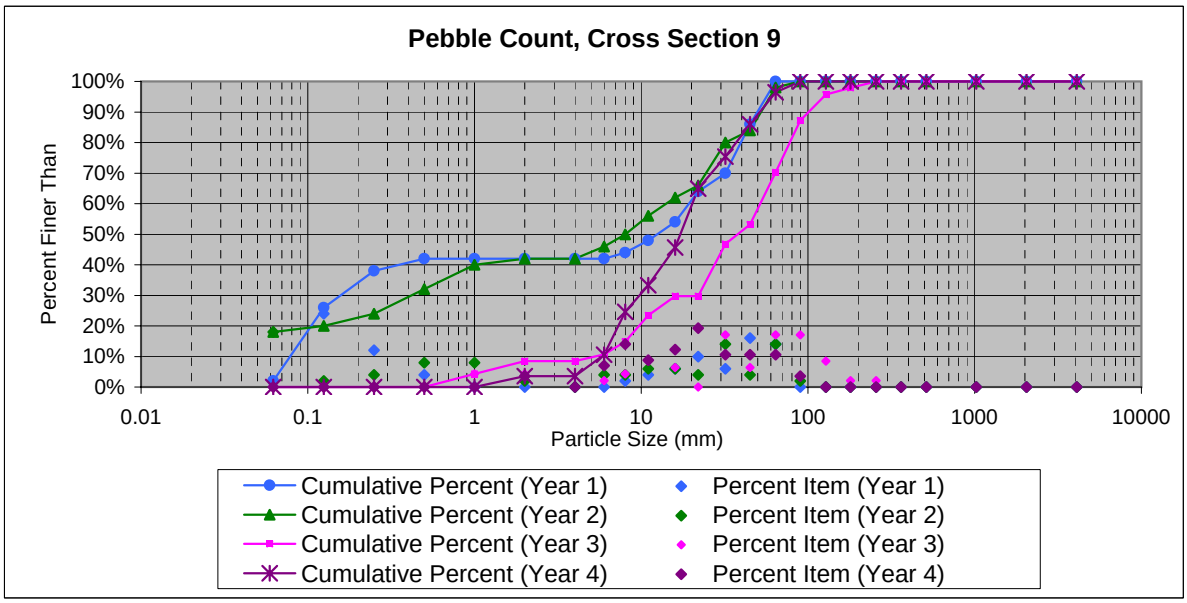
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 9	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**		0	0%	0%
	Very Fine	.062-.125	SAND		0	0%	0%
	Fine	.125-.25			0	0%	0%
	Medium	.25-.50			0	0%	0%
	Coarse	.50-1.0		0	0	0%	0%
.04-.08	Very Coarse	1.0-2		2	2	4%	4%
.08-.16	Very Fine	2.0-4.0		0	0	0%	4%
.16-.22	Fine	4-5.7	GRAVEL	4	4	7%	11%
.22-.31	Fine	5.7-8		8	8	14%	25%
.31-.44	Medium	8-11.3		5	5	9%	33%
.44-.63	Medium	11.3-16		7	7	12%	46%
.63-.89	Coarse	16-22.6		11	11	19%	65%
.89-1.26	Coarse	22.6-32		6	6	11%	75%
1.26-1.77	Very Coarse	32-45		6	6	11%	86%
1.77-2.5	Very Coarse	45-64		6	6	11%	96%
2.5-3.5	Small	64-90	COBBLE	2	2	4%	100%
3.5-5.0	Small	90-128		0	0	0%	100%
5.0-7.1	Large	128-180		0	0	0%	100%
7.1-10.1	Large	180-256		0	0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	57	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

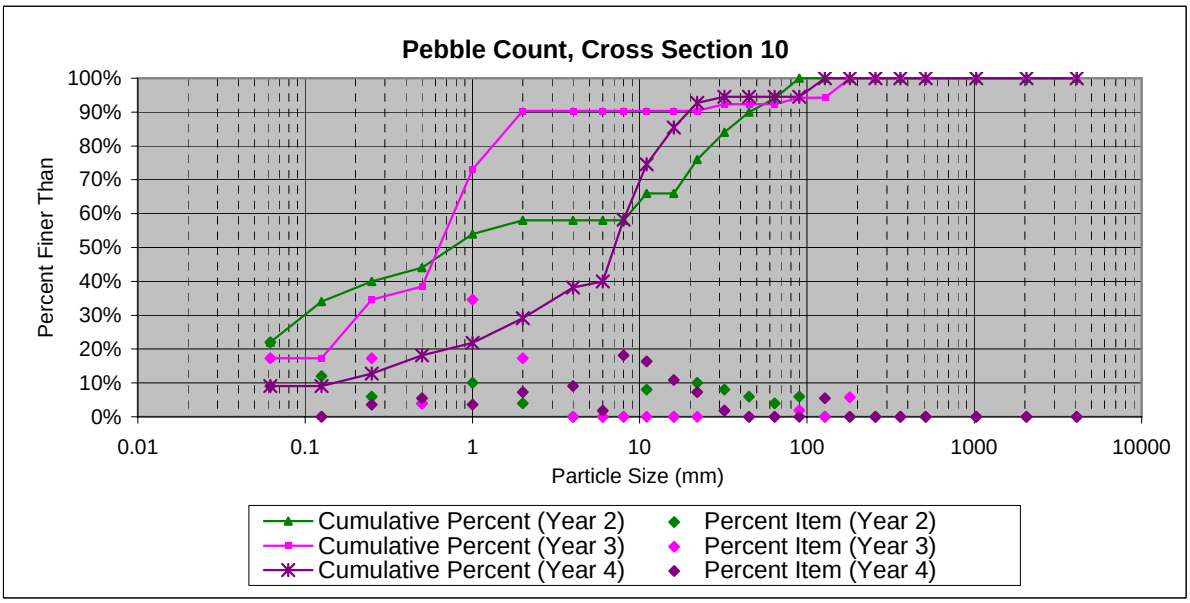
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 10	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	5	5	9%	9%
	Very Fine	.062-.125	SAND	0	0	0%	9%
	Fine	.125-.25		2	2	4%	13%
	Medium	.25-.50		3	3	5%	18%
	Coarse	.50-1.0		2	2	4%	22%
.04-.08	Very Coarse	1.0-2		4	4	7%	29%
.08-.16	Very Fine	2.0-4.0	GRAVEL	5	5	9%	38%
.16-.22	Fine	4-5.7		1	1	2%	40%
.22-.31	Fine	5.7-8		10	10	18%	58%
.31-.44	Medium	8-11.3		9	9	16%	75%
.44-.63	Medium	11.3-16		6	6	11%	85%
.63-.89	Coarse	16-22.6		4	4	7%	93%
.89-1.26	Coarse	22.6-32		1	1	2%	95%
1.26-1.77	Very Coarse	32-45		0	0	0%	95%
1.77-2.5	Very Coarse	45-64		0	0	0%	95%
2.5-3.5	Small	64-90	COBBLE	0	0	0%	95%
3.5-5.0	Small	90-128		3	3	5%	100%
5.0-7.1	Large	128-180		0	0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	55	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

