Morgan Creek
Stream Restoration Site

Year 2 Draft Monitoring Report
Project ID Number: 16-D06027

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1.0 SUMMARY

This Annual Report details the monitoring activities conducted during 2010 (Year 2) on the Morgan Creek Mitigation Site. Construction of the site, including planting of trees, was completed in July 2008. Due to stream damage associated with several, consecutive tropical storm events in August 2008, the majority of the Year 1 monitoring efforts were postponed until repairs were completed in February 2010. The Year 2 vegetation monitoring occurred in June 2010 and the stream monitoring was delayed until October and November 2010. The 2010 (Year 2) data represent results from the second year of stream and vegetation monitoring.

The mitigation design plan for the Morgan Creek Site involved restoration, enhancement, and preservation associated with nine stream reaches. After construction, it was determined that the project generated 7,855 linear feet of stream restoration, 1,797 linear feet of stream enhancement level I, 1,629 linear feet of stream enhancement level II, and 7,491 linear feet of stream preservation amounting to 11,203 stream mitigation units (SMU's). Due to stream bank and bed damage from high flows in August 2008, repairs were deemed necessary for portions of the restored reaches. Repairs were completed in February 2010 and because of restoration pattern changes along Morgan Creek, Unnamed Tributary 4, and Unnamed Tributary 7, the footage of stream restoration was reduced to 7,804 linear feet. Based on the reconstructed pattern, the total combined assets at this point are 11,152 SMU's.

This Annual Report presents the data from 16 cross-sections, 3,168 linear feet of longitudinal profile, three crest gauges, eight vegetation monitoring plots, and 70 photographic reference locations; as specified in the approved Mitigation Plan (EBX, 2008).

The Year 2 stream channel data indicates that the restored stream reaches are in the process of reaching the desired equilibrium that will provide the intended habitat and hydrologic function. The longitudinal profiles, cross-sections, substrate, and visual assessments indicate bed adjustments as compared to the As-built conditions. The restored stream channel continues to receive significant sediment inputs from upstream sources which are likely driving the bed form changes observed between monitoring years. Stream hydrology monitoring during Year 2 recorded a bankfull event for the site.

Vegetation plot (VP) monitoring during Year 2 indicates survival rates between 283 and 850 stems per acre with an average of 543 planted stems per acre for the entire restoration site. Overall, planted stems are surviving well at the project site. Only two of the eight plots are not on track to meet the interim success criteria (VP2 and VP3). While individuals classified as volunteer recruits significantly increased between years, this change is likely attributed to the planting effort associated with the earlier stream repairs. When planted and natural stems are combined the average stem density for the entire restoration site is approximately 769 stems per acre, which is well above the interim success criterion of 320 stems per acre at the end of the Year 3 monitoring period.

2.0 INTRODUCTION

2.1 Project Description

The Morgan Creek Stream Mitigation Site was identified and developed through the North Carolina Ecosystem Enhancement Program (NC EEP) full delivery process. The site is located in southern McDowell County approximately eight miles south of Marion, North Carolina **(Figure 1)**. The project streams lie within the Broad River Basin (Hydrologic Unit Code 03050105040040) and the North Carolina Division of Water Quality (NCDWQ) sub-basin 03-08-01.

The Mitigation Site consists of Morgan Creek and nine unnamed tributaries encompassing 18,772 linear feet. The nine distinct unnamed tributaries (UT) are identified as UT1, UT2, UT3, UT4, UT5, UT6, UT7, UT8, and UT9. Morgan Creek lies within a relatively flat valley with UT1, UT2, UT3, UT5, UT8, and UT9 originating within the property boundary in the mountainous area to the south of the Morgan Creek valley. UT4, UT6, and UT7 originate off the property north of the Morgan Creek valley and are included in the project easement area where they flow into the property. The USGS Sugar Hill topographic quadrangle **(Figure 2)** shows the project streams drain to the larger Cove Creek watershed. All reaches drain watersheds consisting of predominately forest and agricultural land. The site is defined by a conservation easement surrounding the streams and adjacent riparian buffers that total approximately 36.6 acres.

Channel restoration (improved pattern, dimension, and longitudinal profile) was completed on all of Morgan Creek and the downstream portions of UT1, UT2, UT3, UT4, UT5, UT6, and UT7 contiguous with Morgan Creek. An additional 163 feet of channel on UT8 was restored by stabilizing the downstream crossing through grading, boulder installation, and elimination of the backwater effect associated with a failed culvert. The middle section of UT1, upstream from the restoration reach was enhanced (enhancement level I) was enhanced by installing livestock exclusion fencing, a supplemental riparian buffer planting, and the stabilizing severely eroding logging roads. The middle sections of UT2, UT3, and UT5, located upstream of the restoration reaches, were enhanced (enhancement level II) by installation of livestock exclusion fencing. The stable headwater reaches and associated riparian buffers of UT1, UT2, UT3, UT5, UT8, and UT9 were protected under preservation criteria.

Prior to restoration, Morgan Creek and the sections of tributaries located within the valley were highly degraded due the presence of livestock, channelization, minimal riparian buffers, and failed culvert crossings. The enhancement reaches had been previously impacted by livestock access, limited riparian buffers, and adjacent eroding logging roads.

The 2010 monitoring season represents Year 2 of the monitoring period. Monitoring during 2010 included stream and vegetation monitoring stations **(Figure 3)** as approved in the Mitigation Plan (EBX, 2008).

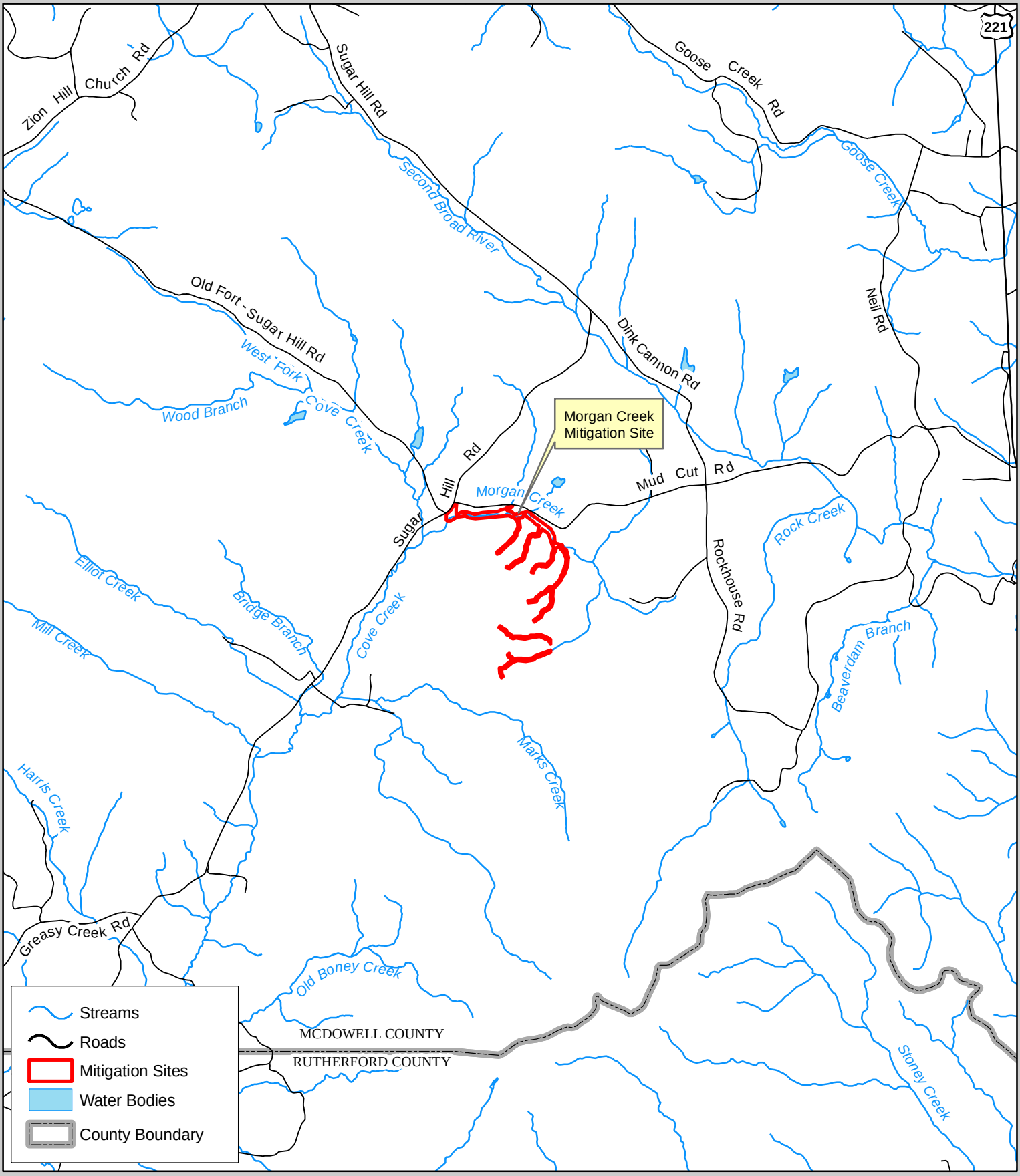
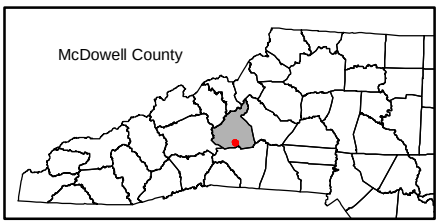


Figure 1
Morgan Creek Mitigation Site
Project Vicinity Map

0 0.25 0.5 1 Miles



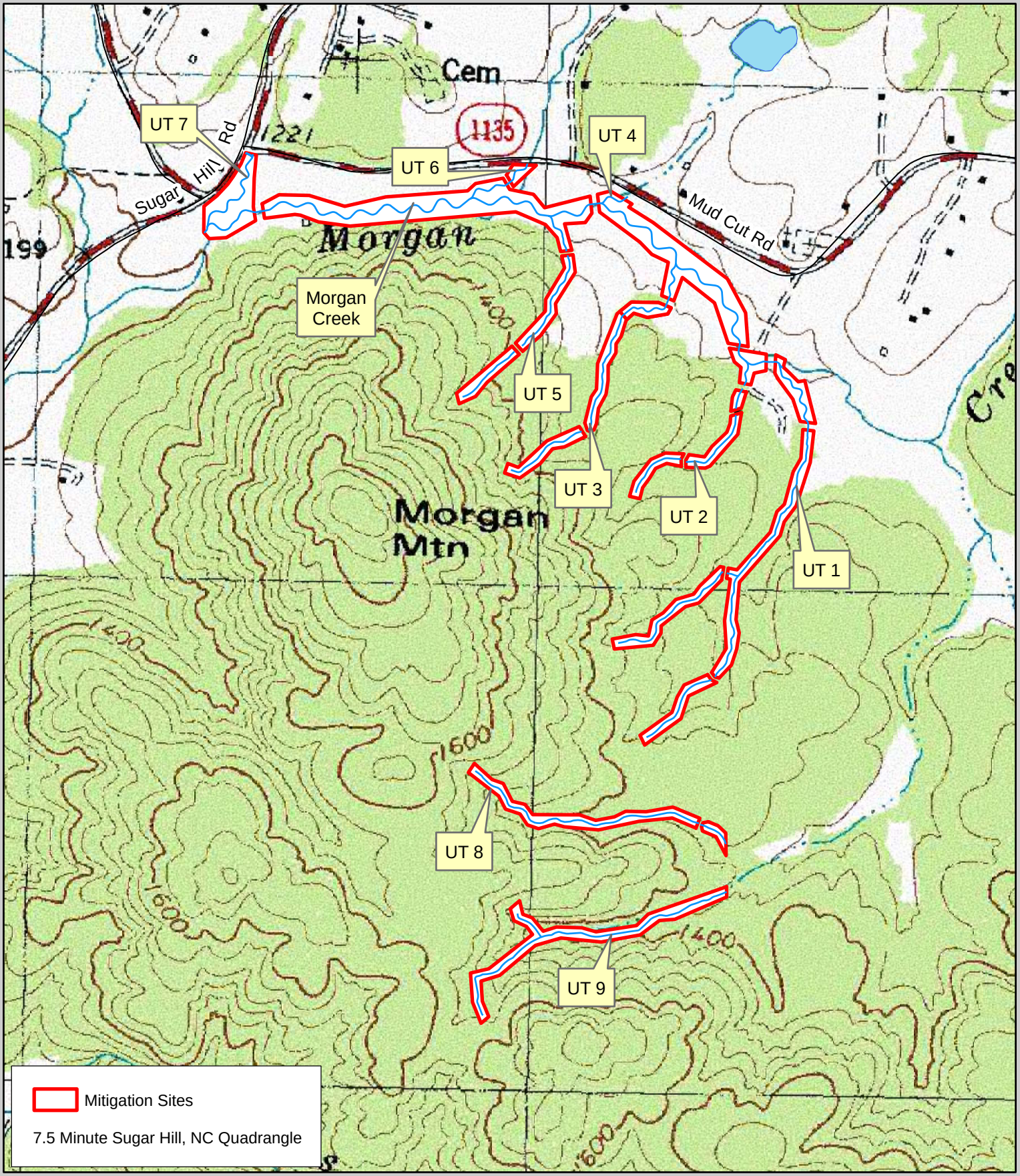
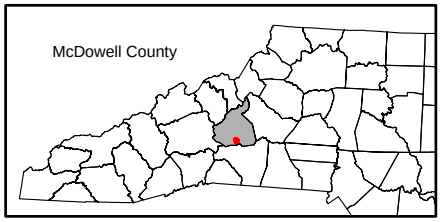
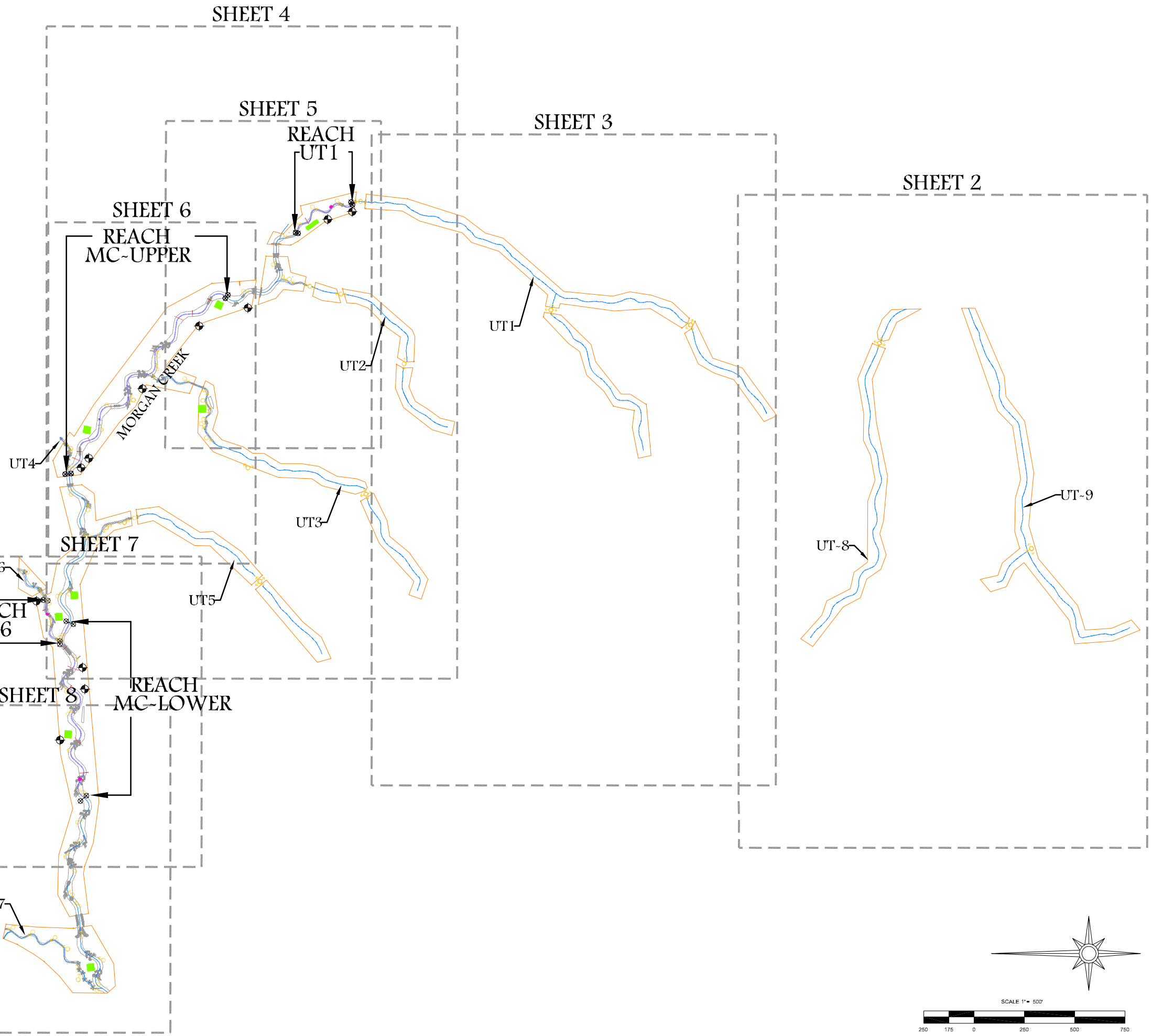


Figure 2
Morgan Creek Mitigation Site
USGS Map

0 500 1,000 2,000 Feet





LEGEND

- Vegetation Monitoring Plots
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Control Point
- Cross Section
- Crest Gauge
- Photo Point
- Constructed Riffle
- A-Vane
- Cross Vane
- J-Hook
- Log Sill
- Root Wad
- Rock Log Riffle
- Double Rock Drop Cross Vane
- Double Log Sill
- Rock Sill

SCALE 1" = 500'

250 175 0 250 500 750

Morgan Creek

McDowell County, NC

Monitoring Plan
Figure 3

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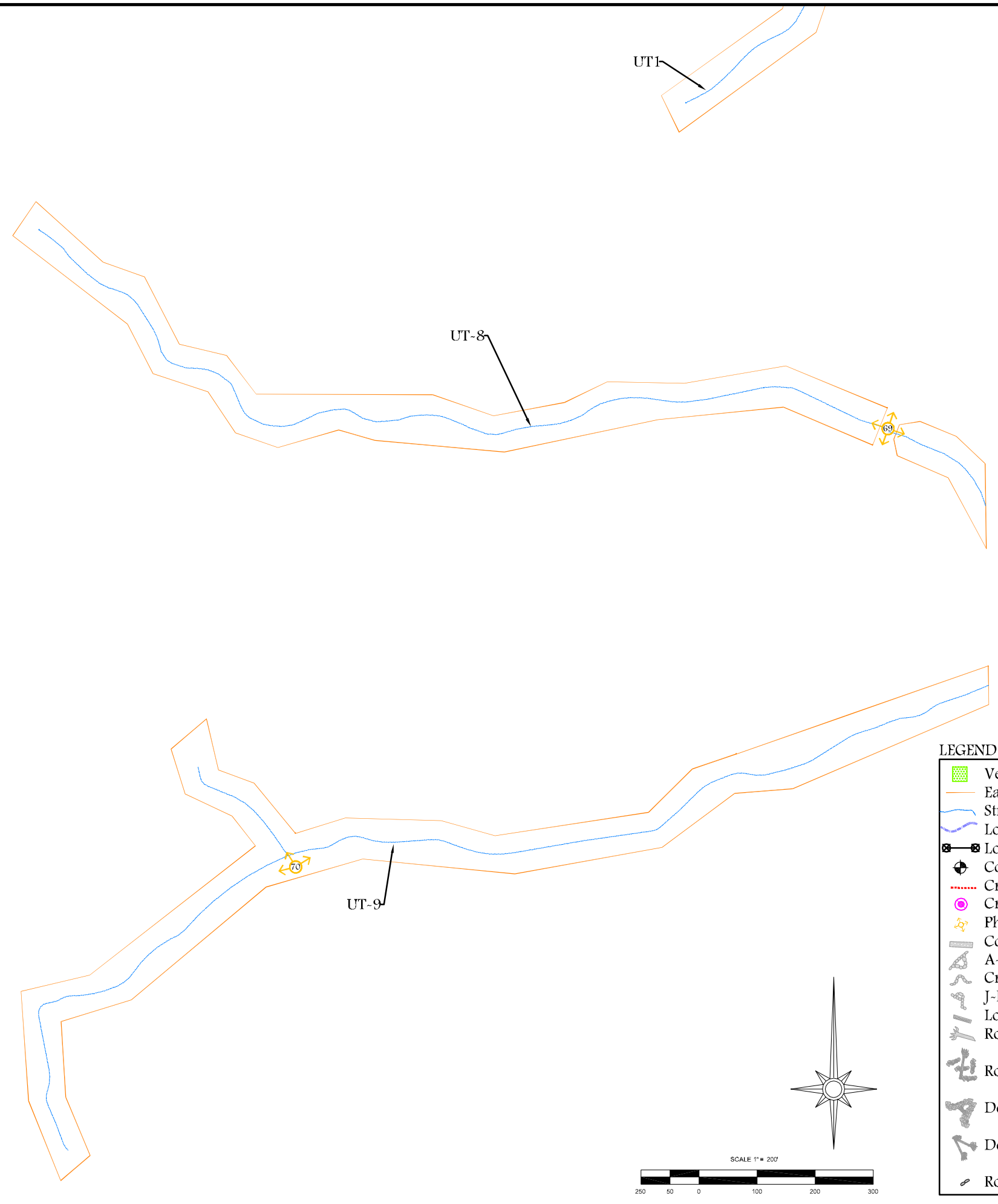

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McDowell County, NC

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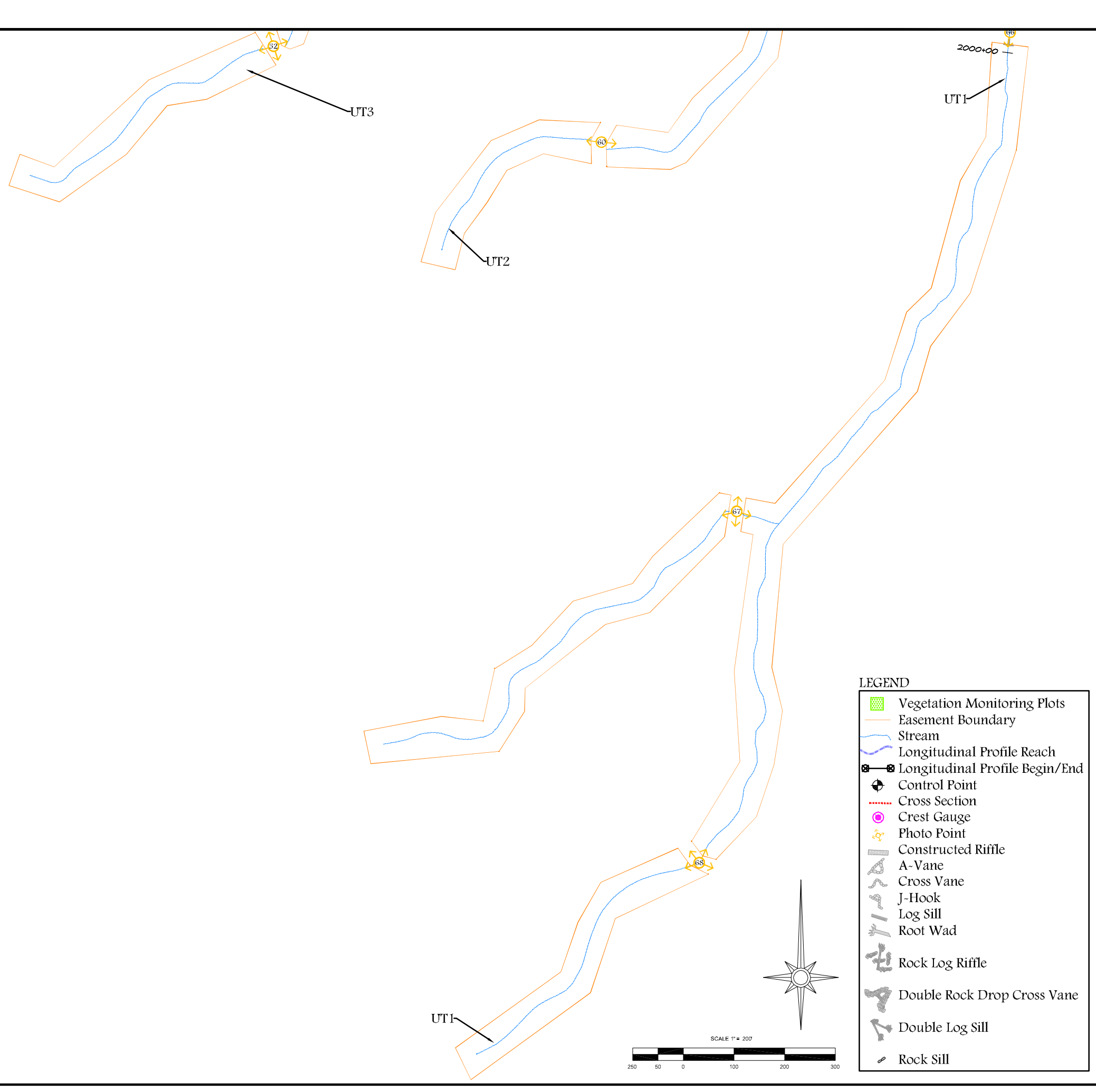

Morgan Creek

McDowell County, NC

Monitoring Plan
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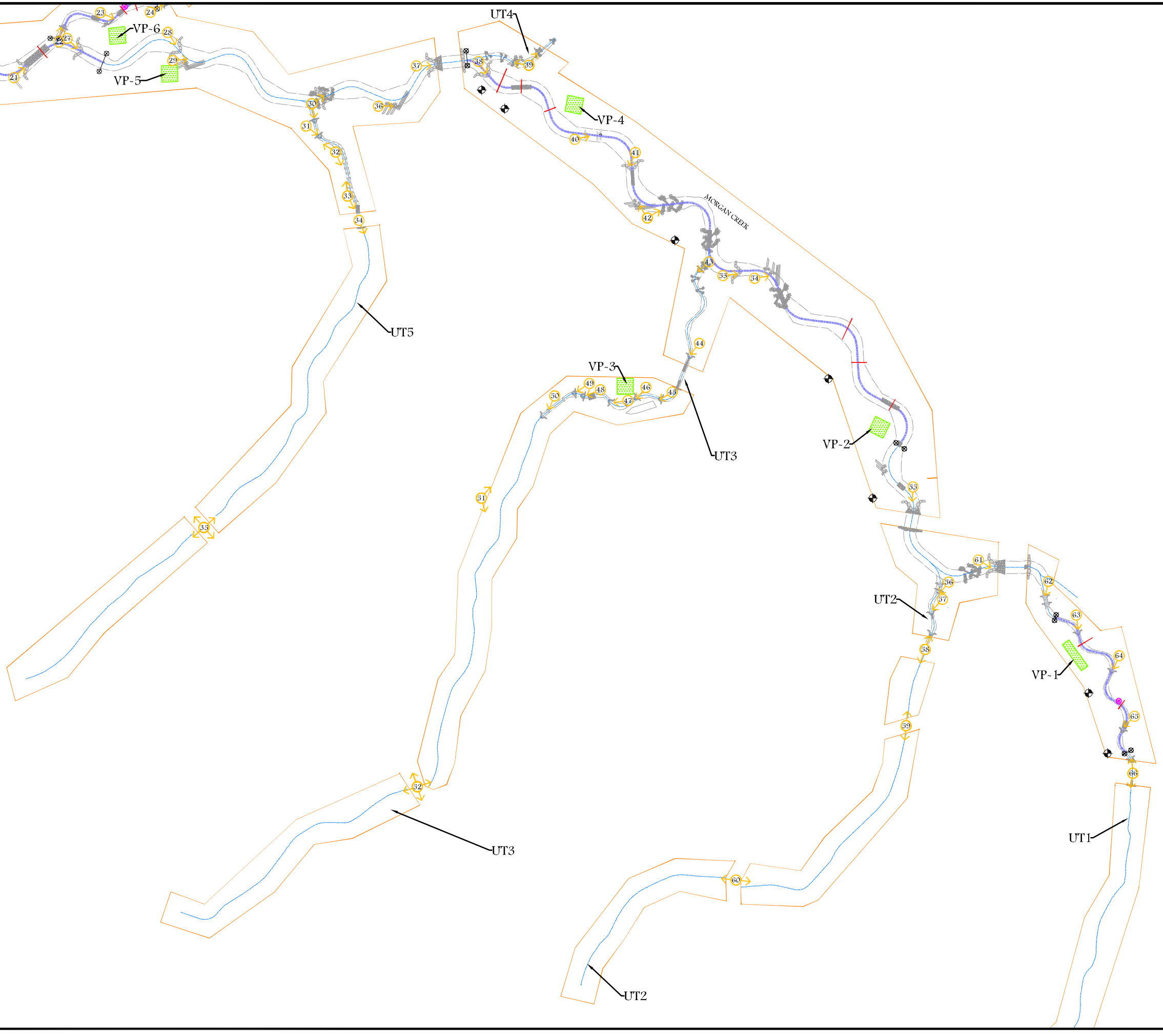
Morgan Creek

McDowell County, NC

Monitoring Plan
Figure 3



SCALE 1" = 200'

250 50 0 100 200 300

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MC Upper-P1
XS Station=1008+66.76

MC Upper-R1
XS Station=1006+56.98

MC Upper-R2
XS Station=1007+84.30

VP-3

VP-2

VP-1

UT3

UT2

UT1-P
XS Station=2003+77.15

UT1-R
XS Station=2001+95.47

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SCALE 1" = 100'