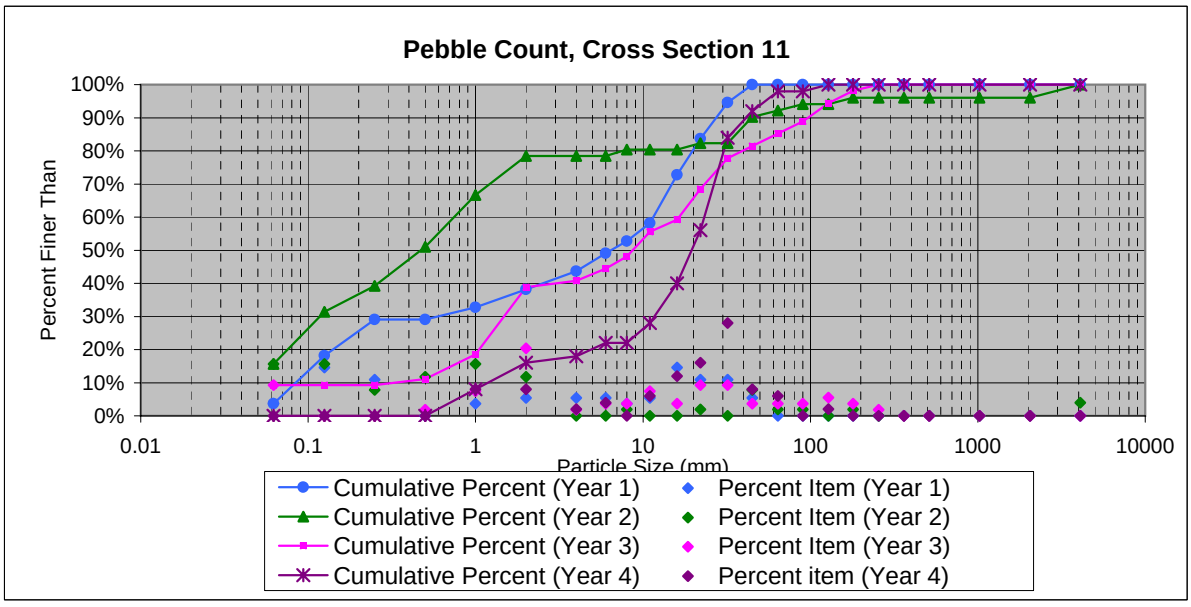
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 11	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	0	0	0%	0%
	Very Fine	.062-.125	SAND	0	0	0%	0%
	Fine	.125-.25		0	0	0%	0%
	Medium	.25-.50		0	0	0%	0%
	Coarse	.50-1.0		4	4	8%	8%
.04-.08	Very Coarse	1.0-2		4	4	8%	16%
.08-.16	Very Fine	2.0-4.0	GRAVEL	1	1	2%	18%
.16-.22	Fine	4-5.7		2	2	4%	22%
.22-.31	Fine	5.7-8		0	0	0%	22%
.31-.44	Medium	8-11.3		3	3	6%	28%
.44-.63	Medium	11.3-16		6	6	12%	40%
.63-.89	Coarse	16-22.6		8	8	16%	56%
.89-1.26	Coarse	22.6-32		14	14	28%	84%
1.26-1.77	Very Coarse	32-45		4	4	8%	92%
1.77-2.5	Very Coarse	45-64		3	3	6%	98%
2.5-3.5	Small	64-90	COBBLE	0	0	0%	98%
3.5-5.0	Small	90-128		1	1	2%	100%
5.0-7.1	Large	128-180		0	0	0%	100%
7.1-10.1	Large	180-256		0	0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	50	**100%**	**100%**



PEBBLE COUNT

Site: Wells Creek

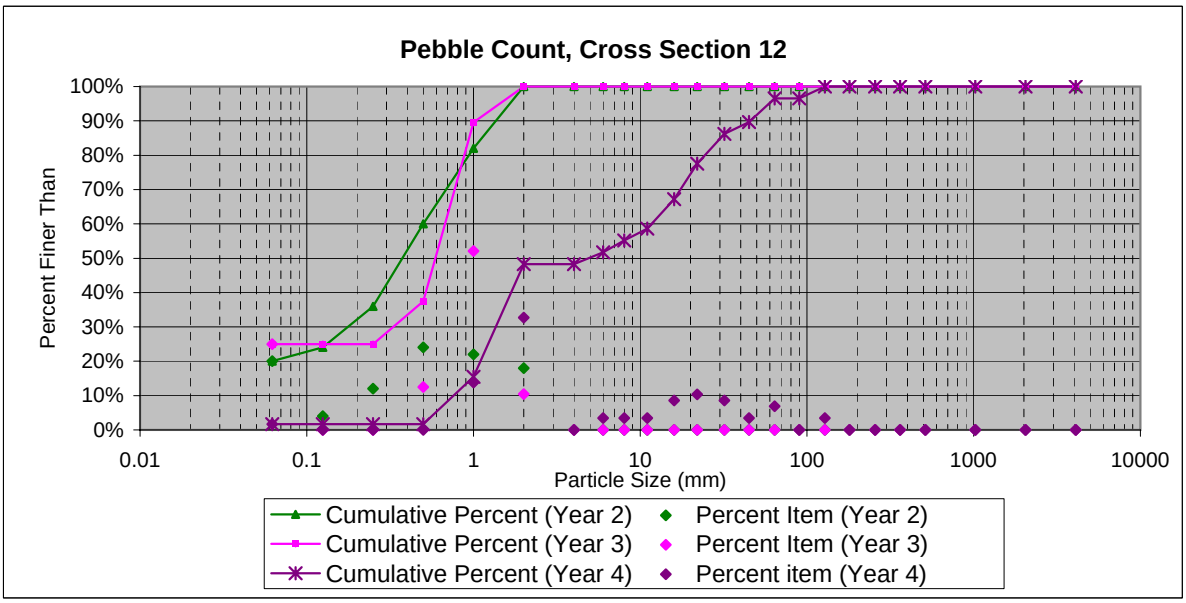
Party: IPJ & PDB

Date: 10/9/2008

SEPI ENGINEERING GROUP

PARTICLE COUNT

Inches	Particle	Millimeters		CS 12	TOT#	ITEM %	% CUM
	Silt/Clay	< 0.062	**S/C**	1	1	2%	2%
	Very Fine	.062-.125	SAND	0	0	0%	2%
	Fine	.125-.25		0	0	0%	2%
	Medium	.25-.50		0	0	0%	2%
	Coarse	.50-1.0		8	8	14%	16%
.04-.08	Very Coarse	1.0-2		19	19	33%	48%
.08-.16	Very Fine	2.0-4.0	GRAVEL	0	0	0%	48%
.16-.22	Fine	4-5.7		2	2	3%	52%
.22-.31	Fine	5.7-8		2	2	3%	55%
.31-.44	Medium	8-11.3		2	2	3%	59%
.44-.63	Medium	11.3-16		5	5	9%	67%
.63-.89	Coarse	16-22.6		6	6	10%	78%
.89-1.26	Coarse	22.6-32		5	5	9%	86%
1.26-1.77	Very Coarse	32-45		2	2	3%	90%
1.77-2.5	Very Coarse	45-64		4	4	7%	97%
2.5-3.5	Small	64-90	COBBLE	0	0	0%	97%
3.5-5.0	Small	90-128		2	2	3%	100%
5.0-7.1	Large	128-180			0	0%	100%
7.1-10.1	Large	180-256			0	0%	100%
10.1-14.3	Small	256-362	BOULDER		0	0%	100%
14.3-20	Small	362-512			0	0%	100%
20-40	Medium	512-1024			0	0%	100%
40-80	Large	1024-2048			0	0%	100%
	Bedrock		**BDRK**		0	0%	100%
				TOTALS →	58	**100%**	**100%**