50 25 0 50 100 150

Morgan Creek

McDowell County, NC

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UT4

MC Upper-R4
XS Station=1018+35.29

VP-4

MC Upper-P2
XS Station=1018+80.45

MC Upper-R3
XS Station=1017+49.90

MORGAN CREEK

UT5

VP-3

UT3

MC Upper-R2
XS Station=1007+84.30

MC Upper-P1
XS Station=1008+66.76

MC Upper-R1
XS Station=1006+56.98

VP-2

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SCALE 1" = 100'

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Morgan Creek

McDowell County, NC

Monitoring Plan
Figure 3

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UT6

UT6-P
XS Station=7002+81.15

UT6-R
XS Station=7003+09.20

MC Lower-R4
XS Station=1037+69.44

MC Lower-P2
XS Station=1037+36.08

VP-7

VP-6

VP-5

MC Lower-R3
XS Station=1035+34.24

MC Lower-R2
XS Station=1032+07.04

MC Lower-P1
XS Station=1030+71.42

MC Lower-R1
XS Station=1029+53.31

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Morgan Creek

McDowell County, NC

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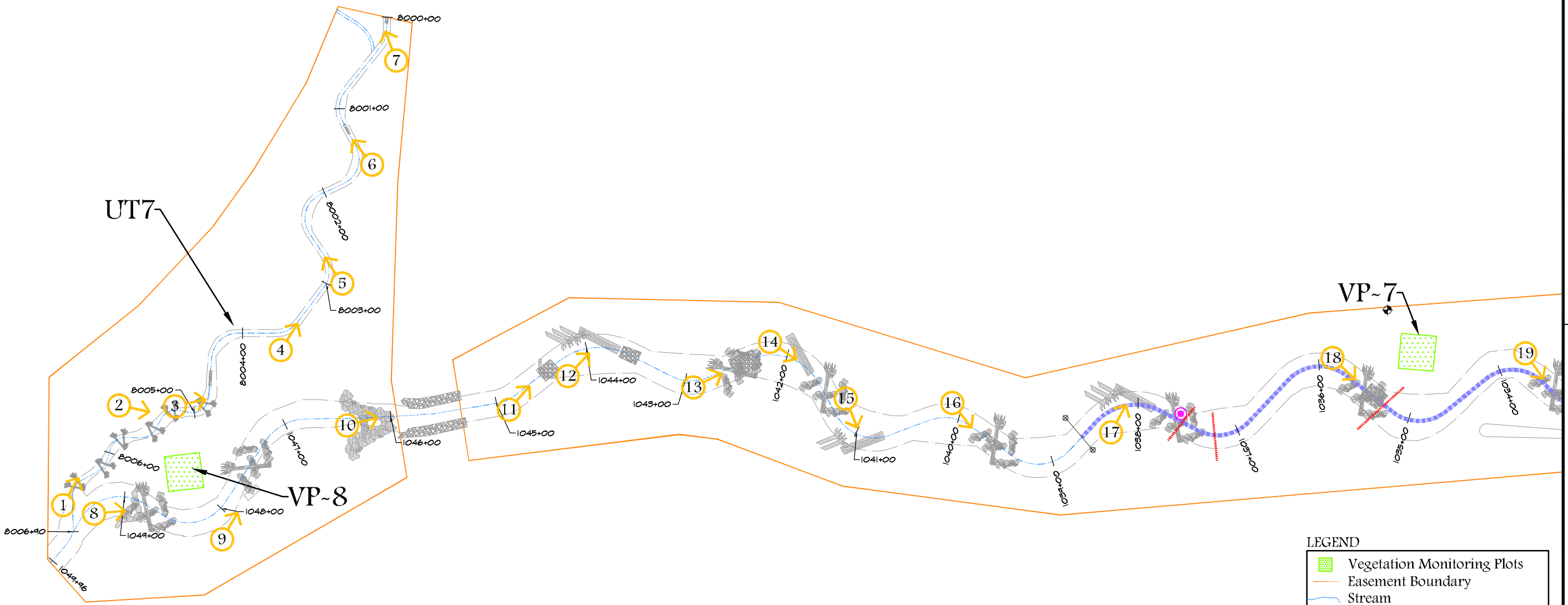
Morgan Creek

McDowell County, NC



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Monitoring Plan
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2.2 Project Purpose

The objective of the project was to provide 11,118 stream mitigation units (SMU's) for the NC EEP full delivery process in the Broad 03-08-01 Basin. In addition to providing mitigation credits; riparian habitat, aquatic habitat, and water quality improvements are expected to result from the restoration and enhancement of the stream channels at this site.

The Morgan Creek Mitigation Report (EBX, 2008) documented 7,855 linear feet of stream restoration, 1,797 linear feet of stream enhancement Level I, 1,629 linear feet of stream enhancement Level II, and 7,491 linear feet of stream preservation resulting in 11,203 SMU's **(Table 1)**. Due to alignment modifications associated with stream repairs made in 2010, the total linear feet of stream restoration was reduced to 7,804 linear feet. Based on the repair As-built conditions, a total of 11,152 SMU's were documented for the site **(Table 1)** as compared to the original mitigation units.

Table 1. Project Mitigation Structure and Approach

Reach Name	Stream Restoration (linear feet)	Stream Enhancement Level I (linear feet)	Stream Enhancement Level II (linear feet)	Stream Preservation (linear feet)	Total (linear feet)
Morgan Creek	4,794	-	-	-	4,794
UT1	507	1,797	-	1,569	3,873
UT2	162	-	120	928	1,210
UT3	583	-	807	559	1,949
UT4	171	-	-	-	171
UT5	275	-	702	454	1,431
UT6	460	-	-	-	460
UT7	689	-	-	-	689
UT8	163	-	-	1,693	1,856
UT9	-	-	-	2,288	2,288
Total Site Linear Feet	**7,804**	**1,797**	**1,629**	**7,491**	**18,721**
Total Site SMUs	**7,804**	**1,198**	**652**	**1,498**	**11,152**

Annual monitoring of the site is required to demonstrate successful mitigation based on criteria established in the Restoration Plan (EBX, 2007) and through a comparison to As-built and reference conditions. The success criteria components adhere to guidance provided by the United States Army Corps of Engineers (USACE) – Wilmington District (USACE, 2003) and recommendations from the NC EEP. Stream and vegetation monitoring are conducted annually for five years or until success criteria have been met. This Annual Monitoring Report details the results of the monitoring efforts for Year 2 at the Morgan Creek Stream Mitigation Site. Results from the Year 2 monitoring efforts are included within the following sections and **Appendix A**.

2.3 Project History and Schedule

The project was constructed in the spring and summer of 2008. Shortly after completion of the baseline data collection efforts, portions of the restored reaches were degraded due to significant

rainfall events. Stream repairs were delayed until early 2010, resulting in the postponement of the Year 1 monitoring efforts. The Year 2 vegetation plot monitoring occurred in June 2010 with the morphological data collected during October 2010 **(Table 2)**. **Table 3** lists the project contacts.

Table 2. Project Activity and Reporting History

Month / Year	Activity
August 2007	Restoration Plan
June 2008	Construction Completed
July 2008	Planting Completed
September 2008	Mitigation Plan / As-Built Report
December 2008	Supplemental Planting
February 2010	Repairs Completed
February - April 2010	Year 1 Morphological Data Collection
May 2010	Year 1 Annual Monitoring Report
October 2010	Year 2 Morphological Data Collection
December 2010	Year 2 Annual Monitoring Report
December 2011	Year 3 Annual Monitoring Report (Scheduled)
December 2012	Year 4 Annual Monitoring Report (Scheduled)
December 2013	Year 5 Annual Monitoring Report (Scheduled)

Table 3. Project Contacts

Contact	Provider Information
Full Delivery Service Contractor Norton Webster	Environmental Banc & Exchange 909 Capability Drive Suite 3100 Raleigh, North Carolina 27606 (919) 829-9909
Designer William Wilhelm	Kimley-Horn and Associates, Inc. 4651 Charlotte Park Drive, Suite 300 Charlotte, North Carolina 28217 (704) 333-5131
Construction/Seeding Contractor Robert Grady	RFG Construction Inc. 1907 Cambridge Drive Kinston, North Carolina 28504 (252) 523-2405
Planting Contractor Robert Cato	Superior Wildlife Services 2105 Sparre Drive Kinston, North Carolina 28504 (252) 939-0465
Repair Designer David Bidelspach	Stantec Consulting Inc. 801 Jones Frankline Road Raleigh, North Carolina 27606 (919) 851-6866
Repair Construction Contractor Darrell Westmoreland	North State Environmental 2889 Lowery Street Winston-Salem, North Carolina 27101 336-725-2010
Monitoring Contractor Steve Melton	Equinox Environmental Consultation & Design, Inc. 37 Haywood Street, Suite 100 Asheville, North Carolina 28801 (828) 253-6856

3.0 STREAM MONITORING

3.1 Stream Success Criteria

As stated in the Mitigation Plan (EBX, 2008), the stream geometry will be considered successful if the cross-section geometry, longitudinal profile, and channel sinuosity are stable or reach a dynamic equilibrium within the 5-year monitoring period. While the channels may not adhere to the design or reference ratios of stream geometry, the streams will be considered stable if the following key indicators are present:

- *Stream Type*: Maintenance of the design stream type or progression toward or conversion to a stable stream type such as B, C, or E will indicate stability.
- *Bank Height Ratio*: Bank height ratio between 1.0 and 1.2 will indicate that flood flows have access to the active floodplain and that higher flows do not apply excessive stresses to stream banks.

A minimum of two bankfull events is required during the 5-year monitoring period. If two bankfull events do not occur, the monitoring period may be extended at the discretion of the USACE.

3.2 Stream Morphology Monitoring Plan

The stream monitoring program will document trends and progress in achieving the channel success criteria. Monitoring will occur annually for five years or until the final success criteria are met, whichever is longer. The locations of the individual stream monitoring components are shown in **Figure 3**.

3.2.1 Cross-Sections

A total of 16 cross-sections were established as part of the As-built monitoring efforts. Cross-sections for Morgan Creek include four riffles and two pools for each of the two monitored reaches, Morgan Creek Upper (MC-Upper) and Morgan Creek Lower (MC-Lower). Due to stream and bank repairs within MC-Lower, cross-section locations had to be re-established prior to the Year 1 monitoring efforts. Additionally, the MC-Upper Riffle4 / Cross-Section 5 also was impacted and in a change in bankfull elevation between monitoring years. The Monitoring Plan View **(Figure 3)** has been updated to reflect these changes in cross-sectional monitoring stations. The UT1 and UT6 restoration reaches each include one riffle and one pool cross-section. Each cross-section was marked on both banks with permanent iron pins to establish known elevations and stationing for comparisons between annual data collection efforts. Annual cross-sectional survey points include all present breaks in slope; including top of bank, bankfull, inner berm, and thalweg. Photos are taken annually at each cross-section to visually document left and right bank conditions.

3.2.2 Longitudinal Profile

Four permanent longitudinal profile reaches were established during the As-built monitoring efforts. Morgan Creek includes an upper (MC-Upper) and lower reach (MC-Lower), whereas UT1 and UT6 include a portion of the restored reaches. The beginning and end of each longitudinal profile reach were marked on both banks with permanent iron pins to establish benchmarks for annual data comparison and analyses. Longitudinal profile measurements include thalweg, water surface, bankfull, and top of low bank elevations. Thalweg and water surface elevation measurements also are collected annually at the head and tail of each bedform type.

3.2.3 Substrate

Bed substrate assessment sites were established at each permanent cross-section. Annual pebble counts are collected utilizing methods adapted from Harrelson et al. (1994). A minimum of 100 particles are selected and measured from each channel feature type sampled. Sampled materials are placed into size classes using the traditional Wentworth scale classes subdivided based on phi scale. These classes are grouped into broader sediment size categories (e.g. sand, gravel or cobble) and are utilized to compare substrate progression from As-built conditions.

3.2.4 Hydrology

Crest gauges installed at the lower end of Morgan Creek, UT1, and UT6 are utilized to document bankfull events during the monitoring period. Crest gauges are checked during each site visit to document the highest flow between visits. Gauge height readings are recorded and digital images of floodplain debris lines and sediment deposition are collected to document annual bankfull events.

3.2.5 Photo Reference Stations

A total of 70 representative photo stations were established throughout the site to subjectively evaluate overall trends in project progression and general site conditions over the duration of the monitoring effort. Additionally, the entire site is visually assessed to document any identified areas of concern. Representative photos are collected to document areas of concern identified during the visual site assessment.

3.3 Stream Morphology Monitoring Results

The Year 2 annual stream morphology data were collected between June and November 2010. Reference station photos were collected in November 2010 to document the general conditions of the site. The Year 2 cross-section, longitudinal profile, and substrate data collection efforts occurred in October 2010. Visual assessments and bankfull documentation were noted during each site visit of the annual monitoring effort. A final quantitative site assessment and data collection effort occurred in November 2010.

3.3.1 Cross-Sections

The MC-Upper, MC-Lower, UT1, and UT6 cross-sectional data collected during the Year 2 monitoring effort have been compared with previous data sets **(Appendices B & C)**. Due to stream and bank repairs that resulted in the loss of cross-sectional stations within the MC-Lower reach, data for the As-built conditions are not depicted within the cross-sectional profiles in **Appendix B**. Furthermore, stream and bank repairs impacted bankfull elevation at MC-Upper Riffle 4 / Cross-Section 5 and data comparisons between As-built and Year 1 are only reported in the tables for reference and not for analysis. Lastly, bankfull elevations for the UT6 cross-sections were set at a higher elevation during Year 1 to reflect the floodplain aggradation that occurred between monitoring years.

Overall, the riffle cross-sectional data for MC-Upper indicate narrowing channels with inner berm feature development along the banks between As-built and Year 1 monitoring. Additionally, the two constructed riffles within the MC-Upper reach maintained similar maximum depths between As-built and Year 1 whereas maximum depths for the two non-constructed riffles significantly increased. Based on the two pools monitored within the MC-Upper reach, cross-sectional area decreased significantly between the As-built and Year 1 data collection efforts. The Year 2 cross-sectional data for MC-Upper reach indicate minimal changes have occurred since the Year 1 data were collected.

Due to the loss of cross-sectional stations within the MC-Lower reach, data comparisons with the As-built conditions are not representative. However, the Year 2 cross-sectional data for MC-Lower indicates minimal changes since the repair As-built data (Year 1) were collected.

Compared to the UT1 As-built data, the Year 2 channel cross-sectional data shows minimal differences between years, indicating that the overall UT1 stream dimensions have remained stable. The riffle cross-section for this reach indicates similar inner berm feature development as seen within the MC-Upper reach.

Stream dimensions for UT6 were impacted from sediment deposition both within the channel and along the floodplain between As-built and Year 1 monitoring. The Year 2 cross-sectional data for UT6 indicates that stream dimensions have stabilized since the Year 1 monitoring effort.

3.3.2 Longitudinal Profile

Longitudinal profile surveys were conducted along four separate reaches of the restoration project, totaling approximately 3,168 linear feet. The surveys included reach MC-Upper from STA 1005+15 to STA 1019+46 (1,431 linear feet), MC-Lower from STA 1028+20 to STA 1039+26 (1,106 linear feet), UT1 from STA 2000+85 to STA 2004+66 (381 linear feet), and reach UT6 from STA 7002+34 to STA 7004+84 (250 linear feet). Due to design changes resulting from repairs made within the MC-Lower reach, the original As-built data are only reported in the tables for reference and not for analysis. Additionally, data for the MC-Lower As-built conditions are not depicted within the longitudinal profiles in **Appendix B**. The longitudinal profiles document bed elevations, stream features, and in-stream grade control structures and compare them with the As-built profiles **(Appendices B & C)**.

Based on stream profiles and visual observations, the project site has experienced some changes in morphology as compared to the previous conditions. While bed conditions within the project site are stable within areas, stream bed profiles and visual observations indicate an overall trend of filling pools and down-cutting riffles.

3.3.3 Substrate

Overall, pebble count data for MC-Upper indicate minimal change in substrate size composition between years for both riffles and pools. The MC-Upper pebble count data collected during Year 2 primarily indicate silt/clay and fine sand particles within the pool habitat types and coarser materials within the riffles. Although pebble counts collected for the MC-Lower reach are not directly comparable to the As-built data due to changes in locations between years, there appears to be a general trend towards a coarser composition within both pool and riffle habitats. The UT1 pebble count data collected during Year 2 reveals a continuing trend towards finer substrate material within both pool and riffle habitats, with substrate composition primarily comprised of silt/clay. The Year 2 substrate composition within the UT6 stream channel indicates both pool and riffle habitat types have also trended towards a silt/clay composition. The pebble count data summary plots are included in **Appendix B**.

3.3.4 Hydrology

Since project completion at least four bankfull events have occurred within the project site. An initial bankfull event occurred in August 2008, shortly after project completion, which registered 0.15 feet above bankfull on Morgan Creek and 0.02 feet above bankfull on UT6. Owing to damaged crest gauges from this initial event, bankfull events in May 2009 and January 2010 were documented with photos. During the Year 2 monitoring bankfull events were documented with crest gauges located on the UT1, UT6, and Morgan Creek mainstem restoration reaches **(Table 4)**.

Table 4. Crest Gauge Data

Month / Year Recorded	Morgan Creek (ft)	UT1 (ft)	UT6 (ft)
August 2008	0.15	0.00	0.02
November 2010	0.56	0.02	0.57

3.3.5 Photo Reference Stations

The Year 2 reference station photos are included in **Appendix D**. Stream areas of concern (SPA) identified through the morphological monitoring and visual assessments include isolated areas of stream bed aggradation and degradation, stream bank erosion, and grade control degradation **(Table 5)**. Representative photos of these areas taken during the Year 2 monitoring are included in **Appendix D**.

Table 5. Stream Areas Requiring Observation

SPA	Feature	Reach	STA	Description	Recommendation
1	Pool	UT1	2001+10	Reduced pool depth due to aggradation	Continue to monitor
2	Rock Vane	UT1	2001+50	Grade control structure piping	Continue to monitor
3	Pool	UT1	2001+55	Reduced pool depth due to aggradation	Continue to monitor
4	Pool	UT1	2001+75	Reduced pool depth due to aggradation	Continue to monitor
5	Pool	UT1	2002+40	Reduced pool depth due to aggradation	Continue to monitor
6	Pool	Morgan Creek	1001+50	Reduced pool depth due to aggradation	Continue to monitor
7	Pool	Morgan Creek	1002+25	Reduced pool depth due to aggradation	Continue to monitor
8	Pool/Riffle	UT2	3000+50	Reduced pool depth and riffle fining due to aggradation	Continue to monitor
9	Pool	Morgan Creek	1003+25	Reduced pool depth due to aggradation	Continue to monitor
10	Pool	Morgan Creek	1004+20	Reduced pool depth due to aggradation	Continue to monitor
11	Pool	Morgan Creek	1005+05	Reduced pool depth due to aggradation	Continue to monitor
12	Riffle	Morgan Creek	1007+75	Riffle down cutting	Continue to monitor
13	Riffle	Morgan Creek	1008+75	Riffle down cutting	Continue to monitor
14	Pool	UT3	4000+10	Reduced pool depth due to aggradation	Continue to monitor
15	Pool	UT3	4001+90	Insufficient pool depth due to aggradation	Continue to monitor
16	Stream Bank	Morgan Creek	1014+50	Bank erosion due to piping behind root wad	Continue to monitor
17	Pool/Riffle	UT4	5001+50	Reduced pool depth and riffle fining due to aggradation	Continue to monitor
18	Stream Bank	Morgan Creek	1021+25	Bank erosion due to piping behind root wad	Continue to monitor
19	Pool/Riffle	UT6	7001+00	Reduced pool depth and riffle fining due to aggradation	Continue to monitor
20	Pool/Riffle	UT6	7003+00	Reduced pool depth and riffle fining due to aggradation	Continue to monitor
21	Pool	UT6	7004+10	Reduced pool depth due to aggradation	Continue to monitor
22	Riffle	Morgan Creek	1038+50	Mid channel bar	Continue to monitor
23	Pool	Morgan Creek	1047+00	Reduced pool depth due to aggradation	Continue to monitor
24	Pool/Riffle	UT7	8000+40	Reduced pool depth and riffle fining due to aggradation	Continue to monitor
25	Pool/Riffle	UT7	8006+00	Reduced pool depth and riffle fining due to aggradation	Continue to monitor

3.4 Stream Conclusions

The Year 2 morphological monitoring and visual assessments indicate an evolving system in which the restoration areas continue to evolve towards stability. Areas of concern identified during Year 2 were primarily associated with pool aggradation and riffle degradation. Upstream sediment sources, in conjunction with on-site riffle down-cutting, appear to be the primary

influences associated with bed profile changes between years. These observations will be monitored during subsequent years to document profile stabilization over time and recommendations will be made, if necessary, to ensure project success. **Table 6** summarizes the riffle morphologic parameters since the As-built conditions; details of the morphologic parameters are provided in **Appendices B & C**. The MC-Lower As-built and Year 1 parameters in **Table 6** are presented for the purpose of comparing the original As-built conditions to conditions following completion of the repairs.

Table 6. Summary of Morphologic Monitoring Parameters

Morgan Creek – Upper Reach			
Parameter	**As-Built**	**Year 1**	**Year 2**
Average Bankfull Cross-Section Area Abkf (sq ft)	28.4	25.0	24.9
Average Bankfull Width Wbkf (ft)	20.8	19.7	19.8
Average Bankfull Width / Depth Ratio	15.5	15.6	16.0
Average Bankfull Mean Depth Dbkf (ft)	1.4	1.3	1.3
Average Bankfull Max Depth Dmax (ft)	2.4	3.0	3.0

Morgan Creek – Lower Reach			
Parameter	**As-Built***	**Year 1**	**Year 2**
Average Bankfull Cross-Section Area Abkf (sq ft)	28.2	42.2	43.1
Average Bankfull Width Wbkf (ft)	22.4	24.3	24.3
Average Bankfull Width / Depth Ratio	17.8	14.1	14.0
Average Bankfull Mean Depth Dbkf (ft)	1.3	1.7	1.8
Average Bankfull Max Depth Dmax (ft)	2.4	3.2	3.4

*Morgan Creek Lower As-built data are presented for the purpose of comparing the original to those of the repair As- built conditions (Year 1) and not for morphological analysis.

Morgan Creek – UT1			
Parameter	**As-Built**	**Year 1**	**Year 2**
Bankfull Cross-Section Area Abkf (sq ft)	4.1	4.2	4.2
Bankfull Width Wbkf (ft)	9.1	9.0	9.7
Bankfull Width / Depth Ratio	19.9	19.4	22.7
Bankfull Mean Depth Dbkf (ft)	0.5	0.5	0.4
Bankfull Max Depth Dmax (ft)	1.2	1.3	1.3

Morgan Creek – UT6			
Parameter	**As-Built**	**Year 1**	**Year 2**
Bankfull Cross-Section Area Abkf (sq ft)	11.1	10.3	9.7
Bankfull Width Wbkf (ft)	13.4	11.7	11.7
Bankfull Width / Depth Ratio	16.2	13.2	14.1
Bankfull Mean Depth Dbkf (ft)	0.8	0.9	0.8
Bankfull Max Depth Dmax (ft)	1.7	1.7	1.6

4.0 VEGETATION

4.1 Vegetation Success Criteria

Successful establishment of vegetation for the Morgan Creek Stream Restoration Project should be the survival of 320 planted stems per acre by the end of Year 3 such that the site will achieve the final requirement of 260 planted stems per acre by Year 5.

4.2 Description of Species and Vegetation Monitoring

Eight vegetation plots (VP), or approximately 1% of the restoration site, were established within the project easement area: seven standard (10m x 10m) plots and one non-standard (5m x 20m) plot **(Figure 3)**. These plots were established in accordance with the CVS-EEP Level II monitoring protocol (Lee et al., 2008) within the planted restoration areas. Approximately 0.025-acre in size, vegetation plots were monitored to determine the success of planted vegetation and the overall trajectory of woody plant restoration and natural plant regeneration at the project site. Plots were placed within the applicable planting zones to capture the heterogeneity of the restored vegetative communities. However, given that several planting zones were too narrow to accommodate the standard or non-standard plots, all vegetation plots were placed within riparian and upland planting zones. Due to the stream repairs completed in early 2010, VP8 had to be re-established and replanted prior to the Year 2 monitoring efforts. A total of 11 tree species were planted on the site **(Table 7)**. Taxonomic nomenclature follows Weakley (2008).

Table 7. Planted Tree Species

Common Name	Scientific Name
Willow Oak	*Quercus phellos*
Water Oak	*Quercus nigra*
Swamp Chestnut Oak	*Quercus michauxii*
Black Willow	*Salix nigra*
River Birch	*Betula nigra*
Yellow Poplar	*Liriodendron tulipifera var. tulipifera*
American Sycamore	*Platanus occidentalis var. occidentalis*
Green Ash	*Fraxinus pennsylvanica*
Buttonbush	*Cepalanthus occidentalis*
Black Willow	*Salix nigra*
Silky Dogwood	*Cornus amomum*

4.3 Results of Vegetation Monitoring

Planted stem counts for each of the eight vegetation monitoring plots were recorded by species **(Table 8)**. Low stem densities reported for the As-built conditions resulted in a supplemental planting that occurred in December 2008. Results from the Year 2 vegetation monitoring documented survivability ranging from 283 to 850 planted stems per acre **(Table 9)**. Vegetation plots 2 and 3 are not on track to meet the interim success criterion, with 283 stems per acre for

each plot. However, the average planted stem density for the entire restoration site is 543 planted stems per acre, which is a 1% increase from the Year 1 monitoring efforts. This increase is primarily the result of relocating some stems that were classified as missing in Year 1.

Table 8. Results of Monitoring Year 2 Vegetation Monitoring by Plot

Species	Plot ID							
	VP1	VP2	VP3	VP4	VP5	VP6	VP7	VP8
Betula nigra	2	1	2	3		12	8	1
Cephalanthus occidentalis	1						6	2
Fraxinus pennsylvanica	4	1	5		12	3		5
Liriodendron tulipifera var. tulipifera	1			3			5	
Platanus occidentalis var. occidentalis	1	2		4		1		
Quercus michauxii		1			1			3
Quercus nigra					2		1	
Quercus phellos	1	1			3			
Salix nigra		1		1		5		1

Table 9. Summary of Vegetation Monitoring Results

Plot ID	Stems Planted (Original Baseline Conditions)	Baseline Stems + Supplemental Planting Stems (Revised Baseline Conditions)	2010 Stems	Percent Survival as Compared to Revised Baseline Conditions	Stems per Acre					
					Stems Planted (Original Baseline)	2009 Year 1* (Revised Baseline)	2010 Year 2	2011 Year 3	2012 Year 4	2013 Year 5
VP1	7	10	10	100%	283	405	405			
VP2	3	5	7	140%	122	162	283			
VP3	5	7	7	100%	202	283	283			
VP4	7	10	11	110%	283	405	445			
VP5	10	17	18	106%	405	688	728			
VP6	14	23	21	91%	567	931	850			
VP7	16	22	20	91%	648	891	809			
VP8	9	21	12	N/A	364	850	486			

Average stems per acre: 543
Range of stems per acre: 405 – 850
*Includes supplemental planting data
N/A – Plot re-established in Year 2 and percent survival is not applicable between existing monitoring years.

A visual estimate of herbaceous vegetation cover within the monitoring plots is provided to assess the overall stability of the restoration site **(Table 10)**. On average, herbaceous vegetation coverage is 81% within the plots. The low herbaceous cover recorded for VP 8 is primarily due to new plantings and seeding associated with the stream repairs that occurred shortly before the Year 2 vegetation monitoring data were collected. Observations of herbaceous cover throughout

the project area were noted during the visual assessment and are documented in **Appendix A**; representative photos are included in **Appendix D**. Herbaceous cover typically consists of dogfennel (*Eupatorium capillifolium*), hollow-stem Joe-pye weed (*Eutrochium fistulosum*), narrow-leaved sunflower (*Helianthus angustifolius*), goldenrod (*Solidago sp.*), and rice cutgrass (*Leersia oryzoides*). Herbaceous cover in bare areas is expected to increase as a result of natural recruitment from adjacent vegetated areas and due to remedial actions undertaken by EBX to improve vegetative cover in the bare areas.

Table 10. Estimated Herbaceous Total Percent Cover

Plot ID	Estimated Herbaceous Cover (%)
VP1	100%
VP2	75%
VP3	100%
VP4	85%
VP5	80%
VP6	100%
VP7	80%
VP8	30%

Commonly encountered woody volunteer or natural species are also documented throughout the five-year monitoring period **(Table 11)**. A large number of the volunteer species documented within the vegetation monitoring plots in Year 2 were of the same species planted at the site. However, due to the small height classes and lack of being previously recorded within the plots it is assumed that these new volunteer species were planted during repair efforts at the site. As a result of natural recruitment and classifying these additional planted trees as volunteers, recruitment between Year 1 and Year 2 increased significantly (299%) across the restoration site resulting in approximately 197 volunteer stems per acre.

Table 11. Volunteer Tree Species

Common Name	Scientific Name
American Persimmon	*Diospyros virginiana*
American Hornbeam	*Carpinus caroliniana*
Black Willow	*Salix nigra*
Tag Alder	*Alnus serrulata*
Buttonbush*	*Cepalanthus occidentalis*
Willow Oak*	*Quercus phellos*
Green Ash*	*Fraxinus pennsylvanica*
American Sycamore*	*Platanus occidentalis var. occidentalis*
Swamp Chestnut Oak*	*Quercus michauxii*
River Birch*	*Betula nigra*

*Likely planted during the earlier repair efforts.