APPENDIX C

PLAN VIEW SHEETS

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	1
PROJECT ENGINEER	

20 0 40
SCALE

NAD 83

*BANKFULL = TOP OF BANK (SHOWN AS BANKFULL LINE OVER ENTIRE REACH 1)

BEGIN MONITORING WELLS CREEK REACH 1 STA.10+00.00

CROSS SECTION 1

VEG PLOT 1

TBM 1
N 789317.6889
E 1868122.4390
EL.=648.3768

PHOTO POINT 1

PHOTO POINT 2

CROSS SECTION 2

PHOTO POINT 3

VEG PLOT 2

CROSS SECTION 3

TBM 10508
N 789936.4368
E 1868044.3914
EL.=648.9304

CROSS SECTION 4

VEG PLOT 3

PHOTO POINT 4

TBM 10507
N 789632.2889
E 1868060.0128
EL.=649.0318

CREST GAUGE

01 15 20

VEGETATION PLOT STAKING

	NORTHING	EASTING
VP 1	790341.4193	1868127.8295
VP 2	789960.9694	1868135.0301
VP 3	789665.0116	1868150.2452

CROSS SECTION STAKING

	NORTHING	EASTING	ELEVATION
XSC 1 LEFT	790305.5148	1868218.0170	647.6658
XSC 1 RIGHT	790314.0373	1868113.8230	649.1659
XSC 2 LEFT	790110.5344	1868176.2530	647.0516
XSC 2 RIGHT	790182.8344	1868135.0260	647.4296
XSC 3 LEFT	789852.9624	1868136.6510	645.8511
XSC 3 RIGHT	789927.1424	1868097.5820	645.5129
XSC 4 LEFT	789672.2703	1868164.3220	645.0177
XSC 4 RIGHT	789640.7034	1868076.9910	643.5958

WELLS CREEK - REACH 1

LEGEND

STREAM FEATURES
- THALWEG 2008
- BANKFULL 2008

PROJECT ELEMENTS
- CONTROL POINT/BENCHMARK (TBM)
- CROSS-SECTIONS
- VEGETATION PLOT WITH PHOTO CORNER (ARROW)
- PHOTO POINT
- EASEMENT BOUNDARY

STRUCTURE TYPES
- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

Ecosystem Enhancement PROGRAM

LOCATION:	WELLS CREEK MONITORING PLAN VIEW MONITORING YEAR 4
PROJ #:	414
COUNTY:	ALAMANCE
PREPARED BY:	IPJ
CHECKED BY:	PDB
DATE:	2/4/09

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	2
PROJECT ENGINEER	

20 0 40
SCALE

VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 7	786127.0713	1867630.9720
VP 8	786340.6505	1867794.9420
VP 9	786427.8047	1867937.4060

WELLS CREEK - REACH 2

CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 9 LEFT	786147.0086	1867645.1790	605.1506
XSC 9 RIGHT	786109.7831	1867662.7060	606.0970
XSC 10 LEFT	786229.4962	1867681.8020	604.8637
XSC 10 RIGHT	786208.5385	1867718.8310	604.6050
XSC 11 LEFT	786418.2249	1867980.2450	602.9365
XSC 11 RIGHT	786407.2489	1868024.1950	603.0278
XSC 12 LEFT	786600.8247	1868079.4820	601.5332
XSC 12 RIGHT	786522.4359	1868100.7920	602.3083

LEGEND

STREAM FEATURES
- THALWEG 2008
- BANKFULL 2008

PROJECT ELEMENTS
- CONTROL POINT/BENCHMARK (TBM)
- CROSS-SECTIONS
- VEGETATION PLOT WITH PHOTO CORNER (ARROW)
- PHOTO POINT
- EASEMENT BOUNDARY

STRUCTURE TYPES
- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

Ecosystem Enhancement PROGRAM

LOCATION:	WELLS CREEK MONITORING PLAN VIEW MONITORING YEAR 4
PROJ #:	414
COUNTY:	ALAMANCE
PREPARED BY:	IPJ
CHECKED BY:	PDB
DATE:	2/4/09

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	5
PROJECT ENGINEER	

20 0 40
SCALE

NAD 83

BEGIN MONITORING
UT TO WELLS CREEK
STA.10+00.00

TBM TP1
N 786906.8681
E 1866313.3470
EL.=605.3300

PHOTO POINT #0
CROSS SECTION 5
VEGETATION PLOT #4

TBM 9988
N 786857.9531
E 1866283.4459
EL.=609.7917

CROSS SECTION 6
PHOTO POINT #1
VEGETATION PLOT #5

TBM 9985
N 786836.6864
E 1866232.4380
EL.=609.2259

CROSS SECTION 7
PHOTO POINT #2

TBM TP2
N 786398.2934
E 1866169.0180
EL.=604.8980

CROSS SECTION 8
VEGETATION PLOT #6

10
15
20

UT TO WELLS CREEK

VEGETATION PLOT STAKING

	NORTHING	EASTING
VP 4	786838.9045	1866257.9760
VP 5	786634.8714	1866265.6880
VP 6	786300.2329	1866062.8870

CROSS SECTION STAKING

	NORTHING	EASTING	ELEVATION
XSC 5 LEFT	786862.4549	1866351.6519	609.7649
XSC 5 RIGHT	786893.9555	1866271.9524	608.4476
XSC 6 LEFT	786700.8207	1866288.0700	609.6833
XSC 6 RIGHT	786715.8993	1866199.4730	606.5492
XSC 7 LEFT	786596.8813	1866250.9420	609.3301
XSC 7 RIGHT	786586.2595	1866172.4990	605.5594
XSC 8 LEFT	786403.0018	1866163.2910	604.9927
XSC 8 RIGHT	786394.8939	1866106.6040	604.3983

LEGEND

STREAM FEATURES
- THALWEG 2008
- BANKFULL 2008

PROJECT ELEMENTS
- CONTROL POINT/BENCHMARK (TBM)
- CROSS-SECTIONS
- VEGETATION PLOT WITH PHOTO CORNER (ARROW)
- PHOTO POINT
- EASEMENT BOUNDARY