4.4 Vegetation Observations and Conclusions

Overall, planted stems are surviving well at the Morgan Creek Stream Restoration Site. Only 6% of planted stems were found to be dead or missing during Year 2 monitoring. Planted stem mortality was highest at VP6 and VP7 although the majority (81%) of planted stems observed in Year 2 had good or excellent vigor scores.

Excluding VP2 and VP3, all vegetation monitoring plots meet success criterion. With the significant increase in volunteer stems in Year 2, the average stem density across the whole site for planted and volunteers combined is approximately 769 stems per acre, which is well above the interim success criterion of 320 stems per acre at the end of Year 3. With the exception of the re-established VP8, herbaceous vegetation cover was relatively high during Year 2.

Invasive exotic plants such as multiflora rose (*Rosa multiflora*), Japanese stiltgrass (*Microstegium vimineum*), Japanese honeysuckle (*Lonicera japonica*), and privet (*Ligustrum sp*.) were generally abundant throughout the easement area. Japanese knotweed (*Reynoutria japonica*), tree of heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*), Oriental bittersweet (*Celastrus orbiculatus*), kudzu (*Pueraria montana var. lobata*), and thorny olive (*Elaeagnus pungens*) were also documented in dense isolated patches within the easement boundary **(Appendix A).** Control of the kudzu, knotweed, and other high-priority species has begun, with subsequent control efforts planned throughout the monitoring period. Currently it appears that the knotweed has been eliminated from the site. Representative photos of these areas during the Year 2 monitoring are included in **Appendix D**.

5.0 CONCLUSIONS AND RECOMMENDATIONS

- The morphological data and observations of stream conditions indicate an evolving system in which the restoration areas continue to evolve towards stability. Areas of concern identified during Year 2 monitoring were primarily associated with pool aggradation and riffle degradation. The restored stream reaches will continue to be monitored during subsequent years and appropriate recommendations made if profile changes indicate that the criteria specified in the Restoration Plan (EBX, 2007) will not be met.

- Vegetation monitoring efforts have documented the average number of planted stems per acre for the entire restoration site to be 543 stems per acre for the 2010 monitoring year, which represents an increase of 1% from 2009. Individuals classified as volunteer species significantly increased between years and is likely attributed to the planting effort associated with the earlier stream repairs. In general, most planted stems are surviving at the project site, but VP2 and VP3 are not on track to meet the interim success criterion. Lastly, expansion of invasive exotic plant populations should continue to be monitored and controlled as warranted.

- Stream and vegetation monitoring are scheduled through 2013.

6.0 REFERENCES

EBX (Environmental Banc & Exchange). August 2007. Restoration Plan – Morgan Creek Creek Site. McDowell County, North Carolina. Project ID No. 16-D06027.

EBX (Environmental Banc & Exchange). September 2008. Morgan Creek Mitigation Report. McDowell County, North Carolina. Project ID No. 16-D06027.

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Weakley, A.S. 2008. Flora of the Carolinas, Virginia, Georgia, northern Florida, and surrounding areas. Working draft of 7 April 2008. University of North Carolina Herbarium (NCU). North Carolina Botanical Garden. University of North Carolina at Chapel Hill. Chapel Hill, North Carolina.

APPENDIX A

Monitoring Year 2
Current Condition Plan View

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

SHEET 4

SHEET 5

SHEET 3

SHEET 2

SHEET 6

SHEET 7

SHEET 8

UT1

UT2

UT3

UT4

UT5

UT6

UT7

UT8

UT9

MORGAN CREEK

SCALE 1" = 500'

250 175 0 250 500 750

LEGEND

- Vegetation Monitoring Plots
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Control Point
- Cross Section
- Crest Gauge
- Photo Point
- Constructed Riffle
- A-Vane
- Cross Vane
- J-Hook
- Log Sill
- Root Wad
- Rock Log Riffle
- Double Rock Drop Cross Vane
- Double Log Sill

Notes:

1. Coordinate System is State Plane Feet NAD 83.
2. Base map information provided by Kimley Horn & Stantec: Dwg title(s): ACAD-018336000-BASE.dwg & 171300323_ASBUILT_BASE_corrected.dwg respectively
3. Aerial photography is McDowell County 2005

Morgan Creek

McDowell County, NC

Current Condition Plan View
Final
YEAR 2 Monitoring-2010
OVERVIEW

Sheet:
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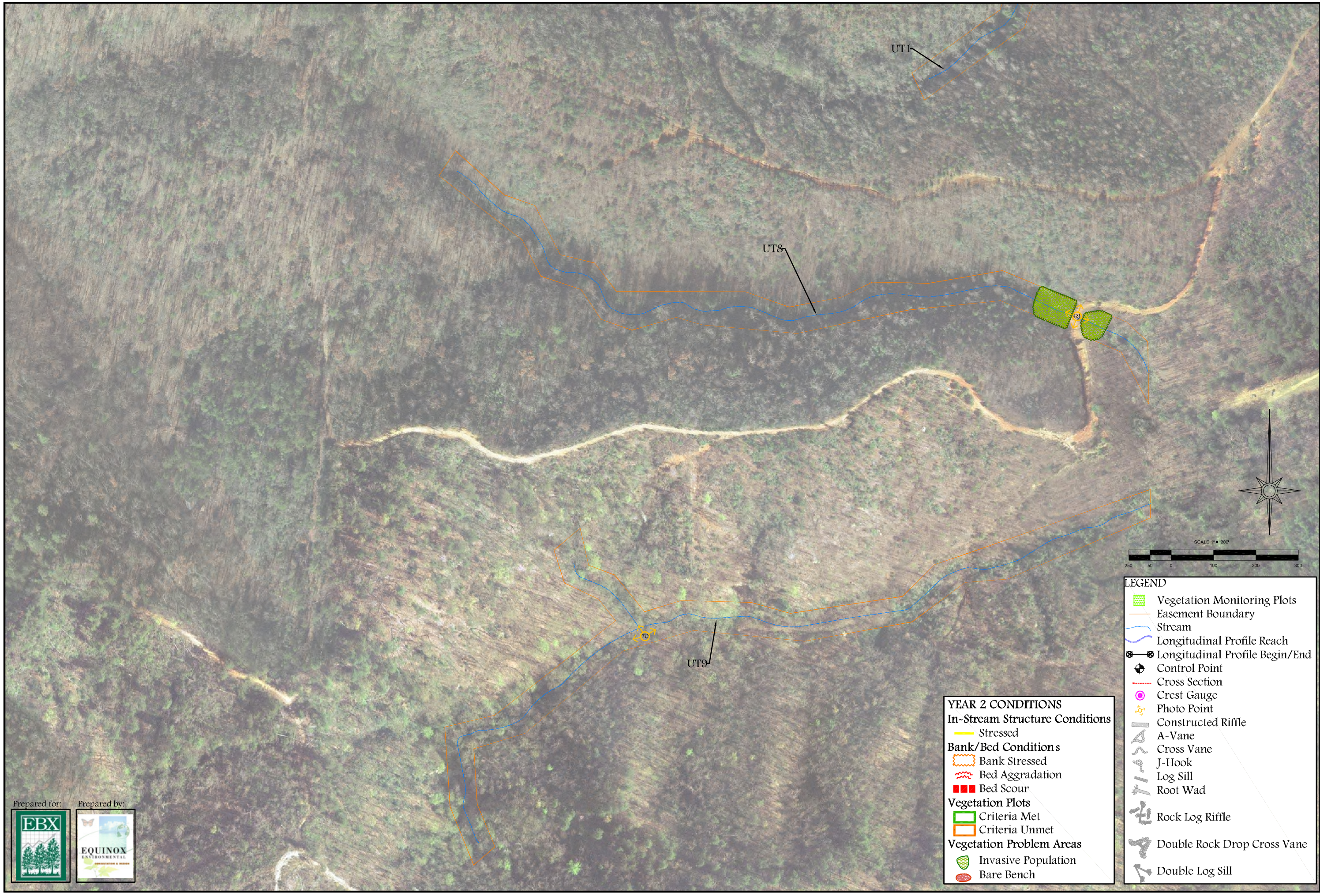
of 8

Date:
December, 2010



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2. Base map information provided by Kinley Horn & Stantec Dwg title(s): ACAD-01833600-BASE.dwg & 171300323_ASBUILT_BASE_corrected.dwg respectively
3. Aerial photography is McDowell County 2005

Morgan Creek

McDowell County, NC

YEAR 2 CONDITIONS
In-Stream Structure Conditions
- Stressed

Bank/Bed Conditions
- Bank Stressed
- Bed Aggradation
- Bed Scour

Vegetation Plots
- Criteria Met
- Criteria Unmet

Vegetation Problem Areas
- Invasive Population
- Bare Bench

LEGEND
- Vegetation Monitoring Plots
- Easement Boundary
- Stream
- Longitudinal Profile Reach
- Longitudinal Profile Begin/End
- Control Point
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- Root Wad
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- Double Rock Drop Cross Vane
- Double Log Sill

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

Current Condition Plan View
Final
YEAR 2 Monitoring-2010

Sheet: 2 of 8

Date: December, 2010

Notes:
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3. Aerial photography is McDowell County 2005

Morgan Creek

McDowell County, NC

Current Condition Plan View
Final
YEAR 2 Monitoring-2010

Sheet:
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of 8

Date:
December, 2010

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

YEAR 2 CONDITIONS

In-Stream Structure Conditions
- Stressed

Bank/Bed Conditions
- Bank Stressed
- Bed Aggradation
- Bed Scour

Vegetation Plots
- Criteria Met
- Criteria Unmet

Vegetation Problem Areas
- Invasive Population
- Bare Bench

LEGEND
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Morgan Creek

McDowell County, NC

Current Condition Plan View
Final
YEAR 2 Monitoring-2010

Sheet:
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of 8

Date:
December, 2010

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

Morgan Creek

McDowell County, NC

Current Condition Plan View
Final
YEAR 2 Monitoring-2010

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SCALE 1"= 100'

50 25 0 50 100 150

YEAR 2 CONDITIONS
In-Stream Structure Conditions
- Stressed

Bank/Bed Conditions
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- Bed Scour

Vegetation Plots
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- Rock Log Riffle
- Double Rock Drop Cross Vane
- Double Log Sill

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

Sheet: 5 of 8

Date: December, 2010

UT4

VP-4

MORGAN CREEK

UT5

VP-3

UT3

VP-2

SCALE 1" = 100'

50 25 0 50 100 150

YEAR 2 CONDITIONS

In-Stream Structure Conditions
- Stressed

Bank/Bed Conditions
- Bank Stressed
- Bed Aggradation
- Bed Scour

Vegetation Plots
- Criteria Met
- Criteria Unmet

Vegetation Problem Areas
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Morgan Creek
McDowell County, NC

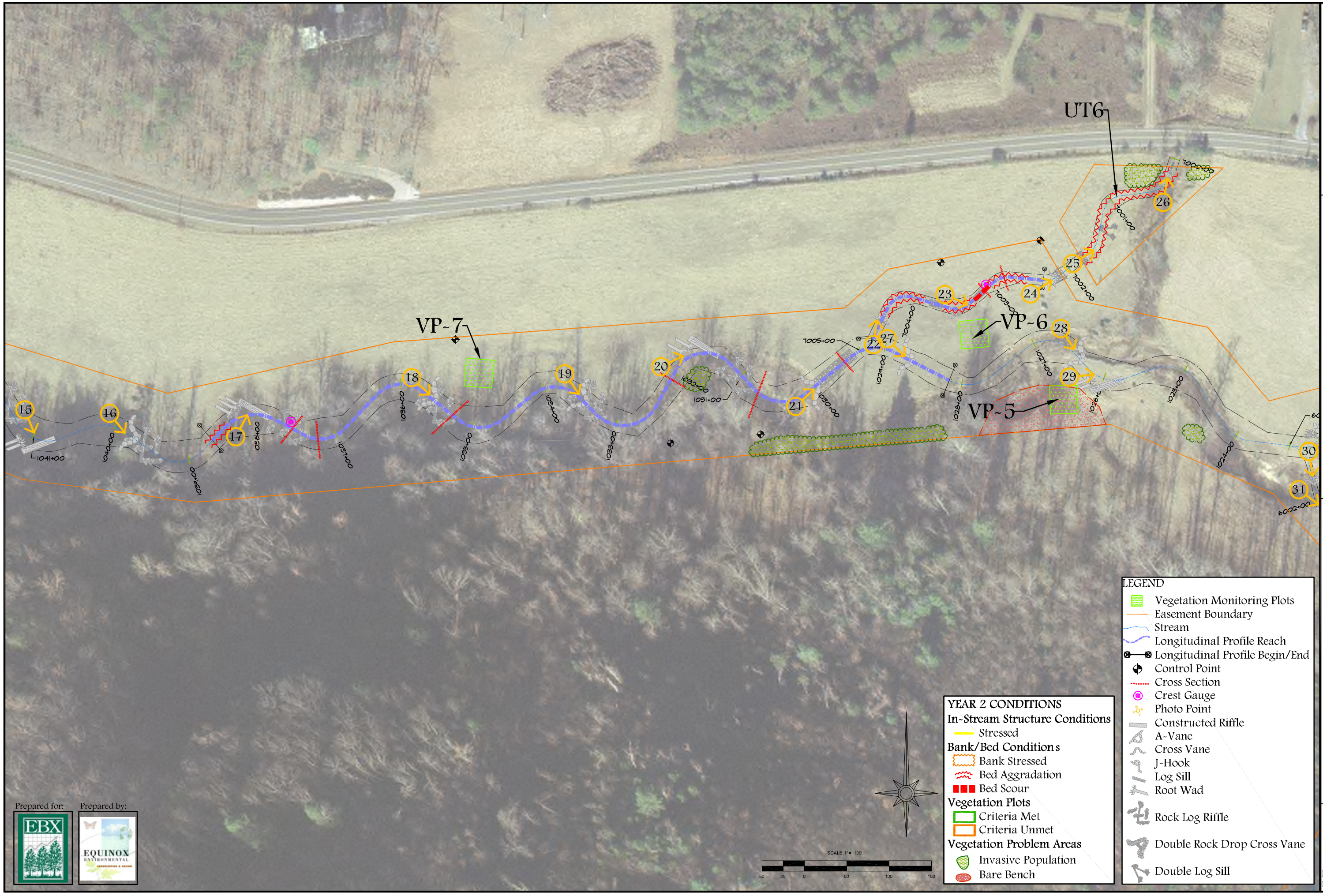
Current Condition Plan View
Final
YEAR 2 Monitoring-2010

Sheet:
6
of 8

Date:
December, 2010

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL



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Morgan Creek

McDowell County, NC

Current Condition Plan View
Final
YEAR 2 Monitoring-2010

Sheet:
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Date:
December, 2010

LEGEND
- Vegetation Monitoring Plots
- Easement Boundary
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- Double Log Sill

YEAR 2 CONDITIONS
In-Stream Structure Conditions
- Stressed

Bank/Bed Conditions
- Bank Stressed
- Bed Aggradation
- Bed Scour

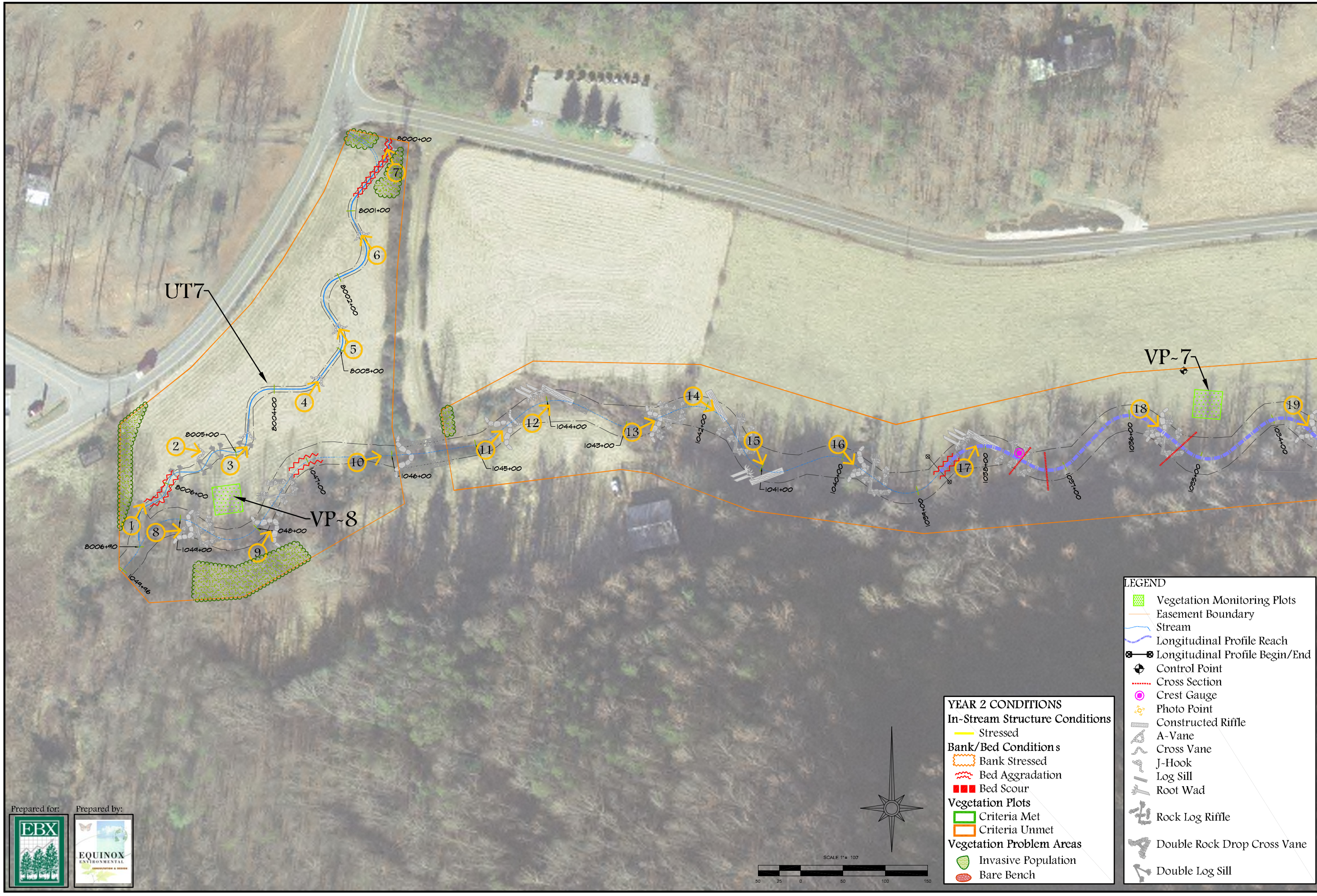
Vegetation Plots
- Criteria Met
- Criteria Unmet

Vegetation Problem Areas
- Invasive Population
- Bare Bench

SCALE 1" = 100'
50 25 0 50 100 150

Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL



Prepared for: EBX

Prepared by: EQUINOX ENVIRONMENTAL

SCALE 1"= 100'

50 25 0 50 100 150

YEAR 2 CONDITIONS
In-Stream Structure Conditions
- Stressed

Bank/Bed Conditions
- Bank Stressed
- Bed Aggradation
- Bed Scour

Vegetation Plots
- Criteria Met
- Criteria Unmet

Vegetation Problem Areas
- Invasive Population
- Bare Bench

LEGEND
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3. Aerial photography is McDowell County 2005

Morgan Creek

McDowell County, NC

Current Condition Plan View
Final
YEAR 2 Monitoring-2010

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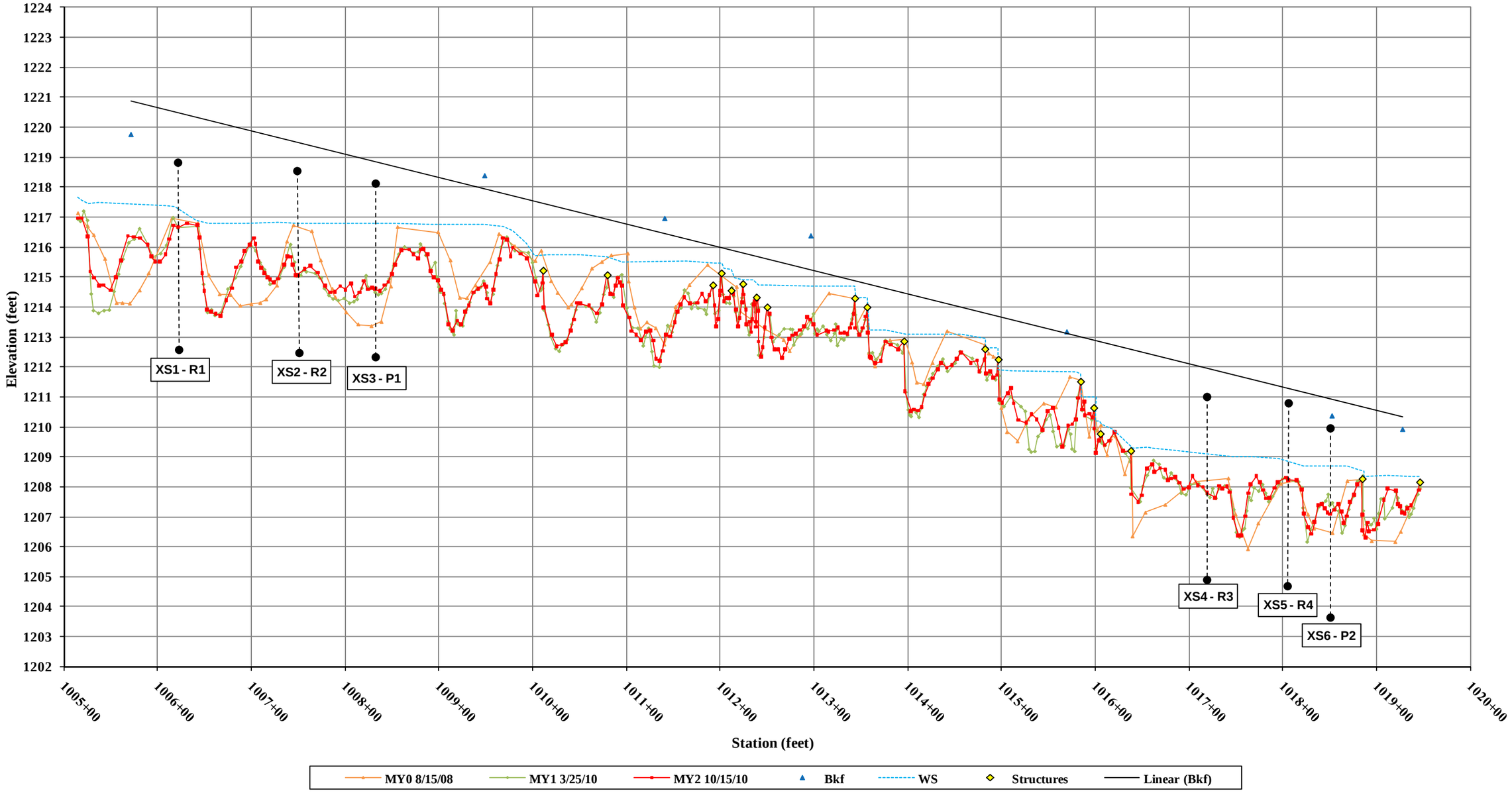
8
of 8

Date:
December, 2010

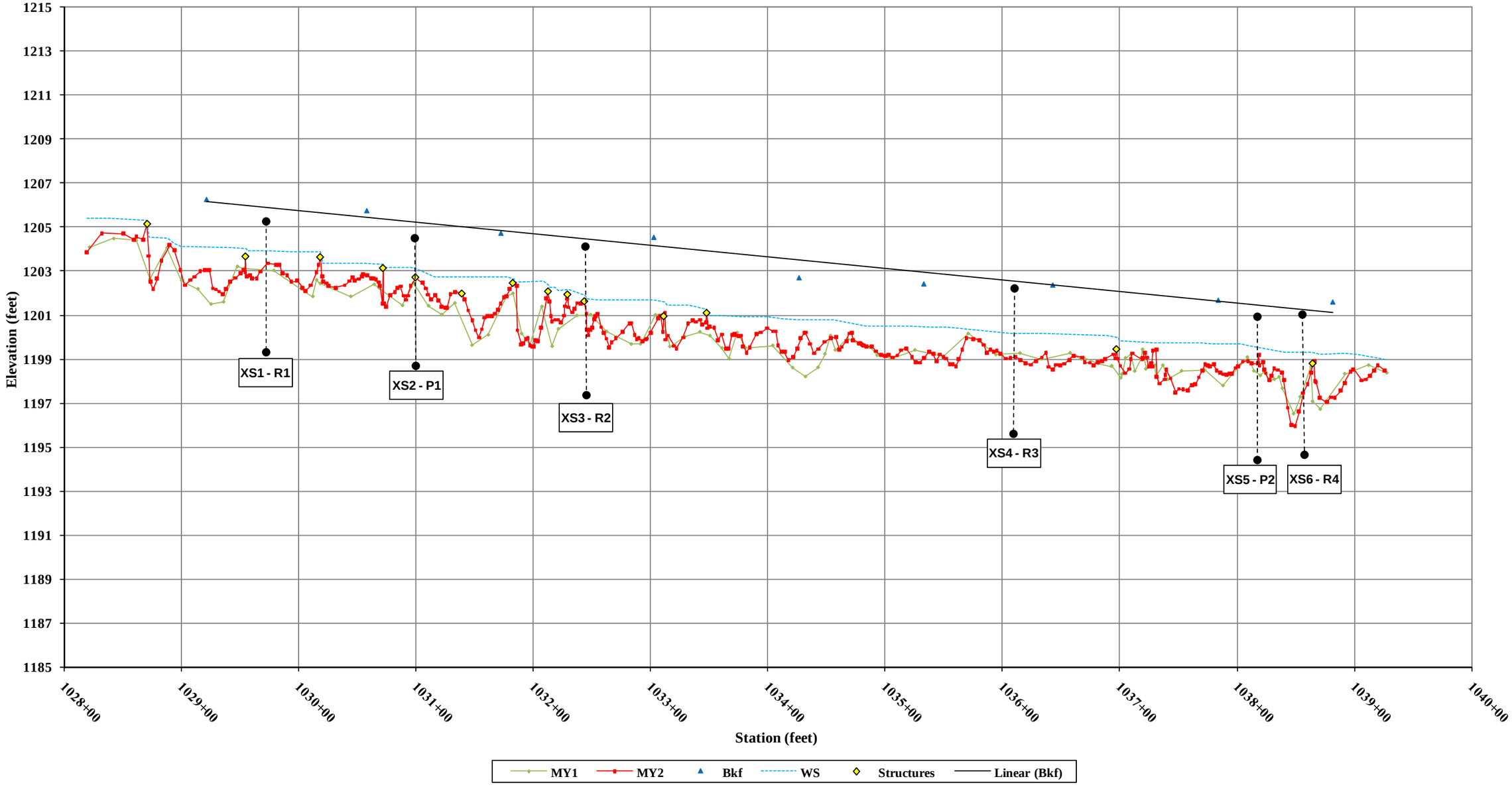
APPENDIX B

Monitoring Year 2
Profile, Cross-Section, and Substrate Data

Morgan Creek - Upper
Longitudinal Profile

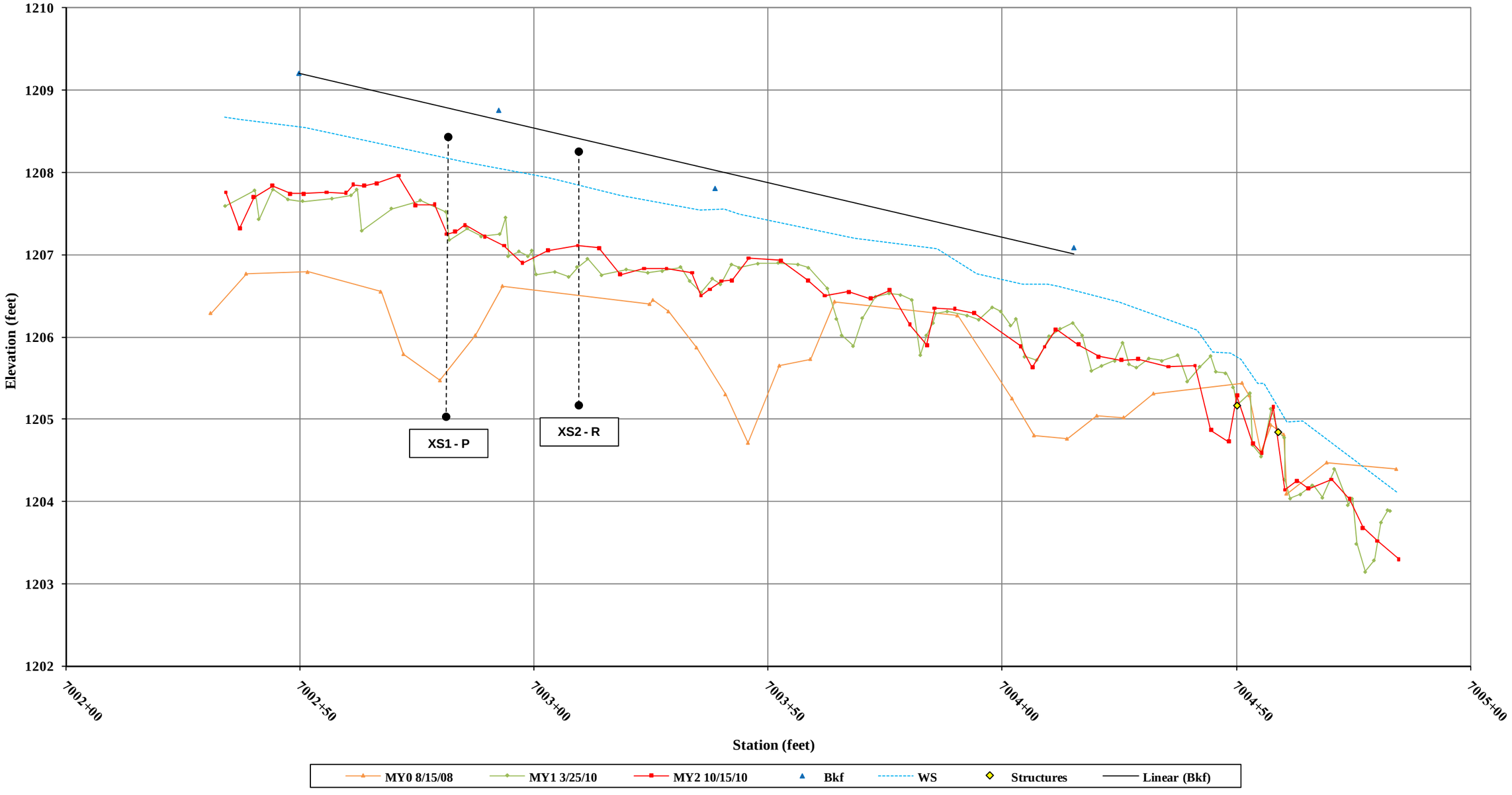


Morgan Creek - Lower
Longitudinal Profile



Morgan Creek - Unnamed Tributary 1
Longitudinal Profile

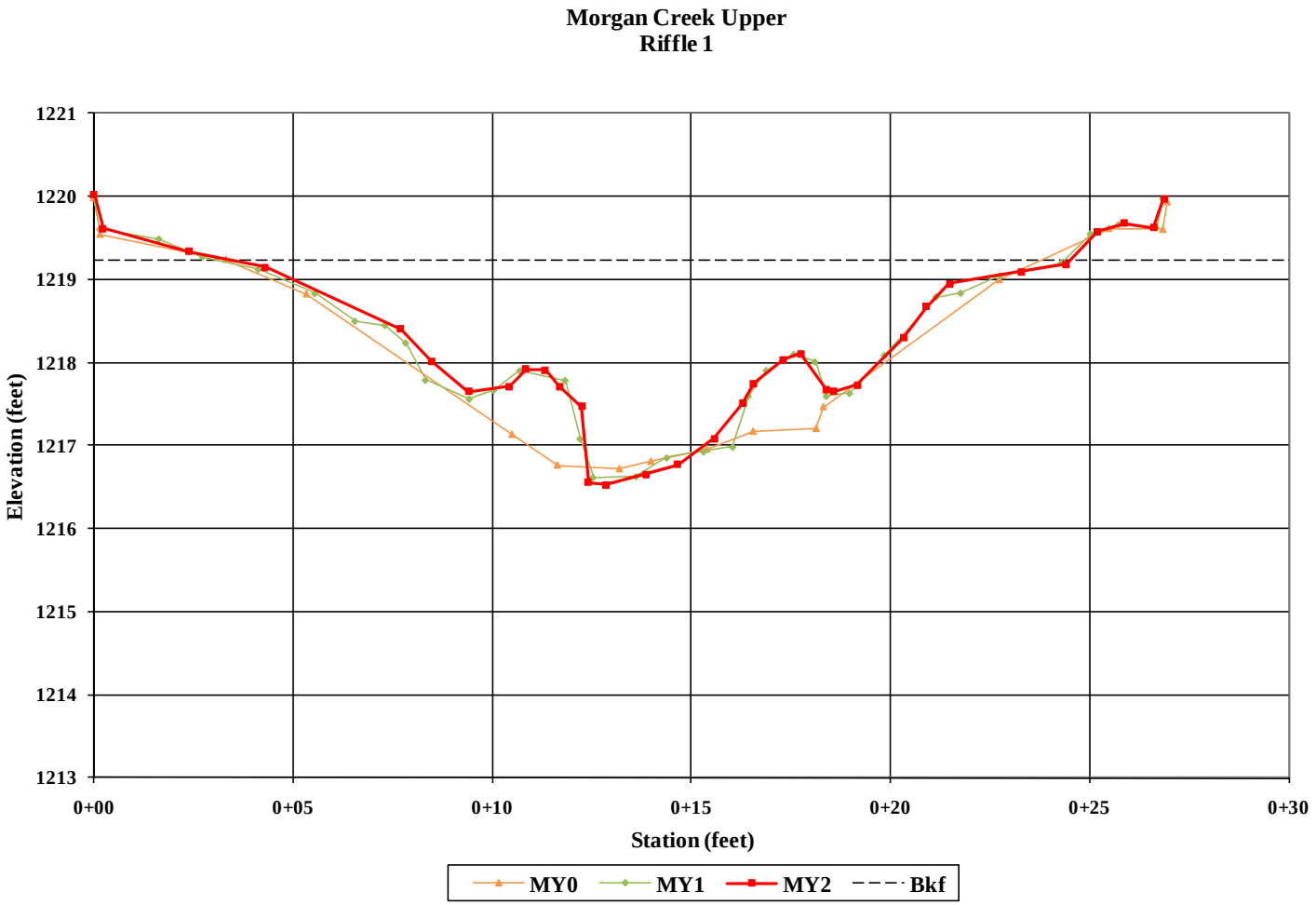
Morgan Creek - Unnamed Tributary 6
Longitudinal Profile



Morgan Creek Upper – Riffle 1
Cross-Section 1

Looking at Left Bank

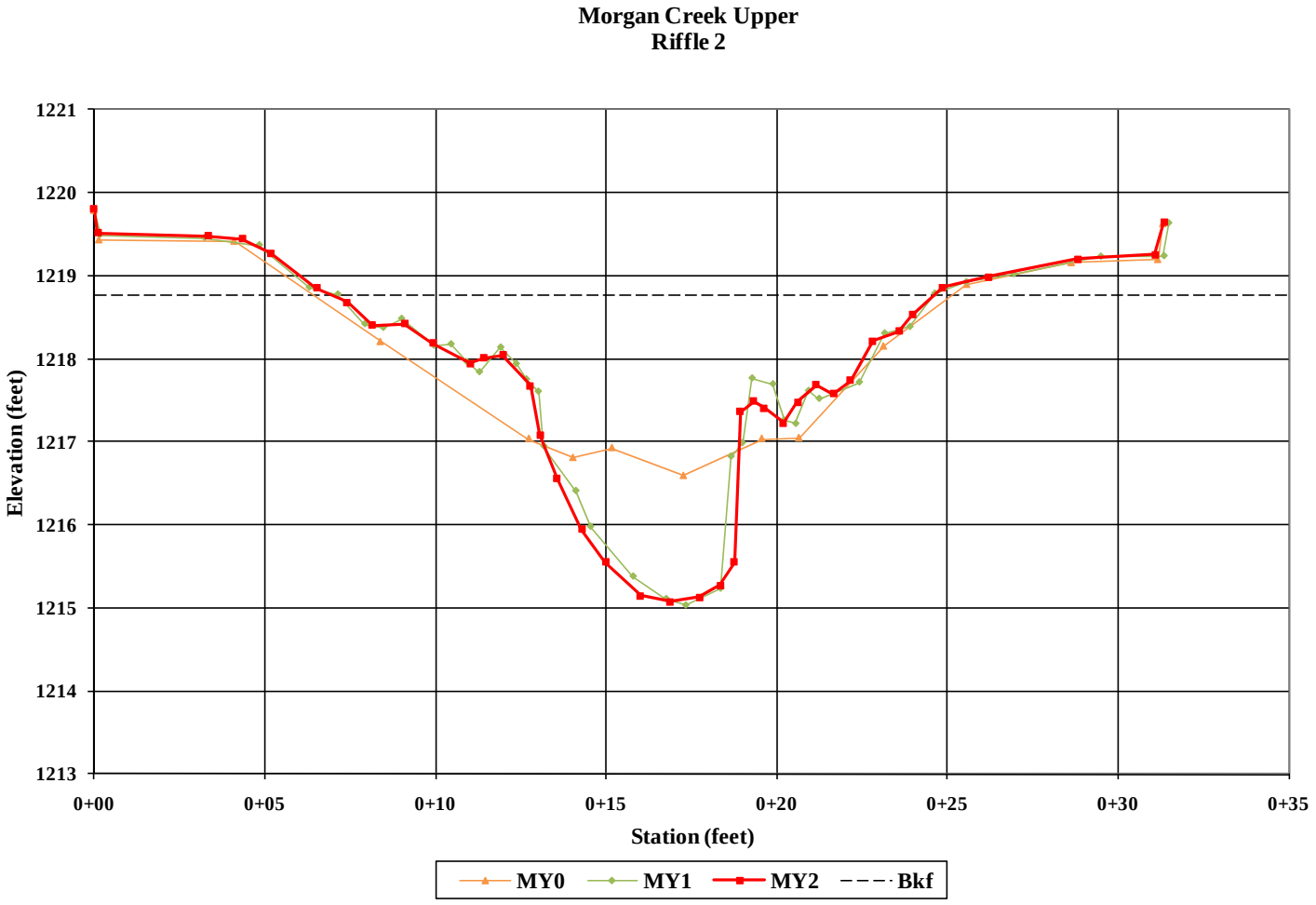
Looking at Right Bank



Morgan Creek Upper – Riffle 2
Cross-Section 2

Looking at Left Bank

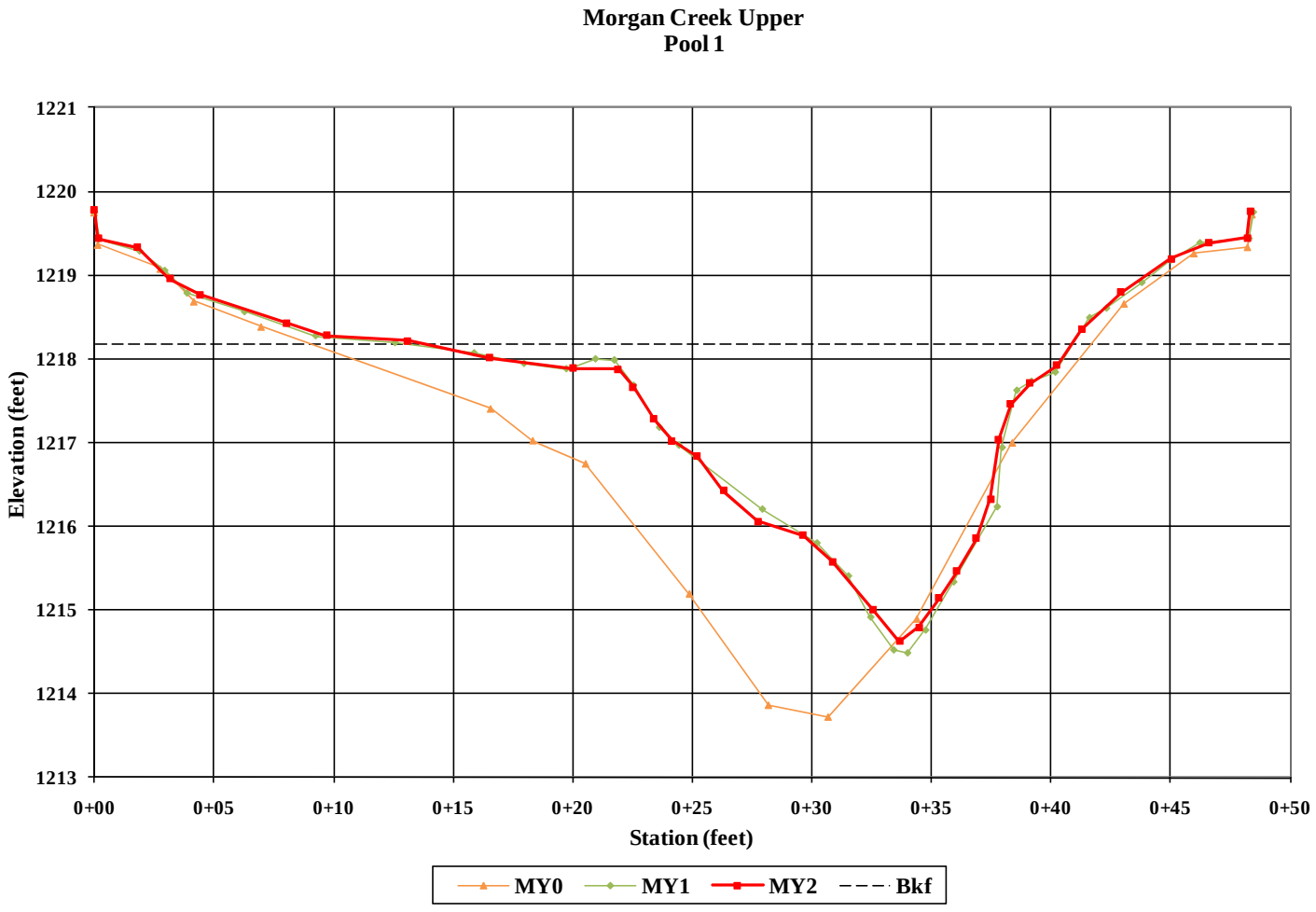
Looking at Right Bank



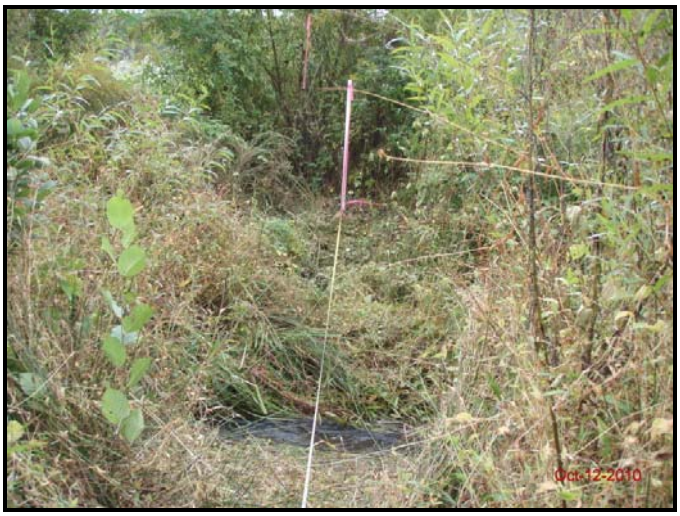
Morgan Creek Upper – Pool 1
Cross-Section 3