STRUCTURE TYPES
- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

Ecosystem Enhancement PROGRAM

LOCATION: WELLS CREEK MONITORING PLAN VIEW MONITORING YEAR 4

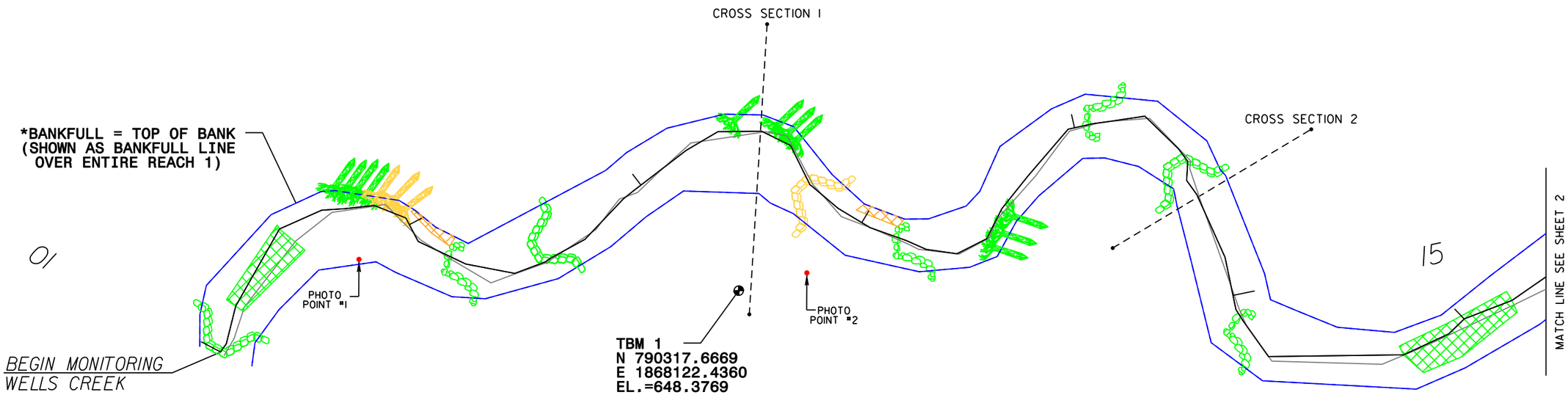
PROJ #:	COUNTY:
414	ALAMANCE
PREPARED BY:	
IPJ	
CHECKED BY:	DATE:
PDB	2/4/09

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	1
PROJECT ENGINEER	

10 0 20
SCALE

NAD 83



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 1 LEFT	790305.5148	1868218.0170	647.6658
XSC 1 RIGHT	790314.0373	1868113.8230	649.1659
XSC 2 LEFT	790110.5344	1868176.2530	647.0516
XSC 2 RIGHT	790182.8344	1868135.0260	647.4296

LEGEND

THALWEG 2007
THALWEG 2008
BANKFULL 2008
CROSS-SECTIONS

BANK EROSION
SEVERE BANK EROSION
UNDERCUT BANK
AGGRADATION
SIDE/CENTRAL BAR

STRUCTURE TYPES
ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

COLOR CODE FOR STRUCTURES
GOOD STRUCTURE
STRUCTURE WITH POTENTIAL PROBLEM
FAILING STRUCTURE

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

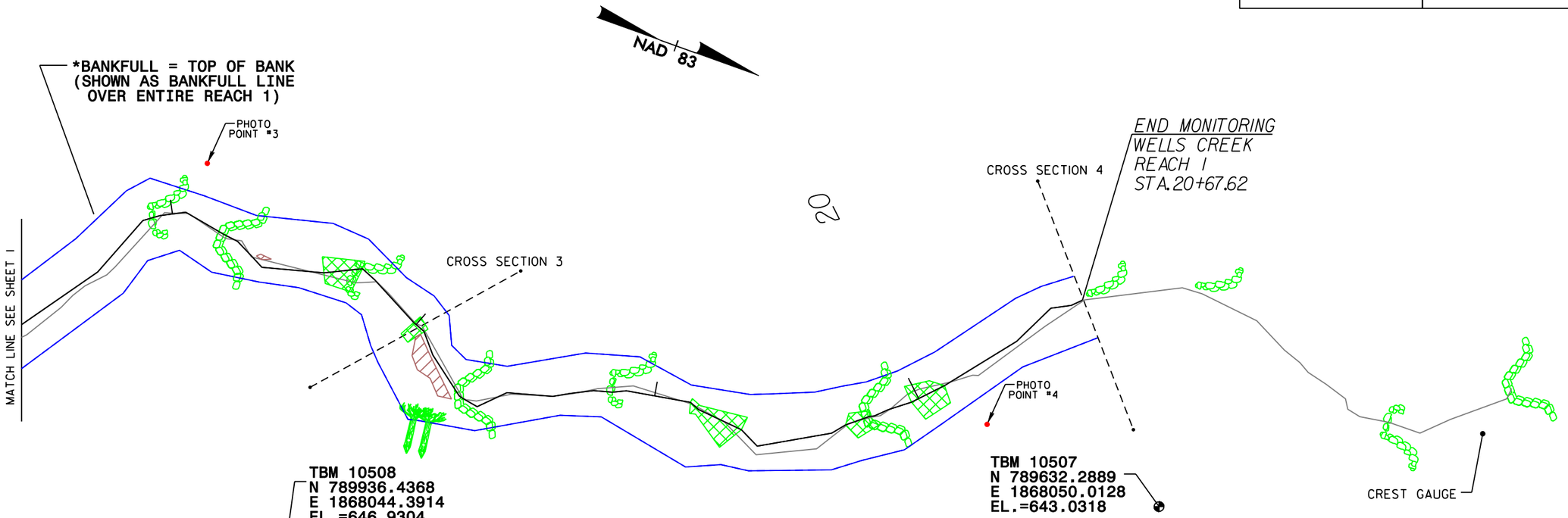
LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 4

PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: IPJ
CHECKED BY: PDB
DATE: 2/10/08

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	2
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 3 LEFT	789852.9624	1868136.6510	645.8511
XSC 3 RIGHT	789927.1424	1868097.5820	645.5129
XSC 4 LEFT	789672.2703	1868164.3220	645.0177
XSC 4 RIGHT	789640.7034	1868076.9910	643.5958

LEGEND

THALWEG 2007
THALWEG 2008
BANKFULL 2008
CROSS-SECTIONS

BANK EROSION
SEVERE BANK EROSION
UNDERCUT BANK
AGGRADATION
SIDE/CENTRAL BAR

STRUCTURE TYPES
ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

COLOR CODE FOR STRUCTURES
GOOD STRUCTURE
STRUCTURE WITH POTENTIAL PROBLEM
FAILING STRUCTURE

WELLS CREEK - REACH 1

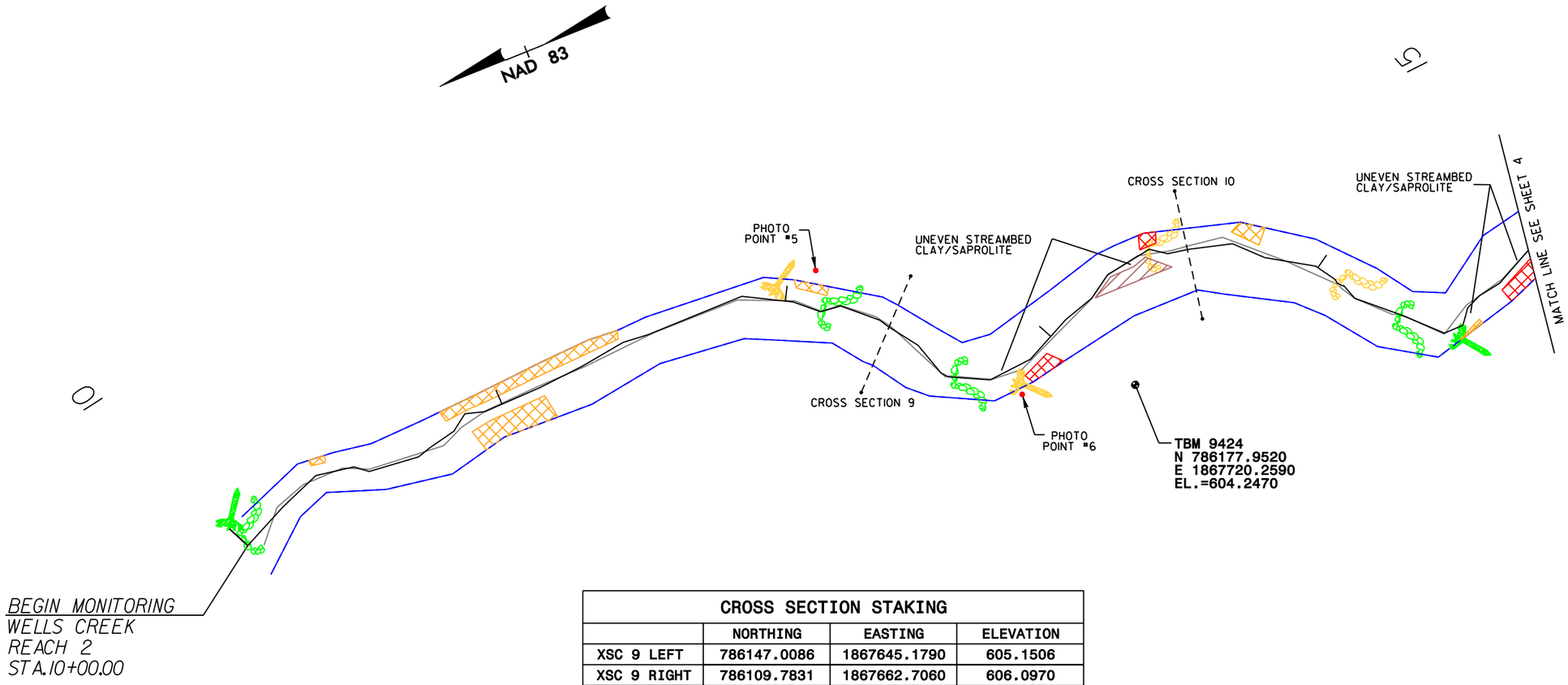
Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 4

PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: IPJ
CHECKED BY: PDB
DATE: 2/10/08

SEPI ENGINEERING GROUP	PROJECT REFERENCE NO.	SHEET NO.
1025 WADE AVENUE RALEIGH, NC 27605 TEL: 919-789-9977 FAX: 789-9591	414	3
	PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 9 LEFT	786147.0086	1867645.1790	605.1506
XSC 9 RIGHT	786109.7831	1867662.7060	606.0970
XSC 10 LEFT	786229.4962	1867681.8020	604.8637
XSC 10 RIGHT	786208.5385	1867718.8310	604.6050

LEGEND

- THALWEG 2007
- THALWEG 2008
- BANKFULL 2008
- CROSS-SECTIONS
- BANK EROSION
- SEVERE BANK EROSION
- UNDERCUT BANK
- AGGRADATION
- SIDE/CENTRAL BAR

STRUCTURE TYPES

- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

COLOR CODE FOR STRUCTURES

- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

WELLS CREEK - REACH 2

Ecosystem Enhancement PROGRAM

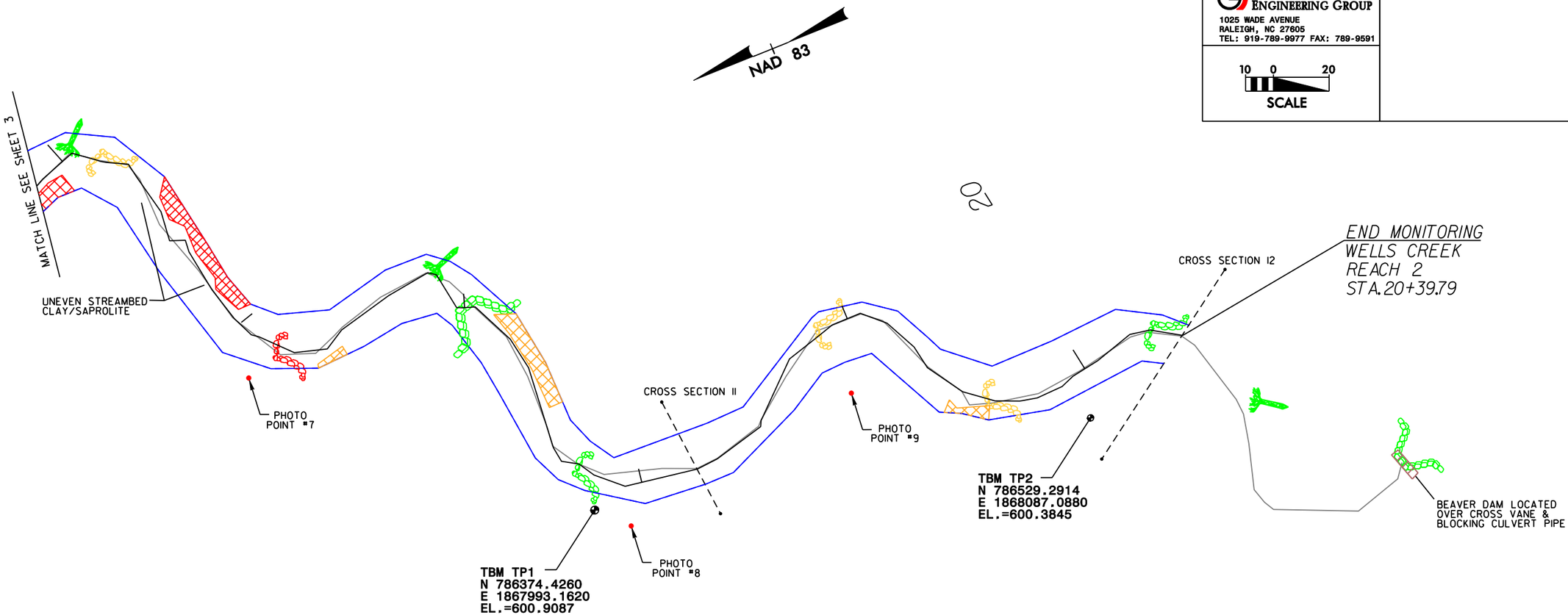
LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 4

PROJ #:	COUNTY:
414	ALAMANCE
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 2/10/08

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	4
PROJECT ENGINEER	

10 0 20
SCALE



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 11 LEFT	786418.2249	1867980.2450	602.9365
XSC 11 RIGHT	786407.2489	1868024.1950	603.0278
XSC 12 LEFT	786600.8247	1868079.4820	601.5332
XSC 12 RIGHT	786522.4359	1868100.7920	602.3083

LEGEND

- THALWEG 2007
- THALWEG 2008
- BANKFULL 2008
- CROSS-SECTIONS
- BANK EROSION
- SEVERE BANK EROSION
- UNDERCUT BANK
- AGGRADATION
- SIDE/CENTRAL BAR

STRUCTURE TYPES
- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

COLOR CODE FOR STRUCTURES
- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

WELLS CREEK - REACH 2

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 4

PROJ #:	COUNTY:
414	ALAMANCE
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 2/10/08