Looking at Left Bank

Looking at Right Bank

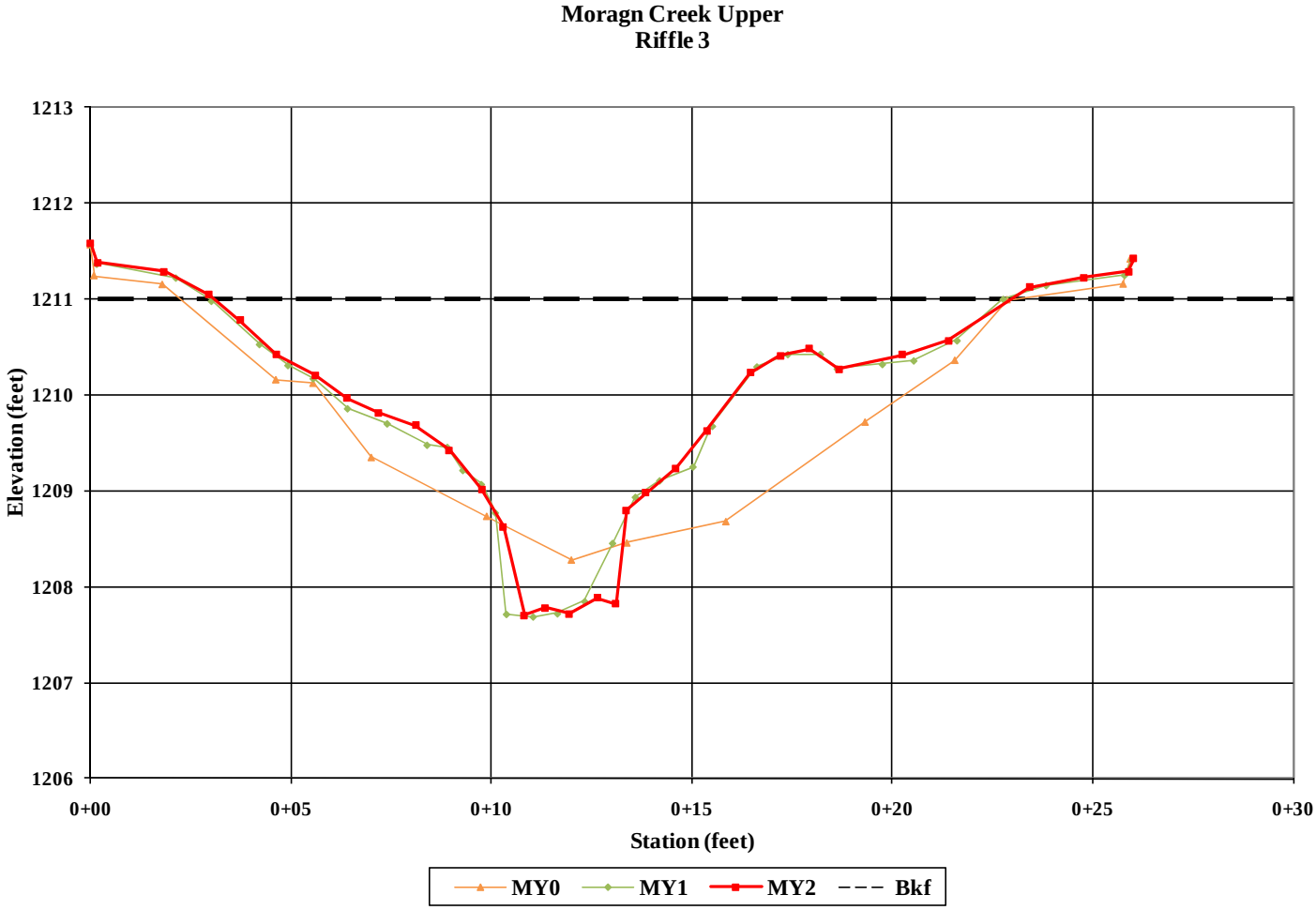


Morgan Creek Upper – Riffle 3
Cross-Section 4



Looking at Left Bank

Looking at Right Bank

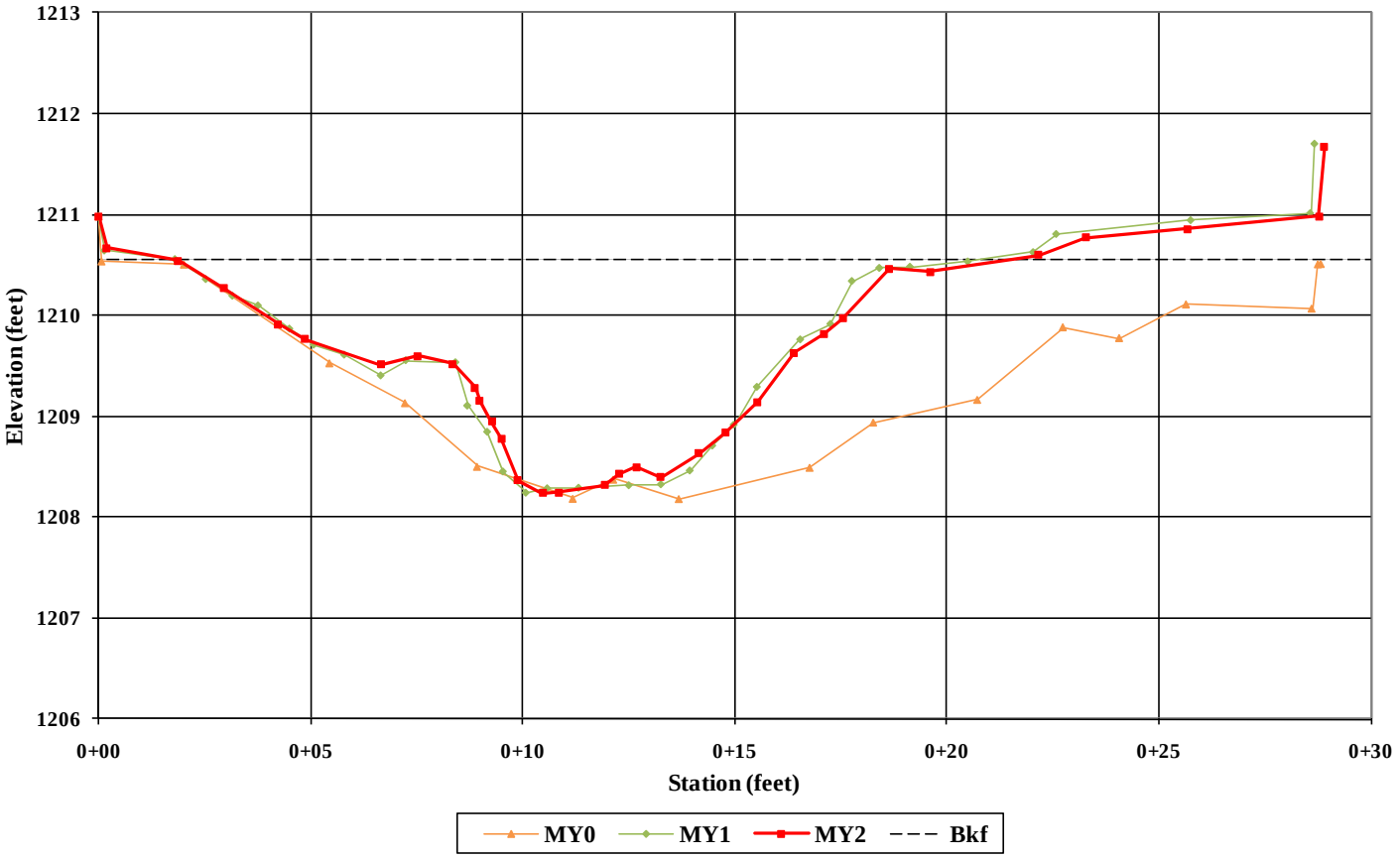


Morgan Creek Upper – Riffle 4
Cross-Section 5

Looking at Left Bank

Looking at Right Bank

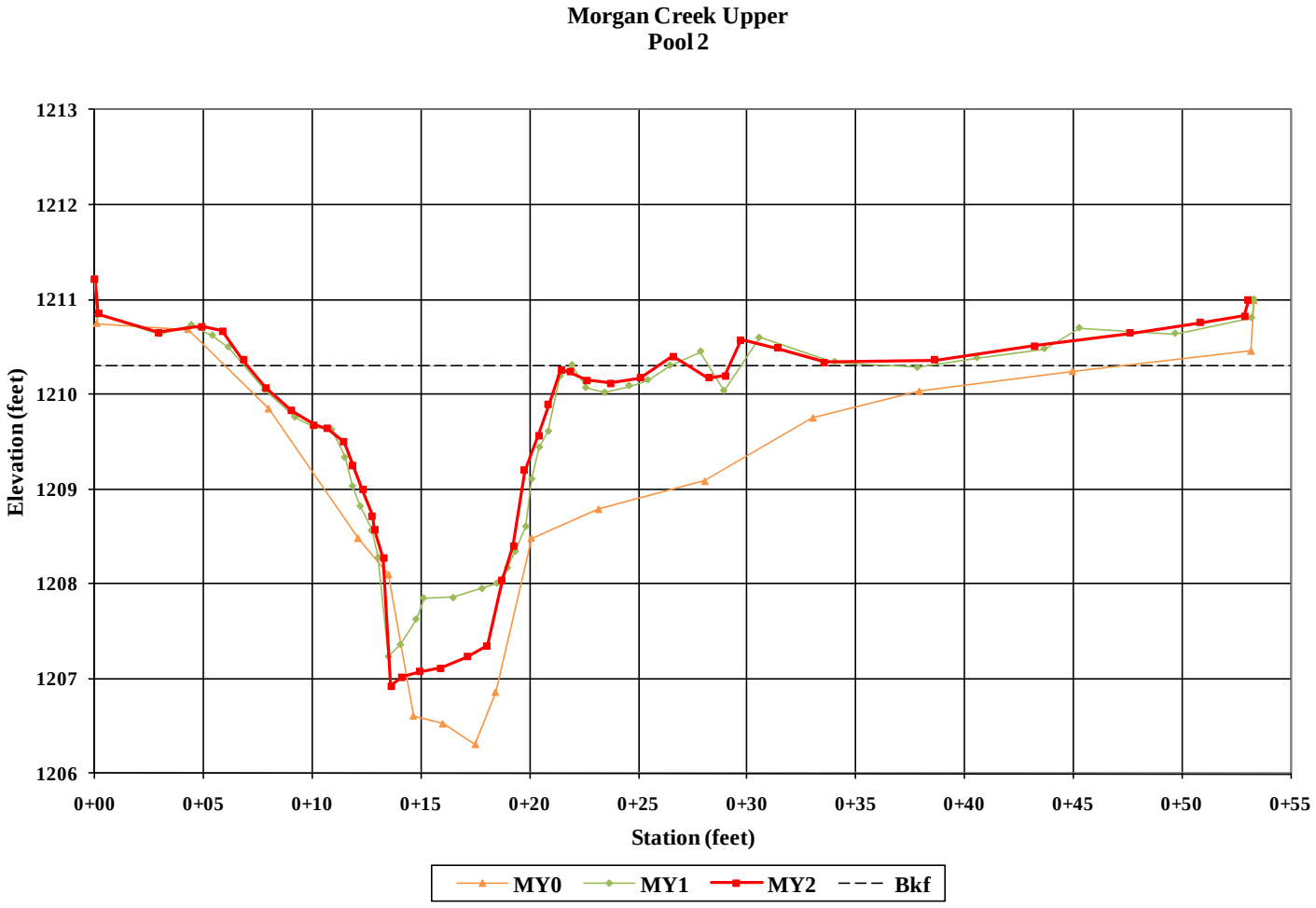
Morgan Creek Upper
Riffle 4



Morgan Creek Upper – Pool 2
Cross-Section 6

Looking at Left Bank

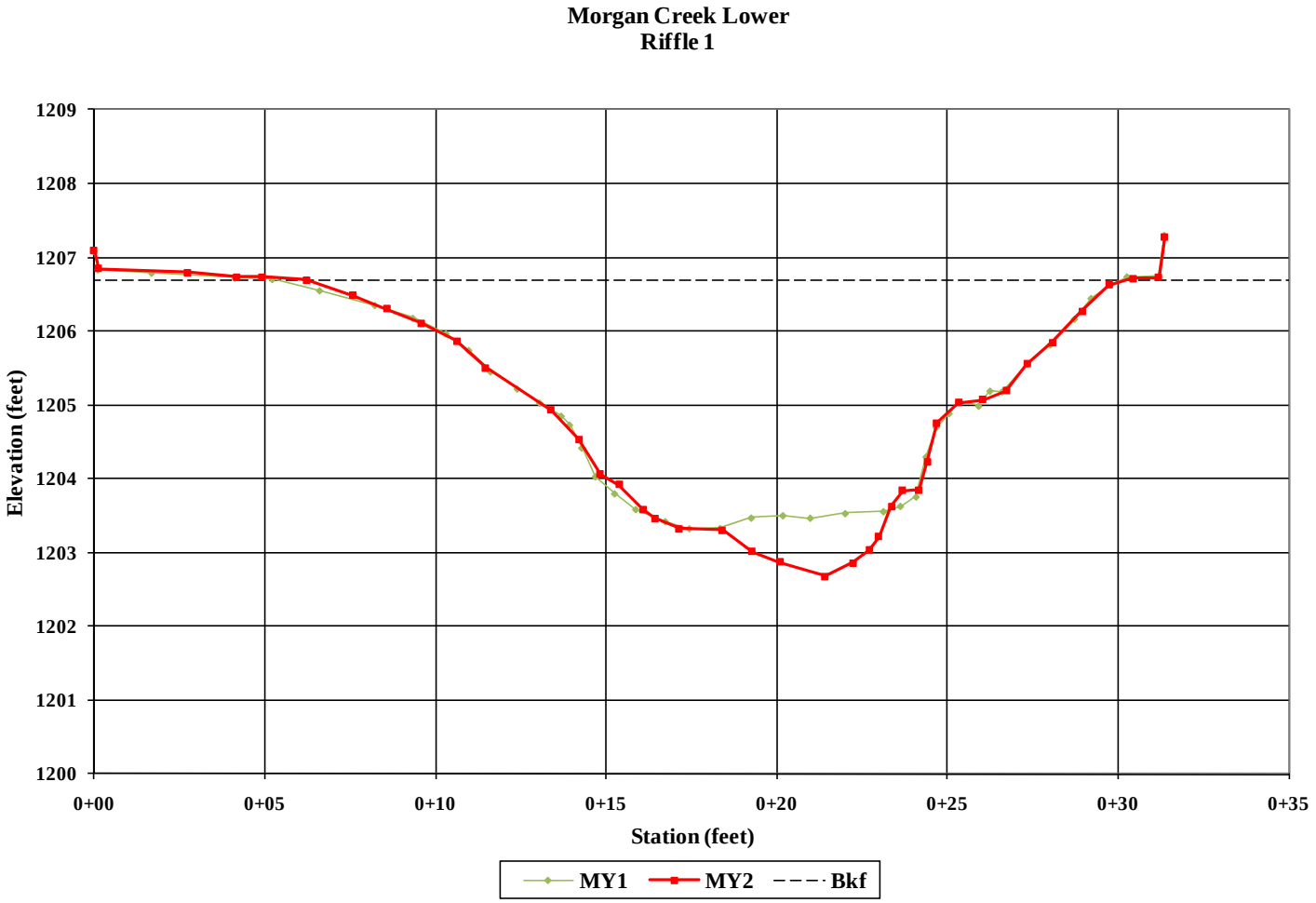
Looking at Right Bank



Morgan Creek Lower – Riffle 1
Cross-Section 1

Looking at Left Bank

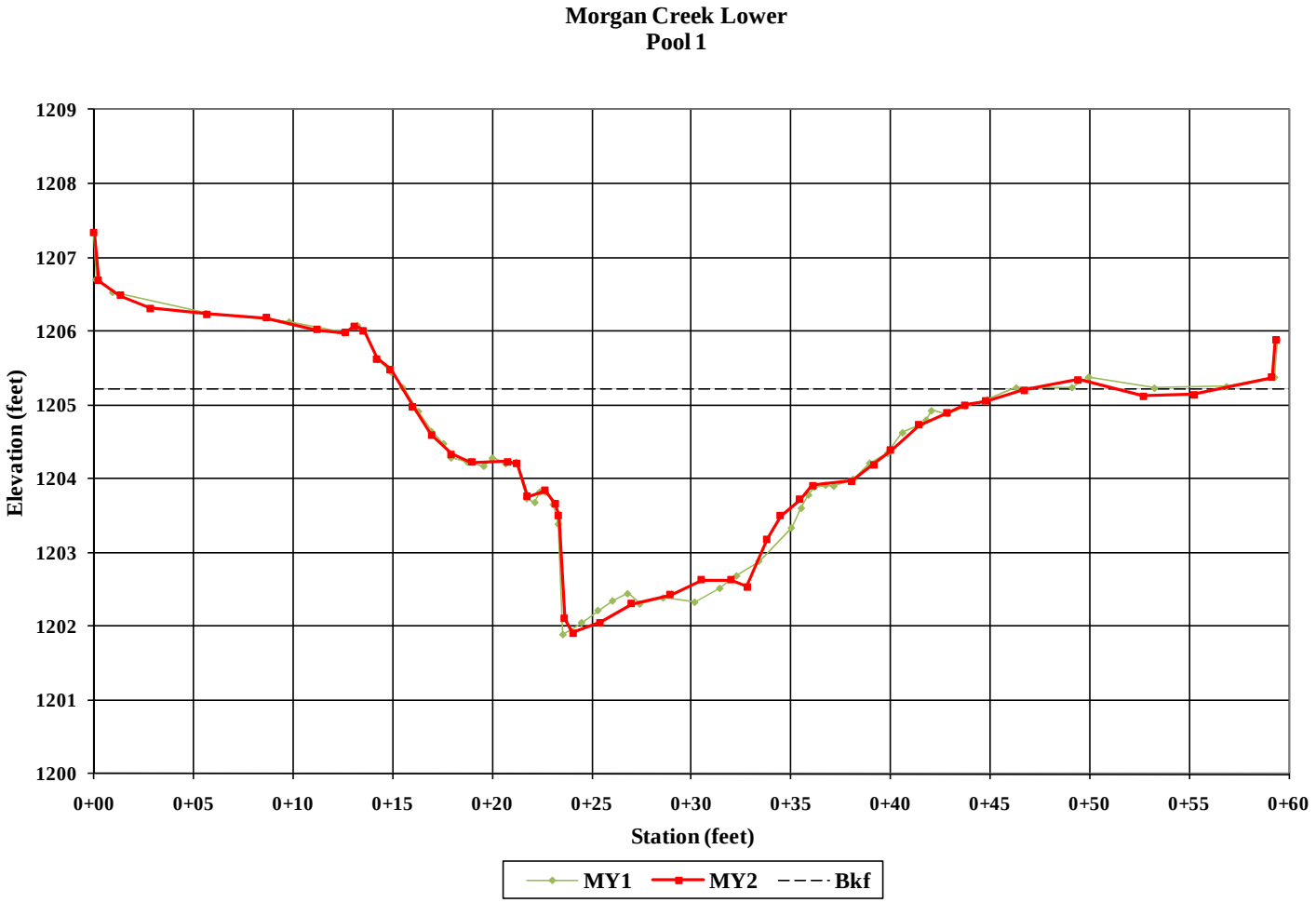
Looking at Right Bank



Morgan Creek Lower – Pool 1
Cross-Section 2

Looking at Left Bank

Looking at Right Bank

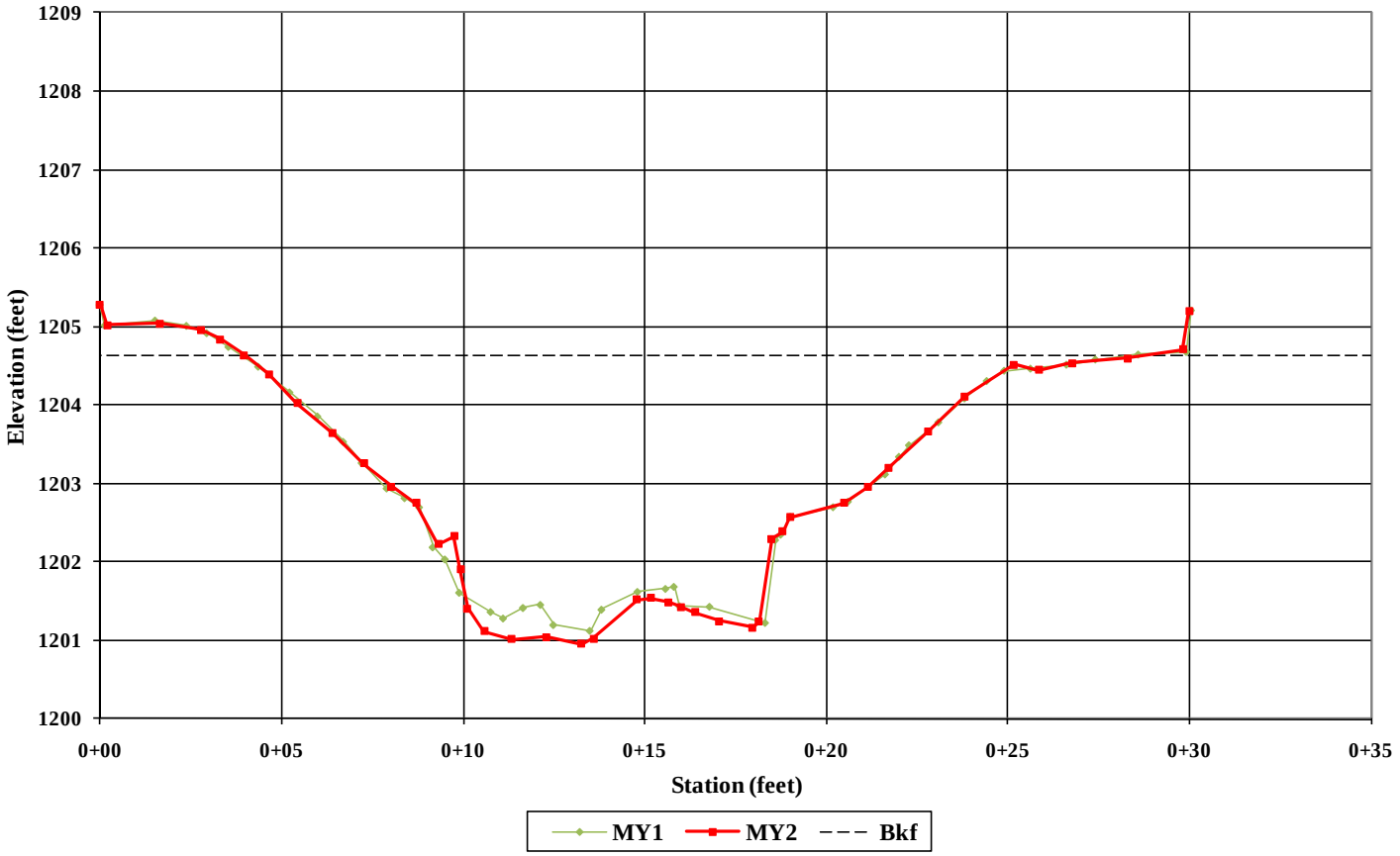


Morgan Creek Lower – Riffle 2
Cross-Section 3

Looking at Left Bank

Looking at Right Bank

Morgan Creek Lower
Riffle 2

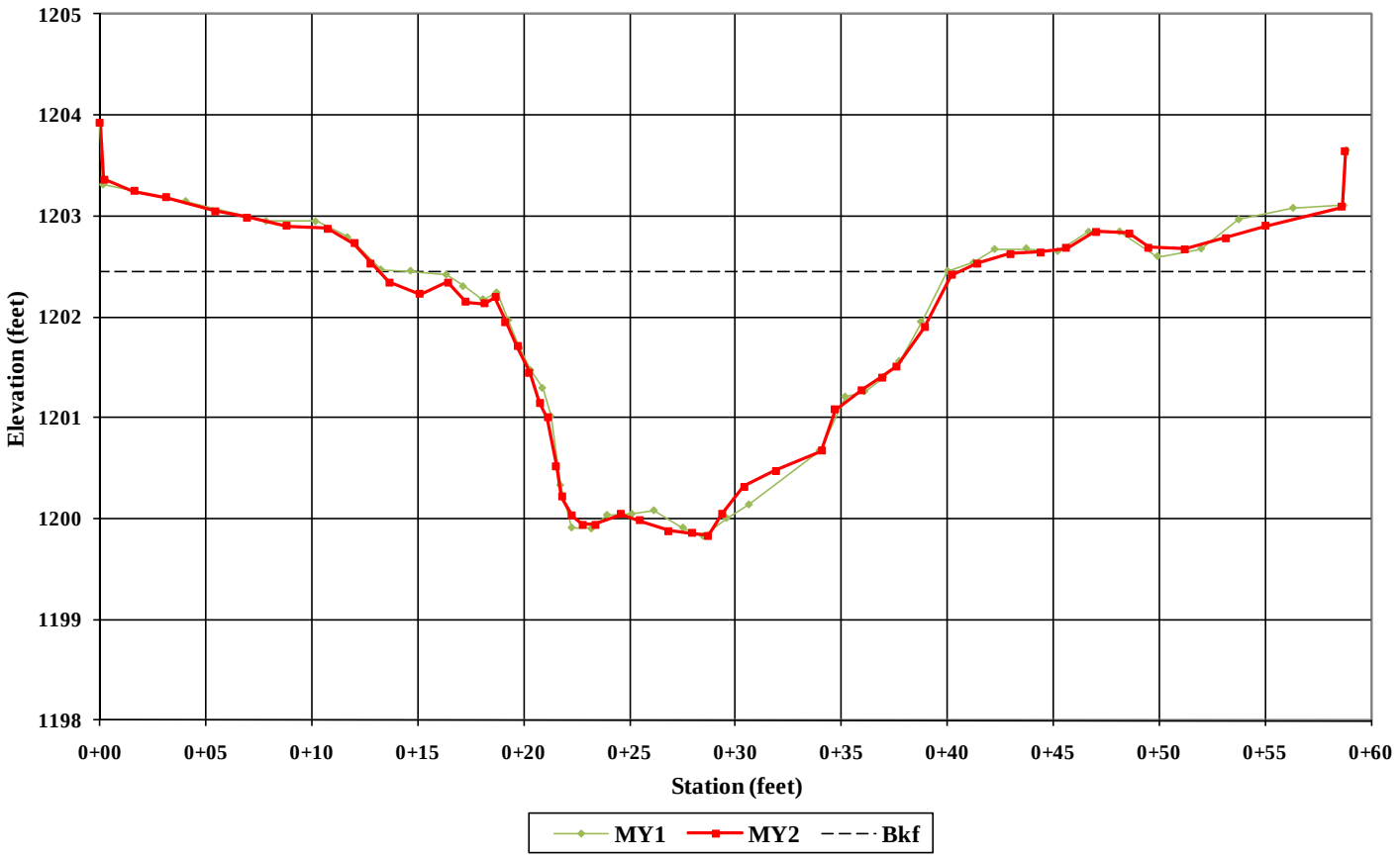


Morgan Creek Lower – Riffle 3
Cross-Section 4

Looking at Left Bank

Looking at Right Bank

Morgan Creek Lower
Riffle 3

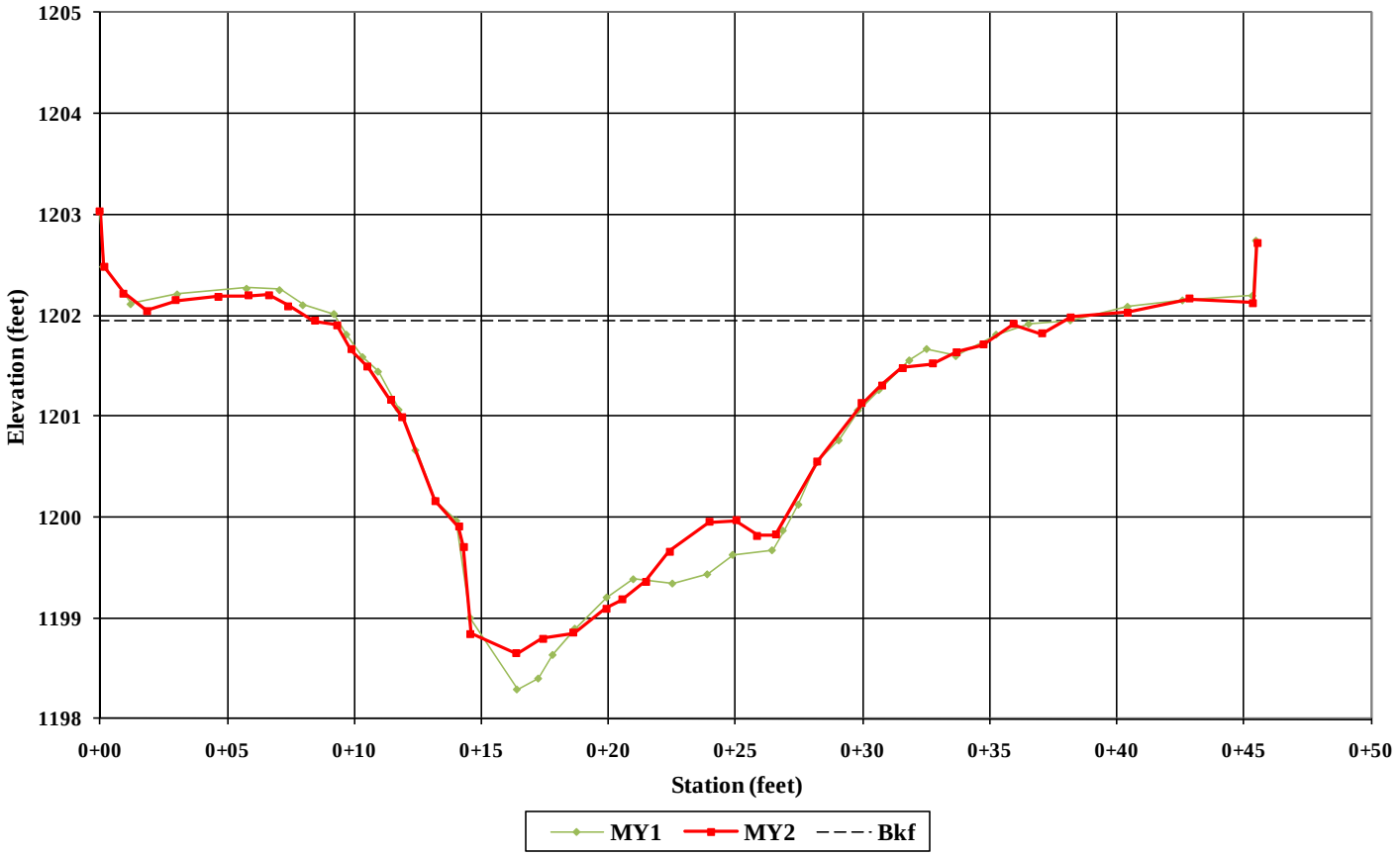


Morgan Creek Lower – Pool 2
Cross-Section 5

Looking at Left Bank

Looking at Right Bank

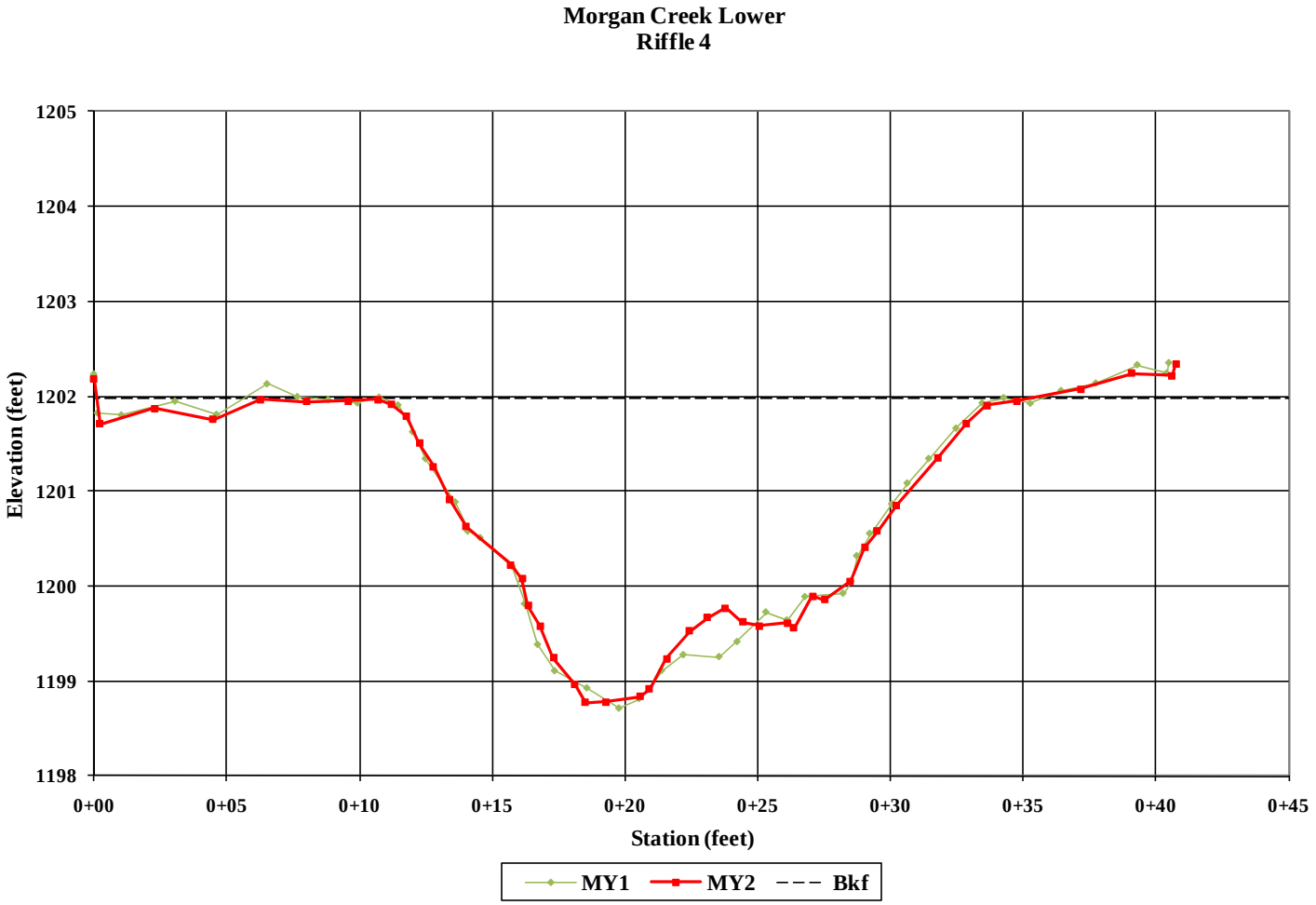
Morgan Creek Lower
Pool 2



Morgan Creek Lower – Riffle 4
Cross-Section 6

Looking at Left Bank

Looking at Right Bank

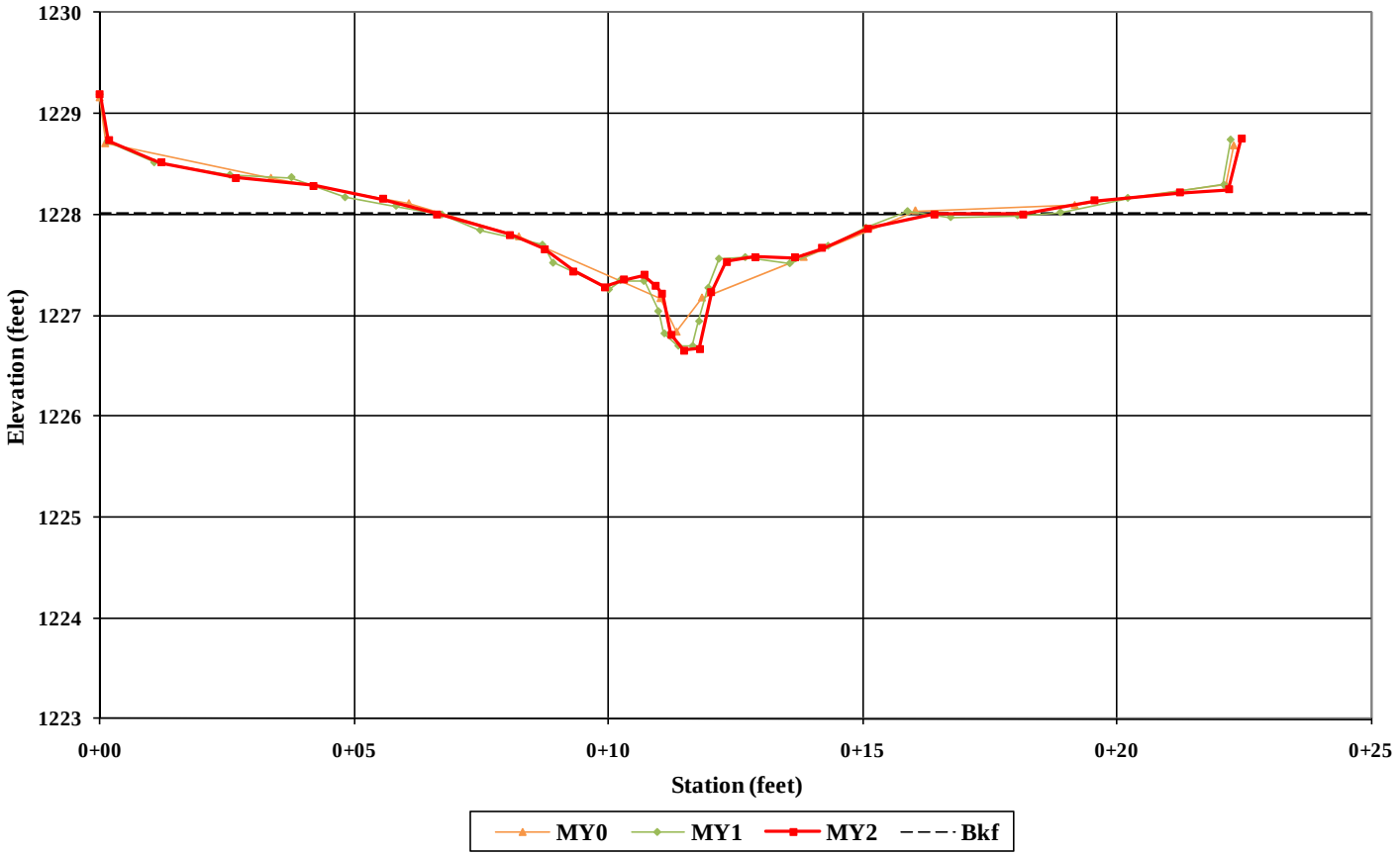


Unnamed Tributary 1 – Riffle
Cross-Section 1

Looking at Left Bank

Looking at Right Bank

Unnamed Tributary 1
Riffle

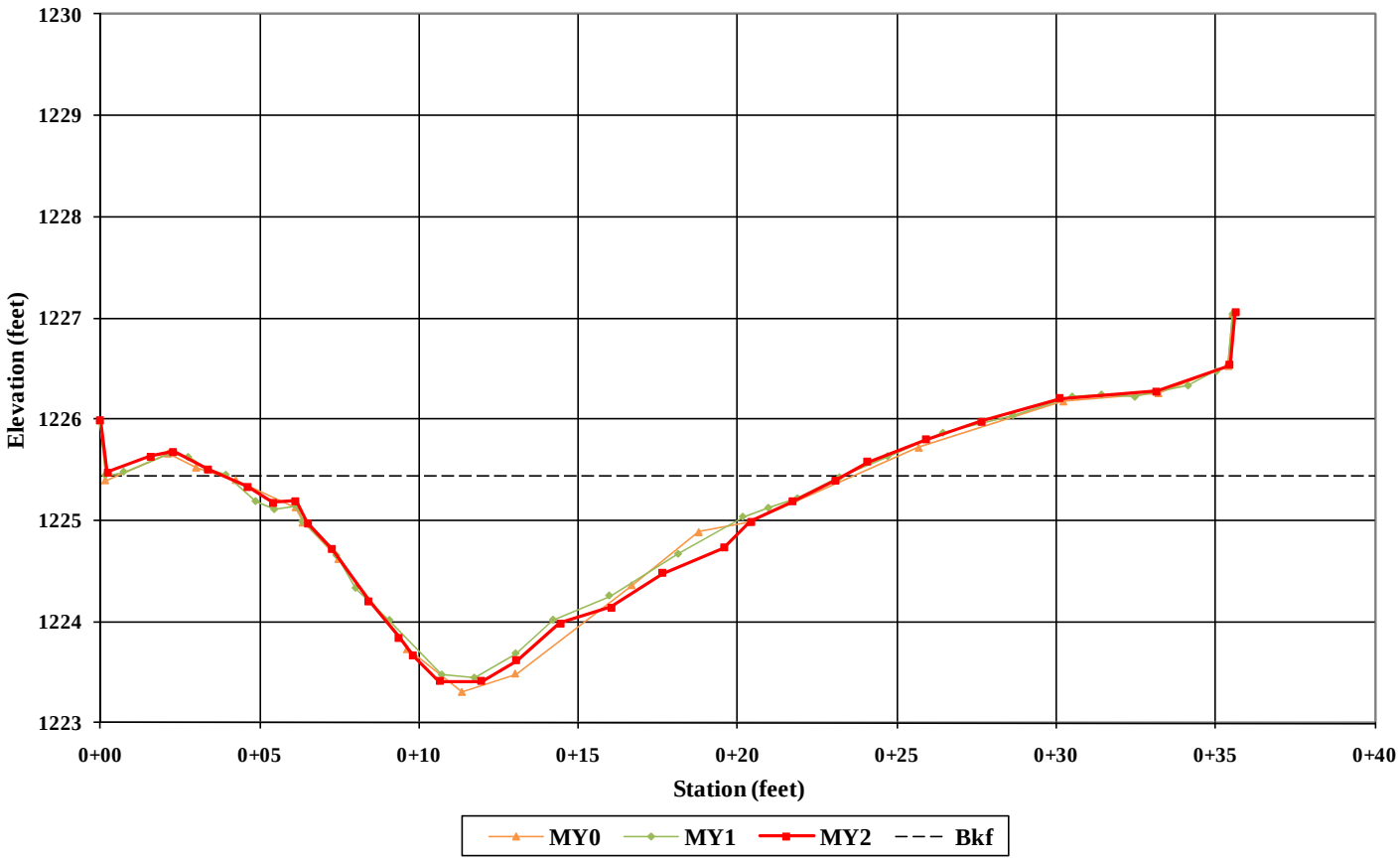


Unnamed Tributary 1 – Pool
Cross-Section 2

Looking at Left Bank

Looking at Right Bank

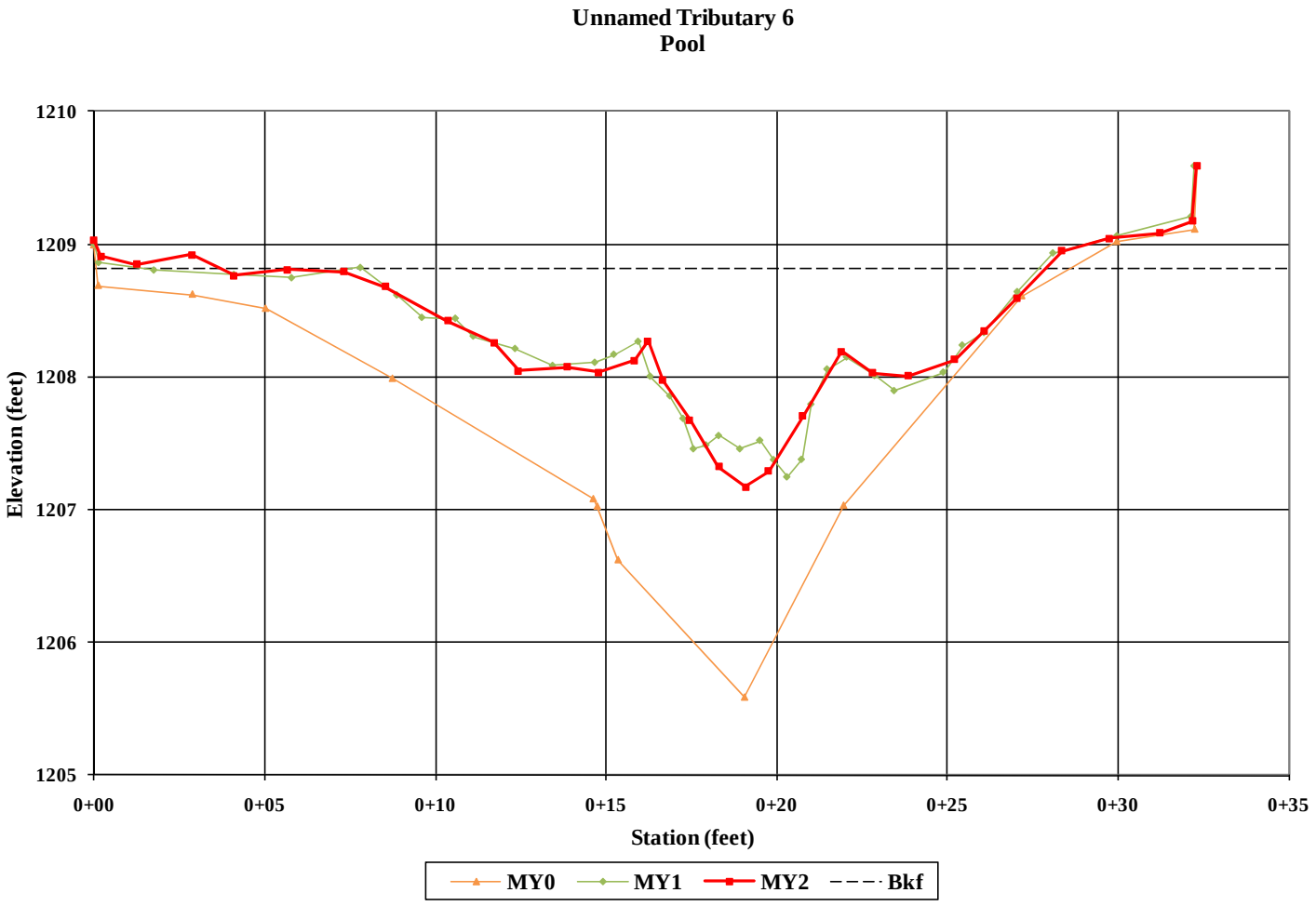
Unnamed Tributary 1
Pool



Unnamed Tributary 6 – Pool
Cross-Section 1

Looking at Left Bank

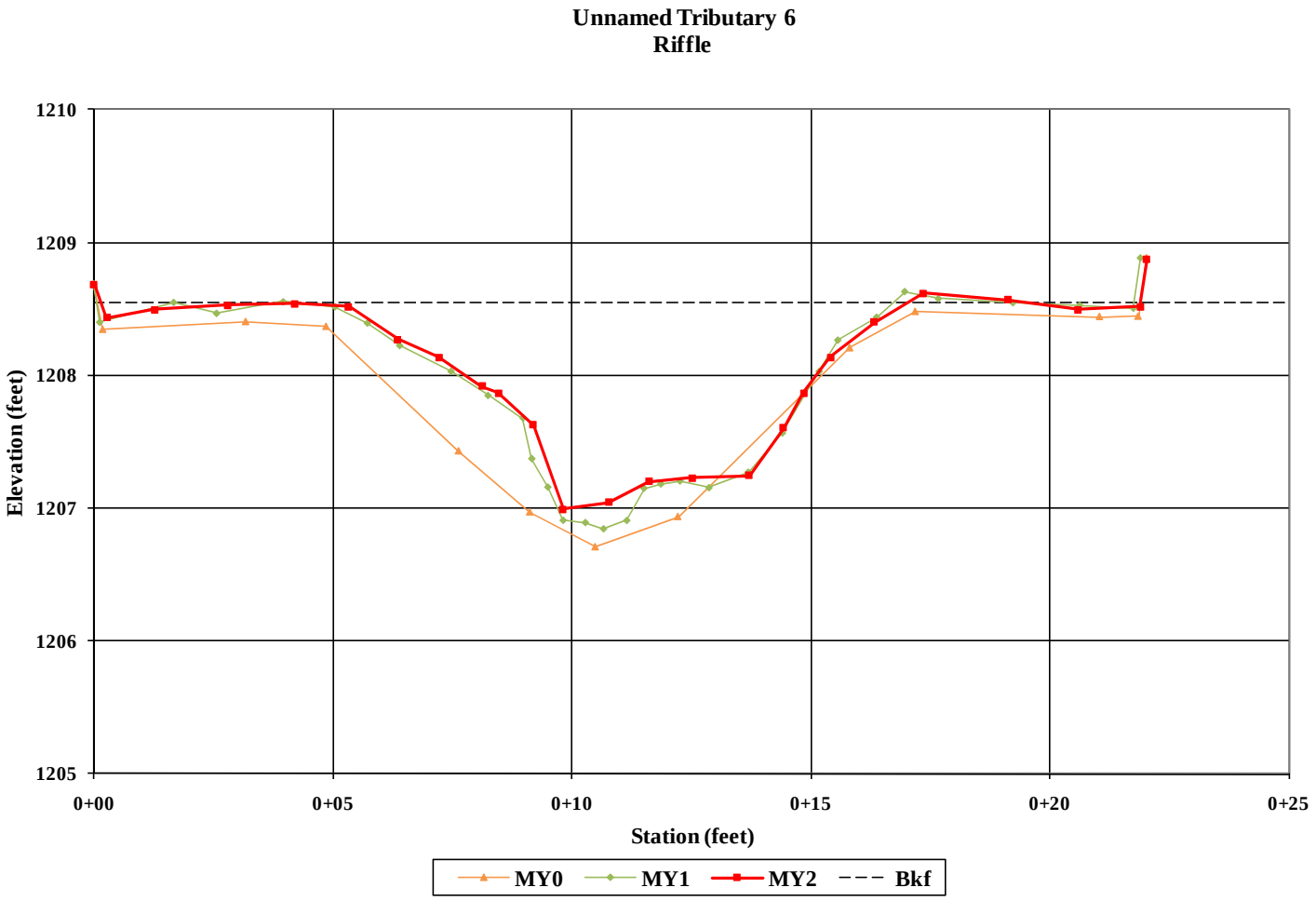
Looking at Right Bank



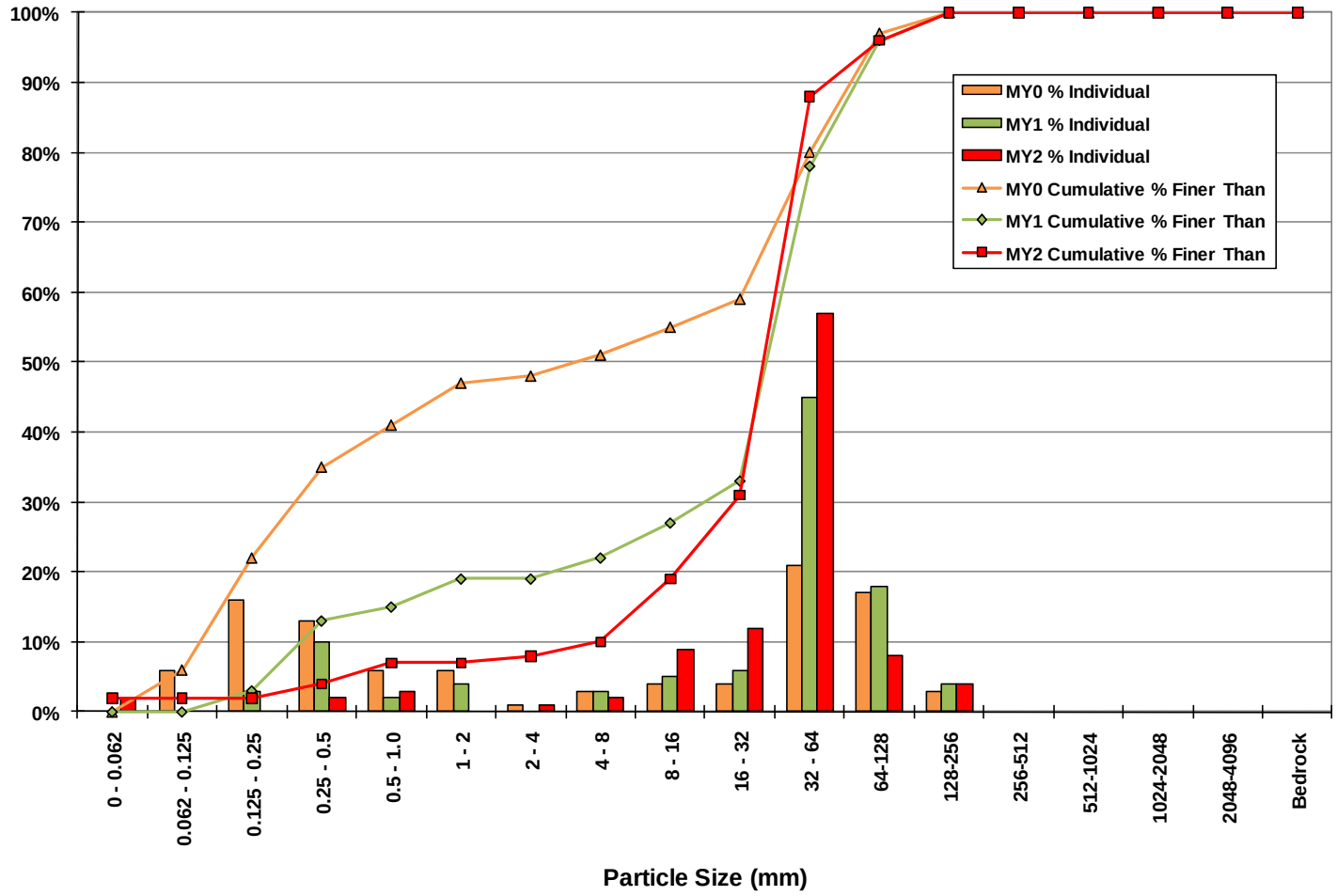
Unnamed Tributary 6 – Riffle
Cross-Section 2

Looking at Left Bank

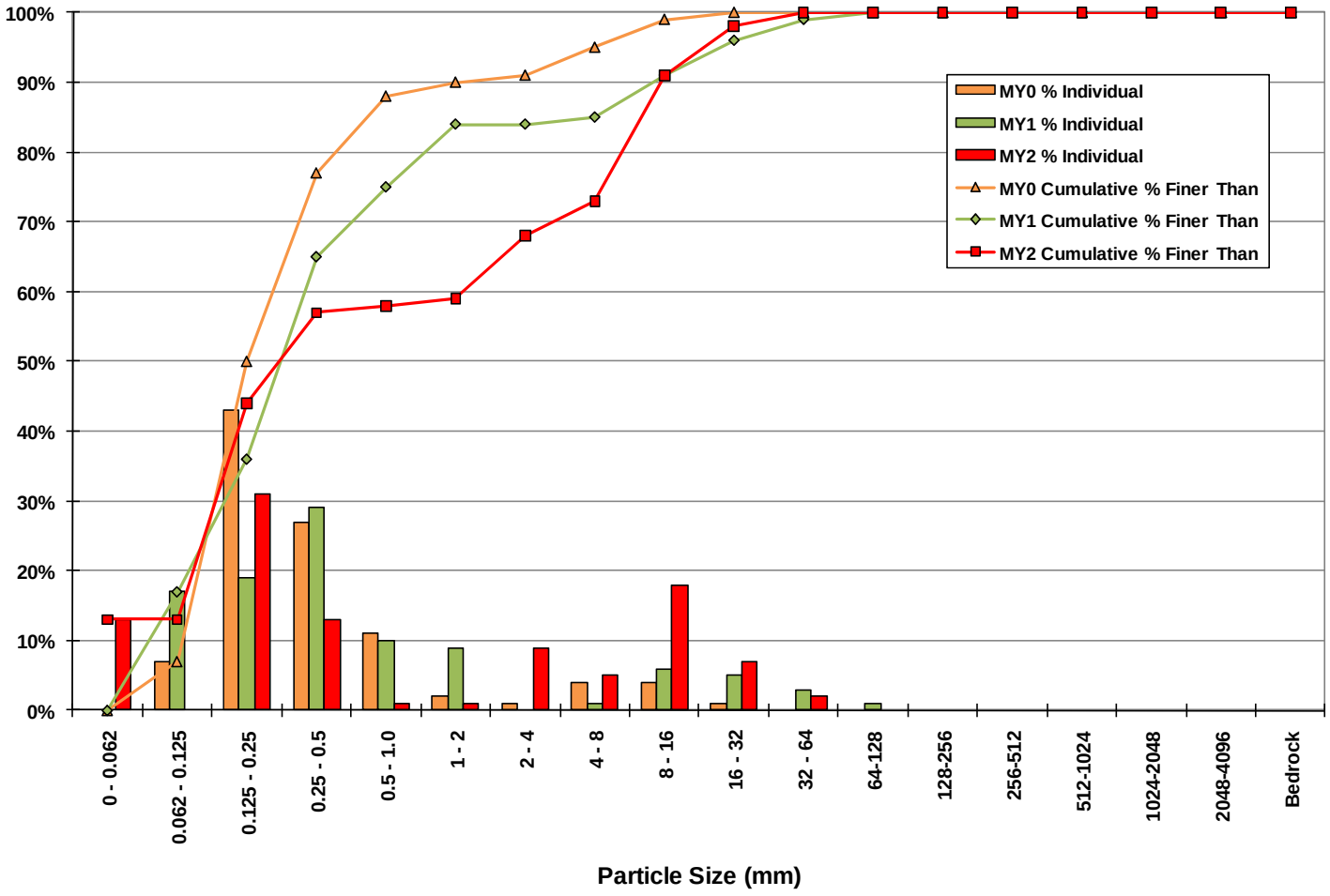
Looking at Right Bank



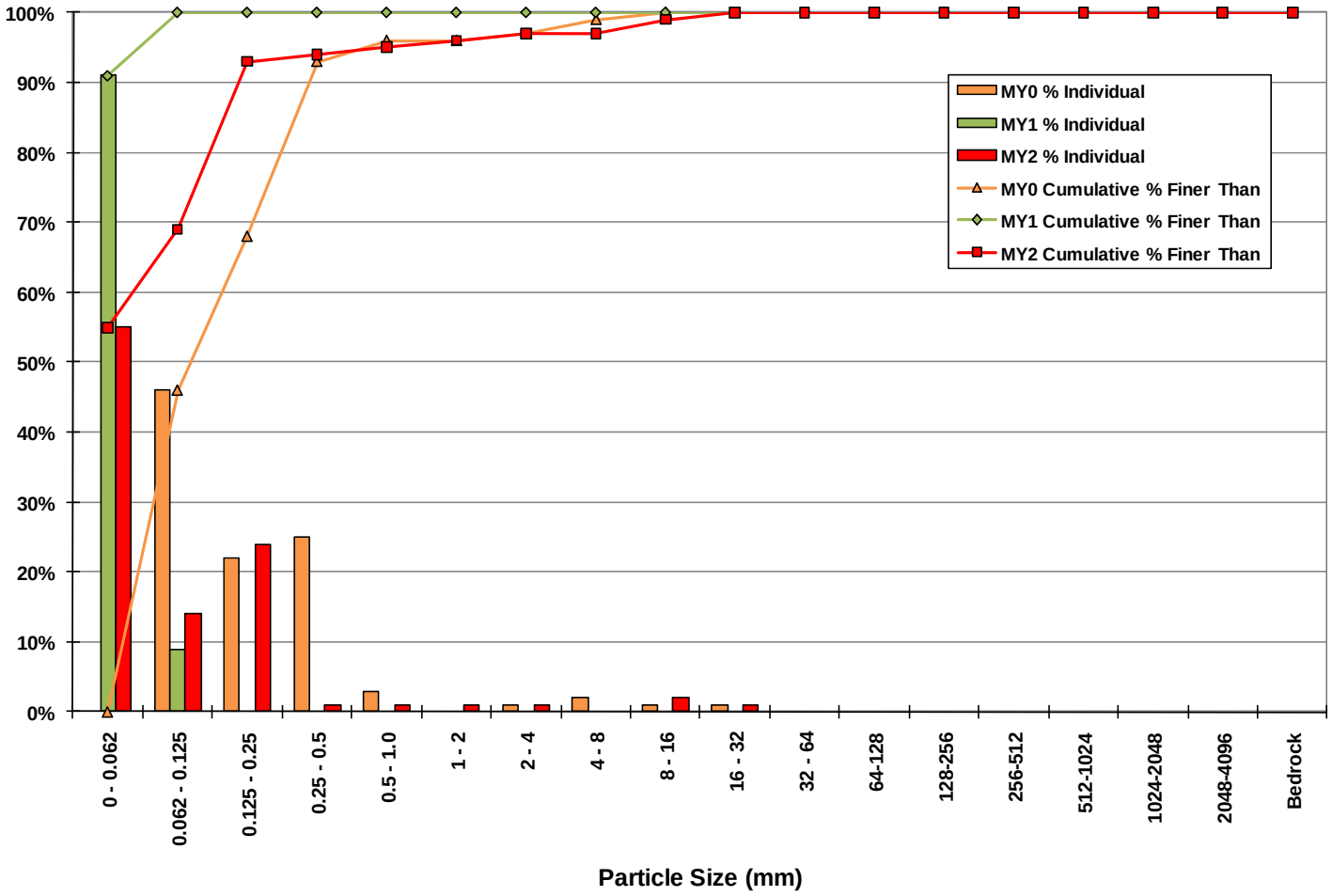
Morgan Creek Upper – Riffle 1
Pebble Count



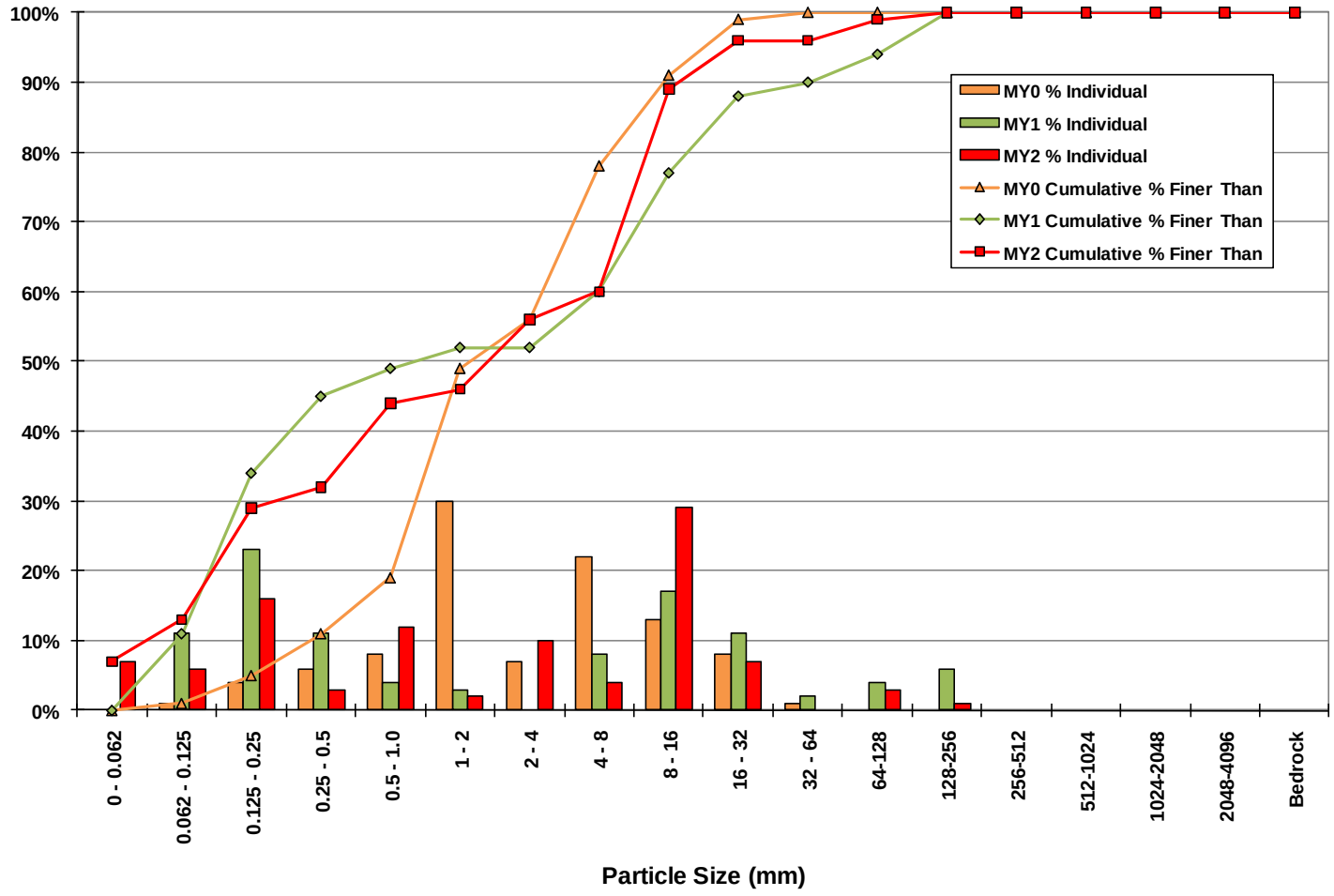
Morgan Creek Upper – Riffle 2
Pebble Count



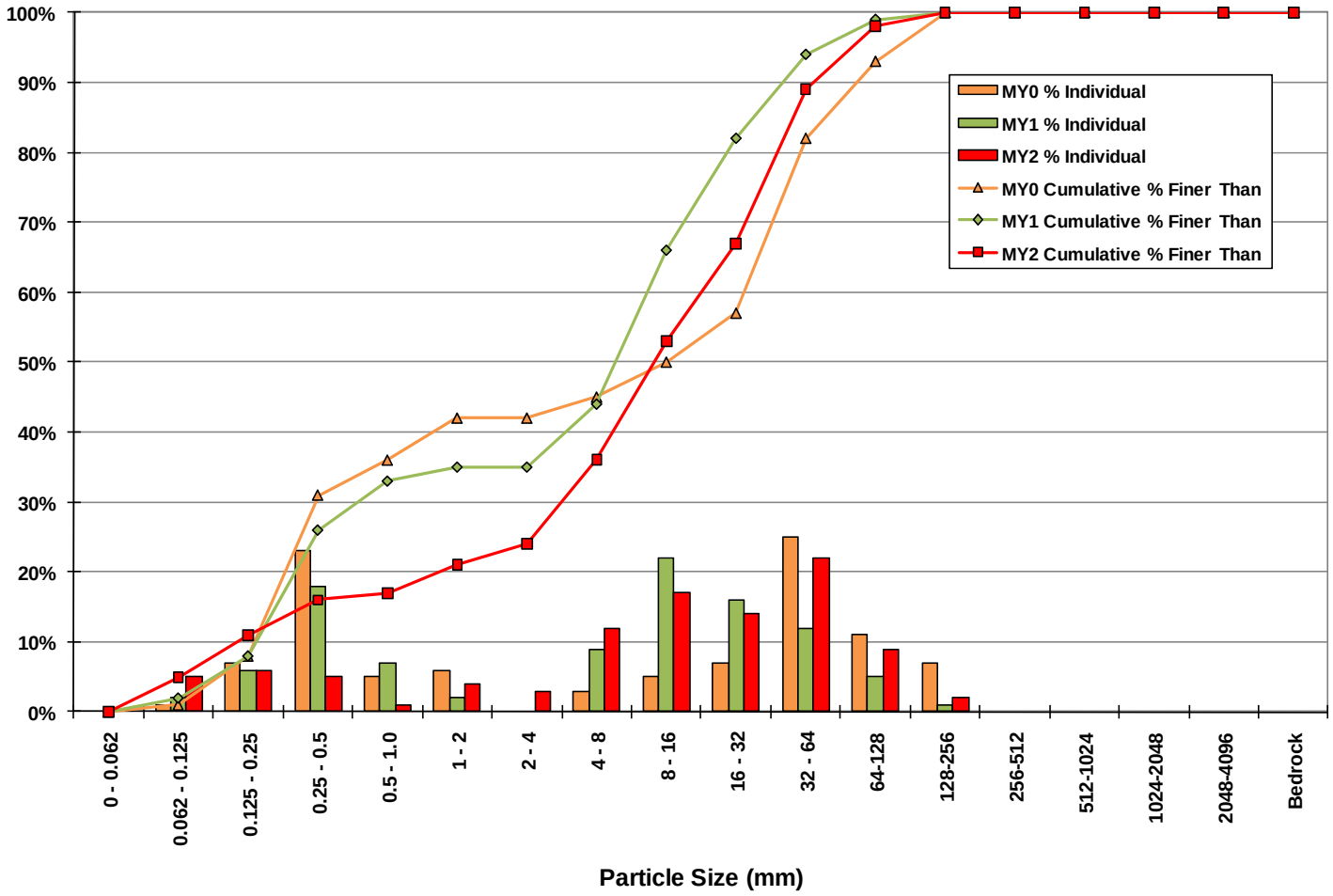
Morgan Creek Upper – Pool 1
Pebble Count



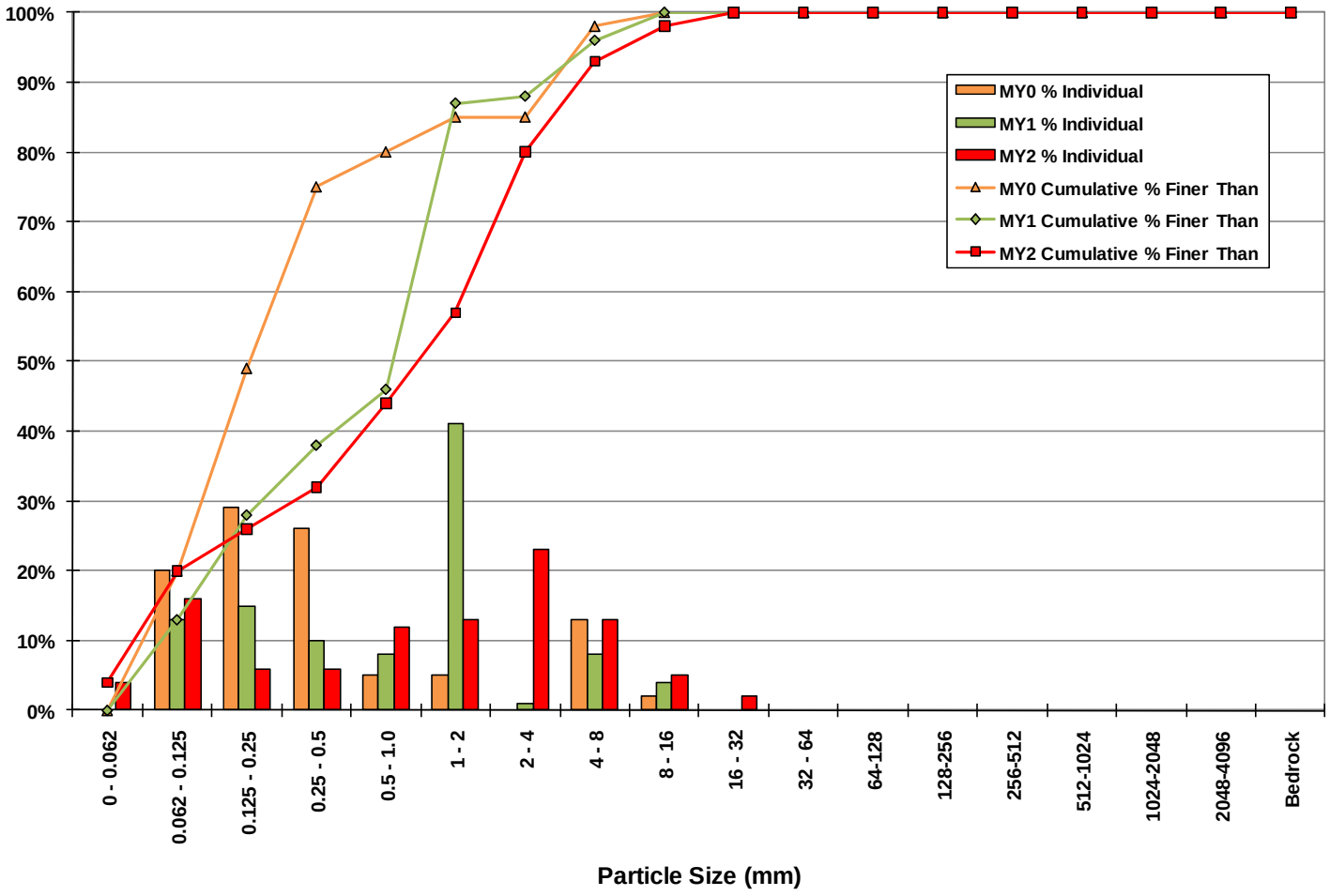
Morgan Creek Upper – Riffle 3
Pebble Count