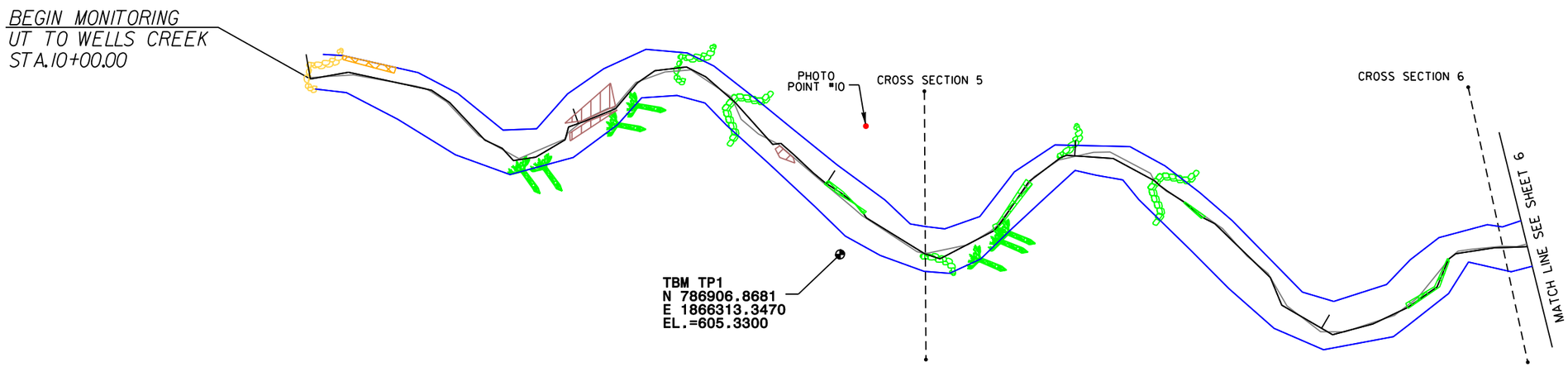
SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	5
PROJECT ENGINEER	

10 0 20
SCALE

NAD 83

10



CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 5 LEFT	786862.4549	1866351.6519	609.7649
XSC 5 RIGHT	786893.9555	1866271.9524	608.4476
XSC 6 LEFT	786700.8207	1866288.0700	609.6833
XSC 6 RIGHT	786715.8993	1866199.4730	606.5492

LEGEND

- THALWEG 2007
- THALWEG 2008
- BANKFULL 2008
- CROSS-SECTIONS
- BANK EROSION
- SEVERE BANK EROSION
- UNDERCUT BANK
- AGGRADATION
- SIDE/CENTRAL BAR

STRUCTURE TYPES
- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

COLOR CODE FOR STRUCTURES
- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

UT TO WELLS CREEK

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 4

PROJ #:	COUNTY:
414	ALAMANCE
PREPARED BY: IPJ	
CHECKED BY: PDB	DATE: 2/10/08

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	6
PROJECT ENGINEER	

10 0 20
SCALE

NAD 83

15

20

TBM 9966
N 786657.9531
E 1866283.4459
EL.=609.7917

TBM 9965
N 786536.6864
E 1866232.4360
EL.=609.2259

TBM TP2
N 786398.2934
E 1866169.0180
EL.=604.8960

END MONITORING
UT TO WELLS CREEK
STA. 20+20.87

CROSS SECTION 7

CROSS SECTION 8

PHOTO POINT #11

PHOTO POINT #12

MATCH LINE SEE SHEET 5

EASEMENT FENCE DOWN AT THIS APPROXIMATE LOCATION

CROSS SECTION STAKING			
	NORTHING	EASTING	ELEVATION
XSC 7 LEFT	786596.8813	1866250.9420	609.3301
XSC 7 RIGHT	786586.2595	1866172.4990	605.5594
XSC 8 LEFT	786403.0018	1866163.2910	604.9927
XSC 8 RIGHT	786394.8939	1866106.6040	604.3983

LEGEND

- THALWEG 2007
- THALWEG 2008
- BANKFULL 2008
- CROSS-SECTIONS
- BANK EROSION
- SEVERE BANK EROSION
- UNDERCUT BANK
- AGGRADATION
- SIDE/CENTRAL BAR

STRUCTURE TYPES
- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

COLOR CODE FOR STRUCTURES
- GOOD STRUCTURE
- STRUCTURE WITH POTENTIAL PROBLEM
- FAILING STRUCTURE

UT TO WELLS CREEK

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
STREAM MONITORING - YEAR 4

PROJ #: 414
COUNTY: ALAMANCE
PREPARED BY: IPJ
CHECKED BY: PDB
DATE: 2/10/08

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	1
PROJECT ENGINEER	

10 0 20
SCALE

NAD 83

*BANKFULL = TOP OF BANK (SHOWN AS BANKFULL LINE OVER ENTIRE REACH 1)

01

15

PHOTO POINT #1

VEG PLOT 1

TBM 1
N 790317.6669
E 1868122.4360
EL.=648.3769

PHOTO POINT #2

MATCH LINE SEE SHEET 2

BEGIN MONITORING
WELLS CREEK
REACH 1
STA.10+00.00

VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 1	790341.4193	1868127.8295

LEGEND

THALWEG 2008
BANKFULL 2008
PHOTO POINT
VEGETATION PLOT WITH PHOTO CORNER
VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES
ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

BARE BENCH/BANK
BARE FLOODPLAIN
ROSA MULTIFLORA PRESENT
MICROSTEGIUM VIRMINEUM PRESENT
LIGUSTRUM SINENSE PRESENT
AILANTHUS ALTISSIMA PRESENT

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

LOCATION:	WELLS CREEK VEGETATION ASSESSMENT - YEAR 4
PROJ #: 414	COUNTY: ALAMANCE
MONITORED BY:	IPJ
CHECKED BY: PDB	DATE: 2/10/08

SEPI ENGINEERING GROUP
1025 WADE AVENUE
RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	2
PROJECT ENGINEER	

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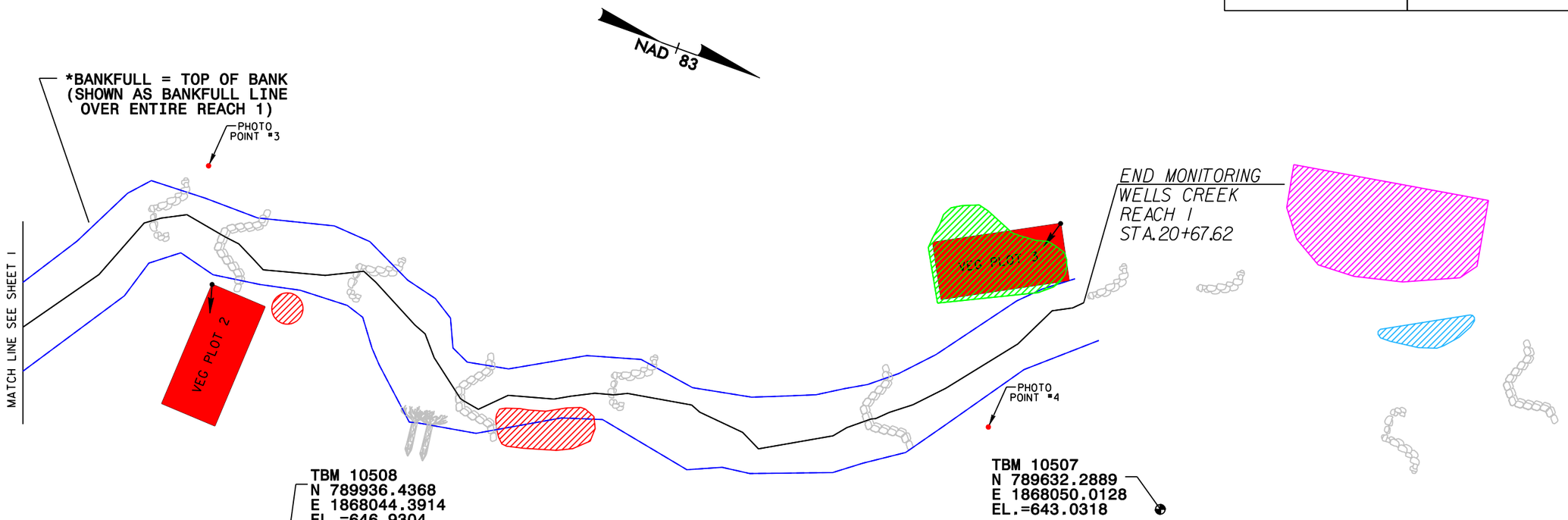
SCALE



VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 2	789960.9694	1868135.0301
VP 3	789665.0116	1868150.2452

LEGEND

- THALWEG 2008
- BANKFULL 2008
- PHOTO POINT
- VEGETATION PLOT WITH PHOTO CORNER
- VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

- BARE BENCH/BANK
- BARE FLOODPLAIN
- *ROSA MULTIFLORA* PRESENT
- *MICROSTEGIUM VIMINEUM* PRESENT
- *LIGUSTRUM SINENSE* PRESENT
- *AILANTHUS ALTISSIMA* PRESENT

WELLS CREEK - REACH 1

Ecosystem Enhancement PROGRAM

LOCATION:	WELLS CREEK VEGETATION ASSESSMENT - YEAR 4
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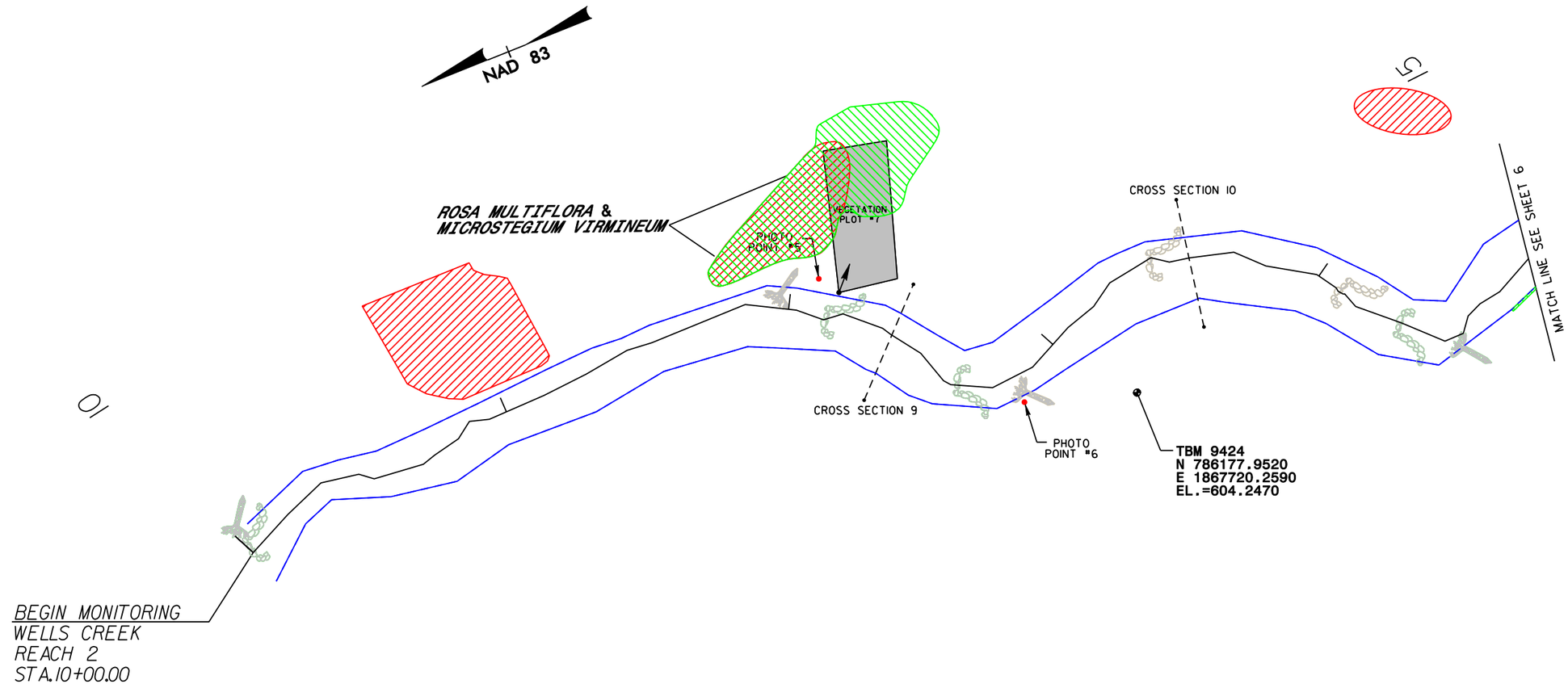
PROJECT REFERENCE NO.	SHEET NO.
414	5
PROJECT ENGINEER	

10 0 20
SCALE



VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 7	786127.0713	1867630.9720

LEGEND

THALWEG 2008
BANKFULL 2008
PHOTO POINT
VEGETATION PLOT WITH PHOTO CORNER
VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES
ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

BARE BENCH/BANK
BARE FLOODPLAIN
ROSA MULTIFLORA PRESENT
MICROSTEGIUM VIRMINEUM PRESENT
LIGUSTRUM SINENSE PRESENT
AILANTHUS ALTISSIMA PRESENT

WELLS CREEK - REACH 2

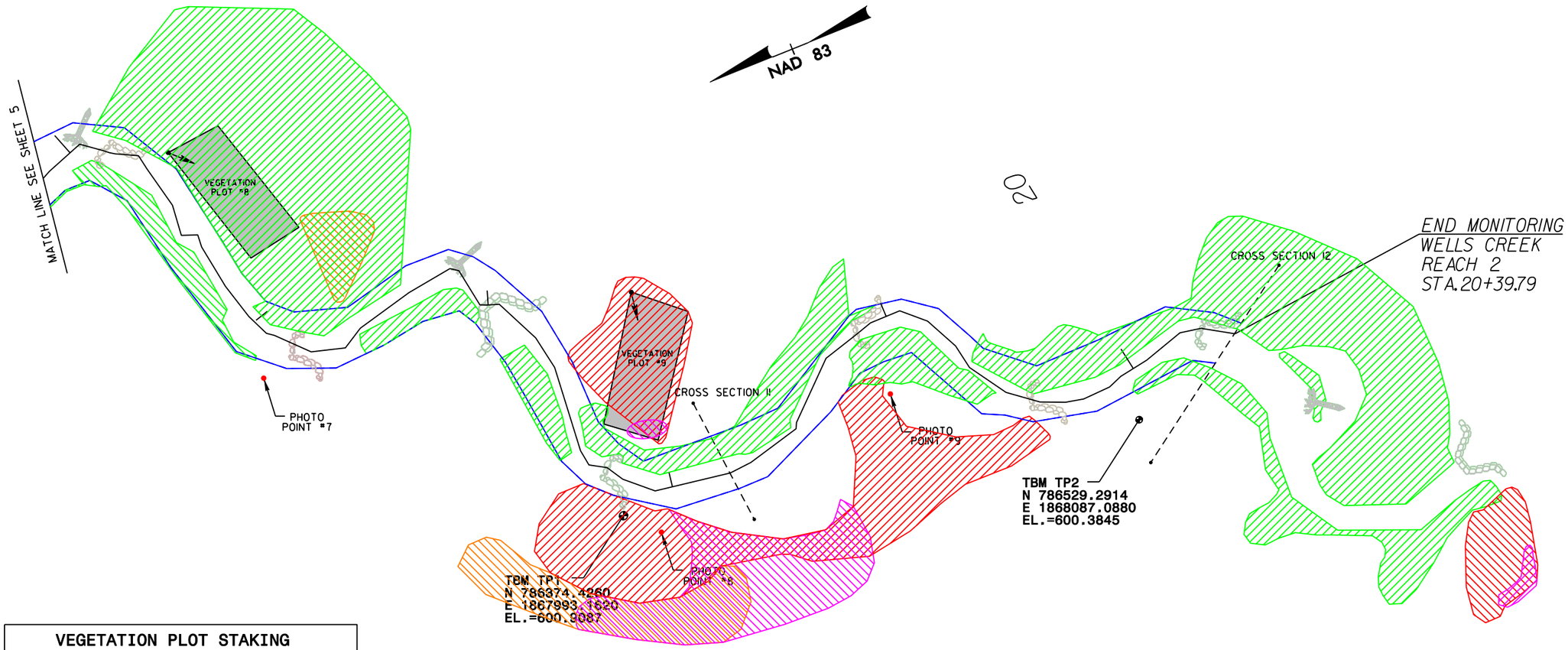
Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
VEGETATION ASSESSMENT - YEAR 4