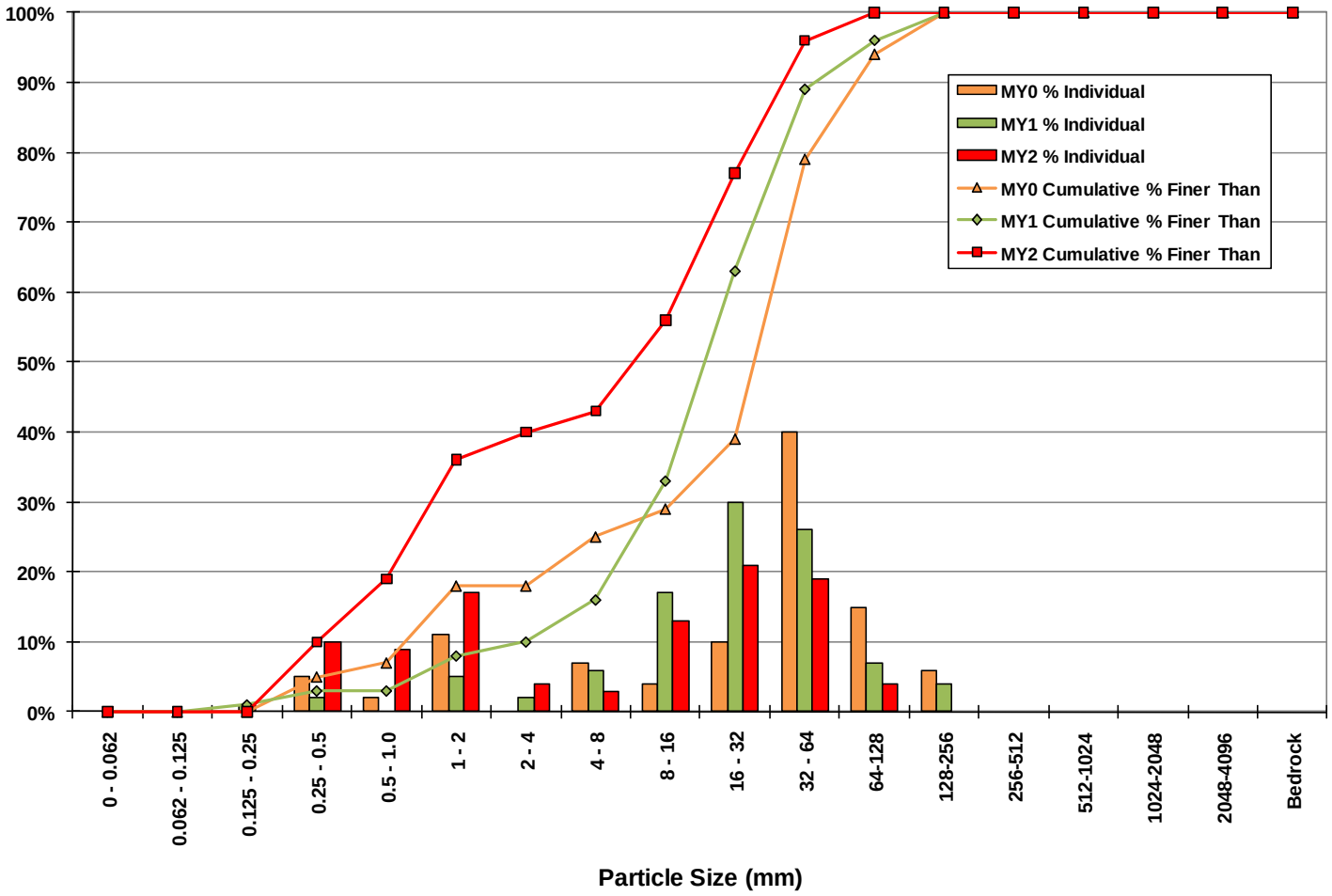
Morgan Creek Upper – Riffle 4
Pebble Count



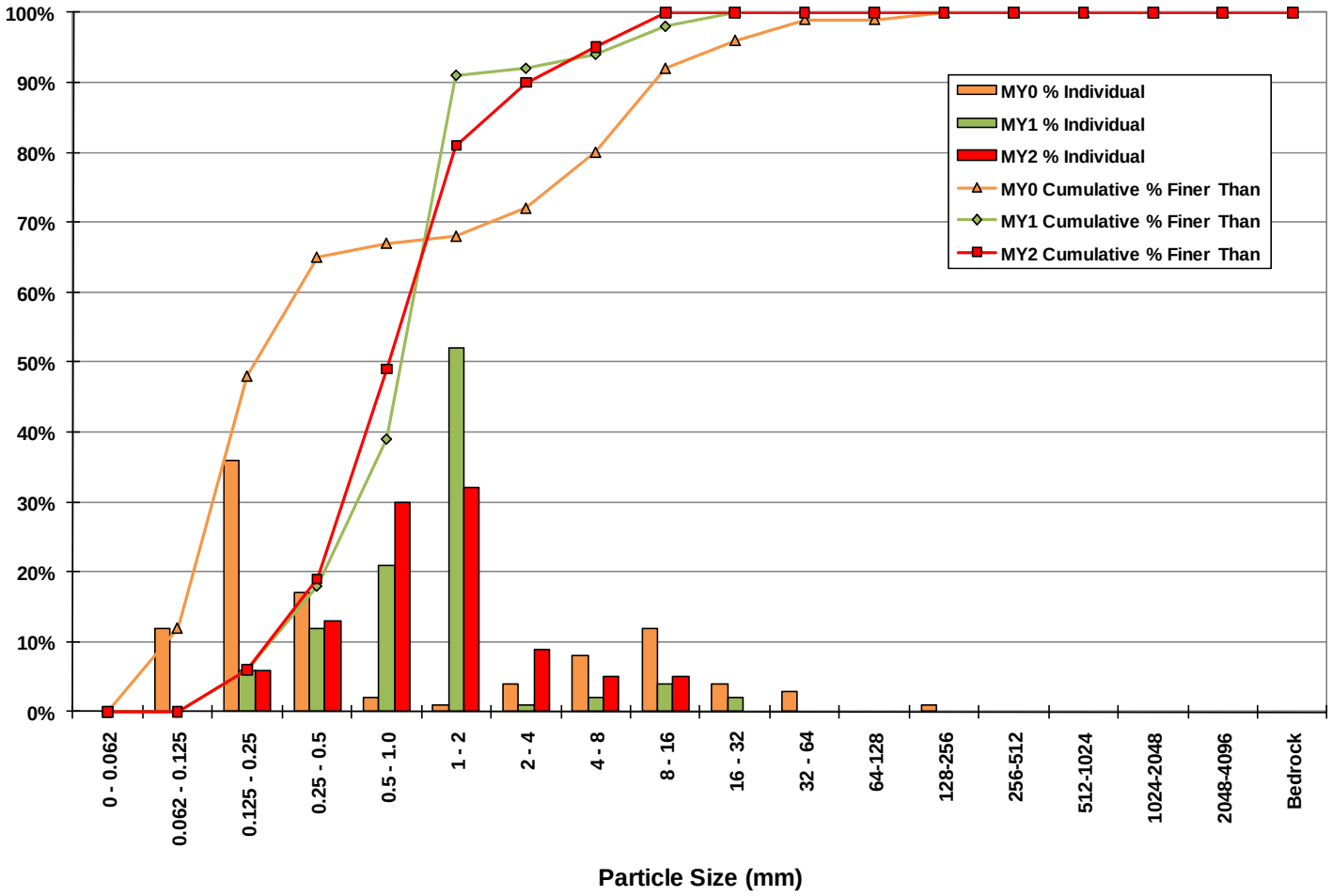
Morgan Creek Upper – Pool 2
Pebble Count



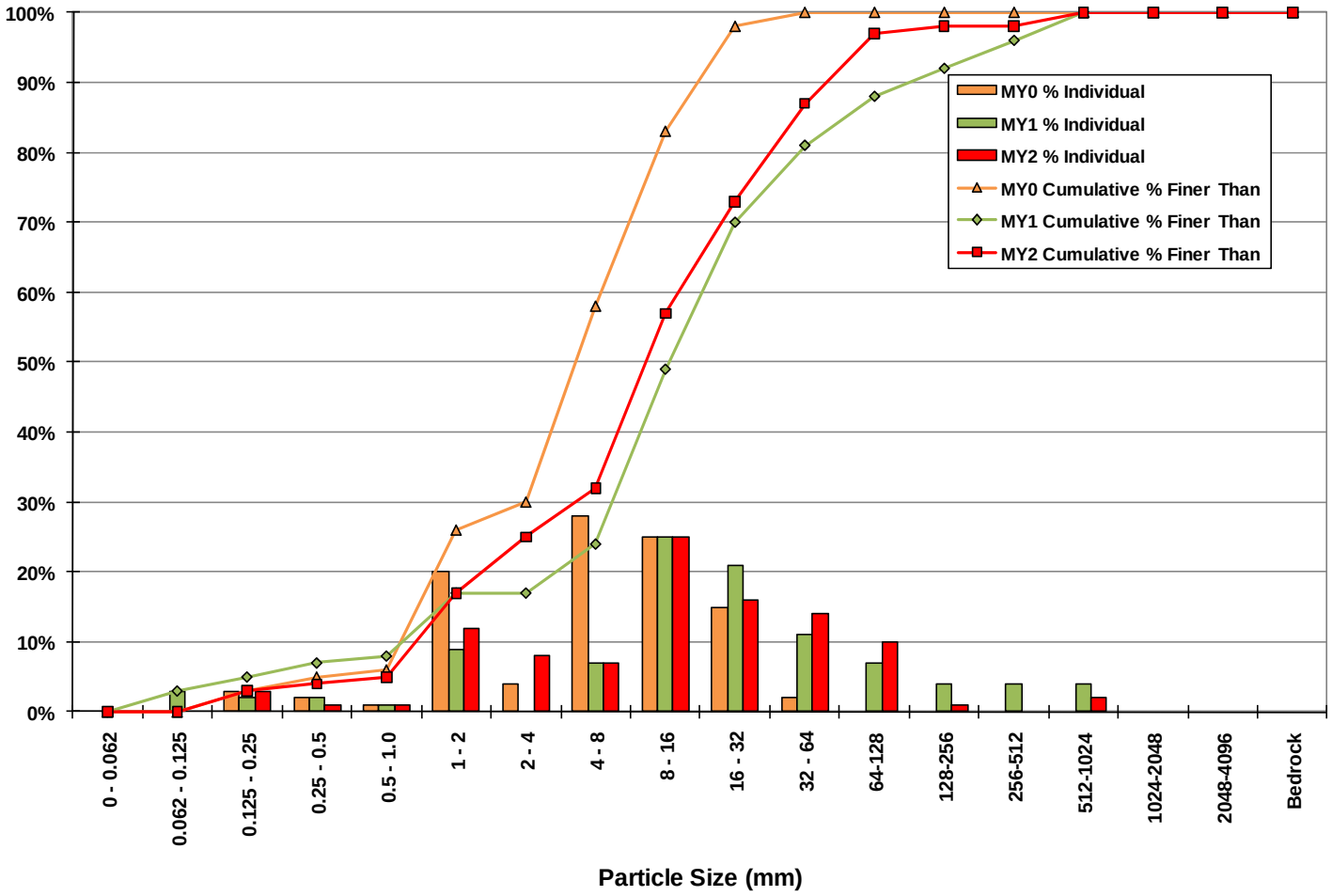
Morgan Creek Lower – Riffle 1
Pebble Count



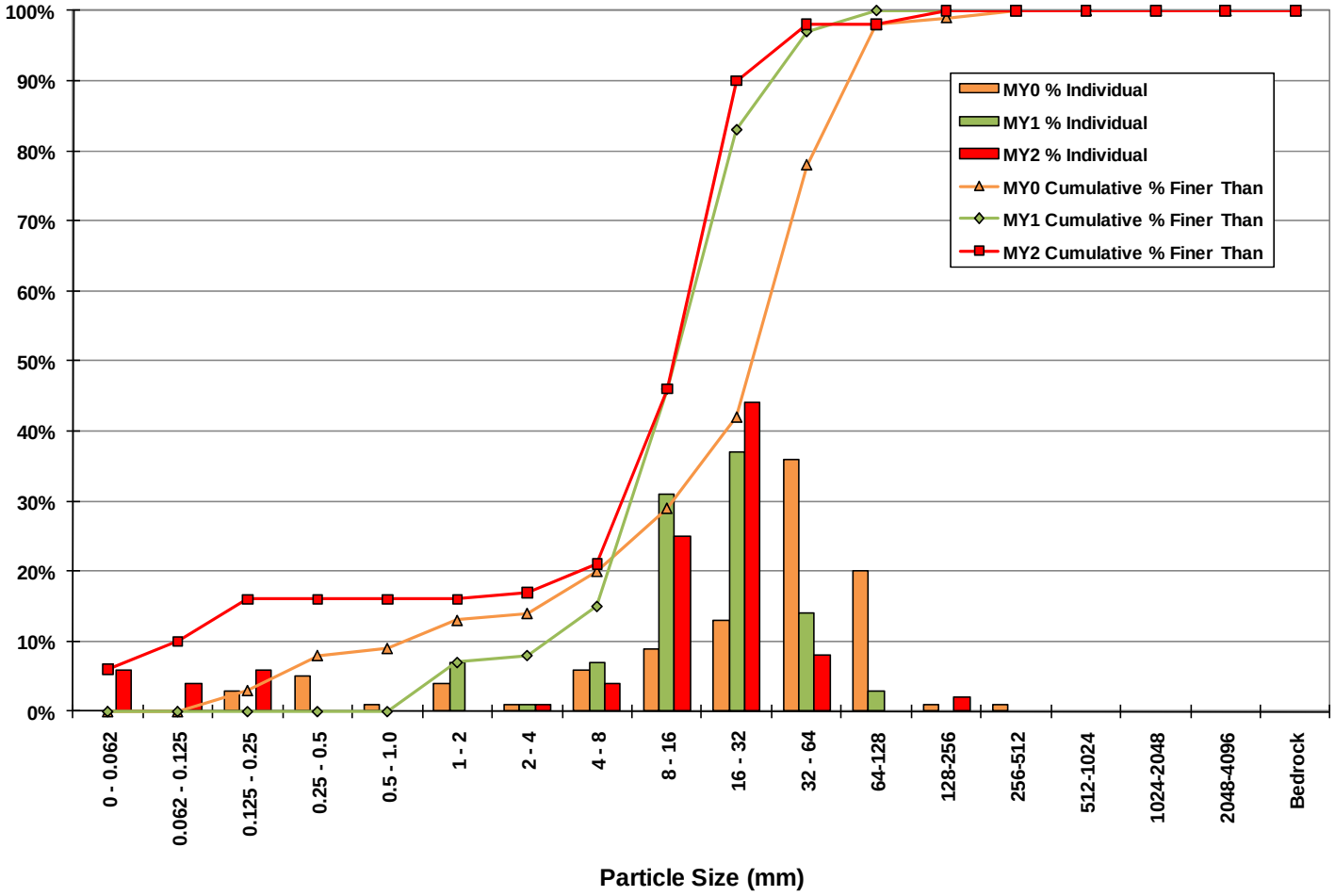
Morgan Creek Lower – Pool 1
Pebble Count

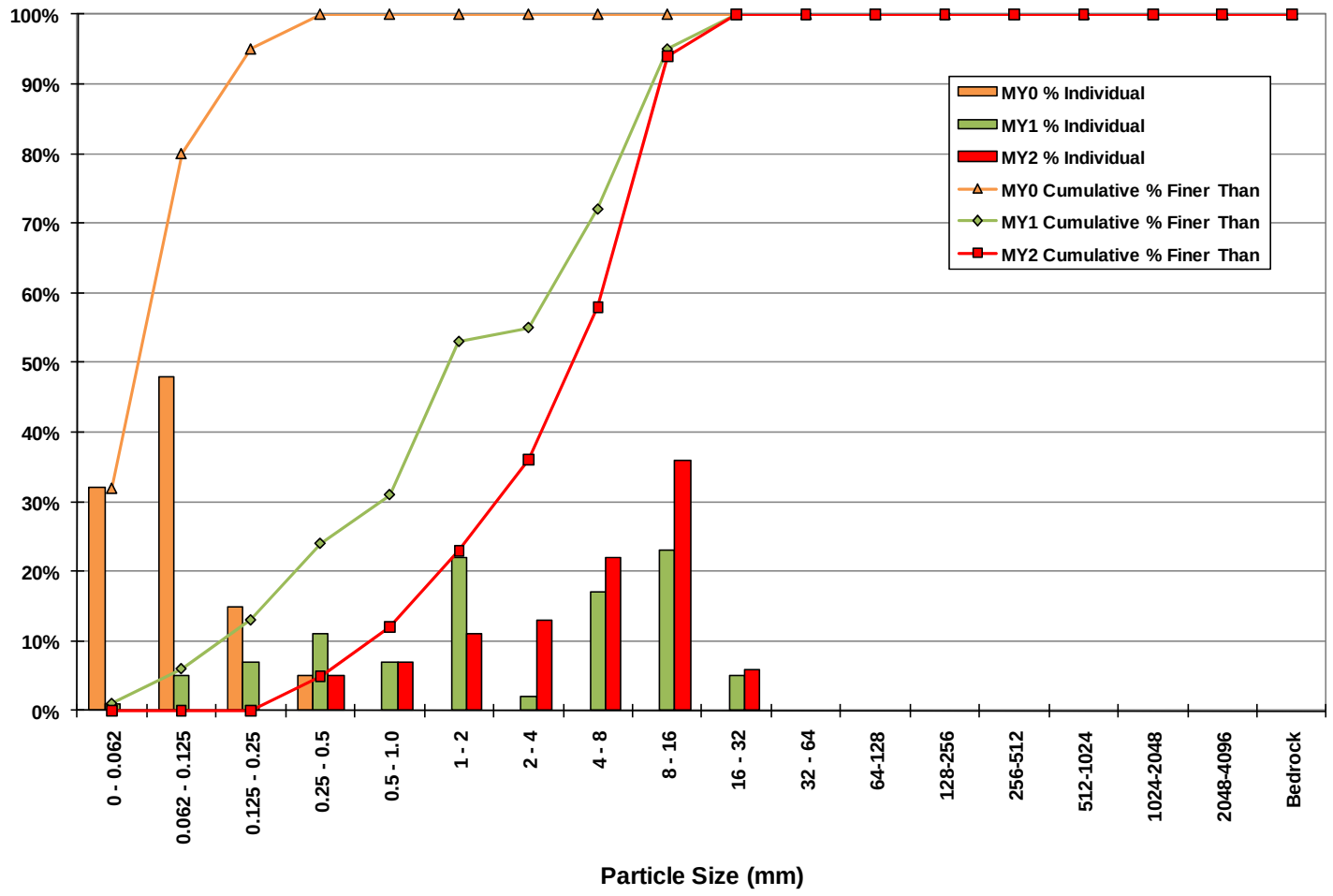


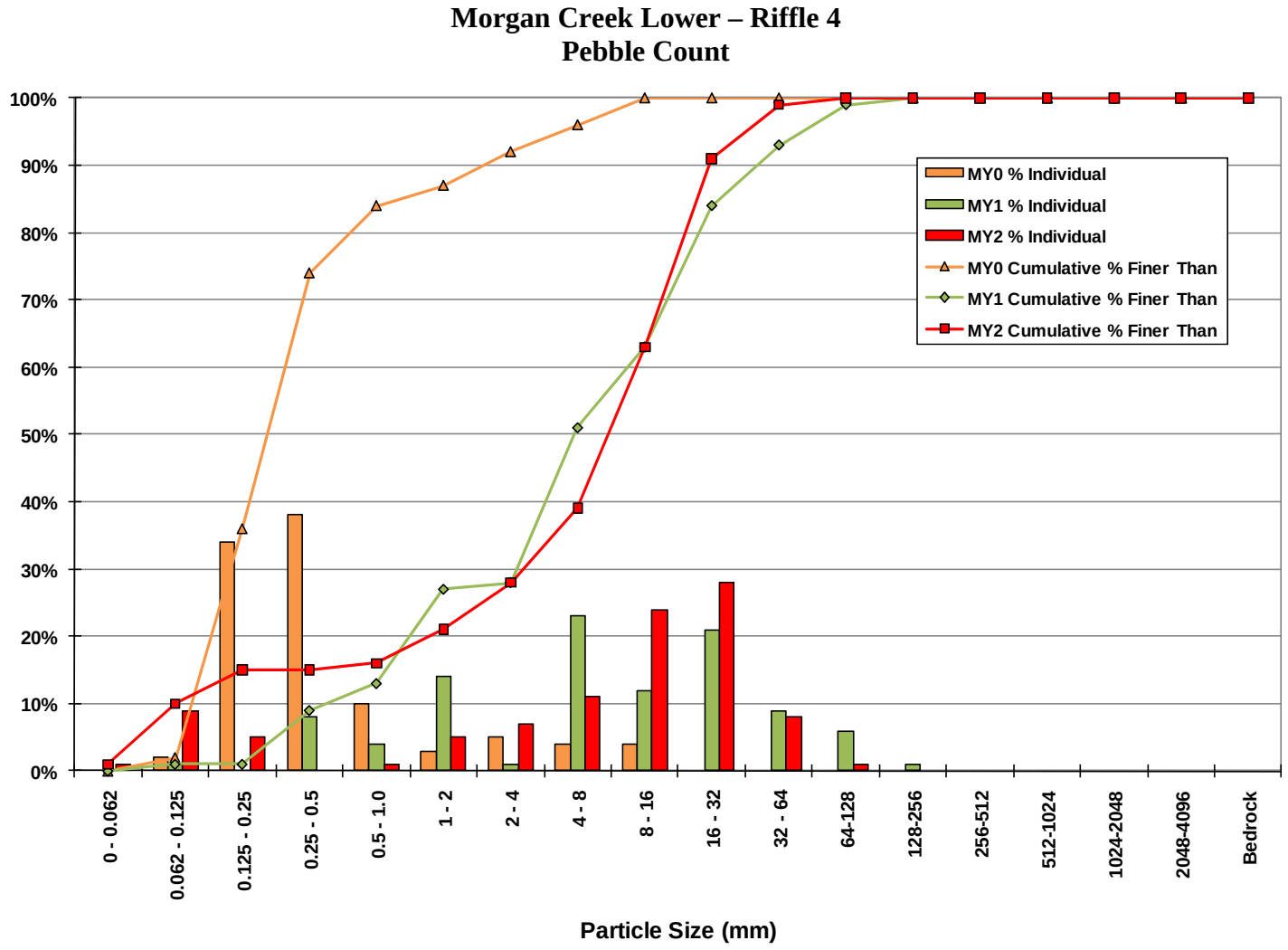
Morgan Creek Lower – Riffle 2
Pebble Count



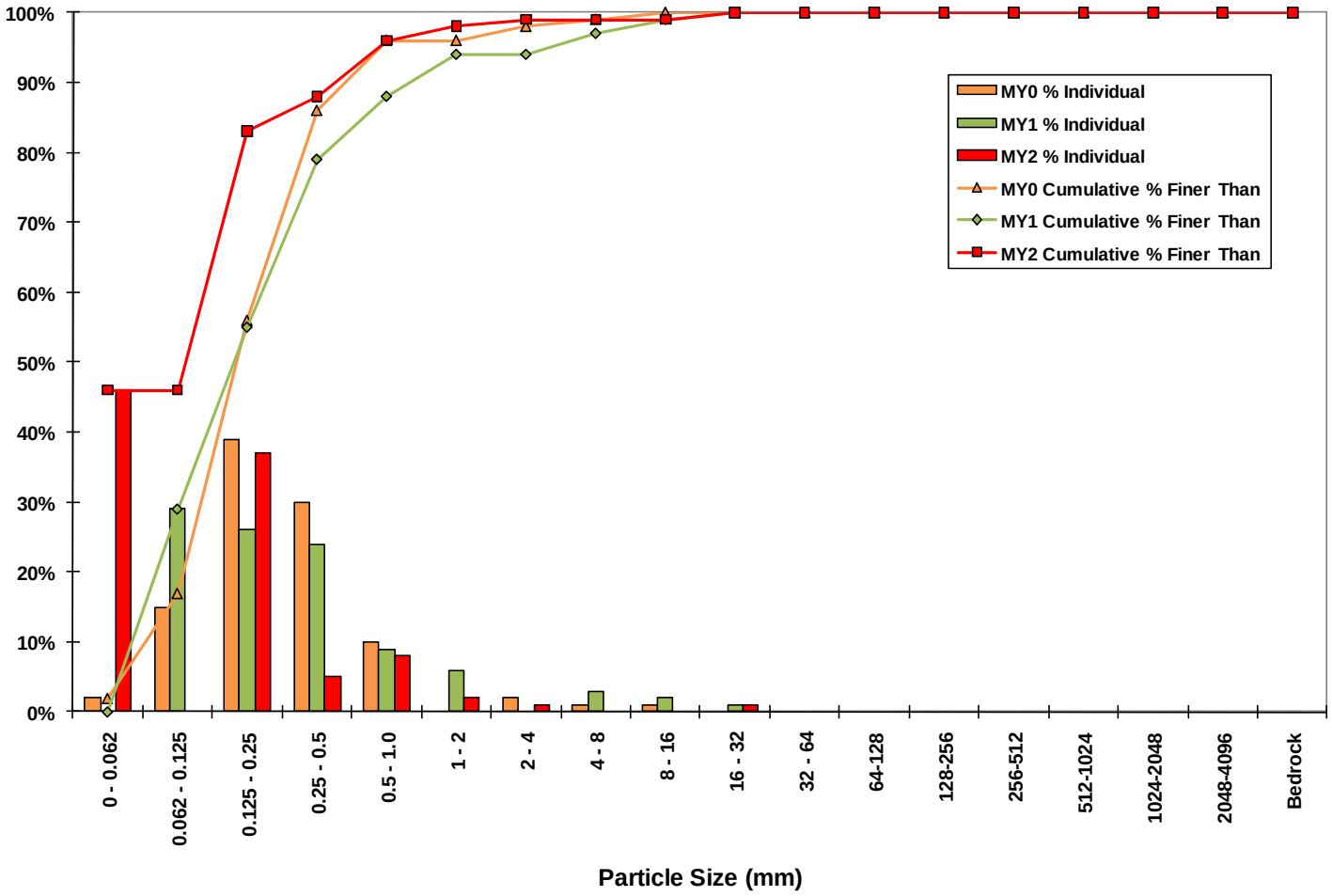
Morgan Creek Lower – Riffle 3
Pebble Count



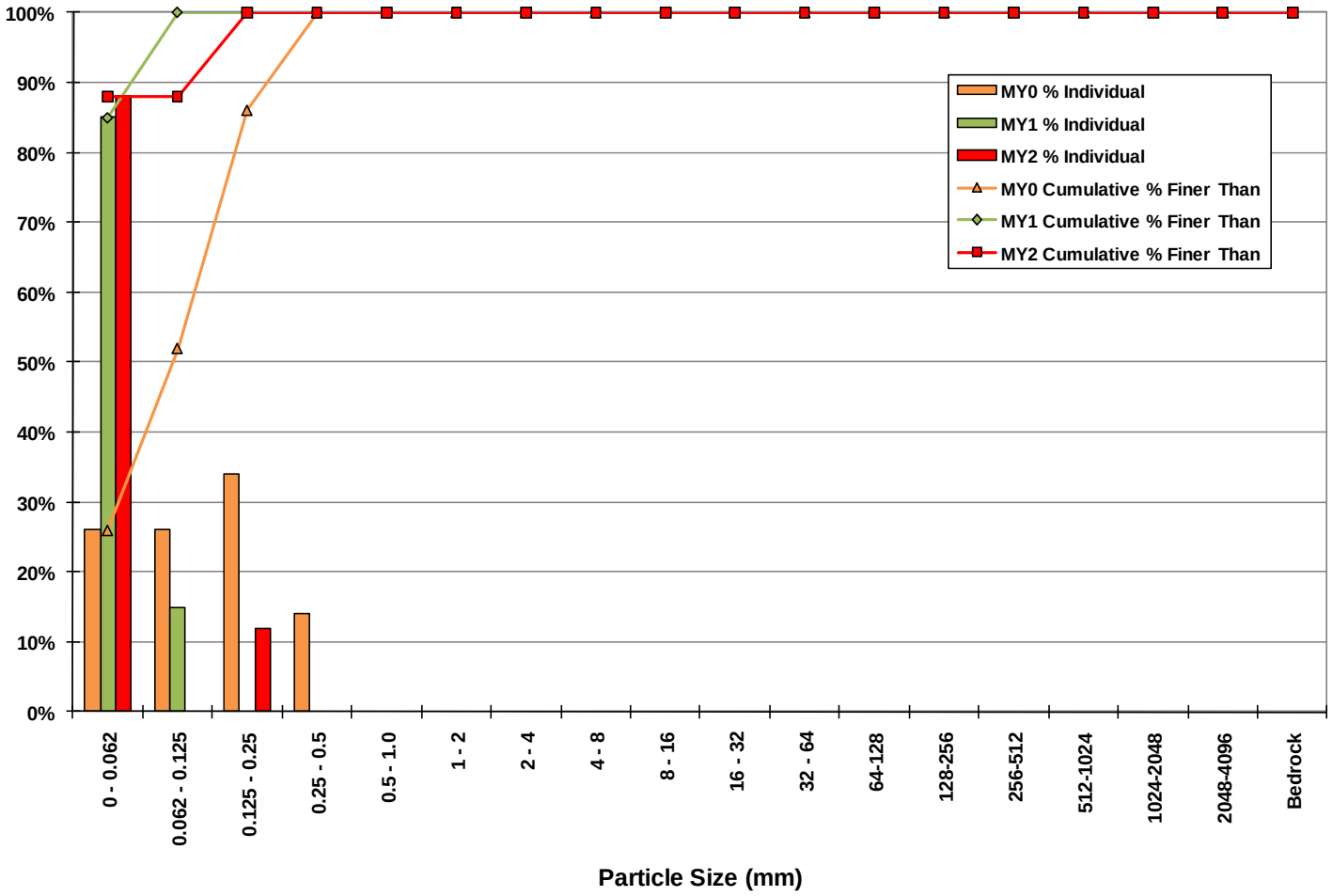

Morgan Creek Lower – Pool 2
Pebble Count
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
MY0 % Individual
MY1 % Individual
MY2 % Individual
MY0 Cumulative % Finer Than
MY1 Cumulative % Finer Than
MY2 Cumulative % Finer Than
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size (mm)


Morgan Creek Lower – Riffle 4
Pebble Count
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
MY0 % Individual
MY1 % Individual
MY2 % Individual
MY0 Cumulative % Finer Than
MY1 Cumulative % Finer Than
MY2 Cumulative % Finer Than
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size (mm)

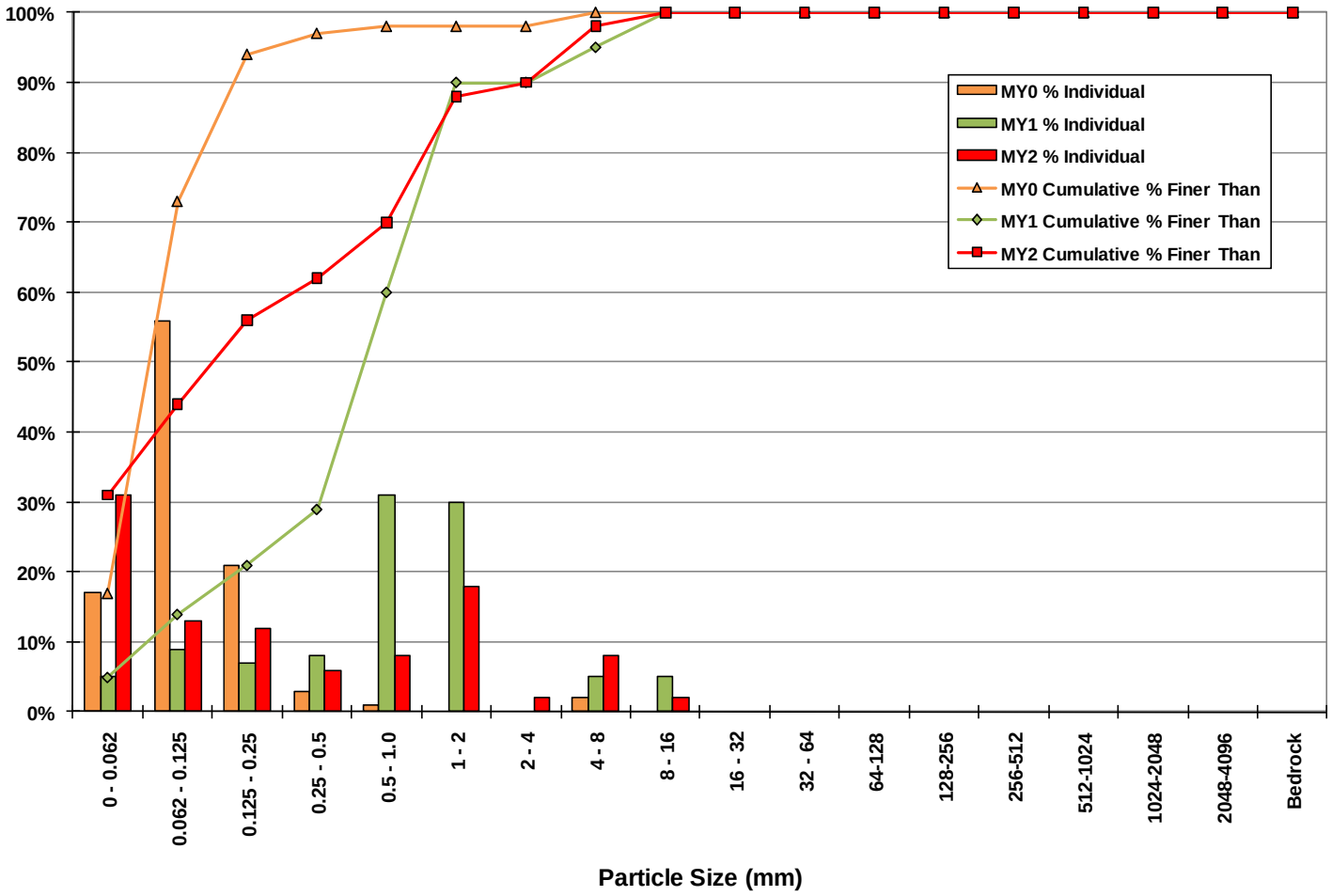
Unnamed Tributary 1 – Riffle
Pebble Count

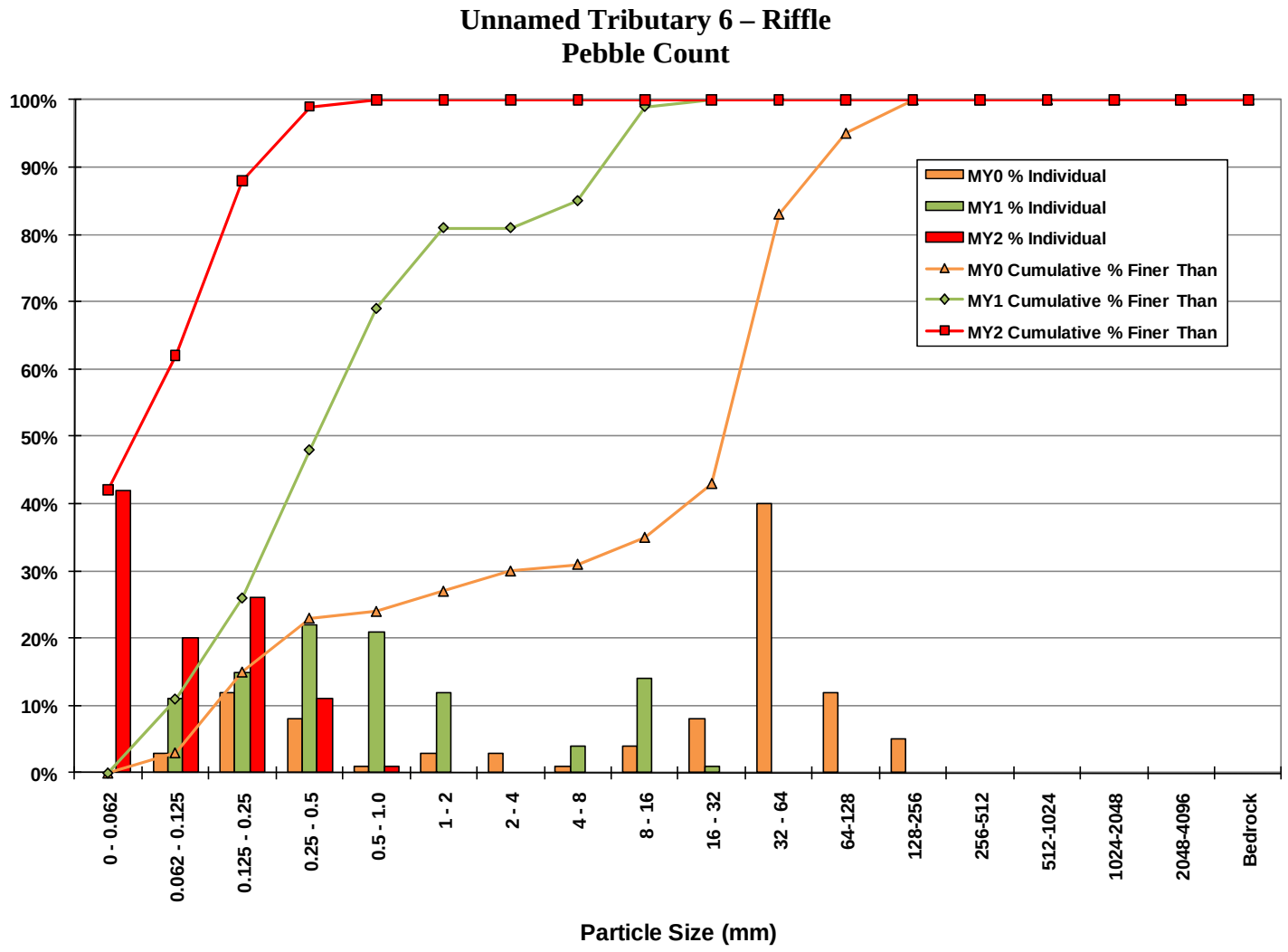


Unnamed Tributary 1 – Pool
Pebble Count



Unnamed Tributary 6 – Pool
Pebble Count




Unnamed Tributary 6 – Riffle
Pebble Count
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
MY0 % Individual
MY1 % Individual
MY2 % Individual
MY0 Cumulative % Finer Than
MY1 Cumulative % Finer Than
MY2 Cumulative % Finer Than
0 - 0.062
0.062 - 0.125
0.125 - 0.25
0.25 - 0.5
0.5 - 1.0
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
32 - 64
64-128
128-256
256-512
512-1024
1024-2048
2048-4096
Bedrock
Particle Size (mm)

APPENDIX C

Monitoring Year 2
Morphologic Monitoring Parameters

Morgan Creek – Upper Reach																		
Parameter	**Cross-Section 1 Riffle 1**						**Cross-Section 2 Riffle 2**						**Cross-Section 3 Pool 1**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	20.5	21.4	21.2				19.6	18.8	18.4				32.9	28.3	27.3			
Floodprone Width (ft)	>100	>100	>100				>100	>100	>100				>100	>100	>100			
BF Cross Sectional Area (ft^2)	29.4	25.2	24.4				26.6	28.1	29.1				65.7	38.3	38.0			
BF Mean Depth (ft)	1.4	1.2	1.2				1.4	1.5	1.6				2.0	1.4	1.4			
BF Max Depth (ft)	2.5	2.6	2.7				2.3	3.8	3.8				4.5	3.7	3.6			
Width/Depth Ratio	14.3	18.1	18.4				14.5	12.6	11.6				16.4	20.9	19.6			
Entrenchment Ratio	>4.9	>4.7	>4.7				>5.1	>5.3	>5.4				>3.0	>3.5	>3.7			
Wetted Perimeter (ft)	21.3	23.4	23.1				20.3	22.9	21.8				34.4	30.2	29.0			
Hydraulic Radius (ft)	1.4	1.1	1.1				1.3	1.2	1.3				1.9	1.3	1.3			

Morgan Creek – Upper Reach																		
Parameter	**Cross-Section 4 Riffle 3**						**Cross-Section 5 Riffle 4**						**Cross-Section 6 Pool 2**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	20.6	19.7	19.8				22.3	18.7	19.6				39.0	22.7	20.6			
Floodprone Width (ft)	>100	>100	>100				>100	>100	>100				>100	>100	>100			
BF Cross Sectional Area (ft^2)	32.7	25.7	25.1				24.7	21.0	20.9				49.2	23.4	24.8			
BF Mean Depth (ft)	1.6	1.3	1.3				1.1	1.1	1.1				1.3	1.0	1.2			
BF Max Depth (ft)	2.7	3.3	3.3				1.9	2.3	2.3				4.0	3.1	3.4			
Width/Depth Ratio	13.0	15.1	15.6				20.0	16.6	18.4				30.8	22.1	17.1			
Entrenchment Ratio	>4.9	>5.1	>5.0				>4.5	>5.4	>5.1				>2.6	>4.4	>4.9			
Wetted Perimeter (ft)	21.4	21.9	22.0				22.8	19.9	20.6				40.9	25.0	23.3			
Hydraulic Radius (ft)	1.5	1.2	1.1				1.1	1.1	1.0				1.2	0.9	1.1			

Morgan Creek – Lower Reach*																		
Parameter	**Cross-Section 1 Riffle 1**						**Cross-Section 2 Pool 1**						**Cross-Section 3 Riffle 2**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	18.7	24.8	24.3				34.4	30.8	31.2				22.2	23.8	22.7			
Floodprone Width (ft)	>100	>100	>100				>100	>100	>100				>100	>100	>100			
BF Cross Sectional Area (ft^2)	22.5	45.3	47.7				54.5	48.0	47.6				29.4	43.5	44.5			
BF Mean Depth (ft)	1.2	1.8	2.0				1.6	1.6	1.5				1.3	1.8	2.0			
BF Max Depth (ft)	2.3	3.4	4.0				3.4	3.3	3.3				2.3	3.5	3.6			
Width/Depth Ratio	15.5	13.6	12.3				21.7	19.7	20.5				16.7	13.0	11.6			
Entrenchment Ratio	>5.3	>4.0	>4.1				>2.9	>3.3	>3.2				>4.5	>4.2	>4.4			
Wetted Perimeter (ft)	19.3	26.5	26.2				35.3	33.1	33.3				22.8	26.3	25.3			
Hydraulic Radius (ft)	1.2	1.7	1.8				1.5	1.4	1.4				1.3	1.7	1.8			

*Morgan Creek Lower As-built data (Base) are presented for the purpose of comparing the original to those of the repair As-built conditions (MY1) and not for morphological analysis.

Morgan Creek – Lower Reach*																		
Parameter	**Cross-Section 4 Riffle 3**						**Cross-Section 5 Pool 2**						**Cross-Section 6 Riffle 4**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	24.9	25.1	27.4				26.4	28.6	29.5				23.9	23.4	22.9			
Floodprone Width (ft)	>100	>100	>100				>100	>100	>100				>100	>100	>100			
BF Cross Sectional Area (ft^2)	31.0	37.7	38.5				41.3	47.2	45.4				30.0	42.2	41.6			
BF Mean Depth (ft)	1.2	1.5	1.4				1.6	1.6	1.5				1.3	1.8	1.8			
BF Max Depth (ft)	2.3	2.6	2.6				3.7	3.7	3.3				2.5	3.3	3.2			
Width/Depth Ratio	20.0	16.7	19.5				16.9	17.3	19.2				19.0	13.0	12.6			
Entrenchment Ratio	>4.0	>4.0	>3.6				>3.8	>3.5	>3.4				>4.2	>4.3	>4.4			
Wetted Perimeter (ft)	25.6	26.3	28.6				27.8	30.3	31.2				24.6	24.8	24.3			
Hydraulic Radius (ft)	1.2	1.4	1.3				1.5	1.6	1.5				1.2	1.7	1.7			

*Morgan Creek Lower As-built data (Base) are presented for the purpose of comparing the original to those of the repair As-built conditions (MY1) and not for morphological analysis.

Unnamed Tributary 1												
Parameter	**Cross-Section 1 Riffle**						**Cross-Section 2 Pool**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	9.1	9.0	9.7				19.1	18.9	19.0			
Floodprone Width (ft)	>50.0	>50.0	>50.0				>50.0	>50.0	>50.0			
BF Cross Sectional Area (ft^2)	4.1	4.2	4.2				18.6	17.8	18.8			
BF Mean Depth (ft)	0.5	0.5	0.4				1.0	0.9	1.0			
BF Max Depth (ft)	1.2	1.3	1.3				2.1	2.0	2.0			
Width/Depth Ratio	19.9	19.4	22.7				19.6	20.1	19.1			
Entrenchment Ratio	>5.5	>5.6	>5.2				>2.6	>2.6	>2.6			
Wetted Perimeter (ft)	9.5	10.0	10.7				19.7	19.5	19.5			
Hydraulic Radius (ft)	0.4	0.4	0.4				0.9	0.9	1.0			

Unnamed Tributary 6												
Parameter	**Cross-Section 1 Pool**						**Cross-Section 2 Riffle**					
Dimension	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**	**Base**	**MY1**	**MY2**	**MY3**	**MY4**	**MY5**
BF Width (ft)	24.3	19.9	22.2				13.4	11.7	11.7			
Floodprone Width (ft)	>50.0	>50.0	>50.0				>50.0	>50.0	>50.0			
BF Cross Sectional Area (ft^2)	29.4	14.6	14.8				11.1	10.3	9.7			
BF Mean Depth (ft)	1.2	0.7	0.7				0.8	0.9	0.8			
BF Max Depth (ft)	3.0	1.6	1.6				1.7	1.7	1.6			
Width/Depth Ratio	20.2	27.1	33.2				16.2	13.2	14.1			
Entrenchment Ratio	>2.1	>2.5	>2.3				>3.7	>4.3	>4.3			
Wetted Perimeter (ft)	25.3	20.7	22.8				13.9	12.5	12.4			
Hydraulic Radius (ft)	1.2	0.7	0.7				0.8	0.8	0.8			

Morgan Creek – Upper Reach																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	60.0	92.7	81.2	62.5	95.48	87.6	62.5	95.48	87.6									
Radius of Curvature (ft)	42.3	55.6	49.7	34.6	56.6	48.9	34.6	56.6	48.9									
Meander Wavelength (ft)	141.4	215.2	200.3	153.7	219.3	199.6	153.7	219.3	199.6									
Meander Width Ratio	3.68	3.87	3.70	4.28	4.87	4.65	4.13	4.76	4.42									
Profile																		
Riffle Length (ft)	16.93	43.38	26.51	14.13	68.47	27.23	8.82	87.11	22.83									
Riffle Slope (ft/ft)	0.0024	0.0197	0.0035	0.0018	0.0209	0.0079	0.0010	0.0320	0.0074									
Pool Length (ft)	13.27	80.84	44.42	15.25	68.17	33.69	10.12	80.00	34.90									
Pool Spacing (ft)	51.77	138.88	102.18	58.30	170.24	106.81	19.12	162.26	85.29									
Additional Reach Parameters																		
Valley Length (ft)	1181.5			1181.5			1181.5											
Channel Length (ft)	1424.7			1465.5			1463.0											
Sinuosity	1.21			1.24			1.24											
Water Surface Slope (ft/ft)	0.007			0.007			0.007											
BF Slope (ft/ft)	0.009			0.008			0.007											
Rosgen Classification	C4			C4			C4											

Morgan Creek – Lower Reach*																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	57.5	84.9	70.4	62.5	85.5	70.2	58.7	85.1	73.7									
Radius of Curvature (ft)	30.7	53.7	34.1	30.2	55.8	36.8	24.5	54.6	33.8									
Meander Wavelength (ft)	170.2	200.3	181.2	172.1	203.9	180.3	175.6	200.9	181.5									
Meander Width Ratio	2.83	3.76	3.17	2.76	2.95	2.80	2.69	3.25	3.03									
Profile																		
Riffle Length (ft)	14.76	53.25	44.15	30.46	91.11	47.28	12.73	116.57	33.82									
Riffle Slope (ft/ft)	0.0016	0.0201	0.0076	0.0037	0.0206	0.0103	0.0017	0.0310	0.0113									
Pool Length (ft)	38.51	80.98	60.72	15.40	38.70	30.03	8.09	47.56	23.88									
Pool Spacing (ft)	92.14	157.68	109.52	40.56	234.10	109.20	19.21	242.08	58.75									
Additional Reach Parameters																		
Valley Length (ft)	865			865			865											
Channel Length (ft)	1054.4			1083.7			1116.5											
Sinuosity	1.22			1.25			1.29											
Water Surface Slope (ft/ft)	0.006			0.006			0.005											
BF Slope (ft/ft)	0.007			0.005			0.005											
Rosgen Classification	C4			C4			C4											

*Morgan Creek Lower As-built data (Baseline) are presented for the purpose of comparing the original to those of the repair As-built conditions (MY1) and not for morphological analysis.

Unnamed Tributary 1																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	36.6	65.0	39.6	32.0	65.4	44.1	32.0	65.4	44.1									
Radius of Curvature (ft)	22.1	29.9	26.7	13.3	25.9	23.1	13.3	25.9	23.1									
Meander Wavelength (ft)	95.6	109.3	101.4	94.6	103.4	103.0	94.6	103.4	103.0									
Meander Width Ratio		4.35			4.89			4.54										
Profile																		
Riffle Length (ft)	13.18	25.73	23.34	9.24	29.68	17.52	11.18	26.08	18.06									
Riffle Slope (ft/ft)	0.0084	0.0467	0.0222	0.0062	0.0324	0.0155	0.0036	0.0365	0.0222									
Pool Length (ft)	4.34	30.99	20.78	4.12	38.54	21.86	6.51	35.32	15.21									
Pool Spacing (ft)	17.63	77.03	36.48	22.69	91.52	37.28	25.89	77.14	40.92									
Additional Reach Parameters																		
Valley Length (ft)		310.3			310.3			310.3										
Channel Length (ft)		378.1			386.4			384.3										
Sinuosity		1.22			1.25			1.24										
Water Surface Slope (ft/ft)		0.011			0.012			0.012										
BF Slope (ft/ft)		0.013			0.013			0.013										
Rosgen Classification		C5			C5			C5										

Unnamed Tributary 6																		
Parameter	**Baseline**			**MY1**			**MY2**			**MY3**			**MY4**			**MY5**		
Pattern	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med	Min	Max	Med
Channel Beltwidth (ft)	28.7	43.5	42.3	29.6	45.4	45.0	28.6	46.2	42.6									
Radius of Curvature (ft)	27.7	31.7	30.2	21.7	32.1	22.5	22.1	27.4	24.5									
Meander Wavelength (ft)	114.0	123.1	120.1	100.9	120.3	119.5	101.2	121.3	117.6									
Meander Width Ratio		3.16			3.85			3.64										
Profile																		
Riffle Length (ft)	14.86	30.95	28.19	7.28	25.67	16.29	7.94	44.39	25.23									
Riffle Slope (ft/ft)	0.0013	0.0110	0.0042	0.0014	0.0237	0.0108	0.0104	0.0432	0.0269									
Pool Length (ft)	2.38	18.09	14.64	4.02	15.59	8.70	2.16	5.20	3.56									
Pool Spacing (ft)	5.90	66.37	54.03	14.52	54.28	28.32	4.99	71.09	24.79									
Additional Reach Parameters																		
Valley Length (ft)		222.5			222.5			222.5										
Channel Length (ft)		252.4			258.9			254.5										
Sinuosity		1.13			1.16			1.14										
Water Surface Slope (ft/ft)		0.008			0.010			0.017										
BF Slope (ft/ft)		0.014			0.010			0.013										
Rosgen Classification		C4			C5			C5										

APPENDIX D

Monitoring Year 2
Site Photos

Permanent Photo Point 1 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 2 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 3 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 4 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 5 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 6 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 7 – Unnamed Tributary 7
Looking Upstream
November 11, 2010

Permanent Photo Point 8 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 9 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 10 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 11 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 12 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 13 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 14 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 15 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 16 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 17 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 18 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 19 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 20 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 21 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 22 – Unnamed Tributary 6
Looking Upstream
November 12, 2010

Permanent Photo Point 23 – Unnamed Tributary 6
Looking Upstream
November 12, 2010

Permanent Photo Point 24 – Unnamed Tributary 6
Looking Upstream
November 12, 2010

Permanent Photo Point 25 – Unnamed Tributary 6
Looking Upstream
November 12, 2010

Permanent Photo Point 26 – Unnamed Tributary 6
Looking Upstream
November 12, 2010

Permanent Photo Point 27 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 28 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 29 – Morgan Creek
Looking Upstream
November 12, 2010

Permanent Photo Point 30 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 30 – Unnamed Tributary 5
Looking Upstream
November 11, 2010

Permanent Photo Point 31 – Unnamed Tributary 5
Looking Upstream
November 11, 2010

Permanent Photo Point 32 – Unnamed Tributary 5
Looking Downstream
November 11, 2010

Permanent Photo Point 32 – Unnamed Tributary 5
Looking Upstream
November 11, 2010

Permanent Photo Point 33 – Unnamed Tributary 5
Looking Downstream
November 11, 2010

Permanent Photo Point 33 – Unnamed Tributary 5
Looking Upstream
November 11, 2010

Permanent Photo Point 34 – Unnamed Tributary 5
Looking Upstream
November 11, 2010

Permanent Photo Point 35 – Unnamed Tributary 5
Looking Downstream
November 11, 2010

Permanent Photo Point 35 – Unnamed Tributary 5
Looking 115 Degrees
November 11, 2010

Permanent Photo Point 35 – Unnamed Tributary 5
Looking Upstream
November 11, 2010

Permanent Photo Point 35 – Unnamed Tributary 5
Looking 358 Degrees
November 11, 2010

Permanent Photo Point 36 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 37 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 38 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 39 – Unnamed Tributary 4
Looking Downstream
November 11, 2010

Permanent Photo Point 39 – Unnamed Tributary 4
Looking Upstream
November 11, 2010

Permanent Photo Point 40 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 41 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 42 – Morgan Creek
Looking Downstream
November 11, 2010

Permanent Photo Point 42 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 43 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 44 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 45 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 46 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 47 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 48 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 49 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 50 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 51 – Unnamed Tributary 3
Looking Downstream
November 11, 2010

Permanent Photo Point 51 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 52 – Unnamed Tributary 3
Looking Downstream
November 11, 2010

Permanent Photo Point 52 – Unnamed Tributary 3
Looking 110 Degrees
November 11, 2010

Permanent Photo Point 52 – Unnamed Tributary 3
Looking Upstream
November 11, 2010

Permanent Photo Point 52 – Unnamed Tributary 3
Looking 355 Degrees
November 11, 2010

Permanent Photo Point 53 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 54 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 55 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 56 – Unnamed Tributary 2
Looking Upstream
November 11, 2010

Permanent Photo Point 57 – Unnamed Tributary 2
Looking Upstream
November 11, 2010

Permanent Photo Point 58 – Unnamed Tributary 2
Looking Downstream
November 11, 2010

Permanent Photo Point 58 – Unnamed Tributary 2
Looking Upstream
November 11, 2010

Permanent Photo Point 59 – Unnamed Tributary 2
Looking Downstream
November 11, 2010

Permanent Photo Point 59 – Unnamed Tributary 2
Looking Upstream
November 11, 2010

Permanent Photo Point 60 – Unnamed Tributary 2
Looking Downstream
November 11, 2010

Permanent Photo Point 60 – Unnamed Tributary 2
Looking Upstream
November 11, 2010

Permanent Photo Point 61 – Morgan Creek
Looking Upstream
November 11, 2010

Permanent Photo Point 62 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 63 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 64 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 65 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 66 – Unnamed Tributary 1
Looking Downstream
November 11, 2010

Permanent Photo Point 66 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 67 – Unnamed Tributary 1
Looking Downstream
November 11, 2010

Permanent Photo Point 67 – Unnamed Tributary 1
Looking 185 Degrees
November 11, 2010

Permanent Photo Point 67 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 67 – Unnamed Tributary 1
Looking 360 Degrees
November 11, 2010

Permanent Photo Point 68 – Unnamed Tributary 1
Looking Downstream
November 11, 2010

Permanent Photo Point 68 – Unnamed Tributary 1
Looking 94 Degrees
November 11, 2010

Permanent Photo Point 68 – Unnamed Tributary 1
Looking Upstream
November 11, 2010

Permanent Photo Point 68 – Unnamed Tributary 1
Looking 327 Degrees
November 11, 2010

Permanent Photo Point 69 – Unnamed Tributary 8
Looking Downstream
November 11, 2010

Permanent Photo Point 69 – Unnamed Tributary 8
Looking 168 Degrees
November 11, 2010

Permanent Photo Point 69 – Unnamed Tributary 8
Looking Upstream
November 11, 2010

Permanent Photo Point 69 – Unnamed Tributary 8
Looking 53 Degrees
November 11, 2010

Permanent Photo Point 70 – Unnamed Tributary 9
Looking Downstream
November 11, 2010

Permanent Photo Point 70 – Unnamed Tributary 9
Looking Upstream 196 Degrees
November 11, 2010

Permanent Photo Point 70 – Unnamed Tributary 9
Looking Upstream 248 Degrees
November 11, 2010

Vegetation Plot 1

Vegetation Plot 2

Vegetation Plot 3

Vegetation Plot 4

Vegetation Plot 5

Vegetation Plot 6

Vegetation Plot 7

Vegetation Plot 8

Morgan Creek Representative Photos of Stream Areas Requiring Observation

SPA 6 Morgan Creek Sta. 1001+50 – Reduced pool depth due to aggradation
November 11, 2010

SPA 9 Morgan Creek Sta. 1003+25 – Reduced pool depth due to aggradation
November 11, 2010

Morgan Creek Representative Photos of Stream and Areas Requiring Observation

SPA 10 Morgan Creek Sta. 1004+20 – Reduced pool depth due to aggradation
November 11, 2010

SPA 11 Morgan Creek Sta. 1005+05 – Reduced pool depth due to aggradation
November 11, 2010

Morgan Creek Representative Photos of Stream and Areas Requiring Observation

SPA 22 Morgan Creek Sta. 1038+50 – Riffle aggradation due to mid-channel bar formation
November 11, 2010

SPA 23 Morgan Creek Sta. 1047+00 – Reduced pool depth due to aggradation
November 11, 2010

Unnamed Tributary 1 Representative Photos of Stream and Vegetation Areas Requiring Observation

SPA 4 UT1 Sta. 2001+75 – Reduced pool depth due to aggradation
November 11, 2010

SPA 5 UT1 Sta. 2002+40 – Reduced pool depth due to aggradation
November 11, 2010

Unnamed Tributary 1 Representative Photos of Stream and Vegetation Areas Requiring Observation

UT1 – Isolated Area of privet (*Ligustrum sp.*)
November 11, 2010

Unnamed Tributary 2 Representative Photo of Stream and Vegetation Areas Requiring Observation

SPA 8 UT2 Sta. 3000+50 – Reduced pool depth and riffle fining due to aggradation
April 15, 2010

UT2 – Isolated Area of Japanese honeysuckle (*Lonicera japonica*)
November 11, 2010

Unnamed Tributary 3 Representative Photo of Stream Areas Requiring Observation

SPA 14 UT3 Sta. 4000+10 – Reduced pool depth and riffle fining due to aggradation
November 11, 2010

Unnamed Tributary 4 Representative Photo of Stream Areas Requiring Observation

SPA 16 UT4 Sta. 5001+50 – Reduced pool depth and riffle fining due to aggradation
November 11, 2010

Unnamed Tributary 5 Representative Photo of Vegetation Areas Requiring Observation

UT5 – Isolated Area of privet (*Ligustrum sp.*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*)
April 15, 2010

Unnamed Tributary 6 Representative Photos of Vegetation Areas Requiring Observation

UT6 – Isolated Area of privet (*Ligustrum sp*.) and multiflora rose (*Rosa multiflora*)
November 12, 2010