PROJ #:	COUNTY:
414	ALAMANCE
MONITORED BY: IPJ	
CHECKED BY: PDB	DATE: 2/10/08

SEPI ENGINEERING GROUP	PROJECT REFERENCE NO.	SHEET NO.
1025 WADE AVENUE RALEIGH, NC 27605 TEL: 919-789-9977 FAX: 789-9591	414	6
	PROJECT ENGINEER	

10 0 20
SCALE



VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 8	786340.6505	1867794.9420
VP 9	786427.8047	1867937.4060

LEGEND

- THALWEG 2008
- BANKFULL 2008
- PHOTO POINT
- VEGETATION PLOT WITH PHOTO CORNER
- VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

- BARE BENCH/BANK
- BARE FLOODPLAIN
- *ROSA MULTIFLORA* PRESENT
- *MICROSTEGIUM VIMINEUM* PRESENT
- *LIGUSTRUM SINENSE* PRESENT
- *AILANTHUS ALTISSIMA* PRESENT

WELLS CREEK - REACH 2

Ecosystem Enhancement PROGRAM

LOCATION:	WELLS CREEK VEGETATION ASSESSMENT - YEAR 4
PROJ #: 414	COUNTY: ALAMANCE
MONITORED BY:	IPJ
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RALEIGH, NC 27605
TEL: 919-789-9977 FAX: 789-9591

PROJECT REFERENCE NO.	SHEET NO.
414	3
PROJECT ENGINEER	

10 0 20
SCALE

NAD 83

10

BEGIN MONITORING
UT TO WELLS CREEK
STA.10+00.00

PHOTO POINT #10

TBM TP1
N 786906.8681
E 1866313.3470
EL.=605.3300

VEGETATION PLOT #4

MATCH LINE SEE SHEET 4

VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 4	786838.9045	1866257.9760

LEGEND

THALWEG 2008
BANKFULL 2008
PHOTO POINT
VEGETATION PLOT WITH PHOTO CORNER
VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

ROCK CROSS VANE
J-HOOK VANE
ROOTWAD
ROCK VANE

BARE BENCH/BANK
BARE FLOODPLAIN
ROSA MULTIFLORA PRESENT
MICROSTEGIUM VIMINEUM PRESENT
LIGUSTRUM SINENSE PRESENT
AILANTHUS ALTISSIMA PRESENT

UT TO WELLS CREEK

Ecosystem Enhancement PROGRAM

LOCATION:
WELLS CREEK
VEGETATION ASSESSMENT - YEAR 4

PROJ #:	COUNTY:
414	ALAMANCE
MONITORED BY: IPJ	
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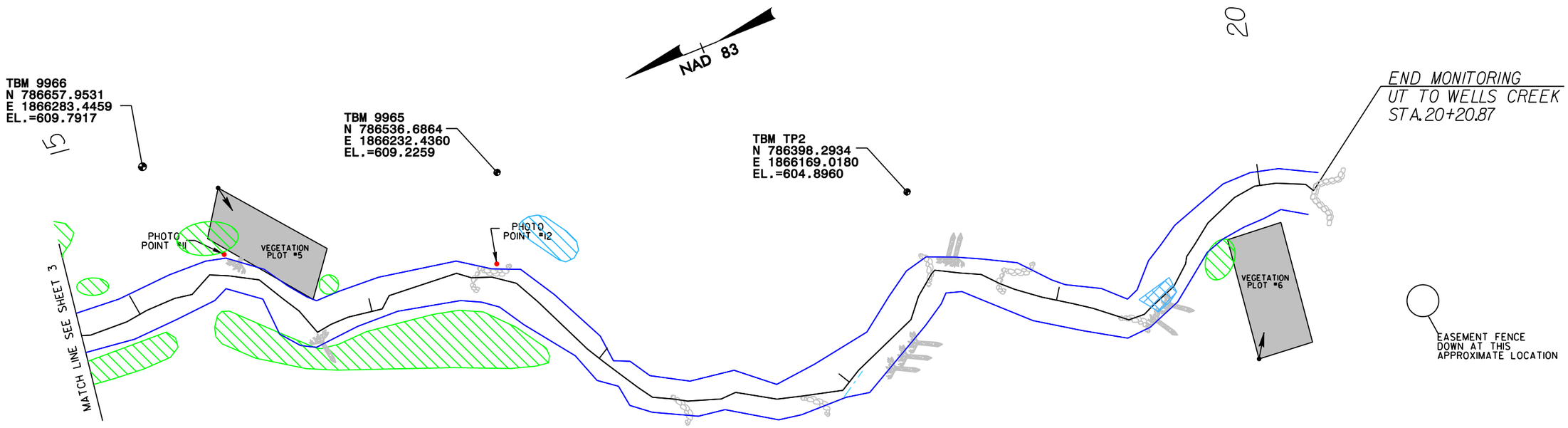
PROJECT REFERENCE NO.	SHEET NO.
414	4
PROJECT ENGINEER	

10 0 20
SCALE



VEGETATION PLOT STAKING		
	NORTHING	EASTING
VP 5	786634.8714	1866265.6880
VP 6	786300.2329	1866062.8870

LEGEND

- THALWEG 2008
- BANKFULL 2008
- PHOTO POINT
- VEGETATION PLOT WITH PHOTO CORNER
- VEGETATION PLOT NOT MEETING SUCCESS REQUIREMENTS

STRUCTURE TYPES

- ROCK CROSS VANE
- J-HOOK VANE
- ROOTWAD
- ROCK VANE

- BARE BENCH/BANK
- BARE FLOODPLAIN
- *ROSA MULTIFLORA* PRESENT
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- *LIGUSTRUM SINENSE* PRESENT
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UT TO WELLS CREEK

Ecosystem Enhancement PROGRAM

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